Describing and characterising the main types of HNV farming systems in Scotland

Report prepared for the Scottish Government

Supplementary Paper 1 to "Summary Report on Developing High Nature Value Farming and Forestry Indicators for the Scotland Rural Development Programme"

Report to the Technical Working Group on High Nature Value Farming and Forestry Indicators for the Scotland Rural Development Programme

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Purpose and intent

The purpose of this document is to provide some background information to the Technical Working Group on:

- Why it is important to consider farming system characteristics when looking to estimate the number and extent of High Nature Value (HNV) farm holdings in Scotland
- What the broad characteristics of Scottish HNV farming systems are likely to be
- The rationale behind the decision that the focus should only be on HNV livestock farming systems in Scotland
- The detail of the approaches taken to estimate the number and extent of HNV farm holdings in Scotland at a broad level using farm holdings level data as surrogates for detailed data on habitat type/condition and management intensity
- How such a farming system approach compares with the work conducted by SNH on considering nature conservation characteristics

Note that the broad term “farmland biodiversity” encompasses an extremely wide suite of concerns (e.g. from livestock and crop genetic composition through species assemblages to ecosystem health) and biological foci (e.g. from soil micro-fauna through different habitat plant species compositions to the wide range of wildlife species and groups that utilise agricultural land in all its many forms throughout Europe).

Hence in any discussion about High Nature Value it is essential to be clear what exactly is being talked about and considered. From the initial development of the High Nature Value farming concept, the focus has been put specifically on those wildlife species and habitats associated with, and intimately linked to, farmland and farming practices and which have been deemed to be of high nature conservation value.

Why focus on the farming system characteristics?

The HNV farming concept recognises that many European habitats and landscapes considered to be of high nature conservation value are intimately associated with the continuation of specific low-intensity farming systems. The underlying principles behind the development of the HNV farming concept were, and remain, that:

- Market, agricultural policy and social pressures are increasingly making such HNV farming systems economically unviable
- Any resulting intensification or abandonment of such farming systems would adversely impact on the associated HNV

- There is therefore a justifiable case to be made for directing additional financial support to these farming systems to help maintain the HNV

Across Europe, HNV farming systems are characterised by either (1) low intensity of land use and a high proportion of semi-natural vegetation forming the forage or fodder resource or (2) low-intensity of land-use sitting with a diverse landscape mosaic of natural and semi-natural habitats (Figure 1 below; Beaufoy, 2008). However, there is no universally applicable dividing line between HNV and non-HNV farming systems any more than between low-intensity and intensive farming. The biological diversity of farmland ranges along a gradient between the lowest and the highest values. But for a given situation, a judgement can be made of what types of farming should be considered as HNV, on the basis of available knowledge about the land cover, the farming systems in question and their inherent value for biodiversity. Ideally a clear differentiation between HNV and other farmland can be made; but realistically, Member States will have to choose between criteria likely to *include* as much HNV farmland as possible and those which *exclude* as much farmland of lower interest as possible. Based on this judgement, indicators can be designed.

Although some HNV farming systems occur in association with traditional cropping systems (such as extensive olive production in the Mediterranean or non-irrigated crop production in northern Spain), in general the majority of Europe's remaining HNV farming systems are now largely associated with livestock grazing systems on semi-natural habitats in the mountains and other remote areas of Europe (Bignal & McCracken, 2009). Ensuring the maintenance of the farmland biodiversity value associated with such areas therefore depends on ensuring the continuation of appropriate farming systems in those areas. This requires an understanding not only of how the different elements of HNV farming systems interact to maintain the HNV but also of how HNV farming systems can be identified. The identification of whether the system practised at a farm holding level is HNV or not is important, since ultimately it is at the farm level that any public funded support (be it Single Farm Payment or funds from the SRDP) is directed.

Overview of general ecological principles

Within any agricultural landscape, biodiversity is generally greater within areas that (a) contain a wide range of niches (e.g., different habitats, different vegetation structures), (b) are subject to medium levels of disturbance (e.g. through climatic or management factors), (c) occur at a large enough scale to allow enough individuals to survive and maintain viable populations and (d) provide a sufficient amount of similar habitats (though with varied environmental conditions) within close proximity to each other to allow the individuals of each species sufficient choice of potentially suitable habitats at any one time. Many European farming systems are of high biodiversity value because:

- They continue to utilise and maintain a high proportion of semi-natural vegetation managed at relatively low levels of intensity. This may be largely by default in that climatic and topographic constraints limit the intensification of vegetation management and agricultural practices that can be applied to these areas. However, the outcome is a greater range of ecological niches over much of the area utilised within the farming system.

- These climatic and topographic constraints also generally mean that not all of the land in an area is available for utilisation by all the different land use components of the system (e.g. grazing by domestic animals, growth of crops). Hence, crops, more intensively managed pastures and semi-natural vegetation are generally found within a mix of more natural habitats (not only woodlands but also other landscape elements such as hedgerows and wetlands).

- The constraints imposed on the vegetation by climate and topography control not only the type but, just as importantly, the timing of the management that is applied to the vegetation. Hence, the farm management practices are generally synchronised with the annual natural growth cycle of the vegetation and so are not imposed at a time when it would be detrimental to a wide range of the plant species involved. In addition, soil type and nutrient limitations place limitations on the type of crops which can be grown or the number of years they can be grown in succession. There is therefore also more of a need to include a greater variety of crops in the crop rotation (including periods of fallow in which to build nutrients to a level at which the subsequent crop can be supported).

- For most of the year, the nutritional value of much of the semi-natural vegetation is generally low which places limits on the number of animals and the duration of grazing intervals in a given area. It also leads to a need for larger areas to be utilised. Hence, grazing pressure on any one area is generally either low or (in closely shepherded flocks) only high for a very short period, which leads to a greater heterogeneity of vegetation structures.

- The need to produce fodder to carry livestock through the winter and the constraints on the amount of fodder which can be grown mean that (a) there is a limit to the total number of animals that can be supported and (b) there is a need to move animals to other areas during the period of growth and harvesting of winter fodder in the summer. Both these factors markedly reduce grazing pressure on any one area of land over the course of the year. In addition, not only do the fodder crops introduce further heterogeneity into the landscape, but many of these are also of extremely high biodiversity value in their own right.

- The habitats of many wildlife species are naturally unstable and it is common for populations to disappear from one area and for new ones to appear when a suitable niche becomes available elsewhere. These

farming systems and associated farming practices are maintained at a scale and intensity which ensures sufficient area of potentially suitable habitat is available within relatively (in terms of the distance that the species can move) close proximity to each other and thereby allows scope for these cycles of colonisation and re-colonisation to take place.

- By the same token, these systems are much more favourable to a wider range of wildlife species (especially the larger vertebrates) because they are practised over a wider scale and therefore (a) the conditions required at any one time of year (especially by more mobile species) can be found at a wide variety of locations and (b) the different requirements by these species at different times of year are catered for, i.e. through changes in the mix of structures and habitats in any one area through the year.

The high biodiversity value of many European farming systems therefore relates both to the spatial and temporal diversity that they introduce. In a spatial context, they produce a patchwork of habitats - meadows, grass pastures, crops, fallows, woodland, hedgerows, natural pastures (including alpine grassland, heath, moorland, saltmarsh, marshland, bog, wood-pasture) as well as more intensively managed land around settlements and farmsteads. In a temporal context, not all land is managed in the same way at the same time; so neighbouring farms with essentially the same production systems may sow and harvest crops at different times. This produces a patchwork of the same crop at different stages of development. In a similar fashion, adjacent pasture under different ownership will be grazed in different ways (e.g., with different animals and at different stock densities) and at different times of the year. This diversity provides much more favourable conditions for plants and animals (especially invertebrates) to find areas with suitable conditions for the completion of their lifecycles (Bignal & McCracken 2000).

The need to use farming system characteristics as surrogates of HNV

The key broad ecological and production characteristics of HNV systems are well known (e.g. Bignal & McCracken 1996, 2000; Beaufoy 2008) and over the years these have been used to try to identify surrogates from agricultural statistics which could be used to develop broad HNV farming system typologies at a wider European level (e.g. Andersen *et al*., 2004; Cooper *et al*., 2007) or inform the focus of work assessing the potential for undesirable land abandonment which could result from further CAP reform or trade liberalisation (e.g. Renwick et al., 2011).

Someone with ecological expertise would potentially be able to make some prediction as to whether or not a farm was of High Nature Value if she/he visited the unit and could make an assessment of the following factors:

FACTOR	INFORMATION OBTAINABLE IF VISIT FARM?	INFORMATION AVAILABLE IF DON'T VISIT FARM?
The species occurring on the farm	Feasible to obtain to some extent but many more hidden than others, so in reality it is time-consuming to gain indication from a one-off visit without previous knowledge of the location	Little or no information available for majority of farms – only designated sites on farms will have better info *So some sort of surrogates needed to allow prediction of HNV status to be obtained*
The amount and type of habitats occurring on the farm	Feasible to obtain provided that information is available at a detailed enough level re: the type of habitats (i.e. sub-categories of grass, crops etc)	Current information on SAF-IACS coarse and only focuses on managed farmland *But could potentially use surrogates such as proportion of rough grazing (as a suggestion of presence of semi-natural habitats) or diversity of crop types (as a suggestion of on-farm heterogeneity)*
The condition of those habitats	Feasible to obtain in field if know what is considered to be ideal condition – but time-consuming to obtain and needs to be qualified with some idea of how managed	No information available for majority of farms *So some sort of surrogates needed to allow prediction of HNV status to be obtained*
The management practices	Feasible to obtain provided can speak to the manager and obtain an indication of the intensity and timing of management on each habitat	No information available for majority of farms. *But could potentially use surrogates considering issues such as LU/ha and nutrient input*

Datasets of detailed farm holding-level ecological and farm management characteristics do not exist, but there is the potential to use some of the farm holding-level structure variables as surrogates as to what may be happening on the ground (in terms of the type of habitats present, and hence associated farmland biodiversity, and the intensity at which these are being managed). Such surrogate information can be used to try to make some estimate of likely HNV status at the farming system and hence farm holding level.

HNV farming systems in Scotland

Table 1 highlights the major broad farming systems expected to occur within Scotland and which formed the focus of considering their likely HNV characteristics. These are listed in descending order of their likelihood of being HNV (based on the characteristics of the majority of farms practising each system). The first column highlights the farming system name used in this exercise, while columns 2 and 3 indicates the equivalent RERAD Farm Accounts system typology and new FADN farming system typology, respectively. Given the uniqueness, and high HNV importance, of crofting in Scotland, a separate category has been created for this, even though there is no direct FADN or RERAD Farm Accounts equivalent. Appendix 1 provides an indication of the distribution of Farm Types across Scotland, largely (but not completely) drawn using the RERAD Farm Account classification.

Appendix 2 sets out basic components of the broad HNV farming systems that need to be considered within Scotland. It is based on page 11 of the EC guidance document (Beaufoy & Cooper, 2009) and draws especially on information contained in Jones & McCracken (2003) and Jones (2006) and, to a more limited extent (since this largely reiterates previous studies), in Swales & Moxey (2008).

In order to gain some broad estimate of how many farms (and the overall hectarage of these) across Scotland may have be practising HNV farming systems, there is a need to consider the system characteristics of farms across Scotland and identify those more likely to be of HNV.

Table 1: Major broad farming systems considered to occur in Scotland

Broad Scottish farming system	Equivalent RERAD Farm Account farming system	Equivalent New FADN farming system
1) Crofting	No equivalent	No equivalent
2) Sheep system	Specialist sheep (LFA)	Specialist sheep
3) Beef cattle system	Specialist beef (LFA)	Specialist cattle rearing & fattening
4) Combined sheep & cattle system	Cattle & sheep (LFA) Lowground cattle & sheep	Sheep & cattle combined
5) Mixed livestock & arable system	Mixed (part)	Mixed crops & livestock
6) Arable system	Cereals General cropping	Specialist cereal, oilseed & protein crops General field crops
7) Dairy system	Dairy	Specialist dairying
8) Mixed arable and horticulture system	Mixed (part)	Mixed horticulture & cropping
9) Horticulture system	No equivalent	Specialist horticulture
10) Pig system	No equivalent	Specialist pigs
11) Poultry system	No equivalent	Specialist poultry

Focussing in on HNV livestock-based systems

A number of systems occurring in Scotland (i.e. arable systems, dairy systems, mixed arable & horticulture systems, horticulture systems, pig systems, poultry systems) are very specialised and the vast majority are managed very intensively. Hence the majority of farms practising such systems cannot be considered to be of HNV (in terms of any strong positive link between the system characteristics and farmland biodiversity value). Some semi-natural landscape features (such as hedges, ponds, wetlands and small uncultivated patches), can still occur around such intensively managed farmland that otherwise is of limited nature value, and such features are certainly important for conserving vestiges of biodiversity. However, the presence of these features do not qualify such farming systems to be classified at HNV systems, rather they simply indicate that such productive farming systems can (depending on the landscape context in which they sit) contain some features of HNV interest (Lukesch & Schuh, 2010). In any farm situation where the arable or dairy system is managed much more extensively (in terms of the amount of nutrient input, the range of grassland habitats and crop types present and the cutting and grazing regimes practised), then there is more scope for the system on that farm to be regarded as being HNV. However, the data collected at a broad level across all farms in Scotland does not provide any indication of input levels (other than data which could be used to form a broad indication of livestock densities) and so it is not possible to attempt to identify the relatively small (if any) number of farms with such HNV systems using the approach being suggested here. Any such identification would need to be achieved by taking a case-study approach where the characteristics of the farms could be set in a more detailed wider landscape and management inputs context.

The other farming systems occurring in Scotland (i.e. crofting, sheep systems, beef cattle systems, combined sheep & cattle systems, mixed livestock and arable systems) have a higher possibility of being HNV, but this is very dependent on the range of habitats occurring at a farm holding level (especially those utilised as forage and fodder resources) and the intensity at which these are managed. As indicated above, datasets of detailed farm holding-level ecological and farm management characteristics do not exist, but there is the potential to use some of the farm holding-level structure variables as surrogates as to what may be happening on the ground (in terms of the type of habitats, and hence associated farmland biodiversity, present and the intensity at which these are being managed). However, the data which are available to use as surrogates are much more relevant to use on livestock dominated farming systems and hence, for the same reasons as highlighted in the previous paragraph, the approach taken here will not be able to identify a proportion of HNV mixed livestock and arable systems, especially any which do not contain a large proportion of rough grazing as part of the Utilised Agricultural Area. While it may be feasible to combine a wider range of existing variables in an attempt to identify such systems, it was decided that this would only be considered (in order to avoid a lot of coding and computing work for potentially little return) once the value of taking such an approach has been investigated for livestock dominated systems (which in

any case are expected to form the bulk of the existing HNV system resource in Scotland).

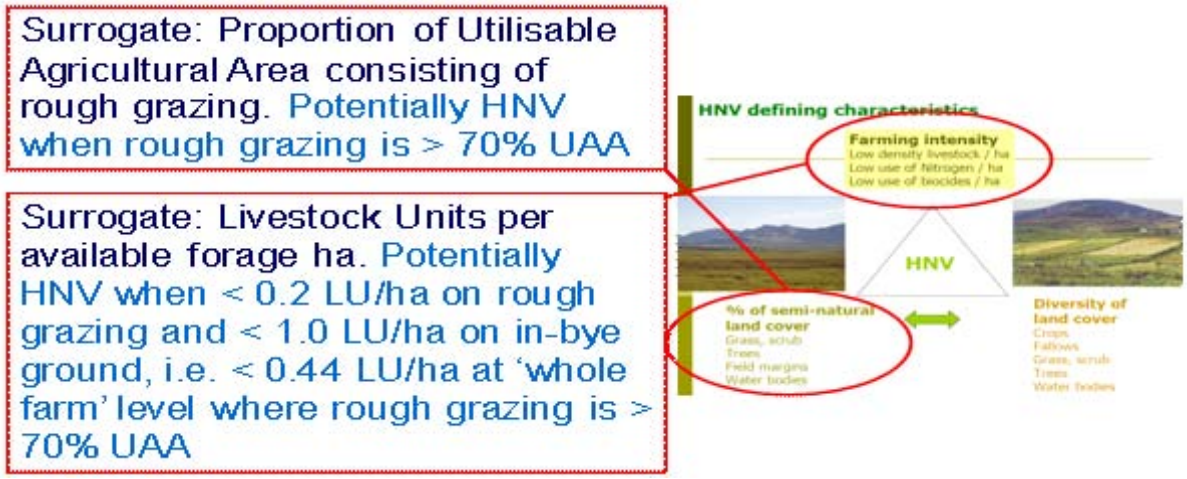
The approach taken here therefore focused on considering the livestock-dominated farming systems occurring in Scotland (i.e. crofting, sheep systems, beef cattle systems, combined sheep & cattle systems) and attempting to estimate the number and extent of these with HNV characteristics, using the proportion of rough grazing on the farm holding as a surrogate for the amount of semi-natural habitat which may form the forage and fodder resource and a broad calculation of livestock densities as a surrogate for the intensity at which forage resources across the farm holding are utilised.

Hence, for the purposes of this exercise, livestock-dominated systems in Scotland considered to be of HNV were taken to be those (Figure 1):

> *where rough grazing (used as a surrogate for semi-natural occurrence) makes up more than 70% of the UAA and where livestock units per available forage ha (as a surrogate of farming intensity) are less than 0.44 LU/ha at the whole farm holding level.*

These thresholds have been set based on previous work and on the basis that if there is more than 70% of the UAA on a farm holding consisting of rough grazing then this puts a constraint on the ability of the farmer to try to increase profitability by increasing the intensity of management on the in-bye ground. Obviously it is feasible to try to increase profitability in those situations by increasing livestock numbers, hence the reason for including the overall stocking density threshold.

Figure 1 The surrogates used to estimate the amount of HNV grazing systems in Scotland



The goal

The overall ideal goal was to be able to construct (at whole of Scotland and/or regional level) a simple table for HNV livestock-dominated farming systems along the lines of the following:

Farming System				
Region	**Total Number of farm holdings under this system**	**Total area of farm holdings under this system (ha)**	**Estimated number of farm holdings estimated to be under an HNV system**	**Area of farm holdings estimated to be under an HNV system (ha)**
Scotland				
Region 1				
Region 2				
Etc				

since this would provide an estimation of the number and extent of farms under HNV farming systems and allow a calculation of these as a proportion of the total number and extent of farm holdings in Scotland and/or at a regional level.

Although Scotland is only required develop relevant indicators and report on HNV farming at a national level, looking at the estimation of HNV at a regional level was felt to be helpful in assessing the potential value of the approaches taken (since it is known that broad farming systems vary geographically across Scotland and hence those with HNV characteristics would also be expected to vary depending on location) and making linkages to the work conducted by SNH on considering the use of nature conservation characteristics to estimate HNV. It was therefore decided that the eleven broad RPAC (Regional Proposal Assessment Committee) regions established in Scotland for the assessment of Rural Priorities proposals within the SRDP (Appendix 3) would be a suitable regional level at which to focus efforts.

Approaches taken to estimate the number and extent of HNV farms in Scotland at a broad level

None of the Scotland wide farm holding datasets currently available have been designed specifically with the intent of providing an indication of the extent and distribution of HNV farming systems and holdings. Hence, at the start of the exercise it was acknowledged that only so much can be expected from analyses of such data. As a result, the decision was taken not to overcomplicate the approaches taken. In particular, it was agreed that a relatively simple approach was necessary, both in terms of ease of access to the data and to aid the subsequent interpretation of the analyses.

The approaches taken were therefore primarily aimed at:

- providing a broad overview of the estimated extent and distribution of HNV farm holdings across Scotland

- helping identify any apparent gaps in knowledge or parts of Scotland where further more detailed investigation may be needed

Two main datasets are available in Scotland from which information on farm holding level structure (and hence system characteristics) can be drawn:

- The June census agricultural holding data seeks to obtain information (from all c. 52,000 individual farm holdings in Scotland) of the livestock and land cover on each farm holding in June of each year. The data so-obtained allows each holding to be allocated to one of ten robust Farm Types: Cereals, General Cropping, Horticulture, Pigs, Poultry, Dairy, Cattle & Sheep (LFA), Cattle & Sheep (Lowland), Mixed and Other. The June census data does not recognise crofting per se as a separate farm type. In addition, as the June census does not pick up animals which are off the holding at that time of year, then it will not include any information on animals which are out on common grazings at that time. Nevertheless, given that it draws on information across all holdings occurring in Scotland, the June census data was regarded as a suitable database to investigate: what Farm Type(s) primarily occurred in association with more than 70% of the UAA consisting of rough grazing; and what Farm Type(s) primarily occurred in association with holdings with less than 0.44 LU/ha. In other words, this first consideration of the June census data was used to test the basic assumptions made in the estimation of HNV set out above.

- The Single Application Form (SAF-IACS) must be completed each year if farmers/land managers want to be eligible to receive support payments such as the Single Farm Payment Scheme, Less Favoured Area Support Scheme and/or be eligible to apply for agri-environment payments under the Land Managers Options or Rural Priorities scheme. This dataset therefore only includes information from the c. 24,000 farm holdings in Scotland on which support payments are actually being claimed. The SAF-IACS data is collected at the level of the farm business, and hence the information can potentially relate to more then one farm holding if the business is so structured. The original intent was to use the SAF-IACS data to focus in on those businesses/holdings that were potentially the main potential recipients of support payments and only estimate HNV system extent distribution with regard to those holdings. However, discussions with Scottish Government statisticians indicated that it was feasible to identify and separate out SAF-IACS holdings from non-SAF-IACS holdings in the June census data. It was therefore decided to consider SAF-IACS and non-SAF-IACS holdings separately since this would allow a consideration of whether non-SAF-IACS holdings were contributing to the estimated HNV resource in Scotland, even if they were not

currently in receipt of support payments. Maintaining a link with the June census dataset also allowed each of the SAF-IACS and non-SAF-IACS holdings to be allocated to an individual Farm Type and therefore allowed a consideration of whether there was any difference in the breakdown of Farm Types between SAF-IACS and non-SAF-IACS holdings. Estimates of the extent and distribution of SAF-IACS and non-SAF-IACS HNV holdings was made both at the national and RPAC regional levels.

Hence the SAF-IACS/June census data was used to provide a broad estimate (at a whole of Scotland and RPAC regional level) of the number (and total extent) of farm holdings meeting HNV characteristic threshold levels, while the analyses of Scotland wide June census data was used to guide the selection of Farm Types to include in the estimated HNV calculations. Note that the ability to allocate holdings to robust Farm Types was also considered of potential long-term interest, since that allowed for the potential (at a later date) to link across to Farm Accounts and/or Farm Structure Survey data to investigate how much income/support for specific HNV systems may be coming from the SRDP. Both approaches were also used in order to help consider: what the pros and cons of each approach would be (in terms of practicalities of extracting the data as well as the robustness of the data themselves); how they potentially complemented each other; and how they could be used to complement the nature conservation approach being taken by SNH.

Note that the author of this document did not access these datasets himself, but rather it was agreed at that start that he would provide guidance on the thresholds to apply for different categories, and that the data extraction would be conducted by individuals within the Scottish Government with relevant access and familiarity with the structure of the datasets concerned (and who in any case would have the responsibility of extraction in the future).

Note also that both approaches involved (as will be evident from the next sections) multiple layers of data extraction, manipulation and interpretation by Scottish Government statisticians and the author. The electronic files containing this detailed information have been provided to Scottish Government but will not be reproduced in the their entirety here. Instead the following sections concentrate on highlighting the detail of the approaches taken and providing summary overviews of the findings.

The June census approach

This first set of analyses focussed specifically on considering the characteristics of **all ten** of the different robust Farm Types recognised as occurring in Scotland (i.e. **Cattle & Sheep (LFA), Cattle & Sheep (Lowland), Mixed, Dairy, General Cropping, Cereals, Horticulture, Pigs, Poultry** and **Others**), with the exception of crofting which is not recognised specifically as a Farm Type within the June census.

The 2009 June census dataset was used to allocate each individual holding across Scotland to its most relevant robust Farm Type. The following steps were then applied (Table 3):

1. Calculate and record (a) the overall total number of holdings and (b) the overall total amount of UAA across those holdings held within the dataset

2. Using the information on the allocation of each holding to a robust farm type, group the overall number of holdings into:

    a. Those regarded as being **Cattle & Sheep (LFA).** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    b. Those regarded as being **Cattle & Sheep (Lowland).** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    c. Those regarded as being **Mixed.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    d. Those regarded as being **Dairy.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    e. Those regarded as being **General Cropping.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    f. Those regarded as being **Cereals.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    g. Those regarded as being **Horticulture.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    h. Those regarded as being **Pigs.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    i. Those regarded as being **Poultry.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

j. Those regarded as being **Other.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

3. Using proportion of rough grazing as a surrogate for amount of semi-natural habitat present on the ground, group the overall number of holdings **within each robust farm type** into:

   a. Those with no rough grazing within the UAA. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

   b. Those with rough grazing making up less than 30% of the UAA. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

   c. Those with rough grazing making up between 30% and 70% of the UAA. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

   d. Those with rough grazing making up more than 70% of the UAA. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

4. Using the number of livestock present, calculate and record for each holding falling in groups 3(a), 3(b), 3(c) and 3(d) an indication of the total broad livestock units on each holding using a simple calculation of Total LU at farm holding level = (number of sheep x 0.15 LU) plus (number of cattle x 1.0), in both cases ignoring any individual less than one year old where possible to do so.

5. Using the land uses/crops present, calculate and record for each holding falling into groups 3(a), 3(b), 3(c) and 3(d) an indication of the total amount of forage hectares on each holding. Ideally this would be calculated based on summing the areas of all potential forage crops on the holding (e.g. including all the different categories of stock feed). However, for ease of broad calculation, use a simple calculation of Total forage hectares at holding level = rough grazing plus grass over 5 years plus grass under 5 years.

6. Calculate and record for each holding falling into groups 3(a), 3(b), 3(c) and 3(d) an indication of the Overall livestock density, i.e. LU/forage ha = Total LU at farm holding level divided by Total forage hectares at holding level

7. Using LU/forage ha as a surrogate for grazing intensity on the ground, further group the overall number of holdings in each of 3(a), 3(b), 3(c) and 3(d) into:

    a. Those with no livestock (and hence no LU/forage ha calculation feasible). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    b. Those with LU/forage ha more than 0.5 LU/ha. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    c. Those with LU/forage ha between 0.5 LU/ha and 1.0 LU/ha (i.e. a subset of 7(b)). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    d. Those with LU/forage ha more than 1.0 LU/ha (i.e. a subset of 7(b)). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    e. Those with LU/forage ha less than 0.5 LU/ha. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    f. Those with LU/forage ha between 0.2 LU/ha and 0.5 LU/ha (i.e. a subset of 7(e)). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

    g. Those with LU/forage ha less than 0.2 LU/ha (i.e. a subset of 7(e)). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

8. Within each of the resulting 20 sub categories of holdings within each robust farm type, use holding level data to calculate and record an indication of:

    - Overall total number of holdings and overall total amount of UAA across those holdings
    - Average (and observed minimum and maximum) total amount of UAA at holding level
    - Average (and observed minimum and maximum) total amount of rough grazing at holding level
    - Average (and observed minimum and maximum) total amount of grass over 5 years at holding level

- Average (and observed minimum and maximum) total amount of grass under 5 years at holding level
- Average (and observed minimum and maximum) sheep LUs at holding level
- Average (and observed minimum and maximum) cattle LUs at holding level
- Average (and observed minimum and maximum) total LU/forage ha at holding level

As indicated in previous sections, the working definition was that holdings estimated to be practising HNV livestock systems would be those with a LU/forage ha of less than 0.5 LU/ha on holdings where rough grazing is more than 70% of the UAA. Holdings with no livestock were not included in any of the HNV extent estimates (on the basis that if no livestock were present then that could reflect that no livestock farming system was in operation).

Overview of findings from the June census approach

The calculation of the number of holdings and total extent of UAA falling within each of all the robust Farm Types allowed comparison to be made across the different Farm Types with regard to: what Farm Type(s) primarily occurred in association with more than 70% of the UAA consisting of rough grazing; and what Farm Type(s) primarily occurred in association with holdings with less than 0.44 LU/ha (which for ease of calculation in the data extraction phase was taken to be less than 0.5 LU/ha).

Table 4 highlights that the vast majority of holdings with more than 70% of UAA consisting of rough grazing primarily fell into either the Farm Type Cattle & Sheep (LFA) or the Farm Type Other. Indeed, of all the holdings falling within the more than 70% of UAA is rough grazing category, 89.35% of the holdings and 95.71% of the UAA occurred within these two Farm Type categories. In addition, detailed examination of the extracted data indicated that holdings with stocking densities of less than 0.5 LU/ha (irrespective of the proportion of rough grazing present) were generally uncommon across all of the Farm Types with the exception of Cattle & Sheep (LFA). For example, in the Farm Type Dairy, 97.9% of the holdings and 95.6% of the UAA under Dairy fell into the category of more than 0.5 LU/ha.

Table 5 illustrates, that although a large proportion of holdings with more than 70% of UAA as rough grazing fell into the Farm Type Other, the vast majority of those holdings had no livestock recorded as being present. Consequently, it was not considered feasible to consider this Farm Type further in the analyses.

Hence the initial assessment of 2009 June census data indicated that the Farm Type Cattle & Sheep (LFA) was the main farm type likely to contain the majority of holdings meeting the HNV definition under investigation.

Table 3: Basic overview of the output obtained for <u>each</u> of the ten June census robust Farm Types recognised in the dataset

<table>
<tr><th colspan="10">ROBUST FARM TYPE 1</th></tr>
<tr><td colspan="10">Overall total number of holdings and overall total amount of UAA across those holdings</td></tr>
<tr><td colspan="5">Category 1: Those with rough grazing making up less than 30% of the UAA.</td><td colspan="5">Category 2: Those with rough grazing making up less than 30% of the UAA.</td></tr>
<tr><td rowspan="2">Those with NO livestock</td><td colspan="2">Those with LU/forage ha more than 0.5 LU/ha</td><td colspan="2">Those with LU/forage ha less than 0.5 LU/ha</td><td rowspan="2">Those with NO livestock</td><td colspan="2">Those with LU/forage ha more than 0.5 LU/ha</td><td colspan="2">Those with LU/forage ha less than 0.5 LU/ha</td></tr>
<tr><td>Those with LU/forage ha > 1.0 LU/ha</td><td>Those with LU/forage ha 0.5 - 1.0 LU/ha</td><td>Those with LU/forage ha 0.2- 0.5 LU/ha</td><td>Those with LU/forage ha < 0.2- LU/ha</td><td>Those with LU/forage ha > 1.0 LU/ha</td><td>Those with LU/forage ha 0.5 - 1.0 LU/ha</td><td>Those with LU/forage ha 0.2- 0.5 LU/ha</td><td>Those with LU/forage ha < 0.2- LU/ha</td></tr>
<tr><td colspan="10">Within <u>each</u> of the 20 sub-categories obtained for each Farm Type level, holding level data was used to calculate and record an indication of:

Overall total number of holdings and overall total amount of UAA across those holdings
Average (and observed minimum and maximum) total amount of UAA at holding level
Average (and observed minimum and maximum) total amount of rough grazing at holding level
Average (and observed minimum and maximum) total amount of grass over 5 years at holding level
Average (and observed minimum and maximum) total amount of grass under 5 years at holding level
Average (and observed minimum and maximum) sheep LUs at holding level
Average (and observed minimum and maximum) cattle LUs at holding level
Average (and observed minimum and maximum) total LU/forage ha at holding level</td></tr>
</table>

Table 3 (continued): Basic overview of the output obtained for <u>each</u> of the ten June census robust Farm Types recognised in the dataset

ROBUST FARM TYPE 1									
Overall total number of holdings and overall total amount of UAA across those holdings									
Category 3: Those with rough grazing making up between 30% and 70% of the UAA.					**Category 4: Those with rough grazing making up more than 70% of the UAA.**				
	Those with LU/forage ha more than 0.5 LU/ha		Those with LU/forage ha less than 0.5 LU/ha			Those with LU/forage ha more than 0.5 LU/ha		Those with LU/forage ha less than 0.5 LU/ha	
Those with NO livestock	**Those with LU/forage ha > 1.0 LU/ha**	**Those with LU/forage ha 0.5 - 1.0 LU/ha**	**Those with LU/forage ha 0.2- 0.5 LU/ha**	**Those with LU/forage ha < 0.2- LU/ha**	**Those with NO livestock**	**Those with LU/forage ha > 1.0 LU/ha**	**Those with LU/forage ha 0.5 - 1.0 LU/ha**	**Those with LU/forage ha 0.2- 0.5 LU/ha**	**Those with LU/forage ha < 0.2- LU/ha**
Within <u>each</u> of the 20 sub-categories obtained for each Farm Type level, holding level data was used to calculate and record an indication of: Overall total number of holdings and overall total amount of UAA across those holdings Average (and observed minimum and maximum) total amount of UAA at holding level Average (and observed minimum and maximum) total amount of rough grazing at holding level Average (and observed minimum and maximum) total amount of grass over 5 years at holding level Average (and observed minimum and maximum) total amount of grass under 5 years at holding level Average (and observed minimum and maximum) sheep LUs at holding level Average (and observed minimum and maximum) cattle LUs at holding level Average (and observed minimum and maximum) total LU/forage ha at holding level									

Table 4: Breakdown of holdings occurring within each of the ten robust Farm Types across the four rough grazing categories

Excludes sheep stock clubs that have no area in sole occupation. Source : Scottish Government RERAD REAS Statistics(Agriculture)		Total	No rough grazing	Rough Grazing <30% UAA	Rough Grazing 30-70% UAA	Rough Grazing >70% UAA
ALL ROBUST TYPES	Holdings	52,034	29,817	7,181	2,914	11,627
	% of ALL holdings	100.00	57.30	13.80	5.60	22.35
	Area(ha)	5,165,393.26	824,355.39	831,095.56	446,389.90	3,063,552.41
	% of ALL UUA	100.00	15.96	16.09	8.64	59.31
ROBUST CEREALS	Holdings	3,710	2,195	1,346	132	37
	% of ALL holdings	7.13	4.22	2.59	0.25	0.07
	Area(ha)	360,017.40	150,873.52	173,950.25	17,527.47	17,666.16
	% of ALL UAA	6.97	2.92	3.37	0.34	0.34
GENERAL CROPPING	Holdings	2,374	1,324	815	100	135
	% of ALL holdings	4.56	2.54	1.57	0.19	0.26
	Area(ha)	317,496.72	117,814.26	140,565.40	21,326.32	37,790.74
	% of ALL UAA	6.15	2.28	2.72	0.41	0.73
HORTICULTURE	Holdings	1,036	665	81	95	195
	% of ALL holdings	1.99	1.28	0.16	0.18	0.37
	Area(ha)	10,543.52	4,438.11	2,181.42	763.02	3,160.96
	% of ALL UAA	0.20	0.09	0.04	0.01	0.06
PIGS	Holdings	235	136	12	3	84
	% of ALL holdings	0.45	0.26	0.02	0.01	0.16
	Area(ha)	5,495.35	1,572.89	866.35	9.26	3,046.85
	% of ALL UAA	0.11	0.03	0.02	0.00	0.06
POULTRY	Holdings	1,923	1,262	99	82	480
	% of ALL holdings	3.70	2.43	0.19	0.16	0.92
	Area(ha)	17,448.60	8,339.59	2,495.25	1,604.62	5,009.13
	% of ALL UAA	0.34	0.16	0.05	0.03	0.10
MIXED	Holdings	2,222	1,062	885	135	140
	% of ALL holdings	4.27	2.04	1.70	0.26	0.27
	Area(ha)	292,090.74	73,014.00	138,292.55	27,096.16	53,688.02
	% of ALL UAA	5.65	1.41	2.68	0.52	1.04
DAIRY	Holdings	1,298	751	468	60	19
	% of ALL holdings	2.49	1.44	0.90	0.12	0.04
	Area(ha)	157,346.04	74,425.41	64,139.64	10,771.42	8,009.57
	% of ALL UUA	3.05	1.44	1.24	0.21	0.16
CATTLE & SHEEP (Lowland)	Holdings	1,900	1,492	231	29	148
	% of ALL holdings	3.65	2.87	0.44	0.06	0.28
	Area(ha)	54,099.74	31,518.39	18,813.69	713.81	3,053.85
	% of ALL UAA	1.05	0.61	0.36	0.01	0.06
CATTLE & SHEEP (LFA)	Holdings	14,024	6,622	2,319	1,933	3,150
	% of ALL holdings	26.95	12.73	4.46	3.71	6.05
	Area(ha)	2,656,817.57	210,793.69	256,607.41	334,520.11	1,854,896.36
	% of ALL UAA	51.43	4.08	4.97	6.48	35.91
OTHER	Holdings	23,312	14,308	925	840	7,239
	% of ALL holdings	44.80	27.50	1.78	1.61	13.91
	Area(ha)	1,294,037.59	151,565.53	33,183.60	32,057.71	1,077,230.76
	% of ALL UAA	25.05	2.93	0.64	0.62	20.85

Table 5: Breakdown of holdings with more than 70% UAA within the Farm Types Cattle & Sheep (LFA) and Other, showing the breakdown across the five livestock density categories

Excludes sheep stock clubs that have no area in sole occupation. Source : Scottish Government RERAD REAS Statistics(Agriculture)		Total	Rough Grazing >70% UAA					
				No livestock	Those with LU/forage ha less than 0.5		Those with LU/forage ha more	
			Sub-total	No livestock	Those with LU/forage ha <0.2 LU/ha	Those with LU/forage ha 0.2 - 0.5 LU/ha	Those with LU/forage ha 0.5 - 1.0 LU/ha	Those with LU/forage ha > 1.0 LU/ha
CATTLE & SHEEP (LFA)	Holdings	14,024	3,150	64	1,129	1,066	458	433
	% of ALL holdings	26.95	6.05	0.12	2.17	2.05	0.88	0.83
	Area(ha)	2,656,817.57	1,854,896.36	18,411.12	1,375,871.71	400,491.05	52,854.74	7,267.74
	% of ALL UAA	51.43	35.91	0.36	26.64	7.75	1.02	0.14
OTHER	Holdings	23,312	7,239	7,237	1	0	1	0
	% of ALL holdings	44.80	13.91	13.91	0.00	0.00	0.00	0.00
	Area(ha)	1,294,037.59	1,077,230.76	1,077,222.16	5.60	0.00	3.00	0.00
	% of ALL UAA	25.05	20.85	20.85	0.00	0.00	0.00	0.00

Although, for completeness and as data checking approach, the subsequent June Census and SAF-IACS and non-SAF-IACS analyses did look at the breakdown of all Farm Types occurring within each RPAC, only data drawn from within the Cattle & Sheep (LFA) Farm Type was used in the estimated HNV calculations.

The June Census/SAF-IACS approach

The 2009 June Census and SAF-IACS datasets were used to separate out the 24,875 holdings (containing 4,410,048 ha of UAA) which were on the SAF-IACS database from the 27,438 non-SAF-IACS holdings (containing 817,320 ha of UAA). The extracted information on SAF-IACS and non-SAF-IACS holdings were then subject to the same RPAC/Farm Type/HNV characteristics analyses as indicated below. Although calculated separately, the SAF-IACS and non-SAF-IACS Cattle & Sheep (LFA) holdings meeting the HNV rough grazing/stocking density thresholds were then combined in the calculation of estimated extent and distribution of HNV holdings. As indicated in previous sections, it was decided to consider SAF-IACS and non-SAF-IACS holdings separately since this would allow a consideration of how much, if at all, non-SAF-IACS holdings contributing to the overall UAA total were also contributing to the estimated HNV resource across Scotland.

Within <u>each</u> of the eleven RPAC regions, the following steps were applied <u>separately</u> for SAF-IACS holdings and non-SAF-IACS holdings (as illustrated in Table 6):

1. Calculate and record (a) the overall total number of holdings and (b) the overall total amount of UAA across those holdings.

2. Using the information on the allocation of each holding to a robust farm type, group the overall number of holdings into:
    a. Those regarded as being **Cattle & Sheep (LFA).** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

b. Those regarded as being **Cattle & Sheep (Lowland).** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

c. Those regarded as being **Mixed.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

d. Those regarded as being **Dairy.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

e. Those regarded as being **General Cropping.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

f. Those regarded as being **Cereals.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

g. Those regarded as being **Horticulture.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

h. Those regarded as being **Pigs.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

i. Those regarded as being **Poultry.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

j. Those regarded as being **Other.** Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

3. Using proportion of rough grazing as a surrogate for amount of semi-natural habitat present on the ground, group the overall number of holdings **within each robust farm type** into:
   a. Those with no rough grazing within the UAA. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

   b. Those with rough grazing making up less than 30% of the UAA. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

   c. Those with rough grazing making up between 30% and 70% of the UAA. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

   d. Those with rough grazing making up more than 70% of the UAA. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

4. Using the number of livestock present, calculate and record for each farm holding falling in groups 3(a), 3(b), 3(c) and 3(d) an indication of the total broad livestock units on each farm holding using a simple calculation of Total LU at farm holding level = (number of sheep x 0.15 LU) plus (number of cattle x 1.0), in both cases ignoring any individual less than one year old where feasible

5. Using the land uses/crops present, calculate and record for each farm holding falling into groups 3(a), 3(b), 3(c) and 3(d) an indication of the total amount of forage hectares on each farm holding. Ideally this would be calculated based on summing the areas of all potential forage crops on the farm (e.g. including all the different categories of stock feed). However, this may be time-consuming to compute so for ease of calculation, use a simple calculation of Total forage hectares at farm holding level = rough grazing plus grass over 5 years plus grass under 5 years

   Note that for farm holdings with a large amount of arable land under crops for stock feed this formula will result in an overestimate of the LU/forage ha. However, having large amounts of arable land under such crops is likely to reflect the fact that the farming system is carrying higher livestock numbers than the other forage on the farm holding would normally support and hence such farms would be unlikely to be considered HNV

6. Calculate and record for each farm holding falling into groups 3(a), 3(b), 3(c) and 3(d) an indication of the Overall livestock density, i.e. LU/forage ha = Total LU at farm holding level divided by Total forage hectares at farm holding level

7. Using LU/forage ha as a surrogate for grazing intensity on the ground, further group the overall number of farm holding in each of 3(a), 3(b), 3(c) and 3(d) into:
   a. Those with no livestock (and hence no LU/forage ha calculation feasible). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

b. Those with LU/forage ha more than 0.5 LU/ha. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

c. Those with LU/forage ha between 0.5 LU/ha and 1.0 LU/ha (i.e. a subset of 7(b)). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

d. Those with LU/forage ha more than 1.0 LU/ha (i.e. a subset of 7(b)). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

e. Those with LU/forage ha less than 0.5 LU/ha. Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

f. Those with LU/forage ha between 0.2 LU/ha and 0.5 LU/ha (i.e. a subset of 7(e)). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

g. Those with LU/forage ha less than 0.2 LU/ha (i.e. a subset of 7(e)). Calculate and record (a) the overall number of holdings and (b) the overall total amount of UAA across those holdings falling into this category

8. Within each of the resulting 20 categories of holdings, use farm holding level data to calculate and record an indication of:
    - Overall total number of farm holdings and overall total amount of UAA across those farm holdings
    - Average (and observed minimum and maximum) total amount of UAA at farm holding level
    - Average (and observed minimum and maximum) total amount of rough grazing at farm holding level
    - Average (and observed minimum and maximum) total amount of grass over 5 years at farm holding level
    - Average (and observed minimum and maximum) total amount of grass under 5 years at farm holding level
    - Average (and observed minimum and maximum) sheep LUs at farm holding level
    - Average (and observed minimum and maximum) cattle LUs at farm holding level
    - Average (and observed minimum and maximum) total LU/forage ha at level

Table 6: Basic overview of the output obtained separately for SAF-IACS and non-SAF-IACS holdings within <u>each</u> of the eleven RPAC regions. Although the primary focus was on obtaining information for the Cattle & Sheep LFA Farm Type, the breakdown of data shown in the Table was calculated for each broad Farm Type occurring within each RPAC.

<table>
<tr><th colspan="8">RPAC Region 1 – Cattle & Sheep LFA Farm Type</th></tr>
<tr><td colspan="8">Overall total number of holdings and overall total amount of UAA across those holdings</td></tr>
<tr><th colspan="4">Category 1: Those with rough grazing making up less than 30% of the UAA.</th><th colspan="4">Category 2: Those with rough grazing making up less than 30% of the UAA.</th></tr>
<tr><td rowspan="2"></td><td colspan="2">Those with LU/forage ha more than 0.5 LU/ha</td><td colspan="2">Those with LU/forage ha less than 0.5 LU/ha</td><td rowspan="2"></td><td colspan="2">Those with LU/forage ha more than 0.5 LU/ha</td><td colspan="2">Those with LU/forage ha less than 0.5 LU/ha</td></tr>
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<tr><td colspan="8">Within <u>each</u> of the 20 sub-categories obtained for each Farm Type level, holding level data was used to calculate and record an indication of:

Overall total number of holdings and overall total amount of UAA across those holdings
Average (and observed minimum and maximum) total amount of UAA at holding level
Average (and observed minimum and maximum) total amount of rough grazing at holding level
Average (and observed minimum and maximum) total amount of grass over 5 years at holding level
Average (and observed minimum and maximum) total amount of grass under 5 years at holding level
Average (and observed minimum and maximum) sheep LUs at holding level
Average (and observed minimum and maximum) cattle LUs at holding level
Average (and observed minimum and maximum) total LU/forage ha at holding level</td></tr>
</table>

Table 6 (continued): Basic overview of the output obtained separately for SAF-IACS and non-SAF-IACS holdings within <u>each</u> of the eleven RPAC regions. Although the primary focus was on obtaining information for the Cattle & Sheep LFA Farm Type, the breakdown of data shown in the Table was calculated for each broad Farm Type occurring within each RPAC.

<table>
<tr><th colspan="10">RPAC Region 1 – Cattle & Sheep LFA Farm Type</th></tr>
<tr><td colspan="10">Overall total number of holdings and overall total amount of UAA across those holdings</td></tr>
<tr><th colspan="5">Category 3: Those with rough grazing making up between 30% and 70% of the UAA.</th><th colspan="5">Category 4: Those with rough grazing making up more than 70% of the UAA.</th></tr>
<tr><td rowspan="2"></td><td colspan="2">Those with LU/forage ha more than 0.5 LU/ha</td><td colspan="2">Those with LU/forage ha less than 0.5 LU/ha</td><td rowspan="2"></td><td colspan="2">Those with LU/forage ha more than 0.5 LU/ha</td><td colspan="2">Those with LU/forage ha less than 0.5 LU/ha</td></tr>
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Overall total number of holdings and overall total amount of UAA across those holdings
Average (and observed minimum and maximum) total amount of UAA at holding level
Average (and observed minimum and maximum) total amount of rough grazing at holding level
Average (and observed minimum and maximum) total amount of grass over 5 years at holding level
Average (and observed minimum and maximum) total amount of grass under 5 years at holding level
Average (and observed minimum and maximum) sheep LUs at holding level
Average (and observed minimum and maximum) cattle LUs at holding level
Average (and observed minimum and maximum) total LU/forage ha at holding level</td></tr>
</table>

Table 7 Comparison of RPAC UAA estimates made in this report (drawing on 2009 data) with those made by SNH (drawing on 2007 data)

	Total UAA (ha)						
RPAC	SAF-IACS	Non SAF-IACS	Common Grazings	Total	SNH	% difference	
Ayrshire	191,996	28,621.66	1,338.10	221,955	225,668	-2	-3,713
Argyll	377,765	44,935.00	8,283.24	430,983	447,739	-4	-16,756
Borders	341,192	13,361.92	0	354,554	370,729	-4	-16,175
Clyde Valley	169,764	33,221.13	0	202,986	216,559	-6	-13,574
D&G	396,540	32,209.34	0	428,749	439,850	-3	-11,101
Forth	377,133	47,508.08	0	424,641	406,196	5	18,446
Gramp Moray	554,889	65,449.15	5,552.90	625,891	618,460	1	7,431
Highland	1,267,033	429,838.48	209,453.76	1,906,325	1,786,836	7	119,489
North Isles	148,666	18,355.85	68,873.35	235,895	224,195	5	11,701
Tayside	532,348	71,024.66	33.54	603,406	603,301	0	105
West Isles	52,722	32,795.02	214,215.33	299,733	270,770	11	28,962
TOTAL	4,410,048	817,320	507,750	5,735,118	5,610,302	2	124,816

As indicated in previous sections, the working definition was that holdings estimated to be pratising HNV livestock systems would be those Cattle & Sheep (LFA) holdings with a LU/forage ha of < 0.5 LU/ha (on holdings where rough grazing is more than 70% of the UAA). Holdings with no livestock were not included in any of the estimated HNV extent calculations (on the basis that if no livestock were present then that could reflect that no livestock farming system was in operation).

Overview of findings from the June Census/SAF-IACS approach

The detailed information on the breakdown and characteristics of all the different Farm Type/Rough Grazing/Stocking Density combinations within each RPAC are included in the electronic files supplied to the Scottish Government with this report. The focus on the remainder of this section is on the interpretation and implications for estimated HNV calculations of the data drawn from the Cattle & Sheep(LFA) data within each RPAC.

Table 7 indicates that the overall calculation of UAA (at a Scotland and individual RPAC level) made via the approaches used in this report are similar to the calculations made by SNH in their separate work mapping the occurrence of UAA across Scotland. It is important to note though, that this match only occurs once the amount of common grazing present in each RPAC is added to the June Census/SAF-IACS data, i.e. detailed information on common grazing occurrence is not included in the June Census data. This is an important consideration to be aware of, since Table 7 also highlights that common grazings make up a large proportion of the total UAA in some RPACs, notably in Highlands, Northern Isles and Western Isles.

Although detailed information on the management practices/stocking densities on common grazings is not readily available, Table 7 therefore highlights that if common grazings were not included in the estimated HNV calculations in some form then this would mean that those calculations would substantially underestimate the HNV for some RPACs (especially as most common

Table 8 Estimates of HNV farming system in Scotland: total ha and proportion of overall UAA within each RPAC in 2009 (based on Cattle & Sheep (LFA) holdings which met the HNV criteria)

RPAC	June Census/SAF-IACS TOTAL UAA (ha)	June Census/SAF-IACS Estimated HNV (ha)	June Census/NON-SAF-IACS TOTAL UAA (ha)	June Census/NON-SAF-IACS Estimated HNV (ha)	Common Grazings	TOTAL Estimated HNV (ha)	Estimated HNV as % TOTAL RPAC UAA	Estimated HNV as % TOTAL Estimated HNV
Ayrshire	191,996	45,494	28,622	947	1,338	47,779	22	2
Argyll	377,765	260,755	44,935	8,503	8,283	277,541	64	12
Borders	341,192	116,934	13,362	374	0	117,308	33	5
Clyde Valley	169,764	55,765	33,221	2,305	0	58,070	29	3
D&G	396,540	104,933	32,209	2,401	0	107,334	25	5
Forth	377,133	126,676	47,508	1,618	0	128,294	30	6
Gramp Moray	554,889	86,947	65,449	4,261	5,553	96,761	15	4
Highland	1,267,033	651,988	429,838	42,943	209,454	904,385	47	39
North Isles	148,666	50,355	18,356	1,960	68,873	121,188	51	5
Tayside	532,348	225,259	71,025	4,539	34	229,831	38	10
West Isles	52,722	10,237	32,795	1,380	214,215	225,832	75	10
TOTAL	4,410,048	1,735,343	817,320	71,231	507,750	2,314,324	40	100

grazings are likely to still be in some form of active management, Jones 2010). It was therefore agreed that the overall calculation of estimated HNV extent would include common grazings (on the assumption that they meet HNV threshold characteristics with regard to grazing densities), but that amount of common grazings included in the estimated HNV calculation would be identified separately at the RPAC level.

It was also agreed that non-SAF-IACS Cattle & Sheep (LFA) holdings meeting the HNV threshold would also be included in the overall calculation, on the basis that such holdings still formed part of the UAA as a whole and that it would be important to have information on them in order to help with the interpretation of any future observed changes at RPAC level.

Table 8 provides a summary of the estimates of HNV extent made at RPAC level using the 2009 June census and SAF-IACS datasets, i.e. the total estimated HNV ha within each RPAC is the sum of total ha of common grazings in the RPAC together with the total ha of Cattle & Sheep (LFA) SAF-IACS and non-SAF-IACS holdings which have more than 70% of their UAA in rough grazing and an overall stocking density of less than 0.5 LU/ha. Any holdings with no livestock were not included in the calculation.

In total it is estimated that across Scotland in 2009 Cattle & Sheep (LFA) HNV holdings accounted for 2,314,324 ha (or 40% of the overall UAA in Scotland), and that the estimated proportion of UAA within any RPAC under such HNV holdings varied from as little as 15% to 22% in Grampian Moray and Ayrshire respectively, to as much as 64% to 75% in Argyll and the Western Isles, respectively. Nationally, Highland is estimated to hold the greatest amount of area under HNV holdings, with Argyll, Tayside and the Western Isles also holding a significant proportion of the national resource.

To set these estimates in their wider context, Table 9 shows the detailed breakdown of the total number and UAA of SAF-IACS and non-SAF-IACS

Table 9 Detailed breakdown of SAF-IACS and non-SAF-IACS Cattle & Sheep (LFA) holdings with more than 70% of UAA consisting of rough grazing in 2009. The total number of holdings and total area of UAA occurring across each of the five LU/forage ha stocking density categories are shown for each RPAC.

		Number and area of those holdings with:				
		No	< 0.2	0.2-0.5	0.5-1.0	> 1.0
RPAC		Livestock	LU/ha	LU/ha	LU/ha	LU/ha
Ayrshire	SAF-IACS holdings (no.)	1	22	35	14	9
	SAF-IACS UAA (ha)	9	23,113	22,381	7,637	1,440
	non-SAF-IACS holdings (no.)	4	8	6	4	8
	non SAF-IACS UAA (ha)	22	75	872	559	35
Argyll	SAF-IACS holdings (no.)	1	153	121	23	11
	SAF-IACS UAA (ha)	168	198,121	62,634	4,382	613
	non-SAF-IACS holdings (no.)	7	19	14	10	9
	non SAF-IACS UAA (ha)	121	5,800	2,703	141	58
Borders	SAF-IACS holdings (no.)	0	39	89	20	2
	SAF-IACS UAA (ha)	0	50,793	66,141	7,030	200
	non-SAF-IACS holdings (no.)	1	1	4	2	4
	non SAF-IACS UAA (ha)	2	1	372	61	89
Clyde Valley	SAF-IACS holdings (no.)	0	27	37	17	4
	SAF-IACS UAA (ha)	0	28,625	27,139	5,142	345
	non-SAF-IACS holdings (no.)	3	12	9	6	2
	non SAF-IACS UAA (ha)	19	1,080	1,225	83	5
D&G	SAF-IACS holdings (no.)	0	28	98	34	4
	SAF-IACS UAA (ha)	0	34,208	70,725	17,783	367
	non-SAF-IACS holdings (no.)	6	9	7	11	12
	non SAF-IACS UAA (ha)	99	2,357	44	518	53
Forth	SAF-IACS holdings (no.)	0	45	56	7	7
	SAF-IACS UAA (ha)	0	86,980	39,696	2,465	765
	non-SAF-IACS holdings (no.)	3	9	5	4	9
	non SAF-IACS UAA (ha)	10	1,530	88	18	145
Gramp Moray	SAF-IACS holdings (no.)	0	27	23	4	1
	SAF-IACS UAA (ha)	0	71,938	15,010	960	5
	non-SAF-IACS holdings (no.)	4	4	2	1	6
	non SAF-IACS UAA (ha)	197	4,251	10	2	50
Highland	SAF-IACS holdings (no.)	7	333	151	65	53
	SAF-IACS UAA (ha)	15,384	621,135	30,853	2,872	1,305
	non-SAF-IACS holdings (no.)	13	59	43	31	67
	non SAF-IACS UAA (ha)	71	41,943	1,000	140	171
North Isles	SAF-IACS holdings (no.)	2	129	184	60	39
	SAF-IACS UAA (ha)	16	26,791	23,564	2,588	656
	non-SAF-IACS holdings (no.)	3	34	28	27	32
	non SAF-IACS UAA (ha)	45	990	970	259	261
Tayside	SAF-IACS holdings (no.)	1	75	53	6	4
	SAF-IACS UAA (ha)	2,217	184,675	40,584	2,902	259
	non-SAF-IACS holdings (no.)	4	8	6	2	4
	non SAF-IACS UAA (ha)	9	3,797	742	18	6
West Isles	SAF-IACS holdings (no.)	1	53	52	51	52
	SAF-IACS UAA (ha)	13	8,473	1,764	760	397
	non-SAF-IACS holdings (no.)	4	48	56	63	97
	non SAF-IACS UAA (ha)	11	977	403	367	248

Note that this table does not include the overall ha of common grazing occurring in each RPAC

Cattle & Sheep (LFA) holdings with more than 70% of their UAA consisting of rough grazing in 2009. It can be seen that the vast majority of holdings of this type that declared they had livestock in 2009 also had estimated stocking densities of less than 0.5 LU/forage ha. Across Scotland as a whole, only 18,413 ha of UAA on holdings of this type (i.e. Cattle & Sheep (LFA) holdings with more than 70% of the UAA as rough grazing) occurred in association with holdings where no livestock was declared. A further 64,163 ha of UAA on holdings of this type (i.e. Cattle & Sheep (LFA) holdings with more than 70% of the UAA as rough grazing) occurred in association with holdings with estimated stocking densities of more than 0.5 LU/forage ha.

The common grazing elements included in the estimated HNV calculations are unlikely to change markedly from one year to the next, since these are based on designation of the grazing resource rather than any data on management practices per se. It is suggested that it is still valid to include common grazings in the HNV calculations, but that it would also be important to seek ways of finding out more about the management practised on the grazings in order to set them in context and justify their inclusion in the calculation. Note that Jones (2011) has suggested that less than 9% (c. 50,000 ha) of common grazings across Scotland either may not be used at all or alternatively may in fact still be in use but simply not claimed/declared via the SAF-IACS system. In addition, Jones (2011) also noted that at the parish level, less than 5% (c. 20,000 ha) of common grazings declared on SAF-IACS were not used with respect to LFASS claims. Hence, although there is no detailed information on stocking densities practiced across Scottish common grazings, the limited data available currently does not provide any justification for excluding them completely from estimated HNV calculations.

The other components included in the calculation have the potential to change from year to year, and therefore to act as indicators and provide information on trends. The calculations at RPAC level described above have the potential to identify where and to what extent any broad changes in estimated HNV are occurring, while the underlying detailed information included in the calculation process has the potential to allow more detailed investigation to set those changes in context (and suggest where more targeted investigation as to drivers and processes may be required).

This underlying detailed data has the potential to allow consideration of a wide range of questions. For example, Table 10 shows (for illustrative purposes) the detailed breakdown of Cattle & Sheep (LFA) holdings (SAF-IACS and non-SAF-IACS combined) across the whole of Scotland in 2009, highlighting the level of detailed information available for comparison within and between rough grazing and stocking density categories. Such level of detail has been extracted for all robust Farm Types occurring within any one RPAC. Such data could be used to investigate questions as:

- Has there been marked changes from one period to another within the Cattle & Sheep (LFA) Farm Type in terms of the distribution of stocking densities across holdings with more than 70% of UAA in rough grazing (e.g. in terms of increases or decreases in holdings with no livestock)?

Table 10 Detailed breakdown of Cattle & Sheep (LFA) holdings (SAF-IACS and non-SAF-IACS combined) across the whole of Scotland in 2009, illustrating the level of detailed information available for comparison within and between rough grazing and stocking density categories

ROBUST CATTLE & SHEEP (LFA). Excludes sheep stock clubs that have no area in sole occupation. Source : Scottish Government RERAD REAS Statistics(Agriculture)		Total	No rough grazing						Rough Grazing <30% UAA					
				No livestock	Those with LU/forage ha less than		Those with LU/forage ha more			No livestock	Those with LU/forage ha less than		Those with LU/forage ha more than	
			sub-total	No livestock	Those with LU/forage ha <0.2 LU/ha	Those with LU/forage ha 0.2 - 0.5 LU/ha	Those with LU/forage ha 0.5 - 1.0 LU/ha	Those with LU/forage ha > 1.0 LU/ha	sub-total	No livestock	Those with LU/forage ha <0.2 LU/ha	Those with LU/forage ha 0.2 - 0.5 LU/ha	Those with LU/forage ha 0.5 - 1.0 LU/ha	Those with LU/forage ha > 1.0 LU/ha
Utilised agricultural land (ha)	Holdings	14,024	6,622	137	612	903	1,420	3,550	2,319	12	90	243	551	1,423
	% of ALL holdings	26.95	12.73	0.26	1.18	1.74	2.73	6.82	4.46	0.02	0.17	0.47	1.06	2.73
	% of CATTLE & SHEEP LFA holdings	100.00	47.22	0.98	4.36	6.44	10.13	25.31	16.54	0.09	0.64	1.73	3.93	10.15
	Area(ha)	2656817.57	210793.69	1152.58	47336.25	22393.50	39698.85	100212.51	256607.41	259.14	7203.43	21138.53	66042.92	161963.39
	% of ALL UAA	51.43	4.08	0.02	0.92	0.43	0.77	1.94	4.97	0.01	0.14	0.41	1.28	3.14
	% of CATTLE & SHEEP LFA UAA	100.00	7.93	0.04	1.78	0.84	1.49	3.77	9.66	0.01	0.27	0.80	2.49	6.10
	Mean	189.45		8.41	77.35	24.80	27.96	28.23		21.60	80.04	86.99	119.86	113.82
	Max	22576.71		85.66	10114.59	817.28	751.01	509.83		115.29	1027.62	959.92	1248.93	1022.70
	Min	0.00		0.00	0.00	0.30	0.20	0.07		2.02	2.83	1.52	0.70	1.40
Rough grazing (ha)	Mean	138.22		0.00	0.00	0.00	0.00	0.00		3.78	8.81	12.20	17.60	11.92
	Max	22576.71		0.00	0.00	0.00	0.00	0.00		21.72	175.00	267.73	356.40	202.90
	Min	0.00		0.00	0.00	0.00	0.00	0.00		0.20	0.10	0.01	0.03	0.01
Grass under 5 years (ha)	Mean	10.01		2.12	1.50	1.56	3.71	6.27		3.08	6.16	9.28	22.52	34.68
	Max	599.69		50.92	114.93	92.98	184.04	216.38		27.22	112.21	220.35	243.25	299.55
	Min	0.00		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Grass 5 years or over (ha)	Mean	38.66		6.05	75.63	23.16	23.82	20.36		14.70	63.87	64.46	75.47	56.40
	Max	10114.59		73.16	10114.59	817.28	751.01	509.83		88.23	852.62	896.29	715.83	812.66
	Min	0.00		0.00	0.00	0.00	0.00	0.00		0.00	2.30	0.00	0.00	0.00
Sheep Livestock Units	Mean	31.28		0.00	11.97	5.66	10.58	15.31		0.00	4.60	19.15	35.51	38.60
	Max	1022.85		0.00	460.20	339.00	267.30	401.70		0.00	106.50	228.45	496.95	752.25
	Min	0.00		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Cattle Livestock Units	Mean	42.49		0.00	2.25	2.93	10.18	41.51		0.00	3.11	13.50	55.45	140.07
	Max	2493.00		0.00	424.00	187.00	388.00	1587.00		0.00	49.00	225.00	833.00	2493.00
	Min	0.00		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Livestock Units per forage ha	Mean	1.74		0.00	0.11	0.35	0.75	4.26		0.00	0.10	0.37	0.77	2.08
	Max	743.57		0.00	0.20	0.50	1.00	743.57		0.00	0.20	0.50	1.00	61.72
	Min	0.00		0.00	0.00	0.20	0.50	1.00		0.00	0.00	0.20	0.50	1.00
Sum of mean RG + Grass < 5 + Grass > 5 (ha)		186.89		8.17	77.13	24.72	27.53	26.63		21.56	78.84	85.94	115.59	103.00
mean Forage as % of UAA (%)		98.65		97.15	99.72	99.68	98.46	94.33		99.81	98.50	98.79	96.44	90.49

ROBUST CATTLE & SHEEP (LFA). Excludes sheep stock clubs that have no area in sole occupation. Source : Scottish Government RERAD REAS Statistics(Agriculture)		Rough Grazing 30-70% UAA						Rough Grazing >70% UAA					
			No livestock	Those with LU/forage ha less than		Those with LU/forage ha more			No livestock	Those with LU/forage ha less than		Those with LU/forage ha more	
		sub-total	No livestock	Those with LU/forage ha <0.2 LU/ha	Those with LU/forage ha 0.2 - 0.5 LU/ha	Those with LU/forage ha 0.5 - 1.0 LU/ha	Those with LU/forage ha > 1.0 LU/ha	sub-total	No livestock	Those with LU/forage ha <0.2 LU/ha	Those with LU/forage ha 0.2 - 0.5 LU/ha	Those with LU/forage ha 0.5 - 1.0 LU/ha	Those with LU/forage ha > 1.0 LU/ha
Utilised agricultural land (ha)	Holdings	1,933	13	194	565	728	433	3150	64	1,129	1,066	458	433
	% of ALL holdings	3.71	0.02	0.37	1.09	1.40	0.83	6.05	0.12	2.17	2.05	0.88	0.83
	% of CATTLE & SHEEP LFA holdings	13.78	0.09	1.38	4.03	5.19	3.09	22.46	0.46	8.05	7.60	3.27	3.09
	Area(ha)	334520.11	109.58	43476.37	93285.95	147230.32	50417.89	1854896.36	18411.12	1375871.71	400491.05	52854.74	7267.74
	% of ALL UAA	6.48	0.00	0.84	1.81	2.85	0.98	35.91	0.36	26.64	7.75	1.02	0.14
	% of CATTLE & SHEEP LFA UAA	12.59	0.00	1.64	3.51	5.54	1.90	69.82	0.69	51.79	15.07	1.99	0.27
	Mean		8.43	224.10	165.11	202.24	116.44		287.67	1218.66	375.70	115.40	16.78
	Max		26.81	9048.69	1943.61	3286.22	1341.01		14391.09	22576.71	3266.30	3272.57	379.09
	Min		0.60	3.10	1.50	0.40	0.87		0.07	0.90	0.72	0.15	0.04
Rough grazing (ha)	Mean		3.66	119.49	94.11	100.25	51.18		283.23	1172.26	324.77	92.84	13.97
	Max		11.68	4654.71	1219.19	1681.65	553.64		14351.89	22576.71	2873.25	2482.12	306.43
	Min		0.20	1.10	0.60	0.20	0.40		0.07	0.90	0.72	0.15	0.04
Grass under 5 years (ha)	Mean		0.46	3.89	10.08	21.40	17.51		0.25	5.59	7.22	4.05	0.46
	Max		2.01	215.36	444.71	389.17	599.69		15.67	305.99	233.22	398.89	54.87
	Min		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Grass 5 years or over (ha)	Mean		4.31	99.80	59.22	75.19	41.44		4.19	39.88	42.08	17.52	2.19
	Max		15.28	4385.79	527.28	1188.83	370.00		215.29	1270.40	787.17	244.48	113.52
	Min		0.33	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Sheep Livestock Units	Mean		0.00	13.79	39.10	63.48	51.71		0.00	67.79	77.28	39.12	16.36
	Max		0.00	268.20	777.00	1022.85	591.60		0.00	689.55	708.00	816.15	300.30
	Min		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Cattle Livestock Units	Mean		0.00	7.07	20.41	77.60	114.14		0.00	18.30	34.10	34.57	11.43
	Max		0.00	533.00	330.00	1871.00	2287.00		0.00	406.00	619.00	942.00	461.00
	Min		0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00
Livestock Units per forage ha	Mean		0.00	0.12	0.36	0.72	2.08		0.00	0.10	0.32	0.69	4.05
	Max		0.00	0.20	0.50	1.00	68.38		0.00	0.20	0.50	1.00	265.35
	Min		0.00	0.00	0.20	0.50	1.00		0.00	0.00	0.20	0.50	1.00
Sum of mean RG + Grass < 5 + Grass > 5 (ha)			8.43	223.18	163.41	196.84	110.13		287.67	1217.73	374.07	114.41	16.62
mean Forage as % of UAA (%)			100.00	99.59	98.97	97.33	94.58		100.00	99.92	99.57	99.14	99.05

Table 11 Comparing the June census/SAF-IACS and SNH estimates of extent of HNV at the RPAC level - once common grazings and non-SAF IACS holdings are included in the June census/SAF-IACS approach

RPAC	SNH Estimated HNV in UAA (ha) - TYPE 1	June Census/SAF-IACS TOTAL Estimated HNV (ha)	SNH HNV (ha) - June Census/SAF-IACS HNV (ha)	SNH HNV as % of TOTAL HNV	June Census/SAF-IACS HNV as % TOTAL HNV	Of which Common Grazings (ha)
Ayrshire	117,266	47,779	69,488	3	2	1,338
Argyll	386,837	277,541	109,296	10	12	8,283
Borders	177,549	117,308	60,241	5	5	0
Clyde Valley	119,231	58,070	61,161	3	3	0
D&G	212,712	107,334	105,378	6	5	0
Forth	189,018	128,294	60,724	5	6	0
Gramp Moray	245,460	96,761	148,698	6	4	5,553
Highland	1,604,181	904,385	699,796	42	39	209,454
North Isles	145,240	121,188	24,052	4	5	68,873
Tayside	390,243	229,831	160,411	10	10	34
West Isles	255,789	225,832	29,957	7	10	214,215
TOTAL	3,843,526	2,314,324	1,529,202	100	100	507,750

- Has there been any marked changes in extent of estimated HNV or UAA within or across RPACs (e.g. are any changes potentially driven by changes in the number/extent of estimated HNV holdings per se or by more general changes in the amount of land within the UAA or a combination of both)?

- Has there been any marked changes in extent of the ha of SAF-IACS and non-SAF-IACS holdings within the Cattle & Sheep (LFA) Farm Type within any RPACs (e.g. suggesting movements in or out of the support payment system)?

Taking such an approach to investigating any changes observed in estimated HNV at a broad level may therefore be useful in helping target where best to target any detailed studies seeking to gain a better understanding of what may be driving such changes.

Comparisons with work conducted by SNH on considering HNV extent based on nature conservation characteristics

The June census/SAF-IACS approaches were focussed specifically on Cattle & Sheep (LFA) holdings with more than 70% of UAA in rough grazing. As such the estimates obtained by that route would be more directly applicable to the estimates of total extent of HNV Type 1 habitats occurring within the UAA made by SNH.

Table 11 provides detailed breakdown of the comparisons of the estimates of HNV occurring in each RPAC using each approach. The SNH estimates are consistently larger than the June census/SAF-IACS estimates, but this is to be expected given that:

- the SNH approach identifies the potential overall total occurrence of HNV-associated habitats irrespective of whether they are a major component of individual holdings or not. Conversely, the June census/SAF-IACS data indicates that in many cases these habitats only make up a small proportion of any one holding and/or occur a low levels across a wider range of Farm Types than simply Cattle & Sheep (LFA). Hence a proportion of the ha identified by SNH is not a significant component of the underlying farming system on which it occurs and therefore is discounted in the June census/SAF-IACS calculations

- the June census/SAF-IACS data also indicates that in many cases a lot of the HNV habitats identified by SNH as occurring within the UAA are either not grazed at all or stocked at LU/ha densities that are higher than the HNV thresholds being used in the June census/SAF-IACS approach

Taking this into account, Table 10 indicates that although there may be differences in the overall extent of HNV estimated by the two approaches, both provide similar estimates in terms of the proportion of estimated HNV occurring within any one RPAC and hence in terms of the estimated overall distribution of HNV across RPACs in Scotland.

The June census/SAF-IACS and SNH approaches can therefore be compared and contrasted in a number of ways. For the purposes of this report the emphasis was put on comparing and contrasting with regard to the following questions :

- Q: Are the June census/SAF-IACS approach (at national and regional level) and SNH Type 1 estimates sufficient to give a broad indication of estimated HNV farming system extent (via both approaches) and (via SAF-IACS) broad trend?

  A: Yes – they appear sufficient for all 11 RPACs with regard to broad extent and for at least 8 of the 11 in full and 3 others in part with regard to broad trend (assuming for the moment that no additional focus will be put on investigating any annual changes at common grazing level)

- Q: Does a comparison of the findings from the June census/SAF-IACS approach (at national and regional level) and SNH Type 1 estimates identify or suggest any inconsistencies needing more detailed investigation?

  A: No inconsistencies have been identified as such – there are no marked differences in both approaches which cannot be explained

- Q: Does a comparison of the findings from the June census/SAF-IACS approach (at national and regional level) and SNH Type 1 estimates

suggests the need to look at either datasets in more detail (to answer specific questions)

A: The common grazings issue is an important one to seek more detailed information on how they are managed, but this is not something that can have more light shed on it via either approach. Given its importance as an HNV farming system, there is also a need to seek ways of obtaining more detailed information of individual crofts and their links to the common grazing resource, in order to be able to identify Crofting as a distinct Farm Type. However, this requires the collation of croft-specific information from other sources.

The SNH approach provides an indication of the amount of HNV habitats (with particular focus on Type 1) occurring across Scotland, but it is recognised that this dataset is only updated every c. 10 years. The SNH data could, however, be incorporated in the basket of indicators since it would be feasible to calculate the proportion of the overall amount of HNV Type 1 habitats that fall within the UAA each year (thereby helping set a wider context to the annual June census/SAF-IACS system-based calculations).

Conclusions

The aims of this study were primarily to:

- provide a broad overview of the estimated extent and distribution of HNV farm holdings across Scotland

- help identify any apparent gaps in knowledge or parts of Scotland where further more detailed investigation may be needed

As already highlighted, neither of the datasets used in this study have been designed specifically with the intent of providing an indication of the extent and distribution of HNV farming systems and holdings. Nevertheless, the relatively simple approaches taken (which are robust, transparent and repeatable) have shown that it is feasible to obtain estimates of HNV occurrence at a broad Scotland and RPAC level and to obtain additional underlying data through those approaches that can potentially be used to investigate any observed changes in estimated broad extent and distribution once estimates from other years are available.

It must, however, be remembered that the approaches used were not intended to try to identify the exact locations of individual holdings practising HNV farming systems. Hence, different approaches, focussing more on holding or regional specific cases studies, would be required to investigate the detail of any changes that may be occurring within RPACs where any changes in broad estimates of HNV appear to be happening. Such regional level case studies could, for completeness, also be used to confirm that the data drawn from the June Census and SAF-IACS returns in the approaches used in this study do reflect stocking density levels on the ground.

The estimates of broad HNV extent and distribution in 2009 have been made using surrogate data at the holding level anticipated to reflect the underlying farming system characteristics. The robustness and accuracy of the estimates would be greatly improved if additional data (such as type, size and spatial location of different habitat type on the holding; actual stocking densities and nutrient input levels across the holding) were readily available for all holdings across Scotland.

Crofting is a unique farming system which is recognised to be of particular High Nature Value. As such, it would be useful to be able to easily identify holdings which are crofts in national annually collected agricultural statistics, and for the statistics collected from crofting holdings to reflect what is happening on the full extent of the land being managed/utilised by each individual croft, i.e. the in-bye land managed by the crofting holding and the common grazings utilised by each croft need to be easily recognisable and connectable in agricultural statistic data collection.

In addition, more detailed information is needed on what is actually happening on common grazings. Such grazings may only be c. 9% of the overall total UAA across Scotland, but within some RPACs common grazings are a considerable component of the UAA, e.g. in the Western Isles and Northern Isles RPACs common grazings cover over 70% and nearly 30% of the UAA, respectively. Just as importantly, over 20% of the estimated extent of HNV in Scotland in 2000 was common grazings. Given their overall HNV importance, there is a need to know much more about common grazings and how aspects of their management and underlying nature conservation value may be changing. In this respect, it is important to note that Jones' (2011) assessment of some of the underlying issues also provides a list of detailed recommendations as to what could be done to obtain more information on Scotland's common grazings.

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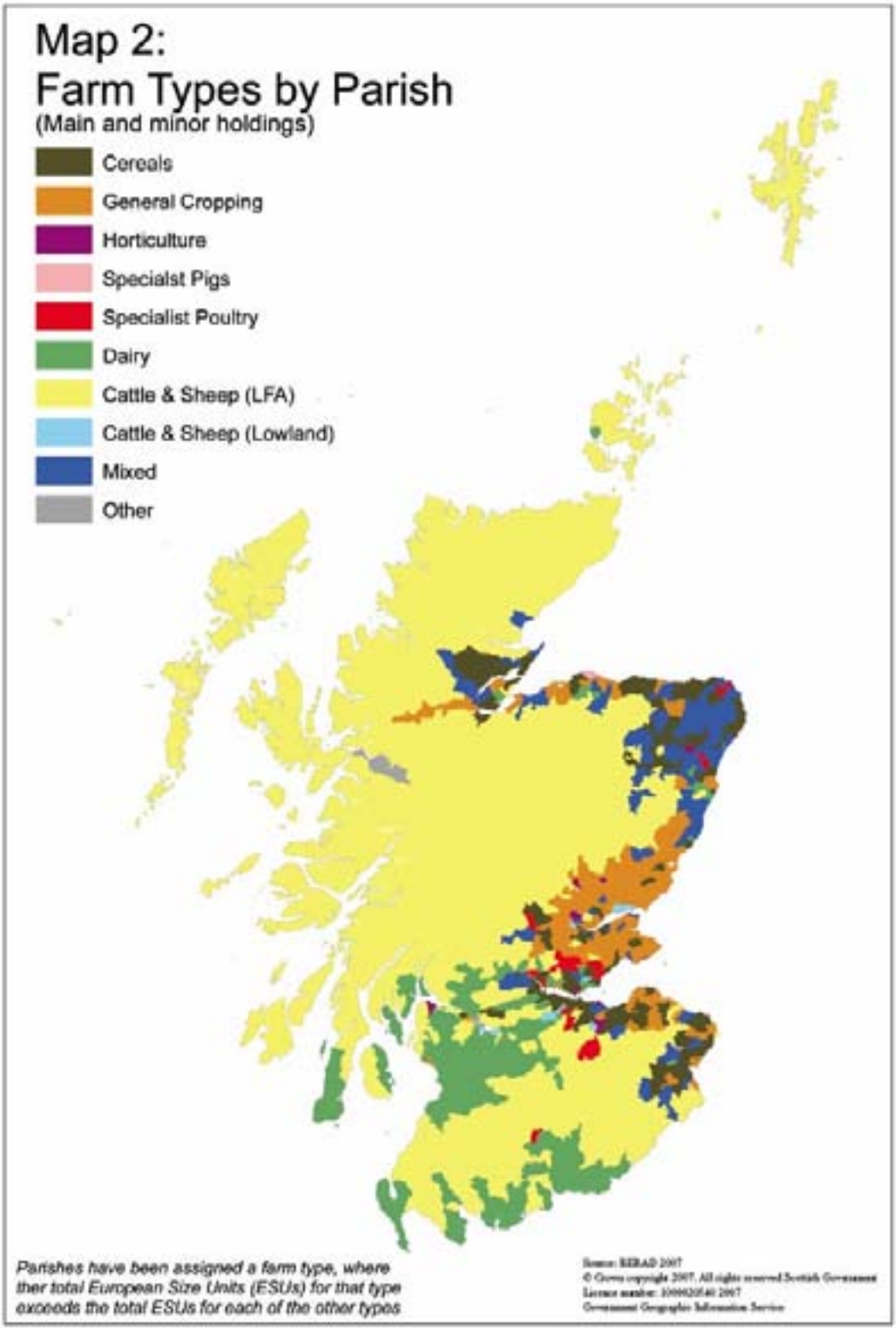
Appendix 1: Farm types in Scotland by parish (main and minor holdings).

From [Economic report of Scottish Agriculture 2008]



Appendix 2: Basic Components of the Broad HNV Farming Systems Scotland

1) Crofting	FADN: No equivalent	RERAD Farm accounts: No equivalent

Notes

Characteristic	EC Guidance	Scotland: Qualitative Description	Note of any Relevant Dataset
The way in which the land is managed by the predominant farming system and its characteristics and practices	*Grazing regimes*	Livestock normally graze permanent grass pastures and moorland during the summer, when silage and crops are grown on the better land. Sheep and many of the cattle (if present) are not housed in the winter, with cattle being fed silage on rough pastures, especially on sandy soils in coastal areas which are not so prone to waterlogging.	
	Cropping patterns	A small amount of cereals, mostly barley but also some oats may be grown annually (spring sown) for use as winter feed. Where cattle are present silage will also be harvested for winter feed.	
	Intensity of use (for example, livestock densities per hectare of forage, nitrogen inputs, fallow)	Relevant HNV stocking rates at the level of the rough grazings would be < 0.2 LU/ha, but at the farm level this would be combined with a stocking rate for the inbye land not exceeding 1 LU/ha.	
	Other		
Description of Land Cover	*Semi natural vegetation*	Rough grazings make up at least 70% of the Utilised Agricultural Area (including common grazings). These are large, mainly 'unenclosed' areas, dominated by low productivity semi-natural vegetation. These comprise mostly wet heaths and blanket bog, but grasslands are present throughout where local conditions of topography and grazing allow. Due to the severe climatic gradients a wide range of habitat types are present, almost all of which are listed in the Annexes of the Habitats Directive. On the inbye ground, species-rich hayfields and other semi-natural grassland communities (not otherwise represented on the rough grazings) can occur.	
	Types of cropped land and their spatial coverage	Small proportion of cereals (mostly barley or oats, with occasional rye) grown for winter feed for cattle (where present).	
	Distribution at the farm level (for example, approximate proportion of farmed area, mosaic patterns)	Each crofting unit generally consists of a small amount of better quality (grass pasture and/or machair) in-bye land (< 20 ha) and the right of use of larger areas of unenclosed common grazings (moorland/rough grazing)	
	Farmland features (field margins,	'Features' are limited in importance, but provide an element of diversity	

	semi-natural patches, water bodies and dry-stone walls)	which would otherwise be absent. On most crofts, boundary features are limited: stone walls are locally present, as are earth banks, but hedges are rare, and wire fences are the commonest parcel boundary on most crofts. Arable land, due to its low-intensive management and the fact that it forms at most small patches in otherwise pasture-dominated landscapes, can also add value, with breeding populations of species, such as corn bunting, as well as supporting wintering finches and buntings in general. In the Uists, as well as very rarely elsewhere, local cultivars of cereals are grown in a rotation with, at least traditionally, bare fallow and, again traditionally, binding and stooking of the crop, with considerable biodiversity interest at all times of the year.	
	Other		
Species	*Species of conservation concern associated with these forms of land cover and farming practices*	A wide range of birds are associated with the habitats utilised by the crofting system and the system is recognised as important not only for rarities but also for the richness of species once more common and more widely distributed in lowland Britain. For example, Meadow Pipit, *Anthus pratensis*, Skylark, *Alauda arvensis*, Wheatear, *Oenanthe oenanthe*, Stonechat, *Saxicola torquata*, Dunlin, *Caladris alpina*, and Oystercatcher, *Haematopus ostralegus*, are all typical breeding birds. Less common are Golden Eagle, *Aquila chrysaetos*, Peregrine, *Falco peregrinus*, Raven, *Corvus corax*, Twite, *Carduelis flavirostris*, Corncrake, *Crex crex*, , and Chough, *Pyrrhocorax pyrrhocorax*. The addition of winter visitors such as Barnacle Goose, *Branta leucopsis*, and Greenland White-fronted Goose, *Anser albifrons*, makes these areas of cropped fields, grass pastures, moorland and coast internationally significant for nature conservation.	
Habitats	*Habitats of conservation concern associated with these forms of land cover and farming practices*	Some of the most restricted habitats in Europe occur commonly associated with crofting. The sand dune and machair systems are internationally important and the survival of their floristic interest is intimately linked with agricultural practice. The moorland, bog and wet heath communities are characterised by many plants with very restricted western European distributions - Lesser Twayblade, *Listera cordata*, Pale Butterwort, *Pinguicula lusitanica*, Bog Asphodel, *Narthecium ossifragum*, Great Sundew, *Drosera anglica*, and many species of *Sphagnum* bog moss - although dominated by what is often regarded as common plants - Heather, Cross-leaved Heath, *Erica tetralix*, Deer Grass, *Scirpus caespitosum*, Cotton Grass and Purple Moor Grass.	

2) Sheep system	FADN: Specialist sheep	RERAD Farm accounts: Specialist sheep (LFA)

Notes
RERAD Farm Accounts definition "Farms in the less-favoured areas with more than two-thirds of the total standard gross margin coming from sheep"

Characteristic	EC Guidance	Scotland: Qualitative Description	Note of any Relevant Dataset
The way in which the land is managed by the predominant farming system and its characteristics and practices	*Grazing regimes*	As with the crofting system, the sheep normally graze rough grazings for the vast majority of the year, with some of the flock being brought onto the permanent grasslands forming the in-bye ground at other times of the year (e.g. prior to tupping and at lambing time).	
	Cropping patterns	A small amount of forage turnips or brassica crops may be grown but otherwise HNV sheep systems are dominated by the use of permanent grass and rough grazings.	
	Intensity of use (for example, livestock densities per hectare of forage, nitrogen inputs, fallow)	As with crofting systems, relevant HNV stocking rates on the rough grazings would be < 0.2 LU/ha, but at the farm level this would be combined with an stocking rate for the in-bye land not exceeding 1 LU/ha. On HNV holdings, the dominance of rough grazings puts limits on the ability to 'fatten and finish' each seasons crop of lambs so the vast majority (> 90%) of each season's lambs are sold off the farm at < 6 months old for fattening and finishing elsewhere. The inbye permanent grasslands on HNV systems are also likely to be more semi-natural in nature and receive < 40kg/ha/year of inorganic fertiliser.	
	Other	Sheep-only systems are largely confined to the upland areas of Scotland. A typical upland Scottish sheep farmer will have a large sheep flock on a large area which is farmed solely by himself and his family. There is very little difference in the farming systems carried out by crofters and larger HNV sheep farmers, except for scale (with landscape and habitat diversity implications) and the fact that crofting is more likely to utilise grazings on common land.	
Description of Land Cover	*Semi natural vegetation*	As with crofting system, rough grazings make up at least 70% of the Utilised Agricultural Area. These are large, mainly 'unenclosed' areas, dominated by low productivity semi-natural vegetation (e.g. wet heaths and blanket bog but grasslands are present throughout where local conditions of topography and grazing allow). Due to the severe climatic gradients a wide range of habitat types are present, almost all of which are listed in the Annexes of the Habitats Directive. On the inbye ground, semi-natural grassland communities (not otherwise	

		represented on the rough grazings) can occur.	
	Types of cropped land and their spatial coverage	A small amount (< 10% of the inbye ground) of forage turnips or brassica crops may be grown but otherwise HNV sheep systems are dominated by the use of permanent grass and rough grazings.	
	Distribution at the farm level (for example, approximate proportion of farmed area, mosaic patterns)	See above	
	Farmland features (field margins, semi-natural patches, water bodies and dry-stone walls)	As with the crofting system, 'features' are limited in importance, but provide an element of diversity which would otherwise be absent. Boundary features such as stone walls and remnant earth banks can form an important component of the rough grazings, as can hedges around the inbye fields of some of the lower altitude farms. As with crofts, wire fences can be the commonest parcel boundary on many sheep farms.	
	Other	Where rough grazings make up less than 70% of the Utilised Agricultural Area on the farm, this gives more scope to utilise the inbye grasslands more intensively (e.g. for tupping and then subsequent lambing of a greater proportion of the flock, trying to finish a greater proportion of each seasons lamb crop) and this (and subsequent increased numbers of livestock carried) can have the knock-on effect of increasing the intensity of management of the rough grazings throughout the year, thereby reducing the overall HNV potential.	
Species	*Species of conservation concern associated with these forms of land cover and farming practices*	As per the crofting system, with a greater emphasis on upland bird species and with exception that birds such as corncrake, chough and wintering geese are not major features.	
Habitats	*Habitats of conservation concern associated with these forms of land cover and farming practices*	As per the crofting system with exception that sand and machair habitats do not feature	

3) Beef cattle system	FADN: Specialist cattle rearing & fattening	RERAD Farm accounts: Specialist beef (LFA)	
Notes RERAD Farm Accounts definition "Farms in the less-favoured areas with more than two-thirds of the total standard gross margin coming from cattle."			
Characteristic	**EC Guidance**	**Scotland: Qualitative Description**	**Note of any Relevant Dataset**
The way in which the land is managed by the predominant farming system and its characteristics and practices	*Grazing regimes*	Beef cattle systems in Scotland can be more variable than sheep systems (see information in other section below). Like crofting and sheep systems, beef cattle systems likely to be of HNV will be those where the cattle graze a combination of permanent grasslands and rough grazings for a large proportion of the year, with silage and crops for winter feed being grown on the better land during the summer months.	
	Cropping patterns	Silage will be harvested from inbye permanent grassland for use as winter feed and in many cases some cereals (mostly barley but in some traditional breed systems also oats) will also be grown and harvested for this purpose.	
	Intensity of use (for example, livestock densities per hectare of forage, nitrogen inputs, fallow)	Farms with an HNV beef cattle system are likely (as with crofting and sheep systems) to be those which are disadvantaged by having low yielding or seasonally productive land and where early finishing of calves for slaughter is not possible. On such HNV farms, rough grazings form the dominant (> 70% UAA) grazing resource within the Utilised Agricultural Area, arable crops (cereals in particular) are likely to form < 20% of the remaining inbye ground and the vast majority (>80%) of those crops are retained on farm for winter feed. The permanent grasslands making up the remaining inbye ground on such HNV farms generally receive < 100kg/ha/year of inorganic fertiliser and where silage is made only one cut is taken per year. The vast majority (> 80%) of the calves from such HNV systems are either being sold before 8 months old or after 24 months. Overall stocking density being mostly <1.4 LU/ha, but still with a much lower (<0.2 LU/ha) utilisation of the rough grazing areas.	
	Other	Beef systems in Scotland exhibit more potential variation than sheep systems. The type of grazing regime (or at least the different contributions of forage and fodder in the diet) will depend on whether	

		the farm is practising a suckler system (i.e. rearing calves and selling them off-farm generally before they are 8 months old) or a rearing and finishing system. In the former, the cattle and their calves graze permanent grass pastures and moorland during the spring to early autumn (when silage and other crops are grown on the better inbye land) and following sale of the calves in the autumn, the adult cattle may be kept out-of-doors on these habitats through the winter (and fed the silage/crop winter feed) or housed (and fed those preserved crops) for some part of the winter. On farms practising rearing and finishing, the adult cattle may follow a similar grazing regime (though in some cases being housed for longer through the winter) but with the calves retained on farm after weaning and kept on permanent pastures (and housed during the winter months) and fed silage/grain/concentrates with a view to selling them for slaughter at between 18-24 months old. Those suckler systems with a high proportion of semi-natural vegetation in the UAA together with those more specialised traditional breed (e.g. Highland cattle) rearing and finishing systems which rely on extensive grazing systems and selling calves for slaughter at > 24 months old, are the beef cattle systems more likely to be HNV in Scotland.	
Description of Land Cover	*Semi natural vegetation*	As with crofting and sheep systems, HNV systems more likely to occur where rough grazings make up at least 70% of the Utilised Agricultural Area. These are large, mainly 'unenclosed' areas, dominated by low productivity semi-natural vegetation (e.g. wet heaths and blanket bog but grasslands are present throughout where local conditions of topography and grazing allow). Due to the severe climatic gradients a wide range of habitat types are present, almost all of which are listed in the Annexes of the Habitats Directive. On the inbye ground, semi-natural grassland communities (not otherwise represented on the rough grazings) can occur and can be an important part of the fodder and forage resource.	
	Types of cropped land and their spatial coverage	As with crofting and sheep systems, HNV systems are limited in their extent of inbye ground, but a greater proportion of this (< 20%) will be given over to annual (spring sown) cereal crops. A larger proportion of the remaining permanent grassland on the inbye ground will be given over to 1 cut of silage (or in more limited situations) hay per year	

	Distribution at the farm level (for example, approximate proportion of farmed area, mosaic patterns)	See above.	
	Farmland features (field margins, semi-natural patches, water bodies and dry-stone walls)	As with crofting and sheep systems, 'features' are limited in importance, but provide an element of diversity which would otherwise be absent. Boundary features such as stone walls and remnant earth banks can form an important component of the rough grazings, as can hedges around the inbye fields of some of the lower altitude farms. As with crofts, wire fences can be the commonest parcel boundary on many sheep farms. The arable land in an otherwise pasture-dominated landscape, can also add value by supporting wintering finches and buntings in general. In the Uists.	
	Other		
Species	*Species of conservation concern associated with these forms of land cover and farming practices*	As per the crofting system	
Habitats	*Habitats of conservation concern associated with these forms of land cover and farming practices*	As per the crofting system	

4) Combined sheep & cattle system	FADN: Sheep & cattle combined	RERAD Farm accounts: Sheep & cattle (LFA) Lowground cattle & sheep

Notes
RERAD Farm Accounts definition "Farms in the less-favoured areas with more than two-thirds of the total standard gross margin coming from sheep and beef cattle together" AND "Farms NOT in the less-favoured areas with more than two-thirds of the total standard gross margin coming from sheep and beef cattle"

Characteristic	**EC Guidance**	**Scotland: Qualitative Description**	**Note of any Relevant Dataset**
The way in which the land is managed by the predominant farming system and its characteristics and practices	*Grazing regimes*	As with the separate crofting, sheep and beef systems, combined sheep and cattle systems likely to be of HNV will be those where the livestock graze a combination of permanent grasslands and rough grazings for a large proportion of the year, with silage and crops for winter feed being grown on the better land during the summer months. Lowground cattle and sheep systems will utilise a much greater proportion of inbye permanent grasslands as a forage and fodder resource. The more intensive management of the grazing resource will means that any HNV of such lowground systems will therefore be more directly linked to the diversity of crops grown and to the associated features on the farm (as opposed to the characteristics of the grazing regime itself).	
	Cropping patterns	HNV systems will involve silage being harvested from inbye permanent grassland for use as winter feed and in many cases some cereals (mostly barley but in some traditional breed systems also oats) will also be grown and harvested for this purpose. Most lowground examples of this system will involve a greater proportion of the Utilised Agricultural Area being used for two-three cut silage production as well as cereal crops for use as winter feed for the cattle and calves and potentially also brassicas as winter forage for finishing lambs. The HNV of such lowground systems will therefore depend on the diversity of crops being grown (and the intensity of management of those) and the associated features on the farm.	
	Intensity of use (for example, livestock densities per hectare of forage, nitrogen inputs, fallow)	Farms with an HNV combined sheep & cattle system are likely (as with the separate sheep and beef cattle systems above) to be those which are disadvantaged by having low yielding or seasonally productive land and where early finishing of lambs or calves for slaughter is not possible. On such HNV farms, rough grazings form the dominant (> 70% UAA) grazing resource within the Utilised Agricultural Area and	

		the remaining intensity of use factors follow those for sheep and beef cattle systems with (given the importance of the cattle to this system) increased emphasis on those characteristics. Hence arable crops (cereals in particular but potentially also brassica crops) are likely to form < 20% of the remaining inbye ground and the vast majority (>80%) of those crops are used on farm for winter feed. The permanent grasslands making up the remaining inbye ground on such HNV farms generally receive < 100kg/ha/year of inorganic fertiliser and where silage is made only one cut is taken per year. The vast majority (> 80%) of the calves from such HNV systems are either being sold before 8 months old or after 24 months and the lambs (>80%) being sold at < 6 months old . Overall stocking density being mostly <1.4 LU/ha, but still with a much lower (<0.2 LU/ha) utilisation of the rough grazing areas.	
	Other	The likely high intensity of use of the Utilised Agricultural Land within lowground combined sheep and beef system mean that any HNV is less likely to be associated with LU/ha or inorganic inputs per ha and more directly associated with the occurrence and condition of associated features on the farm (e.g. hedgerows, woodlands, wetlands etc).	
Description of Land Cover	*Semi natural vegetation*	As with individual sheep and beef cattle systems, HNV combined sheep and cattle systems more likely to occur where rough grazings make up at least 70% of the Utilised Agricultural Area. These are large, mainly 'unenclosed' areas, dominated by low productivity semi-natural vegetation (e.g. wet heaths and blanket bog but grasslands are present throughout where local conditions of topography and grazing allow). Due to the severe climatic gradients a wide range of habitat types are present, almost all of which are listed in the Annexes of the Habitats Directive. On the inbye ground, semi-natural grassland communities (not otherwise represented on the rough grazings) can occur and can be an important part of the fodder and forage resource. Lowground systems do not feature large areas of semi-natural vegetation. Hence HNV examples of such systems are more likely to include boundary features (such as hedgerows) and more natural habitats (such as woodlands, wetlands) which are in good ecological condition and which are interspersed over the farm.	
	Types of cropped land and their spatial coverage	As with separate sheep and beef systems, HNV combined sheep & cattle systems are limited in their extent of inbye ground, but a greater	

		proportion of this (< 20%) will be given over to annual (spring sown) cereal crops or brassica crops for winter forage. A larger proportion of the remaining permanent grassland on the inbye ground will be given over to 1 cut of silage (or in more limited situations) hay per year. Any lowground examples of this system are more likely to be HNV where there is a range of different crops/grass covers at any one point in time. Any examples of such system are more likely to occur in marginal zone of the lowland/upland interface.	
	Distribution at the farm level (for example, approximate proportion of farmed area, mosaic patterns)	See above	
	Farmland features (field margins, semi-natural patches, water bodies and dry-stone walls)	The importance of the rough grazings and associated semi-natural permanent grassland habitats on most examples of HNV combined sheep & cattle system mean that (like the separate systems) 'features' are not a major contributor to the HNV but can add to it. Hence stone walls and remnant earth banks can add to the overall HNV. In lowground areas, there has been a significant loss of large areas of semi-natural habitats (e.g. dry grasslands, wet grasslands) over the years. As a result, features will be a much greater influence on the potential HNV of any examples of such system, with not only the occurrence of habitats like hedgerows, woodlands and relict areas of semi-natural vegetation (such as lowland raised bogs and wetlands) but also their underlying ecological condition being a major determinant of the actual HNV.	
	Other		
Species	*Species of conservation concern associated with these forms of land cover and farming practices*	As per the individual crofting, sheep and beef cattle systems for the majority of HNV examples of this system which occur in upland and/or western coastal areas. Additional species associated with hedgerows, wetlands and relict semi-natural systems being of more importance in any lowground HNV examples of this system	
Habitats	*Habitats of conservation concern associated with these forms of land cover and farming practices*	As per the individual crofting, sheep and beef cattle systems for the majority of HNV examples of this system which occur in upland and/or western coastal areas. Additional semi-natural and natural habitats with hedgerows, wetlands and relict semi-natural systems being of more importance in any lowground HNV examples of this system	

5) Mixed livestock & arable system	FADN: Mixed crops & livestock	RERAD Farm accounts: Mixed (part)

Notes
RERAD Farm Accounts definition " Farms where no enterprise contributes more than two-thirds of the total standard gross margin. (in part)"

Characteristic	EC Guidance	Scotland: Qualitative Description	Note of any Relevant Dataset
The way in which the land is managed by the predominant farming system and its characteristics and practices	*Grazing regimes*	As with the separate crofting, sheep and beef systems, mixed livestock and arable systems likely to be of HNV will be those on the margin between upland and lowland areas where the livestock graze a combination of permanent grasslands and rough grazings for a large proportion of the year, with silage and crops for winter feed being grown on the better land during the summer months. Lowground mixed livestock and arable systems will utilise a much greater proportion of inbye permanent grasslands as a forage and fodder resource. The more intensive management of the grazing resource will means that any HNV of such lowground systems will therefore be more directly linked to the diversity of crops grown and to the associated features on the farm (as opposed to the characteristics of the grazing regime itself).	
	Cropping patterns	HNV systems will involve silage being harvested from inbye permanent grassland for use as winter feed and in many cases some cereals (mostly barley) will be grown. Most upland/lowland marginal land and lowground examples of this system will involve a greater proportion of the Utilised Agricultural Area being used for two-three cut silage production as well as cereal crops for use as winter feed for the cattle and calves and potentially also brassicas as winter forage for finishing lambs. The HNV of such systems will therefore depend on the diversity of crops being grown (and the intensity of management of those) and the associated features on the farm.	
	Intensity of use (for example, livestock densities per hectare of forage, nitrogen inputs, fallow)	Farms with an HNV mixed livestock and arable system are likely to be those in the margins between upland and lowland areas which have some disadvantages which limits the intensity of arable production available from the land (and hence means that >70% of the crops sown are spring crops). Both the arable and in-bye grassland areas of most mixed livestock and arable system farms will be managed at moderate-high intensities in terms of nutrient inputs (>150 kg/ha/year	

		of inorganic fertilisers and/or slurry spreading), thereby limiting their HNV potential. HNV examples of such a mixed arable and livestock system will therefore have low-moderate inputs of nutrients onto the majority of fields on the farm combined with a diversity of crop types and low stocking densities of livestock (<1.4 LU/ha on in-bye ground and a much lower <0.2 LU/ha on any rough grazing areas).	
	Other		
Description of Land Cover	*Semi natural vegetation*	As most HNV mixed livestock and arable systems are likely to occur in the margins of upland and lowland areas, then rough grazings would be expected to make up some element of the Utilised Agricultural Area. These are large, mainly 'unenclosed' areas, dominated by low productivity semi-natural vegetation (e.g. wet heaths and blanket bog but grasslands are present throughout where local conditions of topography and grazing allow). Due to the severe climatic gradients a wide range of habitat types are present, almost all of which are listed in the Annexes of the Habitats Directive. However, the inbye ground is unlikely to feature large areas of semi-natural vegetation (such as species rich grasslands) and hence HNV examples of such systems are more likely to include boundary features (such as hedgerows) and more natural habitats (such as woodlands, wetlands) which are in good ecological condition and which are interspersed over the farm.	
	Types of cropped land and their spatial coverage	Arable crops (cereals and brassica crops) are likely to form between 30% - 60% of the Utilised Agricultural Area, with <30% of the UAA being dominated by any one land cover (where cereals, other crops, grass for grazing and grass for cutting are each treated as individual land cover categories).	
	Distribution at the farm level (for example, approximate proportion of farmed area, mosaic patterns)	See above	
	Farmland features (field margins, semi-natural patches, water bodies and dry-stone walls)	There has been a significant loss of large areas of semi-natural habitats (e.g. dry grasslands, wet grasslands) in most mixed livestock and arable farms. As a result, much of the biodiversity value of these has declined and is now largely associated with remaining boundary habitats (such as hedgerows or woodlands) or proximity to relict areas	

		of semi-natural vegetation (such as lowland raised bogs and wetlands).	
	Other		
Species	*Species of conservation concern associated with these forms of land cover and farming practices*	More species-rich communities of farmland birds (esp. song birds and waders), vascular plants and bryophytes, invertebrates associated with the boundary features (such as hedgerows) remnant areas of natural habitats (such as woodlands and wetlands) and the less intensively used parts of the farm.	
Habitats	*Habitats of conservation concern associated with these forms of land cover and farming practices*	As per the individual crofting, sheep and beef cattle systems for the habitats which occur on any rough grazing associated with this system in the margin between upland and lowland areas. Additional semi-natural and natural habitats with hedgerows, wetlands and relict semi-natural systems being of importance in association with the inbye land	

6) Arable system	FADN: Specialist cereal, oilseed & protein crops General field crops	RERAD Farm accounts: Cereals General cropping

Notes
RERAD Farm Accounts definition "Farms where more than two-thirds of the total standard gross margin comes from cereals and oilseeds."
AND "Other farms where more than two-thirds of the total standard gross margin comes from all crops."

Characteristic	EC Guidance	Scotland: Qualitative Description	Note of any Relevant Dataset
The way in which the land is managed by the predominant farming system and its characteristics and practices	*Grazing regimes*	Livestock are not a major feature of arable systems in Scotland	
	Cropping patterns	Intensification of arable farming practices (largely driven by increases in mechanisation and the availability of inorganic fertiliser and crop protection products has led to a marked specialisation of many arable farming systems in one or two crops types. This has resulted in large areas being dominated by mono-cultures of crops (especially cereals) and to situations where field sizes have increased (and hence the occurrence of surrounding boundary and field margins have decreased) in order to accommodate machinery and increase the speed of cultivation and harvesting techniques.	
	Intensity of use (for example, livestock densities per hectare of forage, nitrogen inputs, fallow)	This single crop species dominance together with spacing at which the plants are planted and the intensity of any crop protection strategies employed generally limits the range of wildlife which is able to utilise such arable systems. Therefore, the majority of well-managed (from an agricultural production perspective) arable systems in Scotland cannot be considered to be of HNV (in terms of any strong link between the system characteristics and biodiversity value) and generally provide only limited opportunities for utilisation by wildlife through the occurrence of remnant hedgerows and natural features such as woodland or wetlands.	
	Other		
Description of Land Cover	*Semi natural vegetation*	Most farms under an arable system do not feature large areas of semi-natural vegetation though remnant hedgerow networks and more natural features (such as woodlands and wetlands) may occur around the farm.	

	Types of cropped land and their spatial coverage	As the name of the system suggests, arable crops (cereals, brassicas and other crops such as potatoes) are likely to form over 60% of the Utilised Agricultural Area, with the majority of the crops being winter sown as opposed to spring sown. Because of the high degree of specialisation any one crop type is likely to dominant the UAA, and so overall crop diversity at the farm level is likely to be low.	
	Distribution at the farm level (for example, approximate proportion of farmed area, mosaic patterns)	See above	
	Farmland features (field margins, semi-natural patches, water bodies and dry-stone walls)	There has been a significant loss of large areas of semi-natural habitats (e.g. dry grasslands, wet grasslands) associated with arable systems. As a result, much of the biodiversity value of these farms has declined greatly and is now largely associated with remaining boundary habitats (such as hedgerows or woodlands) or proximity to relict areas of semi-natural vegetation (such as lowland raised bogs and wetlands).	
	Other		
Species	*Species of conservation concern associated with these forms of land cover and farming practices*	Farmland birds (esp. song birds and waders) had an intimate link with arable systems in the past, but intensification of the system has meant that the bird, vascular plants and invertebrates interest of the productive land has declined greatly. Wintering geese can be associated with the productive land but otherwise any species interest is confined to any remnant boundary features (such as hedgerows) and natural habitats (such as woodlands and wetlands) on the farm.	
Habitats	*Habitats of conservation concern associated with these forms of land cover and farming practices*	Largely confined to remnant semi-natural habitats (such as hedgerow networks) and natural habitats (woodlands and wetlands) around the intensively managed arable land	

7) Dairy system	FADN: Specialist dairying	RERAD Farm accounts: Dairy

Notes
RERAD Farm Accounts definition "Farms where more than two-thirds of the total standard gross margin comes from dairy cows."

Characteristic	**EC Guidance**	**Scotland: Qualitative Description**	**Note of any Relevant Dataset**
The way in which the land is managed by the predominant farming system and its characteristics and practices	*Grazing regimes*	Dairy systems in Scotland are very specialised, with the adult milking cows grazing permanent grasslands in the vicinity of the milking parlour through spring to autumn (depending on weather conditions each year) and being housed and fed fodder crops (silage and crops grown for winter feed on the farm, such as maize for incorporating into silage, together with bought-in concentrates). Young stock (for replacement of the adult milking cows) may be grazed on pastures further from the farm steading, but are also housed and fed fodder crops during the winter. The intensive nature of dairy systems mean that very few (if any) of these systems can be considered HNV.	
	Cropping patterns	Silage is intensively produced under a two-three cut system and in some instances farms have switched to zero grazing (whereby animals are housed throughout the year and the grasslands cut and the feed brought to the animals). Any associated crops on farm which will largely be cereals for use as winter fodder) are also generally intensively managed to provide high yields with high nutritional value for the dairy cattle.	
	Intensity of use (for example, livestock densities per hectare of forage, nitrogen inputs, fallow)	This grassland dominance together with the intensity at which the grasslands are managed (e.g. strip grazed in rotation, two-three cuts of silage per year, high inputs of inorganic fertiliser and slurry) markedly limits the range of wildlife which is able to utilise such dairy systems. Therefore, the majority of well-managed (from an agricultural production perspective) dairy systems in Scotland cannot be considered to be of HNV (in terms of any strong link between the system characteristics and biodiversity value) and generally provide very limited opportunities for utilisation by wildlife through the occurrence of remnant hedgerows and natural features such as woodland or wetlands.	
	Other		
Description of Land Cover	*Semi natural vegetation*	Most farms under a dairy system do not feature large areas of semi-	

		natural vegetation though remnant hedgerow networks and more natural features (such as woodlands and wetlands) may occur around the farm.	
	Types of cropped land and their spatial coverage	Grassland is likely to form over 80% of the Utilised Agricultural Area in dairy systems, with any crops being grown being largely confined to cereals for winter feed. Hence overall crop diversity at the farm level is likely to be low.	
	Distribution at the farm level (for example, approximate proportion of farmed area, mosaic patterns)	See above	
	Farmland features (field margins, semi-natural patches, water bodies and dry-stone walls)	There has been a significant loss of large areas of semi-natural habitats (e.g. dry grasslands, wet grasslands) associated with dairy systems. As a result, much of the biodiversity value of these farms has declined greatly and is now largely associated with remaining boundary habitats (such as hedgerows or woodlands) or proximity to relict areas of semi-natural vegetation (such as lowland raised bogs and wetlands).	
	Other		
Species	*Species of conservation concern associated with these forms of land cover and farming practices*	Farmland birds (esp. song birds and waders) had an intimate link with dairy systems in the past, but intensification of the system has meant that the bird, vascular plants and invertebrates interest of the productive land has declined greatly. Wintering geese can be associated with the productive land but otherwise any species interest is confined to any remnant boundary features (such as hedgerows) and natural habitats (such as woodlands and wetlands) on the farm	
Habitats	*Habitats of conservation concern associated with these forms of land cover and farming practices*	Largely confined to remnant semi-natural habitats (such as hedgerow networks) and natural habitats (woodlands and wetlands) around the intensively managed arable land.	

8) Mixed arable & horticulture system	FADN: Mixed horticulture & cropping	RERAD Farm accounts: Mixed (part)
Notes RERAD Farm Accounts definition "Farms where no enterprise contributes more than two-thirds of the total standard gross margin. (in part)" Mixed arable and horticulture systems in Scotland generally contain, as indicated with arable systems above, large mono-cultures of a small number of different arable crops together with a wider range of different horticultural crop types, some grown in open fields while others are grown under some form of protection (historically in glasshouses but now increasingly under plastic stretched over frameworks placed in the fields). The intensity of the arable cropping system, the spacing at which the plants are planted, the regular turnover of horticultural crop plants, the fact that much production now occurs under protection and the intensity of any crop protection strategies employed limits the range of wildlife which is able to utilise such mixed arable and horticulture systems. Therefore, the majority of well-managed (from an agricultural production perspective) mixed arable and horticulture systems in Scotland cannot be considered to be of HNV (in terms of any strong link between the system characteristics and biodiversity value) and generally provide only limited opportunities for utilisation by wildlife through the occurrence of remnant hedgerows and natural features such as woodland or wetlands on the farm.		

9) Horticulture system	FADN: Specialist horticulture	RERAD Farm accounts: No equivalent
Notes Horticulture systems in Scotland can contain a range of different horticultural crop types, some grown in open fields while others are grown under some form of protection (historically in glasshouses but now increasingly under plastic stretched over frameworks placed in the fields). The spacing at which the plants are planted, the regular turnover of crop plants, the fact that much production now occurs under protection and the intensity of any crop protection strategies employed limits the range of wildlife which is able to utilise such horticulture systems. Therefore, the majority of well-managed (from an agricultural production perspective) horticulture systems in Scotland cannot be considered to be of HNV (in terms of any strong link between the system characteristics and biodiversity value) and generally provide only limited opportunities for utilisation by wildlife through the occurrence of remnant hedgerows and natural features such as woodland or wetlands on the farm.		

10) Pig system	FADN: Specialist pigs	RERAD Farm accounts: No equivalent
Notes Pig and poultry systems can consist of housed or free-range systems. Within Scotland, the free range systems do not utilise habitats on the farm as a forage resource (i.e. rather the animals range over the fields but are fed largely bought-in grain and other feedstuff) and hence the farming system does not have a direct link to the habitats occurring on the farm. As such (and because of the intensity of production in such systems) even free-range systems are not considered to have any HNV potential and hence are not considered any further		

11) Poultry system	FADN: Specialist poultry	RERAD Farm accounts: No equivalent
Notes Pig and poultry systems can consist of housed or free-range systems. Within Scotland, the free range systems do not utilise habitats on the farm as a forage resource (i.e. rather the animals range over the fields but are fed largely bought-in grain and other feedstuff) and hence the farming system does not have a direct link to the habitats occurring on the farm. As such (and because of the intensity of production in such systems) even free-range systems are not considered to have any HNV potential and hence are not considered any further		

Appendix 3: The eleven RPAC (Regional Proposal Assessment Committee) regions established in Scotland for the assessment of Rural Priorities proposals within the SRDP.