SANCTUARY

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SANCTUARY

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Sanctuary is the Ministry of Defence's (MOD) annual sustainability publication, which has been in print since 1975. It features articles about sustainable development in the MOD, environmental and heritage conservation across the MOD estate, as well as the sustainable management of the MOD's built assets. The publication illustrates how the MOD is undertaking its responsibility for stewardship of the estate in both the UK and overseas. It is designed for a wide audience, ranging from the general public through to serving personnel, MOD civilian staff and MOD Conservation Group volunteers.

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

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The Sanctuary Team would like to say a big thank you to our sponsors. Each year our industry partners kindly sponsor the publication of *Sanctuary* magazine and the Sanctuary Awards. We would not be able to produce hard copies of the magazine for people to enjoy without their contributions. Once again, this year we have received enough money to print 4,500 copies. As ever, we appreciate the continued support of our sponsors which allows this iconic magazine to be published.

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Foreword by Lt Gen Richard Nugee CB CVO CBE

Climate Change and Sustainability Review Lead

This has been an extraordinary year, with the COVID-19 pandemic disrupting so much of our normal lives. Yet it has also been a year where during the lockdowns, nature and the environment seemed to have reclaimed, even if only temporarily, some of what had been lost. At the same time the ravages of climate change, from the fires in Australia and California to the ever more regular floods in the UK, have become increasingly apparent and are hitting the headlines far more frequently. Governments have demanded a green recovery as we come out of the pandemic crisis; awareness of the issues and the importance of the environment is increasing throughout the world, with Defence playing its part. Indeed, there are articles from each of the Services (Around The Services) on what they are doing in terms of sustainability. But, as the article on the Climate Change and Sustainability Report makes clear, there is so much more that Defence can and should do.

Sanctuary highlights the wonderfully rich and diverse nature of Defence's environmental importance, with responsibilities and actions across the globe. This can be witnessed from the farthest south, with HMS Protector's support to the Thwaites Glacier Project, Antarctica, to the Himalayas with DIO (Nepal)'s article on sustaining the water demand in Kathmandu through rainwater harvesting and reject water utilisation. Along the way, the DIO in Belize are at the centre of environmental community engagement, ensuring the protection of the jungle environment whilst enabling troops to train.

Water security will be increasingly important in a climate changed world. This year's articles include Bovington Training Area's long-term freshwater monitoring study, which proves controls are working and projects to ensure the sustainability of water resources for British Forces Cyprus.

Whilst it is vital that Defence is as sustainable and environmentally aware as possible, our purpose is to defend the nation with the best and most effective equipment as possible. So, a major theme covered is the important works to prepare for the aircraft carriers becoming operational, with articles on HMS Queen Elizabeth's Grey Water Treatment Project and HMNB Portsmouth's Princess Royal and Victory Jetties Project. Similarly, an article on HMNB Portsmouth's Combined Heat and Power plant shows the potential to a lower carbon future.

Preserving our heritage is also critical, with a feature length article on this and a celebration of 10 years of Operation Nightingale and its importance in aiding the recovery of Wounded, Injured and Sick service personnel and veterans. Similarly, with 2020 being the 80th anniversary of the Battle of Britain, there is an article on the legacy of the few at Thorney Island.

Much of this can only be achieved through the dedication of hundreds of volunteers who devote their time to improving conservation and sustainability across the MOD estate (Conservation Groups, service personnel and civilian staff) – thank you!

Finally, I congratulate the Winners and Highly Commended individuals and project teams for their success in the 2020 Sanctuary Awards – choosing the best was hard, and also so uplifting!

The Sanctuary Awards board for 2020 comprised of:

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Sanctuary Awards 2020

The Sanctuary Awards have been recognising outstanding contributions to conservation across the Ministry of Defence (MOD) since 1991. To celebrate a new decade, and to further encourage support of the MOD's sustainability ambitions, the 2020 Sanctuary Awards' categories were modernised to include the:

- **Sustainable Procurement Award** which celebrates projects that improve the sustainability of equipment or services, the management of supply chains or product life cycles
- **Individual Achievement Award** which celebrates people who have made a significant personal contribution to MOD conservation or sustainability as a MOD employee, contractor or volunteer
- **Energy, Low Carbon & Resource Efficiency Award** which celebrates projects that reduce energy, water or resource consumption, enable recycling, the use of renewable energy or contribute to the MOD's Net Zero carbon ambition
- **Environmental Protection & Enhancement Award** which celebrates projects that focus on wildlife and biodiversity, environmental research or tackle pollution and contamination issues
- **Sustainable Construction Award** which celebrates new build and refurbishment projects that innovate in fields such as novel materials or designs, resource management, the reuse of historic buildings or climate resilience
- **Social Value, Community & Heritage Award** which celebrates projects that focus on the social aspects of sustainability, including heritage, public access, community engagement and education

The winners of each category were also considered for two further awards. The prestigious **Silver Otter Trophy** was donated in 1991 by the Commandant of Otterburn Training Area and is awarded annually to the best Conservation Group led project or individual conservation effort on the MOD estate. The **Sustainable Business Award** is presented to more commercial projects which deliver sustainable solutions to enable the Armed Forces to live, work or train effectively.

The Sanctuary Awards 2020 ceremony was postponed to March 2021 due to the COVID-19 pandemic, and for the first time the event was held virtually. The Awards were presented by the Minister for Defence Procurement and Lt Gen Richard Nugee, the MOD's Climate Change and Sustainability Review Lead.

The number of entries this year was substantial, and the Sanctuary judges undertook much deliberation to determine the Winners and Highly Commended nominations. The Sanctuary Team extend their thanks to Commerce Decisions for the sponsored provision of their Award® Tool software.

AWARD® Tool – Judging Software

Commerce Decisions was proud to support the MOD Sanctuary Awards for a 4th consecutive year. The Awards play a key role in showcasing the achievements of teams and individuals working to preserve and protect the estate, both in the UK and overseas. The judging of the Sanctuary Awards utilised Commerce Decisions' AWARD® evaluation solution which enabled all submissions to be assessed in a robust, controlled and objective manner, ensuring absolute integrity. The process involved the entries for each category being assessed in AWARD® by a panel of judges, followed by a moderation where a final score was recorded for each entry. Delivery of AWARD® via a secure hosted service enabled judges from across the MOD to access the nominations at any time, from any workstation with an internet connection. AWARD® helped support sustainability targets and simplified the management of large volumes of information. Electronic submission of pages, alongside online judging, resulted in substantial time savings, reduced the cost of travel and subsistence and lessened the volume of printed paper.

The Sanctuary Awards judging underway © Crown

Samantha Bevan-Talbot, MOD Account Director, Commerce Decisions said *"We are proud that AWARD® was chosen to support the judging of the Sanctuary Awards again this year. As AWARD® is designed to run without interruption throughout periods of disruption, it ensured that the Awards judging process could successfully run remotely during the COVID-19 pandemic".*

About Commerce Decisions

AWARD® has been supporting the successful delivery of procurements across the MOD since 2001, with a corporate licence in place since 2013. Commerce Decisions works alongside the MOD to ensure that procurement processes are standardised and efficiencies are maximised, supporting the MOD to achieve significant savings.

To obtain further information about entering the next Sanctuary Awards please email DIO-Sanctuary@mod.gov.uk

SUSTAINABLE PROCUREMENT AWARD **WINNER**

The Defence Equipment and Support (DE&S) Support Directorate and a team of industry packaging experts led a review of the Defence Standard (DefStan) that sets the policy and standards for corrugated materials used in Defence packaging. The project sought to modernise the DefStan, specifying corrugated board for use in military level packaging (MLP).

The DefStan had become outdated due to modernised production methods, with the use of virgin cardboard grades that were unique to the Ministry of Defence (MOD) risking a pricing premium for the materials, alongside lead-time issues for supply.

The technical committee of experts looked at defining the required performance of the packaging in place of the previous approach, which set out specific materials to be used in the manufacturing process. This new approach gives much greater scope for the use of commercially available materials in the production of corrugated Defence packaging, including recycled cardboard.

The public interest around packaging issues is growing and the work undertaken as part of this project demonstrates how DE&S and the MOD are taking a lead with such matters. In addition, the wider Government and MOD Greening Government Commitments are supported, as these commercial grades maximise the utilisation of recycled cardboard, providing environmental benefits from the reuse of materials.

See the full article on page 78.

Military equipment undergoing packaging using corrugated board © Conway Packing Services Ltd

INDIVIDUAL ACHIEVEMENT AWARD **WINNER**

Sgt Ryan Duffy's fight against SUPs © RAF Brize Norton Photography Section

Over the course of two years, Sgt Ryan Duffy has been on a personal mission to drive down the consumption of single-use plastics (SUPs) at RAF Brize Norton, with notable success. Starting with his personal area of responsibility, his initiatives have grown to encompass the whole force at RAF Brize Norton and beyond – reducing landfill waste and the carbon footprint whilst saving much needed money for Defence.

In 2018, as an instructor at the Defence Movements Training School, Sgt Duffy challenged behaviours and changed attitudes amongst students and staff, introducing a well-supported ban on single-use water bottles and coffee cups. The momentum generated from this earned the support of the Station Commander, ultimately leading to the launch of the Station wide #PlasticFreeBrize campaign in January 2019. A Sustainability Committee was also established to identify, coordinate and drive yet more positive change.

Working collaboratively with whole force partners including AirTanker and Sodexo has brought some real environmental benefits. However, Sgt Duffy's biggest achievement is the replacement of non-recyclable air cargo pallet bags with a recyclable carbon neutral version. Over 3,000 units are used a year and so the introduction of this sugar cane based version has annually saved over 10.5T in plastic waste going to landfill, 27T of carbon dioxide emissions and £4,750 in packaging tax.

Sgt Duffy's work is quite an achievement. It is also a poignant demonstration of how one motivated individual can drive real, lasting change.

See the full article on page 63.

INDIVIDUAL ACHIEVEMENT AWARD **HIGHLY COMMENDED**

Rebecca (Becky) Wooldridge, Wildlife Biologist, Panthera, was the contract lead and interface between the international wildlife monitoring organisation, Panthera, and Defence Infrastructure Organisation (DIO) British Army Training Support Unit Belize (BATSUB).

The project aims to collate data to inform and highlight both the positive and negative impacts on the wildlife, habitats and sustainability resulting from military activity within the Training Areas of Belize.

Since 2017, Becky has consistently supported and advised DIO on environmental, safety and potential Training Area land security matters. Becky trekked through austere environments, travelling 250km on foot each month in order to set up, inspect and download information from her motion cameras. This took her through the most arduous terrain; dense jungles with dangerous wild animals, rivers, hot, humid conditions, lightning storms and floods, always with the potential to encounter armed illegal hunters.

Infectiously enthusiastic, Becky gave talks to several hundred soldiers at a time, dispelling fears and concerns for those entering the jungle for the first time, whilst simultaneously supporting the important 'protect the environment' message. Becky's delivery of these informative 'jungle survival animal safety briefings' were not within her contracted responsibilities; her assistance to all exercises was universally highly valued. Many soldiers will have benefitted from her detailed descriptions of animals that roam the Training Areas and the actions they should take should they encounter dangerous species such as jaguar and puma.

Becky's work directly aided UK Defence operations, supported the UK – Belize Memorandum of Understanding and significantly helped maintain the operationally imperative 'consent to train' in Belize.

See the full article on page 85.

Becky on a Belizean river © Maj Alan Grant

INDIVIDUAL ACHIEVEMENT AWARD **HIGHLY COMMENDED**

Peter on a STANTA heath © Peter Feakes

Stanford Training Area (STANTA) Conservation Group (SCG) has existed from the very early 1980s, which in itself, is an indication of the significance placed on conservation across this Breckland estate. Peter Feakes has been a valued member of the SCG for almost 40 years. Throughout his membership, Peter has been at the forefront of developing an informal yet very effective conservation partnership with the staff at West Tofts Camp. This has been the result of years of dedication by Peter and his long-term commitment and passion for the wildlife of STANTA has unquestionably enhanced the reputation of the Ministry of Defence (MOD) with several Non-Governmental Organisations and statutory bodies.

Peter's leadership and tireless enthusiasm, as well as his ability to encompass the interests of the diverse stakeholders that make use of STANTA, has resulted in the SCG becoming an important influence on the management of the Training Area.

A recent biodiversity audit across Breckland has highlighted the ecological importance at a national level of this distinct region, which includes STANTA. This has acted as a catalyst for various academic projects across the Training Area. Peter's intimate knowledge of STANTA's wildlife and habitats, alongside his deep involvement in their conservation over many years, has placed him and the SCG in a leading position to offer invaluable support to visiting students. As a result, Peter's work is now recognised as representing a significant legacy for others that may decide to follow in his footsteps.

See the full article on page 68.

ENERGY, LOW CARBON & RESOURCE EFFICIENCY AWARD **WINNER**

The Combined Heat and Power plant engine bay © Iain Greenlees

Portsmouth Naval Base's energy consumption is the largest single site in Defence, with an annual load above 120GWh. The arrival of the Queen Elizabeth Class carriers had forecast demand from the base peaks at an unsustainable 50% of the National Grid capacity in Portsmouth. To mitigate this, the Naval Base commissioned the installation of a 14MWe Combined Heat and Power plant. The plant consists of three mains gas-fired engines, two heat recovery boilers and heat exchangers, together with a 3MWh Large Scale Battery System to provide 'black start' capability and broaden further site operational and energy resilience.

The whole base network, which also includes photovoltaic arrays, is overseen by a new Power Management System, which is responsive to external grid pressure and fluctuating local load, assuring optimum site-wide performance. Waste heat from the generation process is recovered and used to reduce the load on the site's steam heating network.

Going live in October 2019, the plant has reduced energy bills by more than £4M in its first year. Although very cost efficient, producing each unit of electrical energy requires three units of gas energy, significantly increasing the site's carbon footprint. To offset this, the base has commissioned assessment studies for the installation of carbon capture in the flue stream, hydrogen generation to mix with the mains gas and converting the elderly district heating to a Low Temperature Heat Network, driven by the plant's thermal energy, as well as looking into provision of excess capacity to local users in the city.

See the full article on page 82.

ENERGY, LOW CARBON & RESOURCE EFFICIENCY AWARD **HIGHLY COMMENDED**

SDE installed © Optimised Sciences LLC

Software Defined Electricity (SDE) is a product that is under trial with the Ministry of Defence (MOD). The project has been initiated by Lt Cdr Jonathan Parker, outside of his day job, rather than directed from the top. SDE is a proprietary technology from a small company in the USA called 3DFS which can measure and correct three-phase alternating current (AC) electricity in real time. It has not been industrially deployed at any scale and the MOD are so far the only external organisation to have tested it.

The first trials took place in February 2020 at the HQ of the small company in North Carolina. These were funded by the Defence Innovation Unit directly and included Underwriters Laboratories LLC as an independent third party to verify the results.

The results were impressive with;

- Typical mixed load efficiency gains of 25%
- Inductive load efficiency gains of up to 77%
- Phase specific power factor and harmonic correction
- Neutral current reduction to a negligible level

SDE also provides electrical system safety and resilience, demonstrating the ability to reduce the risk of some of the common conditions that lead to electrical fires.

The success of this first phase has allowed for the planning of a second stage, which will consist of applied trials within the MOD estate as well as independent academic assessment. The team recently submitted a bid to the Defence Innovation Fund Round Nine for monies to fund the second stage, which has now been approved.

The overall impact to the MOD could be considerable, as SDE can be applied to every activity that the Department is involved with. It could result in £44M of energy savings per year, assuming only 20% efficiency gains across the estate. This would also equate to greenhouse gas emissions reductions of 112,107 tonnes of CO_2 equivalent.

See the full article on page 36.

ENVIRONMENTAL PROTECTION & ENHANCEMENT AWARD **WINNER**

Eurasian curlews are one on the UK's most iconic birds, a large wader with a down turned bill and a haunting call. They are also in decline. Many aspects of the curlew's natural habitat, of open uplands or coastal mudflats, are also found on airfields. However, with a wingspan of around 1m and approaching 10kg in weight, they pose a significant threat to flight safety.

Curlew pictured at RAF Honington © Harry Ewing, University of East Anglia

The decline of Eurasian curlews is keenly felt in the West Country, where the Wildfowl and Wetlands Trust's Slimbridge reserve on the River Severn, is at the forefront of their conservation. Could curlews be relocated from other areas, to boost local, declining populations? The seeds of the Curlew Head Start project had been sewn.

Air Command's Flight Safety and Environmental professionals, Station Air Traffic Control and Wildlife Control Units, developed and approved a methodology whereby nests on seven RAF airfields could be identified and safeguarded long enough to enable egg removal, without posing a threat to aircraft activities.

The expertise and close cooperation from Defence Infrastructure Organisation and the Grounds Maintenance contractor AMEY was pivotal. Much hard work and partnership working enabled Natural England to remove the eggs from seven air stations across the east of England against challenging deadlines and get them to safety. The team transferred 62 eggs to Slimbridge reserve. The project took an awe-inspiring level of problem solving and collaboration, not to mention the energy of the local Natural England Team.

See the full article on page 26.

ENVIRONMENTAL PROTECTION & ENHANCEMENT AWARD **HIGHLY COMMENDED**

The marsh fritillary *Euphydryas aurinia* butterfly is a European Protected Species which has suffered from significant habitat loss. Since the 1970s it has experienced an 80% distribution decline in the UK and in the mid-1990s it was lost entirely from north-east Hampshire.

In 2009, Hampshire & Isle of Wight Wildlife Trust (HIWWT) began managing parts of Minley Training Area for conservation purposes, gradually bringing tracts back into suitable marsh fritillary condition. However, natural re-colonisation from distant colonies was extremely unlikely as the marsh fritillary is a poor flier. Local experts from the Ministry of Defence (MOD), Butterfly Conservation (BC), HIWWT and Natural England therefore held a series of discussions in 2012 with the idea of re-introducing the marsh fritillary to north-east Hampshire.

The team had a very resource intensive task ahead – with the need to understand why the species had been lost, as well as finding suitable donor populations. The land is used for military training and therefore protocols also had to be put in place to ensure BC volunteers could visit safely.

Marsh fritillaries at larval web stage © Iain Perkins

An adult marsh fritillary butterfly © Iain Perkins

After four years of planning, 300 marsh fritillary larvae were collected under licence from six sites on Dartmoor, before being distributed for breeding in captivity. In April 2018, the first releases of larvae took place and these soon pupated, with the first adults seen on the wing in May 2018 – the first to fly over north-east Hampshire in over 20 years.

Despite high rainfall, surveys in March 2020 showed that good numbers of larvae had successfully over-wintered, with larval webs found every three minutes and each web typically containing 70 – 90 larvae.

See the full article on page 37.

SUSTAINABLE CONSTRUCTION AWARD **WINNER**

SUSTAINABLE BUSINESS AWARD

A telescopic cable boom connection powers the carriers when berthed © Andy Amor

VolkerStevin reconstructed two jetties at HMNB Portsmouth to create 21st century moorings that accommodate the Royal Navy's two new 65,000 tonne aircraft carriers – HMS Queen Elizabeth and HMS Prince of Wales. Working with design partner Jacobs, they met the Defence Infrastructure Organisation's non-negotiable programme dates to berth the two new carriers, substantially completing Princess Royal Jetty three months early and Victory Jetty two months early.

Sections of the existing jetties were up to 90 years old and would not have been able to support the huge new carriers. The team demolished and replaced these sections with tubular piled and concrete deck structures, including strong points to support the 80 tonne fender spacer units that bridge the 20m wide gap created by the carriers' arched hulls.

New infrastructure was also installed, such as navigation aids in Portsmouth Harbour, mooring dolphins, shoreside services, and dedicated high voltage electricity supplies to power the carriers when they are berthed.

Whilst the two jetties were reconstructed under separate contracts, key client, design and construction team members provided a seamless transition between the two. For an ever-greater collaborative working environment and levels of trust they enabled the Victory Jetty procurement and works delivery to meet crucial programme dates to berth HMS Prince of Wales. The sustainability of the construction work and ongoing operations were at the heart of all decisions. The project team delivered a low carbon, efficient solution that will serve the Royal Navy for years to come.

See the full article on page 43.

SUSTAINABLE CONSTRUCTION AWARD **HIGHLY COMMENDED**

Soldiers training at Westdown Camp on Salisbury Plain Training Area, were recently the first to benefit from new carbon efficient accommodation blocks. These were delivered as part of the Ministry of Defence (MOD)'s £45M Net Carbon Accommodation Programme (NetCAP).

The programme will deliver 40 new carbon efficient accommodation blocks, providing more than 1,700 bed spaces, rolled out across the UK Defence Training Estate. This is being project managed by Landmarc Support Services (Landmarc) in partnership with the Defence Infrastructure Organisation (DIO) and modular build specialists Reds10.

This Westdown Camp prototype, powered by air source heat pumps and rooftop solar panels, received an A-rated Energy Performance Certificate (EPC) when it was installed last summer, which was just 12 points from achieving Net Zero. Using SMART technology, the project team have since been able to improve on the prototype to deliver an EPC rating of -5 for the next three buildings at Nesscliff Training Area in Shropshire, which means the buildings will generate power for the site, reducing electricity costs. This technology will continue to drive improvements to the design to ensure all future buildings are carbon neutral.

Air source heat pumps provide part of the building's heating and energy requirements © Crown

The buildings provide up to 46 bed-spaces each, which can be subdivided as needed. This innovative design means that different military units, whether trained soldiers or cadets, male or female, can be accommodated within the same block together. Showers, ablutions and drying rooms are also part of the accommodation, improving the overall lived experience for training troops by providing them with the high-quality accommodation that they expect and deserve.

See the full article on page 24.

SOCIAL VALUE, COMMUNITY & HERITAGE AWARD **WINNER**

SILVER OTTER WINNER

Chicksands Camp is located in rural Bedfordshire. It is home to the Intelligence Corps, who are fortunate enough to share the site with the Grade II listed Chicksands Priory building and its adjoining walled garden.

Sadly, with little direction and no investment, the gardens had been left to grow wild. The plants had been left uncultivated and waist-high grasses dominated the lawns and flower beds. There was very little evidence of what should have been a jewel for the community to use. In June 2019, a group of community members met in the gardens and decided to do something about it.

There was little funding and no support contract in place. Therefore, it was clear that the team faced many challenges and lots of hard work – they needed advice and they needed a plan! The group hosted both the Defence Infrastructure Organisation's Heritage Team and the Greensand Country Landscape Partnership to better understand the cultural significance of the site and gardens and to gain information about some agencies who could support the group's targets.

Making the garden accessible and returning it to the community was the main aim, with sustainable solutions, productivity, wildlife conservation and project longevity all factored into the plan. By June 2020 the Chicksands Community Walled Garden had become a stunning example of what can be achieved. A wildlife pond and formal beds have been re-established and treasures have been revealed. The garden has become a sanctuary for all serving personnel and their families on-site.

See the full article on page 53.

Restored flower beds in the early summer © Katie Greenwood

SOCIAL VALUE, COMMUNITY & HERITAGE AWARD **HIGHLY COMMENDED**

The idea for 'Be Seen, Be Safer' began in 2013, when Sqn Ldr Kim Leach took up post as the Community Engagement Relations Officer at RAF Shawbury and identified a number of low flying complaints from the equestrian community in the surrounding area and across Shropshire.

Mindful of the reputational damage that these complaints, and potentially serious incidents could have on the RAF and the wider Ministry of Defence, Sqn Ldr Leach decided to draw up a five-year plan for a project called 'Be Seen, Be Safer,' with three main aims:

- To reduce the number of low flying complaints from within Low Flying Area 9
- To increase the number of members of the equestrian community wearing high visibility clothing and equipment
- To ensure all RAF Shawbury based aircrew were trained in measures to avoid equestrian disturbance when low flying

The campaign was launched internally in 2014 with the buy-in of aircrew, and then in April 2015 it was officially launched at the first of the now annual RAF Shawbury Rider Awareness Days. This was attended by RAF personnel, local riders and equestrian clubs, local press and the safety team from the British Horse Society.

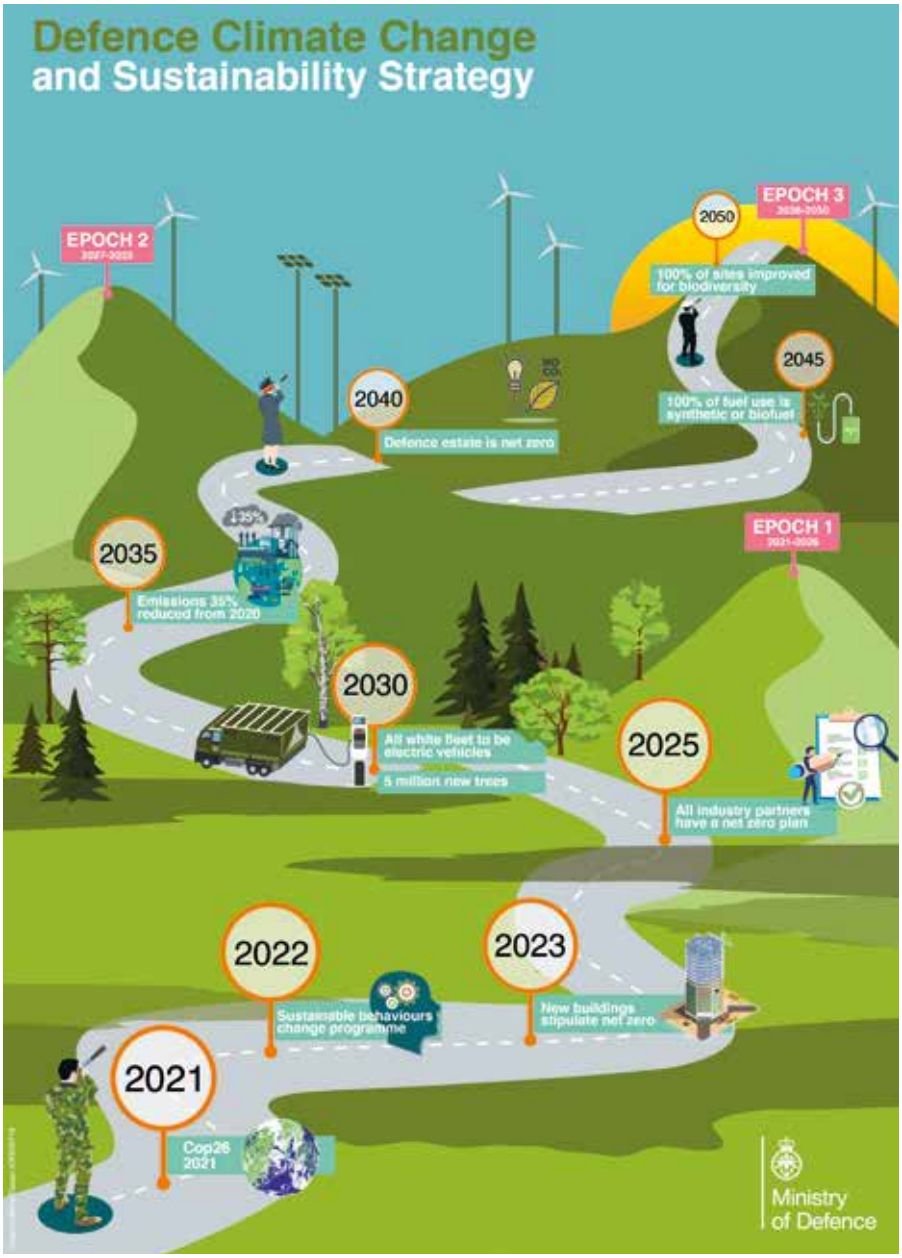
Through these Rider Awareness Days and the work of the project, over 4,000 pieces of high visibility clothing and equipment have been issued, through funding from the RAF Shawbury annual budget, to members of the equestrian community throughout Shropshire.

The project has been recognised for its success by the British Horse Society with the presentation of a number of awards.

See the full article on page 60.

The 'Be Seen, Be Safer' poster © Crown

Climate Change and Sustainability Report – what is it all about?



All mapped out – the Defence Climate Change and Sustainability Strategy pathway © Crown

Just before Christmas 2020 I gave my report on climate change and sustainability to the Minister, Permanent Secretary and Chief of Defence Staff, the culmination of a great deal of work by a few dedicated individuals over a 10 month period. But what an extraordinary 10 months they have been.

Whilst the most obvious feature of 2020 has of course been the COVID-19 pandemic, there have also been huge changes in the realisation that climate change is going to affect us, and we cannot ignore the environment we operate in any longer. The raging fires in Australia and California, floods in the UK and storms that have washed away beaches are all indicators that something is going on. More worrying were the reports of the permafrost in Siberia thawing and increasing melting of the Arctic and Greenland icecaps. With increasing confidence in the science, there is a realisation now that we have already locked in the climate of 2030 – and it will be different. There are some that say we have already reached over half of the tipping points that leads to an unstoppable change to the way the world's ecosystem operates. Along with a growing understanding of the global loss of biodiversity, there are increasing demands that 'something must be done'.

So, should Defence do more? After all, *Sanctuary* has been showing how much we care for the environment for over 45 years, and maintenance of our Sites of Special Scientific Interest and historic estate are some of the best in the country. Is it not our purpose to defend the nation and its citizens, which has not changed?

My report argues categorically that we must do more, far more, not only because we will become less effective if we ignore how the environment around us changes, but also because we must reduce the impact we are having on the climate. The Ministry of Defence represents about 50% of the emissions of greenhouse gases of central Government, and as it is now written into UK law that as a country we will be Net Zero emissions by 2050, Government will not achieve its aim unless Defence acts. As one of the major military powers in the world, I argue that we have the opportunity to lead the global debate over how militaries should act.

The report lays out three strategic ambitions that can be achieved: Defence **acts and is recognised as a global leader** in response to the emerging geopolitical and conflict-related threats being exacerbated by climate change; Defence has **adapted** to be able to fight and win in ever more hostile and unforgiving physical environments; Defence has **reduced its emissions and increased its sustainability** activity and as a Department has contributed to the

UK legal commitment to reach Net Zero emissions by 2050. There is so much that Defence can do, that will lead to operational advantage, a more efficient use of resources and at the same time improve the biodiversity of the UK. It will require investment, but perhaps more importantly will require the recognition that it is in ours and the country's best interest to act, now.

The report, which comprises a case for change, a review of what we are doing now (which is far from nothing), a strategy, a proposed plan for the first five years and a compendium of research, has been written for the specific Defence context. It offers a realistic and practical way ahead for Defence, in ways that will both enhance our effectiveness as well as set us on the path to greater sustainability.

Atlantic Future Forum discussing climate change on HMS Queen Elizabeth in October 2020 © Crown

What are the key take aways, beyond the headline ambitions?
The report acknowledges that climate change will increasingly lead to a more unstable and unpredictable world, where many of the dynamics we have been used to over the last 100 years (such as a reliance on fossil fuels, and a climate that has broadly been self-balancing) are changing rapidly. Defence should not just react – with increased humanitarian assistance and disaster relief at home and abroad for example, but instead anticipate where the nexus of weak governance and the worst effects of climate change interact and build the resilience of those who will be affected most. NATO recognise this and in their emerging 2030 strategy will recommend nations act. The 26th UN Climate Change Conference of the Parties (COP26) in Glasgow this year offers a once in a generation opportunity for the Defence sector across the world to embrace the importance of climate and security and the operational necessity for militaries to become more resilient and sustainable.

But helping others is not enough. Defence must adapt itself to be able to operate in a more extreme climate changed world, with the potential for the Arctic ice melting in the summer in the next 15 – 20 years and the heat in the Gulf and the Sahel demanding different responses from our people and equipment. To do this, we need to identify what a 2050 climate changed world will look like, and then measure how effectively our equipment will operate. Many aspects of our current approach to equipment, operations and tactics will be affected and must be adapted – from our training efficiency in a much hotter environment (in Cyprus we are anticipating 100% of August being too hot to train, up from 40% currently), to the efficacy of our sensors both above ground and below the sea, and the capability of our engines in hotter seas or in hotter air.

Without change, Defence will become increasingly constrained in where it can deploy and when, and its freedom of manoeuvre will be limited. Inevitably though, much of the focus both externally and internally has been on the sustainability of Defence and its emissions. Can we get to Net Zero, and become one of the first major militaries to state we can? I believe we can and my report asserts as such. This will affect almost every aspect of Defence, if we are going to reach Net Zero and at the same time become more sustainable and increase our biodiversity. We must take every opportunity to reduce the demand for fossil fuels, in our equipment (through increasing adoption of new propulsion systems where appropriate), on our estate (through much more efficient buildings, properly insulated and modernised) and through our everyday use (for example by not travelling when a virtual call will suffice and replacing all our light bulbs with LED). We must then build into all our new contracts, whether for facilities or for capital equipment, major incentives for reducing and eventually if possible eliminating emissions; this requires a look at the commercial and acquisition processes.

We must embrace the principles of the circular economy in our supply chain and build our equipment with their disposal at the forefront of the design. Finally, but where we must start (as it potentially will take the longest), we need to ensure that the estate captures carbon at every opportunity and to its full potential. We have to improve the management of the estate to be even more ecologically excellent, to sequester more and improve the habitats and biodiversity. We can then use this to offset necessary military emissions.

We must build on the outstanding work *Sanctuary* has often highlighted. We have the opportunity to be a beacon of excellence if we choose to – Defence in my view can and must choose to.

Lt Gen Richard Nugee
Climate Change & Sustainability Review Lead
Ministry of Defence

Around the Services
Royal Navy

HMS Northumberland (an example of a Type 23 frigate) visits her affiliated town © Crown

The Royal Navy is undertaking a range of measures aimed at reducing our carbon footprint and protecting the environment. Here are some examples of the work taking place;

Hydrodynamic efficiencies
Vaned Propeller Boss Caps (VPBC) are specially shaped fittings on the centre of a propeller which improve the hydrodynamic efficiency of the water flow over the propeller end. This can result in fuel savings of around 3%, which for a frigate is somewhere in the region of 700 tonnes CO_2 equivalent per year. The trial of VPBC will take place on a Type 23 frigate in the New Year 2021. If successful, this will be adopted across the fleet and will pay for itself in fuel savings in approximately two years per vessel.

Ministry of Defence's (MOD) underwater sound planning trial
Underwater sound is capable of travelling great distances and it is crucial that all Defence maritime operators understand how their activity can cause interference and the cumulative effects on the environment. Navy Command (NC) has initiated a new Defence underwater noise activity central planning tool that shows the 'who, what, where and when' of planned activity throughout UK waters. Any unit can make themselves aware of what other Defence activity is creating noise and deconflict their own if necessary. For the first time MOD will have a single picture of what sound Defence is creating in our home waters.

Refrigeration gas replacement
A range of refrigeration and cooling systems are required in ships to store food, provide air conditioning and to keep weapons and other equipment at optimal working temperatures. These services rely on the use of fluorinated gases which, whilst no longer at the levels of CFCs identified as harmful in the 1980s, still have high global warming potential if released to atmosphere. NC are trialling several new gases which will reduce this effect, initially by a third using blended gases as direct replacements for existing ones, and then to less than 1% through the use of new gases and modified equipment. It is estimated that NC will be reducing its direct global warming impact from use of refrigerant gases from around 50,000T CO_2e in 2016 to around 100T CO_2e once all gases have been replaced by the 2030s.

HMS Collingwood – Modern Energy Partners
At HMS Collingwood, Hampshire, future investment in planned carbon reduction targets and modernisation seemed to be misaligned with infrastructure budgets. The establishment of Modern Energy Partners in 2018 by the Government Departments of Business, Energy and Industrial Strategy, the Cabinet Office and the Treasury presented an opportunity for HMS Collingwood to become one of four pilot sites aiming to demonstrate how the public sector estate could help stimulate the market for integrated energy efficiency solutions. The project began with a full site energy survey which identified measures which could reduce carbon footprint and deliver cost savings of 20% per year. Subsequently, three projects were initiated;

- Installation of new energy efficient LED internal lighting
- A new Building Management System to assist with heating optimisation control
- Installation of new sub meters to monitor energy usage remotely

Against a cost of £2.4M, this work will result in savings of over 500 tonnes of carbon per year and reduce energy by approximately 9%.

The future
As the requirement to achieve Net Zero carbon in Defence by 2050 moves ever closer, the Royal Navy will be working with DE&S, Dstl and other frontline commands in expanding our green development work. We will aim to keep all informed through future *Sanctuary* articles.

RAdm Andrew Burns
Royal Navy Director Development
Royal Navy

Installation of energy efficient LED lighting at HMS Collingwood © Mark Powell

Around the Services
Royal Air Force

Coast Care Team members working with RAF Boulmer personnel © Becky Bass

Our network of Station Environmental Protection Officers (SEPO) oversee station Environmental Management Systems, enabling them to initiate and coordinate local projects. Some recent projects include;

Relocating bats at RAF Coningsby
Environmentally, the Best Available Technique utilises synthetic trainers for routine pilot training. The extension of RAF Coningsby's training facility required the demolition of a purpose-built bat barn. Paula Howarth (SEPO) worked with project-contracted ecologists to identify suitable locations for a temporary bat house and replacement bat barn, to be built during spring 2021. To comply with the Bat Mitigation Licence, a registered ecologist was responsible for the welfare of the bats throughout the process. Despite purpose-built bat barns, some juvenile bats inevitably became grounded, including a bat found in October 2020. After a short period of rehabilitation it was released back on to site, with the help of local bat worker James Simpson.

In August 2020, Nicki Mullen (SEPO) invited a Coast Care Team to help enhance the **RAF Boulmer conservation pond**. Coast Care is an initiative that trains volunteers to contribute to the management and conservation of the north Northumberland coastline. This was a wonderful example of civilian volunteers and RAF personnel collaborating on a conservation task, whilst learning techniques to manage the pond's future.

In 2020, the **RAF Brize Norton Sustainability Working Group** was established, with the aim of making Brize Norton a more sustainable station. Military, Civil Servants and Contractors are working collectively to achieve goals such as zero plastic and sustainable energy projects.

The RAF has undertaken larger scale projects, including **RAF Leeming's Carbon Capture Pilot Trial**, in collaboration with Newcastle University. Volcanic rock dust (Remin) and Biochar (organic material carbonised under high temperatures) was applied to 32 sample grass plots, with monthly soil samples taken to measure the amount of carbon drawn from the atmosphere and stored in the ground.

The **Curlew Headstart Project** features in this year's magazine. Unfortunately, the project was suspended in 2020 due to COVID-19, but funds were invested, with plans afoot to relaunch the project in 2021.

CESO(RAF) are keen to promote behavioural change, as demonstrated in the following projects;

When the government launched its 25 Year Environment Plan (2018), CESO(RAF) rolled out the **Year of Green Action Project**, encouraging personnel to make an environmental pledge (for example to eat less meat) and sustain their pledge beyond one year. In addition, 2,000 reusable coffee cups with a 'Refuse-Re-use & Reduce' logo were distributed to stations.

HQ AIR Media and Communications collaborated with CESO(RAF) to launch a **Behavioural Change Video** in autumn 2020, with a rebranded Ministry of Defence (MOD) version also created to gain the maximum impact across the MOD community. Polar bears are used in the video to show the impact of climate change on the animal kingdom and encourage viewers to take actions to reduce their environmental footprint.

In 2020, Deputy Commander Operations unveiled the **AIR TLB Environmental Award Scheme**, which recognises outstanding contributions across AIR TLB towards enhancing the environment and reducing AIR's energy consumption. A goal of the scheme is placing the environment at the forefront of everyone's minds, whilst recognising how small initiatives can have a significant local impact.

Sustainability is at the heart of ASTRA, the Royal Air Force's journey to the next generation Air Force, looking to the next 20+ years. June 2020 saw the inaugural meeting of the **RAF Green ASTRA Network**, a volunteer community of all ranks and grades, with a goal of surveying sustainability activity across the RAF to share best practice and ideas. The newly appointed DACOS ASTRA Sustainability, Gp Capt Maurice Dixon will be coordinating sustainability issues across A1-A9 aspects of RAF sites. This will range from the technical aspects of energy reduction and Net Zero energy generation to conservation and biodiversity.

AVM Simon Ellard
Air Officer Commanding No 38Group/Chief of Staff Support
Royal Air Force

Around the Services
British Army

Signing the Memorandum of Understanding for Project MARKER © Army HQ – DB&I

Tackling climate change is not a discretionary Army task; the imperative to act is clear and the implications of failure are far too profound. Our approach is to *"think big, start small, scale fast"* and our strategic leadership remains fully committed to take a lead role in Defence. In September 2019, the Chief of the General Staff, Gen Sir Mark Carleton-Smith, set an ambitious target and Herculean challenge; to aim for Net Zero by 2045.

Our estate is responsible for over 64% of the Army's total carbon emissions and thus key to achieving the Army's climate change challenge. The Army aim to *"reduce energy use, switch to green supply and capture or offset remaining emissions".* To drive implementation, the Army have launched multiple pilot projects this year, showcasing opportunity from which the intent is to 'scale fast'.

Reducing demand
The Army spends a staggering £92M every year on heating and lighting, so reducing demand makes financial, as well as environmental sense. This is not without difficulty on a built estate comprising over 22,000 assets, with 58% over 40 years old. Energy efficiency measures include; a new build near zero energy pilot alongside smarter building energy management systems across the estate. To deliver at scale, the Army looks to implement energy performance contracts, through industry partners, which guarantee savings commensurate with investment over 10 years.

Increasing green energy supply
So much of our current energy comes from fossil fuels and few cost-effective, large scale viable alternatives are available (yet) for heating. The need to wean off a natural gas dependency is therefore key. To enable this, the Army are exploring alternatives, from heat pumps to solar and direct electric heating. A feasibility study launches next year to explore geothermal energy generation, as well as the exploration of initiatives to directly import renewable energy from providers alongside a project to import biomass energy.

The Army has also commissioned ground-based solar farms with the first four pilot sites built by mid-2021. Thereafter, the plan is to deliver at scale to a further 76 estate sites. A Defence Innovation Fund funded pilot will also deliver a solar car park for electric vehicles, with integrated storage and micro-grid, in early 2021.

Carbon capture and offsetting
Just as financial efficiency and greenhouse gas reduction go hand in hand, so too do biodiversity and carbon capture. Plant life and the ecosystems which support it are relied on to absorb greenhouse gases. This is not simply planting more trees but a deeper commitment to support the Government's biodiversity targets in the Defra 25-Year Environment Plan.

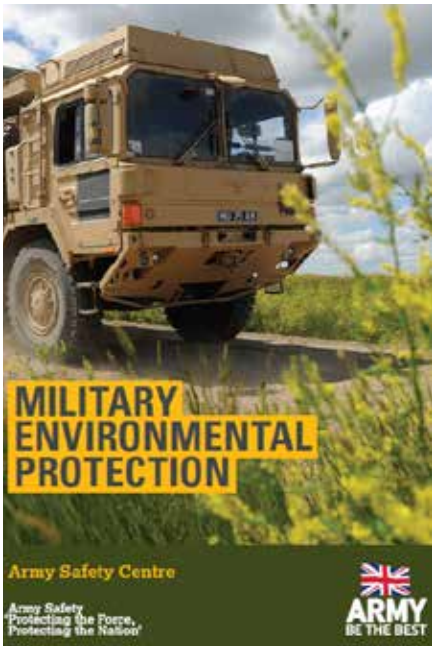
Strategic partnerships underpin all the Army does, with the Defence Infrastructure Organisation (DIO), industry and environmental stakeholders. The Army helped launch, and co-chairs with DIO, The Westdown Group, which aims to better understand, develop and exploit the ecological potential of the MOD estate. The group commissioned an environmental audit with two leading universities which reports next year, and also oversees projects including peat restoration, afforestation and habitat creation.

Project MARKER, a partnership with the Environment Agency, will deliver 85ha of inter-tidal habitat and flood defences at Thorney Island. Project MARKER is the Army's first habitat scheme and yields considerable infrastructure value and will deliver carbon sequestration, biodiversity and flood defences at no cost to Defence. Site surveys are underway with construction to be complete by 2024.

The Army is clear that the imperative to act is not simply financial, or political, but also moral. Everyone must *"think big, start small but scale fast"* to tackle this generational challenge.

Maj Gen David Southall
Director, Army Basing and Infrastructure and the Army's Sustainability Champion
British Army

The Commander's Guide to Military Environmental Protection



The Commander's Guide to Military Environmental Protection © Crown

The Army Commander's Guide to Military Environmental Protection provides a basic level of guidance and direction during exercises in the UK and overseas.

The idea came following the Army Safety Centre's (ASCen) involvement in discussions between several nations attending the Enhanced Forward Presence Environmental Co-operation Workshop in Estonia at the beginning of 2019. All nations agreed that more Environmental Protection (EP) guidance was needed for Commanders on exercises and pondered how this could best be achieved.

Later that year ASCen acquired a copy of the small EP guide that the Norwegian Ministry of Defence had produced for Exercise Trident Juncture. This provided the encouragement to think about a similar product that could be used for all land-based military exercises.

The idea of producing an EP guide was discussed at the Army Safety and Environmental Working Group (ASEWG) in September 2019, which gave agreement and directed the ASCen to proceed with the design.

A rough draft was created and sent to various stakeholders for comment and refinement. These included; Army Force Protection Advisors, Regional Point of Contact Brigade Safety Health and Environment (SHE) Officers, Regional Command SHE Officers and the Defence Infrastructure Organisation Technical Service's EP professionals. The ASCen examined the comments, with most influencing the guide in some way, including the suggested use of appropriate graphics to illustrate key points.

After the necessary amendments the draft was sent to Wood PLC for publishing (using the ASCen's enabling contract). It is now available for Commanders to use. The aim of the product is to provide Commanders with a simple guide that is accessible as a hard copy booklet or through the Ministry of Defence (MOD) intranet or internet. It informs Commanders of their EP responsibilities through all the stages of an exercise; from planning, through execution, to the post exercise clean up. By following the guide, any harm to the environment will be prevented or mitigated.

The guide is made up of the following sections:

- Commander's responsibilities: lays out the 'what' and 'why' of the general EP responsibilities that a Commander will be expected to undertake before, during and after an exercise
- Planning: instructs which documents to examine, who to consult and what EP content to include in exercise plans and risk assessments. It also covers the extra planning needed when exercising overseas
- Implementation: generalises what to do and look for when conducting the exercise
- Various EP areas: this part of the guide gives advice on the different EP areas that a Commander may encounter e.g. waste management, bio-security, driving care and water. Guidance is given listing the 'Do's and Don'ts' relating to each area and some examples of good practice
- Reporting, investigations, damage and complaints: states what to do in the case of environmental incidents
- Post exercise: gives advice for the unit to leave the Training Area as they found it, thus helping to protect the MOD from any claims or reputational damage. It also includes the need for measuring the exercise EP performance and using the information and any other lessons learnt to improve EP related procedures
- Environmental checklist: allows the guide user to tick off the various EP areas as they progress and make notes should they wish
- Further information and contacts: gives key contacts where further advice can be acquired. Also listed are the various MOD EP policy documents; Army risk assessment, occurrence report and investigations forms and information on the Defence Training Estate Aide Memoires

The Commander's Guide to Military Environmental Protection can be found on the Army Safety site within the Army Knowledge Exchange.

Simon Morriss
SO2 Environmental Protection
Army Safety Centre

Spill kit next to an armoured vehicle © Woods PLC

A long way south – HMS Protector and the **Thwaites Glacier Project**

Cover image feature article

HMS Protector overflown by a RAF C-130 aircraft © Crown

Ever since its discovery in January 1820 by Fabian von Bellinghausen, or Edward Bransfield depending on which version of the history you favour, Antarctica has been synonymous with adventure, science and the furthering of our understanding of the earth's climatic changes. Indeed humanities' desire to research in such an inhospitable area has led to some significant technological advancements, from designing ships capable of navigating in ice infested waters, to the state of the art Halley VI Research Station, which can be moved around the ice shelf.

The Royal Navy (RN) has been heavily involved in the exploration of the Antarctic continent and has used its capabilities to assist in the understanding and protection of the territory. Today, the UK has the oldest formal territorial claim to a portion of the continent and surrounding waters – The British Antarctic Territory (BAT). Whilst there are rival and overlapping claims to this, the terms of the 1959 Antarctic Treaty mean that relations are managed peacefully and collaboratively. Numerous countries are permitted to operate scientific research stations within the BAT, which the RN helps to inspect on behalf of the Foreign, Commonwealth and Development Office (FCDO).

The RN continues its long involvement in Antarctica under this treaty and works with partner nations to ensure that it is adhered to by all those working in and around the frozen continent. This role is primarily performed by the Ice Patrol ship HMS Protector. The current HMS Protector entered service with the RN in 2011 as a short-term replacement for the damaged HMS Endurance. Nearly 10 years later she is still serving, and is currently undergoing a significant maintenance and upgrade package that should see her continue to fulfil her unique role well into the next decade. Whilst Protector's organic capabilities lie mainly in her ability to survey the uncharted waters, she is also a vital support ship to the interests of a number of key stakeholders including the FCDO, British Antarctic Survey (BAS) and UK Antarctic Heritage Trust, to name but a few. In an average Austral Summer season she can be involved in a myriad of tasks such as; the resupply of BAS stations, moving of scientists between areas in the BAT and providing a mobile platform from which wildlife and the environment can be monitored. One of the most interesting projects Protector has been involved in recently is the resupply of the Thwaites Glacier Project.

The International Thwaites Glacier Collaboration (ITGC) is a UK/US led partnership set up to investigate the retreat of one of the largest glaciers in Antarctica and its subsequent impact on global sea levels. At approximately 192,000km^2, the Thwaites Glacier is roughly the same size as the state of Florida. Over the past 30 years the amount of ice that has come off the glacier has nearly doubled, highlighting the need for the project in order to fully understand the glacier. The project began in 2018 and will last five years, gathering data to assist in the modelling of the retreat and help to better understand the interdependencies of the environment around the glacier. Whilst the project operates under one name, it is actually made up of eight multi-disciplinary research areas, ranging from offshore surveys to sophisticated computer models of the glacier's carving. Protector's involvement in the project was one of resupply and support. Whilst the task

may appear ‘business as usual’ for the ship, it was one of the most remote places ever visited by a RN vessel.

The ship left the Falklands in December 2018 and proceeded south. After crossing the Drake Passage she called in at Deception Island, a frequently visited site owning to it being one of the most sheltered harbours in Antarctica. The Island itself is actually a 15km wide active volcano caldera (the last recorded eruption occurred in 1970). The ship spent 24 hours in Deception where she enjoyed Christmas Day in a very unique setting before continuing the passage to Thwaites. Nearing the limit of the ice she would need to break through to get to the glacier, Protector was joined by her sister ship, the RRS Ernest Shackleton. The ‘Shack’, as she was affectionately known, is Protector’s older and slightly smaller sister and at the time was operated by the BAS in a similar role to the one Protector undertakes. Shackleton has since been retired from service with the BAS and now operates under an Italian flag as the NR Laura Bassi.

Working together, the two ships made their way to the edge of the ice shelf. Berthing alongside the ice itself, on a flat edge carved out by the Shack, the main task began. The ship offloaded some 170 cubic tonnes of fuel for the project’s generators, transports and snowmobiles as well as using her 60 tonne crane to disembark a number of pallets worth of general stores from inside her main hold. The significant amount of stores and supplies delivered by Protector and her sister ship meant the project was able to continue operations for the remainder of the 2018/19 season and into the 2019/20 Austral Summer. Once all supplies had been delivered there was enough time for a game of ‘glacier rugby’ against some of the scientists before the ship began her journey back to the Falkland Islands for a maintenance break to prepare her for the final two work packages of the season.

Stores are unloaded from HMS Protector’s hold © Crown

During the 2018/19 ice season, Protector undertook five separate work packages (the Thwaites Glacier mission was the third). The final work package of the season, and indeed the final visit of the package, was to Elephant Island and more specifically the site where the crew of Ernest Shackleton’s famous, yet ill-fated Antarctic expedition had been rescued nearly a year after they had abandoned their ship Endurance. The sheer remoteness and hostility of the environment was clear to see even on a relatively calm day. The visit served as a fitting reminder that despite all advances in modern communications, ship design and other technologies, those who live and work in Antarctica are still vulnerable to an environment that can change in a moment, and one that should not be underestimated.

A member of the ship’s company playing rugby on the ice shelf © Crown

As with many organisations, the ITGC has not escaped the effect of the COVID-19 crisis. It has taken the decision to suspend all scientific work scheduled for the 2020/21 season and deploy just a skeleton crew to the glacier with a focus on maintaining and protecting equipment ready for the next opportunity to continue the important scientific research. For Protector, the pandemic has also had an impact, particularly on key supply chains for some of the new equipment due to be fitted. With that said, planning is well underway to deploy at the end of 2020 in order to arrive in the Antarctic in late January 2021, ready for a full programme of scientific and logistic support, surveying and environmental conservation. The ship’s progress can be followed on Twitter @hmsprotector.

Lt James Breaks
Navigating Officer
HMS Protector

A decade of discovery – 10 years of Operation Nightingale

A Channel 5 TV documentary crew film the excavation of the Catterick stables © Crown

Operation Nightingale is a Ministry of Defence (MOD) project that utilises archaeology as a means to enable the recovery of injured service personnel. When Operation Nightingale started in 2011, it was unknown that the appetite to keep going would still be here in 2020.

Since the inception, the project has made discoveries of national importance, written well-received publications and even has an intellectual property mark owned by the Secretary of State for Defence! The programme has also developed – to increase partnerships with external organisations, to work with groups that can examine precisely what works from a recovery perspective and also to design fieldwork that facilitates training opportunities.

It has been found that historic military sites really do appeal to the Nightingale volunteers. In 2019, one of the major excavation components had very much this theme which was popular with the participating veterans; the examination of a World War One (WW1) horse hospital at Catterick, North Yorkshire.

Catterick stables excavation

Catterick Garrison was founded when Baden-Powell designated the area as prime land for an army camp in 1909. In August of 1914 Britain entered WW1 and the British Army's requirement for manpower hugely increased. These men needed training and camps such as Catterick were enlarged for this purpose.

The British Army's logistical system was dependent on horses for transportation purposes. The Cavalry was only one small part of the British Army's requirement for horses, and the camp at Catterick had structures to house and feed the animals, including the large stable block and sick horse hospital. Today, original structures of the stable block remain and are used by the Catterick Saddle Club, a thriving horse and pony club. The rest of the original complex has long since been demolished, but traces remain below ground.

In 2019 an Operation Nightingale project focused on the underground remains of the original stable block. The project had several aims; to assess the extent of the remains, to record the archaeological deposits, thereby adding to the knowledge of the historic development of Catterick Garrison and also to engage volunteers as part of the work.

The volunteers were drawn from a wide range of backgrounds including the local population of Catterick itself, archaeology students, and serving military personnel. Alongside these were veterans who had been injured during their service and suffered from various mental and physical injuries. Many of the veterans were part of the Help for Heroes recovery programmes and support networks such as those at Phoenix House. Most of the participants had little or no experience in archaeological fieldwork and professional archaeologists from Allen Archaeology led the project, to ensure the volunteers were trained in various archaeological field techniques.

The excavation was concentrated on a paddock field of the Saddle Club, and in some places, concrete could be seen just below the grass. It was therefore thought that the team would be able to remove the turf and reveal the archaeology! Although

Remains of a WW1 style spur strap found in the stables © Crown

RMP participants sieve the soil for small bone fragments, the prison hulks long since replaced by the new aircraft carriers © Harvey Mills Photography

this was the case in several places, it was a week's hard digging that finally revealed some of the original structures of the stable block.

Three trenches were opened, each measuring approximately 4m x 2m wide. One of the trenches only revealed the drainage system running across the field, which was probably contemporary with the original structures. However, two of the trenches demonstrated that there was a lot more left underground than anticipated. Approximately 50cm below the ground surface both trenches revealed the original foundations of the stables.

The buildings were built with concrete foundations and wooden posts were used for the wall supports. The concrete was still in place and the whole structure appeared to have been dug slightly below the original ground surface, with each block built on a terrace following the shape of the land. There was also evidence for the surface of the floor in the stables. These were made from bricks of 'blue sets' which can be seen in the local area in use in back passages around houses. The sets were made from moulded industrial waste creating a quick and cheap floor surface.

There were quite a number of artefacts recovered during the excavation. These included pottery and metal fragments. The most notable was a fragment of a WW1 spur strap, the connection with horses being obvious.

The excavation featured on a Channel 5 documentary, which was a great way of demonstrating the Ministry of Defence's (MOD) commitment to the historic environment. A number of veteran volunteers were featured on the programme, talking about their experiences and the Operation Nightingale project. This really showed the supportive work that Operation Nightingale is able to lend to veterans through archaeology.

Operation Nightingale has established a large group of veteran and civilian volunteers working alongside the serving Wounded, Injured and Sick (WIS). Operation Nightingale has therefore increased the capacity of Defence to react to emerging cultural heritage requirements without having to draw upon huge budgets. Added to this, the sites themselves can also be useful training for serving military personnel. One such site, seen in *Sanctuary* in previous years, is Burrow Island, known colloquially as 'Rat Island'.

Exercise REDCAP RECOVERY

Since 2017 members of the Royal Military Police (RMP) have joined forces with the Defence Infrastructure Organisation (DIO), specialists from Cranfield Forensics Institute and the veteran's charity Breaking Ground Heritage to save archaeology at risk on Burrow (Rat) Island, Portsmouth. The island, which is part of the MOD estate, was the burial site for convicts who died on the harbour prison hulks around the start of the 19th century.

Exercise REDCAP RECOVERY, as it is known to the RMP, not only helps to protect the remains of the convicts, which would otherwise be consigned to sinking deep into Portsmouth estuary as a result of tidal erosion; it also trains and develops a crucial policing capability – Disaster Victim Identification (DVI). The RMP are responsible for responding to any disaster or mass casualty incident that involves Defence people, wherever it

Participants on Ex REDCAP RECOVERY at the Forensics Department at Southwick Park with some of the Rat Island remains © Harvey Mills Photography

A member of the RMP and a Cranfield Forensics Institute human remains expert © Harvey Mills Photography

happens around the globe. Specially trained investigators are held at 24 hours' notice to move at all times and training of this nature, alongside forensic anthropologists and other specialists, helps them to keep their skills and procedures honed and up to date.

The RMP has its home in Portsmouth (MOD Southwick Park) and members who have taken part in the exercises in recent years have all shared their pride in being involved in such culturally important work, particularly on their own 'Regimental doorstep'. It has also provided great opportunities for currently serving soldiers to work alongside WIS veterans, supporting them in their recovery. The impact on some Military Police Non-Commissioned Officers (NCOs) was so lasting that they volunteered to be involved in other projects alongside DIO Archaeologists Richard Osgood and Alex Sotheran.

Exercise REDCAP RECOVERY is set to continue for years to come, as more human remains are exposed by storms each winter, and the requirement for the RMP to provide a DVI capability will endure long into the future. The findings at Burrow Island have been included in a report sent to the Hampshire Historic Environment Record (HER), whilst Allen Archaeology have written a report on Catterick for North Yorkshire HER. This is crucial as excavation without reporting is not much better than destruction. These documents make the results available to everyone for future scrutiny and to develop new theories.

The longest-standing Operation Nightingale site has been that of Barrow Clump, beginning for the team in 2012 not long after the programme began. It too, now proudly boasts a publication of the fieldwork.

Barrow Clump book launch

"We tried to express how much Barrow Clump meant to us all. There was something uniquely formative about the whole experience: like the adult equivalent of that record which inspired you to take up an instrument and try to form a band. My life has changed immeasurably since I first got on the plane to go digging, but just about every success and every major turn has its roots on a windy hillside in 2012, on the night before the start of the Barrow Clump excavation" said Rifleman Savage on page 10 in 'A Prehistoric Burial Mound and Anglo-Saxon Cemetery at Barrow Clump, Salisbury Plain, Wiltshire'.

In 2003, Defence Estates (as was) facilitated the exploration of a Bronze Age burial mound on Salisbury Plain by English Heritage to look at badger damage. The site was re-examined in 2012, and in many subsequent years since. This was because the 2003 project revealed a 6th century cemetery that was being burrowed away, leading to the site being deemed 'Heritage At Risk' by Historic England.

This site has been a focal point for much of the work of Operation Nightingale. It has generated a huge amount of data and revealed some very precious finds.

After years of excavation, the final season took place in 2019 and a major monograph was published on the main components of the cemetery. This book was launched in the presence of the Chief Executive of DIO at the Wiltshire Museum in Devizes, in January 2020. What made the volume so special was that a chapter had been written by the military participants themselves.

The project had many heritage aims to achieve from the offset – to recover all the cemetery and the human bones that were being disturbed. However, this was only part of the project as the programme provided the perfect opportunity for many years of excavation by the team of service personnel and veterans, giving them an astonishing opportunity. Mike Kelly of the Rifles wrote *"I've been to Afghanistan… what greater respect for a fallen warrior to be dug up by another warrior, rather than the badgers that were finding them?"* Mike was one of many soldiers that took part and who developed great abilities in interpreting sites and finds.

Although the majority of participants did not envisage leaving the military to become archaeologists, some have done so, and others now

One of the celebrated finds from Barrow Clump. A 6th century drinking vessel (also known as 'Kenny's Bucket') © Harvey Mills Photography

have archaeology degrees from universities. They have also formed a very social group of friends from their experience at the Clump and on other sites. A band of brothers (and sisters) with trowels.

One of the key accomplishments required of archaeological projects is to write up the results so that others can see what they were, can interpret the findings, and can draw their own thoughts on how these discoveries relate to a broader context. Usually this takes the form of a technical report to the Local Authority HER, but sometimes even more can be accomplished. The spectacular quality of the finds at the Clump and the high standards of work meant that the team was also able to get their work into national magazines, on the radio and on several television programmes – not least of which was Time Team. A lottery funded project also enabled a group of young adults to make their own film of the site. The archive was so substantial at the Clump that it became obvious that a small report would not be sufficient, this dig needed a major book.

Wessex Archaeology brought together the relevant specialists and collaborated with Historic England, the Operation Nightingale veterans and DIO to produce a really important monograph. It combined not only the technical elements of the project, the scientific assessments of artefacts and the conclusions on the various archaeological phases, but also some beautiful illustrations of the finds. Furthermore, the service personnel on Operation Nightingale wrote about their own personal experiences and what they had learned from their participation over the several seasons on the site.

When the book was finished, an event was held at the museum that will hold all the archives and objects from the project – Devizes. For one evening the finds were put on temporary display, along with film of the excavation and dig team members from across the country came along to see the results of their work. This, of course, brought many of the veterans together again and their writings formed the first of the chapters in the book.

Jonathan, Richard and Phil, three of the authors, holding the finished volume © Harvey Mills Photography

Their contribution in many ways is what separates this from other major cemetery excavations; there is another purpose to the archaeology rather than simply the archaeology itself. The writings of the military personnel expressed their fondness for the Clump *"from a veteran's perspective the opportunity to be part of a shared endeavour of such validity once more was the reward itself. What followed was the experience of a lifetime over the next three summers. There was something magical about Barrow Clump"* Dave Hart, Rifles.

In addition to the chapter written by the military, there is one about the military too. The first Defence purchases of land on Salisbury Plain took place in 1897 and MOD have been laying down their own corporate levels ever since, with items from the Boer War, through WW1 and World War Two, to more recent conflicts. Many of these tell their own stories and this was emphasised at Barrow Clump, where even a humble military fork can lead to a wartime story and a soldier, in just the same manner as the Visigothic brooch found on one of the Saxon graves told something about the woman that it was buried with. The military debris has frequently been overlooked by past works, but we hope reports such as this will change that situation, and that tales of past soldiers will be told again.

The results of all the archaeology have featured in past issues of *Sanctuary* and the information yielded by the excavation has informed how the MOD manages that part of Salisbury Plain. Furthermore, the MOD have been able to demonstrate to Historic England that the use of the locality by military vehicles is not detrimental to buried remains. Also, by recovering the cemetery, the barrow is no longer deemed 'At Risk'.

Although the work at Barrow Clump is finished (we hope!) there is still much that needs to be done and opportunities for our veterans to participate or service personnel to gain training benefits. As one of the military contributors to the book, former Marine, Dickie Bennett wrote *"heritage is not just there to look at but to really get involved with. To use our past to help build our future".* The book now forms part of the archaeological corpus, it is in university libraries and museums. When people come to look at the history of Salisbury Plain and its use, they will now be able to see the use of the landscape by the military in a whole new light and note that their presence in this area really has benefitted the heritage of the region which, in turn, has helped them.

Richard Osgood[1], Alex Sotheran[2] & Maj Ryan Parmenter[3]
Senior Archaeologist[1], Archaeologist[2] & Officer Commanding 4 Investigation Company[3]
Defence Infrastructure Organisation[1, 2] & Royal Military Police[3]

Bringing life back to the **Fossil Forest**

Vertical Technologies install new rock netting © Crown

The Fossil Forest is a remarkable remnant of an era over 145 million years ago. Nestled within the Dorset Jurassic Coast Area of Outstanding Natural Beauty (AONB), England's only natural World Heritage Site, the Fossil Forest is of international importance. The Fossil Forest plateau is found in the south-west corner of Lulworth Range, next door to Lulworth Cove, on land the Ministry of Defence (MOD) lease from the Lulworth Estate. The rock plateau features large fossilised remains of a forest that would have sat on a very different landscape, a unique reminder of this long-lost time.

Public access to this plateau has been available for decades but quite when the steep access steps were put in is unclear. Extending from an old range hut, they have served as an opportunity for visitors to get close to these prehistoric remains. This first-hand experience of such a rare phenomenon, enhanced by the surrounding geological spectacle, has been appreciated by all, including academics, archaeologists and geological specialists from all over the world.

As is perfectly highlighted by the fossil plateau itself, time does not stand still. In 2015, weather and coastal exposure lead to rock fall directly onto the single point of access into the site, promptly closing it. Further rock fall was likely due to an overhanging section of rock, potentially forcing permanent closure.

Aware that a long-term or perhaps even permanent closure was likely to be met with outcry, but also conscious that a resolution was likely to be expensive, James Nevitt from the Defence Infrastructure Organisation's (DIO) Public Access and Recreation Team called a stakeholder meeting to highlight the issue and work towards reopening the site. DIO, the Lulworth Estate, Dorset AONB/ Jurassic Coast Trust Team, Dorset Council and Natural England gathered to seek a resolution, with the main aim of restoring safe access to the site. Sally King, Visitor Tourism and Access Manager for the Dorset AONB/ Jurassic Coast Trust Team agreed to lead on the project. This allowed the project to have better resource allocation and greater scope for external funding to be raised.

It did not take an expert to recognise that the reopening of the Fossil Forest was going to be a challenge. The plateau is situated on a steep and exposed coastal cliff side. The only easy point of access was the same flight of stairs that were covered in loose stone. This would make it extremely difficult to get equipment and materials on to site.

The rock fall had highlighted the mobile geology and had exposed a weak area of the cliff face. Initial project plans had to adapt as the rock face changed. New infrastructure had to accommodate this tough environment and be effective at keeping the Fossil Forest open.

To add to these challenges, the Fossil Forest is within the busy Lulworth Range. Training could not be stopped so any access to the site was subject to range activity, forcing the bulk of repair and installation work to be carried out during Easter and summer shutdown. Extensive work programmes, involving considerable physical undertaking, had to be fitted into tight time frames.

Delivering access to this hard to reach site does not come cheap, so the solution needed innovation. Furthermore, the primary benefactors of direct access provision to the Fossil Forest are the public. Such expenditure was not justifiable solely for the MOD. Sally and the AONB/Jurassic Coast Trust Team leading the project ensured it had the right focus that it merited and enabled external funding to be sought. Sally successfully bid for money via the Government's Coastal Communities Fund (CCF) as part of the wider Dorset Coastal Connections – People and Places, a portfolio project connecting and coordinating 18 coastal sites

Freshly installed rock netting © Crown

across Dorset. Generous donations were also made by DIO, the Lulworth Estate and the Geologists' Association Curry Fund – a fund supporting Geology related projects. It was clear everyone wanted a positive outcome.

Every possible option for reopening the Fossil Forest was explored before a design commitment was made. New means and points of access were considered, but a final decision was made to restore the existing access way, making it safer with rock netting installed by the highly experienced Vertical Technologies.

To update the appearance of the site, Aileen Shackell Landscape Design brought a creative eye to what had historically been very rough and ready. The remit was to balance creating a feature whilst ensuring it fitted in with the surrounding landscape. The results incorporate both an entrance way and a seating area where visitors can pause, rest and admire the stunning views across the coast. Interpretation panels inform visitors of why the site is so important, alongside signs highlighting the need to tread carefully.

Once the project was underway, Tony Stirling, Deputy Training Safety Officer and Landmarc Support Services (Landmarc) staff all provided essential on-site support to the Fossil Forest contract staff. The tight turnaround times meant it was essential that logistics ran smoothly. Pre-planning ensured that the site was prepped, and contract staff expressed their gratitude for the support given.

Burrs and bumps – evidence of algae and moss from 145 million years ago can be seen in the rock © Crown

Dorset Council Highway Engineers employed their ingenuity to install a new stair and hand rail system in a location where nothing was level or straight. The bespoke work added pressure to an already tight time frame. The physical work was a mammoth undertaking with the construction team having to carry all tools and materials, including bags of cement, blockwork, railings and fittings up and down 97 steep steps.

To complement the newly installed interpretation panels, large pieces of fossilised tree were donated by Albion Stone of Portland. Getting these heavy objects into place presented a serious challenge. Their ideal location would be on the seating area, half way down the stairs on the hillside. However, they were too heavy to be manhandled into place. Using old Royal Navy contacts Tony managed to arrange for pick-up and delivery by helicopter, a plan that worked perfectly.

It is with huge satisfaction that the site is now open once again and its reception has rightly been positive. The significant funding raised ensured a lasting solution was delivered which will stand in place for decades to come. New additions to the infrastructure have also improved the ability to manage the site for safety purposes and have added to the aesthetic. Information and seating dispersed higher up the cliff allows for those less mobile to be more informed and the segments of donated fossilised tree give visitors a hands-on experience of what can be found at the site, even if they cannot reach the plateau. The site is now benefiting even more of the visiting public.

The success of the project and the reopening of the site has been a shining example of partnership working to deliver a unique product that fits within an active and important military training establishment. The public will continue to be able to enjoy the Fossil Forest first hand for many years to come, experiencing this rare glimpse into our prehistoric world.

The newly installed seating area, complete with interpretation panels and fossil remains © Crown

James Nevitt
Senior Access & Recreation Advisor
Defence Infrastructure Organisation

Carbon efficient accommodation on the Defence Training Estate

Representatives from Landmarc, Reds10 and DIO at the official opening at Westdown Camp © Landmarc

The Ministry of Defence (MOD)'s £45M Net Carbon Accommodation Programme (NetCAP) is currently underway across the UK Defence Training Estate (DTE). The programme will see the construction of 40 new carbon efficient modular accommodation blocks, which will provide 1,700 bed spaces.

Landmarc Support Services (Landmarc) are managing the project in partnership with the Defence Infrastructure Organisation (DIO) and Reds10, a construction company that specialises in modular buildings.

The installation at Westdown Camp was the first of its kind on the DTE, not only because it provided a modern living space for our Armed Forces but because it was a Nearly Zero Emissions Building (NZEB), scoring only 12 on its Energy Performance Certificate (EPC). The facility replaced two very old and inefficient buildings on the camp. Its delivery influenced this multi-million pound investment into carbon efficient accommodation, which will make a MOD contribution to the Government's target to achieve Net Zero emissions by 2050.

Air source heat pumps and rooftop solar panels provide the building's heating and energy requirements. The building is also equipped with SMART building technology to monitor energy use, including the ability to control the building remotely. Data includes heating usage, occupancy sensors, motion sensors, water usage and window contact sensors, all of which can be used to control and lower heating requirements to optimise energy use.

Lessons identified using data from the Westdown Camp prototype meant that improvements could be made to a second set of buildings installed later in the year at Nesscliff Training Area in Shropshire. This subsequently resulted in the DTE's first ever carbon neutral buildings. The buildings have an EPC rating of -5, as well as a 30% reduction in embodied carbon compared to Westdown Camp. This -5 rating means that the buildings will now generate power for the site, reducing electricity costs, and has paved the way for all future buildings in the programme to be carbon neutral.

The modular accommodation is being designed and constructed off-site by Reds10, before being transported to site for assembly and installation. The process took just 15 weeks to complete at Westdown Camp.

A key benefit of modular construction is that the same design can be used for later blocks with improvements and alterations put in place as necessary. As well as the carbon savings at Nesscliff, a second improvement was a reduction in the installation time from 15 weeks for one building at Westdown, to 13 weeks for three buildings at Nesscliff. This helps minimise disruption for training troops when compared to traditional construction methods. Labour is also being locally sourced, helping to reduce the carbon footprint and boost local economies by providing 400 jobs across the programme, 150 of which are new.

Buildings will range in size as required, typically providing up to 46 bed spaces each, which can be subdivided as needed. This innovative design means that different military units, be it female or male, whether trained soldiers or cadets, can be accommodated within the block together. The lived experience of troops has also been improved, as showers, ablutions and drying rooms are all part of the complex, removing the need to move between different buildings.

The welfare of troops that use the estate is a top priority and these accommodation facilities are key to delivering the best possible training experience. The programme will continue into 2021 and early 2022, with further installations planned at Knook Camp on Salisbury Plain, Brunswick Camp in Hampshire, Castlemartin in Pembrokeshire, Warcop in Cumbria and West Tofts and Wretham in Norfolk.

Allan Fox[1] & Paul Ruddick[2]
Head of Programme Delivery[1] & CEO[2]
Landmarc[1] & Reds10[2]

South Cerney Station – a community level adaptation to climate change

Removal of the tanks © LCM Environmental

South Cerney Station is located near Cirencester in Gloucestershire and is the home of 29 Regiment, The Royal Logistic Corps whose role is to provide postal courier and movement for all three of the Armed Services. The Regiment has the capability of mounting very high readiness land forces based in the UK for overseas deployment. In preparation for future climate change, the unit has taken early action to mitigate the impact of extreme weather events.

The Army Force Protection Advisor engaged with the Defence Infrastructure Organisation (DIO) Climate Resilience Team and over a period of three years, accumulated information from the Environment Agency (EA), British Geological Survey, UK Government Climate Projections and the Met Office to facilitate the Climate Impact Risk Assessment Methodology (CIRAM).

The National Risk Register of Civil Emergencies was used to identify, assess and prepare for climate change. An analysis for the site was compiled to advise the unit on risks, namely flooding, power failure and extreme weather events which will affect critical infrastructure. This information was included in the Site Hazard Survey, Environmental Management System, Business Continuity Plan and CIRAM. This highlighted where investment was needed to maintain Defence outputs and optimise operational capability. Regular meetings were held with the unit, DIO, industry partners and the Army Basing & Infrastructure Team.

Local Resilience Forum Community Risk Registers, Met Office weather warnings, the EA's emergency flood line and the National Oceanic Atmospheric Administration Space Weather Prediction Centre were also utilised. Lectures were delivered to all site personnel to raise awareness, enlighten individuals and generate interest in climate change.

The Army Basing & Infrastructure Team engaged with Public Power Solutions, a subsidiary of Swindon Borough Council. As a result, a planning application for Project PROMETHEUS (Solar) Wave 1 was accepted by Cotswold District Council, for a 1.4MW subsidy free solar power plant consisting of 5,200 solar panels. The solar power plant will generate electricity to power approximately 350 homes and all the power will be consumed on-site, with 400 tonnes of CO_2 saved annually. It will account for one third of the site's total annual consumption. The project is planned to be completed in 2021.

After one year of operation the site will see a reduction in costs amounting to £108,718. After 10 years there will be a saving of £1,087,176 and over a 25 year period £2,717,940 will have been saved. The fuel oil heating system has been replaced by a gas boiler and will equate to an annual saving of circa £50,000 per year on oil costs. The pollution risk to the primary aquifer has been reduced and the oil tanks were successfully removed by Lorne Stewart Engineering, LCM Environmental (Craggs Environmental Ltd) and Amey Defence Services.

The main catering facility will be supported by an emergency generator to ensure that life support can be maintained during future power outages caused by severe weather events. In conjunction with the local Farming and Wildlife Group, control measures have been put in place to ensure that flooding is also reduced on-site.

These projects not only represent significant financial savings, but more importantly demonstrate a physical, tangible commitment to protecting the environment and preparing for climate change. This is central to the greening of our site and helps to reduce the UK's overall carbon emissions, contributing to the Government's Net Zero 2050 target.

Working as *"One Station, One Team and One Family"* the unit remains at the forefront of embracing new opportunities and seeking innovative solutions to emerging problems. Along with the help, guidance and advice of the DIO Climate Resilience Team, South Cerney Station now have a robust risk assessment which will assist the unit in preparing for future adverse climate challenges.

Capt Nigel Williams
Army Force Protection Advisor
29 Regiment
The Royal Logistics Corps

Relocating RAF curlews to the Wildfowl and Wetlands Trust

Released curlew feeding on the Severn Estuary mudflats © Nigel Jarret

In 2019, the RAF and its partners, working with Natural England (NE) successfully relocated 58 curlew eggs to the Wildfowl and Wetlands Trust (WWT) Slimbridge reserve. The eggs removed as part of this ground-breaking 'Head Start' conservation project, would otherwise have been destroyed under licence to control potential flight safety risks.

The Eurasian curlew is a Red Listed Bird of Conservation Concern and a Priority Species under Section 41 of the Natural Environment & Rural Communities (NERC) Act 2006. Airfields provide curlews with extremely favourable habitat, namely open grassland but with characteristics which may also discourage predators. Unfortunately for curlews, airfields are also home to some of our largest, fastest and most important military assets. Curlews weigh up to 10kg and have a 1m wingspan, which can pose a serious threat to aircraft. Six Aerodrome Wildlife Control Units (AWCUs) obtain annual licences which allow the destruction of curlew eggs from nests to maintain flight safety. Sadly, in 2018 more nests/clutches were destroyed under licence on these airfields than were known to have successfully bred in southern England.

Whilst the absolute priority is for air safety, the RAF decided to establish a practical conservation project to test whether curlews could be supported within the constraints of air safety. A collaborative approach was therefore developed between Defence Infrastructure Organisation (DIO), Air Command, Heads of Establishments, Grounds Maintenance staff (Amey), Flight Safety staff, including Station Air Traffic Control Officers (SATCOs), AWCU staff from NBC Environmental, Station Safety Teams and the RAF's Chief Environment and Safety Officers (CESO (RAF)) Team and NE. RAF Stations taking part included RAF Marham, RAF College Cranwell, RAF Barkston Heath, RAF Waddington, RAF Scampton, RAF Wittering and RAF Coningsby. Once agreed and set in motion by a working group, representing all the stakeholders, the success of Head Start would still require a huge team effort, involving NE and Station SATCOs, their AWCUs and Amey ground staff, across each of the Stations.

A protocol which was acceptable from an air safety perspective, deliverable by Amey and agreeable to meeting the conservation requirements of the project was agreed by all. Once a nest was identified it was monitored by AWCU and SATCO Teams to ensure it did not pose a threat to flight safety. SATCOs considered whether the nest was in a 'red', 'amber' or 'green' zone. A red zone nest posed an air safety threat and would be managed under existing licence conditions. An amber zone nest could remain in situ for longer. Green zone nests posed no air safety threat.

Keeping grass at a safe height is crucial to airfield management. Amey conduct two processes. 'Bottoming out' cuts grass to 20mm, with harrowing and raking to remove insect habitat and improve grass uptake. 'Topping off' takes the grass height down to 150mm. Both processes are essential to grass management to ensure safe airfields, and timing is critical. To ensure their protection, the nests were marked with flags and a 1m circle painted around them. The Amey Grounds Manager and Grounds Maintenance Contractor were informed of the location and the

First steps in a hatching tray © Tanya Grigg

requirement to allow an 8m clearance around the nest site when conducting bottoming out, cutting and all grass management activities. The nests were then monitored, allowing the eggs to remain in situ for as long as possible.

The intention was to relocate eggs that would normally have been destroyed under licence. Green zone nests were therefore not subject to egg removal. Amber zone eggs were removed by NE, before being transferred to Slimbridge. Curlews lay three to five eggs in an individual clutch, taking up to five days to complete laying. To avoid birds continuing to lay eggs to replace any eggs removed, and minimise air safety risk of returning birds, AWCU staff monitored nests and only removed eggs once a complete clutch had been laid.

This process required a team effort, enthusiasm, energy and hard work by all parties involved. AWCU Teams worked tirelessly, identified nests and continually engaged with NE and Amey. The support of SATCOs across all Stations was essential and they were involved throughout. Close partnership working and swift communications enabled NE to resolve any obstacles speedily, with continuous dialogue between all stakeholders.

In 2019 18 clutches of eggs, 17 of which were intact, were successfully transferred to Slimbridge. Unfortunately, RAF Wittering's only clutch was damaged, probably by the adult birds trampling on their eggs. The clutches comprised 62 eggs, of which 59 were successfully hatched, 55 at Slimbridge and four at a location in Shropshire. Two eggs were clear, meaning they were either unfertilised or suffered an early embryo death. One of the eggs contained a dead embryo. Overall, this represented a 95% hatch rate. Station, by Station, the success rate of eggs transferred to Slimbridge can be seen listed in more detail in the table below.

Hard release directly onto the Severn saltmarsh at Slimbridge © Nigel Jarret

Lessons were learnt and reviewed by stakeholders to enable the project to continue in future years, and to inform future initiatives beyond the RAF's Head Start programme. Due to air safety concerns, many clutches were removed earlier than may have been preferred from an ecological perspective. However, the project proves curlew eggs can be hatched successfully when moved from nest to incubator in the early stages of incubation (less than 14 days), across distances of 200 – 250 miles and withstanding periods of four to six hours in a battery-operated portable incubator. Processes such as more fluid protocols which do not label 'zones' and enhanced communication between Station Teams and NE will also be developed. Additional sites are proposed for future years including the Vale of York, RAF Benson, RAF Fairford and Wattisham, expanding into other Top Level Budgets. The project has been discussed in Downing Street, as well as gaining The Prince of Wales' interest, with Sandringham and the Duchy of Cornwall estates being potential future release sites. Last year the project featured on the BBC's Countryfile television programme. With Royal patronage, it is anticipated that the project will again be in the public eye.

The Head Start project was a huge success, bringing together the seemingly juxtapositions of air safety and the protection of such an iconic but threatened species of bird, to brilliant effect. As conveyed by Nigel Jarrett, WWT *"Success resulted from excellent communication between NE, RAF bases, bird control teams and WWT personnel, leading to rapid, appropriate action and self-perpetuating goodwill and support of the project from partners".* Eager cooperation, willingness to find solutions and hard work, from AWCU personnel, Amey Grounds Maintenance staff and NE made this success possible. Across such a broad range of stakeholders and Stations, the impact of military activities was minimised and the potential to support curlew numbers in areas where their numbers are depleted was realised.

Station	RAF Marham	RAF Waddington	Barkston Heath	RAFC Cranwell	RAF Scampton	Total
Nests	3	7	5	1	1	17
Eggs	9	24*	18	4	3	58
Chicks hatched	9 (100%)	24 (100%)	15 (83.3%)**	4 (100%)	3 (100%)	55 (94.8%)
Fledglings released	7 (77.8%)	24 (100%)	14 (77.8%)	3 (75%)	2 (66.7%)	50 (86.2%)

* RAF Waddington's figure excludes a further four eggs transferred to a location in Shropshire, at the point of hatching.
** Barkston Heath's eggs included one dead embryo and two infertile eggs.
(Table courtesy of N. Jarrett, WWT)

Neil Durrance
RAF CESO EP SO1
HQAir RAF Safety Centre

Securing the future of ash trees on the Defence Training Estate

Euroforest tree felling on Salisbury Plain Training Area © Euroforest

Ash dieback *Hymenoscyphus fraxineus* is a fungal disease, which spreads quickly through airborne spores. There is no cure and it infects native ash *Fraxinus excelsior* populations. It was first identified in the UK in 2012, having swept across continental Europe in the preceding years, leading to a mortality rate of over 95%.

In 2016, the first large-scale infection on the Defence Training Estate was recorded in woodlands within the Cinque Ports Training Area (CPTA) in south-east England. This led to subsequent survey work, identifying infection in many of the woodlands across the Defence Training Estate, in varying degrees of severity.

Whilst young infected trees succumb to the disease quickly, generally within a couple of years, older specimens take longer to deteriorate. They become unstable, brittle and prone to collapse and are at risk from secondary infection through their root system. This presents a significant health and safety risk to service personnel training on the Defence Training Estate, as well as other users, including the general public, who may come across these trees along public rights of way and roadsides, where ash is common in hedgerows.

Landmarc Support Services (Landmarc), the Defence Infrastructure Organisation's (DIO) industry partner for managing the Defence Training Estate, quickly concluded that fast action was required. An early warning was raised in 2018 to enable Landmarc, Defence Training Estate staff and the DIO's Environmental Support & Compliance (DIO ES&C) Team to work together to develop a solution.

Working collaboratively

Landmarc rural specialists worked closely alongside DIO foresters to take early collaborative action in addressing this threat, and in the early stages, advised the Forestry Commission on how Landmarc and DIO were jointly responding to the outbreak. It was agreed that a wide-scale tree felling programme would help protect the health and safety of users of the Defence Training Estate, but in areas where the risk was low ash trees would be retained and monitored to see how the disease developed, with a view to leaving trees which showed disease resistance or resilience.

A collaborative ash dieback strategy was developed to deal with the disease, with a seven point risk management process, which has been implemented across the whole of the Defence Training Estate. The strategy involves identifying the location of all ash trees, mapping them onto the Landmarc Geographical Information System (GIS) and identifying locations that are the highest risk to people and property, all in order to prioritise action appropriately.

A complex programme

Once agreed, Landmarc engaged with its supply chain to procure the services required to safely and effectively fell the infected ash trees. This is a highly complex process and involves specialist machinery, road closures, ecological surveys and where possible, securing a financial return from the felled timber. To date, over 25,000 trees have been felled across CPTA, Salisbury Plain Training Area (SPTA), Sennybridge Training Area, Stanford Training Area and Colchester (Friday Woods) with further works planned for Caerwent Training Area and the north region.

By undertaking such a large and wide-spread programme, the Forestry Team must continue to uphold the project's aims which are;

- Maintain, as far as possible, the values and benefits associated with ash woodlands and their place in the British landscape
- Preserve as much genetic diversity in ash trees as possible to help ensure the presence of ash in the future

Infected tree stump © Landmarc

- Minimise the impact on associated species and the wider biodiversity
- Secure an economic return where viable timber can be recovered
- Manage the health and safety risks from dead and dying trees
- Engage with the local community

Learning from experience
Following the initial works at CPTA, it was important to reflect on the lessons learned to help inform the following phases. In order to highlight the health and safety implications of the scheme and to demonstrate its impact on military training, Landmarc organised an educational visit to Watersend Woods at CPTA for its south-west team, prior to commencing the felling programme on SPTA. This included a trip to the local biomass plant, where the majority of the felled timber is being sent for processing into renewable energy. The 10ha site at Watersend is also a Site of Special Scientific Interest (SSSI), so invaluable lessons were identified about the importance of timing felling works to help minimise soil damage, as well as planning around bats and the bird nesting season.

Restoration begins
Reinstatement and restocking plans are in place for each location where felling takes place. The long-term intention is to re-establish mixed broadleaved woodland, with prolific and species-rich ground flora and to encourage deadwood habitats, where small habitat piles of timber are left to decompose, for woodland insects to help maintain the SSSI status. The resilience of the Defence Training Estate's woodlands is extremely important, not only for its ongoing military use, but also for maintaining landscapes and biodiversity. Landmarc therefore had extensive discussions with both the Forestry Commission and Natural England, specifically to agree how the woodlands would be regenerated and what species could be planted to replace the ash. Following felling, cut stumps have been left to regenerate and open areas have been restocked with hornbeam, small-leaved lime, field maple, oak and wild service tree – all of which can be found in adjacent woodlands.

Investing in the woodlands
As with all harvesting operations, Landmarc and DIO aim to generate an income to fund reinstatement works. Trees in felling parcels are sold standing through competitive tender to timber harvesting contractors once the tree has been broken down into its constituent parts. For ash, this could be as roundwood or used for biomass, where foresters chip the poorer quality material and harvesting arisings on-site and move it directly to Kent Renewable Energy, the wood-fuelled power plant in Sandwich, Kent. Any revenue realised is used to fund ground preparation, fencing, track and access repairs and replanting the woodland.

Engaging local communities
Knowing the importance of the general public's cooperation, Landmarc and DIO have engaged with the local community in each location where felling takes place, posting information notices, speaking to Parish Councils and stakeholders and informing the local press. Prior to work starting on SPTA, Landmarc and DIO also worked with the Forestry Commission to hold a joint stakeholder meeting for farming, sporting tenants and the local Parish Councils. This opened up a dialogue on ash dieback and the planned programme of works, allowing local stakeholders the opportunity to understand more about the issue and ask questions – something that was greatly received.

Working in partnership to protect our woodland
The value of working collaboratively cannot be underestimated on this project, which has had to consider


Ash dieback infected trees on CPTA © Landmarc

a wide range of factors involving statutory bodies, many specialists who have a vested interest in woodland management, the military, and other estate users. Foresters and rural teams across both Landmarc and DIO have gone above and beyond to implement the project, minimising any disruption and reinstating access to the woodlands for all stakeholders in the quickest possible time. This is a true reflection of the depth of knowledge and experience of all parties involved in the management of woodlands across the Defence Training Estate.

Judith Peachy
Forestry Harvesting and Arboricultural Advisor
Landmarc Support Services


Felled ash trees with evidence of rot and ash dieback in Ashdown Copse © Fiona McKnight-Burton

Enabling Armageddon – filming '1917' on Salisbury Plain Training Area

Stretcher bearers move past the infantry down the film set trench © Location Team 1917

"Rain swept the open country and poured into the white-chalk trenches. When at night several companies entered the trenches to take up their positions, men floundered through pools of whitewash, and got covered with sticky white mud. Verey lights went hissing up through the driving rain, to illuminate a dreary landscape. Rifles cracked, and the dull detonations of hand grenades momentarily drowned the angry hissing of the rain" (Fairey, 1920, 7, The 38th Battalion AIF, Bendigo), training for a 1917 battle.

Although this quote seems to resonate for the battlefields of the Western Front, it is in fact taken from an Australian diary about their training for a particular battle in 1917. The realism is palpable and it was this aspiration for 'simulacrum' – replication of realism that lay behind a request received by the Production Team of a film.

Oscar-winning '1917' was for a large part filmed on the Salisbury Plain Training Area and the Director, Sam Mendes, wanted trenches, farms, explosions and a landscape appropriate for the enormity of his film. Therein lay the problem; this is one of the most designated landscapes in Britain both for ecology and archaeology; from Sites of Special Scientific Interest (SSSI) and rare species through to scheduled monuments and a World Heritage Site, as the film crew found out!

Discussions immediately took place between Landmarc Support Services (Landmarc), the location managers, set designers and the Defence Infrastructure Organisation's (DIO) Environmental Support & Compliance (ES&C) Team to establish just what was possible in such a large endeavour. From the outset, the Production Team had a very clear vision of the settings they wanted for each scene. The unique approach of using extended, uncut takes to create the impression of long continuous shots meant the Salisbury Plain landscape was going to be an integral part of the film and a star of the show.

The majority of the Plain is designated as a SSSI for a variety of species and habitats, ranging from the largest area of chalk grassland in north-west Europe, to breeding stone curlew and the rare fairy shrimp that can be found in the ephemeral pools, puddles and tank ruts along many of the chalk tracks. Any filming activities and set construction would need to avoid damaging these features and secure approval from both Natural England and Wiltshire Council. Given this included digging trenches, building a French farmhouse, creating an orchard and part burying a lorry, amongst many other things, it was a significant challenge.

The DIO ES&C Team have well developed protocols for managing the impact of military training on wildlife and archaeology and they followed the same approach with 1917. Avoidance is the first step in the mitigation hierarchy and it proved possible to identify enough suitable locations outside

The skeleton of a 'French' barn stands on Salisbury Plain © Location Team 1917

areas of chalk grassland where sets could be constructed and trenches dug. However, to avoid the need for computer-generated imagery, extensive landscaping was still required. Chalk tracks were covered with turf, cherry trees on metal base plates were imported to create the orchard and trees were painted black to create the effect of fire and bomb blasts. All this was planned to ensure there was minimal disruption and sets could be removed with no lasting impacts.

The scale of the film presented another challenge. The sheer number of crew and extras involved meant access to the film sets and the location of welfare facilities, canteens, car parking and other facilities had to be carefully planned. The set construction and filming all took place between April and August 2019, which coincides with the breeding period for ground nesting stone curlew, for which Salisbury Plain supports a significant portion of the UK population. The birds mostly nest on specially cultivated bare ground plots and three of the filming locations were in the vicinity of these plots. To ensure nesting was not compromised, no filming was allowed within 500m, no dogs were allowed on set and the extras and crew were briefed not to wander away from the set where they could inadvertently disturb the birds.

Careful planning enabled the wildlife and film stars to go about their business without crossing paths. But not all the wildlife played ball. The construction of an authentic French farmhouse on a remote part of the Plain provided a rare opportunity for swallows to nest amongst the open grassland that provides so much insect prey. When filming finished, the production company were preparing to strike the set and demolish the buildings, when two nests were discovered and it was explained that all bird nests are legally protected. Work was put on hold as the progress of the growing chicks was closely monitored. Both nests successfully fledged chicks but in the blink of an eye a second brood of eggs were laid, work was delayed again and the nest cameras were deployed for a further few weeks to confirm another successful breeding outcome. A truly happy ending for what must rank amongst the most expensive birds in the history of cinema.

The infantry plod through the 'trench' on Salisbury Plain © Location Team 1917

From an archaeology perspective, the challenge was to be able to replicate such a large trench system – one of the key moments of the film, whilst not damaging buried deposits. The first stage was to examine just what might be in the chosen fields by undertaking a geophysical survey. This in fact revealed the presence of a previously unknown Bronze Age burial mound and large ditch system. Following discussions and permission from Wiltshire Council, the trench was thus designed to avoid these features and archaeologists from Wessex Archaeology excavated 5% of the film area (an 'evaluation') and scrupulously watched all the subsequent set digging. Although press statements said that the film might affect and even damage the Stonehenge World Heritage Site (WHS), in truth the locations were nowhere near the boundaries and were not detrimental in the slightest.

As the mechanical diggers (rather than thousands of soldiers with entrenching tools and picks) dug the replica trench, the archaeologists recorded the few features that were seen, discovering three pits which held pottery over 4,000 years old (late Neolithic – Early Bronze Age), animal bones and worked (and burnt) flints. After the actors had left the site, a group of veterans and volunteers from the Operation Nightingale programme (several of whom had experienced real conflict sites) were able to walk through the trench system. You could still see small shrines, faces carved into the chalk and other details that replicated the acts of bored soldiers during the war on the Western Front.

Across Salisbury Plain you can still trace the trenches that were dug for training in World War One – from those at Perham Down for the Battles of the Somme in 1916, to the Bustard for the Battle of Messines in 1917, and Beacon Hill for generic training. The 1917 film trenches are now filled in and the land restored, with no hint that such a major event had taken place. Fortunately, the barn that appears in the film and which the swallows found to be so realistic, was simply a large prop as otherwise it could certainly have found its way onto Historic England's Heritage at Risk list! It too has gone.

Through all this, the film production company liaised closely with DIO's ES&C Team and all the relevant authorities to ensure that any concerns were properly addressed. It was a steep learning curve for both sides but the result is not only a phenomenal piece of cinematography, but also a landscape that shows no traces of this ever happening.

Richard Osgood[1] & Oliver Howells[2]
Senior Archaeologist[1] &
Senior Ecologist[2]
Defence Infrastructure Organisation[1, 2]

COVID-19 lockdown delivers a CO_2 knockdown

The Sanctuary Team have adapted to home working, even for editing the magazine © Crown

No doubt history will show the COVID-19 pandemic to be one of the most significant events of the last 100 years. It has had profound impacts on families, individuals and societies across the world, and has presented numerous challenges. However, like with many challenges, there also comes opportunities.

As the largest Department of State, the Ministry of Defence (MOD) is a complex and dynamic organisation, even in normal times. Its people and systems have been extensively tested during the pandemic, but one of the MOD's biggest strengths is undeniably its people. The Department's top priority is ensuring that staff can continue to work effectively while keeping them and their families safe.

Remote working posed challenges to begin with, but subsequently transformed into an opportunity. Working in this way has not always been the norm within Defence, with many staff not equipped with MOD laptops, and an expectation that most work be conducted within the office. Much of MOD's work requires access to secret computer terminals, and not all meetings can easily be conducted outside of a physical meeting room. For some, it was impossible to avoid the workplace throughout the pandemic, but for others, adjustments to their ways of working has allowed outputs and productivity to continue as normal without coming into the office.

While some of these measures are temporary, this enforced change to ways of working could have lasting benefits for both the Department's people and the environment. The Defence Digital Team put a huge amount of work into improving the MOD's infrastructure so it could support widespread home working, delivering 23,500 laptops and other devices, and facilitating a fourfold increase in remote capacity. Face to face meetings have been replaced by Skype and Zoom, and teams have been making the most of the Microsoft Office suite with increased use of Teams and Groups to support collaborative working at a distance.

There has been a long standing expectation that meetings held in MOD Main Building should be attended in person. During the pandemic the MOD Permanent Secretary very successfully chaired multiple Boards via Zoom and Skype, including the Executive Committee and the Defence Safety and Environment Committee, helping to dispel the notion that running meetings in this way is less effective. Coupled with a moratorium in place for all but business critical travel, the cost of travelling between MOD sites has dropped significantly. During the first month of the first national lockdown, Army Headquarters reported a 71% reduction in travel costs compared to the previous year, coupled with a reduction in CO_2 emissions during April 2020 of 79%, totalling a saving of 3,577 tonnes.

A by-product of these new, smarter working practices has been a significant reduction in emissions. Attendance at the MOD Headquarters, Main Building, dropped to around 20% of total capacity – a similar story across the MOD estate – indicating a huge drop in commuting. Many have been walking or cycling instead of taking public transport or driving. By continuing to encourage alternative commuting methods, the MOD hopes that the environmental benefits seen since March 2020 can continue into the future.

The MOD has not stopped learning from COVID-19. Its people have shown themselves to be highly adaptable and resilient and continue to perform at a very high level despite the challenges faced. While benefits have generally been a by-product of the transition towards smarter working practices, there is an important lesson from the impact it has had on its emissions. Workplace attendance will undoubtedly start to increase again over the coming months, but Defence remains hopeful that the environmental benefits of reduced travel will be felt for a while longer as it heads towards being carbon neutral by 2050.

Mike Baker
MOD Chief Operating Officer
Ministry of Defence

Revitalising the Imber Range Perimeter Path for the 21st century

The Westbury White Horse is an ideal location to start with ample parking and wonderful views © Crown

The Imber Range has been an essential part of Salisbury Plain Training Area (SPTA) for 100 years. Its creation took place primarily in the lead up to World War Two and was not without controversy. Inhabitants of Imber village were moved out of their homes to aid the war effort and the surrounding countryside became off limits due to the dangerous training taking place.

Public rights of way across the range were originally closed in 1944 under emergency powers, but due to the ongoing military requirement and the risks that training posed to the public, it was agreed that 58 paths would be formerly closed by Order. This was met with significant protest before a resolution was found by public inquiry, held in 1961.

The closure of the rights of way was approved, but to offset the loss of so many paths it was agreed that a footpath running around the perimeter of the range, outside the range danger area, would be created. Opened in 1962, the Imber Range Perimeter Path (IRPP) was formed, providing community links and opportunities for localised recreation by linking other paths.

The original route could only be completed in its entirety on foot. In working towards improving management of public access across SPTA, the Defence Infrastructure Organisation (DIO) committed to review the path, conscious that outdoor recreation had developed over the past 70 years. The challenge of upgrading the IRPP to a minimum of bridleway was considered. This would enable people to walk, horse ride or cycle around the 50km circumference of Imber Range, without impacting on the use of the Training Area and accounting for the sensitive environment the path passes through.

The solution was to provide alternative segments for horse riders and cyclists and to alter the course of short sections of the path. The longest division of the route sits just outside of Warminster. The original path encompasses the historical features of Battlesbury, Middle and Scratchbury Hills. This would be retained for walkers, but it was not acceptable to allow horses or bicycles to follow the same path due to likely erosion. Instead an alternative southerly section was provided, allowing for enjoyable views of this enigmatic landscape, but ensuring the scheduled heritage remained protected.

The route has also been altered to allow for safer use by all, moving away from roads that have become far busier since the route opened in 1962. This has been particularly successful on the outskirts of Tilshead, where the route now travels along field edges and through pleasant woodland.

As ever, in providing public access around the Training Area, visitor safety remains paramount. The route is extensively waymarked alongside safety and warning signs. New visitor information has been published, complementing existing SPTA visitor information. Available in both electronic and paper format, the information incorporates a map of both the walking and horse riding/cycling routes and important information that visitors should be aware of. Additionally, utilising the Ordnance Survey Ltd online application, the route has been made available to download and follow either using a GPS device or Ordnance Survey's own application. This sits alongside the same crucial safety information.

Overall, these changes have provided a better experience for the walker and increased opportunities for those on horseback or bicycle. Working in conjunction with Wiltshire Council, DIO have installed a series of people counters to monitor levels of use throughout the year. This will aid future planning by identifying trends in use to direct future investment, and also highlight the benefit that many people will be getting from wider recreational access opportunities.

James Nevitt
Senior Access & Recreation Advisor
Defence Infrastructure Organisation

Bovington Training Area – long-term monitoring of sediment management

The outflow of Diversion Pond (left), a silt trapping pond which was constructed in the lower catchment to divert sediment-rich water into Harvard's Pond (right) a constructed wetland, at times of high flow © Patrick Armitage

Background

In 1916, Bovington Camp was established as the Training Area for Heavy Branch Machine Gun Corps and Tank Corps Units and remains to this day the home of the Royal Armoured Corps. The majority of the Bovington Training Area is situated on elevated land overlooking the River Frome floodplain in Dorset. The region is characterised geologically by sands, clays and gravels covered with heathland vegetation. The action of heavy armoured vehicles over the years on this terrain has eroded vegetation, removed topsoil and exposed underlying sediments. The area is drained by the Bovington Stream which carries high suspended sediment loads from the eroded catchment into the River Frome. Not only was this unsightly, but it had the potential for reducing the ecological quality of the River Frome, a renowned salmon river and Site of Special Scientific Interest. By 1997, large areas of topsoil had been removed and the situation demanded major management actions.

The main controls of sediment movement prior to 1997 were three large silt ponds in the upper catchment. Eight more silt ponds were added and further silt trapping and soil stabilisation devices were deployed throughout the upper catchment in small drainage channels and runnels. The construction of the All-Weather Driving Circuit in 1998 was a major factor in reducing erosion and sediment movement in the upper catchment. In addition, a silt trapping pond (Diversion Pond) was constructed in the lower catchment which diverted sediment-rich water into a constructed wetland (Harvard's Pond) at times of high flow (*Sanctuary* 34, 2005). This system removed a considerable quantity of sediment, but the outflow to the River Frome was still discoloured by suspended fine silt and clay particles. It was important to know whether the outflow was having a negative impact on the ecology of the River Frome.

Monitoring

The diversity of small animals (macroinvertebrates) such as snails, shrimps, worms and leeches along with insects such as mayflies, caddis flies and beetles living on the stream bed provide a good indication of prevailing conditions. A rich and varied range of macroinvertebrates indicates that the conditions necessary to support this life must have been present for a sustained period of at least several months.

The abundance and diversity of macroinvertebrates from sites on the Bovington Stream, above and below the Diversion Pond and on the River Frome above and below its junction with the Bovington Stream have been monitored in a consistent manner every year since 1998. The River Invertebrate Classification Tool was used to measure the ecological condition of each site, banded into five quality classes (High, Good, Moderate, Poor and Bad).

Results

The Bovington Stream sites, above and below the Diversion Pond, improved in ecological quality over the duration of the study, from 'Moderate' or 'Good' between 1998 to 2003, to consistently 'Good' or 'High' quality in subsequent years. In contrast, the two Frome sites were consistently classed as 'High' quality throughout the study period. This suggested that there was no discernible difference in the ecological quality of sites immediately upstream and downstream of the Bovington Stream confluence and that the Bovington Stream was not having a marked impact on the Frome.

Further indications of positive change in Bovington Stream were provided by increases in the diversity of animals

known to be sensitive to fine sediment pollution. This measure indicated that a degree of improvement/recovery from fine sediment pressure had occurred at the Bovington sites and that no directional change was evident in the Frome over the same period. Detailed analyses of the species data have found that there was a marked improvement in the diversity of animals found in Bovington Stream between the period prior to 2004 and the period after. Over the same period there was no change in the consistently high numbers of taxa recorded at the two Frome sites.

The Training Area in 1997 and 2020 © Dorset County Council (1997) & MOD (2020)

Conclusions

No major land-use changes or extreme events have occurred in the catchment during the 19 year period of study which would have affected the river, other than the sediment remediation work. It is therefore possible to conclude that the observed improvements in the Bovington Stream (increased richness and improved ecological quality) and lack of any environmental impact on the River Frome are due mainly to the sediment management strategies employed by the Ministry of Defence (MOD). A clear demonstration of the success of the remediation measures is seen when aerial views of the catchment in 1997 and 2020 are compared.

However, continued success depends on regular maintenance of dams in the upper catchment. The lowest dam in the upper catchment can hold 2,000 tons of sediment and if the dam were breached, the released silt could pollute 11km of the River Frome, therefore regular inspections are vital. The smaller silt trapping ponds should be emptied periodically to maintain their capacity and silt traps in the smaller channels and runnels should be examined to ensure they are functioning correctly. In addition, the pipes draining the Diversion Pond should be observed regularly to ensure sufficient flow to maintain the benthic community downstream of the pond.

Despite the lack of any negative effects on the fauna, the waters of the Frome continue to be discoloured after periods of heavy rain because the settlement ponds are not so effective at removing the very smallest particles of suspended sediment. To ensure maximum removal of such fine sediment and clays, Harvard's Pond area would need to be increased by a factor of 13. This is probably not feasible and may not be justified, because it is known that these light clay particles are not settling out on the bed of the River Frome downstream of the Bovington Stream confluence.

In 1998 the main contributor to discolouration of the lower Frome was output from the Bovington Stream but by the end of the study the River Win (a small tributary draining an agricultural catchment 600m upstream of the Bovington/Frome confluence) was the main contributor to discolouration. This offers more evidence that remediation measures in the Bovington catchment are decreasing sediment loading into the Frome.


The River Win/River Frome confluence in January 2015 © Patrick Armitage

Acknowledgements

This long-term project was funded by a series of grants from Defence Infrastructure Organisation and carried out initially by staff from the Freshwater Biological Association River Laboratory and subsequently by staff from Queen Mary, University of London, based at the River Laboratory. The team are most grateful to Maj (Ret'd) George Preston who was the driving force behind the initial investigations and to the numerous colleagues who have contributed to the project over the last 20 years, especially the late John Blackburn for his invaluable taxonomic skills in the early years of the project from 1998 to 2004.

Patrick Armitage[1] & John Murphy[2]
Researchers[1, 2]
Freshwater Biological Association[1] &
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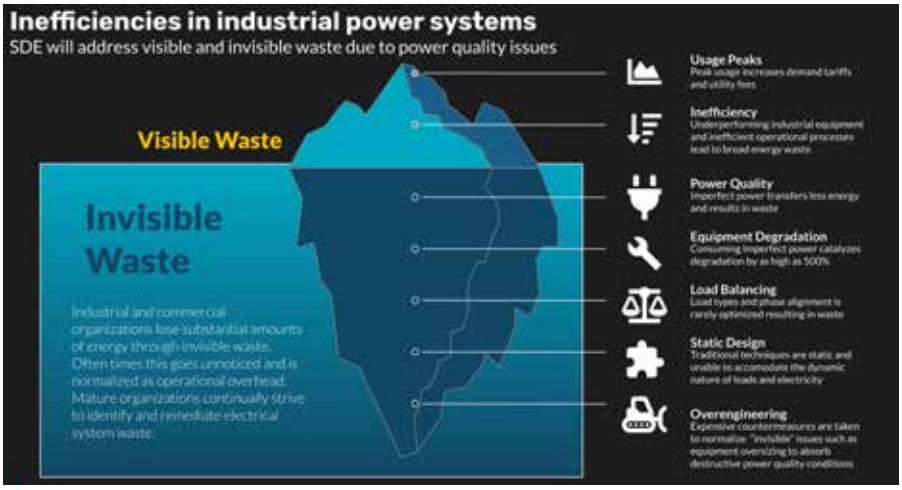
Electrical energy efficiency – going deeper and seeing more



Traditional demand based control is only the tip of the efficiencies possible © Optimized Sciences LLC

Software Defined Electricity (SDE) is a proprietary technology from a small company in the USA called 3DFS, offered by Optimized Sciences, which can measure and correct three-phase alternating current (AC) electricity in real-time. A project to trial it has been run by Lt Cdr Jonathan Parker outside of his day job whilst working in Defence Digital. In October 2019, a bid to the Defence Innovation Unit was awarded funding to evaluate the technology with a trusted third party. This was conducted at 3DFS' factory in February 2020 by Lt Cdr Parker, with Underwriters Laboratories witnessing and Deloitte acting as trial integrators.

SDE works by correcting the waveforms in voltage and current of a three-phase AC supply. In this process, it creates a dynamic mathematical model of the electrical loads it is correcting for. This enables sensor-less or agent-less monitoring by utilising electrical signature analysis to detect and report anomalies, which displaces traditional sensor-based approaches.

The results were even more impressive than the claims. A 25% efficiency gain was found to be a baseline figure for a mixed load estate and reductions in energy draw were verified at up to 77% depending on the load and status of the power supply at the time. Additionally, the conditions to support safety improvements were validated, such as an improved harmonic distortion and neutral current reduction by up to 94%.

Analysis of the Defence Infrastructure Organisation's (DIO) energy bills showed approximately 43% of Ministry of Defence (MOD) sites would be suitable for SDE installation, which accounts for 99% of the MOD's electricity consumption. A coarse 20% saving would equate to approximately £44M per year in pure energy costs. It does not factor in reduced maintenance and equipment life replacement costs. There would also be greenhouse gas emissions reductions of 112,107 tonnes of CO_2 equivalent.

Taking the UK Public Sector electricity bills, adoption at a national Government scale, and assuming a pessimistic 10% overall reduction in use translates to £240M annually, and a reduction of 596,396 tonnes CO_2e. However, the expected greenification of the grid means that whilst the technology could help from a cost perspective, it may not ultimately contribute to achieving Net Zero in the longer term if the electricity supply moves to green energy sources.

SDE also provides electrical system safety and resilience. SDE has demonstrated the ability to reduce neutral currents to negligible levels and the ability to mitigate or 'absorb' power surges. These are some of the common conditions that lead to electrical fires.

Before the leap to those sunlit uplands however, there needs to be a series of second stage trials and a recent bid to the Defence Innovation Fund Round Nine for monies was successful. The second stage will include the University of Strathclyde's Power Network Demonstration Centre, the cross-Government Modern Energy Partners Programme which DIO leads for the MOD, and a small number of discrete devices to be trialled at other MOD locations. This will prove the equipment as installed on the MOD estate and allow the data collection and reporting to be validated, if not fully exercised at this time.

The MOD is currently leading the world in exploitation and assessment of SDE. It can be applied to every activity the Department is involved in, from housing, workshops, offices, data centres, operational bases and the deployed environment. Furthermore, the implications for every facet of power delivery across the UK from off-shore generation, National Grid distribution and industrial consumption, to domestic, transport and off-grid activities are potentially gigantic.

The benefits of SDE are primarily commercial and environmental, and while it is applicable to operations, it is not on its own fighting technology. The MOD is therefore keen to share these results with co-investors and parallel experimenters. This will help bring SDE to the point it can be mass produced cheaply and provide an attractive return on investment.

Lt Cdr Jonathan Parker
SO2 Maritime
DE&S Future Capabilities Group

Re-introducing the marsh fritillary butterfly to north-east Hampshire

Adult marsh fritillary *Euphydryas aurinia* © Dr Andy Barker

The marsh fritillary *Euphydryas aurinia* is one of the jewels in Britain's butterfly fauna. The distinctive chequerboard markings make adults easy to identify when on the wing in May and June. Their beauty is sadly no protection against habitat loss and the species has suffered a massive 80% decline in its UK distribution since the 1970s. It is a European Protected Species and one of Europe's most threatened butterflies.

The marsh fritillary was lost from north-east Hampshire in the mid 1990s. However, an extensive stretch of Ministry of Defence (MOD) land in the Minley Training Area included former breeding sites for the butterfly. The Hampshire & Isle of Wight Wildlife Trust (HIWWT) began managing the sites for conservation purposes in 2009 and within a few years large tracts gradually came back into suitable condition for the marsh fritillary. The key requirement is a shaggy sward containing abundant purple moor grass *Molinia caerulea* and devil's-bit scabious *Succisa pratensis* for the larval stage of its life cycle.

The idea of re-introducing the marsh fritillary to north-east Hampshire began in 2012 with discussions between local experts from Butterfly Conservation (BC), HIWWT, Natural England and the MOD. The marsh fritillary is a relatively poor flier and natural re-colonisation from distant colonies was extremely unlikely. However, deciding to re-introduce a rare species is never an easy decision. It is necessary to understand why the species was lost in the first place and its ecology throughout all its life stages. Re-introductions are resource intensive and there is also the challenge of finding donor populations that are sufficiently strong and similar in character.

The MOD's support was crucial. The land is used for military training and no re-introduction would have been possible without the MOD's wholehearted agreement. Protocols were put in place to ensure visits by BC volunteers only took place with prior clearance. Eventually, after four years of planning, 300 marsh fritillary larvae were collected under licence from six sites on Dartmoor in September 2016.

No more than 50 larvae were collected from any one donor site and no more than 10 larvae were collected from any one larval web. This was designed to maximise genetic diversity amongst the donor stock and minimise the impact on donor populations. The larvae were distributed between four breeders in Wiltshire, Hampshire and Buckinghamshire to rear two successive generations in captivity. This approach greatly reduced the risk of disease or accident at one location compromising the whole project.

The productivity of a female marsh fritillary is impressive. At one breeding site near Romsey, 70 mated females laid 24,000 eggs. The larvae were housed in 12 large breeding cages and fed from a stock of 6,000 devil's-bit scabious plants. This is a lot of plants, but in warm conditions just 15 larvae can devour one food plant in a day.

The first releases of larvae were made in April 2018. These soon pupated and on the 21 May 2018 the first adults were seen on the wing, the first to fly over north-east Hampshire in over 20 years. Over 27,000 larvae were released over three sites between April 2018 – March 2019.

Surveys in March 2020 showed that good numbers of larvae had successfully over-wintered despite the high rainfall. Larval webs could be found every three minutes or so in some areas with each web typically containing 70 – 90 larvae. Almost 200 adults were seen on the wing during later surveys in 2020, a fine sight. Only time will tell whether the re-introduction has been a success, but the initial signs are very encouraging.

Clive Wood & Dr Andy Barker
Project Leads
Butterfly Conservation

Late stage larva feeding © Dr Andy Barker

DIO in Belize – environmental community engagement

The team checking wildlife cameras on the Mountain Pine Ridge Forest Reserve and Training Area © Crown

Belize gained its independence in 1981 and since then Britain has continued to maintain a military presence. In 1994, the British Army Training Support Unit Belize (BATSUB) was established. It was mothballed as a result of a 2010 Defence Review, but under the Army 2020 programme training was reactivated in March 2016.

BATSUB hosts and enables Company (150 soldiers) and Battalion (500 soldiers) level jungle training, facilitated and supported by contractors such as Astrum Aviation, British Healthcare Partners and Belize Communication Systems Ltd. Operating under a Memorandum of Understanding and the Statement of Forces Agreement, BATSUB has a licence to train up to 3,750 personnel per year. This takes place across a network of Government and privately owned land, alongside the Belize Defence Force (BDF) and other foreign forces.

The licence to operate is key and Defence Infrastructure Organisation (DIO) BATSUB work exceptionally hard to maintain and enhance reputation and relationships which enable the licence to train, especially with environmental compliance and protecting the land that DIO BATSUB use for training. British support includes employment and procurement opportunities for local communities and businesses, disaster relief, construction and wider community engagement. BATSUB is well-supported by a professional, long serving and loyal Locally Engaged Civilian (LEC) workforce of 134 personnel. Many LEC's deliver critical clerical, infrastructure and technical support and also ensure that BATSUB remains embedded in the local community and are all the richer for their service.

The DIO BATSUB Range Control Team have worked hard to integrate military training with the sustainable management of the jungle and be an effective partner within the local community. BATSUB has built strong and trusted relationships with Training Area landowners and Government agencies to whom they ensure compliance, and NGOs and environmental agencies with whom they mutually support, assist and learn from. Training is at full capacity and so Maj Alan Grant asked his stakeholders for feedback on BATSUB's sustainable range management performance.

The Regulator

The Belize Department of Environment (DOE) are one of the key regulators that DIO BATSUB work with to secure permission to train in the jungle. Mr Antony Mai, Senior Environmental Officer said *"I have always been impressed with their professional work ethos and tight grip of environmental responsibility and culture. Originally, we conducted an inspection of a training estate every month, whereupon we soon identified that they consistently produced the highest of environmental standards and were repeatedly identified by the DOE inspectors for producing best practice in Belize. With skilled local Subject Matter Expert staff, dedicated military leaders, stringent processes and procedures in place, combined with an honesty to seek advice or own up if mistakes happen, it made it an easy decision to reduce inspections to only twice a year. They should be congratulated for their exemplary efforts".*

Belize Training Areas

Mr Tom Wilson, owner of land in Manatee, Belize District reported *"over the past couple of years, the DIO BATSUB Team has bent over backwards to look after my land, doing reforestation of native species in areas that were utilised for jungle training exercises historically, and work on tracks utilised to cross our property and installing security barriers".*

Mr Jeff Roberson, manager of Yalbac & Laguna Seca estate stated that *"we have noticed a great reduction in trespassing which in turn has led to a decline in illegal logging and illegal hunting. They have also gone to great lengths to ensure the protection of the forest, from thorough orientations for the new trainees to actually sandbagging a high value mahogany tree that was a little close to a firing range. I am looking forward to many years of great cooperation and mutual benefits with their presence in our forest".*

Mr Alan Jeal, the Operations Manager, Gallon Jug Estates, Orange Walk District, said *"as an ex squaddie myself*

there is a complete turnaround in the way the guys respect and care for the nature, lands and wildlife not witnessed before. We have a large amount of Mayan archaeological sites on the property and appreciate the way DIO BATSUB ensures the troops on exercise preserve and respect these areas and also ensure the restoration to any area that is disturbed".

Belize DOE, BATSUB and DIO conducting an environmental inspection © Crown

Wildlife research and support

DIO contracted Panthera in 2019 to assess the status of wildlife populations in the jungles used by the military for training and to quantify the effects, both good and bad, of military presence and activity on wildlife dynamics. Panthera detected over 300 images of jaguars from their camera trap survey at Manatee Forest Reserve. The images included at least 22 individuals of males, females and cubs. At both Training Areas they detected all five cat species found in Belize, as well as many other mammal and bird species. Several species, including jaguars and pumas, were detected whilst military exercises were being conducted.

Panthera staff go over and above their agreed monitoring contract. They give wildlife safety briefings to exercising troops and meet and host UK VIPs to explain the importance of their outstanding work, whilst loyally aiding and advising BATSUB.

Panthera Board Member, Lt Gen Sir Graeme Lamb said *"This exceptional partnership between Panthera and the British Army demonstrates how, if carried out well, responsibly and with sensitivity to local habitats, conservation flourishes. As Charles Darwin reminded us 'in the long history of humankind (and animal kind, too) those who learned to collaborate and improvise most effectively have prevailed'. This project embraces that powerful suggestion and worthy challenge, to ensure the coexistence between wild cats and communities as one of the crucial ways in which the long-term survival of species like the jaguar will be solidified, and the wonderful gift of nature, that is Belize, kept in balance".*

Diplomatic relationships

Claire Evans OBE, High Commissioner, Belmopan, British High Commission, stated *"Together with like-minded local stakeholders, they have made an incredible difference and showcased what can and should be done. We have been privileged to host BATSUB stakeholder meetings which bring together landowners, Government agencies, NGOs and environmental agencies, to help build and maintain strong relationships as well as providing a platform for discussion and subsequent action".*

The Environmental Audit Team © Crown

Partner nation support

The closing response is from the Belize Defence Force whose support and partnership is highly valued. Maj Jermaine Burns Commanding Officer Service Support Battalion stated *"BATSUB has promoted environmental security, planted trees and kept jungle Training Areas immaculate in accordance with the country's environmental legislation. BATSUB has integrated the Belize Defence Force in its pursuit to better care for the environment through awareness exercises and conferences and we are now writing more comprehensive policies to lift standards and the preservation of our Training Areas significantly. BATSUB's presence within Belize and the Chiquibul has proven to be a deterrence to transnational criminals and statistics have shown the reduction of illegal incursions, poaching, theft of natural resources, and the direct threats to tourism. The country of Belize is beyond appreciative of DIO BATSUB and the British Consulate's operations in Belize. Both have gone beyond the call of partnering across the spectrum of Operations, and it is imperative that the partnership continues along similar trends with a view to reap mutual benefits".*

Maj Alan Grant[1], Oliver Howells[2] & Richard Snow[3]
Training Safety Officer Belize[1], Senior Ecologist[2] & Senior Environmental Advisor[3]
DIO[1, 2, 3]

Wartime reflections at Castlemartin

Brownslade mansion built in 1782 was used as the Officers' Mess until 1941 © Gordon Smith

The Stackpole Estate in south Pembrokeshire was a productive agricultural area when in 1939 the War Office requisitioned 6,000 acres to create Castlemartin Range, used as a tank training range. The residents of 14 farms and 11 cottages were evicted, having been given between six months and six weeks to leave.

As the 80th anniversary of the range approached, Pembrokeshire Coast National Park Authority's (PCNPA) Ranger for the Ministry of Defence (MOD) estate, Lynne Houlston, realised that the generation of people who could remember what the area was like before the military moved in was slowly being lost. Lynne wanted to learn what it was like to live and work in this area and to preserve those memories for future generations.

In early 2019, having secured funding from the Defence Infrastructure Organisation's (DIO) Conservation Stewardship Fund, Lynne started to search for people who were born in the area before 1939. She interviewed them and scanned old photographs and documents, gathering together an incredible amount of material. Independent Film Producer, Dave Welton, filmed some of the interviews and was then able to use the footage, maps and photographs to create a short film. The film told the story of the land, the people, their displacement and their memories.

The film was shown at an 80th anniversary gathering that Lynne organised for ex-residents and their descendants. The event was popular, with 78 people attending, including seven who could remember being evicted by the military. The event was not a celebration, but a time to reflect and remember what had happened and why.

The gathering included a service at Flimston Chapel and a tour of Flimston Farmhouse, before six minibuses took guests to different locations across Castlemartin Range. May Roberts, born in 1928 in Flimston Farmhouse, was one of the guests attending the event and was happy to explain what life was like.

It was an emotional day for some as there was very little left of their ancestral homes – a stone wall, a pile of earth or in some cases, nothing at all. There were also some very memorable moments including cousins meeting for the first time, and a gentleman meeting his mother's bridesmaid and being given a sepia photograph of the event.

After the showing of the film, people asked for their own copy and so the film was made available on DVD. It was distributed to all contributors, gathering attendees, as well as to the National Library of Wales and the Dyfed Archaeological Trust Library.

The film has been shown to PCNPA staff and members, DIO and Range staff as well as at three public events attended by 153 people. One of the events was to an almost entirely Welsh speaking hill farming community who have transported their 10,000 sheep to graze on Castlemartin Range for 70 years. This community had fought against a plan to create a military range on their hills, known locally as the 'Battle of the Preselau'.

The film will be a valuable resource for future generations and the photographs and documents that Lynne collected will be used by PCNPA volunteers when leading public guided walks and tours across Castlemartin Range.

Castlemartin was very important to the ex-residents of the range and in early 2021, using additional funding from DIO, a second film will be completed showcasing the importance of the range today. It will focus on the grazing partnership, the flora and fauna that thrive there as well as the military training. Nowadays, Castlemartin Range is the premier Armoured Fighting Vehicle (AFV) live firing range in the United Kingdom. The film is available to watch on YouTube at: https://youtu.be/9hqLtqyYJF8

Lynne Houlston
PCNPA Ranger for the Military Estate
PCNPA

The story of Imber – sustaining cultural heritage through music

St Giles' Church packed for the annual Festival of Carols © Brian Coles

In the midst of the Salisbury Plain Training Area (SPTA) lies Imber, a village evacuated in November 1943 to facilitate the training of troops for the World War Two D-Day landings. It has remained in military use ever since, with the Ministry of Defence (MOD) enabling public access several times a year.

The beautiful church of St Giles, a symbol of Imber and all it represents, is still standing. Every Christmas Bratton Silver Band plays at the Festival of Carols – a poignant event where people come from near and far to bring the ancient church alive with music and voices.

Bratton Silver Band chose to mark its 160th anniversary in 2019 with a project commissioning a piece of music entitled 'The Lost Village of Imber'. Just as the MOD preserves cultural heritage for future generations, the band wished to share the Imber story and keep memories alive through music, by paying tribute to those who have lived and worked there and those who continue to maintain and sustain access to this special place.

Bratton Silver Band, with the help of Brass Bands England, successfully applied for an Arts Council National Lottery Project Grant and a grant from the Norman Jones Trust Fund. Together, with support from the Friends of St Giles' Church and the fundraising efforts of the local Bratton community, the project became a reality.

Christopher Bond, Composer in Residence for the world famous Cory Band, was chosen to work alongside Bratton Silver Band to create an exciting and accessible piece of music. The band was eager to involve both its own members and the wider community in the project to generate ideas for the music, and increase community awareness about the Imber story.

The Band staged an 160th anniversary exhibition and also took part in the Bratton Art in the Garden Trail. This gave visitors the chance to contribute their own thoughts and ideas to the project. Research visits to Imber with archaeologist Julian Richards and Imber Conservation Group volunteer Peter Green were filmed and the band members were interviewed about their experiences of the project.

Players took part in composer-led workshops as the music was being written and were thrilled to perform in a concert with the Cory Band. This was a great opportunity for Bratton Silver Band players, aged from 10 – 82, to learn from the best and improve their musical skills.

The project produced an outstanding 12 minute musical composition 'The Lost Village of Imber,' a legacy for future generations to hear and perform. This was premiered nationally by the Cory Band at the Royal Northern College of Music Festival of Brass, locally at Wiltshire Music Centre and will also be performed by Bratton Silver Band at St Giles' Church.

The music consists of three movements. 'Imber on the Downe' depicts rural life. 'The Church of St Giles' portrays emotions of villagers leaving their homes, whilst offering a symbol of hope that they might one day return. Finally, *'Imemerie Aeternum'* captures sounds of military activity through which the bells of St Giles' Church ring in triumphant style, signifying and celebrating that the church is preserved and access to Imber is sustained by the MOD. It depicts and heralds the balance between the overriding requirement for safe and sustainable military training on SPTA and the conservation of our heritage.

Through the tradition of brass band music, historic stories and events are kept alive through performance. It is anticipated that this will become a key work in brass band concert programmes, broadcasts and recordings, spreading the story of 'The Lost Village of Imber' across the world stage, and so it lives on…

Lucy Scott & Sue Jackson
Bratton Silver Band

Net Zero Naval Bases – the journey starts here

Her Majesty's Naval Base, Devonport © Crown

How the Royal Navy responds to the Government legislation on delivering Net Zero by 2050 will be a defining aspect of our generation. As the three largest Defence energy using sites, Naval Bases offer a unique challenge in the development of a Net Zero approach for Defence in the UK. These strategic mounting bases for maritime operations contain a complex range of activities and outputs and are also nested within communities where climate emergencies have been declared. Local interest in the development of a Net Zero plan is also increasing and our activities are permissioned by our relationship with our local regions. To address this, and start the journey, a Naval Base Net Zero carbon conference was convened to better understand the challenges within the Naval Base community and support the wider Defence discussion.

The agenda was built from the top down – a key note address from the Department for Business Energy and Industrial Strategy (BEIS) reminded us of the ambition to limit the rise in global temperature to 1.5ºC and noted that the Ministry of Defence (MOD) owns half of UK Public Sector emissions, of which mainland infrastructure is 35%. The day included insights into the challenges of defining scope, the necessary targets, risks and opportunities presented, and the contextual impacts of emerging policies. It gave a global perspective, and also looked at 'Clean Ports' and the emerging lessons.

The importance of what the Royal Navy has already achieved was not lost and there has been substantial progress across the Naval Base estate; a headline reduction in energy related carbon across the three bases of 62% in the last decade. This has been achieved through a range of initiatives from an Energy from Waste facility at Devonport, through to oil-fired boiler replacements, site-wide metering, heat pumps and widespread LED installation.

One of the most thought-provoking presentations was a 2050 retrospective, hypothesising on building from the 2020 waypoint. The journey toward a theoretical net carbon 'sink' was marked by a focus on reducing the energy arising from heating, increasing use of technology ready renewables, trading clean energy across the wider MOD estate and improving 'sustainable' build quality. Further out, solutions might include the adoption of clean gas technologies, such as hydrogen fuel cells, increasing digitisation, clean transport and Clean Ship solutions, as well as carbon capture and storage, either at a national or a local level.

The second half sought contributions from the cross-section of attendees, to develop and test a draft vision for the Naval Bases' Net Zero carbon policy, future governance, and identify and share initiatives that will drive future performance. There were 220 such initiatives identified, reflected in the post-conference report which identified three options for future management of the Royal Navy carbon footprint, currently seeking high level endorsement.

To sum up, the point was made that technology alone will not address the current challenges faced. Rising to the Net Zero agenda will require strong leadership, direction and policy and new working practices across the entire spectrum of delivery, almost certainly into unfamiliar waters. 'Think Global, Act Local and Get on With It' was encouraged, which is exactly what is being done.

Cdre Jeremy Bailey
Naval Base Commander Portsmouth
Royal Navy

'Navy Fit' bikes in Portsmouth Naval Base © Crown

A sustainable home berth for the Navy's new aircraft carriers

Queen Elizabeth Class aircraft carriers berthed together © Andy Amor

The Defence Infrastructure Organisation (DIO), working with main contractor VolkerStevin and design partner Jacobs, delivered £90M of jetty rebuild out of £200M total infrastructure works, to prepare HMNB Portsmouth as the homebase for the Royal Navy's two huge new aircraft carriers – HMS Queen Elizabeth and HMS Prince of Wales.

Two adjacent jetties were rebuilt to meet the two carriers' delivery programme. Firstly, for Princess Royal Jetty, the team demolished and replaced jetty sections with a new tubular piled and concrete deck structure. Berthing facilities and shoreside infrastructure were upgraded, and new offshore navigation aids installed. The work was successfully completed on time and huge crowds gathered around Portsmouth Harbour in August 2017 to welcome HMS Queen Elizabeth for the first time.

The DIO's focus soon shifted towards preparing the adjacent Victory Jetty. Recognising the programme-critical nature of the works, VolkerStevin engaged in 'early contractor involvement' at the end of the Princess Royal Jetty phase. As part of a subsequent successful procurement process, VolkerStevin built a collaborative team of designers, suppliers and end-users to produce a buildable, value for money design with the Ministry of Defence. This collaborative early involvement approach saved 16 months on a traditional procurement route contractor position and helped identify £870,000 of savings.

The jetty face was modified and strengthened, shoreside infrastructure was installed or upgraded, a new mooring dolphin was installed, and an existing jetty link bridge and approach ramps were relocated. Construction works were completed five weeks early and Victory Jetty came into use in October 2019.

Sustainability was a key consideration in reconstructing both jetties. At Princess Royal Jetty, Jacobs' designers and VolkerStevin's construction experts carefully assessed both the existing structures, which dated back to the 1920s and 1970s, and the wider context of the adjacent 19th century seawalls, docks and slipways. They developed a complex demolition process that left structurally sound deck sections in place into which new precast units interlocked. This allowed 50% of the Princess Royal Jetty and subsequently 97% of Victory Jetty to be retained, reducing both the cost and carbon footprint of construction.

The carriers' arched hulls create a 20m wide gap to the jetty. Bespoke fender support units were fabricated to bridge the gap and protect the carriers' hulls from impact. These floating pontoons absorb loads through hydraulic arms that slot into the jetty and move with the tide. The pontoons can be removed for safe storage and maintenance, prolonging their lifespan and providing flexibility to berth other vessels.

Shoreside power supplies were installed to meet the carriers' huge power needs and allow their carbon-intensive generators to be switched off when berthed. The team built a substation within the base, installing two and a half miles of cable through Portsmouth's streets to connect it to the National Grid. Huge rotary frequency converters transform the typical 50Hz frequency to the ships' 60Hz demand.

Bespoke telescopic cable booms were designed and fabricated to bridge the gap from each jetty to the carriers. These world-first booms send the 11,000 volt power supply to the carriers and move with the ship on the tide to ensure connection.

Navigation towers and control systems guide the vessels through Portsmouth Harbour. Their LED lights are solar and battery powered and visible 20 nautical miles away. This was the first use of the triple transit configuration in the UK.

The team also protected the site's heritage. At Princess Royal Jetty static load tests during demolition and reconstruction were used to gradually assess the historic wall and reduce the risk of overloading damage. These results informed the design and the existing deck edge was strengthened to relieve this load.

Jon Benton
Contracts Director
VolkerStevin Limited

Fell top to river bed – **revitalising Redesdale at Otterburn**

Training volunteers in recording techniques © Phil Abramson

In 2018, the Ministry of Defence (MOD) started delivering the 'Life on the Ranges' project as part of the Revitalising Redesdale Landscape Partnership, a £2.8M scheme celebrating Redesdale's rich cultural heritage and protecting and enhancing the area's unique landscape and wildlife.

Revitalising Redesdale is a partnership project delivered by Natural England (NE), with partners including MOD, Northumberland National Park, Environment Agency (EA), Northumberland Wildlife Trust (NWT), Tyne Rivers Trust, The Battlefields Trust, Northumbrian Water, Northumberland County Council and the local community, including the Parish Councils and farmers.

The Life on the Ranges project focuses on land within the River Rede catchment, on Otterburn Training Area (OTA). OTA is the second largest military Training Area in the UK and the largest artillery impact area, covering 23,472ha of north-west Northumberland and almost a quarter of Northumberland National Park. This vast, undeveloped moorland stretches up to the Anglo-Scottish border and straddles the borderland between the Rede and the Coquet valleys.

The remote location of OTA has helped to preserve a rich array of archaeological remains, from prehistoric cairns and burial monuments to 20th century military bunkers. The Otterburn Ranges have a history of military activity, with an extraordinarily high concentration of Roman marching camps and the remarkable Roman military complex at Chew Green. The Roman road of Dere Street, originating in York, runs through the OTA on its way up to Scotland and is now a modern military road. The route that was once paced by Roman hobnailed boots is now driven over by tanks and modern military vehicles.

In more recent times, the area was patrolled by the infamous Border Reivers who stole from neighbours' lands and destroyed livelihoods. The concentration of bastles (fortified farmhouses) dotted across the OTA is testament to these lawless times.

Since 1911, the land has been owned by the MOD as a military Training Area. Legend has it that Winston Churchill, visiting his friend Lord Redesdale, the then landowner, suggested its suitability as a military Training Area. Despite the area's violent history and continued use as a live-firing range, OTA is incredibly important for wildlife and conservation, home to both nationally and internationally important plants and animals.

The Revitalising Redesdale project area extends from the source of the River Rede to just above the confluence with the North Tyne. It includes the tributary streams within the Training Area; Cottonshope, Bellshiel, Sills, Durtrees, Otter and Elsdon Burns. Within this catchment there is a mosaic of priority habitats including blanket bog, wet heath, upland hay meadows and areas of semi-natural woodland.

An array of work is currently underway that will improve water quality, restore peatland, enhance upland wildflower meadows and restore connectivity of habitats throughout the area. Peatland restoration is taking place in the upper reaches of several catchments including Bellshiel and Durtrees Burn and includes grip blocking (covering areas of bare peat with a mulch of cut moorland vegetation which prevents erosion and encourages the growth of new vegetation) and the removal of self-seeded non-native conifer trees. This grip blocking will help to restore natural drainage patterns and will

Bog cranberry © Jennifer Care NWT

encourage characteristic peatland vegetation to re-establish. When it rains, water will be held for a longer period in the uplands, reducing the velocity of the water travelling through the catchment, therefore also reducing erosion of the peat and in turn, leading to a decrease in the amount of sediment entering the water courses.

This work may also contribute to reducing flood risk further downstream during heavy rain events. In addition, these improvements remove the artificial drainage channels created decades ago, re-wetting the peat and restoring the natural integrity of the peatlands. This will capture and store carbon, something which is essential to tackling climate change as drained peatlands are responsible for some emission of greenhouse gases into the atmosphere. Further work to improve water quality has included planting trees on river banks as well as fencing off sections of river bank to prevent cattle from entering the water. This reduces damage to the river banks leading to decreased levels of silt in the water course.

The Revitalising Redesdale project is also working in partnership with the EA who are investigating the feasibility of re-introducing the endangered freshwater pearl mussel to watercourses within the Redesdale catchment. Pearl mussels are filter feeders, requiring clean rivers. The River Rede is one of the few rivers in England where they remain. The concern is that the population is comprised of older individuals which are no longer reproducing, however a captive breeding programme has been successful at Kielder Hatchery. It is anticipated that the work to reduce sediment entering the watercourses may help to improve water conditions, thus allowing the re-introduction of the freshwater pearl mussel to the River Rede.

This part of Northumberland is also one of the last strongholds of upland hay meadows. Another aim of the project is to increase the floral diversity and improve the sward of upland hay meadows that are requiring enhancement. This can be achieved by cutting and collecting 'green hay',

Volunteers at the World War One practice trench system, Silloans © Phil Ambramson

which acts as a seed source from species-rich meadows. This can then be transported and spread on meadows that are less species-rich. Working in partnership with the local community, including farmers and Groundwork North East, selected seeds are collected, cultivated and replanted as plug plants.

The programme of habitat improvements is being integrated with the restoration of archaeological sites, celebrating the OTA's military heritage through heritage events and improvements to public access. Conservation work has been undertaken at Burdhopecrag Roman Camp and the World War One practice trenches at Silloans, both scheduled monuments which were being negatively affected by erosion from a landslip as well as being damaged by sheep. There has also been a major programme of conservation applied to all of the historic military bunkers within the project catchment area.

In August 2019, 25 local volunteers working alongside several military veterans took part in archaeological investigations at Bellshiel Rigg, directed by Wessex Archaeology. The participants learnt archaeological skills in geophysical survey, metric survey and osteology over the course of the two weeks, as well as developing their digging technique through coaching from Wessex Archaeology staff. A second excavation was undertaken at Todlaw in September 2020, which included Wounded, Injured and Sick veterans under the Operation Nightingale initiative, working alongside local volunteers.

Improvements to waymarking of permissive footpaths and the installation of interpretation panels are planned. This work will be focused on the southern part of the Training Area, providing safe access to the public.

The MOD has been a vital partner to the Revitalising Redesdale project providing essential match funding through Conservation Stewardship Funding (CSF). Most of this work has been carried out by Landmarc Support Services and managed by the Defence Infrastructure Organisation (DIO), with some work also being conducted by tenant farmers.

It is hoped that through this extensive partnership project, the area's rich natural and historic heritage will be both better protected and understood, in order for future generations to continue to enjoy the special character of Redesdale.

Karen Collins[1], Moira Owen[2] & Karen Fisher[3]
Heritage and Engagement Officer[1] & Ecologists[2,3]
Revitalising Redesdale Landscape Partnership[1] & DIO[2,3]

Ensuring sustainability of water resources for British Forces Cyprus

Dhekelia Reverse Osmosis Plant and Photovoltaic Park © ISP

Background
The Defence Infrastructure Organisation (DIO) Cyprus has set one of its primary objectives, through close collaboration with British Forces Cyprus (BFC) and Infrastructure Support Provider (ISP), to transform the management of the Ministry of Defence (MOD) private water resources and become a sustainable utilities supplier.

The MOD private water resources across the Sovereign Base Areas (SBA), British Retained Sites (BRS) and BFC (Episkopi, Akrotiri, Dhekelia, Ayios Nikolaos, BRS Nicosia, Troodos and Mt Olympus) include:

- Kissoussa Spring: this is the main water resource of the Western Sovereign Base Area (WSBA – Episkopi and Akrotiri) located approximately 24km north-east of Episkopi Garrison, with an average and maximum yield of 600,000m^3 and 800,000m^3 annually, respectively
- Symvoulos Reservoir: storage capacity of 1,075,000m^3, located at Episkopi Garrison
- Boreholes (production and monitoring): there are approximately 35 MOD production boreholes scattered across the SBA
- Reverse Osmosis plants: there are two Reverse Osmosis plants at the Eastern Sovereign Base Area (ESBA – Dhekelia and Ayios Nikolaos)

To achieve sustainability in water supply within the BFC, a number of actions have been implemented.

Reducing the carbon footprint
The two Reverse Osmosis plants installed at Dhekelia and Ayios Nikolaos have recently been renovated to enhance the water self-sufficiency of the BFC through a number of initiatives including Energy Recovery Systems (ERS), enhancements to telemetry-based monitoring system and the addition of Photovoltaics.

The Photovoltaics Park, installed two years ago at Dhekelia Garrison, can sustain the operation of the Reverse Osmosis plant. The electricity produced during the day fully meets the electricity demand required for the whole operation (abstraction of the sea water, treatment using the Reverse Osmosis plants incorporating ERS and pumping to the high-level reservoirs at Pyla Tanks. The treated water is then distributed to the station by gravity).

Therefore, by taking advantage of the solar power during the day, the carbon footprint from a predominantly fossil fuel sourced Republic of Cyprus (RoC) energy system is minimised. An additional Photovoltaics Park will shortly be installed at Ayios Nikolaos Reverse Osmosis plant to further reduce the power demand from the Electricity Authority Cyprus' (EAC) grid.

Construction of the Symvoulos Reservoir at Episkopi
The Symvoulos Reservoir commissioned in 2001 has increased the resilience of water storage, with a capacity of 1,075,000m^3. It is designed to collect any excess water produced from Kissousa Spring during the rainy season, including any precipitation from the surrounding catchment area (17.4km^2). It also provides strategic reserves for the WSBA and contributes to the sustainability of the region's flora and fauna. This is demonstrated by the regular number of nesting birds in the vicinity and healthy fish stocks permitting licensed fishing activities. Furthermore, the Symvoulos Reservoir, under overflowing conditions, provides artificial recharge to Happy Valley sports pitches and protects the aquifer from saline intrusion.

Use of treated effluent for irrigation
Wastewater effluent is used to minimise the use of drinking water to irrigate common areas. DIO has incorporated the use of the treated effluent into the water balance equation. All sewage treatment plants within the BFC are designed to produce tertiary effluent of a quality sufficient to irrigate areas of amenities, such as sport fields.

Borehole protection zones
To sustain groundwater quality from an increase in nitrate and nitrite levels, due to intense agricultural

activities from farmers, protection zones around each MOD production borehole have been demarcated and the guide to good agricultural practices has been enforced.

In addition, to sustain and prolong the life of the Paramali Aquifer from saline intrusion due to over-abstraction, a safe cumulative yield of the Aquifer has been calculated using transient modelling (FEEFLOW). The model has been developed and implemented following the collection and close monitoring of massive groundwater data from nested piezometers.

Reducing household water usage
DIO in cooperation with the RoC, continues to promote water conservation by issuing leaflets and broadcasting relevant messages. In addition, DIO in cooperation with ISP, provides regular educational forums to school children and hosts visits to the BFC water sources where the importance of water saving measures are emphasised. Furthermore, the SBA has enacted the same control regulations which are applicable within the RoC such as a general hosepipe ban for the cleaning of verandas, pavements and washing cars.

Reducing leakage from the water distribution network
An ambitious target has been set to reduce water leakages below 10%. Monitoring water leakages 24/7 via a telemetry system enables immediate identification and subsequent repair. Additionally, 521STRE (Water Development) and 506STRE (Water Infra) undertake regular systematic leakage studies of each Station/ Garrison within the BFC as part of their training.

Reducing water mains failures
Life Cycle Replacement (LCR) as a result of condition monitoring ensures replacement of all heavily corroded/ delaminated steel pipelines, generally installed in the 1950s, with appropriate pipelines made from High Density Polyethylene (HDPE) and polyurethane (PUR). All asbestos coated pipelines are also being replaced through LCR with appropriate materials to sustain the pressure and flow, as required by prescribed standards.

Monitoring water quality
To monitor the water quality distributed to consumers, thorough and systematic sampling and testing is carried out by an accredited laboratory. The water is tested chemically and bacteriologically, and the results are analysed to identify trends. Furthermore, the water quality (free residual chlorine, TDS and pH) supplied to the end users is continuously monitored 24/7 via a telemetry system, where any pollution incident is promptly identified with appropriate action taken to protect the public health of the consumer. Notwithstanding these points, all water treatment plants have an on-site laboratory, where sampling and on-site tests are carried out by suitably trained personnel employed by the ISP Contractor.

Implementing niche environmentally friendly technologies
DIO in liaison with ISP has recently utilised a Horizontal Directional Drilling (HDD) technology to install approximately 530m of HDPE pipeline, outer diameter 315mm via a bore of 450mm, through an Environmentally Protected Zone (Natura 2000/Special Conservation Area). This environmentally friendly methodology was used to minimise the environmental impact to habitats. Further information for the project can be found in *Sanctuary* 48, 2019.

Conclusions
DIO Cyprus, through collaboration and cooperation with the ISP and the RoC has developed and now maintains an end to end water system. This includes; production, operation, treatment and distribution to point of use, including disposal and reuse of the treated wastewater. It operates in a sustainable manner, assures strategic reserves and enables a high degree of self-sufficiency over a specified period. The MOD private system can also be supplemented (subject to water availability) from the Republic's distribution network.

However, there is always room for continuous improvement by implementing an enhanced Water Resources Management Plan which focuses on sustainability issues. Water Supply Sustainability is achieved by supplying adequate 'wholesome' water, not only to meet current needs, but to develop long-term resilience that will meet future demands across BFC/SBAs. Consequently, further sustained investment is essential for the maintenance and improvement of the water infrastructure across SBAs/ BFC.

Eur Ing Panayiotis Pashas[1] & Lt Col Anthony Hastings[2]
DIO Cyprus Chief Engineer/Technical Manager[1] & DIO Cyprus SO1 Hd Plans, Performance & Risk[2]
Defence Infrastructure Organisation[1, 2]

Waste water treatment plant © ISP

Combatting rabbits to reduce Porton Down's Heritage At Risk

Recent works to a long barrow including rabbit netting © Guy Salkeld

The Defence Science and Technology Laboratory (Dstl) is a Government agency applying Science and Technology to the defence and security of the UK. The site at Porton Down, Wiltshire is famous for its role in the development of chemical and biological warfare agents. Porton Down's origins can be traced to April 1915 when Germany released chlorine gas against the Ypres Salient. The attack was successful but not followed through, mainly due to a lack of confidence in the new weapon beforehand. The British decided to develop a similar capability and land at Porton Down was secured for development and testing.

A set of gas testing trenches, comprising concentric circles with mean diameters of 182m and 364m, were laid out in 1916. Gas could be released from the inner trench and sampled on the outer one, regardless of wind direction. After a short period of use these were deliberately backfilled, although their remains have been designated as a nationally important archaeological monument.

The archaeology of Porton Down extends far beyond World War One however. The area shares the densely packed and closely-studied archaeological landscapes of the Stonehenge World Heritage Site, Salisbury Plain Training Area (SPTA) and the area around Boscombe Down to the north-west. From its early inception Porton Down has fired the archaeological imagination. J. F. S. 'Marcus' Stone, a chemist who joined the Chemical Warfare Experimental Station in 1925, revealed many archaeological sites at Porton Down and designed the 'no dig' star which is still seen across the Ministry of Defence (MOD) estate today.

David Ride, who joined as a meteorologist in 1962, was equally smitten and ended up publishing a superb archaeological guide in 2006 after a long career of conservation interest. More recent excavations have suggested near identical burial arrangements over 4,500 years ago on Porton Down and at Barrow Clump on SPTA, giving an insight into the Bronze Age people who lived, worked, and travelled across this part of Wiltshire.

Porton Down's rare chalk grassland gives a wonderfully authentic landscape setting to its extensive prehistoric burial mounds, boundaries and flint mines. Rabbit grazing is an essential component in the maintenance of the ecologically rich sward, but their burrowing has proven damaging to the archaeology over the years. Of the 34 scheduled monuments at Porton Down, as of 2014 there were 16 monuments on Historic England's Heritage At Risk Register with a further seven monuments potentially at risk due to decline. The prime cause of damage was rabbit burrowing, although scrub and tree cover and other animal damage factors were also present. MOD is mandated to reduce Heritage At Risk through its environmental stewardship responsibilities and so something had to be done.

Dstl worked closely with Defence Infrastructure Organisation (DIO) and Historic England to improve the monuments. Dstl's Charlie Hobbs in particular implemented effective and imaginative strategies to clear scrub and tree cover to prevent further decline. A major campaign of works began in 2016 and geophysical surveys were commissioned, under Historic England licence, prior to meshing with a strong material to prevent rabbit burrowing. Results have been spectacular and there are now only four monuments at risk, with plans underway to improve one which is suffering extensive badger damage.

The remaining monuments at risk are situated in a highly sensitive area where access and maintenance are virtually impossible due to the nature of operations. Historic England are developing policies for sites such as these, and others suffering in circumstances such as coastal erosion. One of the monuments is the remains of the gas testing trenches and their presence is a direct link to the origins of Porton Down itself. In addition, their scheduled status captures the national historic significance of the place. In a strange quirk of environmental stewardship, the continuum of military use that commenced with the trenches has also now placed them beyond mitigation and so, for the foreseeable future, they will stay at risk.

Guy Salkeld
Archaeologist
Defence Infrastructure Organisation

Green action in Africa – why volunteering benefits the MOD

A cheetah in the Namib desert sunrise, Kanaan © J. Lindley

Sqn Ldr Jayne Lindley welcomed in the Year of Green Action (YoGA) beside a camp fire under the starlit night of the Namib Desert. The 2019 YoGA initiative was a yearlong drive to encourage people to become involved in projects that improve the environment. Jayne was volunteering to support conservation in Namibia, south-west Africa, which is home to 25% of the world's cheetah population. In Namibia, 90% of cheetahs live in the wild and all are under threat.

This provided Jayne with an opportunity to learn about wildlife conservation and human-animal conflict resolution in one of the most beautiful, but challenging terrains in the world. The landscape ranged from the lush scrubland in the north, to the rocky canyon leopard territory of Neuras, and the research station of Kanaan, based in the desert with a focus on cheetahs, brown hyaenas and black-backed jackal.

The Naankuse Foundation charity pioneers conservation through innovation, to preserve the landscapes, culture and wildlife of Namibia. It offers volunteers the opportunity to aid rehabilitation and release injured or orphaned wildlife back into the wild. Naankuse embraces technology including radio telemetry and footprint identification to educate about wild animal behaviours. It works in partnership with farmers who perceive (often wrongly) that wild leopards, cheetahs and hyaenas are a threat to their livelihood.

Innovation and sustainability were in evidence, with solar and wind powered water holes providing a lifeline. Recycled water from luxury lodges was used to irrigate the Queen's Commonwealth Canopy Project, designed to help the indigenous San people of Neuras grow staple crops. Slipping in someone else's waste water whilst watering fruit saplings was not Jayne's finest hour and it certainly redefined the phrase 'mucking in'!

Jayne and the other volunteers mucked out, scrubbed, tracked, gutted (chickens), fed, walked (cheetahs and baboons), patrolled (anti-poaching), bottle fed (orphaned baboon), health-checked, created (enrichment activity), counted (game), dug, built and fixed. Volunteers also braided reclaimed wire to replace existing impenetrable fences.

Bottle feeding an orphaned baby rhino in early 2019 and seeing her released onto the reserve 12 months later, was a moving experience. Other work included hiking in leopard country through dry river bed canyons to check camera traps and discovering a healthy male leopard had passed by the camera trap just two hours before.

In addition to the voluntary work, no visit would be complete without hiking barefoot up the second largest sand dune in the world, at sunrise in the Namib desert. Seeing the dry season give way to an abundance of flowers and butterflies almost overnight after lightning storms, was breathtaking.

Why should Ministry of Defence (MOD) staff volunteer?
The volunteers on Jayne's trip were of all ages and from different backgrounds, and all desired to make a difference.

The benefits of volunteering to the MOD includes physical and mental well-being for employees, particularly through engaging and connecting with nature. Volunteers gain confidence and learn new skills; some pass on knowledge through mentoring others, all of which aids personal development and effectiveness in and out of the workplace. An organisation that values volunteering and promotes sustainability will enhance the reputation and attractiveness of the organisation as an employer of choice.

The MOD is steward to a diverse range of green spaces, yielding opportunities for RAF Units to create innovative and diverse volunteering opportunities. Communities of interest are growing, and the RAF has launched the ASTRA Green network of ambassadors, a band of volunteers passionate about contributing to the MOD's sustainability targets.

Whilst 2019 was the YoGA, its legacy endures. Sqn Ldr Lindley ended the year as she began and once again answered the call of the wild to return to Africa in December 2019.

Sqn Ldr Jayne Lindley
SO2 A4 Commodities
Air Command, RAF

Community engagement on the Northern Ireland Training Estate

Camphill residents and staff with Adam Mantell and Maj Canniford © MOD

Community outreach in Northern Ireland saw a very busy year in 2020, with some very exciting projects happening. The team worked on three conservation projects and one particularly exciting project providing land to the Gaelic Athletics Association (GAA) at Ballykinlar, a historic example of the benefits from the Peace Process.

The Camphill Community

The Camphill Community Mourne Grange supports independent living for people with disabilities and involves tenants in many activities. Woodworking is one of the many crafts available. Ballykinler Training Centre is home to pine marten and apart from simply having these beautiful animals on-site, the team wants to encourage pine marten to help the population of red squirrels. Pine marten are highly effective predators of the non-native grey squirrels and reduce the chances of red squirrels succumbing to disease spread by the grey squirrels. Mourne Grange make pine marten boxes and other types of boxes for birds and invertebrates too. These simple measures directly support the All-Ireland Pollinator Plan and Buglife's B-Lines initiative, which aim to improve habitat for pollinators across the Northern Irish landscape.

Seed harvesting smooth cat's-ear

True Harvest Seeds is a local plant charity. They collect seeds from plants growing in the wild and preserve them in special conditions to make them available for conservation projects.

Magilligan Training Centre is the last known place in Ireland for smooth cat's-ear. Formerly a plant of cornfields, it is adapted to disturbed dry sandy ground and will not tolerate competition with other plants. At Magilligan Training Centre it is still found in a few places where wind blows the loose sand from hollows in the dunes. The area that the plant occupies has always been small and monitoring shows the abundance of the plant is declining rapidly.

The team worked with True Harvest Seeds to collect seeds from this protected plant under licence. Several other measures are also planned:

- To collect more seed
- To grow more seed in controlled conditions
- To create new habitat suitable for the plant at Magilligan, by artificially disturbing the sandy ground

Local groups visit Training Centres

The Northern Ireland Fungus Group visited Ballykinler in September 2019. Many fungi are good indicators of the quality of grassland, and the site had not been surveyed for a long time. The team were keen to find out what fungal treasures were hidden there.

One of the more surprising finds was an earpick fungus, a very unusual species which grows on buried pinecones. The stem of the fungus grows down one side of the cap rather than the centre, and it has spines rather than gills. There are very few previous records of this fungus from Northern Ireland. A number of other good grassland indicator species were also found, including a number of waxcap species.

An Ulster Wildlife members' day walk was held at Magilligan in June, allowing people to experience the wildlife that the Training Centre has to offer. A tour of the dune slacks was given to 20 people. Slacks are continually damp, low-lying areas in dunes with a unique flora and fauna. Late June is a fantastic time to visit when they are carpeted with beautiful wild flowers. Many orchids, helleborines and the very rare round-leaved wintergreen in full flower, were seen. Members also saw caterpillars and the candy-floss webs of the rare small eggar moth.

Adam Mantell
Conservation Officer
Ulster Wildlife

Round-leaved wintergreen © Gary Gray

Down GAA Training Centre of Excellence

There is great excitement building within Down GAA as they await a decision from the Planning Authorities on the proposed new centre of training excellence at Ballykinlar.

This is a project that has captured the imagination of people not just within Down GAA but in the wider community. A partnership between the GAA and the Ministry of Defence (MOD) in the development of this site shows the positivity and new spirit that exists across wider civic society.

Artist's impression of the project © McGurk Architects

The potential of a partnership was first mooted back in 1994, four years before the Belfast Agreement was signed, but whilst sport was alert and willing to engage across boundaries, wider society was just considering the options for a new future.

Fast forward to 2016, and through good community outreach by Maj Canniford, the Senior Training Safety Officer and Head of Establishment for the Defence Training Estate in NI, the potential for a partnership was back on the table.

The proposed development and leasing of lands was endorsed by the GAA at national level (Croke Park) – and during a historic meeting of Down GAA, the 47 Clubs of Down gave their support to the Down GAA Board to continue the work to bring the project to fruition.

The agreement between the GAA and the MOD is a wonderful example of how a positive story can arise from the Peace Process. It also highlights the importance of sport as one of the many pillars of engagement and inclusivity that is supported by people across the Island and beyond.

The development will see Down GAA and future generations have, for the first time, a training base that they can call 'Home'. It will cater for the whole GAA family and all of its sports: Gaelic Football, Hurling, Handball, Camogie and Ladies Football, with four full size pitches, changing facilities, an indoor arena, fitness suites, meeting rooms, catering facilities and spectator facilities.

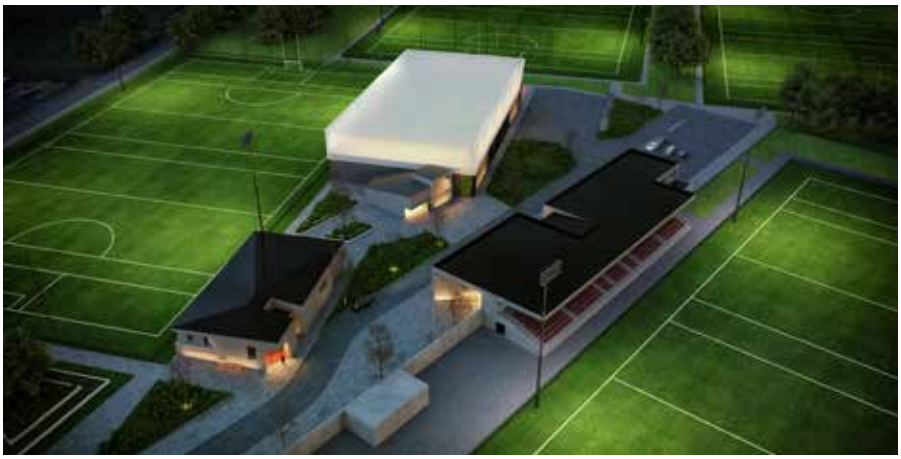
There will also be an outreach benefit for the local community with the opportunity for residents of the area to avail of the fitness suites, together with educational and personal development opportunities – all on-site.

Given the shared history of the site, there will also be an interpretive centre and museum which will reflect the history of this island and Europe in the early 20th century, giving a passing-nod to the role played by Ballykinlar Camp in that period.

Down GAA will house their archive materials and, in partnership with Down Museum, artefacts from World War One training trenches at Ballykinlar, together with exhibits from the internment camp. It will be tailored to the local area, capturing, amongst other things, the role of prominent families at home as well as those who left to go abroad, politicians over centuries and general local history. It will also serve as a central node for GAA, including the history of the various sports.

A project board has been established under the Chairpersonship of Mr Feargal McCormack, a past President of the Chartered Accountants of Ireland, to ensure that we can deliver the project, one that will see an investment of around £8M in the local economy.

The project will be the first significant and exciting development in the area for many years and should provide a variety of meaningful economic and employment opportunities for the local community.



Artist's impression of the pitches at completion of the project © McGurk Architects

Maj Tony Canniford
Commandant and Senior Training Safety Officer NI
Defence Training Estate Northern Ireland

West Moors – food waste and battery recycling schemes

Staff using the battery recycling box © Crown


Staff using the food waste caddy © Crown

Logistics Delivery Operating Centre West Moors is a 533 acre bulk fuel depot situated in the heart of Dorset's heathland. It was used by the Americans during World War Two and handed over to the Ministry of Defence (MOD) shortly after.

Over 70% of the site is designated as a Site of Special Scientific Interest. The site also has a number of other conservation designations for its rare plants, birds, butterflies and dragonflies. Bulk fuel is distributed from the site by tankers and also in jerry cans. Around 50 staff work on the site covering multiple roles within the fuels business.

Seeing an opportunity to increase recycling on the site in line with the Greening Government Commitments, food waste recycling was introduced in 2019. Originally this was run as a three month trial in partnership with ESS who are the waste management contractors for the site. Food waste was already being collected from the main canteen, but individual staff rest rooms which are used for the preparation and consumption of food were neglected. Food caddies were put in three rest rooms as a trial. They were placed in the Headquarters, the fuel depot rest room and one was given to the Dorset and Wiltshire Fire and Rescue Service, who run a training facility from the site.

An email was distributed to all staff and posters were placed in prominent places promoting the food waste recycling, detailing what can and cannot go in the caddies. All Defence Equipment & Support staff and lodgers got on board and made an effort to use the caddies.

Now the food waste produced on-site is bulked up with the kitchen waste and collected by Biffa. Its final destination is an Anaerobic Digester (AD) operated by Eco Sustainable Solutions based in Dorset. This has two benefits as the site has not only redirected this waste from landfill, but also reduced the carbon footprint of the onward recycling.

The resultant products of the Anaerobic Digestion process are an agricultural fertiliser and a methane gas produced during the process. As well as being used to power the AD plant itself, the methane gas is sent to the grid as renewable energy. According to the Defra Waste Hierarchy paper, AD is currently the most environmentally friendly way to recycle food waste. In the future the site will roll out two more caddies to the site's NHS lodgers and to one other staff room.

As well as food waste recycling, West Moors has also introduced battery recycling. Through a local organisation called Valpak, the site was able to obtain a battery recycling box which is situated in the MOD Guard Service control room.

The box was filled and emptied within the first month of it being on-site. It turns out that the on-site Petroleum Laboratory equipment uses quite a lot of batteries and, not wanting to put them in the general waste bins, the staff had collected a huge tub full. The battery box and the collection is free so it was an opportunity not to be missed. The Environmental Protection Officer and the Guards monitor the box and arrange for it to be collected when required.

All MOD staff on-site have embraced the changes to the way they dispose of their waste. As well as reducing the amount of waste the site sends to landfill, it also raises awareness on-site and shows visitors how seriously West Moors take their environmental awareness and responsibilities.

Claire Cowdrey
Environmental Protection Officer
Defence Equipment & Support


A food waste caddy in the staff room © Crown

Lifting the COVID-19 gloom – **bringing Chicksands' lost garden into bloom**

Raised rose beds by the shed © WO2 John Wignall

Chicksands Camp is home to a Grade II listed walled garden. In November 2019, volunteers from the Chicksands Conservation Group organised a community-led restoration with the intent of transforming the abandoned and unproductive land into a buzzing community asset. This was symbolic of a community pulling together through the COVID-19 lockdown.

The garden had not been formally worked this century and while the listed infrastructure was in good condition, the function of the garden was all but derelict and wild. Members of the community were unaware that it existed or believed it to be out of bounds.

Since the inception of the project, it was clear that the aims could only be realised with a workforce of enthusiastic and dedicated volunteers. To overcome the significant knowledge gaps in the project team, Capt Gosling and WO2 Wignall hosted surveying visits from the Defence Infrastructure Organisation (DIO), Greensands County Landscape Partnership (GCLP), The Tree Registry, Bedfordshire Flora Society, Warden Vineyard, Orchards East and Central Bedfordshire Council. These visits provided invaluable input from a variety of experts and assisted in creating a more coherent plan.

Volunteer groups were formed, and the initial hard labour cleared the debris. In addition, social media platforms were used to increase understanding of the heritage and ecological value of the walled garden and to invite residents to use it as a well-being space.

Central to the project was Chicksands resident Annie Stables. Annie displayed a knack for discovering useful skills that people could share with the project and empowered people to run their own micro projects, enhancing the overall effort. The re-established memorial, fountain and medieval beds are all testament to her dedication.

Hundreds of plants were germinated and propagated from garden specimens and old stores of seeds discovered in the sheds. These were made available for families to grow in their own homes. As the garden grew in beauty, the project gained momentum and more people offered to help, increasing the footfall. The lack of any formal budget drove innovation and recycling from around the site and was intrinsic to its success. Old railway sleepers from the range provided the framework for new allotment plots, unused sand and pebbles provided the basis for the wildlife pond and a composting system was introduced to recycle the green waste generated.

The garden has returned to its origins, producing food on an impressive scale. Residents can now harvest the bumper crop of apples, pears, blackcurrants, berries and plums. This summer offered the community crops of tomatoes, radishes, cucumbers and squashes. Pumpkins were available for Halloween celebrations and a variety of herbs are now always at hand. This was particularly well received during the lockdown as many residents were unable to find fresh herbs in the supermarkets. Thanks to another resident, Katie Greenwood, there is even the optimism of producing wine.

This project showcases the dedicated care for heritage assets on the Ministry of Defence estate and is likely to generate interest with the wider community. The planned introduction of wildflower areas within and outside of the walled gardens will enable Chicksands to establish itself within England's B-Lines network.

Ongoing works continue to enhance this now beautiful facility; money is being pursued outside of the Defence budget to maintain the greenhouse and attempts at funding for a permanent gardener's position are underway. It is remarkable how much has been achieved with so little money and how much can be accomplished by a motivated community.

WO2 John Wignall
Regimental Quarter Master Sergeant
Defence Intelligence Training Group

Cyprus to Madagascar – Eleonora's falcon, a fly and forage migrant

Eleonora's falcon flying across Episkopi cliffs © Thomas Hadjikyriakou

Migration is part of the annual cycle of many bird species. The driving force is the exploitation of food resource fluctuations at certain times of year, avoiding resource depletion. Despite our understanding of the principal factors that shape bird migration strategies, there is unexplored ground regarding the role of habitat in shaping migration routes and schedules. This study used solar powered GPS transmitters, obtaining high accuracy data, to monitor the migratory movements of Eleonora's falcon *Falco eleonorae* breeding in Cyprus, examining the relationship between migration speed and vegetative cover. The high accuracy transmitters identified the extent that migratory routes of Eleonora's falcon target favoured habitats with rich vegetation for stopovers and for refueling, using a fly and forage strategy.

Eleonora's falcon is a complete, long-distance, trans-equatorial migrant species. Its breeding population spreads from Cyprus in the east, westwards along the Mediterranean Sea, the Atlantic coast of Morocco and the Canary Islands. Almost the entire population overwinters on the island of Madagascar. The species has evolved to take advantage of unique breeding and wintering niches in the Mediterranean and Madagascar respectively, utilising abundant resources and avoiding interspecific competition. Eleonora's falcon feeds predominantly on insects, though during the breeding season it feeds primarily on migrating birds. The delayed breeding period of Eleonora's falcon coincides with the peak of autumn bird migration passage, with falcons catching migrant birds on the wing in order to feed themselves and their nestlings during the offspring rearing period.

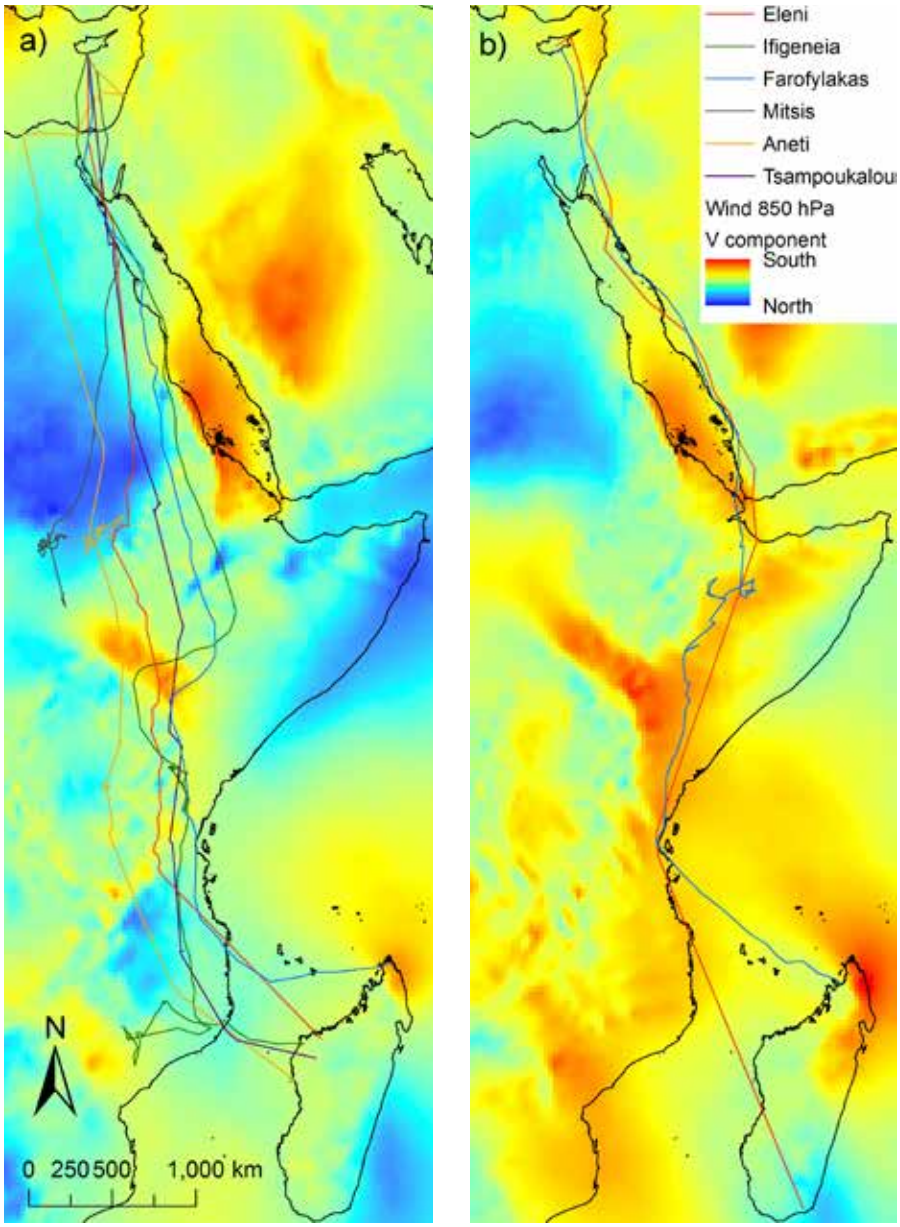
Cyprus hosts around 138 pairs of Eleonora's falcon nesting on the south coast of the island, from Cape Gata on the Akrotiri Peninsula in the east, to Cape Aspro in the west. GPS telemetry technology providing high spatial and temporal detail was used between 2013 – 2017 to monitor the year round movements of Eleonora's falcons originating from Cyprus.

Eleonora's falcon perching at Akrotiri cliffs © Thomas Hadjikyriakou

The study identified an active selection of vegetation-rich areas used by the tagged individuals, in combination with reduced migration speeds there, allowing the migrating falcons to combine migration during the day with fly and forage refueling. Birds roosted during most nights, combining refueling stopovers at selected vegetation-rich areas before or after crossing ecological barriers. Conversely, both during day and night, tagged individuals overflew unsuitable habitats more quickly. The results suggest that habitat is an important factor in Eleonora's falcon migratory strategies, and that landscape characteristics are guiding the routes and the migration speed. Individuals are behaving as 'sprinting migrants' when feeding opportunities are lacking, such as over the Sahara Desert. Characteristically, the remarkable non-stop flight by one individual for 3,530km in 85 hours, a first such record for Eleonora's falcon and one of the longest trips recorded for any species, indicates the capacity of Eleonora's falcon to travel extensive distances, over sea and other ecological barriers, such as deserts, without refueling.

Tagged individuals repeatedly exhibited an anti-clockwise loop migration pattern, with spring routes being more easterly than autumn ones. This is most likely attributed to habitat availability and the need for refueling, yet the effect of wind cannot be overlooked. Northerly tailwinds appear to aid the southbound Sahara crossing. Conversely, in spring, prevailing winds might contribute to the eastwards shift towards Ethiopia and Somalia. This anti-clockwise pattern is contrary to the overall trend in many species, where autumn migratory routes are more eastern than spring ones in the Palearctic. Furthermore, the relatively small latitudinal temporal differences between consecutive trips and the moderately narrow migration corridors between consecutive routes, suggest individual repeatability. As soon as migrants establish an optimal route and survive, they remember and copy it for consecutive years, enhancing migration success.

Multi-year monitoring provides us with a greater understanding of migration cycles and this four year study is the longest telemetry study on Eleonora's falcon thus far. Apart from duration, this study is the first to use GPS-GSM loggers on Eleonora's falcon, providing opportunities for more detailed information on migratory routes, and also allowing for more accurate explanations of bird migratory strategy in relation to wind, vegetative cover and feeding opportunities.



Migratory routes of Eleonora's falcon between Madagascar and Cyprus during (left) autumn and (right) spring, overlaid on to the respective monthly north-south winds. Line colours represent the different tagged individuals © Thomas Hadjikyriakou

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Biological recording – how to make good use of your wildlife sightings

Biological recording in action in Anglesey, as part of the UKCEH's research © Daniel Hauck, UKCEH

Many people enjoy observing the varied and often very special wildlife that can be found across the Ministry of Defence (MOD) estate. These sightings can be turned into biological records, which can subsequently identify how well wildlife is doing on the MOD estate and beyond. So, how does a wildlife sighting become a biological record?

The four Ws

All that is required is to note down some details of your observations. The required details are sometimes referred to as the 'four Ws' – **w**hat (species has been seen), **w**here (was it seen), **w**hen (was it seen) and **w**ho (saw and identified it). Other information may also be useful, especially for the rarer and more unusual sightings, such as habitat and behaviour details for the species in question.

Making records available

The record then needs to be made available so that it can be used. There are many ways to do this. One option is to add the record to the iRecord website or app, maintained by the UK Centre for Ecology and Hydrology (UKCEH) Biological Records Centre (BRC). Wildlife records added to iRecord become immediately available to national wildlife recording schemes and local environmental records centres, and are subsequently shared via the National Biodiversity Network Atlas. This means that individual wildlife records have the potential to be used many times, for example to help monitor changes in our wildlife, to guide land management, to help protect wildlife sites and to contribute to national and international biodiversity research.

For records to be of benefit in all these different contexts, it is essential that they are as accurate as possible. A really important part of the iRecord system is that it brings wildlife records together so that they can be checked and verified by volunteer experts working on behalf of the national recording schemes. This allows potential errors to be corrected, and provides an opportunity for verifiers to give feedback to new recorders and help them develop their skills.

By creating records of the wildlife you see, you can make a valuable contribution to biological recording. You can take this interest further by getting involved with more systematic wildlife surveys, such as those supported by the UK monitoring schemes for birds, butterflies, mammals, plants and pollinators. Some of these also make use of iRecord, or they may have their own systems for collating and sharing the information that is gathered.

Putting records to work

BRC works closely with the national recording and monitoring schemes to help analyse biological records. Working with partners, BRC carries out research on species distribution and change, and on how this links to other environmental factors such as land use and climate. BRC also analyses the records to produce some of the Government's annual UK Biodiversity Indicators.

Getting involved

Many areas of the MOD estate have teams of dedicated wildlife recorders who have helped highlight the value of the habitats within these sites, and who continue to monitor the wildlife on them. iRecord has the potential to bring these records together and to share them further. For some sites it may be useful to set up an iRecord 'Activity' page to show what is being recorded and to provide feedback to the recorders.

However you choose to get involved with biological recording, your wildlife records can make a real difference and can contribute to local conservation as well as global research. Thank you to all who are already involved, and welcome to anyone who wishes to take this up!

For more information, visit the BRC website at www.brc.ac.uk/gettingstarted or iRecord can be found at www.brc.ac.uk/irecord.

Martin Harvey
Research Associate – Scientific Data Support
UKCEH Biological Records Centre

Pillboxes and pillwort

Pillwort showing a spore-bearing 'pill' and crozier (inset) © Barry Wright & Anne Carter

Whilst many Ministry of Defence (MOD) sites have pillboxes, some also have pillwort *Pilularia globulifera*, an unusual grass-like fern that is uncommon and endangered. Its favoured habitat is pond margins and it has suffered declines in recent years from both neglect and the in-filling of ponds. Neglect leads to colonisation of competing plants that choke out the pillwort.

Pillwort is unusual in that it can survive, if not thrive, in ponds that frequently dry out. This can give it a competitive edge as it can grow in places where more aquatic species that demand permanent water cover cannot.

In 1986 the Yorkshire Fern Group (YFG) of the British Pteridological Society (BPS) were asked to check historic records of pillwort at Strensall Training Area (STA). The group re-found it on a north-south oriented eastern firebreak/ track. This extensive colony was maintained favourable for pillwort by rotavating and herbicide treatment in alternate years, plus vehicle trafficking. The bare soil, with gentle undulations and seasonally wet low areas supported a pillwort colony, with a report stating it to *"extend over probably a quarter of an acre".*

The interest was re-kindled in 2016 when the YFG were again asked to survey ponds on STA. The group made contact with their new partners, the Freshwater Habitats Trust (FHT) and Anne Carter, the Northern Project Officer for their 'People, Ponds and Water' project. Pillwort was found in two out of 20 ponds mapped by FHT.

'Doli Pond' is a small and vegetated pond with some pillwort and a 'scrape' called 'Pillwort Pond' created in 2010 by the Defence Infrastructure Organisation, that spontaneously colonised shortly after construction (it is now a flagship FHT pond). The group investigated some of the other ponds on STA that did not have pillwort, but that seemed to provide suitable conditions, and set about translocations in 2018 and 2019. The ideal conditions that the group were looking for were mineral soils with gently sloping shorelines, creating a significant drawdown zone. Light animal poaching favours pillwort.

The group have succeeded in getting translocated material to overwinter in a number of ponds. The next stage is to introduce pillwort to new sites using the 'sporocarps' that the plants often produce in summer. These contain spores that split and germinate as the rains return during the autumn, producing new seedlings. This method has advantages as the sporocarps can be cleaned and dried, and no soil or water is moved from donor to receptor site (helping to ensure biosecurity).

Sporocarps turn ripe and blacken, remaining viable, if dried, for over a year. These can then even be posted to a suitable receptor site and scattered onto the water in autumn. Alternatively, they can be sown into a dish of sandy soil, covered by water and grown to transplanting size.

Other MOD sites may have pillwort, or have suitable ponds to receive it. Sites can also create new 'pillwort scrapes,' as was carried out at Foxglove Covert Nature Reserve, Catterick Garrison. Foxglove Covert already had a small colony on one 'choked' pond, but also created two new ones – Plover Pond and Spigot Mere. The material translocated to these ponds has been with good success. These are different to those on STA, as they are stream fed and have outlet sluices that can potentially be used to manage water levels.

The group currently work with the STA Conservation Group and the Foxglove Covert managers, but are aware that there must be more sites that could help conserve this rare species, and add to the MOD's reputation as key custodians of pillwort. If you are interested in getting involved please email DIO-Sanctuary@mod.gov.uk and the editors will be happy to help.

Dr Barry Wright[1] & Anne Carter[2]
Chairman[1] & North of England Project Officer[2]
Yorkshire Fern Group[1] & Freshwater Habitats Trust[2]

Ripe pill cut open to show mega and micro spores © Anne Carter

Environmental risk management in Singapore – Senoko Oil Fuel Depot

Senoko OFD from the east with Straits of Johor in the background © Rob Duke

Spring 2021 will see the completion of a seven-year, £25M programme of capital investment in the Senoko Oil Fuel Depot (OFD), Singapore. This will bring the facility up to modern standards for compliance and will significantly reduce risk to the environment. The history of Senoko OFD stretches over almost 90 years and the depot continues to play an important strategic role in the UK's contribution to Defence engagement in the Far East.

Senoko OFD opened in February 1938 and was originally one of five large oil fuel depots which were built by the Admiralty in Singapore. These depots were planned and constructed during the inter-war years as Singapore became increasingly important for the British Empire. Shortages of fuel oil supplies during the final years of World War One reinforced the need for strategic fuel storage in the Far East to meet the ever-increasing demand of a large and active Royal Navy fleet.

In 1928, Ramsay MacDonald's Government approved plans for the construction of a Naval Base in Singapore and the Admiralty awarded a contract to Sir John Jackson Ltd for £4M (£252M at 2020 values). The location for the new Naval Base at Sembawang on the Straits of Johor was at that time an uninhabited swamp on the northern coastline of Singapore Island. The contracted works included clearance of the jungle, rerouting the Sembawang river, construction of wharfs, warehouses, a vast dry dock, and an oil fuel depot comprising 39 tanks on high ground to the west of the dockyard at Senoko. When originally planned, the 100 acre Senoko OFD was the first Admiralty oil fuel depot to include individually bunded tanks.

Today Senoko OFD has reduced from 39 to 12 tanks; some of these were destroyed during the Japanese invasion of Singapore in 1942 and the subsequent Allied attacks on the dockyard, others were demolished in the post-war years due to reduced demand. The OFD is now surrounded by high rise industrial and accommodation units and, where the secondary jungle has reclaimed some areas of the depot, it plays host to a wide array of flora and fauna. The site is owned by UK Strategic Command with a small Defence Infrastructure Organisation (DIO) Regional Delivery (RD) Team responsible for operation and maintenance of the OFD.

Whilst much has changed during the first 82 years of the OFD's operation, the strategic importance of Singapore has diminished little and, since gaining independence in 1965, the republic has become a global economic powerhouse. The British military relationship with Singapore has continued to evolve since independence. Following the formation of the Five Powers Defence Arrangement (FPDA) in 1971, which comprises the UK, Australia, New Zealand, Malaysia and Singapore, the UK has retained close military ties to Singapore. The OFD supports the warships and auxiliaries of the FPDA as well as the United States Seventh (Pacific) Fleet and other Allied nations.

In common with many other areas of the Ministry of Defence (MOD) estate, Senoko OFD is a facility built at a time when environmental legislation was less stringent. This, coupled with under investment in recent decades, resulted in a facility which

had not kept pace with changes to UK regulations and had significant areas of non-compliance. The case for investment in Senoko OFD was twofold; firstly in 2013 ownership of the facility passed from the Defence Fuels Group (DFG) to the newly formed Joint Forces Command (JFC) (now UK Strategic Command) and with this transition came a fresh appreciation of risk on the estate and investment priorities. Secondly, incremental improvements in the MOD's Major Accident Control Regulations (MACR) as a result of regulatory changes to the underpinning EU directives, meant that some areas of non-compliance were now no longer deemed acceptable.

The most significant area of non-compliance centred on the permeability of the earth bunds which surround the fuel storage tanks. Whilst the design of the secondary containment was exemplary in the 1930s, the permeability of grass covered soil meant that in the event of a fuel storage tank failure, any fuel captured within the bunded area around the tanks would seep into the soil, contaminating groundwater and potentially reaching local watercourses. The bunded volume was also insufficient to meet current MACR, under which secondary containment must capture the fuel holding capacity of the tank as well as rainwater, fire-fighting water and foam, with enough freeboard to avoid over-topping the bunds. In 2013, a range of non-compliant factors at Senoko, including secondary containment, resulted in the Defence Safety Authority issuing an Improvement Notice on the site. This required JFC to deliver a number of compliance improvements to conform with MACR, or face escalation to a Prohibition Notice and risk immediate site closure.

The need to address the permeability of secondary containment bunds led to the initiation of a capital works project through DIO Major Projects and Programmes (MPP) in 2014. DIO MPP appointed Ramboll UK Ltd as the project Technical Support Provider with a brief to provide JFC with options to address the permeability of secondary containment; these ranged from the full replacement of all tanks and bunds on the site, through to more cost-effective alternatives. The agreed solution retains the original tanks in place but increases the bunded volume and fully seals the bunds. The earth profile is covered with a heavy-duty butyl liner which is welded at the seams and held in place with a layer of single sized gravel. As well as achieving compliance, the improvement works have also delivered greater automation with a system of sump fuel sensors and automatic pumps to keep the bunds free of rainwater, whilst providing an upstream indication of minor tank leaks and enabling early action to be taken.

The contract to install the new secondary containment at Senoko OFD was awarded to a UK engineering firm, Trant Engineering Ltd, in October 2018 and works have been completed to a high standard using both the contractor's in-house team and specialist Singaporean subcontractors. In contrast to the original depot construction in the 1930s (during which watercourses were diverted, swamps filled and jungle cleared) the principal contractor and their supply chain have sought to minimise the environmental impact of construction. Construction site water discharges into the main watercourses have been closely monitored by the Singaporean water authority, with tight limits on suspended solids and remote monitoring to provide alerts when out of tolerance; all discharges during construction have been well within limits. Throughout the construction phase, the contractor has worked to minimise disruption to the secondary jungle habitat and minimise environmental impact on the site.

Remote monitoring equipment © Rob Duke

In addition to the DIO MPP project to resolve the permeability of secondary containment, a number of smaller projects have also been delivered by the DIO RD (Singapore) Team. These include an automatic tank gauging system which provides real-time monitoring of fuel levels and early warning of fuel loss, and installation of automatic cut-off valves to prevent tanks from being overfilled. Collectively the site improvements at Senoko will result in a higher level of compliance and a lower risk of environmental contamination. The capital investment in improving the site is a measure of a collective commitment from the MOD to meet environmental obligations and to Defence engagement in the Far East.

Bund clearance, forming and lining around Tank 12 © Andy Leishman

Maj Rob Duke
SO2 Overseas Projects
UK Strategic Command Infrastructure

Be Seen, Be Safer – equestrian safety in a low flying area

A member of aircrew from RAF Shawbury with members of the local equestrian community © Crown

A tragic accident in 2003 resulted in the death of a horse rider, after she was thrown from a horse which had been startled by a low flying helicopter. The Ministry of Defence (MOD) subsequently worked closely with The British Horse Society (BHS) to improve equestrian safety in areas where low flying training may take place. In 2005, a joint campaign called Operation Bright Eyes was launched, which promoted the wearing of high visibility items by the equestrian community, in an effort to make both horses and riders much more visible to aircrew. This project was a great success and the work of the MOD was recognised by The BHS with a Safety Award in 2005.

When Sqn Ldr Kim Leach arrived in post as the Corporate Engagement Relations Officer at RAF Shawbury in 2013, she identified several helicopter low flying complaints from horse riders in Low Flying Area 9 (LFA9), which covers the whole of Shropshire and some areas of bordering counties.

RAF Shawbury is home to No.1 Flying Training School, which trains aircrew for the Royal Navy, British Army and the Royal Air Force. RAF Shawbury also houses the Central Flying School (Helicopter), which delivers the next generation of helicopter instructors.

Sqn Ldr Leach quickly identified that there had been little safety engagement with the equestrian community across Shropshire since the initial success of Operation Bright Eyes. To mitigate this, Sqn Ldr Leach planned a community based horse rider safety campaign called 'Be Seen, Be Safer'. Research revealed many riders were unaware of the safety benefits of high visibility clothing, and that aircrew had difficulty in detecting riders if they were not wearing high visibility items. The initial objectives of the campaign were to achieve:

- A 50% reduction in low flying complaints from horse riders in LFA9 over a five-year period
- An 80% increase of horse riders who wear high visibility clothing over the same period
- 100% of Shawbury based aircrew to be trained in actions to reduce disturbance to horse riders

The campaign was launched internally in 2014, garnering the support of aircrew through briefings and focus groups. Aircrew also delivered talks and distributed leaflets at community engagement events.

In April 2015, the campaign was officially launched at the first RAF Shawbury Rider Awareness Day, attended by local riders, The BHS Safety team, aircrew and press. The event included presentations on the benefits of high visibility clothing and distribution of clothing to local riders. However, perhaps the most important element of the event was the opportunity for attendees to take a helicopter flight. This demonstrated the challenges that aircrew face when airborne in spotting a rider without high visibility apparel.

The Rider Awareness Days have become a very successful annual event at RAF Shawbury and to date 150 people have attended. This includes representatives from The BHS, District Commissioners of local Pony Clubs, local riding and bridleway groups, Shropshire Bridleways and Carriage Drivers Group, the British Riding Club Area Safety Advisor, local livery stables, local riding schools, Riding for the Disabled Association (RDA), Shropshire Council Outdoor Partnership Team, the Shropshire Council Bridleways Officer, Walford College Equine Studies, local hunts and local riders.

The 'Be Seen, Be Safer' campaign has so far issued 4,000 items of high visibility apparel to the local equestrian community. This has included hatbands, tabards and quarter-sheets. The campaign has also been replicated by HQ Air Safety Cell along with other rotary aircraft locations including Joint Helicopter Command and RAF Benson.

Feedback for the campaign has been overwhelmingly positive, and The BHS awarded RAF Shawbury The BHS Tarquin Trophy in 2015. Sqn Ldr Leach was awarded the LG Groves Memorial Ground Safety Award the same year. In 2020 the project also received a Highly Commended Social Value, Community & Heritage Sanctuary Award.

Scott Ashworth
Access & Recreation Advisor
Defence Infrastructure Organisation

Enhanced wet grassland management at MOD Otmoor

Curlew chicks within a fenced exclosure to help reduce predation risk © RSPB – Otmoor office

Ministry of Defence (MOD) Otmoor is located 8km north-east of Oxford and lies at the centre of the Otmoor Basin, which forms a shallow floodplain of the River Ray. The site covers approximately 186ha. The land was acquired by the Royal Air Force in 1920 for use as a bombing range up until 1958. MOD Otmoor is currently used by the British Army as a Converted Gallery Range with an associated safety area.

Most of the site (approximately 157ha) is designated as a Site of Special Scientific Interest (SSSI) for its species-rich unimproved neutral meadows, extensive damp grassland, ditches and scrub hedges. These support a rich and diverse assemblage of flora and fauna such as fen violet, breeding and wintering birds and black and brown hairstreak butterflies. Most of the site is summer grazed by cattle and/or cut for hay to benefit such interests.

The water regime over Oxford Clays is a critical factor in Otmoor's history, current character, land uses and opportunities for future management. The River Ray rises rapidly after rainfall and the water regime is largely based on rainfall within the catchment and surface flow discharge to the river system. The pattern consists of winter flooding and summer flooding after storms with significant annual variation. For centuries, the Basin was managed as rough grazing marsh.

The Basin drainage has been substantially modified since the 1820s, with extensive diversions and re-shaping of the River Ray to leave old paleo-channels at Otmoor and the addition of weirs and pumps operated by the Environment Agency (EA). These works sought to improve the control of water, retain wet fences for cattle grazing and allow more productive farming. Although MOD Otmoor remained as grassland, there were resultant adverse ecological impacts.

Since the 1980s, agri-environmental schemes have sought to address such adverse impacts, notably to increase water retention into spring and early summer to provide feeding habitat for breeding waders. This was initially managed by installing flexipipe bunds in some ditches and setting grazing and hay cutting patterns. This was extended in 2000 – 2001 by the EA, with Natural England (NE), MOD and tenant farmers creating shallow scrapes and enhancement of the paleo-channels. Works were also needed to ensure the safe operation of the military range whilst protecting the SSSI interests.

From 2018, three new Countryside Stewardship Schemes covering all of the area managed by the three MOD tenant farmers have seen further enhancements for the SSSI features. These include a more robust and user friendly flexipipe system, additional shallow scrapes, light annual rotavation to enhance bare muddy edges as bird foraging habitat and continuation of beneficial cattle grazing and hay cutting.

In tandem, parties are updating the hedge management plan to allow for the continued mosaic with annual trimmed safety sight lines, dense scrubby 'hedges' for breeding turtle dove and butterflies, and occasional pollarding of big willows and retention of root systems for otter.

The MOD Conservation Group helps to guide such habitat management including via the 2020 update of the Integrated Rural Management Plan (IRMP). It is increasingly taking on board the value of semi-natural wet grassland for capturing high levels of carbon, water cycling and regulation of water flows as ecosystem services, within an increasingly urbanised catchment and context of more variation to weather patterns and climate. This links to the current public discourse of 'payments for public goods and services' and being open to ideas as to how best to adapt to such changes and opportunities for MOD Otmoor, whilst still maintaining the integrity and safe function of the military range and other land use features such as the scheduled Roman road, farming and public access.

Sarah Jupp
Ecologist
Defence Infrastructure Organisation

Behaviour change on the MOD estate

The Government published its Net Zero 2050 (NZ50) legislation in June 2019 and this is now being discussed across the Ministry of Defence (MOD). Sustainability on the MOD estate can come in a variety of forms such as design, contracts, projects, procurement and process.

It is easy to think *"well, someone else is responsible for doing that",* but everyone has a role to play in making the MOD more sustainable. The actress Lily Tomlin said, *"I wondered why somebody was not doing something about this, and then I realised I am someone."* This applies to everyone across the MOD, as regardless of experience or job, our behaviour affects the day to day management and performance of the estate, as well as sustainability.

There are plenty of little things that estate users can do, without too much effort, to make our environment greener. Often these are done daily at home and can easily be transferred to the workplace. Estate users may not consider these actions as being sustainable or making much of a difference. However, if every person on the estate took small steps, then these thousands of individual actions could start to make a big difference.

How then can the MOD ensure that the behaviours exhibited at home are transferred to the workplace? It is important that estate users realise that sustainability affects us just as much at work as it does at home, in the way we use energy, water and produce waste.

This is supported by behaviour models such as COM=B (Capability Opportunity Motivation = Behaviours), which is a proven tool in addressing change in sustainability. On the estate there is already the capability and opportunity. In addition, in this instance, we already have the behaviours too!

When it comes to motivation, the response is often *"why should I do this?"* or even *"what is in it for me?"* The answer is because it is the right thing to do. It protects resources and the environment and it also saves money that can then be spent beneficially elsewhere.

Adopting the right behaviours can make a 3 – 5% improvement on performance. In isolation this may seem small, but as a proportion against the MOD estate energy budget for example, it is a significant amount. Although the below ideas may seem obvious, it if often not the case. To give an example of such conversations:
Employee – *"I am sustainable at home, turning off the lights and recycling my rubbish. But I do not do it in the office".*
Author – *"Why not?"*
Employee – "*Well, you know…"*
Author – Silence…(because, well I do not know!)

Purely from a position of utilities, the use of energy and water and production of waste are something that all occupiers of the estate, either permanent or visiting, will utilise during their time 'inside the wire'. Everyone is therefore responsible.

So, what activities from home can you transfer into the workplace? This request should be a relatively straightforward one:

- Do not leave taps running. If there is a drip or leak, make sure to report it
- Put waste into the right bins. Make sure to segregate your waste to support recycling efforts
- Turn off lights and equipment when you have finished using it, if you are the last person to leave a room, or are going on a holiday shutdown

These are little things, and by no means the solution by themselves. However, through working together, we can all do a little extra to help. After all, someone has to do it.

Adam Spencer
Senior Sustainability Manager - Waste
Defence Infrastructure Organisation

Make sure to turn off the tap © Crown

Segregate waste to support recycling © Crown

Turn off lights and equipment after use © Crown

Reducing single-use plastics at RAF Brize Norton

Recycling from Voyager aircraft with whole force partners © RAF Brize Norton Photography Section

Single-use plastics (SUPs) are costly to the environment in terms of energy, oil and carbon footprint. They are also likely to end up in landfill or in our rivers, lakes and oceans. It is well known that they are damaging to the environment, but how many of us go out of our way to do something about it, beyond taking a reusable water bottle to work or the gym? This is not the case for Sgt Ryan Duffy, a Logistics (Movements) specialist at RAF Brize Norton, who for two years has made it his mission to reduce SUPs consumption at the Station.

As an instructor at the Defence Movements Training Squadron in early 2018, Sgt Duffy set a goal to reduce the use of SUPs by students and staff. Starting with education, awareness of the issues caused by use of SUPs soon grew and subsequently their usage dropped. The momentum gained leading to a well received squadron-wide ban on single-use coffee cups and water bottles. Buoyed by this success, Sgt Duffy pitched the idea of a wider campaign to the Station Commander, who gave his full backing for the #PlasticFreeBrize campaign. This was launched in January 2019, promoting the culture of 'reuse, reduce, recycle'.

Sgt Duffy was able to reach a much larger audience with the help of the Station media staff and other advocates. His passion and enthusiasm led to the establishment of a Station Sustainability Committee. This committee, now with over 30 whole force and cross rank/grade members, has set the conditions for a legacy of sustainability at RAF Brize Norton, with a focus to implement, champion and share initiatives. Sgt Duffy is ever present and these have included working with whole force partners on the Station, such as AirTanker and Sodexo, to change their working practices. By introducing sustainable alternatives to SUPs, they have reduced waste and increased recycling, including from long-haul Voyager passenger flights.

Whilst many small changes can aggregate to make a difference, Sgt Duffy also set about tackling a major source of personal frustration as a Logistics (Movements) specialist. Acutely aware of the landfill waste from air cargo pallet bags, he researched sustainable alternatives for the 3,000+ items disposed of per annum. Ultimately deciding on a carbon neutral, recyclable version called Polyair made predominantly from sugar cane, he was able to work with the procurement team to change the supplier. This single change, solely down to Sgt Duffy, has saved 10.5T of landfill waste and 27T of CO_2 footprint per annum, plus £4,750 in tax savings as the bags are now classed as paper and not plastic.

Further afield from RAF Brize Norton, the recycling of Costa Coffee cups on Station through 'Simply Cups' has been adopted by the Recruitment Training School at RAF Halton. This again demonstrates the breadth of exposure and impact of Sgt Duffy's work.

Already with significant sustainability achievements to his name, Sgt Duffy now has his goals set on a five-year plan to make RAF Brize Norton completely free of SUPs. This includes making the two main annual Station events, BrizeFest and Families' Day, SUPs free which would save a huge amount going to landfill.

Sgt Duffy's contribution to sustainability has been remarkable and the spectrum of his work has been key to his success. The combination of small behavioural and cultural changes with large one off projects, alongside the formation of organisational structures has been a force multiplier. It has already reaped rewards and it will continue to do for years to come.

Sqn Ldr Arnie Arnison
OC Ops Spt Sqn
No.1 Air Mobility Wing (1 AMW)

Some SUPs alternatives © RAF Brize Norton Photography Section

Tanks to the dinosaurs – conserving endangered heathland species

Marsh clubmoss © Dominic Price, SRT

Marsh clubmoss is a living relic from over 400 million years ago, when lycophytes dominated the planet. They were the first plants our vertebrate ancestors saw as they emerged from the water to colonise the land. Unlike angiosperms, they lack flowers and reproduce using spores, borne from structures called sporangia. They were the first species to start capturing carbon dioxide in industrial quantities, and as fossil evidence suggests, the first to harness the power of fungi and establish symbiotic mycorrhizal relationships. Nowadays, most lycophytes are extinct, and the remaining ones tend to occur in habitats similar to their original ones, on windswept mountain tops, damp heaths and bog edges. They do not cope well with excessive competition from vascular plants, nor with pollution or agricultural improvement to land.

Clubmoss is now confined to under 100 sites in England. In the south, it has a stronghold in the New Forest due to free-roaming herds of animals which enable the species to move around in the landscape. It thrives in periods of heavy disturbance, especially on the edge of boggy heaths, followed by a period of recovery. In ancient times this may have occurred when a herd of diplodocus, or more recently auroch, used a waterhole and then moved on to new pastures. One of the closest scenarios to this nowadays is on military training ranges, where the hooves of a dinosaur are replaced by the tracks of a challenger tank track. This, combined with the fact that military use has saved thousands of hectares of heathland from intensive agriculture and house building, means the Ministry of Defence (MOD) estate is one of the best locations to find remaining populations.

Bovington Training Area contains one of the largest clubmoss populations in England. The Species Recovery Trust (SRT) counted 19,360 plants at the last survey. The plants are all found on old tank tracks from the days when the heathland was more extensively used for training, rather than being confined to the main tracks that are used today. The depressions left by the tanks have provide a near perfect micro-habitat for the plants, knocking back heather and more aggressive grasses, and giving space for the clubmoss to develop.

The site is home to another scarce plant species, coral necklace. Named after clusters of tiny pink flowers that are strung along red stems, it also likes damp, bare areas with little competition from larger plants. It favours bare sandy tracks, particularly where water stands in the winter, and can be found on the margins of tank tracks.

Over 80% of clubmoss populations in the Thames Basin Heaths can be found on MOD land. This heathland would have long been built on had it not been held for training purposes, and it supports a phalanx of rare species. However, a reduction in heavy vehicle usage over the last two decades led to conservationists trialling a range of scrape-digging techniques to remove competing vegetation and create areas of bare peat that favour clubmoss.

The SRT has monitored these sites annually and unfortunately observed a dramatic decline and loss of populations. There are multiple factors at play, including the impact on soil quality of elevated levels of air pollution. It is thought that the scrapes are not as effective at supporting plants as the more subtle depressions formed by tank tracks. One factor the team are now becoming more aware of is the role of mycorrhiza – minute fungi occurring naturally in the soil that form symbiotic relationship with plants. By scraping off the top layer, much of this fungal matter may have been lost, making it harder for clubmoss to re-establish on the bare ground.

Conservation work has successfully increased the size of existing populations. As a perennial that is dependent on disturbance to create open conditions, clubmoss is reliant on dynamism within habitats, meaning that on small, isolated sites, it will remain vulnerable to over-disturbance. Conversely, insufficient disturbance may lead to it being out competed. MOD sites provide a unique chance for this species, allowing it to thrive within an actively worked landscape.

Dominic Price[1] & Sophie Lake[2]
Director[1] & Project Manager[2]
SRT[1] & Plantlife[2]

Coral necklace © Crown

Water on board HMS Queen Elizabeth

UK Carrier Strike Group (HMS Queen Elizabeth, HMS Northumberland & RFA Tideforce) joined by HNoMS Thor Heyerdahl as it transits east across the Atlantic following the WESTLANT 19 deployment to the USA © Crown

The Queen Elizabeth Class Aircraft Carriers are the largest warships ever constructed in the UK and were delivered by the Aircraft Carrier Alliance, a unique partnering relationship between BAE Systems, Babcock, Thales and the Ministry of Defence. The initial outline design was developed under competition and the detailed system design was undertaken within the alliance.

The class is two vessels, HMS Queen Elizabeth and HMS Prince of Wales. Three times the size of the Invincible Class Aircraft Carriers, these huge ships use the latest technology and equipment, enabling them to operate with a streamlined crew of 679, roughly the same complement without air crew as the previous carriers. The intent of the design was to utilise technology where possible to improve operability, reduce through life cost and reduce the manpower loading through life.

HMS Queen Elizabeth entered service into the Royal Navy in December 2017. The ship has gone above and beyond statutory compliance, with extra commitment to environmental protection demonstrated by installing a treatment plant that is capable of gathering and treating all wastewater prior to storage or discharge.

Wastewater can be divided into two categories; black water and grey water. Black water is waste generated from toilets, as well as drainage of the medical dispensary and sickbay via wash basins and washtubs. It can contain pollutants including nutrients, metals, toxins and pathogens, which can negatively affect the quality of the sea water and aquatic ecosystems, as well as present risks to human health.

In addition, waste from the galleys (ships' kitchens) is collected independently and separated into food waste (then dried), grease (then stored prior to further treatment) and residual grey water which is passed through the grey water system. Grey water includes wastewater from showers, sinks and laundry, which can contain nitrates, phosphates, antibiotics and other chemicals. Like black water, grey water discharge into the sea can contribute to marine pollution and strips oxygen from the water, making survival for marine organisms in these areas extremely difficult.

Most legislation focuses on the treatment of black water and, although there are a few exceptions, grey water is not yet covered by legislation. As well as being the right thing to do, HMS Queen Elizabeth's grey water treatment system future proofs the ship for any change to grey water environmental regulations and therefore ensures that she retains access to areas subject to restrictions now and in the future.

By integrating a treatment plant that can treat both grey and black water, HMS Queen Elizabeth not only demonstrates compliance with international maritime legislation, but she also achieved an optional Lloyds Register Notation Grey Water (G) Character, which demonstrates enhanced environmental protection for operations anywhere in the world.

Whilst it was a challenge to route drains through the ship from multiple sources and ensure contaminations from oils and greases would not impact the performance of the integrated treatment plant, this was met by a talented design team. Both the grey and black water systems achieved performance characteristics and acceptance.

Treating grey water on the ship prior to discharge reduces the detrimental effects on marine life and water quality. It eliminates harmful pathogens being introduced into the ocean and fisheries. As other vessels adopt this type of system it should also help to improve the visual quality of coastlines, which in turn could have a positive impact on visitor enjoyment and tourism.

Martin Douglass[1] &
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ACA Engineering Director[1] &
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BAE Systems[1, 2]

Woodland creation across the Ministry of Defence estate

New mixed woodland established during the first stage of the woodland creation programme © Crown

This is a very exciting time for foresters, it would seem that the planets are finally aligning and a significant increase in tree planting is on the cards. Most foresters would love to cover every inch of the country with trees, but recognise this is a biased view, and unfortunately this is neither sensible nor achievable. The UK is a small island with some fantastic natural habitats that need protecting, simply covering the land in trees would only replicate some of the mistakes that the forestry industry made in response to previous tree planting initiatives.

The forest industry has changed massively over the years, with sustainability and integration being the key management objectives. As forestry is such a long-term commitment, a great deal of thought and effort is put into how woodlands are managed. The decisions made now will impact on the future management of the Ministry of Defence (MOD) estate for hundreds of years. Although the primary objective has always been to provide and manage woodland for military training, there is now a need to consider a rapidly changing climate and a whole host of destructive tree diseases and invasive new pests.

Resilience and diversity is the key, but unfortunately, it is relatively unknown how things are going to change and what new issues will be faced in the future. Over the past decade many iconic tree species have succumbed to new diseases and pests. Huge areas of larch woodland have been felled due to *Phytophthora ramorum*, millions of Corsican pines are dying with red band needle blight, there is also sweet chestnut blight, acute oak decline, alders are dying with *Phytophthora* and perhaps the most destructive of all, ash dieback. These are just a few of the issues being faced and it is hard not to become gloomy.

The UK MOD estate has approximately 19,500ha of woodland, which is around 12% of the rural estate. The Defence Training Estate (DTE) has circa 17,000ha of woodland which is approximately 88% of UK MOD woodland cover. In addition to this, there are significant areas of urban woodland and amenity tree cover across many sites that also contribute to the MOD woodland resource. Although impossible to accurately count, there are at least 60 million trees across the estate.

The Defence Infrastructure Organisation (DIO) Forestry Team consists of six dedicated foresters who manage these woodlands by providing national and international coverage to DIO customers, working to MOD and UK Forest Policy. As the authority role, the DIO Forestry Team provides a consistent approach to forestry across the MOD estate and ensures MOD Forest Policy reflects current and future military training requirements. The Forestry Team also provides an audit and assurance role to ensure industry partners manage woodlands and amenity trees as per MOD policy and industry best practice.

MOD's forest cover is around 56% conifer and 44% broadleaf. This reflects the planting of large areas of conifer woodland during the Cold War to replicate an eastern European landscape. As our primary objective for woodland management has always been military training cover, sound silvicultural management was often abandoned in favour of the military training need. Although the training objectives for this woodland resource have been met, these Cold War training features have now reached the end of their useful life. The majority of this conifer cover are single species plantations, established using the commercial forestry techniques of the time. These plantations have a limited lifespan, and in a commercial management system would normally be clear felled before they reach the stage at which they blow over.

Fortuitously, an aging forest resource that must be developed is providing a significant opportunity to provide a more robust, diverse and climate change resilient woodland. On

average around 300,000 trees are replanted each year using a much wider range of tree species more suited to the ever-changing military and environmental requirements.

Apart from replanting what is felled, there is also a need to increase woodland cover, not only to expand the military training resource but to help mitigate climate change. Climate change is a hot topic for the planet, and as a Government Department, the MOD are signed up to key Government policies aimed at reducing our carbon footprint, moving towards a low carbon society and utilising renewable energy sources.

A Gurkha recruit training amongst the trees at Catterick Training Area © Crown

Trees are uniquely placed to deliver these benefits because they are truly sustainable, if managed correctly. All recent research points to the need for more trees in the UK, which incidentally has one of the lowest amounts of tree cover in Europe. Responding to this challenge, the MOD is undertaking a new study to identify how many more trees it can plant on its estate.

This drive to expand woodland is nothing new for the Forestry Team, and several years ago a partnership agreement was entered with the Woodland Trust to explore woodland creation opportunities. In 2010, using a seconded member of staff from the Woodland Trust, a survey of the whole MOD estate was carried out to identify possible woodland creation opportunities. By licencing areas of land to the Woodland Trust and working with tenant farmers, 577ha of new woodland (approximately 1.4 million trees) was established.

The future of MOD woodlands

The mantra for this new tree planting initiative is 'the right trees in the right place'. DIO foresters have learnt a great deal over the years about woodland creation and how to deal with the unique issues faced on the estate. It is unlikely that many other forestry departments have become so familiar with unexploded ordnance! Careful design is the key, ensuring the new woodlands fulfil the military training requirement and meet the environmental and climate change mitigation aspirations.

The overarching aim is to have all MOD woodlands managed through Long Term Woodland Management Plans. These ensure that all MOD sustainable woodland management requirements are integrated into the wider military and environmental objectives. These plans are the ideal place to capture any woodland creation opportunities and ensure a robust consultation process is followed. The plans are being produced under MOD direction by our industry partners, and the work should all be completed by 2021. This has been a huge task, but well worth the effort.

Potential tree planting opportunities have already been identified across 25 UK sites, covering around 750ha of land with the potential of planting two million trees. Planning work is already underway at Otterburn, Okehampton and Driffield Training Areas. It is important to say that tree planting is not the only way to help mitigate climate change and reduce our significant carbon footprint. The MOD estate is extensive and has some of the most important natural habitats in Europe. The rolling grasslands of Salisbury Plain, the vast tracks of moorland across northern Training Areas, the heathlands of the Home Counties, the valleys of Wales and the Glens of Scotland all sequester carbon. If managed sensitively, these areas can support more woodland as part of a wider landscape approach to climate change mitigation.

Part of an 100ha new mixed woodland planted on Catterick Training Area © Crown

Jez Kalkowski
Senior Forester
Defence Infrastructure Organisation

Peter Feakes – conserving Stanford Training Area, a jewel of Breckland

Peter erecting a kestrel nest box © Peter Feakes

Stanford Training Area (STANTA) in Breckland, Norfolk was created from farmland in 1942 to serve the military needs of the time. It continues today as a key facility to provide service personnel with essential pre-deployment training. The Training Area has, in the main been protected from agricultural intensification and development and represents one of the largest areas of lowland heath remaining in southern England. The majority of the 9,000ha area is a Site of Special Scientific Interest (SSSI). It is grazed predominantly by sheep and the remnants of the former rabbit warrens that once had a profound ecological influence by creating the loose, disturbed soils favoured by the birds, invertebrates and flora of Breckland.

In this nationally rare landscape, the STANTA Conservation Group (SCG) supports the MOD in meeting its stewardship obligations in relation to the estate. Peter Feakes has been the Bird Group Recorder since 1984 and Chairman since 2008. He has become a valued adviser to the Ministry of Defence (MOD) and Landmarc Support Services regarding conservation and land management on the Training Area. Examples include assisting with the planning of seasonal forestry works to avoid the nest sites of rare raptors and recently surveying trees infected with ash dieback for nesting birds prior to felling.

To replicate land use conditions synonymous with Breckland, the MOD has encouraged its agricultural tenants to enter Higher Level Stewardship (HLS) Schemes. An example is the creation of around 100 cultivated plots as part of a 10-year HLS Scheme. These aim to replicate the historic land use of the Brecks, which included managed rabbit warrens and subsistence farming, both of which resulted in ground disturbance. The plots are attractive to stone curlew and woodlark, but also provide habitat for insects, beetles and plant species. The University of East Anglia (UEA), SCG and Peter have played a very important role in monitoring the plots. In addition, Natural England and the RSPB have delegated the monitoring of stone curlews across STANTA to Peter, and as most nests are on the arable land of the Training Area, they require regular attention to avoid damage by farm machinery.

Other academic studies in which SCG and Peter have had a significant input include an UEA study on the predation of common curlew nests on STANTA. There has also been a study into the ecology of the common curlew across Breckland, including at STANTA which holds an important population of this Amber listed wader. Good historical data is essential at the beginning of any project and Peter has been able to offer the data collected by the SCG going back over 40 years. He has also resurrected an old Nissen hut as a conservation room where meetings can take place and records are stored.

Academic interest in STANTA has also stimulated work by the SCG into most fields of natural history so that they now report annually on birds, mammals, butterflies, dragonflies, grasshoppers and flora. A recent night moth trapping session with a Norfolk Wildlife Trust expert revealed 82 species including two that are nationally rare.

STANTA also hold sites for scarce Breckland flora, such as Breckland mugwort *Artemesia campestris* and maiden pink *Dianthus deltoides*, again monitored by SCG with assistance from the Breckland Flora Group for whom Peter arranges access with Range Control.

The bird species that are surveyed annually by the SCG include stone curlew, common curlew, nightjar, long-eared and barn owl, redstart, woodlark, goshawk, kestrel, hobby and red kite. There are also nest box programmes for barn owl, kestrel, spotted flycatcher and redstart. In addition to these programmes, swift nesting boxes have been replaced in a Training Area church.

The benefit from the dedication, commitment and enthusiasm of Peter and the SCG is not just to species and habitats but also to the MOD, whose reputation for conservation on STANTA is consistently high, and is recognised as a 'jewel of Breckland'. The hard work of the dedicated members of SCG who help ensure STANTA is managed holistically, to not only deliver key pre-deployment training for our service personnel, but also to maintain a fantastic ecological resource, is much appreciated. Alongside Peter, special thanks goes to all Conservation Group members, both past and present.

Bernard Pleasance
Conservation Group Member
STANTA Conservation Group

Managing the grey seal colony at Donna Nook

Grey seals at AWR Donna Nook © Matt Blissett

The Air Weapons Range (AWR) at Donna Nook on the Lincolnshire coast is home to one of the largest grey seal colonies in England.

The AWR was established as a nature reserve in 1978 by a management agreement between the Ministry of Defence (MOD) and the Lincolnshire Wildlife Trust (LWT). The site was designated a Site of Special Scientific Interest in 1981 and declared a National Nature Reserve in 2002. The reserve covers 10km of coastline and consists of an extensive inter-tidal area of mud, sand flats and saltmarsh backed by a thin line of low-lying dunes.

A substantial part of the reserve is used for air weapons training with access restricted when the range is in operation. The range first became a safe haven for grey seals in the 1970s, when a small colony chose this location to give birth to their pups on the outer sandbanks. The seals soon discovered the safety of the dunes, away from tidal inundation and numbers have increased year on year. In 2019, a record-breaking total of 2,187 pups were born.

The AWR is now home to a population of approximately 7,500 seals, this is calculated on 3.5x the number of pups that are born. The seals have also become accustomed to fixed and rotary wing aircraft, showing no reaction to the noise and action overhead. The restricted access onto the range has also protected the seals from human disturbance.

The seals make their way from the sea to the dunes from late October through to early January. Annually, they provide one of the greatest wildlife spectacles in the country. In a wild and windswept setting, visitors can witness the full life cycle of the seals; births, bull seals fighting, mating and inevitably some deaths – nature in the raw at close quarters.

Over the years the number of visitors have also increased. In 2019, 60,000 people came to view the seals. The colony not only attracts local attention, but visitors from all over the country and internationally. Many thousands follow weekly seal updates via social media, with the announcement of the first birth in 2019 having been viewed 90,000 times on Facebook!

Management of the high visitor numbers requires excellent liaison and organisation between LWT, Defence Infrastructure Organisation and Landmarc Support Services (Landmarc) staff, together with the cooperation of a local landowner. This collaborative management prevents the sudden influx of people during the pup season, which would bring military activity on the range to a halt.

Preparation for this annual event starts several months before the first seals arrive to give birth. Permanent fencing exists along the main viewing area, but additional fencing, gates and interpretation displays are erected to separate seals from visitors and to offer a warning that seals bite and dogs are not allowed. Landmarc staff erect barriers and heap up sand banks to prevent seals from entering the target assembly base, control tower and range warden posts.

A temporary traffic regulation order is applied for and a traffic management team is contracted for the busiest weekends. A one-way system and prohibition of roadside parking is imposed on the narrow single-track roads to maintain access and flow of traffic. At the peak of the season, up to 6,000 visitors can be expected on a weekend day which requires parking for 2,000 vehicles. A neighbouring land owner allows use of his grass fields for car parking and provides toilet facilities which offers a great help with the management of visitors.

In 2019, 55 volunteers gave a total of 1,985 hours assisting LWT staff to warden the site. LWT staff and volunteer seal wardens engage with the public and ensure the MOD can continue with operations as near-normal during these busy times.

The seals return each year to rear their pups, oblivious to the effort and organisation that goes on around them.

Matt Blissett
Outer Humber and Coastal Warden
Lincolnshire Wildlife Trust

DIO Nepal – **sustainable water solutions** to meet demand

The filtration treatment process includes birm, carbon and resin filters © Crown

The Defence Infrastructure Organisation (Nepal) (DIO(N)) are the authority responsible for facilities management, maintenance and operation of infrastructure within Nepal in support of British Gurkhas Nepal (BGN).

The history of BGN stems back to the establishment in 1885 of the first temporary depot in northern India for the recruitment of Gurkhas. BGN has occupied many different locations over its 200+ year existence including Ghoom and Jalapahar near Darjeeling and Gorakhpur and Lehra between Lucknow and Patna; all of which are in India. In the mid-1950s it became politically desirable for Gurkha recruitment to be moved from India to Nepal. Here, new camps were constructed in Paklihawa and Dharan due to their access to a railhead.

In the early 1970s, with the introduction of air connections between Nepal, the UK and Hong Kong, railhead access was no longer required. As a result, Paklihawa's camp moved to Pokhara and a movement control transit camp was established in Kathmandu. In the late 1980s, as a result of Defence cuts, the majority of Dharan's camp was handed back to the Government of Nepal. Today, the effects of relocating, downsizing and closures means three main sites make up BGN's estate; British Gurkhas Kathmandu (BGK), British Gurkhas Pokhara (BGP) and British Gurkhas Dharan (BGD).

The BGN mission has always been to deliver the recruitment of Gurkha soldiers into the British Army, which continues to be its primary function today. In addition to this, BGN also provides local welfare, settlement and pension support to serving members of the Brigade of Gurkhas and their veterans. BGN maintains disaster relief preparedness within resources in order to support the firm base activity in Nepal in accordance with UK Defence Strategy; such as the earthquake in 2015 and most recently the COVID-19 Pandemic.

When someone mentions Nepal, generally the things that come to a person's mind would be the world's highest mountains found in the Himalayas, a vastly diverse culture with the pivotal figure of Buddha at the forefront and Gurkha soldiers with their formidable reputation that precedes them.

One would be excused for not giving a second thought to some of the highest annual rainfalls and vast areas of the land that is impacted by flooding, which is all attributed to the formidable monsoon season that affects the country annually between June and September. Within the Kathmandu Valley alone an average upwards of 1,500mm of rain falls yearly, which is one of the lowest recorded average rainfalls found across Nepal. Over 75% of this annual rainfall, 1,128mm to be precise, falls during the months of the monsoon season. In order to contextualise this amount, Kathmandu's monsoon season rainfall is comparable to the average annual rainfall of the entire UK, 1,240mm, but it falls in just a third of the time.

Despite the negative impacts that are associated with heavy monsoon rain falls, the DIO(N) are exploiting the opportunities that these rains

RWH storage tank and sand filter © Crown

present through the implementation of Rainwater Harvesting (RWH) systems to turn the negative impact into a benefit.

In the Kathmandu Valley, where the Headquarters (HQ) of BGN are located, there are six RWH storage tanks installed. These tanks range from a capacity of 1,500L to 4,000L each, which together provides a total rainwater storage capacity of 15,000L. The roof tops of several buildings adjacent to these storage tanks are utilised as a catchment area for the falling rainwater. This rainwater is then channelled via the buildings' guttering and down pipes, through the RWH pipe network into the storage tanks. Once the tanks reach capacity, the rainwater is transferred by a pump which is automatically engaged by a switched float valve. The rainwater passes through a sand filter into one of the two underground water storage tanks via a buried pipe network. This underground tank, which can hold a total of 81,000L, is also utilised to store water drawn from the site's two boreholes. From this underground storage tank, the raw water undergoes a full filtration treatment process including Reverse Osmosis.

The next stage in the treatment process is the removal of ammonia and polishing before the water is finally chlorinated. The resulting product of the treatment process is water that is fit for human consumption, meeting

Final ammonia removal and polishing © Crown

The Reverse Osmosis unit © Crown

the British Standard requirements. This is then pumped up to the high-level storage tanks for distribution as potable water.

Annually the RWH system in BGK contributes approximately 100,000L of water which helps sustain BGN's water demand. This reduces the reliance on conventional sources of supply and their associated costs, such as Kathmandu's district water providers, water delivery via tanker or the camp's own borehole water source.

To further assist in sustaining the BGN water demand, the DIO(N) have implemented a system whereby reject water that is produced during the Reverse Osmosis treatment process is utilised rather than flushing it to waste.

The Reverse Osmosis water treatment process is a necessary additional stage in the production of water fit for human consumption in BGK when utilising the borehole as the initial source. This is due to the borehole water containing high levels of impurities such as dissolved salts, known as ions, which require a finer method of filtration to remove them.

Reverse Osmosis incorporates semi-permeable thin membranes with microscopic pores which the water is forced through under pressure. This use of pressure ensures the water will pass through the membrane pores whilst at the same time retaining the unwanted impurities. The high pressure side is then flushed to clear the impurities away to a reject water storage tank.

The reject water is distributed and used to supply toilet and urinal cisterns across the site, rather than the traditional use of potable water. This means approximately 7,000L of reject water is now used in place of potable water each day. This not only reduces the consumption of potable water, but also reduces the frequency of treatment required and the chemicals that are used within it.

All water sustainability projects implemented in Nepal are funded by the Ministry of Defence (MOD) via the DIO. To contribute to the most efficient use of budget in more demanding areas DIO(N) is continually exploring additional opportunities where RWH can be utilised across the BGN estate.

Two specific areas being explored are the increase of RWH capacity in BGK and the introduction of RWH in BGP, where the annual rainfalls are even higher than BGK. Any increase in the use of rainwater is a positive step in order to economically and efficiently sustain the water demand of BGN. This is even more prevalent as water utilities and deliveries become an increasingly scarce and expensive commodity due to the ever expanding population in both the Kathmandu Valley and Pokhara.

WO2 (QMSI) Richard Hunt
Estate Facilities Manager
DIO (Nepal)

Barbastelle bat surveys and monitoring on Salisbury Plain

Four juvenile barbastelle bats, part of a Wiltshire Bat Group bat box study © Paul Colley

Salisbury Plain Training Area (SPTA) is the largest military training area in the United Kingdom at over 94,000 acres. It is used for live firing, armoured vehicles, engineers' artillery, infantry and aircraft training. It provides training for aspects of military operations which cannot be properly practised elsewhere in the UK with live firing taking place around 340 days per year. Some 50,000 acres of the Training Area forms six Sites of Special Scientific Interest.

SPTA and its locality is not renowned for extensive woodland habitat, however the evidence increasingly suggests that the rare barbastelle bat, more typically associated with ancient and/or semi-natural woodlands, is frequently encountered within SPTA. It is one of the largest remaining areas of calcareous grassland in north-western Europe and is a predominantly agricultural area.

Whilst there are approximately 6,000 acres of woodland, this is predominantly scattered copses and shelterbelts. There are some larger woodlands on the wider Salisbury Plain such as Grovely Wood and Great Ridge Wood, however these are some distance from the Training Area.

The barbastelle bat *Barbastella barbastellus* is found throughout Europe. In the UK, it is restricted to rural areas in the southern counties of England and Wales. The barbastelle bat is considered to be rare, enigmatic and is a specialist predator of moths. It is listed on the International Union for Conservation of Nature Red List (2013) and British Red List where it is classified as Vulnerable. The barbastelle is also listed on Annex II & IV of the EU Habitats Directive and is a priority species for conservation in the UK Biodiversity Action Plan.

In England and Wales, the barbastelle shows a strong preference for roosting in old, dead and dying oak trees, often leading to an association with wood pasture or parkland with veteran trees and ancient woodland. Radio-tracking has shown that riparian margins and broadleaved woodland are strongly selected for foraging but that unimproved grassland, field margins and hedgerows are also important. Studies in southern England have shown that female barbastelles can range between 8km and more than 20km from their maternity roosts, commuting and then foraging over large distances each night in doing so.

Traditionally therefore, barbastelle bats were considered to be a woodland bat however there appears to be increasing recognition that they will forage widely in the surrounding landscape. Barbastelle bats are becoming increasingly studied in Wiltshire and a number of studies have been undertaken on and around SPTA in recent years, which adds merit to the assertion that the Plain is supporting one or more populations.

In 2008, Geoff Billington of Greena Ecological Consultancy was commissioned by the Ministry of Defence to conduct surveys for bats across SPTA. Trapping surveys

Daytime radio-tracking © Gareth Harris

resulted in the capture of a barbastelle bat at Imber village, whilst static acoustic monitoring resulted in recorded passes on SPTA West (at Ranscombe, Imber and Ladywell) and on SPTA East at Everleigh.

During 2016 and 2017, the area of Salisbury Plain abutting the south of the military Training Area was subject to ecological survey by the Atkins-Arup joint venture, in relation to the proposed A303 Stonehenge project, Amesbury to Berwick Down.

This work confirmed the importance of barbastelle bats in this area. Radio-tracking studies in 2017, by DW Ecology, focussed on woodland bat species including the barbastelle bat. Four barbastelle bats were trapped in copses and scrub close to the proposed A303 route in an otherwise open landscape.

The radio-tracking of these bats demonstrated that the maternity colonies of barbastelle bats trapped foraging in the vicinity of Winterbourne Stoke and the Stonehenge World Heritage Site were located 9km to the south in Grovely Wood. Bats foraging in the vicinity of the A303 were at the northern edge of the range of this maternity group.

A barbastelle bat maternity colony, located a few kilometres to the north of Salisbury Plain has been monitored since 2015. Two adult females were radio-tracked in May 2018 and they travelled 12km south to forage on chalk downland and gorse scrub on the central impact area of SPTA.

The Central Impact Area, SPTA – the foraging area of two radio-tagged barbastelle bats © Gareth Harris

In recent years, barbastelle bats have been recorded foraging at other locations around Salisbury Plain, including Copehill Down village, south of Tilshead and Tidworth. Together, this and other evidence indicates that barbastelle bats are utilising SPTA and the wider Salisbury Plain and may suggest that multiple maternity groups, whose woodlands are dotted around the perimeter, are commuting onto the Plain to forage, travelling long distances to do so.

This has significant implications for their conservation. It suggests that Salisbury Plain is supporting multiple breeding populations, so potential impacts may affect more than one maternity colony. Secondly, given the large landscapes that these bats utilise, it is likely that at least some barbastelle bats accessing the Plain are also utilising one or more of the hibernation sites in south Wiltshire, which are designated under UK and EU legislation.

Since barbastelle bats can traverse entire landscapes each night, significant changes to land management and impacts upon habitat features used by foraging and commuting bats may negatively and directly impact this species. Even small changes may impact more than one breeding colony. Further survey work is therefore required to understand how barbastelles may be utilising plantation woodlands on SPTA.

Going forwards, it will be important to consider barbastelle bats in assessments of potential impacts on SPTA, including assessments of direct impacts upon habitats as well as indirect impacts such as new lighting schemes.

The management of SPTA is currently providing a significant resource for many bat species, including those that are normally associated with wooded landscapes. Long may this last, as local studies continue to research this unique area. All of those who have contributed to this work are warmly thanked.

Two female barbastelle bats – tracked to the Central Impact Area, SPTA © Gareth Harris

Gareth Harris
County Recorder
Wiltshire Bat Group

The legacy of the few – Thorney Island and the Battle of Britain

Vertical aerial view of RAF Thorney Island, Hampshire. Note the attempt to camouflage the airfield and runways as hedge and field patterns © Imperial War Museums (catalogue number HU92962)

The year 2020 marked the 80th anniversary of the Battle of Britain, which took place between July and October 1940. The Nazi victory in the Battle of France in June 1940 had brought the Luftwaffe within 20 miles of Britain, across the English Channel. When the British rejected Adolf Hitler's calls for surrender on 16 July 1940, plans for a Nazi invasion began. However, this first required the elimination of the Royal Air Force (RAF).

The British had developed a coordinated system of air defence under Air Chief Marshal Hugh Dowding. The 'Dowding System' was based around coastal 'Chain Home' radar stations and inland observation posts that monitored approaching aircraft. Fighter Command Headquarters relayed the information to Group and Sector Headquarters, allowing local Commanders to deploy their fighters.

The Luftwaffe launched its most critical attack on 18 August 1940, with three big raids. The events are described in detail in Alfred Price's formidable book 'The Hardest Day'. The third wave comprised the largest concentration of JU87 Stuka dive bombers yet deployed – 109 aircraft were to attack the airfields at Gosport, Ford and Thorney Island, and the radar station at Poling, although none of these airfields were in use by Fighter Command.

The Stukas, laden with 250kg (550lb) and 50kg (110lb) bombs, crossed the channel in a huge formation supported by 157 Me109 fighters. *"The formation was a magnificent sight"* wrote 25 year old Leutnant Kurt Scheffel, piloting one of the Stukas.

1st Gruppe, with 28 Stukas, headed for Thorney Island on the south coast. Oberleutnant Julius Neumann, leading the 10 aircraft covering the Stukas, soon spotted small specks in the patchy haze to the north and alerted his Staffel. Moments later, 18 Hurricanes of the RAF's 43 and 601 Squadrons smashed into the bombers. One of the first casualties was the Stuka of Unteroffizier August Dann, which was caught on camera plunging to the ground near Chichester. One German radio operator later recalled *"there were burning Stukas all over the place".*

As the attack progressed, Thorney Island's own Blenheims of 235 Squadron took to the air. The fleeing attackers raced low over Chichester Harbour and out to sea, through (as Alfred Price later described) a 'witch's cauldron' of tracer rounds, plunging aircraft and floating parachutes. Despite the German losses, two hangars and several buildings were wrecked. Four aircraft were destroyed or damaged, and five civilian workers slightly injured – but the airfield continued in use.

Today, Thorney Island (now Baker Barracks) is home to 7 Air Defence Group (7 AD Gp), the Formation Headquarters responsible for the Army's Ground Based Air Defence Capability. The Group is a descendant of Anti-Aircraft Command, which provided anti-aircraft capability under the command of a Royal Artillery officer, but under the Operational Command of Fighter Command, during the Battle of Britain. There are four RAF personnel in the Headquarters, and their roles in Air (and Space) Operations can be traced to the Fighter Controllers of Fighter Command during the Battle of Britain.

In addition, 7 AD Gp includes 12 Regiment which provides Close Support Ground Based Air Defence, employing the Starstreak missile system for short range air defence and protection of land forces. 16 Regiment also gives General Support Ground Based Air Defence, with the Rapier Field Standard C Missile System, shortly to be replaced by the Sky Sabre system. 16 Regiment have an Air Surveillance capability, known as LEAPP (Land Environment Air Picture Provision), providing air situational awareness to Commanders. 49 Battery is commanded by an RAF Air Ops (Surveillance) Squadron Leader and is unique within the British Army, with an Artillery Battery commanded by an RAF officer.

So many of our airfields have disappeared or found other uses, with the occasional listed or scheduled mess block, control tower or fighter pen to recognise the historic significance of the physical remains. Groups such as the Biggin Hill Memorial Museum or Kenley Revival tell their stories through the personal experiences of those who served there, or on heritage walks. From the skies Thorney Island would still be recognisable to a Battle of Britain aircrew and the presence of 7 AD Gp illustrates the continuing need for protection from the air.

Guy Salkeld[1] & Wg Cdr Cal Lowey[2]
Archaeology Advisor[1] &
Deputy Commander[2]
DIO[1] & 7 AD Gp[2]

Coastal habitat restoration for flood management – **Green Shores Project**

Volunteers planting behind biodegradable in situ bio-rolls on the Leuchars Station foreshore (near Shelly Spit, Eden Estuary). The natural stands of saltmarsh in the background were the donor site © Clare Maynard

Nestled alongside Leuchars Station in north-east Fife is the Eden Estuary Local Nature Reserve, a wonder of glorious mudflats, sand dune systems and saltmarshes. Wildlife abounds in this jewel of Fife's natural heritage, from ospreys diving into the water at the mouth of the estuary and shelducks raking through eelgrass beds on the mudflats, to rare salt-tolerant flora clinging to the estuary's exposed margins.

Coastal landowners like the Ministry of Defence (MOD), the University of St Andrews and the St Andrews Links Trust may sound like unusual partners, but the prevailing climate change crisis gives these major employers in Fife more common ground. Rising sea levels increase the potential of damage from flooding and erosion to coastal infrastructure, be it roads, golf courses, or Leuchars Station. Coastal habitats like saltmarshes, sand dunes and eelgrass beds are recognised globally for the vital role they play in protecting valuable land assets from flooding and erosion. However, these natural resources are themselves under mounting threat from climate change, and from adjacent land-use pressures. Traditional options to fortify land against the tide have been to build expensive sea defences, or simply to retreat and lose valuable land to the sea. However, over the last few years, the MOD has worked with the University of St Andrews and other organisations to find a more cost-effective and sustainable solution.

Leuchars Station is part of a pioneering effort to restore the Eden Estuary's fragmented fringing saltmarsh habitat, thus providing the Station with greater natural flood defences. The Green Shores Project, unique to Scotland, transplants saltmarsh from donor marshes into sections of degraded shoreline. This strategy was largely inspired by the United States Army Corp of Engineers' work in the 1970s and the 1980s, who created thousands of hectares of saltmarsh along the Eastern seaboard of the USA to stabilise degraded shoreline sediments. This has developed into a 'Living Shorelines' concept.

Green Shores began with the help of RAF Leuchars Conservation Group in the Eden Estuary in 1999, borrowing methods from the USA to help establish a strategy for restoring Scotland's coastal saltmarshes. The strategy has adapted over time to use biodegradable coir rolls and mats to protect the young and vulnerable transplants until they have established. A coastal plant hub, erected in 2017 at St Andrews Links, has also been established to grow native coastal vegetation to support the project and as an outreach facility for local volunteers.

Conservation projects on wave-swept, muddy shorelines present challenges such as extreme weather and awareness of regulations regarding wildlife disturbance. Many sites are difficult to reach, over rough terrain or located across security-conscious military land. Green Shores has benefited from financial and in-kind MOD support and enthusiastic volunteer testaments from more than 30 local and national organisations. Whether it is unemployed youth learning a new skill, military personnel lending team strength and camaraderie, students seeking direct conservation action opportunities, or Chief Executives simply taking a break from the office, it has been found that hard, muddy work, a worthy cause and inclement weather unites people to do ever more to sustain their local community.

All projects like this require cooperative partners and this one would not have been possible without the MOD, St Andrews Links Trust, Fife Council, Fife Coast & Countryside Trust, Scottish Natural Heritage, Scottish Environment Protection Agency, Royal Dornoch Golf Club, Fife Leader and Fife Environment Trust. This work would also not have happened without the help of over 700 volunteers.

Dr Clare Maynard
Head of the Green Shores Project
University of St Andrews

Partnerships and volunteers help biodiversity on the MOD estate

A newly created scrape at Thorney Island © P. Hughes

The Ministry of Defence (MOD) has a long history of support from volunteers and partner organisations through its extensive network of Conservation Groups. The Defence Infrastructure Organisation (DIO) has been looking to develop its volunteer and partnership engagement a stage further, by working with some key organisations to utilise their own established volunteer networks to carry out hands-on conservation activities. Four sites have recently been targeted across Hampshire, Sussex and Dorset.

The DIO Ecology Team approached Amphibian and Reptile Conservation, (ARC), Hampshire and Isle of Wight Wildlife Trust (HIWWT), Chichester Harbour Conservancy (CHC) and Dorset Wildlife Trust (DWT) to initiate a range of projects. The projects included heathland restoration at West Moors, scrub clearance to enhance the calcareous grassland habitats at Horsea Island and Blandford Camp and wetland habitat improvements at Thorney Island. These sites are all covered by various nature conservation designations. A contribution from the DIO's Conservation Stewardship Fund enabled three of the organisations to run a series of volunteer tasks utilising their existing, often highly experienced and skilled volunteers. The Thorney Island project was of a scale that also needed contractors, so a contribution was made to take this forward rather than using volunteers. However, the CHC Team arranged and supervised the work.

Recruiting, engaging and managing volunteers' tasks is a specialist activity and these organisations all have dedicated staff with extensive expertise in this area. Fantastic support was given from MOD site staff to facilitate these activities, as the sites had significant security, health and safety requirements.

As well as achieving some great work on the ground and giving new groups access to some of the MOD's best wildlife sites, these projects have strengthened relationships between the MOD and these key partner organisations. Each partner has written a summary of their involvement below. It is hoped that over the next few years these volunteer programmes will involve more MOD personnel from the sites themselves, enabling both serving and civilian staff to use the volunteer days available to them as special paid leave.

West Moors

ARC are currently working towards securing funding to take on the long-term management of the West Moors site, due to commence in 2021. They felt it important however to get involved prior to that, as some areas of encroaching scrub had been highlighted that would be just right for their team of dedicated volunteers.

Over a period of five days during the winter of 2019, a team of volunteers and staff set to work on an area of dry heath within the Site of Special Scientific Interest (SSSI) that required some enhancement to improve its condition for reptiles. Later, both sand lizards and adders were seen in a nearby area.

ARC's winter work generally involves the heathland staples of pine, birch and gorse control, albeit with an added twist at West Moors, where arisings had to be chipped rather than burnt due to safety requirements. The team enjoyed seeing a new site and appreciated the chance to spend a few days on a single area which allowed them to see the big impact they had made in such a short time. ARC is excited about the potential of this site for reptiles and other heathland specialist species and looks forward to continuing their long-term collaboration with the MOD, getting the area back into a more favourable condition.

Horsea Island

HIWWT is one of the largest conservation organisations within the two counties and values building strong partnerships with other organisations to deliver a high level of conservation management on a range of habitats. The Trust works closely with the MOD on a number of sites across Hampshire and values this relationship, providing the opportunity to be involved in landscape scale conservation. This is the first time that the organisation has been involved in managing the SSSI at Horsea Island.

The Trust worked on the site for three days with their volunteer groups,

consisting of approximately 10 people on each day. The aim was to remove the scrub regrowth from the meadow that has species-rich calcareous grassland and expand the potential area for this, by moving the scrub edge back a couple of metres and creating scalloped edges, providing a range of microclimates that would benefit different invertebrate communities. The volunteers managed to clear all three of the meadows in some fairly adverse weather conditions.

The Trust has a long history of working with volunteers who provide the bulk of their practical work force. There are many years of experience within the groups who are well trained in the use of a range of machinery, allowing them to effectively tackle tasks such as the one at Horsea Island.

Thorney Island

The pasture alongside Thorney Deeps is coastal grazing marsh, supporting many feeding duck, geese and waders during the winter months, and breeding waders such as lapwings and redshanks during the summer. In recent years, the summer breeding waders have fared poorly, in part due to scrub encroachment and lack of suitable feeding habitat.

In a partnership between the MOD, CHC and the tenant farmer, a project was instigated to improve the habitat for a range of wildfowl and waders. The aim was to increase the amount of small pools ('scrapes') on the grassland whilst removing some of the encroaching scrub, to create the wet open landscapes that these birds like. Improving and enhancing this habitat around the harbour is critical for many species, and as managers of the Chichester Harbour Area of Outstanding Natural Beauty, CHC are reliant on cooperative landowners to do this important work.

HIWWT undertake scrub clearance © Chris Lycett

ARC volunteers at work on West Moors © Crown

Four days of work was carried out in the autumn of 2019, and by mid-winter the sites were looking in great condition. During January 2020, flocks of grazing brent geese and feeding curlew testified to the improvement of the habitats. Surveys during spring and summer 2020 showed that five pairs of lapwings and a pair of redshank were using the new scrapes, with their young chicks feeding on the margins of the pools. This was a very impressive result for the project.

Blandford

One crisp February morning DWT's north Dorset volunteers branched out from Fontmell Down Nature Reserve, tackling the scrub invading a Site of Nature Conservation Interest on Blandford Camp. Removing the bramble and hawthorn that smothers the delicate chalk grassland flora is a constant battle, which in the absence of grazing animals must be done manually. Three DWT volunteers and two DIO staff cut the scattered scrub, plus a large area of bramble across the slope behind the cricket pitch. The cuttings were stacked in the woodland belt above, providing habitat for woodland wildlife. The volunteers enjoyed assisting with work outside of DWT reserves and gained a better understanding about the land which the MOD manages.

DWT volunteer and DIO staff clear scrub © Crown

Chalk grassland, a declining habitat nationally, can be some of the most diverse habitat in the UK, sometimes with over 40 plant species per m^2. In cleared areas it is hoped rejuvenation of chalk grassland flower species, such as horseshoe vetch and common rock rose, will occur. These provide nectar sources for insects and foodplants for the caterpillars of chalk grassland butterflies.

Working in partnership with the MOD is mutually beneficial. It enables sharing of technical expertise and labour and engages a wider audience on the sites with wildlife conservation.

Acknowledgements

Thanks to Gary Powell (ARC), Chris Lycett (HIWWT), Pete Hughes (CHC) and Steve Masters, (DWT) for their contribution to this article and the projects featured.

Hanna Etherington
Ecologist
Defence Infrastructure Organisation

Thinking inside the box – corrugated board in Defence packaging

Military equipment undergoing packaging using corrugated board © Conway Packing Services Ltd

A team of industry packaging experts, led by Bob Deary from the Defence Equipment and Support (DE&S) Support Directorate, recently undertook a review of the Defence Standard (DefStan) that sets the policy and standards for corrugated materials used in Defence packaging. The project sought to modernise the DefStan specifying corrugated board (more commonly known as cardboard) for use in military level packaging (MLP).

Cardboard is one of the most commonly used packaging materials within the Ministry of Defence (MOD) supply chain. Modernised production methods meant the DefStan, which specified the use of virgin cardboard grades that were unique to the MOD, had become outdated. The DefStan risked both a pricing premium for the materials and lead-time issues for supply. To mitigate these risks, the team recognised that the MOD needed to maximise opportunities for utilising environmentally sustainable, fit for purpose and readily available commercial grades of cardboard.

Taking a requirement-led approach, the technical committee of experts from the MOD and industry looked at defining the required performance of the packaging. This would replace the previous, more prescriptive approach, that specified the (often bespoke) materials to be used in the manufacture of the corrugated packaging. This means there is now much greater scope for the use of commercially available materials in the production of corrugated Defence packaging. This aims to maximise the utilisation of recycled cardboard from both UK and European waste streams, providing environmental benefits from the reuse of materials in line with the wider Government and the MOD's Greening Agenda.

The work undertaken as part of this project helps to address the growing public interest around packaging issues and demonstrates how DE&S and the MOD are taking a lead with such matters. The project commenced in June 2019 and thanks to the hard work and dedication of the multi-agency team, it successfully concluded in June 2020, with the finalisation of a revised DefStan awaiting formal publication. Whilst the project was led by Bob and the DE&S Support Directorate Defence Packaging team, there was invaluable support from Military Packager Approval Scheme (MPAS) members and the corrugated industry, utilising the MOD and Industry Packaging in Equipment Acquisition & Support Forum (PEAS) as the vehicle for the management and co-ordination of the project.

The revised DefStan will allow the use of corrugated board containing more recycled material, without degradation to MOD requirements. The ability to use increased recycled material will have a positive environmental impact and will help the MOD and DE&S to meet Greening Government Commitments. It also has the potential to enhance the MOD's reputation as a responsible user of packaging looking to maximise the use of recycled material in the supply of military capability.

The work has developed a highly effective model. Through the creation of a technical committee, the PEAS community are able to regularly review the impact of new technologies, legislation and standards. The packaging community is acting swiftly to ensure that information on the environmental impact of a multitude of materials is understood and available, so as the customer can make informed and environmentally responsible decisions.

Adam West
Internal Communications
Business Partner
Defence Equipment & Support

Military equipment, the finished pack © Conway Packing Services Ltd

Cleaning the Cold War telephone exchanges in Corsham Tunnels

Mark Bennett and team standing between the newly cleaned telephone exchanges © Mark Bennett

In *Sanctuary* 48, 2019, an outline history of the underground complex at Ministry of Defence (MOD) Corsham was given, as well as the start of the staged restoration of the Cold War telephone exchanges. The tunnels began as a Roman stone quarry, expanded in Victorian times and were then used during World War Two as an aircraft factory and a Naval ammunition depot. The most iconic use was as the Cold War Central Government War Headquarters, which would be used as a command centre for the Government in the event of nuclear attack.

The command centre was fully stocked for 4,000 people to live safely underground for many months whilst the world above them was contaminated with nuclear fall-out. As well as the Prime Minister, it would house the Chiefs of the Navy, Army and RAF, key personnel from the Home Office and Intelligence Services, as well accompanying support staff such as telephone operators, secretaries and cooks.

A key piece of equipment was the telephone exchange (also known as 'Woodlands'). It was so large and complex that it took between 1957 – 1961 to complete the installation. The exchange was linked to other secret regional command posts, known as Regional Seats of Government (RSGs). The RSGs had been dispersed across the country in Civil Defence regions to mitigate a single nuclear bomb on London wiping out all Government infrastructure. There were 17 RSGs, located at sites such as Kirknewton (Edinburgh), Cambridge, Dover, Nottingham and Drakelow.

Contained within the Woodlands exchange are two sets of Private Manual Branch Exchange (PMBX) operators' positions. A larger one with 40 positions is for switching internal calls (to the thousands of telephones on-site) and a smaller set of 14 positions switches external lines across the UK and overseas, such as to Commonwealth Governments, British Embassies and NATO headquarters. A directory enquiries desk still contains directories listing the whole of the UK. Tansad operators' chairs were provided and many remain still wrapped in their original brown paper. To the rear are extensive areas of exchange apparatus supporting the PMBX. The area is an unique example of the evolution of these types of exchange apparatus, as without space constraints older equipment remained in place when new upgrades were installed.

Until recently the PMBX exchange was deteriorating rapidly, but the installation of a roof covering (stage one of the restorations), dehumidification units (stage two) and lighting (stage three), all of which can be read about in last year's *Sanctuary*, indicated the potential for stage four, which was specialist surface cleaning. Monies were made available from the Conservation Stewardship Fund for conservation cleaning, and the Cold War specialist Mark Bennett was employed to clean the exchanges. Mark's team cleared debris from the previous roof collapses and under the direction of a conservator the exchanges were brush vacuumed and surface cleaned. Particularly effective was the cleaning of the foot rests and an application of conservation grade wax polish (Renaissance wax) to some of the wooden parts. The final phase (stage five) is the installation of more fans and dehumidification units to regulate the humidity in the room.

The consoles have regained much of their former glory. The construction of the new protective roof structure and the cleaning of the positions has been very worthwhile, enhancing both the physical stability and longevity of the consoles, but also the perception of them and their future. Standing back and looking at the room and the positions now is quite something.

Chris Daniell
Senior Historic Buildings Advisor
Defence Infrastructure Organisation

Telephone operator position 31 after conservation cleaning © Mark Bennett

Pond restoration work at Yardley Chase Training Area

Bunker A10 pond 2 showing a closed canopy. Most of the woodland ponds had this much cover in 2014. This is one of the ponds that has been left to accommodate the specialist invertebrates that associate with more shaded ponds © J. Blincow

Yardley Chase Training Area, Northamptonshire contains a unique system of woodland and meadow ponds created from 'borrow pits' of various shapes, sizes and depths, mostly dug during World War Two (WW2), with some in the 1950s.

The ponds were created following the construction of several storage bunkers serviced by a rail system. The compass direction of every storage bunker is different, adding variation to the ponds. Since WW2 the site has been used for various purposes, with the undisturbed ponds creating a unique range of microhabitats which have evolved to support a wide range of aquatic animals and plants. The railway lines were removed in the 1980s and as the use of the site changed so did the management. Many of the ponds became overgrown and the wildlife suffered.

Most of the 83 ponds are in woodland and the increasing cover of trees and scrub has caused problems of overshading and eutrophication, which can threaten the ponds' biodiversity. The problems have led to a loss of stoneworts in some of the ponds. Surveys have shown that the changes to the algal flora, including stonewort are most affected by the regeneration of the woodlands, increasing the amount of leaf litter, riparian shade, fallen branches, growth of reedbeds and silt.

The ponds support nationally important populations of great crested newt (GCN) *Triturus cristatus.* A lack of shade leads to a wider diversity of macrophytes to be present and this is important for GCNs to proliferate.

The ponds also support nationally important populations of dragonflies. Dragonflies are just one of the many groups of invertebrates that flourish on the Training Area. Currently, 309 species of aquatic invertebrate have been recorded in the ponds and that is a nationally significant number for a lentic site.

An eft GCN sloughing its skin © J. Blincow

Clearance work

The threats to the ponds' biodiversity led to Natural England categorising the Site of Special Scientific Interest (SSSI) as 'Unfavourable'. In response, significant funding has been invested since 2014 by the Defence Infrastructure Organisation's (DIO) Conservation Stewardship Fund to enable Landmarc Support Services (Landmarc) to deliver the required programme of scrub and woodland clearance to bring the ponds into 'Favourable' or 'Unfavourable Recovering' condition. The work has targeted the growth of the riparian canopy and understorey, which had led to the loss of biodiversity in some of the ponds. Teams have cleared willow, coppiced hazel and hawthorn, and felled oak, willow and silver birch over several winters. Removing the root systems of willow growing in the ponds has also contributed greatly to the success of the work. There are species present that require specialist microhabitats and with 83 ponds the clearance work has been managed to ensure a range of microhabitats.

Monitoring water quality

Aquatic macroinvertebrate communities are regarded as useful for assessing the conservation status of inland wetland habitats. Such assessments may compare individual water bodies within a larger complex, or provide local management recommendations which may form an integral part of any long term decision-making process for initiatives designed to protect and manage the aquatic environment.

Four-spotted chaser holding territory © J. Blincow

Left: this photograph, taken in May 2017, shows no surrounding or overhanging scrub or trees. The root systems of willows were not removed from the area, but were placed nearby as hibernacula for the newts. Right: by September 2019 the pond was in excellent condition. There had been strong growth of macrophytes including stonewort and pondweed and also emergent vegetation. The invertebrate assemblage had also increased significantly © J. Blincow

The aquatic invertebrate community data is currently being summarised using the Community Conservation Index (CCI) system. CCI is a community-based classification scheme that uses species level aquatic invertebrate data to provide scores showing the community richness of a feature's ecosystem. The summarised data has been interpreted into CCI scores that can be used to assist with future site management, confirm if the management has had the desired effect or assess the feature over the long term. As an example, the CCI scores for one of the managed ponds shows the effect that management has had on aquatic invertebrates.

Bunker B9 pond 1 CCI data:

Year	2016	2017	2018	2019
CCI Score	8.78	9.36	18.69	18.33

Key:

<5.0	A community of low taxon richness. Low Conservation value.
>5.0-10.0	A community of moderate taxon richness. Moderate conservation value.
>10.0-15.0	A community of high taxon richness. Fairly high conservation value.
>15.0-20.0	Sites supporting several uncommon species, a community of high taxon richness. High conservation value.
>20.0	Sites supporting several rarities, including species of national importance, or at least one extreme rarity and/or a community of very high taxon richness. Very high conservation value.

Bunker B9 pond 1 responded very positively to the clearance work, which increased the CCI by over 100% and changed from 'moderate conservation value' to 'high conservation value' in less than two years. Survey data for all ponds indicates a range of scores, from features including dense woodland to open meadow ponds, several of which have CCI scores approaching 20 – very high conservation value.

The GCN Habitat Suitability Index (GCNHSI) is a useful tool to assess the biological state of ponds. GCN presence is a good indication of the biodiversity of a pond and the surrounding area.

GCNHSI results:

GCNHSI 2016-19 data	Number of ponds	% total area of **ponds**
Poor	0	0
Below average	14	6
Average	22	16
Good	15	20
Excellent	32	58

The size of some of the smaller ponds negates them from being ideal for GCNs. The percentage of the ponds is a fairer indication of the state of the ponds with 94% of the standing water in the Training Area being 'average' or better, and 58% being classified 'excellent'. To ensure a range of microhabitats are available to support as biodiverse assemblage of species as possible, the team are not aspiring for 100% of the ponds to be excellent for the GCNHSI.

There is not a national database that records all the biological and environmental data for the site, e.g. the status for stoneworts, GCN numbers, macroinvertebrate communities and the Biodiversity Action Plan/Habitats Directive Annex species. It is therefore difficult to compare the site nationally, however collectively the 83 ponds are probably amongst the most valuable lentic ecosystems in Britain. They are part of a wider 143 pond system that spans the whole Yardley Chase Site of Special Scientific Interest (SSSI). It is difficult to think of a more diverse lentic ecosystem elsewhere in Britain.

Future

Further pond restoration continues on-site as part of DIO's programme of SSSI management, ensuring that the quality of these features are maintained.

The conservation team now has sufficient data to attribute CCI values for every pond and this can now be used to directly influence any work. By surveying every year, the effect of the management can be seen, and more detailed plans can be made for the future.

A more complete assessment of the conservation status of the ponds will be achieved by using the Predictive System for Multimetrics (PSYM) index. This uses a range of plant and invertebrate measures to define the general ecological condition of a feature. The results from this assessment should be available within the next 12 months.

Jeff Blincow
Conservation Group Member
Yardley Chase Conservation Team

HMNB Portsmouth's **Combined Heat and Power initiative**

HMNB Portsmouth's CHP boilers © Iain Greenlees

HM Naval Base (HMNB) Portsmouth is the homebase of the majority of the Royal Navy's surface vessels including the two Queen Elizabeth Class (QEC) aircraft carriers, providing their support at home and around the world. Established formally in 1193 by Richard the Lionheart, its size and facilities have adapted continuously over the centuries as the needs of the Fleet have evolved and the base has often been at the forefront of technological development. It now comprises 300 acres at the western edge of the City of Portsmouth, and the military Dockyard Port oversees shipping movements in the second busiest harbour in the UK.

As complex industrial sites with a wide range of personnel, logistics and heavy engineering support activity, most of the energy consumption is used to provide shore power to ships alongside, allowing critical maintenance to occur on ships' generators and relief for watchkeepers. This has been common practice in Naval Bases for almost a century. Grid derived electrical power also has significantly lower cost and environmental impact than running diesel engines alongside, in what are inevitably built-up areas. Recent classes of ships have developed to be larger than their preceding classes, demanding more shore supply to serve their increased equipment and air conditioning demands. For example, the Invincible Class carriers typically drew up to 2.5MW energy when alongside, while the new carriers have a peak demand of ~11MW.

The base's principal industrial partner, BAE Systems, provides an Energy Bureau Service to the site and has driven many years of active energy reduction measures. Despite this, the arrival of the QEC carriers now means that Portsmouth sits atop Defence's list, consuming 120GWh annually. This demand varies through the year with the Fleet's operational cycle, and typically represents 20% of the base's operating costs – as such measures to control this budget require continuous attention. The drive to reduce demand has been particularly acute here where the peak base load is 40% of the entire grid capacity on Portsea Island. Over the last 15 years, financially driven initiatives have reduced demand on the grid, and its associated carbon, by over 60%.

In anticipation of this pressure from the QEC, in 2008 the base ran a competition to build a large-scale Energy from Waste (EfW) plant. However, in the wider economic downturn, the preferred bidder's backers withdrew. Nevertheless by 2017, the previous decade of energy demand reduction measures provided sufficient headroom for the base to provide power to HMS Queen Elizabeth. However, when the second carrier was confirmed to be operational in 2015, the base was left with the choice of a major project reinforcing the grid supply to the island or generating its own energy. Experience from the earlier competition had identified that there were significant advantages from local generation, both to the base and to the wider community, reducing pressure on established capacity.

Market analysis confirmed the gains to be unlocked from an on-site Combined Heat and Power (CHP) plant. In addition to meeting the operational timeline, such a source could provide additional site wide energy resilience, protecting against any future interruption to grid supply, and offer electrical and thermal energy at a highly competitive rate. A further competition established that a mains gas-fired solution generating at 13MW would meet the base's steady state load and 80% of the operational load demand, provide surplus heat for the site's steam district heating system and offer an annual utilities cost reduction of £3.5M.

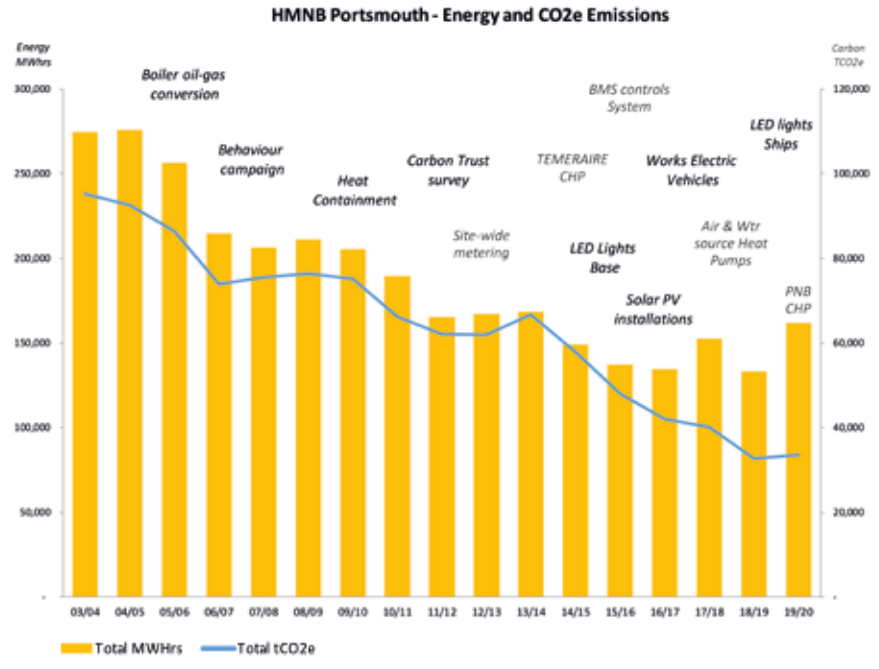
Assembling funding from the QEC Infrastructure programme, the Defence Infrastructure Organisation and Navy Command, the business case was approved in August 2017 and detailed design of the revised network began. The identified location for installation was to be at the centre of the site, immediately adjacent to both the grid incoming supply and the main boiler house. The design settled on three gas-fired engines, each generating 4.5MW of electrical power at 11kW and together releasing up to 11MW of thermal energy. This modular

system allows for operating flexibility to react to the changing maritime load, providing internal redundancy for maintenance and thus site resilience. The system is backed up by three 1MWh containerised batteries which serve to provide an uninterruptible power supply and thus ensure a rapid 'black-start' capability in the event of grid failure. Together, the systems have a design life to 2045.

The CHP engine house at HMNB Portsmouth © Iain Greenlees

For the BAE Systems' project team, this would be the largest single infrastructure project delivered under the Maritime Support Delivery Framework (MSDF) contract. In addition to the taut imperative of the arrival of HMS Prince of Wales in the autumn of 2019, they were faced with two principal challenges. Firstly, all civil works on a site of Portsmouth's history requires an exploration – for remnants of the World War Two bombing campaign against the site and then for the legacy of imprecisely recorded underground networks. Thereafter, the key technical challenge was to integrate these new systems into the elderly electrical, gas and steam networks. Parallel projects installed new conversion machinery into the QEC supply, fitted a new static frequency changer into the wider 60Hz supply and upgraded the whole network's supervisory control and data aquisition system, whilst critically ensuring no loss of supply to the waterfront or heating across the site. To bring these all together efficiently a new software power management system also had to be established and optimised.

Although no ordnance was uncovered, the remains of a demolished 'asbestos-rich' building were uncovered when preparing the foundations for the new engine house. Then, having cleaned and cleared the spoil, a redundant but filled Furnace Fuel Oil pipeline was uncovered, causing further delay in construction. Fortunately, engine manufacture in Germany proceeded apace and system commissioning began in the summer of 2019, with the first engine runs successfully providing electrical power to the base four weeks before the critical deadline.



HMNB Portsmouth's energy and carbon record © Iain Greenlees

The CHP system runs on an Operate and Maintain contract, guaranteeing 92% availability annually, ensuring sufficient power for the Fleet and underwriting the forecast cost reduction. While there have inevitably been teething troubles in the first six months of operation, these have been short-lived, the planned saving has been realised steadily and cost recovery of the initial capital outlay should be recovered within three years.

The project team has largely overcome the initial hurdles and are looking to bring forward initiatives to improve the system's performance further. Mains gas-fired, the system consumes three units of gas for each unit of electrical energy produced and the site's associated carbon footprint has risen sharply as a result. To offset this, the base has commissioned assessment studies for the installation of carbon capture in the flue stream, hydrogen generation to mix with the mains gas and converting the elderly district heating to a Low Temperature Heat Network, driven by the plant's thermal energy, as well as looking into provision of excess capacity to local users in the city. As energy and carbon reduction and environmental protection figure ever more largely in Defence thinking, this system's successful installation has provided a substantial reduction in the cost of operating the Naval Base and is another step on the ladder towards achieving efficient Net Zero operations by the middle of the century.

Iain Greenlees
Infrastructure Superintendent
HM Naval Base Portsmouth

Delivering an improved water supply to Salisbury Plain Training Area

Existing soakaway pipe and support removal from the Stonehenge Cursus © Paul Chadwick

The Army Basing Programme has seen approximately 5,000 Army personnel and families relocated to Salisbury Plain Training Area (SPTA). These personnel live and work in the areas surrounding Larkhill Camp and Bulford Camp. The drinking water supply and waste water infrastructure at both sites required improvements to ensure an uninterrupted service to meet this increase in population.

Defence Infrastructure Organisation (DIO) and Ancala Water Services (AWS) were tasked to ensure that SPTA infrastructure could cope with increased drinking water demand and waste water treatment whilst protecting the environment. An Integrated Water Management Strategy was developed, in consultation with the Environment Agency, Natural England, English Heritage, Wiltshire County Council, National Trust, local farmers and landowners. AWS assessed the existing infrastructure and implemented the upgrades, working with design and construction partners WSP, Dyer & Butler and Chemdose.

Pollution reduction, ground water resource management, heritage and infrastructure improvements were the key drivers for the scheme. Water supply to Larkhill Camp was predominantly supplied from three boreholes. To maintain security of supply, major improvements were required to the existing Wessex Water backup supply, including additional water treatment, a new high level break-tank and upgrades to valving arrangements which will allow fine control of all water sources. The additional supply from Wessex Water will ensure that abstraction will not exceed the forthcoming abstraction licenced quantities.

Waste water from Larkhill and the immediate camp area was historically treated at Larkhill Waste Water Treatment Works (WWTW) south of the camp, directly adjacent to the Cursus, a large Neolithic monument around 3km long, close to Stonehenge. The existing WWTW did not have sufficient capacity to cope with additional flows. A range of options were considered, to upgrade or replace the WWTW and after consultation with Wessex Water, a new Sewage Pumping Station (SPS) was constructed to transfer foul flows to Wessex Water's Ratfyn WWTW. This allowed the existing WWTW site to be returned to its natural state, improving the setting of the Stonehenge Cursus and removing pipe work that intersected it.

Transferring waste water flows to Ratfyn WWTW allowed a more efficient treatment process and improved effluent quality. To avoid disruptive excavation for the new pipeline to transfer flows, trenchless technology was utilised reducing impacts during construction.

The water supply to Bulford Camp was sourced from two boreholes, however, there was no alternative water backup arrangement. The Integrated Water Management System therefore included the provision of a new additional Wessex Water backup supply. AWS installed a new directionally drilled pumped main, a water treatment works and break tank to provide an alternate drinking water source, thus facilitating future abstraction licence compliance. AWS were engaged to assess the existing infrastructure and implement the upgrades, working with both their design partners WSP and construction partners Dyer & Butler and Chemdose.

Waste water from Bulford Camp already transferred to Wessex Water's Ratfyn WWTW via a SPS adjacent to the Nine Mile River. Whilst this SPS worked well under normal conditions, heavy rainfall events could lead to localised flooding and potential pollution incidents. To improve the robustness of Bulford SPS04, an additional pump and 100m^3 of storm water storage, with improved reliability and increased capacity ensured that storm flows remain within the waste water network. The scheme also included provision for 225 new Service Family Accommodation properties, improving resilience at Bulford village.

DIO and AWS project teams have worked closely with environmental stakeholders, design and construction partners to prevent a deterioration in the water environment on SPTA. This has also provided additional environmental benefits, improved the setting of scheduled monuments and significantly reduced the risk of sewage entering the water environment.

Paul Chadwick
Programme Manager
Ancala Water Services Ltd

In partnership with **Panthera**

The most recorded jaguar in Manatee Training Area © Panthera

The reactivation of British military training in Belize has come with a number of obligations that are captured in the Environmental Compliance Plan agreed with the Belize Department of the Environment. This includes a three-year commitment to monitor the impact of British Army Training Support Unit Belize (BATSUB) activities, and live firing in particular, on wildlife. All of the jungle Training Areas are located in Forest Reserves or Private Reserves with several in key wildlife corridors, therefore ensuring training is not disturbing or displacing wildlife is crucially important.

To achieve this, the Defence Infrastructure Organisation has recruited Panthera to undertake monitoring using networks of camera traps in two of the most heavily used Training Areas. The data collected from the camera trap networks is compared to data from a reserve with no military training. In the first year of the monitoring in 2019, a total of 104 cameras were deployed at 52 locations resulting in 5,284 trapping nights. In total, the camera traps in the two jungle Training Areas cover an area of almost 200km^2.

The results have been spectacular, with a wide range of mammals and ground dwelling birds being recorded for sites with very little systematic survey previously. At both Training Areas surveyed in 2019, Panthera recorded all five cat species found in Belize. Between them, 20 individual jaguars were photographed and only one of these had been recorded before. Repeated recording of individuals allows Panthera to distinguish resident animals from those passing through using their unique markings, and over time it is possible to establish home ranges and population dynamics. As well as jaguar, numerous other species were recorded within the Training Areas, including ocelot, margay, puma, neotropical river otter, white-lipped and collared peccaries, crested guan and currasow.

It is too early to correlate the findings with military activity but early indications suggest the localised effect of military training is having little or no impact. However, the camera traps have recorded high levels of illegal hunting that pose a significant threat to many species along with illegal logging. It is hoped that the presence of BATSUB and regular military exercises will reduce these illegal activities and the data being collected by the cameras will help assess this assertion.

Panthera is an international organisation dedicated to the conservation of the world's wild cat species and their habitat. The data being generated from the BATSUB surveys is therefore supporting a wider wildlife conservation effort in Belize and helping fill gaps and inform the production of national conservation management plans for one of the most biodiverse and wilderness rich countries in Central America.

The collaboration with Panthera goes beyond monitoring, with Panthera staff giving wildlife and safety briefings to exercising troops to brief them on what they will see, highlighting how to stay safe in the jungle environment and identify hazards from venomous snakes, spiders and biting insects. Panthera staff have also helped host UK VIPs to explain the importance of the BATSUB collaboration.

Panthera staff work closely with the BATSUB Team on the ground by conducting joint patrols to share local knowledge and identifying the best locations to place camera traps. The passion shown by Panthera through this work is helping educate BATSUB staff, their families and British troops passing through the country. This fosters a respect for the incredible array of wildlife found in Belize and the wider environment with benefits for all.

Maj Alan Grant[1] & Oliver Howells[2]
Training Safety Officer, Belize[1] &
Senior Ecologist[2]
Defence Infrastructure Organisation[1, 2]

Becky from Panthera inspecting a camera at 1963 Training Estate Belize © Maj Alan Grant

Heritage Hit Parade – the MOD Archaeologists' top five sites

The Cocidius Shrine at North Yardhope, Otterburn Ranges © Phil Abramson

The Ministry of Defence's (MOD) Historic Environment Team (HET) is charged with the stewardship of the heritage assets on the MOD estate. This is no mean feat considering that at the last count there were 1,063 listed buildings, 781 scheduled monuments, over 10,000 archaeological monuments, parts of 10 World Heritage Sites, six registered battlefields and eight registered gardens and parks – over half of the Government's historic assets, and that is just in the UK.

An important part of the job is to ensure that the historic environment is valued and promoted wherever possible. In reality, this means advising customers in the three military services and the Civil Service on best practice with respect to heritage conservation. In addition, it involves giving lectures to local societies, representing archaeology on MOD Conservation Groups, arranging visits to the sites and writing articles in magazines like *Sanctuary.*

A commonly asked question is, *"What is your favourite archaeological site on the MOD estate?"* Now that COVID-19 has confined us to barracks, the team have had the time to give that question some serious consideration. After much deliberation, the team came up with our personal top five sites in the 'Heritage Hit Parade'. Four of the sites have been chosen by the archaeologists in the HET Team, with a fifth site selected by our guest contributor, Richard Brooks, the Environmental Support and Compliance Principal and keen advocate for the Historic Environment.

An Engraving of the Deity at the Shrine to Cocidius (Phil Abramson, Archaeology Advisor)

In the Roman period the God Cocidius was worshipped in northern Britain, particularly in the Hadrian's Wall area, where several images and altars to the deity have been discovered. The Romans tolerated native religions and often conjoined the names of their own Gods with those of the people they conquered – a process known as syncretism. The Romans equated Cocidius with Mars, God of war and hunting and also with Silvanus, God of forests and groves. An altar from a milecastle on Hadrian's Wall reads *"…To the God Cocidius the soldiers of the Twentieth Legion Valeria Victrix willingly and deservedly fulfilled their vow…"* He was probably worshipped by lower-ranked Roman soldiers as well as by the native Britons for whom he was likely a tribal God.

The Otterburn Cocidius was discovered in the 1980s at North Yardhope in the eastern area of the ranges, where his engraved image stands as a sentinel at the entrance to his shrine. The shrine is a small square chamber measuring 2m x 2m and between 1.5m to 2m high, formed from large natural boulders with a narrow opening at the north-east corner.

The Inscribed Stone, Salisbury Plain (Richard Osgood, Senior Archaeologist)

At a lonely, secluded spot on Salisbury Plain, a large sarsen monolith stands. On it are two iron plaques describing, in wonderfully self-righteous language, the demise

The Inscribed Stone, Salisbury Plain © Iain Perkins

of a highwayman. *"This monument is erected to record the awful end of Benjamin Colclough, a highway robber, who fell dead on this spot".*

This is a fascinating monument as it evokes a lost time, highlighting a threatening natural landscape. It is, in fact, the second part of the story. The initial memorial is located at the edge of the A360 road and tells the tale of the robbery of Mr Dean of Imber by four highwaymen, Benjamin Colclough, Thomas Saunders, George Waters and Richard Harris, on 21 October 1839. These felons escaped across the Plain with three £20 notes and other items, but were not to enjoy their ill-gotten gains for long.

Mr Dean raised a posse who embarked on a three-hour chase to apprehend the robbers. Eventually they were surrounded and all bar one captured, the money recovered. The final miscreant, Benjamin Colclough, had disappeared. He was found, dead, at the spot now marked by the 'Inscribed Stone', the monument stating in great delight that *"The Robbery of the Wicked shall destroy them".*

As such this monument, paid for by public subscription, effectively acted as a gibbet – a warning to others that might be tempted by a life of crime. The military started buying land across Salisbury Plain from 1897 and this therefore marks the end of the non-military usage of the area.

So, what of Colclough's 'Companions in Iniquity?' Well, they were sentenced at the Devizes Assizes to 15 years transportation to Tasmania arriving on 5 February 1841. One wonders what visiting Australian troops make of this feature today!

Ynys-Hir Stone Circle and Cairn on Sennybridge Training Area (Guy Salkeld, Archaeology Advisor)
Mynydd Epynt is a desolate tract of upland plateau in central southern Wales, one of several high and remote moorlands towards the southern edge of the Cambrian Mountains. The greater proportion of Epynt was requisitioned in 1939 by the War Office and remains in use today as the Sennybridge Training Area.

The cairn at the North Pole, Sennybridge © Guy Salkeld

Deep in the Training Area lies a small circle of stones and cairn marked by the standard MOD 'no dig' star, denoting a scheduled monument. The circle is a simple arrangement of small locally sourced stones, 18m across with two entrances, it sits at 396m OD on an open crest with extensive views in all directions. The site was excavated in June 1940, as the last of the farms were emptied and hurried preparations for military training were in hand. The excavation revealed that the circle and cairn were constructed in the Early Bronze Age (EBA) four thousand years ago – a period that saw new pottery types, burial practices, stone monuments and metalwork. Inside the circle was a single post, perhaps of religious significance.

The cairn contained charcoal, two cremation burials, an anthracite bead and a small clay 'pigmy cup'. The cup shows links with the Peak District, whilst the bead probably came from the Carmarthen coalfield 30 miles to the south-west.

The EBA environment comprised grass heath with hazel scrub and mixed woodland. The later Bronze Age saw major environmental change as the climate grew colder and wetter, causing peat growth in the uplands which eventually became moorland.

The purpose of the circle is now lost, although it still receives occasional attention. One such visitor must have felt the cold and remoteness in the recent past as they left a faded message on the no dig star, recording that they reached the 'North Pole' at 14:00hrs on 30 January 1971.

St Kilda (Alex Sotheran, Archaeology Advisor)
St Kilda is a tiny group of islands 40 miles off the west coast of Scotland. In 1930 the last 36 human inhabitants were evacuated, leaving the island empty. In 1957 the MOD leased part of the island to build a missile tracking station to cover the north Atlantic. The island's position is such that a wide area can be scanned and the radar station has been in operation almost every day since. The station staff provide the island with a human element, but St Kilda is also home to various species of animals and birds, such as the St Kilda wren *Troglodytes troglodytes hirtensis*, which is unique to the islands.

The islands are dotted with historical features, including the main street of houses built in the mid-19th century. Archaeological evidence has demonstrated human occupation dating back to prehistory. Scattered across the islands are cleits: stone-built, squat structures which were used to store peat and food. Cleits were built with deliberate gaps in the stonework to allow the wind to pass through and dry or preserve whatever had been placed inside. There are approximately 1,200 of these structures on the island!

Dramatic view of the cleits and houses on St Kilda © Alex Sotheran

The unique aspects of the island means that St Kilda has both natural and cultural World Heritage Site status, one of only 39 mixed-status sites in the world. The MOD is committed to safeguarding the fragile historical and archaeological aspects of the island and recently commissioned an open-area archaeological excavation prior to the construction of some new accommodation blocks. The new structures are more sympathetic to the island's character, with low silhouettes and bio-roofs. The excavation was the largest ever undertaken on St Kilda and it has provided a unique insight into the island's historical development, with the recovery of artefacts and features which predated the 19th century houses.

Dreamer's Bay, Cyprus (Richard Brooks, Principal – Environmental Support & Compliance)

RAF Akrotiri is a UK Sovereign Base providing support to British Forces Cyprus. It is also home to a beautiful and exciting archaeological site – Dreamer's Bay.

Dreamer's Bay is found on the southern coast of the Akrotiri Peninsular, Cyprus. Popular with station personnel and families as a recreational beauty spot, it is becoming increasingly apparent that some 2,000 years ago this secluded spot was a bustling Roman harbour. Archaeological evidence indicates this natural anchorage was supported by a man-made breakwater, cliff quarries, warehouses, stores and potentially even a lighthouse! The port obviously served Akrotiri's Roman village communities but was also an important trade gateway for the city of Kourion, 13km to the north. Evidence has demonstrated that ships brought cargo here from many parts of the Roman Empire until the harbour was destroyed – potentially by an earthquake in circa 360AD.

From the clifftop above the bay the remains of the breakwater can still be seen through the clear Mediterranean water; divers in the bay have recorded broken and complete amphorae and nautical detritus such as anchors.

On the shoreline vast amounts of broken pottery is strewn across the shore and around the remains of the harbour buildings. Archaeological excavations and marine recording by the Universities of Leicester and Southampton, supported by the Station, the Republic of Cyprus Department of Antiquities, Defence Archaeology Group, Operation Nightingale volunteers, and many more partners too numerous to mention, is slowly revealing the secrets this beautiful spot holds.

Back on the clifftop the incredible archaeology of the bay takes another twist. Hundreds of tombs have been identified along the eroding cliff edge, varying from simple grave cuts in the bedrock to elaborate architecturally arched tombs cut and constructed on the vertical cliff face, perhaps indicating the wealth and status of those interred.

As you can see, the sites chosen by the team cover the whole of Great Britain, with one further afield. Those of you who have trained on the MOD estate, or have worked on it in some other capacity, may have come across some of the sites and will perhaps have your own particular favourite. But when all said and done it is a personal choice... and these are ours!

Phil Abramson
Archaeology Advisor
Defence Infrastructure Organisation

The view from the cliffs overlooking Dreamer's Bay © Simon James

NEW YEAR HONOURS LIST 2021 – RICHARD OSGOOD MBE

Richard Osgood is the Ministry of Defence's (MOD) Senior Archaeologist. He is responsible for the stewardship of one of the most important and complex heritage estates, as described on p86.

Despite the demands of this role he was one of the originators of, and remains the driving force behind Operation Nightingale, a programme that uses archaeology to influence the lives of Wounded, Injured and Sick military personnel and veterans. For 10 years Richard has worked tirelessly with Statutory Bodies, charities, Defence commands and service individuals to create a unique environment to aid recovery by participation in essential Defence archaeological work, as part of mixed civilian/military teams. In excess of 250 service and veteran personnel have engaged in unique projects and life experiences. These include excavation of Anglo-Saxon cemeteries on Salisbury Plain, World War One practice trench systems, a war horse hospital, a Spitfire crash site and tide exposed 18th century skeletons in Portsmouth harbour.

As a result of Richard's remarkable drive, commitment, natural empathy and humility, the impact has been remarkable. For some, it has been a catalyst to managing their problems better, while for others it has changed the course of their lives with completion of archaeology qualifications and careers in heritage.

Richard's inspirational enthusiasm has generated support from across Defence, heritage bodies, archaeology companies, academia and local communities who have been inspired to volunteer their time and expertise. Often in his own time, he appears on television, at conferences and in written media to promote the MOD's custodianship of its heritage estate and to garner support for Operation Nightingale.

As a mark of the impact of the programme, his exceptional personal commitment and his standing amongst his peers, Richard was awarded an MBE in the Queen's New Year Honours List 2021.

Richard Brooks
Principal Environmental Advisor
Defence Infrastructure Organisation

OBITUARY – MAJ (RET'D) TONY CREASE MBE BEM

Many *Sanctuary* readers will have known or encountered Tony Crease who sadly died on the 4 January 2021 after a period of illness. Tony was a great advocate and supporter of *Sanctuary* and contributed many articles to its pages, encouraging others to do likewise. Its content has been richer for his input. Tony was an extraordinary man with a huge enthusiasm for the natural environment and a charm and drive that made seemingly impossible environmental projects entirely possible.

There is no better demonstration of this enthusiasm and passion than the legacy he has left in Foxglove Covert. Foxglove grew from a patch of scrub where he walked his dogs while QM of his Regiment nearly 30 years ago, to a nationally recognised exemplar of environmental stewardship with its unique mosaic of wildlife habitats. The Foxglove achievements under Tony's leadership would fill these pages many times over, but it would be remiss not to include some of the most significant. Foxglove has hosted nearly 750,000 visitors, 42,000 educational visits by children, ringed over 130,000 birds, and won the prestigious Silver Otter Sanctuary Award twice.

Tony's other great interest was ornithology, a hobby he discovered as a young boy and which he pursued with a passion until his death. He was a bird ringing trainer for the British Trust for Ornithology, a qualification not easily earned, and was nationally known for his commitment to training new ringers. For 28 years he planned and led Operation Auk, the annual trip to Cape Wrath Ranges to carry out the Environmental Impact Survey, ringing over 55,000 seabirds, contributing to a variety of research projects.

Tony was a stalwart supporter of the Conservation Groups in Defence Training Estate (DTE) North, making a point to attend each one. He would particularly encourage participation by experts from less well-known areas of the natural environment, most notably bryologists (who study bryophytes (such as mosses and liverworts)) and dipterists (experts on flies belonging to the order Diptera). Tony was a champion of the sustainability of the DTE, Chairing and driving the DTE North conservation and stewardship projects with a fierce focus on our woodlands, which the Defence Infrastructure Organisation's Senior Forester will attest to!

Maj (Ret'd) Tony Crease at Foxhenge © Crown

Above all, Tony was an unfailingly polite, charming, strong-willed and unforgettable man who touched not only those of us who count him as a friend, but all those who came into contact with him. While we will miss Tony, we should celebrate and perpetuate his considerable conservation achievements.

Lt Col Mark Holden
Commander North Training Estate
Defence Infrastructure Organisation

A guide – MOD Conservation Groups

Members of Salisbury Plain Conservation Group completing their annual surveys of Nine Mile River © Crown

The History of Ministry of Defence (MOD) Conservation Groups

Lt Col (Ret'd) Norman Clayden was the first Conservation Officer for the MOD, appointed in 1973 in response to recommendations that the MOD do more to protect the environment. Lt Col (Ret'd) Norman Clayden formed important relationships and links between MOD land managers and civilian organisations and coordinated conservation projects, facilitating the formation of over 35 Conservation Groups in only a short space of time.

As a result of his efforts, by 1983, two thirds of the MOD estate had been surveyed for its wildlife and archaeology. By 1993, 37 Sites of Special Scientific Interest (SSSI) had been designated and archaeological features not recorded anywhere else had been discovered. Lt Col (Ret'd) Clayden's legacy is reflected in today's network of over 125 active MOD Conservation Groups, supporting sustainability, environmental and heritage conservation projects across the estate in both the UK and overseas.

Why are MOD Conservation Groups beneficial?

MOD Conservation Groups are chaired by the site's Commanding Officer or Head of Establishment. They bring together representatives from across the MOD, relevant statutory bodies and other experts in wildlife, heritage and public access, most of whom are volunteers, to discuss conservation initiatives and sustainable land management. Meetings are usually held biannually.

Conservation Groups benefit the MOD estate in innumerable ways. Bringing together stakeholders provides a forum for internal discussion of future management, enables a wealth of knowledge to be shared, forms lasting relationships between organisations and communicates the good stewardship credentials of the MOD. Conservation Groups enable surveying and monitoring work to be carried out, mostly by volunteers whose skills and expertise are invaluable to both small and large-scale projects.

Conservation Groups embed Defence in a local context, providing transparency of MOD activity and stewardship to the wider public. They act as an important interface between the military and local communities. Projects such as allotments, garden creation and school nest box schemes also enhance both the military living community and the workplace environment.

Brig Jonathan Bartholomew said "*The Overseas and Training Estate has the challenge to meet the evolving requirements of Defence in some of the world's most environmentally sensitive and remote locations. Conservation Groups provide my team with the ability to collaborate one to one with leading land managers and environmental specialists, whose knowledge is not only highly valued but is also vital as we work together to deliver a sustainable estate".*

Running a Conservation Group

It is mandatory under Joint Service Publication (JSP) 850 to establish a Conservation Group wherever there are nationally protected sites on MOD land (such as SSSIs). It is however widely encouraged that all establishments set up a group due to the conservation benefits they can provide.

Resources are available to assist with setting up and running a Conservation Group, including the dedicated Conservation Groups and Sanctuary Team. The Chairpersons' pack offers guidance on the role of the Chairperson, the development of site dossiers, templates for meeting agendas and essential contact details. The quarterly Conservation Update newsletter communicates sustainability matters occurring across the estate and provides news on active projects. Funding opportunities are also available through the Conservation Group Grant, for purchase of tools and equipment.

Maj Rick Bevan is a Conservation Group Chairperson. He said *"MOD Training Areas are home to some of the most threatened species in the country. Conservation Groups are about putting something back to benefit wildlife in MOD Training Areas, which include some of the most unspoilt countryside in the UK. Being a Conservation Group Chair allows me to draw on a large pool of specialist knowledge that allows me to make decisions that maximise support to conservation and the environment. It is, without doubt, the most pleasurable part of my job"*.

For further information about MOD Conservation Groups, please contact the team at DIO-ConservationGroups@mod.gov.uk

Rebecca Jenkins
Assistant Conservation Groups & Sanctuary Officer
Defence Infrastructure Organisation

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. **Spotlight on... Home Counties**
2. **Catterick Training Area** North Yorkshire
3. **Yardley Chase Training Area** Northamptonshire
4. **South East Training Estate** Kent & East Sussex
5. **Newtown Range & Jersey Camp** Isle of Wight
6. **RAF Valley** Anglesey
7. **Magilligan** Northern Ireland
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9. **Dstl Porton Down** Wiltshire
10. **South Cerney Station** Gloucestershire
11. **Castlemartin & Templeton** Pembrokeshire
12. **Bicester Garrison** Oxfordshire
13. **Salisbury Plain Training Area** Wiltshire
14. **BATSUB** Belize
15. **DM Gosport** Hampshire

Spotlight on...
Home Counties

Habitat enhancement exclosure at Browndown 2020 © Sarah Jupp

Ministry of Defence (MOD) sites in the Home Counties cover 6,283ha of Site of Special Scientific Interest (SSSI). Many are also of international importance as Special Areas of Conservation and/or Special Protection Areas (SPA) for lowland heath, breeding birds, herptiles and invertebrates. Conservation management is mainly delivered via agri-environmental schemes by various parties working closely with MOD. There are also locally designated wildlife sites such as Sites of Nature Conservation Interest (SINC) or non-designated areas with priority habitats and species which the MOD seeks to positively manage.

The sites have a complex suite of land use interests, with a need to meet changing military needs within increasingly urbanised settings. These various matters are managed by the MOD, with the help of MOD Conservation Groups, via Integrated Rural Management Plans (IRMP), or other plans on sites with nature conservation designations. The IRMP's are in final draft at the time of publication. The groups are very active, helping to deliver and monitor wildlife survey data. Such information is critical for helping land managers to make informed and integrated decisions for agri-environmental scheme works and via the MOD Conservation Stewardship Fund (CSF).

Tweseldown, Aldershot – a major turn around in conservation fortunes

Tweseldown is an internationally renowned racecourse located within part of the MOD Aldershot Training Area and Thames Basin Heaths SPA. The site is let to a business tenant who from 2016 ventured into the 'new' world of biodiversity management. Excellent collaborative working and experience sharing by the tenant and staff, military personnel, Natural England (NE), Hampshire and Isle of Wight Wildlife Trust (HIWWT) and members of MOD Bourley Conservation Group have turned a site from unfavourable declining to nearly favourable SSSI condition, whilst ensuring business sustainability and continued public access.

The site is in the second year of a five-year Countryside Stewardship term, with completion of extensive capital works such as the removal of approximately 10ha of scrub and bare ground creation. These have quickly showed the development of desirable regenerating common gorse, ling heather and acid grassland and very encouraging breeding SPA bird data. Ongoing Countryside Stewardship work will focus on managing a mosaic with improved habitat connectivity.

Barton Stacey – SSSI lowland chalk river, priority habitats and notable moths

The current five-year Management Plan for the River Test chalk stream SSSI is being updated to better reflect the desirable features of a 'wild fishing river' as guided by the Barton Stacey Fly Fishing Club, Wild Trout Trust, Environment Agency and NE. Recent works undertaken by the Fishing Club and MOD include periodic removal of aquatic vegetation, coppicing and pollarding to enhance the sunlight mosaic along the riverbanks and installation of woody debris to improve localised water flow, sediment quality and habitat for small fish fry and invertebrates. There are also ideas for larger scale river restoration works.

Other areas are not designated but support the Natural Environment and Rural Communities Act 2006 S41 priority habitats and species. MOD is part way through collating and extending the coverage of wildlife data from Conservation Group members as an IRMP Annex. This has helped guide a more integrated assessment for essential new military training woodland and highlighted the value of other areas such as the species-rich calcareous grassland on the range floor at Moody Down. The safety mowing management prevents the sward from becoming rank and allows flowering to benefit pollinators.

Other S41 habitats include Open Mosaic Habitats on Previously Developed Land and Wood Pasture and Parkland. The former can often be underestimated as it offers high value for wildlife adapted to harsh conditions such as free draining and dry niches around hard-standings.

The resultant flora such as dark mullein support the nationally rare striped lychnis moth and S41 birds such as yellowhammer. In just one of the training compartments, 293 moth species have so far been found with 10 as S41 species.

Longmoor – partnership working; native cattle grazing, silver-studded blues and historic range features

The new Countryside Stewardship schemes with HIWWT and Amphibian and Reptile Conservation (ARC) cover approximately 484ha and levered in monies for extensive scrub management. The National Lottery Heritage Fund monies, via the South Downs National Park Authority, have complemented such works by helping with an upgrade on stock fencing and water provision and purchase of more longhorn cattle to extend beneficial grazing. MOD in-house has undertaken habitat management such as increasing the extent of suitable bare ground and pioneer vegetation within mature dwarf shrubs to benefit sand lizard and smooth snake as a partner contribution.

A smaller project is looking at how to integrate visual improvements to historic range features such as raised butts and low-key public access, with woodland glade management to benefit SPA birds which are sensitive to disturbance. A Conservation Group volunteer is continuing with butterfly surveys on Longmoor Hub sites, including S41 species such as silver-studded blue and mapping key habitat areas and corridor linkages, which ARC, HIWWT and the MOD aim to include in their respective management plans.

CSF works to create woody debris at Barton Stacey © Sarah Jupp

Aldershot Training Area and bats

The MOD recently funded a survey as to whether bats are using a few World War Two pillboxes which had roost features added about eight years ago. The findings suggested at least one was being used, with recommendations such as focussed scrub removal which have been added to the MOD CSF five-year rolling works plan. A local voluntary bat surveyor is undertaking surveys in the same locality of woodland and wetland habitats. It was great to watch Daubenton's swoop over the water with pipistrelles circling above and the classic loud 'chip chop' echolocation calls of noctule in the mix. After just a few very localised visits, seven bat species have been reliably identified and there is a hope to do more such surveys across the estate.

Ash Ranges – a spider heaven

The Surrey Wildlife Trust manages large parts of Ash, Pirbright and Barossa Ranges for MOD via agri-environmental schemes. These ranges are all rich in wildlife with recent entomological surveys by NE specialists highlighting their importance for nationally rare invertebrates. Ash Ranges is probably the best spider site in the country with an amazing array of small creatures. One could easily 'walk on by', not realising that for example, the lynx spider, rather than making a web and waiting for prey to come along, speedily runs and leaps amongst the vegetation as an ambush hunter!

Browndown Training Area – heathland, winter pools and fen

The MOD continues with annual works to manage the high-quality coastal heathland and other habitats such as winter pools over bare to semi-bare shingle substrate, supporting rare plants such as dotted sedge. More commonly found plants such as bird's-foot trefoil play an important role as the host plant for the endangered Gilkicker weevil. As part of continued integration for military training, public access and ecology, recent initiatives include a fencing exclosure to help restore semi-vegetated shingle and improved information awareness of a valuable high tide winter roost area for ringed plover, dunlin and sanderling so they can rest up before returning to their Arctic breeding grounds in spring. The fen – scrub-heathland ecotone on the SINC sites are also being positively managed for breeding birds, water vole and notable flora.

Longhorn cattle at Woolmer heathland © ARC

Sarah Jupp
Ecologist
Defence Infrastructure Organisation

North Yorkshire
Catterick Training Area

Little grebe © Chris Catling

A note from the Editors. The following article was written by Maj (Ret'd) Tony Crease prior to his recent death. His annual contributions to Sanctuary will be greatly missed:

Our most recent Conservation Group meeting was a casualty of the current COVID-19 situation and so it has been a challenge in the circumstances to keep abreast of the group activities. Various factors seem to have conspired to disrupt the annual routine, not least the weather which produced five months of rain over winter leaving the Training Area utterly saturated. That was followed by weeks of baking heat and sunshine drying out wetter areas into what resembled the fringes of Akrotiri Salt Lake, which in its own way seemed to diminish spring and leave the ground a vast mosaic of deeply cracked mud.

Since then we have been through the lockdown and with all the restrictions that were in place we expected to be permanently gated and achieve very little. Reality has proven rather different and, imagination or not, many species seem to have thrived. Where possible we progressed the monitoring of the nest boxes which are quite active here from early March. With over 800 to control it was a busy period.

As ever food is the catalyst and this year small mammals have flourished. Without going into detail, we have ringed more than 70 tawny owls and kestrels and at over 80 already we still have more barn owls to go. In the local woodlands the oak trees in the vast bluebell fields have attracted very good numbers of pied flycatcher with over 150 ringed and decent but lower totals of redstart (27). Some of these woods are just perfect for these species, yet surprisingly the trees themselves seem reluctant to self-generate. We have these beautiful specimens, many over 100 years old, but almost none of them appear to raise any young! It is the same story in many of the oak woods we frequent in Swaledale.

Swallows have done poorly this year and noticeably reduced pairs seem to have returned. They were outnumbered initially even by the buzzards, which considering there were only two pairs 20 years ago, have expanded into many of our small local woodlands with 12 pairs nesting within a three mile radius of Wathgill Camp. We managed to ring nearly 30 but they were quite hard work and time consuming.

Botanically it has been a bumper year for orchids and in some areas there are fields of them. Work on pillwort with our friends from Strensall has been very productive and we now have quite substantial areas of this scarce fern spreading throughout Foxglove. The early flowers in the wildflower meadows have done remarkably well and we have introduced a small flock of Hebridean sheep to reduce the worst of the vegetation, whilst hopefully limiting the damage.

Addled eggs have been a rather disturbing feature of some of our raptors and we have found six out of eight merlin eggs, an entire peregrine nest and several kestrels, all failing to hatch. Some eggs we have sent off for analysis to see if there is any common denominator other than poor fertilisation.

The moth-ers have been active when the weather has permitted and much to their delight they added two new species to their records. These were beautiful snout and coronet, the former only the second record for North Yorkshire, taking the moth total to 560.

It has been a very unusual few months and there will be more news to come. The group activists have not been deterred and results of the butterfly and dragonfly transects are just coming in. What has become very obvious has been the abundance of species seen on the range bases and Training Area which compares very favourably with the adjoining Dales' habitats. We are very fortunate to enjoy the amazing variety of wildlife and opportunities that we have within the Catterick footprint. Early indications show over 200 lapwing ringed and more than 30 curlew – what a privilege!

Maj (Ret'd) AJ Crease
Deputy Commander
Defence Training Estate North

Large emerald moth © Janet Hutchinson

Northamptonshire
Yardley Chase Training Area

Left: ancient field maple stool that is 500+ years old. Right: veteran large leaved lime coppice © J. Blincow

Beetles
In 2016, the Conservation Team at Yardley Chase Training Area in Northamptonshire began a beetle project, targeting species associated with deadwood. Little was expected of this project, but now, with five years of data we realise that the Training Area supports an internationally important assemblage of invertebrates associated with deadwood. Most of the other deadwood projects elsewhere in England focus on ancient trees in wood pasture, but it quickly became clear that our important beetles were in the woodland, as well as the veteran and ancient oaks in the Training Area parkland.

Coppice trees
Yardley Chase contains a unique system of woodland. Prior to the 20th century much of the ancient woodland in Northamptonshire was managed as coppice with standards. The coppice system was not abandoned until the heavy felling to meet the demands for World War Two. To the trees in the Training Area this was just another coppice cycle and since then most have been untouched.

The spotlight of the beetle project moved towards the woodland in 2017. The relict coppice has proven to contribute significantly to the invertebrate assemblage, and the old coppice trees and high levels of standing and fallen deadwood are the contributing features identified. Work on veteran and ancient trees normally focuses on single stem trees in open environments. One would not normally look in woodland for ancient trees.

The small volume of literature that was available has enabled us to age the trees. Trees enclosed in woodland grow more slowly than those in parkland, and some of these old coppice stools have proven to be as old as, or older than, the single stem ancients in the deer park. The large amounts of dead and living wood in the coppice stools and root systems create a complex array of micro-habitats that are home to many rare and little-known invertebrates. This is the natural storage zone for the myccorhizal fungi that research has shown the forest trees of the future will need to associate with.

Woodland designation
The project has been able to identify and document valuable woodland features and enable the ancient woodland to be correctly designated. Yardley Chase Training Area was not visited by the Nature Conservancy Council when ancient woodland was originally mapped, and also missed out in subsequent updates. Consequently, the Training Area woodland was incorrectly labelled as plantations on ancient woodland sites (PAWS). A successful application was made to ensure the Ancient Woodland Inventory was amended through Natural England and Defra. The amount of ancient semi-natural woodland (ASNW) on Ministry of Defence (MOD) land has therefore increased by 100ha.

Action by the MOD
Now that the value of the old coppiced trees in the relict coppice has been identified it is important to incorporate these into woodland management plans. Keeping the amount of deadwood at the current significantly high levels will also help. The old coppiced trees have all been mapped and with advice from Natural England, the Defence Infrastructure Organisation have made available numbered tree tags. The tagging of the trees will have been completed by the time this article is published.

Future
The history of the woodland was recorded in the country estate documents and since the MOD has taken over the site, the management has had a suitable low-footprint. The beetle survey has increased knowledge, understanding and the value of the woodland. The site has more old and ancient trees in the woodland than in the wood pasture. The coppice stools and deadwood are helping to support an internationally notable set of saproxylic invertebrates. We are only now scratching the surface of the value of this site. The long history of protection by a country estate, followed by the secrecy and protection afforded by the MOD has given us a unique site. It is a complex mosaic that supports a huge biodiversity.

Jeff Blincow
Conservation Group Member
Yardley Chase Conservation Team

Kent & East Sussex
South East Training Estate

A hibernating dormouse at Mereworth Woods Training Area © Suzie Simpson

The year was dominated by felling ash trees infected by the fungus *Hymenoscyphus fraxineus* across the East Kent Training Area. This resulted in 15ha of diseased ash trees being felled. Landmarc Support Services (Landmarc) have ensured that saplings of English deciduous species have been planted to replace the ash. However, in the short term the landscape of parts of the Training Area has been sadly altered.

On 17 May 2019 the Crowborough Conservation Group visited Mereworth Woods to look for snakes. The walk was led by local herpetologist Rick Hodges of Kent Reptile and Amphibian Group and Suzie Simpson from Hadlow College. Numerous slow worms were encountered during the walk although the hoped for adders were not seen. In addition, a sleepy dormouse was discovered curled up on a bed of moss in one of the dormouse boxes and a brood of nuthatches had chosen to nest in one of the Conservation Group nest boxes.

The following week, on 22 May 2019, the Cinque Ports Training Area (CPTA) conservation walk visited the Swingfield valley in the East Kent Training Area to look at species-rich grassland projects sponsored by Natural England (NE). The walk was led by Dan Tuson of NE and Sue Buckingham, the CPTA Conservation Group botanist. Over the last 20 years, NE has encouraged the Ministry of Defence's (MOD) tenant farmers in the Lydden, Swingfield and Temple Ewell Training Areas to sow native provenance wildflower seeded grasslands across the East Kent Downs. The result is arable land rich in flower and grass species.

On 2 July 2019 the Mayor of Dover opened the Kearsney Abbey Loop permissive path on behalf of Dover Ramblers. This allows the public to use a path along the boundary of the East Kent Training Area in order to avoid a dangerous stretch of road at Kearsney.

In September 2019, CPTA and Landmarc staff assisted the North Downs National Trail to install an oak bench on a particularly beautiful stretch of the trail at Etchinghill. The bench overlooks a picturesque part of the Kent Downs landscape and on a summer day it provides a lovely spot to sit and listen to skylarks and yellowhammers in the skies above Tolsford Hill.

For a third year, CPTA, Landmarc and George Peet, the Defence Infrastructure Organisation's south-east forester, collaborated to plant 2km of new hedgerows on the East Kent Dry Training Area. Part of this included laying 400m of old hedgerow to thicken and enrich an existing hedgerow.

In early 2020, Richard Goslett, Landmarc Rural Manager, collaborated with Kent Bat Group to convert four World War Two bomb shelters in Reinden Wood into 'bat caves' to protect bats that roosted in them. This nicely links in with Kent Bat Group's project using tree mounted bat detectors to confirm if the rare greater horseshoe bat has returned to the Dover area.

After years of consultation and environmental surveys, work by the Environment Agency (EA) on the Hythe Ranges sea defences commenced in April 2020, with the main sea defence works completed in December 2020. The sea defence work to 'hold the line' at Lydd Ranges has been subject to prolonged delays to planning approvals due to NE's position that natural erosion and flooding processes should have precedence on the site.

Storms in February 2020 badly damaged the green bank at Lydd Ranges and eight ranges were flooded by sea water. The EA were forced to start significant emergency sea defence works along a 1km length of the wall from Jury's Gap to reduce the risk of flooding to the wider Denge Marsh peninsula. Works were temporarily halted over the summer of 2020 because of the presence of six nesting avocet pairs on a lagoon in the Midrips section of the ranges, but are due to complete before the next winter storms. It is hoped that we will be able to report progress with the full sea defence scheme in the next edition of *Sanctuary*.

Maj Rick Beven
Senior Training Safety Officer
Cinque Ports Training Area

Isle of Wight
Newtown Range & Jersey Camp

Newtown Range footbridge, Rodge Brook © W. J. Woolcock

Newtown Range and Jersey Camp is an 810 acre estate situated on the north-west of the Isle of Wight. The majority of the estate is designated a Site of Special Scientific Interest, a Ramsar site and an Area of Outstanding Natural Beauty. The site also forms part of the Newtown Nature Reserve.

Acquired by The Territorial Force Association of the County of Southampton in 1911, the ranges have been used to train Regular and Reserve forces throughout World War One and Two. Today the estate is owned and managed by the South East Reserve Forces' and Cadets' Association and its main role remains the provision of a training facility for Cadets, Tri Service, Regular and Reserve forces.

The estate is home to an abundance of flora and fauna, none of which could be recorded and monitored without the professionalism and untold wealth of knowledge held by our enthusiastic Conservation Group members. Both a nightingale and a woodland management project are underway with support from the Defence Infrastructure Organisation's Conservation Stewardship Fund (CSF).

Botany
The meadows of the range have been managed for well over 100 years by receiving a late season cut and bail without any grazing or input of nutrients. The meadow flora is certainly distinctive. Floristic richness has been at the expense of nutritional value so that today our fields are rich in floral species but are very poor as a hay crop. The meadows are the largest area of unimproved hay meadows on the Isle of Wight, very rich in grassland plants with a total of 77 species recorded. On estimate, there are at least 86 meadow species present.

Some species, namely heath dog-violet *Viola canina*, Dyer's greenweed *Genista tinctoria*, dodder *Cuscuta epithymum* and saw-wort *Serratula tinctoria* are present in higher densities than any other site on the Island. Not only is this the only site for the species within neutral grassland on the Island but this habitat is very rare for dodder, not just in Britain but in Western Europe.

Entomology
Marbled white butterflies emerged in May and flew in their thousands within Locks Copse and the meadows until July. The range meadows are also a haven for the common sighted small heath butterfly which usually broods twice in a season.

Despite these sightings, it is without a doubt that our star butterflies are the white admiral and silver-washed fritillary which live within Lock Copse but emerge to feed on the bramble flowers on the edge of the copse. A very rare variant of the silver-washed fritillary is the valesina which has been spotted within Locks Copse. This variant was first recorded in the New Forest in the 19th century.

Ornithology
The varied habitat is in pristine condition for wildlife, particularly birds where up to 124 species are recorded each year with some 60 species remaining for breeding. Over the past 12 months we have recorded three new species, namely black swan (obviously an escapee), white-tailed sea eagle and brambling. Monthly Wetland Bird Survey counts continue with numbers of waterfowl such as brent geese, widgeon, teal and pintail in huge numbers. On 8 February 2020, 56 species were recorded including one spoonbill and two jack snipe. A pair of peregrines have again successfully raised young on one of the osprey poles.

Good numbers of nightingales were present including eight along the Clamerkin holding territory. It was here that with a CSF grant habitat management was carried out, the aim of which is to extend the life of suitable habitat for breeding nightingales.

Many thanks to Iain Perkins and James Nevitt for their continued support.

Conservation Group Members
Newtown Range Conservation Group

Peregrine falcon chick being ringed © J. Willmott

Anglesey
RAF Valley

Anglesey Flora Group arrive at RAF Valley for the site's first botanical survey since 2006 © Aled Rowlands

Botanical survey

During the year WO Paul Shanks and Station Environmental Adviser, Aled Rowlands hosted 14 members of the Anglesey Flora Group to conduct a botanical survey of the airfield. This is the first time a survey had been conducted on the base since 2006 and forms part of the Botanical Survey of Great Britain 2019. It was slightly out of season for the group as early to mid-spring is usually the best time of year for recording purposes. The method used for the floral survey consisted of measuring the diversity of species in each 1km x 1km square (monad). Within many of the monads covering the airfield the number of plant species previously recorded were only in the hundreds. However, throughout the survey, numerous non-recorded species were added, potentially taking some of the scores well over 200.

The group were particularly impressed with Area 2 (an area of the airfield which is untouched). In discussions with the group, which consists of both botanical specialists and ecologists, it became apparent that this untouched area is an example of what the area would have looked like before the airfield was there. It was in this area that the group found a hybrid horsetail, a species only found in one other place in the whole of Britain (which happens to be in Valley wetlands).

As the surveyors navigated the area, several ant hills were also discovered and were believed to be 200-300 years old! On the second day of surveying, further discoveries of the hybrid horsetail were made (two further specimens), in addition to several other rare species that had been discovered over the course of the two days.

In summary, the group were very pleased with what they saw and found. In the words of the team leader, the hybrid horsetail find was the *"best of the year"* and day one was *"exceptional"* in survey terms. A formal report of the findings will follow in due course together with a formal submission to the Great Britain Botanical Survey.

RSPB Skerries Trip

As part of our close working relationship with the RSPB protecting the tern colony at Ynys Feurig adjacent to our base, RAF Valley Conservation Group members where kindly invited to visit The Skerries on a RIB Charter. The Skerries are a group of sparsely vegetated rocky islets (skerries), with a total area of about 17ha, lying 3km offshore from Carmel Head at the north-west corner of Anglesey.

The Islands have a seabird colony, which is particularly important for the Arctic tern, numbers of which are nationally important. The roseate tern also breeds occasionally in very small numbers. Atlantic puffin, black-legged kittiwake, common tern, herring gull and lesser black-backed gull also breed here.

Because of these birds, in particular the terns, the island has been designated as part of the Ynys Feurig, Cemlyn Bay and The Skerries Special Protection Area along with two other nearby sites, Cemlyn Bay and Ynys Feurig, and all three are also classified by BirdLife International as an Important Bird Area. The Skerries have also been designated as a Site of Special Scientific Interest. The islands are wardened by the RSPB during the tern breeding season, and part of our visit was to bring fresh food and drink supplies to the volunteers based there.

An Arctic tern © Aled Rowlands

On the islands there were hundreds of terns as well as a group of grey seals whom had settled there. The visit was an amazing experience that we will never forget, many thanks to the RSPB for inviting our Conservation Group.

Aled Rowlands
Station Environmental Adviser
RAF Valley Conservation Group

Northern Ireland
Magilligan

Excavated trench showing in situ and collapsed sand bags © H. Montgomery, Queen's University Belfast

The landscape at Magilligan Training Centre is rich in archaeological remains including a scheduled World War Two Heavy Anti-Aircraft Gun Battery and a Grade A historic building. The early military occupation has shaped much of the character of the camp as it is seen today.

Work carried out in 2020 by the Centre for Community Archaeology (CCA), together with previous archaeological investigations at Ballykinler Training Centre, identified well preserved World War One (WW1) practice trenches and fieldworks at Magilligan. Sections of trenching very similar to those investigated at Ballykinler can be traced throughout the Magilligan landscape using aerial photographs and other topography data. A recent archaeological audit of the Magilligan Training Centre identified certain relic WW1 practice trench systems to be of elevated heritage value. In particular, a number of crenulated trenches sited in an area of flat grassland and plantation north-west of the prison were of interest. The CCA were commissioned by the Ministry of Defence to undertake an investigation on a number of relict earthworks sited in an area of flat grassland and tree plantation near the prison.

A key purpose of the project was to connect local people with the WW1 heritage landscape in their area, by generating increased levels of knowledge and awareness about Defence heritage within Magilligan Training Centre. This was achieved through a programme of community based archaeological fieldwork. It was intended that the work would enable an accurate interpretation of the physical remains within the area. The local community and schools worked alongside professional archaeologists to increase the understanding of the lives of the soldiers and the training regime within the camp during WW1.

Working in collaboration with the Defence Infrastructure Organisation (DIO), Landmarc Support Services (Landmarc) and Andrew Bratton from the Causeway Coast and Glens Heritage Trust (CCGHT), the excavation work successfully facilitated a community engagement programme with adult volunteers and over 90 children from local primary and secondary schools. The project also helped two undergraduate students from Queen's University Belfast gain valuable archaeological field experience. Both students were local to the Limavady area, with one already an Army Reservist and the other a former Army Cadet.

As a result of the excavations undertaken at Magilligan, a fuller understanding of the relict trench systems, including the level of preservation and how these features were used during WW1 has been obtained. Similar to Ballykinler, it is likely that trench digging was taking place at Magilligan during, or near to, the latter period of the Second Boer War, possibly as early as 1900. The year 1909 saw the production of the Field Service Regulations handbook within which it was noted that trenching was becoming an essential component of defensive tactics for the period. Field practices included the art of creating hasty entrenchments and the use of such entrenchments in the field.

The excavated features are important evidence of the past training infrastructure within the military landscape at Magilligan. The results will inform further archaeological investigations and the ongoing management of the historic elements of the estate's landscape.

Trenches were a vital part of the fighting that took place in France and Belgium from 1914 – 1918. Whilst soldiers will have undoubtedly left the training camp much better equipped for trench digging, it can only be speculated how different they found the light sandy ground at Magilligan compared to the clinging wet mud and atrocious conditions of the WW1 battlefield trenches.

Heather Montgomery
Archaeologist
Queen's University Belfast

Essex
MOD Shoeburyness

Goat grazing trial at MOD Shoeburyness © Place Services

MOD Shoeburyness is located near Southend-on-Sea in Essex on the south-east coast of England. It is managed by QinetiQ (QQ) on behalf of the Ministry of Defence (MOD). The site offers an array of ordnance, munitions and explosives test and evaluation, as well as military training over both land and firm tidal flats. The range covers a land area of 7,500 acres, with 35,000 acres of tidal sands including 31 Site of Special Scientific Interest (SSSI) units. MOD Shoeburyness consists of 21 operational firing areas and has unique capabilities for Demilitarisation and Environmental Testing of live and inert stores.

The MOD Shoeburyness Conservation Group has been running for over 30 years and has members from QQ, RSPB, Natural England (NE), Essex Wildlife Trust (EWT), Defence Infrastructure Organisation (DIO) and local farmers. The group also works closely with the Foulness Conservation and Archaeological Society, which has established a Heritage Centre in the former school located on Foulness Island. Routine activities of members include ringing and counting birds, undertaking species surveys and providing land management and natural environment advice.

Breeding bird projects

It was a busy year for the Conservation Group, with various projects to help beach and ground nesting birds such as little tern, common tern, oystercatchers and ringed plover. Works have been coordinated through the MOD Conservation Group including QQ, DIO, NE, EWT and the RSPB, with approximately 25 volunteers from across the organisations. The aim of the projects was to try to reintroduce breeding little terns, which have reduced nationally by 25% since the 1980s, as well as beach nesting birds to the site, where historically good breeding numbers had been reported until the early 2000s.

In January 2020 a nesting area was built on a disused platform on the MOD foreshore at Shoeburyness Old Ranges. The project was conducted by EWT with logistical and safety support from QQ. The nesting area used oak railway sleepers to form the perimeter, with an infill of sharp sand, builders' sand and shingly seashells. The platform is approximately 80m from the sea wall where members of the public can view the nesting area.

In March 2020, 30 little tern sand patches and sound lure decoys were installed on a shingle beach off Foulness Island, using a no dig option due to unexploded ordnance threats. This is a new method in the UK used to encourage tern nesting, with collaboration between RSPB, QQ and DIO. Associated monitoring of these projects is currently underway with the RSPB from the Wallasea Island Nature Reserve, which is adjacent to the site.

Goat grazing

Over the past 10 years work has been undertaken through the Conservation Group and DIO to establish two grazing fields to improve the condition of the SSSI. MOD funding has enabled over 18ha of grazing field to be established. Both fields are now under Countryside Stewardship, with Place Services via Legacy Grazing as a new partner for SSSI management at Shoeburyness.

The previous cutting of small scrub areas was insufficient and impractical to scale up and sustain longer term. Instead, an improved ratio and quality of scrub habitat for notable species, such as turtle dove and nightingale and species-rich coastal grazing marsh was proposed. In January 2020, goat and cattle grazing was established within one of the grazing fields using a rare breed of old English goat and red poll cattle. In July 2020, a visit from the RSPB's Turtle Dove Conservation Officer reported greater potential habitat for turtle doves, which have been declining in recent years. The grazing experiment has proved successful with further goat and cattle grazing now established within both of the fields.

Matthew Elmer
Conservation Group Chairman
MOD Shoeburyness

Little tern decoy installation © QinetiQ

Wiltshire
Dstl Porton Down

Completed chain mesh work on a tumuli © Dstl

Like many other sites across the country, the year has not quite gone to plan in these strange times. Last winter things were ticking along as usual with a large scale scrub removal project taking place, clearing 2.8ha from a steep bank of chalk downland. This is the start of a project that over the next three years will completely regenerate the bank, removing 8ha of scrub. The work is all part of a larger ongoing scrub management plan.

In the same period, 300 trees were cleared from one of our woodlands to benefit the Duke of Burgundy butterfly, by thinning out trees and removing those affected by ash dieback. Rides and openings were created to let in sunlight to encourage the primroses to spread further through the woods away from their core area. Here the Duke of Burgundy butterflies are doing really well with several hundred of them recorded in this area. It is hoped that by opening up more sections and connecting the two Duke patches, the population will be able to stretch its wings and continue to increase in numbers throughout the wood. This spring, primroses were already around in larger areas showing that the seeds had just been waiting for an opportunity for more light. Hopefully we will be counting more Dukes in a few years' time.

It has also been the end of an era, with Terry Jeanes, the previous Rural Estates Manager retiring in January 2020. Her final project on biodiversity enhancement has been coming into its own this year with the number of farmland birds increasing across the areas. The birds have really benefited from the huge amounts of winter seed crops that have been sown as well as the cover areas that provide winter protection. Yellowhammers, linnets and greenfinches are flourishing as well as grey partridge, which over the past 10 years has increased from just a couple of pairs to coveys being recorded over 10 strong in several areas.

The ponds that have been put in have been extremely beneficial, attracting a wide range of species from deer to a host of bird species. These included red kites and goshawks. The ponds are also popular with insects such as dragonflies, darters and bees coming to drink. The wildflower and pollen margins are buzzing with pollinators including bumblebees, solitary bees and hoverflies too. The provision of nectar from early spring to the first frosts is a simple action that can deliver a real improvement to these important insects.

Archaeology is an important feature of the Porton Down landscape, but one that often gets little mention. The site is rich in history with over 200 monuments found within its boundary from Stone Age through to Bronze Age burial mounds. The Monument Protection Project is now in its final phase, this project was started with the aim to reduce the number of at risk scheduled monuments from 16 to six. Work is now underway on the last one and this is the culmination of five years of hard work.

Lockdown meant life had to be restructured, but wildlife has continued to thrive on the site with these biodiversity areas providing the habitats and resources required. Stone-curlew have also taken no notice of border restrictions, arriving to the site on time in late March. The curlews were soon busy undertaking their nesting attempts.

Butterflies have been doing well with clouds of chalkhill blues, marbled whites and meadow browns. Silver-spotted skippers have also been having a very good year with high counts recorded. It will be interesting to see what the next year brings.

Sarah Atkinson
Ecological Officer
Dstl

Duke of Burgundy on primrose © Dstl

Gloucestershire
South Cerney Station

The Recycle Now campaign. *"We are making a difference, are you?"* © Nigel Williams

It has been another proactive and successful year for South Cerney Station. Our soldiers, industry partners, colleagues in Defence Infrastructure Organisation (DIO) and families have continued to work together as *"One Station, One Team and One Family"* and have fully supported various activities to ensure that our environment is protected and preserved.

Our Amey Defence Team, Steve Udolloress and Colin Jones made 40 bird boxes throughout April. These were then sited around the barracks by Maj (Ret'd) Dave Martin.

In May, the Regiment appeared as a case study in the Defra Greening Government Commitments annual report, which highlighted our commitment to save the Ministry of Defence (MOD) money on energy costs through spend to save initiatives.

Rural Link Veterans briefings were discussed at our annual meeting in July 2019 with the south-west's Farming & Wildlife Group (FAWG). These will assist military personnel who are interested in land based careers in conjunction with the Royal Agricultural University Rural Estate Management Team.

In August lectures were delivered to building custodians on their environmental protection responsibilities, including weather precautions, energy management, waste and recycling.

On a beautiful September evening, Richard Dodd, an ecologist from Wildwood Ecology Ltd in Cirencester, with the assistance of the FWAG Team, delivered a presentation on bats that live within the Station to our soldiers, families and children. This was followed by a walk in the dark around the barracks where the attendees searched for bats with bat detectors.

In September, the Station family took part in the UK's annual recycling campaign 'Recycle Now'. This was organised by Alison Felton, our ESS General Manager, who inspired personnel to increase recycling rates.

In November, the Army Force Protection Advisor deployed to the British Army Training Unit in Kenya to deliver climate change, environmental protection and waste management lectures to military, civil servants and locally employed civilians. He helped the Command Team with their Environmental Management System and advised on how they could set up their waste and recycling contract. He also wrote an Environmental Action Plan for the Commander.

The Station completed its Climate Impact Risk Assessment workshop in December with the DIO Climate Resilience Team. The unit continues to prepare for climate change.

A significant result occurred for the Energy Management Team in December 2019. After 10 years of dedication, commitment and hard work to protect the environment and make monetary savings for the MOD, the Army Basing and Infrastructure Organisation informed the unit that it had been successful for Project PROMETHEUS. A planning application was submitted to Cotswold District Council for an 1.4MW subsidy free solar power plant and has been approved. The application included proposals for grassland maintenance of the site and additional biodiversity enhancements for birds and reptiles.

In January 2020, the Duke of Gloucester Barracks' playgroup and the Station youth clubs participated in the RSPB Big Garden Birdwatch. Participants recorded bird species that landed in their gardens. A consolidated return was then submitted. During February 2020, the Station took part in the British Trust for Ornithology's National Nest Bird Week to promote and enhance the biodiversity and conservation of the Station's breeding birds and wildlife. The resident blue tit population have taken full advantage of the new bird boxes.

In conjunction with the Met Office and UK Defence Business, South Cerney is now one of the key 25 sites in Defence that has a weather site. After six months of work between SSgt Hughes and Ann Evans of the Met Office, our readings now appear on their website which gives daily temperature readings.

During the Coronavirus pandemic the Station continues to stand *"Steadfast in the Face of Adversity".*

Capt Nigel Williams
Army Force Protection Advisor
29 Regiment RLC

Pembrokeshire
Castlemartin & Templeton

Small sallow mining bee *Andrena praecox* female found on Templeton Airfield © Clare Flynn

Species-rich Templeton

Lockdown provided an opportunity for useful wildlife recording at Templeton Airfield in central Pembrokeshire. Developed by the Royal Air Force in World War Two, the site remains in use as a training ground and as a destination for walkers and cyclists. It comprises 403 acres of open, sheep-grazed acidic grassland and dense scrub dominated by mature willow, hawthorn and gorse.

The abundant flowering willow provides a rich pollen and nectar source in early spring and Clare Flynn, an ecologist living in the neighbouring village of Templeton, discovered the small sallow mining bee *Andrena praecox* there in April. This species is a specialist on willow pollen and its distribution is restricted in the south of the UK to heathland and woodland where there is sufficient sallow *Salix* to support it. The presence of the small sallow on the airfield is an indication of the richness of the site in spring, being only the second record of this bee in Pembrokeshire and one of only a handful of sites where the species has ever been recorded in Wales.

The airfield has also been alive with the sound of bird song during lockdown, with chiffchaff, skylark and significantly, yellowhammers singing across the site. In Pembrokeshire, as elsewhere in the UK, yellowhammer populations have plummeted in recent decades. County numbers have fallen from an estimated 13,000 breeding pairs in 1988 to only 19 singing males in 2018 at 17 isolated locations. The undisturbed scrub and open grazed areas of the airfield are evidentially providing a habitat for several breeding pairs to survive in Pembrokeshire and may represent a last stronghold for this iconic farmland species. Clare is liaising with Castlemartin Ranger Lynne Houlston and local monitoring ecologist Clive Hurford to map and evaluate this precious yellowhammer habitat in spring 2021.

The 2020 chough breeding season at Castlemartin

The breeding chough population at Castlemartin peninsula (the majority of which are in Castlemartin Range) has been monitored annually without fail for more than 30 years. However, 2020 presented some real challenges as COVID-19 access restrictions were in place during the critical late March to late June breeding season. Thankfully, observations by Lynne Houlston were possible during other permitted routine duties on the range. Paul Culyer of Natural Resources Wales was also able to provide some information from the nearby Stackpole National Nature Reserve. An easing of access restrictions in late June made it possible to make some late season visits to determine how successful the chough breeding season had been in this unprecedented season.

The coast suffered from storms during late winter, but just as lockdown measures kicked in, conditions improved. April and May were very warm, sunny and dry being generally quite settled. The chough population was stable at about 16 pairs (13 of these being within Castlemartin Range) but breeding success was higher, no doubt helped by the fine spring and early summer weather:

- Almost 90% of the chough pairs on the Castlemartin peninsula managed to breed successfully
- Breeding success was the highest for 12 years
- Nest-failure rate was the lowest for 17 years
- A minimum of 36 young fledged on the peninsula, the highest for five years

Two of the successful pairs included colour-ringed females of known age and origins. One, now in her 16th year, has bred successfully at Castlemartin Range for over 12 years, having been born just east of where she now breeds within Range West. The other chough, a younger bird, was born in 2014, 60km north in neighbouring county Ceredigion. This was her first year of successful breeding (2020), having arrived on the south Pembrokeshire coast in 2015.

Clare Flynn & Bob Haycock
Ecologists
Pembrokeshire Ranges
Conservation Group

Yellowhammer, Templeton Airfield © Graham Flynn

Oxfordshire
Bicester Garrison

Bird monitoring exercise © Crown

Bicester Garrison Conservation Group welcomed the incumbent Garrison Commander, Lt Col AJ Atherton RLC as president of the group. The Garrison Commander's involvement and enthusiasm is appreciated by all group members.

Paul Watts (ecologist) first encountered Bicester Garrison and its outstanding habitats in 2009, when undertaking ecological surveys in support of the development of training facilities on site. During bird surveys it was like stepping back in time, recording scarce breeding birds in numbers that one would relate to years gone by, prior to recent declines. Paul has been working with the Garrison Conservation Officer on a voluntary basis ever since.

Bicester Garrison is set on the boundaries between Buckinghamshire and Oxfordshire and the area contains some of the most special habitat in the region. The site consists of large blackthorn dominated scrub and open expanses of rough grass. It supports good numbers of common warblers, as well as some of the last breeding grasshopper warblers, nightingales and turtle doves in Buckinghamshire and Oxfordshire. The area is also outstanding for its butterflies and supports good breeding populations of the nationally rare black hairstreak and brown hairstreak.

It is the combination of extensive scrub habitat and limited footfall disturbance that make this site so special for nature. However, the scrub is a successional habitat, and left alone it will lose its value as a supporting habitat for such an important range of species.

In order to ensure that the Conservation Group continues to support such important habitats and associated species it includes a number of key external organisations such as; the Chiltern Rangers, Upper Thames Butterfly Conservation, Thames Valley Environmental Records Centre (TVERC) and the Bucks, Berks and Oxon Wildlife Trust (BBOWT), not forgetting the volunteers. The Conservation Group hopes to organise more awareness days in the future.

Scrub clearance sessions have been a key factor every winter for the last three years (funded by the Trust for Oxfordshire's Environment). In order to manage the scrub and grass habitats these sessions should continue to be supported to provide the diverse structure that the breeding birds and butterflies require.

The Conservation Group also note other important sightings for the areas with regards to nature. The bird monitoring surveys have included over 10 years of bird ringing data. This data is used to help monitor the breeding populations in the area, focusing on warblers, nightingales and turtle doves, allowing us to better understand the migratory movements of these birds. Over the years the site has produced some interesting ringing records, including a blackcap that had been ringed in Spain and two lesser whitethroats that had been ringed in Israel!

The butterfly monitoring has recorded good numbers of species, some being regional high priority. The annual monitoring has demonstrated that the scrub management has been extremely successful for providing new habitat for the larvae of the black hairstreak and brown hairstreak.

HQ Bicester Garrison and Defence Infrastructure Organisation (DIO) have been extremely supportive of the work that the Conservation Group undertakes and have provided funding for items of equipment and supplementary bird seed for turtle doves. It is hoped that the strong relationship between HQ Bicester Garrison, DIO and the Conservation Group will continue to grow, securing long-term monitoring and management of the area's habitats for future years, that will be enjoyed by generations to come.

The Garrison has some amazing areas that the Conservation Group are very proud to be working to protect and enhance for the future. We welcome the Freshwater Habitats Trust and Newt Conservation Partnership to the group and the support by HQ Bicester Garrison.

Paul Watts
Bird ringer & Surveyor
Bicester Conservation Group

Wiltshire
Salisbury Plain Training Area

A large scabious mining bee © Iain Perkins

An interesting year that we can hopefully soon describe as unique, the global pandemic has had an impact on all of our lives. Sadly we have also lost two of our active and knowledgeable members to non-COVID-19 illnesses and both were a great shock. Dave Kjaer was a professional photographer and a keen advocate of how we manage Salisbury Plain. His main interests were birds, butterflies and moths and he always supported the Defence Infrastructure Organisation (DIO) and the Sanctuary Team with his fantastic wildlife images, including the *Sanctuary* 44, 2015 stone-curlew cover image. Tony Hopkins had only been a member for a short time, but brought a lot of experience to the group. His main focus was on entomology and especially in the rare bees found on Salisbury Plain Training Area (SPTA), particularly the sainfoin bee.

In March 2020 the COVID-19 lockdown meant some surveying was disrupted, which may have left some gaps in the recording of stone-curlew data. However, the Owl & Raptor Teams reported a good year for kestrels. Although it was difficult to make up the lost time, thankfully others were still able to take place later in the year.

There was a big focus on recording the distribution of solitary bees, such as the rare scabious mining bees and their cuckoo nomad bee species, the osmia species and melitta species including red bartsia and sainfoin bee which is predominantly found on SPTA. Tony Hopkins co-led a targeted survey across SPTA and the results were surprisingly good.

Butterflies and moths were well recorded. Mervyn Grist monitored the ebbs and flows of our fantastic marsh fritillary population on SPTA East, whilst Mike Lockwood continued to record new brown hairstreak colonies and to enhance and monitor the habitat for Duke of Burgundy and white-letter hairstreak across the Centre and East of SPTA. This coincides with one particularly interesting new record of a white-letter hairstreak being recorded by Graham Stacey during one of Mike Smith's monthly moth evenings in Imber Village. Plans are therefore afoot to plant some disease resistant elms to bolster this new found colony.

The wet winter and the lack of training was beneficial to the important population of common toad which breeds in the temporary ponds, especially on the West, along with great crested newt and the enigmatic fairy shrimp.

In support of a Natural England funded project members of the SPTA Conservation Group undertook a great crested newt (GCN) eDNA survey along the Nine Mile River (a winterbourne), that leaves a series of temporary ponds when water levels drop. The survey gave positive results and in some cases was also verified by sweep-netting (under licence) GCN efts (newt tadpoles). This helped to validate the recent habitat management and pond creation which was funded by DIO.

The DIO Conservation Stewardship Fund funded successful restoration on the River Avon with the invaluable assistance from Wiltshire Wildlife Trust's Water Team. River modifications and tree planting were carried out with the help of local civilian and military volunteers from Ruralink.

The increase in security across SPTA has had a crackdown on anti-social behaviour and has been beneficial to conservation and wildlife.

Lt Col K Cammack
Commandant and Senior Training Safety Officer
Salisbury Plain Training Area

A great crested newt eft caught during the sweep-net survey © Crown

Belize
British Army Training Support Unit Belize (BATSUB)

Exercise Tropical Alliance © Crown

Exercise Tropical Alliance
British Army Training Support Unit Belize (BATSUB) took the lead in developing Exercise Tropical Alliance, a mass casualty and environmental catastrophe, three phase exercise, in support of the Belize Department of Environment (DOE), involving all blue light agencies, Belize Natural Energy, Astrum, Belize Coast Guard and Belize Defence Force. Martin Alegria, DOE Chief Environmental Officer praised the role of BATSUB stating that it was a resounding success, which was subsequently echoed by Antony Mai, Head of Enforcement at the Belize DOE.

Commonwealth Litter Programme
Funded by the UK Government, UK scientists worked with Belizean partners to help fight litter pollution in the ocean by gathering data to identify the degree and type of marine litter existing in the Belizean environment. Defence Infrastructure Organisation (DIO) Range Control BATSUB closely aided the Commonwealth Litter Programme and the scientists from the Centre for Environment, Fisheries and Aquaculture Science by providing lecture rooms for seminars and training. Range Control staff helped gather over 15,000 litter samples for the scientific monitoring of oceans and beaches.

Price Barracks' community orchard
DIO, BATSUB and Belize Defence Force personnel and their families planted an orchard named Montezuma's Orchard, after Montezuma Oropendola, the stunning weaver bird, in Price Barracks.

The area had stored the damaged infrastructure from Hurricane Earl and having been cleared, 226 fruit trees such as mango, custard apple and soursop were planted to the sweet tunes of reggae music. The trees were purchased by DIO Overseas Stewardship Funding and were planted by the team, providing a valuable resource for service families, wildlife and as a carbon sink. It is almost a year since they were planted and these small trees are now over six feet tall and some have produced their first small fruit.

The Archaeological Joint Partnership Project
DIO Belize instigated an archaeological evaluation and removed rubbish from a cave to the north of Manatee Forest Reserve on an area of land that was used for training in the past. This joint partnership initiative was led by DIO's Senior Archaeologist Richard Osgood in partnership with landowner Tom Wilson, the Belize Institute of Archaeology (IOA) Officers and BATSUB trackers. The project successfully removed 10 bags of rubbish and a large tyre. Spent small arms brass dating from 2007 to 2015 and two live rounds not of British or Belize origin were also recovered. Amongst the finds were shells placed by the Mayan inhabitants and pottery dating to the late pre-classical period. The caves were laser scanned and this data, along with the evaluation of the finds, has been submitted to the Belize DOE.

Environmental stakeholder meetings
BATSUB hold six-monthly environmental stakeholder meetings. Our first meeting of the year was held within the British High Commission, Belmopan, while the second was an international conference delivered through Microsoft Teams observing COVID-19 restrictions. The virtual conference was opened by Brig Bartholomew, Head of Overseas and Training. The conference hosted speakers from DIO Technical Services in the UK, Belize Government departments and NGOs. Topics included Range Control Procedures, archaeological evaluation of a cave, wildlife monitoring, forest management challenges such as fire management, illegal logging, poaching and carbon capture. These meetings provide a valuable interface between BATSUB, Belize Government departments, NGOs and landowners. They facilitate effective communication and improve BATSUB's environmental delivery.

Richard Snow
Senior Environmental Advisor
Defence Infrastructure Organisation

Hampshire
DM Gosport

Female black redstart on pipework © Gary Calderwood

Defence Munitions Gosport (DMG) is a 208ha Defence Equipment & Support site located within Hampshire. The establishment is responsible for the storage, maintenance and distribution of weapons, ordnance, munitions and explosives in support of frontline operations. Working within a closed fence with strict access controls, it creates a providential environment for biodiversity to flourish. The site has County Wildlife Site status with a Site of Nature Conservation Interest designation across areas of improved and unimproved grassland, wetlands, classified ancient woodland and more.

DMG is situated on the western shore of Portsmouth Harbour, a large industrial estuary with tidal creeks, mudflats and saltmarsh. The whole harbour is classified as a Site of Special Scientific Interest, has Special Protection Area status and is registered as a Ramsar site under the Ramsar Convention.

Mudflats with beds of green algae, eelgrass and sea lettuce provide feeding areas for crucial numbers of dark-bellied brent geese and suitable feeding and roosting places for redshank, greenshank and the RSPB Amber Listed curlew, many of which make their way onto the site's grasslands and dedicated brent geese grazing area. Interesting floral species can be found on the differing levels of saltmarsh that extends from the eastern fence including glasswort, sea aster, golden samphire and coastal grasses.

There are a diverse range of habitats within the fence line – woodland, both old and new, which holds resident avifaunal species such as the great spotted and green woodpecker, various tits and the ever present robin. Common buzzard and tawny owl breed on-site. There is always the possibility of identifying other birds of prey and they can usually be found on the site's disused buildings. Peregrine falcons can be seen perched up high scanning for food, as well as a pair of little owls that try to be secretive about their existence, as well as kestrels who make use of the site's kestrel boxes.

Across the seasons, passage and breeding migrants grace the depot. During spring and autumn there is an obvious movement of swallows and martins to and from their breeding grounds. The scarcer migrants include the cuckoo, nightingale, willow warbler and whimbrel. Breeding migrants include the chiffchaff, common whitethroat and reed warbler.

Fort Elson, one of Palmerston's forts, is the site's scheduled monument and provides a favourable location for grey herons and little egrets. It is considered one of the largest heronries on the south coast. Pipistrelle bats also roost in the vicinity and use the inaccessible fort buildings as a hibernaculum. Bird counts are conducted on-site with results provided via BirdTrack to aid data collection and help drive conservation efforts.

The butterfly glades, located on the northern edge of DMG, boast a diverse range of butterflies, including the UK Biodiversity Action Plan (BAP) species; grizzled skipper, white-letter hairstreak and small heath, as well as more common varieties such as; the gatekeeper, meadow brown and marbled white. The BAP species of moth, the large golden case-bearer, can be found within the coastal grasslands. Larval casing were discovered on the grassland herb Dyer's greenweed. Over time the populations of the floral species have fluctuated but in 2019, an abundance of new growths were discovered and have since been conserved with an adapted mowing regime and use of the yellow post system.

Other initiatives on-site are continually developing including the red mason bee nests, bird nest boxes, corrugated sheeting for reptiles and freshwater ponds. All of these will be monitored over the year and adapted accordingly, establishing DMG as playing a vital role in supporting Gosport's natural wildlife.

Raffaele Turk
Compliance Manager Environment
Defence Munitions Gosport

Kestrel feeding on a slow worm © Gary Calderwood

Useful contacts

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Update – DIO's Environmental Support & Compliance Team

What a year 2020 has proven to be. I need not remind you all of the lockdowns, the home working amongst children and dogs, the endless Zoom calls, our concern for families, friends and colleagues and all the frustrations this has collectively brought to us all...

What I would like to focus upon is the huge amount of work and progress that has been demonstrated in sustainability and the environment in Defence. Gen Nugee has outlined some of the work he has been progressing and throughout *Sanctuary* 49 it is easily apparent that the good works continue. It is also very clear that to achieve the Net Zero carbon and other sustainability and environment targets being set by Government, and being developed in sustainability strategies across Defence, the MOD collectively will have to continue to embed new thinking in all of its ambitions and delivery.

In reflection of the continued importance of sustainability in Defence, the Sanctuary Awards categories were reviewed and revised this year. The Sanctuary board believe this will enable a wider range of initiatives and best practice to be championed. The new categories and this year's successes are highlighted on pages 3 – 9 and I would also urge you to look at the new Sanctuary Award internet page (www.gov.uk/guidance/ministry-of-defence-sanctuary-awards). Do make sure to nominate all of your exciting and innovative projects and individuals for the next round of awards.

Delivering the first virtual Sanctuary Awards this year was a break from our norm, but enabled us to reach a wider audience and greater participation. Going forward we will look to ensure that this wider participation can be continued in whatever format the 2021 Sanctuary Awards is delivered.

Can I just take a moment here to thank the sponsors of *Sanctuary* magazine and Sanctuary Awards 2020, without whom the printing of *Sanctuary* would not have been possible. These sponsors all play a key role in helping Defence deliver sustainable solutions and their on-going support for Sanctuary is hugely appreciated. A full list of our sponsors can be found on the inside front cover of the magazine.

Richard Brooks © Crown

Within Defence Infrastructure Organisation's (DIO) Technical Services we have seen an expansion of our resource. You may well have seen a number of jobs advertised recently including posts focussed on sustainability, climate resilience, natural capital and environmental planning. These new posts will supplement our existing expertise and help drive forward the sustainability agenda, supporting the teams and posts already in existence across Defence which are focussed on working towards the challenging targets being set.

Finally, as ever, a huge thank you to the Sanctuary Team and also to the Communications Teams in both DIO and the Directorate of Defence Communications for their exceptional work this year in delivering Sanctuary in this hugely challenging environment. Well done on yet another fantastic Awards and magazine.

Richard Brooks
Principal Environmental Advisor
Defence Infrastructure Organisation

Policy FMC update

As I reflect on last year's update, I feel positive about how, as a Department, we have collectively grasped the challenge and opportunities from the increased awareness of climate change, Net Zero and sustainability.

In Summer 2020, MOD accepted the National Audit Office's (NAO) findings from their Overview of the Approach taken by the Department to Environmental Sustainability. Whilst the NAO acknowledged the firm foundations and good practice in our estate stewardship, guidance and processes, specialist teams and performance to date, it also pointed to areas for improvement. Their findings have given us an additional focus for the Climate Change and Sustainability Review that was commissioned by our Permanent Secretary and led by Lt Gen Richard Nugee, as you will have read about earlier in the magazine. Our Financial Military and Capability (FMC) Infrastructure Team has worked alongside Lt Gen Richard Nugee to support this work and there is now awareness and momentum at a senior level within MOD. This sets the conditions for MOD to be able to act on and react to climate change from the perspective of Defence operational effectiveness as well as mitigating the impact of our Departmental carbon footprint. I am looking forward to the launch of the Climate Change and Sustainability Strategic Approach and we will relish the challenges that will follow. We will build on firm foundations and drive our contribution towards the Government commitment of Net Zero emissions by 2050. We will also continue to enhance our sustainable practices in infrastructure and estate, contracting, culture, equipment and operating practices.

Julia Powell © Julia Powell

FMC are closely involved in many of the cross-Government discussions that are building pace in response to the Defra 25 Year Environment Plan and the 'Green Recovery'. To complement this, we have started projects to map the estate's Natural Capital assets and sequestration potential and we continue to improve our sustainability data and baseline information. Within the bounds of the primary purpose of the MOD estate, there are real opportunities for nature recovery, climate resilience and carbon efficiency.

As a fellow environmental specialist, I was enormously impressed and motivated by the diversity of projects and the dedication of teams and individuals that I had the pleasure of reading about whilst judging Sanctuary Awards. I am sure that our new award categories and the continuing focus on climate and emissions will encourage further high quality applications – I look forward to challenging and enjoyable deliberations during the judging!

Julia Powell
Deputy Head
FMC Infrastructure Policy and IOM

COVER IMAGE: Elephant seals lined the beaches during a beach clean-up by the crew of HMS Protector in South Georgia © Crown

BACK COVER: A penguin in front of HMS Protector in the heavy snow at Port Lockroy, Antarctica © Crown

Some of the photographs featured in this year's magazine were taken before the COVID-19 pandemic. All photographs taken during COVID-19 complied with social distancing requirements. Finally, a special thanks goes to Harvey Mills Photography, for his ongoing support in the provision of images for *Sanctuary* magazine.

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.

Editorial Message

Dear readers,

The Sanctuary Team hopes you will enjoy this year's magazine. We are always interested in hearing from you with 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 it as a last resort.

Thank you.

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