

Future CAP Payments

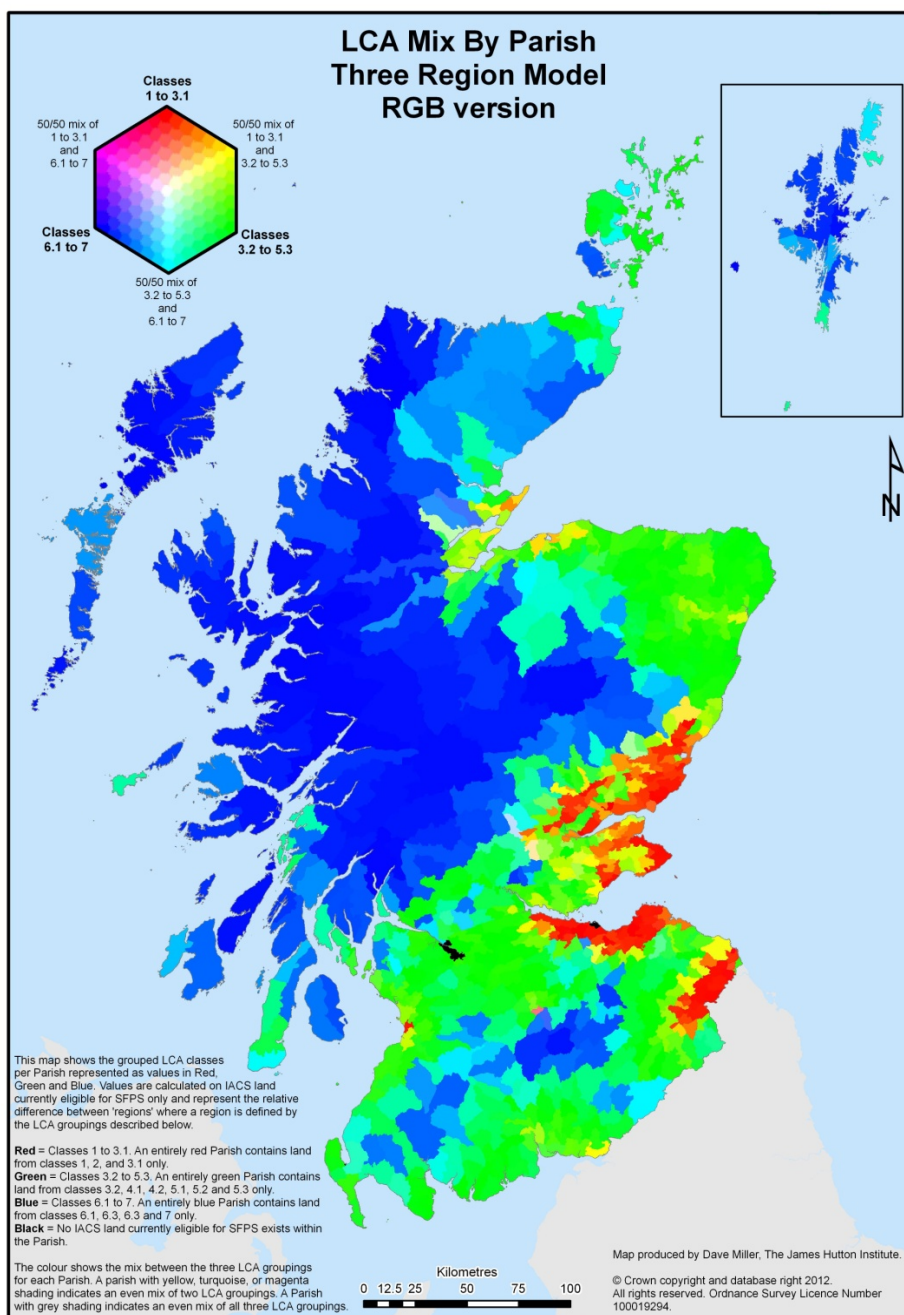
LCA Mix per Parish – An analysis of Land Capability for Agriculture (LCA areas) for each Agricultural Parish

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Final Report



27 November 2012



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EXECUTIVE SUMMARY

The paper presents the results of classifying Parishes on the basis of their LCA mix. This analysis was conducted to define regions by which the area-based Basic Payment Scheme could be distributed. The paper presents two alternative classifications:

- 1) Two regions defined as LCA classes 1-5 and classes 6-7; and
- 2) Three regions defined as LCA classes 1-3.1, 3.2-5.3 and classes 6-7.

The paper presents the methodology and datasets used in the analysis and maps of the resulting classifications. Parishes were included in a class if more than 50% of their eligible area was made up of a single LCA class grouping. In the case of the three region model this left twenty Parishes in which no dominant class could be determined and the paper suggests ways in which a tie-break rule could be implemented. The paper also highlights that using thresholds to place Parishes in a single class does not reflect the diversity of LCA classes present within Parishes. Based on experience from previous research this is likely to result in higher overall levels of redistribution of CAP funding. Depending on the outcome of the classification up to 49% of the area in a two class system or up to 65% of area in a three class system could be paid at rate that would not reflect its inherent qualities, and could be seen as misclassified. In reality the misclassified area is smaller in percentage terms (21% of the eligible area) but still amounts to 1.116M ha. For 759,402 ha (68%) of this misclassified area, better quality land is included in Parishes classified as having a poorer dominant LCA quality and in 32% of the misclassified area poorer quality land is included in Parishes classified as having a better dominant LCA quality. Assuming better quality land paid at higher rates this asymmetry would mean underpayment for the 68% and over payment for the remaining 32%. Individual businesses are unlikely to see over and underpayment even out except perhaps where they straddle Parish boundaries. To better visualise the geographic distribution of this issue an alternative map of the classification emphasising the mix of LCA classes present in each Parish was developed. This highlights where the issues occur and their relative magnitude. The paper concludes by setting out more technical issues, including the quality of digital Parish mapping) some of which may need to be considered with a view to implementation. .

1. INTRODUCTION

This document is intended to contribute to the development of Scotland's position during the post-2013 CAP reform process.

The objective was to establish and map a 'dominant LCA region' for each agricultural Parish under both of the following models:

- 1) Two regions defined as LCA classes 1-5 and classes 6-7; and
- 2) Three regions defined as LCA classes 1-3.1, 3.2-5.3 and classes 6-7.

Dominant LCA was defined as where more than 50% of the land within a Parish fell within one of the regional definitions. The land included only those land parcels currently registered with the Integrated Administration and Control System (IACS) whose land use is eligible for payment of Single Farm Payment Scheme (SFPS). It should be noted that using the eligibility criteria of the Pack Inquiry¹ up to an additional 1.42M ha could be

¹<http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/inquiry>

included in an area-based Basic Payment Scheme (BPS), dependant on the operation of EU regulations on entitlement and decisions on stocking-rate based activity measuresⁱⁱ. These analyses are intended to inform the development of options for the regionalisation of the area-based BPS.

2. MATERIALS AND METHODS

The analysis combined, in a geographical information system (GIS) the IACS field boundary map, the hybrid Land Capability for Agriculture (LCA) mapⁱⁱⁱ and an Agricultural Parish boundary map. The output from this analysis was a table of LCA areas for all 13 LCA classes for each Parish. These 13 classes were grouped based on the classifications defined above, into two and three regions. Figure 1 presents a simplified illustration of the methodology and the outputs in terms of tabular and spatial datasets.

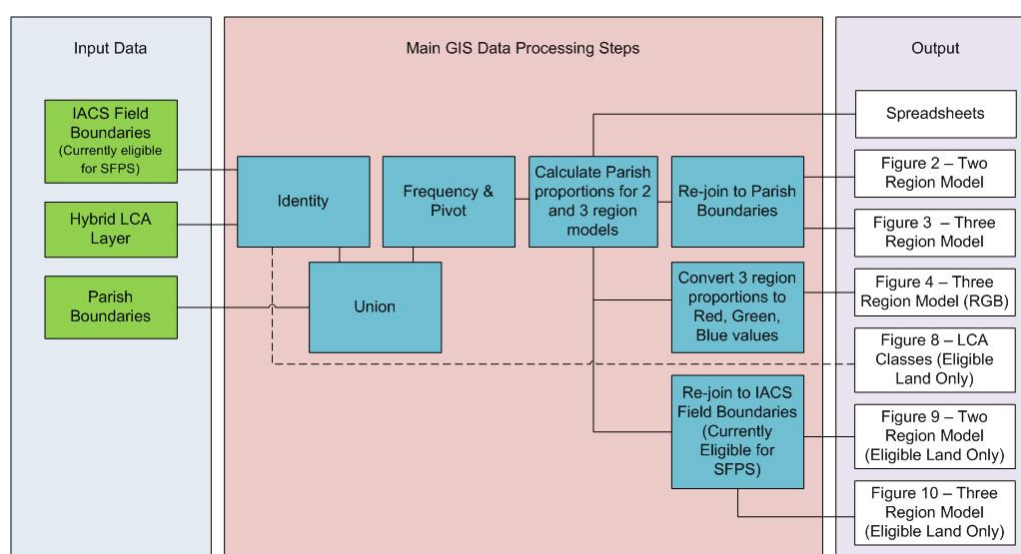


Figure 1: Simplified illustration of the analytical process conducted.

The broad structure of the output tables is given in Table 1

Table 1: Structure of the tabular outputs

Parish	LCA Areas	LCA Regional Totals	LCA Regional Proportions	Dominance
e.g. Alford	Column for each class & division 1 – 7 (13 cols)	For the groupings within either the two region or three region model (5 cols)	The proportions of each region (5 cols)	To denote the dominant class (2 cols)

3. RESULTS

The outputs of this analysis is a dataset containing the total areas of each LCA class per Parish, the total areas contained in each of the regional definitions defined above and their relative proportions. The results of the analysis are summarised in the maps in this section.

The per Parish maps of dominance are shown in Figure 2 for the two region model and Figure 3 for the three region model^{iv}.

ⁱⁱ See <http://www.mcaulay.ac.uk/LADSS/reports/Existing%20and%20New%20Recipient%20Analysis%20v3.0%20FINAL.pdf> for details of the factors influencing potential newly eligible area.

ⁱⁱⁱ A combination of 1:50,000 scale mapping in lowland areas and 1:250,000 scale mapping in upland areas.

^{iv} Note that there are two circumstances where dominance could not be determined for a Parish. In the first there are five

In Figure 4 the mix of the LCA groupings for each Parish is shown to highlight Parishes where a dominance based classification fails to well represent the mix of LCA classes present. Since the three region classification defines the proportion of each LCA grouping present per Parish it is possible by assigning each LCA grouping a primary colour to illustrates the mix of LCA groupings present. The intensity of a primary colour (Red, Green or Blue) indicates the degree of dominance by a single LCA grouping. Intensity of secondary colours (Yellow, Turquoise and Purple) indicate Parishes where two LCA groupings make up the bulk of the area^v. Greys indicate where all three LCA groupings are present. For example the green area in North East Scotland (Figure 3) is made up of substantially different combinations of LCA classes 1 to 3.1 (red) and 3.2 to 5.3 (green). The map emphasises that the boundaries defined by the dominance relationship hide substantial heterogeneity in the proportions of LCA class groupings present.

Parishes where there is no land currently eligible for SFPS within the Parish boundary (Cathcart, Govan, Leith, Rutherglen and Stranraer). In the second, there are twenty Parishes for which a dominant region could not be determined in the three region model due to the balance of areas between the three classes and the threshold for dominance of 50%.

^v Yellow indicates a combination of LCA1 to 3.1 and LCA 3.2 to 5.3, Turquoise a combination of LCA 3.2 to 5.3 and LCA 6.1 to 7 and Purple LCA 1 to 3.1 and LCA 6.1 to 7 (not present).

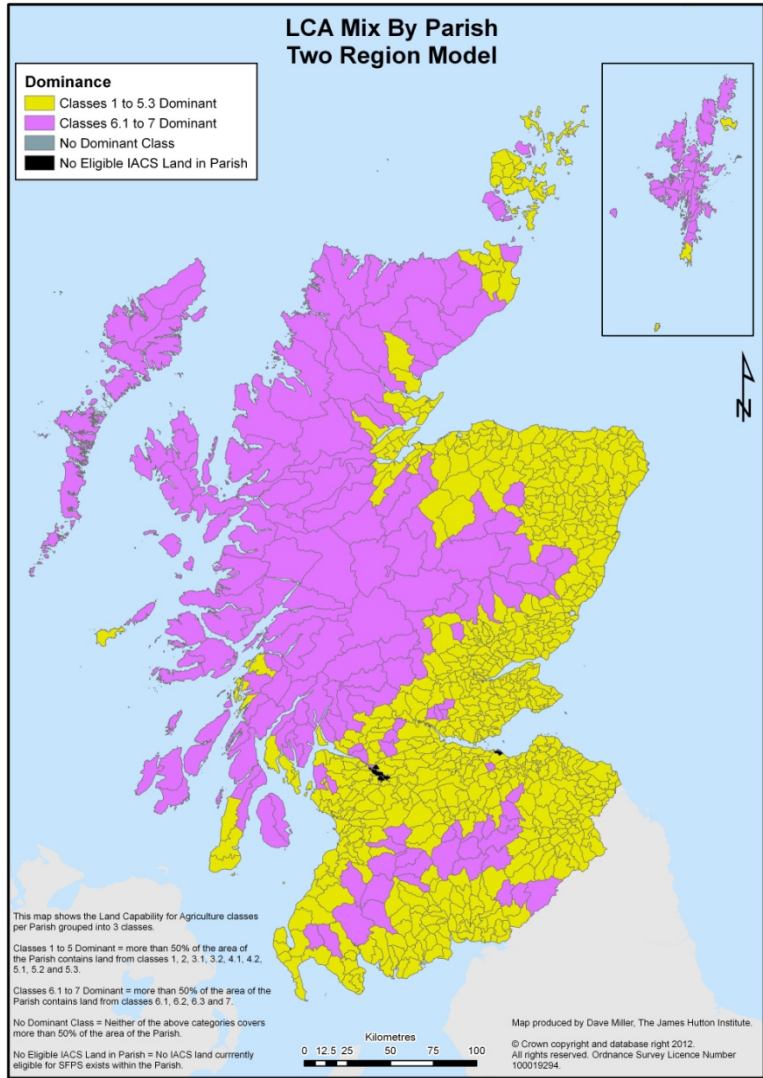


Figure 2: The two region model symbolised for the dominant class

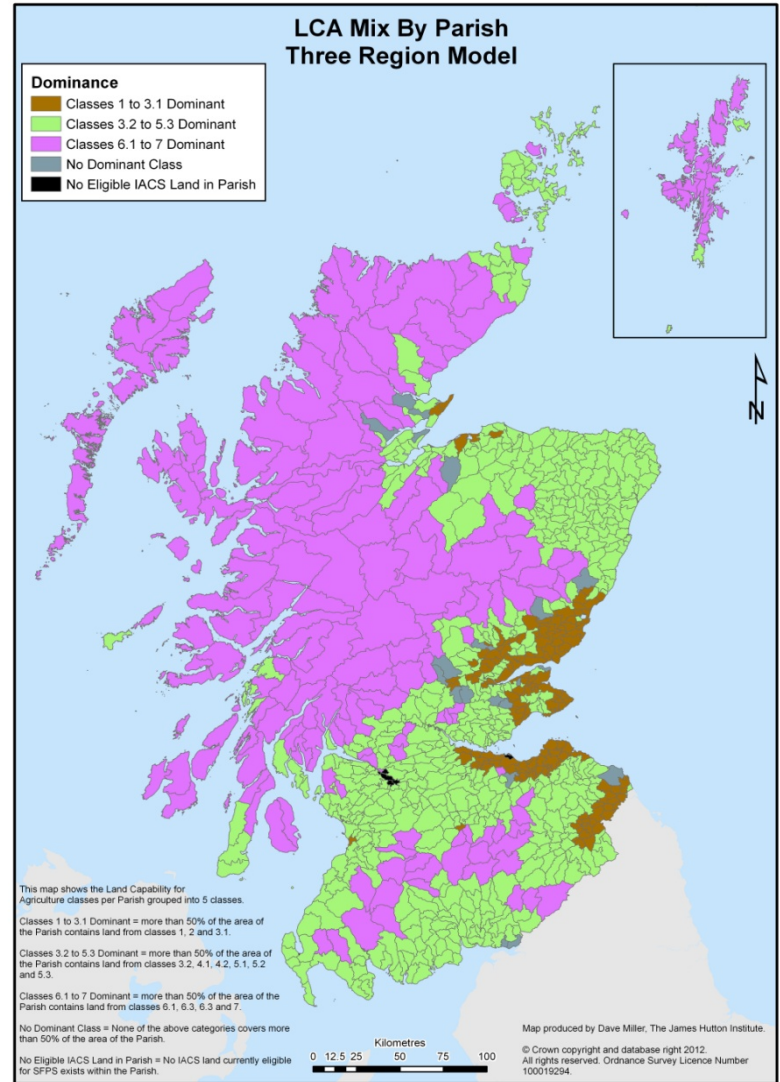


Figure 3: The three region model symbolised for the dominant class

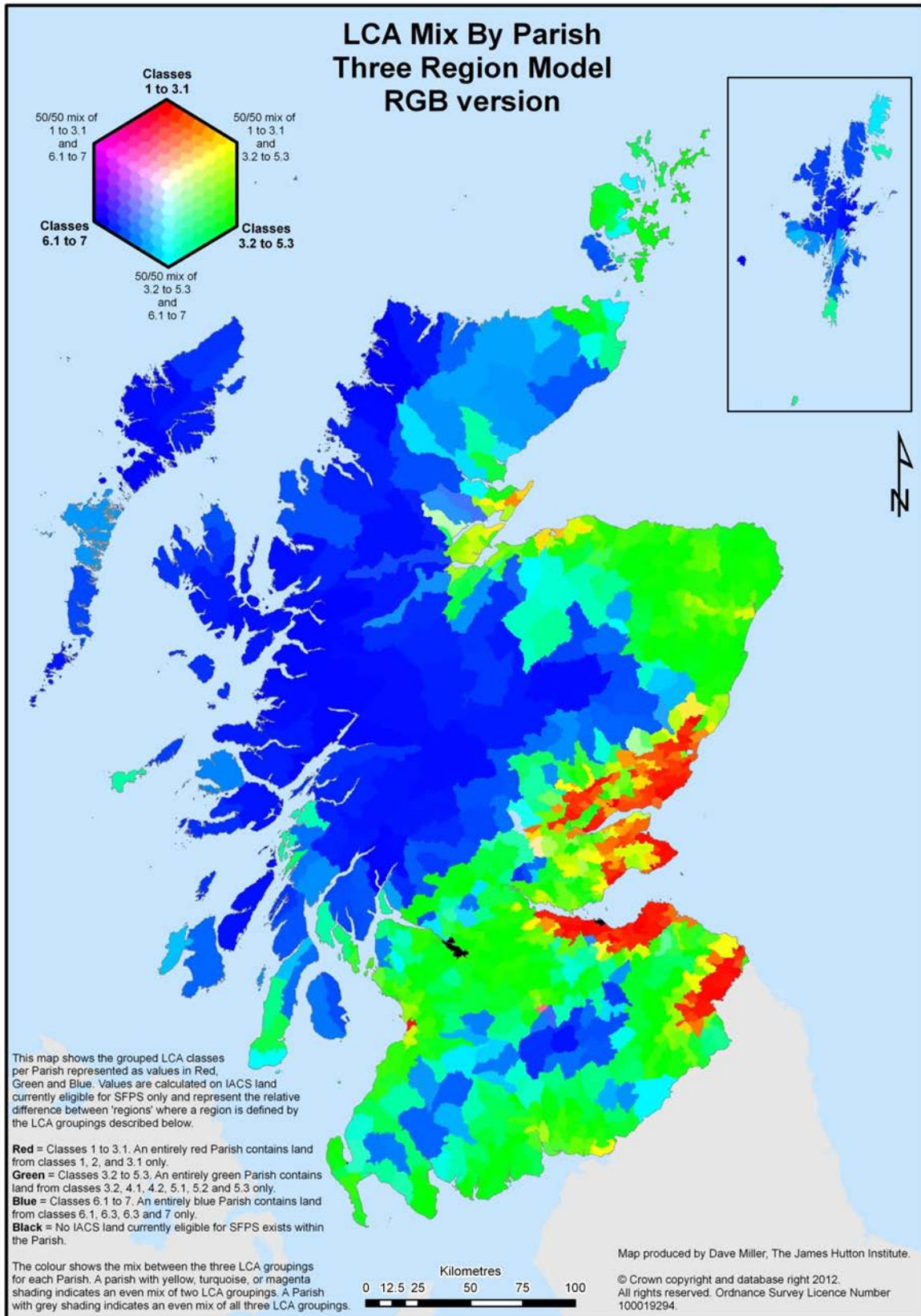


Figure 4: Red, Green, Blue representation of the three region model

3.1. Case Study Parish – Dunning

To illustrate the issues raised by the RGB analysis in greater detail the authors have chosen to present a case study example of Dunning Parish. This Parish was chosen as it has a near equal split of land between each of the LCA groupings in the three region model. While Dunning is not typical in having such an even split between all three LCA groupings the extent of Parishes lacking a single dominant LCA class can be readily appreciated by the map in Figure (the red, turquoise and grey Parishes). The magnitude of dominance is further explored in Section 4.1.2.

The location and extent of Dunning Parish is presented in the first two maps in Figure 5. This is a Parish with a wide range of LCA classes present (see the third map in Figure 5). There are 12 separate LCA classes present in this Parish ranging from LCA class 2 land through every class and division to LCA class 7, and built up land. There are approximately 75 holdings whose boundaries fall within this Parish. Their size ranges from less than 1 hectare to over 1,100 hectares.

While the two region analysis places this Parish in the ‘Class 1 to 5.3 Dominant’ category (yellow in Figure 2), the three region analysis places this Parish in the ‘No Dominant Class’ category (grey in Figure 3 and the fourth map in Figure 5) indicating that none of the categories totals an area >50% of the currently eligible IACS land in the Parish. The Red-Green-Blue mix for the three region dominance analysis yields a yellow-green colour (fifth map in Figure 5) indicating that this Parish is mainly a mix of the class 1 to 3.1 grouping (red) and the 3.2 to 5.3 grouping (green). In fact when looking at the proportions for this Parish the LCA 3.2 to 5.3 grouping just fails to form a majority. Table 2 shows the proportions for each LCA grouping or region for the Parish.

Table 2: Proportions of LCA Groupings in Three Region model for Dunning Parish

LCA Grouping or Region	Proportion of currently eligible IACS land in Parish
Classes 1 to 3.1	33.98%
Classes 3.2 to 5.3	49.75%
Classes 6.1 to 7	16.27%

At only 0.26% short of being assigned to the LCA 3.2 to 5.3 grouping in the three region model, this Parish is highly sensitive to any change either in eligible claimed area, a shift in the dominance threshold (see Section 4.1.1 for discussion on thresholds) or in a shift in the Parish boundary (see Section 4.2 and Appendix I – Examples of Parish Boundaries). Any change in one of these datasets could be sufficient move the classification for this Parish into the LCA 3.2 to 5.3 grouping.

The example also serves to illustrate that through using a Parish level classification based on dominance there will be substantial areas of land that will be paid at rates that would not reflect their inherent qualities as defined by their LCA class. Assuming higher rates of payment are made to higher quality LCA classes such misclassified land either receives higher payments (in this case the 16% of land in the LCA 6.1 to 7 classes) or lower rates of payment (the 34% of land in LCA 1 to 3.1 classes). These effects are not estimated relative to current entitlements but against the intent that groupings of LCA classes be paid at a single defined rate. Using a parish-level dominance-based classification means farmers with different land qualities in the same parish will be paid the same rate, yet across the parish boundary farmers with the same quality of land could be paid different rates. This would seem to raise issues of consistency of outcome.

This conclusion is reinforced when a holding level analysis is undertaken. For each holding a Red-Green-Blue visualisation value was determined using the per-holding mix of LCA classes. The last image in Figure 5 shows how these proportions of LCA Grouping combine for each holding. While all of the holding boundaries cannot be seen in this representation, it is clear that there are a wide variety of dominant land qualities within holdings in this Parish. To the north the holdings are strongly red, indicating a majority of Classes 1 to 3.1 land while to the south some holdings are strongly blue indicating a high proportion of LCA 6.1 to 7 classes. The use of a single dominant LCA class grouping across the Parish does not even out within holdings, but results in redistribution of payments between holdings within the Parish. These parish-based effects seem likely to increase the overall rates of redistribution seen in previous CA based analyses^{vi} but further research is required to confirm this hypothesis.

^{vi}Kevin Buchan, Keith Matthews, Dave Miller, Willie Towers (2010) Modelling Scenarios for CAP Pillar 1 Area Payments using Macaulay Land Capability for Agriculture (& Less Favoured Area Designations), Final Report for RESAS. http://www.macaulay.ac.uk/LADSS/research_policy.html.

LCA Regionalisation Example - Dunning Parish

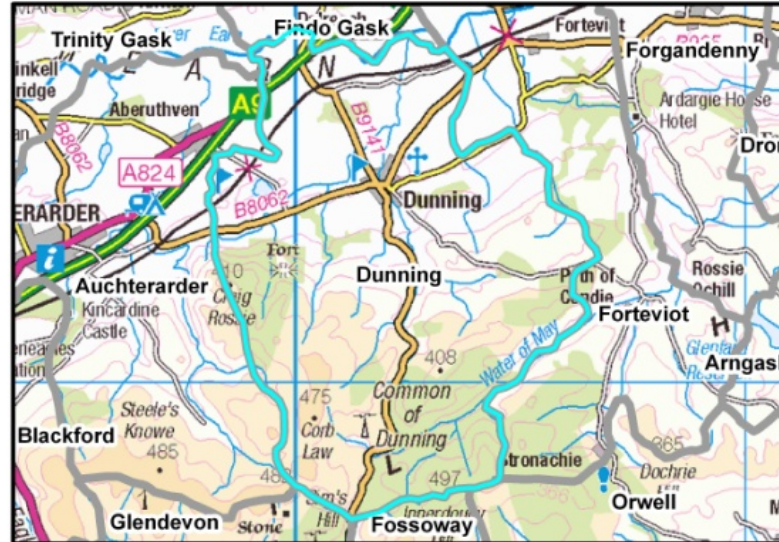


Location of Dunning Parish



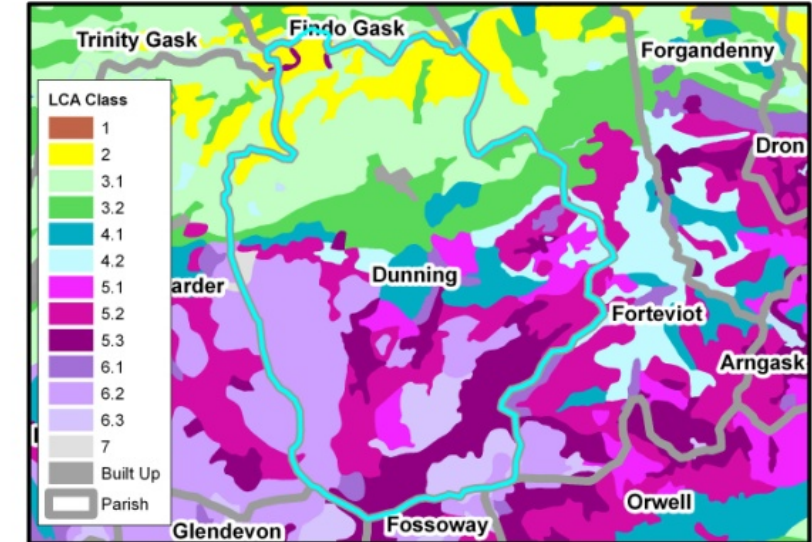
This map shows the location of Dunning Parish just east of the A9 between Perth and Stirling.

OS 1:250,000 Mapping of Dunning Parish



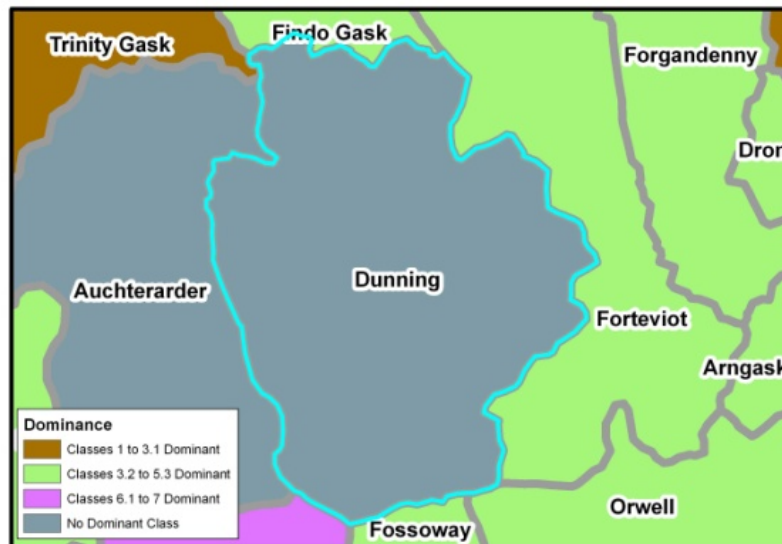
This map shows the Ordnance Survey 1:250,000 scale mapping of the Dunning Parish and surrounding area.

Original LCA Mapping



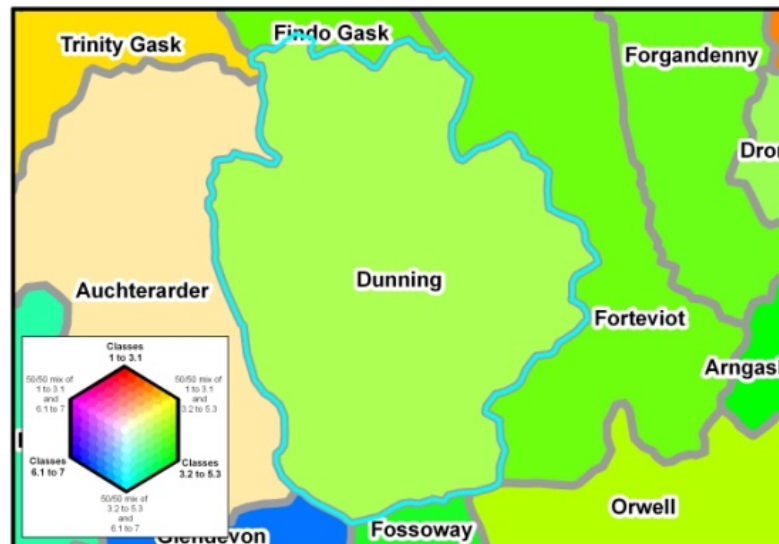
This map shows the hybrid Land Capability for Agriculture mapping. Dunning Parish (highlighted in blue) consists of 13 separate LCA classes from class 2 through to class 7.

LCA Mix By Parish - Three Region Model



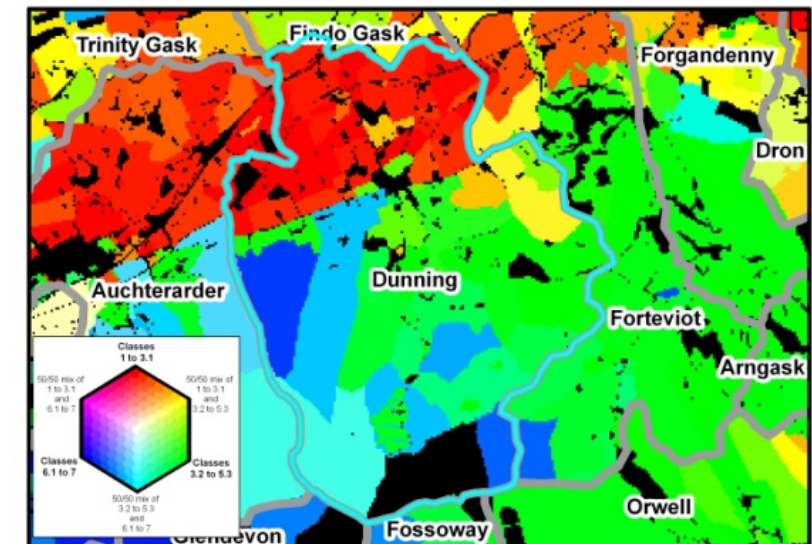
In terms of the 'Dominant Region' under the three region model Dunning Parish falls within the No Dominant Class grouping.

LCA Mix By Parish - Three Region Model (RGB)



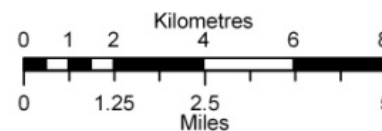
This map shows the Red-Green-Blue mix for the Three Region Dominance analysis at Parish level where the mix of Red-Green-Blue reflects the mix of the three LCA groupings in this model. The green colour shows that the Parish is a mixture of groupings.

LCA Mix By Holding - Three Region Model (RGB)



The Red-Green-Blue mix for the Three Region Dominance analysis can also be conducted at Holding level. This shows that the Holdings within Dunning Parish are split between the better quality land in the north and the poorer quality land in the south.

The maps on this page showcase an example Parish (Dunning) which contains a mix of LCA classes and holding sizes. They are designed to show the effect of the Three Region Model when applied to a Parish with a wide variety of LCA classes and holding sizes.



Maps produced by Dave Miller, The James Hutton Institute.

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Figure 5: LCA Mix By Parish - Dunning Parish

4. TECHNICAL COMMENTARY

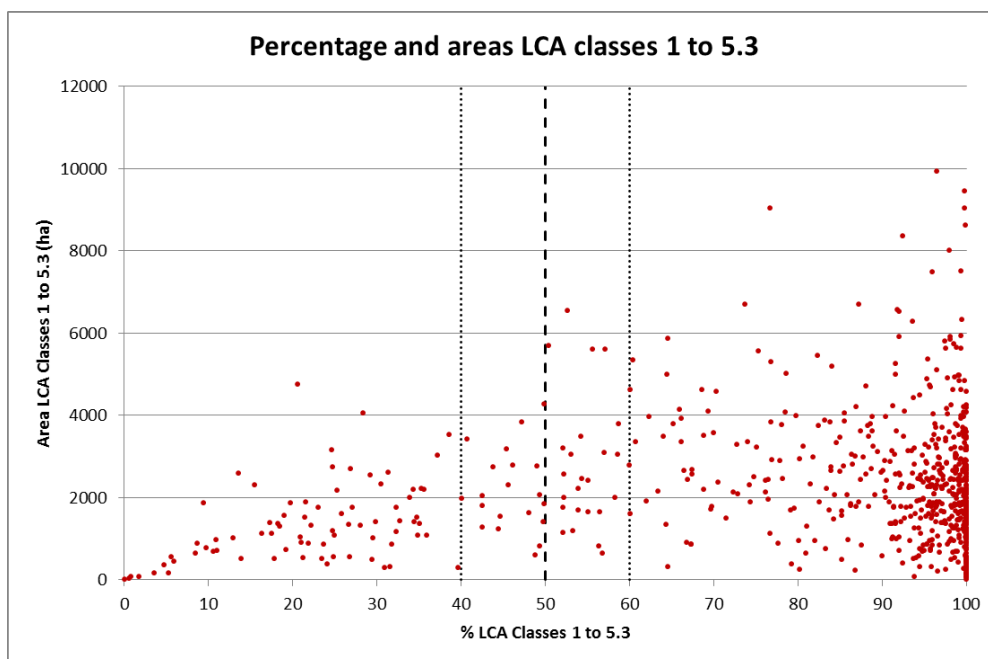
4.1. Thresholds, Tie-breaking, MAUP and Other Consequences

Whilst it is possible to produce the dominant grouped LCA class according to the regions specified, the resulting predominance maps disguise more subtle variation between Parishes as seen in the RGB representation. It is also necessary to comment on other features of the resulting dataset and their implications for operational use.

4.1.1. Thresholds

With only two LCA groupings defining the regions a simple majority (>50%) of eligible area can be used to determine the predominant LCA grouping in a Parish. Where there is a near balance between the two LCA class groupings then there will be substantial proportions of higher quality land included in Parishes classified as LCA 6.1 to 7 dominant. If LCA 1 to 5.3 were to receive a substantially higher rate of payment then it is possible that these areas could be severely disadvantaged. To explore the magnitude of this issue a supplementary illustration has been generated (Figure 6). The upper graph shows the percentage share of LCA 1 to 5.3 land and the area the percentage this represents for each Parish. Those Parishes to the right of the 50% line are classified as LCA 1 to 5.3 dominant.

The first part of the figure shows the number of Parishes (and their area) effected by a plus or minus 10% change in the dominance rule. The second part of the Figure 6 shows the total additional area that would be included if the threshold were relaxed or tightened by the same 10%. Relaxing the threshold (setting dominance at a value less than 50%) would include more of the Parishes to the left of the 50% line and tightening the criteria (dominance at a value greater than 50%) would remove some of those to the right. This could provide a fine tuning mechanism for the implementation of a parish-level, LCA –based BPS.



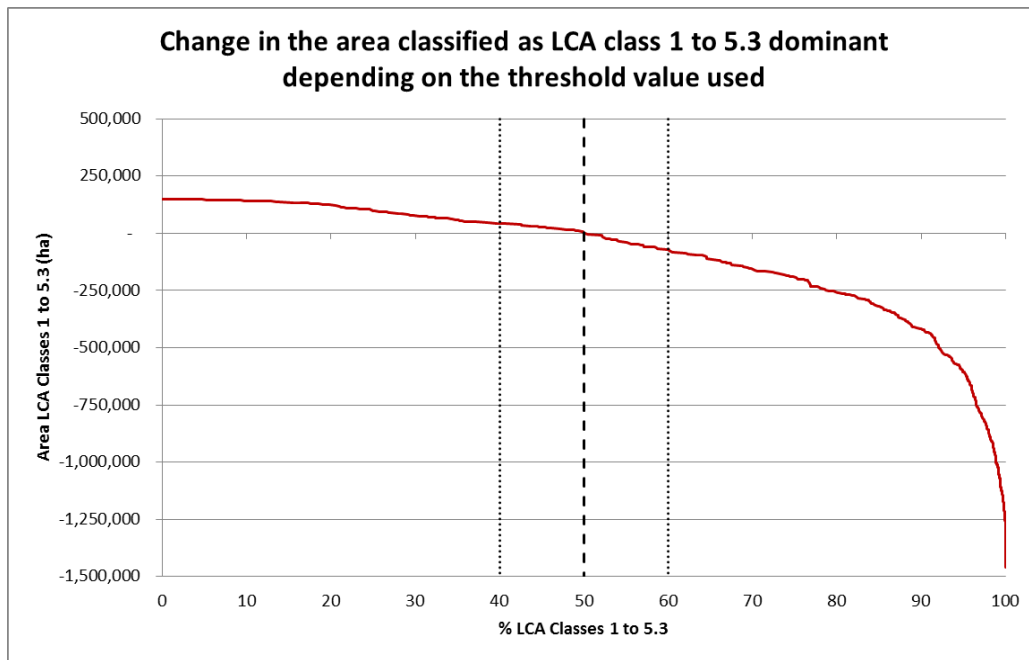


Figure 6: The total change in areas associated with relaxing or tightening the threshold for dominance.

4.1.2. Tie-breaking

Where more than two zones are used then the need for tie-breaking arises when an overall majority is not achieved. The need for tie breaking occurs in 20 parishes with a total area of 80,780 Ha of included land with LCA classes 1 to 7. A tie breaking rule is necessary as it would be highly undesirable to classify Parishes on the basis of simple majority when none achieves more than 50% of the overall included area. In a three regions model, this would mean that a Parish with 34% in the LCA 6 and 7 class grouping could achieve a majority and mean that the remaining 66%, if split equally across the other two regions, would be paid at the rate for the poorest quality land (option a in Figure 7). In this case the suggestion is that in the event of no class having predominance (however defined) then the Parish should be placed in the middle class. This is because since the combined area of LCA class 1 to 3.2 and LCA class 3.2 to 5.3 together must exceed the predominance threshold otherwise the LCA class 6.1 to 7 would have been predominant (option b in Figure 6).

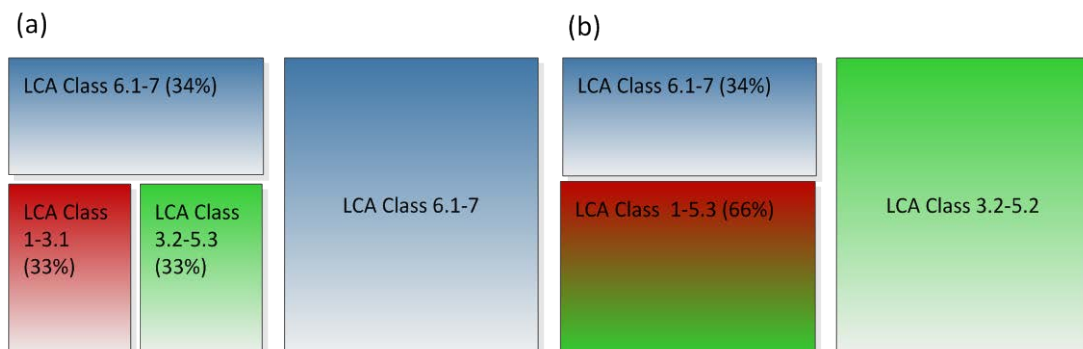


Figure 7: An undesirable outcome of majority decision with three LCA class groupings (a) and a tie-breaking option (b)

While there are small numbers of Parishes without an overall majority there are 129 where the majority is less than 10% of the eligible LCA class 1 to 7 area (see Figure 8). This means that for these Parishes the classification is more likely to be sensitive to the quality of input datasets.

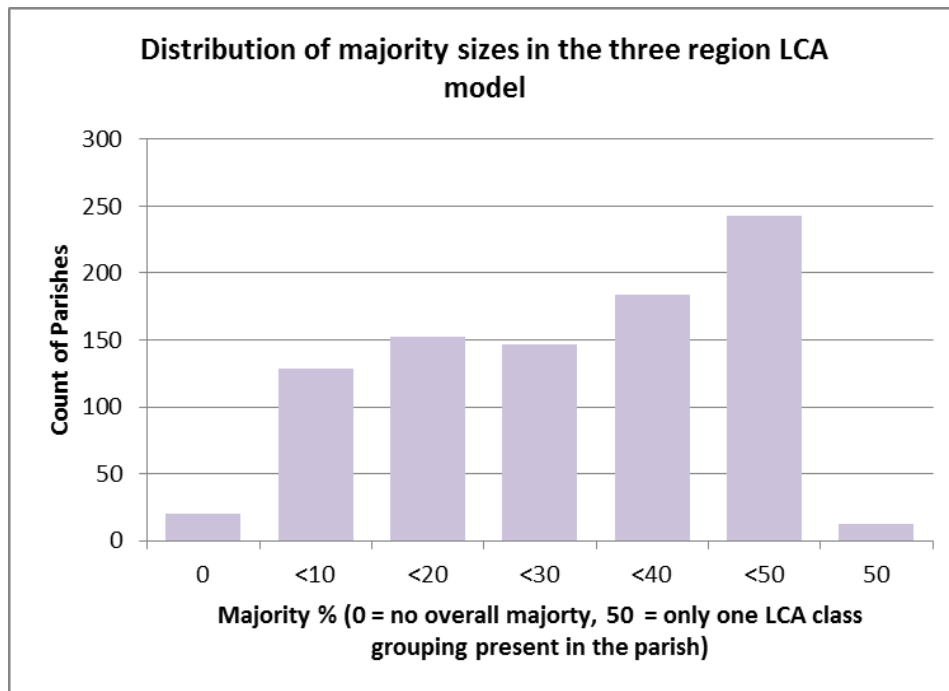


Figure 8: The count of parishes classified by the size majority for the dominant LCA class

4.1.3. Modifiable Areal Unit Problem (MAUP)

Despite the use of thresholds and tie-breaking it is likely that the use of Parishes as the unit of aggregation for a classification based on predominance will result in inconsistencies. It is possible because of the variation in the size of Parishes that the same area of better quality, LCA class 1 to 3.1, land included in a small Parish would result in the Parish being classified as predominantly LCA class 1 to 3.1 but in a larger Parish would not constitute predominance and the Parish would be classified as another LCA class grouping (compare Parishes 1 and 2 in Figure 7). Indeed it is possible again due to variations in the size of Parishes that the area of better quality land included in a Parish classified as another LCA class grouping could be considerably larger than that within a smaller Parish classified as LCA class 1 to 3.1 (shown by Parish 3 in Figure 7). This is an artefact of the use of Parishes as the unit of classification and is referred to as the Modifiable Area Unit Problem (MAUP).

The area of other LCA classes included within Parishes classified as LCA class 1 to 3.1 dominant is 53,255 Ha. For Parishes classified as LCA class 3.2 to 5.3 dominant the other classes make up 451,073 Ha. Finally, for Parishes classified as LCA class 6.1 to 7 dominant the other classes make up 612,092 Ha. Thus the use of Parishes as a unit of classification means that 1.116 M Ha would be paid at a rate other than the one intended based on the land's LCA class grouping.

The asymmetry of the errors is also significant with a much larger incidence of areas of better quality land being included in Parishes classified with poorer LCA groupings: 612,092 of LCA class 1 to 5.3 land within LCA 6.1 to 7 dominant Parishes, and 147,310 Ha of LCA class 1 to 3.1 land within LCA class 3.2 to 5.3 dominant Parishes. The total area of higher quality land included in Parishes with a poorer dominant LCA grade is thus 759,402 Ha. This contrasts with 357,017 Ha of poorer quality land included in Parishes where the dominant LCA grouping is higher.

The magnitude of these misclassification errors perhaps need to be taken into account when assessing the merits of a Parish based approach or using the LCA mapping directly at individual farm business level.

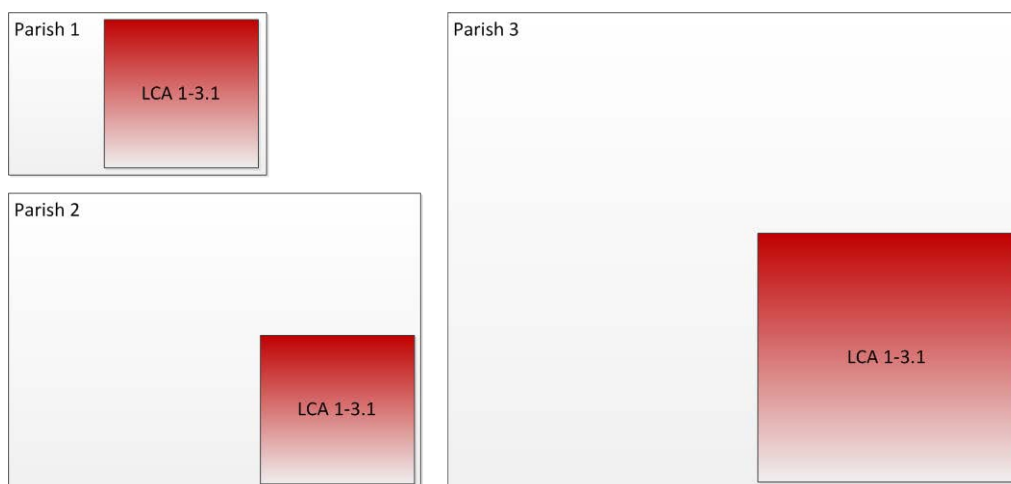


Figure 9: Example of the modifiable areal unit problem (MAUP) and its effects on Parish classification

4.2. Strengths and Limitations of the Parish Mapping

Parishes have significant strengths; being of intermediate size (average ~80,000 ha) and often being defined by natural features that coincide with property or management boundaries. They are also well understood by stakeholders. Use of Parishes as a unit of aggregation for LCA overcomes the limitations of the large scale LCA dataset since it means that a spatial linkage does not define the payments for individual fields.

Setting payments for a business will, however, require determining which fields (or parts of fields) fall within a Parish or other region since it would be highly undesirable to allocate a payment rate to all fields in a business based solely on the basis of the location of the main farm buildings^{vii}. This means that the quality of the Parish boundary dataset is crucial if the same issues as those that affect the LCA dataset are to be avoided.

Parishes are not, however, a boundary actively used by other parts of government. From communication with the National Library of Scotland, the Parish boundaries were last revised in 1929 and their direct administrative function ceased in 1930. They appear in no standard digital dataset from the Ordnance Survey. **The existing digital Parish map was digitised by then Scottish Office in 1994 almost certainly from a 1:63,360 scale map^{viii} (1" to the mile) and has serious limitations in terms of the quality of digitising and the registration of the digitised map (errors of up to 200m, for examples see Appendix I).** These errors have the consequence that Parishes could be misclassified in terms of their predominant LCA class and that land parcels may be assigned to the wrong Parish and thus receive the wrong payment rate. These errors could be overcome by recapturing the Parish boundaries from the 1:63,360 scale mapping with more modern digitising methods and perhaps using older but more accurate mapping 6" to mile or 25" to mile mapping (available only for parts of Scotland).

Other digital geographies are available that could serve as a basis for regionalisation. Wards have been considered by the ANC working group as an alternative to Parishes. Wards, however, have the disadvantage of being much larger in the most remote rural areas (with low population densities) and very small in peri-urban

^{vii} This is particularly an issue for multi-holding businesses with widely separated holdings but with Parishes there are also significant numbers for holdings that cross boundaries.

^{viii} Not 1:625,000 as stated in the Scotland's Key Geographies: Part 1 Definitions and Inventory, <http://www.scotland.gov.uk/Publications/2005/08/31114510/45128#a7>.

areas. This wider range of sizes makes it harder to justify using of wards as the preferred unit of aggregation for area based payment schemes as the granularity of aggregation is even less well linked to the variability of the phenomena. Other alternatives would include geographies used by the General Register of Scotland (GROS) with a range of options possible and which have the advantage of smaller scale units nesting exactly within the larger. However, these geographies would also give rise to the MAUP problem outlined earlier.

4.3. Caveats to the analysis

While the results presented are robust enough to inform policy and implementation deliberations they have necessarily included decisions that could affect the classification of Parishes. These are highlighted here as the decisions would need to be revisited when implementing an operational scheme.

4.3.1. Defining utilisable agricultural area included and excluded land uses

Within the specification of the research the area to be considered in defining the LCA mix for the Parish was the utilisable agricultural area (UAA). UAA is defined by included and excluded land uses. This means that below the Parish level summary there is still the need to overlay in a GIS the land parcels map with the LCA map. As noted in other reports the 1:250,000 scale LCA map for much of Scotland has significant limitations in supporting such an analysis. Since the results are aggregated to Parish level, however, the individual errors are less likely to be significant except where the LCA mix means the Parish is on the margins of two LCA class groupings (where the tie – breaking rules should mean individuals are not disadvantaged). The use of land use data does, however, raise two issues – predominance and extrapolation.

4.3.2. Predominance

Where multiple land uses and multiple LCA classes are present within a field it is not possible to be certain on which LCA class(es) each land use occurs because within-field distributions of land uses are not explicitly represented. Use of a single predominant land use per field removes this issue and in most cases has little impact on the final outcome (in 2009 2% of the area was affected with rough grazing affected most and most errors being very small). Use of predominant land use could, on the other hand, mean that ineligible land uses would be included and eligible land uses may be missing, particularly since woodland (ineligible) and rough grazing (eligible) are the two land uses most affected by predominance. This could affect the final Parish classification, particularly where majorities are small. The predominant land use dataset for 2011 was used in this analysis since staff and time availability were constrained. A further analysis of the sensitivity of the Parish classification outcomes to this issue is possible using individual IACS claim data for each field. The claims data can be classified into included and excluded classes and if multiple LCA classes are present then claimed areas may be disaggregated across the LCA classes assuming a relationship between the land use classes and LCA is made. Previous analysis has assumed best-first inclusion for LCA classes but this can be distorting by over-representing the better LCA classes and a *pro rata* approach may be preferable. Note that this analysis while improving the definition of the land uses present, relies on assumptions about their relationship with LCA classes and therefore introduces a different and unquantifiable uncertainty.

4.3.3. Extrapolation

As with predominance, extrapolation introduces uncertainty into the definition of the included and excluded

areas. Extrapolation is required when the claimed area is less than the area of the land parcel in the GIS field map. In the predominant land use map used in this analysis the land use is assumed to apply to the whole area of the field. In most cases this is not an issue, but where there are significant areas where no land use is recorded then extrapolation may introduce errors in defining the included and excluded land uses and thus the Parish LCA mix. Again rough grazing (10% of area) is affected most, but also grasslands (5%) and forestry (4%) based on previous 2009 data. Use of IACS claims data only would again raise the issue of how to determine which of the LCA classes the land use occurred on. Some of these issues may be addressed by combining the IACS mapping with decadal sources of land use data such as the National Forest Inventory and this is being explored within the SG strategic research programme.

4.3.4. Representation of the Parish level data as maps

In mapping the predominant LCA class grouping a single colour is applied to the whole area of the Parish. This results in a map with strongly defined boundaries and apparent certainty. The degree of uncertainty in the predominance decisions is communicated well in the supplementary RGB map. The impression, however, is also given that the LCA class grouping applies to the whole area of the Parish. It is perhaps useful to consider presenting the Parish level classification only for the included land parcels as this emphasises where the scheme would and would not apply. Figure 8 below shows the LCA classification for only those IACS polygons included in the calculations – that is IACS land currently eligible for SFPS – while Figure 9 and Figure 10 show the LCA Mix by Parish for the Two Region and Three Region models using the same currently eligible IACS fields only.

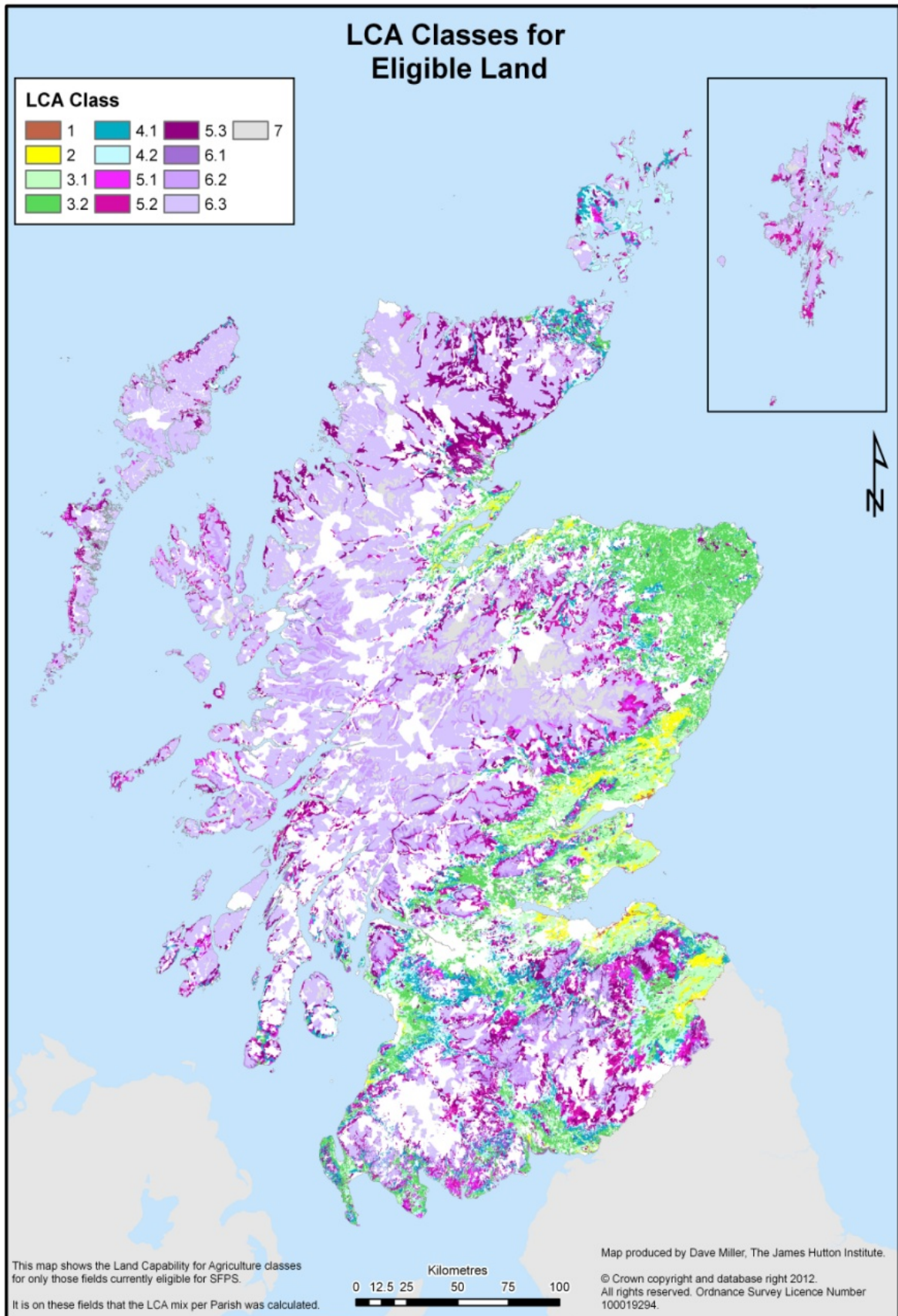


Figure 10: The Land Capability for Agriculture classification for IACS land currently eligible for SFPS only.

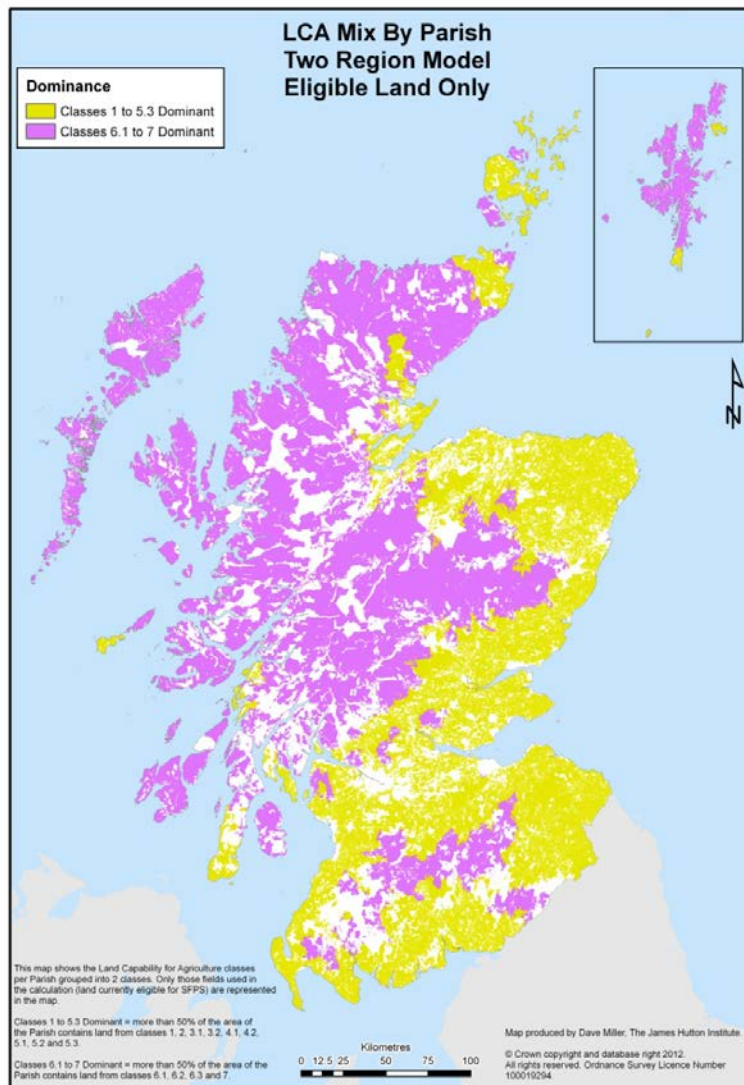


Figure 11: LCA Mix by Parish for the Two Region model for IACS land currently eligible for SFPS only.

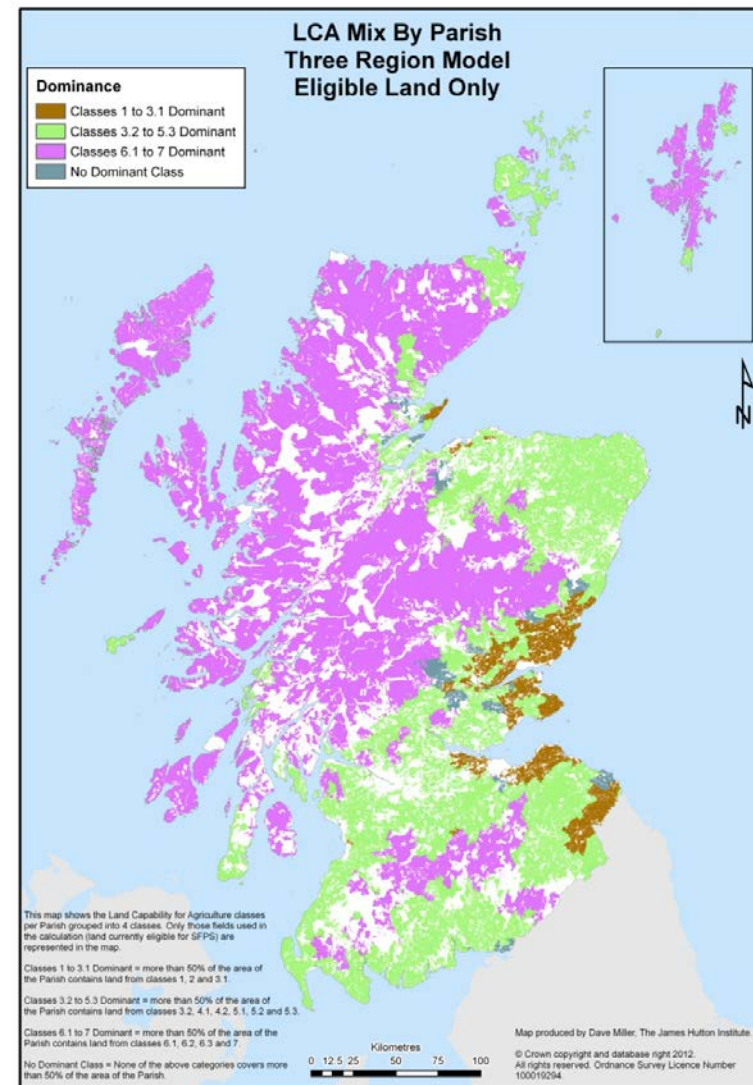


Figure 12: LCA Mix by Parish for the Three Region model for IACS land currently eligible for SFPS only.

APPENDIX I – EXAMPLES OF PARISH BOUNDARIES

Kemnay Parish – Aberdeenshire I

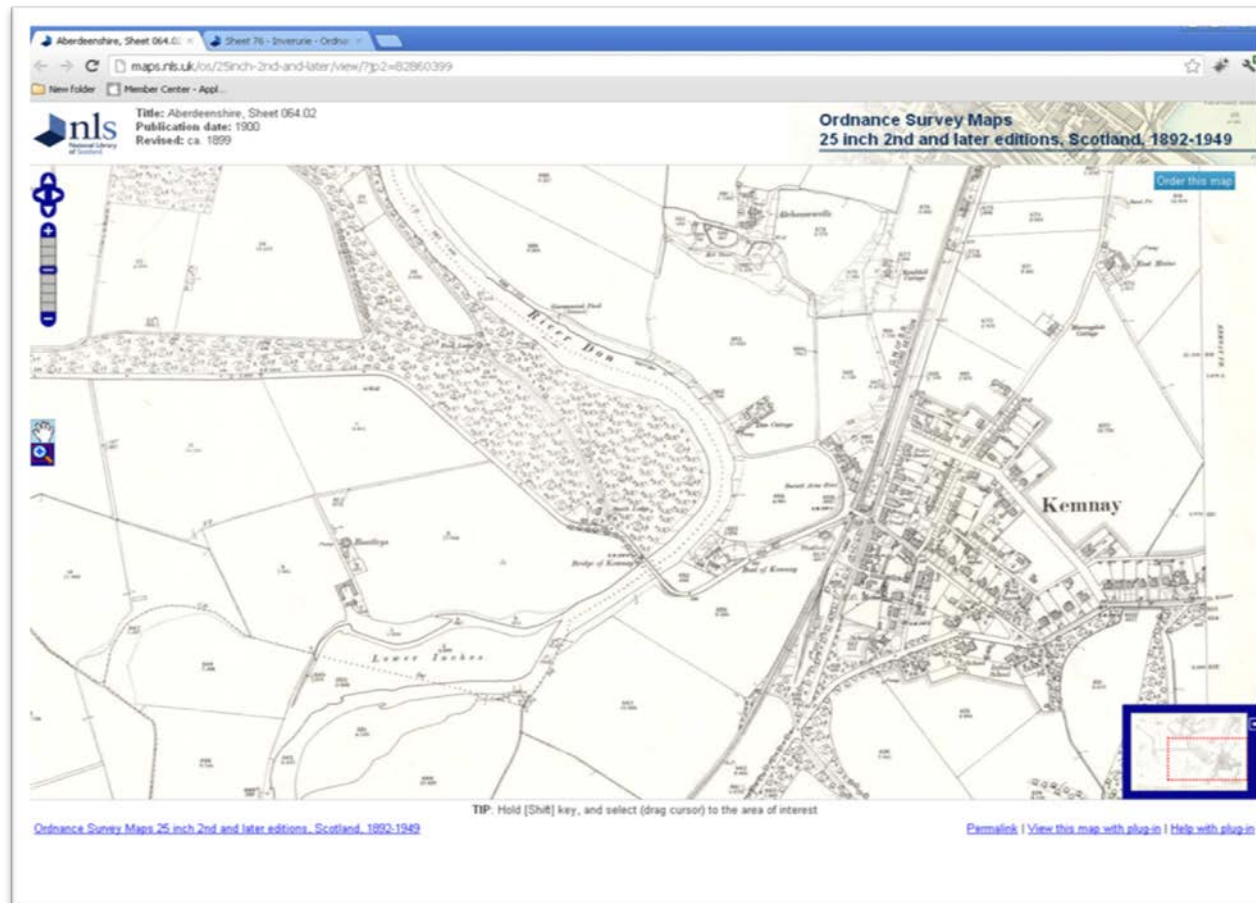


Figure 13: The boundary for Kemnay Parish in Aberdeenshire as represented on the Ordnance Survey 25-inch to the mile series. Note the dotted line through the centre of the river Don which represents the Parish boundary. Compare this to the red line as captured in the digitised Parish Boundary layer shown in Figure 12.

Kemnay Parish – Aberdeenshire II

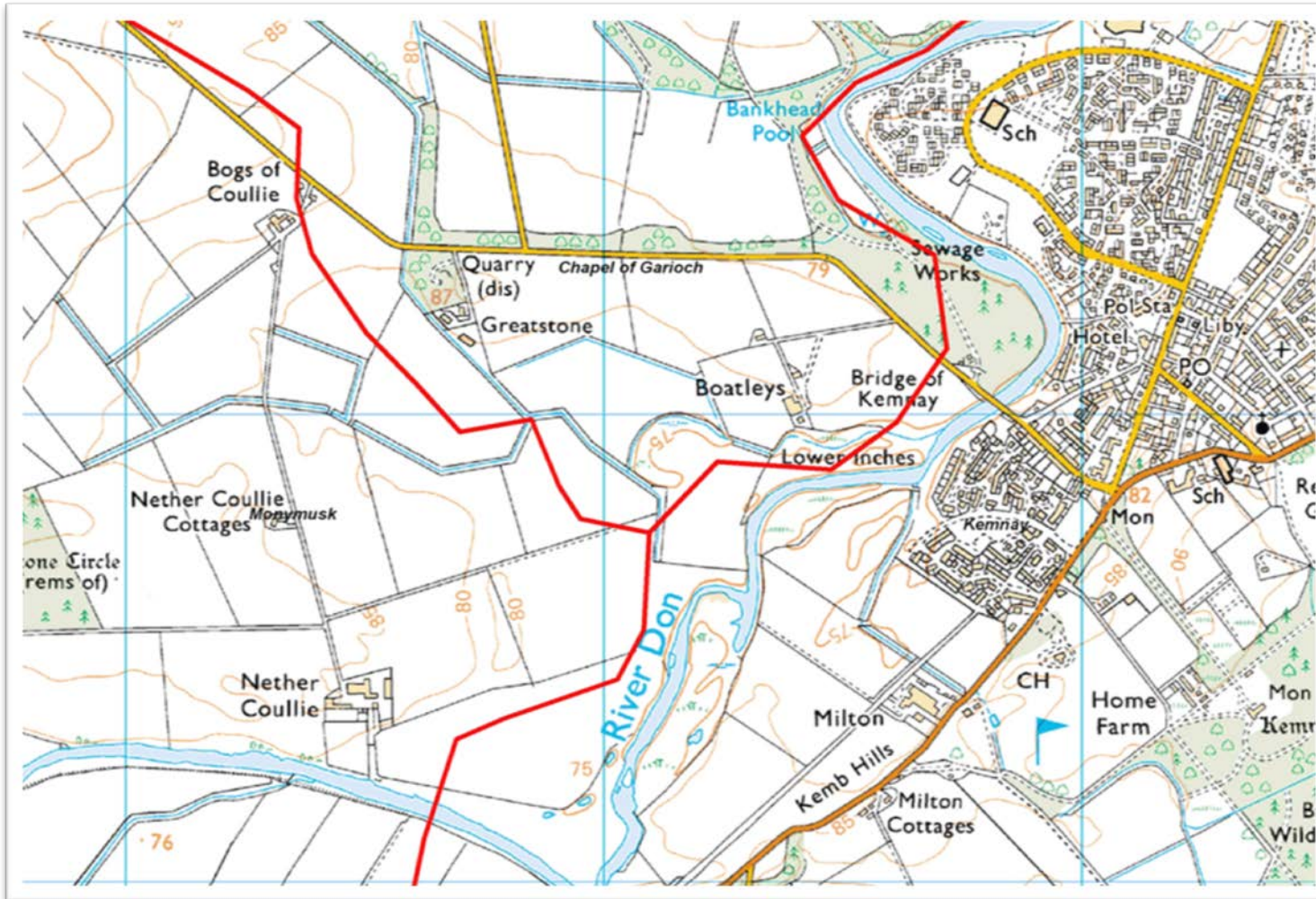


Figure 14: The Parish boundary layer (in red) overlain on Ordnance Survey 1:50,000 scale mapping for a section of the Kamnay Parish in Aberdeenshire. Notice the difference between this line and the boundary line as captured on the 25-inch to the mile series shown in Figure 11.

Stirling

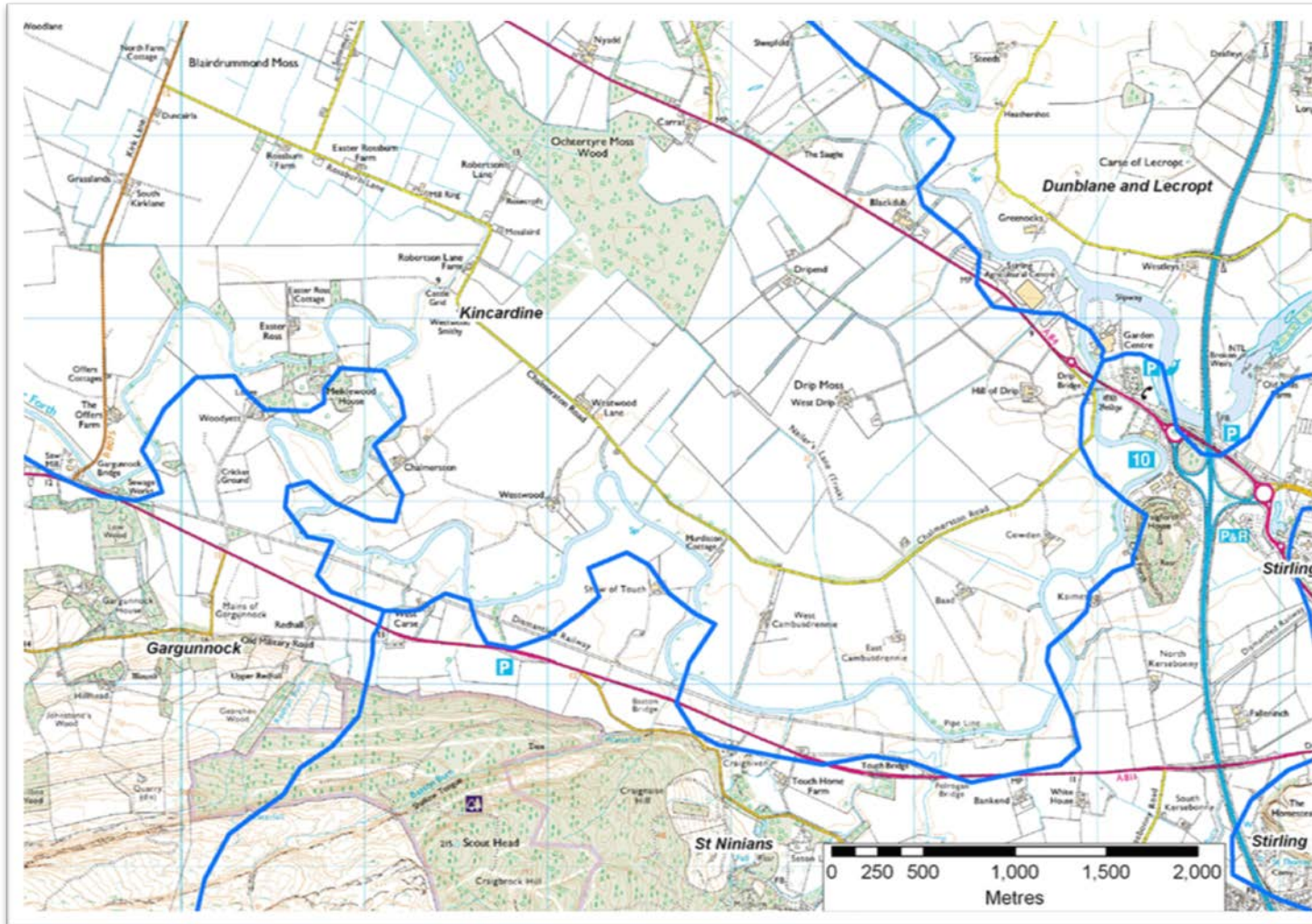


Figure 15: The Parish boundary layer in an area to the west of Stirling (in blue) overlain on Ordnance Survey 1:50,000 scale mapping. Notice that the boundary appears to be approximately 200m south of its true position.

Yell - Shetland



Figure 16: This image shows the Parish boundary layer (in red) together with the Ward boundary layer (in blue) for a part of Yell, Shetland. Notice how the Parish boundary appears to be approximately 200m west of its true position.