Norbury™ Traps Reduce the Cost of Squirrel Control by Over 70%

Jo Bradwell, **Dan Simmons**, **Alex Malkin**, **Kyle Pattinson** and **Andy Smith** describe the development of a novel squirrel trap and its potential benefits for woodlands in the UK.

We have developed a novel squirrel trap that only needs checking once a week and has been designed and tested at Norbury Park in Staffordshire. It is similar to the Kania 2000™ spring trap but with an added trap door to release dead squirrels and a food hopper that provides bait for two weeks. By reducing trap inspections from once a day to once a week or more, costs are cut by over 70%. This will reduce grey squirrel control costs on large estates and help manage squirrels in smaller woodlands that are not visited frequently.

Introduction

Bark stripping by grey squirrels (*Sciurus carolinensis*) poses a major threat to young woodlands in Britain and Ireland. Trees aged between five and 40 years with thin bark are vulnerable, and while sycamore (*Acer pseudoplatanus*), oak (*Quercus* spp.), beech (*Fagus sylvatica*), hornbeam (*Carpinus betulus*) and sweet chestnut (*Castanea sativa*) are particularly at risk, stripping has been reported on at least 40 different species (Mayle, 2005; Dutton, 2016). Damage occurs during periods of vigorous growth in spring and early summer and tends to be worse in dominant trees as they have thick nourishing phloem. It has been suggested that squirrels target this as a source of sugars or trace nutrients, although the exact reasons are questioned (Gill, 1992; Nichols et al., 2016). Even if trees survive attacks, there is decreased growth, while open wounds increase susceptibility to fungal infections which severely diminish timber quality. A recent report suggested that grey squirrels cost the timber and forestry industry nearly £60 million per year (Taylor, 2022). Clearly, woodlands that contain vulnerable species should embrace full squirrel control (Foott, 2025).

In a recent publication, we documented successful squirrel control at Norbury Park Estate (Whyatt et al., 2021) using the Kania 2000 trap on 312 ha of woodlands at a cost of £16,400 per year (£52/ha per year), 85% of which was for salaries. Similar costs have been noted at the Sotterley Estate in Suffolk (£58/ha per year) and at Bron Haul Farm, Conwy (£47/ha per year) (Whyatt et al., 2021). Such expenditure is prohibitive on many large estates, and it may be impractical in small woods if their owners live remotely.

> "By reducing trap inspections from once a day to once a week or more, costs are cut by over 70%."

The reason for the high salary costs is that live cage traps and spring traps should be examined every day. In the former case, it is because trapped animals (including by-catch) must not suffer dehydration or starvation, and in the latter case, it is to ensure that trapped squirrels are not still alive. Since salaries comprise 85% of squirrel control costs, reducing daily inspections to once a week would reduce costs by over 70%. Such benefits are inherent in the Goodnature A18™ bolt-action vertical trap (a modified possum trap), which releases dead animals to the ground where they become carrion. However, in our experience it is unsatisfactory. We compared 16 Goodnature traps with 16 Kania 2000 spring traps using similar woodland conditions (Shortman, 2022). Over a four-

week period in early spring, all traps were checked daily, collecting bins were placed beneath each one and several were monitored with cameras. The Goodnature traps killed one squirrel, 11 great tits and two pheasants. In contrast, the 16 Kania traps caught 22 squirrels with no by-catch. The disappointing results from the Goodnature traps led us to discontinue their use.

Because of current trapping limitations, other developments are in the pipeline. Of interest is the use of an oral immune contraceptive. By introducing an immunising preparation directed against a fertility hormone (gonadotrophin releasing hormone – GnRH) into food bait, it is hoped that induced antibodies will sterilise squirrels (Gill et al., 2022). After eight years, proof of principle remains to be established in extant squirrel populations. Furthermore, any success is not likely to have an impact on squirrel populations for many years. An alternative proposal is to use gene drive. In this technique, modified genes are injected into squirrels that subsequently enter the population and reduce fertility. However, even if it is experimentally successful, fears of modified genes becoming unstable or entering other animal populations will lead to regulatory barriers.

To reduce trapping costs in the absence of these unproven technologies, we have modified the successful Kania 2000 trap by adding a large food hopper and a trap door to release dead squirrels as carrion. This reduces daily inspections to once a week or longer. We have developed and assessed the traps at Norbury Park and on the neighbouring Bradford Estate with the help of a £50k innovation grant from Defra (2023).

Design of the Norbury trap

Our initial thoughts for a new trap were to have a repeat action trap door so successive dead animals would be released to the ground. However, this was technically difficult and required a power source such as a battery that might be unreliable in wet weather. Since our Kania traps are only activated once or twice a month on average, a single release trap door was considered sufficient.

Of similar importance is the provision of bait for a week or more, both at the front and at the back of the trap. Food is essential at the entrance to tempt squirrels from a distance. Unfortunately, birds, small mammals and squirrels eat any visible food within a day, so it needs to be replaced repeatedly. Likewise, bait at the rear of the trap is eaten by small birds and mammals. They are tempted into the trap for food, and pass over the trap door and treadle without it being activated. This is an important feature of the Kania trap as it prevents small animal by-catch.

Initial thoughts for baiting the trap involved electrically driven feeders at both front and rear, but these were expensive options. Our simple solution was to add a food hopper and funnel at the back (like a bird feeder) and tilt the trap forward by 20 degrees. Small animals eating food at the back spill more under gravity which flows over the trap door and out through the front.

The various components of the trap can be grouped as follows:

- *Treadle, spring mechanism and tunnel*. These are identical to the effective Kania 2000 trap (Figure 1) which is based on pushing a treadle to release a spring onto squirrels' necks. The entrance tunnel guides the animal into the correct position.

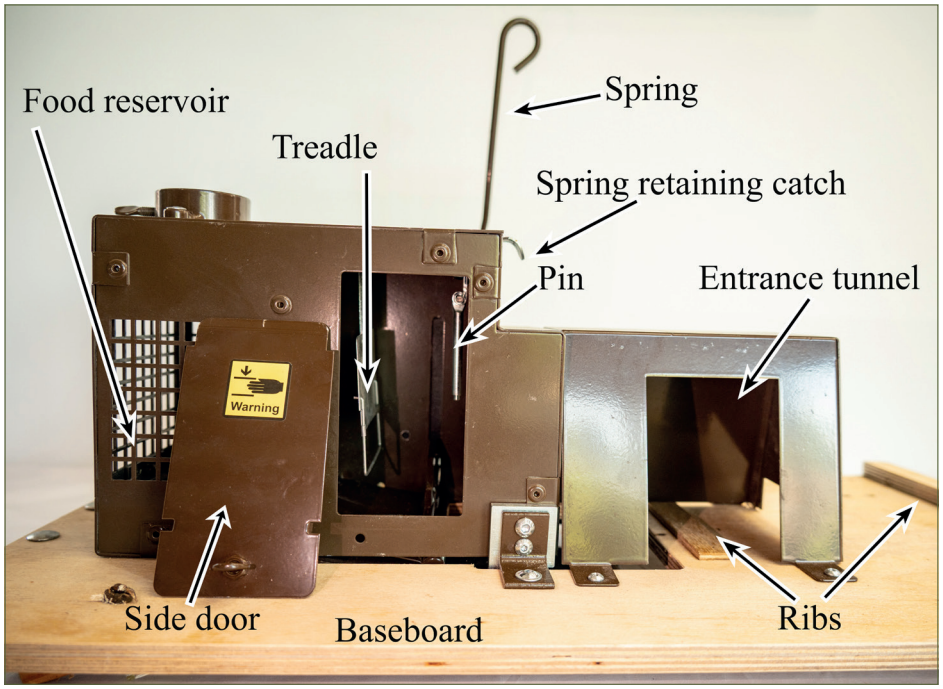

Figure 1. Copy of the Kania 2000 trap showing the entrance tunnel, treadle, release pin, and rear food reservoir. Modifications include windows to illuminate food, a more robust construction and a wooden base; otherwise, the two traps are identical. This similarity means it is approved under the Spring Traps Approval (England) Order 2018. It is sold in the UK as the Shelmore trap since Kania traps are not available.

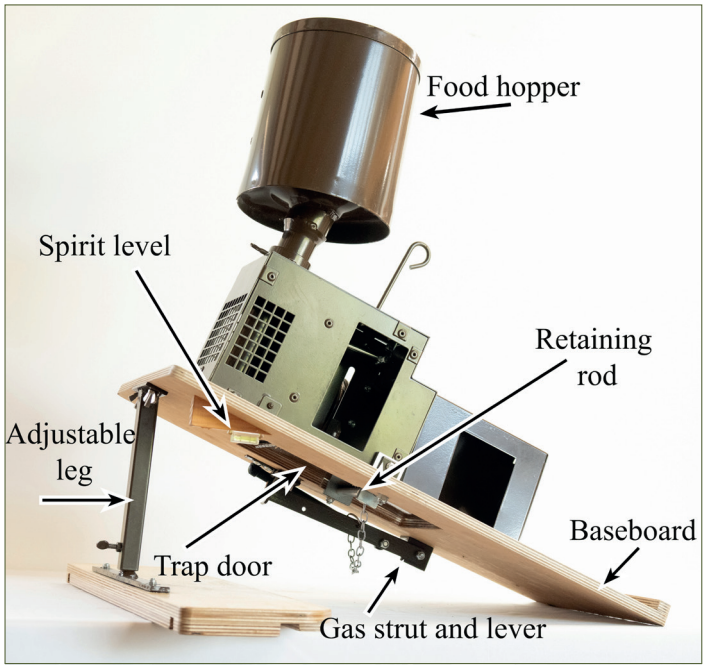

Figure 2. Norbury trap, based on the Shelmore trap (Figure 1), with the addition of a food hopper and a trap door. The trap door retaining rod, gas strut and lever are shown in a closed position.

- *Trap door and release mechanism*. The trap door is in the base of the entry tunnel beneath the spring that hits a squirrel's neck when the treadle is pushed. The spring also hits an external pin that releases a lever attached to a gas strut (piston) (Figures 2 and 3). Over 10-20 seconds, this pulls out a retaining rod that opens the trap door.
- *Food reservoir, hopper and adjustable leg*. A 4-litre hopper and funnel, containing sufficient food for 10-14 days, is positioned above the reservoir at the rear of the trap (Figure 2). The trap is set at 20 degrees by adjusting a rear leg using an attached spirit level as a guide. As small animals eat food from the reservoir, more is released from the funnel, with surplus flowing out through the front of the trap under gravity. This overcomes the daily need to replace bait both at the entrance and beyond the treadle, as in the Kania trap.
- *Baseboard*. A marine ply baseboard contains a rectangular hole that allows the trap door to open. Ribs on the baseboard retain food inside the entrance tunnel and at the front of the trap.

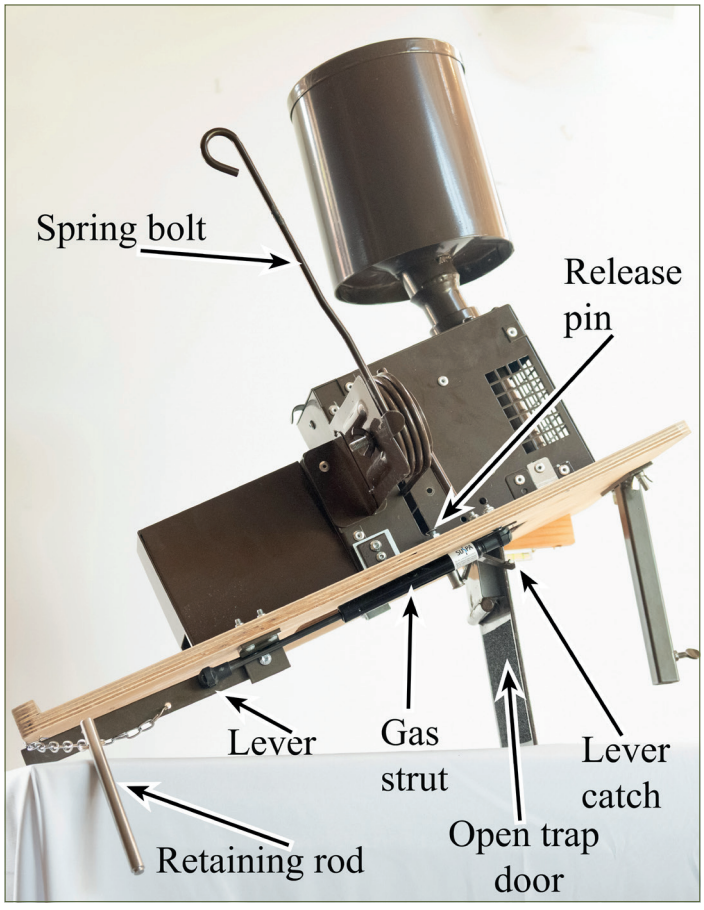

Figure 3. Norbury trap from the other side showing the open trap door with the gas strut extended and the retaining rod on its chain.

Figure 4. Norbury trap positioned on posts with a platform bridging to a tree.

- *Materials*. It is built of aluminium, zinc-coated steel and stainless steel and then powder coated in long lasting polyester brown paint (Ral 8014).

Using the traps

They should be placed adjacent to a tree or similar squirrel habitat at approximately one metre above the ground and screwed onto posts so the trap door can open freely (Figure 4). It is primed in the following steps:

1. The rear leg is adjusted to raise the back to 20 degrees from the horizontal. The food hopper is pushed to the base of the food reservoir and filled with four litres of maize.
2. The side door is opened and the spring moved to the top of the chamber and the pin pushed into the hole at the top of the treadle.
3. The trap door piston is closed by pulling the lever and slotting its end into the catch while pushing up the release pin.
4. The trap door is closed and the retaining rod on a chain is positioned into the slots under the trap door.
5. The side door is replaced and the spring primed by bending it under the retaining catch.
6. The hopper is lifted by around 2.5 cm (approximately to the mark on the funnel) so some food flows out of the funnel and downwards, over the trap door, through the entry tunnel and onto the front of the platform.
7. Maize is rubbed through the back windows to fill the reservoir and more scattered into the entrance tunnel and on the front platform.

Evaluation of the Norbury trap

Numerous studies were carried out over a four-year period as the traps were developed and tested in woodlands. Generally, we used between 120 and 150 traps at a density of one per three hectares over 300-400 ha of woods. Bins were placed under all Norbury traps to collect and confirm kills and by-catch. Comparison of the Shelmore and Norbury traps showed they were similar in terms of squirrel catch rates and by-catch (~4% of kills being rats and rarely pheasants). Fifteen cameras were used to observe trap functions and squirrel feeding patterns. Initially, all traps were examined five days a week and unset on Fridays. As confidence in the effectiveness of the food hopper and trap door increased, traps were examined on a weekly basis. The annual cull rate at Norbury over nine years is shown in

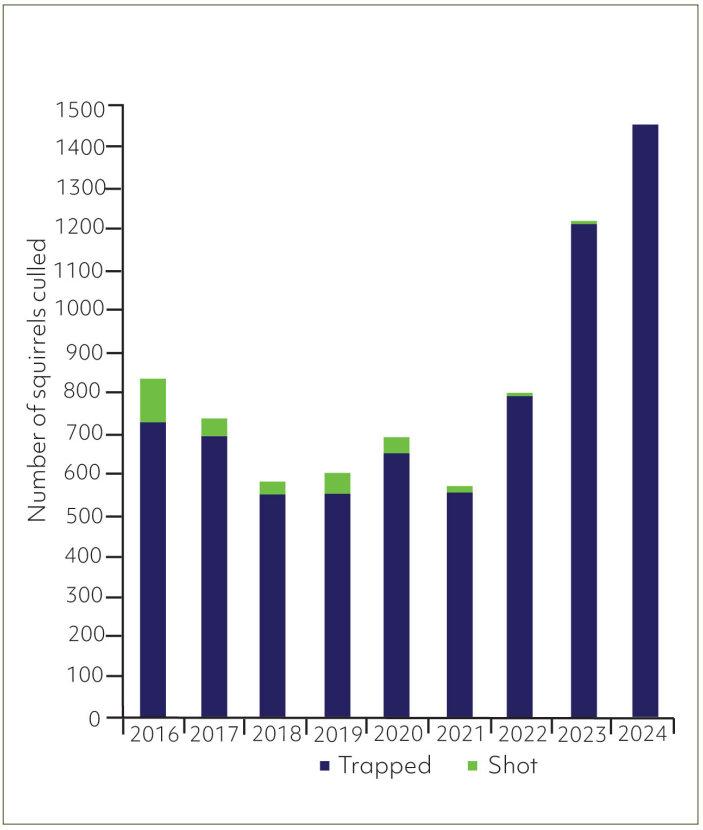

Figure 5. Annual cull rate of squirrels over nine years. The Norbury trap gradually replaced the Kania traps starting in 2023 and was complete in 2024. Data for 2023 and 2024 include those from the neighbouring Bradford Estate.

Figure 5. The high numbers for 2023 and 2024 include those from the neighbouring Bradford Estate as we added the Norbury traps.

Costs

The main purpose of the Norbury trap, with its hopper and trap door, is to reduce salary costs. In 2021, the annual cost of squirrel control using Kania traps was £16,400, of which 85% was the salary for a full-time staff member for six months per year – February through July (Wyatt et al., 2021). Traps were examined from Monday to Friday when they were unset for the weekends. In contrast, the Norbury traps are checked once every one to two weeks when they are filled with maize and reset if triggered. They are operational for seven days a week (unless triggered) rather than four days a week. If squirrel numbers are high, then more frequent checking is useful, but if low, traps can be checked once every 10-14 days. Hence, costs are reduced to about one quarter (Table 1).

Until 2024, we used traps between February and July. In other months, competing natural food from trees reduces

Table 1. Estimated costs per year for 100 traps on 312 hectares (2025).

Costs	Shelmore traps at £100 each		Norbury traps at £200 each	
	1st year	2nd, 3rd years etc.	1st year	2nd, 3rd years etc.
Capital cost of 100 traps	£10,000	£0	£20,000	£0
Salary	£16,800	£16,800	£3,600[1,2]	£3,600
Transport	£1,200	£1,200	£600[3]	£600
Bait	£600	£600	£600[4]	£600
Total	**£28,600**	**£18,600**	**£24,800**	**£4,800[5]**

Notes on the Norbury trap:
[1] Assumes they are being checked weekly. Lower cost if checked once every 10-14 days.
[2] Continuously active for 7/7 days, not 4/7 days for Shelmore traps – 75% more days, so may need less traps, but this is offset by traps being inactive when triggered.
[3] Reduced vehicle and fuel costs because they are visited less frequently.
[4] Similar food requirements for both traps. However, Norbury traps take more time to service since the hopper needs filling on each visit.
[5] £15 per hectare per year over 312 hectares. Defra grants are £60 per hectare per year.

trapping rates, plus squirrels rarely cause tree damage in autumn and winter. Hence, checking 100 or more traps daily outside February to July is time consuming for little benefit. However, with the Norbury trap only requiring weekly checks, in 2024 we trapped from August through December. We used 75 traps and they were examined every seven to ten days, with the monthly culling rates shown in Figure 6.

Over that period, we caught 246 squirrels. Assuming 100 were pregnant and each had three live offspring, it potentially avoids culling perhaps 300 young squirrels in the spring and summer of 2025. The low monthly numbers for 2025 (the lowest in nine years) (Figure 6) and few visible squirrels in the woods suggest that this was an effective strategy. Clearly, it is better to kill females in the winter rather than killing females plus their young the following spring. However, this means trapping throughout the year, which increases salary costs. We are undecided about this policy and how many traps might be needed. By-catch between August 2024 and April 2025 was 19 rats, one pheasant and one stoat. The squirrel catch was 523, giving a by-catch to squirrel ratio of 4%.

We have used maize throughout the trials with no obvious reduction in trapping rates. However, peanuts are used on some estates, and we found broken walnuts are particularly attractive. Future trials might resolve such issues.

Table 1 shows that the ongoing cost of squirrel control with the Norbury trap is around £15 per hectare per year. Grant support for new woodlands was £60 per hectare per year (Defra/Rural Payment Agency, 2024).

Discussion

The Norbury trap has evolved in several stages over five years. From an initial plan to have a multi-kill trap with squirrel release (as in the Goodnature trap), it has become a Kania 2000 type device with the addition of a trap door and food hopper. Since each trap catches on average only one to two squirrels per month and the Goodnature traps must be visited weekly for re-baiting, multi-kill devices are

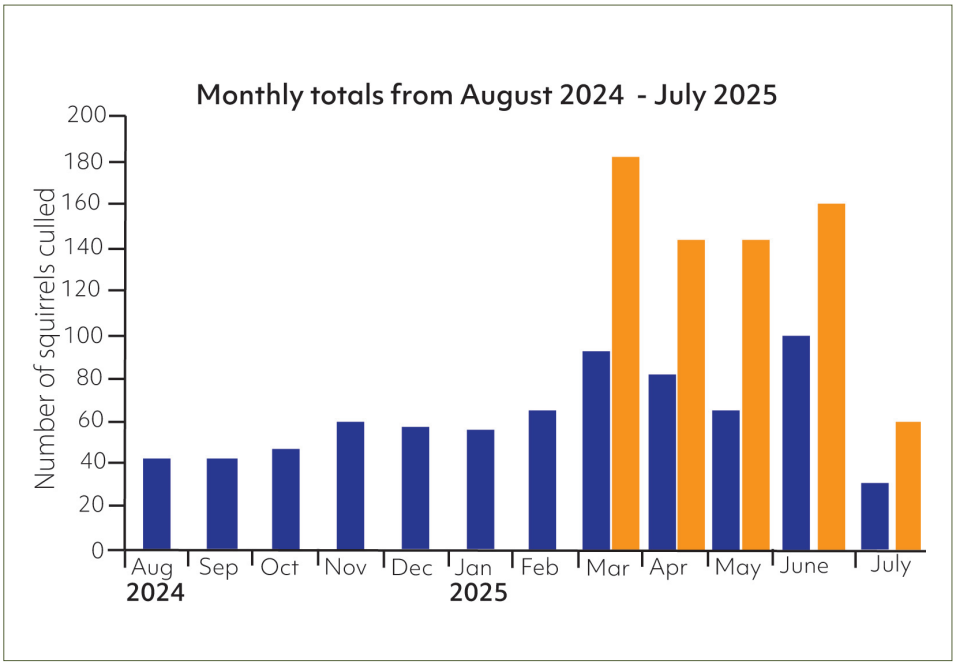

Figure 6. Monthly cull rates from August 2024 through July 2025 (blue) compared with the average of years 2020-2024 for March through July (orange).

generally unnecessary and add to costs. Furthermore, bait located only beyond the bolt, as in the Goodnature trap, is less attractive than bait visible at the trap entrance. We did not test other traps such as the body grip traps (e.g. Fenn trap) since all require daily inspections and in our experience are not as effective as the Kania 2000. We prefer spring traps to live cage traps because there is no requirement to kill trapped animals or release frightened by-catch. Other snap and spring traps require dealing with dead animals that may have been partly eaten. Drop traps are better because there is no requirement to dispose of the animals.

The dominant cost of squirrel control is staff remuneration. Compared with inspecting traps daily, inspecting them weekly or fortnightly reduces these costs by 60-80%. This is paralleled by the reduced transport costs of visiting every trap daily. Furthermore, the Norbury traps are 'active' for seven days a week rather than only four days a week (if serviced during a normal working week of five days). Together, these savings have reduced annual squirrel control costs at Norbury from nearly £18.6k to £4.8k, or put another way, £66 per hectare per year to around £15 per hectare per year. These costs can be reduced further with grants from the Forestry Commission through the Countryside Stewardship funds (Defra/Rural Payments Agency, 2024a). They include 80% of the price of the trap purchases and ongoing costs of trapping at £60 per hectare per year for five years. The latter grant easily covers all expenses when traps are inspected weekly.

In spring and early summer, when squirrels are hungry and easier to catch, it may be useful to check the traps more than once a week. At other times of the year when numbers are low, inspections could be reduced to once a fortnight. At Norbury, we have usually trapped from February through to July. Nevertheless, some estates trap squirrels all year round to be certain there is no tree damage (Sotterley Estate). Whatever annual trapping plans might be, weekly or fortnightly trap inspections make both seasonal and year-round trapping more cost effective.

One interesting suggestion is to identify triggered traps by adding a sensor and a phone link to an App. While such devices cost around £100 (Perdix, 2025) there is also a monthly phone charge of £5. If traps are rarely triggered, they might be a useful although expensive option. However, it is unlikely that they would be helpful with the Norbury trap since the hopper needs filling every 7-14 days.

There is also the question of finding dedicated staff. There are few people who are prepared to travel around woodlands in all weathers, five days a week, to set and unset traps. In the case of small woodlands with no permanent staff, the burden of squirrel control probably falls upon the owners, but this is impractical if they live remotely. Hence, woodlands that are perhaps visited a couple of times a month are ideally suited to the use of Norbury traps. In contrast, large estates may have sufficient staff for daily trap inspections, but by reducing trap checks from daily to weekly, their skills can be allocated to other projects, or traps can be placed in additional woodland areas.

The number of traps required per hectare depends upon their efficiency. We have used one trap per three hectares of woodland plus modest winter shooting and have had minimal squirrel damage over 13 years. We have not yet assessed whether the efficiency of the Norbury traps allows for reduced trap numbers.

> "A recent report suggested that grey squirrels cost the timber and forestry industry nearly £60 million per year."

There is considerable interest in increasing tree species numbers in UK woodlands (Langham et al., 2024). In North America, trees are relatively free from grey squirrel damage, but this may be because raptors such as the red-tailed hawk (*Buteo jamaicensis*) provide good control. However, as the trees co-evolved with squirrels, they may have developed some immunity. Nevertheless, new tree species introduced into UK woodlands are likely to need squirrel control measures.

Future developments in grey squirrel management may comprise contraceptive devices, reintroduction of pine martens, eradicating greys in selected areas of the countryside (as exemplified by Anglesey) and protecting reds by immunising against squirrel pox. Even if any of these ideas develop into practical applications, squirrel trapping will remain an essential part of woodland management for many years.

Conclusion

The high costs of grey squirrel control at Norbury Park have led us to develop the Norbury trap. By incorporating a trap door and a food hopper into the Kania 2000 model, the traps only need checking once every one to two weeks. Rigorous testing over four years has shown that they are as effective as Kania traps at less than 30% of the annual

running costs. With the added benefit of grants from the Forestry Commission, grey squirrel control across large parts of England can be considerably more affordable.

Please note: Norbury trap – Provisional UK Patent No. GB 2617262. US Patent No. 12167727. The Shelmore and Norbury traps are marketed under the Guarantree trademark (https://www.guarantree.co.uk).

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Kyle Pattinson used the Norbury trap in an urban garden in Oxford. He assessed the trap functions over six months using photography to check squirrel feeding patterns.

Alex Malkin MICFor is the Head Forester at Norbury Park Estate. He has a background in commercial softwood production and private forest management and is now focusing on forest resilience and over-yielding utilising complex mixtures.

Dan Simmons is an owner and Director of T.O.C Limited and has helped design and build the traps.

Andy Smith is the squirrel control practitioner at Norbury Park with over ten years' experience. His work includes locating and setting traps, carrying out trapping trials, monitoring grey squirrel damage and documenting results.