

SANCTUARY

THE MINISTRY OF DEFENCE SUSTAINABILITY MAGAZINE

Number 47 • 2018



TIME AND TIDE
Archaeological recovery
on a MOD island

POLLINATORS
Making a buzz on the MOD estate

PRESERVING THEIR MEMORY
Archaeologies of the First World War

SANCTUARY

Editors

DIO Sanctuary Team

Editorial Board

Jane Hallett (Chair)

Richard Brooks

Contact

Defence Infrastructure
Organisation (DIO)
Building 88
Westdown Camp
Tilshead
Salisbury, SP3 4RS

DIO-Sanctuary@mod.gov.uk
01980 674807

Sanctuary is an annual publication about sustainable development in the Ministry of Defence (MOD) and the sustainable management of the natural and built assets across the MOD estate. It illustrates how the MOD is undertaking its responsibility for stewardship of the estate in the UK and overseas. It is designed for a wide audience, from the general public, to the people who work for us or volunteer as members of the MOD Conservation Groups.

Sanctuary is produced for the MOD by the Defence Infrastructure Organisation.

Sponsors

The Sanctuary Team would like to give a big thank you to our sponsors.

Each year our industry partners kindly sponsor the publication of Sanctuary Magazine. Without their contribution, we would not be able to produce hard copies of the magazine for people to enjoy and pass on to others. Once again, this year we have received enough money to print 4,500 copies. We appreciate the continued support of our sponsors which allows this iconic magazine to be published.



Sanctuary Awards

- 2 Foreword by Rt Hon Tobias Ellwood MP
- 2 The Sanctuary Awards 2018

Sanctuary Features

- 8 We will remember them, Sanctuary commemorates WW1
- 10 Shadows of the long white cloud – re-chalking the Bulford Kiwi
- 12 Pollinators – making a buzz on the MOD estate
- 16 Facing Magwitch. The Rat Island prisoners
- 18 Strategic Access Management and Monitoring on Thames Basin Heaths
- 20 Preservation of historic fortifications in the south of England
- 22 Penhale peregrines – a battle of the sexes
- 23 Collaborative project brings financial and carbon savings to RAF Marham
- 24 On the right track – making a tank and commemorating soldiers
- 26 Poaching patrol – on foot in the Malawian bush with the British Army
- 29 Ancala Water Services – keeping it clean
- 30 Designing tents & managing munitions. Tackling waste in the supply chain
- 32 Excavations on the edge of the world
- 34 Considerate construction on St Kilda
- 35 Combatting Lyme Disease – phages, the sharpshooters of enemy bacteria
- 36 Shell Filling Factory Disaster! Remembering Chilwell's Canaries
- 38 Gathering the evidence – Salisbury Plain Training Area
- 40 Holcombe Moor – mills of industry in the valley of the Red Brook
- 42 A soldier's war on waste
- 44 Land management of military training areas in Surrey – a partnership
- 46 Flavius Valens and Corunna Barracks hob-nail boots & soft-skinned vehicles
- 48 Improving access on Dartmoor
- 50 The Arborfield Infirmary Stables
- 52 Stanford Training Area, bold & innovative management on a landscape scale
- 54 Fire and ice – Saxon burials at Barrow Clump
- 56 Celebrating sustainable waste champions
- 58 Archaeological investigations into the training trenches at Barry Buddon
- 60 Searching out micro molluscs in Ascension Island

- 61 *Coleophora pennella* – a first for Portsdown Hill
- 62 Working together as 'one team and one station family'
- 64 Bird ringing on the MOD estate
- 65 Tracking the migration patterns of whinchat from Salisbury Plain
- 66 Knot conservation aided by colour ringing at Altcar Training Camp
- 67 Kier contributes to a sustainable society
- 68 How to preserve an 150 year old military uniform
- 70 Safeguarding elms on Salisbury Plain
- 71 A fungus first for Strensall Training Area
- 72 The most anxious and perplexing problem of oil fuel
- 74 Assessing water quality and biodiversity correlations on the Roman River
- 76 A finders' paradise – Exercise ARTEMIS, Cyprus
- 78 Northern Ireland – partnerships, bugs and bullets
- 80 Least we forget – conservation, flora and fauna at a military cemetery
- 82 Monitoring heavy metals in Cardigan Bay

Sanctuary Around the Regions

- 84 Germany, Senne Training Area
- 85 South Central, Porton Down and Portsdown West
- 86 North Yorkshire, Catterick
- 87 Essex, Fingringhoe Ranges
- 88 Home Counties, UK Defence Training Estate
- 89 Wiltshire, Bulford
- 90 Oxfordshire, Bicester
- 91 Pembrokeshire, Castlemartin
- 92 Kent and East Sussex, DTE South East
- 93 Cornwall, Antony Training Area
- 94 Cumbria, Warcop
- 95 Isle of Wight, Newtown Range
- 96 Cyprus, Akrotiri
- 97 Wiltshire, Imber
- 98 Staffordshire, MOD Stafford
- 99 Hampshire, Thorney Island
- 100 Wiltshire, Larkhill and Westdown
- 101 Hampshire, DM Gosport
- 102 Cornwall, RAF St Mawgan
- 103 Gloucestershire, South Cerney Station
- 104 Environmental Support & Compliance Update
Commerce Decisions AWARD®

Foreword by Rt Hon Tobias Ellwood MP,

Parliamentary Under Secretary of State and Minister for Defence People and Veterans

As the Minister for Defence People and Veterans, I have responsibility for the MOD estate and it is my job to ensure that our environment is both protected and sustained. As the MOD is the country's third largest land owner this remit covers a range of high profile and sensitive issues which I take a great interest in. In 1973 Lt Colonel (Retd) Norman Clayden was appointed as the MOD's first Conservation Officer, since then, the MOD has gone from strength to strength and we are proud of our reputation as responsible stewards.



This year the Sanctuary magazine features a wonderful array of projects, with a particular focus on commemorating the WW1 centenary. Articles highlight the archaeological investigations of WW1 practice trenches at Barry Buddon, the conservation of a WW1 memorial at the National Shell Filling Factory and caring for war graves at the now demolished Royal Victoria Military Hospital. The front cover is of efforts to preserve the Bulford Kiwi, a chalk hill carving created by New Zealand troops during 1919 which is now a Scheduled Monument. It is so important that this history is not forgotten.

Before becoming an MP, I served as a Captain in The Royal Green Jackets and I am proud to still be a British Army Reservist today. A large part of my Ministerial role is to ensure the welfare of current service personnel and veterans. So, I am particularly pleased that the Operation Nightingale programme, which assists the recovery of both current and former service personnel through archaeological investigations across the MOD estate, has continued to be such a success. Recent Operation Nightingale projects feature in this year's magazine including the building of a WW1 tank replica.

I also welcome the articles on data collection and the recording and sharing of this information with a range of internal and external organisations. It is vital that we collect, collate and analyse robust scientific data on the condition of our habitats, species, archaeology and listed buildings. This supports our estate planning and management decisions and contributes to wider national and international databases as we face challenges such as climate change.

I would also like to take this opportunity to thank the thousands of volunteers who work on the MOD estate, giving their time and expertise to ensure our heritage and environment are conserved for future generations to come. The community spirit that these world-wide projects foster is so special, as highlighted by the work of this year's Sanctuary Award winners and runners up. I offer them my warmest congratulations!

Sanctuary Awards 2018

The Ministry of Defence's prestigious Sanctuary Awards recognises and encourages group and individual efforts that benefit sustainable development, energy saving measures, wildlife, archaeology, environmental improvement or community awareness of conservation on or within land and property that the MOD owns or uses in the UK and overseas.

The 2018 Awards were divided into five categories: Environmental Project, Heritage Project, Sustainability Project, Utilities Project and Individual Achievement. The winners of each category were then considered for two further awards. The coveted Silver Otter is awarded to Conservation Groups or individuals, MOD personnel or MOD-led projects. The Sustainable Business Award is awarded to more commercial projects who have achieved a particular success in ensuring sustainable solutions that deliver against the commitment to the Armed Forces by enabling them to live, train and work.

The Sanctuary Awards board would like to congratulate, on behalf of the MOD, the following winners and runners-up for 2018.

For further information on entering the 2019 Awards please contact the Sanctuary Team DIO-Sanctuary@mod.gov.uk

The Sanctuary Awards board for 2018 comprised of:

FINANCE AND MILITARY CAPABILITY (FMC)

Jane Hallett
Assistant Head
Estates Policy

Ray Dickinson
Assistant Head
Policy Environment Compliance

DEFENCE INFRASTRUCTURE ORGANISATION (DIO)

Alan Mayes
Chief of Staff Service Delivery

Richard Brooks
Principal Environmental Advisor
for Environmental Support & Compliance

Mark Hill
Deputy Head
Energy, Utilities & Sustainability

EXTERNAL JUDGE

Martin Baxter
Chief Policy Advisor at the Institute of Environmental Management & Assessment (IEMA)

The judges would like to thank Commerce Decisions, see inside back cover for more details.

HERITAGE PROJECT AWARD WINNER

SILVER OTTER WINNER

Exercise MAGWITCH – Rat Island, is one of the latest projects in the Operation Nightingale programme. In 2014 human skeletons of those who died on 18th and 19th century prison ships were recovered from Burrow ('Rat') Island in Portsmouth, having been revealed during storms.

In 2017 Operation Nightingale returned to continue the excavation. Exercise Magwitch participants included Wounded, Injured and Sick (WIS) service

personnel and veterans on Operation Nightingale, with the assistance of Breaking Ground Heritage. Metal detecting volunteers from Hampshire History Hunters/Combat Stress monitored the area to ensure safety and full recovery of objects. The participants were supported by partners from across the MOD, including the Royal Military Police and 17 Port and Maritime Regiment (Royal Logistics Corps). In addition, forensics experts, professional

archaeologists, osteologists and historians provided their expertise.

It is essential that the MOD manages its historic estate with care. This well organised project worked around the harbour's tides to professionally recover four 18th/19th century skeletons. Forensic examination was undertaken at Cranfield Forensics Institute and facial reconstruction of one skull was carried out by Liverpool John Moores University.



The team walk back from Rat Island © Harvey Mills Photography

Project leaders attended the Chalke Valley History Festival, highlighting to the community the phenomenon of Rat Island's prison ships. Discussion took place with school children around the importance of archaeological science in determining the stories of these men and women. Technological advances meant the team could 3D print a skull and obviate the need to display human remains. The project also featured on BBC's 'Digging for Britain'.

See article on page 16

HERITAGE PROJECT AWARD RUNNER-UP

Exercise ARTEMIS 17 (Defence Archaeology Group) is part of the Operation Nightingale venture, in partnership with the Defence Infrastructure Organisation and the Department of Antiquities Republic of Cyprus (RoC). The aim of the exercise was to continue the excavations of the 7th century Byzantine structures found to the east of RAF Akrotiri in the Western Sovereign Base Area (WSBA), RoC.

This exercise supports Wounded Injured and Sick (WIS) personnel in their recovery pathway, by fostering team spirit and cohesion through engagement with a project that has a purpose. It also helps to highlight the importance of conservation, heritage and culture, by providing participants with an understanding of the processes required to capture and record such activities.

For the last five years, the site director Dr Eleni Procopiou has invested a huge amount of personal time and effort encouraging the WIS personnel through her dedicated professionalism in teaching. This has led to a very successful collaboration between HM Forces and the RoC and helped to make the project such a success.

The support staff are all serving military personnel who volunteer to support this worthwhile project above and beyond their normal duties. It should not be underestimated how difficult and demanding an undertaking this is, especially in regards to assisting personnel with profound physical injuries and/or mental illness both in the UK and overseas.

And finally, this award is for the effort and enthusiasm shown by the Operation Nightingale participants

themselves. They fully embraced the opportunity, whilst becoming secure in the knowledge that they are not alone.

See article on page 76



Ex ARTEMIS excavations taking place on the site © Defence Archaeology Group

UTILITIES PROJECT AWARD WINNER

**SUSTAINABLE
BUSINESS AWARD
WINNER**

29 Regiment, The Royal Logistic Corps' 'Energy Management Team' was formed to generate interest, commitment and action to help prepare the Station for future rising energy costs. It aims to ensure that operational capability can be maintained during any future possible power outages or interruption of supply which may directly affect the UK's national infrastructure.

Based at the Duke of Gloucester Barracks, the dedicated team identified areas where savings and improvements could be made and implemented in



Col C G Munce MBE RLC CO 29 Regiment RLC and Maj P Walker RLC Regimental Quartermaster © Crown

an Energy Management Action Plan. Through the plan, staff at all levels were empowered by their managers to make behavioural changes and take responsibility for their workplace areas. Awareness around energy efficiency was delivered through training sessions on sustainable development and all staff, including military personnel, completed a Workplace Induction Package which covered climate change, environmental impact and energy saving information.

Energy consumption on site was monitored monthly to measure current usage. A 'TRIAD Warriors' group was set up at the Station's Youth Club. They designed posters which were displayed around the Station. This helped lead to the considerable savings which have been made during peak times of energy usage, when the National Grid is under pressure.

A survey was commissioned, and the report highlighted the 'Spend to Save' opportunities available to bring the Station up to date with technological

asset upgrades which will save money in the immediate and the long-term future. These suggestions are gradually being implemented as funding becomes available.

During the judging process the Sanctuary Awards Board felt that the team demonstrated an innovative multi-tasking approach. The judges were particularly impressed with the team's engagement with all communities on site to initiate behavioural change.

See article on page 62



Duke of Gloucester Barracks' information sign © Crown

UTILITIES PROJECT AWARD RUNNER-UP

Landmarc Support Services' Sustainability and Waste Management Teams work in partnership with the MOD to deliver a waste management strategy that has improved recycling on the Defence Training Estate. Rates increased from 4% in 2008 to 56% (including composting) in 2017/18, with 95% of waste diverted from landfill. These impressive reductions in waste contribute directly to meeting Greening Government Commitments.

The operation of eight Waste Sorting Stations across the UK are central to the strategy, ensuring large amounts of material are segregated for recycling. The approach is tailored to each site, depending on user requirements and geographical constraints, helping to maximise efficiency at site level and improve landfill diversion, recovery and

recycling rates. Considerable effort has been invested in a Waste Data IT Service to help better understand waste requirements across the Defence Training Estate.

Each site has a nominated waste focal point who is responsible for overseeing waste management and driving improvements. Landmarc's Sustainability Team has delivered Waste and Resource Management Training to all operational staff involved in handling waste. This teaches staff to consider

waste as a resource, apply the waste hierarchy, understand legal requirements and the environmental impact of waste. To date, nearly 200 staff across six regions have taken part in 18 training sessions, with further sessions planned soon. Staff have gone above and beyond their core duties, taking the initiative to prevent unnecessary waste and have demonstrated a commitment to sustainable waste management.

See article on page 56



Clearing waste on the Defence Training Estate © Landmarc Support Services

SUSTAINABILITY PROJECT AWARD WINNER

Operation MARMAT, (initially Operation LAYLAND) conducted Humanitarian and Disaster Relief (HADR) works in Nepal after a series of enormous earthquakes struck the Gurkha homeland in April 2015.

Personnel from 36 Engineer Regiment & Queen's Gurkha Engineers were deployed for 20 months. Initially, the Regiment reinforced water supply capability in Kathmandu, undertook rubble clearance, built Internally Displaced Person (IDP) camps and repaired transport routes.

In 2017, more permanent solutions were delivered to support the Gurkha

Welfare Scheme objectives. This included rebuilding key infrastructure in several villages, particularly the construction of schools and community centres. Earthquake resistant homes were built for the Gurkha pensioner community, many of which were constructed under the supervision of the Regiment.

The Construction Supervision Team concept was extremely successful, it combined small numbers of military manpower with the skills of local tradesmen. This idea was subsequently used by Commando Sappers on Operation RUMAN, a HADR operation

to restore the impacts of the hurricane season on the British Virgin Islands.

The deployment included British & Gurkha Sappers of all artisan trades, Combat Medical Technicians, Chefs, Vehicle Mechanics, Clerk of Works and an Environmental Health Technician. Partnerships were the norm on Operation MARMAT and all of those deployed worked with locally employed civilians.

Since the first deployment the Regiment maintained a significant presence in Nepal, including British, Foreign and Commonwealth and Gurkha soldiers united by a common humanitarian goal. Throughout, they have stood shoulder to shoulder with the Nepalese people – military, political and civilian. The unit has worked closely with local communities to build capacity, such that the Nepalese people are better placed to continue to rebuild their own lives.

See Sanctuary 46, 2017 page 56



Hard at work on a water project in the hills © Crown

SUSTAINABILITY PROJECT AWARD RUNNER-UP

Albemarle Barracks War on Waste Project is led by Warrant Officer Class Two (WO2) Richards, the Regimental Quartermaster Sergeant (Maintenance) of 3rd Regiment Royal Horse Artillery in Albemarle Barracks, Northumberland. The barracks, based at an old RAF station from circa-1940, had very limited familial-based infrastructure and is isolated from the nearest town centre by some fifteen miles. On arrival, WO2 Richards was therefore tasked to look at multiple areas to enhance the quality of life for soldiers and families on site. He has worked assiduously to make improvements, with the morale and wellbeing of the soldiers and families increasing due to his actions.

He has transformed waste management at the site, with the more common collection banks found at a recycling centre



WO2 Richards at the recycling area © Crown

(e.g. glass, cardboard and many more) now installed. To carry out these improvements, WO2 Richards implemented partnership working with the local council as well as with many local and national charities.

WO2 Richards' determination to increase awareness of the reasons why

waste should be properly recycled, with staff, forces personnel and their families alike has helped significantly in the success of the project. His dedication has resulted in a vastly improved working and living environment for all.

See article on page 42

ENVIRONMENTAL PROJECT AWARD WINNER

Rame Peninsula Beach Care is a beach cleaning group run by Claire Wallerstein, as part of the Tregantle Conservation Group based at Tregantle Fort and Antony Training Estate, in Cornwall.

Due to the tides and currents, Tregantle is one of just a few beaches around Cornwall which acts as a magnet for microplastics (plastics measuring less than 5mm across), which are incredibly hard to remove from the environment. Many microplastics start out as bigger items but a large proportion comprises industrial preproduction plastic pellets that enter the sea at this size.

This depressing situation was brought to the attention of Rame Peninsula Beach Care who, as well as picking up the larger more visible plastics during beach cleans, wanted to help reduce the microplastics at Tregantle.

Using a separation machine developed by volunteer Rob Arnold, the floating microplastics can be removed, allowing the sand and other organic material to

sink and be returned, clean, to the sea. Using this machine approximately nine million pellets were removed from an 100m-wide stretch of beach in only seven sessions over one year and many more continue to be removed. During regular beach cleans the group has removed many hundreds of sacks of plastic waste from Longsands Beach, which is part of the Defence Training Estate at Tregantle.

There has been much partnership working to facilitate and continue this innovative project, with close liaison between Defence Training Estate and

Rame Peninsula Beach Care. The group has devoted an enormous amount of time and effort to protecting Cornwall's beaches, especially on the MOD Estate.

The Government are currently attempting to find ways to reduce plastic waste and this project is contributing significantly to this aim for the MOD, both in terms of reducing environmental pollution on the estate and increasing awareness of the proliferation of plastics in the marine environment.

See Sanctuary No 46, 2017 page 39



Claire and the volunteers of Rame Peninsula Beach Care on one of the many beach cleaning events © Neil Hope

ENVIRONMENTAL PROJECT AWARD RUNNER-UP

Army Ornithological Society (AOS) Ascension Seabird Conservation Project started when members visiting the island en-route to the Falklands reported massive seabird declines in many species. The Society mounted its first field expedition in 1990 with soldier-naturalists beginning what became a long-term monitoring programme. Its enduring goal being the collection of scientific evidence on the significant influences on the seabird populations of the island.

The enthusiasm of 55 volunteers from all services, who contributed to 23 expeditions between 1990 and 2018 is remarkable. Heat, poor facilities and rough terrain make conditions on Ascension arduous and limited time requires teams to start work immediately on landing. The AOS Ascension project has been

largely self-funded and conducted in all cases by volunteers who have often given up their leave and made personal financial contributions.

Many of the AOS Ascension team members bring their professional qualifications to the project such as ringing, blood sampling and fitting harnesses. Between 2002 and 2018 the AOS assisted staff at the newly formed Ascension Island Conservation Office with hundreds of hours of monitoring and training in the handling of seabirds.

Lectures to the public and professional conservation bodies on this demanding field conservation work, the provision of training to locally employed staff, enabling school children to see the birds at close quarters, and the publication of research findings have all helped to bring the plight of Ascension's seabirds to the attention of the public.

Acknowledgements of the MOD support to conservation work on Ascension are included in the 15 papers published in international scientific journals. These have considerably enhanced the MOD's reputation in the eyes of the scientific and conservation communities.

See Sanctuary 45, 2016 page 68



Ringed sooty tern © R Moody

INDIVIDUAL ACHIEVEMENT AWARD WINNER



Ballykinler Training Area overlooking Murlough and the Inner Bay (Site of ancient Kings of Ulster burial ground with Dan Snow filming) © Dr H Montgomery

Maj Tony Canniford has been the Senior Training Safety Officer for Defence Training Estate in Northern Ireland for over six years and is the Head of Establishment for Ballykinler and Magilligan Training Centres. These two sites support almost 1,500ha of Area of Special Scientific Interest (ASSI), and both also have Special Areas for Conservation designations. These sites are widely recognised as two of the most important for wildlife in the whole of Northern Ireland and support an array of archaeology, including WW1 practice trenches, possible ancient Kings of Ulster burial ground and other military infrastructure.

Tony has acted as a champion for biodiversity conservation both within Northern Ireland and the wider Scotland and Northern Ireland region. He has become a role model for environmental management within Defence Training Estate, showing how ASSI management and other wildlife protection initiatives can be integrated with military training. He has facilitated the work of other MOD specialists, statutory bodies, external professionals and volunteers and has taken a very active interest in their work. He has led projects, such as the red squirrel re-introduction partnership project between Belfast Zoo, Northern

Ireland Environment Agency and MOD. He has also hosted many TV and radio productions such as WW1 History, Secret Britain and Walk the Lines.

Tony has fostered a close working relationship with other key partner organisations and dedicated much of his own time to hosting visits and events. In addition, Tony has led from the front as Chairman of the MOD Conservation Groups at both sites by supporting and facilitating numerous surveys and management activities.

INDIVIDUAL ACHIEVEMENT AWARD RUNNER-UP

Richard Hull's passion for the Fingringhoe Ranges began after his first visit to the Fingringhoe Wick Nature Reserve in 1962, where he spent many hours in a bird hide overlooking the Ranges. Richard later became the Colchester Garrison's

MOD Conservation Group Ornithologist in 1970 as a volunteer; where he still continues his weekly bird surveys.

Richard's lifelong work has been a herculean effort, producing a huge volume of data to the BTO/MOD which

is of National and Local Importance, supporting statutory bodies and the MOD in the management of the Ranges. Recently his data has assisted in the development planning of two new ranges, which has been crucial, as the site is an International, European and UK Protected Area.

Richard is a professional fine artist specialising in birds, many of which he has seen and painted on the Ranges. He has recently combined his passions and produced a book of his paintings and the data he has collected, promoting the unique ornithological qualities of the Ranges.

Now in his 70s Richard is still a very active member of Fingringhoe Conservation Group and his years of passion and dedication make him extremely worthy of this award.



Richard Hull, long standing ornithologist for Fingringhoe Conservation Group © Crown

We will remember them

Sanctuary commemorates WW1



RAF Halton's reconstruction of a WW1 trench network © Crown

At 5am on the 11th November 1918, following four years of war, an armistice was signed by Allied forces and Germany in a railway carriage deep in the Forest of Compiègne, near Paris. The armistice came into force at 11am the same day, signalling the end of World War One (WW1). The terms stipulated that Germany must surrender its weapons and vacate invaded territories within two weeks.

Remembrance

The significance of Armistice Day has been commemorated annually since 1919, with two minutes of silence held at the 11th hour, on the 11th day, of the 11th month to remember those who made the ultimate sacrifice. After the war Moina Michael, an American academic, sold silk poppies to raise funds for veterans having been inspired by Lt Col John McCrae's poem *'In Flanders Fields.'* The poem described how poppies grew in abundance at Ypres, Belgium despite heavy landscape bombardment. It is important that WW1 is not forgotten and the poppy is now widely recognised as a symbol of remembrance and hope. The Royal British Legion adopted the logo of the poppy in 1921 and the first Poppy Appeal was held the same year with the Poppy Factory offering

employment to disabled veterans. Today more than 30 million poppies continue to be made annually by disabled veterans, raising vital funds that support service personnel, veterans and their families.

This year marks 100 years since the end of WW1 and as such the 2018 edition of Sanctuary magazine explores centenary activities across the MOD estate. However, the pages of Sanctuary have long featured projects relating to WW1 and this article highlights some of these remarkable ventures.

WW1 training trenches

Traces of WW1 training trenches are an interesting archaeological landscape feature across the MOD estate, visible as both aerial features and earthworks.

Whilst temporary trenches had at times been used in previous conflicts such as the Boer War, the trench warfare of WW1 was on an unprecedented scale, quickly developing into a sophisticated fortification network that spanned miles across Europe.

Training trenches were established across Britain and Northern Ireland, with trench warfare taught alongside marching and drill by the British Army

during Basic Training. Soldiers had to learn how to construct and maintain trenches, with varying techniques dependant on terrain, geology and use. Key skills included construction of machine gun posts and dug outs, setting barbed wire in the dark after nightfall and trench attack techniques.

Excavations at Ballykinler, Northern Ireland provided an insight into how the 36th Ulster Division were trained in preparation for the Somme. The project won the 2017 Sanctuary Heritage Award for its work in dispelling the myth that soldiers were sent into the battle with little idea of what they may face.

Other archaeological works undertaken include those at Colchester Barracks, Essex which revealed evidence of training trenches used to teach soldiers to utilise grenades and how to prepare for gas attack. A section of the infamous Hindenburg Line was even built at Bovington, Dorset to enable troops to practice trench warfare. The Hindenburg Line (or Siegfried Line) was a defensive barrier made of concrete, steel and barbed wire constructed by the Germans between Arras and Soissons on the Western Front in 1916. It formed the focus of much of the latter part of



A Phase 2 recruit excavates the Horse Isolation Hospital area at Larkhill © Harvey Mills Photography

WW1, including the Battles of Cambrai and Bullecourt and was finally broken by the Allies in the Hundred Days Offensive of September 1918.

In 2011 the Station Commander at RAF Halton made enquiries about a series of earthworks crossing the landscape. On learning that these were remnants of training trenches, staff asked if these could be used for force development.

Service personnel who were awaiting trade training at RAF Halton were tasked to reconstruct a network of WW1 trenches to be used as an educational resource. The project helped personnel to directly engage with military heritage. It is important that personnel can explore the history of the origins of the Royal Air Force, which has been based at RAF Halton since its formation 100 years ago.

Digging War Horse

Horses played a vital role in WW1, with 869,931 working for the British Army by 1917. The Horse Isolation Hospital was built at Fargo, Larkhill on Salisbury Plain in 1914 and in 2014 a community project was initiated to locate the hospital. Geophysical survey was undertaken followed by targeted excavation. The project included Operation Nightingale participants, Conservation Group members, Phase 2 British Army recruits and local school children. Whilst the hospital itself was not found, many artefacts were uncovered that told the story of the soldiers who were based there. These included buttons, badges from across the Commonwealth and cartridge cases. The project both highlighted and commemorated the role of artillery horses in WW1, winning the 2015 Sanctuary Heritage Award.

The Battle of Jutland

The Battle of Jutland took place between the Royal Navy's Grand Fleet and the Imperial German Navy's High Seas Fleet from 31st May – 1st June 1916, in the North Sea. It was the most significant naval battle of WW1 and the last major battle in world history where opposing fleets fought using naval guns as the principal weapons. More than 250 ships took part with significant losses on both sides. The Royal Navy lost 14 ships with 5,672 fatalities and the Imperial German Navy 11 ships and 2,115 fatalities.



2nd Battle Squadron in action at the Battle of Jutland © Royal Naval Museum, Portsmouth

Although both sides claimed victory, the Battle confirmed British supremacy in the North Sea, ensuring the naval blockade of Germany remained intact, preventing Imperial German Navy ships accessing the Atlantic.

In 2006 the British shipwrecks at Jutland became protected under the Provision of Military Remains Act (PMRA) 1986 and are military graves. This means that whilst the shipwrecks continue to be popular with scuba divers, a 'look but do not touch' rule is in place and artefacts cannot be removed without prior licensing from the MOD. The Jutland shipwrecks are an important part of the Royal Navy's history and it is fitting that these graves have been protected.

As this centenary year draws to a close, in the words of Robert Binyon's poem

'For the Fallen,' it is imperative that their sacrifice is not forgotten:

*"They shall not grow old, as we that
are left grow old:
Age shall not weary them, nor the
years condemn.
At the going down of the sun and in
the morning;
We will remember them."*

These features can be read in Sanctuary 33, 40 and 45 (WW1 trenches), Sanctuary 37 (Battle of Jutland) and Sanctuary 44 (Digging War Horse). Past copies of Sanctuary can be downloaded from <https://www.gov.uk/government/publications/sanctuary>.

Holly Broomfield
Assistant Sanctuary & Conservation
Groups Officer
Defence Infrastructure Organisation

Shadows of the long white cloud re-chalking the Bulford Kiwi



A view of the Kiwi from the Chinook helicopter © SAC Pippa Fowles RAF

The Bulford Kiwi commemorates the occupation of Sling Camp by soldiers of the New Zealand Expeditionary Force during the First World War. It was designed by Sgt Maj Percy Blenkarne and surveyed onto the slopes of Beacon Hill, Salisbury Plain, by Sgt Maj Victor Low. The 'Kiwi' was cut by soldiers from the Canterbury, Otago and Wellington Battalions under the direction of Capt Harry Clark over a three month period ending on 28th June 1919.

Sling Camp no longer exists but it used to lie in the area now occupied by trees, houses and fields at the foot of the Kiwi. The Kiwi was restored in 1980 by the soldiers of 249 Signal Squadron (AMFL) and maintained by them until the squadron was disbanded in 2003.

"To the old soldiers in the new country, from the young soldiers in the old country, our ink is carved forever in the timeless hills of Salisbury Plain". So reads the plaque installed upon a small stone cairn directly above the giant chalk figure carved into the hills overlooking the Bulford Ranges. The Kiwi is around 130m long and is visible from miles away. Sling Camp was the principal training depot for New Zealanders in England prior to their deployment

to the Front. Although designed to accommodate 4,000 men, in September 1917 the camp housed 4,500.

By 1919, frustration with further overcrowding and the continued enforcement of discipline after the end of the war led to the looting of a canteen and the officers' mess. The ring leaders were jailed and then shipped home, and some of the remaining troops were set to work, removing 12 inches of top soil and replacing it with chalk pebbles. The designer, Sgt Maj Percy Blenkarne, was a drawing instructor in the New Zealand Army Education Corps. Blenkarne

travelled to the Natural History Museum in London to confirm the anatomical dimensions of the bird.

Although, as the plaque states, initially intended to be seen from Sling Camp, the carving is still a prominent figure and landmark for those training on the east of Salisbury Plain Training Area. Or at least it was. In recent years despite regular re-scouring events, the plumage of this bird was looking a little tired, perhaps even shabby and thus it was in need of new chalk.

In 2017 Historic England designated the chalk carving as being a Scheduled Monument, the same inscription as for the many Bronze Age burial mounds and linear ditches located on Beacon Hill. This scheduling stated *"List entry number: 1443438. The model is strongly representative of the First World War period, which had a huge impact on communities throughout the world. 10% of the New Zealand population (100,000 people) fought in the War and the Kiwi Chalk Figure is testament to their significant role during the War. Hill figures in chalk downland areas are rare, the site is well understood and documented and First World War military chalk hill figures are also present on Fovant, Compton and Sutton Downs in Wiltshire (all scheduled) and represent a recognisable and significant historic feature in the landscape."*



Chalk delivery incoming! © SAC Pippa Fowles RAF



3rd (UK) Signals Regiment open the chalk bags © Harvey Mills Photography

The MOD has committed to caring for its historic estate and one of the key Government targets is to minimise the department's holdings of 'Heritage at Risk'. It was obvious that the Kiwi was thus vulnerable to being placed within this category and so a team was assembled to ensure this would not happen.

Major infrastructure works on Salisbury Plain as part of the Army Basing Programme had carved out a lot of fresh chalk as part of ground works, not least by the new washdown facility at Bulford. This presented the team with a great source of raw material for the clean-up. The challenge was getting it to site! The last great re-chalking, by 249 Squadron of the Royal Corps of Signals, had taken place over 30 years ago and had been accomplished by hand, quite an achievement! Enter the Royal Air Force.

The New Zealand High Commission provided 50 aggregate bags which were filled with chalk by Landmarc Support Services (Landmarc). A Chinook helicopter from RAF Odiham, which was able to move eight one tonne bags at a time, relocated the chalk from old Carter Barracks onto the Kiwi, a spectacular sight that was accomplished in little over an hour. The first hover over the figure saw some of the old chalk dust rise into the sky to form its own white cloud, and it was tempting to observe that this was perhaps the first ever time that a Kiwi has flown. The Chinook crews support civilian operations frequently, especially during disaster events such as

flooding and this task provided a training opportunity beyond the usual tasking.

It was then on to the ground-based team to spread this chalk. This was a real community effort with an eclectic group of helpers from; Landmarc, Bulford Conservation Group, RAF Odiham, The New Zealand High Commission, Army Basing, 3rd (UK) Signals Regiment, DIO, volunteers and the New Zealand diaspora. Having weeded the figure beforehand, shovels, rakes, spades and other implements were deployed to ensure that the Kiwi was gleaming in a little over two hours, much quicker than predicted. The soldiers from the Royal Corps of Signals were in their regimental t-shirts, resplendent with a red Kiwi on the sleeve and serving to emphasise the long standing links between their unit

and the soldiers from New Zealand that came before them. For those that had carried out the last mission to chalk the Kiwi, perhaps the access to a Chinook created a powerful envy, given that the soldiers of 249 Signal Squadron under the command of Col (Retd) Danny Fisher had to do all their work by hand. Their efforts had ensured that the Kiwi had not been lost. Col Fisher commented *"I can't believe we did this off the cuff over thirty years ago and it is still going strong."*

One only has to visit the local military cemetery at Tidworth to see the many graves of New Zealand soldiers from the First World War to see the sacrifices made by soldiers of this nation and why it is so important to maintain the monument to their memory. The New Zealand High Commissioner, Lt Gen (Retd) Sir Jerry Mateparae, said *"the links between the UK and New Zealand are still strong and it has been touching to see so many people involved in looking after and protecting the Kiwi for generations to come."*

When one walks over the ploughed fields at Beacon Hill, one does occasionally find New Zealand military buttons and it is then impossible not to imagine the lives of those based here in the war. The Kiwi will celebrate its 100th birthday in 2019 and it will be gleaming for all of its 99th year in the lead-up to this event thanks to wonderful partnership work and a splendid community day.

Richard Osgood
Senior Archaeologist
Defence Infrastructure Organisation



Volunteers spread the chalk onto the Kiwi © Crown

Pollinators – making a buzz on the Ministry of Defence estate



A feral honey bee colony on Salisbury Plain Training Area © Helen Sheridan

What are pollinators?

Pollinators carry pollen from flower to flower to fertilise plants. Pollen from a flower's male anther must reach the female stigma for fertilisation to occur. A wide range of animals are involved in pollination such as birds, bees, bats, butterflies, moths and beetles. Insects are the main pollinators, particularly bees. Hoverflies are considered the second most important pollinator and at higher altitudes the bumblebees may be the only pollinators present.

Bees are the most widely recognised pollinators. Their hairy bodies and electrostatic charge mean they are perfectly adapted to catch pollen grains. Nectar is collected for honey production and pollen is gathered to nurture their young, which inadvertently transfers pollen between visited flowers, triggering pollination.

Humans rely on circa 1,000 plants for food, materials and medicines that require insect pollination. Without pollinators, there would not be coffee, chocolate, grapes, strawberries or

cotton, to name a few. Looking at the bigger picture, oils that come from crops require pollination by animals and 90% of the world's flowering plants rely on pollinators. There are over 4,000 pollinator species in the UK and many are declining.

Why does this involve Defence?

The Ministry of Defence (MOD) manages some of the largest areas of Government land, providing havens and all year round forage that supports pollinators in the wild. Significant areas have remained uncultivated, with an absence of chemical applications for several decades. Consequently, many sites have a rich variety of plants, which in turn provide forage for pollinators.

The MOD is working in partnership with Wildlife Trusts, National Farmers Union, Centre for Ecology & Hydrology, Kew, Praise Bee, Buglife, Bee Improvement and Bee Breeders Association (BIBBA) and other organisations to support pollinators. As a signatory to the National Pollinator Strategy, the MOD is committed to improving and enhancing

the MOD estate by identifying and maintaining existing and potential habitat that can provide all year around forage for pollinators.

How can we make a difference?

Through the efforts of many Conservation Group members, supported by Defence ecologists, the MOD estate has maintained these plant rich areas. Several pollinator friendly initiatives have been overseen by the Defence Infrastructure Organisation's (DIO) Conservation Groups Team, which are highlighted in this article.

Native honey bees on MOD land

The native honey bee *Apis mellifera mellifera* also referred to as the black bee, is distinct from many of the honey bees that have been imported into the UK, and because of these imports is now critically endangered. This is due to hybridisation between species which makes it extremely difficult to breed the true black bee allowing the population to recover.

BIBBA, working together with the MOD is seeking to conserve and preserve the few remnant populations of the black bee, by establishing several isolated breeding sites on the MOD estate. Should the project be successful then there will be a consequent increase in the number of colonies throughout the British Isles. This project also supports the UK Government's Pollinators Initiative and the National Pollination Strategy.



A common carder bumblebee on a thistle © Crown

The project has run as a pilot scheme on Tregantle Ranges, south east Cornwall for several years, whereby the geographical isolation makes it suitable for a breeding site for this critically endangered native honey bee. Tregantle Ranges form part of England's first black bee reserve on the Rame Peninsula.

Local BIBBA bee keepers look after the hives through the summer months whilst working closely with range staff and the site's Head of Establishment to ensure the bees live in harmony with training military personnel.

Since its very inception it has always been an ambition that this project could be implemented on the MOD estate throughout the UK, as most provide the requirements to make them suitable as mating apiaries. An isolated mating apiary was established in Sennybridge, Wales this year.

More information on this project can be read in Sanctuary 44, 2015.

Mason bees are the BUZZ word

A coordinated breeding programme for the mason bee *Osmia bicornis* was reported in Sanctuary 43, 2014.

The initiative started with humble beginnings at RAF Shawbury, with pupae bred on the Station dispersed into four surrounding churchyards. This year, just under 70 churchyards across Shropshire have now received new colonies, with the help of the



Viv Marsh of Praise Bee meets Maj James Keeley MBE to discuss mason bees at RMA Sandhurst © British Army

county Women's Institute, The Church of England and other denominations. Not all the colonies will succeed due to the lack of flora around each church but the results should, nevertheless be vital to the research programme.

The restoration of this indigenous, non-stinging or swarming bee will do much to create a rebalance of pollination in the UK and much of Europe. The project represents an effective opportunity for community environmental engagement with all Service branches that could ultimately be rolled out across the UK.

A professional approach was adopted with RAF Shawbury working with the Entomology Department at Harper Adams University. Through the help

of DIO's Conservation Groups Team the scheme has now expanded to RAF Cosford, RAF Halton, RAF Brize Norton and DM Gosport, along with MOD Donnington and Stafford plus the Defence Training Estate at Nesscliff. This year the research has become fully Tri Service, with empty bee nests deployed at Royal Military Academy Sandhurst, Britannia Royal Naval College Dartmouth and Royal Air Force College Cranwell, to see if the mason bee is already present. If bees have not nested naturally at these three iconic Service Colleges, then stock bred from RAF Shawbury and RAF Brize Norton can be introduced.

Similar programmes are also being developed at West Mercia Police Divisional Headquarters and with the NHS. The 97% loss of meadows and hedgerows since the 1940s is the main reason bee and insect numbers have declined, alongside insecticides and other factors. A new wildflower meadow establishment research programme has therefore started in Shawbury village, supported by the RAF.

Making a B-Line through the Ministry of Defence

Buglife is working across the UK's towns, cities and countryside; enthusing people to act for wild pollinators as part of the B-Lines programme. B-Lines was initiated in 2012 to take a strategic joined up approach to wild pollinator conservation, by increasing the area of wildflower-rich habitats in priority areas. To aid pollinator movement around the country, the B-Lines link together the



Cdr John Patterson RN and Peter 'Tansy' Lee receive BRNC's empty bee nest © Royal Navy



Planting at Warminster Garrison © Ancala Water Services

best of our existing wildflower-rich sites into a UK-wide network. The aim is to join these sites up by 'filling' 10% of the B-Lines with wildflower-rich areas.

'A Green Future: Our 25 year plan to improve the environment' published by the Government in 2018 supports the B-Lines approach, highlighting the need for landscape-scale restoration of wildflower-rich grasslands to create Nature Recovery Networks with improved habitat for pollinating insects.

B-Lines is a huge partnership programme. Everyone who owns or manages land, lives or works within the B-Lines is being asked to act. Added together even the smallest actions will make a massive difference. Many individuals, businesses, local authorities, conservation organisations, and farmers are already helping, however there is a lot more to do. Partners already involved include Northern Powergrid, Northumbrian Water and The Land Trust who are taking steps such as adjusting grassland mowing regimes and restoring wildflower-rich grasslands.

The MOD has a huge role to play in the development of the B-Lines. It is already contributing significantly through the management of thousands of hectares of land and schemes such as those mentioned in this article, however there is more that can be done.

Creating quality habitats for pollinators can take many forms, from maintaining

or restoring wildflower-rich grasslands and heathlands, to developing spring-flowering scrubby areas. Outside of the large tracts of semi-natural habitats owned by the MOD, there will be a wealth of other opportunities on the MOD estate within the B-Lines to create new wildflower-rich grasslands, plant blossoming trees, create nesting sites for bees and hoverflies, and simply change cutting regimes on areas of amenity or other grassland. The MOD are working hard to implement these changes across the estate through the Conservation Groups network and industry partners.

More information on B-Lines is available at www.buglife.org.uk/b-lines-hub along with a map of some of the work that is taking place.



Planting at Duke of Gloucester Barracks © Ancala Water Services

Give the mower a rest!

Ancala Water Services (AWS) are responsible for the package A region of Project Aquatrine, providing water and waste water services to the MOD. AWS care about the environment and so decided to 'give the mower a rest.' Grounds maintenance within operational boundaries previously meant that all grassed areas were cut on a regular basis. Reducing this to only mowing around assets and walkways means that large areas are left to grow naturally. This activity, known as conservation mowing helps to support pollinators.

The RSPB says that conservation mowing *"creates a mini jungle through which beetles and other small creatures can wander and where sparrows and goldfinches may come to feed on the seeds of various wild plants. The grasses will set seed, wildflowers will grab their opportunity to bloom and the longer stems will create a sheltered microclimate."*

The RSPB also suggest planting wildflower seed to enhance the benefits of leaving areas of grass to grow. Planting native wildflowers creates a wildlife haven which can be vital for encouraging species such as native bumblebees to thrive once again in the UK. Wildflowers also create spectacularly colourful and beautiful areas for people to enjoy and it is great fun planting them!

AWS operate an ISO14001 certified environmental management system, which makes a commitment



Deputy Commandant, Grp Capt Gordon Bettington and Tony Hird, Station Health and Safety Advisor decide to take action to help bees at RAFC Cranwell © Royal Air Force

to increasing the biodiversity on operational sites. Earlier this summer AWS were joined by volunteers from the Environment Agency, QinetiQ, the Pembrokeshire National Park, DIO and wider MOD to plant over 1,000 wildflower plugs at six sewage treatment works throughout the Aquatrine package A region. These included RAF St Mawgan, Cornwall, Castlemartin Training Area, Wales, Duke of Gloucester Barracks, Gloucester, RAF Valley, Wales, Army Aviation Centre Middle Wallop, Hampshire and Warminster Garrison, Wiltshire. The species of wildflower planted included black knapweed, oxeye daisy, teasel,

lady's bedstraw, meadow cranesbill, field scabious, musk mallow, cowslip, red campion, greater knapweed, small scabious and bird's-foot trefoil.

The planting event was a resounding success and a thoroughly enjoyable experience. The children of AWS' staff created beautiful pictures of bees, butterflies, flowers and birds to create signage for the wildflower areas too.

The way forward

The examples highlighted have shown that Conservation Groups can provide a source of locally devised knowledge. Partnership working with the military, other organisations and industry partners can successfully initiate pollinator projects on the MOD estate. Large tracks of land are not needed to make a difference, small scale change makes an important contribution too. Even daisies and dandelions provide an important early source of nectar for bees weak from overwintering, so maybe think twice before reaching for the weed killer! In late autumn, ivy provides an excellent nectar source, helping bumblebees and honey bees to prepare for winter hibernation.

Conservation Groups are encouraged to assess the feasibility of the above initiatives in consultation with DIO's Conservation Groups Team and if necessary can bid for funding through the Conservation Stewardship Fund or Conservation Group Grant.

If MOD sites are interested in joining any of these schemes, contact can be made via the MOD Conservation Groups



Wildflower restoration at Fryston Country Trails © David Spencer, Groundwork

Team at DIO-ConservationGroups@mod.gov.uk.

The following authors have contributed to this article;

Stewart Guy & Helen Sheridan
FMC Cap

Nick Bentham-Green
Chairman
BIBBA

Viv Marsh
Founder
Praise Bee

Paul Evans
B-Lines Programme Manager
Buglife

Sarah Maiden
Environmental Manager
Ancala Water Services



Wildflower meadow restoration in the B-Lines © Paul Evans, Buglife



The poster by Sian Telor Joyce © Ancala Water Services

Facing Magwitch

The Rat Island prisoners



Skeleton of an adult male in an elm coffin © Harvey Mills Photography

"People are put in the hulks because they murder, and because they rob, and forge, and do all sorts of bad; and they always begin by asking questions" Charles Dickens, *'Great Expectations'*.

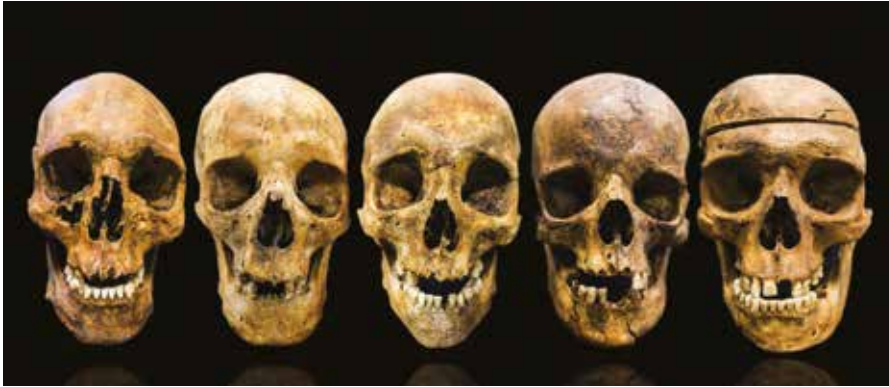
The tidal island of Burrow Island (colloquially known as 'Rat Island') between Portsmouth and Gosport has a wonderful strategic location overlooking Portsmouth Naval Base. The Royal Navy has been a central part of the city since 1194 and is home to almost two-thirds of the Royal Naval surface ships, including the new aircraft carriers. In the 18th and 19th centuries this vista was altogether more macabre with the rotting hulks of ships which were moored throughout the harbour and which held some of the most unfortunate members of society. This was the location of many of the prison hulks made even more notorious for being the home for the convict Abel Magwitch in *'Great Expectations'*. As a son of Portsmouth, Dickens would have been familiar with these brooding structures which featured in his later novel. We have documentary evidence for at least one convict, a 'Charles Morris Jones' from Aberystwyth who was

sentenced to 14 years transportation for theft from his employer. Charles died on a Portsmouth prison ship before his sentence was carried out and was supposedly buried on Rat Island. There were not only hulks for British malefactors (however minor the crime), some of the prison ships were specifically tasked to confine prisoners captured in the many wars fought by Britain in this age of Empire.

Local legend has it that those that died on the hulks were not afforded the dignity of a burial in a churchyard, but instead were disposed of in the muds of Rat Island. In the storms of 2014 (see Sanctuary 43) the skeletal remains of a number of individuals were exposed and recovered by an MOD-sanctioned team and so the local stories were proved to be true. But the stories did not end there. More of the



Former soldier recovering the remains of an adult male of Rat Island © Harvey Mills Photography



The skulls of five of Rat Island's men. The skull on the far right had facial reconstruction © Harvey Mills Photography

south eastern section of the cliff had eroded in the years following the first recovery work and this had left a tree overhanging the foreshore with an associated risk to the safety of anyone going onto the beach, even though this may well be trespassing!

The initial task was to remove the heavy limbs of the tree and then following that, to assess whether human limbs were revealed below it in the crumbling cliff. In May 2017 an Operation Nightingale team accessed the island to answer this question. Veterans working with Breaking Ground Heritage worked with Cranfield University Forensics Institute to excavate areas below the tree and were assisted in these endeavours by both 17 Port Maritime Regiment Royal Logistics Corps (enabling access to the island from the water) and by the Royal Military Police with their own investigative skills. The excavation worked around the tides and the team gently removed sands and gravel from rectangular features cut into the rock, features which were soon clearly seen to be graves. Each of these graves was examined by a veteran with an archaeology volunteer in support and with overall forensics assessment provided by Dr Nick Marquez-Grant.

As the graves were cleared it became noticeable that far from being random depositions in the mud, these burials had been afforded a degree of care in their placement. They were aligned east to west in classic Christian fashion and had been placed into the ground in elm coffins rather than simply thrown into the muds in their shrouds. The coffin wood and nails survived well in places and showed these entities to once have been fairly sturdy; a far cry from the situation suggested in the tale 'By Celia's

Arbour' written by Walter Besant and James Rice in 1878:

"Brave and honest soldier – there is the roll of musketry over his grave – God rest his soul! Down below, creeping sluggishly along, go the gangs of convicts armed with pick and spade. No funeral march for them when their course is run; only the chaplain to read the appointed service; only an ignoble and forgotten grave in the mud of Rat Island."

By the end of the excavation the team had found the skeletons of four men, with Wessex Archaeology photogrammetrically recording two of them. One of the bodies (numbered A7 in the fieldwork report) was especially fascinating in that it was clear that his body had been subject to a rudimentary autopsy with a craniotomy having been performed. Although there was nothing that could provide a precise date for these burials, the history and stratigraphy of the island is such that they must have been placed there in the late 18th or early 19th centuries, consistent with the clay pipes present along the foreshore and indeed with the evidence of clay pipe smoking exhibited in the teeth of the skulls of several of the men excavated. It is more than likely that the burial found in 2017 had been examined during the period known as the 'Enlightenment' but before the Anatomy Act of 1832. This may well be the attempt of an early surgeon, using very rudimentary techniques, to discover the cause of death; was it cholera, typhus, tuberculosis or one of the myriad other maladies suffered in this era? We shall never know if the surgeon discovered this and no traces of diseases were clear on the bones. These bones did however tell us more about the man. He was aged from 30-45 and was 1.70 - 1.76m tall.

Examining the isotopic signature present in his teeth told us that he hailed from the European mainland rather than from Britain. So perhaps he WAS a prisoner of war? There is, of course, the possibility that he was simply a man that emigrated to Britain and then committed a crime deemed worthy of incarceration on one of the hulks. For the most part, such prisoners were later transported overseas to Australia. The work was thus not yet able to finally answer the question of whether the burials were solely prisoners, or prisoners of war, or were a mix of both because two of the other isotopic signatures showed other burials to be of British people.

Having accomplished the assessment of the remains, the final work was to reveal what 'A7' would have looked like in life and a facial reconstruction was carried out by Facelab at Liverpool John Moores University. The result was striking. We are now able to look upon the face of a man who lived and died by the Naval base some 200 years ago. Perhaps not the face of Abel Magwitch, and perhaps not even someone who had committed any crime at all, but someone whose bones still can tell a story. Ultimately he and the other individuals recovered will be reburied and we will keep a watchful eye on Rat Island to see if erosion yields more of the people from the hulks.

Richard Osgood
Senior Archaeologist
Defence Infrastructure Organisation



Facial reconstruction of one of Rat Island's men
© Facelab, Liverpool John Moores University

Strategic Access Management and Monitoring on Thames Basin Heaths



Thames Basin Heaths' engagement event © Crown

The Thames Basin Heaths (TBH) is one of the most important wildlife sites in Europe. It is a network of heathland sites spread over the three counties of Hampshire, Surrey and Berkshire, covering 8,200ha. This ecologically rich island represents a fragment of an ancient landscape that once covered vast areas of southern England. The Heaths are collectively classified as a Special Protection Area (SPA), forming part of the European network of sites of international importance for nature conservation.

The Heathlands provide a home for some of Britain's rarest breeding bird species: Dartford warbler, nightjar and woodlark, all of which rely on the heathland habitat. The TBH are also host to a range of other wonderful and rare native wildlife species including smooth snakes, sand lizards and silver-studded blue butterflies.

The Ministry of Defence (MOD) has been present throughout the Thames Basin for over two centuries, currently owning over 50% of the TBH SPA. The land provides essential training ground for the military, with fixed ranges, driver training areas, terrain for the Royal Engineers to practice and much more. As with many other parts of the MOD estate celebrated for its important biodiversity rich landscape, it is this MOD ownership that has protected

these very special areas, preventing the spread of housing development or intensive agriculture.

Despite protection from significant landscape change the TBH SPA is under threat, largely due to a growing local population and limited outdoor green space. Increasing recreational pressure, fly tipping, dog fouling and arson all impact on the diverse range of important and protected species. The TBH Partnership Project was set up in an attempt to mitigate against these adverse impacts and to safe-guard the sensitive environment.

The Project, hosted by Natural England (NE), is a partnership of 26 organisations, including the Forestry Commission, RSPB and the Crown Estate. Wardens have been employed since 2015 to monitor visitor trends and engage with visitors and local communities, educating the Heaths' closest neighbours, promoting conservation of the protected area and its rare wildlife.

A key aim is to help ensure the Heaths can be enjoyed for generations to come. To complement this work, nearby green spaces have been either specially created or enhanced to provide



Participants on the MOD training day © Natural England

communities with high quality outdoor places to explore and enjoy, whilst easing recreational pressure on the more sensitive, protected heathland.

January 2018 marked an historic moment for the TBH Partnership and the MOD. On the 9th January Lt Col Dickie Bishop, on behalf of the Secretary of State for Defence and Andy Smith, on behalf of NE, signed a joint access agreement enabling TBH Partnership staff to warden areas of TBH SPA owned by the MOD.

The MOD are highly supportive of the TBH Project, however it was recognised that the MOD estate is a niche environment in which to work. Granting NE Wardens access to the MOD estate without providing means of communication or some form of security or safety briefing would prove disastrous. Consequently, a joint access agreement was important to ensure Wardens working throughout the estate were appropriately briefed on aspects of military training and engaged with the mechanisms of the Defence Infrastructure Organisation (DIO), thus providing safety to the Wardens, ongoing security of the MOD estate and creating easy lines of communication between all parties.

The agreement, drawn together by DIO's Senior Access and Recreation Advisor James Nevitt, has allowed the TBH Project to dramatically increase its reach, engaging with visitors and local communities, whilst enabling NE, the MOD and other partnership members to work together to enable the sustainable management of the MOD estate.

On signing the agreement Andy Smith, Area Manager for NE stated *"It is the*



The access agreement being signed © Crown



MOD training day highlighting debris munitions © Crown

culmination of five years' work which will help us to secure a winning solution for people and nature."

Focusing on key visitor hotspots across the TBH, NE Wardens interact directly with visitors, raising public awareness of the sensitivity of these special places and encouraging responsible behaviour by all. To help inform these face to face interactions the DIO/NE partnership provides better opportunity for information and messages to be shared between organisations and then the general public. Briefings from DIO Training Safety Wardens ensure TBH Wardens are fully aware of current site training requirements, training schedules and safety concerns. This important information can then be shared with the visiting public, raising awareness of the dangers associated with visiting the MOD estate and how to minimise risk. The Wardens act as a conduit for printed safety information, such as the Dog Walker guidance or 'Spot the Risk' cartoon. Produced by the DIO Access and Recreation Advisory team, these give national guidance, relevant to all Defence Training Estate. NE Wardens also act as extra eyes and ears across Defence Training Estate, quickly reporting anything dangerous or unusual back to the Training Safety Wardens.

The Agreement is set to continue until 2020, although it is hoped that these initial years will set firm foundations

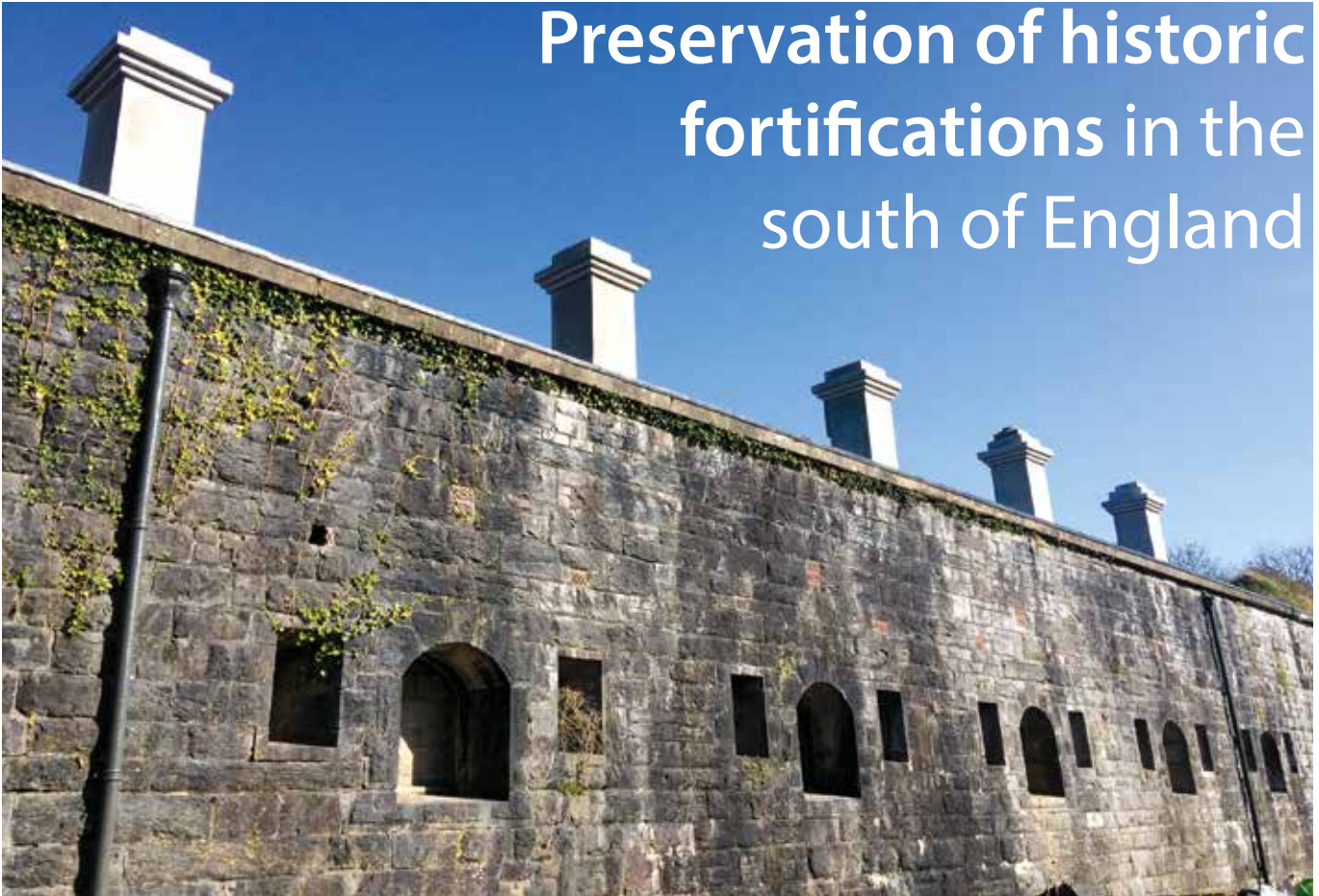
for a much longer working partnership. Monitoring of visitor trends will support a better understanding by DIO of how the Home Counties Defence Training Estate is used by the local community. Anecdote can be quantified with data which in turn should enable better resource allocation for estate management. For example, knowledge of how visitors are using sites may indicate a need to improve or create links with those locally alternative green spaces, created to reduce pressures on the more sensitive environments. Similarly, new or better directional signage could be installed to guide visitors to areas that will have a minimal impact on the environment or military training.

It is already clear that the presence of the enthusiastic TBH Wardens will be an asset to the Defence Training Estate and their on the ground support has been warmly received by DIO's own Training Safety Wardens. In addition to widening visitor awareness of site risks, it is hoped that the project will continue to support the optimum use of the Defence Training Estate, protect the natural environment and ensure that those areas accessible by the public are safe.

James Nevitt

Senior Access and Recreation Advisor
Defence Infrastructure Organisation

Preservation of historic fortifications in the south of England



Scraesdon Fort's re-rendered chimneys © Steffan Jones, Landmarc Support Services

The southern England MOD estate includes many historic buildings. Scraesdon Fort, located near the village of Antony, is one of several forts in south east Cornwall which, alongside Tregantle Fort, formed a ring of defences to protect Plymouth Sound and docks from enemy naval attack. Both forts are recognised for their national importance and are dual designated as both Scheduled Monuments and grade II listed buildings. To ensure the heritage assets remain protected and continue to serve as important military training facilities, the Ministry of Defence (MOD) has invested heavily over the years in their conservation.

Landmarc Support Services (Landmarc) is the Defence Infrastructure Organisation's (DIO) strategic partner for managing the national Defence Training Estate and has undertaken work to maintain these monuments.

Scraesdon Fort

Scraesdon Fort (built in 1868) is currently on the Heritage at Risk Register (HARR). As part of an on-going commitment to the conservation of

historic fortifications across the UK, DIO has worked in partnership with Landmarc to repair the leaking flat roof to the front elevation of the fort.

The works, planned and managed by Landmarc, were funded by the MOD Conservation Stewardship Fund and comprised a complete renewal of the asphalt roof, repairs to the concrete sub-structure and to the open guttering. The fort was fitted with new rainwater down-pipes and hoppers, the vaulted brick ceilings in the rooms below were re-pointed and the six chimneys were re-rendered.

By maintaining this historic and valued structure, Landmarc and DIO have made huge advances in ultimately removing the building from the HARR. The works have ensured that the fort is conserved for years to come and enabled it to continue to be used as a safe and strategic military asset.

Tregantle Fort

Tregantle Fort was built the same year as Scraesdon Fort and is also on the HARR. The Keep, lying within the fort confines

on the eastern side, was in a particularly poor state of repair and is specifically mentioned in the HARR.

Over the last decade several projects have focused on managing and preventing further deterioration of this historic structure. Initially the asphalt roof was replaced, followed by the windows and doors. Most recently, Landmarc project managed the conservation and replacement of the interior floors and joists.

An original feature of the outward facing rooms was a sloping wooden floor facing towards the exterior window. This unique feature was designed to minimise the recoil from the guns used in these rooms. Historic England permitted the floors to be lifted in favour of reinstating the level flooring which was added some time later, with an example of the sloping floors retained in one of the rooms of the Keep.

Having lifted the floorboards, the contractors could inspect the condition of the original joists. If a joist was

damaged at the wider end of the outer room, it was cut down and used to replace a rotten joist in the narrower end of the inner room, thus conserving the original fabric of the Keep. Where this was not possible, new timbers were sourced, cut to the same dimensions as the originals and installed. This work has significantly improved the fabric of the fort.

Martello 14

Martello Towers, sometimes known simply as Martellos, are small, round castle-like fortifications. Along the south coast of England 103 were built, with 74 in Kent and Sussex alone. These were constructed between 1805-1808 to resist potential naval attack or invasion during the Napoleonic Wars. The towers stand approximately 30ft high with walls 13ft thick on the seaward side. Each tower was garrisoned by an officer and 15-24 men, with a powerful cannon on the roof.

The Martello Towers in Hythe, on the south coast of Kent, are located on the MOD estate. Although the Kent towers never saw active service during the Napoleonic Wars they are a fascinating part of the UK's military history and a significant number still survive. After the Napoleonic Wars they were used as lookouts for smuggling activities. The towers were used as recently as the Second World War when they were rearmed with anti-aircraft guns.



The re-pointing works completed at Martello 14
© Landmarc Support Services



Martello 14 Hythe Ranges, Kent © Landmarc Support Services

There are three Martello Towers on the shore within the boundaries of Hythe Ranges on the MOD estate, two of which are in reasonable condition, but location and age were taking a toll and the structures were in decline. As part of Landmarc's National Training Estate Prime (NTEP) contract, all listed buildings on the MOD estate are subject to inspections every four years. These surveys and reports are carried out by a team of experts from Savills, on behalf of Landmarc, to identify the current condition of the buildings and suggest maintenance works required.

The quadrennial reports for Martellos 14 and 15 showed that considerable work was required to remove damaging vegetation, to re-point and consolidate brickwork, to ventilate and prevent water ingress, as well as to manage a pigeon problem which had left considerable quantities of damaging guano inside the structure.

The key driver was to ensure that Martello 14 and its neighbour, Martello 15, are not included on the HARR. The MOD's Conservation Stewardship Fund provided £80,000 to fund the project, however due to the high cost of working on listed buildings it was decided to focus on Martello 14 in 2017-18 and to tackle the similar issues on Martello 15 in 2018-2019.

There were many individuals and organisations involved in the successful

development and delivery of this highly complex project. All the elements had to come together successfully at the same time to ensure the scheme was delivered on plan and according to specifications.

The very nature of historic buildings is that if they are not managed and maintained properly they deteriorate quickly, meaning the potential costs can escalate rapidly. It is therefore essential to continue to repair buildings such as Martello 14 to avoid substantial repair works and bills in the future.

The NTEP contract held by Landmarc includes over 70 listed buildings and the associated quadrennial inspections inform the management and future funding requirements of some of the nation's most valuable heritage. This allows accurate forward planning and budget forecasting. When it comes to listed buildings and ancient monuments, a stitch in time really does save nine.

Duncan Glen
Rural Estate Delivery Manager
Landmarc Support Services

Steffan Jones
Rural Manager
Landmarc Support Services

Penhale peregrines a battle of the sexes



A breeding female © Peter Welsh

Peregrines hold a breeding territory on the coastal fringe of the Penhale Training Area and this is one of two breeding pairs resident on MOD land in the north of Cornwall. The peregrines are monitored under a Schedule 1 License.

Over the past five years the birds at Penhale have given a valuable insight into previously undocumented breeding behaviour within one particular pair bond. During this period the pair returned to the same nest ledge (an old raven nest) and successfully raised 12 young to fledging from 19 eggs. However in their interactions they displayed a complete role reversal from the more usually understood dominance within a pair bond. In this case the male was in almost total dominance, a behaviour that was observed until the winter of 2017/18 when the adult male failed to return to the site.

As a rule, it is the female that dominates within the pair from the outset, often with a role reversal later in the breeding cycle. In this case the female normally laid a clutch of four eggs with the final egg being laid at an interval of four to seven days after the third so that when incubation started with the third egg

there would be a delay in the hatching of the fourth.

The female allowed the male to dominate to the extent that he incubated the eggs during hours of darkness, hatching eggs in each of the five years. The male hatched the first two or three synchronous eggs within a few hours, despite some often elaborate and inventive ruses by his mate to get him to leave. In an effort to draw him off the eggs, the female invented defensive displays of being mobbed by a raven and herring gull, would fake cache defence, offer food or solicit for copulation. All these tactics failed and

he would rise from the newly hatched young and leave the ledge only when he was satisfied that no remaining eggs were at imminent hatch point.

Further behaviour divergence was shown, with the male dictating for the first few days when first and subsequent morning feeds were given to the newly hatched chicks. He also fed very young chicks, whereas in most other cases the females would not normally tolerate this during the first week after hatching.

As the female allowed the male to dominate during the breeding season, it could suggest that she was of a somewhat timid character. This is however not the case for this particular bird. She would regularly challenge any intruding female with apparent ease, to the point that birds instantly recognised her dominance as the resident territorial female. During observations of several intrusions by wandering females all were moved on without chase or blows being struck. She would simply wait until the intruding bird perched and then fly directly at it in a behaviour known as perch displacement. This is a behaviour used by breeding females to enforce dominance over their respective mates after ledge display and copulation.

The female has now recruited a juvenile mate and so the study will focus on any changes in attitude to the adult female and male dominance.

Peter Welsh
Volunteer
South West Peregrine Group



The Penhale pair demonstrate ledge display © Peter Welsh

Collaborative project brings financial and carbon savings to RAF Marham



Members of the collaborative project team at the generating plant © Crown

Since February 2015, Defence Infrastructure Organisation (DIO) Utilities has been working with the Crown Commercial Service (CCS) Utilities & Fuels Category, DIO's electricity supplier EDF, and EDF's supply chain partner Future Biogas, on a project for EDF to supply baseload power to RAF Marham. The electricity provided had to be sustainable, green and provide financial savings over grid-imported electricity. Finally, the project had to be carried out under the terms and conditions of the CCS Half-Hourly Electricity framework agreement, as well as the model contract signed between EDF and DIO.

The generating plant, built by Future Biogas, is situated approximately four miles east of RAF Marham, and generates 4.5MVA of electricity every day. The plant had initially been generating and exporting electricity to the National Grid, via the local Distribution Network Operator. The plant is fuelled via multiple biogas-powered generators, which are fed from an on-site Anaerobic Digestion (AD) plant in which a fermentation process takes place fed by locally grown crops. The gas produced from the AD is then collected and is used to power multiple gas generators, producing the electricity. Additionally, the waste residue from the AD process is dried and

used as a fertiliser on the local fields. A truly green sustainable solution which benefits the local economy.

The local DIO Area Utilities Manager, Steve Perry, established a team in 2016 which included military personnel, civil servants and the private sector, to undertake a feasibility assessment of the project. This investigated all aspects of the proposal, and determined that the supply of clean energy from the AD plant to RAF Marham would achieve the following tangible benefits:

- Annual electricity savings of £0.29m per year (Net present value of £5.4m)
- Reduce carbon emissions by 14,000 tonnes of CO₂ annually, contributing to the MOD's sustainable development strategy and delivery plan 2011-2030
- Increase power resilience at RAF Marham by providing multiple pathways to electrical resources
- Deliver a capital cost neutral and low risk project for DIO, as there are no costs to DIO for the build, operation, and maintenance of the plant, or the connection to RAF Marham

The feasibility study recommended that the project should be pursued and

therefore a business case was developed and approved by DIO in October 2017.

Due to the Official Journal of the European Union (OJEU) procurement regulations, DIO could not negotiate directly with the source energy supplier, but had to discuss proposals through the electricity supplier. Crown Commercial Services Utilities & Fuels Category are currently developing a new commercial route to market. This new agreement will enable all public sector organisations to deal directly with the energy generators rather than electricity suppliers. The British Army is already working with CCS on projects that will use and benefit from this new commercial route.

EDF and its supply chain partner have commenced with the planning and installation phase, which will culminate with final connections to RAF Marham being completed in 2018. This project is a catalyst for encouraging other parts of the MOD and the wider public sector to engage in similar initiatives, following in DIO and RAF Marham's sustainable footsteps.

Steve Perry
Area Utility Manager
Defence Infrastructure Organisation

On the right track – making a tank and commemorating soldiers



The replica of tank 796 © Harvey Mills Photography

During World War One (WW1), on the morning of 11th April 1917, eleven Mark II tanks slowly trundled into action over the fields of Bullecourt in northern France as part of the Battle of Arras. Soon, nine of them were destroyed by the German artillery and infantry and half of the tank crews involved were killed. 100 years later, a team of British military veterans on the Operation Nightingale programme set about ensuring that the role of these crews were suitably commemorated.

The Heritage Lottery Fund gave a grant to Breaking Ground Heritage, the charity which Operation Nightingale asked to manage the project, to construct a 2:3 scale replica of tank 796. This particular vehicle, commanded by 2nd Lt Skinner, was one of the eleven tanks at Bullecourt, though unusually all of its crew survived the battle – something which led to 2nd Lt Skinner being awarded the Military Cross. The original tank weighed 28 tonnes, but the replica was to be substantially lighter as it was to be constructed from wood – in the same fashion as many of the decoy tanks made in WW1. The team intended that this tank would visit history festivals, schools, and other commemorative events and be something which could be moved by hand, by the soldiers that built it.

The team visited the Tank Museum in Bovington to take photographs of the only surviving Mark II tank in the world. They had the additional benefit of some archaeological knowledge, as a group of them had just returned from an excavation at Bullecourt where components of the original tank 796 had been discovered, just by the shell crater which had been its final resting place. The prize discovery had been a two-metre length of tank track, complete with some of the original paint work. The colour? British Racing Green – perhaps ironic given the maximum speed of four miles per hour reached by the original tank. Armed with this information, the creation of the replica could begin.

The project build leader was Andy Robertshaw, the historic advisor to Stephen Spielberg for the film 'War Horse' no less, and he worked with the artist Peter Birkett to create a suitable model and template for the build. The engineering skills of the military personnel on the programme quickly came to the fore as this plan was adapted. The wooden skeleton of the replica tank soon grew, much to the amazement of the residents of the Help for Heroes Recovery Centre at Tedworth House in Tidworth, Wiltshire which was project headquarters. After

only a fortnight the tank was complete and the replica was wheeled onto a 'tank transporter' to begin its tours of Wiltshire. Its first 'battle honour' was the Chalke Valley History Festival near Salisbury where many of the comments were to express surprise that this was made of wood and not, in fact, armoured. The military personnel supporting the presentations, including former Royal Tank Regiment soldiers, were able to discuss the history of 796 and of the crews involved from 1916 to the present day. After another mission to Salisbury Cathedral to support SSAFA the team took the tank to nearby Nursteed School in Devizes.

Giving the children 'tank driving lessons' on the school playground and explaining roles of the soldiers in the war, on both sides of the wire, as well



The model of the build © Harvey Mills Photography

as the archaeology a century later was a rewarding experience for pupils and veterans alike. Some testimonials from the Year Six pupils illustrate how much they learned through this experience;

"Firstly, I loved the tank. Then we got in the tank. I thought I was going to faint because I was so excited!" (Rowan).

"Thank you so much for coming in and telling us tonnes and tonnes of facts about WW1 I loved it. I enjoyed riding the tank, I found out more about tanks and all the international trenches... it was by far the foremost best school day ever. Please come back again!" (George).

"The tank was great I loved being the driver because the commander tells you what to do – then you tell the messengers what direction to go and they tell the gears people to turn the right direction. I learnt a lot, thank you for teaching us. Who built the tanks? Who said to make the tanks? Was it a good idea to make them? The tank was strong" (Taylor).

The tank "looked so realistic. When we went in it was cool – I thought it would be easy to drive but it was very hard. We all had a go at different stations. My favourite part was the pushing but it was very hard. It must have been very uncomfortable with all that steam and noises in WW1" (Reuben).

The experience was clearly educational with the pupils learning a great deal about history, science, maths and foreign languages in an environment different



Loading the tank onto the 'tank transported' © Harvey Mills Photography

to the normal school day. It also perhaps revealed some secrets for the parents:

"Thank you very much for the sensational day you brought to our school – we enjoyed it very much. I was enthralled by every word you said about the war. Everything influenced me to go on and learn more about WW1. I enjoyed the tanks most – I loved being in charge of the guns because you get to destroy things and I love destroying things (especially my brother's Lego creations)" (Amelia).

The tank has become a feature of local commemorations of WW1, including for Cambrai Day (the major Battle Honour of the Royal Tank Regiment) at Westdown Camp and for Armed Forces Day 2018 in Trowbridge. Given that the Royal Tank Regiment is now based in Tidworth this is most appropriate.

For the soldiers involved in the creation too, this exercise had been valuable: *"I came into this project low in confidence and having been quite isolated for a long time. The team at Breaking Ground Heritage made me very welcome and instantly like a part of a great team. I was given a task and grew in confidence, having instantly made friends with other veterans, staff and venerated professionals within the heritage field. Seeing something come to life from a concept on a piece of paper, through to a 2:3 size replica WW1 tank you now see before you, was both immensely challenging and rewarding. The pride I now feel having achieved this feat with my new friends, has given me greater confidence and belief in myself" (Anonymous, British Army).*

As custodians of so much military heritage and ethos, it is of vital importance that the stories of those men and women that fought in WW1 are told. Although none of the combatants are now alive, there are still so many traces in the landscapes of the MOD estate and the memories of those lives can still be perpetuated through such studies. Archaeology continues over in Bullecourt, with more tank discoveries being made – yet the build of the replica of 796 has also been important in creating memories and for the veterans of recent conflicts to discover new capabilities and to make new and lasting friendships.

Richard Osgood
Senior Archaeologist
Defence Infrastructure Organisation



The tank being painted at Tedworth House © Harvey Mills Photography

Poaching patrol – on foot in the Malawian bush with the British Army



The Liwonde Wildlife Reserve © Lt Col Tim How

It is before dawn and several groups of Land Rovers and motorbikes are making their way through the darkness down dusty tracks towards the Majete and Nkhosakota wildlife reserves in Malawi. In the gloom the headlights catch the dust and occasional cyclists, bikes piled high with goods, unsteadily making their way to work. The rover teams enter the reserve and split up, heading their respective ways deep into the African bush. As dawn breaks the tracks run out and nature takes over, the groups stop and men in combats, lugging rucksacks and carrying machine guns get out and go into all round defence. The vehicles move off, and the men stay silent and still watching and listening. Then, with a low whistle and short hand signal they move off into the bush. The counter-poaching patrols are operational.

For three years the British Army has been part of the UK's efforts to tackle the illegal wildlife trade with commitments in the Gabon and Kenya. This year, following a successful pilot in 2017, the Army expanded its efforts with the deployment of an 18 strong counter poaching training team to Malawi. It is now these soldiers, alongside the Malawian Park Rangers, who move stealthily through the bush, tracking animals, removing snares and traps and monitoring for all signs of poaching.

This initiative is the first step in a partnership between the UK Government, the Government of Malawi and African Parks (a not-for-profit organisation committed to the long-term preservation and management of several wildlife reserves across Africa). This sees the MOD, Department for

Environment, Food and Rural Affairs (DEFRA) and the Department for International Development (DFID) work together with partners in Malawi as part of a comprehensive package that fights back against the illegal wildlife trade.

During counter-poaching patrols the soldiers and rangers work together in teams of three with the soldier providing mentorship in tactics, first aid and communications, and the rangers sharing their incredible bush-craft and tracking skills. The teams deploy at first light and patrol throughout the day. At dusk they will cook tea and then in the rapidly falling darkness move to an area they deem low risk from animal encounters and bed down for the night. These patrols last several days and are a visible deterrent to would be poachers as well as finding and removing the grim

tools of poaching; thick wire snares, brutal iron traps, and crude spears, knives and clubs. On their return to base there will be a thorough de-brief and intelligence download – this will allow law enforcement agencies to follow up any leads that target the poachers. 2017's successful pilot in the Liwonde Reserve saw over 350 snares and traps removed, nine poacher camps smashed, 11 poachers arrested and convicted, and three animals rescued (including one elephant). One year on, Liwonde has enjoyed its first year without a rhino or elephant being lost to poaching.

Rhino tracking is also a key part of conservation. In addition to the deterrent value, the rhinos are identified and tracked by their collars, and observed to confirm they remain in good health. For this the tracking teams need to approach on foot, ever vigilant to the wind direction, their own movement and the temperament of the rhino. Rhinos are among the most dangerous animals – with great hearing and sense of smell, but poor eyesight and usually grumpy. The experience and skill of the rangers is key; they have expert knowledge of the bush and wildlife, and employ hard won skills to ensure they can get within 20m of a rhino while keeping themselves and the



3 RIFLES and a Park Ranger inspect spoor by a dead water buffalo © Lt Col Tim How

animals safe. But even this requires the ability to be able to climb a tree at very short notice and very quickly!

But joint Army-Ranger counter-poaching activity is not the whole story – there is more than one front line against poaching. Engagement with the communities surrounding the reserve, and understanding their situation is key to finding an enduring solution to the illegal wildlife trade. This is where African Parks, DEFRA and DFID work together with the Malawian authorities

to stimulate alternative, sustainable livelihoods, such as bee keeping, and fund rehabilitation programmes for reformed poachers, so enabling them to contribute to local economies and become community role models. Further incentivisation to resist poachers and poaching comes through healthcare support such as anti-malaria initiatives and primary healthcare, and improved fencing and responsibly sourced fuel reduces both animal-human conflict and competition for natural resources. The UK's commitment



A joint counter poaching patrol in Majete Wildlife Reserve © Lt Col Tim How



Up close with elephants in the Liwonde Wildlife Reserve © Lt Col Tim How



3 RIFLES and Park Rangers on rhino patrol at dawn © Lt Col Tim How

has recently been restated as Minister for Africa, Harriet Baldwin, visited the region and experienced tracking first hand and met with local communities and African Parks, she also announced an £1 million aid package to improve the lives of people living next to national parks.

This deployment into the Malawian bush is an incredible experience for everyone involved. It is a long way from home, and requires some austere living and tough patrolling...but the rewards are extraordinary. Daily the soldiers find themselves up close and very personal with some of Africa's most incredible beasts including lion, elephant, water buffalo, hyena and rhino. They are learning tracking and bush skills from the very best, and picking up some rather unorthodox techniques (finding the best tree to climb in a hurry...who knew that would be so important one day). They work with local communities around the park and even their physical training sessions have curious impala, nyala and baboons looking on as they conduct circuit training among the baobab trees. They do all this in the knowledge they are making a difference, both to the fight against the illegal wildlife trade and more widely helping preserve natural habitats that would otherwise be lost.

Lt Col Tim How RTR
SO1 Campaigns
Directorate of Defence Communications



The park boundary – where nature is reclaiming the bush from man's encroachment © Lt Col Tim How

Ancala Water Services – keeping it clean



The mouth of the Porth River reaches the sea at Porth Beach © Ed Wakefield Ancala Water Services

Royal Air Force (RAF) St Mawgan sewage treatment works discharge into a tributary of the Porth River which reaches the sea at Porth Beach, Cornwall. Ancala Water Services (AWS) operate this sewage treatment works under Package A of Project Aquatrine, a 25 year partnership to deliver water and waste water services to the Ministry of Defence (MOD).

The 9km² stretch of coast between Kelsey Head and Trevelgue Head at Porth Beach was designated in January 2016 as the Newquay and Gannel Marine Conservation Zone (MCZ). There are 50 MCZ around England's coast and similar schemes operate in Wales, Scotland and Northern Ireland. A MCZ protects marine wildlife, geomorphology, geology and habitats and helps contribute to the Government vision of productive and biologically diverse oceans and seas. The Newquay and Gannel MCZ is home to species such as the rare giant goby, a fish native to the coastal marine and brackish waters of the eastern Atlantic and provides a variety of habitats such as sandy beaches, rocky shores, coastal saltmarsh and estuaries, all of which support thriving ecosystems.

The water quality along the coast is monitored during the water bathing season by the Environment Agency (EA) to ensure compliance with the Bathing

Water Directive. Water samples are taken by the EA to ensure standards are maintained. AWS has been working with the EA for several years to improve the quality of effluent discharged from RAF St Mawgan's sewage treatment works.

The sewage treatment works only receives effluent from RAF St Mawgan. Treatment of this effluent is completed through settlement of solids and biological action in the percolating filter beds on site. This process produces sludge and final effluent which is disposed of off-site. The environmental permit held by AWS includes conditions for levels of Biochemical Oxygen Demand, ammonia and suspended solids discharged into the water course together with a limit for the volume of water which is treated and discharged from the sewage treatment works.

AWS has invested significantly in numerous improvements to the sewage treatment works. These include the installation of new arms for the filter system to increase distribution of the effluent across the percolating filter beds and therefore advance the effectiveness of the treatment. The syphon system delivers the effluent to the percolating filter bed. Improvements mean the effluent is delivered in the right quantities and frequencies to the filter bed, providing the best chance of achieving effective biological treatment.

An MCerts flow meter has been installed so that the volume of water being treated can be accurately recorded. This information is being shared with the EA and indicates the flow rates are high. AWS are therefore embarking on an infiltration study across the site to determine if and where there is surface or groundwater ingress into the sewerage system. Decreasing the amount of infiltration will decrease the flow rate through the sewage treatment works and will contribute to improved compliance at the final effluent discharge point. This study and the recordings from the MCerts flow meter may inform future amendments to the environmental permit.

The infiltration and flow monitoring is ongoing. If this results in the EA tightening the permit conditions, AWS may have to invest once again in an upgrade to the treatment assets. AWS care about the environment and so will do what is needed to achieve compliance and reduce the impact on the precious receiving environment.

DIO Aquatrine Technical manager Ian Burtenshaw said *"This report is another example which highlights the levels of effort put into the protection of our environment under the Aquatrine PFI. The MOD's water and wastewater networks are in the capable hands of our Industry experts (in this case Ancala Water Services), who continually ensure that our water and waste water activities meet all the required standards."*

Sarah Maiden
Environmental Manager
Ancala Water Services



The new filter arms on the sewage treatment works
© Ancala Water Services

Designing tents & managing munitions Tackling waste in the supply chain



Ammunition containers palletised and loaded © Crown

The MOD operates in an increasingly financially and resource constrained environment, whilst continuing to deliver the most effective military equipment and support solutions to front line users. This includes understanding and addressing key sustainability challenges.

The MOD continue to look at where sustainable solutions across the Defence acquisition cycle can be exploited. This includes embracing new and emerging technologies in equipment design and production, influencing behaviours and specifying sustainable requirements for equipment, support and infrastructure. This approach offers an important range of benefits to military capability, including cost reduction, energy efficiency, resilience to climate change, material recovery, recycling and also achieving enhanced equipment longevity, mission endurance and equipment interoperability. The following case studies illustrates this approach.

Sustainable munitions packaging

Munitions packaging is a fundamental part of ensuring munitions safety, life

preservation and protection from the environment. Designing munition packaging can be costly due to special features and quality required. To reduce cost and minimise waste it is common for munition packages to be refurbished and reused many times. Usually crafted from metal, wood or robust plastic, general munition containers simply require redesign of the inner configuration. The H83 steel ammunition container is used widely across Defence to hold a range of ammunition natures including 5.56mm, fuse assemblies and explosive components for larger weapons and torpedoes. Annually 500,000-800,000 H83 containers are refurbished and reused.

Complex weapons often require bespoke new packaging designs although some containers can be refurbished to take newer variants, especially if there are no significant changes in missile design. For example the Advanced Short Range Air-to-Air Missile Block 4 is being upgraded to Block 6, with the containers reworked to house the new munitions. This will significantly reduce the environmental impact, decreasing overall raw

material usage and cutting the volume of packaging waste without compromising safety and quality requirements. Whilst complex weapons packaging has a longer life cycle than smaller containers like the H83, it can also be returned for reuse. The recovery and refurbishment of different types of munitions packaging over the procurement of new stock has significant cost savings for the MOD.

Defence Munitions facilities are working to establish key sources of waste, so that this can be fed back to procurement teams and subsequently to suppliers and manufacturers. Future work will assess the viability of using recyclable materials for packaging and measure the impact of current materials such as reinforced polymers.

Defence Equipment and Support (DE&S) will continue to seek sustainable solutions that support the Armed Forces.

New design for General Service tents

General Service tents are an important military requirement for UK training and overseas operations. The MOD's



Ammunition containers in use © Crown

existing canvas tents have been in service for many years, however the canvas is no longer available. This gave an opportunity to improve the existing design, investigate modern materials and manufacturing techniques to make the system supportable for the future.

The old cotton tents absorbed water, were prone to leaking and required regular re-proofing. The new PVC tents are waterproof and quick drying making them easier to take down, transport and store. Dirt can be washed off and damage repaired in the field. The seams are welded (previously they were stitched) which eliminates the risk of leaking. PVC does not need to be re-proofed therefore reducing the through life maintenance burden, which allows soldiers to concentrate on their operational duties and results in savings.

PVC is stronger and due to the UV and mildew resistant properties the lifespan is significantly extended. The material also complies with environmental standards so can be safely disposed of at the end of product life.

The new tents are white on the inside, providing better light reflection and reducing reliance on artificial lighting. Depending on the operational environment insulation liners can be added, helping to reduce energy consumption. This is an important consideration as the costs and resources involved in providing energy and power to forward operating bases can be a significant challenge.

Whilst the cover material has been modernised and the frame upgraded to improve both strength and durability,

reverse compatibility with all existing in service equipment has been maintained.

The through life support of the new design is expected to significantly reduce the requirement for replacement tents and provides a valuable example of how the DE&S Operational Infrastructure team is driving forward sustainability and environmental benefits across the estate.

Lauren Jenkins
Weapons Operating Centre
Environmental Liaison Officer
Defence Equipment & Support

Jeannette Morris
Modular Domestic Accommodation
Service Delivery Manager
Defence Equipment & Support



External and internal view of Mk4 tent © Colpro-Utilis

Excavations on the edge of the world



St Kilda is a UNESCO World Heritage Site with dual status © Crown

St Kilda is one of the most remote places in the UK and a recent archaeological excavation by GUARD Archaeology has shed light on the agricultural methods and structures built by the islanders. The archaeological work was commissioned by QinetiQ ahead of the development of new sustainable MOD accommodation blocks. St Kilda consists of an archipelago of four islands, Hirta, Dùn, Soay and Boreray and lies about 40 miles off the western coast of Scotland. Uniquely in the UK, the islands have a dual World Heritage Site status for both historic and ecological interest. There are only 38 dual World Heritage Sites across the globe making St Kilda a place of significant cultural importance. Not only does Hirta have the highest sea cliffs in the UK but all the islands have an impressive assortment of seabirds along with a unique species of both wren and wood mouse.

Alongside the biodiversity present on St Kilda are the archaeological remains that stretch back into prehistoric times, with evidence for Neolithic farming and tool making across the islands. More recent remains that survive today on Hirta are a row of cottages that were built in the mid-19th century by the land owner to provide the inhabitants with modern dwellings, along with an associated schoolhouse, manse and

church to support the community. Previously, the islanders had lived in what were known as 'Black Houses' which were rough built stone structures that lacked basic sanitation and were used to shelter animals as well as the family! Also on the island are over 1,200 cleits; stone built structures used by the islanders as storage and for drying peat blocks used in their fires. Many of these are designated as Scheduled Monuments, which means they are protected by law and are maintained by National Trust for Scotland volunteers, who repair any that have collapsed and conduct general upkeep on the island during the summer.

For the original islanders, the core source of food was predominantly seabirds, mainly fulmars and gannets. The eggs and young birds were harvested from the sheer cliffs of the smaller islands in dangerous expeditions. Despite being surrounded by water the St Kildans rarely fished due to quickly changing weather and unpredictable seas. The 19th century saw the arrival of the first tourists to the islands, who were interested in seeing one of the remotest parts of the UK, something which continues today.

The First World War had little impact on the islands, except in 1918 when a



The 'street' and the 19th century cottages © Crown

German U-Boat surfaced close to the village and shelled the radio mast that had been built in 1913. The isolated community that existed on St Kilda did so until 1930 when life became unsustainable for the remaining 37 islanders who were evacuated to the mainland. The islands then remained uninhabited for the next 27 years.

In 1957 the MOD leased land from National Trust for Scotland for the construction of a missile tracking base on Hirta due to the island's location, which allowed uninterrupted radar coverage. These structures built included accommodation blocks, offices, a power generator and other assorted support buildings for the tracking station. A recent modernisation programme was implemented to reduce the footprint of the MOD buildings and create sustainable and sympathetic structures to house the QinetiQ and MOD staff who are now the only inhabitants of the island. This development prompted an archaeological excavation of the footprint of the new buildings and in 2017 and 2018 a team of archaeologists from GUARD conducted the largest open area excavation to date on the island.



The excavations revealed a stone lined drain © Crown

Other archaeological work has been conducted on St Kilda, but it has generally consisted of small exploratory digs designed to answer a specific question about certain structures, so the recent work was a unique opportunity to understand the development of the island. The dig



A cleit overlooking the modern MOD base © Crown

revealed the remains of the demolition phases of the previous MOD buildings that were removed between 1969-70. These included ablutions blocks, a gymnasium, Nissan huts and ratings accommodation that were originally built in 1957 by the Air Ministry Unit.

Evidence for early human habitation of the islands came from finds of flint, although none of it was worked. Flint is not a natural stone on the islands, so its presence suggests that it was imported at some point in the past. The archaeologists also recovered over 350 pieces of Craggan Ware pottery, this type of pottery can be dated from the prehistoric through to the 19th century, so although it is difficult to date, it may also indicate early habitation on St Kilda. Possible tools made from stone were also identified in the excavations, these included hammers, pounding and rubbing tools, and hoe blades. The latter indicating the agricultural methods used on the islands. Similar stone tools have been found dating from the middle Iron Age on St Kilda, demonstrating that some of these tools could be very old indeed.

Agricultural soils were also identified during the dig and these may be the remnants of one of the more peculiar practices that were carried out when the St Kildans lived in the Black Houses. Over winter the population would accumulate ash from the fire, mix it with dirty water and animal manure and spread this over the floor of the house. Over time this material could grow up to a height of four feet and the householder would have to clamber over it to get into the house! In the

spring the accumulated soil was then spread on the fields as a nutrient rich fertiliser. The method of accumulating the fertiliser inside the Black Houses was one of the driving forces behind the construction of the new cottages in an effort to give the islanders a more sanitary existence.

An old structure which may have been a possible water channel was identified in the archaeological excavation. The channel was lined with large stone blocks and appears to match a stream channel that was recorded on a 1957 map of the island. The channel may have been used as an effort by the islanders to reduce surface water. The lower part of a similar water channel still exists today close to the modern MOD buildings, with water still flowing through it.

The excavations by GUARD have revealed a large amount of unprecedented information about the island and the development of the common ground area close to the mid-19th century village. The importance of these archaeological findings, on such an interesting and remote part of the UK, demonstrates the MOD's commitment to safeguarding the historic environment and has provided an unique glimpse into the daily lives of the St Kildans. The accommodation development work was managed for QinetiQ by Jordan Porter and the archaeological site supervised by Alan Hunter Blair and managed by Warren Bailie for GUARD.

Alex Sotheran
Archaeology Advisor
Defence Infrastructure Organisation

Considerate construction on St Kilda



Maintaining bio-security of deliveries to site is an essential requirement of the brief © Guard Archaeology Ltd

The existing radar station buildings at Hirta, St Kilda have reached the end of useful life and a comprehensive redevelopment of the station, operated by QinetiQ, is underway.

Galliford Try International (GTI) were entrusted to deliver this project, working with Hugh Broughton Architects. The team drew on experience gained from building similar facilities in remote, sensitive environments with challenging climates such as Halley VI Antarctic Research Station for the British Antarctic Survey. GTI also undertakes considerable work for the MOD in the Falkland Islands.

The scheme comprises of a accommodation building for staff and a new energy centre. The new facilities are designed to minimise impact on the sensitive environment, merging into the existing landscape far better than the previous buildings and ensuring a sustainable future for the MOD's presence on the island. The project promotes environmental excellence through the introduction of numerous sustainable features, including a bespoke sustainability Building Research Establishment Environmental Assessment Method framework.

The accommodation building is being constructed on precast concrete foundations to minimise excavation and potential impact on the island's archaeology, as well as facilitate its removal at the end of life span. The lower segments of the new buildings are curtained with stone to blend into the St Kildan landscape as well as offering an architectural echo of the nearby cottages and cleits of Village Bay. The buildings are clad in larch boards which will weather with time and merge with the surroundings. Larch was selected for its aesthetic quality and performance close to the marine environment.

The superstructure of the accommodation building (floor, walls and roof panels) is formed in cross laminated timber, helping to achieve good levels of air tightness. High levels of insulations have been specified to achieve U-Values more than current building regulations. U-Values measure how effective an insulator elements of a building's fabric are. The lower the value, the less energy needed to heat the building. The windows are triple-glazed to achieve a U-Value of 0.7 W/m²K.

Roofs to both buildings feature indigenous soil and turf to minimise

visual impact when seen from above and avert the need to import foreign soil to the island. John Hammerton, Operations Director for GTI, explained the reasons for the latter *"it is critical that no new invasive species of flora or fauna, such as rats, are introduced to preserve the existing ecology, especially the ground nesting birds. We employ a full-time environmental manager who works closely with National Trust of Scotland staff to monitor the site and work to a tight bio-security policy to protect the island."*

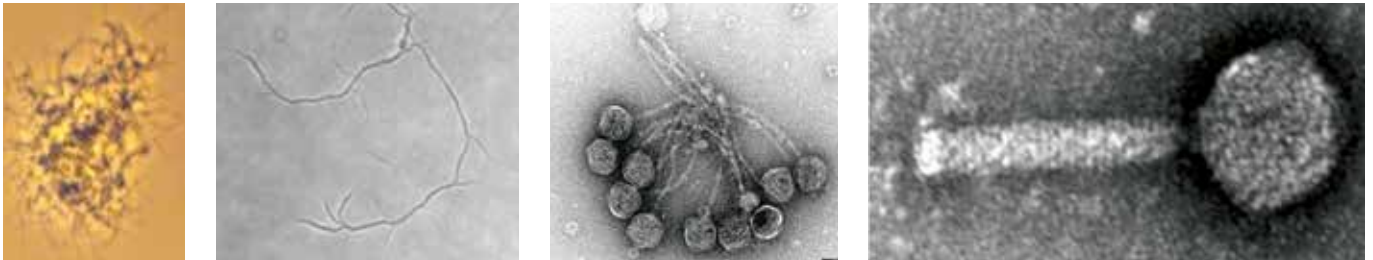
Other features include the installation of a new combined heat and power plant with waste energy used to heat the accommodation building and materials with a low Volatile Organic Compounds content. Grey water is used for flushing toilets, with low water usage sanitation fittings. Black-out blinds have been installed to all glazed openings to prevent light pollution and reduce the impact on the fledgling bird population of puffin and Manx shearwaters.

Hugh Broughton, director of Hugh Broughton Architects, said *"working at St Kilda on a dual World Heritage Site is a tremendous privilege but equally presents considerable design and construction challenges."* The project has been awarded a certificate by the Considerate Constructors Scheme for scoring 45 out of a maximum 50 points which represents 'performance beyond compliance'. The scheme rates projects according to appearance, respect for the community, protection of the environment, people's safety and value placed on the workforce.

The redevelopment of the station signals a continuing commitment by Defence Infrastructure Organisation to sustainable facilities in the Western Isles, which remain of great economic importance to island communities. The new facilities will be handed over next year.

Paul Kirkwood
PR Manager
Galliford Try International

Combatting Lyme Disease – phages, the sharpshooters of enemy bacteria



Left to right: Borrelia, causative agents of Lyme disease in aggregate form; Borrelia in free living form; Phages in a group; An individual phage © University of Leicester

Defence Deer Management (DDM) is the voluntary organisation that operates on the MOD estate to ensure the welfare and management of British wild deer. During 2017-18 the DIO Conservation Groups Team liaised with the DDM via their annual seminars to support a study on Lyme Disease (LD).

LD is caused by the bacterium *Borrelia*, which is transmitted to humans when ticks (vehicle of *Borrelia*) drink blood. Deer have been closely linked to the overall tick abundance and LD in humans. Carriage of *Borrelia* in ticks varies geographically, ranging from 3.3% to 40% of ticks being infected. In Europe, including the UK, the average *Borrelia* carriage rate in ticks is approximately 10%. LD cases have increased steadily over the last two decades with an estimated 100,000 cases in Europe every year. In England and Wales, the rough estimate is 3,000 cases per year. Considering how inaccurate and insensitive Lyme diagnostics are currently, the true number of Lyme patients most certainly exceeds these current estimations.

LD is a severe and debilitating disease, but it can be cured with antibiotics if treatment begins early enough. However, currently no laboratory tests exist to detect early stage LD. Consequently, most LD cases develop into late stage, which is extremely difficult to treat. Patients often endure years of strong antibiotic treatment, often to no avail as this does not guarantee a full recovery. Without reliable laboratory diagnostics, there is significant controversy regarding the 'right' way to diagnose and treat LD. To

avoid prolonged suffering, new Lyme diagnostic tests are urgently needed.

Researchers at the recent International Lyme and Associated Diseases Society conference held in Warsaw in June 2018 emphasised the importance of developing early Lyme diagnostics. The research team led by Dr Jinyu Shan and Professor Martha Clokie from the University of Leicester has been addressing this by investigating the use of naturally occurring viruses (bacteriophages (known as phages)) to detect and treat LD.

The Leicester team has made significant progress in developing phages as a LD diagnostic, showing that there is a tight connection between phages and LD. A highly sensitive phage-based method has been developed to diagnose LD. The performance of the method was evaluated against 222 patient samples and showed an overall sensitivity of >90%. In contrast, the current Lyme diagnostics only have around 30% sensitivity against the same group. This novel method would significantly improve the existing Lyme diagnostic standards and provide evidence for clinicians to better manage patients. A fully validated phage based Lyme diagnostic method would change the Lyme clinical practice for good.

Phages have a long historical record of being used to treat disease. Each phage only infects and kills one bacterial species and are therefore seen as 'sharpshooters' of bacterial pathogens. This means a phage that could kill LD would not be able to kill other bacterial species, animals, plants

or humans! The Leicester team has a strong track record in studying phages to develop new antimicrobials. The general strategy for phage hunting is to search environments where bacteria are found. In this case, *Borrelia* phages are most likely to be found in ticks. The DDM have therefore sent ticks from culled deer carcasses to Leicester University. This has helped to screen thousands of ticks, many of which have come from deer on the MOD estate. Several samples to date look positive for phage presence. When these phages have been isolated, they will be tested and developed as therapeutics.

In the long term this project will benefit those training on the MOD estate, as the diagnostic test will be able to confirm if LD infection has occurred from a tick bite, therefore enabling swift treatment. The University of Leicester are keen to continue receiving tick samples, to become involved contact DIO-ConservationGroups@mod.gov.uk

Jinyu Shan
Postdoctoral Researcher
University of Leicester



Removing a deer tick © Crown

Shell Filling Factory Disaster!

Remembering Chilwell's Canaries



Female workers operate cranes in the National Filling Factory around the 21st August 1917 © IWM

In 1914, trench warfare became static along the Western Front as shrapnel shells previously designed to maim and kill troops had become ineffective against the fixed defence works which required high explosive shells. By 1915 there was a 'Shell Crisis' due to a severe shortage of artillery shells and other munitions. The Ministry of Munitions formed and the Munitions of War Act was passed in July 1915 to maximise munitions production and ensure tighter control over private companies supplying the Armed Forces.

National Shell Filling Factories were set up across the UK, including No. 6 Chilwell which opened near Nottingham in 1916. The factory, designed and built by Viscount Chetwynd, Managing Director was purposely sited within a valley to shield against any explosions. The location remained secret for fear of enemy attacks.

Vast numbers of men joined the forces following campaigns such as 'Your Country Needs You,' causing a shortfall in the male workforce. Women filled

the vacant posts and demonstrated an ability to undertake skilled factory work, changing the perception of women in the workplace. In April 1916 women were recruited to drive the overhead cranes in the filled shell store at No. 6 Chilwell. The cranes operated above the rows of filled shells, with access via a narrow ladder temporarily held in place. A rope was provided for descent, with skill and strength required to avoid falling onto the shells below. The shells were filled with amatol (a mixture of TNT and ammonium nitrate) which often turned the women's skin a canary yellow colour. Consequently, the women became known as the 'Chilwell Canaries'.

The factory's production rates were substantial. To support the planned July 1916 offensive in France a record 46,725 shells were filled in just 24 hours. Ever increasing levels of production were achieved through pioneering designs of new machinery which could double output and reduce manpower.

Personal accounts of working conditions describe a hazardous, poorly ventilated atmosphere filled with noise and heat. On warm days ice was used to keep the TNT at a stable, cool temperature. The work was extremely dangerous and by early 1918 there had been 17 explosions at the factory, two of which resulted in loss of life. Shortly into the evening shift on Monday 1st July 1918, an unusually hot day, eight tons of TNT exploded. Chaos ensued as workers struggled to descend the cranes to safety, with the explosion felt 20 miles away. The blast destroyed a large part of the factory killing 134 people. Only 32 of the dead could be identified, 25 of whom were women and a further 250 people were hurt, many with life changing injuries. The unidentified bodies were buried in a mass grave at St Mary's Church, Attenborough.

Employees worked tirelessly through the night to ensure the factory could open the next day. Despite rumours of sabotage, it was concluded that high production demands had led to relaxed

health and safety measures, whilst unseasonably warm weather caused instability of the TNT.

To commemorate those who died in the factory explosions, employees constructed a large memorial in 1919. The obelisk monument, clad in local Stancliffe sandstone is sited on the grounds of the former factory. The memorial remembers the tragic impact of world events on the local community and its great sacrifice, particularly on the Home Front during the First World War.

As custodians of the monument, the Defence Infrastructure Organisation (DIO) are active stewards of this heritage asset. To mark the 100th anniversary of the explosion and the centenary of the First World War, DIO worked with CarillionAmey to appoint a conservation stonemason to sensitively clean the memorial.

Before any cleaning works commenced, background information was collected to ensure an informed approach was taken and the least intrusive cleaning method was chosen. A visual inspection of the monument identified a build-up of dirt and lichen growth to the stone finish and some of the inscriptions were obscured. In consultation with the Conservation Officer at the local Council,



The memorial after cleaning © Crown

steam cleaning was deemed to be the most sympathetic method which would remove surface material such as the lichen and allow a controlled clean of the dirt deposits.

Initial cleaning trials carried out on discreet parts of the memorial demonstrated the effectiveness of the cleaning method. Careful judgement was then made on how much cleaning was needed to conserve the integrity of the monument and maintain a stable finish

to the stone. It was decided that this sensitive cleaning method would be used to clean the whole memorial, including the inscription panels and stone steps. The cleaning, part funded by the MOD Conservation Stewardship Fund, has safeguarded this nationally recognised monument and has helped maintain a dignified and cared for appearance.

Kathryn Sayner
Historic Buildings Advisor
Defence Infrastructure Organisation



The memorial being cleaned © Crown

Gathering the evidence on Salisbury Plain Training Area



Entomological survey on SPTA © Crown

In spring 2016 Defence Infrastructure Organisation (DIO) funded a project with Wiltshire & Swindon Biological Records Centre (WSBRC) to improve the quality and quantity of biological data available to inform management of Salisbury Plain Training Area (SPTA). The project offered solutions to key problems surrounding access to historic and current biological data.

SPTA is primarily in south Wiltshire, comprising an area of 38,000ha. Large areas are included within protected sites designated under UK and European legislation, including Sites of Special Scientific Interest (SSSI), a Special Protection Area and a Special Area of Conservation. The Plain has a variety of habitats, including species-rich chalk grasslands (14,000ha), chalk heath and juniper communities and species such as hen harrier, hobby, quail, tuberous thistle, marsh fritillary and fairy shrimp.

Such a vast biodiversity resource requires regular monitoring and surveys. Monitoring priorities are generated by a range of organisations, from Natural England (NE) (for SSSI condition assessments), to DIO (for management of the MOD's estates). The three Conservation Groups (Bulford, Larkhill & Westdown and Imber), organise their own surveys and monitoring programme feeding into DIO's management planning. Furthermore, many amateur naturalists visit SPTA and the surrounding area each year, drawn by the habitats and species found here.

Over several decades a great mass of knowledge and expertise has been generated for the area. This knowledge has however been collected in a piecemeal fashion by a range of professional ecologists, local experts and citizen scientists with little or no coordination of effort, collation of data,

verification or centralised data storage. DIO identified in the 2000s an urgent need for better data management, to improve coordination of monitoring and survey effort by the Conservation Groups, to improve the data management and to source data generated by local and national recording schemes e.g. British Trust for Ornithology bird surveys and Botanical Society of Britain and Ireland surveys. All too often, this data remained unavailable to DIO.

WSBRC is the county's environmental records centre, gathering, managing and interpreting detailed information on species, habitats and geology, supplying the data to a range of users. This information comes from a wide variety of sources but over half of the data received each year is from the network of county recording groups, coordinated by the county recorders. These county recorders fulfil an essential role in verifying and quality assuring data. This ensures the county's records are accurate, robust and up-to-date.

The joint project, launched in spring 2016 as part of a Service Level Agreement between DIO and WSBRC, would promote the sharing of biological data, feeding not only into DIO's management of SPTA, but into the work of other organisations working across this wider landscape. It comprised three key strands:

Historic and recent data held by DIO

Firstly, all biological data held by DIO for SPTA was shared with WSBRC and subjected to their routine processes, including verification. Much of the data held by DIO had not been received by WSBRC previously.

Identify monitoring and survey data generated on SPTA not held by DIO

Secondly, the project worked with DIO staff and the Conservation Groups, to identify the main sources of data generated on SPTA, including where recorders were contributing to national recording schemes and local projects,

where data was sent and whether it was submitted to more than one destination. This also included work commissioned by DIO, NE and speaking to environmental consultancies working on the training estate. This stage of the project demonstrated that despite the significant efforts involved, much of the data generated was not received by DIO.

It was agreed that in the future all biological records generated on SPTA should be submitted directly to WSBRC. Data management is time-consuming and as this is the WSBRC's core business, the records centre was resourced to collate and quality assure the data on DIO's behalf. This also simplified the overall data flow and discouraged recorders from submitting the same data to more than one place (leading to duplication of records). An enhanced data flow is more efficient, saving recorders, data managers and data users considerable time. This was only achievable by working closely with the county recording groups and county recorders to gain support, but most importantly, by working with the three SPTA Conservation Groups and promoting the use of Living Record's website for submitting data.



Making the most of technology to record data, such as the red hemp nettle © Crown

This led to a series of communications, training events and production of guidance for the submission of biological records on SPTA.

Obtaining additional data

Finally, the project has spent some time liaising with other organisations (such as Centre for Ecology & Hydrology), NE

and consultant ecologists, to ensure that survey and monitoring data generated on SPTA is captured and made available to WSBRC in an appropriate format.

The benefits of this work have been rapid and wide-ranging. Considerable volumes of data have been captured from reports and mobilised to the databases of WSBRC. The data has been subject to rigorous data management procedures, ensuring that it is of high quality and robust.

The outsourcing of data management has enabled datasets to be updated, making them more complete and reliable. It has also released DIO Subject Matter Experts' time to deliver other priority tasks.

The data has also been made available to other users in the county, from Wiltshire Council to SPTA Conservation Group members, allowing it to feed into a wide number of other initiatives as well as policy and planning processes. Such data sharing is increasingly accepted as necessary to ensure that decisions are based on the best available evidence and are as cost-effective and transparent as possible.

The recent data supplied has been used to inform the DIO farmers' scrub plan review project, required to help maintain SSSI condition. Salisbury Plain SSSI butterflies such as Duke of Burgundy and brown hairstreak require sensitive scrub management and the new records have informed the management plans.

The data has been used to inform a recent military exercise requiring digging, with new or previously unknown notable plant records identified so that sensitive areas were avoided during the exercise.

Another example of the wider importance of this work is *The Herpetofauna of Wiltshire*, published, in March 2018 by WSBRC. This atlas is the first produced in Wiltshire and promotes the county's populations of reptiles and amphibians.

Conservation Group members on SPTA have generated considerable records of species of ephemeral ponds such as fairy shrimp *Chirocephalus*



Two members of the Imber Conservation Group at a moth trapping event © Crown

diaphanous and common toad *Bufo bufo*. The monitoring of common toad populations on SPTA, and the associated recording of other amphibia, comprises one of the most intensive studies of herpetofauna in the county.

The inclusion of the data in the atlas publication was enabled by the partnership project between DIO and WSBRC, neatly demonstrating the value of a project that promotes data quality and data sharing.

Although the circumstances of biological recording vary in each county, with similar but differing processes in place, it is hoped that this project can inspire recording groups studying other MOD sites to overcome seemingly impossible odds and complexity to promote the sharing of biological data. Supporting and safeguarding the natural environment should be an evidence-led process.

Further information:

All datasets are subject to WSBRC's Data Access Policy ensuring that sensitive sites and sensitive species are safeguarded and can be viewed at <http://wsbrc.org.uk/about-us/policies/>.

The Herpetofauna of Wiltshire, 2017; <http://wsbrc.org.uk/herpetofaunaofwiltshire/>

Lisa Wade
Ecologist
Defence Infrastructure Organisation

Holcombe Moor – mills of industry in the valley of the Red Brook



Holcombe Moor Heritage Group members on site © Holcombe Moor Heritage Group

Holcombe Valley has been used for military training since 1912 but its rich and fascinating history goes back much further in time.

After the Norman Conquest of 1066 the area was known as Holcombe Forest and in the year 1225 it was gifted, via a Deed of Charter, to the Monks of Monk Bretton, near Barnsley, by the then landlord Roger de Montbegon. Over the next 300 years or so, until the Dissolution of the Monasteries, the Monks used the land for sheep farming and most probably iron smelting. The stream that runs through the valley is known as Red Brook, possibly due to the high iron content in the surrounding landscape. Other hints of Medieval iron smelting in the valley can be found in the names of the farms and fields, the main one of these being Cinder Hill Farm. Cinder Hill is a common name found throughout

the country wherever iron making had been taking place and refers to the large 'hills' of slag, the waste product from the iron smelting process, being found there. At Holcombe these hills of slag have long since been taken away to mend roads and to be used as hard-core, leaving only the place name evidence as a reminder of the former activity that took place.

As time went by, farms and dwellings were built in the valley – the farmers would also have been part-time spinners and weavers, taking advantage of quiet times in the agricultural calendar to make cloth both for themselves and for sale. This set the scene for the momentous changes that were to come in the 18th century when the valley of Holcombe was at the heart of a revolution that changed the way of life in so many of the valleys all over the north of England.

In a 1794 survey of Tottington, the estate of Cinder Hill near Holcombe was owned by Lawrence Brandwood. It was occupied by his son John and contained a building listed as an engine house. But what was an engine house, what did it produce and how was it powered? These were the questions that were raised by Holcombe Moor Heritage Group (HMHG) in 2010. HMHG is a small group of enthusiastic volunteers who investigate the history of the valley which, in turn, helps to inform the MOD on the stewardship of the heritage assets under its care.

To answer these questions the Group undertook a desktop assessment which delved into historical documents and carried out a five-year excavation project on a site in the valley, known from the 1850s as 'Bottoms.' The work of the Group has unraveled the story of the site, from its early industrial use

as an engine house to its conversion in the 1830s to a small terrace of workers' cottages, and subsequent abandonment in the later 19th century.

This being the time of the Industrial Revolution, Brandwood invested in the new moneymaking venture of 'cotton spinning'. A weir was constructed across the Red Brook and the associated leat fed a small pond 100m downstream. In front of the pond dam a stone engine house was constructed, measuring 9 x 5m and probably three storeys high. Attached to the eastern side of the building, a 16' x 18' water wheel was constructed and was fed as a high breast shot wheel. It is possible to imagine the assortment of different machines that would have been housed in the building. Water-driven carding engines, probably of Richard Arkwright's design, would have been positioned on the ground floor. An open fireplace would have held a large cauldron filled with boiling water that served to provide the damp atmosphere required for processing the cotton. On the second floor a series of spinning machines, probably examples of Crompton's Spinning Mules, would have spun the fibres into yarn. The third floor would have housed weaving frames to utilise the freshly spun cotton yarn.



A set of wooden rollers from an early spinning machine
© Holcombe Moor Heritage Group

The archaeological excavation provided some extraordinary detail to this narrative. For instance, fragments of the mechanism of Samuel Crompton's Spinning Mule were found – so called because the Mule was a hybrid between Richard Arkwright's water frame and James Hargreave's Spinning Jenny. It was also evident that the original insertion of the waterwheel met some unforeseen engineering problems. It appeared that it had been catching



Cinder Hill Engine House at the end of the project © Holcombe Moor Heritage Group

against the rear wall of the wheel pit, causing it to require an overhaul. This may have been due to settlement of the pond bank. The whole wheel was detached from its original position and moved 1.5m towards the front of the mill, a process that also entailed rebuilding all the stonework which housed the wheel and the repositioning of the drive shaft opening in the east wall of the engine house. The term 'engine house' was widely used at this time to indicate that a mechanised process was being utilised inside the building. The work of the Group established that at Bottoms the driving force for the early spinning mill was not coal but water power.

Around 1823 the estate and mill were taken over by John Parker, who moved into the farm at Cinder Hill with his family and started the construction of a new spinning factory 200m downstream of the engine house. As there was no longer a need for the original engine house to be used as a spinning mill, it was probably converted to a finishing or bleaching house that finished the products from the new factory. This conversion necessitated the removal of the water wheel. The water wheel pit was filled in and two new bays were constructed onto the east side of the engine house, presumably holding equipment to facilitate the finishing process. The pond bank was altered and extended, so that a new leat could run down to the new factory.

Documentary evidence in the form of a newspaper advert from the 1830s shows that Parker was changing the function of his new factory and probably no longer needed the finishing house. It is reasonable to assume that around this time, the engine house was converted into the row of cottages known as 'Bottoms' to house workers for Parker's new factory. The cottages remained in use until the final demise of the factory in the 1870s and according to census information they remained empty from 1881 until disappearing from the records in the 1890s.

During the excavations at Cinder Hill Engine House, a large deposit of tap slag and an assemblage of gritty ware pottery were found along with several pieces of charcoal, one of which was sent off to Glasgow University for carbon 14 dating. The date of AD1024-1182 was totally unexpected and points to iron-working in the area almost 1,000 years ago. By a fortunate turn of events the Group started new excavations in a field some 150m east of Bottoms and early results suggest that this was the core area for iron smelting in the valley in the Medieval period. The name of the site is Cinder Hill Field and we hope our work here can continue to be reported in future editions of Sanctuary.

Neil Coldrick
Dig Director
Holcombe Moor Heritage Group

A soldier's war on waste



Doing the right thing and recycling © WO2(RQMS) Mark Richards

In 2016 Mark Richards was promoted to the rank of Warrant Officer Class 2, into the role of Regimental Quartermaster Sergeant within 3 Royal Horse Artillery (3 RHA). Mark soon discovered that this challenging role included waste management for Albemarle Barracks, Northumberland. At the time of his promotion, Mark never realised that waste would be such an emotive subject, one which he would later become intimately involved in!

The first bill Mark received for cross-contamination of general waste at Albemarle Barracks was in excess of £3,000. The sub-contractor would routinely deliver the offending items back to the regiment for sorting and onwards recycling at a charge of £35

per item and an £150 haulage fee to deliver it. Sorting through 30 days of rotting food waste to locate the items that required recycling compounded the task. Needless to say, Mark knew something had to change including the working policies of the regiment of 3 RHA and its three lodger sub-units. The QM's department set about changing the central bin area into a recycling centre, with all bins clearly marked to show what should be placed where. Recycling information was placed onto Regimental Part One Orders and the area slowly evolved to become orderly.

A Waste Electrical and Electronic Equipment (WEEE) skip was placed on site to comply with EU/UK law, which

states that no WEEE should be placed in the general waste streams. The WEEE skip has been well used since, with 2 tonnes of waste being disposed of correctly.

The next problem on the agenda was turning attention to the mountain of fridges that were stored in the QM's department. The fridges presented their own problem as they are included in WEEE waste but disposed of under different regulations. Mark was staggered to find out that each fridge attracted a £12 disposal charge. The total cost to dispose of the fridges came to a staggering bill of £900 to rid the barracks of 75 units, to which 'WOW!' was something of an understatement. The Regimental Second in Command (2IC) was approached for funds; after he nearly fell off his chair and following a lot of explaining about the amount of waste the team had been dealing with since Mark became the RQMS, the fridges were removed.

The council provided bottle, paper and metal can banks which arrived over the next few weeks. These recycling banks proved an instant hit with the barracks' residents, reducing the general waste disposal and carbon footprint of the families and single living personnel. It soon became noticeable that the 14 yard general waste skip required emptying less frequently, going as long as 10 days before requiring servicing. This was a huge improvement on the period before the recycling push, when it was emptied every 3-5 days. Ultimately, soldiers using the correct skip and recycling where possible saves significant money. Despite steps in the right direction, there was more work to do and Mark set about contacting other agencies for solutions and advice.

The British Heart Foundation (BHF) were keen to supply textiles banks to the barracks. A few weeks' later four BHF banks were placed in the recycling area and on the families' estate. Within four days they had all been filled and BHF came to empty them. In total 75 bags of clothing had been donated and whilst the BHF van was packed to the rafters, the driver had to make two collection



An orderly recycling area © WO2(RQMS) Mark Richards

trips. Over the next few weeks other charities, including The Children's Charity and Combat Stress, contacted the regiment to ask if they could place a bank on site and these were received with thanks. These charity banks further reduced the carbon footprint and the frequency in which the general waste skip is emptied.

The recycling campaign continued with the help of various serving personnel who monitored some of the waste including portable batteries, which were among the items not being recycled. It is shocking to discover that the UK has

one of the poorest recycling rates in the European Union for batteries. To improve this situation the site applied for a number of containers from the Defence Equipment Sales Authority (DESA) which were placed at key locations around the site. Since the battery recycling boxes have been in place they have been so heavily used that DESA has had to make a collection. Success!

Paper waste was the next target of the purge and with the help of the sub-unit logistic staff the team was able to place a waste paper shredding bag in each office. A simple measure that further reduced

the amount of general waste. Mobile phones and printer cartridges were also targeted with containers placed at two key sites; The Welfare Centre and the Quartermasters. Again, this facility has been heavily used with the 11th box being collected for recycling at the time of writing this article.

Running alongside the war on waste was the wider camp clean-up which included removing abandoned vehicles from site. This was no easy feat and after engaging with Hexham Council and with the help of a local company, 37 vehicles have been removed much to the relief of the Regimental Duty Sergeant.

The focus has now moved on to other areas with room for improvement, including a green waste site which has helped to stop fly-tipping in the local area. The war on waste and recycling is a long and continuous battle, but Mark will continue to provide recycling advice, information and updates about the facilities available on camp.

WO2(RQMS) Mark Richards
RQMS
3rd Regiment Royal Horse Artillery



The bin area before the war on waste © WO2(RQMS) Mark Richards

Land management of military training areas in Surrey – a partnership



Lowland heathland habitat inside Pirbright Ranges © Surrey Wildlife Trust

Since 2006 Surrey Wildlife Trust (the Trust) has been managing parts of the MOD estate in Surrey for the benefit of wildlife and nature conservation. These areas comprising of; Ash Ranges, Pirbright Ranges, Barossa, Brentmoor Heath and Folly Bog, Royal, Ockley and Guinea Commons, together with Elstead total almost 4,000ha of dry and wet lowland heathland, acid grassland, deciduous and coniferous woodland. This suite of habitats support an incredible variety of rare and endangered wildlife.

The conservation designations of these sites highlight their immense significance and importance, with all areas designated Sites of Special Scientific Interest. Furthermore, a large proportion of these areas make up the Thursley, Ash, Pirbright and Chobham Special Area for Conservation for its mosaic of lowland wet heath and valley mire vegetation.

Some of these areas support all six species of Britain's native reptiles including the elusive smooth snake and the stunning sand lizard. Most areas of the MOD estate that are managed by the Trust form part of the Thames Basin Heath (TBH) Special Protection Area (SPA). This was designated on the 9th March 2005 and forms part of Natura 2000, a European-wide network of sites of international importance for nature conservation, established under the European Birds and Habitat Directives. The TBH SPA is one of the south east's most important natural assets with lowland heath supporting significant populations of Dartford warbler and vulnerable ground nesting birds such as nightjar and woodlark.

The Trust liaise and work alongside several organisations to deliver the stewardship agreements across the MOD estate. This complex working relationship has developed and grown

over the past 12 years. The very nature of the MOD estate means that there is restricted access and so Trust employees often work alongside military personnel. Delivering conservation objectives inside the most restricted areas such as the Danger Areas of Pirbright, Barossa and Ash Ranges presents a unique set of challenges. The Trust has worked hard with the



Adult male adder basking © Surrey Wildlife Trust

Defence Infrastructure Organisation (DIO), Landmarc Support Services (Landmarc) and Natural England (NE), to implement and deliver scheduled works whilst ensuring safe access and working inside these zones. Accessing these sites with multiple contractors, surveyors, volunteers and Trust staff is a logistical challenge, but since the introduction of the centralised Longmoor Operations Room, signing on and off areas such as Ash Ranges has become much simpler. Having a single point of contact for booking access, incident reporting and general site information has improved the way the Trust can work on the MOD estate, particularly for checking grazing livestock. Reporting directly to an operations room ensures that DIO staff are also kept up to speed with events taking place on the ground.

DIO chair regular Conservation Group meetings specific to each site, with multiple agencies, organisations and surveyors in attendance. This is a fantastic opportunity to share key information and update stakeholders on the most recent works completed as well as providing an opportunity to layout future conservation plans. Key military training objectives and estate management is relayed, ensuring all stakeholders can deconflict with military activity. This engaging and proactive approach to land management means most problems can be avoided. Site visits are also a key opportunity to liaise with DIO ecologists, Area Safety



Surrey Wildlife Trust's Belted Galloway cattle © Surrey Wildlife Trust

Marshals, foresters, range control staff and NE regarding the ongoing conservation and site management. These face-to-face meetings are invaluable as conservation and military requirements can be discussed whilst in the landscape, ensuring that every aspect of site management is covered. Through partnership working with DIO and Landmarc, the Trust has helped to create new areas which can be used for training. This has been achieved through the removal of specific areas of scrub, whilst ensuring retention of others to create a mosaic of open habitat and occasional scrub cover. Military training requirements and conservation objectives can often go hand-in-hand. This mosaic of dwarf scrub, mature trees,

open heathland and common gorse also benefits the habitat conditions for a huge range of wildlife.

Conservation grazing is utilised across the vast areas of lowland heathland that the Trust manage. This can vary from the completely enclosed grazing compartments on Ash, Barossa and the Folly Bog to temporary electric fencing on the Elstead commons and Brentmoor Heath. The Pirbright Ranges Red Deer Project (Sanctuary 46, 2017) is another conservation grazing tool that has been incredibly successful and has allowed the Trust to deliver conservation objectives across the 720ha area. To deliver a grazing project of this scale requires close collaboration with Area Safety Marshals to ensure military personnel can train whilst also maintaining the stock and site infrastructure.

The Trust is now entering new Countryside Stewardship agreements for Ash Ranges and the Elstead group of commons, whilst continuing to deliver the Higher Level Stewardships across the rest of the MOD estate. The Trust look forward to building on the strong working relationships that have developed with all stakeholders to deliver these agreements, helping to protect and conserve wildlife across the MOD estate to facilitate military training and effective land management in Surrey.

Ben Habgood
Conservation Manager (MOD Land)
Surrey Wildlife Trust



Cotton grass in the mire © Surrey Wildlife Trust

Flavius Valens and Corunna Barracks hob-nail boots & soft-skinned vehicles



The excavation of the Roman Cemetery at Corunna Barracks © Wessex Archaeology

The site of the former Corunna Barracks, Ludgershall, Wiltshire is earmarked for the construction of 246 new army family homes under the Army Basing Programme on behalf of the Defence Infrastructure Organisation (DIO). Proposed development includes land for a new primary school and community facility, public open space, play areas, landscaping, internal roads and associated infrastructure.

Corunna Barracks had its origins in a huge construction programme that built vehicle depots to maintain and store the Army's armoured and soft-skinned vehicles (such as cars and trucks) that had replaced horse transport. The Barracks went on to play a vital role during Operation Bolero as a Central Vehicle Depot dealing with the arrival of United States forces in Britain in readiness for the invasion of occupied Europe in 1944. The depot closed to vehicle storage and maintenance in 1997, however the site was used for a time by the Medical Supplies Agency.

The barracks were used recently in support of major exercises conducted on Salisbury Plain prior to Operation HERRICK deployments to Afghanistan.

Wessex Archaeology has been engaged in major excavations for several years on behalf of the Army Basing Programme and were commissioned by Lovell Partnerships to support their work in preparing the land for development at the former barracks. The work to investigate the decommissioned site began in March 2018 and several discoveries were made. A small section of Iron Age ditch and the remains of a Romano-British cemetery were identified. A Ministry of Justice licence was granted for exhumation and a team of archaeologists excavated 14 graves in March of this year.

Despite decades of re-modelling and redevelopment at the barracks the graves had survived reasonably well. The graves were sited in a prominent position overlooking a gently sloping

south facing valley. The post-excavation analysis phase has only just begun but already there are some interesting observations to be made. Cut through solid chalk, the graves were aligned either north to south or west to east and most contained one burial each. The individuals were probably buried in coffins or plank-lined graves. Similarly to many other cemeteries of a similar date, most were buried without grave goods. The majority of the burials were laid to rest wearing hob-nailed shoes or boots. One individual was buried with a spindle whorl and another with a single coin. The coin (a nummus) was minted during the reign of the Emperor Flavius Valens (AD 364-378) and is likely to have been issued from Trier, London or Arles.

The chance survival of this small group of late Romano-British burials will enhance our understanding of the area in the waning years of the Roman occupation. There are few records of Roman find spots in and around Ludgershall, although Roman

villas are recorded at Shoddesdon Grange, Thruxton, Ragged Appleshaw and Redenham which may have served as the administrative focus of large farming estates including the Ludgershall area.

The small section of ditch discovered during the excavation of the graves belongs to the middle Iron Age having been securely dated by pottery to around 800 years earlier than the Romano-British cemetery. It is entirely possible that the ditch once enclosed a settlement of people exploiting a prominent slope close to fertile soils around 400 BC. There is a common misconception that Roman people somehow replaced the indigenous Iron Age Britons and certainly the discovery of a middle Iron Age ditch and then a late Roman cemetery within Corunna Barracks would appear to confirm this. In reality the gradual social and economic transformation of British life, the trade in exotic goods, technical innovations and ideas over centuries led to a significant proportion of Britons (specifically those south of Hadrian's Wall built in AD 122) to become Romanised, hence the term Romano-British.

The land, until recently occupied by Corunna Barracks may have been the focus of a settlement of Iron Age Britons from around 400 BC. It is possible that a settlement would have comprised a small number of roundhouses, although no evidence has survived in the areas investigated, which were within an enclosure ditch. By the middle Iron Age



Three inter-cutting burials (scale 1m) © Wessex Archaeology

Britons were already enjoying some of the trappings of a large trade network including olive oil and wine imported from the Mediterranean.

Some 800 years later a cemetery was established on one side of the earlier ditch (it is not clear as to whether this was inside or outside the earlier settlement boundary) where families laid their dead to rest towards the very end of the Roman period in Britain. These people lived in challenging times both politically and economically. Groups from Scotland, Ireland and Germany constantly raided areas under the Romanised administration and

plundered towns resulting in a growing state of anarchy. In AD 369 Theodosius arrived with a large force from Rome and drove the invaders back. How much this situation effected the local population is speculation, but the shocks would have been felt by populations such as those buried in Ludgershall.

The archaeology encountered in advance of construction for the Army Basing Programme has prompted a rethink of what archaeologists understood about the origins of the beautiful Wessex landscape. The excavations at Corunna Barracks have established the very real possibility that the land around Ludgershall was occupied from at least the middle Iron Age and that Britons living there experienced generations of Roman rule.

It is often said that American tourists are mesmerised by Britain's incredibly rich heritage. World War Two American troops that drank coffee in the Barracks' canteen whilst planning the downfall of one 'Empire', would no doubt have been astounded to discover their boots were only half a metre above the remains of people who had experienced the end of another.

Simon Cleggett
Project Manager & Archaeologist
Wessex Archaeology



The lower part of a Roman burial still wearing hobnailed footwear © Wessex Archaeology

Improving access on Dartmoor



Cramber Tor visitor survey © Crown

Military training has been undertaken on Dartmoor in Devon for over 140 years. Today, the Dartmoor Training Area encompasses approximately 13,000ha offering a wealth of different opportunities for realistic training.

Preserving the natural habitats on the Ministry of Defence (MOD) estate and balancing the array of needs and requirements of visitors and stakeholders takes strong collaborative working and careful planning, as recent projects have proved.

Meeting Cramber's visitors

Cramber Training Area (CTA) is located south of Princetown, home to Dartmoor's ominous prison. It is one of the newer and lesser known training areas located within this world-renowned landscape, but equally as important.

CTA is used for foot-based military 'dry' training. As the site lacks live ranges, public access is unrestricted. Local residents and visitors can explore the area on numerous pathways across the moor and, if lucky, may see troops taking part in various tactical training exercises.

The MOD has leased land around Cramber Tor since 1980. In 2013 Dartmoor National Park Authority

(DNPA) renewed planning permission for CTA to permit ongoing military training for 40 years subject to conditions. This included undertaking a visitor survey in 2017 and every five years thereafter. The results would build upon earlier research carried out in 2002 and 2011, as part of the planning application.

To replicate the 2011 survey, it was agreed that the Defence Infrastructure Organisation (DIO) Access and Recreation Team, with support from colleagues, would undertake the 2017 study 'in house'. This would save DIO funds by negating the need to employ external consultants.



Erosion on Dartmoor © Steffan Jones

The previous surveys identified that military training had minimal impact on visitor perceptions and recreational enjoyment. In both instances, most visitors were not affected by the military using the CTA for dry training purpose. The 2017 results proved equally positive.

Results indicated that military activity continues to have a minimal effect on visitor perceptions and visiting patterns. In 2017 there was a rise in respondents stating that the military had a positive impact on their enjoyment of the area. Comments included; "[We] enjoy seeing soldiers," it is "cool to see" and "adds to the experience."

Overall the task was a positive one, giving DIO staff an opportunity to connect directly with visitors and discuss first-hand how military training is perceived. The study provides tangible evidence that MOD efforts to minimise disturbance and actively engage local communities are effective and well received.

Erosion control

When reflecting on Dartmoor, most people often think of testing weather. The working landscape can often bear the brunt of these wild elements. Last winter Landmarc Support Services

(Landmarc), DIO's strategic partner for managing the national Defence Training Estate, was tasked under the MOD Conservation Stewardship Fund programme to assist DNPA with heavily eroded gullies and wet areas across the National Park.

The DNPA targeted two locations where heavy rains and damage caused by flooding and livestock had left areas difficult to cross for training units and visitors to the National Park. A solution was needed to ensure the areas remained safe and accessible.

After initial discussions, the team discounted wooden walkways because it was thought they could become a potential hazard over time and would look out of place within the natural landscape. Following a meeting with representatives from DIO, DNPA, Duchy of Cornwall, and Landmarc, a solution was agreed using large granites to construct a causeway. This would provide a sustainable and more natural solution across the damaged moor.

Local contractors were procured and following provision of the granite from the Duchy, construction began. The stone was delivered to Prison Newtake, near the Holming Beam Range Hut and near the Cowsic River on Merrivale Ranges before being positioned to create a walkway. The work has helped washed-out gullies recover, where until now peat loss from the moorland had been an issue due to erosion. By slowing water flow the granite walkways have allowed the sediments to settle and create a soil. This has enabled rushes, sphagnum moss and other moorland plant species to colonise, further slowing water flow and therefore enabling recovery.

DNPA and DIO are now looking at other areas that could benefit from this type of restoration.

Updating access agreements

Dartmoor is a huge draw to visitors from around the world. Visitor management takes many forms, including unseen measures such as access agreements between the MOD and DNPA. The Countryside and Rights of Way Act 2000 was significant for public access across England and Wales, giving the right of



Tavy Cleave on Willsworthy, Dartmoor © Nigel Sharpe

free access on foot across mountain, moor, heath, downland and registered common land. In many cases walkers had been using these landscapes for open air recreation already, but the 2000 Act provided a legal right which had not previously existed.

Dartmoor was an exception as most of the open moorlands were already covered by the Dartmoor Commons Act 1985 ('the Act'). As well as creating a structure to manage the land the Act gave the public the right to use all registered common land for recreational purposes on both foot and horseback. It also allowed DNPA to create Byelaws which enable Rangers to ensure the public exercise their rights responsibly. However, the Act did not grant a right of access to land that was not registered common.

The MOD has three live firing Ranges on Dartmoor; Okehampton, Merrivale and Willsworthy. When the Ranges are not in use for live firing it is safe for the public to have access. Okehampton Range and Merrivale Range are both common land and so the Act applies. However, when the MOD purchased Willsworthy in the early 1900s, the common rights were bought out, resulting in 3,000 acres of moorland to which the Act did not apply. There are no barriers on the ground meaning the public are unaware whether they are on common land, causing confusion.

There had been a Willsworthy access agreement, but it was out of date and

only covered part of the land. In January 2017, a new agreement between MOD and DNPA was completed, giving the public the right to use Willsworthy moorland for informal recreational purposes on foot and horseback, on similar terms to the adjoining commons. There are restrictions excluding firing range infrastructure and DNPA Rangers can access MOD land to police the National Park Byelaws. The agreement will enable the public to enjoy the stunning beauty of Willsworthy in largely the same way as on the rest of Dartmoor commons.

More to come

Preserving the extraordinary Dartmoor landscape and balancing the array of stakeholder needs and requirements is a challenge, but offers a diverse range of opportunities to seek innovative solutions for exciting projects. It is undeniable that the MOD's ongoing presence on Dartmoor will depend on successful projects such as these for many years to come.

James Nevitt

Senior Access & Recreation Advisor
Defence Infrastructure Organisation

Steffan Jones

Rural Manager
Landmarc Support Services

Nigel Sharpe

Senior Estate Surveyor
Defence Infrastructure Organisation

The Arborfield Infirmary Stables



Stables after restoration, finished to a very high standard in accordance with conservation principles © Crown

During the 19th century the Army's requirement for a constant supply of horses resulted in the purchase of horses from civilian owners (breeders, auctions and private families) and training them to be war horses. The Continental armies followed a different system and had their own stud farms.

The British system worked well in peacetime, but by the late 19th century it became apparent that in times of war, such a system would not be sustainable. The Remount Department of the War Office was established in 1887, resulting in over 14,000 animals being registered as the Army's reserve war horses. The system was tested during the Boer War and whilst it worked well initially, the number of horses needed was grossly under-estimated. The horses soon became overworked and quickly succumbed to injury or exhaustion.

After the Boer War the Army expanded the scheme and two additional depots were established at Melton Mowbray and Arborfield to cater for horses used in the UK, supplementing those at Woolwich and Dublin for the horses being sent overseas. The land for the Remount Service at Arborfield was acquired from three local agricultural farms which

allowed space for buildings and stabling as well as enabling grazing and forage to be grown. In times of peace, the Arborfield Depot was also used for rest and recuperation of horses sent there by regiments if they became too weak. High demand led to the purchase of a local farm at Chiddingfold to provide additional facilities.

At the outbreak of the First World War the demand for horses quickly increased by ten-fold from the 14,000 reserve to more than 140,000. The problems this presented had been foreseen. Previously the country had been divided into districts and each district was responsible for collecting information about the numbers and types of civilian horses that could be requisitioned. The pre-planning resulted in 115,000 horses being requisitioned in just 12 days on the outbreak of war. Whilst the horses would have been 'broken in' by their civilian owners, they needed to be trained for military service, for example, by being schooled in military manoeuvres and becoming used to gunfire.

The Remount Depot featured in the local newspapers. At the start of the war an urgent appeal was made for a large number of grooms for the stables and the

Major in Charge, Maj Badcock was able to offer "*liberal terms to suitable men*". Prior to the outbreak of war a regular point-to-point race was held at Arborfield, but this was suspended during the war. However, there were occasional sports days and a recreation hut was created for soldiers, complete with two bagatelle tables, puff billiards and other games. As it was run and largely funded by the Oxford Diocesan Temperance Society no alcohol was allowed. Occasionally accidents happened such as in April 1915 when Frank Williams, a dresser of sick horses, was kicked in the stomach by a horse and died the next day.

At Arborfield different sections of the site were used for different purposes. Horses would be received at the Reception Stables where newly acquired horses were stabled to make sure they were free of infectious diseases. Another section was used as Isolation Lines where infectious animals could be segregated. Further stables, two blocks of loose boxes, were built in 1912 to provide Sick Lines for animals in need of veterinary treatment.

It is these two blocks which have survived to the present day, partly due to the use of the stables as the Garrison Saddle Club during the 1960s, 1970s

and 1980s. However when the Garrison Saddle Club relocated, the stables fell into redundant use and were left to slowly deteriorate. Over time the other buildings of the Arborfield Remount Service had been either converted or demolished making the remaining two original stable blocks worthy of national designation as a Scheduled Monument in the 1980s. A Scheduled Monument is the highest form of historic designation that can be bestowed and others include Stonehenge and Windsor Castle.

The two stable blocks, called East and West Infirmary respectively, were very carefully designed. Clean air was brought into the stalls by low level pipes in the walls and then the foul air escaped through roof vents. In the East Block these were metal cowls, whilst in the West Block they were timbered louvred vents which were fully adjustable to carefully manage the flow of air.

In 2016, a relocation programme started for the whole Garrison at Arborfield. The stables, and their restoration became the focus of a new vision for the site as part of a major housing development on the former MOD land. The first stage in restoration was to determine how many records survived and to the conservators' delight many original plans were found at the Historic England archive in Swindon. The plans showed the care and attention to detail that was given to the original designs.

Unfortunately, the plans also revealed that the original designs included the use of asbestos in the roof tiles and in some of the wall construction.



North and south elevation drawings © Crown

As asbestos is no longer permitted in buildings, the conservation of the stables proved to be quite a challenge and special care had to be taken to meet with the standards required by their scheduled designation. Matching the colour and look of the original red asbestos tiles proved to be a particular problem. Roof tile companies were approached for similar tiles, but none of these were an appropriate colour match. Eventually, on-site trials and investigation found that by simply turning the tiles upside down the colour was a better match.

In accordance with good conservation principles, as much as possible of the original fabric was retained in-situ and sensitively repaired. There was extensive ivy growth cloaking areas of the building which had to be removed. Great care had to be taken as the ivy had penetrated into the mortar and inappropriate methods of removal could have caused significant further damage. In places the ivy had grown so extensively that its thick roots had damaged the foundation

brick work, which had to be carefully dismantled and rebuilt using the salvaged bricks.

Today the stables have been brought back to a very high standard and the workmanship has been meticulous. The project team have been acknowledged by the Sanctuary judging panel for demonstrating a highly professional and dedicated approach. The well-informed methodology and appreciation of the buildings' historic and architectural significance, took into account not only the construction and heritage issues, but also the nature conservation aspects.

Today the future of the stables once again looks bright as new community uses are being actively sought in the heart of the new developments. The historic development of the site has been recorded and the stables conserved for the enjoyment of future generations.

Chris Daniell
Senior Historic Building Advisor
Defence Infrastructure Organisation



Stables before restoration © Crown

Stanford Training Area – bold & innovative management on a landscape scale



Establishing the shallow-cultivated plots. The 66 treated plots cover a accumulative area of 212ha (equivalent to 297 football pitches) © Robert Hawkes

Stanford Training Area (STANTA) is one of the UK's major live-fire training and manoeuvre facilities, covering 30,000 acres and remaining in use 350 days per year. STANTA contains approximately half of the grass-heath remaining in Breckland (3,500ha), making this unique landscape one of the UK's most important wildlife sites. Historically STANTA was intensely grazed by livestock and dug over by rabbits (farmed in warrens) until it resembled a shingle beach. However, from the 1980s the rabbit population declined, dense grassland dominated and bare ground became restricted to localised areas of military activity (e.g. trench digging and shelling) and 16 plots which were managed for breeding stone-curlew *Burhinus oedipnemos*.

Despite many conservation successes over the past 30 years, most efforts have either focused on generic 'habitat management' or on a small subset of well-known and charismatic species (often birds and mammals), while neglecting other less well-known groups (particularly invertebrates). 'Biodiversity Auditing' identifies how many species are present within a region, which species should be prioritised and systematically analyses their management requirements. This means it is possible to objectively target limited resources to maximise benefits for much greater numbers of species of conservation concern.

The Biodiversity Audit approach was pioneered in the Breckland region of eastern England, an area characterised by its sandy soils and semi-continental climate. It was demonstrated that bare open ground supports a wealth of important species across the region's semi-natural grass-heaths. However, over the past few decades the suitability of these internationally important sites has deteriorated due to the loss of the dynamic processes that historically created these conditions (e.g. rabbit grazing, turf removal, mineral extraction and episodes of arable cultivation).

A landscape-scale experiment

Due to its size, and thanks to the availability of conservation funds through Higher Level Stewardship (HLS), STANTA presented a unique opportunity to trial bold and innovative management techniques

on a landscape-scale, something rarely possible on nature reserves. This has enabled one of the UK's largest field experiments to determine the biodiversity consequences of different ground disturbance techniques.

Management started in 2015 and comprised of two disturbance treatments (shallow vs deep cultivation) across 66 plots, plus 40 undisturbed controls (to determine what happened if nothing was done). Disturbance was repeated in early 2016 and 2017. Whilst 26 of the plots were maintained in the same location, remaining two-hectares in size and treated annually, 40 were diversified by cultivating a partially overlapping two-hectare section each year, that developed into a complex-mosaic of subplots that differed in disturbance history and fallow age.



Some of the rare invertebrates caught on STANTA.

From left to right; *Arenocoris waltlii*, *Cleonis pigra* and *Hypera diversipunctata* © Annabelle Horton

It was anticipated that two bird species of conservation concern; woodlark *Lullula arborea* and stone-curlew, plus large numbers of scarce, rare and threatened invertebrate species, some of which are found nowhere else in the UK, would respond positively. Confirmation could encourage more widespread uptake across other sites. For other species, such as Eurasian curlew *Numenius arquata*, the impact was unclear. Since 2015, the University of East Anglia (UEA), in partnership with Defence Infrastructure Organisation, the Royal Society for the Protection of Birds and Natural England have been monitoring this experiment through a PhD project. Generally field experiments focus on a small number of species, however this research focused on birds, plants, beetles, true bugs, spiders, bees, wasps and ants, providing an exceptionally broad and detailed assessment of biodiversity outcomes.

Consequences of management

Full project findings will be available in 2020 however, initial highlights include:

- Woodlark – numbers have increased three-fold on the plots since their establishment thanks to the bare open feeding habitat that has been created
- Stone-curlew – prior experience, alongside monitoring since plot establishment, confirmed stone-curlew used areas of bare ground for nesting, but it was unclear whether they would also use ground disturbance plots for feeding. GPS tagging of five birds demonstrated that recently-disturbed plots were selected for foraging in preference to the surrounding grassland, highlighting the value of these treatments
- Eurasian curlew – monitoring by UEA MSc student Natalia Zielonka demonstrated that shallow-cultivated plots were selected as nesting habitat. From 36 nests across two years, 14 were on plots and 11 of these were on shallow-cultivated plots, despite these covering only eight percent of the grass-heath area. However, productivity was extremely low (30 nests failed at egg, two deserted, three failed at chick stage, and only one fledged a chick). Nest cameras showed that foxes were the main predator, but one nest was predated by sheep and another by crow suggesting a need for



Union Heath, STANTA, in 1996 (top) and 2017 (bottom), illustrating the decline in rabbit populations and the associated loss of bare open micro-habitats © RSPB and Robert Hawkes



greater predator control and/or nest protection measures

- Invertebrates and plants – when the treated plots were first established in 2015, they immediately increased the densities and richness of scarce, rare and threatened invertebrate species, compared to undisturbed grass-heath controls. Intensive monitoring of plants and invertebrates in 2017 assessed complex ground disturbance mosaics comprised of different disturbance frequencies, and fallow ages. Identification of material is ongoing, but already 194 species of plant and 765 invertebrate species (comprising 410 beetle, 112 spider, 121 true bug, 22 ant, and 100 bee and wasp species) have been recorded. Some notable highlights include the insect *Arocephalus languidus*, a new species to the British Isles. This information will reveal optimal management approaches across these different groups and the benefits and biological costs of physical ground disturbance

Applying the evidence

The Biodiversity Audit quantified the potential importance of physical ground disturbance and this experiment has confirmed its value in the real world. Since management was applied on a landscape-scale, across a range of different soil and vegetation types, the results will be applicable to other chalk grassland, grass-heath and lowland heathland sites beyond STANTA. This literally ground-breaking experiment shows what can be achieved by bold and innovative management on the MOD estate when HLS funding is available to pay for conservation work.

Acknowledgments

Many thanks to all the people who have supported this project and helped to make it happen.

Robert Hawkes
PhD Candidate
University of East Anglia

Fire and ice – Saxon burials at Barrow Clump



Daybreak at Barrow Clump © Harvey Mills Photography

"Like ice when the world's Eternal Lord loosens invisible fetters and unwinds icicles and frost. As only He can, He who rules time and seasons" Beowulf.

The final season of excavation at the Anglo Saxon cemetery and Bronze Age burial mound of Barrow Clump on Salisbury Plain took place in the summer of 2014 and the post-excavation work began in earnest in readiness for the archaeological publication programmed for the end of 2018. But badgers do not always work to these plans...

Outside the area of the burial mound protected as a Scheduled Monument by Historic England, the badgers continued to expand their sett and occasional human bones were found lying in the ground surface close to a trackway. Kathy Garland of Bulford Conservation Group and Tom Theed of Landmarc Support Services monitored these developments frequently and reported back any alarming tidings to the archaeology team at Westdown Camp. In recognition of the urgency of the matter, MOD provided a budget from its Conservation Stewardship Fund (CSF) to investigate the spoilheaps thrown out by the badgers and to undertake limited evaluation work adjacent to them to

establish whether the 6th century cemetery was even bigger than first thought. A license for the archaeological recovery of human remains was acquired from the Ministry of Justice in advance of digging in case more bones were found.

The time period for work was limited as a badger license would not be granted by Natural England (NE) from December onwards. This meant the investigating team would need to excavate at the end of November, in the cold.



The first intact pot found at the site, dating from the 6th century © Harvey Mills Photography

The fortnight of fieldwork was in golden winter sunshine perfect for photography, but these clear skies also ensured bitterly frosty nights and mornings with those hardy team members camping on site needing fires to keep warm. Water on site would be frozen when people started to work and this reminded project staff now based in offices why they had perhaps chosen not to carry out digging endeavours in the winter months as part of their careers.

The work at Barrow Clump was undertaken as part of Operation Nightingale and thus Wessex Archaeology was joined by military personnel assembled by Breaking Ground Heritage, Conservation Group members and other volunteers. The results were incredibly worthwhile with sieving of soil from the badger setts recovering several large fragments of human bone and an Anglo Saxon iron knife. These discoveries alone justified the project but the evaluation trench was to prove even more sensational.

In previous summers, the archaeologists led by Phil Andrews of Wessex Archaeology had noticed that there seemed to be a distinct spatial pattern to the cemetery with more infant burials

on the periphery, to the south-western side. This distribution continued in 2017 with the remains of three children being excavated, although one of the juveniles found this time had a bronze brooch by its skull.

Two adult burials were seen, placed into rectangular graves cut down into the solid chalk bedrock. Both lay on their backs (in archaeological parlance 'extended and supine') and they both had grave goods accompanying them in death.

These two inhumations were pre-Christian and likely 6th century AD in date. The burials from this period at Barrow Clump have tended to be quite gender specific with regards to the material in the graves and these were no exception.

The adult male had a large spear with him, as well as a quite exquisite pot, the first such complete vessel from the site, with decorations that had been stamped into the clay. The pot was carefully wrapped with cloth to enable it to be lifted intact and, very gingerly was raised from the grave to be taken to the finds laboratory for further consolidation and analysis. The soil inside the item was excavated back at Wessex Archaeology to see whether it contained any evidence for having once held a cremation, but there was none forthcoming.

The female had jewellery. A lot of jewellery. She was placed in the ground with amber and glass beads, two



Adult male found with a spear and decorated pot © Harvey Mills Photography

elaborate disc brooches (one of which had been displaced by burrowing animals, being found by her feet rather than up at her collar bones), an iron knife, a small copper pendant perhaps made from an old Roman coin and a set of bronze tweezers that were almost identical to the set used by the woman excavating the burial!

Two further long linear excavation trenches were cut by a machine just to the west of the track to examine the extent of the cemetery. One was completely void of any burials but the other had an infant burial and also a small cremation burial composed of a heavily fragmented pottery urn with burned human bones within it. This is the most south westerly cremation

urn from the 6th century thus found in Britain. It was certainly the first such burial from the Saxon period to have been found at Barrow Clump although prehistoric examples had been seen in previous seasons. Another striking feature of this work was quite how close to the ground surface several of the burials were, indeed you could have taken the turf off a couple of them and been touching human bone within only a few centimetres. This was somewhat alarming given that the trackway gouged deep into the soil and therefore potentially into the underlying chalk which could easily be damaged. Given that there are burials now either side of the track, there is therefore a high potential for further graves to be located underneath the track with the threat of compaction damage, but that is for later investigation.

The excavations of 2017 raised the number of burials uncovered at this site to around 80 and highlighted the need for continuous monitoring of certain sites as designation areas are only relatively arbitrary at times. The finds and burials were taken back to Wessex Archaeology for conservation, cleaning, recording and publication and will add another chapter to the already rich saga that is Barrow Clump.

Richard Osgood
Senior Archaeologist
Defence Infrastructure Organisation



Remains of an adult female, found with disc brooch, Roman coin, pin, beads and tweezers © Harvey Mills Photography

Celebrating sustainable waste champions



The champions sorting through general waste © Fiona McKnight-Burton, Landmarc Support Services

Landmarc Support Services (Landmarc) is the Defence Infrastructure Organisation (DIO)'s partner for managing the Ministry of Defence (MOD) Defence Training Estate. Minimising the environmental impact by managing waste responsibly has always been high on the agenda. The company has set itself ambitious targets to recycle 70% of waste by 2020 and ensure less than 5% of waste is disposed to landfill each year. Ultimately the aim is zero waste to landfill and Landmarc is continuing to coordinate effort and investment into sustainable waste management to achieve this. Meeting these targets requires commitment, both in training and embedding good practice, and from the operational staff who do the hard work at the frontline.

In April 2017 Landmarc launched a new Sustainability Strategy, using the United Nation's Sustainable Development Goals (SDGs) as a framework for prioritising action. The goals seek to mobilise efforts around a common set of targets, covering a wide range of topics such as poverty, health, education and climate change. Goal 12 'Responsible Production and Consumption' and 13 'Climate Action,' as well as the Greening Government Commitments and Sustainable MOD

Strategy inform Landmarc's approach to sustainable waste management.

To support this Landmarc has committed considerable investment and staff resource into developing an effective approach which includes investment in eight Waste Sorting Stations (WSS), a renewed focus on staff training and development and partnership working with key stakeholders. But critical to the company's success is its passionate operational staff who have a genuine commitment to the cause.

The WSS are located in six regions across the UK; Westdown Camp in the south west, Lydd in the south east, Castlemartin and Sennybridge in Wales and west, Otterburn and Warcop in the north, Barry Buddon in Scotland, and West Tofts in the east. Originally established to sift for military debris, the WSS teams are also adding significant value by segregating waste for recycling and implementing the waste hierarchy. Each site has a nominated waste focal point responsible for overseeing waste management locally and driving improvements. The teams are passionate about waste management and pride themselves on delivering waste hierarchy improvements and cost savings.

At Westdown Camp the WSS team led by Chris Hollis has a keen eye for opportunities to improve performance. Their success is based on great team work. Chris said *"This job, despite its somewhat unfavourable circumstances at times, does rely on us working very closely as a team. We make a continuous effort to support and assist each other on a day to day basis, maintaining humility and morale to see us through the more unpleasant aspects of the job. Our success lies in understanding and accepting that this type of work must be carried out and done well. We know we are contributing towards achieving a better, healthier environment and playing a part in reducing our carbon footprint where we can."*

The team demonstrated initiative after noticing a large volume of unused hexamine cookers being sent for disposal following exercises on Salisbury Plain. Putting the hexamine packs to one side, they re-packed and returned the field cookers back to the DIO Field Training Unit supply chain. Between September 2016 and April 2017 alone, a total of 2,280 stoves were diverted from waste. In addition to the savings achieved for DIO, this initiative also avoided unnecessary disposal costs. Even though the hexamine stoves are now being phased out by the MOD, the team still identifies any unused new-style gel stove packs that can be returned.

Landmarc has made a commitment to ensuring its teams have the skills and knowledge to contribute to waste management objectives. As part of a wider drive to develop sustainability skills, the Sustainability Team has toured the UK delivering Waste Management training to operational staff involved in handling waste.

The aim is to ensure colleagues consider waste as a resource, apply the waste hierarchy, understand legal requirements and the environmental impact of waste and are equipped to contribute to waste targets. The training has been delivered in all six regions of the UK (tailored to the different

legal requirements of the devolved nations) and has resulted in positive feedback across the board. To date almost 200 staff have participated, with further sessions planned. Formal training is supported by workplace talks and on the job training assignment instructions, with more resources being developed all the time.

The SDGs call for partnerships at all levels to ensure stakeholders work together to achieve a sustainable future. Businesses must coordinate with a broad range of actors to deliver services in a sustainable manner and Landmarc is committed to taking a collaborative approach to sustainability.

A key partnership in delivering sustainable waste management is the relationship with national waste broker GPT. The rural and often remote locations of sites across the Defence Training Estate present significant challenges in finding contractors that can provide quality waste services within the available budget. Landmarc works with GPT to benefit from the business efficiencies achieved by dealing with one supplier, whilst still investing in the local economy through GPT's network of service providers that includes smaller, local companies.

Landmarc supports a flexible approach to sustainable waste management and services, meaning each site is tailored to meet user requirements and geographical constraints. This



Even the smallest items of military debris are found © Landmarc Support Services

maximises efficiency at site level, encourages landfill diversion, and improves recovery and recycling rates. In addition, GPT Account Managers work closely with waste focal points to recommend improvements.

At Lydd Camp, Site Operative Simon Buttigieg has a passion for sharing knowledge of sustainable waste management. As well as carrying out a high degree of waste segregation at the WSS, Simon developed a waste brief to deliver in person to all visiting units. His infectious enthusiasm for sustainable resource management rubs off on everyone he meets.

As Simon explains, building good working relationships and talking to

Units is critical. *"I brief the soldiers, which works perfectly. Once I have got a signature off the soldier they will go out of their way to make sure they do not get it wrong. I am proud of the waste station, it has taken a long time to get things working the way I want. For me it is about taking pride in my work and the knowledge that I am doing my part to protect the Armed Forces and civilians outside."*

Thanks to a long-term commitment to the development of waste and resource management strategy on the Defence Training Estate, Landmarc has seen performance improve from a 4% recorded recycling rate in 2008 to a 56% recycling rate in 2017/18, with just over 95% of waste diverted from landfill.

There are countless examples of Landmarc staff who have gone above and beyond core duties, taking the initiative to prevent unnecessary waste and demonstrate a commitment to sustainable resource management. All those involved deserve a mention for their hard work, enthusiasm and ideas to improve performance in this area, with the sustainable waste management champions continuing to be critical to achieving Landmarc's goals.

Amanda Williams
Sustainability Manager
Landmarc Support Services



Chris moving heavy waste materials with the forklift © Fiona McKnight-Burton, Landmarc Support Services

Archaeological investigations into the training trenches at Barry Buddon



An iron observation turret overlooking the trench system and possibly used to monitor a training exercise © Crown

Barry Buddon is situated on a spur of land on the north bank of the River Tay estuary, seven miles east of Dundee and has been used for military training for close to 170 years. The area was first used by the Forfarshire Rifle Volunteers, the Fife and Forfar Yeomanry, the Panmure Battery of the Forfarshire Artillery Brigade and a Royal Naval Reserve Battery. In 1897 the site was sold to the War Office for exclusive use as a military training area. The visible traces of its history are clear and present: bunkers, gun platforms and even a building that

replicates the gundeck of a ship of the Main, but the First World War training trench complex is perhaps the most enigmatic of all. As the First World War became a predominantly artillery war, so trenches developed to protect the soldiers on the front lines. This began just before the winter of 1914 and the trenches remained a feature of the battlefields until 1918 when mobility returned to the fighting. These defences were extremely complex in layout and as part of training, soldiers dug trenches in areas across Britain before leaving for France and Belgium.

Trench manuals were also produced to train the soldiers in the proper construction of fighting positions.

In 2017 Defence Infrastructure Organisation (DIO) sponsored a group of Operation Nightingale volunteers working under the supervision of Wessex Archaeology, to sample the remarkable trench system thought to have been dug during the First World War as a realistic training resource for the troops. No previous work has been undertaken on the site so any information recovered by the dig would contribute to the relatively new discipline of 20th century military conflict archaeology.

The American journalist and writer Napoleon Hill stated that patience, persistence and perspiration make an unbeatable combination for success. Well, at Barry Buddon there were all three...with a bucketful of passion thrown in for good measure. The team of Operation Nightingale diggers, working under the Supervision of Wessex Archaeology staff did a superlative job recovering information from one of Scotland's premier First World War period archaeological sites. Operation Nightingale engages Wounded, Injured and Sick veterans in archaeological work to aid in their recovery. Archaeology requires teamwork, attention to detail and a methodological work practice that has been demonstrated to improve the wellbeing of participants, providing transferable and vocational skills.

At first glance the trench complex at Barry Buddon looks deceptively simple; crenelated front line trenches and zig-zag communication trenches designed on a rectangular plan. What could be more straightforward? But on closer inspection interconnecting trenches, machine gun positions, target trenches and a contemporary iron turret become part of the mix. To clarify the situation a small-scale excavation was commissioned in August 2017 and



Members of the team record the layers within the trench © Crown

a team of veterans and professional archaeologists working together opened four trial trenches.

One of the principal archaeological trenches was located on what was thought to be a front-line practice trench. The prevailing soil at Barry Buddon is sand, which is easy to dig but inherently unstable and being on the coast the water table can be relatively high. It was evident that both these factors came into play in the trench system. Rather than digging trenches that were above head height, the trenches were relatively shallow, but both the parapet in front of the trench and the parapets to its rear had been raised by sandbags to create an impression of depth. This was a technique called a breastwork and was used predominantly in the battlefields of Belgium where the water table is very high due to the geology. Similarly, within the trench the remains of rotted sandbags had deposited a dark turf band and brown sandy layer creating an effect known as 'tiger striping'. This was clear evidence that sandbags had also been used to revet the internal faces of the trench. Furthermore, the remains of wooden posts were also seen to be still in place although largely rotted away, probably due to the waterlogged soils. These wooden posts would have held the sandbags in place. Examples of breastworks can be seen in period photographs of the front-line trenches and are detailed in

contemporary trench manuals but this was the first time it had been identified in a training trench in the UK.

A second significant structure was a corroded iron turret situated on an artificial knoll overlooking the trenches. Prior to the excavation this was thought to have been a relatively rare and specialised machine gun post known as an Allan Williams turret. Invented during the Second World War the Allan Williams turret enabled a 360 degree field of fire by the use of a rotating mechanism. Excavation of the turret revealed that it was bedded onto a concrete base and was in a fixed position. The turret is now thought to be contemporary with the trench system and allowed an observer to monitor training exercises in the nearby trenches in relative safety. The provision of a second layer or skin around the top of the turret was probably used to provide additional protection from stray rounds.

Prior to the start of the excavation an Explosive Ordnance Clearance (EOC) survey located several items of ordnance buried relatively close to the surface. A toolbox briefing was advised and this was given by Gary Archer the Barry Buddon Senior Training Safety Officer. Fortunately, no live ordnance was uncovered, although a number of spent mortars were located below the depth of the EOC scan. Spent bullet cases were present in abundance and, because each case has a date stamp

on its base, they proved to be one of the most important sources of dating evidence. Surprisingly perhaps, most of the bullets dated to the inter-war period, suggesting that the site was used for training after 1918. This supports the idea that troops often trained for the last war by using techniques that are familiar, but which with hindsight were superseded by tactics which were governed by technological advances. Luckily, one of the bullets found in an excavation trench indicated that the trenches were also used for training during the period of WW1. Also uncovered was ammunition from the late 19th century, from Martini-Henry, Snider and Enfield rifles. All of this evidence shows a continued use of Barry Buddon in training soldiers from the Victorian period through to modern day, in an unbroken military tradition.

The team of Operation Nightingale excavators was recruited by Breaking Ground Heritage (BGH), an organisation headed by Dickie Bennett, a former Royal Marine who has worked tirelessly to provide archaeological experiences to forces veterans. BGH is a Community Interest Company (C.I.C) created by veterans to assist in the recovery of other veterans and serving personnel using heritage as a pathway. Barry Buddon offered an opportunity to work in Scotland, a first for BGH, and a team of veterans supervised by Wessex Archaeology spent two weeks living and breathing the archaeology of the trenches. On completion of the work Wessex Archaeology produced a comprehensive report which described and interpreted the results of the excavation.

But all is not done. Through the generosity of the MOD Conservation Stewardship Fund, a further two weeks work is programmed for 2018 with the aim of establishing if the trenches were all built as a single unit or, as is looking more the case, if they were progressively added to, in order to meet the requirements of training.

Phil Abramson & Alex Sotheran
Archaeology Advisors
Defence Infrastructure Organisation

Searching out micro molluscs in Ascension Island



Collecting sand during a scuba dive © Dr Judith Brown

Ascension Island is an isolated volcanic island in the equatorial waters of the South Atlantic Ocean, about 1,000 miles from the west coast of Africa and 1,400 miles from the coast of Brazil. It is situated 7°56' south of the Equator with a sea surface water temperature range of between 24-28°C for the past three years.

The Ascension Island underwater marine environment is relatively unexplored. The inshore waters surrounding the island are particularly rich in micro molluscs, however minimal research had previously been undertaken in Ascension and therefore very little was known. Molluscs are a group of invertebrate animals which include snails, clams, scallops, oysters, topshells, chitons and even octopus and squid. A micro mollusc is an animal which, even at full adult size, is usually less than 6mm but can be as small as 1mm or less.

Over the last two years Defence Infrastructure Organisation's (DIO) Senior Estates Facilities Manager, Sarah Browning-Lee, has been searching for micro molluscs in Ascension. Sand and sediment samples are collected using scuba diving equipment. Small bags of material are taken from a variety of

dive sites and different environments such as under rocks, on ledges and amongst algae. Whilst the research had previously been limited to the depths of recreational scuba diving, it has recently been expanded to the deep sea marine environment using a Van Veen grab. Once ashore, the sand is left to dry out and initial collection details, such as date, location, depth and substrate are recorded.

The sediment takes several days to completely dry, after which an initial sift is conducted to remove the larger pieces of detritus. Identifying micro molluscs is a rare skill and so



Shells that had been sorted from sand and separated into groups © Frank Swinnen

the samples are sent to an expert in Belgium, who undertakes detailed analysis of the sand using a microscope. The shells and micro molluscs present in the samples are recorded and the scientific data is sent back to DIO before being shared with Ascension Island Conservation Marine Department for their database.

The identification of species that are new to science, or molluscs that have never previously been recorded in Ascension Island waters are of particular importance. So far several new species for the Island have been recorded from the sand sample collections. It is hoped that in the future a species new to science will be found, although the identification process for confirmation can often take over a year to prove.

It has been a privilege to work in such a fascinating Overseas Territory and to be able to contribute to the important scientific research that goes on in this remote corner of the MOD estate.

Sarah Browning-Lee
Senior Estates Facilities Manager
Defence Infrastructure Organisation

Coleophora pennella – a first for Portsdown Hill



Coleophora pennella at Maritime C5 Support Unit © WO1 Tindale

Throughout 2016 a 40W Actinic Heath Trap, procured through the Defence Infrastructure Organisation's Conservation Group Fund, was operated at the Maritime C5 Support Unit located on top of Portsdown Hill, Hampshire. The Maritime Support Unit provides IT and Information Systems equipment to all Naval units. The facility is situated adjacent to an extensive Site of Special Scientific Interest, comprising of calcareous grassland to the south and arable farmland to the north. The moth trap was left on overnight within the secure site and the reward was a total of 196 moth species (72 micro and 124 macro) that included several notable records.

Nationally Scarce A (Nationally Notable) relates to species found in 30 or fewer 10km squares of the National Grid. Nationally Scarce B species are found in 31-100 of the National Grid's squares.

Micro

Without doubt the highlight was *Coleophora pennella*, a species of micro moth that was a first for the county of Hampshire. A total of five specimens were caught, including two in one night, which indicated the presence of a healthy resident population of the Nationally Scarce A species that inhabits calcareous grassland. Although small it is well worth closer scrutiny with the veins highlighted golden yellow against the white ground colour of the wings.

Another *Coleophora* species, the *Amethystinella* was seen – the second ever recorded in Hampshire. The first

record was found 1km further west at Portchester Common eleven years ago, in June 2005. The survey also confirmed the continued presence of the Nationally Scarce A *Pelochrista caecimaculana*, with six records from late June and throughout July suggesting an established population.

The presence of three other micro moths, now considered resident, were recorded with single records of each species. *Cynaeda dentalis* is an inhabitant of calcareous grassland and shingle beaches with Nationally Scarce A status. It is rarely recorded at coastal sites in Hampshire. *Hypochalcia ahenella* is Nationally Scarce B and is infrequently encountered on chalk downland within the county. The third, *Depressaria badiella* has a Local status and is a species that inhabits sandhills and quarries throughout the country.

The coastal species *Dolicharthria punctalis* was the one other Nationally Scarce B species of micro moth recorded during the survey with a single record. It is an uncommon species in Hampshire from typically coastal locations.

Macro

Notable species of macro moth included a single ruddy carpet and 11 light feathered rustic, which is a typical inhabitant of calcareous grassland, with its dark irregular cross-lines contrasting against the pale ground colouration of the fore wings. Both are Nationally Scarce B status. Other macro highlights included a single record of netted pug and regular records from July to

September of galium carpet (maximum of eight in one night). Although netted pug is fairly well distributed nationally, predominantly on chalk and limestone, it has remained a rarely encountered species in Hampshire. Records of galium carpet in the county are more numerous, particularly on the coast but the extent of records during the survey was notable.

In 2017 the trap was relocated to Whale Island, where it has been operated at Fleet Headquarters. A single box-tree moth on 3rd September 2018 has been the most recent notable record. Although a very attractive species, it is native to Asia and was first recorded in Hampshire in 2013. Its larvae cause extensive defoliation of box and its continued spread within the UK is of concern.

Acknowledgments

Thanks go to entomologists Richard Dickson and Keith Wheeler for confirming the identity of the less familiar species.

Antony D Tindale
WO1ET(WE)
Royal Navy



A light feathered rustic © WO1 Tindale

Working together as 'one team and one station family'



Lord Redesdale, 29 Regt RLC, Industry Partners and DIO colleagues attend the EMA Awards © Energy Managers Association

In preparation for future rising energy costs 29 Regiment, the Royal Logistic Corps decided to take early action to help mitigate the impact of rising utility costs. Under the direction of the Station Safety and Environmental Adviser an Energy Management team was formed and regular meetings continue to take place. The team consists of military staff, industry partners, colleagues in the Defence Infrastructure Organisation (DIO), Duke of Gloucester Playgroup and the on-site youth clubs. Energy efficiency is based around a 40:20:40 ratio- 40% of energy efficiency is achieved by technological asset upgrades, 20% by control systems and 40% by behaviour change. The Station team were tasked to:

- Engage with colleagues in defence and industry partners to investigate where efficiencies could be made through 'Spend to Save' technological asset upgrades
- Engage with the facilities management company to see if Building Management System efficiencies could be made

- Enhance the site's power generating capacity and security of supply to maintain operational capability during any interruptions of power supply
- Engage with Station personnel to increase, enlighten and raise awareness of the cost of energy

The team developed work that had already been highlighted in the Station's Environmental Management System. Initial improvement started with changing the expectations on performance and behaviour. The Safety Health Environmental & Sustainable Development Workplace Induction package was enhanced, which is completed by all military personnel, civil servants and supporting contractors.

Behavioural management strategies were implemented throughout the Station and include the Safety & Environmental Advisor's lectures on environmental change and sustainable development given to all levels of management to generate interest, commitment and action. Building custodians and industry partner 'Green

Teams' were issued with Terms of Reference. Posters and signage were displayed in key areas around camp to help influence individual behavioural change towards energy. Green Teams monitored departments to ensure that electrical items were switched off at the end of each working day. This greatly assists in reducing costs during the daily Distribution Use of System periods and when TRIAD alerts are received. Security teams and duty personnel were empowered to carry out checks during silent hours to ensure that all buildings had been closed correctly. Access is gained where electrical items have been left on and senior management re-instructs the relevant department manager the following morning. An improved energy and utility saving culture within the workplace environment now exists and it has become second nature for staff to switch off electrical equipment when leaving workstations for extended periods of time. Closedown procedures are issued by the Quartermaster for holiday periods. Offices, accommodation and workplaces are inspected prior to stand down to ensure

that electrical equipment is turned off and that radiator thermostats are moved to frost protection.

Consumption of utilities are actively monitored each month by the Quartermaster, DIO Area Utility Manager and the DIO Estate Facilities Manager. It became clear that not all buildings on-site have individual meters. The team cannot manage what cannot be measured and so the Area Utility Manager organised an external energy management survey which highlighted the 'Spend to Save' opportunities required in the immediate and long-term to modernise the Station.

The survey identified that the 110 service families' houses are connected to the Ministry of Defence electricity supply and so are included in TRIAD and increased energy cost periods. Pte Lauren Barr was inspired after attending one of the Station Safety & Environmental Advisor's lectures and formed the Station youth club's 'TRIAD Warrior' group. Children took part in the energy saving awareness campaign, with 58 primary and 30 secondary school children successfully qualifying as 'TRIAD Warriors'. To raise awareness, the children designed posters and leaflets which were displayed and delivered to houses on camp to assist residents in conserving energy.

The survey identified foreseeable future savings in energy and utilities. The following Estate Service Requirements have been submitted and are now being considered;

- Conversion of the heavy oil installation on-site to a natural gas supply. This will equate to an annual saving of circa £50,000 on oil costs and eliminates the risk of pollution to the Grade 1 Aquifer and local stream. DIO have recognised that these savings could also be replicated at other sites across the UK
- Replacement of external lighting with LEDs. This project will be undertaken when funds become available

Servicing and maintenance of the on-site emergency generators has been reinstated, enabling the unit to maintain operational capability. The

Station continues to be proactive during the daily Distribution Use of System periods and TRIAD campaigns. Last year there were 12 TRIAD alerts and the unit achieved savings on 11 occasions which resulted in the unit sitting within the top 10% of DIO's annual TRIAD league tables. In July 2017, the unit was awarded a Wildcard £1000 Award for its behavioural changes.

To highlight the hard work, dedication and continued commitment that the team has achieved the Safety and Environmental Adviser submitted an entry to the Energy Managers Association (EMA) 2017 industry awards ceremony. Against many competitors, including the Hilton Hotel Group, Royal Mail and Tesco, the Regiment were successful in winning the Energy Management Team of the Year Award. The ceremony took place at ExCel Centre, London and the award was presented by Lord Redesdale, Chief Executive Officer CEO of EMA. Lord Redesdale said *"The winning team from 29 Regiment RLC, through good leadership, inspiration and teamwork is achieving and delivering sustainability and driving energy efficiency performance in their organisation and this makes them worthy winners of the EMA Energy Management Team 2017."*

In May 2018 the Regiment also won the Chief Environmental Safety Officer, Army, CESO(A) Unit Environment Award

at the Army Safety and Environmental Conference for the delivery of an exemplar Environmental Management System and coordinating work with service families at South Cerney Station. The award was presented by the Deputy Chief of the General Staff, Lt Gen Pope CBE.

The Regiment is extremely proud and honoured to have most recently been selected as the winner of the 2018 MOD Sanctuary Utilities Award. This award will help in recognising the continued hard work, dedication and commitment not only by the Regiment but also for colleagues in DIO and industry partners who provide daily support. When the identified 'Spend to Save' initiatives are funded the Station will really start to reap the rewards.

To win four awards over the past year is a great honour and is a fantastic achievement for the Regiment, colleagues, industry partners and residents. It has proven that good leadership and working together as 'one team and one Station family' can make a difference, especially through these times of paucity. It is hoped that this story helps raise awareness and inspires other military units to get involved.

Nigel Williams
Safety & Environment Adviser
29 Regiment, The Royal Logistic Corps,
South Cerney Station



Carrying out the weekly check on the fuel oil facility © Crown

Bird ringing on the MOD estate



Foxglove ringers at an early morning meadow pipit session on Catterick Training Area © Elizabeth Dickinson

When the Ringing Scheme was set up over 100 years ago, its main purpose was to see where migrant birds spent the winters. Today, tracking devices can remotely follow an individual bird to tell researchers where it goes, by what route and how fast it flies. So why do the British Trust for Ornithology's (BTO) 3,000 volunteer bird ringers continue to ring approximately one million birds in Britain and Ireland each year, and how can people get involved with ringing on MOD land?

Ringing data make a major contribution to the study of population changes and to the understanding of species decline. Essentially, bird populations are determined by the number of fledglings raised and the survival of both juveniles and adults. Whilst ringers collect data on survival, volunteers for the Nest Record Scheme collect information on productivity. The results can be analysed in combination with population trend data, such as that collected through the BTO, Joint Nature Conservation Committee and Royal Society for the Protection of Birds Breeding Bird Survey, to determine at which stage of a bird's life cycle there might be a problem. This enables

scientists and conservationists to target appropriate mitigation measures.

Information on survival is generated by re-encountering ringed birds, either through reports of dead birds, recaptures of live birds or by sightings of birds wearing colour marks (rings, flags, wing tags and so on). Ringing is not only about survival though. Changes in species composition or abundance at a site level can alert land managers to potential problems with the habitat or inform management decisions.

By ringing chicks, it is possible to determine where birds disperse to and by ringing at bird observatories, researchers can record the timing of spring and autumn migration. This can help to determine how well species can adapt to new situations, such as the effects of climate change. As well as fitting a ring to a bird, biometric data is collected such as wing length, weight, age and sex (where possible) and information on whether the bird is breeding, moulting or preparing for migration. Collecting data on the age of birds during ringing also allows productivity to be estimated alongside survival; by simultaneously monitoring

the two main processes that determine whether a species is in decline, the chances of identifying, and ultimately tackling, the cause are greatly increased.

There are no formal qualifications needed to become a bird ringer, although trainees are expected to be able to identify most common species. Ringing training is carried out by qualified trainers who hold BTO ringing permits; as bird welfare is paramount, all ringing activities will be supervised closely until a trainer determines the trainee has sufficient knowledge to become a qualified ringer. Training requires time and real commitment; it normally takes around two years to reach the standard needed to operate mist nets independently. It is also not a cheap hobby, with most ringers paying for rings and equipment, but the vast majority of ringers find it hugely fulfilling and enjoyable. To find a trainer, visit the BTO's website <https://www.bto.org/volunteer-surveys/ringing/about-ringing/faqs>.

To ring on the MOD estate a permit must first be obtained from the MOD Conservation Office (part of Defence Infrastructure Organisation), and this must be carried at all times whilst on MOD land. To gain a permit, approval must be sought from the Head of Establishment, who will be recorded as the permit sponsor. In order to retain a permit, copies of recovery details and an annual ringing report must be submitted to the MOD Conservation Office at the end of each year. A permit application form can be obtained by emailing DIO-ConservationGroups@mod.gov.uk.

The MOD encourage and support the BTO and bird ringers on the MOD estate and there has been a network of ringers for over 40 years. One of the main sites for training is Foxglove Covert, however long-term projects also include monitoring barn owls and whinchats on Salisbury Plain and knots at Altcar Training Camp.

Ruth Walker
Ringing Surveys Organiser
British Trust for Ornithology

Tracking the migration patterns of whinchat from Salisbury Plain



A male whinchat fitted with a geolocator. The light stalk is visible © BTO

In order to conserve migrant birds, it is vital to understand their year-round ecology, levels of habitat dependency and movements throughout the annual cycle. Salisbury Plain is home to the UK's largest military training area and is the most important lowland site for breeding whinchats in England, where a 400 plus strong population of pairs persists against a declining national trend. On the Plain the birds' breeding ecology has been well studied but outside the breeding season almost nothing was known about whinchat migration routes or winter ecology.

The British Trust for Ornithology (BTO) instigated a tracking study of whinchats which combined with a similar study by the Royal Society for the Protection of Birds (RSPB) in Cumbria, was the first of its kind in Britain for this species. There are many important implications for survival depending on how and where birds migrate to. For example, in whinchats it could be that the Salisbury Plain breeding population connects to a single common winter location where the entire breeding population is vulnerable to small scale habitat loss. Could the breeding population

disperse across Africa and in this way become far less vulnerable to localised losses of habitat?

Thanks to part-funding from the MOD's Conservation Stewardship Fund and permission from the Head of Establishment, in 2016 the study fitted a tracking device to 20 adult male whinchats that had been trapped near Berril Valley and Imber on Salisbury Plain. In 2017 nine of the tags were retrieved, a good return given that normal adult male survival rates for Salisbury Plain are around 45-50%. Data from the nine tags revealed a journey south through France and Spain with the birds being at their most southerly latitude by late October/early November. Tracking revealed that at this point individuals from Salisbury Plain spread out over an immense latitudinal distance of 1,500km across west Africa, from south western Mali and Guinea through the Ivory Coast and Ghana to Benin and Nigeria. This is roughly the same distance as between London and Warsaw. Clearly the Salisbury Plain birds were not wintering together in a single location but dispersing far and wide.

Regarding winter habitat, whinchats are found in December and January in west Africa in the northern humid zone and the transition zone towards the drier Sahel. In ecological terms whinchats exploit relatively temporary, early successional habitats that may change position over time such as grassland and light scrub. Whinchats are commonly encountered using weedy, sparse rotational fallow crops, for example previously of cassava or maize as the old stems provide essential perches necessary to search for prey movement and the bare ground offers access to those insects. The main threat to habitat in Africa is large-scale agricultural intensification, which for decades has been responsible for the widespread declines of this species as a breeding bird across western Europe.

Acknowledgements

There are many people to thank for this project; the MOD, Wiltshire Ornithological Society and the ringers, Imber Conservation Group, BTO colleagues, Malcolm Burgess (RSPB) and those who helped fund the tracking works.

Ian Henderson and Jenni Border
Senior Research Ecologist
British Trust for Ornithology



Migration patterns from Salisbury Plain © BTO

Knot conservation aided by colour ringing at Altcar Training Camp



Waders gathering to roost on the foreshore of Altcar Training Camp © Philip H Smith

The foreshore of Altcar Training Camp, Merseyside hosts an internationally important high tide roost of wading birds that find refuge there when their feeding grounds in Liverpool Bay are disturbed by humans. Volunteers have provided monthly counts since 1969 as part of the nationally coordinated Wetland Bird Survey. Data shows that 40,000 knot were regular visitors in the 1980s, peaking at 51,000 in January 1990. Numbers have fallen somewhat since but the Altcar roost is still second only to The Wash for numbers of knot, with an average peak count of 26,000 in recent years.

Knot breed in the high Arctic tundra of Greenland and northern Canada, meaning that whilst a flock of immature knot usually spend the summer at Altcar, adult knot of breeding age are absent between early May and late July. The knot is seen as an indicator species for understanding the impacts of global warming and is thus a target of research throughout its geographical range. One such project led by Jim Wilson, has marked many knot in Norway and Iceland with unique identification leg-tags called flags. Sightings of these birds by project teams, birdwatchers and the general public build up life histories of the movements of individual birds without the need for recapture. Recent

field observations of these and other colour ringed knot around Liverpool Bay have revealed that over the course of the year a series of different populations of knot use the area. Interestingly, these have included populations that have no colour rings and whose migrations were thus unknown. To fill this gap in understanding, a team led by Steve Dodd and Richard du Feu caught 519 knot in September 2017 and 494 in March 2018 at the Altcar roost and fitted the birds with flags.

These flagged knot have already yielded many new ecological insights. Due to an intensive effort to sight the newly-ringed knot on the Sefton Coast, Dee Estuary and elsewhere, over 80% were sighted throughout the winter, some numerous times and principally around Liverpool Bay. This demonstrates that many of the knot present in September stay for the winter. Small numbers were sighted in the nearby Ribble Estuary, Morecambe Bay and elsewhere around the Irish Sea and there were some unexpected northerly movements during the winter, including to Moray, Scotland.

In the September catch about half the knot had almost completed their moult and these were most likely the summering immature birds. The other,

less advanced half were the adults recently returned from the Arctic. Over time these flagged birds will yield knowledge about migrations of both immature and adult knot. The proportions of immature and adult flagged knot stayed constant, demonstrating that both groups stay for the winter and the knot moved freely between Altcar, Crosby and the Dee Estuary.

Whilst historic sightings indicated that many knot move from Liverpool Bay to the German Wadden Sea in early spring, only one of the Altcar birds was sighted there, suggesting that they now mainly stay in the UK until migrating north. The knot departed in early May and fieldwork in Iceland, where knot pause to build up fat reserves before the hazardous flight to the high Arctic, showed that Altcar birds were not concentrated in a specific region but were widely spread. Over their lifetime these knot are sure to yield a great deal of new knowledge that will inform conservation practice.

The author acknowledges the assistance of Lt Col Gordon Black, Gerry Allen, John Houston, Ian Wolfenden and Steve Cross in facilitating the fieldwork at Altcar.

Peter J Knight
Visiting Professor
University of Leeds



Knot 'JX' was flagged at Altcar in September 2017, photographed at Findhorn Bay, Moray in May 2018 and sighted again on Benbecula, Outer Hebrides three days later © Richard Somers Cocks

Kier contributes to a sustainable society



The DIY SOS team renovated an entire street in Manchester for veterans © Kier

Like many big businesses sustainability at Kier is wider than the green agenda. The environment is important, of course, but sustainability is also about supporting communities, local economies and society as a whole. For many years, Kier Group has been making a real difference, creating a positive social and environmental impact every day through the projects delivered.

'The Kier effect' has been applied to many initiatives involving the defence community. Few schemes have grabbed the headlines quite like the collaboration between Kier and DIY SOS, the popular and life-changing BBC TV show where volunteers transform a property, or in this case a street. Kier's Housing Maintenance team project managed and led a hugely ambitious scheme to renovate a dilapidated street in Manchester and turn it into housing for veterans, alongside a Walking with the Wounded advice and therapy centre. At the height of construction, more than 250 tradespeople were on site and there was a special visit from Princes William and Harry, royal guests whose links to defence are well chronicled.

The team returned to Manchester two years later to play a key role in the second phase of the scheme, refurbishing 17 empty properties by well-known veterans' charity, Haig Housing to create a veterans' village.

Last year, Kier was working at Baker Barracks on Thorney Island in Hampshire, when an opportunity was spotted for a community engagement initiative to transform a welfare centre for the 1,100 soldiers and 247 families on the site. The team pulled in support from across the company and with the help of sub-contractors the centre was completely refurbished in just eight weeks. More than 480 hours of time was volunteered and The Kier Foundation donated £5,000 alongside many other materials donated by local suppliers. Maj Ian Battersby of the 42 Air Defence Support Battery Royal Artillery said the project has been responsible for *"turning an almost derelict area into a much needed community centre for families."* The project, which would have cost approximately £17,000, was delivered at no cost and has recently been announced as a finalist in the 2018 Construction News Awards Community Engagement category.

Kier naturally delights in being able to deliver such transformative projects but its support for the defence community extends far beyond one-off initiatives. The values of Kier and the military are closely aligned, with a focus on collaboration, enthusiasm and forward-thinking, and the company offers a range of opportunities for service leavers, with something to suit all skillsets. Kier was one of 22 companies to achieve

the Employer Recognition Scheme Gold Award in 2016 and was one of the first to sign the Armed Forces Council Community Covenant in 2013 which now forms part of Group policy; for example, Reservists are given additional annual leave to conduct their military training.

Recently, Kier helped to design the Armed Forces Employment Pathway and collaborates closely with the Armed Forces Career Transition Partnership to offer a recognised, accelerated route into its industry for service leavers, offering apprenticeship and graduate schemes and gas safety courses.

The benefit of these initiatives is two-fold; for service leavers, a structured and supported path into civilian life and the opportunity to build a lasting career, and for Kier the enhancement of its workforce with the 'can-do' attitude that those with a military background bring. Jim Fernandes, defence lead at Kier summarises the point nicely, *"we have ample opportunities for leavers and we want them to be a part of our ambitious company and leave a lasting legacy across the country by delivering first-class projects."*

For more information on the Kier Armed Forces Career Transition Programme, visit www.kier.co.uk or email Louise. Bloxham@kier.co.uk.

Louise Bloxham
Communications
Kier



James Walters is a regional SHE Health and Safety Advisor for Kier and Royal Navy veteran © Kier

How to preserve an 150 year old military uniform



The Military Stores tunic © RLC Museum

The Royal Logistic Corps (RLC) Museum brings together the collections of the Royal Army Ordnance Corps, Royal Corps of Transport, Royal Pioneer Corps and Army Catering Corps, with a few small objects from the Postal and Courier Section of the Royal Engineers.

With a small salaried staff supported by volunteers, the museum holds a vast

collection of objects and archives dating back to the RLC's first recognised unit, the Royal Corps of Waggoners, raised for the Flanders Campaign of 1794. The RLC medal collections are similarly extensive, containing many Victoria Crosses and other unique medal groups, many of which will be on display when the museum and medal collections move to a new building in Worthy Down, in 2020.

Preserving the past

At the start of the Crimean War (1853-1856) logistic support to soldiers in the field was not under the control of the Army. It was instead provided mainly by the Commissariat, which belonged to the Treasury and the Field Train Department of the Board of Ordnance. The Commissariat were woefully under resourced with just 75 mules and a few carts to support a force of 33,000 soldiers. The lack of control over supplies arriving at the small harbour of Balaclava on the Crimean Peninsula exacerbated matters.

The advent of the telegraph meant that journalists were able to report their stories on the war back to the UK in almost real-time. This led to public outcry over the lack of supplies and the terrible conditions in which the men fought in Crimea, resulting in the likes of Florence Nightingale and Mary Seacole traveling to the area.

To improve matters, responsibility for supplying the Army moved from civilian to military control, eventually leading to both the Board of Ordnance and the Commissariat being disbanded. A Land Transport Corps was raised to replace the Commissariat and in 1857 the Field Train Department was replaced by a newly formed Military Store Department which was assisted firstly by Military Store Clerks and later by a Military Store Staff Corps. This organisation was responsible for running Army supply depots both in the UK and on expeditions abroad.

Recently the RLC Museum discovered and purchased a very early ordnance soldier's tunic on an auction website for £500. The tunic dates to just after the Crimean War, between 1857 and 1865 and would have been worn by one of the very first Stores Clerks in the British Army.

The tunic was in quite poor condition with many moth holes and large rips in the lining. This raised the question as to whether it should be conserved



The Military Stores tunic © RLC Museum

or restored. To conserve the tunic it would simply be given a light clean and stabilised to prevent any further damage occurring. Restoring it would involve repairing damage, replacing sections of torn lining and making it look as it would have when first worn 150 years ago. The museum decided to conserve it. This is because the damage is not so severe that it prevents the visitor appreciating what it is and the deterioration actually gives the tunic an age and an authenticity which might otherwise be lost if it were significantly altered in an attempt to make it look new.

One of the first conservation tasks is to remove moths, eggs and other creatures which may be present in the tunic or hidden in the lining. In Victorian times fabric dyes mainly came from plants and animal extracts; the red dye in this tunic probably came from the madder root, which is much less hard wearing than modern synthetic dyes. Thus great care had to be taken not to damage the material when destroying insect infestation. This is achieved by carefully wrapping the tunic in museum grade tissue paper and then in polythene (not PVC), before placing it in an industrial freezer at -30°C for three days or a domestic freezer at -18°C for at least a week. A thermometer should be placed into the freezer to ensure that the proper temperature has been reached. To avoid the build-up of condensation the tunic is slowly brought up to room

temperature and kept there for 48 hours before it is removed from its bag. This freezing process will kill all insects regardless of lifecycle stage whether this is egg, larva or adult.

The tunic can then be gently cleaned using a specialist museum vacuum cleaner which allows the suction to gently increase as required. This removes dust, surface dirt, eggs and dead insects. The tunic must have spent most of its life in storage away from light sources as the fabric colours are remarkably bright. Whilst this is excellent for the tunic, keeping it stored away is not good for achieving a good visitor experience and this visibility versus vulnerability dilemma is a constant worry for museum professionals. It is for this reason that museums are often so dim, particularly in areas showing uniforms or paintings, as curators desperately try to balance the needs of the object with the needs of the visitor. Museum staff assiduously monitor and record light levels throughout the galleries, replacing light bulbs with lower UV alternatives whilst calculating the total light exposure each object receives annually to ensure damaging levels are not reached. Some particularly precious and vulnerable objects may only go on show for a few months each year and are kept in darkness when the museum is closed.

Moisture levels can have an adverse effect on clothing and so temperature and relative humidity (RH) are monitored throughout the museum. Drastic changes in temperature and RH can lead to the growth of mould and mildew or the slow degradation of an object. Whilst a cold frosty morning followed by full winter sunshine is great news for gardeners, it can prove challenging for museum managers who need to safeguard collections from rapid temperature and moisture level fluctuations.

A recent flood subjected the museum's three – four million 'tracer cards' dating from World War Two (WW2) to very high moisture, or RH. These cards give a brief account of a soldier's postings and are an invaluable record which must be preserved. A specialist conservator gave the museum advice on how to reduce the moisture levels in the air,

increase air flows in the store and thus slowly stabilise the environment in which the cards are kept. The cards nearest the leak were removed to another location and loosely placed on tissue paper. In time the whole collection is going to be placed into specialist archive boxes and it is hoped in the future to digitally scan the cards, so that the information can be safely retained for future generations.

When the tunic goes on display at the RLC Museum, it will go into a specialist glass display case alongside objects which require similar conditions. There will be limited light in the main gallery and the display case will have its own internal lighting which will strike a balance between allowing the tunic to be seen and limiting the UV levels it will receive. People are tactile by nature and love to touch objects, however, fingerprints can do a lot of damage to an item due to salty sweat, natural oils and dirt which over time can discolour and damage objects. Museum staff will wear nitrile gloves when handling the tunic, although freshly washed hands can be equally as effective. The conservation works mean the tunic will continue to be enjoyed by visitors to the Royal Logistic Corps Museum for years to come.

The RLC museum is at the Princess Royal Barracks, Surrey, or visit the website <http://www.royallogisticcorps.co.uk/heritage/museum/>.

Maj (Retd) Simon Walmsley
Museum Manager
Royal Logistic Corps Museum



One of the tunic buttons © RLC Museum

Safeguarding elms on Salisbury Plain



Huntingdon elm in Bulford © Mike Lockwood

Standing alone and majestic in Bulford Garrison on the edge of Salisbury Plain, Wiltshire, is a magnificent mature elm tree. Its forked trunk with distinctive latticed ridges in the bark and elongated glossy leaves identify this as an Huntingdon elm.

Nowadays there are few large deciduous trees on the Plain but historically many grand elms reminiscent of those captured in paintings by John Constable would once have graced the river valleys and villages on the periphery. Sadly, most of these have been lost to successive waves of Dutch Elm Disease (DED), which by 1990 had wiped out 80% of the UK elm stock.

Among the last of the veteran 'English' elms on the Plain were felled near Imber in the 1980s at almost 200 years old. A disc from one of these is on display in Amesbury Museum. The Defence Land Agent planted 50 golden elms (probably *Dampieri Aurea*) as replacements 10 years later, mainly in the small woods north of the Wessex Ridgeway/Imber Range Path on the west of Salisbury Plain; some of which still survive.

Considering the plight of our elms it was a surprise to find many healthy mature trees in Hexagon Wood at Larkhill. The

mystery of their survival was solved in 2015 when they were identified as rare European white elm from their typical buttressed trunks. Although white elm has no intrinsic immunity to DED it exhibits resistance due to a chemical compound within the bark which the scolytus beetle finds distasteful. These trees represent the largest plantation in the UK and were presumably located to shield a former bomb decommissioning site known as the Down Barn Destructor. A test in April 2018 revealed the elms to be 72 years old and catalogues in the Royal Horticultural Society library mention white elm being available in 1950 from Hillier nurseries who offered delivery by rail to Salisbury.

Ironically, there are probably more elms in the UK now than before the epidemic but these are usually young regenerated field or Dutch elm, often displaying the onset of persistent DED. A few mature trees survive and some, such as the roadside wych elms at Gore Cross and Sheepbridge support colonies of the white-letter hairstreak (WLH) butterfly, a UK priority species which remains under threat as their only foodplant, elm, is lost. A fine row of tall elms growing along the banks of the River Bourne at Tidworth are natural hybrid field elms and in the adjacent Polo Field ten 'New Horizon' disease resistant elms,

established by Aspire in 2007, have attracted the attention of WLH breeding on the larger trees.

In 2016 the newly formed Wiltshire Elms Group started a conservation project, with the aim of planting elm cultivars resistant to DED in the vicinity of known colonies of WLH to sustain the butterfly in the event that their host elms are lost to disease. In March 2018, resistant elms including fuente, dehesa and ademuz, all cultivated forms of native field elm rather than hybrids, were planted on the edge of Hexagon Wood near a group of Dutch elm where WLH occurs. This followed another project the previous year at Beacon Hill, Bulford, when LUTECE cultivars and white elm propagated from Hexagon Wood seed were planted near a hairstreak colony on wych elm.

Under the Army Basing Programme, Aspire intend to plant a block of nine 'New Horizon' cultivars at Larkhill. During winter 2018/19 a commemorative tree planting scheme at Tedworth House to mark the centenary of the end of World War One will also include a number of resistant elms.

The planting of resistant trees will bring two significant benefits; to replace the beautiful elms which once characterised our countryside and hopefully act as a safeguard for an endangered butterfly.

Mike Lockwood
Conservation Group Member
Larkhill & Westdown Conservation Group
Aspire Defence Capital Works



Fitting tree guards © Mike Lockwood

A fungus first for Strensall Training Area



Cortinarius huronensis var. *olivaceus* © Malcolm Greaves

The MOD Defence Training Estate and firing range just outside York is part of Strensall Common and is an area of lowland heath designated as a Special Area of Conservation and a Site of Special Scientific Interest. It has been studied and highly regarded for years by the entomology world and includes a variety of wetlands with the jewel in the crown being Kidney Pond, a relatively small but hugely rich pond in the middle of the Common. Surrounding the open water of the pond is a rare and interesting floating raft of sphagnum moss. Four species of fungi were found growing on this during a fungus foray.

The first was a *Cortinarius* of some kind but with a lot of very similar small brown species (which are difficult to separate)



Laccaria pumila © Malcolm Greaves

it is not a popular group amongst most mycologists. Its examination would normally have gone to the back of the queue, but on this occasion with only three other finds to look at, it keyed out quite quickly to *Cortinarius huronensis* var. *olivaceus* a species only recorded on a couple of previous occasions in the UK.

The second was a member of the deceiver family *Laccaria pumila*. Although it looks the same as its common cousin *Laccaria laccata*, under the microscope the differences are obvious with the spores developing in twos rather than the more common four. This was recorded from the Common back in 1971 but with the note 'doubtful record,' it now looks as though it was probably correct.

The next was a dark brown capped milkcap a *Lactarius*. The milk which exudes when the fruit body is damaged, one of the defining characteristics of the group, turned relatively quickly from white to grey/green and the flesh/ milk were both quite acrid. The keys all pointed to *Lactarius pilatii*, a species which had been tentatively recorded from woodland just a mile or so away some years before. On that occasion, although it was under its preferred tree (birch) and in a patch of moss, it was in a relatively dry area. This species is

supposedly found in boggy ground so this occurrence was much more in keeping with its favoured habitat. This is the only area in the UK where this species has been identified and recorded.

The final and most exciting fungus was a small brown gelatinous disc which was assumed to be a *Peziza* of some sort. When removed from the sphagnum it was found to have a distinct granular stalk. The microscopic features did not fit any *Peziza* species in the British list so the details were posted on a European mycology forum. Nicolas Van Vooren who had recently written an article on this species in the *Ascomycete.org* journal gave the identification as *Lepidotia hispida* (Qué.) "a species rarely cited and illustrated since its publication in 1879" and never before recorded in the UK.

Finding these four rare species within several feet of each other surely now justifies classifying Kidney Pond as an important site for fungi, as well as its current classification for insects.

All of the specimens have been passed on to Kew.

Malcolm Greaves
Fungi Recorder
Mid Yorkshire Fungus Group



Lactarius pilatii © Malcolm Greaves



Lepidotia hispida © Malcolm Greaves

The most anxious and perplexing problem of oil fuel



"The incessant clatter caused by the electric riveting has ceased..." © Crown

Gosport, Hampshire has a long association with the Royal Navy, providing defence infrastructure and supplies to the Naval Base at Portsmouth. The establishment and expansion of the oil fuel facilities at Gosport can be traced through reports in *'The Portsmouth Evening News'* from 1905 to 1913, and illustrate the developments in Admiralty thinking during this period with regards to the use of oil as a fuel for warships.

The closing years of the 19th century saw rapid developments in maritime propulsion, but oil fuel was not seriously considered until the appointment of Sir John Fisher as First Sea Lord in 1904. Experiments in 1905 demonstrated the value of oil fuel as a substitute for coal on board the battleship King Edward VII.

At Portsmouth Naval Base provision was made for the storage of about 20,000 tons of oil in four huge tanks at Gosport. The oil was to come from Nigeria or Texas. The future of oil versus coal was still uncertain and there were proposals to combine coal storage at Gosport. The Admiralty acquired land abutting Forton Creek to the north. This older fortification, with its ramparts and moat, protected the victualing yard and St

George Barracks to the east. *'The News'* newspaper reported that the Director of Works employed a considerable number of men in erecting the necessary plant and stores, marking out the ground, and preparing the foundations. The great tanks were to be built of steel on a masonry base and would resemble gasometers more than anything else when completed, unlike the petrol tanks at Haslar which were sunk into the ground.

Pipes ran through the ramparts to the Clarence Victualling Yard creek, used for many years by the late Queen Victoria on trips to and from the Isle of Wight. The landing-stage, used by the Queen, was considerably enlarged and extended down to the end of the creek. Mud banks were dredged away to allow a Dreadnought or one of the larger armoured cruisers to lie alongside the jetties.

By mid-1909 four tanks were completed so that oil could be stored in them and transferred to warships. The intention was to provide 10 tanks with a capacity of 5,000 tons each, making a 50,000 tons capacity altogether. Building commenced on a further four tanks in August that year.

In July 1912 *'The News'* reported that 12 tanks had been practically completed. Eight of the tanks were connected by pipes from which ships were supplied at the new Clarence Yard Pier, but none of the plant was operational and temporary pumps were in use. The reporter noted that *"residents of the Forton district will not be sorry that the incessant clatter caused by the electric riveting has ceased, for the present, at any rate."*

As the prospect of European war loomed, concerns over the use of oil grew. In October 1912, the Admiralty refused to confirm the degree to which new battleships were being designed exclusively for the use of oil. Winston Churchill had referred to oil fuel as being



Typical 24" access hatch at base of tank © Crown

“the most anxious and perplexing problem which the Admiralty had to meet,” because every drop had to be imported and the question was whether sufficient reserves could be supplied in the event of protracted war.

In January 1913 *The News* reported that a further seven acres of land to the south of the tanks was to be surrendered to the Admiralty for expansion of the depot. By July, Churchill’s pronouncement that oil fuel would be used by the Navy on a far more extensive scale did not come as a surprise to those who had watched the development of the oil-fuel depot at Gosport: a massive expansion of tanks was pushed rapidly forward, with 17 tanks complete and a further 18 under construction. A series of bunds was installed to control spillages and fire. The site appears to have reached its culmination by 1919 with 40 tanks, holding up to 224,000 tons of oil.

A stock plan held at the depot shows that 40 tanks were still in operation by 1934. However, as the prospect of a second world conflict loomed, it was realised that developments in air capability posed a new threat to assets such as the depot.

In early 1940 the fire protection was completely revised. Six tanks were dismantled to make room for a new set of bunds around the whole site, incorporating the moat, and raised up to the level of the older ramparts to the east. A saltwater ring main provided water to portable pumps, and concrete channels led to lagoons equipped



Gosport Fuel Depot identified as a Luftwaffe target in April 1939. Folder ‘German Maps & Aerial Views of Portsmouth with Targets’, shelf reference 940.53422792, item reference C800089208 © Portsmouth Library and Archive Service, Portsmouth City Council



General view looking north © Crown

with fireproof baffles to enable oil to drain into the moat. Foam hoists were installed and some tanks were encased in splinter-proof block works. A Luftwaffe reconnaissance photograph shows the start of the works and a further sortie allocated target number B2134 to the completed works.

Portsmouth suffered three major raids in 1941 and the depot was attacked on 10th March by Ju88s and HE 111s of Luftflotte 2 and 3. The sky was clear with a full moon, and an intensive incendiary raid commenced at 20:00hrs on Monday the 10th. The victualling yard was practically gutted, although fires in the tank farm were quickly extinguished by 46 depot men, fire watchers and naval ratings.

Between midnight and 01:00hrs Tanks 11 and 12 were hit by high explosive bombs: the roofs were blown some distance and the oil ignited. Fire crews were called from Reading and London. Tank 11 flashed twice before the fire was finally extinguished, but luckily most of its 4,700 tons of oil was saved. By Tuesday morning considerable quantities of foam had been applied to Tank 12 which contained 2,000 tons of oil, but the effort was hampered by high winds and up-draught. Most of the oil had been salvaged overnight and it was decided to let the tank burn out to reduce the beacon effect. By the afternoon the flames were very high and bright and there were fears that the tank would boil over. However, as the oil reached coking stage, it was decided

to put water into the burning tank and the fire was completely extinguished by 21:30hrs. In the meantime a new air raid had begun and cooling operations continued under a heavy barrage until midnight. The depot survived the rest of the war unscathed, but as sail then coal gave way to oil, so oil has been replaced by other fuels.

In the years following the Second World War, the tanks have been removed or adapted for diesel, water (for firefighting) and Avcat for aircraft. Storage and safety specifications have also changed, and it is now time to replace the remaining centenarian tanks if Gosport Oil Fuel Depot is to continue to support the modern fleet. Concurrent projects are remediating over a hundred years of hydrocarbon spillages into the ground and works have started to replace the ageing tanks with new storage facilities.

Defence Infrastructure Organisation has produced a heritage statement and specifications for further archaeological investigation as required by the planning process. New research and archaeological recording of the tanks and buildings will ensure that the depot’s past is preserved for future generations, whilst the new works will ensure the depot continues to carry out the role for which it was designed, supporting the Royal Navy.

Guy Salkeld
Archaeologist
Defence Infrastructure Organisation

Assessing water quality and biodiversity correlations on the Roman River



A beautiful demoiselle damselfly that breeds on the Roman River, one of the few breeding habitats for this species in Essex, part of the rich Roman River biodiversity © Iain Perkins

Friday Wood is owned by the MOD and is situated within a Site of Special Scientific Interest through which runs the Roman River. It is an important site for military training for the nearby garrison town of Colchester, home to the Army's airborne rapid reaction force 16 Air Assault Brigade, who are specially trained and equipped to deploy by parachute, helicopter and air landing.



A researcher surveying biodiversity in the Roman River © Iain Perkins

The area supports a wide and diverse range of plants and animals and this biodiversity is linked to the environment. That is to say animals and plants exist only where conditions allow, and the more suitable the conditions, the greater the viability of the species. Conditions include not only the natural physical environment but factors such as predation together with human influences such as pollution and habitat disturbance or destruction. In the case of the physical environment and in particular that affecting aquatic animals and plants, appropriate water quality is essential. This may seem obvious, but what is suitable for one species may be entirely unsuitable for another. Moreover, different species have different tolerances to the impact of poor water quality. Some effects of poor water may be discomfort, reproductive constraints, increased susceptibility to disease and at the extreme, death. A fair definition of good water quality is that which supports the maximum range of healthy and viable plants and animals. How good is the water in the Roman River and how is this known?

On 22 December 2000 the Water Framework Directive (WFD) was introduced, followed by associated

legislation in England and Wales. The WFD is a comprehensive management planning system, designed to protect and improve the ecological health of rivers, lakes, estuaries, coastal waters and groundwaters. The standards that this introduced gave guidance for the management of risks to the ecological quality of the water environment. In other words a means of mitigating the adverse impact of humans.

Water quality is monitored by various bodies, but in particular, data collected by the Environment Agency (EA) is freely available under Open Government Licence V3 from their website the Water Quality Archive (<http://environment.data.gov.uk/water-quality/view/explore>). In the case of the Roman River, although various biodiversity studies have been made, none seem to have been conducted specifically on the short stretch of the Roman River within Friday Wood, nor holistically, in that the condition of the environment has not been linked with the biodiversity that it supports.

Concerns were raised by people who knew the river over a half century ago, that the condition of the environment had deteriorated and that consequently the range of animals and plants had diminished. This introduced the possibility of a study of water quality and environmental factors, and, with the permission of the MOD, to a subsequent comprehensive study of biodiversity. If water quality and environmental factors are good an extensive range of biodiversity can be expected. This expectation would need to be tested as a hypothesis.

A study of water quality and environmental factors (i.e. physico-chemical and hydromorphological) in the river in Friday Wood has recently been completed. Within this study those determinands (i.e. constituents or properties of water that is determined, or estimated, in a sample) most likely to impact on biodiversity were selected.

These were considered to be;

- Dissolved Oxygen
- Ammonia
- Phosphorus
- Water Temperature
- Nitrate
- pH

Using data from the Water Quality Archive, it was possible to examine trends from the year 2000, the earliest available data, to date. It was also possible to allocate a rating in accordance with EA and WFD methodology. These ratings measure deviations from natural conditions as a result of human activity and the impact on amenities, wildlife and fisheries. From best conditions to worst the ratings are High, Good, Moderate, Poor and Bad. (High quality should not be confused with high levels). Dissolved oxygen, ammonia, water temperature, nitrate and pH were found to attract a 'High' rating in that there is no current cause for concern. Ammonia was normally rated High, but there was an unusually large increase in December 2016 for which there is no explanation. Later readings in 2017 showed this to have returned to a normal level. Phosphorus (more accurately orthophosphate, which is a form that can be used by plants) has been a problem in this river for several years and is generally thought to be due to agricultural runoff and input from sewage treatment works. Although levels were considerably reduced in the



A stretch of the Roman River in early autumn © Iain Perkins

period 2011 to 2013 current levels are still in need of improvement.

Linked with the direct measurement of water quality by determinands, is the use of phytobenthos and in particular, diatoms. Diatoms are probably best described as 'algae in glass cases'. There are thousands of species that can be divided into two main classes centric and pennate with pennate being subdivided into raphids and araphids. Centric are roughly symmetrical on a circular form, whilst raphids are elongated with bilateral symmetry and a central slit that is absent in araphids. Diatoms are small but extremely common and easily identified under the microscope. They account for up

to three quarters of all plant species in the UK. If a stone is picked up from a river bed diatoms are present as a brown film that will be recognised by anyone with a fish tank as the same algae that has to be scraped from the glass. When diatoms are used for sampling water quality it is assumed that the distribution of species is related to variables in water quality. Different diatom species have different tolerances to water conditions and can be ranked accordingly. If the majority of diatom species in a water sample are intolerant of poor water quality then this is a pointer to good water quality. If the majority of diatom species found are tolerant of poor water quality, this is a pointer to poor water quality. This sampling methodology relies on an experienced sampler with a good and consistent technique and is not without its critics. No independent tests have been conducted by the author but the use of data from the EA and their dedicated computer program DARLEQ2 indicates that water quality in 2009 ranged from Good to Moderate.

These tests cannot measure or predict pollutants that might be introduced into the river accidentally or deliberately, such as detergents or motor oil, but overall, on the basis of the available information, water quality in the Roman River is probably amongst the best of all Essex rivers.

Tony Thorn
Volunteer River Warden
Essex Wildlife Trust



A typical stretch of the Roman River © Iain Perkins

A finders' paradise

Exercise ARTEMIS, Cyprus



Nightingales, UK graduates and the Cypriot team unearth the past © DAG

In 2000, whilst walking the perimeter of RAF Akrotiri, Cyprus, the Western Sovereign Base Area (WSBA) Archaeological Group stumbled across loose tesserae, which led to a further discovery of a mosaic floor section. These were reported to the Republic of Cyprus (RoC) Department of Antiquities and, after securing funding, excavation of the site at Katalymata ton Plakoton began in earnest under the direction of Dr Eleni Procopiou in 2007. Early discoveries suggested the site was a 7th century early Christian basilica, later confirmed through dating finds and mosaics. Subsequent excavations have since revealed a second three-aisled basilica.

The two basilicas are part of a monumental ecclesiastical complex, related to the Patriarch of Alexandria and Patron Saint of Limassol, St John the Merciful. The first basilica is a burial monument 36m wide by 29m long, with an apse protruding to the west. The other basilica is also a burial monument and is 20m wide by 47m long. The site is tightly dated to between AD 616-617 and the evidence suggests that the complex was destroyed by an earthquake in the mid-7th century.

Discoveries have included a bust of the Byzantine Emperor Heraclius, personified as Alexander the Great. There have been 16 different designs of mosaics found thus far, suggested as being the best in Cyprus to date and an important inscription was uncovered in a circle (medallion) that correlated with hymns of the Divine Liturgy. Large quantities of column marble fragments and Corinthian capitals were also found alongside limestone examples, (mainly from cornices set over horizontal architraves), some of which were found intact and decorated with acanthus leaves in relief. Fragments of transenna chancels (from intercolumnar spaces or window openings) were excavated along with tables made from luxurious imported marbles and large quantities of colourful and gold plated tesserae, indicating an extensive and remarkable surface of wall mosaic decoration.

Dr Procopiou states *"This literally helps us understand and re-write the history of the 7th century in Cyprus. We estimate that after its construction, it had a very short life-span of approximately 30 years before it was abandoned and destroyed. This was a very important place and housed the relics of some very important people."*

The Defence Archaeology Group (DAG) has been involved with the excavation (as Exercise ARTEMIS) since 2013 (the sixth year of excavations), as part of Operation Nightingale in collaboration with the Defence Infrastructure Organisation (DIO) and the RoC Department of Antiquities. Exercise ARTEMIS 17 was a continuation of the excavation programme and took place between 30th September – 11th November 2017. This work helps to validate current understanding of the site and its hinterland and to inform on the limitation of scheduled areas for the RoC statute bodies, the WSBA Administration and DIO.

There is close correlation between skills required by the modern soldier and those of a professional archaeologist. These include survey, geophysics (for ordnance recovery or revealing cultural heritage sites), ground appreciation, chart plotting, navigation, site and team management, communications, planning and physical and mental robustness to handle hard manual labour in often inclement weather.

Op Nightingale enables diverse Vocational Recovery Activities for Wounded Injured or Sick (WIS) serving personnel and veterans. Utilising heritage and archaeology to develop and enhance the composite physical and social capabilities of Tri Service WIS personnel. The main effort focuses



Mosaics start to emerge © DAG

on both technical and social aspects of field archaeology, to help with the recovery, management and skill development of personnel. Accordingly, it provides opportunities to accomplish comprehensive skills training exercises using various aspects of archaeology and heritage management to develop dexterous abilities, complementing other recovery programmes.

Exercise ARTEMIS 17 commenced in the 10th digging season involving 15 serving WIS personnel (known as 'Nightingales') from all three services, with varying degrees of health issues. The programme was conducted in three, two-week blocks and was supported by a team of five volunteers from DAG, all of whom are serving military personnel. Nightingales were split over two areas and worked under guidance from UK archaeologists (recent graduates on placement), with direction from Dr Eleni Procopiou and her Cypriot team. This year's excavation extended the second basilica (where it was hoped to find the altar). From day one, a plethora of marble and tesserae were found and by day three, intact mosaics were being revealed. Fierce competition to find a coin (that could provide invaluable dating evidence) began and one was subsequently discovered by a Nightingale during week four. A piece of jewellery was found through sieving mountains of dirt and sand, excavated from the trenches. The jewellery, thought to be an earring very much like that worn by Emperor Justinian I, demonstrates the significance of this site. Dr Eleni was super excited with this find, as was the Nightingale.

Alongside the digging and sieving, Nightingales were responsible for cleaning and recording finds under



The Corinthian Capital, unearthed by a Nightingale, and promptly whisked away to the museum © DAG



All in one day, a plethora of marble just from one trench © DAG

the expert eyes of Dr Eleni's team and, in so doing, started to understand the importance of heritage and conservation through their experiences. The Nightingales thoroughly engaged themselves in all activities and were always thrilled to learn about artefacts excavated and how it fits into the puzzle.

Nightingale finds were numerous: fragments of marble columns with lovely patterns and designs, mosaic walls and floors, roof tiles and glass. One complete piece of capital was so significant and in such excellent condition that it was immediately cleaned and documented, before being transported directly to the museum. The Nightingale carefully guarded this find and processed it with Dr Eleni's help, until it left the site.

Fundamentally, ARTEMIS supports WIS personnel on their recovery pathway by fostering team spirit and cohesion. In addition, engagement with a meaningful project highlights the importance of conservation, heritage and culture, through understanding processes that capture and record future inheritance. Awareness of heritage under the care of the MOD and partners is also raised within RAF Akrotiri, the WSBA and broader, through coordinated visits and media exposure. In addition, the training affords individuals' opportunities to refocus mindsets and return to work or develop potential for future civilian careers.

For the past five years, Dr Eleni Procopiou has invested a phenomenal volume of personal time, encouraging the WIS personnel through dedicated professionalism in teaching. Fostering relationships with Cypriots and

enhancing the MOD's reputation through these recovery activities has led to a fruitful collaboration between HM Forces and the RoC, making this project a gratifying achievement.

Moreover, ARTEMIS would not work without the support from the Command and staff of RAF Akrotiri Station. Maj (Retd) Steve Smith (aka Smudge), has relentlessly garnered support, to ensure the Nightingales have the vital logistics. This programme is unfunded and supported through the constant goodwill and total professionalism of its battle-hardened supporters.

Supporting staff are serving military personnel, who volunteer to sustain this worthwhile project, above and beyond their normal duties. Key to the ARTEMIS organisational successes, notably over the past five years, has been Capt Richardson, with support over the last two years of Sgt Griffiths. It should not be underestimated how difficult and demanding a task of this magnitude is to organise, particularly with regards to supervising personnel with profound physical injuries or mental illness in the UK and overseas. The Nightingales are a credit to the programme and must be praised for the effort and enthusiasm always shown. They fully embrace the opportunity, secure in the knowledge they are not different or alone.

More information about DAG can be found at: <http://www.dag.org.uk/>

Maj Michelle Richardson
SO2 Reserves Defence Healthcare
Education and Training & Defence
Archaeology Group Secretary
Joint Force Command

Northern Ireland – partnerships, bugs and bullets



Dunescape at Magilligan © Adam Mantell

The Ministry of Defence (MOD) looks after the two military training areas at Ballykinler in County Down, and Magilligan Strand in County Londonderry. The MOD Conservation Stewardship Fund helps to employ a Conservation Officer in partnership with Ulster Wildlife. The Conservation Officer works with military staff, DIO's in-house environmental specialists and contractors to identify the top priorities for conservation management across the Defence Training Estate each year and ensure that wildlife and military training needs are, as far as possible, fully integrated.

Both sites are extensive sand dune systems that have been designated as Areas of Special Scientific Interest (ASSI) and have the highest level of European conservation designation. The dunes at Ballykinler are about 6,000 years old and most of the lime-rich shell fragments in the sand have dissolved, giving the site an acidic chemistry. The acidic soil has a profound effect on the vegetation type and Ballykinler, along with its nearby sister site at Murlough have about 15% of the UK's total area of coastal heath habitat. In comparison, Magilligan dune system is just 600 years old so still has a lot of shell fragments within the sand. The calcareous nature of the site means a

very different, but equally interesting plant community with very extensive areas of diverse fixed dune grassland.

Sandy well-drained areas like dunes are rare in Northern Ireland compared to the rest of Britain. The Northern Irish landscape is better known for cool, wet peaty habitats, such as lakes, fens and bogs. Well-drained, dry and comparatively warm habitats like sand dunes are much less frequent. The species that require those special conditions are therefore much less common in Northern Ireland which gives the MOD training areas added conservation significance.

Conservation management includes a wide range of activities e.g. controlling

scrub, installing new fences to support conservation grazing and creating new habitats for wildlife. In some cases the MOD works in partnership with other organisations to achieve benefits for wildlife. As an example, the DIO is currently running a project with the Downpatrick branch of the charity Men's Shed to convert old World War Two pill-boxes into suitable bat habitat at Ballykinler. Most of the work is funded as part of the MOD Conservation Stewardship Fund so it is essential to make sure that the very best value is achieved from limited funds.

Working with graziers is another important element, as grazing is essential to maintaining the extensive sand dune habitats across both sites



Herd of Galloway cows at Ballykinler © Adam Mantell



Gonodera luperus at Ballymaclary © Roy Anderson

in good condition. Without the right number of livestock in the right places the grass or heather can become dense with a layer of dead plant material that results in lower botanical diversity. It can also encourage bracken and scrub to become established. Tall grass with bracken and scrub can hinder troop training by making it difficult for dismounted troops to practice field firing, conceal hazards such as holes and significantly increase fire risk. The importance of controlling fire risk has been highlighted in this very dry summer of 2018, after a serious fire in the Benone dunes adjacent to Magilligan. MOD has strict protocols for managing the risk of fire breaking out from pyrotechnics and certain types of rounds are banned during periods of dry weather.

Due to the importance of the sites, the value of regular surveying and monitoring for better understanding cannot be overstated. Recent studies of the invertebrate interest at both sites illustrate this point.

Last summer a field day for entomologists was held at Ballykinler, with some notable finds despite poor weather. A rare stilt-bug *Neides tipularis* was re-found, known to be in just two sites in Northern Ireland that had not been recorded for decades, alongside a rare bee which has an unusual lifestyle, called Gooden's nomad bee *Nomada goodeniana*. There are nearly 100 species of bees in Northern Ireland, most of which are solitary. Nomad bees look remarkably like wasps and have an unusual life strategy. They hunt out the nests of solitary bees, invade the

nests and lay their own eggs in the nest chambers. The nomad bee larvae then consume not only the food that was stocked but also the larvae of the other bee species.

Magilligan has its fair share of rare invertebrates too. During works for Northern Ireland Environment Agency a very rare whorl snail was discovered! This snail is usually found in dry woodlands on shaded drystone walls and Magilligan is the only known site in Northern Ireland, although even here it seems to be confined to a small area of approximately 60 x 60m. The snail itself is a diminutive 1.5mm long, and is difficult to pick out because of its resemblance to glossy seeds.

As part of the same survey the *Gonodera luperus* beetle was found, which despite being widespread in Britain is known on only two sites in Northern Ireland. Until this record the beetle had not been seen here for over 100 years. A number of specimens have been found, suggesting it is doing reasonably well despite the 100 year gap between records! The ecology of this beetle is something of a mystery; the larvae develop in



Vertigo pusilla at Ballymaclary © Roy Anderson

dead wood, but mature trees are not a significant feature of the dunes. The likely habitat may be the stands of blackthorn *Prunus spinosa* that are a prominent feature across parts of the site.

The blackthorn is also vitally important to the increasingly rare small eggar moth *Eriogaster lanestris* which feeds upon it as a caterpillar. This species is obvious when caterpillars congregate on large white candy-floss webs in the summer. The first survey of this species was completed in 2017 by counting the larval webs and was repeated in 2018. The moth is doing very well thanks to the careful rotational cutting of the blackthorn which creates a patchwork of different aged stands, ideal for ensuring a continuous supply of food.



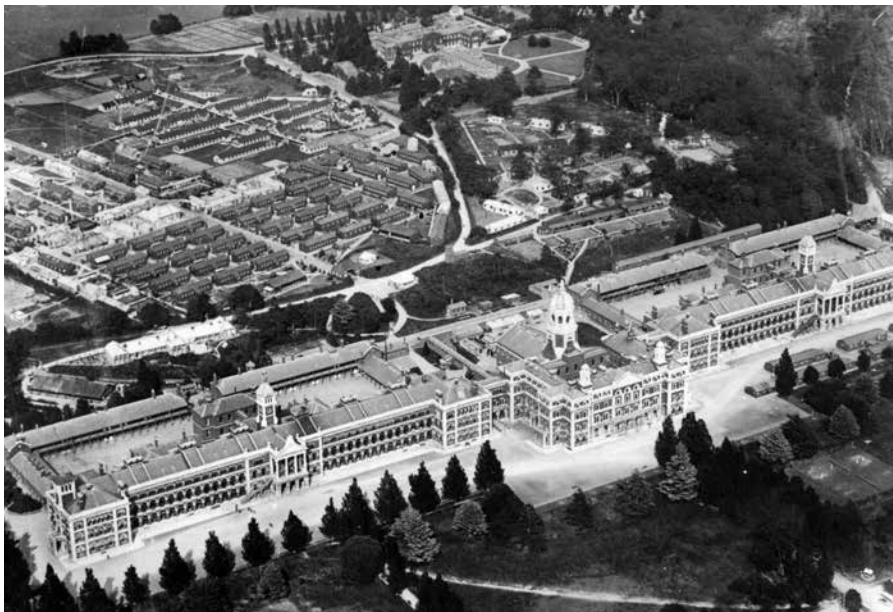
Small eggar larval web © Adam Mantell

The rare snail and beetle found at Magilligan and a selection of other invertebrate finds, usually seen in woodland, hint at a past that may have been very different. It is possible that relict populations still survive from a time when the site would have been extensively tree covered.

Part of the reason for the conservation designation of these sites is the number of rare invertebrates which require quite specific conditions to survive and thrive. As the Conservation Officer, understanding these issues, whether plant or animal, is critical to ensuring the best site management advice can be given to the MOD. It also helps to make a case for investment in the site and to explain to others why these amazing places are so important.

Adam Mantell
Conservation Officer Ballykinler and
Magilligan
Ulster Wildlife

Least we forget – conservation, flora and fauna at a military cemetery



Aerial view of The Royal Victoria Military Hospital, circa 1920 © Hampshire County Council

During the summer of 2017, Portsmouth Defence Infrastructure Organisation (DIO) were tasked with reviewing Permanent Military Cemeteries in south Hampshire that are owned by the MOD. The cemeteries are maintained by the DIO in conjunction with the Commonwealth War Graves Commission.

It is important that the lives of the fallen are not forgotten and the MOD have a duty to ensure their resting place is maintained as a fitting tribute. Visiting a military cemetery can be poignant. Reading the epitaphs of those who died brings into perspective those who made the ultimate sacrifice to enable us to live on in relative peace. Significant numbers of First World War graves are present in the cemeteries and include service personnel, many of whom were patients in large military hospitals.

The settings for the cemeteries, within a living landscape are often beautiful and although they can be easily passed by, are certainly not forgotten. Netley Military Cemetery, Hampshire is now set in a country park. The cemetery is a place of respect and education and viewing the gravestones in the tranquil and beautiful setting helps one reflect on the lives of the fallen.

The cemetery originated because of a large Victorian hospital complex nearby. As the Crimean War came to an end there was a realisation that the dreadful conditions of military hospitals needed to be seriously addressed. On 5th March 1855, Her Majesty Queen Victoria wrote a letter to the Secretary of State for War stating that suitable hospitals *"for our sick and wounded soldiers are absolutely necessary and now is the moment to have them built."*

On 19th May 1856, Her Majesty Queen Victoria laid the foundation stone of

The Royal Victoria Military Hospital at Netley. She placed a copper box into the foundations, containing the plans of the hospital, various coins, a Crimean War medal with the four campaign clasps and a Victoria Cross medal that is speculated to be the first one ever made. The hospital had 138 wards and at the time of construction was the largest military hospital, as well as the world's longest building at ¼ mile long. Over time the hospital's grounds expanded to nearly 200 acres and its large military cemetery contains nearly 4,000 graves of British, Commonwealth, Armenian, Russian, Maltese, German, Belgian, Polish and Italian nationals. The last internment was in 2003.

There are 636 First World War graves which include British and Commonwealth forces, 69 Germans and 12 Belgians. These date between 20th August 1914 – 7th August 1921. This demonstrates casualties were treated at Netley from the very beginning of the war, with many of the injured continuing to be cared for until their deaths several years after fighting had ended.

During the First World War Maj Arthur Hurst, a General Physician with an interest in neurology, organised occupational therapy treatments for shell-shock, now known as Post Traumatic Stress Disorder. The patients



Entering the cemetery from the south gate © Lee Attwells

were filmed both before and after their treatment by Pathé cameramen in an attempt to convince medics and the military that shell-shock was a serious but treatable illness, during a time when such an affliction was largely dismissed.

The Royal Victoria Military Hospital served as a major military hospital through various wars and campaigns before eventually closing to patients in the late 1950s. The main building was damaged by fire in 1963 and subsequently demolished, except for the central chapel which was purchased in 1979 by Hampshire County Council.

The cemetery continues to be owned and maintained by the MOD and the Commonwealth War Graves Commission. In 1980 the rest of the site reopened as Royal Victoria Country Park and a £3.2m Heritage Lottery Funded project has recently been completed to bring the chapel back to its former glory, providing a visitor centre with views across The Solent from the 46m tower.



Restoration works underway at the chapel © Crown

The country park has magnificent views over Southampton Water where coastal birds, including oystercatchers and Brent geese can be seen from the promenade, which is located where the hospital landing jetty once stood. The hospital's construction at Netley was partly due to proximity of the site's foreshore to Southampton Water. The intention was that troops could be brought to the hospital by ship, although later a railway station was built on site, with many injured troops making this journey from the Western Front during the First World War.



The cemetery is planted to reflect an English country garden © Crown

The woodland area of the park is well established with various species of non-native ornamental trees and plants that were introduced from across the British Empire during Queen Victoria's reign. Within the park the mixture of habitats supports an abundance of wildlife; deer are often spotted in the woodland, as well as 115 species of bird, 25 species of mammal and 30 species of butterfly.

In the cemetery, butterflies flutter amongst the graves as if dancing in the sun, including holly blue, gatekeeper, meadow brown and speckled wood species. The gatekeeper is common in southern coastal areas and usually found in tall grass, hedgerows and gateways. The meadow brown is sometimes mistaken for the gatekeeper, but the eye-spots have single white pupils instead of double pupils. It is one of the most commonly found butterflies in most habitats. The speckled wood is usually in shaded woodland or gardens and has been fighting back from the decline seen in the 19th century.

The headstone borders are planted to imitate an English country garden, with a mixture of roses and herbaceous perennials such as iris, foxglove and delphinium. Rosemary is present, representing remembrance. Low growing plants are chosen for areas immediately in front of headstones, ensuring that inscriptions are not obscured and preventing soil from splashing back during rain. The plants imported from the British Empire,

such as rhododendron, bloom quite spectacularly adding colour to the cemetery. The atmosphere is of a tranquil space with the trees protecting it from less clement conditions.

The headstones stand proudly and each tells its own story of those buried there. Many of the graves are still visited today, as evident by the carefully placed flowers and cards. They now all lay together in a peaceful cemetery surrounded by a stunning country park where birds sing without disturbance.

Lee Attwells
Estates Surveyor
Defence Infrastructure Organisation



Holly blue butterfly © Iain Perkins

Monitoring heavy metals in Cardigan Bay



An aerial view of MOD Aberporth © QinetiQ

MOD Aberporth is in Ceredigion on the west coast of Wales and the Range Danger Area covers an impressive 6,500km² of Cardigan Bay from sea level to unlimited height. Cardigan Bay and the waters beyond benefit from international protection in recognition of its importance for populations of harbour porpoise and bottlenose dolphin. Cardigan Bay is also home to a commercially important scallop fishery.

In collaboration with Defence Infrastructure Organisation (DIO), QinetiQ has developed a sampling programme to monitor the levels of heavy metals in sediment and shellfish (scallops), in support of Royal Air Force (RAF) training requirements at MOD Aberporth.

The RAF approached QinetiQ via the Air Warfare Centre (AWC) with a requirement to conduct firing training with 27mm Frangible Armour Piercing (FAP) ammunition at MOD Aberporth. Until now, the RAF have deployed to the Netherlands to conduct this activity. Being able to use UK Ranges brings significant benefits; logistically, financially and from a sustainability

perspective. The instrumented range at Aberporth provides the RAF with the perfect arena.

QinetiQ operates the range on behalf of the MOD under the Long Term Partnering Agreement (LTPA). As part of standard procedure, QinetiQ completes a sustainability appraisal for all new and novel activity to consider the potential positive and negative impacts on social, economic and environmental factors. The FAP rounds contain a segmented tungsten-nickel-iron alloy penetrator surrounded by tungsten spheres. Heavy metal tungsten alloys are commonly used in ammunition for their hardness and penetration performance. In recent years, MOD has adopted a precautionary approach to managing activity involving tungsten alloy on its estate, over a concern around the potential to cause harm to human health and the environment.

The main concern regarding the firing of FAP rounds into Cardigan Bay relates to the potential pathway for heavy metals (primarily tungsten, nickel and iron) to enter into the human food chain

via shellfish (mainly scallops) harvested from the bay. Consultation with DIO highlighted the need for baseline monitoring to establish that the levels of tungsten and other heavy metals in the sediment and shellfish are not elevated above background levels as a result of range activity. This prerequisite sampling aimed to establish a baseline, which can then be repeated periodically to monitor any change and provide assurance that this type of activity does not represent a risk to human health or indeed the wider marine environment.

QinetiQ worked on developing a cost effective solution that would provide a representative sample of an area of 50km² and in depths of up to 50m. This was a challenging task; a first of its kind for the MOD that will provide a useful benchmark for other ranges to follow. Specialist consultants Salacia Marine supported the development of the sampling methodology and ensured the process was adhered to. The scallop vessel FV Harmoni M147, was contracted to extract sediment and scallop samples from fixed locations around the moored target barges, where much of the range activity is concentrated and across a wider area where the scallop fishery is active.

The sampling was successfully undertaken in March 2018. The samples were analysed by The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) and the results indicate that the levels of tungsten, for both the sediment samples (29 in total) and for the biota (14 in total), were below the limits of detection (this being 0.5mg/kg). The information yielded by this monitoring exercise has enabled MOD to support the introduction of FAP training at Aberporth and reflects the wider commitment to achieving sustainable management of activities across the MOD estate in the future.

Danny Oldfield
Environment Advisor (Wales & West)
QinetiQ

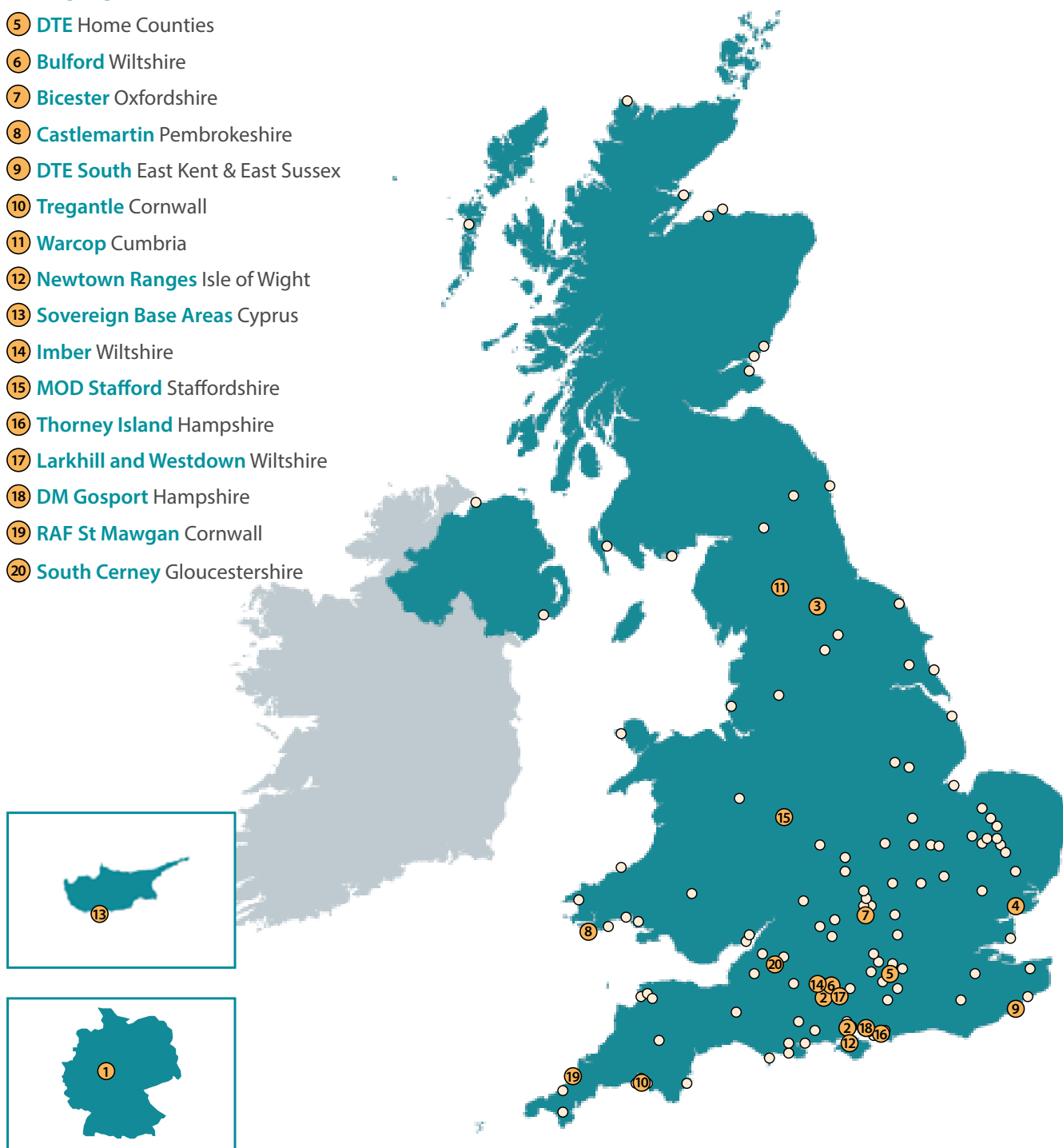
Around the Regions with the Conservation Groups

There are over 125 Conservation Groups operating across the MOD.
The following section provides an update on the dedicated work of some of these groups.

KEY: UK MAP

- 1 Featured Regional Conservation Group
- Other Regional Conservation Group

- 1 **Senne** Training Area Germany
- 2 **Porton Down and Portsdown West** South Central
- 3 **Catterick** North Yorkshire
- 4 **Fingringhoe** Essex
- 5 **DTE** Home Counties
- 6 **Bulford** Wiltshire
- 7 **Bicester** Oxfordshire
- 8 **Castlemartin** Pembrokeshire
- 9 **DTE South** East Kent & East Sussex
- 10 **Tregantle** Cornwall
- 11 **Warcop** Cumbria
- 12 **Newtown Ranges** Isle of Wight
- 13 **Sovereign Base Areas** Cyprus
- 14 **Imber** Wiltshire
- 15 **MOD Stafford** Staffordshire
- 16 **Thorney Island** Hampshire
- 17 **Larkhill and Westdown** Wiltshire
- 18 **DM Gosport** Hampshire
- 19 **RAF St Mawgan** Cornwall
- 20 **South Cerney** Gloucestershire



Germany

Senne Training Area



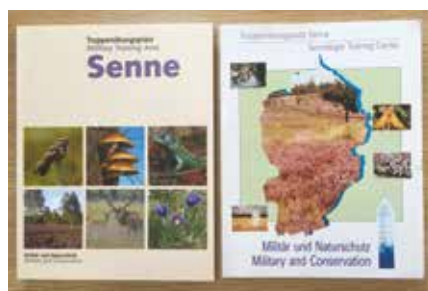
Damage to woodland from Storm Friederike © Heiko Arjes

In the early 1990s, a book was published, written in both English and German, called *'The Senne Training Area – Military and Conservation'*. This unique book contained information on the history of the area and 100 years of military use, the origins of the Senne landscape and management of heathland and forest, as well as specific chapters on the nature and conservation of the plants, fungi, insects, fish, birds and mammals found on the training area. An updated version of this book is now available that details the current estate and conservation practices, including, for example, the new Natura 2000 Conservation Management Plan for the Senne Training Area. This publication is yet another example showing the compatibility of military use with nature conservation, when there is positive cooperation and friendly relations between British forces, German authorities and conservation bodies. Any readers of Sanctuary magazine who have a particular interest in the Senne Training Area, its military history, wildlife and conservation, can write to the Land Agent at Sennelager, BFPO 16, as there are a number of free copies of the book available on a first come, first served basis.

A matter that had a more direct effect upon the training area, occurred on the afternoon of Thursday 18th January 2018

and proved particularly dramatic for those living in British Forces Germany, as Storm Friederike tore through the eastern part of North Rhine-Westphalia. The sudden onset of storm-force winds had a profound impact on the pleasant, wooded camp of Normandy Barracks in Sennelager, but especially the surrounding Senne Training Area, of which over 50% is covered by forest.

During a couple of hours, thousands of trees were blown down, uprooted, or had trunks and branches broken and smashed upon impact with the ground; almost no part of the training area was left unaffected. Live firing had been stopped however, and no one was hurt and damage to buildings and other range infrastructure was limited, with the main problem being trees fallen across range roads and tracks. Unfortunately, there were fatalities across the State,



The new (left) and old (right) Senne Military and Conservation book © Mark Johnson

with deaths caused by trees hitting cars or drivers losing control in the storm. No sooner had the high winds abated, the Plant Troop from Sennelager Range Control with heavy machinery, working alongside the Defence Fire and Rescue Service with chainsaws, sprang into action to begin removing fallen trees from the roads leading up to the ranges and training facilities. On the following day, the Land Maintenance Team (LMT) also joined the effort to re-open the training area for military use. All ten members of the LMT are trained to use chainsaws, as part of their role in maintaining the open areas of the Senne Training Area. The Bundesforst (German Federal Forestry Department), who are responsible for managing the forests on the area, then began what will be a mammoth, long-term task of clearing fallen trees from more than 5,000ha of woodland in the Senne.

Storm Friederike could be considered a disaster for the beautiful landscape and attractive, managed woodlands of the Senne, which will take some time to recover. However, thanks to the rapid reaction, hard work and excellent cooperation between those responsible for the maintenance of the rural estate, the storm's impact on the core business of training was minimal, with the full programme of military use returning to normal within a very short time. Some of the fallen timber and fractured, standing trees will be left to decay naturally, benefiting insects and providing nesting holes for woodpeckers and other woodland birds. From an ecological perspective, within the large extent of the training area, and in the longer term, large storm events can drive key natural processes of disturbance, re-colonisation and succession, and increase the diversity of habitats and species. Nature always takes its chance at turning adversity into opportunity.

Mark Johnson
Land Agent, Germany
Defence Infrastructure Organisation

South Central

Dstl Porton Down & Portsdown West

Dstl seeks to encourage biodiversity on sites. Our Sustainability Policy states we will ensure opportunities for conservation and biodiversity enhancement are taken wherever possible. A Biodiversity Project to enable Dstl to demonstrate this commitment was agreed last year and is being developed within the built environment initially at its Portsdown West Site and later at Porton Down.

The Project has two key objectives: to assist with staff wellbeing and engagement, giving people the opportunity to utilise outdoor space during the working day and to produce sustainable biodiversity benefits.

This Project will be developed over time, taking into consideration resources and other site developments.

Portsdown West

Portsdown West already allowed an area of grass to develop for the benefit of wildflowers, invertebrates and as a potential foraging area for the site's barn owls. The grass is cut on an annual basis with the arisings removed. The meadow now supports a wealth of flora and fauna. Adjacent to this meadow is a mature copse and an earth bund with a mixture of native hedgerow plants.

Several additions were made to enhance the area. A pond was completed last year and has already proven to be successful, with resident pond skaters, water boatman and visiting southern hawker dragonfly. Frog spawn also appeared in the spring. A log pile was situated near the pond as a potential hibernation site



Linear feature on Porton Down © Crown



A red kite hovering © Dstl

for animals, such as newts, and a bench was provided to allow staff to sit and watch the wildlife and habitat develop.

This season several bird boxes, including a barn owl box have been installed along with bug hotels suitable for solitary bees and other insects. Later in the season bat boxes will be added. Now all we must do is hope that the wildlife approves of our efforts and adopts this new habitat!

Porton Down

Talking of ponds, the two wildlife ponds at Porton Down have proven of benefit to wildlife especially during this very hot, dry summer. Both ponds had an explosion of frog spawn in the spring, most of which developed. The smaller pond still has tadpoles at the time of writing this article in July! The larger of the ponds, which was newly installed last year, also had toad spawn and

seven smooth newts! The ponds must be regularly 'topped-up' during the summer and as both ponds have trail cameras we hope to capture some more spectacular images.

Porton Down contains a rich variety of archaeological monuments including Neolithic flint mines and burial sites, Bronze Age barrows and cemeteries, an Iron Age boundary ditch, and the unique circular gas testing trenches. Several monuments are suffering rabbit erosion or scrub encroachment and are currently assessed 'at risk' by Historic England. The landscape is challenging as rabbits are crucial to maintaining the rare chalk grassland. However, careful management is required as they burrow in monuments.

DIO Archaeologists visited Porton Down with Historic England last year and two monuments were removed from the 'at risk' register. This is very good news and reflects the efforts made. Also, works were carried out on monuments potentially at risk. There is still much to do and the balance between maintaining the chalk grassland and protecting monuments must be carefully monitored.

Terry Jeanes
Rural Manager
Dstl Facilities Management Services

North Yorkshire

Catterick Training Area



Four spotted chaser © Elizabeth Dickinson

No doubt like many other sites, Catterick has experienced a succession of extreme temperatures throughout the year with repeated blizzard conditions in the spring, followed by over two months of blazing sunshine and balmy Mediterranean evenings during the summer.

The impact on the landscape and the wildlife it supports is difficult to quantify but during the cold spells there was almost a complete absence of invertebrates and conversely, the butterfly and moth populations have benefited enormously from the recent prolonged sunshine. Some bird populations seem to have done well although lately the ground surfaces have been scorched and solid which has affected the waders. Moles are no longer travelling beneath the compacted surface and are routinely seen scampering across the grass!

The small bird boxes on the training area did remarkably well with the great tit population at an all-time high. The larger boxes, on the other hand, especially the tawny owls that had laid their eggs during the blizzards, seemed to have struggled, with many raising only one chick as the vole availability declined. Kestrels had moderate success and buzzards flourished, while last year's

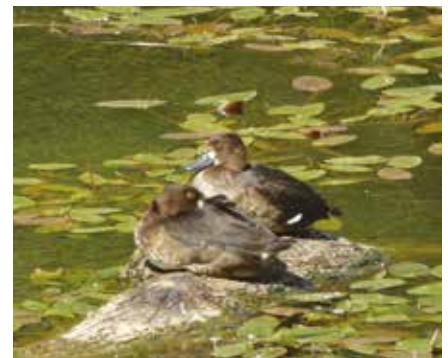
bourgeoning barn owl distribution helped create many more breeding pairs. Alas, the number of chicks fledging was quite small.

At Foxglove, the Exmoor ponies have really shown their worth and for the first time ever we have had breeding barn owls there too! Moth trapping continued on a weekly basis and this increasingly popular pastime has seen the ranks of its supporters swell significantly. Some of the more interesting species caught included eyed hawk-moth, light emerald and Chinese character.

On the moor the fear of wildfires has been a major concern and some species seemed to find the situation difficult to cope with. Golden plover, one of our most ubiquitous residents during the breeding season, seemed uncomfortable with the arid conditions and many broods were very quickly reduced to one. Curlews, a red listed resident of some concern, had an amazing early season with many more birds than usual pairing up and nesting. Unfortunately, they were then faced with the extreme hot weather and the young seemed unable to thrive despite an abundance of insects. Most pairs were lucky to have a single chick reach the flying stage.

The fortunes of the plant life were short lived as extended swathes of common spotted orchids and marsh cinquefoil succumbed rapidly and had 'gone over' in really quick time. Beds of pillwort, a rather insignificant grass-like fern, disappeared almost entirely from some well-known locations, but they appeared elsewhere to the relief of our botanists. At Plovers Pool lapwing bred for the first time which was a welcome outcome in what proved a very moderate season for them.

Victims of the last few cold, wet summers have been the much reduced butterfly, dragonfly and damselfly populations but certainly this year has reversed that trend. Greater numbers of butterflies have been seen, particularly small copper, brimstone and common blue. On the odonata front there have been many more damselflies, and recently the hawkers have been more evident than ever with golden ringed routinely seen in all its delicate splendour.



Recently fledged tufted ducks © Elizabeth Dickinson

No major conservation projects have taken place at Catterick over recent months but there has been a great deal of effort put in to the monitoring of our existing projects. The success stories are the barn owl, which has expanded into areas hitherto unknown, and a male hen harrier that graced us with his presence and raised hopes of breeding before, after 10 days on the area, he failed to attract a partner and moved on.

Maj (Retd) AJ Crease MBE BEM
DComd/EO
DTE North

Essex

Fingringhoe Ranges



The rare weevil *Rhynchites auratus* and the great silver water beetle *Hydrophilus piceus* © Crown

"A BioBlitz is an event that focuses on finding and identifying as many species as possible in a specific area over a short period."

Over five years of concentrated Site of Special Scientific Interest (SSSI) management including scrub removal, conservation grazing and invasive species eradication has taken place across the Fingringhoe Wick marshes, in accordance with Natural England conservation prescriptions. DIO therefore felt it would be a good time to gauge the effects. Access can be difficult as the Ranges are heavily used so the Conservation Group suggested having a series of 'BioBlitz' recorders' days.

Coordinated by Sven Wair the Conservation Group hosted two weekends in May and July, inviting colleagues from the Colchester Natural History Society, Essex Field Club, along with County Recorders and other local naturalists. Their assistance meant DIO was able to confirm the presence of many SSSI flora and fauna notified features as well as many other notable species, enabling gaps within the species maps for Essex and at a national level to be updated. The weekends proved a great success, with over 30 naturalists, including six County Recorders covering

specialisms that are highlighted in the following short report.

In May, a very rare weevil *Rhynchites auratus* was found which until recently was thought to be extinct in Britain, as the last recorded specimen was in Kent in 1839. This was only the fourth record since it was rediscovered in 2005 at Abberton Reservoir, having later been found at Old Hall and on the MOD Defence Training Estate at Friday Wood. On the marsh, two nationally scarce status (Sc) weevils, the bald-beaked sloth weevil *Bagous glabrirostris* and *Sibinia arenariae* were found on spargularia at The Point. Both events recorded the near threatened great silver water beetle. In May the *Limnoxenus niger* and three other diving beetle species of nationally scarce status were recorded.

The hairy dragonfly is the UK's smallest hawk and was recorded in May. Several species were found in July within and hunting around the borrow dykes; southern migrant hawk, scarce emerald damselfly, ornate Brigadier soldierfly (Vulnerable status) and the black Colonel (Sc). The spider *Tetragnatha striata* (Sc) was also found in the seasonally wet water-body near the Horseshoe.

In May the discovery of three patches of the large flowered field mouse-ear *Cerastium arvense* on the Langenhoe Marsh was notable, the 13th Essex record. Two surprises were the presence of grass *Bromus lepidus*, a once widespread alien that has now died out over most of the UK and the absence of *Vicia sativa* var. *segetalis* which is ubiquitous elsewhere in Essex. However, the native var. *nigra* was present in vast quantities across the marshes. The pure un-hybridized form of Brackish water-crowfoot was abundant in the ditches. It has become rare elsewhere in Essex as years of rain have leached the marshes and is now being hybridized out with *Ranunculus aquatilis*. In July the small area of Wick Marsh was investigated near the head of Geedon Creek and located patches of Greek sea-spurrey, the second record for Essex. Dead heads of sea clover (Sc) were also abundant.

In May the long-horned bee, a UK priority species, was recorded near the sea wall along with the sleepy carpenter bee which is alleged to sleep in buttercups. During the daytime visits plenty of common Lepidoptera was recorded including the starwort larvae (Sc) feeding on sea aster at The Point. On the three moth evenings 48 species were recorded, with highlights being two white-spotted pinion in July and a rare saltmarsh horsefly.

Ornithology was well represented with ringers recording many species as expected including marsh harrier, hobby, stonechat, reed warbler and a population of greylag goose.

Herpetofauna included records of grass snake, adder and the noisy marsh frog. Other species recorded were bats, marine mollusc and lichen.

Many thanks to all those who took part.

Iain Perkins
Ecologist
Defence Infrastructure Organisation

Home Counties

UK Defence Training Estate



A curlew on eggs © David Kjaer

Conservation Group (CG) members in the Home Counties have continued their enthusiastic involvement in helping the Defence Training Estate to deliver a robust and high quality military training environment, which also protects and where possible enhances our commitments to wildlife. Considerable work continues in ensuring Agri-Environment Schemes, managed by Surrey and Hampshire Wildlife Trusts and Amphibian and Reptile Conservation Trust (ARCT), which cover extensive areas around Longmoor and Aldershot have been successful. The Schemes are coming to the end of their 10 year term, with detailed involvement by all parties to work up new Schemes. The new capital works programmes include biodiversity data from other CG members such as the distribution of herptiles, birds or notable invertebrates.

One new Scheme at Otmoor, which started in January 2018, renewed flexi drain pipes to better manage water levels along scrapes and ditches in the lowland grassland. It is already delivering positive news for breeding waders during the 2018 season, with lapwing

and redshank turning up again, along with breeding curlew. The photos from the two cameras which were provided through the Defence Infrastructure Organisation's Conservation Group Grant, have been run by the RSPB from spring to summer 2018 and are proving helpful in trying to determine the cause(s) for nest loss at egg or chick stages. This complements the continuation of a RSPB local research project, looking at temperature and food availability in and around a curlew nest to improve understanding on critical breeding factors.

The CG continues to input their extensive experience of farming, hydrology and wildlife to such Schemes as well as parts of the site which are directly managed in-house by the Ministry of Defence (MOD). This includes updating the main objectives for different hedgerows and copses across the site such as for turtle dove, long-eared owl and black and brown hairstreak butterflies. Survey work continues to help inform proposals for re-introducing the marsh fritillary. The CG visited a MOD site near Aldershot in Autumn 2018 where this

species was successfully re-introduced in 2018 after a disappearance of several decades. The aim is to exchange ideas and experiences about grassland sward structure and species composition, varied management regimes as well as the breeding and release programme. Numerous devils-bit scabious plants are being successfully grown on to plant out later and help increase this critical food plant for the larvae.

The MOD is continuing with extensive habitat management works at Browdown, both on the Site of Special Scientific Interest (SSSI) and the Site of Nature Conservation Interest (SNCI), using survey data including resumed bird ringing studies from CG members. Both the SSSI and SNCI sites have high quality lowland heath valuable for fauna such as Dartford warbler, adder and grayling. Other valuable habitats include annual or perennial vegetation found along the high-water line and slightly further inland, ephemeral winter pools on the shingle with saline and fresh water and dense fen and reed bed, home to water voles. All these habitats require management input such as removing dense scrub from heathland and opening the fen edges to reduce drying out. The CG reported the continuing presence of the Ginkicker weevil, an endangered and priority species listed in the Biodiversity Action Plan, which likes very warm micro-climates found in semi-bare shingle where the larvae feed on plants such as common bird's-foot trefoil.

CG members continue to input their time and skills at Barton Stacey, such as a recent survey to start systematically recording and mapping areas of semi-natural grassland, important as a local Biodiversity Action Plan habitat and supporting notable flora, such as autumn gentian, plus the nationally scarce striped lychnis moth, whose larvae feed exclusively on dark mullein.

Sarah Jupp
Ecologist
Defence Infrastructure Organisation

Wiltshire

Bulford



'Sept 12th 1944' arborglyph in Polo Wood, probably carved by a soldier from the US Armoured Troop, who were stationed nearby during World War Two © Crown

Arborglyphs, or tree graffiti, are pictures, words, letters or numbers carved on tree trunks. They are usually found on smooth barked trees such as beech, lime or aspen trees and are created by using a bayonet or some kind of knife. Most arborglyphs consist of initials or names with an "I was here" type of message, but occasionally there are carved hearts which are tokens of romance. Some arborglyphs show a certain amount of skill on behalf of the carver. On Salisbury Plain, arborglyphs have been found mainly on beech trees and it is presumed that the majority have been carved by the military who have been active on the training area for more than one hundred years.

Bulford Conservation Group have been involved in recording arborglyphs since the Barrow Clump excavation of 2012. They were first noticed on a pre-excavation visit to the site. Historic

England was contacted and Dan Miles arranged to help us record the arborglyphs during the first few days of the excavation. These arborglyphs were carved onto beech trees which formed a horse-shoe shape around the barrow.

There were 83 arborglyphs recorded at Barrow Clump and whilst most appear to be linked to the military, some are perhaps from young teenagers two decades ago. The earliest dated arborglyph was a New Zealand Field Artillery (NZFA) serviceman, "GA \ [**LAN] \ NZ FA \ 24/7/16." The \ indicates a change of line, * is for missing letters and the " " the beginning and end of the arborglyph. One of the carved cap badges was researched by Mark Khan who was able to identify it as most likely someone from the 1st Dragoon Guards based at Tidworth from 1929-1931. The Wimpy arborglyph may be linked to RAF personnel. Wellington Bombers were called Wimpy after the rotund figure of J Wellington Wimpy in the Popeye series of cartoons. The first Wellington Bombers were produced by Vickers in 1936.

There were eight glyphs linked to the 1920s. An example "D.H. \ AW \ LW LS \ SWD \ 1922". The area is quite prolific in arborglyphs, unfortunately many were unreadable. Once trees are carved, the bark does not heal and they can be prone to infection which causes the arborglyphs to distort and become unreadable.

Scotland Wood, inaccessible to the public, is situated on the edge of the Plain. Seven trees were found to have a total of 42 arborglyphs of which 36 were possibly connected to the military. The earliest was "B JOHN[S]ON \ A.I.F. \ 24/5/16" and the latest "PA MAKE \ LOVE 1952". There were five arborglyphs carved by New Zealand personnel and two by Australians.

Dumbell Copse near Carter Barracks, Bulford, has a total of 13 arborglyphs. These include a cartoon face with curly

hair; a romantic message from Anni Cambell to Andy Swan; and "N4L \ JH \ WAS \ HERE \ 84 \ a long arm with finger pointing to figure with gun". These arborglyphs may suggest civilian rather than military carvers.

In cooperation with Imber Conservation Group (Archaeology), we recorded a number of arborglyphs from a beech wood in Area 4 near Breakheart Bottom and the Southern Transit Range road. These trees were much altered by military action. There is a total of 11 trees with 36 arborglyphs. The earliest dated carving was "ATE 1950". Two of interest are a carved shield and a possible bird within, and another USA A***S. American soldiers were billeted at Tilshead Lodge in World War Two and were within easy reach of the arborglyph site.

Arborglyphs are a useful tool for investigating personal and military history. However very few of the recorded arborglyphs have been researched and so there is much work still to be done.

Kathy Garland
Archaeology Sub Group Leader
Bulford Conservation Group



A possible civilian arborglyph © Roger Collins

Oxfordshire

Bicester



A turtle dove feeding © Buckinghamshire Bird Club

Bicester Garrison Conservation Group is a voluntary group of external ecology partners who have a passion for their particular area of interest within the ecosystem. The Group has made a huge impact with regards to its future development. As Chairman, the achievements over the last six months have been challenging but none the less rewarding in most areas, particularly with the development and production of the Garrison Woodland Management Plan, which has been warmly received. Much of my time has been taken up by organisation and deconflicting conservation activities with essential military training and other training tasks. However, when I have had the opportunity to get out and about I have been carrying out vital monitoring as well as identifying key sensitive areas. Being the eyes and ears for the group has paid dividends, especially where birds and butterflies are concerned. At the time of writing several successful community engagement opportunities have been arranged and executed. I would like to thank Mr Paul Watts, a volunteer within the group who has expertly assisted, especially where ornithology is concerned.

Community engagement is a key factor in achieving conservation

objectives. We have arranged visits from Buckinghamshire Fungi Group who had the opportunity to survey the land, paying particular attention to sections of Training Area South that are located within the county and a second visit by Buckinghamshire Bird Club. They were delighted to witness and see the turtle dove and hear the singing of the nightingale on the training area. This is evidence that the habitat is just about right. We have also had another successful bid approved through the Trust for Oxfordshire Environment for scrub clearance activities from October 2018 – March 2020 which will be led by Chiltern Rangers. It allows for volunteers from the local community to be invited on the training area to engage in scrub clearance in the winter months thereby improving habitat areas that are vital for the long-term management.

Monitoring is very much a primary task as it has been evident that the estate has some outstanding areas of habitat, which species such as turtle dove *Streptopelia turtur* and nightingale *Luscinia megarhynchos* thrive on. Turtle doves are ecologically unique, being Europe's only long distance migratory dove. They spend two thirds of their time outside the UK where they face a range of threats along their migratory

route, which takes them from wintering grounds in west Africa to their breeding grounds in the UK. Loss of habitat is the biggest factor driving their decline in the UK. For this reason, it is essential to establish good feeding and nesting habitat over the turtle doves' core UK breeding range in East Anglia and south east England.

In order to encourage breeding on site and to retain the turtle doves, Buckinghamshire Bird Club kindly purchased 80kg of special supplementary food. This has kindly been matched by the Defence Infrastructure Organisation through the Conservation Group Grant.

Turtle doves are obligate granivorous i.e. their diet consists solely of seeds but this provides very little fluid, so a source of clean fresh water nearby is essential. This can be in the form of a pond or ditch, providing it has gently sloping edges, preferably with an open aspect to the south facing edge. Such a source of water also benefits a variety of wildlife. Turtle doves nest in tall, dense scrub or hedgerows, with thorn hedges generally preferred, especially if they are native.

The most important find for the Conservation Group this season has to be a nightingale nest with chicks.

Gary Beckett
Conservation Officer
HQ & Bicester Garrison Support Unit



Turtle dove © Buckinghamshire Bird Club

Pembrokeshire

Castlemartin



Green Bridge of Wales. The greyed rock section (far right) was destroyed in storms © Steve Moss, Cherish Project

The Pembrokeshire Ranges Nature Conservation Group has been active for many years. I became secretary of the Group back in 2010, but some of our committed members have been with us since 2003. Our members are a highly valued resource comprising dedicated and committed individuals who help Defence Infrastructure Organisation (DIO) monitor and conserve the many species and habitats of the Ranges in Pembrokeshire. We have specialists in flowers, bumblebees, birds, invertebrates, lichens and the marine environment – people who all give their time, effort and expertise for free!

The storms of autumn 2017

Storms Ophelia and Brian caused havoc across the country. Castlemartin was not immune. The iconic Green Bridge of Wales lost a huge chunk of its seaward leg, the sand dunes shrunk inwards and approximately 22 grey seal pups lost their lives.

Chough 2018

The cold and wet spring, followed by the dry summer could have caused problems for our stunning red-billed chough, as they must dig into the ground to find

grubs to eat. Thankfully 11 pairs of birds managed to fledge 31 youngsters.

Fires

The dry summer prompted numerous fires across the Ranges, caused by hot illuminating (tracer) rounds within the ammunition landing on dry vegetation. In 2018, 11 fires have been mapped so far, accounting for 325,049.4m² of burnt vegetation. This is devastating for caterpillars, reptiles and nesting birds. In response, the MOD placed a temporary ban on tracer ammunition being fired during dry weather.

Ogof Gofan cliff cave

Two years of MOD Conservation Stewardship Funding has resulted in 13 specialist visits to Ogof Gofan to collect biological and archaeological data.

This has revealed that whilst many lesser horseshoe bats visit the cave during the night for feeding and temporary roosting, they are not as important for hibernation as was once thought. A maximum of three horseshoe bats were recorded during the specialist visits. The caves are described by Dyfed Archaeological Trust as “spectacularly well decorated, quite

uncommon to the likes in the area and can be considered an archaeological site of national importance.”

Access by specialist caving groups is controlled by a permit system, operated by Pembrokeshire Coast National Park Authority and DIO. The study data has provided assurance that visitors to the cave who are interested in its spectacular karst geomorphological features have consistently acquired a permit to do so. The number of visiting cavers remains relatively low but one visitor said “*though the caving distance is relatively short, we all agreed that this is a very remarkable cave and the chambers within truly spectacular.*”

Goldilocks Aster

This summer the Castlemartin Conservation Group repeated a 2001 survey of this nationally rare plant. All except one of the populations were relocated and it was agreed they looked healthy with little change in population size. Although it is a poor competitor, and is usually intolerant of heavy grazing, at Castlemartin it is found in low growing, sheep grazed, clifftop grassland and heath. There is a concern though that in some locations the plant is incredibly close to the cliff edge and will be at the mercy of weather and sea erosion.

New bumblebee project for 2018

In 2018 the Conservation Group launched two new projects. One project involves setting up several transects for monitoring bumblebees on a monthly basis across the Ranges, the second will catch moths for identification.

Castlemartin is home to several uncommon bee species. The project hopes to build a more detailed picture of their whereabouts and how they use the available nectar across the site so that in future we can manage this more carefully for their benefit. Watch this space for the results!

Lynne Houlston

National Park Ranger for the Military Estate
Pembrokeshire Conservation Group

Kent and East Sussex

DTE South East



The Churchill School, Emerald Class Three planting Woodland Trust saplings © Rick Beven

Cinque Ports Training Area (CPTA) has had a productive conservation year.

On the evening of 22nd June 2017 members of the Crowborough Conservation Group met at Pippingford Park Training Area on Ashdown Forest. Under the leadership of Matt Kirk, Sussex Ornithological Society, nine members of the Conservation Group went looking for nightjars *Caprimulgus europaeus*. There are at least three pairs of nightjars resident on the training area and they are usually reliable performers at dusk.

True to form, just as the sky was darkening, the distinctive churring call of male nightjars were heard in the valley woods. Later that evening individual nightjars were seen hunting for moths over the heathland, including one clapping its wings as part of its territorial breeding display.

On 5th July 2017, Neil Coombs from Kent Wildlife Trust (KWT) led a CPTA Conservation Group walk in Reinden Wood, East Kent Training Area. Reinden Wood is a Kent Local Wildlife Site comprising of an extensive block of ancient woodland which contains at least 38 ancient woodland plant indicator species.

Neil explained the natural history of the woods, showing the group how field maple *Acer campestre* and hornbeam

Carpinus betulus were historically used as marker trees to delineate boundaries. A highlight of the afternoon was the sighting of a white admiral butterfly *Limenitis camilla*, an uncommon woodland species.

On 1st September 2017 a total of ten CPTA Conservation Group members attended a conservation walk led by Dr Brian Ferry to study the effects of fire on blackthorn, lichens and other flora on Lydd Ranges. Sqn Ldr (Retd) Paddy Flood, Training Safety Officer Lydd Ranges, outlined the precautions taken to prevent and limit the danger of fire occurring and spreading on the shingle site, which has multiple environmental designations.

In September 2017 Maj Beven, Senior Training Safety Officer CPTA, entered the all-weather Reinden Wood circular path for the KWT Richard Neame Local Wildlife Site Award. This was a joint project involving the MOD, Kent County Council and Landmarc Support Services (Landmarc) to provide a first class circular walk for the public living in the villages of Hawkinge and Densole. At the event CPTA won a Gold Award and first prize of £1,000. This will be used to construct a permanent pond on the site of an ephemeral pond in the centre of Reinden Wood, benefiting frogs, newts and other aquatic woodland species. The pond has been dug and we are waiting for it to dry

out before it is lined, but I am pleased to report that thousands of tadpoles and some newts are already resident.

CPTA has also been utilising MOD forestry funding to plant hedgerows on the East Kent Training Area. In March 2018 some 800m of hedgerow was planted around O'Gorman's Wood, Densole, to improve the site for military use; however it will also significantly improve the habitat for wildlife.

The Woodland Trust provided 120 hedgerow saplings to CPTA as part of its community planting programme. CPTA and Landmarc staff jointly assisted Year Three children from The Churchill School, Hawkinge, to plant the saplings in a meadow next to Reinden Wood. We hope to plant further hedgerows next year to improve the habitat of the training area for future generations.

CPTA Conservation Group was very sad to lose Peter Gay, one of its longest members, who passed away aged 79 after a short illness in June of this year. Peter had an exceptional knowledge of the training area's flora and fauna and monitored rare plants and butterflies annually. Peter's contributions to the group included regularly leading field meetings on the training area's chalk downland where his enthusiasm and knowledge were an inspiration to many.

Maj Rick Beven
Senior Training Safety Officer
Cinque Ports Training Area



Peter Gay walking at MOD Lydden © Crown

Cornwall

Antony Training Area



Surveying the refugia © Crown

Cornwall Reptile and Amphibian Group (CRAG) were invited to join the Antony Training Area Conservation Group at Tregantle Fort in 2016. Our aim was to establish the presence and absence of reptiles and amphibians within the MOD site. CRAG have a long-term relationship with Penhale and are well aware of the enormous advantages to nature that occur when a substantial area, such as the Defence Training Estate, has reduced human footfall and building activity. The immediate area at Antony Training Area has little water, so it was logical to disregard amphibians in this instance and concentrate our efforts on the reptiles that may be present.

On 15th May 2017, with the help of Steffan Jones from Landmarc Support Services, we laid down a series of

refugia at the training area. Refugia are sheets of material placed in areas of likely habitat that are intended to attract reptiles at a time when they require warmth. Six of the refugia installed are made from corrugated metal and eight from roofing felt. These form the focus of our surveys, with the first carried out on 3rd July 2017.

Over the past year, the refugia have been inspected a number of times. The best result revealed 14 slowworms *Anguis fragilis*, which have been consistently seen during our surveys. A common lizard *Zootoca vivipara* has also been seen on the site. Strangely adders *Vipera berus* have not been found, although we have been informed that they are present at Tregantle. Adders are common along the Cornish coast and

we would have expected to have seen some indication of their presence by now. They are unlikely to be found on the manicured grass of each firing range, but away from this area there are many wild places where they should thrive, which would offer a safe haven for an important although much maligned and persecuted animal.

Surveying for reptiles is a truly hit and miss operation, governed by many variables such as time of day, time of year, temperature, materials used for refugia and levels of disturbance. So far we only have an indication of Tregantle's reptile populations, and it may be worth the effort to increase the survey area to see if we can improve our knowledge of what is there. We have proven that there is a healthy population of slowworms and we know that common lizards are at least present. The latter are difficult to survey as they are not usually found beneath the refugia, although they do sometimes bask on top. Due to the lack of water locally, grass snakes *Natrix helvetica* are not likely to be present although we are still seeking a population of adders! The project is expected to last the year and we are hopeful that it will provide interesting results.

Chris White
Chairman
Cornwall Reptile and Amphibian Group



A female slow-worm, probably gravid, found during a recent survey © Travina White

Cumbria

Warcop



WTA guard Sally Barnes and red squirrel ranger Gary Murphy filling a squirrel feeder © Chris Bulloch.

Warcop Training Area (WTA) is situated within the North Pennines Area of Outstanding Natural Beauty and lies at an altitude between 160 and 758m above sea level. It extends to some 9,700ha and includes a variety of habitats which support a diverse range of plant and animal communities. WTA includes Sites of Special Scientific Interest, Special Areas of Conservation, and within its boundaries supports several rare and protected species including red squirrels *Sciurus vulgaris*.

The conifer and mixed woodland areas of WTA have had populations of native red squirrels for many years, but the threat posed by the non-native grey squirrel *Sciurus carolinensis* was first highlighted here in 1994 by Lynne Collins, a national red squirrel coordinator. Since their introduction into the UK from North America in 1876, grey squirrels have spread dramatically and in many instances have replaced our indigenous red squirrel. Higher reproductive rates, their ability to exploit a wide range of habitats and foodstuffs, and the fact they are carriers of a squirrel pox, which does not affect them but is fatal to red squirrels, means that the grey squirrel has a competitive edge over the native red squirrel. This has significantly impacted upon red squirrel populations.

A strategy for red squirrel conservation has been developed locally by Penrith & District Red Squirrel Group. It is endorsed by Dr Craig Shuttleworth, a leading UK authority on the subject and has been successfully implemented at WTA by Gary Murphy, a red squirrel ranger.

Research has shown that providing red squirrels with supplementary food can increase populations by 50%. However care needs to be exercised at feeding stations in order not to benefit any grey squirrels or create opportunities for the transmission of squirrel pox.

WTA staff monitor and maintain supplementary feeders which helps support the populations of red squirrels. They provide Gary with information of any sightings of grey squirrels within the locality and of any red squirrels showing symptoms of squirrel pox. These include swelling, skin ulcers and lesions, not dissimilar to myxomatosis in rabbits.

Techniques employed by Gary involve thermal imaging equipment to pinpoint squirrels in dense tree canopies. Surveillance cameras monitor feeding stations and natural corridors, such as hedgerows used by squirrels. Surveillance cameras and camera traps can provide valuable evidence about squirrel

numbers, dispersal, etc. and identify useful locations for the siting of baited traps. A variety of preferentially favoured foodstuffs for grey squirrels is used to bait container traps, which are regularly checked. Any captured red squirrels are examined and released and any grey squirrels are humanely dispatched.

Maintenance and management of the diversity of habitats at Warcop is an important factor in the long-term survival of red squirrels. The tree planting schemes operated by The Woodland Trust are helping to enhance the biodiversity of WTA.

Areas of woodland or refuges which can be well monitored and not so readily accessed by incursions of grey squirrels are considered a way forward in the protection of our native red squirrels. Scientific approaches are examining the prospect of controlling grey squirrel populations by means of contraceptive foodstuffs and the creation of vaccines to suppress squirrel pox. Ongoing vigilance of WTA staff and the dedication of red squirrel rangers is however imperative in ensuring the ongoing survival of red squirrels at Warcop.

The WTA crest has a red squirrel emblem with the title 'Porro', meaning forward and onwards. It is hoped this integrated conservation approach will enable our native red squirrels to do just that!

Chris Bulloch
Conservation Group Member
Warcop Conservation Group



Warcop Training Area crest © Chris Bulloch

Isle of Wight

Newtown Range



Looking over Clayden's Pond © Dave Maidment

I am writing our contribution during May. It is the first time in my 13 years as Range Officer that we have not held an open day, as Jersey Camp is fully occupied! The open day allows the guided public to look around the range, woodland and meadows to view the fauna and flora especially the green winged orchid. Unfortunately, once again this year the orchids are down, showing sparsely around the range.

After a very wet winter we thought we had survived the annual slip of the sand in the range stop butts – no chance. A couple of areas have moved, however not as badly as last time. The ground is still wet and it is not feasible for plant machinery to come in for repairs. We also lost one of the shore Danger Area flagpoles which now sits on the beach awaiting recovery. At the time of writing our tenant farmer has only just put her cattle out to graze, they are normally out by Easter!

The bird ringers have started their Constant Effort Site Survey and listen to the nightingales whilst carrying out their task. Spring has sprung, even the moths cannot escape being trapped by Barry Angell.

During December we carried out pond surveys for Clean Water for Wildlife as part of the Island's effort for the national survey. Some 21 ponds were tested for nitrate and phosphate levels, all with clean results. It was an interesting morning taking samples and we passed the data to the relevant body on the Island.

Another first for the Range and the Island – a micro fungus found on butcher's broom in Locks Copse proved to be *Phyllosticta Hypoglossi* (Ascomycota; Dothideates) recorded by David Biggs, a retired Doctor.

I built a squirrel feeder which is very successful in attracting our red friends to dine. It is a simple box and lid design with a platform for them to sit and eat on whilst they have their photo taken. Of course, we record their activity and pass on the information to Helen Butler of the Isle of Wight Red Squirrel Trust.

Our AGM in November was chaired by Grp Capt (Retd) Keith Lane, Chief of Staff at South East Reserve Forces' & Cadets' Association (SE RFCA) who enjoyed his first meeting. Bill Shepard has retired from the Group and at 97 he is "slowing

down on his commitments." His input and expert advice over the many years (40+) as a founder member of the Group is much appreciated. The staff at the Range will miss 'Uncle Bill's' visits for surveys and of course the open days and AGMs; they respect his opinion on all things botanical. Bill is well known on the Island for his local knowledge of botany and history having written numerous books on the subjects.

We have the peregrines nesting again, this time on another osprey pole. They are being observed from across the creek from the bird hide at The National Trust's Newtown Nature Reserve. A no-go zone has been established around the pole. It is intended that we will ring the young by the same means as the last time, requesting Scottish Southern Electric to come in with their Cherry Picker. We are still waiting for the osprey to settle and nest which will be another first for us and the Island.

Maj (Retd) D C Maidment
Range Officer
Newtown Range & Jersey Camp



A red squirrel enjoys the new feeder © Dave Maidment

Cyprus

Akrotiri Primary School



Building teamwork skills © Andrew Bowles

Akrotiri Primary School is situated at RAF Akrotiri in the western Sovereign Base Area of Cyprus. The school is for the children of serving personnel and UK based civilians. In October 2017, a small team of teachers completed a qualification to deliver a Forest School curriculum to the children of the school.

"Forest School is an inspirational process, which offers all learners regular opportunities to achieve and develop confidence and self-esteem through hands-on learning experiences in a woodland or natural environment with trees" (Forest School Association).

The team were initially presented with the problem of finding a suitable woodland site on the base that would provide a safe, powerful learning experience. Substantial research led to the selection of a site of approximately one acre immediately to the rear of the school, providing instant access for the children. The site had been used in recent years as a storage facility for old athletic equipment and for the disposal of grass clippings and debris from the storm drains. This led to an initial clean up task of some magnitude. Parents, staff, governors and serving personnel all stepped up to the mark in clearing the site to make it safe, achieving the first step in this community project.

With the site ready, children were soon enjoying the new curriculum. Children from age three to eleven have taken part in a multitude of activities including building dens, making fires, cooking, creating art through nature and learning about how to care for the environment. As part of the Forest School ethos, children are given a large amount of independence during a session. The lead teacher will model a choice of activities or a new skill and the children are encouraged to try them out or employ their new skill within their free, adventurous play. Children are then encouraged to reflect upon their learning, identifying where they have used certain skills such as teamwork, respect, risk management or being imaginative.

A large part of the school's focus during Forest School sessions is about awareness of and respect for the environment. As such, children have been involved in planting new indigenous trees, pruning existing trees and identifying the flora around the site. The school is currently working in conjunction with David Reynolds of the Defence Infrastructure Organisation and Akrotiri Environmental and Education Centre to learn about the various flora and ways of preserving and enhancing it over the coming years of site development.

The site is used by up to 550 children and therefore the team have to seriously consider the problem of degradation due to high footfall. This matter is continuously reinforced within sessions, educating the children to consider how much of the natural resources are used and the importance of replacing what is taken from the environment. Additionally, plans are afoot to develop other areas around the school to create vegetable gardens and rear chickens. These could then be used to develop knowledge and understanding of natural science as well as having potential for children to experience the responsibility of running a small business selling produce to parents. There are also sessions planned to provide identified groups of children with opportunities to develop their sense of responsibility and self-confidence. These include watering and nurturing the crops as well as feeding and caring for the chickens. They are then given the chance to share their experiences with the rest of the school and the local community.

The project is a continuous, developing venture that enhances the children's knowledge, understanding and respect for the environment whilst developing both practical and social skills. They love it!

Andy Bowles
Class Teacher & Forest School Leader
Akrotiri Primary School



Creating art through nature © Andrew Bowles

Wiltshire Imber



The Owl and Raptor Team rings barn owl chicks across Salisbury Plain © Richard Clayton

The annual winter hen harrier survey on the western side of the Plain was a little poor, with few sightings of both hen harriers and short-eared owls.

Spring seemed to take ages to arrive and when it did it was very wet. Although detrimental to some species, it was perfect for the common toad. As there were plenty of water bodies to spawn in from mid-March they developed well, even with the interruption of the 'beast from the east'. We initially thought that the first bank holiday mini-heatwave would be disastrous for the tadpoles as many smaller puddles dried out. This was overturned by the following wet bank holiday, which sustained many of the larger ponds long enough for metamorphosis (tadpole to tadlet) to take place successfully. This has been the best year since constant monitoring began in 2013.

Using data collected ten years ago for the Butterfly Atlas, we are re-surveying 1km grid squares for priority butterfly species, with the focus on Duke of Burgundy, marsh fritillary and chalkhill blue. The many tank tracks provide fantastic habitat for the wall brown, another butterfly of Conservation Concern, which are seen in good numbers. We have had four successful moth evenings over the

summer months with some interesting species; lappets, festoon, royal mantle, four spotted footman and bordered pug.

Our annual joint entomological event between the Larkhill & Westdown, Bulford and Imber Conservation Groups and the Natural History Museum (NHM) Entomology Department, supported by County Recorders and other local entomologists was a success. Approximately 25 people visited several areas on the SPTA (west) on 21st July, including Berril Valley, Imber Firs and Battlesbury Hill Fort. Daniel Whitmore, a *Sarcophagidae* (flesh flies) expert from the NHM found multiple specimens of *Sarcophaga arcipes* – a species Chris Raper found on the Plain last year and which was previously only known in the UK from three specimens caught on the Devil's Dyke in Cambridgeshire. It is presumed extinct at the old site so such a healthy colony on the Plain is a really good find. With regards to *Coleoptera*, Antony Coles found several specimens of *Licinus punctatulus* (beetle), a Notable A species and another new record for the Plain. There were only three previous records in Wiltshire, the last in 2001. Other Red Data Book species were also recorded and a full list will be submitted shortly to the County Recorders.

In support of the Bumblebee Conservation Trust and the National 'Back from the Brink' initiative, the three Conservation Groups hosted a two day shrill carder bumblebee survey. Historically, shrill carder bees were found on Salisbury Plain, however, disappointingly the last record is now a decade old (2008). Using previous data, the first day in August was spent on SPTA (east), organised by Mervyn Grist. The group visited the Chisenbury Warren area and nine species of bumblebee were recorded, with one possible shrill carder, yet to be confirmed. The following week on SPTA (west), the group visited White Barrow, Berril Valley, Imber Clump and Battlesbury Bowl, stopping for lunch at Imber church, with six species recorded. This also provided a boost to Jenny Elvin and her team's regular monthly bumblebee walks.



Brown-banded carder on knapweed © Crown

Andy Palmer completed his first year ringing on the west and had good counts of goldfinch, whitethroat and yellowhammer with the occasional grasshopper warbler and lesser whitethroat. The RSPB Stone-curlew Project team on the west reported a good year, ringing 12 chicks, 10 of which fledged.

The dry summer has been ideal for the red hemp nettle plant which has been recorded in high numbers in both their known strongholds and in new areas.

All in all, a successful year for recording.

Andrew Bray
Imber Conservation Group Chairman

Staffordshire

MOD Stafford



Bat house – built with cavity wall and loft space to mitigate the demolished building © Crown

MOD Stafford is situated on the outskirts of the county town of Stafford, to its north, and is surrounded on three sides by farmland. Though not quite 'A Wind in the Willows,' the rural location and semi-natural landscape provides habitat for a variety of wildlife.

Extensive planning and development work has been carried out to accommodate two signal regiments who recently relocated from Germany. Before a spade broke ground, environmental aspects of the site had to be considered. Site personnel were involved with project BORONA from an early stage, providing ecological information to the Defence Infrastructure Organisation (DIO) and working with WYG ecologists on surveys for newts, bats, badgers, snakes and lizards. These surveys identified that the site had a large population of great crested newts (GCN), badger setts and bats in areas directly affected by the development.

The presence of these protected species posed significant challenges to the project. Whilst it may be preferable that natural habitats are not disturbed, the assessment studies concluded that relocating the wildlife was the best option. Due to the seasonal life cycles of the various species the timing of

the development hinged on securing Natural England (NE) licensing and undertaking mitigation work. Licence applications were submitted to NE for GCN, bats and badgers, which included details on the probable impact and proposed mitigation work. The licences were subsequently agreed and issued by NE, which allowed the BORONA development to commence in line with the extremely demanding programme.

A major part of the development was the demolition of the officers' and sergeants' messes. Surveys identified a maternity roost of pipistrelle bats in the roof space and cavity wall of the officers' mess. The solution was the construction of a bat house and scheduling demolition for the winter months when the bats were seasonally absent. Exclusion devices were fitted to the building covering possible access points, which allowed the bats to leave but not return. An ecologist was present whilst the roof was dismantled tile by tile. Three bats were found and they were relocated to the new bat house. Bats have continued to occupy the bat house, albeit in small numbers.

Only one 'outlier' badger sett was affected by the development work. Fortunately, further monitoring of the

sett established it was unoccupied and therefore it was closed under licence.

The construction of the new combined mess would result in the loss of foraging habitat for GCNs. To comply with the licence, mitigation action was completed, which included creating three new ponds, hibernacula, an area of land set aside as GCN habitat and the use of newt fencing and traps to capture and relocate the newts away from the development site. The latter task was time consuming; involving checking over 200 bucket traps and heating ducts each morning and to set it up in the evening for 55 consecutive days. Any newts and other wildlife found in the traps were relocated to the nearby habitat.

Female GCNs lay their eggs on the leaves of aquatic plants, wrapping the leaf around the egg and therefore vegetation is critical for breeding. Whilst new aquatic plants were becoming established, several strips of plastic were weighed down and placed in each pond to act as substitute leaves and to aid monitoring. Further work has been carried out recently on the ponds with the introduction of pre-planted coir matting to cover the pond lining and increase vegetation.

Finally, in accordance with the NE licence, the GCN population will be monitored for five years post development. This is accomplished through night-time surveys of the new ponds, pre-existing Emergency Water Supplies and controlled waters. Having just completed the fourth year the Station is delighted to report that there is still a healthy population of GCNs; several adults have been observed in the new ponds and even eggs spotted on the artificial leaves.

Cheryl Egerton
Station Energy and Environmental
Protection Advisor
MOD Stafford

Hampshire

Thorney Island



Cattle on the sea wall © Simon Sprackling

Since 2001, Thorney Island Conservation Group and the organisations and individuals it represents, has been helping to maintain and protect the Island as an area of outstanding natural beauty for everyone to enjoy. Three Conservation Group members share their experiences:

Farming

My Uncle, Wg Cdr Jim Sprackling was returning to Thorney from Bomber Command when he noticed a derelict farm on the Island, and so it was that the Sprackling family took a farming lease with the Ministry of Defence (MOD).

We farmed conventionally around an active RAF airfield from 1965, which later became home to the Royal Artillery. Around 1988 we became organic farmers and have managed the Island to a high environmental standard ever since.

Thorney Island is an amazing reservoir of rare grasses and plants that occur nationally in only very small numbers such as grass-poly. Birds and wildlife such as endangered species of lapwing, water vole and brown hare make farming on the Island a mixture of 70% environmental management and 30% actual commercial farming. Working closely with Chichester Harbour

Conservancy, RSPB, Natural England and the MOD, an active Conservation Group helps to keep the conservation of this unique area to the fore. I farm in one of the most beautiful areas on the south coast and thanks to the MOD hopefully it will remain an environmental oasis for years to come.

Tern Raft Project

Thorney Deeps is a large, semi-tidal lagoon separating Thorney Island from the 'mainland' and is a designated Site of Special Scientific Interest and part of the Chichester and Langstone Harbour Special Protection Area.

Three species of tern breed in Chichester and Langstone harbour: common, sandwich and little tern, all faring poorly in Chichester Harbour in recent years due to poor breeding success.

Historically, much of Thorney Island, along with the other islands and spits in the harbour, would have been good tern breeding sites. Today however, most 'natural' sites are threatened by tidal flooding, have high levels of human disturbance or are easily accessible to predators such as foxes. Funded by Sussex Ornithological Society, a project to construct and site an artificial nesting raft in the sheltered waters of Thorney

Deeps, providing refuge for common terns and easy access to feeding sites, saw Chichester Harbour Conservancy staff and volunteers launch the raft in early July.

We hope the terns will nest successfully on the rafts in coming years, giving a major boost to the tern population of this special area, and an opportunity for the local community to see these fabulous birds up close.

Thorney Shoot

Game shooting on Thorney Island has always been regarded as a recreational activity for MOD personnel stationed or working here. However, it is perhaps not widely understood that game shooting is closely associated with wildlife conservation through sound habitat management to provide ground cover and food for birds whilst also controlling pest species. This process is a year round activity and not merely seasonal. Thorney, like most shoots nowadays work closely with various conservation organisations to sustain the very wildlife we all seek to protect.

As a stakeholder and active member of the Thorney Island Conservation Group the Shoot works closely alongside other represented stakeholders such as the tenant farmer, RSPB, and Chichester Harbour Conservancy to ensure essential habitat management. This includes; ride clearing, woodland management, scrub clearance, planting cover crops and bird feed as well as vermin control. Shooting activities are pro-actively conducted and coordinated to meet the best interests of each body and successfully contribute to the overall good health of the local flora and fauna on Thorney.

Simon Sprackling
Tenant Farmer

Peter Hughes
Ecologist
Chichester Harbour Conservancy

Maj (Retd) Bob Raley
Chairman Thorney Island Shoot

Wiltshire

Larkhill and Westdown

Larkhill and Westdown Conservation Group have had another busy year. The group has a new chair, Christopher Beese. He has spent considerable time researching the Winterbourne chalk streams on the Plain. These rivers only flow in winter and occasionally flood local villages.

Compared with the previous 10 year mean, Nigel Lewis reports that 2017 was a good year for owls and raptors on Salisbury Plain Training Area (SPTA) with kestrel pulli up 36%, tawny owl pulli up 25%, and barn owl pulli up 190%. This should have boosted the breeding stock for 2018 but the 'beast from the east' caused weaker birds to perish and others to move down to the warmer climate in surrounding farmland. For 2018 tawny owl breeding results are not good, but kestrels and barn owls are doing well, albeit a bit late. Sadly little owls have all but gone from the Plain with just one pair remaining at Warminster.

Paul Castle reported sightings of one osprey and two marsh harriers in 2017. Hen harrier roosts were again monitored during the winter; at least 14 are using the Ranges. Also reported were seven red kites, 17 great bustards, 11 short-eared owls, three merlins and 130,000 starlings. RSPB monitored 13 pairs of stone-curlews. Phil and Graham Deacon ringed 728 adults and 2,292 juvenile birds in 2017, mostly whitethroats, blackcaps, willow warblers, chiffchaffs and one Cetti's warbler, unusually far from water. Wryneck are an infrequent passage migrant and one was ringed at Westdown this year; in the past 15 years only three have been trapped at the site. The wrynecks we catch probably breed in Scandinavia and migrate through in late August, early September using the scrub area to feed up on blackberries and insects ready for their onward flight to tropical Africa. Only two nightingales held territory compared to 14 in 2012. In 2018 the late cold weather affected resident bird species, especially stonechats, and a dry winter in west Africa coupled with adverse northerly



A wryneck ringed at Westdown © Phil Deacon

winds delayed returning summer migrants by a couple of weeks.

Marc Arbuckle has become the Wiltshire County Recorder for coleoptera (beetles) and has continued to monitor the insects on the Plain and led several bee walks during 2017. The results were disappointing with bumblebee populations down again, possibly initially due to the lack of wild flowers. He has discovered the presence of the scarce phantom hoverfly *Doros profuges* and with Iain Perkins organised the annual entomology day on SPTA which added valuable data to the local records centre.

The major archaeological work during the year has been excavations linked to the Army Basing Programme at Larkhill. The new service families' houses turned out to be built on top of a World War One training area. Wessex Archaeology have conducted excavations across the site which is laced with old trenches and underground tunnels up to 10m deep with soldiers' graffiti and some unexploded ordnance. Mark Khan has

conducted a survey of heritage hard targets on SPTA, mostly World War Two armoured vehicles. Operation Nightingale continues to aid soldiers and veterans under rehabilitation on archaeological digs. An iconic signpost has been refurbished with the support of DIO. It can be seen where the old Lavington and Devizes roads diverge in the middle of the artillery Impact Area.

In 2017 Mike Lockwood continued to monitor the butterflies on the Plain and conducted egg searches for brown hairstreak which revealed an increasing population and several new breeding sites. The 2018 season had a slow start due to bad weather with only the whites, brimstones and orange tips seen in any numbers, but since May the number of recorded butterfly species has increased. The newly created habitat for the Duke of Burgundy has taken well and there have been regular sightings during the month.

Lt Col (Retd) R S Clayton
Secretary
Larkhill & Westdown Conservation Group

Hampshire

Defence Munitions Gosport



A little owl © Gary Calderwood MDP

Unlike most other armament depots, Defence Munitions (DM) Gosport is not located in a remote area, instead it is situated within a town, next to a busy city and port. However, DM Gosport's location does not deter the wonderful range of biodiversity being conserved within the 210ha site.

DM Gosport is situated adjacent to Portsmouth Harbour, a Site of Special Scientific Interest, Ramsar site and Special Protection Area. The site has varying landscapes and ecosystems including one of the finest examples of old English coastline in the area, that is virtually untouched. Natural and man-made ponds, dense woodland, green fields and more are all nestled between industrial work processes.

There is a variety of interesting flora on site including an assortment of orchids; autumn lady tress, pyramid, bee, early purple, marsh, green-winged and common spotted. The grounds maintenance team avoid these areas when the flowers are in bloom and work closely with the Conservation Group to manage the requirements of both an explosives site and the conservation efforts needed to protect these plants.

A yellow post system has been developed; Conservation Group

members place wooden stakes across the estate in any areas that wildflowers flourish, continually identifying new spots hidden among the myriad of processing buildings. Wild garlic, primrose, bluebells, rock sea lavender, cowslip and more are found across the site, as well as a 300 year old crab apple tree among other tree species including black poplars, situated in classified ancient woodland.

DM Gosport is home to one of the largest heronries on the south coast which includes a colony of nesting little egrets. Undisturbed by human interference, this has provided an auspicious area for the species to flourish. At the last survey 75 pairs of nesting herons were identified.

As well as the avian species you would expect to find, there are five pairs of breeding buzzards, several owl species and other birds of prey, countless migratory birds, plus the occasional rarer visitor such as the hoopoe.

The wetland habitats that have gained Ramsar status are home to dark-bellied Brent geese, dunlin, curlews, redshanks, godwits, sandpipers and many more. There is also an agreement with Natural England to provide a Brent goose landing strip, a location within the explosive storage area that acts as a

landing and grazing area for Brent geese, but also sustains wintering curlew and numerous other birds.

Also within the explosives storage area are the butterfly glades, with an abundance of common species plus the grizzled skipper, small heath, white-letter hairstreak and gold case-bearer moth, all found on the Biodiversity Action Plan list.

There is a range of mammal habitats on site including badger setts, fox dens, rabbit burrows and bat roosts, with a bat hibernacula situated within Fort Elson; a Napoleonic fort on site which is currently in a state of natural degradation, allowing an assortment of creatures to call it home. The decision was made to prohibit access to the area, further allowing the biodiversity to thrive in an isolated and protected place.



A grizzled skipper © Tim Collingwood

Other site efforts include the Million Ponds Project. Biffaward and DM Gosport, in conjunction with the Ponds Conservation Trust, commenced a joint project to excavate seven ponds to further improve conservation. A critical element is that the ponds have clean water as an effective conservation approach to aid freshwater wildlife. There have also been many bird and bat boxes put up, survey and photography exercises. There are further impending projects planned including a venture with Praise Bee and periodic marine clean-up operations.

Raffaele Turk
Compliance Manager, Environment & Conservation Group Chairman
Defence Munitions Gosport

Cornwall

RAF St Mawgan



A purple hairstreak catching some sun rays © Rowena Castillo Nicholls

Contrary to popular belief RAF St Mawgan is neither closed, nor a sleepy hollow posting. Located approximately three miles north east of Newquay, Cornwall, the site has been in existence since 1939, although it has been through some changes. What remains is the 1941 domestic and technical site and the original RAF Trebelzue that was later subsumed into RAF St Mawgan in 1943.

The Station Health Safety and Environmental Advisor (SHSEA) has successfully engaged with civilian groups enabling them to visit the site. The latest visit was from four members of the Cornwall Butterfly and Moth Group escorted by Mr Aidan Wood, SHSEA, and Mrs Sarah Kretowicz, the acting Health and Safety Advisor.

The day was hot and sunny and ideal for counting butterflies. Immediately on arriving two of the members scrutinised a small patch of long grass in front of the Guardroom and were amazed to see second brood common blues at a density they had not seen anywhere previously this year. The grassy patch was full of greater bird's-foot trefoil, one

of the plant species that the caterpillars of the common blue feed on. Also, there were at least six brown argus, a butterfly that has few thriving colonies in west Cornwall. Further into the site the first ringlet was found. Due to the long spell of hot, sunny weather prior to the visit, the flight period of this species was virtually over, but given the nature of the habitat we are sure that in peak flight time there would have been many more.

Another drier area comprised mainly of the dry seedheads of soft grasses, either creeping soft grass, Yorkshire fog or both. Yorkshire fog is the main food plant of the small skipper caterpillar but only a single butterfly was seen. This may again have been due to the fine weather bringing the flight period to an unusually early end. Despite the lack of flowers in the grassland there were at least 10 male small coppers holding territorial perches; another butterfly we had not seen in such high numbers anywhere else this year. Surrounding the grassy area were a mixture of trees, bushes and bramble, the latter providing nectar for a variety of butterflies, including our first comma.

Sheltered by the taller vegetation, nettles grew along one edge of the field and on one patch of these six small tortoiseshell caterpillars were found. This is a species that has been in national decline for at least ten years.

Two more new species were seen flying around the oak trees at a corner of the field; a single holly blue and at least three purple hairstreaks. There were probably a lot more of these hairstreaks but they are seldom seen as they spend most of their lives in the canopy feeding on the sugary secretions of aphids. On the north side of the site, 40 common blues were counted in this large area as well as many more of the other species already seen. While further west a long line of buddleia bushes gave us our highest count of migrant painted lady for the day.

Land under the control of the military is usually exceptionally good for butterflies and RAF St Mawgan is no exception. The type of habitats seen here are fast becoming few and far between and it was a great pleasure to find them in such good condition. What did surprise us was the sheer number of butterflies seen!

Aidan Wood
Station Health Safety and Environmental
Advisor
RAF St Mawgan



The underside of a male common blue © Iain Perkins

Gloucestershire

South Cerney



Children from the Duke of Gloucester Playgroup play 'I Spy' at their bug hotel © Carole Mercier

The Station's passionate conservation and energy management teams, youth club and play school children have had another busy and successful year in supporting flora, fauna and energy saving initiatives to deliver improved biodiversity and sustainability at the Duke of Gloucester Barracks.

The British Trust for Ornithology carried out our annual breeding bird survey and the report identified 50 different bird species that were observed within the site. A highlight remains the good numbers of house sparrows and house martins which nest in and around our adjoining areas and for the very first time over the past few months we have also seen red kites and nesting little owls. Bird boxes are being made by our Amey staff to provide for the 2019 nesting season.

Our annual species survey identified an increase of mammals living on site notably fallow, roe and red deer. Our nature conservation area adjacent to the airfield has given good protection to hedgehogs during the cold weather earlier this year.

Over the past year we have planted 94 eight foot trees. Maj (Retd) David Martin engaged with the Gloucestershire Woodland Trust and two of our hybrid

poplars have been re-designated to native black poplars. This is the most endangered native timber tree in Britain. The next stage is to get Tree Preservation Orders put on them.

The staff and children at the Duke of Gloucester Playgroup have been busy throughout the year with many of their conservation projects which included the creation of bug hotels, sowing of seeds to grow vegetables, maintenance of their perennial scarecrow themed flower garden and looking after their hedgehog who took up residence in the activity garden.

To protect flora and fauna on site the Station's Environmental Management System has continued to schedule annual grass cutting of the airfield to allow natural seeding to take place. Maintenance of our 'no grass cutting areas' has continued so that we can protect rare plant species and our designated area for the breeding of grass snakes next to our stream is continuous. Also Ancala Water Services have designated a large area of the sewage treatment works that is not needed for operational works as a conservation area.

On the environmental protection side, all our drains have now been colour coded to assist the spillage response

team. The spillage response plan was reviewed which culminated in a planned 'vehicle collision' exercise. The team demonstrated their quick response to protect our principal aquifer and stream.

In May at the Army Safety and Environmental Conference (ASEC18) the Regiment won the Unit Environment Award for the "delivery of an exemplar Environmental Management System and coordinating work with the service families at South Cerney Station."

In June, we had the county recorders for Oxfordshire and Gloucestershire visit the site to conduct a flora survey. There are a good number of wildflowers growing in the grass areas of the barracks. The team recorded well over 100 plant species. Some of the more common wildflowers include bird's-foot trefoil, field madder and lady's bedstraw. More unusual plants included wild thyme, restharrow, hairy violet and hare's-foot clover. The real rarity inside the barracks area is corn parsley *Petroselinum segetum*.



Bee orchid on South Cerney airfield © Chris Dixon

Several verges were of conservation interest, consisting of semi and unimproved lowland calcareous grassland. This habitat has dwindled alarmingly over the past 60 years; around the interwar period, this habitat covered circa 40% of the Cotswolds, whereas now it is thought to cover only 1.5%. Nationally, it is estimated that there are only 40-50,000ha of this habitat remaining in the UK.

Capt Nigel Williams
Safety & Environmental Adviser
29 Regiment, The Royal Logistics Corps

DIO Safety, Health, Environmental Protection and Sustainability (SHEPS)

The Environmental Support & Compliance (ES&C) Team and the Sustainability & Environmental Planning Team (SEP) sit within the SHEPS area of DIO Technical Services and provide specialist expertise to DIO and the wider MOD. Advice and guidance can be given in the fields of: Access & Recreation, Forestry & Woodland, Historic Environment, Natural Environment, Conservation Groups & Sanctuary.

Environmental Support & Compliance

Building 88
Westdown Camp
Tilshead, Salisbury, SP3 4RS

ES&C Ecology:

DIO-EcologyTeam@mod.gov.uk

ES&C Access & Recreation:

DIOSEE-EPSESCAccess@mod.gov.uk

Environmental Planning:

DIOSEE-EPSPEnvTeamWDC@mod.gov.uk

Sustainable Development Support:

DIOSDEUS-SusDevSpt@mod.gov.uk

For all other ES&C enquiries including forestry, heritage and archaeology, and Scottish Environmental Liaison please contact:

DIO-ConservationGroups@mod.gov.uk

Utilities Team

The Utilities Team is responsible for Energy Delivery & Payment, Energy Management, along with Compliance & Data, which covers Water and Waste policy implementation and Utility Data management across the MOD estate in the UK and Overseas.

Energy Management Team:

Tel: 0121 311 3277

Energy Delivery & Payment Team:

Tel: 0121 311 3278

Compliance & Data Team:

Tel: 0121 311 2052



Richard Brooks visiting Ogof Gofan cliff cave © Stuart France

ES&C Update

It has yet again been a pleasure to be involved with the production of Sanctuary 47 and the 2018 Sanctuary Awards. These continue to demonstrate how sustainability and estate stewardship are embedded across all areas of MOD operations.

Several of the articles in Sanctuary 47 are generated around heritage activities including many associated with WW1, so very poignant in 2018. These articles demonstrate the history and longevity of the MOD estate. Working alongside DIO's archaeologists is a continuing education for me, learning about the development of our estate from prehistoric times to the creation of more recent military archaeology because of our presence since the late 1800s.

The longevity of ownership has not only protected the layers of history on the estate but has created significant landscapes of great ecological value. This is demonstrated time and time again in this publication and through many years of Sanctuary Awards. The MOD estate is now widely recognised as being of such high value due to the long history of military use and subsequent stewardship.

Many of the featured projects are supported by the MOD's Conservation

Stewardship Fund (CSF) managed by the DIO ES&C team. The CSF supports projects relating to ecology, archaeology, historic buildings, landscape and sustainable community. The specialists within ES&C ensure that the limited funds are targeted at the most deserving projects, which assist the MOD in fulfilling its environmental policies and maintaining our good reputation for environmental land management.

If you are undertaking environmental or sustainability activity on the MOD estate then please consider the following: Does your project warrant an article in Sanctuary Magazine? Should you nominate your project or any individual effort for the Sanctuary Awards? Do you have ideas or plans that may be eligible for CSF funding? If the answer to any of these questions is yes, then please contact the DIO ES&C team.

Finally, on behalf of the editorial team I would like to thank all the contributors, sponsors, DIO and wider MOD staff who have made Sanctuary 47 possible. In particular, my thanks go to the DIO ES&C Sanctuary Team. The magazine is, as always, a credit to their efforts...

Richard Brooks

Principal Environmental Advisor
Defence Infrastructure Organisation

Supporting the UK Ministry of Defence's commitment to sustainability



The Sanctuary Award Tool Team, Samantha Bevan-Talbot and Heather Herbert © Commerce Decisions

Commerce Decisions is proud to provide continued support to the MOD Sanctuary Awards which play an important role in recognising the commitment to sustainability from staff, volunteers, industry partners and contractors across the MOD estate. The annual Sanctuary Awards showcase the achievements of teams and individuals working to preserve and protect the MOD estate, both in the UK and overseas.

The judging of the Sanctuary Awards is supported by Commerce Decisions' AWARD® evaluation solution which enables all submissions to be assessed in a robust, controlled and objective manner; ensuring absolute integrity.

The process involves the entries for each category being assessed in AWARD® by a panel of judges followed by a moderation where a final score is recorded for each entry. With a geographically dispersed judging team, tight timescales and a large number of documents to manage, AWARD® ensures an efficient, transparent and auditable judging process.

Samantha Bevan-Talbot, MOD Account Director, Commerce Decisions comments: *"We are delighted to be supporting the Sanctuary Awards once again. They play a valuable role in*

applauding innovation and celebrating creativity, community spirit and commitment to the environment."

Supporting sustainability across the MOD. Delivery of AWARD® via a secure hosted service enables multiple stakeholders across the MOD to access their work at a time and a place to suit them. The ability for users to access AWARD® from any workstation with an internet connection and web browser has negated the need for regular travel for geographically dispersed MOD teams; resulting in substantial time savings and drastically reducing the cost of travel and subsistence. AWARD® is proven to support sustainability targets, significantly simplifying the management of large volumes of information on complex projects. A total of over 45 million pages are electronically submitted into AWARD® each year, saving the equivalent of 5,400 trees in printed paper.

About Commerce Decisions.

AWARD® has been deployed by the Ministry of Defence since 2001, with a corporate licence in place since 2013. Commerce Decisions is working with the MOD to ensure that procurement processes are standardised and efficiencies are maximised across the organisation, supporting the MOD to achieve significant savings.

SUBMISSIONS

If you would like to contribute to Sanctuary Magazine or enter future Sanctuary Awards please contact the Sanctuary Team at:
DIO-Sanctuary@mod.gov.uk

The opinions expressed in the magazine are not necessarily those of the Ministry of Defence.

Notwithstanding Section 48 of the Copyright, Designs and Patents Act 1988, the Ministry of Defence reserves the right to publish authors' literary and photographic contributions to Sanctuary in further and similar publications owned by the Ministry of Defence. This is subject to contrary agreement, which must be communicated to the editor in writing. Authors' contributions will be acknowledged with each and every publication. Maps in this publication are reproduced from the Ordnance Survey map, by Defence Infrastructure Organisation, with the permission of the controller of Her Majesty's Stationery Office, Crown Copyright.

Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number GD3189G.

Editorial Message

Dear Readers, the Sanctuary Team hope you enjoy this years magazine. We are always interested in your views on how we could improve it.

Please could we ask, with sustainability in mind, that you pass the magazine on for others to enjoy and only recycle as a last resort. Thank you.



Ministry
of Defence

COVER IMAGE: After scrub removal, a view of the Bulford Kiwi taken from an RAF Chinook.

BACK COVER: The RAF delivering one-tonne bags of fresh chalk to the Bulford Kiwi.

Photographer: SAC Pippa Fowles RAF



Ministry
of Defence

