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Published in:
Scottish Geographical Journal

DOI:
[10.1080/14702541.2017.1353703](https://doi.org/10.1080/14702541.2017.1353703)

First published: 26/07/2017

Document Version
Peer reviewed version

[Link to publication](#)

Citation for published version (APA):

Sutherland, L-A., Hopkins, J., Toma, L., Barnes, AP., & Matthews, K. (2017). Adaptation, resilience and CAP reform: a comparison of crofts and livestock farms in Scotland. *Scottish Geographical Journal*, 133(3-4), 192 - 213. <https://doi.org/10.1080/14702541.2017.1353703>

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Adaptation, Resilience and CAP reform: A comparison of crofts and livestock farms in Scotland

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Word Count: 6653 (excluding references and tables).

Abstract

In this paper, we assess the recent and anticipated changes on Scotland's livestock-producing crofts, using a representative survey of Scottish farmers undertaken in 2013. We find that crofters are similar to other livestock farmers, both inside and outside of the traditional crofting counties, in terms of age, years of involvement in the holding and percentage of identified successors, but are less likely to own their holdings or to operate them for profit. Crofters reported being more subsidy dependent than other livestock producers, and many appear likely to retreat from crofting in the event of substantive subsidy reductions. However, crofting respondents identified input costs, regulations, commodity prices and climate change as having had greater influence on how they manage their crofts than the 2005 transition to the 'Single Farm Payment'. Overall, crofters reported making fewer changes than their counterparts in non-crofting counties, but similar levels to those of other livestock farmers within crofting counties, suggesting less 'room for manoeuvre' within the remote areas in which most crofts are located. However, there is some evidence that 'active' crofts are 'bouncing forward' in response to recent challenges, particularly into forestry and agri-tourism, also reporting significantly higher perceived economic prospects.

Introduction

Scotland's crofts are popularly defined as 'small pieces of land entirely surrounded by legislation' (Shucksmith & Rønningen 2011). Historically, crofts were small-scale, tenanted properties, tied to employment on estates. A series of Acts passed since 1886 have provided crofters with security of tenure, rights to fair rents and compensation for improvements they have made to their crofts (if their tenancy ends - Scottish Crofting Federation 2016). Over the past 25 years, crofting has received considerable policy attention: the legislation on crofting was codified as the Crofters

(Scotland) Act in 1993, followed by reforms addressing 'right to buy' (Land Reform (Scotland) Act of 2003). The conditions for creating, transferring, renting and accessing crofts, as well as regulation by the Crofting Commission, were set in Reform Acts in 2007, 2010 and an amendment in 2013. The Scottish Government also supports crofters directly in its distribution of Common Agricultural Policy funding, specifically through the Crofting Agricultural Grant Scheme, the Croft House Grant and the Crofting Cattle Improvement Scheme as well as subsidised access to advisory services. Crofters are also eligible to apply for funding under the Less Favoured Area Support Scheme (LFASS), Agri-Environment Schemes, and the Young Farmers and New Entrants Start-up Grant Schemes.

In this paper we assess the resilience of Scotland's crofts, focusing on evidence of adaptation and change. Scottish Government has identified crofting as playing a vital role in maintaining the population in remote rural areas, providing a secure base for the development of small businesses and maintaining and supporting a range of unique habitats (Scottish Government 2016). Crofts face similar challenges to other small-scale farms, which lack economies of scale and are more likely to be occupied by older, less commercially-oriented farmers (Zagata & Sutherland 2015). Small-scale farms are frequently operated on a semi-subsistence basis (Davidova et al. 2013), functioning as buffers against poverty rather than as production-prioritising commercial businesses. In the case of crofting, they are also often located in comparatively remote, upland locations and have significant biophysical limits on commodity production, which constrain commercial viability (see Reed et al. 2012). The particular concerns about crofting addressed in recent legislation are the neglect of land, absentee ownership and land speculation (Crofting Commission 2012).

Recent discourses on the viability of different forms of agricultural unit are increasingly utilising the concept of resilience. This concept has roots in both the literatures on socio-ecological systems and developmental psychology, emphasizing the need to adapt and change, rather than to simply buffer shocks and return to the status quo (Darnhofer et al. 2016). There is no singular 'resilience theory'; rather, resilience is used as a framework for assessing the dynamics of socio-ecological systems (Anderies et al. 2006; Cabell & Oelofse 2012). Use of the concept reflects recognition of the increasing unpredictability and risks associated with farming practices (e.g. extreme weather events, market uncertainties), resulting from globalisation and climate change (Darnhofer 2014). In this paper, we draw on the socio-ecological systems approach adapted by Darnhofer et al. (2010; Darnhofer 2014). Darnhofer (2014) argues that to be resilient, a farm needs to be able to buffer shocks of various scales, adapt, and transform. Buffer capability represents the ability to assimilate a perturbation without a change in structure or function (i.e. to 'bounce back' from a shock). Adaptive

capability - the ability to adjust in the face of changing external drivers and internal processes – reflects the ability to ‘bounce forward’ within the current system, and is linked to on-going experimentation and bricolage¹.

In conceptualising resilience, Darnhofer’s (2014) emphasis is thus on positive changes – the ability of farms and of farming systems to bounce back to the status quo, or to bounce forward into neutral or positive positions. While it is important to recognise that change can be positive, her framework does not explicitly elaborate on the assessment of negative changes (e.g. retreat from active farming, land abandonment). Following her reasoning that resilience is evident in the ability to adapt, we suggest that decreased resilience is evident in the extent to which adopted changes decrease the ability of farm households to respond to future shocks and stresses (e.g. reduced resource or overall activity levels). In this paper we assess, at aggregate level, the changes occurring on Scotland’s crofts, identifying the major drivers of change, response to shocks (particularly changes to subsidies), and evidence for adaptation, in terms of changing characteristics the croft (e.g. age of operator, holding size, diversification activities) and assessment of future economic prospects.

In assessing the resilience of small-scale agriculture, subsidy dependence is an important issue. Farm households in the uplands (where crofts are frequently located) tend to be particularly dependent on the state for their incomes (Gaskell et al. 2010; Shucksmith & Rønningen 2011). Owing to their small scale, crofting is undertaken largely on a part-time basis, but oriented towards commercial commodity production (typically beef and sheep production). Members of crofting households are frequently also self-employed (on-croft in diversification activities) or employed in local businesses, social services or government offices². As agricultural producers, crofters are eligible for agricultural subsidies. Scotland’s crofts have received a number of ‘shocks’ in recent years, particularly the decoupling of agricultural subsidies from production in the 2005 reforms to the Common Agricultural Policy. Scotland undertook a ‘historic payment approach’, whereby farmers (including crofters) received Single Farm Payment entitlements based on the amount of subsidy received in 2002-2003. Crucially, this payment was no longer dependent on production, so while many farmers continued to produce as previously, in regions where this was less economically viable – particularly the highland and island regions of Scotland where the crofting counties are located – there was concern about the loss of traditional extensive grazing systems. SAC’s (2008)

¹ Darnhofer *et al.* (2014) also include ‘transformative capacity’ – the ability to implement radical changes. For practical reasons associated with study design, we were not able to include this concept in the analysis.

² And/or receiving state pensions.

report entitled 'Farming's Retreat from the Hills' and Sutherland et al.'s (2014) analysis of census figures demonstrated the changes in commodity production (particularly reductions in sheep numbers) on small holdings in these upland areas. In particular, SAC (2008) links the reduction in livestock production to reduced farm labour and negative economic impacts on local communities, expressing concern that these transition processes could reflect land abandonment (all arguably evidence of decreased resilience of associated crofts and farms).

In order to assess how crofters are adapting to recent and anticipated policy reforms, an analysis was undertaken of the 2013 CAP intentions survey. The survey is part of an ongoing programme of Scottish Government research which assesses adaptation and future plans of farmers and crofters. The analysis first seeks to contextualise contemporary crofts, by comparing the socio-demographic and holding characteristics of livestock-producing crofts (the vast majority of crofts in the sample) with livestock producing non-croft holdings (in and outside of the crofting counties). The analysis then identifies potential shocks, by comparing the factors identified as having had the greatest impact on the holding. Adaptive strategies are assessed by contrasting the changes made to holdings since 2005. Resilience is investigated by evaluating responses study participants made to different scenarios of CAP reform.

The paper is structured as follows: a description of the materials and methods is followed by study findings related to the characteristics of crofters and their holders, factors influencing changes in croft management, the vulnerability of crofters to changes to the Single Farm Payment and evidence for adaptation. We conclude with a discussion of research implications for the future of crofting in Scotland, and directions for further research.

Materials and Methods

The analysis within this paper is based on data from a spatially and sectorally representative telephone survey of 10 000 holdings (termed the 'CAP Intentions Survey'), selected using information from the June Agricultural Census (JAC) on region, activity, size and farming enterprise. In total, 2,416 responses were received. To supplement the survey information, responses were joined to the data collected on the associated holdings by the June Agricultural Census (JAC) of 2013. This data source gives national level coverage and detailed holding information, thus enabling stratification. Other studies (e.g. Guillem et al., 2012) have drawn on Integrated Administration and Control System (IACS) data, which omits holdings not registered to receive subsidies or farm business payments. The JAC represents a more comprehensive dataset, but still somewhat under

represents business holdings with less than 0.5 standard labour requirements, owing to the minimum size requirements of holdings represented (see Barnes et al., 2013). These very small holdings are less likely to reflect 'active crofts' (i.e. those which are actively engaged in agricultural commodity production as a substantive activity). The study thus emphasises the adaptive strategies and changes of active livestock holdings.

The primary purpose of the survey was to assess structural changes on Scottish farms, particularly in relation to the effect of 2005 CAP reforms, and to identify planned future changes under proposed reform of the CAP³. The questionnaire was composed of three main sections: demographic, socio-economic and attitudinal characteristics of the farmer; changes and influences on the farm since 2005; and proposed intentions for the farm up to 2020. The questionnaire addressed a range of farming and land-based activities (e.g. commodity production, herd and land-holding size, labour; agri-environmental scheme, forestry, renewable energy and agri-tourism engagement). This range of activities is particularly important when assessing changes to crofting, given the pluriactive nature of many crofts. Study respondents were initially asked their intentions up to 2020, along a 3 point scale (decrease, increase or remain stable) for each activity. They were then asked the same set of questions after consider hypothetical increases and decreases of 25% to their current Single Farm Payment. As such, the survey measured whether specific changes were likely to occur but did not evaluate the magnitude of these changes. It is also arguable whether farmers can fully disassociate the effects of the CAP from other drivers in decision-making, owing to the inter-connectedness of other issues (e.g. input and commodity markets, labour availability). The approach is similar to others which have assessed potential responses to CAP reform and removal (e.g. Breen et al., 2005; Gorton et al., 2008; Latruffe et al., 2013, Raggi et al., 2013), and was undertaken at a time (2013) when CAP reforms were being negotiated but had not yet been concluded: farmers and crofters were therefore likely to be actively considering how imminent reforms would affect their businesses. Further details of study questions and design can be found in other papers from the dataset (Barnes et al., 2016, Sutherland et al., 2016, Toma et al., 2016, Hopkins et al. 2017).

Within the analysis, 'crofters' were identified as survey respondents associated with holdings which a) reported land registered with the Crofter's Commission (owned land and/or rented croft land), b)

³ The 2005 CAP reforms led to a transition in Scotland from a set of production-based subsidies to a Single Farm Payment (SFP) which was calculated on the basis of 2002/2003 subsidy levels (i.e. a 'historic payment' basis). In 2015, subsidies became allocated on an 'area-based' payment approach, which had the potential to substantially change the amount of subsidies received on individual enterprises.

were located in parishes within the traditional crofting counties or New Crofting Areas (NCA)⁴. Based on this definition, 289 crofters were identified, of which a large majority (261) were livestock producers. In order to put the findings on crofting into context, this paper compares these 261 livestock crofters ('L-Croft') to other non-croft (farm) livestock producers in the traditional crofting counties or New Crofting Areas ('L-Farm-CC', n = 450) and livestock producers in the rest of Scotland ('L-Farm-Outside', n = 1,039). Comparisons are also made between the crofters and all of the non-croft farmers ('N-all', n = 1,489). Additionally, the 261 crofters were split into three groups based on age which were also compared: crofters aged 54 or below ('C <= 54', n = 103), crofters aged 55 to 64 ('C 55-64', n = 81) and crofters aged 65 or over⁵ ('C >= 65', n = 77)⁶.

The topics addressed in the analysis are:

- Crofter and farmer demographics, holding characteristics,
- Factors influencing changes to holding management,
- Crofting and farming activity, changes made in the recent past and planned in the future,
- Holding changes that would be made in response to increases or decreases of 25% to Single Farm Payment (SFP) entitlements,
- Assessment of positive or negative current and future economic prospects⁷.

Statistical analysis was carried out using R (R Core Team 2016) including functions from the 'foreign' (R Core Team 2015) and 'lsr' (Navarro 2015) packages. The analysis focused on the categorical

⁴ Scottish Ministers can designate new areas in Scotland where crofts can be created, with the approval of the Crofters Commission. The traditional crofting counties are Shetland, Orkney, Caithness, Sutherland, Ross-shire, Inverness-shire and Argyll. The New Crofting Areas designated in 2010 are the local authority areas of Arran, Bute, Greater and Little Cumbrae, Moray and parts of Highland not already within the traditional Crofting Counties. Information on these areas included in Scottish Statutory Instruments 29 (http://www.legislation.gov.uk/ssi/2010/29/pdfs/ssi_20100029_en.pdf, accessed 30th May 2016) and <http://www.gov.scot/Topics/farmingrural/Rural/crofting-policy/new-crofting-areas> (accessed 30th May 2016). Parishes were identified using GIS (Esri, 2013) analysis of Agricultural Parish Boundaries (Scotland) and Ordnance Survey Boundary-Line™ data.

⁵ Note that owing to an error in the survey template, this age category was given as "over 65"

⁶ Data on respondent age was collected using the categories in the JAC: 35-44, 45-54, 55-64, 65 and over. As discussed by Zagata and Sutherland (2015), the categorization of 'young farmers' for the purposes of agricultural subsidies (41 and under) is not consistent with the categories utilised in Europe's agricultural censuses, one of several issues making it difficult to accurately gauge the total numbers of young farmers. Owing to the small number of respondents (n=38) who were 44 and under, which would have made it difficult to establish credibly statistical comparisons, 'younger' farmers were aggregated together into the under 54 category.

⁷ Some logical recoding/combining of response categories was done prior to analysis for some variables within these topics.

variables defining farmer groups described above: a) crofters and two groups of non-crofters, b) crofters and all non-crofters, and c) crofters only, split by age group. The Chi square test was utilised to assess whether there was a significant association between farmer groups and other categorical variables (summary of test at Pallant 2013, p. 225). Fisher's Exact Test⁸ was used for this purpose where the Chi square test's requirements for expected counts (described in Freeman and Julious, 2007) were not met. The Kruskal-Wallis test (Pallant 2013, p. 240-1) was used to assess whether farm area was significantly different across three farmer groups, and the Mann-Whitney U test (Pallant 2013, p. 235) assessed whether area significantly differed between two farmer groups. Where measures of effect size are provided, Cramer's V (ϕ_c) was used to calculate association strength between categorical variables where the Chi square test result was significant ($p < 0.05$). The Mann-Whitney U test and effect size r^9 could be calculated for pairs of farmer groups. Cramer's V and r both indicate the strength of an association (Ferguson, 2009). The logistic regression was carried out in R based on code derived from Field et al. (2012, see p. 329-336).

Findings

Characteristics of livestock crofters

The characteristics of croft holdings in the study are consistent with the history of crofts as small, part-time, often tenanted holdings (Tables 1 and 2). The analysis found significant differences in farm size: median values show that crofters have far smaller holdings than non-crofters (Table 1). The difference in area between non-crofters and crofters is highly significant ($U = 119463$, $p = 0$, $r = -0.24$) although the difference between crofters and non-crofters outside of the crofting counties/NCA is larger¹⁰ ($U = 78457.5$, $p = 0$, $r = -0.29$), indicating that holdings in general are smaller within the crofting counties. In line with this, crofters were more likely than non-crofters to have no employees, although the proportions of both groups within the crofting counties and NCA with no employees are very similar, implying that differences are greater based on location than they were between crofters and non-crofters. Compared with the non-croft livestock producers, crofters were far more likely to be tenants (over half were tenants, compared with less than one in five non-crofters).

Table 1 – Notable differences in characteristics between farmer groups [about here]

⁸ Function used within R: <https://stat.ethz.ch/R-manual/R-devel/library/stats/html/fisher.test.html>. P values calculated using Monte Carlo simulation, 2,000 replicates.

⁹ Calculated using method from Field et al. (2012: 665), which cites information from page 19 of Rosenthal, R. (1991). *Meta-analytic procedures for social research* (2nd edition). Sage, Newbury Park, CA.

¹⁰ Based on the effect size r . A 'medium' effect size would be $r = 0.3$ based on the guidance of Cohen (1992: 157) for interpretation of effect sizes, used by Field et al. (2012: 666) to interpret r . Other threshold guidance for r is available (Ferguson, 2009: 533 for social science data).

As demonstrated in Table 1, crofters were less likely than non-crofters to be highly dependent on agriculture for their income (c. 27% of crofters received over three quarters of their income from on-farm agricultural production), were less likely to farm for profit, and were more likely to identify themselves as hobby farmers (and less likely to characterise themselves as full time farmers). However, crofters were more likely to receive at least half of their income in subsidies than non-crofters, and were more likely to participate in environmental schemes. For the subsidy and environmental scheme variables, crofters and non-crofters were not significantly different; however when crofters, non-crofters inside the crofting counties and NCA and non-crofters outside these areas were compared, the association was significant. This may suggest that location rather than croft/non-crofter definition was a stronger influence on group differences.

As demonstrated in Table 2, crofters were not significantly different to non-crofters in terms of age, the percentage who had identified successors (49.0% had) and duration of time on holding (a large majority had been involved in their holdings for more than 20 years). Crofters were significantly more likely than other groups to plan to farm to 2020 (92.3%; L-Croft-CC: 87.1%, L-Farm-Outside: 89.3%). Persistence is an indicator of buffer capacity (Darnhofer, 2014).

Table 2: Characteristics of livestock crofters compared with livestock non-crofters (all non-crofters, and non-crofters outside and in the crofting counties) [about here]

The number of new entrants to crofting (defined as holders with less than 10 years' involvement) in the survey was quite small (n = 38), restricting further statistical analysis on respondents within this group. Some 14.6% of crofters were new entrants, compared with 11.5% of non-crofters; however this difference was not statistically significant (chi square test, p = 0.190). New crofters were not necessarily young: most (n = 24) were 45 or more years old.

Factors influencing change in farm management

Study participants were asked whether a number of factors had changed the way they manage their business (with “no”, “slightly” and “significantly” responses). Table 3 presents the proportions of respondents in each group of farmers, whose farm management had been affected by each factor, with the proportion “significantly” affected by the factor in brackets.

Table 3: Factors affecting farm adjustment [about here]

Certain factors were reported by large percentages of both crofters and non-crofters: changes in input and output prices, changes in regulations (generally and in relation to animal welfare), technology and climate change. Comparing the crofters with non-crofters, overall the crofters were much less affected by land availability (12.7 percentage points (pp) difference in proportions of farmers affected by this factor), changes in the cost of borrowing (12.6pp), changes in trained staff availability (10.4pp), changes in technology (10.0pp) and changes in input prices (9.2pp). Notably, there is evidence that factors related to changing subsidies: the Single Farm Payment (5.4pp difference) and Pillar 2 Payment (3.4pp difference), had each affected slightly more crofters than non-crofters.

Adaptation and Change

The telephone survey asked the respondents about changes they had made to their holdings since 2005, and the changes planned by 2020. The findings are presented here (Table 4) in terms of the overall levels of change within each cohort: the proportion of farmers or crofters who have changed their activity (i.e. increased or decreased it). Where respondents reported changes, or planned changes, these were more likely to be increases in activity than reductions: for all fourteen changes where activity 'direction' was recorded, more non-crofters had increased the activity than had decreased it. For crofters, a similar pattern is clear, however, crofters were more likely to have reduced employed labour (8.6% of all crofters had done this) than increased it (7.0%).

Table 4: Percentage of farmers who have made or plan to make changes to their holding management [about here]

For the majority of study participants (croft and non-croft) the tendency is towards making few changes (i.e. largely maintaining the status quo, suggestive of buffer capacity). For example, since 2005, only 7.3% of crofters had changed the commodities produced, significantly below the respective figure for non-crofters (12.1%). There was no significant association between planned changes to commodities (by 2020) and farmer group. Comparing crofters with non-crofters (all non-crofters, and two groups of non-crofters within and outside the crofting counties and NCA), there were significant associations with changes and planned changes to farm size, and significant associations with past changes to investment in new technologies. For past changes, changes to the level of employed labour, the amount of land rented or contracted out, and renewable energy production, were significantly associated with the cohorts (crofters and either one or two groups of

non-crofters). For these activities, there is evidence that crofters are less likely to have made changes (or intend to make changes). However, it is notable that there were significant differences associated with intentions to change the level of investment in tourism/other recreation: 22.3% of crofters intended to (largely increase) their investment in tourism/other recreation, compared with 14.1% of non-crofters (and only 11.9% of non-crofters outside the crofting counties and NCA). Crofters were also significantly more likely than non-crofters to intend to change forestry area. This is consistent with SAC (2008), who suggested that crofts that retreated from livestock production could switch to forestry. As such, this action is indicative of adaptation.

Further to the two comparisons of crofters and non-crofters analysed above, crofters were also divided into three age categories to distinguish younger crofters, who can be expected to be more active in managing their holdings. There were significant associations between crofter age and past changes to holding size, the intensity of production, level of animal welfare, area of forestry and amount of agri-environmental activity. Intended changes (by 2020) to holding size and investment in new technologies are also significantly associated with crofter age. Figure 1 shows the proportions of crofters in different age groups who had increased, decreased or not changed assessed farm activities since 2005. Broadly, across all farm activities, the oldest crofters (those aged 65 or over) were less likely to have made changes to farm activities, and these changes were more likely to be negative than those of younger crofter groups. For example, 35.0% of crofters aged up to 54 years old had changed the size of their business or holding since 2005 (80.8% of which reflected increases farm size). By contrast, only 15.6% of the oldest crofters had changed their farm size in the recent past (the vast majority of which – some 82.2% had decreased farm size). Over half (54.1%) of the younger crofters had changed the intensity of production (75.4% of which had increased it), but only a third (34.2%) of older crofters had made a change to production intensity, primarily representing decreases (64.0% of the group). In general, it appears that younger crofters are seeking to increase the economic viability of their farms through intensification, whereas older crofters are scaling back their activities as a form of semi-retirement.

Figure 1: Past changes in farm activity (since 2005) among crofters of different age groups [about here]

Anticipated responses to CAP reform

A key focus of the survey was on intended future changes to holdings and practices. As demonstrated in Table 4, the activities where crofters are most likely to make future changes are the

number of livestock, intensity of production, and level of animal welfare. With a few exceptions, such as recreation and tourism investment, and forestry up-take, activity changes were less likely to occur on crofts. Overall, there is a tendency towards decreasing activity changes in the 65 and over category.

Survey respondents were asked to predict future changes to their farms in scenarios related to CAP reform, specifically an increase in Single Farm Payment (SFP) by 25%, and a decrease in SFP of 25% (Table 5). Crofters clearly identified the SFP as highly important to the management of their holdings, with substantial proportions predicting changes to livestock numbers, production intensity and new technology in response to a 25% subsidy increase. In this scenario, for all types of farm activity, the vast majority of changes by crofters would be increases in activity (Figure 2). However, in the event of a reduction of the SFP, for all assessed farm activities except the level of animal welfare, the proportion of crofters making changes would be higher or much higher, and respondents indicated that the vast majority of activity changes would be negative (Figure 2). In both scenarios, predicted changes extended considerably beyond those involving commodity production, and included diversification, environmental scheme participation and off-farm investment. In terms of age, higher rates of change would be made by younger crofters in the case of an increase in the SFP, with significant associations between crofter age and change to holding size, intensity of production, livestock, recreation/tourism investment and animal welfare. However, there was no significant difference in terms of their response to a 25% reduction in the SFP.

When comparing crofters to non-crofters (in and outside of crofting counties), respondents indicated that a future reduction in the SFP would lead to higher change in farm activities, in comparison to a hypothetical SFP increase (Table 5). The number of livestock, production intensity, and holding size would be most strongly affected by SFP decreases; however it is important to note that changes are also anticipated to apparently unrelated activities like forestry area, and agri-environmental activity. For SFP decreases, significant associations were found between farmer type (crofters and non-crofters) and changes to several types of farm activities (Table 5). The figures associated with these activities show a consistent picture: crofters would be more likely to make holding changes than non-crofters in the event of a reduction in the SFP; indicating higher sensitivity to changes in farming subsidies than among other farmers. The widespread nature of these changes across both commodity production and diversification activities, suggests a retreat from crofting in many cases, rather than an adaptive response.

Figure 2: Likely extent of changes to farm activities among crofters in the event of changes to the size of the SFP. [about here]

Table 5: Respondents' intended changes in response to SFP increases or decreases of 25% (% of respondents who would make change) [about here]

Economic prospects and level of change – bouncing forward?

The telephone survey also asked participants about their perceived economic position and future economic prospects. It is clear that the crofters and non-crofters have similar perceptions regarding the economic position of their holdings, and its prospects for the future (Table 6). Chi square tests found no significant association between crofter/non-crofter status and perceived economic position, either where non-crofters are split into two groups based on location ($\chi^2(4,1750) = 4.181$, $p = 0.382$) or treated as a single group ($\chi^2(2,1750) = 1.229$, $p = 0.541$). Respective figures for perceived economic prospects of households also show no significant associations ($\chi^2(4,1750) = 2.359$, $p = 0.670$; $\chi^2(2,1750) = 1.617$, $p = 0.445$). However, taking the crofters separately, croft age group was found to be significantly associated with perceived household economic status ($\chi^2(4,261) = 13.527$, $p = 0.009$, $\phi_c = 0.16$) although there is no significant association with perceived prospects ($\chi^2(4,261) = 3.307$, $p = 0.508$). Figures in Table 6 indicate a tendency for the oldest croft farmers to be most likely of any of the crofter groups to be positive about their current economic position.

Table 6: Crofters and non-crofters: perceived economic position, and economic prospects of household [about here]

In order to assess the resilience of crofters, we explored logistic regression models to assess whether crofters who had been active in changing holdings were more positive about the future. The simple model presented below includes one predictor variable: the percentage of all applicable farm changes which were made in the past, a variable which serves as a proxy for overall farm activity. The model (Table 7) is better than chance at predicting economic prospects ($\chi^2(1) = 14.056$, $p = 0$) and may explain 7% of variance. While this is a relatively small amount, the model suggests that those who had been more active in farm management were more likely to be positive about the future (i.e. have made changes which they believe improve their economic prospects, representing positive adaptation and increased resilience).

Table 7: Perceived economic prospects [about here]

Discussion

The analysis in this paper demonstrates the changes occurring on Scotland's crofts, particularly those held by younger crofters. Some 80.5% of crofters reported making a change to their croft management since 2005; 61.3% plan to make changes by 2020. Study findings are consistent with well-established characteristics of crofts: smaller-scale, part-time, tenanted holdings which are more likely to be non-commercial in orientation (Pakeman et al., 2011; Shucksmith & Rønningen 2011). In this section, we reflect on the implications of study findings for the adaptation and resilience of Scotland's crofts.

Livestock producing crofters in the study demonstrated similar or higher buffer capacity to that of other livestock producers (since 2005): fewer crofters identified being influenced by the range of factors identified in Table 3; crofters were no less likely to have successors and were significantly more likely to be committed to continuing on their crofts until 2020. Indeed owing to the location of crofts in less favoured areas of the highlands and islands, it could be expected that crofters would struggle more than other livestock producers to produce a viable living, and would thus be more influenced by external changes and negative about their economic condition and prospects. This was not the case.

Crofting also appears no less likely to have new entrants than other forms of livestock farming in Scotland. However, it is important to note that most new entrants to crofting were not necessarily 'young' (as defined by Scottish Government's Young Farmers Start up Grant Scheme (i.e. under 41 years of age). It is younger crofters (under the age of 55) who were making the most changes to their crofts. The European Commission's EIP Agri Focus Group on New Entrants to Farming (EIP Agri, 2016) and the FarmPath FP7 project (Sutherland et al., 2015) similarly found that new entrants were important sources of innovation in farming but were not necessarily 'young' by European definitions: older new entrants bring skills, networks and financial assets developed during professional careers, which can be invested in their new holdings. Although the majority of older crofters reported reducing the scale and intensity of their activities, some were expanding and developing their holdings. Further studies specifically addressing new entrants could further illuminate this discussion.

The study also found evidence of adaptation. There appears to be an active cohort of crofters who are making changes to their crofts, enabling them to 'bounce forward' into more positive economic circumstances. However, this reflected only 7% of the variance in the model, suggesting that other crofters are making changes without the hope of economic improvement (i.e. to buffer shocks). Findings also demonstrated the differences in adaptation strategies pursued by crofters, in comparison to other livestock holdings, particularly planned diversification into agri-tourism and

forestry. Whereas commercial, mainstream farmers in Scotland are notoriously resistant to afforestation (e.g. Burton, 2004), crofters appear more open to this land use. The tradition of multiple job holding and part-time agricultural production, as well as less intensive production methods, also lend themselves more to agri-tourism development than highly industrialised commercial farms, and are more suited to pursuit of crofting as a 'lifestyle'. As such, the socio-cultural and the biophysical assets associated with crofting, could enable them to be more resilient (in some cases) than other livestock holdings, to various shocks.

Although Darnhofer's (2014) framework emphasises the positive outcomes of change processes, the distinction between adaptation and retreat was not always clearly evident in the study. The lack of change on some crofts could be indicative of fewer viable options, rather than buffer capacity or adaptation. Broadly speaking, the higher level of economic satisfaction and lower levels of change amongst older crofters suggests acceptance of the status quo, whereas younger crofters were somewhat more likely to express dissatisfaction and also to have made or be planning to make changes to their holdings. Although overall levels of change are similar between livestock crofters and non-crofters, in and outside of the crofting counties, it is notable that crofters are significantly less likely to change the size of their holding or the amount of land rented in or out. Only 16.1% of crofters identified access to land as an issue in holding management, in comparison to 24.9% of livestock farmers within the crofting counties and 30.5% of livestock farmers outside. However, over 25% of crofting respondents under the age of 65 reported planning to change the size of their holding by 2020. Recent Crofting Acts have detailed the conditions for the creation, transfer, renting and accessing crofts, as well as regulation of these processes by the Crofting Commission (Crofting Reform (Scotland) Act 2007, 2010; Crofting Reform (Amendment) (Scotland) Act 2013). The 2010 Act in particular was oriented towards ensuring that crofts are occupied and worked, and if this is not found to be the case, made available to those who want to croft (Scottish Government, 2016). The study findings thus suggest that land access will continue to be important for younger crofters who are making changes to their holdings. The study did not address land access issues for individuals wishing to start crofting.

Study findings indicate that crofters foresee considerable difficulties in responding to significantly reduced subsidy payments (i.e. subsidies appear to represent a foundational element of their ability to buffer and adapt to shocks). While increased subsidy payments were perceived as providing opportunities for investment in the croft business, crofters were much more likely to declare their intention to decrease activities in the event of a subsidy reduction. This suggests that many crofters do not consider themselves able to buffer this shock. Importantly, both subsidy scenarios were

predicted to lead to changes across the range of croft activities – for example, a reduction in subsidy funding was expected to lead to decreases in agri-environmental activities and diversification, as well as commodity production. This suggests that many crofters also see no opportunities to adapt: decreases in subsidies were not expected to lead to increases in other types of activity, suggesting that a retreat from production equated to a retreat from crofting activity as a whole, rather than a transition to a different type of crofting (e.g. one that is more dependent on diversification). As such, study findings confirm the marginality of upland holdings (Gaskell et al., 2010). The positions taken by crofting respondents are consistent with arguments by Shucksmith and Rønningen (2011) who argue that crofting is seen as necessary to maintain 'lights in the windows' of remoter rural areas. However, it is also important to note that the survey focused on the recognised current activities of crofts - it is possible that other opportunities for adaptive change, not identified in the survey, would be pursued.

Limitations

The study has a number of limitations. Examining farmer intentions is somewhat contentious, as the identified intentions may not lead to actual behaviours (Viaggi et al. 2011; Latruffe et al. 2013). Study respondents may not have been actively considering their options prior to being invited to participate in the survey. In addition, the survey was clearly oriented towards informing Scottish Government of the potential impact of subsidy changes; it was thus in the interests of respondents to indicate that any subsidy reductions would have negative repercussions. We note that this was true for all survey respondents currently receiving subsidies; the higher percentage of crofters who would reduce their activities is thus suggestive that proposed reductions would indeed have a stronger effect, or at least were perceived as such by the respondents in question. Assessing the extent to which estimated future actions are matched by actual activity, will be important to better understanding the ongoing adaptation on Scotland's crofts, and is a planned component of ongoing research. Changes to farming practice will also inevitably reflect more than changes to a single driver (e.g. subsidy payment levels), owing to the interconnected relationships within farming systems. However, it is clearly evident from the study that respondents believed that changes to their SFP alone would be sufficient to induce changes on their crofts.

Darnhofer (2014) points out that while surveys capture change, they cannot adequately capture processes which strengthen or erode resilience. In analysing the survey results, it was clear that the theoretical distinctions between buffer capacity, adaptation and the retreat from crofting are

subject to interpretation. In addition, the study did not assess the overall levels of change which would occur, and aggregated the statements of individual crofters, rather than considering system dynamics. Future research utilising qualitative or mixed methods analysis will be important to better understanding the ongoing adaptation on Scotland's crofts.

It is also important to note that subsidy levels represent one of many potential shocks for Scotland's crofts. Subsidy changes were midway down the list of influences on croft management changes since 2005. This could be because the subsidies were paid on an historical basis – for existing crofters, little will have changed in terms of the quantity of their subsidy payment from 2005 to 2013; what has changed is the requirement to produce agricultural commodities. Input and commodity prices, regulations and climate change were identified by more crofters as having impacted on holding management. Assessing responses to shocks in these areas is an important topic for future research.

Conclusion

A European Parliament resolution (2013) stated that there is an important role for small-scale farms in rural areas: small farms play key roles relating to nature - such as maintenance of the countryside and biodiversity; society - through providing employment and reserve workforce for other sectors; and culture - through the preservation of traditions, and manufacturing traditional products; as well as creating favourable conditions for animal welfare. In this paper we have demonstrated that although there are signs of active adaptation occurring on Scotland's crofts, crofters themselves identify considerable subsidy dependence, and sensitivity to subsidy shifts.

At the time of the survey in 2013, the ramifications of transitioning from the historic payment to an area-based payment were not well known. Since that time, the Scottish Government's Economic Condition of Crofting Report (2011-2014) has projected that by 2019, crofters will see an increase in the total Pillar 1 CAP support they receive. Based on the 2014 scheme year exchange rate of €1=£0.773, the total payments made to businesses with a registered croft are expected to rise from around £20 million in 2013 to around £33 million in 2019. As such, the reduction of crofting activities respondents indicated would result from an immediate 25% SFP reduction is unlikely to materialise to any degree in the short term. However, since the survey, the British public has voted to leave the European Union, raising the potential for a new subsidy regime in the medium term. Study findings suggest that the differential response of crofts, and indeed holdings in highland areas, should be specifically assessed prior to implementing any new funding policies.

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