

Auchnerran Report 2020

The Game & Wildlife
Scottish Demonstration Farm







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Acknowledgements

Once again, there are too many who have supported our work over the last year to thank them all here but know that we are truly grateful. We would like to express our continuing gratitude to Andrew Salvesen, the Allerton Project Steering Committee, the EU LIFE+ programme, Working for Waders, Perdix Wildlife Supplies, Kings Crops, Moredun Research Institute, Rory Cooper and John Riley.



Foreword

David Noble
Scottish Chairman

2020 has been a year like no other. The impact of the pandemic has not spared the research and demonstration project at Auchnerran. In contrast, the farming operation continued to make progress and to produce an excellent return for the Trust, both financially and environmentally.

Despite the difficulties, the researchers at Auchnerran did maintain the all-important monitoring of key indicator species despite the absence of the resident research assistant on furlough. I congratulate the four students whose hard work and enthusiasm has ensured that these all-important datasets on birds, mammals and habitats were maintained, along with the other projects described in this report. Senior staff have also found ways to continue their collaboration with external partners further to develop several important new projects, including the baseline natural capital audit work and grass sward research.

Opportunities to demonstrate the interactions between conservation and farming and to explain our research, were, of course, limited to the earlier part of the year. On a more positive note, the completion of the conversion of the Bridgefoot buildings have given Auchnerran the use of a splendid asset to which to return when conditions allow. We are extremely grateful to our landlord, Andrew Salvesen, for the development of these buildings.

I should like to take this opportunity to thank the staff and students at Auchnerran for the way they coped with the unprecedented challenges they faced this year – enforced isolation in what is already a rural setting has been a challenge, as it has across the farming and research sectors. I look forward to a time when they can more freely develop the scientific results and practical advice that will make Auchnerran one of the most important research and demonstration farms in Scotland.

David Noble



David Noble, Scottish Chairman.



GWSDF AIMS

The Game & Wildlife Scottish Demonstration Farm, Auchnerran aims to demonstrate to practitioners, policy makers, influencers and learners of all ages, how a wild, mixed-species shoot and productive farming can contribute to a net gain in natural capital, in a marginal, hill-edge setting.

Introduction

Dave Parish

Welcome to our second annual report for the Game & Wildlife Scottish Demonstration Farm, Auchnerran. What a roller-coaster of a year! Covid-19 and its associated restrictions has greatly impacted everyone's lives and Auchnerran has not been spared from this. That said, we put in place appropriate working practices and I'm relieved to say that we managed to keep all staff and students on site safe. Work on the farm has gone well with another great lambing year (page 8) and a healthy return realised (page 24/25). Our research work was affected to a greater degree as Marlies was furloughed for most of the period between April and October, but our students, Max and Elizabeth, did a sterling job and kept our key projects going throughout. Not surprisingly, our plans for on-site events were not so lucky with everything cancelled from the end of March, including our mixed-species and rabbit shoot days. This is particularly disappointing as we had revamped our wild shoot ready for 2020/21 (page 10).

This year has seen some major changes at Auchnerran. Our landlord, Andrew Salvesen, has very generously renovated some buildings on site, so we now have new and updated facilities for the team and visitors (page 14).

Let's hope we get the opportunity to use them to the full in 2021.

I am sorry to also have to report sadder news. Our trainee advisor, Merlin Becker, left the Trust early in 2020 and moved back to his native Ireland. Merlin ran the small shoot and most of the demonstration events at Auchnerran and was very well liked by all. The homemade stew that he served at lunch on shoot days has become famous! It and he will be sorely missed and we wish him well. We were also deeply saddened to hear of the passing of Alison Espie this year too. Alison was our first research assistant on the project back in 2015. She brought a wealth of knowledge of farmland ecology to the post and being a local was instrumental in initiating community relations. Our thoughts and condolences are with her friends and family.

This report highlights some of our many activities over the last year or so with less background detail than in our previous (and first) report. As ever, I would encourage you to please get in touch with any feedback, or if you wish to arrange a visit to the farm in 2021 (dparish@gwct.org.uk; 07889 891956).



Opposite: Male pheasant © Olivia Stubbington



The Farm

Allan Wright & Dave Parish

After the extreme weather of autumn 2019 and early 2020, Auchnerran has enjoyed reasonable weather for our part of the world during much of spring and summer, including average or above average temperatures and low rainfall. On the back of this, the farm has had a good year with final lambing figures of 129%, another good silage crop (TABLE 1) and the best crop of turnips on the farm since we started growing them in 2017. This will stand us in good stead during the winter when the availability of forage is always key.

The sheep flock now consists of about 1,400 ewes plus their followers and is of a typical age structure. The flock we inherited at Auchnerran had a high average age and included many animals that were consistently unproductive and sick. Starting in 2016, we gradually removed the unproductive ewes in an effort to overcome the factors limiting productivity and improve overall health and lamb production. The improvement in the quality of the animals has been evident again this year at market, where Auchnerran topped the blackface section on each occasion bar one in 2020. We expect to reach our target flock size of around 1,500 ewes in 2021. This is the level that we think is optimal for the available grazing on the farm in winter which is the clear pinch point in the annual cycle (even with the away-wintering of around 800 sheep), plus the optimal size for tick control on the summer hill-grazing area.

The hill grazing incorporates a grouse moor and extends to around 5,000ha. It provides plenty of fresh grass for the sheep when they are on the hill between approx. April and November. In return, they perform an important role removing tick from the moor, thereby decreasing numbers on grouse, wildlife and people. This also reduces the transmission of pathogens like louping ill and Lyme disease. This is achieved by periodically gathering the sheep to treat them with a pour-on acaricide which kills any tick that attach over the subsequent 6-8 weeks. Each year, around 40 sheep from the Auchnerran flock are left untreated to compare with the treated animals (though we don't always catch all 40 again during a gather). We also count tick on sheep that graze neighbouring parts of the moor. Once again in 2020, the average number of tick on the treated (and untreated) sheep was very low (FIGURE 1).

Our battle against rabbits continues with around another 1,000m of rabbit netting installed plus 13 rabbit boxes, which to November had removed 740 rabbits from that section alone. Our monitoring had suggested numbers may have been dropping since control measures began, but it seems the rabbits have had a good breeding season like much else at Auchnerran. This poses an ongoing problem as rabbits are now likely to be the main factor limiting the availability of forage for the sheep on the farm. They also caused significant damage to a section of hedge planted at the end of 2019 that will need extensive patching in 2021.

TABLE I

Flock size and productivity (percent lambs reaching weaning age) at Auchnerran, along with annual silage production.

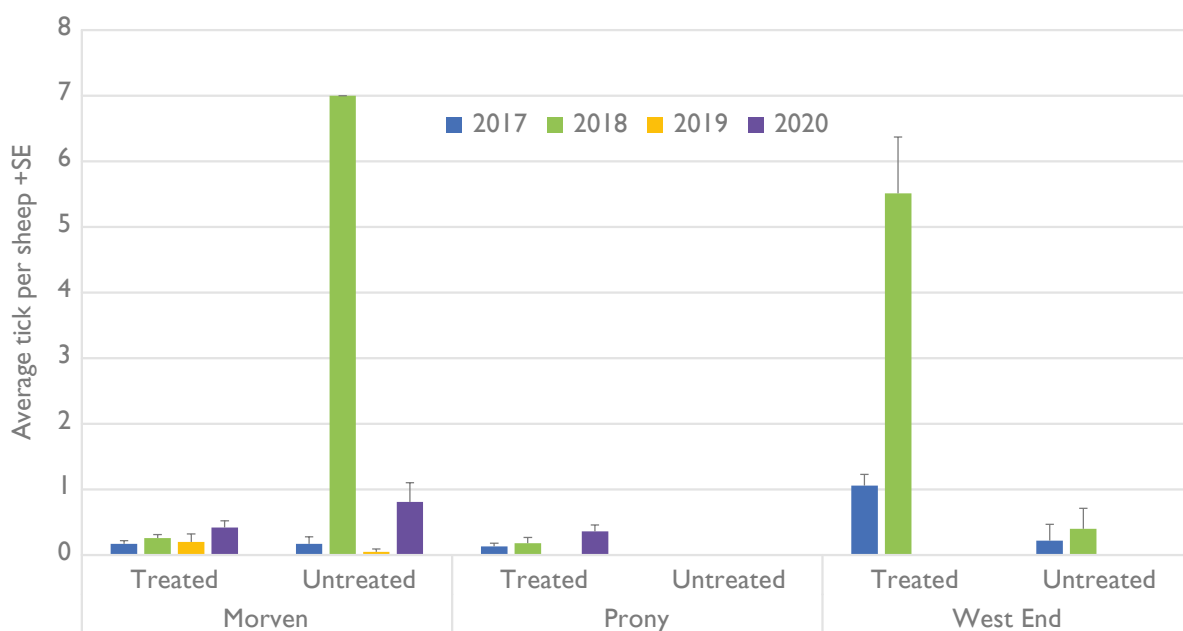
**Projected ewe numbers for 2021.*



	EWES	% LAMBS WEANED
2015	1,440	60
2016	1,205	97
2017	1,126	120
2018	1,000	126
2019	986	124
2020	1,400	129
2021	1,500*	-
	SILAGE BALES	PER HECTARE
2015	730	17
2016	717	20
2017	1,100	25
2018	460	12
2019	986	23
2020	830	24

FIGURE I

Average (+standard error) tick counts on treated and untreated sheep on the hill grazings, 2017-2020. Counts are conducted during gathers. 'Morven' is the area grazed by the Auchnerran flock. There are no untreated sheep at 'Prony' and tick counts paused at 'West End' in 2019. Note: the number of untreated sheep sampled is usually less than 10, sometimes resulting in anomalies such as for West End in 2018, when tick abundance was probably higher as indicated by the treated sheep.





The shoot

Dave Parish & Marlies Nicolai

The 2019/20 season went well with a total of five rabbit and four mixed-species days, hosting a total of 34 guns. In all this produced a respectable haul of game (**TABLE 2**). The bag data from shoot days over recent years reflects nicely the modest increase in brown hare numbers on the farm and also shows how few rabbits are actually taken on shoot days when you consider how many thousands we have!

Everyone who has commented after a shoot day has been thrilled with the uncommon opportunity to shoot wild pheasants along with a variety of other species, which have provided exciting and challenging days against the spectacular backdrop of the Cairngorms. So, we thought we'd try to enhance this by increasing our offering of wild pheasants. Our shooting to date has been sustainable: that is, we have taken a small harvest of pheasants without reducing the stock available for future years, and we know there are many more

pheasants on site than we see during shoot days. We have improved and redesigned drives to draw birds to key areas using an increase in feeders whilst also bringing larger areas of land into drives with additional beaters. The increased number of feeders, along with our ever-improving game crops (see box), will provide more food for pheasants and other wildlife over winter and hopefully increase survival rates.

Coupled with this, we hope that the additional feeders around the farm, which will be stocked until May, will increase productivity of the wild hens and thus lead to increases in autumn stocks. Predation control is of course crucial in maximising productivity too. We are fortunate at Auchnerran to work with the team of gamekeepers who manage the neighbouring grouse moor and who include Auchnerran in their control of certain generalist predators. This gives us a sound foundation upon which to expand our wild-bird shoot.



TABLE 2

Auchnerran shoot-day bag data, 2016/17 to 2019/20.

	2016/17	2017/18	2018/19	2019/20
NUMBER OF MIXED DAYS	1	5	4	4
NUMBER OF RABBIT DAYS	1	6	8	5
PHEASANT, MALE	3	37	23	16
PHEASANT, FEMALE	0	4	2	16
PIGEON	0	5	12	2
WOODCOCK	9	9	3	6
SNIPE	0	3	0	0
MALLARD	1	0	0	0
RABBIT	16	212	271	128
BROWN HARE	0	6	9	8

If we want a sustainable wild-bird shoot we must ensure that any harvest does not damage the breeding stock. A crucial part of our expansion plan is the annual monitoring of pheasant numbers. Our assessments, of both spring and autumn numbers, help inform decisions on bag sizes and number of shoot days each year. This isn't as easy as it may sound at Auchnerran because, unlike a lowland arable shoot with cereal crops and hedgerows, Auchnerran is dominated by pastures and dry-stone walls. This means pheasants are less often found in our fields where there is little cover and instead spend more time in the cover provided by game crops, scrub and woodland. Added to this we now have mostly wily, wild-hatched birds that have more common sense and naturally seek cover, so counting them has become quite a challenge. We have started to compensate for this by using dogs to flush them in autumn which has proven hugely successful.

We see this in the count data (**FIGURE 2**): counts in the early years at Auchnerran detected lots of pheasants after large numbers were released in autumn 2014 but counts gradually dwindled in both spring and autumn as the released birds died off whilst the survivors and their progeny became more risk-averse and harder to count. The flush counts, despite covering a fraction of the area at Auchnerran, now usually reveal the majority of the autumn population. Hopefully, those shooting at Auchnerran over the next few seasons will experience more truly challenging birds!



Alan Johnson

Scotland Technical Advisor, Kings Crops



Ordinarily I visit Auchnerran each year to help plan the next set of conservation crops; however, this year I was unable to do so due to the pandemic. Given the successful establishment of the Kings Alba Mix in 2019, we agreed the best course of action was to establish this mixture again in spring 2020. This annual wild bird seed mixture meets game and stewardship requirements within the current Agri-Environment Climate Scheme (AECS) option 'creating a wild bird seed mix for farmland birds'. The Alba Mix proved successful again in 2020, providing essential pollen and nectar throughout the summer followed by winter feed and cover for farmland birds.

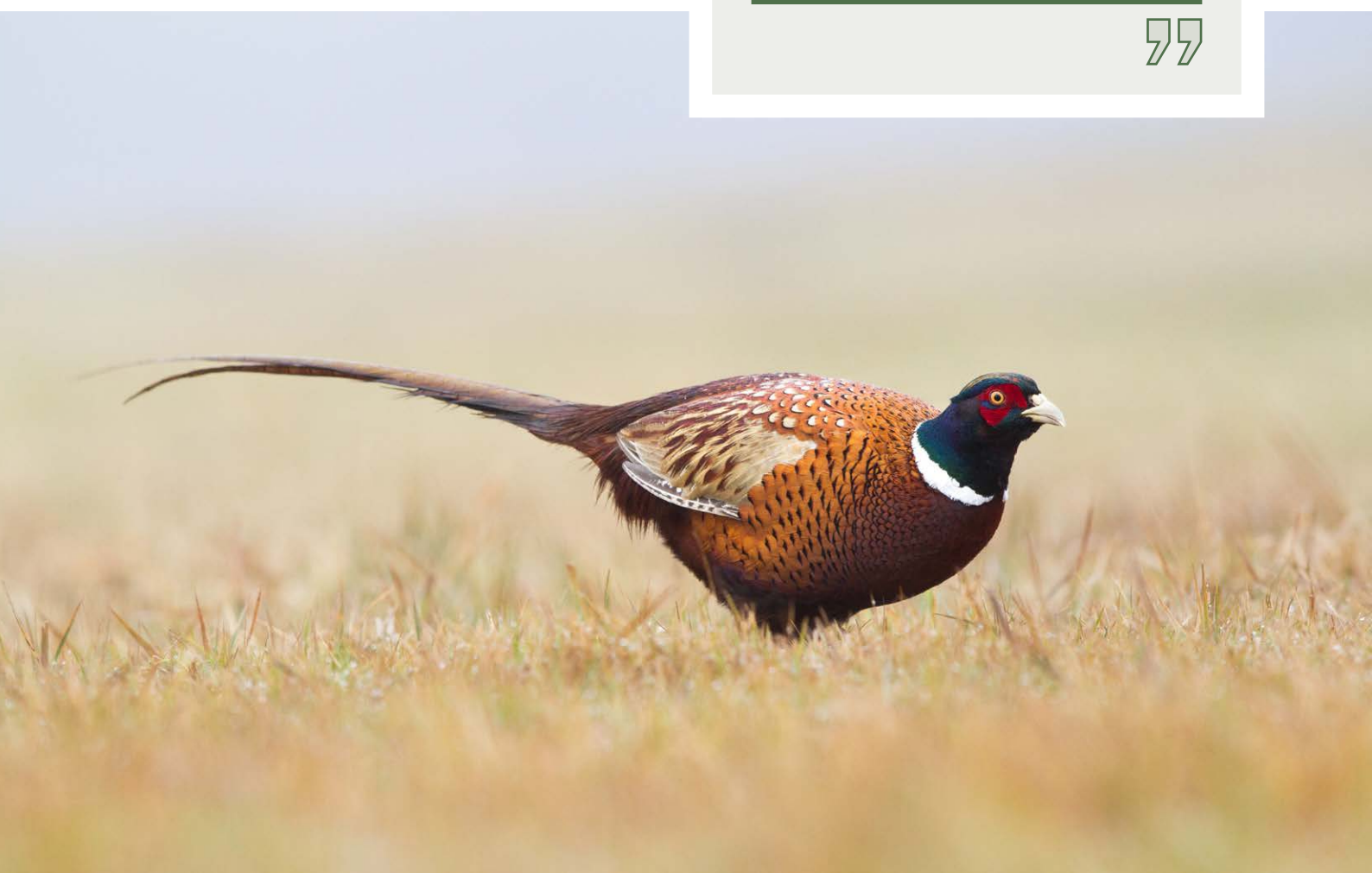
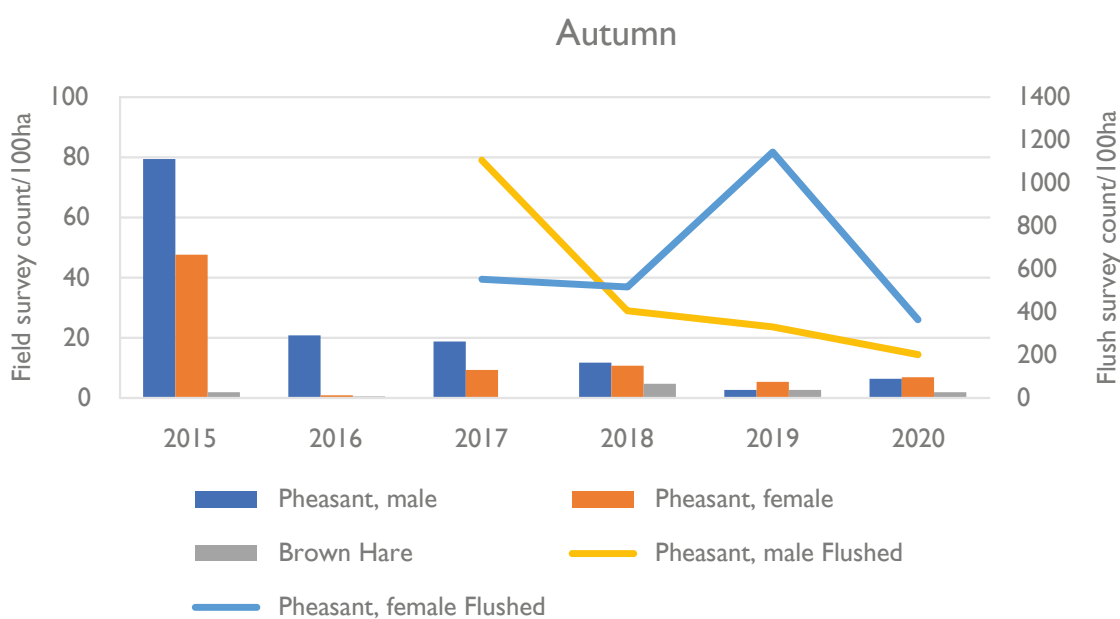
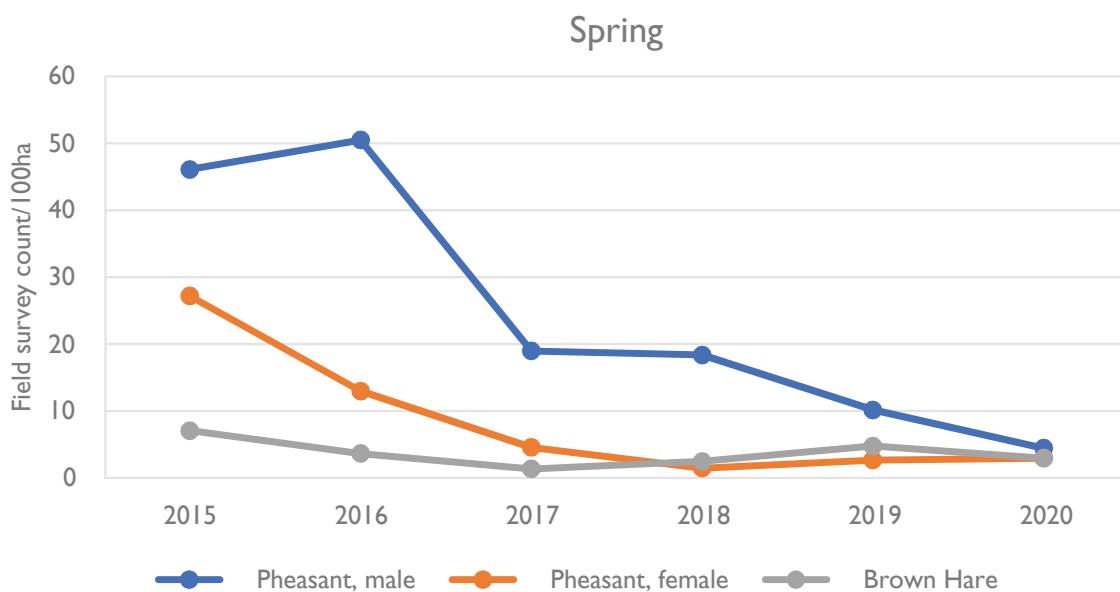
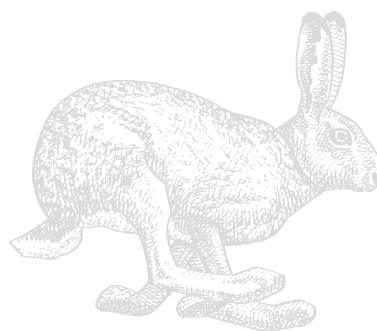


FIGURE 2

Counts of pheasants and brown hares at Auchnerran, 2015-2020. Spring counts (top) are conducted from a vehicle driven round the same route each year, covering open habitats. The autumn counts (bottom) repeat this but also include flush counts with dogs in the game crops and some of the areas of scrub (note the different scale for these).



Demonstration and education

Dave Parish

As you may expect, 2020 was not a productive year for demonstration events at Auchnerran, with Covid-19 understandably putting paid to our early plans. We hope to make up for this in 2021. Looking back through the visitors' book that we started using in mid-2016, it is clear to see the variety of backgrounds and interests of the visitors we have hosted over the last five years. They represent at least 42 organisations (many folk didn't list an affiliation in the visitors' book: **TABLE 3**) including a Cabinet Secretary, a Government Minister and three MSPs (plus some officials); lots of NGOs including The Heather Trust, NFUS and RSPB; many visits by the Scottish Government's research providers like Scottish Rural College (SRUC), James Hutton Institute and Moredun Research Institute; and representatives of seven universities including Aberdeen, Liverpool John Moores and Madrid, to name but a few! The figures in **TABLE 3** don't include those visitors to the farm who are not there to see us. Many folk use the farm to access Morven hill – we have tentatively estimated their number at around 2,000 each year.

Significant progress has been made regarding our long-term plans for demonstration and education at Auchnerran. Andrew Salvesen, our landlord, very generously completed the renovation of the buildings associated with the old mill on the farm which now provide the team with a large, new office, lab space, more storage and most importantly, a larger room for hosting visitors. This will be our meeting-come-lecture room where we will be able to share information with our usual target audience of scientists, farmers, policy makers and influencers, but also whole classes of school children in due course. The lack of such facilities has limited our educational activities in the past, so this will be a real boon to our ambitions.

Our broader educational plans include enhancing the farm's infrastructure to better support and inform visitors

FIGURE 3

The new office and meeting room at Auchnerran.



by installing signposted footpaths including boardwalks in some of the wetter areas and information boards at strategic points. We are fundraising for this now. We began contacting local schools shortly after starting at Auchnerran and both Marlies and our education officer, Iona Laing, have made progress in this area. We hope to step-up our discussions with local schools in 2021, Covid-19 permitting. Auchnerran also regularly hosts university students of all levels from Scotland and abroad who conduct research projects with us. We are hoping to widen our contacts across Scotland and offer Auchnerran as an educational resource wherever possible because it is of vital importance that children and students of all ages better understand how the countryside is managed, what it produces and how dependent upon it we all are. To this end, for example, we have been in discussions with SRUC about helping deliver some of their teaching material, as well as where we might conduct research projects together, and we hope to regularly host students at the farm in future.

TABLE 3

Number of visitors to GWSDF Auchnerran 2016-2020.

*Records for 2016 began in mid-May.

^Covid-19 severely impacted plans for visitors in 2020.

	2016*	2017	2018	2019	2020^
NUMBER OF VISITORS	80	189	121	131	38

Research and monitoring

Dave Parish, Marlies Nicolai & Ross MacLeod

BACKGROUND

We initiated a two-year baseline monitoring period at Auchnerran in 2015, our first full year on site, to determine as far as possible the breadth and abundance of biodiversity on the farm. Since 2017 we have maintained the monitoring of some groups as indicators, helping us adapt farm and shoot management to minimise negative impacts. In addition, we exploit the resources on the farm in stand-alone projects to further our understanding of natural capital management alongside productive farming and other land uses.

Focus on trail cameras

Many of the projects we run at Auchnerran make use of trail cameras. These allow us to keep an eye on, for example, a nest or a grain hopper 24-hours a day without missing any animal activity. This will often reveal details that would be almost impossible to document any other way. As this technology has improved in recent years (see box on page 17) the cameras have become more sensitive and more versatile and can even be monitored remotely via a computer. At Auchnerran we are fundraising to invest in more cameras to allow us to deploy them in more and more ways.

For example, at the time of writing we've had a total of 402 'observation-days' on our feed hoppers this winter (one hopper observed for two days, and two hoppers observed for one day, would both total two observation days). These have revealed 3,630 observations of pheasants around the hoppers (FIGURE 4). This doesn't equate to the number of birds wandering around the feeders as this figure will include repeat visits by some individuals, but it does give a measure of activity and highlights the important role feeders have in supporting pheasants in winter. Feeders will become more important as the winter progresses and alternative food sources become harder to find, which is why we will continue feeding into May 2021.

It wasn't just pheasants observed using feeders. We recorded 16 species during this period, seven mammals and nine birds (FIGURE 5).

FIGURE 4

A fine male pheasant at one of the Auchnerran feeders.



FIGURE 5

Badgers (below) and jays (bottom) have been recorded at the hoppers, along with 14 other species.



FIGURE 6

Frequency of clutch outcomes for lapwing, curlew and oystercatcher, recorded by trail cameras, 2018-2020. Loss to farming includes destruction by livestock and machinery. N=number of nests observed.

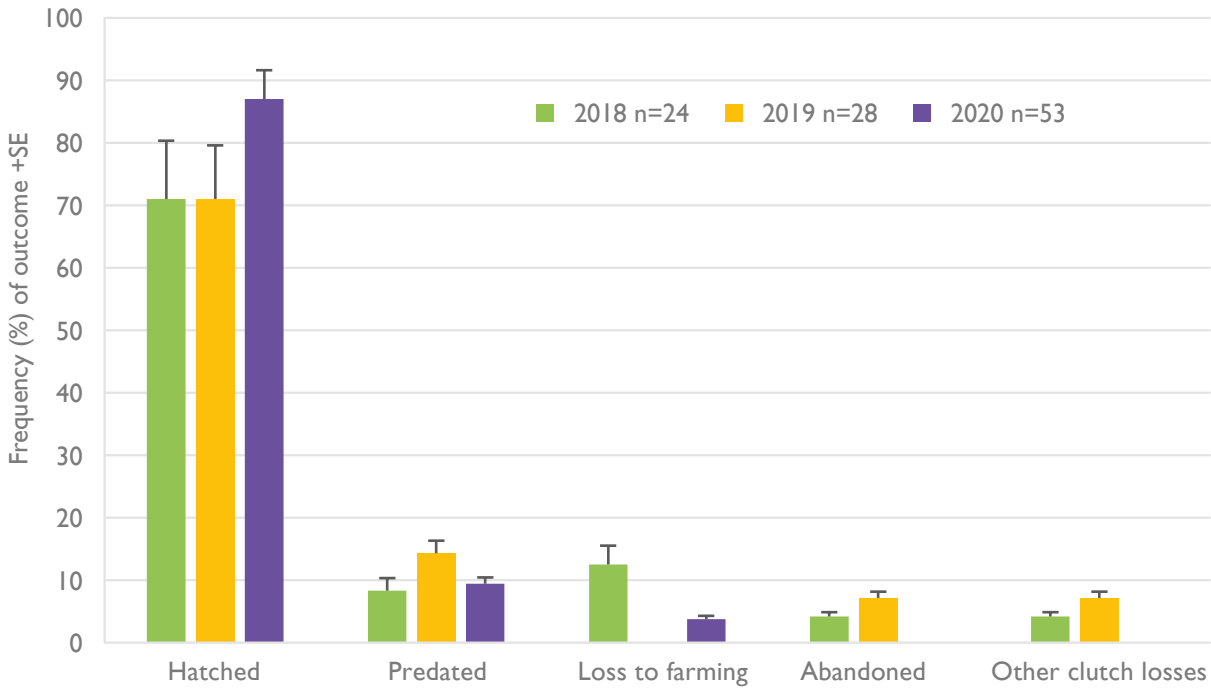


FIGURE 7

A common gull with a lapwing egg just visible in its bill (below) and a badger at an oystercatcher nest (bottom).



These data give us a good idea of where the pheasants are (important when planning drives) but also highlights feeders that are not well used and so might be better redeployed elsewhere. We have found that pheasant activity at feeders providing wheat is almost four times that at those providing barley (an average of 16.1 (± 2.9 standard error) records per observation-day versus 4.3 ± 1.0).

Probably the project where we have made the greatest use of trail cameras at Auchnerran so far is in our studies of breeding waders. The cameras allow us to monitor nests when we can't access fields where lambing might be taking place and capture that crucial 'whodunnit' information should a nest be raided by predators. Traditionally, ecologists have tried to determine what happened to a lost clutch of eggs by interpreting the field sign left after the event. This is possible with some practice and a lot of experience, but is always open to criticism as being subjective, and cannot clarify some key details. For example, it might be possible to say a mammal raided a nest, but which species is often much harder to say.

At Auchnerran we have the pleasant problem of having very low failure rates amongst our wader nests, with between 71 and 87% of all monitored nests hatching. This is testament to the good predation control work that the local gamekeepers and Merlin have done over

the years, coupled with Allan’s vigilance when working around wader nests. It does mean, however, that we have relatively few data on the causes of clutch and chick loss, but this is where the unwavering 24/7 monitoring provided by the cameras helps. Half of those clutches that failed between 2018 and 2020 were lost to predators (FIGURE 6) and the cameras have allowed us to identify the culprit in most cases: the five nest-raiders caught on camera since 2018 were badger (x2), hedgehog and common gull (x2) (FIGURE 7). Of course, the cameras also produce lots of pictures of chicks too (FIGURE 8)!

FIGURE 8

A young curlew wanders past a camera at its nest (below) and a couple of lapwing chicks stick close to mum (bottom).



PERDIX®

Dave Butler
Perdix Wildlife Supplies



It has been a pleasure supporting the important work of the GWSDF team with the latest trail camera technology. As demonstrated above, modern trail cameras provide scientists with a non-invasive way of monitoring game and wildlife in various situations. These insights can then be used to tweak current management practices, such as feeder design, or even develop completely new prescriptions. Over the next few years, the use of mobile-enabled cameras will become increasingly popular due to the convenience of receiving photos and videos directly to a smart device. This technology provides further opportunities for monitoring sensitive wildlife sites such as nests. To assist scientists, farmers, gamekeepers and other land managers in using this technology, Perdix has developed an easy-to-use cloud-based portal called PerdixPro Cameras. We are looking forward to deploying this system on GWSDF in 2021.



Focus on waders

Auchnerran supports lots of breeding waders. The densities of lapwing and oystercatcher (FIGURE 9) suggest Auchnerran is in the top 1% of lowland breeding sites for these species in Scotland*. This provides us with a rare opportunity to study these species and contribute to our understanding of the problems they face and develop and share tools to help them.

Our work at Auchnerran focuses mostly on the breeding season. Each year we estimate the number of breeding pairs on site and the number of fledged chicks. In between, we try to record the fate of a sample of nests – increasingly using trail cameras (page 15). This provides an estimate of the population size of the species concerned and of their hatching and fledging success.

The number of pairs recovered slightly in 2020 after a decline in the previous year (FIGURE 9) and our waders enjoyed another successful year with high productivity for lapwing, curlew and oystercatcher (the three species we monitor) (TABLE 4).

The high productivity probably results from the good breeding habitat we have across the farm, which is mostly diverse, unimproved pastures, plus reduced predation pressure due to the efforts of the gamekeeping team. Predation is still the most frequent cause of clutch loss (50%) with around 11% of all clutches monitored with trail cameras (including those that hatch) succumbing, but this is much lower than often recorded in studies elsewhere in the UK, which can be over 75%.

In 2018 and 2019, we began tagging curlew and lapwing to follow their movements both on and off the farm. Using GPS tags, we can see where they have been around the farm, in Scotland and indeed abroad. This will tell us more about the habitats they select to breed and forage in, and how best to arrange them in the wider landscape where possible. It also reveals their movements through the annual cycle, highlighting potential challenges they may face on their wintering grounds or whilst travelling.

TABLE 4

Wader productivity (chicks per pair) at Auchnerran, 2017 to 2020.

	2017	2018	2019	2020
LAPWING	1.3	0.9	1.5	1.0
CURLEW	0.9	0.9	0.8	0.8
OYSTERCATCHER	0.3	0.4	0.3	0.3



Curlew chick

For example, in 2019 we fitted 13 lapwing with tags that record their location frequently throughout the day, but which only transmit that information to a special receiver unit at the farm, so we had to wait until 2020 to find out about the movements of any survivors. We were delighted to find nine of the 13 on site in spring and their data were collected and uploaded to a website called “Movebank” which helps display the data. This revealed a wealth of information. For example, one of the lapwing wintered near Dornoch in northern Scotland whilst the remainder wintered at various locations (i.e. not together) in Ireland.

Perhaps of greater interest is the degree of detail captured regarding their day-to-day movements during, and immediately either side of, the breeding season. FIGURE 10 gives an example of this. We hope to exploit this information more in future and check the areas being used on and around the farm to document habitat characteristics and build up a picture of ‘hotspots’ of activity.

FIGURE 9

Density of breeding waders (pairs per 100ha) at Auchnerran from breeding bird surveys, 2015 to 2020. We assume monogamy for lapwing. *Woodcock data are densities of roding males.

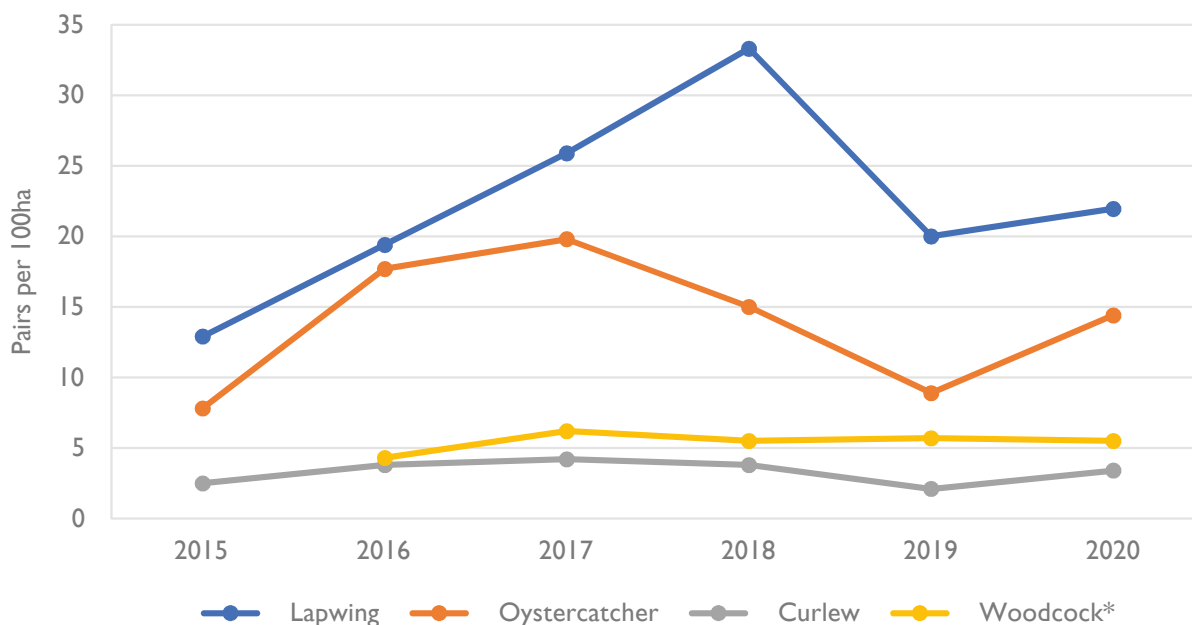


FIGURE 10

A snapshot of the movements of one tagged lapwing on and around Auchnerran. The pink dots show locations and the blue arrows show the sequence of movements. During the spring and summer periods 2019 and 2020, this bird divided its time between the farm (broadly to the west of the A97) and the surrounding area.



Focus on carbon audits and natural capital accounting – a window on future land management?

“Now, we have indeed laboured to make some of the capital which today helps us to produce – a large fund of scientific, technological, and other knowledge; an elaborate physical infrastructure; innumerable types of sophisticated capital equipment, etc. – but all this is but a small part of the total capital we are using. Far larger is the capital provided by nature and not by man – and we do not even recognise it as such!”

E F Schumacher's remarks in the early 1970's presaged the rapid evolution in critical thinking about 'natural capital'. The term is now rarely far from active debate around land and business management, though much remains to translate this into a blueprint for oversight of our natural resources. Natural Capital is embedded in Scottish Government environment strategy, and NatureScot has developed an Asset Index to monitor the capacity of terrestrial ecosystems to provide benefits to people.

These initiatives are driven by global concerns regarding Climate Change and Biodiversity loss. The GWCT has been researching the relationship between agricultural production, greenhouse gas (GHG) emissions, soil health, water management, biodiversity impacts and many other issues through our work at the Allerton demonstration farm since 1992. The Game & Wildlife Scottish Demonstration Farm is now contributing to that research.

2020 saw the commencement of work to establish the balance between Auchnerran's GHG emissions and carbon sequestration. Our first step has been to undertake a Carbon Audit. Laurence Gould, our agricultural advisers, have overseen the work to establish the carbon footprint across the farm. They have also drawn up an Integrated Land Management Plan to map out sustainable options for the future. Setting a baseline at 2018 for the audit process and using the AgReCalc system developed by SRUC (Scotland's Rural College), the balance of GHG emissions and sequestration has been calculated for each of the three years up to 2020. With an increase in the size of the sheep flock on Auchnerran over this period, livestock GHG emissions have also grown. This impact has been mitigated to a significant extent by the amount of carbon sequestering woodland on the farm. The AgReCalc audit process does not yet appear to capture the full extent of natural assets at Auchnerran contributing to sequestration, and it remains to embed a calculation of soil health which may further help to offset emissions. Nevertheless, the audit points to areas where the farm can address ways to reduce emissions through intelligent livestock management, the application of fertilizers and use of equipment.

Early in 2021, we launched a project to assess Auchnerran's Natural Capital. This will produce a register of our principal biodiversity features and place a financial value on the balance of natural assets and emission liabilities. It may also help to fill in any gaps missed by the carbon audit regarding the complete inventory of assets. This is being conducted in conjunction with our neighbours, the MacRobert Trust and so will provide a farm unit and landscape-scale interpretation. To ensure the independence of the valuation, it is being undertaken by Eftec (Economics for the Environment) and Strutt & Parker.

Understanding the emissions and carbon sequestration balance, the benchmarking of our natural assets and the value of assets over liabilities at Auchnerran will provide a variety of research and policy avenues for the Trust to consider. Despite wide adoption of Natural Capital principles by Governments around the globe, there are questions and criticisms to resolve regarding their application. Not least is whether it is possible to ascribe a monetary figure to iconic species assemblages.

This is particularly relevant to Auchnerran because it is a haven for nationally important numbers of wading birds. They are supported by suitable habitat, sympathetic farm management and regular predator control – but how can we place public value on their presence and the work to conserve them? Finding solutions may provide the answer for wider UK approaches.

Drawing on the output from the carbon audit and natural capital initiatives, we will also be working with the Cairngorms National Park to consider how collaborative action at regional scale might address climate change and biodiversity challenges. It will also provide insight into how landowners might be paid for public benefits flowing from sustainable land management, contributing to discussions on the development of agri-environment policy to incentivise sound practice.

Our work on carbon audits and natural capital accounts provides us with the tools to monitor and manage a sustainable farming operation. It also gives GWCT a seat at the table for wider national discussion on research and development opportunities. This has been assisted by our recent appointment to NatureScot's external advisory group on natural capital. We look forward to reporting progress.

¹Based on a lecture given at the Gottlieb Duttweiler Institute, Rüschlikon, Nr. Zürich, Switzerland, 4th February 1972. E F Schumacher, *Small is Beautiful: Economics as if People Mattered*, 1973

FIGURE 11

One of our placement students, Sophie, measuring tree girth as part of our carbon audit to assess carbon sequestration in the farm's woodland.



Photo © Olivia Stubbington

In brief: mud snails

What are they?

Mud snails are tiny snails that like wet, muddy conditions. They can be intermediate hosts for the sheep liver fluke, a potentially damaging parasite of sheep (FIGURE 12).

Why are we studying them?

The liver fluke is an economically important parasite whose prevalence is partly affected by the distribution of mud snails, which in turn can be influenced by farm management. For example, mud snails like neutral soil pH, so liming of acidic soils might be beneficial for them and so potentially counter productive for a livestock farmer. Similarly, they need wet areas so perhaps wader scrapes and the like will help support them, potentially limiting the uptake of this agri-environment scheme measure.

What are we doing?

We are just finishing a liming trial with the James Hutton Institute (JHI) where lime has been applied to half of two of our fields. This is also taking part on two JHI farms. JHI have been comparing vegetation characteristics and soil invertebrates between the two treatments and we have been monitoring mud snails. We count the snails and send a sample away for analysis. We have also been monitoring mud snails at other sites around the farm, and will be including wader scrapes created in 2019 and new ones planned for 2021.



The samples are sent away to the Moredun Research Institute where they screen them for fluke DNA. We also send sheep and rabbit faeces to get an idea of prevalence of fluke in the flock and to see if rabbits host this parasite too. We hope to report preliminary data in 2021.

FIGURE 12

A mud snail (top right © Moredun Research Institute), and the fluke life cycle (below © Farm Health Online).

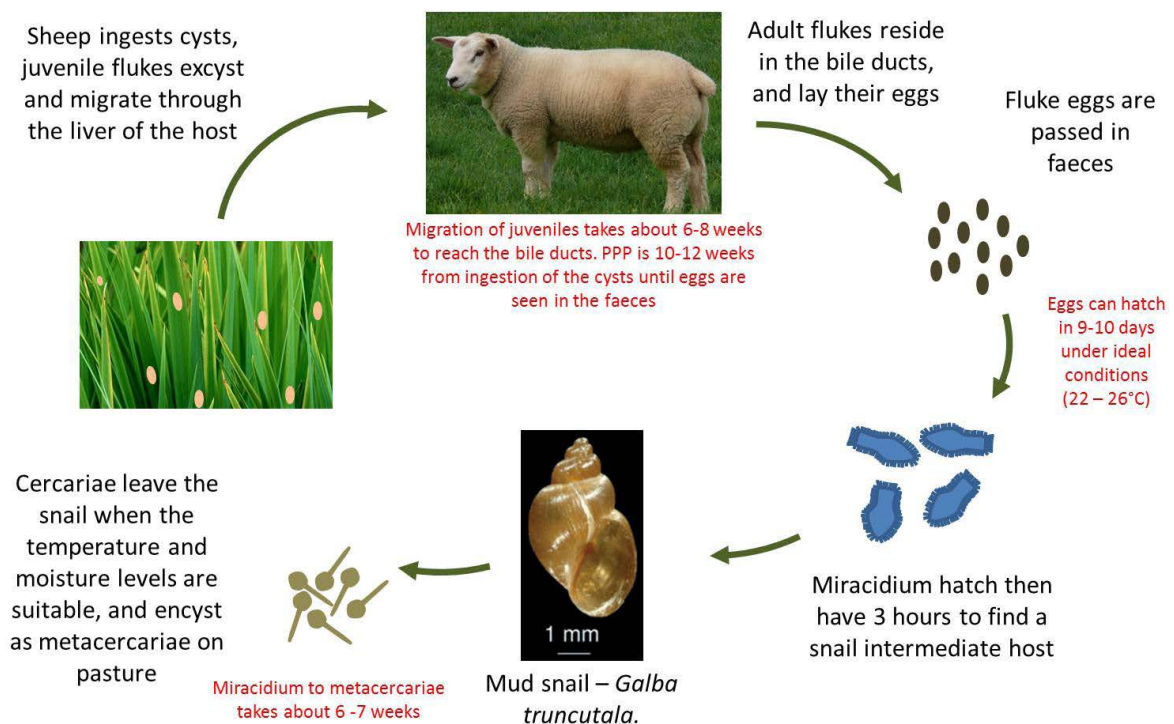


TABLE 5
Full list of activities underway during 2020. Gold cells indicate activities impaired to some degree due to Covid-19 impacts on staff and general travel.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GAMEBIRD & HARE, INCL. AUTUMN FLUSH COUNTS												
DEESIDE WADER, WATERFOWL & CORVID COUNTS												
FARMLAND BIRD COUNTS, WINTER – ALL SPECIES												
FARMLAND BIRD COUNTS, BREEDING – ALL SPECIES												
PRE-BREEDING WADER COUNT												
CORVID COUNTS												
RAPTOR COUNTS												
CANDACRAIG WADER COUNTS												
RODING WOODCOCK COUNTS												
WINTER WOODCOCK & PHEASANT FLUSH COUNTS												
BREEDING WADER MONITORING												
WADER TAGGING, RINGING & BIOMETRICS												
HABITAT USE BY TAGGED WADERS												
CURLEW NEST HABITAT ASSESSMENT												
BREEDING RAPTOR MONITORING												
RED SQUIRREL TRANSECTS												
MAMMAL DISTRIBUTION SURVEY (CAMERA TRAPS)												
RABBIT COUNTS (LAMPING - DRIVEN & WALKED)												
SOIL INVERTEBRATE SAMPLING												
SOIL INVERTEBRATE ANALYSIS												
BUMBLEBEE TRANSECTS												
INVERTEBRATE PITFALL TRAPPING												
MUD SNAIL SAMPLING (DISTRIBUTION & FLUKE ANALYSIS)												
SHEEP & RABBIT FAECAL SAMPLING (FLUKE ANALYSIS)												
TICK COUNTS												
GRAIN HOPPER USE TRIALS												
VEGETATION SAMPLING												
LASER TRIALS												

Financial report

Game & Wildlife Scottish Demonstration Farm
Statement of financial activities (including the
income and expenditure account) year ended
31 December 2020

	2020			2019
	Unrestricted	Restricted	Total	
	£	£	£	£
INCOME & EXPENDITURE INCOME FROM				
Donations & legacies				
Donations	17,386	-	17,386	20,211
Grants	8,781	-	8,781	1,000
Charitable activities				
Farm income	323,551	-	323,551	314,000
Sundry income	434	-	434	2,500
Total income	350,152	-	350,152	337,711
EXPENDITURE ON				
Charitable activities				
Farming	206,351	-	206,351	178,483
Research project	79,185	-	79,185	79,475
Total expenditure	285,536	-	285,536	257,958
Net income/(expenditure)	64,616	-	64,616	79,753
TOTAL FUNDS AS AT 31 DECEMBER 2019	(6,080)	-	(6,080)	(85,833)
TOTAL FUNDS AS AT 31 DECEMBER 2020	£58,536	£0	£58,536	(£6,080)

Game & Wildlife Scottish Demonstration Farm
Balance sheet as at 31 December 2020

	2020		2019	
	£	£	£	£
FIXED ASSETS				
Tangible assets		108,781		133,551
		<u>108,781</u>		<u>133,551</u>
CURRENT ASSETS				
Stock	241,150		213,321	
Debtors	137,834		173,497	
Cash at bank and in hand	116,595		29,827	
	<u>495,579</u>		<u>416,645</u>	
CREDITORS: amounts falling due within one year		<u>22,049</u>		<u>37,601</u>
NET CURRENT ASSETS		<u>473,530</u>		<u>379,044</u>
TOTAL ASSETS LESS CURRENT LIABILITIES		<u>582,311</u>		<u>512,595</u>
CREDITORS: amounts falling due after more than one year		<u>523,775</u>		<u>518,675</u>
		<u>£58,536</u>		<u>(£6,080)</u>
Representing:				
Income & expenditure account		58,536		(6,080)
Restricted funds		-		-
TOTAL FUNDS		<u>£58,536</u>		<u>(£6,080)</u>

Meet the team

Below is the team at Auchnerran, not forgetting the students and volunteers from universities across the UK and Europe who make an invaluable contribution to our work each year. If you have any queries, would like to volunteer at the farm, make a donation, to shoot or would just like to visit, please get in touch:

01738 551511 or scottishhq@gwct.org.uk



ADAM SMITH
FARM DIRECTOR



DAVE PARISH
HEAD OF SCOTTISH LOWLAND
& GWSDF RESEARCH



ALLAN WRIGHT
FARM MANAGER



MARLIES NICOLAI
RESEARCH ASSISTANT
& SHOOT MANAGER



Contact us

GWCT SCOTTISH HEADQUARTERS

Unit 95, Perth Airport, Scone, Perthshire PH2 6PL

Tel: 01738 551551

Email: scottishhq@gwct.org.uk

 www.gwct.org.uk

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