CAVES: Complexity, Agents, Volatility, Evidence and Scale

Grampian Region Field Research Report

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April 9, 2008

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Project funded by the EU 6FP NEST Programme

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Executive Summary

Introduction

This paper presents a summary of the study findings for the CAVES-Grampian case study. The purpose of the CAVES-Grampian study is to provide policymakers with scenario analyses for land use change in the region over the medium term, based on computer-generated models of land use change processes. These models will be based on findings from qualitative interviews with agricultural land users. This qualitative research was conducted in three parts: pilot study, primary field research and validation, undertaken between February 2006 and September 2007. The combination of pilot study and primary field research resulted in total interviews of 44 (24 farmers, six successors, five estate factors and nine key informants). The total number of interviewees was 51, reflecting seven farmer interviews in which a partner (typically a spouse) also participated. For the validation, 8 of the original respondents participated for a second time, providing feedback on the decision-rules derived from the original field research.

Major findings from Field Research

Land Use Change

Respondents were unanimous that farm size in the region is increasing, supporting this contention with evidence that their own farms had increased in size – often double the previous land base of 20 years before. Production of the primary commodities of the region – beef and sheep – have remained fairly constant in terms of total outputs, but as of 2004 were being produced by approximately 2/3 the number of farms, in comparison to 1987. While consistent with reports of increasing farm scale, this does not necessarily indicate increased intensity of production. Although this was certainly the case on some farms, other farms simply grew larger in land-base, apparently producing at similar or lower intensity, as overall production has not increased, nor has significant agricultural land gone out of production. Production of other commodities: field crops (barley, wheat, turnips, potatoes), dairy, pigs and poultry have all declined, supporting respondent statements that their farms were producing fewer commodities in general, and fewer arable crops in particular. Engagement in environmental programs is a new phenomenon in the study site, and most of the farmers had some degree of involvement. The extent of land involved in these programs is not yet recorded in census statistics. Labour on the farms has also reduced, with a 29% reduction in full-time occupiers and 26% reduction in staff. The number of part-time farmers has increased, however, as has the number of part-time spouses, suggesting that some farms have made the transition from primary to secondary employment for household members.

Analysis of census statistics demonstrated that the most notable change in land use in the region over the past 20 years was an increase in the area of woodlands: from 700 to 6000 ha. This is most likely due to a government program (the Native Pinewood Scheme) in the late 1980s. The increase in woodlands was mentioned by only one of the interviewees, himself a factor

heavily involved in woodland development on his estate. This suggests that the forestry program did not impact strongly on farmers in the study site.

Decision-Making

Analysis of farmer decision-making focused in two areas: acquisition of new land (through purchase or tenancy) and change in commodity. In the case of land acquisition, the process primarily involves **opportunity**, rather than a formally reasoned business plan. Land is a limited resource, only available when another landholder decides to reduce his or her holdings. This occurs primarily upon the retirement or death of the existing holder, or if the holder goes out of business, and thus access to a specific plot may occur once in 10 – 90 years, depending on farm succession. However, farm land in a neighbourhood would come available on a much more frequent basis (owing to the number of land holders), as demonstrated by the expansion of most farms in the study over the past 20 years. Due to the physical limitations to transport of labour and equipment, land in close proximity to the existing holding is of high value for expansion, which is in turned believed by most farmers to be necessary for ongoing business success. Farmers therefore are very likely to attempt to purchase or rent neighbouring land (particularly if it is located immediately adjacent to existing holdings), regardless of the current financial climate, as they believe the opportunity is not likely to recur in the near future.

In terms of decision-making regarding commodity change, this typically occurs on a '**needs-must**' basis. Economic pressures, such as the high cost of inputs, labour scarcity and declining commodity prices, have driven most commodity changes. Farmers typically act incrementally at first, gradually increasing or decreasing stocking density or acreage of a field crop. In discontinuing a commodity, typically a breaking point is reached, following the gradual decrease, in which production is stopped completely. Examples of this breaking point range from the drop in beef prices following the BSE outbreak in 1996, to the steady decline of potato prices through out the 1960s and 1970s. In both cases, discontinuing the commodity was considered for several years before it was undertaken. Due to the length of time and investment required to re-start a commodity, farmers in the study site will not typically discontinue a commodity on the basis of a single year's poor returns. Nor will they consider changing commodities when they are satisfied with current returns. Although farms have increased intensity of production, the only new 'commodity' in the area is engagement in environmental programs. Farmer respondents indicated that they entered these programs primarily to benefit from resultant subsidies.

Social Networks

In the study, four primary facets of network relationships were addressed: access to information, social norms, resource sharing and community engagement. *Analysis of access to information revealed network structures that were complex and diverse, reflecting the specific commodities and business structures of the farmers involved.* For example, a beef producer would likely attend beef cattle sales and information events, whereas a sheep producer would attend sheep-based events. As most producers in the study

site produced both commodities, there was considerable overlap in these information networks at a basic level. However, should a third 'commodity' – such as a diversification activity – be added, engagement in other networks reduced of necessity, given the time constraints of the farmer. Farmers must in any case be selective, as there are more information-based events than a single farmer could attend. *Choice of information resources also reflects the personal preferences of the farmer: Some farmers prefer to gather information from paid advisors, others from livestock shows, and others from travelling input salespeople. Most farmers utilised a combination of these resources. Access to information is therefore not limited to the immediate neighbourhood of the farmer.*

Unlike information access, resource sharing was found to be highly localised in geographic terms, as most labour and equipment sharing occurred between immediate neighbours. These relationships are highly based on, and restricted by, trust. For example, while inexpensive pieces of machinery might be shared with trusted neighbours, larger pieces of equipment were only accessible if owner-operated, and therefore usually on a fee for service basis. Similarly, labour sharing was sporadic, and often limited to emergency situations. The value of this labour should not be underestimated, however, given the number of 'one-man bands' operating farms: having a back-up source of labour makes it possible for these farmers to deal with essential absences from the farm, due to family events or personal ill health.

Social norms proved difficult to adequately evaluate, as farmers were reluctant to admit that their decision-making was influenced by others' expectations, while key informants clearly believed this to be the case. From the study of farmers' networks, it is clear that a farmer's reference group is not always his immediate neighbours. Instead, farmers may draw social approval from members of a dispersed network, as in the case of breeding society or diversification network members, and therefore be less influenced by more locally held norms. *Farmers also refer to positive examples for reference – the 'best' farms in the neighbourhood – rather than all farms equally.*

Reputation was found to be important for labour and equipment sharing: farmers are in a position to physically observe the practices of their neighbours, and those believed to be rough with machinery were not trusted with others' equipment. Reputation was also a factor in access to rental land (although land sales went to the highest bidder). Land owners prefer to rent land to a 'safe pair of hands' (in terms of both land maintenance and apparent economic success), and used reputation as part of their land allocation decision.

Community engagement was also investigated, but not found to be particularly relevant to land-use decision-making.

Validation Findings

The Grampian model is based on the TAPAS (Take a Previous Model and Add Something) approach to model design. The FEARLUS modelling framework was in development for several years prior to the CAVES project,

with the structure informed largely by literature review. What the Grampian field research has brought to the FEARLUS model is data specifically derived for use in the model. Due to the focus of CAVES on complexity and social networks, these are the areas in which the model has most advanced. For the purposes of the validation component of the CAVES project, a questionnaire was derived from model components and assumptions. These include the comprehensiveness and relative importance of factors in land use change, principles of land use change, and the decision-making process.

Validated model components

- the decision rule that farmers do not change their current crop or type of stock when their aspiration threshold has been reached, even if there are higher prices in a different commodity.

- the general principle of innovation by a small number of innovative farmers, copied by other farms

- in ordering the factors which farmers take into consideration when changing commodity, the profitability of the new commodity is of primary importance.

- land is differentially desirable, on the basis of previous (and therefore anticipated) profitability.

- In historical runs, farmers will always bid on neighbouring land, if they have sufficient resources. This is less likely to be true in future-based runs.

- Farmer types: entrepreneurial, traditional, pluriactive, lifestyle/hobby/environmental

- Fixed costs associated with commodities.

Important to add to the model

- The principle that farmers will lose money without changing commodity, although restrictions to this principle on the basis length of time over which loss occurs and extent of loss have not been quantified.

- Off-farm income in the model, as a factor in agent's aspiration thresholds.

- Categorisation of agricultural land: 'arable', 'arable grass', 'woodland', and 'improved grazing' are suitable categories. May want to change 'unimproved grazing' to 'rough or hill ground'.

- Farmer ability – impacts considerably on farm profitability.

- Including ‘well established market for new commodity’, ‘suitability to current farm set-up’ and ‘opportunity to benefit from government grants’ as factors in decision-making about new commodity up-take

- Including more specifics on proximity of land and expansion plans to decisions regarding land acquisition. (Expansion plans can be handled through farmer type; the definition of proximity is based on geographic neighbourhood, but can to some extent be varied by the model user.

- Slow speed of farmer response to change events (eg one year delay before responding to the SFP)

- Climate change – will differentially impact by commodity and land use type.

Areas for further exploration

- Succession (not in the model at present) cannot be based solely on the initial success of the farm. Perhaps a complex issue best not addressed at this time.

- Organic farming (not an option in the model at present). Social approval may limit adoption, but land suitability and perceived economic benefits appear more important.

- Economies of scale can be utilised as a general principle, but it is also important to consider limitations imposed by other aspects of the farm business.

- No consistent identification of or response to major ‘shock’ events

- Social approval – difficult to accurately gauge.

Conclusion

The validation process has generated broad support for the accuracy of the field research, while raising issues for further exploration following the completion of the CAVES project. Respondents did not identify any major problems with the model inputs and process, and confirmed several aspects which were intended for addition to the model. Implementation of these inputs will be further addressed in the Grampian modelling report.

CAVES Field Research Report – Grampian Region

Introduction

The purpose of the CAVES Grampian study is to provide policymakers with scenario analyses for land use change in the region over the medium term, based on computer-generated models of land use change processes. These models are based on findings from interviews with agricultural land users, such as farmers and estate managers, as well as other agricultural industry members. These interviews comprise the bulk of the 'field research component' of the Grampian case study. Interviews focus on the patterns and causes of land use change, and the role of land managers' social networks in these processes. This paper presents a summary of the study findings, based on qualitative interviews with 51 farmers and other farming industry members, conducted from February 2006 to September 2007.

Background to the study

The basic hypothesis of the CAVES project is that multiple, long-established social and informational networks increase the resilience of a land use system in response to technological and demographic change, and particularly to external shocks (significant, unexpected events within the system, which may or may not result in 'volatile episodes' of internal system response). *These networks are assumed to consist of 'networks of networks', implying differing types of network, and levels of hierarchy within the system.* The importance of social networks to agricultural decision-making has long been recognised by academics. Rogers (1962) developed a specific interest in the diffusion of agricultural innovations, and looked at both the decision-making process, and influences on it. He argued that 'early adopters' – those who adopt new technology sooner than others – are influenced differently by social considerations than those who wait to adopt innovations. 'Early adopters' typically have many contacts with extension agents and people outside of their social group, and participate actively in many organisations. In contrast, 'late adopters' tend to get their information through interpersonal contacts who have already been successful in adopting the innovation. *The diffusion of innovations concept was widely accepted within agricultural extension for two decades, before being discredited for the assumptions that all innovations are beneficial to all farming operations, and that farmers follow a rational process of awareness, information, evaluation, and trial, before adopting the innovation throughout the farm enterprise. However, the approach has not been replaced with an alternative theory* (Vanclay and Lawrence, 1994), and the basic principle of information diffusion through social networks has remained.

For the Grampian study, 'social networks' are conceptualised utilising Bourdieu's concept of 'social capital'. The basic concept is the economic value of social relationships, an idea which has been developed by multiple other proponents (notably Coleman (1988), Putnam (1993), Burt (2004), Fukuyama (2000) and Lin (2001)). Bourdieu was selected for this research because of his explicit reference to networks in his conceptualisation, in comparison to other authors who conceptualise about social resources more generally. Bourdieu defined social capital as: "a durable network of more or

less institutionalised relationships of mutual acquaintance and recognition - or in other words, to membership in a group" (1983, p. 249). The amount of social capital an individual possesses is thus a reflection both of network size, and the amount of resources held by other network members.

Bourdieu saw the network of relationships to be the product of conscious and unconscious investment strategies. "Contingent relations" – those of geographic proximity – had to be activated by ongoing exchange in order to form "durable obligations" (ranging from subjective feelings of gratitude and respect to institutionally guaranteed rights), in order for social capital to exist. Individuals are born into groups, and have access to social capital as a result, but build these connections over time, making it possible to secure positions of greater wealth – economic, cultural and social – by means of the connections which they reinforce. Social capital is held by the group, which reinforces it constantly by exchanges, again either symbolic or economic. Through these exchanges, the boundaries of the group are maintained. Bourdieu viewed all forms of capital: social, cultural and economic, as representing forms of accumulated labour, which can be transformed back into labour under the correct circumstances. *The purposes of capital development and use, then, are to secure profits, which could be symbolic or economic.*

Bourdieu's theories have already been applied to agriculture in Grampian region. Shucksmith and Herrmann's (2002) work utilised Bourdieu's concept of 'habitus' (a socially embedded disposition reflecting the dominant cultural way of thinking, modified through personal experience, which guides and constrains an individual's freedom to act) along with differences in farm scale, business management approach and off-farm income, to explain differences in farmer likelihood to withdraw from agriculture, expand agricultural production, or diversify into non-agricultural activities. Shucksmith and Herrmann (2002) proposed a typology of six primary farming types: hobby farmers, pluriactive successors, struggling monoactives, contented monoactives, potential diversifiers and agribusinessmen. *In utilising 'habitus', rather than group membership, Shucksmith and Herrmann's work draws on Bourdieu's conceptualisation of cultural capital, which he differentiates from social capital.* Bourdieu is unusual among social capital theorists in distinguishing between the two, but the distinction is retained in this research, which addresses both social norms and network membership.

Burton (2004) looked at social norms among agricultural producers in a case study site in Grampian region, but instead of identifying differentiating factors, he focused on the notion of 'good farming' – farmer's socialised expectations of themselves and others in relation to agricultural practices. Burton argued that farmers have highly socialised perspectives on 'good' farming practices, high levels of productivity, made evident in weed-free, even rows of grain crops and well maintained steadings, and less so actual economic performance. He argued that these ideals impact on propensity to uptake agri-environmental schemes. The nature of this identity differs between geographic regions, however, reflecting the cultural associations with specific commodities (livestock as opposed to field crop production) as well as local

culture. Gray's (1998) work on the west coast of Scotland, for example, found identity linked to the production of livestock, with discourse surrounding the 'inborn' ability to farm. Within the context of the organic farming movement, 'good farming' has been found to entail different elements, such as health and stewardship (Stock, 2007). 'Good farmer' ideals and other social norms can thus also be expected to generate conflicting and evolving norms within regions, and to reflect diversity within farming communities.

Agriculture in Upper Deeside

The Grampian study site was chosen because of the relatively limited amount of land use change that has occurred there in recent decades, in comparison to the Polish and South African study sites. This resilience in the type of agricultural production characteristic of the region has taken place in the midst of changes to the EU Common Agricultural Policy in 1992 and 1999, the BSE epidemic (which restricted beef exports from 1996 - 2006), and the exit of sterling from the ERM in 1992. An analysis of recent 'shocks' to the agricultural system in north east Scotland by Kerr, Mitchell and Cook (2003) identified the following:

- volatile finished cattle prices, which returned to their late 1980s levels in the early 2000s
- weaned calf prices remained 25% below their late 1980s levels in the early 2000s
- sheep prices fell 1988 – 1991, then rose rapidly until 1996, followed by a sharp 3 year down turn. In the early 2000s, sheep prices were at 75% of their 1980s levels
- collapse of cereals prices in 1996 - 1998, which levelled off at between 60% and 70% of their late 1980s values in the early 2000s, with barley prices falling even further

Kerr et al. conclude that following relative stability in cereals and buoyant livestock markets in the late 1980s, most farm produce prices fell sharply after 1996/1997, followed by some signs of recovery, particularly in the livestock sector. These trends reflect a world-wide commodity price slump in the late 1990s, world market competition resulting from CAP reform, and the impact of BSE (which eliminated the export market for UK cattle). Other factors they identify include the introduction of the single currency in 1999, resulting in exchange rate fluctuations of up to 20% which have impacted on exports and subsidies.

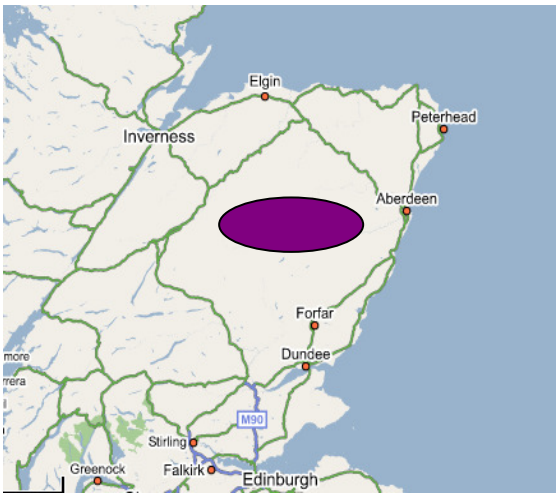
Kerr's report was designed to predict farmer response to further CAP reforms in 2005, which both reduced gross farm subsidy payments, and decoupled these from production. Unfortunately, the most recent census statistics on agricultural production are from 2004, and so do not reflect farmer response to these reforms. However, they provide useful context for interviewee responses about past changes to their operations.

Field Research Activities

Interviews were conducted with land managers and key informants in the Upper Deeside Region (Finzean to Braemar) from February 2006 to July

2007. This reflects several phases of research, which were scheduled into periods of high farmer availability. Respondents represented 24 farms and five estates. The total number of respondents was 51, reflecting seven interviews in which there were more than one interviewee (typically the farmer's spouse), and six interviews with successors of farmers already in the study. Interviews were conducted utilising an interview guide, which was based on the general research questions (identified later in this document). The interviews were recorded and most transcribed in full (notes taken on eight interviews). The interviews form a data set which can be utilised to address a range of research questions; as a result, analysis of the transcribed interviews will be ongoing throughout the research, as new questions emerge. Interviews ranged from 45 minutes to two hours in length.

Figure One: Upper Deeside Study Area



In order to maintain the confidentiality of interviewees, particularly the estates, detailed demographic details will not be given. However, it can be said that the estates ranged widely in size and organisational structure. Three of the five had tenant farmers, but only two were actively 'farming' part of their agricultural land at the time of the interview.

More detail is possible among the farmer respondents. Overall, the farm operators ranged in age from early 40s to late sixties, with the bulk of the farmers being in their 60s. About half of the farmers had some post-secondary education, three with three year college diplomas, and two with university degrees. The respondents' tenures as primary farmer on their operations ranged from 6 to 43 years, with most having operated their farm for at least 20 years. Twelve of the 24 farms had identified successors, who were currently active in the farm business. Six of these successors participated in interviews (separate from their parents).

Farms ranged in size from 34 to 7700 acres; total amount of arable land ranged from 0 to 700 acres; the rest was largely pasture, with some woodland. *The farms were typically a mixture of owned and rented or tenanted land:* only four of the farmers owned all of the land currently being

utilised in their operations. *Most farmers produced beef and sheep, with a few producing one or the other. Those with arable land (about two thirds of respondents) typically utilised it to produce barley, silage and improved grazing, which in turn were used as livestock feed on their own farms.* Some of the farmers also produced malting barley, potatoes, turnip and oilseed rape. Most of the farm households had some form of off farm income; often a family member employed off the farm, but also contract agricultural work and diversification activities.

Due to the large number of expanding, production oriented farmers in the pilot study, the second phase of research was targeted towards identifying a diverse range of farmers within the study site. As a result, the sample includes one 'hobby farmer,' a pluriactive farmer (paid employment rather than the farm is his primary source of income), a 'dealer' (who generates most of his income through buying and selling cattle, including his own), an entrepreneur (who generates most of his income from a diversification activity) and two farmers who have made few changes to their operations in recent decades, and therefore are not considered progressive by other farmers. The study therefore continued to reflect a majority of 'progressive' type farmers, who are most likely to be recommended by other farmers for interviews. It is also likely that the number of hobby and pluriactive farmers in the study site area is lower than other areas of Scotland, due to the high number of estates: factors prefer not to rent land for hobby purposes.

Findings

Field research was structured to address the following research questions:

1) How has agricultural land use in (a study site in) North East Scotland changed over the past 20 years?

2) Why (and how) does agricultural land use change?

3) What is the role of land users' social and informational networks in this process?

Question One: Land Use Change

The question of land use change focuses primarily farm size and the type and intensity of commodities produced. However, the importance of labour also became evident during the study, and is also discussed in this section. The section is concluded with a summary of implications for the computer model.

The nature of qualitative research is that it is descriptive of processes or discourses, providing detailed insight into specific issues. Research based on qualitative approaches does not typically result in findings that are statistically representative of the geographic region of the study. Respondents in the study were asked to identify trends in land use change; these findings are presented here with census statistics from the seven parishes most highly represented in the study, which are used to demonstrate and in some cases challenge respondent statements. In most cases, statistics from Aboyne, Crathie and Braemar, Coull, Logie Coldstone, Lumphanan, Tarland,

Kincardine O'Neil have been aggregated and are presented in comparison with study findings, in order to provide justification for generalisation to the study site[1].

Commodities

The Upper Deeside region is characterised by the 'beef barley' system, whereby farmers grow hay and barley to feed livestock, primarily beef cattle and sheep. Farmers reported that in recent years, the number of commodities produced on a given farm has reduced. So have the number of farms, in line with increases in farm size. Thus, as demonstrated in Table One, numbers of pigs and poultry produced have significantly reduced over the past 20 years. *Although the total numbers of cattle produced have remained fairly constant, the number of farms producing these animals has reduced by one third. Similarly, the number of sheep has reduced about 5 percent, the number of holdings has reduced by 32%.* Dairy farming has never been a major feature of the region (with only 4 farms in 1987, reduced to 2 in 2007). The reduction in number of holding, but fairly constant production levels may be indicative of increased intensity of production. Alternately, farmers could simply be producing at similar intensity on larger farms. *Farmer respondents reported both intensification and extensification of production – those on higher quality land were often intensifying production, through the addition of new buildings and machinery, in order to benefit from economies of scale. Those on poorer quality land reported reducing their input use.* A common prediction for land use change resulting from the SFP was that agriculture would 'come down from the hills' – with hill land going out of production, and farmers with arable land increasing their efforts.

Table One: Livestock in Upper Deeside

	2004		2000		1987	
	Holdings	N.	Hold.	No	Hold	No
Total cattle [2]	113	18328	134	18112	182	18350
Total sheep	70	46253	76	47506	103	48230
Total pigs	6	419	8	621	14	4286
Total poultry	39	1293	34	930	63	1729

Only about 2/3 of the farms in the study had arable land, suitable for producing field crops. Consistent with farmer reports of reduced commodities, production of winter and spring barley have clearly reduced, suggesting a shift away from both commodities, rather than a shift from one to the other. Turnip, oat and potato production has also decreased. Similar to the number of livestock holdings, *the number of crop producing holdings has also increased dramatically, approximately 41%. The amount of land in crop production has decreased 30%. This is partly offset by land now in set aside (414 ha on 57*

[1] Numbers are not disaggregated to census areas in order to protect confidentiality of farmers.

[2] This chart derived from statistics on total cattle. However, there were only two dairy herds in the region by 2004, so these statistics primarily represent beef cattle.

holdings), but likely reflects a move away from field crops towards grass. This is consistent with farmer reports of focusing on economic viability: although it is possible to produce field crops on lower quality arable land, it involves fewer inputs to maintain grasslands. Farmers also reported decreasing their input use, which is consistent with more extensive management structures. With the Single Farm Payment (SFP), which detaches subsidies from specific commodities, farmers expect that grain production will further decline.

Table Two: Crop Production in Upper Deeside

	2004		2000		1987	
	Holdings	Area	Hold.	Area	Hold.	Area
Winter barley	6	42.178	2	12.298	29	283.9
Spring barley	96	2447.572	125	2766.982	154	2780.9
Turnips	35	122.3	51	202.49	143	561.6
Spring oats[3]	9	48.851	10	56.24	64	461.3
Seed potatoes	3	15.3	4	39.69	9	43.4
Main crop potatoes	7	1.2	8	2.25	50	19.8
Total crops	**123**	**3348.32**	**145**	**3679.78**	**208**	**4777**

Statistics in Table Three suggest that farmers are indeed moving towards lower maintenance approaches: the short term mowing and grazing numbers have reduced, both in terms of holdings and amount of land, while the long term (greater than five years) grazing and mowing have both noticeably increased. Rough grazing has fluctuated, somewhat in terms of holdings but considerably in terms of land used. This may reflect a move to remove sheep from the hills in order to encourage heather growth. More recently, sheep have been returned to the hills in order to 'sheep mop' the tick – sheep are dipped with insecticide, which targets ticks. Estate managers found their shooting season compromised due to high grouse mortality resulting from tick infestation, and now actively encourage their tenants to graze sheep in the hills, and to dip their sheep with insecticide as often as possible.

It is expected that more recent statistics would demonstrate even greater amounts of rough grazing, due to the 'naked acres' phenomenon: factors reported that with the move to the SFP, there has been a significant new demand for hill land, to fulfil a payment holder's land obligation. Although on paper this land is used for grazing, in reality, livestock are rarely seen.

Table Three: Grass and Grazing in Upper Deeside

	2004		2000		1987	
	Holdings	Area	Hold.	Area	Hold.	Area
Grass for mowing <5yrs	136	2616.283	146	2617.555	187	2875.9
Grass for	78	687.237	68	630.815	56	356.4

[3] Spring oats were not differentiated from winter oats in the 1987 census. There were no winter oats grown in 2000, but a 14 ha across 2 holdings in 2004.

mowing >5yrs						
Grass for grazing <5yrs	172	2464.028	167	2727.282	219	3777.9
Grass for grazing >5yrs	213	4417.662	222	4191.97	175	3900.2
Rough grazing	164	91385.74	159	76884.5	169	92923.9

The most notable statistic found in the census figures was the increase in woodland from 1987 (43 holdings, 743.1 ha) to 2004 (71 holdings, 6050.21 ha). This was particularly interesting as it was not a phenomenon identified by farmer respondents. A strong move towards forestry, particularly in Aboyne and Crathie/Braemar appears to have occurred in the 1990s. One of the factors did comment on the importance of forestry as a land use, as this was a particular interest.

Another notable land use mentioned by farmers, although not yet recorded in census statistics, is land in environmental programs. All but one of the farmers in the study had some form of engagement with an environmental program, such as land management contracts, the Rural Stewardship program and Less Favoured areas. This often involves removing land from grazing in order to facilitate the development of desired species.

Also of note: census statistics indicate that there are 6 organic farms, and three in conversion, within the seven parishes. The respondents in the study site uniformly denied the existence of organic farms in their areas, with the exception of the well known cattle herd at Balmoral. This may be because the farms are too small to be considered 'real' farms, or because their operators are not well integrated into mainstream farming networks.

Farm Size

One of the major trends reported by respondents was increasing farm size. Most of the farmers in the study reported that their land base had increased significantly in the past 20 years, often more than doubling. Similarly, the estates which had land 'in hand' (farmed for themselves) had either discontinued this practice or increased the amount of land utilised, in order to achieve economies of scale. Estate factors also reported a preference for redistributing land among existing tenants, rather than creating new tenancies, to facilitate the progression of their tenants. This is consistent with reductions in the number of livestock holdings presented in the preceding section.

However, census statistics indicate that the number of agricultural holdings have increased in recent decades (from 288 in 1987 to 307 in 2004), rather than reduced. This can not be explained by the increased number of 'horse people' in the countryside, as this has only increased from 32 to 42. Given that the number of livestock holdings has clearly reduced (see Table One), as have the number of occupiers (see Table Four) this raises questions about approximately 100 of the 306 agricultural holdings which have not been accounted for.

It is important to note that increases in farm size vary dependent on producer types. The hobby farmer in the study clearly had no interest in increasing her land holdings. Similarly, the pluriactive farmers were more involved in their diversification activities, and did not have time for farm expansion.

Labour

Respondents were consistent in identifying a reduction in the amount of labour utilised in current agricultural production. Increased mechanisation of agriculture means that there are fewer people on the farms. Farmers also described a lack of labour availability, and the relatively high cost of acquiring labour outside of the family unit.

Table Four: Farm Labour

	2004	2000	1987
Full time occupiers	83	93	116
Full time spouse	17	19	14
Part time occupiers (> 50%)	25	22	30
Part time spouse (>50%)	14	16	18
Part time occupiers (<50%)	62	75	51
Part time spouse (<50%)	59	60	36
Total regular and seasonal staff	**102**	**130**	**138**

Decrease in number of full time occupiers by 29% but number of full time spouses has fluctuated. Part time occupiers (>50% has also decreased) as have the part time spouses (>50%). Part time occupiers (<50%) has increased 12%, part time spouses <50% is up 60%. Total staffing has declined 26%.

Overall, the pattern is full time farmer, part time (less than 50%) spouse, which fits with the pattern described by farmers and key informants of the household being dependent on off-farm income typically generated by a working spouse, who is also responsible for bookkeeping. Bookkeeping is a farm chore that farmers identified as a major stress: increases in government regulations and opportunities to access grant funding have created an extensive bureaucracy, which must be managed in addition to routine farm activities. Farmer respondents expressed considerable frustration around the amount of time and effort made to track their work, and the limitations this placed on their ability to perform what they consider to be more important farm tasks, such as maintaining regular livestock checks.

It is notable that occupiers are either full time, or less than 50%, and the same with spouses. This suggests that the addition of paid income for the farmer is typically in the form of full-time employment, reducing the farm to part-time status. The statistics are also consistent with the argument that while some farmers may have shifted from full to part time work on the farm, others have simply left farming altogether. This is consistent with the increasing scale of farms reported by respondents. The decreased number of staff is also consistent with farmer reports.

Implications for the Computer Model

The Grampian region was selected as a CAVES study site for its relative stability – in terms of land use change - in comparison to the other case study areas. Results from the study suggest that although no major changes in land use have occurred, there have been subtle changes: increasing scale of operation, reduction in production of cereals and arable crops, intensification and extensification of livestock production, and increases in environmental actions, which result in either land being removed from cultivation, or cultivated differently. Land managers did not report significant transition of land out of agricultural production to forestry, but this appears to have had significant impact in the 1990s. Some land can also be expected to have been utilised for urban development. The number of people working on farms in the area has decreased.

- A commodity can be produced at varying intensities and therefore with varying yields, along a continuum. Therefore, simply stating the commodity present does not completely define the land use.

- An historical run of the model should demonstrate reduced numbers of commodities, and a transition from arable to grass.

- An historical run of the model should demonstrate increased forested area.

- The change in size of farm holdings is questionable: farmers report decreasing numbers of farms, but census statistics do not appear consistent.

Question Two: Causes and Processes in Land Use Change

Qualitative research is particularly useful for studying processes – descriptions of complex interactions and chains of events. This study assumes land use decision-making to be a complex process, influenced by social norms. As such, an inductive approach was utilised, in which respondents were asked to describe decision-making processes, and responses to specific events. Land use decision-making ranges from daily decisions about rotating pastures, to monthly or yearly decisions about stocking density and choice of grain crop, and opportunities to acquire land, which may occur only once in a decade. This study is particularly focused around land acquisition (both through purchase and rental or tenancy) and

changes in commodity (density or extent of production, and decisions regarding changing or maintaining the commodity itself).

Through the respondent interviews, it became clear that two primary types of decision-making occur: *response to opportunity,* and *'needs must' (in response to shock or stress*). In this section, these two processes will be presented, followed by contextualisation against Shucksmith's (1993) work on farming types, and implications for the computer model.

'Opportunity Knocks'

In the case of land acquisition, the decision-making process primarily involves **opportunity**, rather than a formally reasoned business plan.

> Farmer: That's the kind of pattern, that's what we do, we have expanded, we started here in partnership with my father and brother in 1959, my father died in 1962 and we kept the partnership going until 1967 when we split. And shortly after that, probably in 1980 or so the next door farm became vacant just out of the blue and we bought it. Borrowed all the money, and interest rates were about nineteen percent…
>
> Interviewer: Oh my, because that's what they [interest rates] were like back home. I remember.
>
> Farmer: I mean everybody thought I was off my head. And then in another five years or so the other place…another 150 acres or so became available. So we rented it for five years and then we bought it as well. So this is where the 500 acres from the three farms all close together, a nice compact unit, easily worked and easily. It's fine; it's a very compact unit.

The farmer above described land purchase during a time when interest rates were extremely high – not classically an ideal time for land purchase. Land is typically considered a good investment, and has consistently increased in value in recent decades. Land is also a limited resource, only available when another landholder decides to reduce his or her holdings. This occurs primarily upon the retirement or death of the existing holder, or if the holder goes out of business, and thus access to a specific plot may occur once in 10 – 90 years, depending on farm succession. However, farm land in a neighbourhood would come available on a much more frequent basis (owing to the number of land holders), as demonstrated by the expansion of most farms in the study over the past 20 years. Due to the physical limitations to transport of labour and equipment, *land in close proximity to the existing holding is of high value for expansion*, which is in turned believed by most farmers to be necessary for ongoing business success. The farm 'next door' is of particular value, as it allows the enlargement of the base unit. Farmers reported believing that if they did not attempt to buy the land when it became available, another farmer would, thereby denying them future access. Therefore, *farmers will almost always try to acquire new land which becomes available in their neighbourhood.* Rare exceptions to this rule are farmers

who are planning to retire without a successor in the near future, farmers who do not have sufficient labour to make use of additional land, and hobby farmers.

The opportunity of land also makes other opportunities possible, such as bringing a successor into the business full time.

> Farmer: And [son] came back, and he worked for several farms in the area around about here, and he was working steady with another farmer for about a year. Then when the extra land was spoken about we just decided right he will come into the business and he will come home. It was always the…he always was going to come home at some point but there wasn't enough land to justify having him full-time, but now there will be so that's how he is coming home. He is quite looking forward to the challenge like so…aye…

In this case, the opportunity of land brought about an event which was planned in any case – the son joining the business. But this could not happen until land became available. Land acquisition is not necessarily essential to succession – other farmers described an incremental process of expanding the business, and gradually increasing the son's hours on-farm, while he also did contract work to supplement his income. However, in the above case, *access to land enabled a significant step to be taken towards expansion*, resulting in a noticeable change to the land holding. The significance of opportunity to land acquisition makes this process particularly influenced by life events, such as illness, retirement and death.

Succession is also sometimes based on the existing farmers' retirement – on farms where there is only sufficient work for one person, the father's retirement is necessary for the son to become a full-time farmer. Access to farm resources in general are typically based on family relationships – without the capital necessary for farming already within the family, very few young people can afford to start farming (Symes, 1990). Research in the UK has consistently demonstrated that farmers with successors are more likely to invest in their operation and expand, in order to maintain long term viability, than farmers without successors.

Consistent with the concept of 'opportunity', most farmers indicated that they engaged in environmental programs (such as Land Management Contracts and the Rural Stewardship Scheme), because they saw the opportunity to access resources, most recently those they felt they had lost through modulation of the Single Farm Payment.

> Farmer: It's a spur of the moment decision more or less. You get organised for financing and get on with it. We have just newly finished putting up a building at this farm because the government…there is a pot of money to use up and they gave a grant so… We were fortunate; we got a 45% grant on it. That was a decision we just made almost overnight, we put up this building to reap the benefit of this subsidy which…45% hopefully it will pay for itself, when we get the stock inside, it was put up for

stock. So that was….so things like that you don't get time to ponder your decision, you've to really get on with it.

Interviewer: You must have had the idea in your head […]?
Well we were thinking of putting up a building like but when this incentive [came along]…

The need to respond to opportunities can make for fairly quick decision-making. In many cases, these opportunities represent plans that were partly formed – such as new fences or a new building – the government program was simply an opportunity to put those plans in motion. *Farmers act according to broadly formed long term plans, in assessing opportunities which occur at short notice.*

The importance of responding to opportunities means that knowledge circulation is also significant – *farmers reported paying close attention to rumours about life events, such as retirement of local farmers, so that they could 'get a word in with the factor' regarding acquiring the land.* Similarly, knowledge of new government schemes enabled farmers to plan for future development of their land, and in some cases, estimate the possible returns from new land acquisitions. Access to this kind of information is most likely to circulate through networks, which are addressed under Question Three.

'Needs must'

The other decision-making process discovered in the field research can best be described as '**needs must**'. This is more commonly associated with decisions to change commodity, or to sell land. Economic 'stresses', such as the high cost of inputs, labour scarcity and declining commodity prices, have resulted in circumstances under which farmers feel driven to make a change.

> Interviewer: OK. That's less than you have arable land though?
> Farmer: Yeah the rest is grass for cows and grazing, its ploughable land but a lot of it's down to grass, for silage and stuff. We have reduced the crop, it was up to about 160/180 acres of crop but we have reduced it and we are keeping more cattle now.
>
> Interviewer: OK. Why did you decide to do that?
> Farmer: Just since […] crop, I have got a lot of barley sitting in store and I can't even get £70 a ton for it.
>
> Interviewer: So there is no point?
> Farmer: There is no point. The only reason we grow crops is for straw which is a bit stupid but…you need the straw.
>
> Interviewer: You must feed some barley though?
> Farmer: Yeah we feed barley, yes. I would like to feed all the barley on the farm if possible, but we are […], we don't have enough cattle for that yet, but hopefully I will have more cattle and will be more intensive. We are intending increasing the cows to 160/180 or something eventually. And maybe grow a wee bit less crop.

This farmer described a process of incremental change, in response to low barley prices. He gradually reduced his barley production, and increased the intensity of cattle production, feeding a higher percentage of barley to his livestock, and removing it from the formal market place. He also describes limitations on the speed of cattle increase – in this case he appears to be increasing his herd by selling less, rather than buying more in – and so is reliant on natural increase. He also identifies his need for straw as an important factor in the decision to grow grain crops. The grain itself is only part of the commodity value. For field crops, *the market price of the grain must be considered alongside the value of straw.*

When farmers decide to discontinue a commodity, they typically act incrementally at first, gradually increasing or decreasing stocking density or acreage of a field crop. In discontinuing a commodity entirely, typically a breaking point is reached, following the gradual decrease, in which production is stopped completely.

> Farmer: When I came here…after we married we had a few cows, built up the cows to…34 cows, we had about 34 cows and uh…when the BSE thing came in I sold them, then I put sheep up, at that time I had about 230 ewes. And at that time I built the ewes up since that time. I had about 640 ewes, but I've started to cut back so now I just 470 ewes and 120…150 hogs so that's what I have got now.
>
> Interviewer: Was it a difficult decision to let go of the cows?
> Farmer: I had to. I had to because there was…two dry summers on the trot; really dry summers and I had no food for the cows for the summer. And I had to…you know the road goes right up the glen here, I had to put a gate on the tar road and feed the cows on the roadside.
>
> Interviewer: Oh goodness!
> Farmer: Aye. It was so dry that two years you know. So that's why…when the BSE thing came in, we said we have had two dry years, well, put the cows down the road. It wasn't good for the cows and calves at that time. It's just mostly sheep.

This farmer describes his response to the BSE outbreak in 1996 – selling his cattle. This was in contrast to most farmers who simply continued to produce, hoping to ride out the low prices. *The key issue for this farmer was not the BSE event itself, but the two previous summers where he had insufficient grazing for his cattle; the BSE event simply pushed him to make a decision he had been considering in any case. The system 'shock' was not a sufficient justification in and of itself, but rather the 'final straw'. Farmers do not respond to a shock event in isolation, but within the context of previous years' experiences.*

The only new 'commodity' in the study site is engagement in environmental programs. This new commodity is typically small scale: fencing off

waterways, leaving the occasional field aside for wildflower growth, or maintaining a path across their holdings.

Farmer: Yeah, the Land Management thing, we were speaking about it. I was thinking about doing the road you see, but…

Spouse: We were going down to do the road - access - but we were weighing up the impact with more visitors, how it would affect our work.

Interviewer: That's true.

Spouse: You have more people trailing about all over your farm…

Interviewer: It's OK if…

Spouse: OK, I mean mostly we have people go up and out the hill road, that's fine.

Farmer: There aren't many.

Spouse: But then once they start coming in their droves it might cause a problem.

Farmer: So I haven't done anything about that.

Spouse: But that was because we really financially didn't have to do anything this year, but maybe another year we might have to.

Farmer respondents indicated that they entered these programs primarily to benefit from resultant subsidies, which must be balanced against the demands and results of scheme entrance. Government programs can therefore be entered into as an opportunity – to gain resources, or funding for an activity which was already planned (such as fencing), or as 'needs must' in order to generate income to maintain the farm.

Constraints

The concepts of system 'shocks' and 'stresses' is highly important to the CAVES study, where it is hypothesised that long term social networks contribute to the relatively stable land-use system currently in place in the Upper Deeside region. From the study it is clear that change is also limited by the options perceived by farmers. Both responses to opportunities and 'needs must' occur within restrictive parameters. Farmers access opportunities within the constraints of their land suitability, current farming set-up (e.g. infrastructure, asset base and debt load), market trends, subsidy structure and other government programs.

Interviewer: So what kind of changes have you made over the years?

Farmer: Well, just made the fields bigger, put up sheds, and nae a awful lot really. Just cattle. There's not an awful lot you can change about the

> farm. Some farms are just suited to some things, like sheep or cattle, there nae an awful lot you can do up here, you can grow trees, sheep or cattle… It's too near the sun for growing barley crops and such. It's a cattle farm. We've all the buildings for it.

Most respondents in this study do not believe their land is suitable to anything other than the beef, sheep and barley production which has characterised the area for generations. Over time, the production of other commodities has reduced, but these three have remained. Farmers believe that with increasing economic pressures, agriculture will 'come down from the hills' – less viable land will be removed from production, and farmers will produce more intensively on the higher quality land in order to generate economies of scale. *Some farmers are also adopting an extensive approach on their lower quality land, reducing inputs to a minimum, in order to reduce cost of production.* Change in both cases is incremental, small adjustments to existing commodity production, until an opportunity occurs. *Farmers in the study site believe they have few realistic options in terms of alternative commodities to produce.*

Starting a new land use – or indeed continuing a land use which is not common in the area – can pose logistical issues for farmers:

> Farmer: Aye so…we have just moved into this place, it will nearly be four years now. We had another farm […] up at the top like. We are three hundred and fifty acre arable and the same three hundred and fifty of hill. Its beef cattle, and sheep, we used to have pigs, we went out of pigs oh…about eighteen years ago.
>
> Interviewer: There's not much in the way of pigs in this area is there?
> No. No. We couldn't get anybody to pick up the […] pigs you see, not a big enough number. And we went into cows then; we went out of pigs and went into cows.

This farmer went out of pigs because he could not get them to market – the other farmers had stopped their pig production, which reduced possibility of joint shipping. Instead the farmer adopted a commodity widely produced in the area. Several farmers with arable land also noted that biofuel production is not a realistic option, as the closest processing plant is too far away to make it viable*. Market for commodities can be location specific.*

Farmers are also limited by the particular constraints of the commodities they produce.

> Farmer: Well the long term, once you go out of cattle if you have got a big lump sum of money you are taxed on it and then if you want to go back into cattle you haven't got that capital to go back in. *Breeding cattle is not something you can do just overnight, it takes four years to get a cycle going, before you have got the progeny to sell that you want.* [Emphasis added] So…you give up you could be two or three years down the line, you want to go back in again and its not nearly so good to get back in. I have seen farmers go out and go back in and it's always the wrong time.

> If you just keep your…keep it basically as it is then you get the good as well as the bad.

This farmer describes the issues surrounding entering and leaving beef production. *Another farmer also described the learning process associated with a new commodity, arguing that it would take several years to learn how to produce sheep, when his experience had been entirely with beef cattle.* Switching from cattle to sheep production also means changing fencing and holding facilities, and therefore investment of time and money beyond the price of the sheep themselves. Most farmers consider it poor practice to 'chop and change' – switch commodities in response to short term down-turns in the industry. Instead, they prefer to hold out for better prices long term, believing that the industry will 'come right' in a few years, as it has in the past, and indeed the present: reductions to farm subsidy payments with the transition to the SFP in 2006 were offset by increases in the price of beef (through lifting of export restrictions). *Farmers are therefore unlikely to discontinue production of a commodity following a single year of poor returns, particularly if production involves livestock. Nor will they consider changing commodities when they are satisfied with current returns.* Land sales occur only as a last resort; tenanted land is only given up in exchange for land in a different location. *Reduction of land holdings occurs only when a farmer decides to end the farm business, or is forced into it by financial necessity*. However, a farmer may sell land in order to buy other land which is closer to the main enterprise. *Farmer respondents also reported unwillingness to engage in a commodity which would permanently change the land use capability of the land, such as planting trees.*

Most of the farmers in the study had some form of tenanted land – land rented on a semi-permanent basis from a large land holder, typically an estate. Historically, tenancies could be passed between generations, and many of these types of holdings continue to exist. More recently, landlords have opted for 25, 15, 10, 5 and even single year tenanting contracts. As farmer respondents had typically increased the size of their farm in recent years, they could be operating under several different lengths of tenancy, and are often tenants of more than one estate. The importance of increasing the size of the farm is reinforced by *factors*, who *typically redistribute land among existing tenants when a tenant retires or leaves farming, rather than creating a new tenancy. This makes it difficult for new entrants to farming*, unless they are entering an existing holding through succession.

The actual redistribution of land is dependent on the landlord-tenant relationship. Although none of the respondents described serious incidents of broken trust, they were clearly wary of the power wielded by the landlord over the future development of their farming enterprise. Certainly *the landlord holds the power to choose which tenants can expand their operations*. The insecure nature of more recent tenancies – often 1 – 5 years in length – reduces the amount of investment made maintaining or improving land quality, as there is no guarantee that the tenant would still be there to see the benefit in later years. This also holds true for establishing diversification activities on tenanted farms. Tenant farmers also have greater difficulty

acquiring bank funding to invest in the farm, or farm diversification, as they do not own their land, and therefore have no equity in it. *Tenant farmers therefore operate under a different set of constraints and opportunities than farmers who own their land.*

Commodity changes also reflect farmer reliance on subsidies, and the particular orientations of the subsidy structure. Kerr et al. 2003 reported that payments to 'less favoured areas' (which cover the western third of the study site) have historically been based on stocking density and emphasised cattle over sheep. This was affirmed by farmer respondents.

> Interviewer: So have you made any changes, major changes over the years in terms of what you produce? You mentioned you stopped the sheep.
>
> Farmer: Uh huh. That was just a sort of labour thing because we calve in the springtime and the lambing is in the springtime, and everything just happens together so…I used to do the lambing but [brother] and my father used to look after the lambs and the sheep. But when they stopped it was a decision whether we would find a shepherd or… But for 250 ewes it didn't justify a shepherd so…we bought in new lambs for the two years that we needed them for subsidy, to keep our subsidy, we stopped for a year but uh…last year we bought in new lambs again, although we don't need to buy them in now for subsidies. There is grass in the wintertime, […] so we buy in new lambs and sell some…sell the rest for breeding.
>
> Interviewer: So how did that work with the subsidy then?
>
> Farmer: It was on the headage payment before the single farm payment came in. It was on the headage payment and to keep your subsidy for the sheep you had to keep…you had to actually have the sheep on the farm. And you only got them for female sheep so by buying in new lambs and keeping them over the winter we still were able to claim the subsidy.

Notable about this description is both the influence of the subsidy on decisions regarding commodity production, and that the practice of buying in new lambs continued, despite a change in the subsidy. As previously argued, farmers do not change their practices quickly, even when the initial motivator is removed.

The above quotation also raises the particular dynamic of labour: sufficient work and income must be found to justify a full-time employee. Employees can be contracted on a daily basis from the machinery ring, but in general, part time labour occurs on an occasional basis, rather than half or ¾ time. Farmers also expressed concern about the insecurity of hired labour – given the difficulty finding employees, should an employee quit, the farmer might have great difficulty finding a replacement, and be forced into reducing production without notice. This, in combination with the amount of trust associated with operating expensive machinery (further discussed in the social networks section) has made farmers prefer to rely on family-based

labour. *Farmers balance decisions regarding commodity change and land acquisition against resultant labour needs, and the ability to access this labour within the household.*

Farmer Sub-types

In characterising farmer decision-making as based around opportunity or 'needs must', it is not our intention to argue that all decisions are reactionary, rather than pro-active. Farmers do indeed seek out opportunities, but this is far less common than anticipating and reacting to local events. Farmers within the study site are diverse in terms of farm structure and personal orientation:

> Factor (about his tenants): About 12 [tenants], something like that. Some of them are small, some of them are quite big, but some of them have got several farms, some of them have got one, it varies. But that's agriculture. You get big farmers and little farmers, part-time farmers, big business farmers, lifestyle farmers, old, retired people who should have retired but aren't but they still enjoy farming, it's a lifestyle. In this part of the world farming is a lifestyle, it's not a very, if you want to make money you don't come farming in this part of the world. Most of them are doing it because they've always done it, they don't know anything different, and they enjoy it. We call them in some cases 'dog and stick men' because they walk the hill with their dog and their sticks, it's a lifestyle thing, and basically their wife would have a job off the farm to bring in money to pay a lot.

This factor describes the diversity he sees, even between the twelve farmers on his estate. There is an extensive body of literature on types or styles of farming, as a means of accounting for differences in approach to farming. At least a dozen separate typologies of farm and operator types can be found in the Western literature on farm household decision-making. Marsden et al. (1986) identified five types of farmer, based on their orientation toward survival, accumulation or retirement. Salamon (1987) identified yeoman versus entrepreneurial types, based on ethnicity, business orientation and response to risk. Work by Whatmore et al. (1987a,b) and Marsden et al. (1992) utilised degree of subsumption – integration of external capital into the enterprise – to develop a typology and evaluate technological dependency, credit relations and market linkages. Bowler et al. (1996) offered a classification of seven possible pathways of farm business adjustment, based on productivism, diversification, pluriactivity and traditional farming ideals.

The typology of most relevance to this study is Shucksmith's (1993) work on Scottish farmers. Shucksmith (1993), proposed a classification of farmers based on three ideal types: accumulators; conservatives; and disengagers. The accumulators operate as capitalist agribusinesses; the conservatives are rooted in the productivist tradition and show little propensity to diversify; and the disengagers are often farms without an apparent successor where the farming enterprise is reduced in intensity.

For the Grampian case study, we were able to access Shucksmith's findings, from which we drew the forty farmers from the sample which were located in the study site area. These are presented in Table Five. Of these, only one was identified as an agribusinessman, the vast majority were given the label 'conservative', with 20% labelled as disengagers, and likely to leave the region.

Table Five: Farmer Ideal type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Accumulator	1	2.5	2.6	2.6
	Dissengager	8	20.0	21.1	23.7
	Conservative	26	65.0	68.4	92.1
	Other	3	7.5	7.9	100.0
	Total	38	95.0	100.0	
Miss-ing	System	2	5.0		
Total		40	100.0		

Shucksmith was working from a different sampling frame, and so it is impossible to determine the amount of overlap in respondents, although a small amount is quite likely, given that census statistics report only 280 farms in the region at the time of his study. The high number of 'conservative' farmers may reflect the limited land use changes which have occurred in the region. Shucksmith and Herrmann (2002) expanded on Shucksmith's (1993) work through more extensive analysis, resulting in a typology of six primary groups: hobby farmers, pluriactive successors, struggling monoactives, contented monoactives, potential diversifiers and agribusinessmen.

The existence of multiple farming typologies reflects the differential orientations of the researchers involved: typologies are formed to predict or analyse differential response to specific situations, in Shucksmith's case, response to policy shifts by diversification of farming activities. For the Grampian study, the interest was in how farmers approach land use decision-making, and so a different typology emerged. *In the CAVES Grampian study, four approaches to land use decision-making were identified: entrepreneurial, traditional, pluriactive and hobby/environmentalist/lifestyle.* These types represent general orientations toward business development, which become evident in how the farmers respond to opportunities.

The **entrepreneurial approach** is characterised by being business-oriented, experimenting with new commodities, typically expanding their production.

> Interviewer: You have added a lot of land over the years, what was behind those decisions?
>
> Farmer: I don't know I am not sure. Just…I don't know, it's just…I think it's just the way we are. We just like to always be expanding and improving, doing more, you like to think that you are getting somewhere. I

> think that's the…I suppose really behind it all was my father…my father was very forward and progressive, especially when he was young. A human dynamo really! [LAUGHTER] We have been brought up to that.
>
> Interviewer: That's just what you do?
> Farmer: I think when a business is expanding and moving forward it's a sign that it's healthy. It's not very healthy if it's not going anywhere. But I think…well I don't know I think really the expansion…I think this will probably be about it now. The problem now is that you know if you need hired help there is just no one…

This farmer is expressing his belief in business expansion, an orientation shared with, and most likely derived from, his father. His ability to follow this orientation is impacted on my access to labour.

The **traditional approach** is characterised by a maintaining the farm business at a fairly steady state, expanding or adopting new technology slowly. This type of farmer may be oriented towards producing a high standard of livestock or field crops.

> Interviewer: Have you made many changes over the years?
> Farmer: No. Not many changes, not on the farming side of it really.
>
> Interviewer: No more land, new buildings?
> Farmer: No. It was just the very same when I came in here to start…well no not really when I came into start, when I came into start I…there was an old byre and I took down the front of it and kept the back. That's the one this side here, and I put it up myself and then I did the other one, the green one, put it up. The local joiner from the [name] Estate he gave me a hand. That's the only things I have more or less really done, replaced, but just worked up the ground. Another big thing on the farming side here, I don't know about Canada but we have got all these fences, you see all these fences?
>
> Interviewer: Yeah.
> Farmer: Its just different little parks, it takes a lot to keep up all these fences, it costs a lot of money just to keep them up you know.

This farmer continued on to describe all the costs associated with maintaining fences, and the other infrastructure on the farm. He is highly unusual among respondents for not having expanded his land holdings in the thirty years he has been on the farm, but when questioned on it, identified his neighbours as 'greedy', paying too much for land and driving up the price. He has engaged in environmental programs to gain subsidies, but has been selective, preferring not to have the hassle of too many visitors to the farm. His wife works full-time, which they later stated is necessary to maintain their lifestyle, which includes international travel.

The **pluriactive approach** is characterised by full-time employment on the part of the primary farmer. Although these farmers would not appreciate the

stigma of being labelled a ‘part-time farmer’, the time spent in employment inevitably limits their ability to work on the farm, and thus expansion is not a realistic possibility.

> Interviewer: So is your job full-time then?
>
> Farmer: My job is full-time yeah… We feed the cattle, it’s not really too bad because really its morning and nights, in the wintertime you get up in the morning and feed them and at night times. [His employer] for twenty odd years now so…I just take days off, half days off at harvest time, I take half days off. Farmers don’t want to see you at harvest time anyway.
>
> [later in the interview]
>
> Interviewer: So what do you think is going to happen in the future for the farm then?
>
> Farmer: Um…I will continue…a few years yet anyway. It will depend how…I am not going to farm after sixty, if I still have my job there is no point doing both. I won’t be getting any fitter I wouldn’t think at sixty years of age!... I think probably fifteen/sixteen years at the most, maybe even before that because I have got a really good pension at my work. I have been there twenty-one years so I have a good pension at my work so maybe even fifty-five years of age I might pack it in, the farming. It’s more the side line now, even though it’s the family, it’s more a sideline now. I do enjoy my job.

This respondent clearly has different issues surrounding retirement than would his farming neighbours, who would not have access to a company pension. His work fits well with his farming responsibilities, but ultimately is the driving force for his personal decision-making, rather than the farm.

The **hobby/environmental/lifestyle approach** is characterised by orientation towards farming primarily for recreational purposes. The single hobby farmer identified in this study was particularly oriented towards environmental programs, actually exceeding minimum requirements. Although this farmer had expanded the land base in recent years, this was not to increase production or viability of the enterprise, but to limit the unpleasantness of neighbours.

> Interviewer: You said when I came in that you are not really a farmer. What is it that you do?
>
> Farmer: I think we generally say we play at farming; we don’t rely on it for a good part of our living.
>
> Interviewer: How big a farm do you have?
> Farmer: Just under fifty acres.
>
> Interviewer: OK and is that arable, grazing?

Farmer: Its grazing, although we have gone in for the Countryside Premium Scheme seven or eight years ago and now they have just done around of that which is now the Rural Stewardship Scheme and we are just implementing the things that we got in that grant last year.

Interviewer: OK and what would those be?

Farmer: …yeah species rich grassland, unharvested crop, a bit more hedging, we have done a lot of hedging in the early ones, a bit of tree planting, and a pond and a wetland which is the second area […] the last area. And we are fencing off burns too.

[later in the interview]

Farmer: And then we have had great fun with the Countryside Premium Scheme and the Rural Stewardship with the rest of the land.

Interviewer: So you are enjoying that?

Farmer: Yes we are.

Interviewer: Oh that's interesting. A lot of farmers that I have come across complain about it …

Farmer: What, the Rural Stewardship?

Interviewer: Yeah. Having to do different kinds of things to recoup money for […] their land.

Farmer: I can understand that because what they want to do is farm. Um…the Rural Stewardship isn't really what…

Interviewer: Is it really what they consider farming to be about?

Farmer: No. No. Whereas I enjoy conservation so it suits me very nicely. I am really looking forward for instance to the species rich grassland because you can buy a bog standard species rich grassland mix and I am afraid I've pushed the boat out and bought a rather more expensive mix which is based on species rich grassland down by the Dee. And it is much more expensive but I really really want a nice meadow so…but something that's in keeping with the area. So that's going to be interesting when it's sown.

Interviewer: Oh good for you. That is interesting.

Farmer: But I think any farmer would be horrified!

This respondent was careful not to be identified as a 'real farmer', but someone who plays at agriculture and enjoys it.

Implications for Computer model
Findings on farmer decision-making can be summarised into the following features to be included in the model:

- Land managers respond to opportunities for land acquisition and government grants as they arise, within a consistent set of values dependent on their approach to farming

- Land managers do not respond to shocks immediately, unless these are preceded by on-going stresses.

- Changing commodities carries a cost: it takes several years to establish a new beef or sheep herd, as well as alterations to the farm infrastructure.

- Land managers typically begin discontinuing a commodity gradually, before reaching a critical point, at which they discontinue altogether. This 'tipping point' could be either a shock or a long term stress.

- The potential offered by new commodities is limited by access to markets, and the suitability of the land and buildings currently held by the land manager.

- Farm expansion is limited by access to labour: expansion activities must fit within existing labour supply, or result in full-time employment for a staff or family member.

- Tenant land managers operate under different constraints than owner-operators. They are less able to begin diversification activities, and are at a disadvantage when bidding on land for purchase against landholders with equity.

- Farmers can be grouped into four sub-types (entrepreneurial, traditional, pluriactive, hobby/environmental/lifestyle), each of which operates according to specific decision-rules.

- Entrepreneurial farmers are the most likely to bid on land which becomes available in their neighbourhood. Traditional farmers are also likely to bid, but may have fewer resources. Pluriactive and hobby/environmental/lifestyle farmers are the least likely to bid.

- Land in close proximity to the existing holding is of high value for expansion. The farm 'next door' is of particular value, as it allows the enlargement of the base unit.

- The size of the land parcel available will impact on who is likely to bid: a hobby farmer might bid for a small neighbouring plot, but would be unlikely to bid on a large unit.

Question Three: the Role of Land Users' Social and Informational Networks

The conceptualisation of social networks (Bourdieu's construction of social and cultural capitals) was presented in the 'background' section at the beginning of this report. In this section, four issues related to networks are addressed: access to information, resource sharing, social norms, and community integration.

Access to information

There are numerous opportunities for farmers to access business information, many of which are not dependent on social or cultural capital (e.g. farming newspapers, government publications, paid business advisors). It is an assumption of the model that farmers include observation of their neighbour's activities, and respondents confirmed that this was indeed the case:

> Interviewer: One of the things we are looking at is where farmers get their ideas, the incentives to do new things.
>
> Farmer: Oh right aye. Well we do pinch other farmer's ideas, no doubt about that like.
>
> Interviewer: How does that work?
>
> Farmer: Well we just watch what they are doing, and see what they are doing, try out what they have been up to and see if it works. If it works well, we can work it, we do it. Nobody seems to mind because they will be getting some info off us.

Other farmers indicated that this observation is selective, and combined with multiple information sources:

> Farmer: I learn by my mistakes. Once you make a mistake you know not to repeat it. I suppose you…I wouldn't say you learn from your neighbours because I don't have much time for my neighbours, […] you learn by your neighbours mistakes probably. [LAUGHTER] Aye. Uh…the college and that used to…these monitor farms might be good but there is nothing near here, the nearest one is up in Buchan which is miles away. Just reading in the press what things you can do and that, speaking to people I suppose, speaking to salesmen and that you know, say nutrition and stuff. I don't know where you make your decisions from.

This farmer, 'entrepreneurial' by the definitions of this study, was not seeking to emulate his neighbours, and instead preferred to read and speak with experts about new innovations. Later in the interview he described extensive knowledge of his neighbours' activities, although he declared that he did not

learn from them. *Farmers are aware of their neighbours' actions but will only emulate the ones of those of whom they approve.*

Bourdieu's emphasis was on group membership, formal and informal, as overt evidence of social capital. Opportunities for formal group membership included the National Farmers' Union, the Tennant Farmers Association, Grampian Farm and Wildlife Advisory Service, farm building societies, local agricultural show committees, and commodity production groups. Most farmers were members of at least one group. There were also numerous opportunities to participate in agricultural events, which did not require formal group membership: these included local and regional agricultural shows and events, farm walks and open days, agricultural auctions and judging competitions. These events reached a radius of several hundred miles. Attendance at these events brings not only access to the information formally presented through displays and business representatives, but opportunities to discuss informally with other farmers. Farmers also access information informally through travelling salespeople – who often provide information on practices on other local farms – and at non-agricultural events, such as family gatherings and recreational activities. *Farmer sources of information for innovation are not limited to their neighbours*[4]*.*

Given the abundance of opportunities for information exchange, no single farmer can be expected to utilise all available opportunities. Instead, there was a high degree of selectivity, with some farmers involved in more associations, others travelling greater distances to events of particular relevance to their businesses, and others preferring to rely on information from a select few.

> I am not involved in any local agricultural fairs although we support them, we go and show cattle. Um…locally we have a local community council and those sorts of things. I am not particularly involved although they have been here to have a couple of meetings and dinner with us a couple of times. … We are pretty involved, if they need to put up a bonfire in the village for Guy Fawkes night you know, they borrow one of our tractors and trailers to get stuff , practical sorts of things I am involved with… I have been very involved with tourism groups in the area because that's kind of our immediate future really… I used to be very involved and I stepped back a wee bit because they can take a lot of your time really these things. So I stepped back.

Within this geographic spread are commodity specific patterns. Farmers reported engaging in agricultural events of particular relevance to their business. The farmer above described his diversification activity as highly influencing his network engagement – he attends meetings and groups associated with local tourism, rather than local agricultural or community events. This reflects his primary source of income. Farmers who market direct to processors no longer need to attend the regional mart, although they

[4] This is particularly important to the computer model, which at present utilises neighbourhood experiences as the frame of reference for the farmers it portrays.

will occasionally attend to observe pricing levels. Farmers' whose production focuses on seed-stock (high quality genetics) attend breed association meetings and shows; they also have international connections for livestock sales (although have been unable to utilise these in the past decade due to export restrictions from BSE). One farmer identified himself as a 'dealer' – an individual who buys groups of cattle for further sale, in addition to his own production. As a result he travels across Scotland on a weekly basis, attending the different regional marts. His connections are thus extensive, but clustered around these regional centres. These differences in network structure result in trade-offs for the farmers. The 'dealer' stated that he had missed out on grant funding because he was not sufficiently connected to local farmers to learn of it before the dead-line; a new farmer described the loss of many thousands of pounds he invested in beef quota, as he had been poorly advised by a national farming union representative, but did not have sufficient connections at the time to be able to successfully raise a challenge. *Farmers access different information dependent on network membership. Those not directly engaged in their commodity network will not have access to all of the information available through it.*

There were also age-based patterns.

> [Farmer] Well the mart is a good social day but uh, it's an excellent day out the mart but it's the time thing you see. Unless we go to buy cattle I tend not to go but you will get some farmers that will go every Friday, its just their social day out, have their dinner, you see quite a lot of them, there will be like four of them, and one will buy the lunches one week, and it goes in cycles so… There is a few of those going on but uh…
>
> [Interviewer] Is that older farmers or just…?
> [Farmer] It tends to be older ones aye, aye, pension age and beyond like, just…they have always done it, and carried on so... And they are the ones that are always up to date on what is happening!
> [LAUGHTER]

Historically, much social interaction occurred at local auction marts, a reflection of the livestock production dominating agriculture in the region. It was a weekly event to attend the local sale, meet other farmers, and observe prices and quality of production. With improvements in transportation technology, and the establishment of a large central mart near Aberdeen, these village marts have now died out. Although the weekly ritual of attendance has been maintained by older farmers, younger farmers are more sporadic in their attendance. Farming successors tended to base their connections on friendships in the local neighbourhood, and those acquired at agricultural college. As these individuals did not typically have a major role in decision-making, they were less inclined to attend agricultural interest meetings – like the National Farmers Union – but more likely to attend agricultural events, apparently for recreational purposes. *The centres (or nodes) of information access have changed in recent years. There are now more nodes, each of less relative importance.*

Improved transport has also allowed for centralisation of group meetings – the traditional farming 'discussion group' organised by agricultural colleges are now rare, but opportunities for other agricultural events have increased. Attendance at the Royal Highland Show, Scotland's largest agricultural event, appears to have declined slightly, but there are many newer events – like Scots Heap (sheep production) and Beef Expo – which attract thousands of attendees. *Farmer information exchange thus occurs at multiple scales: locally through encounters with neighbours; regionally at agricultural events and through contact with agricultural industry professionals; and more broadly, through international tours and events.* This broadening range of connections is facilitated by relatively cheap and accessible transportation, and increased utilisation of mobile phones.

Information sharing can be one-sided. Several of the apparently socially isolated farmers indicated that they have only one or two people from which they gather information. These people, in turn, are linked to more extensive networks. Other farmers pointed out that information shared may not always been complete, or entirely accurate. This reflects both the typical inaccuracies of 'gossip' among any social group; farmers' reticence to convey all the details of their farm business experience to weaker connections; and deliberate inaccuracies, apparently utilised to maintain business advantage. Similarly, professional sources of advice are not always trusted, and having paid for poor advice once, farmers are reluctant to return. *Farmers are therefore selective in utilisation of acquired information, even when it comes from apparent 'experts'.*

Resource sharing

Most respondents indicated that they do a small amount of equipment sharing – typically pieces which are not expensive or high demand. They also provide emergency labour to neighbours, and occasionally assist with specific annual high-labour tasks, such as sheering or making silage. Both of these types of sharing have increased in recent years, although many respondents reported that sharing labour was much more common before the introduction of the combine several decades ago.

These informal sharing behaviours are almost exclusively with immediate neighbours.

> [Farmer] Reading between the lines in your letter a wee bit, it was about sharing tools, and labour and everything like that. There is very little of that here, in fact it's basically nil. There is no sharing, there is one farmer shares but he shares with somebody about fifteen miles away. It's not in the area.
>
> [Successor] It's mainly, its some machines.
>
> [Farmer] Just some machines that they bought together.

[Interviewer]: That's fifteen miles away?

[Farmer]: Aye. It's strange, because they are both big enterprises, they are both quite sizeable enterprises and why they share a muck spreader I have no idea. [LAUGHTER]

[Successor]: Both enterprises are big enough to support their own machinery no problem. They are bigger than anybody else around about here.

[Farmer]: Aye they are bigger. They are probably the biggest you see.

[Interviewer]: Are they related, like are they relatives?

[Farmer]: No. No. They are friendly but I would think it's a recipe for unfriendliness they way they do it. [LAUGHTER]

[Successor] The only other folk that really share labour around about here…well we share with one farmer, we do his silage work and he comes and works with us at silage time. But that's the only [farmer name]. His son comes and does some odds and ends here but we have worked it out, we sit down every year, we never give each other a bill. It works out within a couple of quid every year back and for. We only do it with one but its just specific jobs, just the silage.

This farmer and his successor describe the anomalies of sharing across a distance of 15 miles, and of two large farms needing to share a standard piece of equipment like a muck spreader. They imply that undertaking this sharing at a distance, to the exclusion of closer farmers, can cause friction within the farming community, and that this kind of sharing is not the norm among large-scale farms. The neighbours this farmer shares with are much closer. *Farmers benefiting from resource sharing arrangements are typically close neighbours.*

Most farm machinery represents a high capital investment: loaning it to a neighbour creates a risk of breakage, both to the equipment, and the social connection. Several farmers expressed concern that broken equipment could lead to the dissolution of the positive neighbour relationship. Farm equipment is likely to break down through wear and tear, so it becomes difficult to establish whether damage occurred through careless use, or would have happened in any case. This results in a high level of vigilance to other farmers' machinery use, because of its importance to later relationships: farmers routinely commented on the quality of their neighbours machinery use, based on their observance of field conditions, speed of work and frequency of machinery going for repairs. Farmers thought to be careless were not loaned machinery, unless a machinery operator was loaned with it. *Social approval of equipment care is separate (but usually linked to) social approval of labour. Disapproval removes the opportunity to share resources.*

Sharing between neighbours is thus not automatic: farmers reported being selective about the neighbours with which they are willing to work. This is consistent with Bourdieu's concept of social capital formation, whereby contingent relations (those of neighbours) are transformed into durable obligations with a select group. A history of positive transactions maintains these relations: sharing behaviours typically had a lengthy history. Trust is thus essential to maintaining sharing relationships. Many of the respondents identified specific instances in which the reciprocal commitment had not been fulfilled, and trust broken at that point. Importantly, several respondents commented on unfulfilled commitments experienced by people they know, which had the effect of limiting their own willingness to co-operate with those individuals. This underlines the importance of a farmers' reputation in allowing access to shared resources. In some cases, reputation also impacts on access to rental land: factors are more likely to establish or enlarge tenancies with applicants considered to be a 'safe pair of hands'. *Farmers experiencing low social approval will have difficulty acquiring shared resources, and accessing rental land, making it more difficult to expand their farms.*

Relationships can also be broken by other issues, most commonly competition over land.

> Farmer: Well I mean a good example, last week one of our neighbours he phoned me at quarter past one, he had a cow still calving, needing a Caesarean so I was there from…I left here at quarter past one and I wasn't home until half past four, so that was my afternoon taken up. But I mean […] going back and for. The last time it happened he came to us. So…
>
> Successor: That's a neighbourly thing, that's just a neighbourly thing you see. Well people free enough to ask you to go and do these things but other people wouldn't ask you see. Like our nearest neighbours I would never ask them…
>
> Interviewer: Really!
>
> Farmer: No.
>
> Interviewer: Why is that then?
>
> Farmer: Well it goes back quite a wee bit when we bought this first farm in fact, they were awful wanting to buy it you see but uh…I don't know, they thought that I had done something underhand in some respect, which I hadn't. I mean I just put in my offer and the offer was there at twelve o'clock on a certain day. And their solicitor was there with his offer as well and we were sitting out in an annexe, kind of a wee bit outside the office and the offers were handed in. My solicitor was there and his solicitor was there as well and invited me to come into the office and they said…the guy jumped up and said is there no way we can increase the offer, no way Mr whatever his name was. You are out. [LAUGHTER]

Successor: He wouldn't speak for years.

Farmer: They didn't speak to us for years. The father and mother both went past and never looked left nor right.

Interviewer: Oh my!

Farmer: Oh aye it was bad. So there is always this underlying grudge I think. And I mean they watch everything we do and everything is criticised and….but I mean there are times we just have to talk because the odd cow goes wrong, or the odd sheep runs along the road or something like that. We have to interact a wee bit. But I mean they haven't just closed the door entirely but that's the situation, there is a wee bit of strain.

Broken trust is therefore not necessarily dependent on the specific act of sharing itself: two farmers reported broken relationships when one was successful in buying neighbouring land on which the other neighbour had bid. Previous friendly relations and sharing behaviours ceased, due to perceived unfair play. *There is therefore a fairly random element to social approval, in modelling terms.*

More recently, some farmers are buying small pieces of equipment together. New sharing opportunities were often created formally – one neighbour asking another if they would also be able to use the new piece of machinery they are considering.

Interviewer: Do you share any equipment or…?

Farmer: Very seldom. I mean…ourselves and one other farmer across the road, across the road quite a bit, we were both out looking for a roller and you want a roller as well do you? Yeah. I said well we are only going to use it for three weeks of the year why don't we buy the roller; we will pay half of it each and pay half of the costs of repairs. When you need it you take it, when I need it I take it and that's working out very good.

Interviewer: Oh that's good.

Farmer: Because realistically we are not going to need it the same three days of the day, or four days of the year you know. And…well you just say well instead of doing it today we will do it another day. That's worked out quite well. And I suppose that's the basis of the machinery ring type thing isn't it?

Interviewer: Formalising sharing.

Farmer: That's all. That's all we do. If someone came and said we want to borrow your loader for a day we wouldn't let the loader go without either [son] or [worker] driving so you would just come to some

> agreement where they paid, that's expensive machinery you know. Other things like…I don't know whatever, you say well you just take it because we will borrow your cement mixer the next time we need one.
>
> Interviewer: Is there a lot of that kind of back and forth goes on?
>
> Farmer: I think there is a fair bit of it going on. We don't see much of it because we don't do very much of it but I think you know…I think there is quite a bit of it. Especially, if its machinery that you know…is not going to cost a fortune to repair. You wouldn't let your good tractor go, or you wouldn't let your good loader go because they are expensive machines. The likes of cement mixers, rollers, levellers, they are not going to do any harm to them. So yeah there is a fair bit of that going on.

The practice of labour and equipment sharing has increased in recent years, due to financial pressures. However, there appears to be a limit to this: respondents reported great reluctance to share important and/or expensive equipment – particularly that used for harvesting: farms that are close enough to share equipment typically also need to harvest on the same day, and in this region, harvesting days are limited. Large machinery was typically owned by each farmer, despite their recognition of the high cost. This equipment is only informally shared in the case of neighbour emergency. Tasks requiring large or expensive machinery are contracted, typically through neighbours but also as far away as neighbouring villages. Scotland also has several large 'machinery rings' – formalised contracting systems whereby access to contractors (equipment and labour) is centrally organised. This facilitates a greater geographic spread of contract work. Informal equipment sharing is therefore limited to small pieces of equipment (rollers, livestock trailers, silage equipment) and emergencies. Labour sharing is also small-scale, limited to emergencies and flexible harvest activities like making silage. There were no examples of neighbours sharing a full or part time employee. Although sharing behaviours have increased somewhat in recent years, the potential for future expansion appears limited. Although sharing of physical resources appears of relatively small economic importance, relative to the large scale of most farms, it may be particularly important for smaller scale, traditional farms. Labour sharing is of greater importance, again for small farms, as it provides support to farms with only a single staff member (the primary farmer).

Social norms

As described in the background section, academics like Burton (2004) and Gray (1998) have argued that farmers work to a standard of performance, based around identity as a 'good farmer'. In the study site, this clearly involved taking good care of livestock, hard work and financial success on the farm:

Some farmers also included long term care for the land and farming infrastructure:

Farmer: I will just take the estate, for example there are one or two guys on the estate which…they don't seem to be in farming for the long haul, they are in just to take what they can get out of the farm, short term. They are not thinking of the long term future, even though there are sons as well, its short term. Like letting the lime levels down, and not fixing their drains, water running everywhere, fences flat, just sort of running down the farm, not spending money on it. And uh…farmers which…well one farmer in particular, I will not mention any names like, but leaving dead sheep carcasses lying everywhere and not picking them up.

Interviewer: Oh dear!

Farmer: Aye. It's not good. That gives the estate a bad name really. What happens come pheasant shooting time you know, all these toff guys in shooting. It doesn't look very good for…that's bad to me. OK we all get dead sheep but at least we pick them up and take it away. This guy he just won't do it so…that's a black mark that.

Other farmers included personal integrity:

What makes them a good farmer, looking after their land and looking after their livestock. That would be the basics of it. A bad farmer would be one that neglects his livestock and neglects his land. Well you can see it, you can see two farmers that farm side by side, and a good farmer, he has tremendous…whether it be arable, he has tremendous crops of barley, and everything is looking well. And then the farmer next door has neglected his land over the years has poor crops. But it doesn't mean he is a better person. What I am saying about…dealing with them and that, that's more the personal side of it, but ninety percent of farmers do…ninety-nine percent of farmers will stand by their word.

What these definitions of 'good farming' have in common is the emphasis taking good care of livestock, the primary commodity in the area. Personal integrity, care for the land, and making money, were also identified as important. *Definitions of 'good' farming vary between farmers, and so will resultant measures of social approval.*

Consistent with the importance of taking good care of livestock, is study site farmer respondents' perspectives on organic farming. This farmer describes his reduction in input use in recent years (to decrease farm operating expenses) but expresses his reluctance to reduce chemicals and medicines beyond the 'last 20 percent.'

Farmer: Things like that…as I say we are fifty percent there no problem, that's not an issue but it's the last twenty percent that bothers me. OK that's one disease we know, but there could be something else comes along in the next year and then if you don't do anything about they just get worse and die which is… [demoralising] plus it's expensive as well. That's what worries me a bit about it. I think we should be…as farmers we should be using new technology, optimising the thing, but we should use

> the stuff that's available. I don't think we should just turn our back on it. I don't think the food would be any better, personally I don't think it would be any better.

His identity as a farmer is based around using new technology and optimising production. He also justifies his decision on the basis that the food would not be any better: as a beef producer, he has confidence in the quality of his product as it stands. To alter it by changing to organic produce, would denounce his production standards for the past 5 years (this respondent was a new entrant). *New commodity options at odds with the dominant paradigm of good farming are less likely to be adopted than those consistent with it.*

Farmers report working long hours for low pay, accepting this as part of their lot as farmers:

> Spouse: You see there's two different cultures. You get your people who, we'll go back to office workers again. They're accustomed to working Monday to Friday. They've always got these two days off every week, and they've got time for hobbies and things like that, leisure pursuits, but when you're farming, it's 24/7, you just, we find that when we go on holiday, by the time we really begin to wind down it's time to come home again (laughs) and it's always farming orientated somewhere, it's like a busman's holiday, looking at farms. You're never far away from your own back door.
>
> Farmer: If you get advice from the college to go into sheep, or go the other way, the best advice you will get from the college is to do the clean opposite of what they want you to do. Because they seem to go into a trend of you shouldn't have cows up here because it's too far up. They cost too much to keep. And I mean they are doing a full costing, a costing of labour costs…labour costs here you just don't bother with because that's us. And we live within the farm, and if we were going to say right I need to get £10 or £15 an hour for working here well your figures at the end of one year would be so far out of line like you wouldn't even come back from the accountant! You have got to overlook that like. As long as you are managing to keep life and soul about the place and everything is…that's why you survive on a hill farm like this. I mean…well there is a neighbour down here, his father used to be a sheep dealer, and he reckoned that his father was…he was worth £20 an hour. I said well I cannae see why you think that like. Oh but if he went down to the mart and […] buying sheep to resell he would make that kind of money. Well he might for a few times but he might lose a few pounds as well. And I didn't think there was anybody worth £20 an hour unless you could prove it like. And uh…no I think…well if all the hill farmers were going to go and take a wage out of the business every week there would be very few hill farmers left.

Consistent with this, farmers stated that they should 'earn' through production, the subsidies given by the government:

Farmer: Aye. Well we are getting…we are really getting less money but I mean they said it would be simple, single farm payments, you didn't really need to keep stock which I know […] because I keep a lot of stock. I have found folk have actually sold stock, are not keeping any stock, they are getting a single farm payment and no hassle. I think it's wrong. You know about all the farmers that are retired and still getting paid like for doing nothing. Some of them are not even in this country like but… I think some folk have said that the single payments should be tied to the farm, I disagree with that, it should be tied to the business. But the business should have to work not sit on his backside and collect money. And if he wants to retire, cash the single payments, or hand them on to his son or daughter, or whatever, but he shouldn't really be left holding them, to draw money on them.

Farmers were consistently opposed to the feature of the Single Farm Payment which allowed farmers to discontinue production while continuing to collect payments. Key informants indicated that the number of farmers actually doing this was very low, but the few examples were widely known, and very unpopular. This was despite recognition that this decision made solid economic sense:

Interviewer: Are there any new people going into farming?

Farmer: No. You couldn't. Think of the costs, I mean…the capital costs and if you have no single farm payment you have nothing to fall back on if things went wrong have you? We have a lot of money invested in this farm.

Interviewer: Oh for sure.

Farmer: Economically if you were to look at things, what we should do is sell the single farm payments, sell everything and live on the interest. But for some reason we don't seem to look at it that way. [LAUGHTER] I mean that would be by far the best way. But…we have stuck at it. So I suppose I am as bad as the rest of them.

This farmer claimed to be making money without the Single Farm Payment, but apparently was also collecting a significant subsidy. It did appear acceptable to collect the SFP while producing less than previous. *Farmers will continue production without specific commodity subsidy incentive.*

Similarly, engagement in environmental programs was not something farmers typically enjoyed, as it was not consistent with their understanding of the purpose of farming.

Farmer: I think the…well maybe partly that aye, but a lot more of it I think is to do now with you know give the farmer a lump sum of money and dictate what he has got to do for that money you know. Say well if you do an environmental feature, you have got to do a certain amount of environmental features, things for the public, I think that's at the back of it

> as well. But uh…well…we took up farming because we wanted to farm, not because we wanted to build bridges for public access and… [LAUGHTER] You know? I mean I can see them going to an accountant and saying you have got to sweep a bit of the street here! [LAUGHTER] I think in a way farmers…I think it's just purely because we get money, subsidy money; they want to make us feel that we have got to jump through hoops.

However, engagement in these programs is widely adopted. This reflects the financial need for the resultant subsidy, rather than belief in the value of the activities. It also reflects a sense of entitlement to the subsidy money, which is derived from the subsidies they historically received for production. *Farmers therefore do not disapprove of neighbours engaging in environmental programs, but typically prefer to undertake activities consistent with improving production on the farm.* Several respondents were also negative about planting trees on arable land, indicating that this would 'ruin' the land for future arable use. Farmers were therefore resistant to the idea of willow as a biofuel, but open to the production of grain-based biofuel crops (in areas where farmers held arable land).

This is not to say that farmers do not recognise climate change.

> Interviewer: That's why I was asking you about where you got the idea for the new shed and…?
>
> Farmer: Well it was partly because there were new rules coming in; you weren't allowed to feed cattle in fields, certain bits of fields, not rough ground. You see you are not supposed to put a feeder in there now so…that was one of the reasons. Plus the winters are getting wetter.
>
> Interviewer: That's what I have heard. Some other farmers are making comments on climate change.
>
> Farmer: Climate change, they are definitely getting wetter. We used to get hard frosts here for weeks and weeks and it was fine, the fields were fine, but now its wetter they poach off the fields so that was another reason for getting them in the shed. And…the cows are better, they are more content, they lie about, they are not eating so much food.

Several of the farmers linked change in climate, new environmental regulations, and their own decision to up-date the infrastructure on their farms, most commonly through building a new cattle shed. Recent shed building was very common in the Lumphanan region of the study site. Interestingly, some of these farmers described building cattle sheds in part because they anticipated future regulations which would make this compulsory.

Although not part of their description of 'good farming', independence is clearly key to farmer identity. This has already been described in relation to sharing behaviours. It is also expressed in relation to government regulations.

> Farmer: DEFRA. Department of Environment and Rural Affairs. What about 'the Department of Farming and Rural Affairs'. But it just gets quite disturbing when people can just come to your home and demand to see all your books, just move in. There were here for a week one time. They checked all our cattle, two three days in the kitchen there checking all the paperwork.
>
> Spouse: We're honest working folk, there's nobody… It could almost defeat you at times. You just feel that your business isn't your own anymore…. WE feel like government workers now.
>
> [later in the interview]
>
> Spouse: My attitude towards farming is that no one knows how to farm better than farmers themselves. You know, and you see all these bureaucrats, and Eurocrats telling everybody. My opinion is 'how dare you'. Most of the farms around here are generations of farms, there have been generations.

The number of regulations – and paperwork confirming compliance – has grown extensively in recent years, despite promises that the implementation of the Single Farm Payment would reduce record keeping. Several farmers reported frustration at the increasing time requirements of the paperwork and tracking activities, which reduce the time available for 'real' farm work. Farmers also described the intrusion and indignity of government employees spending days on the farm evaluating the farmers' records. *It is difficult to say how this reduction in independence is impacting on farming culture.*

Although environmental regulations may frustrate farmers, they are also vigilant in insuring that other farmers also comply: as sense that 'if I can't do it, I'll be sure that no one else can either":

> Farmer: There was a big row here about spreading muck the other day, in the Alford area, about someone spreading muck when it was frosty. And they, and the poor regional guy that's [name] if you speak to him you'll easily know you're speaking to him, he'll tell you something, he's got a way with words, like. (laughs)
>
> Spouse: He lays it on the line.
>
> Farmer: He lays it on the line, and he phoned up the department of agriculture and asked 'what the hell's going on here, spreading this muck' and they managed to squash it down, ye ken. You should go and see him, like.

These are the same respondents as above. Although it was not them that made the complaint, they clearly supported 'fair treatment' whereby all farmers were expected to comply with regulations.

There is also a gendered component to social norms: a woman farmer in the study found that she was discriminated against by male farmers in the area, when she carried on farming after her husband's death. However, the female hobby farmer in this study did not report similar issues, perhaps because she was not considered a 'real' farmer. The number of female land managers in the study was too small to evaluate this phenomenon; it appears from census statistics that full-time operators are predominantly male. *There is insufficient data to support inclusion of gender issues in the model.*

Community engagement.
Community engagement was also investigated, but not found to be particularly relevant to land-use decision-making. (Engagement in the farming community is already covered under resource and information sharing). In general, with fewer people on farms, the 'farming community' is smaller. Farmers also appear less engaged in the local village activities, due to higher labour demands on-farm, and the risk involved in leaving the farm for several hours when there are no other staff members to address emergencies which might arise.

Implications for the Computer Model

- Land managers are aware of their neighbours' experiences, but selective in terms of which ones they emulate.
- Access to information goes beyond the local neighbourhood
- Land managers have differential access to information, depending on commodities produced (All farmer agents will not know everything that their neighbours know. They are likely to have knowledge in the areas of their current and former commodities.)
- Expertise varies according to the number of commodities produced: land managers are less expert at multiple commodities.
- Resource sharing stays within the local neighbourhood. However, land managers are selective about with whom they share.
- Social approval for maintaining livestock, land quality, personal integrity, hard work and making money. Can therefore infer disapproval for organic farming and farming while continuing to receive the single farm payment. Engagement in environmental programs is neutral.
- Community engagement not relevant to the model at this time.

<u>Validation</u>

Validation was the third step in the field research process, following the pilot study and primary research stages**.** The Grampian model is based on the TAPAS (Take a Previous Model and Add Something) approach to model design. The FEARLUS modelling framework was in development for several years prior to the CAVES project, with the structure informed largely by literature review. What the Grampian field research has brought to the FEARLUS model is data specifically derived for use in the model. Due to the focus of CAVES on complexity and social networks, these are the areas in which the model has most advanced. For quantitative inputs, it is fairly easy to validate data, through cross referencing with existing research. Validating qualitative research is more problematic. There are no standard methods for

utilising qualitative research in agent-based modelling. Standard qualitative research validation techniques include the utilisation of multiple data sources (in this case examples include interviewees, key informants, data from other research projects, statistics, and published literature), and feedback on research results by research respondents. Utilising best practice is an academic standard of data validation, and is also part of the validation technique.

For the purposes of the validation component of the CAVES project, a questionnaire was derived from model components and assumptions. These include the comprehensiveness and relative importance of factors in land use change, principles of land use change, and the decision-making process. As agent-based models are not intended to be predictive, outputs of the model were not given to respondents for validation. The focus was instead on model inputs and processes. Consistent with the TAPAS approach, emphasis in validation is on demonstrating improvements to the model resulting from CAVES field research. Similarly, the particular focus on qualitative aspects of model processes (such as decision-making and social approval) reflects the primary input of the field research into the model. However, we did utilise the opportunity of the validation exercise to validate the range of factors included in the calculating farm profitability, and the classification used for agricultural land.

Validation Methodology

Questionnaires were completed with 8 respondents from the primary field research (5 farmers and 3 key informants). The farmers were selected to represent a range of tenures (tenanted and owner operated), ages (41-70), and approaches to farming (tradition vs expanding). The key informants were also chosen to reflect different perspectives. These individuals were a farm business advisor, an environmental program advisor, and a representative of the National Farmers' Union. No factors (estate managers) or farming successors were drawn on for the validation, as the variety of their responses in the primary field research suggested that a single representative of either group would be unlikely to accurately represent, and thus validate, the perspective of the whole.

The questionnaire involved a variety of approaches, including open ended questions, ranking of identified factors and weighting of responses. A concurrent knowledge transfer project on the CAVES project also had a validation component, the results of which are also included in this report. In this project, agricultural industry members attending agricultural events (and therefore not formal study respondents) were asked to comment on the accuracy of statements made in an information note.

Validation Findings

Principles of Land Use Decision-Making

We began the questionnaire (for both farmers and key informants) with a series of statements, to which they were invited to respond: strongly disagree, disagree, generally agree or strongly agree. These statements

were built on assumptions included currently, or planned for inclusion in the model.

Farm profitability as a determinant of land use change

The respondents were in unanimous agreement on the following statements:

- Farmers do not change a current crop or type of stock if they are satisfied with the profit margin.
- Farmers do not change their crop or type of stock solely because they see higher prices in a different commodity.

These statements support key decision rules in the model, guiding agent action. *The unanimous validation confirms the decision rules that farmers do not change their current crop or type of stock when their aspiration threshold has been reached, even if there are higher prices in a different commodity.*

Farm profitability as a determinant of land use change

Most of the validation respondents agreed on the following statements:

- Farmers will continue producing their current crop or type of stock at a small loss, if they see no viable alternative except leaving the farm. (7/8)
- Farmers will accept financial losses for several years before changing their crop or type of stock (6/8)

The same farmer respondent disagreed with both statements, arguing that farms could not afford to lose money indefinitely; he agreed in principle that there is a time delay between making a loss and changing commodities, however. His argument was that farms need to make changes sooner rather than later. *The principle that farmers will lose money without changing commodity can thus be utilised in the computer model, although the length of time over which loss occurs, and degree of loss, have not been quantified.*

Off-farm income

The respondents were also unanimous agreement in supporting this statement:

- Off farm income allows farms to stay viable without generating a profit.

This statement is not yet included in the model, but emerged from field research. *The strong support of both the field research and the validation exercise underlines the importance of including off-farm income in the model, as it impacts on agents' aspiration thresholds.*

Adoption of innovations

Most of the validation respondents were also in agreement with these statements:

- New crops or types of stock are introduced by a small number of highly innovative farmers. (7/8)
- Other farmers watch to see how successful these innovations are, before adopting the innovation themselves. (7/8)
- When discontinuing a crop or type of stock, farmers are most likely to expand production of another commodity they already produce, rather than trying a new commodity. (6/8)

In this case, the disagreeing respondents argued a general position that many farmers are innovative, not just a few. However, respondents supporting these statements are consistent with conventional wisdom from the adoption and diffusion of innovations literature. It is possible that all farmers need to become more innovative to survive in the current economic climate. *The general principle of innovation by a small number of innovative farmers, copied by other farmers, appears to hold true.*

Fixed costs

Six of eight respondents agreed with the following statement:

- There are fixed costs associated with each crop and land use adopted in a farming operation. The more different commodities produced, the higher these are. (6/8)

The descriptive responses in the interviews indicated that while this principle is generally true (there would typically be lower fixed costs for a large number of commodities than a few), there is a benefit to having more than one commodity, as it allows labour (a scarce and expensive resource) to be spread throughout the year. Thus, *while the declining number of commodities on farms can be expected to reduce costs, this will not hold true if study site farms move to a single commodity*. Fixed costs cannot therefore be determined on a linear basis.

Purchase of neighbouring land

The following was a surprisingly contentious statement:

- Farmers will always try to buy neighbouring land when it comes up for sale, unless they are planning to retire or leave farming.(5/8) –

This is a highly important finding, as it is a primary assumption of the model. Respondents indicated that while this used to be true, and is still often the case, farmers now need to think more about the immediate economic realities of the farm: not taking on poorer quality land, if they cannot 'make it pay'. Therefore, although farmers during the interview reported seeking to purchase neighbouring land as an historic behaviour, they do not necessarily see this as appropriate in the future. In the past, land has been a good investment, increasing in value and generally considered necessary to business expansion. With the loss of subsidies on production, farmers are now considering whether it is worthwhile to engage in extensive production, some forecasting that agriculture will 'come down from the hills' – poorer quality land will go out of production, as it is no longer economically viable to utilise, and

higher quality land will be utilised more intensively. Therefore, *we cannot assume that all land in the model is equally desirable. The decision-rule of all farmers bidding on neighbourhood land when it comes up for sale can be utilised in historical runs of the model, but not in runs depicting future scenarios.*

The key informant also disagreed with the statement on the basis that certain types of farmers – particularly hobby or lifestyle farmers – are not interested in business expansion, and thus not interested in the purchase of neighbouring land. *It is therefore important to create different decision rules for different farmer types.*

Succession

- Farms that are profitable are more likely to have successors. (4/8)

Support for this statement was stronger among key informants (2/3) than farmers (2/5). The dissenting farmers argued that farming is a lifestyle, and therefore a lifestyle choice, independent of the opportunity for financial gain. Farm children may or may not make that lifestyle choice. *Succession cannot therefore be modelled solely on the basis of economic viability of the farm.* This does not represent a needed change to the model, as the model does not address succession at this point. The statement was based on an observation of the researcher that the farms in the study have higher than expected succession rate, and that this may be due to the progressive appearance (and implied financial success) of the farms. Due to the complexity of the succession issue, it is not appropriate to include it in the model at this time.

Organic farming

- One reason farmers don't consider adopting organic farming is because they are concerned about what the neighbours would say. (4/8)

Respondents indicated that although social approval might factor into the decision for farmers, more important was the suitability of land and potential economic returns. It was found in both the study and the validation exercise that most respondents do not believe the land in the region to be suited to organic farming. They also question the economic viability of organic farming without subsidies, as they believe the decrease in production would not be worth the greater market returns. Therefore*, although social approval may be an issue with regard to organic farming in the study site, it is not the most important issue limiting adoption.*

Economies of scale

- The larger the amount of a commodity you produce, the cheaper it is to produce each unit. (5/8)

This principle is a basic tenet of economic theory. Respondents indicated that although there are economies of scale, these are limited by the

farm set up, which involves a balance of labour, facilities and land. Expanding production can cost more than it gains (eg if you need to hire labour instead of depending on the family, or build new buildings, the cost may outweigh the benefits). *Therefore, although economies of scale can be utilised as a general principle, it is also important to consider limitations imposed by other aspects of the farm business.*

Important Factors in Decision-Making

The purpose of this question was to assist in both validating the content and order of decision-making in the model. All of the reasons for changing commodity were identified on the basis of respondents' interviews in the primary research phase.

a) changing to a new commodity

Respondents were given the following reasons for changing to a new commodity, and asked to put them in order of importance:

- The new commodity (crop or type of stock) will be more profitable.
- Previous experience producing the commodity.
- Suitability of the commodity to the current farm set up (eg buildings, machinery, labour)
- Suitability of the commodity to biophysical conditions of the farm. (eg soil quality, rainfall)
- Well established market for new commodity.
- Personal interest in the commodity.
- Opportunity to benefit from government grants.
- Opportunity to reduce input costs.
- Opportunity to reduce paperwork.
- Other:

Most of the respondents indicated that the factors were all important, with little to differentiate them[5], but analysis of responses demonstrated a clear emphasis on the profitability of the new commodity, which was ranked first by 5 of the 8 respondents. This was followed by having a well established market for the new commodity, then the suitability of the commodity to the current farm set up, and the opportunity to benefit from government grants. The least important reason identified was the opportunity to reduce paperwork.

[5] None of the respondents identified any 'other' issues of importance.

b) deciding whether to buy local land when it comes up for sale

Respondents were given the following list, and asked to put them in order of importance for deciding whether to buy local land when it comes up for sale.

- Proximity of the land to your current holdings.
- An identified successor to your farm.
- Expansion plans for future.
- Quality of the land.
- Potential to get subsidies or apply for environmental programs (like land management contracts) on the land.
- Other:

In this case, proximity of land and expansion plans for future come out as most important (very close together), followed by quality of land, and more distantly by potential for subsidies and identified successor.

Formula for predicting profitability

Respondents were then asked to review the following list of factors identified as being important for predicting farm profitability.

These are the factors we have identified:

i. Amount of production (yield)
    1. Land quality
    2. Climatic conditions (eg rainfall, length of growing season)
    3. Quality of the farmer's work
    4. Quality of machinery or buildings
    5. Quality of inputs (eg feed or fertiliser/spray)
    6. Intensity of production (eg intensive/extensive)

ii. Cost of production
    1. land
    2. buildings
    3. inputs
    4. machinery
    5. labour
    6. interest owed on debt

iii. Market price

iv. Subsidies

v. Farmer skills/abilities

They were then asked if there were any important factors which were not on the list. Five of the respondents had an addition to the list, but no two respondents named the same factor. Factors identified were: extent of overdraft/debt, quality of livestock, weather/environment, economies of scale and paid vs family labour.

The next question addressed the biggest impact on profitability in their area. (This question was not on the key informant questionnaire) Three of the farmer respondents said farmer abilities. Two of these added second issues: interest/overdraft and subsidies. The other two farmers said interest and machinery, and subsidies. The importance of farmer abilities was further emphasised in response to the subsequent question, asking respondents to identify the factor that would differ most between farms in their area, in which three farmers (two of them different from the previous question) identified farmer ability as differing the most between farms in their area. The next question addressed the biggest difference in these factors between farms. Two were identified – the amount of interest (and thus debt) held by the farm, and the farmer's abilities. In the final question about profitability, all of the farmer respondents identified farmer ability as very important to the success of business, one estimating that as much as 50% of profitability is down to the farmer. The key informants also identified farmer ability as having a 'substantial' impact on farm profitability. *Farmer ability should be considered for inclusion in the model.*

Climate change

Respondents were mixed in response to their predictions of climate change, indicating that it could be good or bad, and that this varied with the type of land and commodity. Warmer, drier summers would produce more grain crops, but decrease grass production. All of the farmer respondents indicated that they have already seen climate change occurring, with warmer winters, and high variation in the amount of rainfall. They all believed that fairly small change in climate would noticeably impact on their yields, as they are already noticing annual variations. However, one of the key informants argued that it would take a significant climate change to impact on what farmers produced, as this is primarily subsidy driven. Another key informant thought that climate change might reduce the range of commodities grown. *Climate change should be represented in the model as differentially impacting yield by commodity and land type.*

Farmer Subgroup

Farmer respondents were asked specifically about agricultural land classifications and the biggest problems they had faced on their farms.

Categorisation of agricultural land

Farmer respondents were asked about the best way to categorise agricultural land, and given the example of the current categorisation of 'arable crops', 'arable grass', 'improved grazing', 'unimproved grazing', woodland. Two of the farmers stated that these categories are acceptable as they are. The other farmers suggested variations: less favoured area, non-less favoured area, and land suitable for grazing; arable, temporary pasture, permanent pasture, rough or hill grazing and woodland; and the third confirmed the importance of distinguishing improved grazing from arable grass and indicated that unimproved grazing is simply hill land. From this feedback*, we can surmise that it is not necessary to distinguish between grades of arable land in the study site, and that woodland is an appropriate*

category. We may wish to consider classifying unimproved grazing as 'hill land'. If we decide to look at how specific subsidies impact on decision-making, it may be worth going into the detail of identifying 'less-favoured areas' but this is beyond the scope of the model at this point.

Biggest problems

Farmers were also asked to identify the biggest problems they had on their farming operation over the past 20 years. Two of them indicated capital investment/borrowing, one the change in subsidy structure, another borrowing, and the final farmer 'none'. Notably, only the change in subsidy structure was a potential shock identified at the outset of the research process. When probed specifically on the issue of BSE (which eliminated beef exports for a decade, negatively impacting on domestic prices), only one made a significant change (selling out his cattle) which he was moving towards in any case: BSE was simply the final straw. The other farmers simply kept producing, or increased production to spread overheads. This was consistent with their comments regarding change in response to problems on the farm: they had either kept producing, produced somewhat more to spread overheads, or shifted their operations to maximise subsidies. Reducing production, seemingly an obvious response to declining prices, was only adopted by one farmer, who stopped producing altogether. *This validation question supports the general research finding that farms do not typically make immediate changes to their operation in response to a system shock.*

Key Informant Subgroup

Key informants were asked specifically about social approval and farmer types.

Social Approval

Key informants were presented with a number of farmer activities, and asked to rate on a scale of one to five how high farmers would rate these activities among their farming neighbours and peers.

- Organic Farming
- Participation in Land Management Contracts
- Acquisition of new land
- Purchase of new farm equipment
- Production of oilseed rape (biofuel)
- Production of tree crops for biomass (eg willow)
- Stopping farming prior to retirement age and taking on paid employment.
- Retiring from farming but continuing to collect the single farm payment.
- Not complying with environmental regulations about spreading waste.
- Selling excess housing from the farm in order to generate income.

Overall, responses were not that consistent, except that organic rates fairly high, and non compliance about waste and collecting the SFP after retirement rank low. It was surprising that two of the key informants ranked acquiring

new land and equipment as low according, as these both appeared highly valued by farmer respondents in the study. *It is therefore difficult to establish accurate social approval measures based on this question.*

Farmer Types

Key informants were also presented with a list of farmer types, and asked to comment on whether this distinction was reasonable, and whether there were other types worth consideration.

entrepreneurial	- business oriented, will experiment with new commodities, typically expanding their production
traditional	- farms using familiar methods, slow to change, oriented towards high standards of production
pluriactive	- major source of household income from off-farm, but operates the farm as a business
lifestyle/hobby/environmental	- farms primarily for recreational purposes

All of the key informants agreed with the types, and when asked to provide estimates of the percentage of each in their area, were fairly consistent in their responses: entrepreneurial (10% - 15%), traditional (40 – 60%), pluriactive (20 – 30%) and lifestyle/hobby/environmental (10 – 20%). They reported that all but the traditional farmers are likely to increase in percentage in the future. *It appears reasonable to include farmer types in the model, with different decision-making priorities and farm characteristics.*

Findings from the Knowledge Transfer Project

Basic study findings were presented to over 20 agricultural industry members at agricultural shows (Thainstone Christmas Classic, the Royal Northern Spring Show, and The Royal Highland Show) in the form of an information sheet (see Appendix A), which they were invited to discuss. These individuals confirmed increases in farm size, the relatively slow speed of land use change (including a delayed response to the single farm payment, and that farmer engagement in environmental programs is often economically motivated. However, they also commented that these findings are somewhat specific to the study site area. This is particularly true with regard to perspectives on farm expansion, and organic farming. Other farmers appear to have more scope for change – crofters are apparently more manoeuvrable, and head more quickly into new funding sources (such as environmental programs), whereas larger scale farmers in the north east have more options with their land. They are also more likely to engage in cooperative ventures. Also – types of farms are important. Participants confirmed that hobby farmers make decisions differently from conventional farmers, as their orientation is different. They are typically less interested in expansion, but more interested in environmental programs.

Synthesis

Validated model components

- the decision rule that farmers do not change their current crop or type of stock when their aspiration threshold has been reached, even if there are higher prices in a different commodity.

- the general principle of innovation by a small number of innovative farmers, copied by other farms

- in ordering the factors which farmers take into consideration when changing commodity, the profitability of the new commodity is of primary importance.

- land is differentially desirable, on the basis of previous (and therefore anticipated) profitability.

- In historical runs, farmers will always bid on neighbouring land, if they have sufficient resources. This is less likely to be true in future-based runs.

- Farmer types: entrepreneurial, traditional, pluriactive, lifestyle/hobby/environmental

- Fixed costs associated with commodities.

Important to add to the model

- The principle that farmers will lose money without changing commodity, although restrictions to this principle on the basis length of time over which loss occurs and extent of loss have not been quantified.

- Off-farm income in the model, as a factor in agent's aspiration thresholds.

- Categorisation of agricultural land: 'arable', 'arable grass', 'woodland', and 'improved grazing' are suitable categories. May want to change 'unimproved grazing' to 'rough or hill ground'.

- Farmer ability – impacts considerably on farm profitability.

- Including 'well established market for new commodity', 'suitability to current farm set-up' and 'opportunity to benefit from government grants' as factors in decision-making about new commodity up-take

- Including more specifics on proximity of land and expansion plans to decisions regarding land acquisition. (Expansion plans can be handled through farmer type; proximity is currently limited to the current geographic neighbourhood, rather than specifying immediate neighbours)

- Slow speed of farmer response to change events (eg one year delay before responding to the SFP)

- Climate change – will differentially impact by commodity and land use type.

Areas for further exploration

- Succession (not in the model at present) cannot be based solely on the initial success of the farm. Perhaps a complex issue best not addressed at this time.

- Organic farming (not an option in the model at present). Social approval may limit adoption, but land suitability and perceived economic benefits appear more important.

- Economies of scale can be utilised as a general principle, but it is also important to consider limitations imposed by other aspects of the farm business.

- No consistent identification of or response to major 'shock' events

- Social approval – difficult to accurately gauge.

Conclusion

The validation process has generated broad support for the accuracy of the field research, while raising issues for further exploration. Respondents did not identify any major problems with the model inputs and process, and confirmed several aspects which were intended for addition to the model. Field research in the Grampian study site has therefore contributed usefully to the development of the FEARLUS computer model, as well as generating topics for further field research. These include:

- The social construction of 'opportunity' among different farming types
- The dynamics of time constraints in farm decision-making: commodity price cycles, seasonal variations and the physical limitations on changing commodity type
- The complexity of farming networks and farming norm generation
- 'Amenity value farming' – further addressing the orientations of farm operators who do not depend on farming for their livelihoods
- The difference in network structure of information access, in comparison to labour and equipment sharing.
- The integration of environmental program participation into definitions of 'good farming'.

The purpose of the CAVES study is to generate scenarios in order to inform policy. Several policy implications emerge directly from the qualitative study. These include:

- Differential response to policy based on farmer type
- Pace of response: farmers seldom make major changes on-farm based on a single year's returns. Farmers are much more likely to make changes in response to permanent or long-term market and policy shifts. It is therefore important to implement policies around which farmers can build long term plans.
- Farmers appear to respond more quickly to 'opportunities' rather that 'needs must' situations. A 'carrot' rather than 'stick' of many current policies would appear more likely to be successful in achieving policy objectives.
- Greater success in farmer response to grant programs can be expected if these are in line with current farming priorities, and definitions of 'good farming'.
- Although farmers are concerned about the environment, engagement in current environmental programs largely reflects a desire to recoup lost income from commodity-based payments.
- Although most farmers in the study site have reduced their level of chemical inputs, they resist 'the last 20%' it would take to achieve organic status.

Further policy implications will be drawn from the scenarios generated through the computer models.

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