

Farming for a Better Climate



Working towards net zero carbon at Auchmore Farm

Auchmore Farm, run by Stephen and Sheena Mackenzie in partnership with Stephen's brother Donald, is a hill farm located to the west of Muir of Ord in the central highlands of Scotland.

The farm covers approx. 290 hectares; 170 ha of that is hill ground, around 80 ha being in -bye and 40 ha of forestry. In addition the farm rents another 16 ha located outside Muir of Ord.

The farm runs 85 autumn calving Shorthorn and Aberdeen Angus cows. Calves are sold as store cattle for breeding or finishing.

There are 200 Cheviot and Cheviot mule ewes which run with Texel, Blue Faced Leicester and Cheviot tupes. Lambs are sold as store in August. Replacement animals for both the cattle herd and sheep flock are bred on farm.

Stephen and Sheena worked with SAC Consulting as one of nine Climate Change Focus Farms under the Scottish Government funded *Farming for a Better Climate* initiative between 2014 and 2018; this case study summarises some of their findings. Auchmore also worked alongside focus farms Clynelish in Brora and Corrimony in Glen Urquhart, forming a satellite group known informally as HiFEN – Highland Farming Efficiency Network.

Carbon offsets from renewable energy

Auchmore is a Class 2 Wind Site and has two 500kW wind turbines located on the farm, the first one was commissioned in November 2013 and the second in December 2014. The wind turbines are a 50% joint venture with one other party.

A 100kW hydro scheme was commissioned at Auchmore in 2015; this cost around £750,000 and has a payback period of between 6 and 8 years. The hydro scheme is located on the banks of the adjacent watercourse on the farm and with the turbine running at 1000 revs per minute and with an inflow water speed of 250 miles per hour. The station has run at an average capacity factor of 79% since commissioning.

Electricity generated from the turbines and the hydro scheme is exported to the grid. Generating energy from renewable sources rather than fossil fuels will offset CO₂e. Its estimated during the project, Auchmore offset the equivalent of 3,728 tonnes CO₂.

Stephen is interested in using some of the electricity generated for use on-farm, and plans are in hand to facilitate this.



Case Study

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- Energy and fuel use
- Renewable energy
- Lock carbon into soils and vegetation
- Optimise the application of fertilisers and manures
- Optimise livestock management and the storage of manure and slurry

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Optimising soil health and nutrient use

Topsoils at Auchmore were all medium textured sandy loams varying in depth from 190 mm to >300 mm. The soils in themselves did not represent any restriction to potential yield. However often had hard layers that can restrict root and water movement (indurated). In the upper profile these are easily removed by cultivation but can have an impact on drainage of the lower profile.

Much of the grass at Auchmore is semi-natural and given the geology of the land and the shallow wetter soils, a total re-seed in the conventional sense is not practical. Instead Stephen decided to focus on effective over-sowing as well as continuing to relieve identified compaction through subsoiling.

Soils were already under consideration before participation in the project, with a programme of liming already in place. Although the average pH is 5.9, it was still felt to be slightly low so Stephen is working to increase this to 6.2/6.3 in the coming years. Although applying lime will increase the carbon footprint in the short term, the benefits from improved grass growth and better fertiliser utilisation are expected to be seen in future carbon footprints.

Incorporating red and white clovers into the sward is an effective way of providing aging leys with a continual supply of nitrogen. In 2014 Stephen over-seeded clover into the in-bye grassland fields and reduced nitrogen applications in crop years 2015 and 2016 by 2,388kg and 3,000kg respectively. Based on a value of £0.66/kg N, that is a total saving of £3,556 and 71,173 kg CO₂e across two years of the project.

In the 2017 crop year, only 12.6t of Muriate of Potash (MOP) was applied; again the benefits of not applying bagged nitrogen will be evident in the following year's carbon footprint. Going forwards and due to the long term effect of clover, using a fertiliser composition matching 5:20:20 would adequately meet nutrient requirements of the farm's grazed grassland, something Stephen has looked for but not yet found. Using this type of fertiliser could result in savings of £1,485 and 29,722kg CO₂e, compared to the 15t of 20-9-9 used previously.



Changes in livestock management leads to improved productivity

Pre 2016, Auchmore was selling their August born calves castrated at 8 months, during the project Stephen made the decision to sell the bull calves whole at 6 months, with the aim of getting them away at a heavier weight earlier and improve feed conversion.

Leaving the cattle entire has resulted in an increase in daily live weight gain of around 15% - 20%. At an average sale weight of 300kgs, up from 250kg is an increase of 50kgs/head, which at current prices (225p/kg approx) gives an increased income of £112.50 per calf sold. Assuming 20 entire calves are sold per year, that is an increase of £2,250 and 2,500kg of extra output, helping to reduce the carbon footprint by 0.9kg CO₂e (2.68%).

Changes have been made to the sheep enterprise in recent years with the flock size decreasing by 20% and the composition changing from 100% pure Cheviot to 50% Cheviot and 50% Cheviot Mule ewes. This has resulted in an increase in the number of lambs born for each ewe kept. Lambs are also sold store in August rather than finishing them off grass/turnips, which has resulted in increased grass growth in the autumn and following spring, so more grazed grassland being available for the ewes and cattle. These management changes also contributed to a reduction in nitrogen fertiliser applications.



What were the key findings from the focus farm work at Auchmore?

- Although already farming efficiently, Stephen and Sheena were still able to make financial savings of over £9,000 due to small changes in practice and reduced their farm carbon footprint by 7% as a result of their participation in *Farming for a Better Climate* initiative between 2014 and 2018, with future changes expected.
- 3,728 t CO₂e were offset by the renewable energy sources in place at Auchmore during the focus farm project. Whilst the energy generated wasn't being used on farm, future developments in battery storage technology could make this possible and provide further reductions in the farm carbon footprint.
- Assuming 20 6-month old entire bulls are sold per year as opposed to the previous practice of selling castrated bullocks at eight months, the result is an increase of £2,250* and 2,500kg of extra output, helping to reduce the carbon footprint by 0.9kg CO₂e (2.68%). (*at 225p/kg approx)
- For other practical ways to reduce the farm carbon footprint, visit www.farmingforabetterclimate.org