Assessing the options for upland livestock systems under CAP reform: developing and applying a livestock systems model within whole-farm systems analysis.

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Abstract

This paper presents a scenario-based analysis of the the impacts of Common Agricultural Policy (CAP) reform for upland agriculture using a Welsh case-study. Specifically the paper examines the impacts of the introduction of the single-farm payment (SFP), the modulation of direct payments under Pillar I of the CAP and the increase in agri-environment payments under Pillar II. Three enterprises are examined, upland sheep rearing with lamb finishing, spring- and autumn-calving suckler-cattle with calf rearing. These enterprises are modelled under conditions in 2002/3, 2004/5 and for the reformed CAP in 2005/6. To support this analysis a livestock system model (LSM) was implemented. The model assesses alternative management regimen using a flexible state-transition approach. This simplifies the realisation and parameterisation of potentially complex management regimen. The

Preprint submitted to Elsevier Science *15 March 2005*

model tracks fodder requirements to achieve targets based on defined diets. The LSM underpins whole-farm analyses of stocking-rates, labour and other resource requirements and net-farm income. From the case study the paper concludes that the impacts of the introduction of the CAP reform on the financial performance of the systems are small but negative (a net reduction of around 5% in support). The larger reduction in direct payments (15-18%) is partially offset by agri-environment measures. The paper concludes that while SFP encourages a more market-oriented outlook, the adaptive capacity within systems as they stand is very limited. There are a range of possible adaptation strategies, but for the uplands the extensification of cattle systems by reducing stock numbers and cutting back on labour seems most probable.

Key words:

livestock systems, CAP, decision-support, scenarios, simulation

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1 Introduction

Upland livestock-based agriculture in the UK and elsewhere in the European Union (EU) remains a significant activity even in a post-productivist phase. The economic significance of the sector (and agriculture more widely) is of limited and reducing importance in rural areas relative to sectors such as tourism

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and recreation. To date the sector has produced commodities at prices not sustainable without tarrif protection and employs (both directly and indirectly) a small and reducing proportion of the rural community. There are, however, non-market factors that mean the sector remains particularly significant. Concerns over food safety, animal welfare, sustainable food production and supply chains mean that it is not acceptable to simply import all livestock products as commodities from lowest-cost production areas and to effectively export environmental damage. Beyond these sectoral concerns it is recognised that there is a significant land area devoted to livestock agriculture where other land using options are very limited. The regions associated with these areas often have a distinctive landscape character that make them attractive for tourism or recreation and in some cases they have significant natural heritage value. Rural policy is increasingly focusing on achieving sustainable rural development with multi-functional agriculture a key sector (DEFRA, 2002; Scottish Executive, 2001, 2002).

Common Agricultural Policy (CAP) reforms as implemented to date, and in their likely future direction, are a fundamental change in the policy culture to a predominantly post-productivist model. It is no longer seen as acceptable to use public funds to secure food production and support rural communities by direct subsidy of primary production. While initially modest (7.5-10%), the transfer (*modulation*) of funding into payments for activities maintaining or increasing public goods is only likely to increase. While direct payments remain in the form of *single farm payments* (SFP), the *decoupling* of payments from particular commodities and production levels has the potential to allow profound changes in agriculture. With the SFP regimen, land managers have greater freedom than for several decades to modify systems to respond to market opportunities. The SFP regimen also recognises minimum standards of good practice through the *good environmental and agricultural condition* (GEAC) regulations. The question remains for the uplands, however, are there alternative systems of production that can deliver both market and non-market goods.

There is considerable uncertainty for both land managers and policy makers as to the likely consequences of CAP reform. To assist in assessing the possible opportunities and impacts of policy change, a whole-farm systems model (WSM) has been developed (Matthews et al., In Press). This WSM can be used to contribute to the process of assessing both the possible impacts of policy change (policy assessment) and, as part of a deliberative process with stake holders, in identifying and assessing the consequences of management adaptation scenarios (Matthews et al., in preparation).

This paper presents a case-study analysis of the impacts of CAP reform for upland Welsh agriculture. The scope of the analysis required the implementation of a livestock system model (LSM) that would allow the assessment of alternative management regimen (Section 3.1). The LSM underpins whole-farm analyses of stocking-rates, labour resource requirements and net-farm income (3.2). The paper uses the LSM to conduct a scenario analysis exploring the possible of impacts of the CAP reforms as implemented for the Welsh uplands. The case-study site and the alternative scenarios are set out in Section 4 and the results presented in Section 5. Conclusions on the outcomes of the policy reform are drawn in Section 6.

2 Related research

2.1 CAP reform

The CAP of the EU is one of the main drivers of European agricultural systems influencing how, and to what extent, resources are used. Since its establishment in the Treaty of Rome in 1957, the CAP has had to adapt several times in order to meet the challenges it has faced over the years. In the early days, it concentrated on the goals set out in Article 39 of the Treaty, e.g. securing a fair standard of living for the agricultural community and ensuring security of food supply at affordable prices. But the focus on food security and productivity caused severe quantitative imbalances on agricultural markets leading to quantitative restrictions (e.g. quotas, set-aside) and eventually to a new policy approach in the MacSharry reform in 1992. For the first time, this significantly lowered institutional market support prices, making compensatory payments direct to farmers, and it also included accompanying measures focussed on agri-environmental and other rural development measures. The aim of the Agenda 2000 reform agreed in 1999 was to deepen and widen the 1992 reform by further replacing price support with direct aid payments, and by consolidating and strengthening this process by Rural Development Regulation 1257/1999 (EU-Commission, 1999). Notwithstanding these reforms, EU enlargement, WTO negotiations, overall budget costs, environmental concerns and farming crises such as BSE and FMD indicated the need for further reforms of the CAP (Schwarz et al., 2003). The Council of Agriculture Ministers of the EU agreed a new reform of the Common Agricultural Policy on 26 June

2003 (EU-Commission, 2003) that will move farmers away from most production based subsidies, and replace these with SFP.

In Wales the responsibility for implementation of SFP and accompanying measures is devolved to the Welsh assembly operating within conditions agreed at UK and EU levels. The SFP of a farm will be based on historic subsidy receipts from 2000 to 2002 instead of an area-based flat rate payment system reducing redistribution effects of the CAP reform. While money will be allocated to all farms receiving subsidies during this period, payments to individual producers will depend on the fulfilment of cross-compliance requirements with respect to statutory environmental, food safety and animal welfare standards. In addition farmers will have to keep all farmland in good agricultural and environmental condition (GAEC). Member States have been given the flexibility to maintain a limited number of coupled (production based) elements in order to avoid land abandonment and possibly to maintain national competitiveness. The Assembly has agreed full decoupling, removing all existing support schemes, emphasising market orientation for land management decisons (Welsh Assembly Government, 2004).

Beside other elements such as revisions to market support measures and the option of new measures in the Rural Development Regulation (RDR) the recent CAP reform introduces compulsory EU wide modulation starting at 3% in 2005, increasing to 4% in 2006 and 5% from 2007 onwards. But compulsory EU modulation does not apply to the first £5000 support payments to farmers. In addition to the compulsory EU modulation the Welsh Assembly announced that voluntary modulation would be adopted. In 2004, voluntary modulation in Wales is applied at a rate of 3.5% and is expected to increase to 4.5% in 2005 and 2006. Current modulation receipts are used to part-fund the *Tir Gofal* agri-environment scheme. In the future, higher modulation funds will be used for additional Tir Gofal agri-environment scheme agreements and, mainly, to finance a new agri-environment scheme, *Tir Cynnal* (DEFRA, 2004; Welsh Assembly Government, 2004). Instead of using the option of introducing a national envelope (where a proportion support payments are *recoupled* to assist specific land use systems, for example upland-beef), the Assembly decided to introduce the new Tir Cynnal agri-environment scheme, which is expected to be open for applications in spring 2005. This entry-level agri-environment scheme aims at bringing 60% of agricultural land in Wales that is not already covered by agri-environment schemes into Tir Cynnal by 2010. Tir Cynnal will require participants to follow a management regimen designed to protect wildlife habitats, traditional landscapes, ancient monuments and historic features as well as reducing pollution and maintaining public rights of way. Estimates from the Assembly indicate that, based on a predicted uptake, Tir Cynnal will cost around 20m a year, which would require modulation in Wales at around 10% in 2006, plus matched funding by the UK treasury (Welsh Assembly Government, 2004).

2.2 Livestock systems modelling

There have been numerous models of animal production systems developed over the past twenty five years, often built as research tools, to allow researchers to explore the complex interactions between livestock performance and nutritional or grazing management. Some of those that are based on pastoral systems include Grazplan (Freer et al., 1998), Graze (Loewer Jr., 1998) and Grazing Lands Application and NUTBAL (Stuth et al., 2002). These models usually have a nutrition sub-model that is used to predict animal performance from nutrient intake and may include an economic sub-model. However few models have been developed that provide a close coupling between the livestock production system and operational management at the whole farm level. The current model allows this close coupling so that the interaction between individual livestock enterprises and whole farm operational management can explicitly be represented.

2.3 Whole-farm systems model

The LSM forms part of a farm-scale integrated modelling framework (IMF) (Matthews et al., In Press). The IMF is structured with a core of bio-physical simulation models overlaid by financial, employment and environmental accounting frameworks. Where possible process-based system simulation models are used (Stockle et al., 2003), for example CropSyst for arable and grass-swards. Otherwise simple empirical models are used, for example for farm-woodlands. The IMF is implemented using a geographic information systems (GE Smallworld) and a knowledge-based modelling system (Gensym G2).

The IMF simulations use a single source of daily weather data unless the farm is made up of units in widely differing circumstances (Rivington et al., Submitted). Soil properties are represented per field and are collected using grid (historically) or field-stratified (current) survey (Wright et al., 2003a,b). For existing systems of land use information on yields achieved, the management regimen and on-farm resources (labour, machinery and buildings) is collected by questionnaire and interview. Other scenarios are developed in consultation with land managers and domain experts. The testing of IMF outputs is conducted against farm records where possible or domain expert assessment.

3 Materials and Methods

3.1 Livestock systems model

3.1.1 Scope

The aim in developing the LSM was to create a flexible simulation framework that could be used to explore the options for a wide range of ruminant livestock production systems. In particular it was important to represent the management options available to decision makers. Since the management regimen options available in livestock-based enterprises are diverse and their interactions potentially complex, a strongly visual approach to implementation was taken to enhance the transparency of model. Since the timing of labour demands and the delivery of stock to markets have such profound effects on the labour and financial accounting the LSM needed to simulate these on at least a month by month basis. To allow the LSM to provide the information necessary to evaluate the limits on the stocking rate implied by fodder availability the LSM needed to consider current and alternative diet formulation and the energy demands from animals at different live-stages. This scope defined the functionality that was implemented within the LSM

3.1.2 Functionality

The LSM implemented is based conceptually on state-transition diagrams. These are used to represent the structure of the livestock enterprise and to track the flows of materials through it on a month by month basis. Each state-transition diagram refers to a single generic type or specific breed (depending on parametrisation) and is structured and parameterised to represent a particular livestock enterprise. Figure 1 shows an example of a state-transition diagram for a generic beef suckler system; spring-calving with home-bred replacements supplemented by bought in stock and a variety of options for storing (period(s) of post-weaning growth) and finishing (the final stage of preparation before slaughter, also refered to as fattening). The livestock system represented is a complex one and was used in the development of the model to test the operation and integration on the components. The state-transition diagram is included here to illustrate the functionality of the LSM and the management regimen features the LSM can represent. Individual real world systems typically have fewer elements (as will be seen in Section 4).

[Fig. 1 about here.]

The *states* in Figure 1 are the *herds* and these determine the management regimen and energy requirements for any animals that are part of the herd. At a given time-step the herd may be populated by zero, one or more *cohorts* of animals. The cohorts are groups of equal-aged animals. Cohorts are the means used to track the breeding and non-breeding stock as they move through the system.

The *transition* of cohorts between herds is controlled by *movement rules* (that define the conditions that must be fulfilled before a cohort moves) and *herd-*

links that define where the cohort moves to next. The conditions for the movement rules are: *at-date*, *after-time*, *at-age* and *at-weight*. Figure 1 shows examples of herds using these movement rules. At-date can be a simple calendar date or relative to an event date, for example at weaning or three months after birth, with the event dates specified as part of the management regimen. The herds in the main breeding cycle use relative event dates. The after-time (specified in months) condition is used for the Calves (at Foot) - Stage I. The at-age (months) condition is used for the Develop Immature Replacements herd. The at-weight condition allows cohorts to move once a target weight has been achieved for example the various store cattle herds.

While moving between herds cohorts can be split based on *decision-rules* or merged with other cohorts. The decision rules are shown by diamonds, with the criteria and parameters specified. The *merging-points* are shown by filled circles Figure 1). An example of splitting cohorts is the separation of male calves for store and female for breeding replacements. Merging can be seen in creating cohorts from bought-in and farm-bred replacements for the suckler herd. A specialised decision rule is used to determine the numbers of offspring. *Create offspring* in Figure 1 both creates a new offspring cohort and routes the breeding herd cohorts on to the next herd. The offspring cohort size is determined by a fecundity parameter.

Three groupings of herds can usefully be recognised: *input, breeding* and *output* (Figure 1). The input herds are the sources of bought-in stock. The numbers bought-in can either be fixed or depend on achieving a target herd-size(s). For the example in Figure 1 the input herds are sources of replacements for the breeding herd, bought-in either pregnant to directly enter the breeding herd or non-pregnant for on-farm bulling. There are a variety of possible sources represented whose main effect is to determine the age and size of the replacement heifers. In Figure 1 the system is structured such that replacements are bought in on a just-in-time basis. If this is not the case then holding herds between inputs and the breeding herds would be required.

The input to one enterprise, represented by the LMS, can be from the outputs of another enterprise on the same farm. This would be a buy-in at zero cost, for example a pedigree herd providing replacements for a cross-bred herd. More generally it is possible to specify any herd as a buy-in, either to ensure the correct numbers of animals entering the system or to configure alternative enterprises such as finishing of store cattle bred off-farm or a dairy-beef enterprise.

There are four main breeding herds that form a yearly cycle with offspring born seasonally as specified in the management regimen (spring-calving for Figure 1). The LSM can also support year-round calving as practised in some continental European systems. Beyond the four breeding herds the calf cohorts are accounted for in two herds *Calves (at foot) - Stages I and II*. Two herds are used as the calves progress from a milk only to a milk and supplements diet. The *bulling replacements* and the *New to Breeding Herd, pregnant for 1st time* herds are required since the bought in cohorts will have different requirements since they are not lactating between the bulling and weaning dates. The other herds at the bottom of Figure 1 are store classes for heifers being raised as replacements.

Breeding herd cohorts are reduced in size (and can be eliminated) by breeding failure, which sends cohorts initially to the *breeding herd - rebreed fail, with calf-at-foot* herd and ultimately for disposal via the *Cast cows* herd. Complete cohorts are dealt with in the same fashion when the maximum number of breedings is reached.

Output herds are those from which stock can be sold. Conditions that trigger sales include age, for replacement and store cattle, and weight for finishing cattle. Other herds have no sell conditions and any stock entering these herds are sold immediately, for example *Cast Cows* and *Immature-, Mature-, Surplus-* or *Pregnant-Replacements*. Figure 1 shows a variety of store (6, 12 and 18 months) and finishing options. In all cases the source, live-weight and sale date are the metrics recorded for the cohorts sold.

Information on energy requirements is stored in the herds. The LSM predicts the energy requirements for ruminants (currently cattle and sheep) grown for meat or as replacements using the formulae published by AFRC (1993). The LSM does not currently consider dairy systems since these are not a significant sector in the UK uplands. The LSM could be extended to assess both the energy and protein requirements of dairy systems, again based on the AFRC published formulae.

Energy requirements are determined per unit (animal or kg live-weight) for each cohort. Common to all herds is an energy requirement for maintenance that includes an allowance for activity levels. For the breeding herds, energy requirements for the concepta and lactation are calculated. Breeding animals may also gain or lose condition, within defined limits, typically losing condition in late pregnancy and early lactation. For replacement females, store and finishing cattle target weight gain trajectories for the breed concerned determine the energy requirements for growth (Meat and Livestock Commission, 2003, 2000). Energy for wool growth is determined for sheep. A safety margin for energy requirements can also be included.

The composition of the diet used to meet the herd's energy requirement is also stored as part of the herd. The seasonal nature of livestock systems in the UK and N.W. Europe means that the LSM has to represent both housed and grazed diets. The diet is specified as a *main diet*, which can be a combination of individual diet items and *supplements*, whose use is generally to be minimised. The quality of individual diet items is reflected in their metabolisable energy values and digestibility (MAFF, 1992).

Other aspects of the management regimen that apply to all herds are also included in the LSM. These include limits on the total number of animals; housing and turnout dates; breeding parameters (age , number of cycles, breeding % and twins to singles ratios for sheep); and mortality parameters.

3.1.3 Creating and parameterising the herd network

Individual livestock management systems are represented as *herd-networks* in G2 using specialisations of classes typically used for modelling the flows of materials in industrial processes (http://www.gensym.com).

Creating the herd network is a matter of cloning LSM items (herds, decision rules or merging-points) from a pallet of options and graphically linking the icons together. Items on the pallet are high-level (user) instances of herds that multiply-inherit their functionality from lower-level (developer) classes. For example the *steer-stores-1* herd inherits from the basic *stores* class and the *move-at-age*, *move-at-weight*, *move-at-calendar*, *sell-at-age* and *buy-in* classes.

It is possible to reuse components or sections of existing herd-networks by selection and cloning. Once the topology of the herd network is constructed it is saved to the WFM database (ORACLE). The LSM at this point generates all the other underlying objects required and sets up the relationships required in the database. The herd-network may be reused for multiple-scenarios if only the parameters of the herds change. If the system to be simulated requires structural change then a new herd-network with appropriate modifications must be built. Having defined the structure of the herd-network, the individual elements are parameterised via the GUI and saved to the database. The sources of data for particular herds are taken, where possible, from interview and otherwise from published sources.

3.1.4 Running the LSM

For a simulation, cohorts are tracked from creation (at birth or at buy-in), as they move round the herd-network or exit (are sold, cast or die). Currently a monthly time-step is used to minimise the processing and data storage, but this can be reduced as required. Figure 2 shows the sequence of processes undertaken each month.

[Fig. 2 about here.]

- The first process at each time step is to determine the number of mortalities. The number of mortalities is generated from a *mortality-percentage* and rounded probabilistically to the nearest whole unit. Individuals are eliminated probabilistically from cohorts with an age-based positive bias in selecting cohorts.
- Stock are then sold and bought from the output and input herds where

criteria have been met. Animals bought in are immediately moved into one of the process herds so that they behave correctly for the buy-in month. The weight gain required for growth, finishing or regaining condition is then calculated. This is the difference between the target weight of the herd and the current weight of individuals in the cohort. The gain required is limited by the maximum gains per day as defined for the herd.

- The next step is to calculate energy requirements and translate these into quantities of feed required from a given diet. If the maximum intake of the main-diet (the dry-matter limit) of the main diet materials does not meet requirements then, if possible, supplements with a higher energy per kilogram dry-matter are substituted for main-diet. These supplements are minimised since they usually represent a higher cost fodder. When supplementation is not possible, or perhaps desirable, then target gains are reduced or eliminated and ultimately stock are allowed to lose condition. The loss of condition is limited both in the total and the per month loss. The process is halted with an error condition if, at this point, the diet cannot meet requirements. The process records, for each cohort, the diet materials required (see Section 3.1.5. Whether these requirements can be met is a separate analysis that depends on whole farm-strategic decisions (see Section 3.2). Options exist to change the livestock system to match the fodder or alter the fodder to match the livestock.
- The variable costs per cohort including for example veterinary or bedding are then calulated.
- The number of animals for each category used by the resources scheduling tool are then calculated and saved to the database and the number of Livestock Units (as used for pre-2005 quotas)determined.
- The cohort metrics are then saved to the database

- Update weights - updates for each cohort the weight at the end of the month. This figure will be used in the next month to determine the maintenance requirements and if appropriate the target gains.
- Move cohorts. The last process is to move all the cohorts that have met the conditions of the movement rules for their current herd . Any movements are assumed to take place on the last day of the month.

During the course of a run, soft-constraints are preferred, with warnings issued if targets are not being met. This flexibility is needed as with event driven processes such as mortality, breeding failure and time lags in the system, there can be periods where targets are not precisely achieved. This also allows for the fine tuning of management regimen and decision rule parameters learning from the outcomes of the simulation runs.

For initialisation of cohorts it would be possible to load predefined cohorts into the herds. It has, however, proven easier to initialise the cohort by running the LSM buying in stock at a rate which results in the correct age structure for the breeding herd. This ensures that all the cohorts and system parameters are consistent. Two factors determine the length of initialisation. These are the maximum number of breedings for stock and the period for which stock are retained on the farm as store and finishing cattle. The latter ensures that the breeding herd is at full size and the former that the number of stock sold from the system is consistent with the full size breeding herd. This typically means 7 + 2 years for Cattle and 4 + 1 years for sheep.

3.1.5 Outputs from the livestock system model

The cohort is the main unit for which outputs are recorded. Metrics are record in the database per month to create cohort profiles of:

- Current herd and size of cohort.
- Energy requirements - gross energy and energy assimilated - broken down into maintenance (including activity), growth, lactation, concepta, condition gain/loss and for sheep, wool.
- Fodder materials required - item and amount.
- Live-weight and change in live-weight.
- Variable costs.
- Mortality.
- Transactions - number of animals bought and sold, selling weight and value.

These profiles provide the raw data on which the whole-farm analyses are based.

3.2 Linking the LSM with the whole-farm model

Determining the feasible stocking rate for the livestock enterprise requires balancing fodder requirements with the *fodder-pool* of materials produced on-farm or bought in. The materials in the fodder pool depend on management decisions made at the whole-farm level, firstly, the total land area devoted to an enterprise and secondly the balance of pasture, silage and fodder cropping. These strategic decisions depend partially on physical and financial factors such as the availability of winter housing and market prices but also on less tangible factors such as the preferences and aspirations of individual land managers.

The quantity of materials within the fodder pool is determined using a multi-crop simulation model, CropSyst (Stockle et al., 2003). For farms in upland UK grass-silage is the main winter fodder, though whole-crop cereals are also used. Silage growth, with one or more cuts, is simulated using a generic rye-grass crop, with phenological development reset after each cutting event. Harvested materials are stored in the fodder pool with older materials used first. Materials have a use-by date beyond which they are assumed to be discarded.

Grass growth under grazing is simulated by imposing daily clipping events. The magnitude of the clipping events (kg of above-ground biomass) are varied by altering the parameters of the herd-network (breeding herd target-size and store/finishing regimen) and calculating the total fodder demands. This demand for grazing is assumed to be evenly distributed across the available pasture.

The maximum feasible stocking rate in the absence of other constraints, and assuming a fertiliser rate specified in the management regimen, is when utilisation of grazing is 50% and winter silage is 80%. Feasible long-term stocking rates need to account for the inherent variability of the pasture-silage system. This variability is simulated using 25 individual years of climate data. The feasible stocking rate is assumed conservatively to fail to meet requirements in only 4 out of 25 years.

Net margin is the preferred metric for assessing the overall performance of the management unit. This accounts both for the variable costs and incomes and the fixed costs such as labour, buildings and capital machinery. The labour and machinery required is estimated using a resource scheduling tool (RST) (Matthews et al., In Press). The RST schedules and accounts for the resources required to complete tasks whose magnitude is defined by running the LSM.

4 Counter-factual analysis

The LSM and analyses defined above were used in a case-study based, scenario analysis of CAP reform impacts on Welsh upland agriculture. A case-study based approach benefits from its ability to represent the situated internal practice of land managers (McCown, 2002; Matthews and Buchan, 2003). While accepting that the WFM is a significant simplification of reality the level of abstraction is not so great that practitioners and other stakeholder fail to relate to the analysis being presented. By representing the management system in significant detail and using historical cases to parameterise the WFM the subsequent counter-factual analysis is made more credible.

The location chosen for the case-study is Bronydd Mawr, near Brecon in Powys, mid-Wales. This is an upland area between intensively managed lowland and extensively managed hills. It is less productive and has a narrower range of enterprise options than the equivalent lowland enterprise and is less likely to receive payments linked to natural-heritage management which are concentrated in the hills. The farm has 188ha of permanent pasture and access to additional areas of rough grazings. The geographic location, elevation and climate mean that the farm has been defined as severely disadvantaged within the less-favoured areas scheme.

The scenarios analysed are incremental rather than radical. The primary land using and wealth generating activity is still assumed to be agriculture. While there are opportunities beyond the agricultural sector, there is anecdotal evidence of resistance to diversification and a desire for opportunities to "be allowed to farm". For the farming systems considered here, diversification or radical changes to enterprise mix is unlikely given the difficulties in generating capital surpluses for re-investment, or in obtaining finances from outside sources. With the removal of CAP quotas, and payment methods that tended to lock in patterns of management, it is worthwhile to consider a wider range of management regimen.

Three management regimen scenarios were compared - sheep only, sheep with spring-calving suckler cattle and sheep with autumn-calving suckler cattle. These regimen are assessed over three periods 2002/3, 2004/5 and 2005/6. The first is the reference period for calculating entitlements for SFP, with the two remaining periods allowing the assessment of the immediate impact of the reforms. The CAP reform scenario is a fully decoupled single farm-payment on an historic entitlement basis, with modulation of 5%.

(1) Sheep only

The management regimen for the sheep system is common to all three scenarios (with differences in the number of stock) and is presented in Figure 3 below.

[Fig. 3 about here.]

The sheep are upland cross-breed (Cheviot ewes with Suffolk rams) with a ewe weight of 50kg at mating. Lambs produced are finished (c. 41kg) on grass for sale in the second week of October. Accounting for ewe and lamb mortality and ewe breeding failure the typical finished lamb percentage is 107%. Ewes with singles are out-wintered, with supplementary feeding of sugar-beet pulp (SBP) and distillers grains (DG) in the last two months of pregnancy. Ewes with twins are housed from January and fed ad lib silage supplemented by SBP and DG for the last month of pregnancy and the first month of lactation. At other times all stock are either on permanent pasture or silage aftermath. The energy requirment profiles for twin and single bearing ewes for the diets defined are shown in Figure 4(a) and (b). Twin-bearing ewes can be seen to lose body tissue (condition) in late pregnancy and in the first two months of lactation. This condition is regained in the three months prior to tupping. For single-bearing ewes the energy profile is neutral, with marginal loss of condition in late pregnancy. Replacements are bought in November.

The grazed pasture has a low-input regimen (50kg/ha of N applied in April). The system requires a relatively small area of silage to which 87 kg/ha N is applied in May). This is harvested in a single cut in early July, with the aftermath grazed later in the year. The stocking rate was set at 10.5 ewes per ha over 188ha (173ha grazed and 15ha ensiled) for a target flock size of 1964. This was consistent with the utilisation constraints (at 47% and 82% for grazing and silage) and the limits of housing (500). The flock size was also consistent with two full-time workers.

[Fig. 4 about here.]

(2) Spring-cattle and sheep

For the sheep with cattle scenarios the sheep numbers are reduced to 1000 but at a higher stocking rate of 11.3 ewes per ha (50% utilisation of pasture and 80% utilisation of silage). The numbers ensure that a specialist shepherd is fully employed with the stocking rate adjusted such that the two enterprises use roughly equal areas of the farm.

Figure 5 shows the management regimen for the spring-calving suckler herd. The suckler cattle modelled are pure-bred Welsh blacks with a live-weight of 550kg at mating. The calves are born in April (to avoid, as far as possible, clashing with lambing), and sold at weaning in October (222kg and 238kg live-weight for heifers and steers respectively). The cattle are housed from October to end of April (a month longer than the average for the uplands in the UK). Cows are fed silage when housed, supplemented by barley and high-protein supplements in late pregnancy and early lactation until turned out onto grass. Calves are fed with a high-protein supplement for the last three months before weaning, at seven months, to ensure growth targets are met. Calves are sold at weaning in October. Replacements are bought in June. The grazing is managed as per the all-sheep scenario. Figure 6 shows the energy requirement profile derived for the spring-calving sucklers.

[Fig. 5 about here.]

[Fig. 6 about here.]

(3) Autumn-cattle and sheep

For the autumn-calving system the herds and transition paths are common. The differences are in terms of the parameterisation of the herds. Calves are born in September, over wintered indoors and then finished outdoors from May. The calves are weaned in July and finished for sale in October at 13 months old (379 and 422 kg live-weight for heifers and steers respectively). Both calves and sucklers receive supplementary feeding in addition to silage when housed, with the calves receiving additional supplements to ensure target sale weights are achieved. Replacements are bought in July. Figure 6(b) shows the energy requirements for the autumn-calving sucklers.

The scenarios assume published historic or current variable and fixed cost rates and output prices (Chadwick, 2004, 2002). Access to labour or contractors is not limited.

5 Results

5.1 Sheep only

Figure 7 shows a stock profile of the sheep only scenario and summarises the numbers of animals, the grazing and silage areas and their utilisation, the fodder requirements and sources. The overall stocking rate is 11.45 per ha for a total of 1964 breeding ewes. The profile of the stock numbers is presented in Figure 7 (a). This number is limited by the amount of housing available (a maximum of 500 ewes can be housed). The break down of the land use plan for the farm is presented in Figure 7(c)). Only a small area of silage is required (13.5ha of 188ha) since all but the twin-bearing ewes are out-wintered on the grazings. The fodder requirements and their sources are presented in Figure 7(d)

[Fig. 7 about here.]

Figure 8(a) presents the labour profile for the system, assuming two full time workers with minimal machinery and contracting out all silage operations. This shows the peak in labour demand during lambing, when to provide 24-hour cover an additional worker is required. Otherwise the utilisation rate is 77 %. The system does require regular overtime to be worked with 217 hours per annum required.

[Fig. 8 about here.]

5.2 Spring-calving sucklers plus sheep

The stock profile for the sheep enterprise in the spring-cattle plus sheep scenario shares the features of the sheep-only scenario and is not therefore presented in full. The stocking rate is approximately 11.25 per ha with a grazed area of 81ha and a silage area of 8ha.

Figure 9 is a stock profile of the spring-calving sucklers system. The enterprise has the stock profile shown in Figure 9(a) with a breeding herd of 190 cows, and a stocking rate of 1.92 per ha. The stocking rate profile in standardised livestock units (LSU)is shown in Figure 9(b). The breeding herd size is set so that the maximum LSU value (in October when the calves are 6 months old and therefore included in the LSU count) is just below the threshold for the lower rate extensification supplement to the suckler cow premium (1.8 per ha). This rate is achieved by offsetting the higher stocking rate of the cattle enterprise against that of the sheep enterprise. While it could be possible to move the stock earlier and thus have a larger breeding herd, the available pasture resources are close to capacity with grazing utilisation of 52% and silage utilisation of 81% (Figure 9(c)). For this system it is notable that the production of fodder from silage aftermath provides the majority of the fodder. Silage aftermath productivity from single cut systems is set at 50% (5t/ha) of total productivity (10t/ha for 87kg/ha N) (Chadwick, 2004). Figure 9(d) shows the profile of the fodder requirements with peaks in late pregnancy (April) and when finishing the calves (September and October).

[Fig. 9 about here.]

Figure 8(b) presents the labour profile for the spring-calving sucklers with sheep system, assuming two full-time and one part-time workers (40 and 20 hours respectively) with minimal machinery and contracting out all silage operations. The pattern is again skewed towards operations in spring. The main period of calving has been set to occur in April to avoid clashing directly with the March lambing and the two thus combine to give a sustained period of activity for ten weeks. Again a seasonal worker is employed to provide 24-hour cover for the 10 week lambing and calving period. The overall labour utilisation for the year is 79 %. This system requires less overtime at 52 hours per annum.

5.3 Autumn-calving sucklers plus sheep

The stock profile for the sheep system is as defined for the spring-calving sucklers scenario. Figure 10 is the stock profile for the autumn-calving sucklers system. The autumn-calving system is based on a breeding herd of 160 animals, at 1.6 per ha. The calves are retained longer in the Autumn-calving system (300 days to weaning plus 60 days as store cattle before sale, compared with 220 days and sold at weaning for the spring-calving scenario). Consequently fewer but larger calves are sold (133 compared to 162), (Figure 10(a)). There is a sustained period when stocking rates are close to the 1.8 LSU/ha limit, (Figure 10(b)) with the sheep enterprise again offsetting the higher rate of cattle stocking. The balance between grazing and silage land is the same as for the spring-calving scenario (Figure 10(c)). The demand for fodder, however, peaks more strongly in September which can pose significant problems for late season pasture management, Figure 10(d). The system also requires more extended periods of supplementation, for example throughout the winter lactation with consequences for the financial viability of the system.

[Fig. 10 about here.]

Figure 8(c) presents the labour profile for the autumn-calving sucklers with sheep system, with the same labour and contracting assumptions as the spring-calving system. This system has two, five-week peaks of activity at lambing and calving but otherwise has similar levels of utilisation (78%). The synergies between the sheep and cattle enterprises are such that only 39 hours of over time are required.

5.4 Financial Analysis

For each of the management regimen a financial analysis was undertaken for the years 2002/3, 2004/5 and 2005/6. The results are tabulated in Tables 1,2 and 3. The year 2002/3 was chosen as this is the reference year for determining the value of the entitlements for 2005/6, while 2004/5 was chosen to highlight the changes due to the introduction of the reformed CAP in 2005/6. For each scenario the gross and net margins are presented with breakdowns of the sources of income and costs, the bases of these figures are presented in an appendix to the paper.

The incomes from grants under Pillar I and Pillar II of the CAP are highlighted, and the net effect of the SFP introduction calculated. Where required, quotas are assumed to be held. The farm is zoned as severely disadvantaged and is thus entitled to the higher rate of payments from the less-favoured area scheme *Tir Mynydd*. For 2005/6 the assumption is that the farm will qualify for the Tir Cynnal entry-level agri-environment scheme and that payments will be as outlined in the proposals.

Since much of the labour for such enterprises is met from within the farm-family then enterprise viability may not depend on ability to meet statutory wage rates. It is informative, therefore, to determine the salaries per full-time equivalent (FTE) (gross margins minus non-labour fixed-costs per FTE). This provides an indicator of the relative incomes from these enterprises. The value of the income may be increased where there is on-farm accommodation at zero cost.

Table 1 shows that the financial position of the sheep-based enterprise improved from 2002/3 to 2004/5 with much of the improvement due to the increased value of cast ewes, but the increased value of the subsidies is also significant. Variable costs are higher but not by enough to offset the gains in output. With two full-time workers supplemented by contract labour during lambing the net margins were negative in 2002/2 and positive for 2004/5. For 2004/5 the effect of introducing the SFP is to effect a 18.6% cut in income from Pillar I subsidies, but this is balanced by 48% increase in Pillar II income (though from a much lower base). This assumes that the enterprise would gain access to the Tir Cynnal entry level agri-environment scheme but this seems reasonable given the management regimen. Given these assumptions the net impact of SFP introduction is a cut of 4.6% in support payments, consequently reducing net margins from almost £2.28 to just above £1.40 per lamb sold.

[Table 1 about here.]

For the 1000-ewe sheep enterprise combined with cattle the marginally higher stocking-rate means a consequently greater net loss from reductions in the per head Pillar I payments that is not compensated for by the area based agri-environment and less-favoured-area payments (a net loss of 5.4%). The 1000-ewe enterprise in 2004/5 and the 2005/6 would make a positive contribution to the overall profitability of £4,805 and £3,728. As previously noted, the pattern of demand for labour in the 1000-ewe with autumn-calving sucklers also means that there are synergies that can be exploited to reduce the need for overtime.

Table 2 shows that the financial position of the spring-calving suckler enterprise in gross margin terms deteriorated from 2002/3 to 2004/5, with increased support payments offset by the reduction in sales income and increases in operations costs. For 2005/6 the gross margins are further eroded by a net reduction in support of 6.7% based on the same assumptions as the sheep-only scenario. There is also uncertainty over the value of cast cows for 2005/6. In the scenario to date these have been disposed of outwith the food chain with farmers compensated at a fixed rate per kg as part of the over thirty-months scheme (OTMS). With the introduction of a BSE testing and sale regimen, the market and hence value is uncertain. The FTE values are low and declining.

[Table 2 about here.]

Table 3 presents the financial profile for the autumn-calving suckler enterprise. This has seen a pattern decline in the profitability of the enterprise similar to the spring-sucklers. In 2002/3 the enterprise was close to break even at standard wage rates but since then the FTE values have fallen significantly. This decline reflects reduced sale prices and increased operational costs. The introduction of SFP has a net reduction in support of 8.1%.

The autumn-sucklers enterprise is generally more profitable than the spring sucklers since the live-weight sold is greater and the variable and fixed costs comparable. Variable costs are comparable with the spring calving sucklers despite the autumn calves and sucklers requiring greater supplementary feeding since the smaller suckler herd requires fewer replacements and has lower operational costs. Fixed costs are marginally higher reflecting the larger housing requirements.

[Table 3 about here.]

6 Discussion and Conclusions

The scenarios presented show the marginal nature of productivist agriculture in the uplands of Wales. For both cattle enterprises, gross margins are narrow and difficult to increase. Fixed costs have been reduced by eliminating, as far as possible, on-farm machinery and contracting machinery- and labour-intensive field operations. Even so, net margins are small and frequently negative, reducing effective wage rates for family farms. Since labour is the largest remaining fixed cost, increasing net margins would require increasing the numbers of cattle per FTE. This would probably have to be achieved by reducing staff numbers since intensifying grazing is probably not an option. While not impossible (rates of 300 cattle per person have been achieved with capital intensive systems) the suckler-cattle enterprises are not generating the income to finance the capitalisation and the returns on investment probably do not justify commercial investment. The systems remain vulnerable to price fluctuations and would be eliminated if returns on sales were at world market prices (£0.75 per kg).

The sheep enterprise with its lower fixed costs (particularly operations and contractor costs) has better prospects but is clearly still vulnerable to price fluctuations (with negative net margins in 2002/3). The possibility must therefore exist that sheep enterprises will displace cattle in the uplands, with cattle moving increasingly to more productive and more heavily capitalised lowland sites.

The impacts of the reforms in financial terms are significant, but the negative impacts have been somewhat offset by the introduction of entry level agri-environment schemes within Pillar II. The full agri-environment scheme, Tir Gofal, has been heavily over-subscribed and it is likely that there will be a strong take up of the Tir Cynal schemes. The scope of the scheme and the measurable outcomes in terms of improvements in agri-environmental condition are uncertain. Without demonstrable increases in public-goods it is likely that these schemes will simply be seen as an alternative way of making direct payments to producers.

By fully decoupling SFP from particular patterns of land use and management, beyond the minimum standards defined in the GEAC regulations, the CAP reforms have provided a significant freedom for land managers to adapt to changed circumstances. While a number of adaptation scenarios to increase profitability have been mooted, including specialisation, vertical and horizontal integration and cooperation (Scottish Enterprise Grampian, 2001) none of these seem as likely as extensification. By way of example reducing the spring-calving cattle herd to 100 and going to a single worker (with the assistance as possible from the 1000-ewe enterprise) turns around the profitability of the system (Table 4). Indeed, for a cattle-based enterprise, short of failing to comply with GEAC conditions there seems little financial incentive to engage in agricultural activity at all. The SFP is not, however, intended as a long term support mechanism with increasing rates of modulation likely to be imposed in the short and medium term. The SFP does, however, provide a means to increase the financial adaptive capacity of systems in the short term. The need for land-based business diversification and pluriactivity would seem likely to increase. There is thus the need for research which integrates agricultural systems and wider rural development in a post-productivist policy environment.

[Table 4 about here.]

The wider consequences of this extensification or de-stocking are less clear. A move to increased numbers of sheep in the uplands would reduce further, the already highly marginal financial viability of hill sheep systems, unless these are supported for delivering natural heritage management benefits. Reduced cattle numbers would have implications for viability and employment within the agricultural services and processing industries. If imports are substituted for upland production there there will, depending on source, be implications for: food quality and safety; animal welfare and environmental degradation. The local consequences for the environmental may be positive, reducing the intensity of management may have positive consequences for bio-diversity but changes to the aesthetics of landscape may make the upland less attractive for recreation. There are significant opportunities to explore further the implications of land-manager adaptations to the CAP reform to better inform all those concerned with the formulation and implementation of rural policy.

Acknowledgements

The research for this paper is funded by the Scottish Executive Environment

and Rural Affairs Department and is coordinated with the DEFRA upland systems research programme.

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Appendix

This appendix presents the basis of the financial analysis presented in Section 5.4.

[Fig. 11 about here.]

[Fig. 12 about here.]

[Fig. 13 about here.]

List of Figures

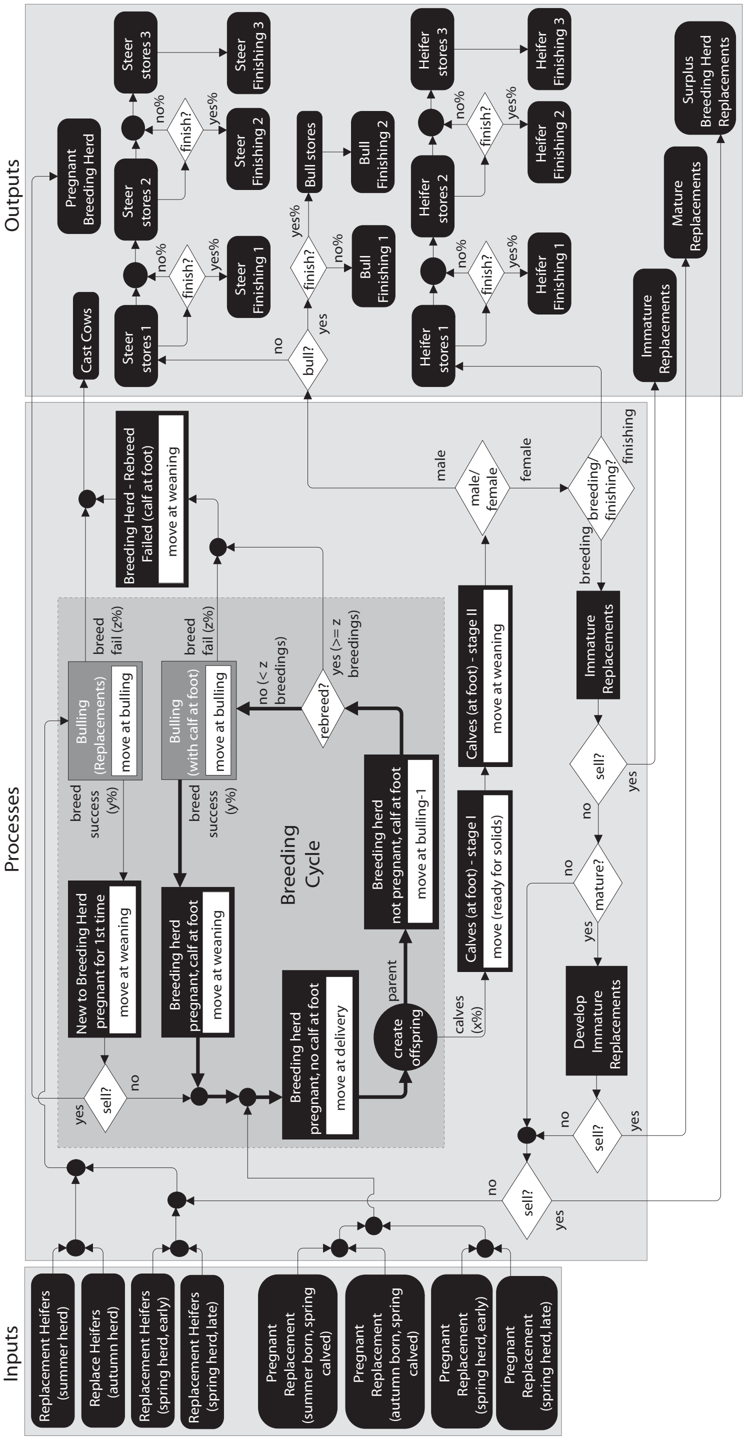


Fig. 1. Exemplar state-transition diagram for a generic beef-cattle system.

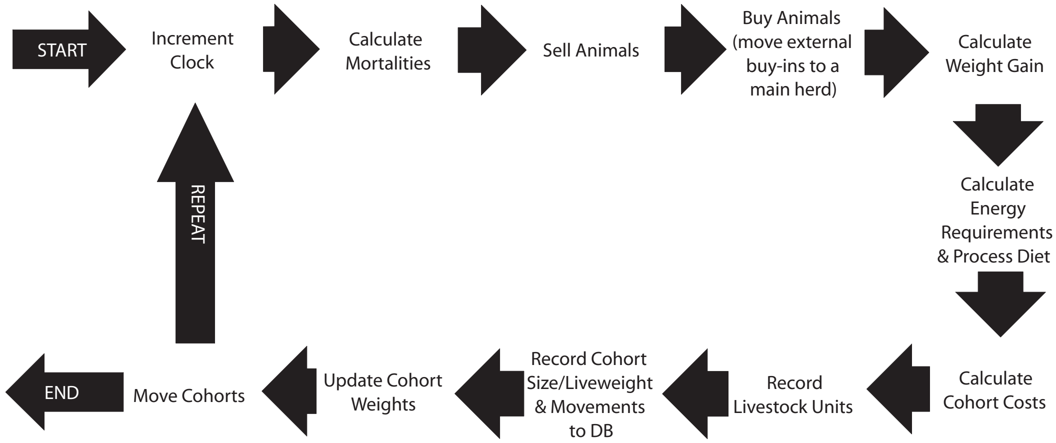


Fig. 2. The steps performed in each time increment of the LSM

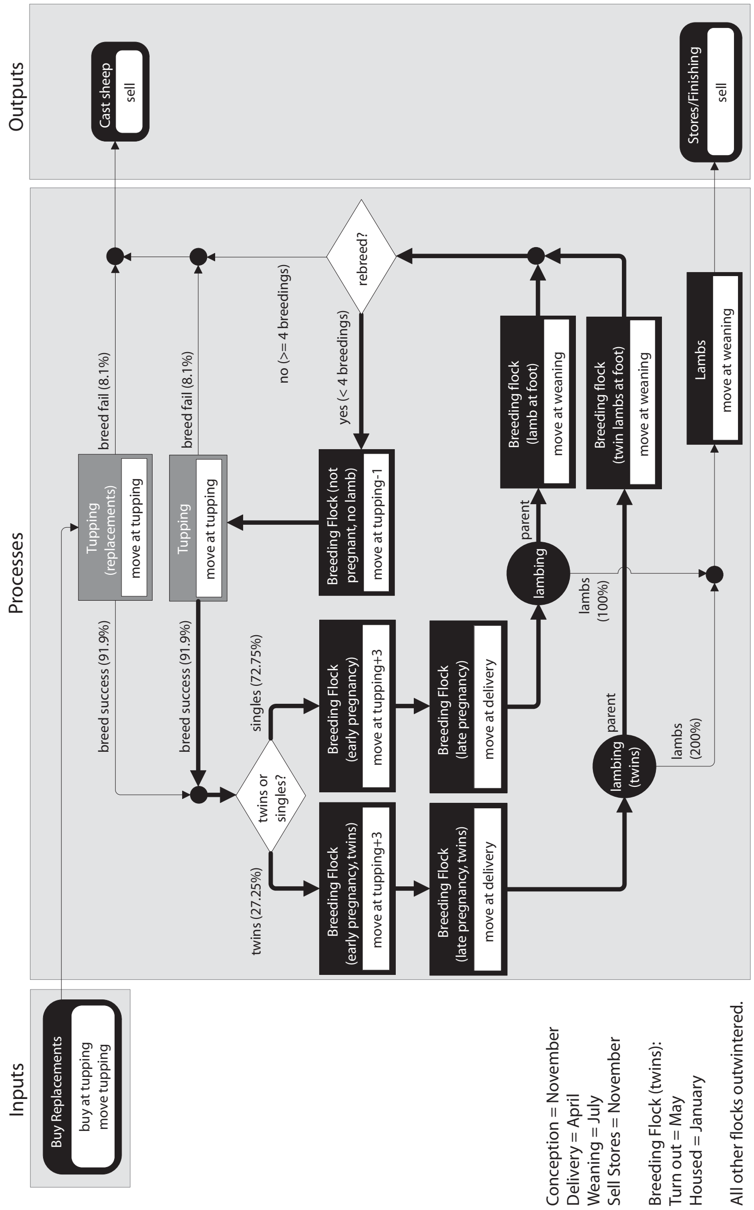


Fig. 3. Upland sheep flock with lambs sold at weaning

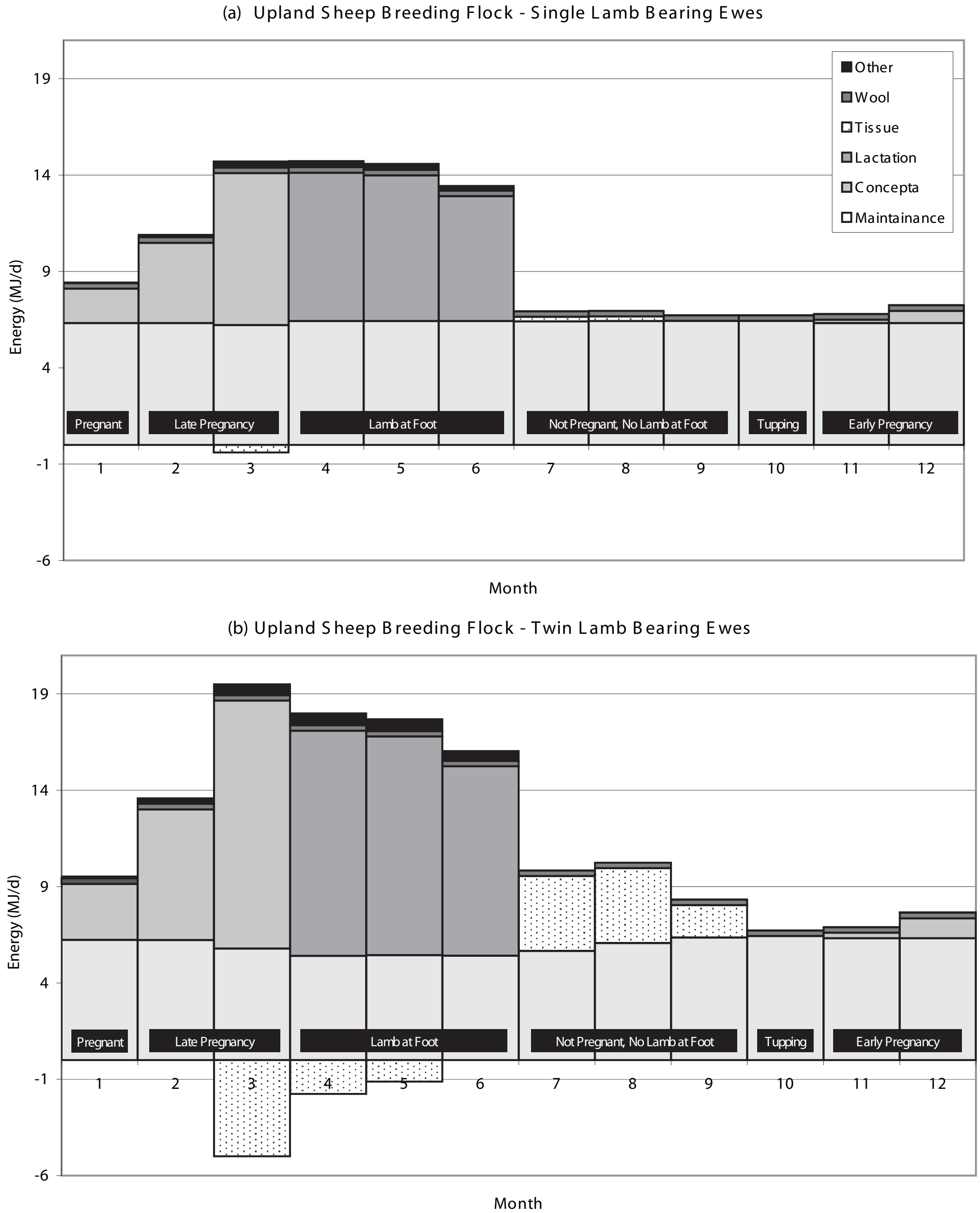


Fig. 4. Energy requirements profile for twin and single bearing ewes.

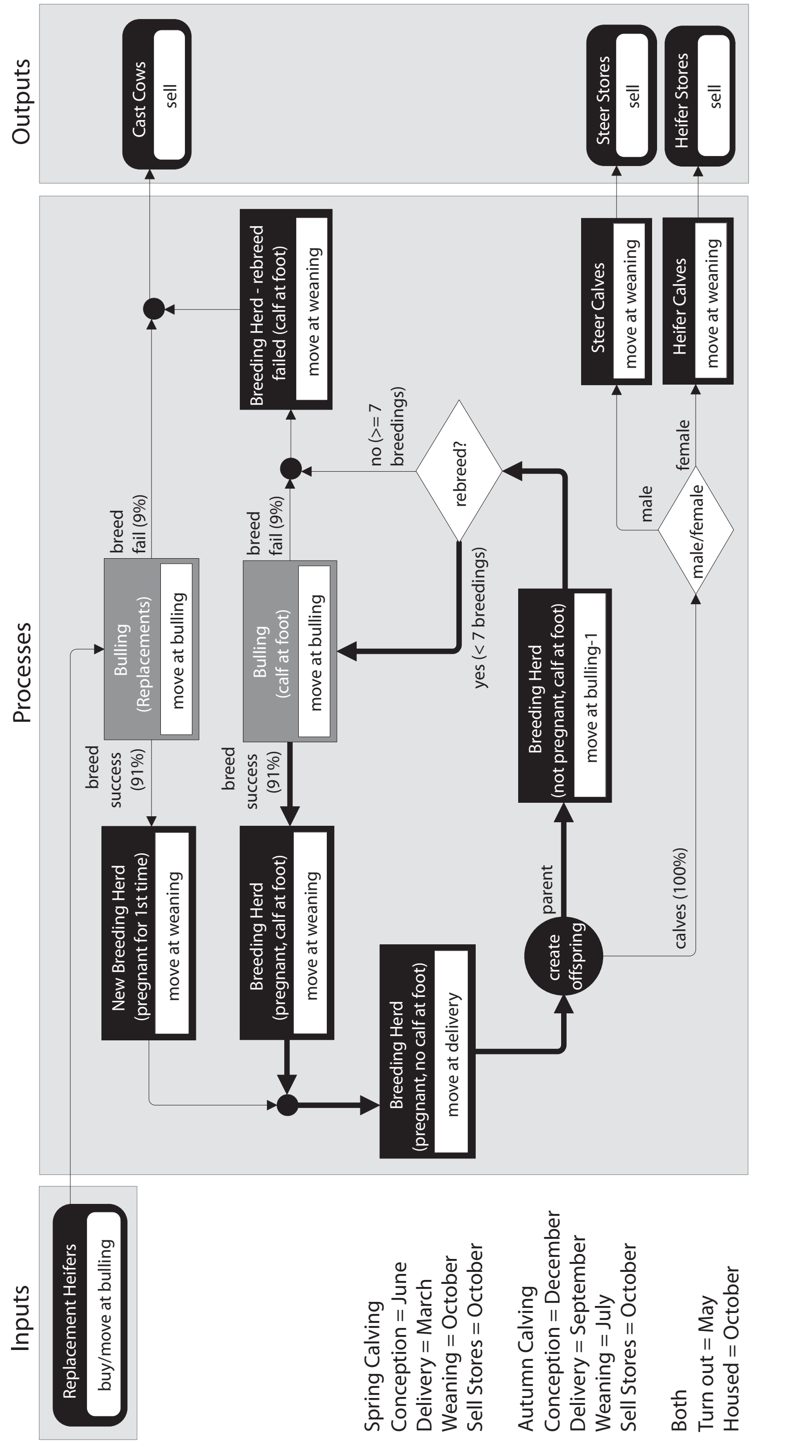
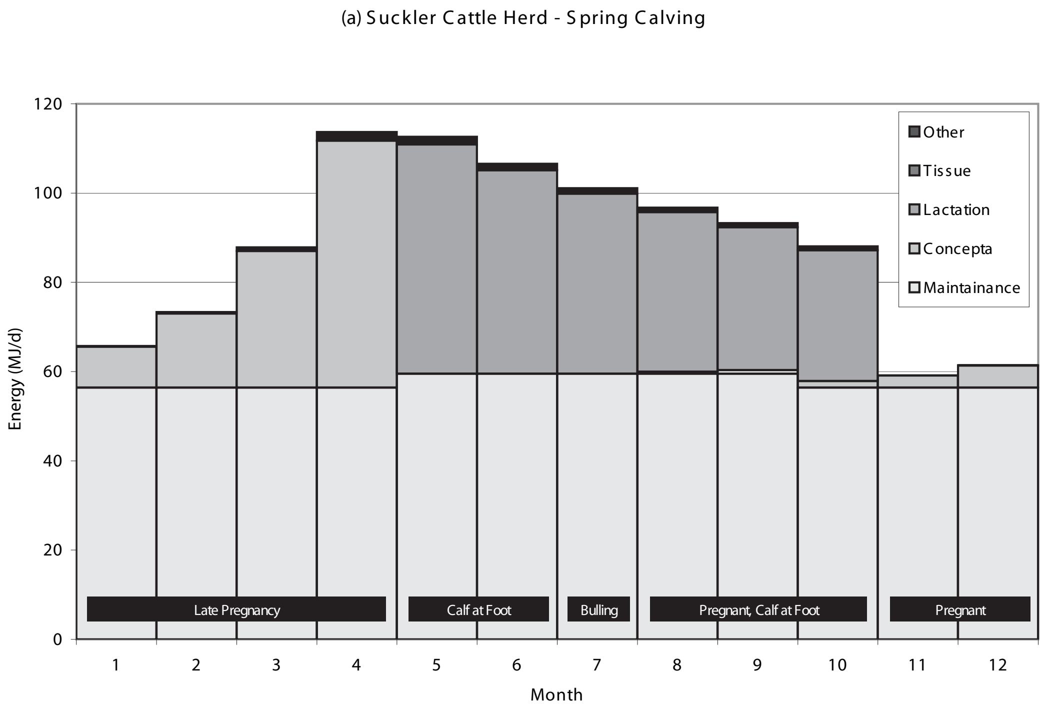


Fig. 5. Spring-calving suckler herd with calves sold at weaning



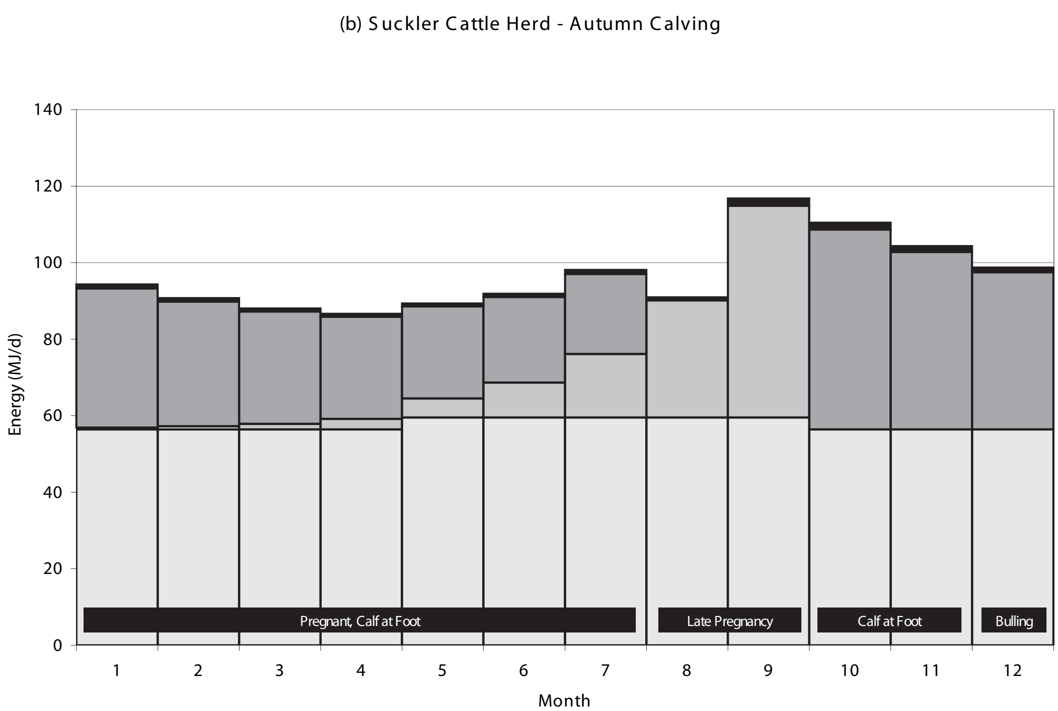


Fig. 6. Energy requirements profile for spring and autumn calving suckler cattle.

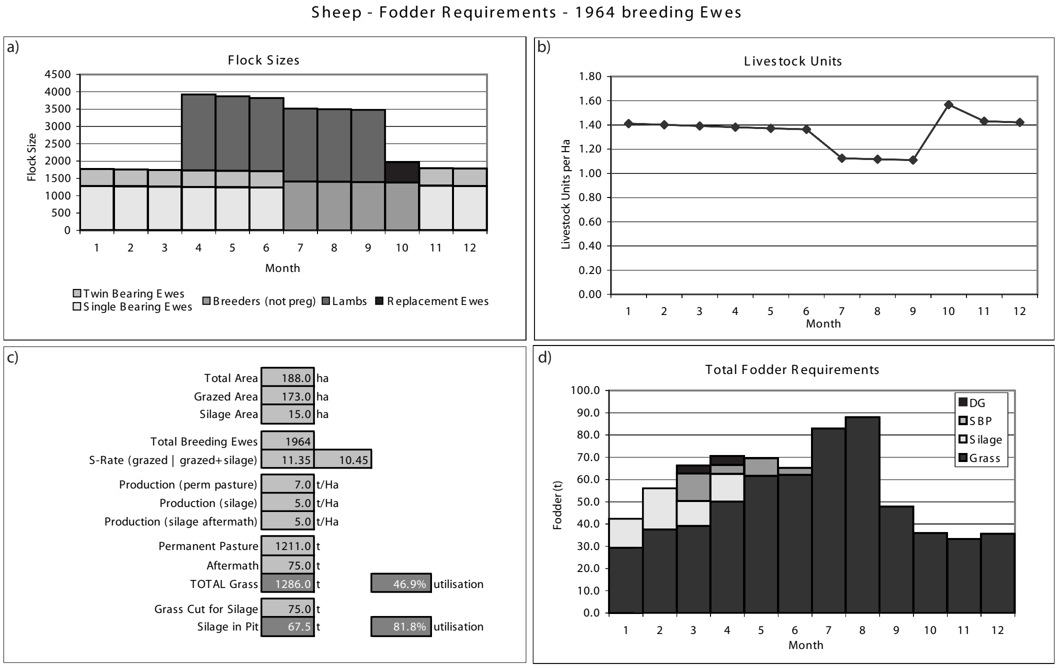


Fig. 7. Stock profile of the sheep only scenario.

a) b) c)

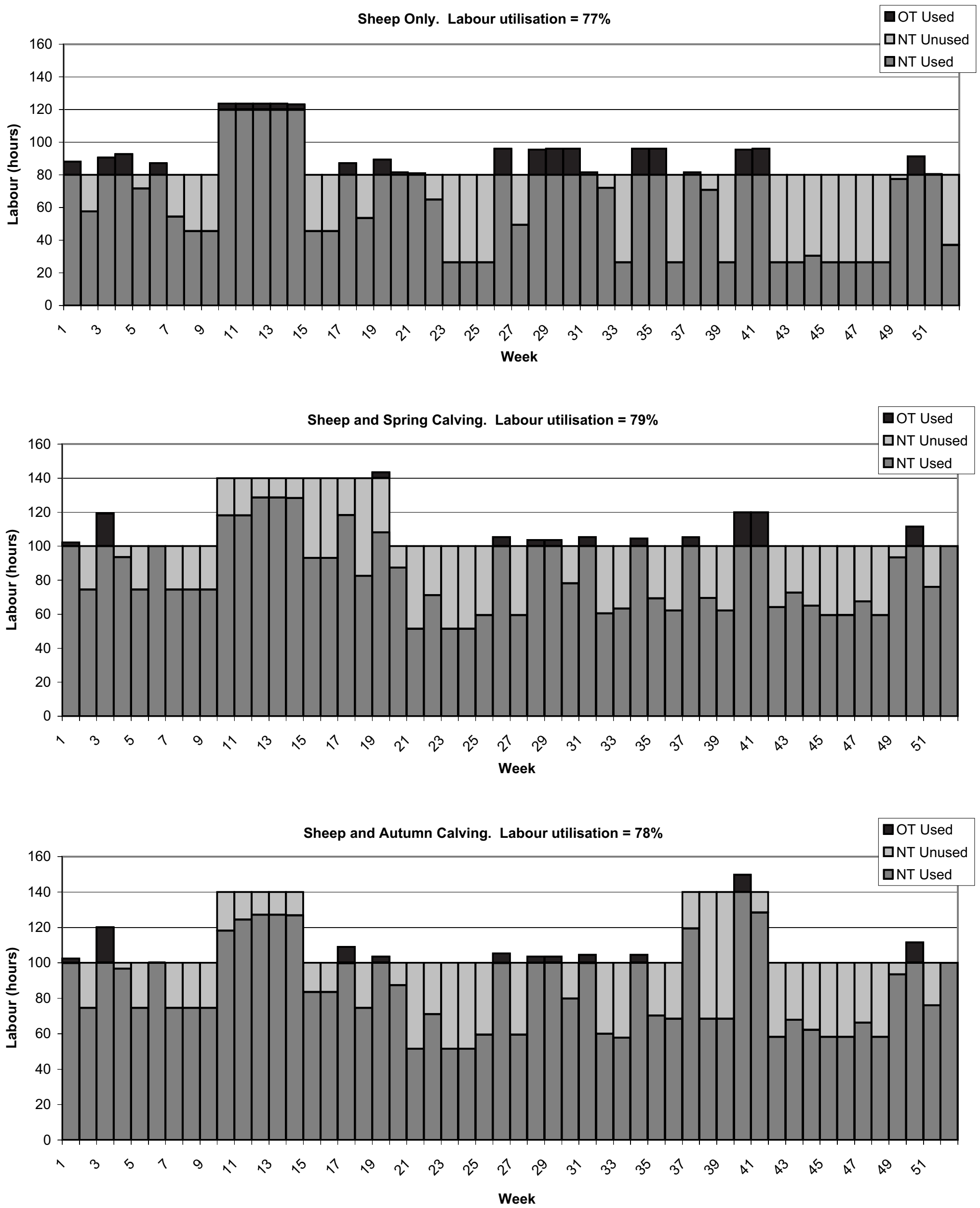


Fig. 8. Labour profiles of the three management regimen.

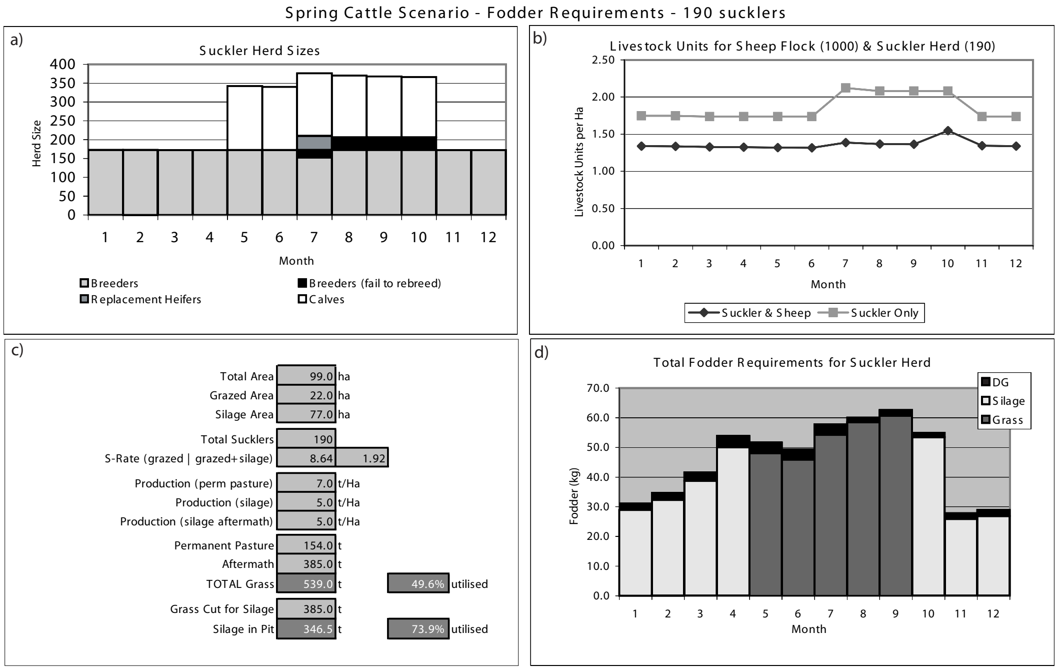


Fig. 9. Stock profile of the spring-calving sucklers scenario.

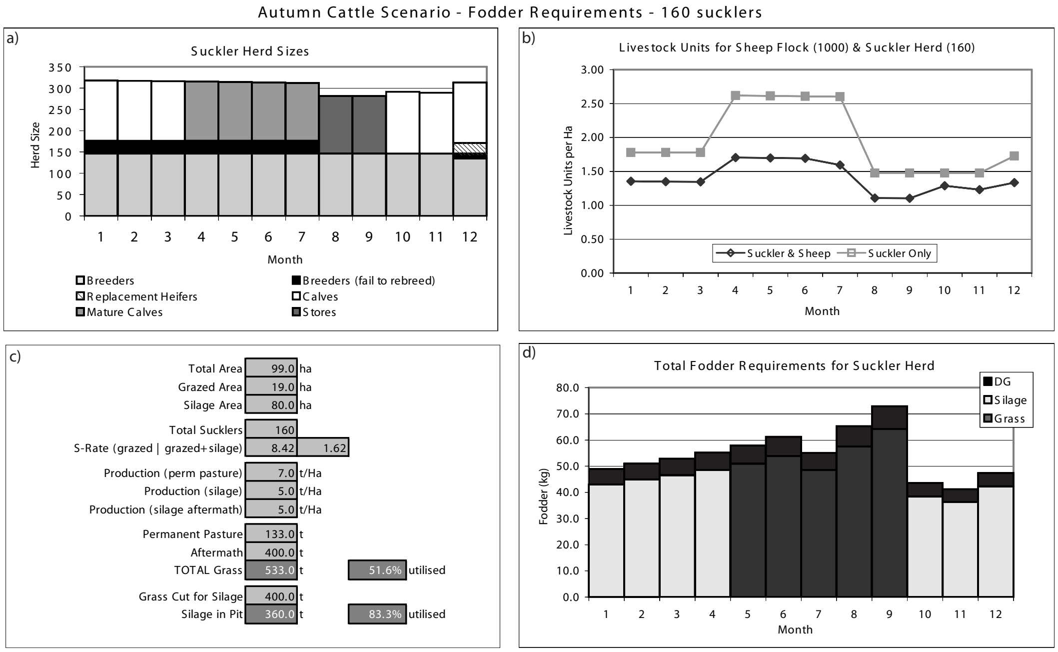


Fig. 10. Stock profile of the autumn-calving sucklers scenario.

		2002/03 All Sheep -1964			2004/5 All Sheep -1964			2005/6 All Sheep -1964				
Item	**Units**	**Value**	**Rate (£)**	**Amount (£)**	**Value**	**Rate (£)**	**Amount (£)**	**Value**	**Rate (£)**	**Amount (£)**	**Change 2005-6**	
Outputs												
Finished lambs	per lamb	2081	£32.00	£66,592	2081	£42.00	£87,402	2081	£42.00	£87,402		
Cast ewes (age and breed fail)	per cast ewe	431	£18.00	£7,758	431	£35.00	£15,085	431	£35.00	£15,085		
Wool sales	per animal	1712	£1.63	£2,791	1712	£1.63	£2,794	1712	£1.63	£2,794		
Sales				£77,141			£105,281			£105,281		
Support												
Sheep annual premium	per ewe	1964	£12.62	£24,786	1964	£14.22	£27,928	1964	£11.99	£23,546		
LFA supplement	per ewe	1964	£4.21	£8,268	1964	£4.74	£9,309	1964	£4.00	£7,855		
Pillar I				£33,054			£37,237			£31,401	-£5,836	-18.6%
Tir Mynydd	per ha	188	£22.75	£4,277	188	£22.75	£4,277	188	£22.75	£4,277		
Tir Cynnal	per ha	na			na			188	£21.28	£4,001		
Pillar II				£4,277			£4,277			£8,278	£4,001	48.3%
Pillar I +I				£37,331			£41,514			£39,679	-£1,835	-4.6%
Sales + Support				£114,472			£146,795			£144,960		
Replacements												
Ewe replacements	per animal	572	-£45.00	-£25,740	572	-£70.00	-£40,040	572	-£70.00	-£40,040		
Ram replacements (share)	per ewe	1964	-£3.20	-£6,285	1964	-£3.20	-£6,285	1964	-£3.20	-£6,285		
Replacement Costs				-£32,025			-£46,325			-£46,325		
				£82,447			£100,471			£98,635		
Operations												
Crude protein	per tonne	23.1	-£142.00	-£3,280	23.1	-£139.00	-£3,211	23.1	-£139.00	-£3,211		
Sugar beet pulp	per tonne	17.5	-£102.00	-£1,785	17.5	-£105.00	-£1,838	17.5	-£105.00	-£1,838		
Vet, drug and dip	per ewe	1964	-£4.71	-£9,250	1964	-£4.00	-£7,856	1964	-£4.00	-£7,856		
Bedding	per twin	497	-£1.68	-£835	497	-£1.68	-£835	497	-£1.68	-£835		
Commission, levies, haulage, shearing, scanning a	per ewe	1964	-£6.35	-£12,471	1964	-£6.92	-£13,591	1964	-£6.92	-£13,591		
Operations Costs				-£27,622			-£27,330			-£27,330		
				£54,825			£73,140			£71,305		
Fodder												
Fodder Costs	per ewe	1964	-£11.34	-£22,272	1964	-£11.34	-£22,272	1964	-£11.34	-£22,272		
GROSS MARGINS				£32,553			£50,869			£49,033		
GROSS MARGINS per LAMB sold				£15.64			£24.44			£23.56		
FTE				2.0			2.0			2.0		
Salary Costs				-£36,560			-£38,040			-£38,040		
Overtime				-£1,598			-£1,758			-£1,758		
Operations Costs				-£4,517			-£4,517			-£4,517		
Contractor Costs				-£1,667			-£1,805			-£1,805		
Fixed Costs				-£44,342			-£46,119			-£46,119		
NET MARGINS				-£11,789			£4,749			£2,914		
NET MARGINS per LAMB sold				-£6			£2			£1		
Per FTE break even				£13,328			£22,745			£21,668		

Fig. 11. Financial profile of the sheep only scenario.

		2002/3 Spring-calve+Finish			2004/5 Spring-calve+Finish			2005/6 Spring-calve+Finish				
Item	Units	Value	Rate (£)	Amount (£)	Value	Rate (£)	Amount (£)	Value	Rate (£)	Amount (£)	Change 2005-6	
Outputs												
Calf sales steers	kg live weight	20230	£1.40	£28,322	20230	£1.15	£23,265	20230	£1.15	£23,265		
Calf sales - heifers	kg live weight	17094	£0.95	£16,239	17094	£1.10	£18,803	17094	£1.10	£18,803		
All sales (kg)		37324			37324			37324				
Sales				£44,561			£42,068			£42,068		
Compensation												
Cast cows	kg live weight	18700	£0.52	£9,633	18700	£0.53	£9,923	18700	£0.53	£9,923		
Support												
Suckler Cow Premium	per suckler	190	£148.00	£28,120	190	£161.96	£30,772	190	£140.60	£26,714	**Modulatior**	0.95
Beef special premium	per steer calf	na			na			na				
Pillar I				£28,120			£30,772			£26,714	-£4,058	-15.19%
Tir Mynydd	per ha	99	£22.75	£2,252	99	£22.75	£2,252	99	£22.75	£2,252		
Tir Cynnal	per ha							99	£21.28	£2,107		
Pillar II				£2,252			£2,252			£4,359	£2,107	48.33%
Pillar I and II				£30,372			£33,025			£31,073	-£1,952	-6.28%
Sales, Comp and Support				£84,567			£85,016			£83,064		
Replacements												
Replacements (share)	per replacment	35	-£700.00	-£24,500	35	-£700.00	-£24,500	35	-£700.00	-£24,500		
Bull replacements (share)	per 200 sucklers	0.95	-£2,000.00	-£1,900	0.95	-£2,000.00	-£1,900	0.95	-£2,000.00	-£1,900		
Calf replacements (share)	per suckler	190	-£5.00	-£950	190	-£5.00	-£950	190	-£5.00	-£950		
Replacement Costs				-£27,350			-£27,350			-£27,350		
				£57,217			£57,666			£55,714		
Operations costs												
Cow concentrates	per tonne	19	-£120.00	-£2,280	19	-£125.00	-£2,375	19	-£125.00	-£2,375		
Calf concentrates	per tonne	16.7	-£140.00	-£2,338	16.7	-£145.00	-£2,422	16.7	-£145.00	-£2,422		
Vet, drug and dip	per suckler	190	-£20.00	-£3,800	190	-£27.00	-£5,130	190	-£27.00	-£5,130		
Bedding	per suckler eqiv	220.5	-£50.00	-£11,025	220.5	-£50.00	-£11,025	220.5	-£50.00	-£11,025		
Commission, levies, haulage, scar	per suckler	190	-£22.00	-£4,180	190	-£23.00	-£4,370	190	-£23.00	-£4,370		
Operations Costs				-£23,623			-£25,322			-£25,322		
				£33,594			£32,344			£30,393		
Fodder												
Feed costs - silage	per ha	77	-£98.00	-£7,546	77	-£100.00	-£7,700	77	-£100.00	-£7,700		
Feed costs - grazing	per ha	22	-£98.00	-£2,156	22	-£90.00	-£1,980	22	-£90.00	-£1,980		
Fodder Costs				-£9,702			-£9,680			-£9,680		
GROSS MARGIN				£23,892			£22,664			£20,713		
GROSS MARGINS per kg				£0.64			£0.61			£0.55		
FTE				1.5			1.5			1.5		
Salary Costs				-£26,070			-£26,070			-£26,070		
Overtime				-£383			-£421			-£421		
Operations Costs				-£8,290			-£8,290			-£8,290		
Contractor Costs				-£3,793			-£4,006			-£4,006		
Fixed Costs				-£38,536			-£38,787			-£38,787		
NET MARGINS				-£14,644			-£16,122			-£18,074		
NET MARGINS per kg sold				-£0.39			-£0.43			-£0.48		
Per person break even				£7,873			£6,913			£5,611		

Fig. 12. Financial profile of the spring-calving sucklers with sheep scenario.

		2002/3 Autumn-calve+ Finish			2004/5 Autumn-calve+ Finish			2005/6 Autumn-calve+ Finish				
Item	Units	Parameter	Rate (£)	Amount (£)	Parameter	Rate (£)	Amount (£)	Parameter	Rate (£)	Amount (£)	Change 2005-6	
Outputs												
Calf sales steers	kg live weight	27852	£1.10	£30,637	27852	£1.05	£29,245	27852	£1.05	£29,245		
Calf sales - heifers	kg live weight	25393	£0.95	£24,123	25393	£1.00	£25,393	25393	£1.00	£25,393		
All sales (kg)		53245			53245			53245				
Sales				£54,761			£54,638			£54,638		
Compensation												
Cast cows	kg live weight	14850	£0.52	£7,650	14850	£0.53	£7,880	14850	£0.52	£7,650		
Support												
Suckler Cow Premium	per suckler	160	£148.00	£23,680	160	£161.96	£25,914	160	£140.60	£22,496		
Beef special premium	per steer calf	66	£114.16	£7,535	66	£128.60	£8,488	66	£108.45	£7,158		
Pillar I				£31,215			£34,401			£29,654	-£4,747	-16.01%
Tir Mynydd	per ha	99	£22.75	£2,252	99	£22.75	£2,252	99	£22.75	£2,252		
Tir Cynnal	per ha							99	£21.28	£2,107		
Pillar II				£2,252			£2,252			£4,359	£2,107	48.33%
Pillar I and II				£33,467			£36,653			£34,013	-£2,641	-7.76%
Sales, Comp and Support				£95,877			£99,171			£96,300		
Replacements												
Replacements (share)	per replacment	27	-£700.00	-£18,900	27	-£700.00	-£18,900	27	-£700.00	-£18,900		
Bull replacements (share)	per 200 sucklers	0.8	-£2,000.00	-£1,600	0.8	-£2,000.00	-£1,600	0.8	-£2,000.00	-£1,600		
Calf replacements (share)	per suckler	160	-£5.00	-£800	160	-£5.00	-£800	160	-£5.00	-£800		
Total reps costs				-£21,300			-£21,300			-£21,300		
				£74,577			£77,871			£75,000		
Operational Costs												
Cow concentrates	per tonne	32	-£125.00	-£4,000	32	-£125.00	-£4,000	32	-£125.00	-£4,000		
Calf concentrates	per tonne	41.4	-£140.00	-£5,796	41.4	-£145.00	-£6,003	41.4	-£145.00	-£6,003		
Vet, drug and dip	per suckler	160	-£22.00	-£3,520	160	-£33.00	-£5,280	160	-£33.00	-£5,280		
Bedding	per suckler eqiv	264.6	-£50.00	-£13,230	264.6	-£75.00	-£19,845	264.6	-£75.00	-£19,845		
Commission, levies, haulage, scar	per suckler	160	-£26.00	-£4,160	160	-£26.00	-£4,160	160	-£26.00	-£4,160		
Operations Costs				-£30,706			-£39,288			-£39,288		
				£43,871			£38,583			£35,712		
Fodder												
Feed costs - silage	per ha	80	-£98.00	-£7,840	80	-£100.00	-£8,000	80	-£100.00	-£8,000		
Feed costs - grazing	per ha	19	-£98.00	-£1,862	19	-£90.00	-£1,710	19	-£90.00	-£1,710		
Fodder Costs				-£9,702			-£9,710			-£9,710		
GROSS MARGIN				£34,169			£28,873			£26,002		
GROSS MARGINS per kg				£0.64			£0.54			£0.49		
FTE				1.5			1.5			1.5		
Salary Costs				-£26,070			-£26,070			-£26,070		
Overtime				-£287			-£316			-£316		
Operations Costs				-£8,890			-£8,890			-£8,890		
Contractor Costs				-£3,793			-£4,006			-£4,006		
Fixed Costs				-£39,040			-£39,282			-£39,282		
NET MARGINS				-£4,871			-£10,408			-£13,279		
NET MARGINS per kg sold				-£0.09			-£0.20			-£0.25		
Per person break even				£14,324			£10,652			£8,738		

Fig. 13. Financial profile of the autumn-calving sucklers with sheep scenario.

List of Tables

Table 1
Financial profile for the sheep-only scenario

Item/Year	2002/03	2004/5	2005/6	Change	%
Total Sales (£)	77,141	105,281	105,281		
Compensation (£)	0	0	0		
Pillar I (£)	33,054	37,237	31,401	-5,836	-18.6%
Pillar II (£)	4,277	4,277	8,278	4,001	48.3%
SUPPORT (£)	37,331	41,514	39,679	-1,835	-4.6%
OUTPUTS and SUPPORT (£)	114,472	146,795	144,960		
Replacements (£)	-32,025	-46,325	-46,325		
Operational Costs (£)	-27,622	-27,330	-27,330		
Fodder Costs (£)	-22,272	-22,272	-22,272		
VARIABLE COSTS (£)	-81,919	-95,927	-95,927		
GROSS MARGIN (£)	32,553	50,869	49,033		
GROSS MARGIN per lamb sold (£)	16	24	24		
FTE	2	2	2		
Wages (£)	-38,158	-39,798	-39,798		
Machinery and Maint (£)	-4,517	-4,517	-4,517		
Contractor Costs (£)	-1,667	-1,805	-1,805		
FIXED COSTS (£)	-44,342	-46,119	-46,119		
NET MARGIN (£)	-11,789	4,749	2,914		
NET MARGINS per lamb sold (£)	-5.67	2.28	1.40		
Per FTE break even (£)	13,328	22,745			

Table 2
Financial profile for the spring-calving suckler enterprise

Item/Year	2002/03	2004/5	2005/6	Change	%
Total Sales (£)	44,561	42,068	42,068		
Compensation (£)	9,633	9,923	9,633		
Pillar I (£)	28,120	30,772	26,714	-4,058	-15.2%
Pillar II (£)	2,252	2,252	4,359	2,107	48.3%
SUPPORT (£)	30,372	33,025	31,073	-1,952	-6.3%
OUTPUTS and SUPPORT (£)	84,567	85,016	82,774		
Replacements (£)	-27,350	-27,350	-27,350		
Operational Costs (£)	-23,623	-25,322	-25,322		
Fodder Costs (£)	-9,702	-9,680	-9,680		
VARIABLE COSTS (£)	-60,675	-62,352	-62,352		
GROSS MARGIN (£)	23,892	22,664	20,423		
GROSS MARGIN per kg sold (£)	0.64	0.61	0.55		
FTE	1.5	1.5	1.5		
Wages (£)	-26,453	-26,491	-26,491		
Machinery and Maint (£)	-8,290	-8,290	-8,290		
Contractor Costs (£)	-3,793	-4,006	-4,006		
FIXED COSTS (£)	-38,536	-38,787	-38,787		
NET MARGIN (£)	-14,644	-16,122	-18,364		
NET MARGINS per kg sold (£)	-0.39	-0.43	-0.49		
Per FTE break even (£)	7,873	6,913	5,418		

Table 3
Financial profile for the autumn-calving suckler enterprise

Item/Year	2002/03	2004/5	2005/6	Change	%
Total Sales (£)	54,761	54,638	54,638		
Compensation (£)	7,650	7,880	7,650		
Pillar I (£)	31,215	34,401	29,654	-4,747	-16.0%
Pillar II (£)	2,252	2,252	4,359	2,107	48.3%
SUPPORT (£)	33,467	36,653	34,013	-2,641	-7.8%
OUTPUTS and SUPPORT (£)	95,877	99,171	96,300		
Replacements (£)	-21,300	-21,300	-21,300		
Operational Costs (£)	-30,706	-39,288	-39,288		
Fodder Costs (£)	-9,702	-9,710	-9,710		
VARIABLE COSTS (£)	-61,708	-70,298	-70,298		
GROSS MARGIN (£)	34,169	28,873	26,002		
GROSS MARGIN per kg sold (£)	0.64	0.54	0.49		
FTE	1.5	1.5	1.5		
Wages (£)	-26,357	-26,386	-26,386		
Machinery and Maint (£)	-8,890	-8,890	-8,890		
Contractor Costs (£)	-3,793	-4,006	-4,006		
FIXED COSTS (£)	-39,040	-39,282	-39,282		
NET MARGIN (£)	-4,871	-10,408	-13,279		
NET MARGINS per kg sold (£)	-0.09	-0.20	-0.25		
Per FTE break even (£)	14,324	10,652	8,738		

Table 4
Financial profile for an extensified spring-calving suckler enterprise

Item/Year	**%**
Total Sales (£)	22,514
Compensation (£)	4,817
Pillar I (£)	26,714
Pillar II (£)	4,359
SUPPORT (£)	31,073
OUTPUTS and SUPPORT (£)	58,404
Replacements (£)	-14,100
Operational Costs (£)	-13,145
Fodder Costs (£)	-4,870
VARIABLE COSTS (£)	-18,015
GROSS MARGIN (£)	26,289
GROSS MARGIN per kg sold (£)	1.31
FTE	1
Salary Costs (£)	-17,380
Machinery and Maint (£)	-6,180
Contractor Costs (£)	-2,479
FIXED COSTS (£)	-26,039
NET MARGIN (£)	249
NET MARGINS per kg sold (£)	0.01
Per FTE break even (£)	17,629