A Nuffield Farming Scholarships Trust

Report

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Can we learn to love the megadairy? Politics, Planning and PR

Amy Jackson

October 2013

NUFFIELD UK

A Nuffield (UK) Farming Scholarships Trust Report

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"Leading positive change in agriculture.
Inspiring passion and potential in people".

Title	Can we learn to love the megadairy? Politics, Planning and PR
Scholar	Amy Jackson
Sponsor	The Trehane Trust
Objectives of Study Tour	• Understand whether herd expansion is necessary for the UK industry. • Examine the different routes to herd expansion and their ramifications. • Identify the social, ethical and perception barriers to expansion in these different ways, and how these translate into political, planning and PR challenges. • Understand how individual dairy farmers and the industry as a whole can overcome these barriers to allow confident expansion. • Improve my understanding of and empathy for others' views on the issue, to find common ground. • Investigate ways in which my business can support the delivery of a solution.
Countries Visited	Australia, Canada, Denmark, France, Germany, Israel, Netherlands, New Zealand, Sweden, UK, USA.

Findings	• If Britain wants to maintain – let alone grow – milk production, an increase in average dairy herd size is necessary, with expansion into mainly specialised grazing or housing systems.
	• Unfamiliarity with scale and systems among planners, regulators, politicians and the public is feeding negative campaigns and affecting confidence to expand among farmers.
	• Despite this, any size or system can deliver high welfare, profit and respect for environment and communities – although 'too big' can bring diseconomies of scale.
	• We might not be able to generate **love** for the megadairy, but we can increase acceptance if:
	  ○ Individual farmers take steps to prove good welfare and respect for the environment.
	  ○ Individual farmers engage and communicate better with their local communities.
	  ○ The industry and food chain work to protect the viability of smaller farms while others are growing.
	  ○ Industry bodies take responsibility for challenging untruths and familiarising regulators, planners and the public with evolving dairy systems.

Contents

continued overleaf

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Disclaimer

1. Personal introduction

I discovered farming at the age of 14 via my Duke of Edinburgh's Award when I opted to gain some practical farming experience at nearby Oatridge Agricultural College, west of Edinburgh. I quickly realised this was the career for me and promptly decided to cram in as much practical experience as possible before, during and after my HND in Agriculture at SAC Auchincruive.

This resulted in work on some fantastic – and some less savoury – dairy farms across the country, but also spells with laying and broiler chickens, pigs, sheep, beef cattle and arable operations.

A fascination with dairy genetics took me to Canada where I worked for 15 months in Ontario in what was the 'Hollywood' for bull breeding at the time, returning to Aberdeen to take on a Farm Business Organisation and Management Course which then led to an MSc. After that, a stint in the auction business in Aberdeenshire gave me the chance to get more involved in showing and stockjudging, but when I moved to Cheshire to immerse myself back in the breeding industry, I found myself heading instead into agricultural communications and PR thanks to the John Deere Guild of Agricultural Journalists training award.

I branched out for several years into mainstream corporate and business-to-business PR and was fortunate enough to have some giants such as Gillette, Toyota and Cadbury as clients, before returning to the agricultural industry.

Back in farming, knowledge gleaned from these and global not-for-profit clients, combined with a practical and technical background, has stood me in good stead. I spent a period as head of communications at the Milk Development Council at a time when it started to reorganise to improve what it was offering to levy payers. Following this invaluable experience, I left to set up my own communications business in 2008.

It has become apparent over the years that communications and PR has become increasingly important across all industries, but particularly so in farming. There is a growing awareness that perception is reality, and with the shortening of the supply chain, farmers are more aware than ever of their end consumers, retailer influence and the power of pressure groups.

My Nuffield Farming Scholarship has once again given me a chance to put my practical farming interests together with my experience in the communications sector. I believe we have a dairy industry to be proud of and a bright future ahead, but failure to engage about how we are changing has led us to what is now a make-or-break point.

2. Background to my study

The trend for farmers to leave dairy farming and others to expand herd size to take up the slack can be seen around the world. Certainly, it is prevalent in Europe where we have seen producer numbers almost halve since 2000 at the same time as herd sizes and individual cow yields have increased on the remaining farms to maintain production levels.

I became involved with the ambitious Nocton Dairies proposal after the first application to set up a farm with 8,100 cows in Lincolnshire had been withdrawn to gather more environmental data. At the time, media reported only shock headlines about cow numbers and the fact they would not graze, ignoring any innovative features such as reintroducing livestock to arable rotation, creation of renewable energy, and cutting use of artificial fertilisers.

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One superdairy, 3,770 cows – and 14,000 objections

Plans for a giant 'factory' dairy farm have outraged those who say cows belong in fields. But its owner, and the industry, say that idea no longer fits a sustainable future

Tracy McVeigh

What became evident after the resubmitted application was withdrawn – this time for 3,770 cows – was the sheer number of barriers facing the project, all of which continue to impact others' expansion plans, not just in dairy, but also in poultry, pigs and horticulture.

The problem is not just one of scale – there is a deep discomfort with housing cows year-round. In my time at the Milk Development Council, I felt we all too often ducked questions about 'zero grazing'; meantime, the industry cheerfully continued to promote black and white cows on green pastures. Of course, there's nothing more certain to set the public's antennae twitching than appearing to hide something, and that's where we ended up – with the sudden bombshell that not all cows go out into fields, and the horror that accompanied that. We well and truly gave away an opportunity to take at least *some* of the public with us by failing to communicate early enough and familiarise people with evolving dairy systems.

We now face a stark equation. The UK has lost a lot of milk production, and the main route by which it will maintain and grow production is expansion of existing farms and the setting up of new large farms by existing producers, as well as the retention of existing farms of all shapes and sizes.

Hence my study doesn't look at the technicalities of how a large scale dairy can be set up and run – Nuffield predecessors have already studied this at length and I cannot hope to improve on their excellent reports. Instead this report examines what a megadairy is, and asks whether we can learn to love it by tackling the political, planning and PR issues that have been dogging applications for new units. It is not only aimed at the farming industry; I am hoping it will prove useful to people outside the industry who want to find out more about this issue.

I hope this report will prompt change. If we can't expand herd size, we will lose milk production in the UK and, with our growing population, end up importing more and more milk and dairy products from countries over whose standards of welfare, and environmental and social impact, we have little control.

3. My study tour

Country	When	Why
Israel	September 2012	Housed systems are the norm – how does the industry communicate this and how do farmers ensure health and welfare in their herds?
Denmark	October 2012	75% of herds are housed. With similar herd size and milk yield to the UK, in a similar climate, how are welfare, environmental perceptions and communication being managed?
Sweden	October 2012	A law ensuring cows must have outside access is much publicised by welfare groups. What does this entail and how does it work?
Germany	November 2012	Very large farms in the east compare with tiny farms in the south of the country, but small farmers are leaving the industry. How is the public accepting the growth in average herd size?
Netherlands	November 2012	The Netherlands set up its Grazing Covenant several years ago to keep cows in fields. How is this marketed and what are farmer views?
France	November 2012	France has recently experienced its first 'megadairy' application. What communication has been carried out and how are public and authorities reacting?
USA – Indiana, Wisconsin & California	November 2012	Wisconsin is a similar size to the UK market, but because of its climate has driven the development of housed systems. How do they ensure good welfare, and what is being done to protect smaller farmers? How does the regulator implement its Green Tier programme to promote a higher level of environmental management? How does the largest farm in the country in Indiana communicate to visitors? California has a reputation for poor environmental performance. Is this true? How does the EPA regulate? Can anaerobic digestion help solve some of the fears around large housed farms?
New Zealand	December 2012	New Zealand has pioneered grass-based systems with very large herd sizes. How is this received, and what is being done about the reported environmental issues?
Australia – Victoria & Tasmania	January 2013	On these mainly grass-based systems, the industry has evolved to ensure some of the nutritional welfare issues in the last decade are firmly consigned to the past and the industry is growing its production and export opportunities. How is this being managed?
Canada – Ontario	March 2013	The Nuffield 2013 Contemporary Scholars' Conference, involving a wide range of trips including dairy, arable, winegrowing and horticulture.
Ireland	May 2013	Teagasc research centre Moorepark has looked at a number of issues around cow comfort and choice. Would they be able to provide information to UK dairy farmers on cow comfort and choice in cows on New Zealand-style systems?
UK	Throughout	How do farmers of all systems and sizes make it work for them? What are the concerns of the pressure groups, the retailers and the regulators? How have other sectors overcome barriers to expansion and negative public and pressure group campaigns?

4. Challenges and prospects for the UK dairy industry

4a. Opportunities for the UK

We have one of the most technically advanced dairy industries in Europe, and a climate ideally suited for growing forage and therefore for dairy farming. With a population of 60m, we have a significant domestic market and around half the 13bn litres of milk we produce, we use ourselves as fresh liquid milk. This means we need half our milk to come from a level, year-round supply. In contrast, New Zealand, with a population of 5m and supply of around 19bn litres, is ideally suited for seasonal production off grass where the milk can be processed into dairy products and commodities for export.

There are a number of reports in existence suggesting considerable future growth opportunities for dairy products globally[1], primarily due to rising populations (*see Figure 1*) and increasing wealth and urbanisation in developing countries. Rising affluence leads to an increase in demand for animal protein, hence predicted rises in consumption of milk and dairy, and meat, by the FAO.

See Figure 2 on next page: forecast increase in consumption of foods.

However, production levels in the UK have suffered as the exodus of milk producers continues.

See Figure 3 on next page: dairy farm numbers.

Furthermore while herd size and yield have both increased, these have not kept pace with the loss in producer numbers. *See Figure 4.*

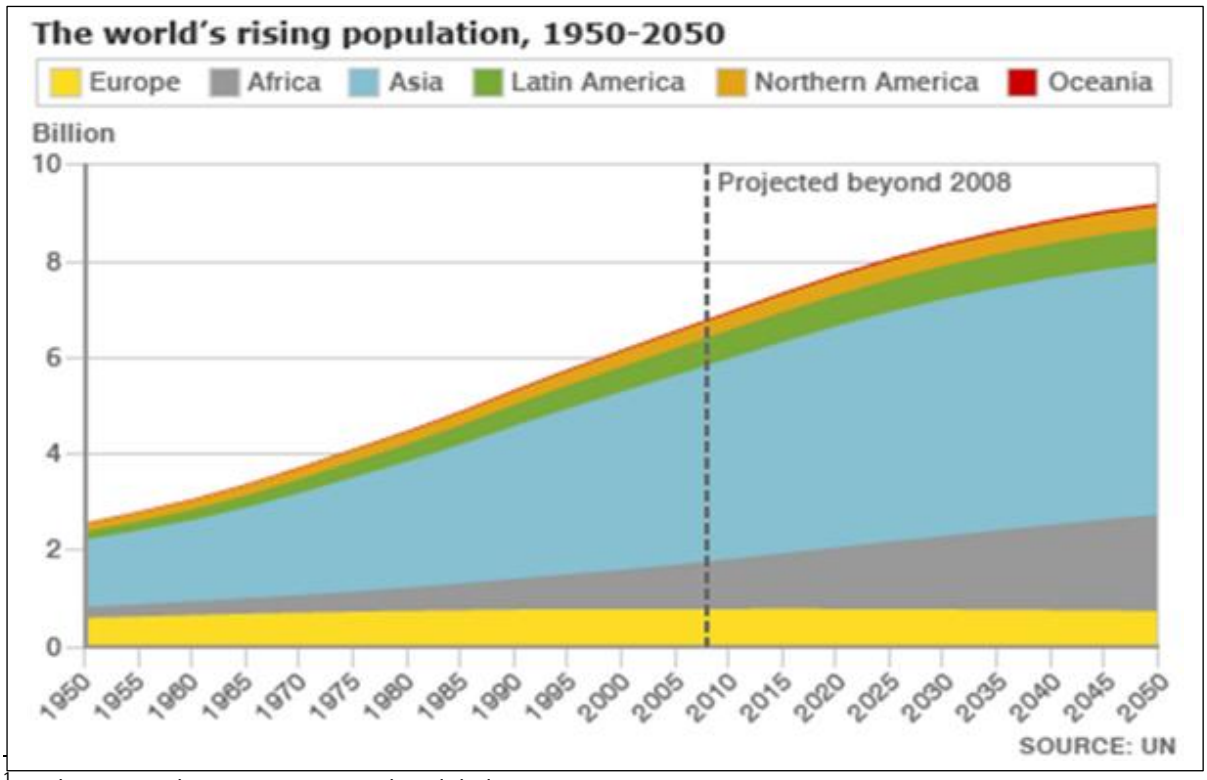


Figure 1 : The world's rising population

[1] Tracking Growth Opportunities in the Global Dairy Market, Euromonitor 2012; Export Opportunities for the UK Dairy Industry, DairyCo 2012; ASEAN-6 Dairy Markets – Milk for the Tigers, Rabobank 2013

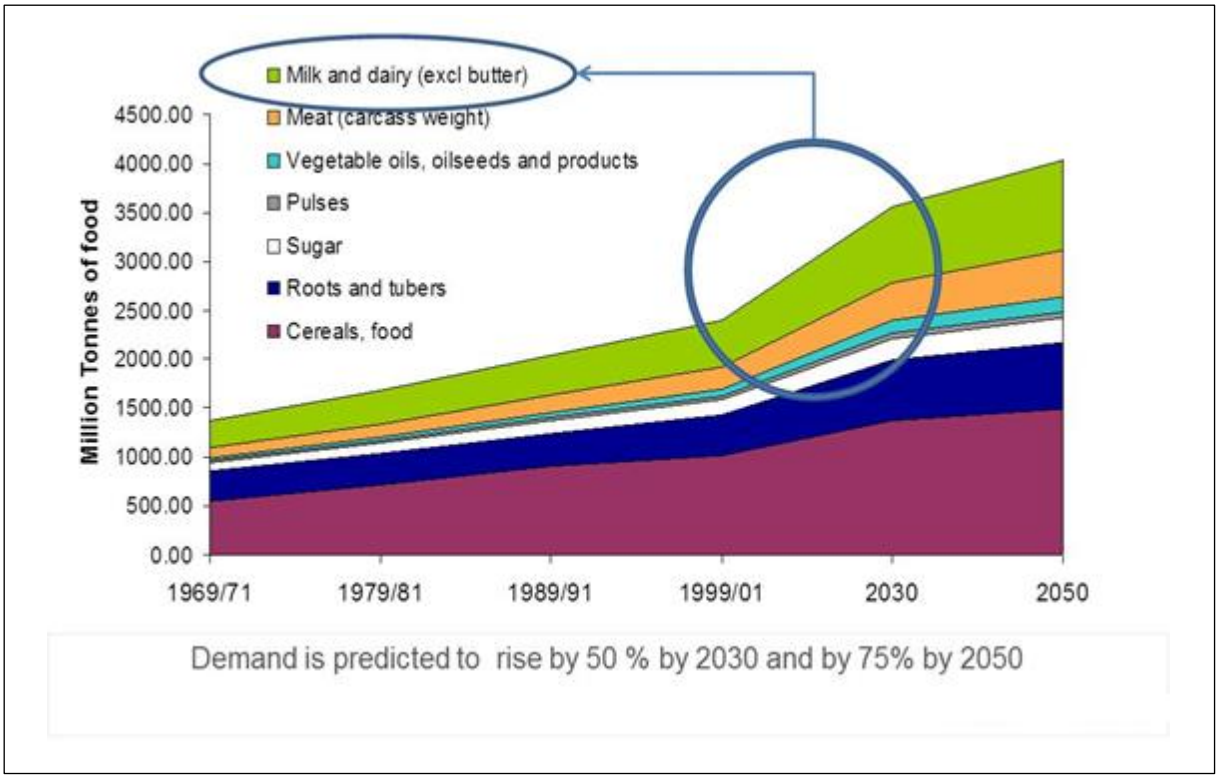


Figure 2: Forecast increase in consumption of foods *(Source: UN FAO 2008)*

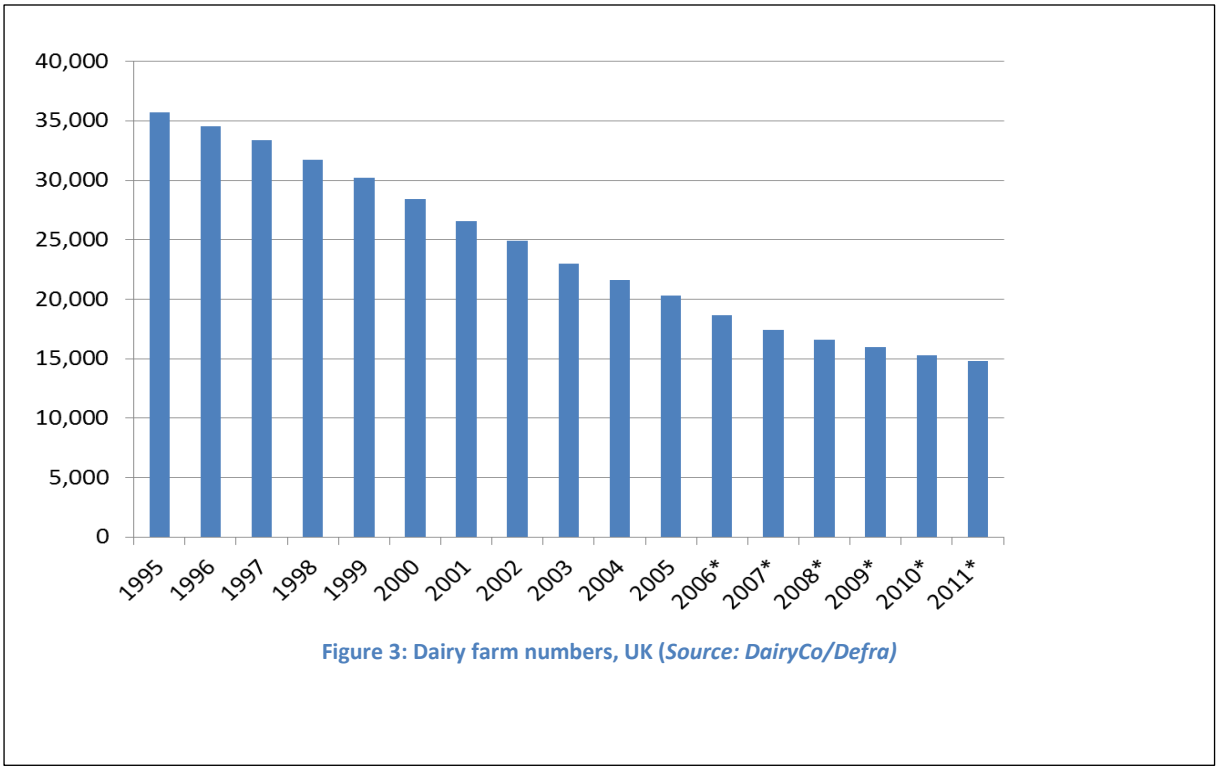


Figure 3: Dairy farm numbers, UK (*Source: DairyCo/Defra)*

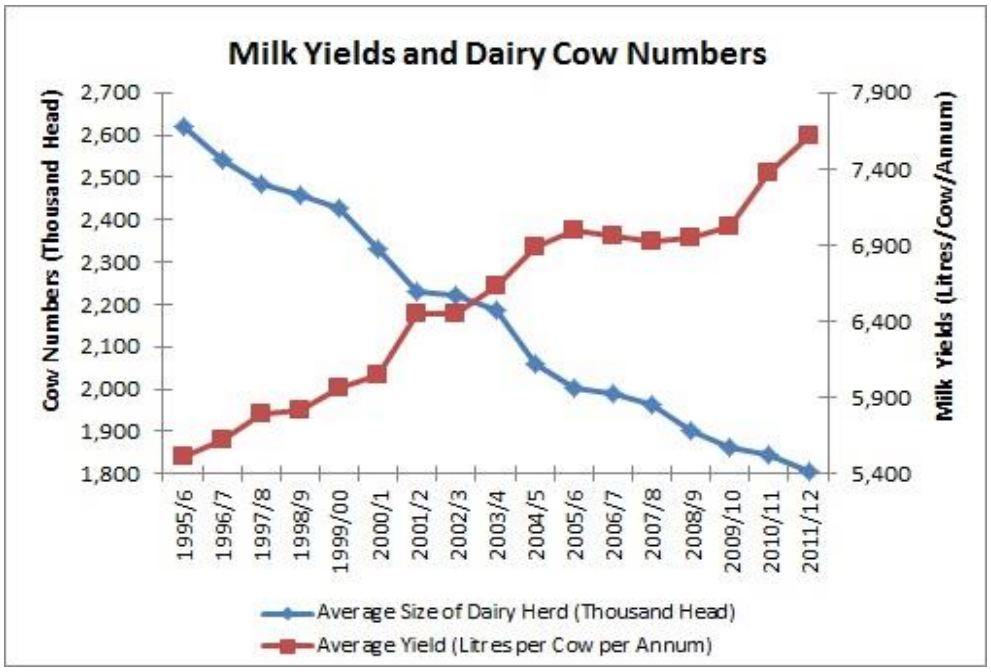


Figure 4: Milk yield vs dairy cow numbers in UK *(Source: DairyCo/Defra)*

4b. The UK production problem

The net result is that while global opportunities are on the rise, the UK doesn't appear well placed to capitalise on them in terms of volume of milk production. This is in stark contrast to our European partners who, with similar forage-producing climates to ours and largely farmer-owned processing capacity, have been taking advantage of the 'soft-landing' policy which is seeing EU quota allocations rise each year in preparation for their removal in 2015.

See chart below: Total deliveries of milk vs. UK quota.

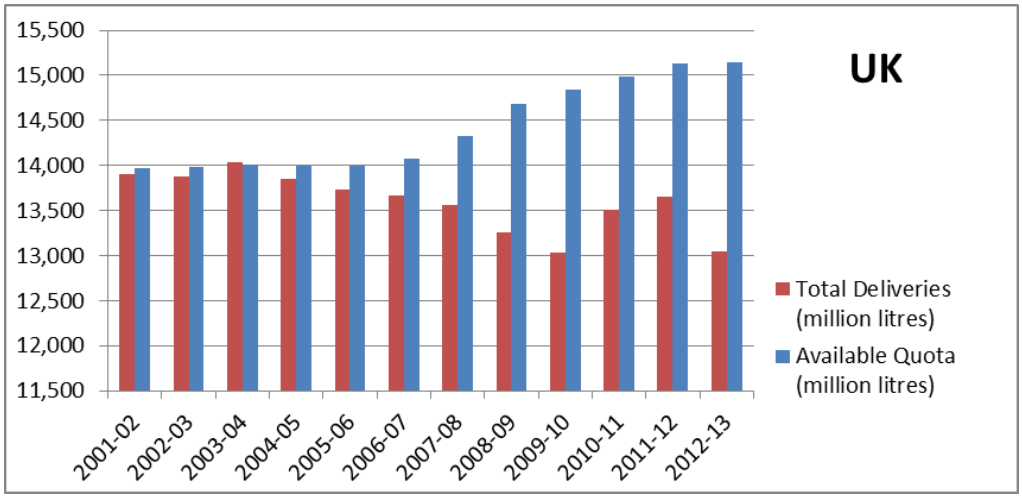


Figure 5: Total deliveries of milk vs UK quota (*Source: RPA)*

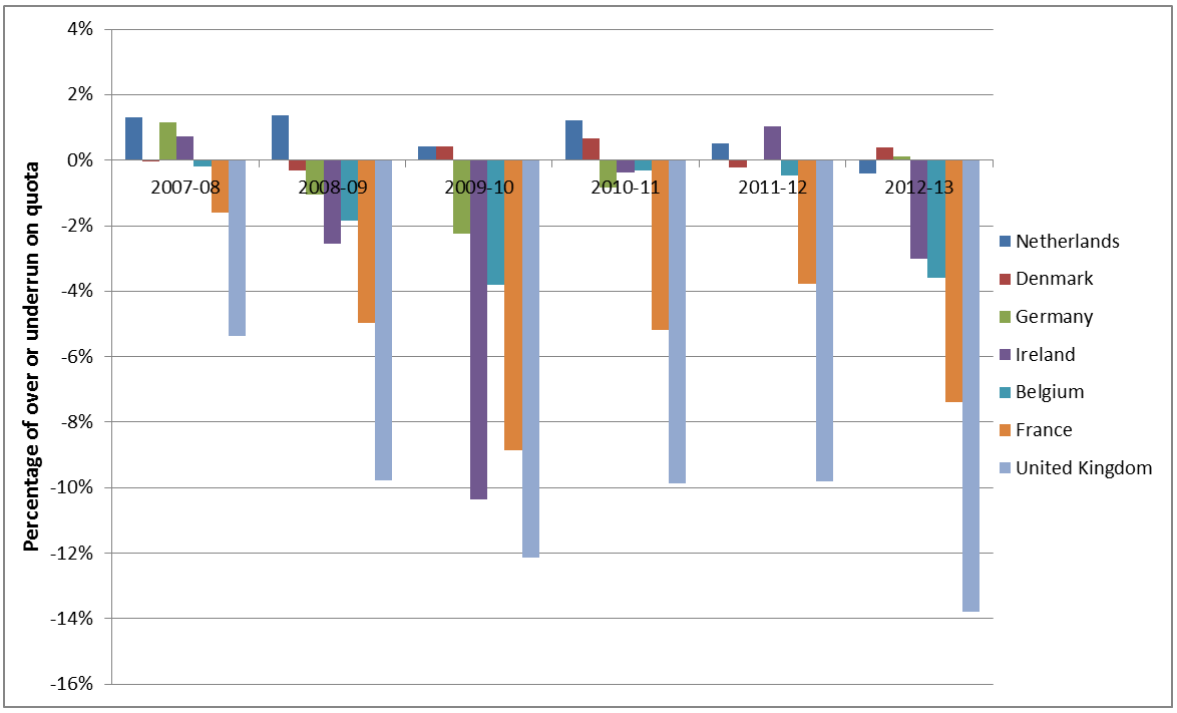
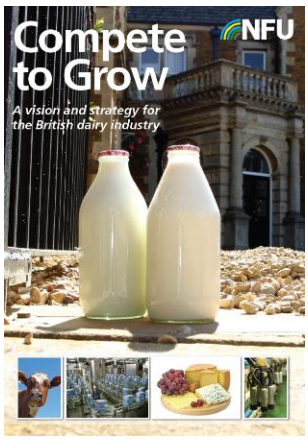


Figure 6: Total deliveries of milk in EU countries vs quota (*Source: DairyCo/Europa*)

While quotas are now largely irrelevant so close to their removal, each country's ability to respond to the increasing licence to produce milk is an interesting indicator of its ability to respond to global dairy market opportunities. The UK is now 1bn litres under its production 10 years ago, but 2bn litres or 14% below its milk quota. It is telling to chart the comparative situation with over or under-run on quota in other countries.



In its recently-launched strategy for the dairy industry[2], the NFU alludes to growing global demand opportunities and quotes DairyCo's investigation of export opportunities[3]: *"While significant opportunities for exporting British dairy products exist, accessing developing markets is a slow process and key dairy exporters such as New Zealand already have a head start on the UK. DairyCo recommends a balanced strategy to displace imports, access nearer export markets and, where possible, accessing developing markets further afield."*

Furthermore, the NFU report warns of the dangers of the UK failing to take the initiative. *"National dairy industries that do respond to the growth in demand, by growing their output, will enjoy improved efficiencies of scale in investment, innovation and efficiency. As the global benchmark moves forward, it will become harder and harder for the British industry to defend even a static position."*

It says that based on predictions and analysis of domestic growth in demand for dairy products in the UK and by maintaining/ achieving 100% self-sufficiency (balanced trade): *"…four to five billion litres of extra milk at farm gate would be required by 2020. Hence it is clear that the UK industry must develop even to stay still, let alone capitalise on upcoming opportunities."*

[2] Compete to Grow, NFU 2013
[3] Export Opportunities for the UK Dairy Industry, DairyCo 2012

Suzanne Clausen, chief advisor at the Danish Knowledge Centre for Agriculture in Århus, Denmark, says the country has 12% of the farms it had in 1984 but is producing the same level of milk through both herd expansion and rising yields. *"We now have less than 4,500 producers but we're maintaining milk production and still exporting 80% of what we produce," she says. She points to the success of Arla, which buys almost all Danish milk, in growing its markets outside Denmark – for example collaborating with German co-op DMK in targeting the ingredients and functional foods markets. Arla, along with Fonterra and Friesland Campina, has also made an active entrance into the Chinese market, setting up processing facilities as well as exporting a number of products including infant formula.*

Germany, Europe's biggest milk producer at close to 30bn litres per year, has a clear manifesto for growth towards 2015. Dr Bjoern Boergermann of Milchindustrie-Verband (MIV), the German dairy industry's association, says the country has been working to fill its quota (the 'soft landing' strategy means it has been increasing by 1% per each year) – but considerable structural change is still likely over the next five years. This includes migration of milk production away from tiny 'hobby' farms in the south to growing medium-sized enterprises in the west of the country. Some of the largest dairy farms in Europe remain in the east of the country, where they operate as part of large mixed enterprises, often with pigs, poultry and large amounts of heavily subsidised maize-fed anaerobic digestion.

5. Herd expansion – why and how

5a. Why expand?

It is evident we need to increase our national milk production, or at least shore it up, if the UK is to avoid being marginalised as a milk producing nation. The NFU strategy report identifies improved technical efficiency and expansion of existing farmers as the routes to increasing production – logical, considering significant barriers remain for those hoping to enter the industry[4].

We also need to account for producers still intent on leaving the industry – just under 10% over the next two years according to the latest DairyCo survey of farmers' intentions[5].

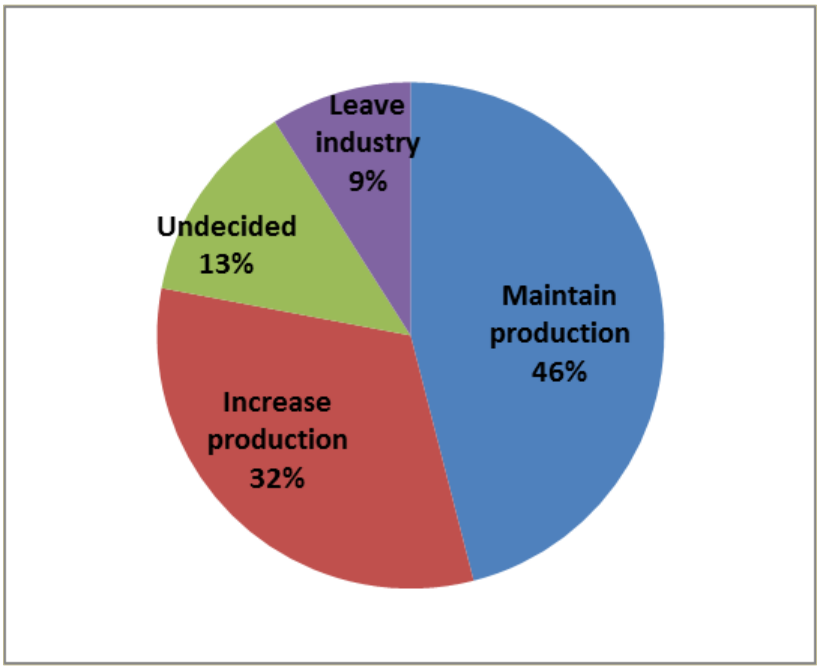


Figure 7: Dairy farmer intentions 2013 (*Source: DairyCo)*

The good news is the same survey indicates 32% of farmers will be looking to increase production over the same two-year period. This is no surprise. To grow his business or net worth, a farmer has three main options:

- to add value to his product
- to diversify
- or to make his existing operations more profitable by increasing output, decreasing costs or both.

Taking the third option is, in essence, implementing the technical efficiencies the NFU mentions to reduce costs and/or increase production. One fundamental way of achieving this for many will be to expand herd size to increase output, multiply profit per litre and spread fixed costs. It is not surprising that many would choose this option as they will already have at least some of the resources and infrastructure in place, as well as the expertise.

Hence expansion of existing dairy enterprises is logical, natural and entirely necessary. And, for most farmers operating the most traditional 'composite' system involving cows housed in the winter and grazed in the summer, with a couple of tonnes per cow of concentrate feeding each year, expansion up to 300 cows or more is entirely achievable with the right resources and set-up.

5b. What happens during expansion?

However, as herds creep up towards 400 cows, even with the best grazing platform and the most conducive climate, problems start to emerge around dry matter intakes, walking distances and sufficient lying time within a traditional composite system using Holstein-based genetics.

[4] Future Of Farming Review Report, Defra 2013
[5] Farmer Intentions Survey, DairyCo 2013

At this point, there is the option of expanding by setting up a sister unit, thus avoiding the issue of expanding the size of the original herd, but it is more likely there will be a divergence towards either specialist grazing or increasing the number of days the cows are housed to allow the expanded herd to operate at optimum levels.

What has become clear to me is there is no 'right choice' here. We can argue the economics until the cows come home but the fact remains that the direction of travel will depend on climate, land base and availability, milk contract, available capital and so on, and it is up to the individual farmer to make that choice and operate at optimum levels.
See Figure 8 below.

Evolving into a specialist grazing system is likely to involve some or all of these features:

- Change of breed, for example to a crossbred that yields higher percentages of solids with less volume, able to walk further distances to pasture
- Development of tracks and infrastructure to maximise grazing
- Increase in milking capacity to gain quicker throughput of cows
- Seasonal calving to make most use of the grazing season
- Resulting change of milk contract, if necessary, away from liquid milk supply to cheese or commodity-based
- Change to once a day milking from twice
- Milking facilities taken to the site rather than cows taken to milking facility

Evolving into a housed system could include some or all of these features:

- Renovation of existing housing to accommodate more animals year round, hence tailor lying and feeding areas, loafing areas, slurry management, cow flow etc.
- Year round calving
- Shift to 3x a day milking to take advantage of cows being nearer and increase output
- Switch to improved bedding materials for cow comfort and health, such as deep sand
- Potential for round-the-clock utilisation of milking equipment
- Increase in yield so costs of infrastructure, mechanisation and labour are spread across more litres
- Increased use of specialists on-farm to look after nutrition and health

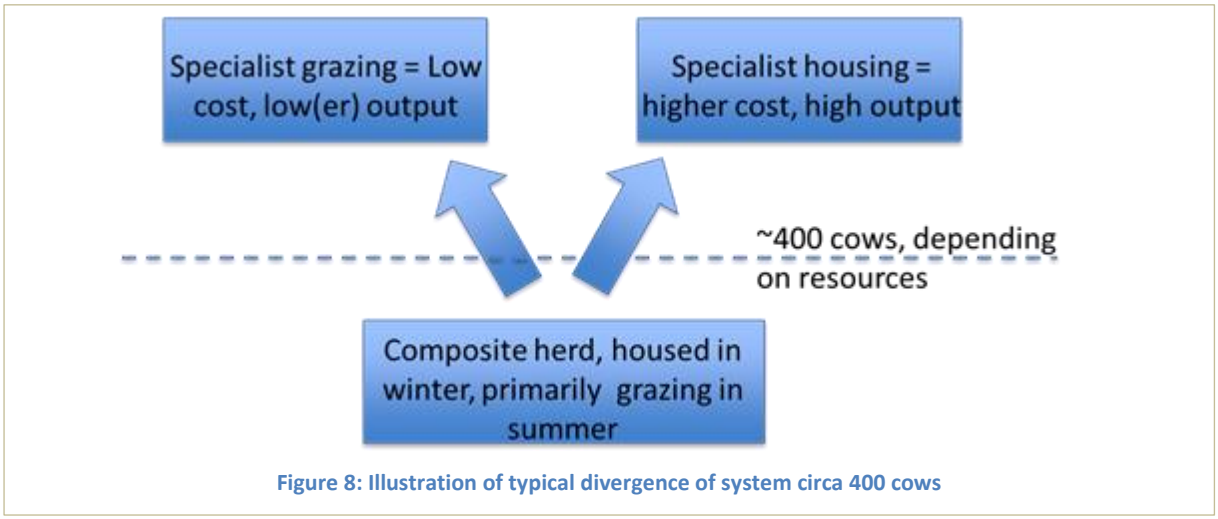


Figure 8: Illustration of typical divergence of system circa 400 cows

6. Challenges to expansion

There will be technical barriers to expansion, but my focus here is on the sustainability and perception challenges, which lead to political, planning and PR barriers. Discussion with farmers using both types of system in the UK brought these points to light, as shown in the table below.

I aim to cover these points in the following chapters, identifying the issues and why they exist. I hope to examine the economic, environmental and social perceptions – including welfare – around expansion, and the lack of familiarity key stakeholders including regulators, planners, politicians and the public have with larger herds and the systems in which they will operate.

Table 1: Pros and Cons of expansion into specialist grass or housed systems

Pros

Expansion into grass-based	Expansion into housing-based
Familiarity of cows on grass for the public, regulators and planners –viewed as a 'normal' way of producing milk	Good use of resources from specialisation, economies of scale, and savings on cow time, wastage of forages etc., producing a high return per hectare
Low cost system with a high level of resilience and high margin in pence per litre (ppl), making good economic use of grass growing areas surrounding the farm	Potential to manage nutritional intakes of Holstein cows thus improving welfare and performance of high yielding cows especially in early lactation
A more feasible and achievable system for young entrants to the industry	Opportunities for renewable energy eg anaerobic digestion, photovoltaics.

Cons

Need a suitable grass growing area/ grazing platform around the farm with conducive climate and soils	System is unfamiliar and largely misunderstood by planners, regulators, the public and local communities, and is the focus of several pressure group campaigns
Output can be highly affected by the weather	Higher risk of some conditions such as lameness and mastitis
Infrastructure - eg cow tracks - needed to maximise use of grazing platform with minimal impact on cows and local communities	Ammonia emissions from slurry storage could face increasing pressure from EU
Potential for poor nutrition in early lactation in a slow growing season	Agreements with neighbours may be required re slurry/waste spreading if cow numbers exceed the carrying capacity of the land base
Seasonally-based production could reduce potential to supply some markets eg liquid contracts	High input and reliant on infrastructure so can be costly if financial risk and exposure to market volatility not controlled

7. Defining the 'megadairy'

7a. Scale or system?

The word 'megadairy' is a confusing one, not least for the industry itself. Used by pressure groups since the Nocton Dairies proposal first hit the headlines, it attempts to convey all that is wrong with modern farming without actually being clear about what it means. It infers size but sometimes the issue appears to be less about scale and more about system. So what is a megadairy and at what point will an expanding farmer inadvertently convert his farm into one?

'Scale' is a relative term that depends on context. Data from the International Farm Comparison Network (IFCN) suggests the average size of all dairy herds around the world currently stands at three cows, with 75% of the world's dairy farmers being classified as 'household' milk producers.

Closer to home in the Netherlands, where the average herd size is around 90 cows, there is a proposal before the Dutch government to limit dairy herd expansion to 500 head (including youngstock). This is a level long since surpassed by many UK dairy farms and exceeded by many times over in countries such as the US and Saudi Arabia, suggesting that what constitutes 'acceptable scale' is more often than not determined by cultural norms rather than any rational or evidence-based assessment.

I was unable to find any scientific evidence that risk to welfare or environment or local quality of life significantly increased at any particular herd size. However, the US Environmental Protection Agency (EPA) sets its limit for compulsory regulation of a dairy farm's operation and impact on the environment at 700 cows, defining it a large Concentrated Animal Feeding Operation (CAFO[6]) at that point.

In discussion with the two pressure groups leading the push against 'megadairies' *(see Chapter 13*), it became clear that the issue for them was less about scale than about system. However, it is recognised that an increase in scale could be leading to an increase in the number of cows being housed year-round. And that, they maintain, is bad for welfare.

Despite these worries relating to size, some recent results within DairyCo's quarterly consumer tracking research suggests that more than half of consumers questioned don't have a view on the size at which a dairy farm becomes 'too large'[7].

It can probably be concluded that size does attract headlines. Much was made of Nocton's 8,100 (later 3,770) cows and the physical area the buildings would occupy. The Foston pig development plans to have 2,500 sows but this is frequently grossed up to 25,000, to include the number of offspring the sows will have at any one time.

The campaign against a recent application for a broiler farm in Shropshire emphasised the 330,000 birds the farm plans to rear at a time. The campaign against the expansion plans of Leighton dairy farm near Welshpool claims "It's too big and it's too near". For many members of the public who grew up with the image of small mixed farming, developments on this type of scale simply cannot be imagined.

[6] Regulatory Definitions of Large CAFOs, Medium CAFO, and Small CAFOs, US Environmental Protection Agency

[7] AHDB/DairyCo on-line survey YouGov Plc

The campaign against a recent application for a broiler farm in Shropshire emphasised the 330,000 birds the farm plans to rear at a time. The campaign against the expansion plans of Leighton dairy farm near Welshpool claim "It's too big and it's too near". For many members of the public who grew up with the image of small mixed farming, developments on this type of scale simply cannot be imagined.

Yet, while Rhys Williams' and David Wynn-Finch's 1,000-cow farm run on a New Zealand-style system[8] in North Wales is often in the trade news because of its scale, this is always in a positive light. A newly-opened 'superdairy' in Shropshire at Sansaw Estates, which will support 1,200 cows also on a New Zealand system, has been acclaimed by Environment Secretary Owen Paterson. Similarly, producers running smaller year-round housed herds rarely attract attention and are not targeted openly by campaigners.

I came away from my meetings with the campaigners clearer that a 'megadairy', in their eyes, is generally a non-grazing farm that detaches farming from the surrounding land and communities. Its scale is likely to have caused it to house its cows, but a large scale dairy – frequently 1,000 cows plus – is often beyond public comprehension and therefore is also more newsworthy.

The greatest barrier to these types of farms is not technical capability – it's social acceptability (termed 'social licence' in Australia), based on conflict with a long accepted vision of what farming is about and should deliver. Every country would have a different perception of what a megadairy constitutes depending on its culture, history and the accepted norm. For example France is going through its very own Nocton Dairies application – but for 500 cows not 8,100.

continued on next page

With scarcity of land, there was only one route forward for entrepreneurial French farmer Michel Ramery when he had a vision for a large dairy farm in Picardie's arable region, about an hour south of Calais. With quota still tied to land, nine dairy farmers pooled resources over 15 years to create a farm with 200 dairy cows – exceptionally large by French standards. Plans are now going through the planning process to increase the cow numbers to 500 with a view to run 1,000 in future, subject to further applications.

The preparation for the application took two years – one to research the options for design, and another to carry out all the Environmental Impact Assessments. The plan has come up against strong local opposition: *"Green algae on our beaches? New viruses? Nitrates in our water? Antibiotics in our milk? Sign our petition before it's too late and stop this aberration."*

This is despite, according to the manager (*Michel Welter, pictured above),* the 200 cows eating arable by-products (and, surprisingly, chopped miscanthus for fibre), and supplying nutrients to the surrounding cropping land. While Britain currently has over 150 herds with 500+ cows, France has never seen dairy farming on this scale.

[8] http://www.ddc-wales.co.uk/client_files/gelli_aur_rhys_williams.pdf

7b. Scale and system in other countries

In Europe, the UK has the largest average herd size next to Denmark; while other countries in Northern Europe have smaller herds, most have experienced the same pattern as just about all milk-producing countries globally (with the exception of New Zealand), in reduction of producer numbers alongside expansion of herd size, and increase in average milk yield. New Zealand has undergone an increase in producer numbers since 2007 following a long decline in line with the rest of the world.

In the table below a relationship can be seen between system and yield, with level of year-round housing increasing as yield rises; however, there appears to be no relationship between herd size and system.

New Zealand has the largest average herd size of all the countries I visited, but as Gwyn Verkerk from Dairy NZ pointed out, New Zealand farms, operating on such a low world market price, need scale to be economically viable. *"Somewhere in the concept of sustainability is the need for farmers to have a reasonable standard of living,"* she says.

With growing awareness of the environmental impact of dairy farming in New Zealand *(see Chapter 9a.),* infrastructure such as stand-off areas, effluent tanks and even housing are being introduced to reduce the effects. "*Where feed used to comprise 95-97% pasture, it's now nearer 90%,"* explains Gwyn. "*We are topping up pasture systems with more managed feed inputs, effluent storage, shelters and so on. This means cost, and to cover that cost, herd size needs to expand."*

New Zealand farms are rated on a 1 to 5 scale depending on their reliance on pasture[9] with Systems 4 and 5, which import 30% or more feed on to the farm, producing upwards of 600kg of milk solids per year. So while volume yields are low in New Zealand, at UK average production levels of 4% butterfat and 3.28% protein, this would equate to around 8,250 kg production per cow annually.

2011/2012	Cows/ herd	Milk yield kg/cow/yr	Predominant Systems
New Zealand	393	4,128	Pasture-based
Ireland	58	5,126	Pasture-based
Australia	240	5,926	Mostly pasture-based
France	47	6,501	Summer grazing, minority with low numbers housed year round
Germany	51	7,387	Summer grazing, some tie-stall housed year-round, herds housed year round in the East
UK	125	7,445	Summer grazing, minority herds housed year round
The Netherlands	76	7,881	80% grazed in the summer, 20% housed year round
Sweden	57	8,048	Summer grazing, growing numbers of robotic herds
Denmark	123	8,278	75% housed year round
Canada	111	9,780	Predominantly housed year round
USA	179	9,862	Predominantly housed year round
Israel	120	11,600	Housed year round

Table 2: Summary of herd size, yield and system in countries visited *(Source: various)*

[9] The 5 Production Systems, Dairy NZ http://www.dairynz.co.nz/page/pageid/2145861231/The_5_Production_Systems

High level of exposure to world market prices is a consistent factor in countries with large average herd sizes. New Zealand operates on a world commodity milk price. Australia has a large domestic market but no cushioning against world prices. Canada and Israel have protected markets or supply management and therefore do not have the same pressures (or opportunities) to increase size. European countries are also protected by supply management in the shape of quotas. It will be interesting to see what impact their removal in 2015 will have on herd size, assuming no other supply management measures take their place.

Martin Sing runs 1,000 cows in the Waikato area of New Zealand. They are split into two groups of 400 cows and a third herd of 220. *"We split the bigger herd because the labour wasn't skilled enough to keep on top of mastitis in the first place, then to deal with milk withdrawal after treatment."*

Martin says many herds in New Zealand settle out at a maximum group size of not much more than 600 cows. Above that, issues creep in such as higher cell counts, increased replacement rates, conception issues and other inefficiencies. *"We're back down to 19% replacement rate now but it needs to go lower. We're yielding 380kg of solids per cow and 1,400kg per hectare. We could push yields up to 2 tonnes of solids/ha but we would need more staff and more housing, and we'd need to handle more effluent. There's always a trade-off."*

The US average herd size of 179 cows is misleading as herds with 500 cows or more are now producing over two thirds of all milk. The two largest milk-producing states are California and Wisconsin. Californian producers, who opted out of the federal milk price many years ago and as a result receive up to $2/cwt less for milk, number just 500 with an average 3,600 cows per herd producing 10,555kg each per year; Wisconsin, with its higher, federally-set milk price, has 10,000 farms of an average 114 cow herd size producing just under 11,000kg per cow. In the past 10 years, the number of dairy herds across the whole country has almost halved, but total milk production has risen 23% to 91bn litres at the same time.

Canada, like the US, tends to house its cows year round, as does Israel. Both these countries suffer extremes of temperature. Where summer grazing does happen in North America, it tends to be on the more temperate west coast areas of North America.

Heat in the summer and excessive rainfall in the winter precludes any grazing at all in Israel. Pressure on land availability and environmental risk is also driving year-round housing in other countries.

Denmark has significantly increased its housing of cows from around 15% 10 years ago to 65-75% now. Many report they would not be able to manage nitrate and phosphate loading on the land if they couldn't house, although housing creates other pressures with ammonia production. A similar trend in the Netherlands has been successfully halted by a grazing covenant *(Chapter 11d.).*

There have been some moves to set up large scale housed farms in both New Zealand and Australia. Southdown Holdings mooted a plan in 2009 to house nearly 11,000 cows on nine dairy farms in Mackenzie Country near the

centre of the South Island of New Zealand[10]. The proposal included lower environmental impact from capturing effluent and methane, better feed utilisation and increased yields. However, as an area of great natural beauty, there was considerable concern over use of resources such as water, the impact on tourism from improving the productivity of the land, and damage to the reputation of New Zealand milk. The plan was shelved.

In Germany, consumers have more of an issue with herd size than system, says Dr Bjoern Boergermann of Milchindustrie-Verband (MIV), the German dairy industry association. He says many small family farms in the south of the country still tether cows year round, and there is no public concern about these.

"The big worry is herd size. The 'large farm' issue started with pig and chicken farms but is now transferring to cows," he explains. *"A recent 3,000-cow proposal in West Germany has been stopped because of trouble with neighbours; it was too big a jump from 1,000 cows. However, we often have the same discussions around farms of only 250 cows that want to expand."*

7c. Britain's balance of scale and system

So how does Britain fare in terms of scale and system? Data wasn't obtained for Northern Ireland, but figures collected from Defra, the Scottish Government and Welsh Government suggest there are currently more than 150 farm holdings with over 500 cows in Britain, and 17 with over 1,000.

This means there are a number of larger scale farms already operating in this country, and judging by the lack of public awareness, these aren't causing huge issues from running large numbers of cows. It is likely these large farms are employing either a specialist grazing system, or a mostly-housed system, and are doing so without making headlines. It is interesting that an application to build the 1,000 cow Leighton dairy in Powys, amalgamating a number of smaller units, is being presented as a precedent by the campaign groups opposing it. However, these figures show there are already at least six other farms with over 1,000 cows in Wales alone.

Looking at predominance of system in Britain, the best source of current data is from a survey carried out by Dr Dave Roberts of SRUC in 2012[11]. His survey of 864 Cattle Information Service (CIS) farms ran the length and breadth of Britain and encompassed herds between 10 and 1,200 cows in size. He found that 7% of herds in the sample were housed year round and 9% were housing their high yielders. Taking account of the larger average herd sizes in these two categories, and a conservative view that ¼ to ½ of the cows in herds housing high yielders would end up inside year round in any one year, this suggested that some 15-20% of dairy cows

Dairy size bands	England Holdings	England No. of Dairy Cattle	Scotland Holdings	Scotland No. Dairy Cattle	Wales Holdings	Wales No. Dairy Cattle	British holdings	% cows in each band
>=40 and <100	3,164	225,196	286	21,208	659	46,535	4,109	19
>=100 and <200	3,188	448,625	568	83,058	697	98,218	4,453	40
>=200 and <500	1,281	355,794	266	73,985	353	97,458	1,900	34
>=500 and <1,000	80	51,868	32	19,999	23	14,869	135	6
>=1,000	5	6,132	6	6,578	6	7,418	17	1
Total	**7,718**	**1,087,614**	**1,158**	**204,828**	**1,738**	**264,498**	**10,614**	**100**

Table 3: Holdings of 40 cows or more in different size brackets in Britain *(Source: Defra, Scottish Government, Welsh Government)*

[10] http://www.odt.co.nz/regions/north-otago/213174/companies-behind-huge-dairying-plans-fold

[11] Dairy cow housing systems in the UK, SRUC Dairy Research Centre 2012

could currently be housed all year in any one year in Britain. *See Table 4 below*.

Group Type	No. of Respondent Farms	Average Herd Size
No Housing	5	225
Summer Grazing	247	137
House Milking Cows All Year	62	270
House Milking Cows Part Day Summer	341	202
House High Yielders All Year	67	266
House High Yielders Part Day Summer	86	226

Table 4: SRUC survey of farm system *(Source: SRUC, D Roberts)*

This tallies with the 2012 National Mastitis Survey. Although the participants are a self-selecting group, it indicates a trend towards housing: *"… in 2012 an increasing proportion of milking cows (16% in 2009 and 22% in 2012) are being kept indoors … This indicates larger herds are more likely to permanently house their milkers or at least their high yielders."*[12]

In the SRUC survey, just over 20% in the sample grazed all summer with no extra feed, but less than 1% of all cows in the survey had no housing at all.

This confirms the polarisation of system is alive and well, and, if the survey is representative, approximately 40% of all cows in the country are split equally between either largely specialist grazing and largely specialist housing systems. One can only predict that this specialisation will rise alongside increasing herd size.

7d. Retaining diversity of production

Two countries which are leading proponents of the pasture-based milk production system, New Zealand and Ireland, don't just have excellent climates for grass-based production, they have relatively low populations as well. According to the 2012 International Farm Comparison Network (IFCN[13]) report, Ireland had 4.5m people, produced 5.5bn litres of fat-corrected milk in 2011, and exported 95%. New Zealand had just under 4.5m people, produced 21bn litres in 2011 and exported 91%. This means there is a ready

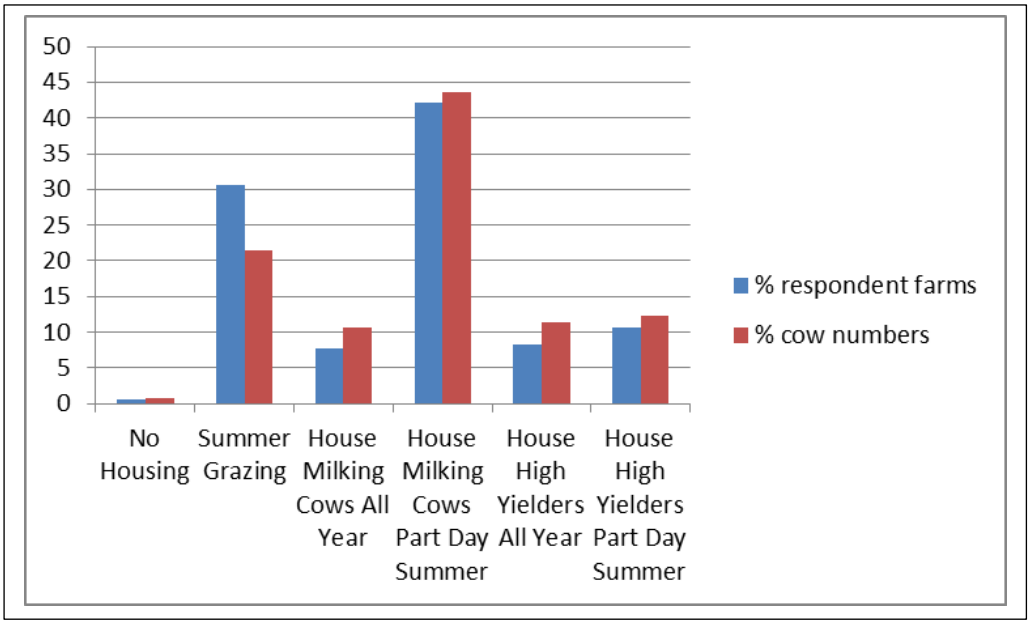


Figure 9: Percentage of farms and cows in SURC survey in different systems (*Source: SRUC, D Roberts)*

[12] MSD Animal Health National Mastitis Survey 2012 via Farmers Guardian

[13] IFCN Dairy Report 2012

international commodity-based market for the almost universal spring calving-based system employed in these two countries.

By comparison, the UK had 62.5m people, produced 14bn litres in 2011 and exported 23%. The prime target market for UK milk is the UK, and more than half heads to liquid milk sales which rely on year-round level supply. This means the UK simply cannot become too reliant on spring grass-based systems as it will not be able to meet its need for year-round level supply.

Furthermore, there is a diverse demand for regional cheeses, organic, grass-fed, high omega-3, non-homogenised, lactose-free or A2, environmentally or welfare-friendly, local and even raw dairy in the UK. Some consumers buy on price, others on attributes, values, provenance or taste. Meeting these wide-ranging preferences rather than serving a largely commodity-based export market means the UK has added value, created new brands, and in the process, maintained and grown a diverse domestic market.

This brings us to a major concern expressed about large scale enterprises – that they are largely homogenised and will kill diversity and small businesses within British farming. I can understand the basis for this fear. With continual pressure on costs, the drive for economies of scale could well lead to a proliferation of larger farms which operate on known models that work, such as intensive grazing or housing – after all, this has happened in New Zealand and to a lesser extent in the US, albeit mainly under family ownership. The attachment the British public has for cows in fields and traditional small family farming, and the feeling of constancy that comes with this, is something we should not ignore.

8. Economic perceptions

8a. The impact of large on small

There has been a trend for one system to knock the performance of another in recent years, and small to knock large and vice versa, but there is a plethora of evidence that profitable milk production is possible at any scale and in any system. This is also evidenced by the existence and growth of producers using different systems, who by dint of this are very likely to be operating profitably – or at least are generating sufficient profits to reinvest.

It is common to hear claims that larger farmers push smaller producers out of business. This was investigated and largely quashed in a recent Andersons/DairyCo report[14], which found that:

- the trend of declining producer and cow numbers combined with increasing herd size and yields has occurred in most of the major dairying countries, with some declining faster than the UK.
- there is no evidence that larger units are forcing smaller units out. While larger units have the potential to make a higher level of profit as a direct consequence of potential economies of scale, they don't necessarily do so. There is a range of profit levels among farms of all sizes, which is more a function of management than of size.
- while milk price is an important and high profile economic indicator, it is only one of the influences on business profitability and no significant link was found between milk price and the rate of exit from the industry. Producers receiving a higher milk price were not found to be any more likely to expand than other producers.

Despite this, there is some anecdotal evidence that very large herds in the US have had more of an impact than suggested here. Concerns are that very big dairies can take markets off the smaller dairies; they can take up local supplies of feed and bedding, and increase their costs. There can also be a social impact – manure and water management becomes difficult, and water quality can be affected, with local wells drying up. But to put this in perspective, these comments were relating to farms with many thousand head of cows, and the people making the comments were quick to point out that some people were 'doing it right'. I will come back to this in Chapter 11 on gaining 'social licence'.

8b. Economies of scale

The range in net margins (pence per litre) in the latest DairyCo Milkbench+ report[15] shows that any size of farm can make a good net margin, but there is a slight trend for more of the larger farms to be making the higher net margins. This could be due to economies of scale, but is more likely because profitable herds have grown, and larger herds have full time labour that allows the owner/manager to step back and manage more effectively. It also needs to be noted that, in the Milkbench report, only 14 herds exceed 500 head and none, 1,000, giving a somewhat limited picture of what larger scale herds can really achieve.

[14] The structure of the GB dairy farming industry – what drives change? DairyCo 2013

[15] Managing costs: Key findings of the Milkbench+ dairy benchmarking programme, DairyCo 2013

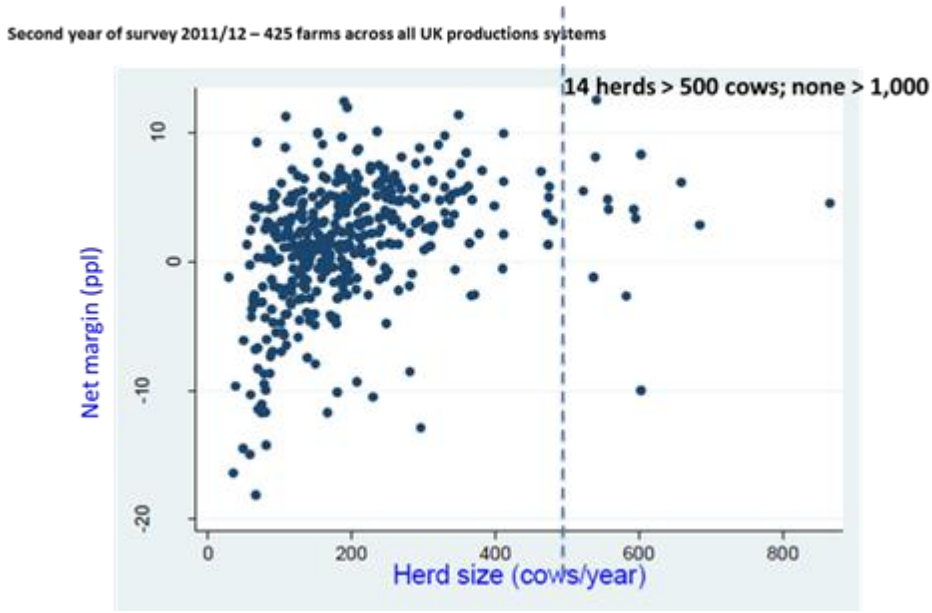


Figure 10: Distribution of herd size in Milkbench+ report 2013 (*Source: DairyCo)*

However, in the US, a 2006 report[16] indicated there was a relationship between scale and margin: *"Large farms with at least 1,000 milk cows had 15% lower dairy enterprise costs in 2005 than farms with 500-999 cows, and 25-35% less than farms with 200-499 and 100-199 cows."*

There is no doubt that even where farms of different scales are producing the same margin in terms of pence per litre, scale still improves profits. The narrowing of margins in recent decades and the need for family farms to increase net income to support more members as time goes on, means expansion is an obvious way to multiply the litres over which that margin is received. Where 100 cows may have been sufficient to support a couple and two children in the past, it may be that 200 cows are now required.

8c. The economics of different systems

The respective profitability of one system versus another has also been the subject of the DairyCo Milkbench+ report for two years now. A number of other reports have been produced by the animal welfare pressure groups laying out a robust economic model for grass-based dairy systems, using a more dual purpose animal than is currently predominant in the industry.

A new report compiled at the University of Wageningen in the Netherlands, and commissioned by the World Society for the Protection of Animals (WSPA), examines the outlook for grazing systems in northern Europe[17]. It says that larger Dutch farms applying extended grazing had, on average, higher net farm incomes than those applying no or restricted grazing. The higher margin was explained by income from subsidies and nature conservation, lower feed costs and lower fixed costs. It adds that this effect was not noted on smaller farms, and that: "*The results do not imply that grazing always results in a better economic performance. Both grazing and non-grazing can result in extremely high and low farm incomes."*

[16] Profits, Costs and the Changing Structure of Dairy Farming, USDA Economic Research Service Report No. 47 September 2007

[17] Grazing dairy cows in North-West Europe (Economic farm performance and future developments with emphasis on the Dutch situation), J.W. Reijs et al, August 2013

	Cows at grass	Composite	High output
Average herd size (cows)	231	123	230
Total non-forage feed (kg DM/cow/year)	1087	2225	2629
Yield (litres/cow/year)	5741	7750	8465
Total cost of production (ppl)	27.3	30.3	28.6
Net margin (ppl)	3.6	-1.3	1.8
Net margin (£'s/ha)	477	-65	340

Table 5: Net margins by system in Milkbench+ 2013 report (*Source: DairyCo)*

These findings are consistent with the Mikbench report which shows that well-managed farms operating any system can be profitable, but with different strengths and weaknesses to each system.

The breakdown of margins on farms of different systems shows specialist grazing systems perform best on net margin per litre. *See Table 5 above.*

While high output systems – which are likely to encompass a greater level of housing – average a mediocre performance on margin per litre basis, their ability to utilise land resources to produce high volume output shows in their better performance on margin per hectare basis.

However, system is not the end of the story – management is a critical factor. This becomes evident when you examine the top 25% of producers in each system: they are all able to perform profitably. The comparison of the bottom 25% shows the grass-based system is probably a more robust all-round system, losing least money, and high output more complex, requiring detailed management to secure a good performance.

Lastly, there is an inherent weakness in both specialist systems. In specialist grazing, profitability and performance is heavily reliant on the weather, and this was made abundantly clear in 2012 and into the spring of 2013 when grazing and forage stocks became extremely short and farmers were forced to buy on the spot market just to keep cows fed.

However, this is just in a bad year and the law of averages suggests the high per litre margins in other years and the inherent resilience from a low cost base is sufficient to see most

	Cows at Grass Top 25%*	Composite Top 25%*	High output Top 25%*
Herd size	226	140	275
Average yield (l/cow/year)	6177	8341	8467
Total non-forage feed (kg DM/cow)	1178	2206	2442
Milk price	28.6	27.7	29.1
Feed and forage cost	6.5	8.4	8.6
Total variable costs	8.8	11.0	11.2
Total fixed costs	11.5	11.7	10.8
Total costs of production	22.8	25.5	24.5
Net margin (ppl)	8.1	4.0	6.3
Net margin (£s/ha)	1038	630	1108
Net margin for bottom 25% (£s/ha)	-124	-888	-515

Table 6: Net margins by system in Milkbench+ 2013 report – top & bottom 25% *(Source: DairyCo)*

operations through the bad times. In contrast, housed systems rely heavily on bought-in feed, fuel and fertilisers, making them very susceptible to volatility in prices. In the US, where they have been running large housed herds for years, sophisticated systems to offset risk and manage volatility have been developed, such as forward contracts and hedging.

The success of these mechanisms became evident in the 2008/9 US price crash, where the milk price dropped almost 60% within a very short space of time.

Despite this, there was very little reduction in overall milk production. This suggests that while government aid extended only to the first million litres or so of each farm's production, the larger producers had mitigated against this volatility well enough to survive and pick up profits again when the price recovered.

Figure 11: US milk price *(Source: USDA)*

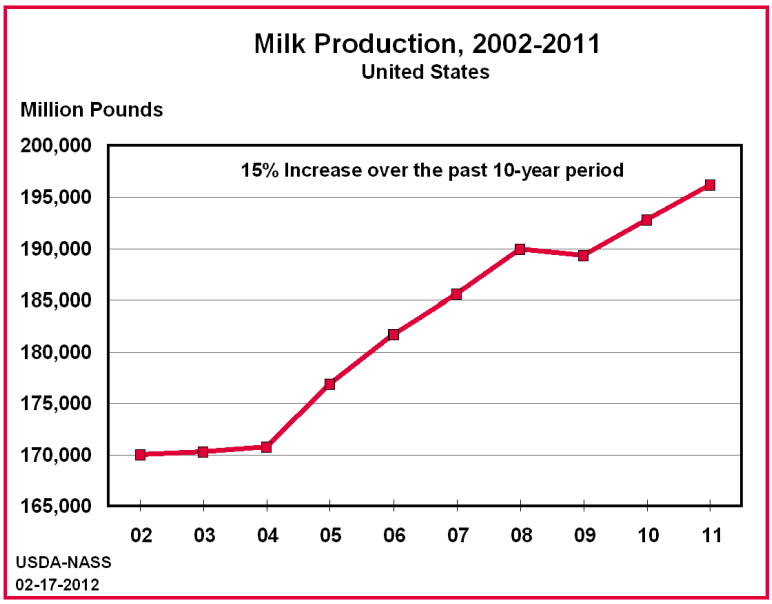


Figure 12: US milk production (*Source: USDA)*

Mark Diederichs at Lake Breeze Dairy in Fond Du Lac, runs 3,000 cows in a housed system, having constructed the dairy in 2002 and built up cow numbers steadily since then. He also heads up the Professional Dairy Producers of Wisconsin group.

Mark locks in his margin every year by forward-contracting to set feed and milk prices. "*We have developed a program (Margin Smart) that calculates your margins depending on the information you enter into the program. It will text you when your margins are met, based on live Chicago Board of Trade pricing.*" Thus Lake Breeze Dairy is operating with known values for its biggest cost and greatest output.

9. Environmental perceptions

9a. Environmental challenges with specialist grazing

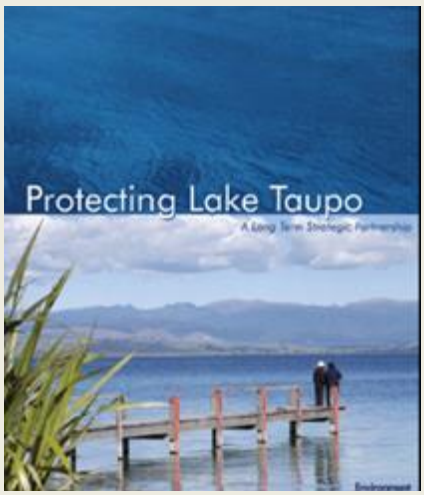
Opponents argue that large-scale intensive livestock production is resource inefficient, highly damaging to the environment and presents an unacceptable public health risk. We tend to associate these claims with housed units in the UK, but as I found in New Zealand, specialist grazing herds that are intensively stocked can also be at risk of causing run-off and leaching.

Cows can excrete around 70% of the nitrogen they consume in faeces and urine[18], and therefore the higher the protein of the grass in spring or the higher the protein in the total mixed ration being fed, potentially the higher the risk of environmental impact, especially in systems that do not capture and store the effluent for more timely application.

Minimising nitrogen losses from grazing land to air and water has been a big focus in New Zealand as their dairy sector has intensified to increase production and compete on a world market using specialist low cost grazing systems. Nitrogen loss in the form of leaching nitrates can potentially contaminate groundwater aquifers or encourage the growth of nuisance weeds and algae in streams and lakes when concentrations are high enough.

Research from Dairy NZ[19] is currently looking at how an average farm can increase annual milk production by up to 200kg/ha with increased profit per hectare, while reducing nitrogen leached by around 40%. Since the start of the 2011/12 season, two farms have been compared, one representing a typical farm in the Waikato region with a stocking

The New Zealand grass-based systems are being forced to change following a national outcry over eutrophication of water bodies from phosphate and nitrate run off in recent years. Particularly affected is the Waikato Area *(Waikato Regional Plan, www.waikatoregion.govt.nz)* and, within this, Taupo lake. (*Protecting Lake Taupo strategy, www.waikatoregion.govt.nz*). This has led to over-wintering of stock outside the catchment or using a feedpad and capturing and storing effluent for disposal over the whole farm. Feedpads take cows off grass in the winter months with heavy rainfall, on to a concrete surface that allows the capture and storage of slurry. There are also regional plans to restrict spreading of effluent on certain soils, topographies and in certain weather, meaning effluent storage capacity has had to increase accordingly. Fonterra, the predominant milk co-op in New Zealand, has taken a very active role in driving the changes on-farm that will allow producers to avoid breaches. There are two reasons for this – milk in New Zealand is seen as 'Fonterra', implicitly, hence failing to act is a reputation risk; but acting now also secures milk supply for the future in what remains a vibrant dairy farming nation.



[18] Reducing protein in dairy cow diets, DairyCo 2013 http://www.dairyco.org.uk/resources-library/research-development/nutrition/literature-review-reducing-protein-in-dairy-cow-diets/

[19] Pastoral 21 research project, details available on the www.dairynz.co.nz website

rate of 3.2 cows/ha, the other with a stocking rate of 2.6 cows/ha, for leaching, yields, margins and overall profits.

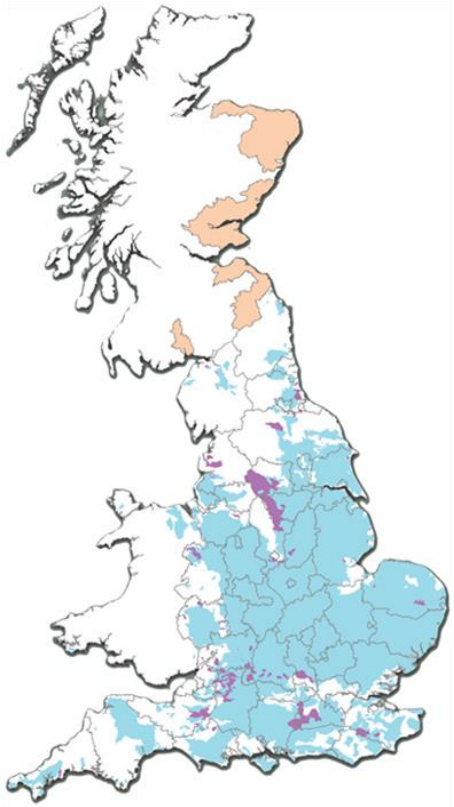
Another technology employed until recently is the use of nitrification inhibitors such as dicyandiamide (DCD). These chemicals slow or 'inhibit' the conversion of N from the ammonium (NH_4) form to the mobile nitrate (NO_3) form, which is easily leached.

On-going research[20] is evaluating the effectiveness of DCD for reducing both nitrous oxide and nitrate leaching losses from grazing land at a number of contrasting experimental sites in the North and South Islands. Because DCD can help retain nitrogen in the top layer of the soil, DCD has also been able to increase grass production. However, a major issue emerged in January 2013 when traces of DCD were found in liquid milk and DCD use was suspended[21] until maximum safe residue levels could be determined. A significant concern would have been the preservation of New Zealand's lucrative Chinese market, which remains acutely sensitive to contamination and food safety issues following the melamine scandal in 2008[22].

In the UK, there is no restriction to stocking rate except in Nitrate Vulnerable Zones, although cross-compliance eligibility for the Single Farm Payment requires land to be kept in good agricultural and environmental condition, so overstocking could be seen as a breach of this if not well managed.

Many of the large intensively grazed herds, however, are in the west of the country – Wales, south west Scotland, Cornwall or other areas of south west England – where NVZs are less prevalent. However, it could well be that with the Water Framework Directive[23] gathering momentum, stocking density of grazed land will come under the spotlight in some areas. Use of nitrification inhibitors may well prove useful for specialist grazers but the jury will be out while more information emerges about the residue levels for DCD.

Figure 13: Map of NVZ areas in Britain *(Source: AMC)*



Scotland: Orange = NVZ area
England & Wales: Blue = NVZ area. Purple = NVZ area introduced 1 Jan 2013

9b. Environmental challenges with housed cows

In housed herds, any waste created by the animal away from the land is also subject to NVZ regulations plus a host of additional legislation including Water Resource (control of pollution: silage, slurry & agricultural fuel

[20] AgResearch, MAF, PGgRC, DairyNZ, Fonterra, Fertiliser industries, Lincoln University and Landcare Research

[21] http://www.mpi.govt.nz/news-resources/news/dcd-suspension-supported

[22] http://news.bbc.co.uk/1/hi/world/asia-pacific/7720404.stm

[23] http://www.environment-agency.gov.uk/research/library/position/41231.aspx

oil) Regulations (SSAFO) 2010, Cross Compliance, and so on.

In theory, a housed herd could grow in isolation from the land surrounding it as the farmer is buying in feed and not relying on physical grazing for nutrition. This is certainly the case in the US where it is common for a farm only to own the footprint the cow housing stands on. The Environment Agency is aware of this, and there have been several cases recently where producers have had to prove (or even have a legal agreement in place for) access to an adequate land base to dispose of the waste, before the Environment Agency will give a positive response to the planning application.

The failure of a manure storage facility on a single 1,000 cow operation would clearly have far greater environmental impact than multiple failures on much smaller units, but the Environment Agency 2011 position statement on building or expanding dairy units[24] recognises the reduction of risk on well-invested farms using new facilities and technologies.

It should also be appreciated that while it is right to be concerned about the impact of a large-scale environmental incident, the size of a farm does not increase the likelihood of an incident occurring. The Environment Agency handled over 9,000 water pollution incidents in 2010; many were farm-related but with no apparent correlation between scale and frequency of incidents; many were on small, under-invested farms with old facilities.

One of the bigger challenges that could be coming for housed herds is ammonia emissions. All pig and poultry units over a certain size must apply for an Integrated Pollution Prevention and Control (IPPC) certificate which examines – amongst many other things – predicted ammonia emissions and the sensitivity of a number of local receptors such as people or susceptible flora and fauna. Already, these are limiting expansion in these sectors. While dairy farms do not currently fall under IPPC rules, some recent applicants have been asked to produce an Environmental Impact Assessment - even more rigorous than the IPPC.

Housed herds in the Netherlands and Denmark are under particular pressure from ammonia restrictions (*see boxed sections on next page).* Many producers have ambitious expansion plans heading towards 2015, but farms near Natura 2000 (European conservation) sites now have quotas to prevent them going over a certain number of livestock units. At the moment you can buy another farmer's 'ammonia' rights but there is concern that upcoming adjustments to legislation could change that. Cow replacement rates have been traditionally high in both countries – around 30-35% – but this is now being pushed down so that fewer youngstock take up precious cow quota. The UK also has Natura 2000 sites so it is feasible that we could see environmental restrictions of some kind become the new 'quota' post 2015.

9c. Resource efficiency

Use of resources is another question that comes up in connection with larger herds – are they resource inefficient? A cow eats what a cow eats, and while that activity may be concentrated on a smaller platform through specialisation, it doesn't necessarily make the enterprise resource-inefficient – quite the opposite in fact. Grazing herds utilise mainly grasses, plants that cannot be used to feed humans, and turn them into nutritious and biologically available human food. They require very few resources other than the sun and water that feeds grass, some additional nutrients, and the management input of getting feed levels just right.

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[24] Environment Agency advice to farmers building or expanding dairy units, Version 1, June 2011 http://www.environment-agency.gov.uk/research/library/position/130513.aspx

Janet Brandsmaa, who is on the council of the Dutch farmers' union LTO, has just finished the new cattle housing for her and her husband's herd of 220 milking cows near Steenwijk – although with an eye on 2015, they have factored in capacity for up to 350 head. The couple have taken steps to control ammonia emissions; the brand new floor slats have special rubber flaps underneath. Other farms monitor the atmosphere inside the shed and have ventilation controls that kick in if ammonia levels rise above a certain threshold.

"*The nearer you are to a Natura site, the tighter the control and the more limited your options for increasing your quota,"* she says. *"We've built in lots of technology to control emissions, but as some of this technology is in its infancy, it's incumbent on the farmer to prove it works. Recently, four farms with exactly the same system had to pay to have their ammonia emissions checked, which cost each approximately* €30,000 (£24,000)."

Controls on phosphates have been in place for several years in the Netherlands. "*The industry has been working closely with feed suppliers to reduce phosphate levels in cattle feed. Unfortunately, alternative sources of protein to soya, such as rapeseed meal, are naturally high in phosphate,"* says Jeanet.

Housed herds also consume large quantities of forage. However, housed herds with their higher outputs will also be fed larger quantities of grain and plant protein, which some argue takes land and food away from humans and places another inefficient step in the pathway to human food production. But they also produce more milk from that. This makes the growing use of by-products from the human food and fuel industry particularly interesting, with the dual benefit of diversion of waste from landfill into the mouths of cows that turn it back into food.

Peter Lundgaard runs a 470-cow herd at Bramming near Esbjerg with his brother Søren and five staff. He recovers the solid fibre fraction from some of his slurry to use for bedding cows – at 60-70% dry matter, few bacteria survive and cows like the comfortable deep compost beds. The remaining liquid fraction joins the rest of the slurry in storage where 7-10 litres of acid per tonne are mixed in to take the pH down to 5.5 so that ammonia emissions are minimised. Acid to treat a tonne of slurry costs around 10 Kroner (£1), not including the capital costs of the tank of the tank and mixing equipment, and related power costs.

"*Where I save money is in being able to spread the slurry on the surface of fields instead of injecting, and the slurry has a higher nutritive value too*," Peter says. "*The acid can be mixed into the slurry just before application, but this doesn't stop ammonia losses in-store."*

There is also a strong need to establish that the site chosen for an expanding or new dairy farm has sufficient water to service the needs of the cows and the plant, without impinging on local water quality and availability … but that should be implicit within a planning application if one is required, which it will be for a housed herd. A grazed herd is different as it doesn't always require a planning application, hence the same safeguards on resource use are not necessarily in place.

Perhaps the simplest way to gauge resource efficiency is to carry out a water footprint and greenhouse gas (GHG) emissions calculation. The GHG calculation will provide a good indication of overall resource efficiency as it takes into account the net energy requirements of producing a litre of milk. Greenhouse gas emissions in general are not shown to be affected by herd size, but by efficient management. As one of the biggest impacts is yield, it appears that the more yield a cow produces, the lower the emissions because the maintenance of the cow is spread over more litres – as shown in the bench-marking for the ASDA producers, monitored by Kite.

The chart below suggests that simply reducing the carbon footprint of a litre of milk from 1,300g to 1,100g (each end of the line above) by approximately doubling yield from 5,000 litres to 10,000 litres per cow, is worth 2.6m tonnes CO_2 over a year of UK milk production; that is equivalent to taking 850,000 – almost 3% of the UK's cars[25] – off the road.

However, the International Dairy Federation's (IDF) common methodology for calculating the carbon footprint of milk[26] does not currently take account of sequestration of carbon by permanent grassland; this means the full footprint of some pasture-based milk production is still not accurately known. If a method is identified to factor in sequestration, then the footprint could be exceptionally low in some permanent pasture systems.

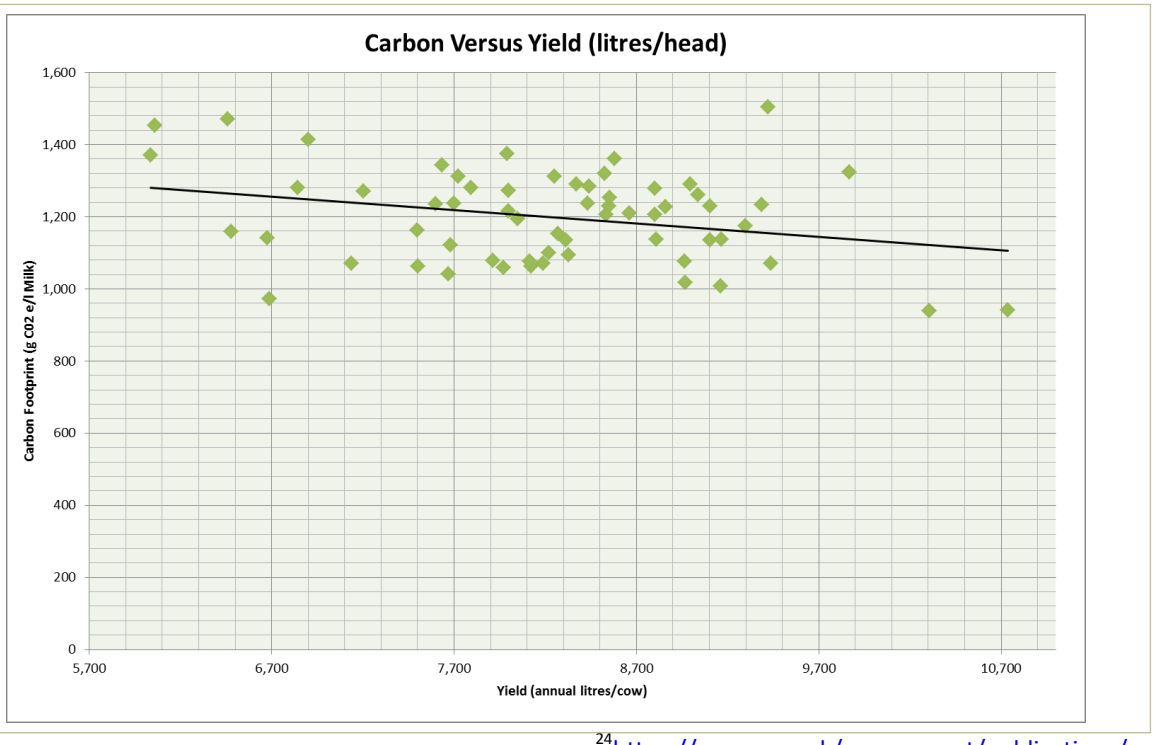


Figure 14: Carbon footprint of milk/litres against milk yield litres/head *(Source: ASDA/Kite)*

[24] https://www.gov.uk/government/publications/vehicle-licensing-statistics-q2-2012 report 28.7m cars registered in the UK in 2012

[26] A common carbon footprint approach for dairy, IDF 2012 http://idf-lca-guide.org/Files/media/Documents/445-2010-A-common-carbon-footprint-approach-for-dairy.pdf

In the meantime, it's worth looking at the average carbon footprint in a New Zealand pasture-based system. An average New Zealand cow produces 364kg milk solids per lactation from 4,128 litres of milk[27]. The IDF functional unit for calculating carbon footprint is a kg of milk with 4% fat and 3.3% protein, which would equate to 4,986 fat and protein-corrected milk. With the average carbon footprint in New Zealand calculated at 9,920 $kgCO_2e$/tonne milk solids[28], this would hypothetically equate to 724g CO_2/kg milk, an exceptionally low footprint – if the NZ and IDF methodologies are comparable – given a global average of 2,400g and UK of 1,200g. The Nocton Dairies proposal was also predicted to produce milk at 720g[29] due to high yields and efficiency of resource use, but this would have been one of the lowest footprints in the UK rather than an average.

According to Capper et al 2009[30], total resource usage by the US dairy industry per unit of output has declined significantly over the past 60 years. Their paper 'The environmental impact of dairy production: 1944 compared with 2007' concluded: *"Modern dairy practices require considerably fewer resources than dairying in 1944 with 21% of animals, 23% of feedstuffs, 35% of the water, and only 10% of the land required to produce the same 1 billion kg of milk. Waste outputs were similarly reduced, with modern dairy systems producing 24% of the manure, 43% of CH_4, and 56% of N_2O per billion kg of milk compared with equivalent milk from historical dairying. The carbon footprint per billion kilograms of milk produced in 2007 was 37% of equivalent milk production in 1944."*

Much of the improvement in performance can be attributed to advances in animal and plant genetics. However, given that to fully exploit this improved genetic potential requires the adoption of modern management practices, then viewed holistically, the evolution of milk production in the US over the reference period, from what was basically a pasture-based model in 1944 to an almost exclusively housed model, has had a profoundly positive impact on the environmental footprint and resource requirement of milk production.

A newly published report from Global Dairy Platform[31] draws attention to the vast amount of forage, by-products and waste consumed by cows, quoting a Dutch study that finds less than 10% of dairy cow diets comprise human-edible food. It also examines the often-quoted hypothesis that consuming plant protein is better for the environment than animal protein, by looking at the nutritional density and composition of dairy products. *"The dairy cow is a protein conversion expert…*[as can be seen by] *the higher bioavailabilty of dairy proteins when compared with plant-based sources: whole milk powder scored 1.22, compared to 0.64 for peas and 0.40 for wheat."*

9d. The role of anaerobic digestion

The ability of the housed cow to create renewable energy has not been lost on the Americans, particularly within its industry levy body Dairy Management Inc, which is starting to position the dairy cow at the centre of a resource-efficient cycle.

She consumes waste products from the human food and biofuel industries; she produces a highly nutritious food for humans; renewable energy from her waste can be anaerobically digested in its own right and act as a biological 'starter' for the digestion of other wastes; the left over 'digestate' can be separated, with the solid fraction composted or dried and used in cattle bedding – the

[27] New Zealand Dairy Statistics 2011-12
[28] Lincoln University http://www.siddc.org.nz/files/Rsceusegreenhousegas.pdf
[29] http://www.fwi.co.uk/gr/Sustainability%20statement.pdf
[30] **The environmental impact of dairy production: 1944 compared with 2007** J. L. Capper, R. A. Cady and D. E. Bauman J ANIM SCI 2009, 87:2160-2167 http://jas.fass.org/content/87/6/2160
[31] Enhancing Nutritional Security: How Dairy Optimises Natural Resources, Global Dairy Platform, September 2013

ultimate in recycling – or sold as peat replacement for garden centres, and the 'odour-reduced' liquid fraction applied back on land to reduce reliance on artificial fertilisers and increase soil organic matter levels.

The digestion process doesn't reduce the nutrient content of the waste – in fact it makes the nitrogen more available – but it does extract the energy in the form of methane, which reduces greenhouse gas emissions and creates renewable energy when run through a power plant or engine. The lower odour is also a big advantage when anticipating resistance from local people regarding smell.

Fair Oaks Farms, the largest dairy farm in the United States, has 38,000 milking cows across 11 units. The farms are situated on 27,000 acres growing mainly alfalfa haylage and maize silage. Every day, vacuum tankers collect slurry from each farm and take it to a central digester which produces enough methane to fuel all 42 of Fair Oaks' milk tankers plus supply power to the entire farm.

Jerry Bingold, director of the Center for Advanced Energy Studies at Dairy Management Inc in Chicago, says that adding anaerobic digestion to dairy enterprises can increase income by $400 per year per cow and markets for the digestate are stable. *"There are 2,647 farms in the US that are feasible for anaerobic congestion, having over 500 cows, but the number with units is currently around 160, and half of those have digesters performing sub-optimally. The potential for the technology is huge. The market potential is $3 billion with an 18% net return."*

This is in a different context from anaerobic digestion in Germany, which is probably the world leader in the technology. As it is so heavily incentivised, many farmers divert vast areas of maize silage into digestion rather than using solely cow or pig waste. The focus there is on revenues and feed in tariffs from energy production rather than processing waste and creating value from the energy and the end products.

While anaerobic digestion has been seen as the holy grail in reducing environmental impact, primarily through harvesting greenhouse gases, it is far from a one-stop shop solution. With sand commonly regarded as the optimal bedding medium for housed cows *(see Chapter 10f. and g.),* the headaches around separating sand from manure before it goes into the digester have never quite been resolved. Some have almost managed to make it work through sand separators and settlement lanes, but others have either given up digestion or switched to another bedding medium such as sawdust, mattresses or separated solids.

Torsten Zahn is one of the owners of the 2,000ha Agrarkandelin mixed farm at Suderholz in north east Germany. The business includes four bio-digesters, two for pig slurry and two for waste from the 1,000 cow dairy; each brings around €250,000 (just over £200,000) per year. Torsten says Government subsidisation is unsustainable, but it's guaranteed income for his business thanks to Germany's commitment to phase out nuclear power by 2030.

The farm grows 900ha of maize for silage, with just over half destined for the biodigesters fed at a rate of 11 tonnes per digester per day, supplemented with 7 tonnes of cow slurry – meaning only a fifth of slurry from the cows ends up going for energy production. A dedicated team (pictured) looks after the biodigesters.

In the Californian Central Valley, intense agricultural production has driven dairy as well as horticulture, grape and nut production. Its unique topography means emissions sit in a basin and often cause local air quality problems. Digesting cow manure and waste to reduce greenhouse gas emission is one part of the equation, but that methane has to be turned into power, and the process of doing that with generators is emitting N_2O, a precursor of ammonia and ground level ozone, both of which are harmful to human health.

continued on next page – Chapter 9e. Biodiversity

With just 680 Holstein cows Larry Castelanelli's Lodi-area dairy farm in California's Central Valley seems small in comparison to his much larger neighbours. Larry's cows average over 11,000 litres of milk each year – but he says his diversification into anaerobic digestion is the only reason he's been able to stay in dairying. *"A hundred dairies have gone broke locally,"* he explains. *"Our costings are up to $20 to produce a hundredweight of milk – but we're getting paid $17.60* (about 28ppl to produce with 25ppl payment at the time of my visit). *The figures stack up pretty poorly against our other enterprises so I'm struggling to persuade my son to keep the cows.*

In fact, the EPA is currently having to strike a balancing act between the need to reduce greenhouse gas emissions, and pressures on local air quality.

continued in next column

Larry says the dairy industry needs to start thinking differently about the cow. "*We really undervalue dairy farming. The cow is a fully sustainable model on-farm. She eats vegetable waste, is bedded on by-products, she produces milk, she produces fertiliser, and we eat her. She also produces Cow Power energy. My son is comparing the dairy income to our 800 acres of grapes – but it's the wrong way to look at it. We need to attach more value to what the cow can deliver at the centre of a successful agribusiness."*

"*We've stayed under the 700-cow limit that defines a farm as a CAFO – Concentrated Animal Feeding Operation – and therefore we don't get the same weight of regulation. We produce renewable energy from anaerobic digestion: 10c per kilowatt gives us $10,000 to $15,000 per month* (£6,450-£9,670) *additional income. But even this is under threat now as there's so much digestion happening in the Central Valley area, the Environment Protection Agency (EPA) is concerned the generators turning methane into power are emitting too much N_2O, causing ammonia and ground level ozone."*

9e. Biodiversity

The importance of retaining and reintroducing biodiversity to the UK has been the subject of much discussion, especially during recent CAP reform debates about the 'greening' of subsidies versus diverting more funds into stewardship schemes. There are two schools of thought – land sparing (involving the setting aside of land specifically for biodiverse habitats) and land sharing (where food production shares the stage with biodiversity, as in organic production).

Any specialised system is likely to focus mainly on maximising productivity on the land available as it is performing as efficiently as possible to keep costs down. Therefore any biodiverse habitats would be contained on less or unproductive land, hence land sparing. It would take a specific incentive scheme rewarding land sharing, such as organic premium, to encourage the dilution of the productivity of the land available.

Few studies have been carried out in the UK on land sparing versus land sharing, but bodies such as the British Trust for Ornithology have looked at this issue overseas and have tried to extrapolate the findings to apply to British conditions[32], concluding that land sparing holds better potential to achieve a number of complex objectives concerning biodiversity and food production.

There is no reason why specialised grazing or housed dairy units couldn't contribute towards biodiversity improvement by turning specific strips of less productive land over to pollen and nectar areas for insects, birdfood production or mammal habitats. In fact one could argue that if their farms are performing profitably and have economies of scale, it may be more feasible to introduce this sort of initiative on a large farm than on smaller farms that may, because of financial pressures, need more incentive for taking land out of production.

[32] Conserving the Birds of Uganda's Banana-Coffee Arc: Land Sparing and Land Sharing Compared, Mark F. Hulme et al http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0054597; Reconciling Food Production and Biodiversity Conservation: Land Sharing and Land Sparing Compared, Ben Phalan et al http://www.sciencemag.org/content/333/6047/1289.full

10. Welfare perceptions

10a. The impact of system

The greatest areas of focus in the housed herds I visited during my study were lameness, mastitis and metabolic disorders. Digital dermatitis was a common cause of lameness, along with sole ulcers, presumably from standing more frequently in wetter conditions on concrete; mastitis incidences pivoted on management of bedding. In farms managing metabolic disorders well, there was particular focus on the transition period 30 days pre- and post- calving. Those farms tackling these issues effectively were experiencing fewer issues with fertility.

In grazing herds, the predominant issues were lameness and nutrition in early lactation. Walking long distances was a factor in lameness rates, with well-constructed cow tracks largely resolving cases of white line disease and punctured soles. Calving in the early spring often preceded grass growth and created a negative energy balance and low body condition score. While this was an on-going concern, selective breeding in New Zealand and Australia has created an animal more resilient to this particular risk – plus the levy bodies and welfare groups in these countries has been campaigning with some success to raise awareness of the need to proactively manage body condition score issues.

In Britain, the GB Cattle Health and Welfare Group (CHAWG) reported in 2012[33] that aside from mortality on-farm and culling for reproductive issues (a sign of poor welfare rather than a welfare issue in its own right), mastitis/high cell counts and lameness were the two main causes of culling on dairy farms, at 18% and 9% respectively in one survey. It also says the last survey undertaken in the UK concluded that incidence of clinical mastitis is between 40 and 65 cases per 100 cows per year, and average cell counts for 2010 were 220,000; the most recent figures for lameness suggest the national average somewhere in the region of 37% but the Farm Animal Welfare Committee has estimated it nearer 17%, and mastitis cases at 20-40 cases per 100 cows per year[34]. These figures are across all sizes of farm and all systems but it should be remembered that the predominant system in the UK is a composite system involving grazing in the summer and the average herd size is 125 cows.

The European Food Safety Authority's 2009 report on the welfare of the dairy cow[35] identified a number of conditions that cows in different conditions could be more susceptible to or have a higher risk of developing.

see Table 7 on next page.

Overall, it concludes that cows in zero grazing facilities have a higher risk of health disorders compared with cows at pasture (see excerpts in **Appendix IV**). But what became evident to me was that:

- the EFSA report, compiled in 2009, doesn't appear to include any studies on the latest, modern deep bedded freestall facilities that have been so successful in North America at improving the ability to manage health

[33] First Annual Report, GB CHAWG, September 2012 http://www.eblex.org.uk/wp/wp-content/uploads/2013/06/Cattle-Health-and-Welfare-Report.pdf

[34] Opinion on the Welfare of the Dairy Cow, FAWC 2009 http://www.fawc.org.uk/pdf/dcwelfar-091022.pdf

[35] Scientific report on the effects of farming systems on dairy cow welfare and disease, EFSA, 2009

Housed or zero-grazing system	Pasture-based system
Lameness (digital dermatitis, hock and knee injuries, sole haemorrhage)	Inadequate energy intake/high competition for feed/hunger
Mortality %	Lameness and hoof injuries
Mastitis	Subacute ruminal acidosis
Metritis/retained placenta	Milk fever
Dystocia	Heat stress/exposure to inclement weather
Metabolic issues including ketosis	Parasite load, flies

Table 7: Conditions to which cows in different UK systems will be susceptible.
(Source: Welfare of the Dairy Cow, EFSA 2009)

- many of the papers included in the report are from European countries where cows can be housed year-round in tie-stall barns or very traditional, unimproved facilities
- risks in housed herds may be higher but I saw plenty of evidence that the risk could and was being managed exceptionally well by many.

To gauge whether my suspicions about the EFSA findings were correct, I compiled a summary of mastitis and lameness levels across a range of systems I found during my study tour. This was not with the aim of deciding which system was best, but to identify whether risks could be adequately managed. The results are in **Appendix V.**

Overall, mastitis levels in this very small sample were higher in housed herds, but the farms in each system performing the best had equal levels. The housed system with the most mastitis cases was bedding on separated solids and was in the process of acquiring a dryer to take the dry matter up on the solids to reduce bacteria and mastitis levels. Lameness levels barely differed between farms on different systems. This was a very unscientific and unrepresentative comparison – and it must be remembered that the farms I visited were generally of a very good standard. Nevertheless the results suggested that risk can be managed, at least where mastitis and lameness alone are concerned.

In 2010, FAWC wrote to the agriculture minister Jim Paice on the subject of the welfare of dairy cows housed all year round and/or in very large herds[36]. It stated that

Advantages	Disadvantages
Feed composition more controlled	Unable to carry out natural foraging behaviour
Diet targetable to specific groups, according to need	Physical barriers within the building to movement with less space
Reduced risk of parasitic infestation	Less environmental choice
Reduced risk of summer mastitis	Absence of soft, non-slip surface (of pasture)
Protection from adverse weather	Increased risk of physical injury and lameness
Greater biosecurity, e.g. reduced exposure to diseases transmitted by air and wildlife	Increased risk of some types of environmental mastitis

Table 8: Advantages and disadvantages of housed systems *(Source: FAWC)*

[36] The welfare of dairy cows housed all year round and/or in very large herds, FAWC 2010 http://www.fawc.org.uk/pdf/cows-welfare-letter.pdf

there were advantages and disadvantages of housing year round:

But overall, provided:

- the facilities allowed the cow to remain healthy
- the cow had good management, highly skilled veterinary care and adequate numbers of stockmen with the highest level of stockmanship
- and the cow could display normal behaviour (as per the fourth freedom, for which more research was recommended – see Chapter 10i.)….

…FAWC's advice was that a cow housed all the year round with little or no access to grazing could have a satisfactory standard of welfare.

Interestingly, many of the modern housed units I came across had introduced the following:

- extra wide passageways with loafing areas and no cul-de-sacs
- fresh mixed feed introduced daily and pushed up regularly
- wide open areas around water troughs
- rubber surfacing in high traffic areas and feed passageways
- deep sand beds groomed and levelled daily
- brushes and other grooming tools

Together, these:

- provided an opportunity for cows to express normal behaviour by manipulating and foraging within their feed
- reduced wear on the feet and increased comfort
- improved cow comfort and reduced lesions and swellings
- created loafing and socialising opportunities.

10b. Automation and robotic systems

Robotic systems offer new opportunities to investigate how welfare can be further improved on both grazing and housed systems. Robotic set ups are increasingly common in the Netherlands and Sweden, but they are now gaining popularity down under too. One of New Zealand's biggest dairy farmers is Van Leeuwen Dairies, in Waimate, South Canterbury. They have a total of 12,000

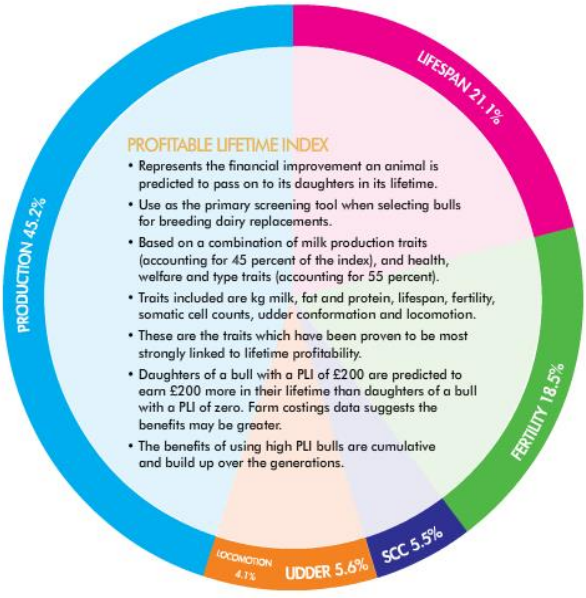
Nick Dornauf's parlour is the first commercial robotic rotary in the world. Gala Farm near Deloraine in northern Tasmania is currently milking 250 cows but has the capacity to milk up to 600. Milking tasks are performed by five robots: two for udder preparation, two for cup attachment and one for teat disinfection after milking. The system operates with grazing cows using a system of smart gates and automatic feeders that the cow must walk through to get access first to molasses balls in the parlour, then out to automatic feeders after milking, then water, and finally grass. The rotary is exceptionally slow and small by manual rotary standards, taking around 24 minutes to turn once, but the pace is leisurely and the cows relaxed.

cows including 1,000 cows housed in two 500-cow robotic milking units. There are plans to add another 500 cow housed unit shortly, but in a country where grazed cows are not just the norm but virtually universal, aside from some winter housing in the far south, housing cows year round has been met with some suspicion.

In fact, a plan to bring in a separate welfare code for housed cows has been mooted. Oamaru vet Ivan Holloway has been quoted as saying that two of the greatest risks to a cow are climate extremes and nutritional deficiency. "*Free-stall barns eliminate both of those straight away*." He said the cows were more easily observed, the cows' nutritional needs better met, and there were even scratching posts that were not available in fields as trees had been taken down on many farms. He said somatic cell counts were lower because of the robotic milking and fewer incidences of mastitis experienced. He observed less lameness because the cows weren't walking so far to be milked.

10c. Breeding

The breeding ethos used in different systems around the world shows there is a particular



CO **Figure 15: The weightings in the revised PLI** ***(Source: Breeding+)***

in making sure the system is carrying the right sort of cows, or welfare can be compromised.

On grass-based systems, for example in New Zealand, there has been a particular effort to breed cows resilient to the prevalent conditions they are likely to face. Predominantly the breeds are a Holstein Friesian, Friesian, Jersey or Kiwicross. The Livestock Improvement Company (LIC) develops genetics that promote aggressive grazing behaviour[37]: "*With little or no supplementary feed available and pasture also sometimes scarce, New Zealand cows have been bred for aggressive grazing behaviour. Trials comparing the performance of New Zealand cows with international strains have shown that New Zealand cows perform equally well in TMR environments as on pasture – and yet maintain better body condition in preparation for subsequent lactations.*"

Similarly the PLI in the UK has started delivering better fertility, somatic cell counts and lifespan since it was revised in 2007 to place more emphasis on fitness traits than production. This has resulted in an improvement in fertility, somatic cell counts and lifespan scores across the whole Holstein cow population in the country.

10d. The impact of scale

FAWC's advice was a dairy cow kept in a very large herd could have a satisfactory standard of welfare, provided the herd was divided into appropriate groups, each managed according to nutritional and other needs, and stockmanship was of the highest standard. The same concerns were expressed about the fourth freedom, pending new research.

The view that welfare need not suffer – and in fact could be enhanced – on large-scale indoor units was stated in an article in the

[37] LIC: Genetic strengths http://www.licnz.com/genetic_strengths.cfm

Veterinary Record[38] from Nottingham University's leading dairy cattle vets Martin Green and Jon Huxley. Reporting on the Nocton Dairies proposal in 2010, they said: *"The application for the UK's first 'super dairy' can be seen as a rational proposal from an industry attempting to counter this prolonged period of poor returns. While many have been shocked by its scale, the idea that unit size per se is a welfare issue is ill-informed."*

This prompted a supportive response in the Veterinary Record by leading UK cattle vet Dick Sibley[39], and further backing from the dairy cattle veterinary profession was expressed by British Cattle Veterinary president John Fishwick[40], who said that good welfare relied on good stockmanship and husbandry, regardless of herd size.

These statements echo a recent position statement by the RSPCA (Appendix III p.86) which stated: "*The RSPCA's overall conclusion is that the size of a dairy farm is not the key issue in relation to the welfare of the animals, it is the conditions, stockmanship and overall husbandry which are the factors which contribute to the overall welfare status of the animals. It is whether the farming operation, regardless of size, can meet the welfare needs of each individual animal that really matters."*

This said, British vet and scientist Dr Nigel Cooke, from the University of Wisconsin, has concerns over very large dairies. In housed herds, he thinks the ideal size is 600 to 2,500 cows. *"Unless the management is exceptional, there is a drop in performance in larger herds with respect to mortality and fresh cow performance. Typically in these large herds, fresh cows are held in headlocks while workers observe and examine the cows for disease. If this lockup time is more than an hour per day it may impact health – lameness risk for example, because the cows do not recover the loss in lying time. Workers may therefore rush to complete the task and miss finding the sick cow, or take too long and negatively impact the whole group. Workers can operate fresh pens of 100-250 cows well, but when pen sizes get closer to 400 cows, finding that sick cow becomes very challenging. This means that as individual herd size heads over 2,000 cows, fresh cow health and welfare potentially suffer."*

Noel Campbell (below) President of Australian Dairy Farmers, says that herd size has grown significantly in Victoria and Tasmania. The average in these states is now 300 cows but recent information suggests 4-600 cow herds are generally the most profitable in Australian grass-based systems. *"Once you get up to a group of 1,000-2,000 cow herds on a grazing system, you are losing efficiency as even 800 cows can mean a 4km walk to get to feed."*

New Zealand farms usually get to around 650 cows (in fact the recognised number one labour unit can manage is 220, so they tend to rise in multiples of this) before splitting down into multiple groups that might share the same milking parlour but graze off different sides of the land unit.

10e. Group size

There is much made of group size with pressure groups recommending small groups sizes, but in either of the specialist systems, large group sizes can be successfully managed. One of the features of specialist grazing is block calving so all animals remain in a single group for the duration of their

[38] https://dl.dropboxusercontent.com/u/45053136/Huxley%20%26%20Green%202010.pdf
[39] https://dl.dropboxusercontent.com/u/45053136/Life%20worth%20Living%20Sibley.pdf
[40] http://www.vetsonline.com/actualites/detail/36673-revues-1/vets-defend-mega-dairy-s-commitment-to-animal-welfare.html

lactation. Housed herds calving year round are likely to be split into low and high yielders with a separate fresh cow pen, then often again by parity, with heifers in a separate group.

While the grazing group size can be very large with up to 7-800 animals, the established social order is rarely disrupted as the only introductions are that year's heifers, as a batch. In housed herds, animals can be moved from one group into another, but it's increasingly thought that this should be done within a sub-group and not individually so that the sub-group social order is constant and single animals do not find themselves in an alien environment.

The time taken to put the group of cows through the milking parlour is another risk – the longer the whole milking process takes, the longer the animals will be standing on concrete, neither eating nor resting.

In New Zealand and Australia this is managed using large high-throughput milking parlours such as 60-point rotaries *(see top picture),* so that there is minimal time away from pasture for the whole group. In housed herds, similar capacity parlours would be used with high yielding cows in groups designed to have a turnaround time (time away from feed and beds) of an hour or less– but on three times a day milking. These parlours are more likely to be operating around the clock.

I heard several times during my tour that cows in small groups have no choice about their companions, whereas in larger groups they quickly form smaller groups with preferred herdmates. This makes sense, as anyone who has ever been forced to spend time with a small group of people will recognise! What is important is whether there are sufficient facilities to deal with the number of cows, irrespective of system. With cows preferring to do things 'as one' – ie eat together, rest together – then the facilities should allow this to happen with minimal displacement and 'idling' (doing nothing because there is no room to lie or no space to eat or drink) among lower order animals. Most housed facilities can either provide sufficient lying space for every cow or sufficient feeding, but rarely both. Whether this is an issue or not is the subject of much debate and many arbitrary figures are put forward for optimum stocking rates.

I believe a more scientific way of determining this could and should be developed. For example, the ultimate test is in levels of aggression, bullying and displacement, and the impact on lower order cows. If there is little or none, then whatever the stocking rate, it is having no impact on the wellbeing of the cows.

10f. Lameness

Lameness is a concern on both housed and grazing farms. The cause varies with system: cows in grazing systems tend to suffer from punctured soles and white line disease, and wearing down from walking long distances on

poor cow tracks. Housed cows are prone to digital dermatitis, sole ulcers or hock damage which causes swellings. Poor nutritional balance in any system can lead to metabolic disorders that manifest in lesions on the foot. Badly laid-out milking facilities involving lots of turning and twisting, and pushing cows up for milking or rushing them through narrowing passageways or past obstacles are all factors.

Providing good facilities for cows only housed for part of the year can be even more challenging as there is not enough investment to put into both housing and grazing infrastructure so one or the other or both can suffer.

Lars Svensson, the manager of a 2,200 ha organic farm near Mariestad in Sweden, runs just under 1,000 cows yielding close to 9,000 litres per year.

Some 230ha of the area around the farm is used for grazing, accessed via a network of carefully designed and managed cow tracks, some of which are over 2km long. He says there are 25-30 paddocks of around 8ha in size, each of which keeps a group of 160 cows going for four 12-hour days.

Work has been carried out in trying to breed for lower lameness incidence in grazing systems. Teagasc's Moorepark Research Centre near Cork has found that animals with a high Estimated Breeding Value (EBI – expressed in euros per lactation and ranking animals on the expected profitability per lactation of their progeny including milk production, fertility and survival, calving performance, beef performance and health) had better locomotion, fewer cases of clinical lameness and less-severe hoof disorders[41].

Dr Nigel Cook has summarised the lameness studies available over the past 20 years in a number of countries **(see Appendix VI***).* While a couple of studies indicate higher lameness in zero-grazed cows than in those that graze, or in conventionally housed cows compared with organic (assuming they graze), there is otherwise very little consistency in results across different systems. Compost barns produced very low lameness, and this is backed up by my experience in Israel where cows loose housed year round in compost barns consistently averaged around 3% lameness.

A wide-ranging study carried out by the University of British Columbia in 2012[42] visited 120 farms across California, British Columbia and northeast USA (including New York State, Pennsylvania and Vermont). 18,000 cows were mobility scored on the US system 1-5, equating to the British DairyCo mobility scoring system as follows:

see Table 9 on next page

Some 28% of cows were clinically lame in BC, the equivalent of a 2 or 3 in Britain, 31% in California and 55% in northeast US. Severely lame (3 in Britain) was 7%, 4% and 8% respectively. Lameness varied greatly from farm to farm, but the incidence of severe lameness was higher on farms using

[41] Effect of genetic group and feed system on locomotion score, clinical lameness and hoof disorders of pasture-based Holstein–Friesian cows, G. Olmos et al 2008

[42] Von Keyserlingk et al, 2012

mattresses for beds in freestalls/cubicles versus deep sand beds.

Lameness Level	US Score	British Score
Not lame	1	0
Not lame	2	1
Clinically lame	3	2
Severely lame	4	3
Severely lame	5	3

Table 9: Comparison of US and British mobility scoring

In the north eastern states, most farms used mats or mattresses with little bedding; here, the odds of lameness were halved where deep bedding was used or when dry cows had access to pasture. Similarly, lameness in California was lower than in north eastern states due to the prevalence of deep beds and/or access to well-bedded dry lots outside; here, lameness was improved where stalls were kept cleaner and where rubber was used in walkways. In general, larger dairies had fewer lame cows; this was put down to the ability to have specialist staff focusing on the issue. Those farms using mattresses had more severe hock (*continued below chart*) lesions overall and cows clearly preferred and spent more time lying down in deep bedded stalls.

Dr Cook has spent much time focusing on lying time as a critical indicator of the comfort of the cow and therefore the likelihood of being lame or developing lameness due to sub-optimal conditions. He says the cow requires at least 12 hours a day rest, and the bedding surface must provide for cushion, traction and support both while the cow is lying down and during the process of standing and lying down[43].

10g. Mastitis

Mastitis continues to present problems to all dairy herds. In grazed herds, summer mastitis is a constant threat. The seasonal increase in somatic cell counts in the UK is largely related to summer mastitis issues.

In a wet season where cows are walking and lying down in mud, this can be greatly exacerbated, as it can be in overstocked conditions. In Australia and New Zealand, I found that milking technique was a key focus in trying to overcome mastitis – in terms of routine, cleaning and preparing the teats, and avoiding under or over milking. Use of dry cow therapy was standard practice across all systems and in all countries, although in Sweden and Denmark, all medicines are administered by vets.

Steps taken to reduce environmental impact *(see Chapter 9)* have the potential to contribute towards environmental mastitis

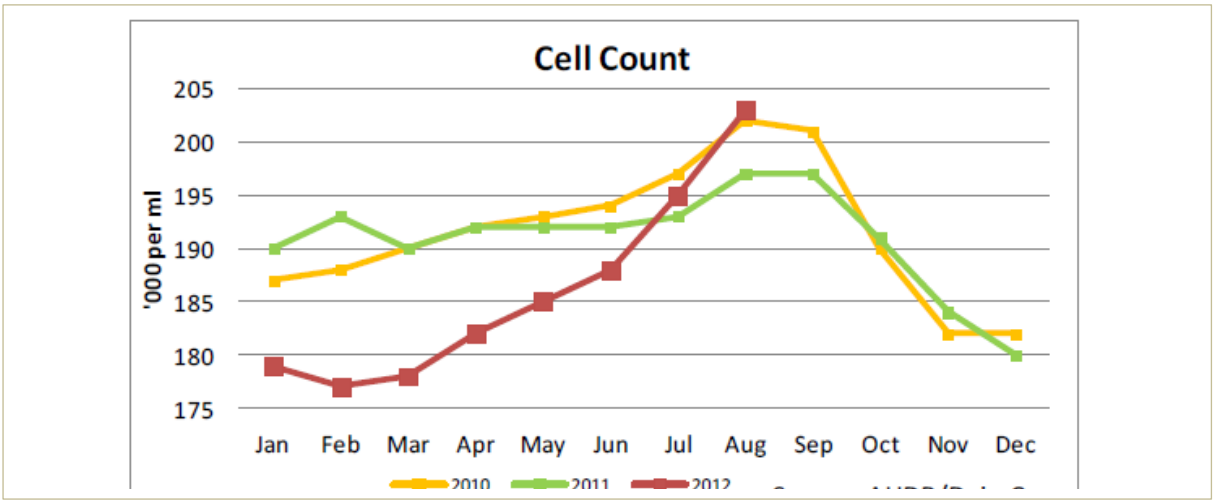


Figure 16: Seasonal somatic cell counts in the UK *(Dairy UK)*

[43] Time Budgets for Dairy Cows: How Does Cow Comfort Influence Health, Reproduction and Productivity? *Nigel B Cook*

risk but as these are used mainly during the dry period, the risk is lessened. Nevertheless, cows are calving down in early spring when it can be very wet, hence at a time when cows are particularly susceptible, environmental conditions can be at their worst.

In housed herds, the potential exposure to environmental mastitis is higher overall. Recent innovations in bedding materials, such as sand, have proven a great success on some farms. Other deep bedded materials such as separated solids are used a great deal in the USA, Denmark and the Netherlands, but concerns about how this could act as a reservoir for bacteria – not just mastitis but diseases such as Johne's or salmonella – means work is still ongoing in this area. Certainly, treated solids, such as heat treated, composted or digested, potentially pose less risk.

Dr Nigel Cook says: *"Sand is the ideal stall bedding surface for the dairy cow because it limits bacterial exposure to the teat end and provides cushion, traction and support for the cow when she is lying down and during the standing and lying process. No other bedding surface meets these two essential requirements. Recycled sand or fresh sand can be used successfully. Cows prefer the most cushioned mattress products, but even then they all benefit from the addition of soft bedding to the surface."*

From a survey of 176 herds in Wisconsin, sand-bedded herds carried a benefit of 3.2kg milk per cow per day and 1,152kg rolling herd average milk. Sand bedded herds also had lower lameness (11% against 17%) and lower somatic cell counts (214,000 against 227,000).

10h. Nutritional welfare

Almost all welfare reviews have recognised that it is easier to manage the nutrition and body condition of housed cows than cows at grass. A total mixed ration delivers known nutrients in known quantities, something which is very hard to ensure on grass-based systems. In New Zealand, supplements are minimal if any, and a cow will often be calving in advance of the spring flush of grass. When the flush comes, the very high protein levels cannot be fully utilised if energy intake is too low. Hence metabolic disorders can sometimes become an issue – sub-ruminal acidosis was a condition mentioned by many of those I met using grass-based systems. Milk fever or grass staggers are also threats.

In Australia it is more common to run a hybrid system – similar to a System '5' in New Zealand (from the 5 Production Systems[44]) – feeding some grain and canola to balance grass intakes and optimise nutrition.

While metabolic disorders are also common in housed herds, these tend to express themselves as ketosis or displaced abomasums (LDAs). The recent focus on transition cow management – homing in on the 21-30 days pre- and post- partum – has identified a number of conditions that can be improved through better management, including metritis and other infertility issues, metabolic disorders, lameness and mastitis. Hence the comment from Dr Nigel Cook about the importance of the fresh cow pen.

Animal welfare pressure groups in the UK appear to place little importance on the nutritional challenges of pasture-based systems in favour of more emotional arguments against housed cows. But a couple of well-documented cases prove this is not a subject to take lightly.

[42].http://www.dairynz.co.nz/page/pageid/2145861231/The_5_Production_Systems

When I visited it, the Van Diemens Land Company in north east Tasmania had 23 dairy farms with 17,000 cows over 2,700ha, producing over 6,000 tonnes of milk solids annually. As one of the oldest trading companies in the world and the only one to be operating under its original royal charter, it got into severe difficulties with welfare in the middle of the last decade. Excerpts from a book published by a former RSPCA (Australian) inspector Frank Bingham[45] catalogue devastating losses among the thousands of cows and calves discovered when he and his colleague Colin Jessup visited.

"Near the calf shed in an adjacent paddock was a mob of dairy cows. The physical condition of these was noticeably poor and both Colin and I, in company with the Dairy Operations Manager, who had suddenly appeared, inspected the cattle. The majority appeared to me to be suffering from long term malnutrition. Their ribs, back bones and hip bones were prominent and plainly visible."….

"The Dairy Operations Manager was advised by Colin to grade the mob and to remove all cows that had a body score of two or less [on the Australian 8-point body condition score scale, less than 3 = very thin and are either severely undernourished or suffering from disease] for drying off and all the cows that were two point five to go to once a day milking. The thing that struck me … was the condition of the cows. To me, thousands were underweight."

10i. Expressing normal behaviour – the Fourth Freedom

The government's advisory body FAWC defined guidelines many years ago for the ideal state of an animal to ensure its physical and mental welfare[46]:

1. **Freedom from Hunger and Thirst** – by ready access to fresh water and a diet to

[45] A Promise to Catbury, Frank Bingham 2007
[46] http://www.defra.gov.uk/fawc/about/five-freedoms/

Things have changed radically within the Van Diemens Land Company business and management is tight, says Hugo Avery, the new Operations Manager (pictured below at Cape Grimm on the far west side of Circular Head). Lameness, nutrition and local impact are all focuses on each farm, which is either share milked or has a manager placed on it. Grain is used to supplement intakes and forage is bought in to fill the gap before grass growth gets fully underway each spring. A programme has started to provide a safe habitat for the threatened Tasmanian Devil and the company is helping a pharmaceutical company to trial a new teat sealant to try and reduce dry cow therapy use. It has also been co-operating with the anti-logging lobby which is trying to halt most of the timber operations in Tasmania.

Another dairy farm under construction (see picture above) took the number of farms to 24, all managed according to standard operating procedures. The New Zealand owners have 100 people working in the business – four focused on operations management and 24 farm managers with between one and 8 staff each.

maintain full health and vigour.

2. **Freedom from Discomfort** – by providing an appropriate environment including shelter and a comfortable resting area.

3. **Freedom from Pain, Injury or Disease** – by prevention or rapid diagnosis and treatment.

4. **Freedom to Express Normal Behaviour** - by providing sufficient space, proper facilities and company of the animal's own kind.

5. **Freedom from Fear and Distress** – by ensuring conditions and treatment which avoid mental suffering.

The Fourth Freedom – the Freedom to Express Normal Behaviour – is the most contentious as welfare groups maintain that if an animal cannot graze then it cannot express normal behaviour. While the Nocton Dairies application was still live, the British Society of Animal Science published a brief[47] looking at the challenges and advantages of housed cows, which echoed the EFSA and FAWC findings that there can be advantages to both housing and pasture systems, but that it was largely down to management.

Often, the behaviour of an animal in the wild is used as an exemplar for how cows in other conditions should be able to behave, but in 2012, Robertson and Matthews[48] found that "*the legislative definition of 'normal' behaviour for the purposes of animal welfare law must be based on legal and scientific constructs that give significant weight and consideration to the animal's ability to adapt, and to the individual animal's past and present environment which includes the presence and role of the human caregiver*." While perceived wisdom tells the public that cows should graze, there is increasing scientific evidence – from the UK and Canada – that high yielding cows choose not to graze and instead want to be near their TMR feed and somewhere comfortable to lie down.

In Sweden there is a legal requirement to put cows outside in the summer months. According to Anna-Karin Modin Edman, formerly of Svensk Mjölk, the Swedish Dairy Association, this law dates back to 1988 and was a 'birthday present' from the government to the author Astrid Lindgren (*below*) who wrote the Pippi Longstocking books after she turned 80.

"The law sets minimum periods during which cows should be outside during the year, varying between two and four months depending on where the farm is located," explains Anna-Karin. The law has recently been criticised by some Swedish farmers who say it dates back to a time when housing involved tethered stock and not the modern housing systems seen today. Interestingly, there is no requirement for the cows to graze while outside.

A meeting with Dr Nina Von Keyserlingk from the University of British Columbia revealed interesting evidence about cow preferences and the studies she brought up plus others are summarised in **Appendix VII**. Fundamentally, they suggest that high yielding cows (ie those more likely to be housed) prefer:

- Unrestricted access to nutritionally appropriate TMR over grazing

[47] http://www.bsas.org.uk/animal_briefs/continuous-housing-of-dairy-cows-2/

[48] 'Normal' Behaviour of the Legal Animal Is More than Just 'What They Do in the Wild', Robertson, Ian A. and Matthews, Lindsay 2012

- Access to indoor feeding and outdoor lying areas as and when preferred
- The impact of social order actively managed – with little or no aggression or bullying
- Soft, dry deep bedded lying areas that permit a wide range of movement and are smooth or groomed regularly
- Ability to avoid wind, rain, sun, heat, humidity and cold at all times
- Ability to stand on a dry surface with all four feet

Given the choice, cows appear to like to go outside at night or in the evenings, but not necessarily to graze – possibly for thermo-regulation or to lie down on a comfortable surface in the right environment, if this is not available inside. The way the heifers have been reared also has a big impact on the choices cows make. Animals reared indoors tend to default to being indoors most of the time; animals reared outdoors tend to choose to be outdoors outside of feeding times.

The position cows sleep in is an aspect keenly debated. The one position cows in cubicles cannot sleep in versus cows in loose housing or on pasture, is lateral lying, or lying flat out. In her 2013 study[49], Alexa Main from University of Guelph says that during rapid eye movement (REM) sleep (of which around 45 minutes is needed each 24 hours), the neck muscles become atonic so the head typically cannot be supported, and must be rested on the body or ground. She says: "*It has been shown that cows in muddy conditions outdoors reduced the amount of time lying with the head resting on the flank or ground, compared to cattle housed in dry conditions indoors … This suggests housing conditions can influence the quality of sleep.*"

According to Dr Cook, 12 hours a day with no lateral lying versus 12 hours a day with lateral lying holds a marginal difference for the cow as she can obtain her REM sleep in cubicles with her head tucked into her flank. He says: *"Cows are amazingly adaptable. Data shows cows don't mind being in barns, especially during the day. What research does tell us is that when given the choice between life in a barn and a life out at pasture they choose both! They prefer to be outside at night and inside during the day. We should be looking at ways to accommodate that behaviour in our new facility designs."* He points out that most graziers house anyway at least part of the year. The tendency when housing is used for only part of the year is to invest less in it – which creates the potential for welfare-related issues. *"My research shows it is possible to build a sand bedded facility to such a high quality that cows don't lose anything significant in terms of health and welfare – all by maximising rest and reducing the risk for lameness."*

Bob Bignani of Brentwood Farms in California provides outside access. He keeps his cows in a series of large airy barns with outside loafing areas between. Most of the time they can get out, except when it's been raining. "*It just feels better to let them outside when they want,*" he says.

He's also made alleyways wider inside and tries to calve cows on pasture; inside, the cows are bedded on separated and composted solids, some on mattresses and some in deep beds, which the cows prefer.

In my view, not enough work has been carried out in the UK examining cow preference when optimum conditions are provided. The increase in cow lying time alone on deep sand

[49] The Effects of a Gel Mat Stall Surface on the Lying Behavior of Dairy Cattle, Main A, 2013 https://atrium.lib.uoguelph.ca/xmlui/bitstream/handle/10214/7529/Main_Alexa_201309_Msc.pdf?sequence=1

(as described by Dr Nigel Cook earlier in this chapter), aside from reductions in mastitis and SCC, lower lameness levels and reduced swellings and lesions, should be enough to indicate that studies examining preferences in these conditions are needed. It was clear to me on my tour that technology and understanding had advanced in leaps and bounds in the past decade; farmers are adopting the latest concepts in the UK but our research is trailing and more is needed to identify optimum conditions and risk under UK conditions. Many bold statements are made about what cows want, but the truth is we don't yet know what they prefer. If we are to have some cows in this country housed year round, we should be conducting research to establish what conditions those cows should be kept in to allow normal behaviour.

Penina Pestiger (*below*) has a small moshav (family farm) in the Golan Heights. Her 47 cows are the 5th highest-yielding herd in Israel at nearly 13,000kg per lactation. She doesn't aim for yield, but for good cow health and calm animals - and yield follows.

As environmental regulation prohibits cows going out in the cooler wetter winter, in the summer she drags the compost out into an open yard and finds the cows like lying there at night. *"They don't need to graze, but they do like to smell the air."*

10j. Welfare assurance

The predominant welfare assurance scheme in Great Britain – Red Tractor – has approximately 10,900 members producing over 95% of the country's milk[50]. It has recently announced a migration to outcome-based criteria for assessing welfare[51]. While it is not yet setting any thresholds for welfare 'achievements' among its members, this move is seen as a positive within the industry. Other schemes perceived as having higher welfare standards, eg Freedom Foods and Soil Association, are yet to adopt welfare outcome measures.

A newly published report from FAWC assessing welfare schemes[52] says: "*We believe that all assurance schemes should include outcomes measures as safeguards that welfare gains are being genuinely made (and that welfare is not being disadvantaged) by scheme adherence*." Welfare outcomes should therefore, in theory, provide an excellent route to truly gauge the health and wellbeing of cows irrespective of scale and system.

Finally, it is interesting to note that in Arla's Arlagården assurance standard, the following is stipulated as a recommendation[53]: *"The animals are kept on pasture when it benefits their health and welfare: we recommend that the animals come out to pasture. Animals on pasture are very visible to the outside world and the consumer and can therefore influence the farmer's and Arla Foods' image. Animal welfare however, is the most important consideration. Grazing is, for example, not beneficial to the animals, and is actually a health risk, during rainy periods when paths are muddy."*

This suggests that grazing is less about welfare and more about perceptions and retaining a connection with the public, as the Netherlands has recognised in its Grazing Covenant *(see Chapter 11d.)*.

[50] CHAWG First Annual Report www.chawg.org.uk
[51] http://assurance.redtractor.org.uk
[52] Review of the implications for animal welfare of farm assurance schemes, FAWC 2013 http://www.defra.gov.uk/fawc/files/Review-of-the-implications-for-animal-welfare-of-farm-assurance-schemes.pdf
[53] Quality Assurance Programme Arlagården http://www.arla.com/Images/arla.com/PDF/arlagaarden/Kvalitetsprogrammet-Arlagaarden_UK.pdf

11. Gaining 'social licence'

11a. Building relationships

Many new and expanding farms I saw in other countries had succeeded in gaining community support for their operations (called 'social licence' in Australia) because of sheer hard work with communication, attention to detail and relationship-building. Once this relationship was in place and being maintained, it created a much more solid base for any future expansion plans.

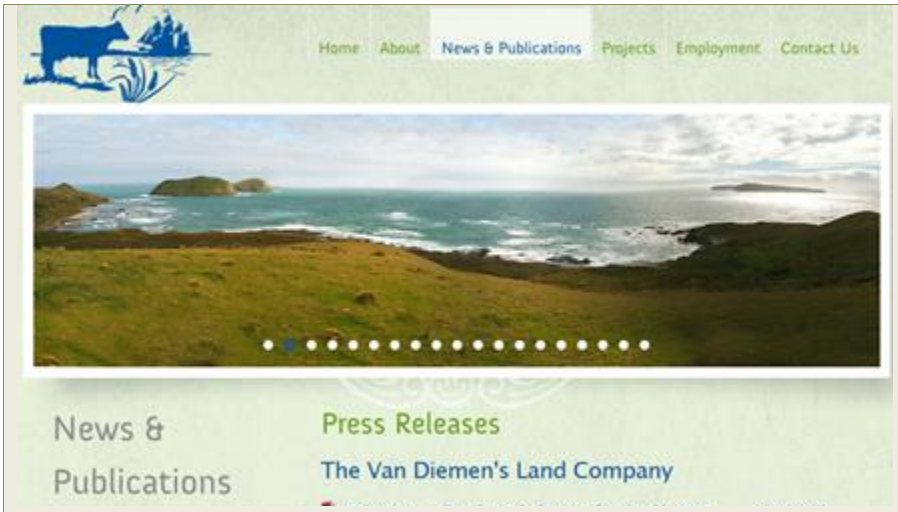
It hadn't been a quick win for most of them; there is little point in suddenly throwing yourself into building relationships when you already have a planning application on the table. Genuine, productive relationships with local communities based on mutual respect had been built over a period of years. The farmers saw it as an investment – and an insurance policy – for the future. So whether it was holding open days, barbecues, school outreach programmes or flying neighbours to existing farms in other states to see what they might expect, this rigour had paid dividends.

Peter Lundgaard at Bramming near Esbjerg works hard at public relations – he and his brother Søren are always inviting neighbours to see the year-round housed herd and, on open days, people come from as far as Esbjerg, 20 miles away. The brothers also keep the roads clean – the day before I visited they had been cutting maize but had cleaned and swept the roads afterwards, even though they were going back out harvesting again that afternoon.

They join other local farmers in donating funds to support the supply of milk to the local nursery school.

Milk Source is one of the largest dairy farming operations in Wisconsin. The farms have open days (see below) every year. Director Jim Ostrom says: "*We tend to take the approach that there will be inherent opposition. You cannot gain total acceptance in a local neighbourhood. You need to communicate with neighbours and county leaders and go through substantial opposition, and this will continue. But nevertheless we issue a quarterly newsletter to towns in the area, sponsor food fairs and the local baseball team. We give away gifts of cheese, clean our roads – and even other people's roads. We try to look after our staff and reward them for long service. Some of our employees have been here up to 25 years.*

A lot of farms will have a family member as a spokesperson. Larger farms are now employing a PR person. They open up to the public and try to develop a strong relationship."



Van Diemens Land Company farms in an environmentally sensitive part of Tasmania, and has made considerable efforts to improve its engagement with local communities and NGOs in the area. At the moment, it is involved in projects to create a refuge area for the Tasmanian Devil, which in other parts of the state is suffering from a tumour-forming disease. It has recently released plans to protect more than 70% of native vegetation on Woolnorth in formal and informal reserves.

11b. Respecting local wishes

Some of the steps that had been taken to engage local people include:

- Injecting and incorporating slurry rather than broadcasting it
- Introducing anaerobic digestion, which as well as being seen as an environmentally positive move, reduced smell
- Advance notification about spread of slurry; willingness to change plans if they were likely to cause significant disruption to a local event
- Creating a local liaison committee that would meet once or twice a year to air problems and communicate developments
- Sweeping roads
- Avoiding local villages during harvest time, or at least forcing contractors to slow down and minimise revving
- Sponsoring local events or football teams
- Holding community open days
- Producing local newsletters.

In east Germany, herds are larger but the population is sparse and employment lower; local people need the work and are less likely to raise objections. It's common to house cows here, but Torsten Zahm, one of the owners of a 1,000 cow farm on a large mixed operation near Rostock, says he recognises the importance of giving the local community access and minimising the farm's impact on their lives.

Of all his investments in cows and buildings and machinery, he says his best has been a road sweeper. *"Keeping the roads and neighbours' cars clean means the sweeper is worth its weight in gold."* Anyone can visit with just a phone call; the surplus heat from his four biodigesters warms the local football pitch changing rooms and the local fire-fighters' headquarters.

F Cobb & Sons farm near Dorchester in Dorset, UK. As well as a website outlining the business and how it operates, they issue a quarterly newsletter to the local community. *(see left)*

Both Glenapp Estate in Ayrshire and Littleton Farm in Dumfries-shire are excellent examples of how you can set up an informative website *(right)* that carries news and information to improve transparency.

11c. Family vs Corporate

One fear of a farm growing bigger is reduced accountability from its owners. A farm run hands-on by its owners or direct stakeholders tends to engender a greater feeling of trust – local people know who to go to and that that person is accessible, not living hundreds of miles away. Where the owner is absent or removed from day-to-day responsibility and the farm is run by management staff, it can sometimes be difficult to maintain standards.

Dairy Holdings based in Timaru, New Zealand, is one of the country's largest corporate dairy farming enterprises. Over the 2012/13 season, 58 dairy units on over 14,000 hectares milked more than 44,000 cows to produce approximately 15.41 million kilograms of milk solids.

Chief executive Colin Glass says corporate farming can be a tough sell to local communities, but it hinges on how they are run. *"There's no doubt it's trickier to get good results on farms where the staff are paid and have no stake in the business,"* he says. *"That's why the family faming model works so well – there's a personal stake and personal pride in what's happening, and what you do on a daily basis is translated into your milk cheque at the end of the month."*

Dairy Holdings harnesses this effect in its operations, aiming to have as many farms as possible under the profit-sharing schemes that are typical of New Zealand's open and accessible approach to new entrants in dairy farming. The business aims for a status of 'employer of choice' through Investors in People New Zealand (IIPNZ) because it recognises that motivated people perform better.

The structures of the farms break down into:

- Managed farms: Dairy Holdings provides the farm, livestock and plant and machinery resources; the milker/manager is paid a wage
- Contract Milking Agreement: the milker provides the plant and machinery and pays some costs; the milker is paid a fixed payment per kilogram of milk solids produced
- Lower Order sharemilking agreements: the sharemilker provides the plant and machinery necessary to operate the farm and may provide some of the livestock but receives a % contribution towards costs; sharemilkers are paid a fixed percentage of the value of milk solids produced
- 50/50 sharemilking: Dairy Holdings supplies the land, buildings and infrastructure, and the sharemilker provides the livestock, plant and machinery necessary to operate the farm; sharemilkers are paid 50% of the value of milk solids produced

This type of approach is only really feasible on simple pasture-based systems because of the low costs involved, and provides an excellent route into the industry for new entrants. Practically speaking, housed high input farms are never going to be able to offer the same openings because of the costs involved – but they can offer career development opportunities.

The structure of a large-scale unit means differentiation of roles and stratification of management – and also the provision of employee benefit schemes (pensions, healthcare etc), allowing a better quality of life for individual employees. Large-scale dairies are also more likely to invest in formalised CPD structures and staff training.

Jim Ostrom from Milk Source in Wisconsin says: "*We try to look after our staff and reward them for long service. Some of our employees have been here up to 25 years. We have awards for people who have given more than five years and we pay $8-$8.50 per hour as our starting wage, which will increase by up to $2 per hour in the first year as the employee gains experience. We encourage people to work their way up through the business – for example Juan Quezada was a milker in Texas and came to work for us in 1999. He became assistant herdsman and then corporate director of safety. Another employee, Ermith Ocampo, works just under one of our partners, John Vosters. He started as a milker, became a herdsmen, and now runs Calf Source, our calf-rearing unit, and now is livestock manager for the entire company. We have two bilingual people and interpreters. We offer both Spanish and English courses for employees. The average wage is $40,000 per year on our farms but there is also a bonus plan for front-line workers.*"

The largest cattle farm in Sweden is Wapnö, near Halmstad in the south. It milks 1,200 cows (the average in Sweden is less than 60 cows). It processes milk itself, which also makes it the smallest processing dairy in the country.

"*Wapnö has become a brand in its own right,*" says Ann-Christin Bengtsson (above). "*It is open every day and last year 50,000 visitors came to look at cows being milked and fed, calves being born and dairy products being made. There is a small hotel on site, and a restaurant; when I visited, a murder mystery weekend was being planned. School children also visit on a regular basis and 5,000 people come to see the cows turned out in the spring.*"

11d. Supporting smaller scale farming

As mentioned in Chapter 7d., Britain has a large population, a healthy demand for a diverse range of dairy products, and a big attachment to cows in fields and traditional family farming. However, with continual pressure on costs, the drive for economies of scale could well lead to a proliferation of larger farms which operate on known models that work, such as intensive grazing or housing. At this point, we need to ask whether the British public would find this acceptable. As campaign groups like to infer that cows will disappear from our fields for ever and small family farms will be driven out of business by megadairies, I suggest they know it's not an acceptable message for the public but also not for small family farmers.

Essentially, farmers grazing their cows or running small, traditional enterprises carry out an essential public relations role on behalf of the whole industry. The Dutch approach allows those who want to house to do so without impinging on others, on the understanding that consumers will still see cows in fields. It strikes me that a similar approach could work with small family businesses which may, at the moment, lack investment. Are there ways of supporting these smaller grazing farms that, despite being profitable, may lack the critical mass to generate the investment income they need?

In the US, Cornell University runs a small farms programme [54] specifically tailored to the needs of these small family businesses. There are also ways of adding value. In Wisconsin, Red Barn Farms is a marketing

In Holland, views of the pig and poultry industries are somewhat negative, says Petra Tielemans of the Dutch Sustainable Dairy Chain (a joint initiative between the dairy processors and farmers' union). *"They close their doors to keep ammonia in and emissions down, but they also keep people out, and this 'hidden' aspect has created concern. We didn't want the dairy industry to attract the same reaction. Seeing cows in fields reinforces the relationship between farm and consumer. It's in our own interests to protect that relationship."*

The answer, says Petra, has been to create a 'Covenant Weidegang' or 'Grazing Covenant' for Dutch milk that rewards farmers continuing to graze their cows in the summer, without detracting from those using housed systems. The covenant includes just about every organisation in the value chain, from processors to feed companies, retailers, government, NGOs and universities. It's become an industry movement to support grazing.

The concept, as the label states, is a simple one: "*This dairy product is made from Dutch meadow milk, sourced from farms where the cows spend at least 6 hours per day, 120 days a year between spring and autumn, on Dutch pasture."* Farmers who achieve this receive a premium of around €0.005 (around 0.43p)per litre. Some smaller co-ops, such as Cono, suppliers for Ben and Jerry's ice cream, can sometimes pay more. The grazing label is just used on domestically-consumer fresh produce, so Holland's large export market means only sufficient milk to meet processing needs – around 20% - has segregated collection. But all who produce in this way receive the premium.

[54] http://smallfarms.cornell.edu/

initiative that promotes the values of small family-run farms[55]. In the UK, Free Range Dairy[56] started by Nuffield scholar Neil Darwent is trying to raise awareness of the value of grass-based systems. Again, this is not scale but rather system specific, and is a concept of potential value to supporting a smaller family farm. While there are aspects to campaigns like this that detract from or can knock larger scale farms, if marketed on a positive-only basis, I can see the benefits to all.

Another way smaller family farms could gain an advantage is through co-operation. In Israel, this concept runs through the veins of all business, whether it's a formal co-op or a cluster of smaller family businesses working together. This does not have to take a conventional form – it could mean several farms collaborating, with one farmer leading on cow management, another on finances, and a third dealing with arable operations – each playing to inherent strengths. The opportunity to form Producer Groups in Britain must present some opportunities for smaller farms to work together in this positive way.

It is evident that if the industry as a whole wishes to find ways to expand its milk production, part of the 'deal' to gaining social licence for larger scale farms is to find ways to actively support and promote smaller, more traditional operations. It may be through brand development, co-operation or support programmes, but thriving operations at that end of the scale will quieten fears about expansion at the opposite end.

Israeli farms split into two main types – the 'Kibbutz' where families and individuals co-operate on a formal basis, living together and working on a number of different enterprises of which farming is just one – and the 'Moshav', family farms, which buy into the business benefits of collaboration by clustering their farms together on the same site. There are 270 'kibbutzim' in Israel, accounting for 40% of the country's agricultural output. Of these, around 160 have dairy herds of between 300 and 2,000 cows.

By comparison, 'Moshavim' family farms are smaller – generally 70–120 cows. They group themselves, 5-12 farms to a site, and together run a communal 'feed station' (*pictured above*) which employs a specialist to source the ingredients, devise the ration and load up the farms' feed wagons every day. A farm doesn't need to have land attached to it, but if it does, it's usually contracted back to the feed station to grow forage, mostly sorghum silage and wholecrop wheat.

[55] http://www.redbarnfamilyfarms.com/
[56] http://www.freerangedairy.org/

12. Engaging regulators and planners

12a. Local planning

Much is made by campaigners of the potential of negative local impact from planned new developments. But it is fair to accept that as with any potentially intrusive development, local communities will want to know what impact the proposal will have on their quality of life and their surroundings. Most of these issues are dealt with under planning law and the Environmental Impact Assessment, and can be summarised as:

- Water – surface and ground water and water resources, to look at whether the proposal will create flooding issues or reduce the quality or quantity of water available in the area
- Air Quality and Amenity – whether the proposal will release any pathogens or pollutants to the air, be it from the farm itself or any anaerobic digestion or other operation, which could affect human, animal or plant life; whether the farm will cause an increase in fly or pest populations and how the farm plans to control this
- Smell – whether the farm itself or any of its waste operations (including the spreading of slurry or digestate) could cause nuisance or loss of amenity; some councils now request odour mapping or spreading agreements to be submitted in planning applications
- Acoustics – whether the development will cause noise nuisance at any time of the day or night to any nearby property
- Traffic and Transport – whether the development will significantly increase traffic movements and risk of accidents, or whether it will reduce safety generally
- Visual impact – whether the development will be visible from various vantage points and whether that constitutes a blight on the landscape or is out of character with the surroundings; photomontages are increasingly used to show how the development would look in the context of the existing surroundings
- Lighting – whether the farm's lighting will change the 'night-time' landscape and cause light pollution

There is no need to go into these in detail as they are technical issues and failure to satisfy the authorities on any of these may well result in a recommendation for refusal. However, these are important aspects to be aware of because they are valid grounds for objection that are frequently used against planning applications, and are also arguments used in PR campaigns.

In some situations, the planning authority will ask for an Environmental Risk Assessment (EIA) to be completed that covers all of the above and many more factors in exhaustive detail. Pig and poultry units rarely have to complete an EIA because they will usually be applying for an Integrated Pollution Prevention and Control (IPPC) permit which already covers the majority of these factors, but several dairy farm applicants have been asked to submit EIAs in the UK recently.

One important point to note is that there is now a track record of local campaign groups becoming organised and teaming up with national lobbying and campaign groups to share a common goal of stopping large-scale farming developments. The local groups are mainly concerned about the impacts mentioned above, but they share the aim of national or international objector groups and

can feed in critical local knowledge to the campaigns.

Equally, the larger groups can supply essential funding and manpower to local operations. Examples of this have been seen with the 8,100 - then-3,770-cow dairy application at Nocton Dairies (CAFFO[57]), the 2,500 pig farm application at Foston (Foston Community Forum), the 1,000-cow dairy expansion at Leighton Farm in Welshpool (CALFe[58]) and the application for 330,000 broilers at Bletchley (Bletchley Broiling Point[59]). It is unlikely the national campaign groups would have had a fraction of the impact if they had not had the foothold in the shape of the local campaign group.

Looking at the nature of objections and campaigning against new or expanding dairy developments, I compiled a rough guide to what I understand as the 'trigger factors' in a local campaign starting and gathering momentum to the point where it starts to cause obstacles. This is shown in the chart below.

It is interesting to note a number of quiet expansions taking place around the UK, with little or no attention. The key difference appears to be the presence of a local campaign group of concerned residents. With no local group of a critical mass, the development often stays below the 'radar' and any national campaign groups taking an interest lack the critical local contacts to gain traction for the campaign.

Table 10: Summary of situations when community objections are more likely to arise

Factor	Least Resistance	Most Resistance
Scale	Under 200 cows	Over 1,000 cows (four figures is seen as a critical threshold)
Precedent	Already in existence – expansion only	New greenfield development
Enterprise type	Typical to that area/familiarity among communities and planners	Atypical in that area/unfamiliar to communities/planners
System	Involves outdoor access/ perceived freedom of movement	Permanent housing
System	In line with common perceptions of system for that species	Perceived as a novel system for that species
Location	More industrialised or poorer rural area	Near heritage sites, AONBs etc.
Proximity to neighbours	Distant, with no sensitive groups nearby	Close/bordering, with schools, hospitals, retirement homes etc
Local Communities	Largely rural, long standing, strong association with local agribusinesses	Large percentage of incomers, affluent, less connection to local agribusinesses
Applicant	Long history in the area	New to area/absentee farmer or corporate entity
Applicant	Has established communications routes and engagement with communities	No existing routes of communication or engagement with communities

[57] http://www.caffo.co.uk/
[58] http://www.support-calfe.org.uk/
[59] http://www.facebook.com/BletchleyBroilingPoint

Gressingham Ducks near Woodbridge in Suffolk sells 7-8m birds a year, and counts Waitrose among its customers. Half the ducks are reared on its own farms, the rest contract-reared by a set of selected farmers around East Anglia. Technical director Steve Urwin (below) says the business frequently submits applications for new rearing facilities for its farmers.

"W*here we've been successful is in establishing a really good precedent the planners can work from,"* says Steve. *"For example, we set up one unit for 12,000 ducks, on an 80 x 220m site that was tightly controlled in an existing farmyard. Once that was up and running, local people, the council and the Environment Agency could all see how successfully it was being managed with minimal impact. From that point we have now expanded into three other houses on the site, and everyone is satisfied that these are well-run units that will have minimal impact on those around them.*

"The biggest barrier is fear of the unknown – you need to get on the front foot and dispel that fear. Don't talk about profits or sustainability. Talk about the impact on local people – vehicle movements, light, noise etc. You need to take your production hat off and look at benefits to the community in an open and honest way."

Steve says they only go for sites where they feel there is a good chance of securing permission. *"We backed out of one application because we could see it was going to cost us a huge amount of money with no certainty of success. We didn't do our homework on that site or spend time getting to understand local concerns and talking to local people. You have to remember that the default position is to say 'No' – you have to give people reasons to say 'Yes'."*

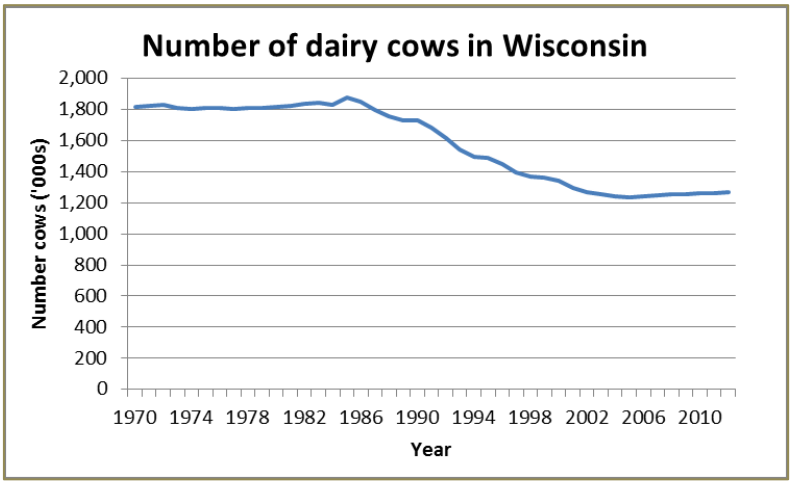
"*The IPCC process is a useful one if handled right. It shows a track record which gives people confidence. Gressingham secures planning then goes for the IPPC certificate afterwards, as the work carried out for planning feeds straight into the IPPC, saving time and costs. In my dealings with the Environment Agency, while the basics must be right, much of the success is about the individual contact. You have to try and find a person who has had experience of the type of proposal you are dealing with, and you need to be able to talk their language. It's all about the individual*."

The Gressingham Approach:

1. Talk to neighbours and all possible stake-holders, eg the WI, local ramblers – go in with a plan they can envisage. The one-to-one approach is best; try to avoid exhibit-tions and public meetings where people congregate and can work themselves up a head of steam. Concerns are often personal and unique to that individual, so deal with them separately. Take comments on board for investigation and resolution where possible.
2. Use local employees to discuss the plan with local residents; never hide behind agents or organisations. Be accountable and visible.
3. Carry out some strategic tree planting or screening in advance to help with visual impact.
4. Hold a pre-application meeting with the council to seek advice (may be a fee attached); ask for first impressions and chances of approval; take officers (and councillors if possible) to the site – demonstrate where, who, how… let them wander around. Take them to another site to show them a precedent if possible. Let them meet the team.
5. Feed back to your stake holders – about the concerns and how you are resolving them or why you can't. Show you've taken their views on board and repeat their words back to them so they know you have listened.
6. Submit the application once local and planning concerns have been tackled so that you can have as much confidence as possible in your proposal.

In Wisconsin at the turn of the millennium, the dairy industry was facing a similar crisis to the one the UK industry could be facing shortly, in that there was a rapid exodus of dairy farmers from the industry.

Figure 17: Dairy cow numbers in Wisconsin
(Source: USDA)



In fact, from being the highest producing state for milk in the US with cow numbers equal to ours, it lost half a million cows and looked set for further deterioration, partly due to confusing and inconsistent regulation around applications to develop livestock sites. Interestingly, this in itself disproves the theory that large farms push out small, as discussed in Chapter 8a.

What changed all this was the Livestock Facility Siting Law (2003 Act 235), enacted in 2004, which was designed to reform local regulation affecting livestock facilities. The law is intended to ensure a more predictable and fairer system of local regulation. While the law retains local authority input to control rural land use through planning and zoning, it mandates that local governments follow state standards and procedures if they require individual approval for new and expanding livestock facilities. Central to the siting law are standards that local governments must apply whenever they make decisions to approve or deny applications for livestock facilities.

These state siting standards protect air and water quality, while providing the livestock industry a predictable regulatory framework within which to grow and modernise. This is in recognition of the significant strategic importance of farming to Wisconsin's economy.

The Wisconsin Dairy Business Association (DBA) was largely instrumental in lobbying for the law. It is a state-wide organisation of dairy producers, processors, industry partners, and professionals actively working to assure that… *"dairy producers, large and small, remain an active, thriving part of Wisconsin's economy, communities, and food chain".*

12b. Environmental regulation

During the Nocton Dairies controversy, the Environment Agency was statutory consultee for a project for which it had no precedent. Unfamiliar with the scope of the project, its size, the system and the protocols it would be working under, it appeared to apply the precautionary principle and asked that all aspects of the plan were underpinned by proven examples. The problem was that as a completely novel proposal in the UK, there were no case studies from which to draw.

This is not an uncommon problem as planners and regulators come under increasing pressure from local campaigners who simply do not want enlarged agricultural developments on their doorstep. This has been exacerbated by the Localism Act[60], which was not in force during the Nocton Dairies planning application, but it is now and is likely to cause issues as it places significantly more influence in the hands of local people over issues that make a big difference to their lives.

[60] A Plain English Guide to the Localism Act, Department for Communities and Local Government Nov 2011

The Tuls family have been farming in Nebraska for many generations but wanted to expand into Wisconsin. It was suggested that Rock Prairie near Janesville was a good site but relationships needed to be established with the local community. Nine different landowners and 5,200 acres of land needed to be tied into the agreement to grow crops and take the manure. Between six and seven months were spent cultivating relationships. A private jet was chartered to take the neighbours down to Nebraska to see how the Tuls family operated on their existing farms. Then the permitting process began.

This involved an application to the Department of National Resources as well as dealing with county and state officials, and the local township. It was important to address people's concerns.

Originally it was proposed that the land would be irrigated by a centre pivot but this was opposed and instead draglines were requested. A digester was considered but the cost was too high and it would have been too expensive to clean and maintain because of the sand bedding. T J Tuls (on left), who runs Rock Prairies Dairy, says: "*Four or five people were determined to stop the project. One lady wanted continual monitoring so we decided we would install six monitors rather than the eight she requested, at a cost of $25,000 each. Third-party monitoring is carried out once a month which is paid for by the farm; this costs $1,000 per month. Prior to the permission being granted, an exhibition was held with 3-D models to show what the site would look like. There was a question and answer session with a nutritionist, and an opportunity for people to interrogate the management team. It was a big project but family-run, although I live eight miles away. A public hearing was held in Janesville which between 500 and 750 people attended".*

Many would perceive that a large dairy farm would create disruption, especially given the negative publicity arising from the Nocton Dairies application, and as specialised grazing farms require minimal infrastructure, it is going to be the farms housing cows that will suffer most under this legislation.

Nowadays, the Environment Agency has made efforts to clarify that the risk from pollution comes from underinvested, older dairies rather than new facilities using the latest technology[61]. But overall, a lack of familiarity with large scale dairy systems among statutory consultees and local communities is a significant and growing issue. While it could be argued that many farmers carry out insufficient communication with local stakeholders in the run up to an application there is no doubt that given the option, many local communities would opt against having a large scale agricultural development on their doorstep.

Another area that could cause more issues in the future is ammonia emissions, which are already a regulatory problem in Denmark and the Netherlands (see Chapter 9b.). Planners and regulators are particularly concerned about these in relation to sensitive receptors – human or plant.

[61] Building or expanding dairy units, Environment Agency 2011 http://www.environment-agency.gov.uk/research/library/position/130513.aspx

Overall, the larger the farm, the increased likelihood of concerns being raised; housed farms are more likely to be applying for planning permission as they need more infrastructure, hence the plans are more likely to come under scrutiny; and large housed farms with unfamiliar facilities and lots of concrete are again going to attract more attention than applications to build a simple feedpad. Hence potential environmental impact could be a significant barrier to expanding into a housed system if not proactively handled.

12c. Self-regulation

As well as assisting with planning issues, the Wisconsin DBA helps administer, for its members, the Green Tier programme run by Wisconsin's Department of Natural Resources (DNR). There are just over 80 businesses and 200 facilities from all sectors involved in Green Tier – but only three dairy businesses at present. Green Tier is an alternative framework to manage environmental issues. It was piloted in 1996 and came into effect in 2004.

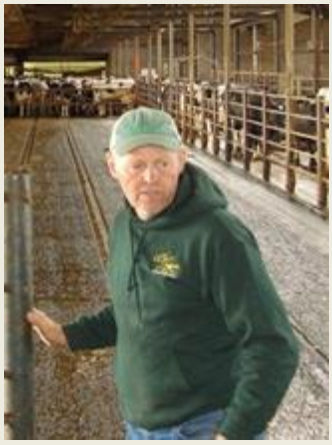
The premise is that if a business is committed to systematically managing its full environmental footprint, and operating a superior and improving system, the DNR can treat you differently. It is all based on the principle of an environmental management and auditing scheme (EMAS). It's not just about being compliant, it's about operating above compliance levels. This differentiates the leaders and gives DNR a reduced workload in relation to these operators.

12d. Animal welfare

A quick note about welfare – it is not currently a material planning consideration, therefore people cannot object to a planning application on the basis of the impact on welfare. While this might seem a blessing to some, it leads to a 'trial by public jury' orchestrated by animal welfare pressure groups, rather than placing an authoritative impartial export in the role of decision-maker. It also leads to a plethora of objections on other grounds, for example, local impact, environment etc.

GREEN TIER

Kenn Buelow is the winner of an Award for Outstanding Dairy Farm Sustainability and one of the three farms in Wisconsin under Green Tier. He says it costs around $25,000 (£16,000) a year between paperwork and managing compliancy on his two 4,000-cow units. But at just over $3 (£2) per cow, the savings the system identifies through good management and better use of resources – and the good publicity it generates – are more than worth it. He also believes the planning permission to build the second of his dairies was much easier to obtain because of his successful membership of Green Tier with his first site.



"I like the EMAS approach because it looks at impacts. It's possible to rank these and start making plans to reduce the biggest ones – for example we made sure our new dairy used gravity flow where possible to move waste and water. The main areas of focus are surface and groundwater, air, traffic, safety, regulations, and CO_2. EMAS is a way to build confidence about farming in a non-agricultural world. It's internationally accredited and a recognised standard."

13. The role of campaign groups

It has been the campaign groups that have really shaped the narrative over larger scale dairy farming. Grazing systems hold little interest for them – instead it is the housed systems that offer the greatest potential to further their campaigns. The World Society for the Protection of Animals (WSPA) has freely admitted it jumped on the bandwagon objecting to the Nocton Dairies proposal, but has gone on to dedicate a 5-year campaign to the issue. "*We were looking for a cause to raise our profile with our UK supporters. Nocton appeared out of nowhere and fitted everything we stood against. We were completely opportunist*[62]*,"* it says.

Compassion in World Farming (CIWF) uses the slogan 'Cows Belong in Fields', a quote also borne out of the Nocton Dairies era, and objects to what is sees as a damaging direction of travel for UK dairy herds. It has stated: "*We see the trend toward larger-scale industrialised farming as a real concern. When it comes to animal well-being, scale per-se may not be the issue…..however, it often indicates a serious underlying threat to animal welfare. Large farms can also pose health risks and, in some cases, have negative effects on the environment*."

Interestingly, the RSPCA has resisted involvement in the debate over megadairies but has confirmed that while its standards[63] will always insist on access to the outside/pasture, the size of farm is not the key issue in relation to the welfare of the animals. "It is the conditions, stockmanship and overall husbandry which are the factors which contribute to the overall welfare status of the animals. It is whether the farming operation, regardless of size, can meet the welfare needs of each individual animal that really matters," a recent position statement[64] says.

13a. Emotive language

There was frequent use of emotive and misleading language from campaign groups during the Nocton Dairies application. For example an IPSOS Mori poll[65] conducted by WSPA used the following statement within the survey: *"There is a proposal for a new dairy farm in the UK, which would produce milk from around eight thousand cows in large indoor dairy sheds. The cows would spend most of the time indoors, only being able to graze outdoors when they are not able to produce milk."*

However, when the survey results, were used within an Early Day Motion[66], this had been rephrased to *"factory milk from battery cows".* The use of 'battery' meaning 'intensive' by campaign groups is increasingly common, but misleading when considering common understanding of the word. I have

[62] "Stopping the 'super dairy' – the inside story", Farmers Weekly 24 February 2011

[63] http://www.rspca.org.uk/ImageLocator/LocateAsset?asset=document&assetId=1232726216807&mode=prd

[64] Large scale farming, a position paper on dairy production, RSPCA 2013

[65] http://www.ipsos-mori.com/Assets/Docs/Polls/WSPA_dairy_Topline_140610.pdf

[66] http://www.parliament.uk/edm/2010-12/942

seen a survey of over 2,000 members of the public in which more than half say the use of the word 'battery' in association with dairy farming would mean cows kept in cages. The irony is that for new year-round housed facilities in the UK, cows are likely to have more room or better facilities than many of those housed just over the winter period.

But in the interests of creating impact, arguments put forward in campaigns often lack coherency. For example, there has been much modification of the behaviour of household pets to suit changing human lifestyles. In fact, people for the Ethical Treatment of Animals (PETA) advises owners of cats to keep their pets indoors permanently to reduce risk of harm or even death[67], yet PETA actively campaigns against housed cattle, which it says are kept in 'cramped, filthy conditions[68].

Comparisons drawn by campaign groups between indoor ('bad') and pasture-based ('good') systems continue to be extreme. For example, CIWF says:[69] *"Dairy farming is at a crossroads, with indoor 'zero-grazing' on the rise. Please vote in our poll and tell us what sort of future you want to see for Europe's dairy cows – A or B." (see photos below).*

WSPA (see above) is equally emotive[70]: *"It's simple, right? Milk comes from cows. Cows that live in fields and graze on grass. Think again. Across Europe, cows are increasingly being confined in factory-style farms. They may never see the sky, feel the sun, or graze on grass. Crowded together, the cows are more likely to suffer from stress, lameness and painful infections. Producing huge quantities of milk, these exhausted animals are often culled early, living shorter lives than they*

[67] http://www.peta.org/living/companion-animals/indoor-cats.aspx

[68] http://blog.peta.org.uk/2010/10/zero-grazing-hell-for-cows/

[69] http://www.ciwf.org.uk/farm_animals/cows/dairy_cows/vote_now_where_do_you_want_our_milk_to_come_from/default.aspx

[70] http://e-activist.com/ea-action/action?ea.client.id=24&ea.campaign.id=17077

should. Help us tell your supermarket that you are backing WSPA's call to keep cows on grass. In the UK, we still enjoy seeing around 90 per cent of our cows roaming and grazing in fields from spring through to autumn. But this also means that around 10 per cent of our cows are already confined indoors. Right now in the UK, your pint of milk, carton of yogurt or slab of cheese may contain milk from cows that never see grass. We need you to help us tell your supermarket that you want to know where your milk comes from."

13b. Pressure on retailers

The tactic of placing pressure on retailers so that they, in turn, apply that pressure back up the supply chain, was one used during the campaign against Nocton Dairies when supermarkets were asked by campaign groups whether they would buy milk for their customers from large-scale indoor dairies. While The Independent reported that supermarkets would blacklist such milk[71], the words used were less clear.

In fact, the Dairy Industry Newsletter pointed out that most supermarkets are already sourcing from the largest farms in the country, most of which are indoors-based[72]. However, this does show the retailers will keep a keen eye on public opinion, and perceived widespread criticism for such systems could mean fewer market options for such milk, irrespective of the evidence.

At the moment with milk being in such short supply this is not a problem. But if milk production rises significantly in the UK, we could encounter greater selectivity against certain farming systems. Ironically, milk production is unlikely to rise significantly unless such farms create the volume required (see Chapters 4, 5 and 6).

[71] http://www.independent.co.uk/life-style/food-and-drink/news/supermarkets-turn-noses-up-at-megadairy-milk-2137056.html

[72] https://dl.dropboxusercontent.com/u/45053136/Dairy%20Industry%20Newsletter.pdf

Sustainable Conservation

Pressure groups don't have to take an antagonistic approach to getting their way. Sustainable Conservation (Suscon) in California believes that protecting the environment can also be good for business. It says its climate, air, water and wildlife initiatives promote practical solutions that produce tangible, lasting benefits for the state. Over the past two decades, Suscon has partnered with some of the state's key industries – including the $4.5bn farming and $2.6bn horticultural industries – to make clean air and water, thriving wildlife and a healthy climate 'business as usual'.

Projects include Cow Power – partnering with California's dairy industry to trap greenhouse gases and produce renewable energy from cow manure. Since 2003, Suscon says it has reduced California agriculture's greenhouse gas emissions by 12,000 tons – equivalent to taking 40,000 cars off the road. Teaming up with farming, industry and regulatory leaders, it put the country's first 'cow powered' commercial vehicles on the road to cut greenhouse gases and promote clean, renewable energy. Another faming-related project is Clean-Air Farming – expanding innovative, low-impact farming practices like conservation tillage in California's Central Valley to cut farm-generated air pollution. Through conser-vation tillage, Suscon's farming partners have cut dust and diesel emissions by 70% and 45% respectively, since 2003.

All the main retailers have now set up standards for their direct suppliers, which are often managed with the help of a vet practice or university. However, this only accounts for the ~20% of milk that is on direct aligned contracts[73].

[73] DairyCo DairyLeader http://www.dairyco.org.uk/resources-

13c. Calls for an EU Directive on dairy cow welfare

A recent campaign by a consortium of Ben and Jerry's (ice cream), WSPA and CIWF has seen them invest over £345,000[74] in an effort to create EU-wide legislation concerning the welfare of the dairy cow. It was originally on the EU petition site but now being progressed through a private petition on www.happycows.eu.

While the titles of Good Housing, Good Feeding, Good Health and Appropriate Behaviour are 'in line with the four EU Welfare Quality principles[75]' only a few aspects under these titles match the findings of the EU project completed in 2009, and only two of the 15 recommendations are outcome-related – the others being prescriptive regarding facilities and system.

In publicising this campaign, the impression is given that there are no rules in the EU governing dairy cow welfare: "*Europe is home to around 23 million dairy cows, but there are no specific rules to protect their welfare as there are with pigs and chickens,*" whereas there are a myriad of rules and regulation in different countries. In fact, FAWC set out legislation protecting the dairy cow in the UK in its 'Opinion of the welfare of the dairy cow' report[76]:

- The Animal Welfare Act 2006 in England and Wales Animal Health and Welfare Act 2006 in Scotland states it is an offence to cause unnecessary suffering to any animal and reasonable steps must be taken to ensure that the needs of animals are met.
- The Welfare of Farmed Animals (England) Regulations 2007 and similar legislation in Scotland and Wales translate EU directives that set down minimum standards for the protection of all farmed livestock. Schedule 1 contains specific requirements, relating to inspections, record keeping, freedom of movement, buildings and equipment and feeding and watering. Cattle are subject to additional provisions in Schedule 7.
- Welfare Codes set out statutory requirements and also communicate best practice. Livestock farmers and employers are required by law to ensure that all those attending livestock are familiar with and have access to the relevant Codes.
- The Conventions of the Council of Europe relating to the protection of animals provide additional safeguards for the welfare of animals. The underlying three principles of the Convention on the Protection of Animals Kept for Farming Purposes and of its recommendations on welfare set out conditions to avoid any unnecessary suffering or injury, and the requirement to take physiological and behavioural needs into account.

library/technical-information/dairyleader/dairyleader-issue-1/

[74] http://ec.europa.eu/citizens-initiative/public/initiatives/obsolete/details/2012/000004

[75] EU Welfare Quality http://www.welfarequality.net/everyone/43299/7/0/22

[76] Opinion on the welfare of the dairy cow, FAWC 2009 http://www.fawc.org.uk/pdf/dcwelfar-091022.pdf

Some industries work very positively with campaign or pressure groups. Scottish Sea Farms near Oban was the first to receive full Freedom Foods accreditation from the RSPCA. Now supplying all M&S salmon under the Lochmuir brand, the business trades on high welfare and the best standards. This, says quality manager John Barrington (pictured, next to the large inlet pipe through which fish are uploaded to the processing plant), has been the result of a long term constructive relationship with the charity.

One of the requirements was to reduce stocking density. While at first this might have seemed counterproductive, they worked with RSPCA to look at the impacts. *"The results showed that while lower stocking rates would potentially yield less salmon meat, the flipside included reduced handling, fewer grading sessions, better survival rates and less disease – which overcame the effects of reducing the number of fish reared,"* explains John. *"Once we made changes to the stocking densities in our seawater standards, we started looking at our freshwater farming. The RSPCA felt these stocking densities were too high as well so we worked together to gain evidence because in these different conditions, our farmers were less convinced about the economics of reducing stocks. So we established some welfare indicators and looked at the issue from all angles.*

"There were costs involved to start with – we were happy to absorb those costs but having different management techniques has more than paid for them. It was a very positive experience working with the RSPCA – they understand we want the best fish possible and that our farmers need to make a living. We're now working with the WWF on a number of sustainability projects as well."

There has been other evidence of campaign groups working constructively with industry – in fact CIWF has worked with Gressingham Ducks to achieve high welfare standards. It also worked with Midlands Pig Producers on their plans for a very large pig unit in Foston, Derbyshire, which is still pending planning permission following widespread objections led by The Soil Association.

13d. Where from here?

I visited WSPA, CIWF and RSPCA twice apiece to discuss their views about large scale dairy farming. Their responses were enlightening – my interviews with WSPA and CIWF as the two main campaign groups opposing 'mega-dairies' can be seen in **Appendices I and II**.

I realised that the campaigning and science sides of these charities can have radically different levels of understanding about an issue, and different priorities. But their *modus operandi* is to create a wave of pressure, through negative publicity, to force an industry to the table – then talk constructively. It has worked with pig and poultry, they say. It will work with dairy.

However, grazing cows need to obtain their nutrition directly from the land on which they graze – herein lies the difference with free range hens. I also believe the divergence into intensive grazing and housing will continue.

This will inevitably result in more housing as one of the two directions, accelerated in some cases by reducing land availability and increasing prices, and by the potential of generating renewable energy or using locally-produced by-products to lower feed costs.

Another of these groups' campaigns – Labelling Matters[77] – aims to enforce method-of-production labelling on all animal produce.

The problem is that unlike pigs and poultry, there is no hard and fast method such as 'caged' or 'free-range' in dairy. Some farmers who house will put cows out *sometimes* or *some* cows out. Some who graze will house when needed. Cows who are housed will almost always have fresh or ensiled grass in their diets, therefore they are grass-fed. Given this situation – and the continuing lack of any compelling evidence that housing is in fact any better or worse than other systems, how can differences be reconciled and progress achieved?

[77] http://www.labellingmatters.org/

14. Engaging farmers

Animal welfare pressure groups often say that farmers themselves don't want 'megadairies'. I was keen to find out what farmers' views really were on the concept of large scale farming, so I carried out a small survey, to which I received 108 responses – not statistically representative of the farming industry by any means, but a useful exercise nonetheless. (*See Table 11 below*).

Here is a breakdown of the respondents by their production system – high input housing year round, housing high yielders and grazing others, a traditional 'composite' system which housed in the winter and grazed in the summer, and specialist grazers.

The attitudes towards large scale dairies – and by this I was perceiving that the majority would be thinking of housed systems – were telling. In response to the question, "Large scale dairies are…..", the following responses were collected (*see Table 12 below*):

This showed that far more producers in this sample had a positive attitude towards large scale dairy farming than negative. Where a large proportion of farmers had concerns was over the damage to the public perception of farming, which related more to how the issue was being presented or 'spun' by others than resistance to the developments themselves.

I broke this down further according to the system the respondent was operating. There were also four operating robotic systems which I didn't include at this level because the sample size was so small.

Table 11: Breakdown of survey sample by system

	Traditional composite	House high yielders	House all year-round	Graze	Robot
Percentage of sample (%)	55	17	11	14	4
Average herd size (cows)	194	346	522	534	161
Average yield/cow (l)	7740	8796	9883	5395	9350
Average replacement rate (%)	20	23	25	20	27

Table 12: Breakdown of survey sample by response to 'Large scale dairies are…'

… capable of being presented in a more positive light	68%
… acceptable within a diverse dairy farming system mix	56%
… damaging to the public's perception of dairy farming	53%
… inevitable	48%
….a big fuss over nothing	33%
… important if the UK is to retain its milk producing capacity	30%
… exciting	28%
… likely to take over the whole industry	16%
… a threat to my business	11%
… all the negative things they've been made out to be	8%
… splitting the industry apart	8%

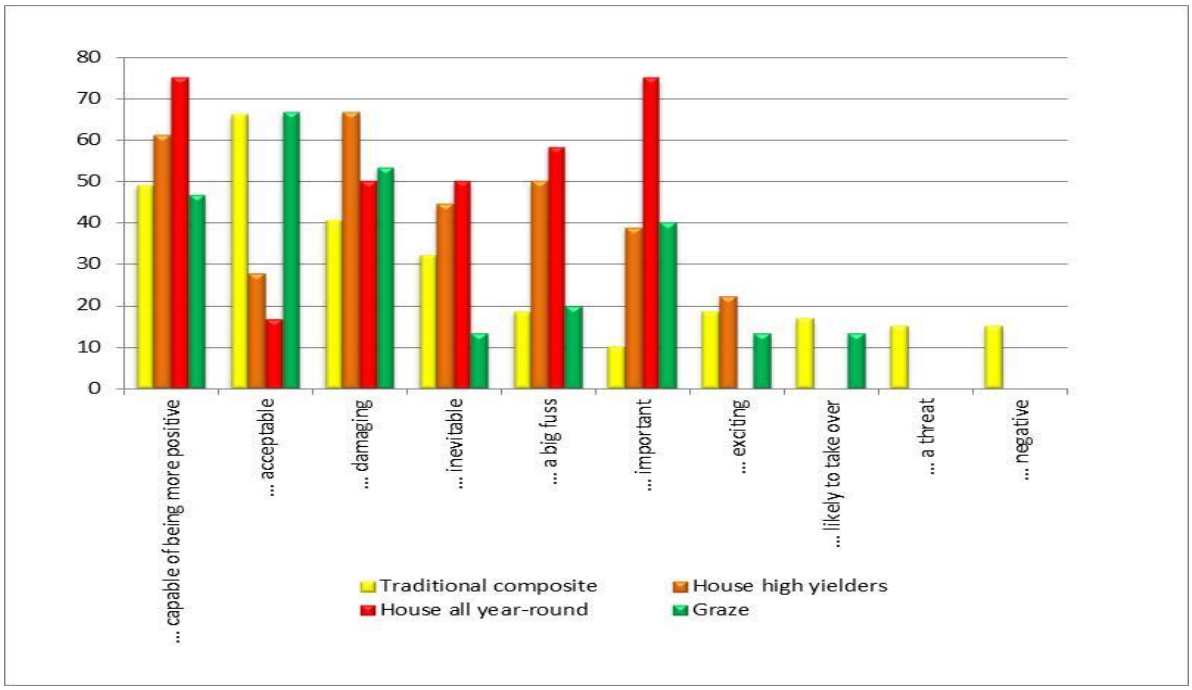


Figure 18: Breakdown of survey sample responses to 'Large scale dairies are…' by system

This indicated to me that grazing and composite farmers are actually quite tolerant about large scale developments and only the composite really had concerns about them being a threat to their business and all the negative things they'd been made out to be. This makes sense when you realise that apart from the four using robots, they have the smallest average herd size in the sample.

Notably, fewer than half of farmers, except those housing year round, felt large scale farming was important to keep British milk production up. This is in stark contrast to the 'call to action' I saw in Ireland, focusing famers and the industry towards the goal of 2020 when milk production was going to increase by 50%[78]. I believe we are missing a common goal and in lacking this, we can resort to in-fighting.

Lastly, the reasons for using the system they did showed a strong recognition of the profitability of grazing-based systems among its users, and a solid appreciation of the health and welfare needs of what are most likely Holstein cows among those using the housed system.

See Figure 19: Breakdown of survey sample responses to why that system is used, by system, on next page

[78] Food Harvest 2020, Department of Agriculture, Food and the Marine, Ireland, 2012

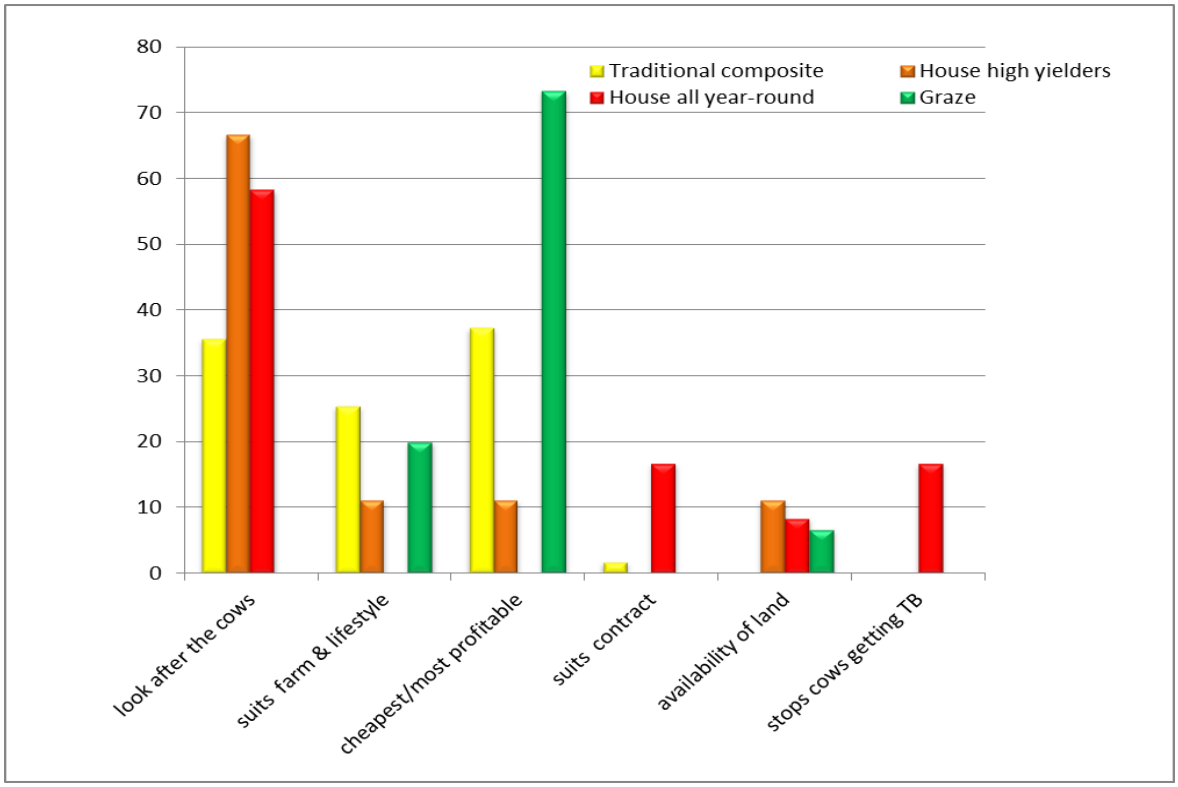


Figure 19: Breakdown of survey sample responses to why that system is used, by system

15. Engaging the public

For years, the British dairy industry has been perpetuating an image of black and white cows on green fields, when in fact the figures in Chapter 7c. – Britain's balance and scale and system – suggest that between winter housing, buffer feeding and housed systems, 50% or more of Britain's 'cow hours' are spent indoors. No wonder so few of Britain's consumers are even aware they tend not to see dairy cows out in fields over the winter.

It's hard to know what the genuine public reaction to large scale dairy farming is, as too often polls or surveys are commissioned by those with an agenda, one way or the other, hence the wording of the survey is leading in itself. Large scale grazing farms are always going to be an easier sell to the public than housed units, but the experiences of those large scale housed farmers in all sectors opening their doors to the public on Open Farm Sunday in June are that very few people react against their farms and are genuinely interested. This suggests that allowing people to see what it's all about, experience it first hand and make up their own mind is the best way to create a valid opinion. But these days, with the advent of 'clicktivism' where a simple concept can be presented through social media to garner wide-scale, albeit potentially superficial, support for a cause, how does the industry communicate the ways in which it is evolving the way it farms?

US Farmers and Ranchers comprises more than 80 farmer and rancher-led organisations and agricultural partners representing virtually all aspects of agriculture. It works to engage consumers in a dialogue about how today's food is produced. What is interesting is its exceptionally robust approach to the issue. With the help of a healthy $10m budget, it is: uniting cropping and livestock areas of farming; engaging consumers in conversation rather than telling them[79]; leading that conversation and setting the agenda; driven by a long term commitment; and using the same sources and platforms from which influencers obtain their information. It's a very grown-up, smart concept and it's been given the resources to do its job.

USFRA founded its strategy on some ground-breaking research that established what the public did and didn't want to hear. The research found that consumers were most concerned about long term health. Anything deemed 'not natural' was a threat. And most interestingly, using science did not help. It was a revelation to find that when we say "*the amount is miniscule", "research shows it is safe", "let's feed the world", "give people choices", "keep prices low" or "it's better for the environment*", we're saying things that few members of the public can actually relate to.

In terms of subjects like animal welfare, people simply wanted to know animals aren't being abused. So messaging focuses on how standards are being tightened and training implemented, and that the consequences of doing the wrong thing – such as stricter penalties – are being well-publicised. Regarding antibiotic use, people want to know concerns are recognised and farmers are

[79] http://www.fooddialogues.com/

you say	they hear
SAFE	"We don't know if pesticides, antibiotics or hormones are safe in the long-term"
AFFORDABLE	"How? At what expense to quality?"
ABUNDANT	"We have an abundance of food, and it's part of America's health problems"

Table 13: USFRA market research findings

doing their bit to prevent resistance. Sustainability messages are best shared through stories about recycling, reusing resources and minimising waste. Messages need to move from the present to the future, and from facts to storytelling and narrative. Continual improvement must be conveyed.

On the basis of these findings, USFRA has hosted a series of Food Dialogues in New York. The panellists have been a diverse group with often opposing positions, including: **Julie Howard**, chief scientist, USAID Bureau of Food Safety; **Ali Velshi,** CNN Chief Business Correspondent; **Tracie McMillan**, author, T*he American Way of Eating;* **Jean Halloran**, Director of Food Policy Initiatives, Consumers Union; **Debbie Beauvais**, New York School Nutrition President; **Keith Ayoob**, pediatric nutritionist, Albert Einstein School of Medicine **Blake Hurst**, president, Missouri Farm Bureau and a number of farmers, ranchers and vets.

USFRA has also run competitions to find the faces of farming and ranching – those who want to be spokespeople for the industry and who are passionate about what they do – and established a FoodSource section of its website[80]. This provides a one-stop location for resources and information on the 'most talked about topics in today's food sector'.

In Denmark, where 75% of cows are housed, Susanne Clausen of the Danish Knowledge Centre for Agriculture in Århus says the industry is also wary following negative experiences with the pig industry. *"There was a reaction from consumers against pig farms in the '90s. They are contained for biosecurity reasons and you can't see what's happening on the farms, but to the public, this makes them seem like a dirty secret."*

The solution was to share and debate issues publicly. Reducing mortality is the latest focus, and it's one that's talked about openly in the media, bringing the public into the problem and keeping them abreast of progress and developments.

"We talk about our problems and invite people to understand them. For example, we have an aim to reduce calf mortality from, 10% to 6%, and cow mortality from 6% to 3%. We're also talking about the recent rise in digital dermatitis. We communicate constantly about new technology and scientific breakthroughs, and we talk to the media, politicians and the public," explains Susanne.

At the enormous Fair Oaks Farms in Indiana, the script is finely honed to show that continual improvement and create a narrative, for example:

[80] http://www.fooddialogues.com/foodsource

"Cows might not be rocket scientists, but they're smart and easy to train. You don't have to do things too many times for the cow and she's ready to do it as a habit. And if she's treated and handled with love and care, a cow will respond by cooperating easily."

"In the digester, the bacteria are devouring the manure and producing a biogas. That biogas contains 70% methane gas. Since this is a closed system none of this gas can escape into the air, it is all collected and the methane gas is used to run generators that produce electrical power for this dairy, the Visitor Center and the Cheese Plant. Imagine! We're creating renewable energy from simple cow manure and helping the environment at the same time!"

"Now corn silage is fermented like sauerkraut, the corn is softened and made easier for the cows to digest at the same time it is preserved. So we chop the entire corn plant, stocks, cobs, kernels and all and pack it into these piles using very heavy tractors that are called packing tractors. Some of the tractors have bulldozer blades on the front for pushing the chopped corn up to the top of the pile."

In the Netherlands, the industry wants to contain the amount of legislation around dairy farming by being more self-regulating. An emerging issue is use of antibiotics; the Government wants to call for a halving in use in the agricultural industry by 2020. The issue of whether or not animal use is causing resistance in humans is irrelevant. The industry view is that the perception is out there and rather than spending lots of time, energy and money fighting this view or disproving it, it should take actions to be seen to be responsible.

Without resorting to legislation but working instead through the supply chain, the industry has now abolished the use of new generation antibiotics that are used in humans and is falling back to traditional antimicrobials. The Dutch national cattle database, which ensures all medications prescribed by a vet are recorded centrally, highlights farmers with abnormally high or persistent use, and singles them out for a consultation where their management is reviewed and support provided

Crave Brothers run a 1,200 cow dairy farm and cheese business in Wisconsin. Although the family is focused on continuing to grow the business, they have chosen to do it slowly rather than by breaking new ground. They are also acutely aware of the need to be supportive of the industry, deliver a good PR image and communicate. Dr Dave Wieckert, a former partner of the business and University of Wisconsin lecturer, says people ignore the science until they know how much you care.

"*Farmers need to speak from the heart and share their passion and beliefs. They need to show it in action, not just words. When you take people to a dairy they are often dissenting so you have to turn that around. Large dairies could do a lot more to communicate and build a strong track record – it's important to listen with humility, but equally, be confident about what you do."*

A recent political debate in Denmark ruled that cow welfare could be equally good, indoors or out. However, farmer-owned co-operative Arla says most Danes still don't appreciate the difference. Hans Rasmussen, who manages several Danish retailer accounts for the co-op, says that while organic sales of liquid milk have always been strong – just under 30% of the market – consumers buy into environmental or food quality values and don't connect with grazing. "*We launched the 'Lærkevang'' brand ("Fresh Danish milk from cows on grass") several years ago and it quickly grew to around a fifth of the conventional market,"* says Hans. *"But it's not growing any further. We even changed the packing recently to show grass around the base of the carton to make it clear what the brand denoted, but consumers don't get the differentiation – to them, all cows eat grass."*

Lærkevang producers must let their cows graze in the summer and feed a higher proportion of forage during the winter. The premium to farmers is *5 øre per litre (just over 0.5 ppl) – 2% over the standard milk price – and consumers pay an extra 1.55 Krone (18 ppl). However, there is debate over whether the brand will continue as it doesn't command the price differential once hoped for.*

16. Discussion

16a. The need for unity and purpose

In comparison with other countries, Britain appears to be a fragmented industry with no unifying focus to rally producers towards a common goal. The NFU has articulated an ambition – to produce 4-5bn more litres of milk annually to fill more of our domestic requirements as well as service some modest export opportunities, but this message does not appear to be penetrating the industry.

In fact, there are some who warn that increased production will just lead to lower milk prices. Others continue to promote their own agendas at the expense of others' milk production systems. If this is what frames Britain's future milk markets, the only way we will be able to maintain high milk prices is through a lack of supply. This will rapidly take us to the bottom – a 7-8bn litre market where British producers are meeting demand for liquid milk and little more. Therefore, increasing our domestic milk production to grow our self-sufficiency and other opportunities is essential to avoid the UK being marginalised as a milk producing nation and incurring ever increasing imports.

Barriers to new entrants remain significant, so to meet these milk production aspirations the expansion of existing herds will be critical. It is evident that while some producers will choose and be able to expand their herds into specialist grazing systems, some will be unable to because of geographical, climatological or other barriers, or will not wish to because of personal preference. This latter group are therefore likely to increase the amount of time or number of animals they house.

I do not believe farmers themselves, in general, oppose herd expansion or large scale developments, but some are very fearful about the negative press larger scale farming brings to the industry, and about their own viability and survival in an environment where herds are growing around them. If the industry is to achieve unity and increase production, it is important that farmers' fears are addressed and they feel positive about others' expansion plans.

16b. The economic debate

Evidence indicates that any size or system of farm can be profitable on a margin per litre basis, but low costs mean specialist grazing systems are more robust. High output housed systems can be very profitable, but require good management as they have higher costs and greater exposure to the volatility of the market.

Should farms have to expand to remain viable? Small farms can secure just as good margins per litre, but because they are producing a lower number of litres, they can lack the critical mass needed to create the investment to keep up with evolving requirements. Despite this, smaller farms play an important role in the industry. They are seen as the life and soul of dairy farming and an essential part of the milk production 'mix'; their presence is an important factor in gaining social licence for the expansion of other herds. I would argue that there should be a viable way in which the 'public relations' value delivered by smaller family farmers can be capitalised by the industry, in much the same way grazing herds are rewarded in the Netherlands. The British public needs to feels secure that some small family farming will remain. Finding ways to support their survival and improve their viability will take pressure directly off other parts of the industry that wish to expand.

16c. Environmental benefits and challenges

Environmental issues and growing regulation are both threats to all dairy farming, not just

large scale. The Environment Agency itself is clear that scale is immaterial and, in fact, investment in newer or upgraded systems reduces risk of incidents. It is likely that the impacts of nutrient load in grazing systems and ammonia in housed systems will receive more attention in the future, so neither is immune.

However, expanded dairy farms offer potential benefits, for example the opportunity to fertilise cropping ground previously reliant on artificial fertiliser, through mob grazing or spreading of slurry or digestate. Housed systems go further than this with the potential to generate power from slurry through the production of methane during anaerobic digestion, and utilise wastes from the food and fuel industries.

While biodiversity does not particularly benefit or suffer from increased scale of dairy farming, larger scale farming can produce the economies of scale needed to make the introduction of biodiversity measures or stewardship more feasible.

16d. Welfare and emotion

Welfare is the main battleground with herd expansion, but here, the arguments still largely appear to be driven by emotion. I have seen superlative and poor health outcomes in housed systems and grazed systems, in large and small herds – the deciding factor is definitely management.

In the interests of creating a simple and compelling rationale to the consumer, campaign groups want to define grazing as 'good' and year-round housing as 'bad', their justification being that grazing systems have a 'higher welfare potential'. So while the industry is moving towards measuring welfare based on outcomes (eg actual levels of lameness, mastitis etc), which is system-neutral, some campaign groups are insistent that outcomes do not tell the whole story and an equal emphasis on input measures must remain. This supports their position on access to grazing – but can only restrict farmers who have to work within varying constraints. It is hard to understand why these groups are taking this position if their primary interest is the welfare of the cow, other than it being in the interests of imposing systems that suit their doctrines.

This is a huge risk and something of a blunt-instrument approach, potentially papering over welfare deficiencies on some farms and condemning what are actually exceptionally good standards on others. There is one shortfall in using only outcome-based welfare measures, and this is the lack of behavioural measures available at the moment. One can measure the mobility, health, nutritional wellbeing and so on of a cow, but how do you measure her level of contentment and the normality of her behaviour? What will indicate whether stocking levels are correct, or the flooring surface appropriate? Recent studies examining cow preferences go some way to resolving this and indicate that given the right conditions, a high-yielding cow chooses to remain largely inside during the day and to eat TMR rather than grass. However, more work using best available UK standards is needed. To simply specify a system is not good enough. We need to make sure that the needs of different types of cow are met, whatever the system, or we will end up short-changing her.

I believe it is virtually impossible for welfare campaign groups to change the dairy industry in the way they are hoping and in the same way they have impacted the laying hen industry. Cows on pasture-based systems rely on the land-base for nutrition, which is not the case with laying hens; land is in short supply and not all is suitable for grazing cows; and cows do not live in defined systems – all systems flex to accommodate the season and the farms' needs. Hence in all but the most rigid systems, method of production labelling is also impractical.

Fundamentally, given modern infrastructure and evolving knowledge about the cow's needs, there is simply no compelling case against either housing cows or grazing them,

where management is good, as each has its own challenges and benefits.

16e. Gaining social licence

The relationship farmers have with their local communities and the wider public continues to be a challenge. Britain is changing and I am not sure farmers have changed at the same pace. We have more affluent rural populations which have certain lifestyle expectations. We have social media. More power and a louder voice has been handed to communities. To underestimate all of this is a folly. Farmers have no God-given right to farm and producing food no longer elevates them to a higher status. There is a new level of accountability that must be achieved to gain support and remove obstacles, and this cannot be built up just when needed. Creating trust takes time, and while aspirations to build a 'statement' farm may be well-founded by economic, environmental and welfare arguments, if there is a level of discomfort in the community or among the public, this can cause bad feelings as a minimum, but worst case can stop the project dead in its tracks.

Similarly, regulators and planners must have more confidence. Part of this is increasing familiarity with modern production systems, and industry has not done enough to see this through. Acclimatising decision-makers and the public to the evolving ways in which the industry produces milk will reduce the feeling of novelty and precedent.

Overall, of the two main routes open to farmers wishing to expand their herd size, large scale grazing is inherently more familiar and therefore acceptable to the public, regulators and planners. With campaign groups also focusing almost exclusively on large scale housed herds, this is where the greatest barriers to expansion will lie. It is certainly possible to expand quietly and attract little attention into a housed system, but some – especially where there is an active local group opposing an application – are likely to fall foul of campaigning and delaying tactics. Hence there is an urgent need to deal with this lack of familiarity and engender a greater feeling of confidence and trust about the future of milk production among dairy farming's most influential stakeholders.

16f. The scale ceiling

There is evidence that a dairy farm can get too big. At a certain size, diseconomies of scale can kick in, with impacts on welfare, management and local acceptance. We continue to have pressure on land use and a large population, and this means we simply do not have the vast tracts of land needed to build megadairies in the true sense of the word.

Anecdotal evidence suggests the ceiling for a British dairy farm may be around 2,000-2,500 cows in a housed system, around 600-1,000 cows in a grazing system, unless replica satellite units are set up. This of course would vary from farm to farm as good management can always push the boundaries further, but given the population density and high demand for land, I believe it is highly unlikely we will ever see an 8,100 cow farm in Britain.

16g. The challenge of communication

Britain has a long way to go in improving communication about how it farms. For years, many farmers have been communicating inadequately with their local communities, reflected in a more widespread lack of engagement with the public at a national level. Even now that we have increased our flow of communication against a backdrop of renewed interest about where our food comes from, we still haven't quite got it right.

Like the industry, our communication can be fragmented between different industry bodies who all convey slightly different messages. Each individual organisation has its own budget instead of pooling funds to avoid duplication and ensure money goes further. Negative allegations and unsubstantiated

asides frequently go unchallenged over social media. Compare this to the centralised efforts to challenge untruths and educate the public about farming as a whole made by US Farmers and Ranchers, and Agriculture More Than Ever in Canada.

We need to start talking and sharing, being accountable and honest about where we are and where we are heading, and showing the many ways in which we farm and the efforts being made to make things better. The current dialogue is lacking on many fronts and there is a huge amount of work left to do.

17. Conclusions

1. Herd expansion within a united UK industry is necessary to deliver the volume of milk needed to remain viable in a global market and to retain or grow current levels of self-sufficiency.

2. To expand, herds are very likely to diverge into specialised grazing and housed systems.

3. While both face potential barriers, housing cows in particular is unfamiliar to planners, regulators and the public, and is the target of campaign groups who feel it is taking the industry in the wrong direction.

4. Any scale or system of dairy farming can, in fact, support a high standard of welfare – although more research is needed on cow preferences.

5. There is evidence that 'too big' brings diseconomies of scale with reduced welfare and profit, and increased impact – but the better the management, the further these boundaries can be pushed.

6. Uncompromising campaigning from welfare groups about housing cows year round threatens to distract from the real issue – the need to raise standards of welfare across the industry as a whole, at all scales in all systems.

7. We might not be able to generate **love** for the megadairy, but we can increase acceptance if:

    - Those expanding into larger scale herds develop a way to prove their delivery of good welfare & respect for the environment to reassure their customers and the public.

    - Farmers engage better with their local communities on a long term basis to gain 'social licence' to expand.

    - The viability of smaller family farms becomes a priority with the industry and food chain, as an important step in reducing fear of the impact of larger scale dairy farms – not just among smaller businesses but among the public as well.

    - The industry collaborates better to challenge untruths, communicate the changing face of the industry, and familiarise regulators, planners and the public with evolving farming systems.

18. Recommendations

1. **GET THE INDUSTRY BEHIND A UNIFIED GOAL**:
   The aim of achieving 4-5bn litres more milk for primarily our domestic market needs to become clearly embedded in all industry strategy and communications, so that everyone has an understanding of where we are heading, why, and their role in achieving this. This will serve to unify the industry and reduce in-fighting based on system of production and other attributes.

2. **IMPROVE WELFARE:**
   The debate about access to pasture is distracting efforts to address the real challenge – implementing much-needed improvements in dairy health and welfare across the UK. This is not only important from an ethical point of view, but also to safeguard the reputation of the entire industry in the eyes of consumers. Therefore, the industry has to get its head around the universal adoption of welfare outcome measures for dairy cows – currently being implemented through Red Tractor – and the possibility that incentives and penalties may have to be set in the future to try and improve standards.

3. **PROVE ACHIEVEMENTS:**
   In the meantime, those farmers finding themselves under particular fire may wish to consider the early adoption of an independently-audited higher voluntary sustainability standard for dairy farming. This could encompass tangible targets for welfare outcomes alongside a voluntary Environmental Management and Audit Scheme, similar to Green Tier (see Chapter 12c.), to resolve any questions over environmental impact.

4. **COMMUNICATE AND EDUCATE:**
   Industry bodies need to work together to familiarise everyone with modern farming systems. For example, all pictures of dairy farming show cows outdoors, yet more than 50% of British cow 'hours' are spent inside. This is simply a default to a more aesthetically-pleasing image which avoids the 'elephant in the corner', and there are plenty of opportunities to use attractive images of cows inside airy, light, modern facilities. A concerted effort should be made to educate decision and policy-makers about modern large scale dairy farming, for example bringing US experts or Green Tier (see Chapter 12c.) officials to the UK to discuss their processes and principles with our environmental regulators, chartered surveyors and local planning government associations. This could be an important step in managing any upcoming regulation.

5. **RESOURCE ISSUES MANAGEMENT PROPERLY:**
   The industry as a whole (and I suggest across all sectors because the public does not differentiate) must start investing some proper resources in proactive issues management, put aside their own agendas, and get far better at communicating as one entity. The USFRA research shows our defensive position is simply the wrong approach. We need to start discussing challenges, sharing problems and increasing transparency.

6. **UNDERSTAND WHAT A COW WANTS:**
   More data on cow preferences is needed in all systems. Only by knowing the conditions a cow chooses in a particular system will farmers know the optimum facilities to create. To date, the only work carried out in the UK and Ireland contains too many variables with cows making choices based on sub-optimal options, for example, loafing areas with inadequate ventilation, beds with mattresses rather than deep sand, and so on. While the Holstein is a common subject in preference trials, we need to know more about the optimum conditions for the hardy grazing breeds as well.

7. **IMPROVE COMMUNITY RELATIONS:**

   Farmers themselves must grasp the nettle and ensure they are doing their best to generate a positive environment around their operations. All problems with proposed housed cow developments have started with local community resistance. There is no quick fix. This is a long term commitment to open engagement and communication with local stakeholders, and being prepared to compromise so that the all-important 'social licence' can be obtained. Farmers operating large scale systems need to accept that communications and community relations are likely to become part and parcel of their daily farm responsibilities.

8. **GET SMARTER AT PLANNING APPLICATIONS:**

   Some clear pointers are to indicate where planning applications and expansion proposals most frequently fall down; the industry should consider the areas over which it really wants to dig its heels in, and those it can concede. There is such a thing as 'too big', so as well as expanding slowly to build confidence rather than in one fell swoop, farmers should seriously consider halting at ~2,500 cows in a housed barn system, and ~1,000 cows in a grazing herd; aside from avoiding more negative public opinion, there is some evidence that diseconomies of scale can kick in at these points unless management is superb . Similarly, as long as welfare remains outside planning law, campaigners will fight on a host of other aspects from traffic and noise to environmental impact. So why not support welfare becoming part of planning law? If the industry has nothing to hide, then let proposals be judged by informed, impartial experts rather than by popular jury or those with an ulterior agenda. This will help put the public's mind at rest. Lastly, there is a strong sense that cows do like to get outside and smell the air from time to time. If this is the case, then how can this be accommodated in future facilities, for example in the form of outside loafing areas?

continued on next page

9. **REALISE THE VALUE OF SMALLER FAMILY FARMS:**
   The industry must address the long term viability of smaller family dairy farms and ensure there is a sustainable plan to allow them to generate the investment funds they need to remain in business. This may be through creating a segregated market for their milk, which can be promoted on family or traditional values. Alternatively, direct reward payments such as the grazing bonus in the Netherlands discussed in Chapter 11d. may be successful, or support in building innovative co-operative structures so these businesses can gain economies of scale without having to expand individually.

10. **WORK WITH CONSTRUCTIVE ANIMAL GROUPS:**
    If they want to improve welfare, campaign groups need to work more constructively with the industry to ensure the best outcome potential can be built in to evolving new systems, and smaller farms have the funds to invest in improving facilities. For example, how can deep beds for cows be introduced widely to ensure a comfortable lying area? Deep sand causes issues with machinery and anaerobic digestion plants so how can technology be developed to separate out and reuse sand more cheaply and effectively? Can practical outside loafing areas be developed? A welfare group that can work with and not against the industry will have the potential to achieve so much more than any current campaigning.

"Only those who will risk going too far
can possibly find out how far one can go"

TS Eliot

19. After my study tour

I have started investigations into setting up a higher voluntary standard for dairy farmers who want to or have a need to prove and communicate the standards they are achieving. This is a project I have undertaken with a business partner and funding from three commercial agribusinesses. There are currently eight pilot large scale farmers involved in submitting data.

I have discussed the concept with five major retailers – ASDA, Marks and Spencer, Sainsbury's, Tesco and Waitrose. Rather than competing with their current assurance schemes, I am hoping this standard could be complementary and support the wider industry when communicating modern production systems.

I have discussed the concept of the higher voluntary standard with Red Tractor, the NFU, Defra and some representatives from the Farm Animal Welfare Council. All have been positive about the project and doing more to communicating good welfare – provided this can augment and build upon Red Tractor.

Discussions with the Environment Agency have been extremely encouraging. The agency has said it fully recognises the potential for new build or well-invested farms to have fewer pollution incidents and wants to demonstrate a more 'can-do' attitude. They are particularly interested in the concept of a higher voluntary environmental management scheme, similar to Green Tier, to recognise those farmers going 'above and beyond'.

The on-going challenge will be to see these projects through, facilitate longer term change in the industry to deliver my other recommendations, and in doing so create a sustainable business model for at least some of these recommendations. Through this, I hope I might be able to derive a future income.

To help me realise these goals, I have applied for a Worshipful Company of Farmers and Duchy College course – The Challenge of Rural Leadership. If I am successful in gaining a place, I believe this will help me turn my ambitions into action.

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21. Report Summary

Britain has lost half its dairy farmers since 2000 and while herd size and milk yield per cow have risen over the same period, production is floundering around a billion litres short of where it was 10 years ago.

The NFU's recently published strategy for the dairy industry identifies markets for an extra 4-5 billion litres of British milk. But the question remains – where will this milk come from?

Our competitors in Europe are gearing up for the 2015 removal of quotas and the UK seems ill-prepared. It is clear much of the milk we need will have to come though herd expansion.

But as herd sizes creeps upward, it becomes increasingly difficult to ensure adequate nutrition and rest for the cow as she walks further to pasture twice daily. We are therefore seeing a migration toward more specialised systems with either a grazing or housing focus. The choice will depend on climate, land availability, milk contract, capital and so on, and it is up to the individual farmer to decide. However, there is no doubt that the route of housing cows for longer periods, in particular, has led to campaigning by animal welfare pressure groups, confusion among the public and a lack of confidence among planners and regulators.

To free up farmers to expand in the way best suited to them, a stronger evidence base is required to prove housed cows can have exceptional welfare and live in conditions they prefer.

Those farmers looking to expand need to work to gain what is known in Australia as 'social licence'. This can only be achieved by being respectful of societal demands.

We must recognise that diversity of system and scale in the UK remains important, and that traditional small scale farmers play an important PR role for the whole industry; we need to find a way to recognise this financially and supply them with much needed investment.

The unfamiliarity the public, regulators and planners have with evolving farming systems is a huge concern, but the industry is largely to blame for perpetuating images of black and white cows in green fields. A concerted effort is needed to educate all about new ways of dairy farming.

If we seriously want to capitalise on opportunities heading our way, the time for transparency and accountability is now – we let this chance slip by at our peril.

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22. Appendices

22a. Appendix I – Meeting with WSPA

What are WSPA's aims?
WSPA is an advocate for animal welfare and the voice of animals within the wider issue of food production – in a world concerned about finding a way of producing food that is good for animals, people and planet. We are focused on working with food companies and governments to develop and promote solutions which ensure good welfare as well as good economics.

How does a campaign work? – structure of organisations, modes of operation
The approach to a campaign depends on what needs to be changed, and the current positions of different stakeholders. Some issues need to gain visibility and public support to be given consideration by government or industry; others need a more engaged approach to promote a solution. 'Notinmycuppa' was about engaging people with their food. While it is designed to influence policy and farming practice, it was about waking the public up to where their food comes from, and encouraging them to speak up. It is about driving debate. Nocton was an important change of direction and thus 'totemic' – we have evolved small zero grazing units but Nocton was a revolution. It could have heralded a wave of major farms in an industry currently still dominated by smaller farmers. We know how fast things can change – look at Denmark as an example. Nocton style farms could have pushed other smaller farmers out of business – our economic study showed that. And it wouldn't just be the effect of one farm – this could have led to 6 or 8 Nocton style farms. There are wider issues about people. We have to care about the people who produce our food so that they can in turn care for their animals.

What is the actual issue? Scale or system? Can you define the exact problem?
It's not about scale per se. There are a diversity of factors. It's about a milk production system which pushes for maximal yield at the expense of the cow and at the expense of the calf. We have not yet generated the debate space with industry to have a rational discussion about this, but there are good examples in the UK, such as the calf forum, which is attempting to deal with one of the consequences of high yield dairy – male dairy calves who are seen as uneconomic to rear. In wider dairy, we've stalled on progress because people are trying to address the symptoms (such as lameness and fertility) not the cause of the issue. There is something wrong at the core of this. We need to rejoin the beef and dairy sectors together so that a more robust dairy animal is producing a beefier calf and living longer in the process. There are physiological issues around yield per animal per year and we need to refocus so that milk is a co-product with a calf, not the calf being a waste by-product of milk production. Otherwise this potentially leads to a 'use 'em up and spit 'em out' attitude which treats animals as disposable production units. We also need to have a serious discussion about the price of milk and farmers' contracts. People think we can have milk for free. Milk is frequently cheaper than water in the supermarkets. It is the responsibility of retailers to build contracts to reward farmers for farming, and dairy companies to source their products responsibly. But we also see pasture as a solution to the cost of inputs; pasture is a more economically resilient model, especially in the face of rising feed prices.

What is a megadairy?
We don't work with a set definition. It's a question of more or less not yes and no. You can use the US's CAFO definitions to describe megadairies. It's not just about overall size, it's about group size and the area available to the cows. It also encompasses the concerns around maximal yield. The closest way we

have defined a megadairy – or factory dairy – is by the system rather than the size.

What is the scale of the issue in the UK? ie number cows housed year round in the UK?
It is difficult to know, as the data on year round housing is not easily available.

Do you feel it's growing?
Yes, it probably is, with the push toward using higher yield animals. However we do know that companies are beginning to be concerned re the impact of feed price volatility, and are looking to pasture again as a lower cost model that was more resilient to feed price fluctuations.

If I pointed to the National Mastitis Survey that indicated year-round housed cows comprise around 22% of cows in 2012, would you be surprised? Bearing in mind this is a self-selecting survey
Yes we would – that's more than we thought, but as you say it's probably not a true representation.

What would WSPA like to see happen regarding megadairy systems? Over what timescale?
We need to recognise that we have the basis for a sound British dairy industry, with good quality pasture – the solution we need for the future is here with us now, but is at great risk, and we need to ensure dairy farmers are rewarded for responsibly managing animal welfare. A system based on healthy cows, who can perform natural behaviour, ideally which have access to grass in the growing season, using a breed that is capable of thriving on this and producing a calf that is capable of being reared and used for beef, not wasted. We want to see the end of aspects of production which come with an animal being a commodity, with a shortened potential life, increased risk of disease, calves that will not be reared on, and behavioural restriction. Solutions for welfare improvement often prioritise the physical health of animals, rather than also addressing mental welfare and providing for their natural behaviour.

We need a multi-stakeholder dialogue about this issue. Roundtable debate, with open conversation about challenges, barriers and solutions, under Chatham House Rules, has been one of the most fruitful developments in moving these debates forward. But we need to have shared concern that there is a problem to solve. In terms of the public, the silent majority do care about what happens to animals – our research shows this - but they rely on others, such as supermarkets, to manage this. So they carry on selecting the cheapest options based on the information they are given, then the agricultural industry slates consumers for wanting cheap food. CIWF's Good Dairy Awards are trying to address this – championing food industry companies who take responsibility at source.

Why do you take the approach of individual farms being vilified on your social media platforms? You ask certain questions that stimulate responses which inevitably include some hurtful or completely incorrect assertions
WSPA does not attack individual farmers full stop. There is no getting away from the fact that with some very public applications it is obvious who the farmer behind the application is. However we have been very careful throughout the whole time we have been campaigning to talk about what these factory farms represent rather than focussing on the farmer behind the farm or application. Indeed around planning applications, for example, we have engaged directly and positively with the farmers concerned. People have a lot of strong views about these issues. We try to provide factually based information, while encouraging debate. It is our job to set the tone for a democratic debate, but not to police response, unless it strays into bullying or racism for example. You will see we keep up comments on Facebook from people who don't agree with our campaign, for this very reason. Social media is a relatively free and open space. We try to encourage considered comment – it doesn't help any organisation to have a debate overtaken by inflamed rhetoric. We ask questions on social media that are relevant to our campaign, the concerns we have over animal welfare, impacts to

communities and the environment to get people thinking. We are transparent in our replies and actively welcome farmers to our pages. It's also the industry's job to correct misperceptions around the reality of the industry, for example marketing or ambiguously worded descriptions of production methods. If the industry believes there is nothing wrong with intensive dairying then they should be accurately representing it in the public domain.

You [Professor Appleby] are also a member of the Farm Animal Welfare Council; were you involved in contributing to its published 'opinion on the welfare of the dairy cow' and in the letter sent to Jim Paice assessing the welfare potential for indoors and large scale dairy systems?

I was part of the committee at the time and as such I signed it off along with the rest of the committee. However, the question there was different. It focused on normal behaviour and satisfactory welfare. To those questions I agreed with the committee that these were possible. However, with a different hat on in my role with WSPA, I very much support the need for 'natural' behaviour, which is different from 'normal' behaviour.

22b. Appendix II – Meeting with CIWF

What are CIWF's aims?
It aims to promote humane and sustainable farming systems without factory farming.

How do campaigns start/operate?
Campaigns are often responsive and arise out of issues and occurrences, but they also need to meet CIWF's key objectives.

What is 'intensive' farming?
The definition of the word intensive in terms of dairy farming is a system where an animal cannot maintain health and welfare through grazing. Grazing is important because we want to promote land-based systems where animal spread their own manure in the environment. Animals should be allowed to roam. Cubicle systems are fundamentally flawed. Straw yards are best but do need good management as it is acknowledged there can be higher mastitis levels in poorly managed straw yards. It should be possible to keep mastitis levels the same in straw yards as in cubicles, but also enjoy other benefits. There has been some research from SAC into straw yard systems which suggested similar levels of mastitis to cubicle systems, presumably due to good management.

What is 'factory farming'?
Factory farming is where the individuality of animal ends. Factory farming incurs avoidable suffering as it involves downright abuse – mutilation, deprivation of natural behaviour and boredom. In factory farming the confinement is either physical or physiological or both. For example broilers may have room to move around but they grow so quickly they cannot walk easily due to fatigue and/or lameness or physically express normal behaviour. This is the same with Holsteins lying down all the time due to fatigue. For this reason, confinement in dairy cows is different from the confinement found with much of pigs and poultry. In a physiologically confined animal, resting and eating are effectively the only choices it has. The energy requirements of high milk production mean that the animal has no energy left for activity. When a cow has little energy she has no time left after eating and resting for socialising and loafing. When people describe animals as couch potatoes, this is not normal and is an excuse for lethargy. This is how the cow responds to what is a depressing environment – moving slowly with the appearance of depression and a lumbering gate. This is in contrast to the lively step of cows in New Zealand coming in for milking, which I have also seen in videos. Factory farming occurs when there is a conflict between production requirements and animal welfare, and the animal becomes a cog in the machine.

What is a mega dairy?
Size is not where we should start from, but poor welfare arises from the systems that are implicit in mega dairy systems. A mega dairy is created at the number of cows above which you cannot keep them on extensive ranging systems and at which natural behaviour is impacted. Ideally animals should be spreading their own manure within the environment and obtain much of their food from grazing. A smaller farm which chooses to keep its cows in is what we call an intensive zero-grazing farm.

How many herds over 1000 cows are there in the UK?
I'm not aware of how many there actually are – maybe one or two – but there is a risk of them becoming more and more prevalent.

Why do farmers get bigger? Do they expand because there is no other way that they can keep their head above water or do they expand because there are successful and therefore look to grow their business? Both

How does a farmer who is not making money generate the investment funds to expand?
I guess then they do need to be successful already but making profits by keeping cows in bad systems is not desirable. The DairyCo report has proven that grass-based systems are the most profitable per litre.

Should planning law be changed to include welfare as a consideration?

That would be a very good development.

Why do you not target 'intensive zero-grazing' farms, ie those that do not qualify as mega dairies? We may not individually but we are through EU law – via our e-petition to get legislation changed so that farmers must graze their cows outside. The other criteria we want to see introduced through this legislation are elimination of tethering and a requirement to measure welfare outcomes – not setting a level but having a programme and targets to improve welfare outcomes. We recognise that 75% of cows in Denmark are already kept indoors and this legislation would force them to be grazed outside. In hot countries, cows could go out at night as it would also help them with heat regulation. Emily Legrande is an MSc student who has looked at grazing at different times of the day in her MSc dissertation at Edinburgh University. Cows spent more time outside at night.

What is the overall health status of dairy cows in the UK?
The level of lameness is between 20% and 40% at any one time according to different studies. At some stage most cows will be lame. This should be much lower. A Bristol study showed that nearly 40% of cows are lame *(Assessment of lameness prevalence and associated risk factors in dairy herds in England and Wales, Barker et al 2010 J. Dairy Sci. 93 :932–941).* This was significantly higher in cows kept indoors. Barker et al found that there were higher levels of lameness in cows indoors compared with those grazing; organic performed better than conventional; and other breeds had lower lameness than Holsteins. The organic results were from an SAC study. I believe mastitis levels in this country have been very high in the past but they have been coming down due to the use of antibiotics; at the moment my view is mastitis incidence has levelled out despite improvements in veterinary care. However, routine use of antibiotics should not be necessary; it should not be a normal part of every year and we are also using cephalosporins, which are essential for human disease control. Using them like this could erode their efficacy and cause human health threats. Fertility is not a welfare issue in itself but it is an indicator of poor welfare and is probably the main cause of involuntary culling, so that is a big problem in the industry.

What are your views of some indoor-based farms having lameness around 3-4%?
I would say that I have not seen evidence of this and I would need to see the data. It would require very intensive management.

What if there were levels of mastitis around the same level?
I wouldn't expect that to be the case.

What is a sign of poor fertility?
When the cow doesn't have a calving interval of 365 days a year. A cow should be able to have a calf every year and get in calf on the first or second attempt.

Some farmers say their cows are high enough yielding that it would be wrong to force them into a 365 day calving cycle. What is your view?
I believe that is an excuse for poor fertility. The reason calving intervals get longer is because the cows aren't getting into calf. However, if a farmer did have a longer calving interval for a particular cow, say 400 days, and she was regularly calving to that with no problems, then that would be acceptable. Infertility is a very big issue with indoor herds and with cows that are not robust; it is a very good indicator of poor systems.

I believe it's a good sign of cow welfare if a cow can calve once every 365 days and gets into calf at first or second attempt. You shouldn't have to use hormones to get a cow in calf. Infertility is the main cause of involuntary culling and a major problem in high yielding intensive systems. So overall I would accept that it's possible some herds might have low levels of lameness, but I don't accept that their mastitis would be lower than other grass-based herds or that fertility is not a huge issue.

What would CIWF like to see happen regarding indoor/megadairy systems?
We would like to see indoor systems phased out and the national herd comprise of more robust cows. We would like all the cows to have lower yields which can be sustained with good health on grazing systems.

How would national milk production be maintained if cows gave less milk?
We could put more land into milk production, but we could also have more cows on the same land if they were smaller and national milk production could be maintained that way. We should also as a nation consume less milk and meat in line with nutritional guidelines – many people consume more than they need to anyway and it would be sensible and sustainable for most people in developed countries to move to a more plant-based diet.

Do you acknowledge that many cows will not be able to derive adequate nutrition from grazing? Yes I do acknowledge that some high yielding cows may struggle to receive nutrients they need through grazing and we do have to look after the cows we have. But this is why we need to breed for robustness and have more robust cows that can gain the nutrition they need from grazing. There are two ways of increasing production – one is when you look after the animal well and production naturally goes up. However there is another type when you begin to push the animal too far and production starts to be at the expense of body condition. We have to accept we have the cows that we have and we have to do the best by them but the long-term strategy should be to have cows that can be kept outside.

Do you recognise that breeding has changed to very much focus on robustness?
Yes I do – the change in the PLI was a big move in the right direction. But we also shouldn't be breeding replacements from cows that aren't robust; however we recognise that there are challenges with buying in replacements as well.

How do you maintain level milk supply year-round on grazing systems?
An autumn calving model would be one model. I believe this is the most intensive we can be. If we block calve cows once a year in the autumn then they will get the nutrition they need indoors in the winter and be turned out on spring grass. This system would complement spring calving cows to keep milk production level throughout the year, although there would still be seasonal production that could go into dairy products. This would also keep cows in stable groups.

How do you keep stable groups when you aren't block calving? It isn't practical to keep high and low yielding cows at different stages of lactation together.
Social groups are very important. That's why we advocate block calving as it means we can maintain social groups.

What research exists into natural behaviour?
EFSA is a key body of research we refer to. The International Society of Applied Aetiology is also a good place to look into studies of animal behaviour. There is also the Association of the Study of Animal Behaviour. But there isn't anything definitive on cow behaviour at the moment; however, EFSA provide a substantial body of evidence that grazing systems offer the best potential for welfare.

If farmers could prove cows exhibiting natural behaviour at least matching those other farms, would that satisfy CIWF?
CIWF will never move away from its position that cows must be grazed since these systems alone provide the potential for high welfare and the proper expression of natural behaviour.

If we can prove that cows are both happy and healthy indoors then what is the problem?
We don't think this can be proved. Cows belong in fields. Consumers want it. Farming will be brought into disrepute if this is not recognised. In the UK we are more free range than other countries because we have wonderful resources in grass. There is no reason not to have cows outdoors. One option may be that with high yielding cows

that cannot get all their nutrition from grass, TMR could be placed in fields to ensure that sufficient nutrition is received. There are ways around these problems.

Should planning law include welfare?
Yes we would very much like welfare to be a condition in planning law. But in the meantime we are supporting welfare through our campaign to introduce dairy farming legislation in the EU. The EU dairy legislation project is an ongoing program that is in its early days. It is promoting high welfare from pasture based farming. We also support the same principles through our Good Dairy Award, the conditions of which are:

- to have pasture based systems so that grass is a significant part of the diet (days grazing is not prescriptive as it depends on geography etc.)
- secondly no tethering
- thirdly there must be measurements of welfare outcomes in place. There are no absolute levels but there must be a programme with targets. This will include lameness, mastitis, body condition scoring, fertility, and cow comfort.

Where the full criteria of the Good Dairy Award cannot be obtained, then we also separate out into commendations for cows and commendations for calves. So it is possible for an organisation to have a commendation for their cows, meaning they meet the welfare standards in the Good Dairy Award for cows but not for calves, for example meaning the bull calves on the farms that supply them may still being destroyed at birth but the management of the cows meets all the standards. In the same way it is also possible for an organisation to have a commendation for calves meaning that their calves meet the standards but the cows do not. Currently, Waitrose, Asda and the Co-op among others have Good Dairy Awards, meaning they comply with these condition for cows and calves, or have a commitment to do so within 5 years. M&S have a cow commendation and Sainsbury's have a calf one.

What defines good welfare outcomes?
Ultimately it is about mental state. If a cow is healthy and comfortable and in the right social groups and can behave naturally on a grass-based system then she has the opportunity for good welfare in a well-managed system.

22c. Appendix III – RSPCA position paper on large scale dairy farming

Large scale farming

a position paper on dairy production

Large scale production of any farm animal enterprise is a controversial issue. The common assumption is that by scaling up the farm enterprise, the welfare of the animals will always and inevitably suffer. The RSPCA's experience and other evidence indicates that this is not necessarily the case.

The RSPCA welfare standards for dairy cattle prohibit systems which house cattle all year round, but they do not set any limits on herd size and there is no welfare related evidence base to indicate this is necessary.

We also have no evidence to suggest that large scale dairy production is set to spread across the British countryside. At present, there are only around 25 UK herds of over 750 animals out of a total of between 11,000 - 12,000 dairy herds in the UK. The average herd size is around 113-120 cows.

Those larger herds that we ourselves have visited have been housed in purpose built accommodation for the modern dairy cow, and we have concluded that the levels of comfort and welfare in these systems combined with excellent levels of stockmanship, have often exceeded those seen in older more traditional housing systems.

It should be acknowledged that if something goes wrong on a large farm (e.g. a disease outbreak; problem with a water delivery system, etc), there is clearly a risk to the welfare of a greater number of animals than would be the case on a smaller unit. This highlights the importance of ensuring that best practice is applied on all units, regardless of size, and that contingency plans are in place to safeguard the welfare of *all* animals should an emergency arise.

The RSPCA's focus is always on the welfare of each individual animal, regardless of the size of a farming enterprise. The Society was one of the first organisations to call for a National Dairy Cow Welfare Strategy, which is now in its second year. The Society continues to be involved in a number of dairy-based initiatives whose goal is to improve the welfare of the dairy cow, notably:

- The Cattle Health and Welfare Group for England, which administers the National Dairy Cow Welfare Strategy
- The Genetics Advisory Forum, which provides the tools for farmers to breed more robust cattle
- The Healthy Feet project, where the aim was to develop strategies to help to reduce levels of dairy cow lameness

- The Assurewel project, where the RSPCA, Soil Association and the University of Bristol Veterinary School are developing a set of practical dairy cow welfare outcome measures, which we hope will eventually be adopted by the UK dairy industry.

We have also been co-sponsors of the National Cattle Mobility Event in the past, and have funded research projects relating to a number of dairy cow welfare issues.

A report by DairyCo, Andersons Consultants and the University of Nottingham published in January 2013 on the Structure of the GB Dairy Farming Industry – what drives change, stated that there was no evidence to suggest that larger producers were forcing smaller producers out of business, and concluded that farm survival was more a function of management than size itself.

The RSPCA's overall conclusion is that the size of a dairy farm is not the key issue in relation to the welfare of the animals, it is the conditions, stockmanship and overall husbandry which are the factors which contribute to the overall welfare status of the animals. It is whether the farming operation, regardless of size, can meet the welfare needs of each individual animal that really matters.

If you require any further information on this please contact the Public Affairs team at the RSPCA at politicalaffairs@rspca.org.uk

22d. Appendix IV – Extracts from "EFSA: Scientific report on the effects of farming systems on dairy cow welfare and disease", October 2009

"There is a large number of studies showing that cows kept on pasture are healthier. Summer access to pasture has been found to reduce mortality of dairy cows in Denmark (*Thomsen et al. 2006; Thomsen et al., 2007).* A number of epidemiological or experimental studies in different countries have found that lactating cows without access to pasture suffer from a higher incidence of a variety of health problems including mastitis *(Bendixen et al., 1986b; Bendixen et al., 1988a; Waage et al., 1998; Barkema et al., 1999a; 1999b; Washburn et al., 2002; White et al., 2002*), tramped teats (*Ekesbo, 1966; Geer and Grommers, 1975; Bendixen et al., 1986b), metritis (Bruun et al., 2002)*, *Salmonella enterica* infections *(Veling et al., 2002),* dystocia *(Bendixen at al, 1986a*), retained placenta *(Bendixen et al., 1987*a) and ketosis *(Bendixen et al., 1987c*). Hock and knee injuries are also more common when cows have no or limited access to pasture *(Haskell et al., 2006, Rutherford et al., 2008)*. Thus, zero-grazing can be considered to increase the likelihood of all of these health problems."

"The most commonly reported welfare problem associated with restricted grazing is lameness. A large epidemiological survey of 4,516 dairy farms in the US, found that a lack of access to pasture in winter was a significant risk factor for a high incidence of digital dermatitis, and that providing access to a dry-lot was not sufficient to overcome this (*Wells et al., 1999*). Nearly four times as many farms on which cows had no access to pasture had a high (>5%) incidence of dermatitis than farms on which cows were kept only on pasture (*Wells et al., 1999).* A smaller study in Chile (*Rodriguez-Lainz et al., 1999)* found supporting results: cattle housed permanently at pasture had a lower probability of developing digital dermatitis than cows housed in buildings for some of the year. This suggests that occasional or seasonal exposure to confinement housing may be as important as the complete absence of grazing. In countries as large as the US and Chile, the type of housing used varies greatly depending on the region, and climatic differences could conceivably account for some of the effects of housing. However, similar effects of a lack of grazing have been noted in smaller countries, which do not have such climatic variation. An epidemiological survey of 86 dairy farms in the Netherlands *(Somers et al., 2003*) reported that all types of hoof disorders were more prevalent in cows in zero-grazing systems than among cows with some access to pasture. Again, the difference was substantial: the prevalence of severe cases of sole haemorrhage was twice as high with zero-grazing compared to other housing systems. Even where cows had some seasonal access to pasture, hoof disorders (but not digital dermatitis) were more prevalent during the period of indoor housing compared to the end of the period of summer access to pasture. In Kenya, where some dairy farmers use zero-grazing, the prevalence of lameness is lower in farms where cows have some access to pasture (*Gitau et al., 1996).* A survey of 37 farms in the UK found a higher prevalence of lameness in cows that could not graze compared to cows that have some ability to graze (prevalence of 39% versus 15%) as well as a higher frequency of swollen knees *(Haskell et al., 2006)."*

"Recent work indicates that even a short period of access to pasture can reduce lameness. When a matched sample of cows were either kept in a free-stall barn or moved out onto pasture, cows on pasture showed a dramatic improvement in gait in just over four weeks of exposure (*Hernandez-Mendo et al., 2007).* However, some studies report an increased occurrence of digital dermatitis *(Holzauer et al. 2006)* or of interdigital necrobacillosis *(Alban et al. 1997*) when cows do have access to pasture. Although these studies indicate that lameness and hoof problems of various sorts are less common for cattle with some access to pasture, they do not allow us to isolate the cause of this difference. Cows in indoor housing are more likely to be standing in manure and on concrete, and eating more grain than cows at

pasture, all of which increase the likelihood of lameness."

"Cattle at pasture are not all free of welfare problems. Cattle at pasture can be exposed to inclement weather, increased parasite load, flies and gad-flies, inadequate energy intake, toxic plants and high competition for feed if stocking rates are too high. In many regions of the world cattle are housed continuously on pasture and must meet their nutritional requirements through the consumption of native herbages. Although this provides a 'natural' diet and freedom of movement, risks to animal welfare arise when either the availability or quality of the grass is low. Even brief periods of feed deprivation cause some hunger in cows (*Schutz et al., 2006*). Longer-term effects of inadequate food intake include lost body weight and body condition (*Stockdale, 2001).* When the herbage quality is low in digestibility and protein quality, cattle are known to lose more than 10% of their weight (*Ritter and Sorrenson, 1985).* Cows can lose body condition and weight especially after calving when kept on pasture, which can be a cause for concern (*Fontanelli et al., 2005).* Poor body condition can also increase the risk of disease such as milk fever *(Roche and Berry, 2006*). Furthermore, the use of some forms of grass at pasture can increase the chance of sub-acute ruminal acidosis *(O'Grady et al., 2008*). When cattle are kept outdoors over winter, the design of the winter pens can influence a number of health parameters *(O'Driscoll et al., 2008a,b).* Poorly designed outdoor pens can increase the chance of some hoof lesions above those found in indoor housing (*O'Driscoll et al., 2008a*). Even at pasture, cattle can compete for food (*Phillips and Rind, 2001)* so that the degree of social competition can be one factor that influences the relative advantage of indoor versus outdoor housing. The risks to welfare associated with poor grazing conditions should not be underestimated. However, for most European dairy cattle this seems to be a minor problem compared to the verified health and welfare problems associated with zero-grazing."

"Poorly maintained outdoor walking tracks can also increase certain types of lameness due to hoof injuries (*Chesterton et al., 1989).* On pasture it is also important that the dairy cows have easy access to clean water where they can drink as much as they need without competing with other cows in the herd. The dominance order that develops for priority of access to water does not necessarily accord with the social hierarchy (*Andersson, 1987)."*

"The effects of heat stress can be especially important for cows kept outside, at least in some areas south of latitude 55° north in the northern hemisphere, especially when shade is not available. A recent study from New Zealand investigated to what extent dairy cows seek shade from the sun when they had free access to shade cloths that blocked 25%, 50% or 99% of solar radiation *(Tucker et al., 2007).* The cows spent more time under shade cloths that gave the most protection from the sun, and time spent in shade was positively related to ambient solar radiation (*Tucker et al., 2007).* A number of experiments have shown the advantage of providing shade to dairy cattle housed outdoors (*reviewed by Armstrong 1994; Silanikova 2000*). More information about the cows' response to heat and solar radiation can be found in chapter 11.4. Much less is known about the effects of cold, although one recent study *(Tucker et al., 2008)* compared behaviour and cortisol responses in cows kept indoors or outdoors under wet and windy conditions in New Zealand during the winter. Cows kept outdoors spent less time lying down, likely because of the wet lying surface, (*Keys et al., 1976)* and experienced higher cortisol levels. Moreover, the negative effects of the wet, windy conditions were most evident for cows that were low in body condition (i.e. relatively thin), indicating that poor food availability, typical of winter pasture, may aggravate the welfare effects of harsh climatic conditions. For more information on the effect of cold climate on dairy cows see chapter 11.4. Clearly, environmental conditions such as extreme cold or hot weather, wind, and rain will play a significant role in the welfare of dairy cows."

"It is quite difficult to compare the effect of access to pasture on the dairy cows health and welfare due to several reasons. Farms vary greatly in how much access to grazing the cows have. In some systems, cows are kept at pasture all the time. In others they have access at certain times e.g. during the summer or during the day. In true zero-grazing systems, cows have no access to pasture at all. Thus, it is needed to know whether the effects on animal welfare are due to the complete absence of access to pasture or the occasional use of indoor housing. Furthermore, zero-grazing systems differ from pasture-based systems in many respects. For example, air quality, the types of surface on which the cows walk and lie down, the stocking rates used and even light/dark cycles may be different. It is difficult to determine which of these factors may be responsible for any difference in welfare. Furthermore, there is always the possibility that some modification of indoor housing systems (e.g. using a different type of ventilation or flooring) would raise the welfare of cows in zero-grazing systems to a similar or higher level than found at pasture. For these reasons, any results concerning the effect of grazing on the welfare of cattle must be interpreted with care. It should not to be assumed that providing cows with access to pasture will automatically improve their welfare, or that a high level of animal welfare cannot be achieved in zero-grazing systems *(Rushen et al., 2008).* However, at present, it is not possible to guarantee that indoor housing without access to pasture will result in the same or better level of welfare that could be achieved if the cows could have access to pasture."

22e. Appendix V – Summary of lameness and mastitis incidence in farms visited

Location	Size	System	Lame *	Mastitis *	SCC
UK average	**125 cows**	**Predominantly housed in winter, grazed in summer**	**20-37% (depending on source)**	**40-65/100 cows/year (depending on source)**	**220,000**
Dorset, UK	470 cows	1x milking, specialist grazing, mobile milking	N/A	21/100 cows/year	N/A
Dumfriesshire, UK	1000 cows	3x milking, housed year round	9%	10/100 cows/year	N/A
Somerset, UK	1000 cows	3x milking, housed year round	5%	30/100 cows/year	110,000
Cheshire, UK	>500 cows	3x milking, housed year round	7.5%	50/100 cows/year	N/A
Pembrokeshire, UK	1000 cows	3x milking, housed year round	4.5%	17/100 cows/year	131,000
Ayrshire, UK	>500 cows	2x milking, specialist grazing	2%	10/100 cows/year	121,000
Derbyshire, UK	230 cows	2x milking, specialist grazing	23% peak	12/100 cows/year	70,000
Israel average	135 cows	Housed year round - deep pack composted manure	3%	N/A	220,000
Bramming, Denmark	470 cows	3x milking, housed year round	N/A	30/100 cows/year	207,000
Rostock, East Germany	>500 cows	2x milking, housed year round	5%	N/A	159,000
Mariestaad, Sweden	>500 cows	2x milking, organic, grazed summer, housed winter	5%	15 cases/100 cows/year	N/A
Steenvijk, Holland	130 cows	Robotic with outside access	N/A	15 cases/100 cows/year	N/A
Indiana, USA	3,200 cows (one unit)	3x milking, housed year round	3%	N/A	N/A
Wisconsin, USA	5,200 cows	3x milking, housed year round	0.2%	23 cases/100 cows/year	125,000
Wisconsin, USA	3,000 cows	3x milking, housed year round	1%	50 cases/100 cows	N/A
Wisconsin, USA	8,000 cows	3x milking, housed year round	1%	60 cases/100 cows/year av.	219,000 average
Wisconsin, USA	500 cows	3x milking, housed year round	3%	30 cases/100 cows/year	130,000
California, USA	600 cows	2x milking, organic grazed year round	7%	15 cases/100 cows/year	160,000
California, USA	1,600 cows	3x milking, housed year round with outside loafing	3%	35 cases/100 cows/year	N/A
Waikato, New Zealand	440 cows	2x milking, specialist grazing	6%	15 cases/100 cows/year	172,000
Christchurch, New Zealand	800 cows	2x milking, specialist grazing	5%	10 cases/100 cows/year	187,000
Victoria. Australia	500 cows	2x milking, grazing all year with added feeding	1%	40 cases/100 cows/year	176,000
Victoria, Australia	1,000 cows	2x milking, grazing all year with added feeding	4%	N/A	N/A

22f. Appendix VI – Summary of lameness studies, Dr Nigel Cook, Dairyland Initiative

Study	Country	No Herds	System	Herd size	Yield (kg)	Lameness %
Wells et al	US	17	Mostly tiestall	50	8,139	13.7 (summer)
Clarkson et al 1996	UK	37	Freestall/grazing	-	-	20.6
Cook 2003	US	30	Freestall/tiestall	121	10,481	21.1 (summer) 23.9 (winter)
Haskell et al 2006	UK	37	Grazing and zero grazing freestall	-	-	15 (grazing) 39 (zero grazing)
Espejo et al 2006	US	50	Freestall	-	11,506	24.6
Amory et al 2006	N'lands	19	Freestall/grazing	76	8,439	16.5 (arch back only)
Barberg et al 2006	US	12	Compost barns	74	10,456	7.8
Rutherford et al 2009	UK	80	Organic vs conventional Freestall/ bedded pack	147	7,319 (O) 8,435 (C)	16-18 (organic) 19.1-23.1 (conventional)
Dippell et al 2009a	Austria	30	Freestall/grazing	35	8,210	31
Dippell et all 2009b	Germany/ Austria	103	Freestall/grazing	48	8,469	33
Barker et al 2010	UK	205	Freestall/bedded pack/grazing	163	7,201	36.8
Ito et al 2010	Canada	28	Freestall	177	10,434	28.5
Lobeck et al 2011	US	15	Crossvent/ conventional freestall/ compost barn	121-1000	11,308	13.1 (CV) 15.9 (NV) 4.4(CB)
Von Keyserlingk et al 2012	Canada & US	121	Freestalls in BC, CA and NY/PA	42 (BC); 1796 (CA); 826 (NY/ PA)	11,734 (BC) 12,029 (CA) 12,238 (NY/PA)	28 (BC) 31 (CA) 55 (NY/PA)

22g. Appendix VII – The preferences of high yielding dairy cows

Cow preference	Scientific finding	Suggested Farm Feature
High yielding cows choose TMR feeding over pasture to meet their nutritional needs	Cows with access to pasture and TMR indoors choose to eat TMR indoors *(Charlton et al., 2011).* Cows at grass have lower body condition scores than cows housed and fed indoors *(Washburn et al 2002)* The rate of BCS loss is slower for cows fed a TMR compared with grazing cows *(Roche et al., 2007).* Continuously housed cows had more body energy than pasture-based Cows *(Chagunda et al 2009)*	**Unrestricted access to nutritionally appropriate TMR with fresh feed delivered daily**
High yielding cows prefer to stay in during the day, and go out at night to lie down*	Cows going out to pasture at night experienced no change in dry matter intake or milk yield compared with cows continuously housed (*Chapinal et al., 2010)* When stocking rate was gradually increased from one cubicle per cow to providing none, and access to pasture for lying down was provided, total lying time still decreased by almost 2 hours/day (over 15%) *(Falk et al 2012)* Cows spent 90% of time indoors although more chose to go out in the afternoon/evening than in the morning *(Charlton et al 2008)* More cows were consistently found outside at night compared with during the day, when given free access *(Charlton 2009, 2010, 2011)* Cows have a preference for pasture at night and to stay in during the day *(Legrand et al, 2009)* **exception is Harper Adams study using cows reared outside & without access to deep beds; further studies required*	**Access to indoor feeding and outdoor lying areas as and when preferred**
Cows like to avoid aggression from herdmates, which can prevent them eating, resting and being milked when they want	Feeding and lying time are compromised when density exceeds 100% of the facility's capacity *(Fregenosi et al., 2007)* When grazing in a field, cattle often synchronise their behaviour such that many animals in the group feed, ruminate and rest at the same times *(Miller and Wood-Gush, 1991).* *Curtis and Houpt (1983)* reported that dairy cows housed indoors also synchronise their behaviour, particularly at feeding.	**Impact of social order actively managed**
Next to feeding, high yielding cows prioritise lying time.	Research has demonstrated that cows prevented from lying down increase the amount of time they do lie down when they are allowed to *(Metz, 1985; Cooper et al., 2007; Jensen et al., 2005).* Cows have a strong desire to lie comfortably for up to 15 hours per day. *(Manninen et al. 2002, Tucker et al., 2004, Cook et al., 2004, Drissler et al., 2005, Fregonesi et al., 2007, Norring et al., 2008, Fregonesi & Leaver, 2002, Haley et al. 2000)* Lying time decreases when cows are kept on pasture compared with freestalls, because adequate intake is first priority *(Hernandez-Mendo et al 2000)*	**Soft, dry deep bedded lying areas that permit a wide range of movement and are smooth or groomed regularly** (when bedding is provided on top of a mattress or mat, it should be greater than 2cm in depth)
Cows would rather lie on dry surfaces	Cows have a strong preference for and will lie much longer in dry lying areas (*Fregenosi et al.,2007)*	
Cows prefer soft deep bedding to shallow bedding or mattresses	Given the choice, cows will select deep sand, compost or sawdust bedding over mattresses or other shallow cubicle bedding options *(Weary & Taszkun, 2000)* Use of deep bedding in northeast US farm study of 40 farms show 50% fewer lame cows with deep bedding (*Chapinal et al., 2013)* Sand cubicles with minimum sand (20cm) and no additional bedding reduced lying times by as much as 7.5h/d compared to cows in stalls with 30-40 cm of sand or additional bedding *(Manninen, 2002; Norring et al., 2010; Tucker et al., 2003).* Cows spend less time lying on concrete stalls with minimum bedding compared with mattresses and mats *(Herlin, 1997; Haley et al., 2000; Rushen et al., 2007)* Sand decreases lameness prevalence by half in comparison to rubber mat and mattresses with little or no bedding (*Cook, 2003; Cook et al., 2004; Espejo et al., 2006)* Sand decreased hock lesions in comparison with mattresses and straw, sawdust or dry/composted manure (Fulwider et al., 2007; Lombard et al., 2010).	

Cow preference	Scientific finding	Suggested Farm Feature
Cows like lying longest in groomed, level beds	Cows will reduce their lying time as the bed becomes more uneven *(Drissler et al 2005)*	**As per above**
Cows don't like hot sun, wet conditions or wind	Cows will use the facilities available to control their thermal load (1 to 9° C: cows move outside if sunny – *Archer, 2011* 14° C to 23 C: cows move outside – *SRUC, Harper Adams data* up to 28 C: cows move inside – *LeGrand et al 2009)*	**Able to avoid wind, rain, sun, heat, humidity and cold at all times** (according to established cow comfort parameters re heat, humidity etc)
She doesn't like her feet being in wet or muddy conditions and will preferentially loaf in the driest place	Cows choose to stand for 1-2 hours a day, but like to stand in dry conditions at this time. Standing 2 feet in a cubicle means she can't stand 4-square in the cubicle with her feet dry (*Proudfoot et al., 2010*)	**Ability to stand on a dry surface with all four feet**