THE ECONOMICS OF THE WELFARE AND LABOUR INPUT OF HILL SHEEP IN THE UK

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Abstract

There is increasing interest by the public, scientists and farmers in animal welfare with a perception that labour input and welfare are positively related. Extensively farmed hill sheep are considered to have a relatively natural life and thus good welfare though there has been little data or research to support this view. This study recorded actual labour deployment on three typical extensive UK hill farms over the lambing period. The data was used to build a Linear Program Model to explore the labour, productivity, and welfare relationship. Tasks observed were categorised into fixed - planned independent of sheep numbers, planned dependant on sheep numbers, unplanned if not undertaken leading to loss of ewes/lambs or to potential loss. Most time was found to be spent on planned routine tasks such as driving, feeding – providing overall flock welfare- and checking to see if other tasks were needed. Very little time was spent on the unplanned welfare tasks such as lambing ewes. Modelling showed that more sheep could be kept if the unplanned welfare tasks were ignored but with serious consequences for those few sheep requiring these tasks. Very few ewes required assistance to lamb so reducing the need to lamb ewes by 90% to simulate 'easy care' sheep had little effect on labour requirements suggesting the hill breeds studied are well adapted to their extensive environment with minimum human intervention. Implementing recent legislation to castrate all male lambs before 7 days of age and to tag all lambs at birth would greatly increase labour requirements. The study supports the hypothesis that labour, productivity and welfare are related in extensive hill sheep farming in the UK.

Keywords: Labour Welfare Hill Sheep Lambing

Sub theme: Farm Management

Introduction/Review

Animal welfare is of interest to farmers, scientists and the public (Rushen, 2003). Although sheep welfare issues are being researched (Blokhuis *et al.*, 2000; Defra, 2007b; Dwyer, 2007; FAWC, 1994; Lawrence & Conington, 2008; Stubsjøen *et al.*, 2009; Winter & Fitzpatrick, 2007), public concern about sheep welfare is low (European Commission, 2007a), perhaps due to the perception that such livestock have a natural life (Goddard *et al.*, 2006), particularly hill sheep. However, Kilgour *et al.*, (2009) challenge this, maintaining that other needs such as freedom from hunger and pain are often compromised in extensive systems. In hill farming, labour, a major cost important for welfare and productivity (Boutonnet, 1999; Wassink *et al.*, 2005), has been decreasing more than in other farming systems, aggravated perhaps by an ageing farming population. Neither welfare nor labour utilisation in hill farming have been recently researched, although Stott *et al*. (2005) suggest, based on secondary data, modelling and interviews, that there may be a negative relationship between labour and animal welfare in extensive sheep farming.

To test the hypothesis, that there are strong links between labour usage sheep welfare and productivity in extensive sheep farming this study attempts to link these through empirical observation and subsequent modelling of the critical lambing period on extensive hill farms in the UK.

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Materials & Methods

Data Collection

All data were recorded by continuous observation by one individual, thus ensuring a high degree of consistency, reliability and comparability. An observation consists of one recorded task, independent of the number of sheep involved (e.g., one checking may involve 60 sheep). Data gathering was a two stage process; first data gathering was aimed at recording all tasks that occur during lambing in sheep farming and the practicalities of data collection, which was initially by pencil and waterproof paper. For this, three SAC research farms (two extensive hill farms and one intensive farm housing sheep indoors) were visited for five days each in 2007 and all labour tasks and durations were recorded. The second stage of data gathering was undertaken for ten days each during lambing on three typical commercial hill farms in April/May 2008 in England (Farm E) and Scotland (Farm S), and April 2009 in Wales (Farm W). To facilitate data collection over long inclement days and subsequent data transfer, recording in the field used a Palm Handheld Tungsten E2 enclosed in a zip lock plastic bag with the Excel support program Documents to Go from which data could be downloaded to Excel for processing.

The data collected on the field studies were collated in Microsoft Excel® for direct analysis and in preparation of the LP modelling. To connect the labour input to productivity of the flock, all labour tasks were categorised into six groups (Table 1) according to whether their use was a fixed or a variable labour cost. Variable labour costs were further classed according to their impact on productivity as shown in Table 1.

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Table 1: Labour Task Classification by Type and Impact

Task Group	*Individual task*
Planned tasks: activities independent of number of sheep (PTI) Fixed	Get ready for work Finish working day Clean up Paperwork Tea breaks Travel Prepare materials
Planned tasks : activities dependent on number of sheep (PTD)	Check flock Prepare feed Preventive medical treatment ewe (dip feet) Score body condition and weigh Prepare pens
Unplanned tasks involving almost certain loss of sheep/lambs if not undertaken (UCL)	Medical treatment of lamb Medical treatment of sheep Mother up lambs Lamb ewe Remove ewe/lamb from source of discomfort Warm lambs Feed pet lambs Foster lamb
Unplanned tasks involving potential loss of sheep/lambs if not undertaken (UPL)	Catch ewe Catch lamb Disinfect navel Preventive medical care lamb Transport ewe Transport lamb
Unplanned tasks without risk of losing sheep, if not undertaken (UTW)	Castrate lambs Castrate lambs (affecting ewes) Tag/mark sheep Sort ewes and lambs
Other tasks (O)	Tasks outside the sheep enterprise, e.g. looking after cattle

It can be assumed that tasks which can kill a sheep if omitted have serious implications for sheep welfare and those which have no impact on productivity have not. Therefore the time per day spent on crucial tasks, allows a limited assessment of welfare without any direct measurements of welfare on the flock.

Using the data from the research farms obtained in spring 2007 an initial LP model covering three days was developed which was expanded to cover a 21-day period typical of the duration of lambing using the data from the commercial farms obtained in 2008/9. The objective function of the LP was to maximise ewe numbers carried per shepherd during lambing subject to available hours and allowing time for all daily tasks as these developed during the course of the lambing period.

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By dropping the requirement to undertake certain classes of task the trade-off between labour input per ewe and hence maximum flock size and productivity could be explored in different runs. Other alterations included reduced need to lamb and mother-up (this run explored the potential of a "lower input" type of Swaledale ewe to save labour time) and (without optimisation) the labour demand of the farmer doing only the absolute minimum legal requirement of care defined as one visit to each area of lambing sheep/day.

Farms

On all the commercial farms, lambing took place on enclosed inbye land to which the sheep were brought from the open hill for the duration of lambing. The Welsh farm was owned and managed by a Charitable Trust, while the other two were tenanted. The English farm (E) in the Peak District kept 1700 predominantly Swaledale ewes managed by two shepherds with three separate in-bye areas. The Scottish farm (S) on a Western Isle in the Highlands and Islands had 400 North Country Cheviots managed part-time by one shepherd. The farm in Wales (W) ran 1600 north Welsh Mountain sheep; some crossbred to Charolais rams with 2 full time shepherds on five separate in-bye areas up to an hour's drive apart.

Results

Direct data analysis (Table 2) shows that six activities were never recorded while many other activities were recorded very seldom.

Given the percentage of time the fixed labour tasks (Task Groups PTI and PTD Table 1) occupied there may be opportunity for labour saving. The large amount of time driving was composed of many short trips between fields to allow checking and feeding tasks. However, without driving and then checking individual sheep welfare, tasks would not be identified and undertaken. Welfare relevant tasks (Task Groups UCL and UPL) occupied a relatively small percentage of time

Farms E and W did not castrate lambs during lambing; therefore castration did not involve any labour time. Farm S castrated in batches. The percentage of labour time spent on assisting ewes with difficulties in lambing although low is an important factor for lambing labour demand and welfare. Only four, three and seven ewes for Farms E, S and W, respectively, required help. Given the respective numbers of ewes, this brings the percentage of ewes needing help to 0.41% for Farm E, 1.25% for Farm S and 0.31% for Farm W. However, labour time used for lambing assistance of individual ewes was highly variable, ranging from 1 to 30 minutes. So when it occurs this task can have a large impact on labour allocation to tasks on a specific day and is unpredictable. Mothering up demanded 0.55%, 4.55% and 2.33% of total time, occurring 5, 11 and 12 times for farms E, S and W respectively. Although infrequent, each occurrence accounted for a considerable amount of time (on average, 5, 18 and 11.5 minutes respectively for Farms E, S and W). Feeding of the flock during lambing only involved forage, small amounts of hay or silage and mineral licks, to supplement grazing; this required physical distribution but could be done at various times through the day. The last of the previous year's lambs housed for slaughter and a few housed ewes also required feeding, Even so, the task of feeding took a significant proportion of time - 8.52%, 1.97%, and 1.91% for Farms E, S and W, respectively.

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Table 2: Number of tasks observed by type on each commercial farm case study & percentage of total time

	Farm E		Farm S		Farm W	
Task type	*No.*	*%*	*No.*	*%*	*No*	*%*
Body condition score and weigh	0	0	0	0	0	0
Castration of lambs	0	0	5	0.96	0	0
Catch ewe	6	0.68	13	2.08	8	1
Catch lamb	2	0.16	2	0.10	3	0.15
Checking	10*	24.9	10*	36.4	10*	27.2
Cleaning up	5*	4.65	0	0	6*	0.6
Disinfecting of navel	0	0	0	0	0	0
Dispose of dead animal/s	4	0.14	0	0	10	0.6
Driving	10	23.0	10	9.37	10	36.6
Feed orphaned lambs	10	1.26	4*	1.03	4*	0.85
Feed sheep	10*	8.52	9	1.97	9*	1.91
Finish working day	10	2.16	10	6.24	10	2.82
Foster lamb	4	0.76	5	5.07	7	0.76
Get ready for work	10	2.16	10	6.24	10	2.82
Assist or actively lamb ewe	4	0.32	3	1.6	7	0.79
Medical treatment of lamb	4	0.62	0	0	1	0.06
Medical treatment of sheep	6	0.5	0	0	6	1.05
Mother up lamb/s	5	0.5	11	4.55	12	2.33
Paperwork	0	0	0	0	6	1.05
Prepare feeding materials	9*	2.89	1	0.12	2	0.13
Prepare materials	10*	5.49	6	4.66	10*	2.52
Prepare pens	2	0.1	1	0.12	3	0.15
Preventive medical care lamb	0	0	0	0	0	0
Preventive medical treatment ewe	0	0	0	0	0	0
Remove ewe/lamb from source of discomfort	4	0.08	0	0	5	0.32
Sort ewes & lambs	0	0	12	3.37	16	5.52
Tag/mark sheep	0	0	0	0	0	0
Tasks outside sheep enterprise	5	1.19	3	1.09	10	3.33
Tea breaks	9*	14.6	10*	6.78	n.a.	n.a.
Transport sheep	7	0.9	19	2.84	40	3.21
Warm cold lambs	0	0	0	0	0	0

Linear program model

Table 3 summaries the task groups in the LP model when set up to reflect different rules for labour deployment and hence different welfare outcomes. It then shows the main results for each model type. Note that the lower welfare scenarios stem from exclusion of particular classes of task and hence imply savings in labour costs, which are reflected in larger flock sizes.

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Table 3: Model Simulations with Different Welfare Effects

Modelling Assumptions/ Results	Basic Run (Highest Welfare)	Medium Welfare	Lowest Welfare	
			No additional mortality	Some mortality*
Types of tasks included in each model run:				
Sum of planned activities independent of number of sheep PTI	Yes	Yes	Yes	Yes
Sum of planned activities dependent on number of sheep PTD	Yes	Yes	No	No
Unplanned Tasks that result in almost certain loss of ewes/lambs if not undertaken UCL	Yes	No	No	No
Unplanned Tasks that result in potential loss of ewes/lambs if not undertaken UPL	Yes	No	No	No
Unplanned Tasks without risk of losing sheep UTW	Yes	No	No	No
Results of each model run:				
Resulting Ewes/Lamb Number	977/910	992/924	1427/1329	1415/1317
Total Labour demand over 21 days (hours)	230	230	230	230
Labour demand per Ewe (minutes)	14.8	14.5	9.7	9.8

* all ewes with serious lambing complications are assumed to die

Table 3 shows that modelling the lowest welfare requirements, 419 additional lambs (1329 vs. 910) could be raised per shepherd not taking increased ewe mortality into account. However, through lack of intervention, the welfare of individual sheep would be severely compromised with possible mortality. However, for the vast majority of ewes, welfare would not be affected in any way. Even allowing for ewe mortality the numbers of ewes that can be kept is much higher, at 1415 than the base run. Note that the highest welfare scenario was the *status quo* situation observed in practice which corresponded to the maximum number of ewes/per shepherd suggested by FAWC (1994). Under this scenario, action was taken as required to deal with observed welfare challenges. Higher welfare scenarios may have been possible if additional labour had been available to increase levels of observation and cover the extra time needed to deal with them. However, it was not possible to model such hypothetical scenarios.

Changes in UK welfare regulations meant that now castration must take place at no older than 7 days which would be within the lambing period. Adding this to the runs for Farm E & W by castrating at birth would reduce ewe numbers to 30% of the base run while castrating in batches every 7 days would reduce numbers to 50%.. EU legislation to be implemented proposes ear tagging of lambs at birth which was found to have similar effects when modelled or with the base numbers would add 202 minutes to the daily tasks.

There has been interest in the UK sheep industry in 'easycare' sheep with little or no need for assistance at lambing. Running the model with 90% fewer incidences of the lambing assistance task attempted to explore this effect. The resulting increase in flock size was small at no more than 4%.

The legal minimum is to check sheep once per day. Modelling this showed a 20-30% reduction in labour time. But as the welfare needs may be missed or not acted on in time the welfare consequences may be higher.

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Conclusions/Discussion

Welfare is not easy to measure, especially in extensive systems or on a commercial farm. However the detailed study and modelling of mortality and cause of death can help with welfare assessment as it is a proxy at least for serious welfare concerns during lambing. Hill sheep farming is a very extensive system with labour input as low as 7 minutes per ewe at lambing time despite the provision of intensive supervision at certain key times such as lambing time as observed here. Hill sheep as a species are well adapted to live in the hill environment, with generally high welfare for most individual animals without human intervention. Labour input can however dramatically improve the welfare outcomes for individual sheep experiencing hardship and welfare problems.

The direct data analysis showed most of the time was spent on fixed labour tasks where some savings might be possible. Driving to and from the animals is essential to provide feed, which is a welfare benefit to the whole flock, and to check them which is essential to identify those few sheep requiring other welfare tasks. However, in checking, the whole flock may be disturbed, thus causing some stress to the flock and interfering with their natural behaviour such as grazing and suckling of the lambs.

The Linear Program Model runs with different welfare levels showed that a large amount of labour could be saved resulting in more ewes and lambs per shepherd but a potentially high welfare risk for those few ewes whose task needs were therefore neglected.. Indeed the reductions in labour modelled go far below current practise though the legal minimum is to only check once per day. On the study farms additional labour input was provided for the benefit of good welfare. However, despite the extremes modelled, there may still be room at the current margin to economise labour usage without jeopardising sheep welfare.

The infrequency of required assistance at lambing and the small impact in terms of increased carrying capacity if the ewes were “easycare” underlines that hill breeds like the studied Swaledale, North Country Cheviot and Welsh Mountain may already be well adapted to low input systems requiring minimal assistance
The recent UK legislation on castration could increase labour requirements and reduce sheep numbers that could be kept. If castrated in batches at intervals it may be possible to bring in extra labour only for that task and so maintain numbers. The task of gathering the sheep and separating the ewes and lambs for castration may lead to mis-mothering and further increase labour to mother the lambs again. The proposed EU legislation for lambs to be tagged at birth would have similar consequences on labour requirement. The sheep industry is lobbying to have this changed to tagging before the lambs leave the farm of birth. Overall the study provided previously mostly unrecorded data on labour in hill farming at lambing time. The model showed that labour is a key element in productivity and welfare in extensive hill sheep farming in the UK.

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