Road Verge Management Guidance – Case Study

Roadside Grassland Biomass Harvesting in Rural Lincolnshire

Road verge biomass harvesting with a tractor-powered suction flail is now being trialled by Lincolnshire Wildlife Trust (LWT) on Lincolnshire's minor rural roads. Herbaceous biomass from road verges is also being trialled as a feedstock for on-farm CHP (combined heat and power) Anaerobic Digesters (AD).

Envisaged benefits that could come from this process include:

- Enhanced biodiversity and the restoration of ecosystem services in roadside habitats;
- More wildlife-friendly and cost-effective vegetation management;
- New and diversified sources of revenue and job opportunities in rural areas;
- Decrease in the consumption of fossil fuels; and
- A reduction in the environmentally damaging maize growing for AD.

For a full list of benefits, see Appendix I at the end of this document.

Method of Cutting

The main concerns for the biodiversity of roadside grassland habitats are cuts that are too frequent or too infrequent, and the leaving of a mulch of cuttings in situ following cutting. Hay-cutting involves multiple passes of machinery and is weather dependent and is therefore far less efficient than a single-pass suction flail.

A side-arm mounted suction flail also reduces the need to run machinery over verges which causes soil compaction and disturbance, decreased water infiltration, increase in ruderal plant species at the expense of scarce meadow flora and higher mortality for invertebrates. The flail can also be carried above ground level towards the back verge where there are concerns for ground nesting birds, hedgehogs etc.

Recent research in Germany has advocated fewer cuts per year (2 instead of 4) for more

energy returned on the energy invested in biomass harvesting and anaerobic digestion of road verge grassland. A review undertaken this year of the biodiversity effects from different road verge vegetation management has concluded that, in most cases, roadside grassland floral diversity benefits most from cut and collect twice per year.

The convergent conclusions made by these separate studies suggest that road verge cutting could be largely self-regulating, being both economically and ecologically viable. This presupposes that verge management would be based on zero herbicide and fertility input and would involve no re-seeding with more productive species.

Lincolnshire Verge Harvesting

Following feasibility studies, pilot trials and demonstration events since 2015, Lincolnshire County Council (LCC) has been leading an ongoing verge biomass harvesting project since 2017 which involves consultancy on logistics, potential chemical and physical contaminants, AD technology, biodiversity and permitting under the Waste Regulations. The company 'Lincolnshire Verge Harvesting' (LVH) was formed in January 2018 which is a collaboration between 3 farming businesses situated in eastern Lincolnshire from the Lincolnshire Wolds to the Wash.

Lincolnshire Verge Harvesting has contributed £50k of funds towards the project which was matched by European funding via the Greater Lincolnshire Enterprise Partnership (GLEP). The total project budget is £100k.

A local agricultural engineering company, Scott's Precision Engineering, was commissioned by LCC to design and build a road verge harvesting machine. The design is modular and based on a tractor as this is seen to be the most practical for farm businesses.

Each of the three business partners shared the machinery to harvest from c.10km radii catchment areas centred on the receptor AD facility in each case. By the end of the trial, a forward speed in excess of 5km/hr was achieved consistently by the harvester which is sufficient to cover all rural verges within each 10km radius catchment with one working width pass within a week. This amounts to over 200km of verge or at least 22ha of harvested area.

Biomass yield data from 2016 trials for the 1.1m carriageway edge strip showed an average total fresh weight over two cuts in one year to be 2.57 tonnes of fresh weight/km of verge or 23.4 tonnes/ha. This gives a predicted yield of over 500 tonnes of fresh weight per week from the verge edge over two cuts. Data from 2016 trials also showed that biomass yields can be doubled for strips of vegetation harvested further towards the back of the verge. Due to a late start to the growth season and prolonged summer drought during the summer of 2018, yields were roughly half of what was predicted by the 2016 figures.

Contaminants

The vast majority of physical contaminants (litter) have been found to be plastic drinks bottles, drinks cans and cardboard fast food containers. These have been found to have a markedly clustered distribution on specific slow moving stretches, very much more often at junctions than along straight stretches and closer to the carriageway edge. As such it is thought that the distribution and type of the majority of litter could be predicted with 'heat maps.'

Additionally, the height of a suction flail is set by a roller which has been found to press the majority of litter down while cuttings are sucked up. This significantly reduces the level of physical contamination of the biomass collected. There was only limited contamination of harvested biomass from physical debris and total values did not

breach the British Standards Institution's (BSI) Publically Available Specification (PAS) feedstock and digestate standards. Some manufacturers (e.g. Mulag) produce vacuum litter picker attachments which can be used to pass over a verge once vegetation has been cut or in early spring before growth commences.

The most abundant forms of roadside litter are recyclable and this too could be a source of revenue. The majority of litter is found to be historical, i.e. litter which has accumulated over time. Cutting, collecting and litter picking will therefore have the effect of bringing verges into good condition, in a way that also reduces litter and makes recently deposited litter easier to collect.

Potential chemical contaminants were analysed by the University of Leeds from random samples of biomass. The levels of potentially toxic elements (PTE's) such as heavy metals and poly-aromatic hydrocarbons (PAH's) were similar to or below levels that would be observed in other feedstocks and significantly below values permitted under PAS 110/100 for digestate from AD operations. As in other trials they were also at the lower end of the normal ranges observed in the Environment Agency's (EA) Soils and Herbage Pollutant surveys.

Financial Viability

The financial modelling undertaken by Leeds University for the 2016 trial concluded that grass can be harvested profitably from a single cut per year, but this depends on a use being found for the heat generated so that renewable heat incentive (RHI) can be claimed. The financial viability calculations assumed a single harvesting vehicle which can cut and travel at reasonable speeds and costs less than £500 per day to operate.

As the area of grass harvested increases, the profit decreases, and for this reason 15km from an AD plant was considered to be the maximum distance practical for harvesting.

Future changes to feed-in tariffs, export tariffs for electricity generated, and RHI payments will impact on profitability. The methane predictions in this study may prove to have been conservative, and it is possible that in practice more can be generated, thus making the process more profitable.

Biodiversity Monitoring

Biodiversity surveys were undertaken for all vascular plants and invertebrates observed in the field to measure impacts on biodiversity from changing the current management practice to cutting and clearing the arisings with a suction flail.

Sample sites and paired controls were selected which covered a wide range of verge conditions and which could be revisited accurately. The aim was to develop a baseline data set upon which future trend analysis could be based.

Survey site selection and survey methodology was peer reviewed by the Chief Scientists' Directorate at Natural England. A single annual survey in July was thought to coincide with the most available information between cuts and represent the most efficient survey effort.

Gradsects were used to account for the environmental gradients and consequent variation in vegetation across verge widths. Due to weather conditions in 2018, results must be taken to represent a low baseline. Nevertheless, anticipated patterns in vegetation were detected.

Partners / Funders

Lincolnshire Wildlife Trust; Lincolnshire County Council; Peakhill Associates; Lincolnshire Verge Harvesting Ltd. Scotts Precision Engineering; Greater Lincolnshire Local Enterprise Partnership.

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Appendix I: Envisaged Benefits of Roadside Grassland Biomass Harvesting

- More cost-effective vegetation management on the 'soft estate' of the road network due to a reduction in cutting frequency;
- A new revenue stream from selling electricity to the national grid which could not only subsidize verge maintenance operational costs but generate profit;
- A new revenue stream for AD facilities if this feedstock qualifies as a waste for Renewable Heat Incentive (RHI) payments;
- A new revenue stream from the recycling of collected roadside litter;
- The creation of jobs in the farming sector in remote rural locations; and the diversification of farm businesses;
- Renewable heat generation for farm/ community buildings;
- Renewable heat source for drying woodchip possibly collected from other roadside operations;
- A reduction in the carbon footprint of local highways authorities;
- A reduction in the requirement for maize in existing and future AD facilities and a consequent release of arable land for food production;
- Reduction in maize growing that would lead to a reduction in farmland soil erosion risk and watercourse quality improvement;
- Roadside drainage water quality improvement through removal of cut and decaying vegetation;
- Nutrient recovery from marginal land for soil conditioning through application of AD digestate onto agricultural land
- A decrease in fossil fuel consumption for national energy generation;
- A resource which could enable research into bio-based replacement for petroleum vehicle fuel and plastics;
- A mainstream enhancement of management for biodiversity benefit throughout extended landscape networks of marginal grassland - these networks can constitute a significant contribution towards the ecological corridor functionality of a national 'Nature Recovery Network' and targets for habitat creation/restoration in the DEFRA 25 Year Environmental Plan;
- Restoration and maintenance of favourable condition to roadside LWSs under Single Data List Indicator 160-00;
- Enhanced provision of ecosystem services such as pollination and natural crop pest control to adjacent farmland;
- The development of an AD feedstock market that could enable biomass harvesting of public open spaces and arable margins; and
- Aesthetic enhancement of both the rural and urban road verge environment with positive effects on the wider determinants of health and wellbeing, tourism and property values.