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ALTERNATIVES TO THE BARREN BATTERY CAGE FOR THE HOUSING OF LAYING HENS IN THE EUROPEAN UNION

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A report by
Compassion in
World Farming
2007

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ALTERNATIVES TO THE BARREN BATTERY CAGE FOR THE HOUSING OF LAYING HENS IN THE EUROPEAN UNION

A report by Compassion in World Farming

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Executive Summary

There are over 300 million laying hens in the European Union (EU), over three quarters of whom are currently housed in battery cages. The 1999 Laying Hens Directive prohibits conventional battery cages from 1 January 2012. All laying hens in the EU must therefore be housed in other systems from 2012. The Directive permits the use of 'enriched' cages and non-cage systems.

'Enriched' cages are similar to conventional battery cages but contain a nest, perches and litter material and provide 600cm^2 of 'usable' space per hen. Non-cage systems provide nests, perches and litter over at least one third of the floor surface and have a space allowance of at least 1111cm^2 per hen (9 birds/m^2). Some non-cage systems also have access to free-range.

In 1997, the EU adopted a Protocol annexed to the Treaty of Amsterdam, which recognises animals as sentient beings. The Protocol requires the EU and its Member States, in formulating and implementing EU policies on agriculture, to "pay full regard to the welfare requirements of animals." With this in mind, this report looks at the various systems permitted for the housing of laying hens after 2012 and assesses their ability to meet the welfare requirements of hens.

The 'enriched' cage

Hens are descended from the red jungle fowl of Southern Asia. Neither thousands of years of domestication nor selective breeding for high productivity have fundamentally altered their behaviour. In a natural environment, hens spend much of their time foraging for food. Hens will walk considerable distances searching for food and are also able to fly short distances. Hens congregate in small groups that have a complex social organisation based on a pecking order or hierarchy. Trees are used for roosting at night and escape from predators. Prior to laying, hens will seek out a secluded spot and build a nest to lay their eggs in. They also perform regular maintenance behaviours including preening and dustbathing.

Experiments have shown that hens will make a great deal of effort to gain access to nest boxes, litter for pecking, scratching and dustbathing, perches (particularly prior to nightfall) and additional space. These experiments demonstrate that such resources are important to the hen. Stereotyped pacing, displacement preening and a specific vocalisation, the gakel-call, are associated with thwarting of nesting and dustbathing behaviour. This indicates that hens are frustrated when they are prevented from carrying out these behaviours.


Jungle fowl hen foraging with her chicks

Well designed non-cage systems currently provide for the nesting requirements of the majority of hens. In the long term, non-cage systems have the potential to meet the nesting requirements of all hens by providing a range of nestbox designs. The limited space in 'enriched' cages means that even where the nest is attractive to the majority of hens, competition for the nest site prevents some hens from fully expressing nesting behaviour.

Hen nesting in a non-cage system

If perches are well designed, sufficient perching space can be provided in both 'enriched' cages and non-cage systems to allow all hens of most types to perch at the same time. However, perches in 'enriched' cages are not sufficiently elevated to be perceived by the hens as a safe roosting place at night. Non-cage systems can provide elevated perches which meet the hens' requirements for night-time roosting.

The 600cm^2 of 'usable' space per bird and a height of 45cm in 'enriched' cages fail to allow sufficient space for hens to perform many important basic behaviours. The greater space allowance in non-cage systems allows hens to display a much broader behavioural repertoire, especially in free-range systems where hens have ample space and environmental complexity in which to freely express their full range of natural behaviours.

Feather pecking can be a major welfare problem in laying hens and can occur in both cages and non-cage systems. Severe feather pecking can lead to outbreaks of cannibalism. In order to control feather pecking and cannibalism, hens are often beak-trimmed. This involves removing around a third of the beak of young chicks and can cause both acute and chronic pain due to tissue damage and nerve injury.

Opportunities for birds to express foraging behaviour are very limited in 'enriched' cages and the birds' requirements for dustbathing behaviour are not met. The incidence of sham dustbathing is the same in 'enriched' cages as in barren battery cages. Litter is available over a large area throughout the day in non-cage systems. If the system is well managed to maintain the litter in a dry friable state, the foraging and dustbathing requirements of the birds can be well provided for.

Hen dustbathing in a free-range system

Hens perching in a non-cage system

Feather pecking and cannibalism can be controlled in non-cage systems without resorting to beak-trimming, through the use of appropriate strains and selective breeding to further reduce the hens' propensity to feather peck, and through the adoption of a range of preventive management practices. Preventive management is dependent on providing birds with opportunities for foraging, dustbathing and perching, which are not adequately provided for in 'enriched' cages.

The high rate of egg production in modern laying hens puts enormous demands on the birds' calcium reserves, leading to osteoporosis and a high risk of bone fractures. Inactivity contributes to bone loss, so the severity of osteoporosis is increased if hens are kept in cage systems where their movement is restricted. The current high incidence of bone fractures in all systems is unacceptable and should be addressed as a matter of urgency through the use of traditional breeds and/or selective breeding of commercial strains. Even with selection to improve bone strength, the limited space in 'enriched' cages means that birds are unable to exercise to maintain bone strength. Non-cage systems provide birds with much greater freedom of movement and opportunities for exercise.

Outbreaks of infectious disease or severe feather pecking and cannibalism can result in occasional higher mortality levels in any system. However, with good management, low mortality rates can normally be achieved in both 'enriched' cages and non-cage systems.

Many of the welfare problems in 'enriched' cages are inherent in the system. The limited space and height mean that many of the behavioural requirements of the hens are not met. Because space is the limiting factor, attempts to improve one resource are likely to impinge on others. For example, if the nesting area were increased to reduce competition, this would necessarily reduce the area available for other facilities, such as the litter area, which is already too small to meet the birds' requirements for foraging and dustbathing. Welfare problems in non-cage systems are not inherent in the system and can be addressed through good design and management.

The evidence in this report demonstrates that well designed and managed non-cage systems provide higher standards of welfare than 'enriched' cages and that 'enriched' cages fail to meet the welfare requirements of hens.

CIWF urges the EU to strengthen the Laying Hens Directive to prohibit the use of 'enriched' cages as well as conventional battery cages.

Changing to more humane non-cage systems will entail a cost but the strategy outlined in this report shows how this cost can be met without harming the livelihoods of EU egg producers.

This report demonstrates that 'enriched' cages do not have the potential to meet many of the welfare requirements of hens or address some key welfare concerns, now or in the future. CIWF therefore calls on the European Union to strengthen the Laying Hens Directive to prohibit the use of all cage systems for the housing of laying hens.

1. Introduction

There are over 300 million laying hens in the European Union (EU), over three quarters of whom are currently housed in battery cages (European Commission, 2005). The 1999 Laying Hens Directive prohibits conventional battery cages from 1 January 2012 (Council Directive 1999/74/EC). All laying hens in the EU must therefore be housed in other systems from 2012. The Directive permits the use of 'enriched' cages and non-cage systems.

In 1997, the EU adopted a Protocol annexed to the Treaty of Amsterdam, which recognises animals as sentient beings. The Protocol requires the EU and its Member States, in formulating and implementing EU policies on agriculture, to "pay full regard to the welfare requirements of animals" (Protocol on protection and welfare of animals, 1997). With this in mind, this report will look at the various systems permitted for the housing of laying hens after 2012 and assess their ability to meet the welfare requirements of hens. The welfare of hens can be poor in any system if design and management are poor. However, this report will focus on the potential for what can currently be achieved in each system if best practice is adopted, in terms of providing for the behavioural needs of hens and addressing key welfare concerns. The report will also consider opportunities for improving hen welfare in each system in the long term.

2. Alternatives to the barren battery cage for the housing of laying hens in the European Union

2.1 'Enriched' cages

'Enriched' cages (also called furnished or modified cages) are similar to conventional battery cages but provide more space and height and contain a range of additional elements intended to enable hens to perform some important natural behaviours. They come in a range of sizes. Smaller ones may house fewer than 10 birds, whilst larger versions may house up to 60 or more birds. The Laying Hens Directive (Council Directive 1999/74/EC) stipulates that 'enriched' cages must provide the following:

- A total floor area of at least 2000cm^2 with a minimum of 750cm^2 of floor space per hen, of which 600cm^2 must be "usable", the rest being used for items such as a nest box (this compares to 550cm^2 per hen in conventional battery cages);
- A height of at least 45cm over the "usable" area;
- A nest;
- Litter "such that pecking and scratching are possible";
- 15cm of perching space per hen;
- "Claw-shortening devices".

A large 'enriched' cage system.

2.2 Non-cage systems

Non-cage systems may be single or multi-tier (up to four levels), with or without outdoor access. Indoor non-cage systems are also referred to as aviaries (for systems with multiple tiers) or barn systems. The Laying Hens Directive stipulates that from 1 January 2007 (1 January 2002 for newly built or rebuilt systems), non-cage systems must provide the following:

- A maximum stocking density of 9 birds/m^2 of "usable" space (units in production on or before 3 August 1999 may continue with a stocking density up to 12 birds/m^2 until 31 December 2011);
- If more than one level is used, a height of at least 45cm between the levels;
- One nest for every seven hens (or 1m^2 of nest space for every 120 hens if group nests are used);
- Litter (e.g. wood shavings) covering at least one third of the floor surface, providing at least 250cm^2 of littered area per hen;
- 15cm of perching space per hen.

In addition to these requirements, free-range systems must also provide the following:

- One hectare of outdoor range for every 2500 hens (equivalent to 4m^2 per hen; at least 2.5m^2 per hen must be available at any one time if rotation of the outdoor range is practiced);
- Continuous access during the day to this open-air range, which must be "mainly covered with vegetation";
- Several popholes extending along the entire length of the building, providing at least 2m of opening for every 1000 hens.

A multi-tier non-cage system

A free-range system

3. The ability of 'enriched' cages and non-cage systems to meet the behavioural needs of laying hens

3.1 The natural behaviour and cognitive abilities of hens

Hens are descended from the red jungle fowl of Southern Asia. Neither thousands of years of domestication nor selective breeding for high productivity have fundamentally altered their behaviour. In a natural environment, hens spend much of their time foraging for food. This means that their exploratory pecking and scratching behaviours are highly motivated. Hens will walk considerable distances searching for food and are also able to fly short distances.

Jungle fowl hen foraging with her chicks

Hens congregate in small groups that have a complex social organisation based on a pecking order or hierarchy. Trees are used for roosting at night and escape from predators. Prior to laying, hens will seek out a secluded spot and build a nest to lay their eggs in. They also carry out regular maintenance behaviours including preening and dustbathing.

Hens are capable of recognising other birds and their relative status within the flock hierarchy. They appear to have preferred flockmates and choose to be close to familiar birds and avoid unfamiliar ones (Mench and Keeling, 2001; Webster, 2002). They are also capable of telling individual humans apart (Davis and Taylor, 2001) and can learn from watching other hens perform a task (Nicol and Pope, 1999). Hens can anticipate future events and the consequences of their actions. For example, experiments have shown that they can show self control by choosing to wait longer for a larger food reward rather than taking a small reward sooner. This means that hens can feel frustrated by thwarting of their expectations and may even feel anxiety about the future (Abeyesinghe *et al*, 2005).

3.2 Nesting

When appropriate nesting facilities are provided, domestic hens display the full repertoire of egg-laying behaviour seen in the jungle fowl. This includes searching, nest site investigation and selection, pre-laying behaviour (gathering, scraping, crouching, sitting and circling or keel rotation), followed by egg laying and post-lay sitting.

Scientific studies have shown that hens place a high value on access to discrete enclosed nest sites. They will overcome high costs (e.g. squeezing through narrow gaps or opening weighted doors) to gain access to nest boxes prior to laying (Cooper and Appleby, 1996a and 2003). Research has revealed that hens will work significantly harder to gain access to a nest box prior to laying than they will work to gain access to food after several hours' food deprivation (Cooper and Appleby, 2003). Stereotyped pacing, displacement preening and a specific vocalisation, the gakel-call, are associated with thwarting of nesting behaviour (Zimmerman *et al*, 2000). This indicates that hens are frustrated when they are prevented from carrying out this behaviour.

Hen in a motivational experiment working to reach a nest box

In order to fully meet the hens' requirements for nesting, the housing system must be able to provide the following:

- **A nest (or nests) that is perceived by the hens as an attractive site for egg laying;**
- **A sufficient quantity of individual nests or sufficient space in group nests to allow each hen to perform nesting behaviour at the time they choose for the full duration of laying behaviour, without being interrupted by other hens.**

Nesting and pre-laying preferences of hens were reviewed in detail by Cooper and Albentosa (2003). Experimental evidence suggests that generally hens prefer to lay in a discrete enclosed nest site with loose material such as straw or a flexible nest lining. However, the variability in individual responses suggests that no single type of nestbox system can cater for the requirements of all hens (Petherick *et al*, 1993). This creates a problem in 'enriched' cages as there is usually only one nestbox per cage (sometimes with room for several hens, depending on the size of the cage) so it is not possible to cater for a range of preferences. In non-cage systems, there are many nests so it is possible to use a range of nestbox designs.

Hens generally prefer discrete enclosed nest sites with loose material such as straw

In both 'enriched' cages and non-cage systems, some eggs are laid outside the nestboxes. Hens who persistently lay on the floor perform more nest-seeking and less nest-building behaviour. Despite generally making more visits to a nestbox than nest-laying hens prior to laying, 'floor layers' then often lay outside the nestbox (Cooper and Appleby, 1996b). Hens that do not consistently lay in nestboxes show the same motivation to find a suitable nest site as those that do (Cooper and Appleby, 1997). This suggests that the nestbox is not perceived as a suitable site for egg-laying by these hens. More work is needed to establish the preferences of such hens. In non-cage systems it should then be possible to provide a range of nestbox designs in order to meet the needs of these hens.

The mean proportion of eggs laid in the nest varied between 43% and 68% in a trial comparing four designs of 'enriched' cages with standard cages, indicating that some designs of 'enriched' cage fail to provide a satisfactory nest from the hens' perspective (Guesdon and Faure, 2004). However, recent data from the EU *LayWel* research project (Table 3.1) show that the proportion of eggs laid in the nest in 'enriched' cages can be comparable with that in non-cage systems for White Leghorn hens, although the proportion of eggs laid in nests for Medium Heavy hybrid hens is significantly lower in 'enriched' cages than in non-cage systems.

Table 3.1: Mean percentage of eggs laid in nests in various systems for two hen types. Data from 56 flocks of White Leghorn and 78 flocks of Medium Heavy hybrids. Source: LayWel (2006a).

Hen type	Housing system				
	Large 'enriched' cages	Medium 'enriched' cages	Small 'enriched' cages	Multi-tier non-cage systems	Single tier non-cage systems
White Leghorn (white shell)	95.4%	99.1%	95.8%	94.8%	97.7%
Medium Heavy (brown shell)	N/A*	89.4%	86.7%	96.7%	95.9%

* There were no Medium Heavy birds in large 'enriched' cages.

Between 2001 and 2002, the Dutch Research Institute for Animal Husbandry conducted a survey of all commercial free-range systems in the Netherlands and found that the proportion of eggs laid in the nests averaged 98% (range 94.4% to 99.6%) (van Emous, 2003).

Some birds may be prevented from laying in the nest as a result of competition from other hens. Birds may be interrupted by other hens whilst they are using the nest or they may be prevented from gaining access to the nest at all. Lundberg and Keeling (1999) investigated the impact of social factors on nesting and found that the length of time a hen stayed at the nesting site was correlated with the level of aggression: the more pecks a hen received, the shorter the time she stayed at the nest.

Laying hens show nest-building behaviours, such as pecking and treading of any nest substrates and circling or keel rotation, for about 20 minutes before egg-laying (Hughes *et al*, 1989). This pre-laying behaviour is important for the hen, as she will delay laying if she is interrupted (Freire *et al*, 1997) or has delayed access to her nest site (Cooper and Appleby, 2003).

The time of egg laying is synchronised in the hen with the majority of hens laying in the morning (peak incidence approximately three hours after 'dawn') (Oden *et al*, 2002). This means that many hens are likely to want to use the nests at the same time, leading to competition for nest sites.

Appleby *et al* (1993) investigated nesting behaviour in experimental cages with space allowances of 675cm^2 per hen plus an additional 375 to 480cm^2 per hen for facilities. Pre-laying behaviour appeared to be settled and hens spent an average of 45 minutes in the laying position. The limited space in 'enriched' cages under the EU Laying Hens Directive (600cm^2 of 'usable' area per hen plus an additional 150cm^2 per hen for facilities) is likely to be insufficient to allow each hen to spend this length of time in the nest if many hens want to lay at the same time. Appleby (1998) recommends providing a nest of 25cm x 48cm (large enough for two hens) in a cage housing four to five hens. This equates to a minimum of 240cm^2 of nest area per hen, much greater than the nest area currently provided in 'enriched' cages.

The greater nesting area available in non-cage systems provides more opportunity for hens to perform nesting behaviour at the time they chose and to remain at the nest site for the full duration of laying behaviour.

Hens nesting in a non-cage system

Lillpers (1991) investigated genetic variation in, and heritability of, the time of day when eggs are laid and concluded that it should be possible to use selective breeding to shift the time of egg laying while maintaining a high production rate. In the long term, it should therefore be possible to produce flocks that lay over a longer period of the day in order to reduce competition for nests.

The European Food Safety Authority (EFSA) Scientific Panel on Animal Health and Welfare (AHAW) was requested by the European Commission to conduct a detailed review of laying hen welfare in various housing systems. The AHAW Panel's Opinion states "Suitable nests, adequately distributed, should be provided in housing systems for laying hens… Although nests are well used, for some ['enriched' cage] systems there is not enough information to conclude whether they fully satisfy the nest-building or selection behaviour motivation of the birds. Non-cage systems contain a greater variety of potential nest sites and elicit less frustration behaviour than systems with inadequate egg-laying facilities." (AHAW, 2005a).

Well designed non-cage systems currently provide for the nesting requirements of the majority of hens. In the long term, non-cage systems have the potential to meet the nesting requirements of all hens by providing a range of nestbox designs. The limited space in 'enriched' cages means that even where the nest site is attractive to the majority of hens, competition for the nest site prevents some hens from fully expressing nesting behaviour.

3.3 Foraging and dustbathing

Foraging behaviour involves searching and scratching at the ground to reveal potential food items, followed by investigation and selection of food items by pecking. In natural conditions, hens spend between 50 and 90% of their waking time foraging, making up to 15000 pecks a day (Webster, 2002; Picard *et al*, 2002). Hens are still motivated to forage even when provided with adequate food (Cooper and Albentosa, 2003).

Dustbathing involves lying down, tossing earth or loose litter material onto the back and wings, rubbing it into the feathers and then shaking it out. Dustbathing removes grease and parasites and, in combination with preening, helps to keep the plumage in good condition. Hens are highly motivated to perform dustbathing behaviour (Lindberg and Nicol, 1997). Under unrestricted conditions, hens will dustbathe about every second day, with each dustbathing bout lasting on average nearly half an hour (Vestergaard, 1982).

Hens foraging in a free-range system

Hens show a strong preference for a littered floor (SVC, 1996). Experiments have shown that hens will make a great deal of effort to gain access to litter for pecking, scratching and dustbathing (Cooper and Albentosa, 2003). These experiments demonstrate that this resource is important to the hen. Stereotyped pacing, displacement preening and a specific vocalisation, the gakel-call, are associated with thwarting of dustbathing behaviour (Zimmerman *et al*, 2000). This indicates that hens are frustrated when they are prevented from carrying out this behaviour. When hens are denied the opportunity to express foraging behaviour, this can result in hens redirecting their pecking behaviour towards other birds in the form of harmful feather pecking (Keeling, 2002).

Hens dustbathing in a free-range system

In order to fully meet the hens' requirements for foraging and dustbathing, the housing system must be able to provide the following:

- **Sufficient quality of litter to enable foraging and dustbathing behaviour (i.e. the litter material must be appropriate and must be maintained in a dry friable state);**
- **A sufficient quantity (area and depth) of litter to enable all hens to fully express foraging and dustbathing behaviour;**
- **Availability of litter during the entire period of daylight each day.**

When hens are denied access to a suitable litter material they develop sham dustbathing behaviour in which they go through the motions of dustbathing in the absence of litter. Bouts of sham dustbathing are abnormally short and incomplete. The performance of sham dustbathing does not appear to satisfy the hens' motivation to dustbathe because they will spend a very long time dustbathing thoroughly when provided with a suitable litter material following a period of deprivation (Vestergaard, 1982).

Hens in 'enriched' cages sham dustbathe on the wire floor even when a littered area is available. Lindberg and Nicol (1997) found that two thirds of dustbathing bouts in 'enriched' cages took place on the cage floor even when hens had unrestricted access to a littered area.

Like egg laying, hens tend to perform dustbathing at the same time of day (mostly in the afternoon) so it is to be expected that there would be competition for the limited area of litter in 'enriched' cages if several hens want to dustbathe at the same time. Indeed, the sight and sounds of other birds dustbathing can increase a hen's motivation to dustbathe (Duncan *et al*, 1998).

However, Olsson and Keeling (2002) found no effect of competition on the occurrence of sham dustbathing, as bouts of sham dustbathing rarely coincided with the littered area being occupied. This suggests that the type, area and/or depth of litter provided in 'enriched' cages do not meet the hens' requirements for dustbathing. Indeed, Olsson and Keeling (2002) found no evidence that providing birds with a littered area in 'enriched' cages decreased the incidence of sham dustbathing at all compared with barren battery cages. In the recent EU *LayWel* research project no complete dustbaths were observed in 'enriched' cages (LayWel, 2006b). This suggests that the littered area provided in 'enriched' cages is entirely inadequate in meeting the hens' requirements for dustbathing. In non-cage systems, where there is litter over at least one third of the floor area, there is no evidence of birds showing sham dustbathing (AHAW, 2005b).

The provision of litter material in 'enriched' cages provides hens with some limited opportunities to express foraging behaviour. However, the limited space means that sufficient litter cannot be provided to allow all hens to engage in foraging during much of the day. Litter is not usually made available throughout the day in 'enriched' cages, so competition for the litter when it is available is likely to be intense, such that many birds may be unable to gain access to it. Litter is available over a large area throughout the day in non-cage systems, providing much greater opportunities for all birds to express foraging and dustbathing behaviour. The *Laywel* project concluded that the "substrate in barn systems gives more opportunities for laying hens to perform dustbathing and foraging behaviour as compared to the substrate area in furnished cage systems. The low proportion of hens performing foraging behaviour and the absence of complete dustbaths in furnished cage systems may indicate that the substrate areas in these systems do not fulfil the needs of the hens" (LayWel, 2006b).

The EU Animal Health and Welfare Panel states: "Litter appropriate for foraging and dustbathing should be provided in all systems and should be managed in such a way that it is friable and is readily accessible to all birds." In 'enriched' cages, "some high priority behaviours (e.g. foraging, dustbathing) cannot be performed or are limited… Foraging facilities are well provided for in most non-cage systems" (AHAW, 2005a).

Well managed non-cage systems can meet the birds' requirements for foraging and dustbathing. Opportunities for foraging are limited in 'enriched' cages and hens' requirements for dustbathing are not met.

3.4 Perching

Hens perching in a non-cage system

In natural conditions, hens roost at night as a means of protection from ground predators. They are therefore highly motivated to perch. When perching space is limited, hens will struggle vigorously to secure a perching space for the night (Appleby *et al*, 1992). Hens that are denied access to a perch show signs of agitation and increased movement around dusk (Olsson and Keeling, 2000). Experiments have shown that hens will make a great deal of effort to gain access to perches, particularly prior to nightfall (Cooper and Albentosa, 2003). These experiments demonstrate that this resource is important to the hen.

In order to fully meet the hens' requirements for perching, the housing system must be able to provide the following:

- **Sufficient length of perching space to allow all birds to perch at the same time;**
- **Sufficient elevation of the perches to satisfy the hens' requirements for a perceived safe roosting place at night.**

The EU Laying Hens Directive stipulates 15cm of perching space per hen in both 'enriched' cages and non-cage systems. Research by Appleby (1995) suggests that this length of perch per hen is adequate for medium weight hybrids. Heavier birds may require greater space allowance but 15cm per bird would seem to be sufficient for most types of hen. However, in some designs of 'enriched' cages, perches are constructed in a crossover design making parts of the perch inaccessible and effectively reducing the total length of perch available.

The limited height in 'enriched' cages (45cm over the 'usable' area) means that perches cannot be situated more than a few centimetres above floor level (perches are usually positioned around 7cm above the floor to allow eggs to roll underneath). The EU Scientific Veterinary Committee (SVC) concluded that a perch positioned 5cm above floor level is "not considered as a perch and has no attractive nor repulsive value" (SVC, 1996). Low perches are likely to be perceived as a different quality of floor but not as a perch (Tauson, 1984). In non-cage systems perches can be well elevated above floor level, providing a perceived safe night-time roosting site for hens.

The EU Animal Health and Welfare Panel states "Resting and perching are important aspects of birds' welfare. Roosting at night on an elevated perch is a behavioural priority… High perches are preferred" (AHAW, 2005a).

Non-cage systems can meet the perching requirements of hens. The limited height in 'enriched' cages means that the perches are unable to satisfy the birds' requirements for a perceived safe roosting site at night.

3.5 Space requirements and social group size

In order to fully satisfy the hens' requirements for space, a system must provide sufficient space to allow hens to express the following behaviours:

- **A whole range of comfort and maintenance behaviours, including preening, feather-ruffling, stretching, tail-wagging and wing-flapping;**
- **A whole range of locomotive behaviours, including walking, running, fluttering and flying;**
- **Escape behaviour from other hens.**

Research has revealed the amount of space used by hens to perform a range of basic behaviours. Table 3.2 shows the results of one such study. To put these space requirements into perspective, a single page of this report covers an area of 620cm^2.

Table 3.2: Area used by medium hybrid hens housed singly in small litter-floored pens. This compares to 600cm^2 of 'usable' space per hen in 'enriched' cages under the EU Laying Hens Directive. Source: Dawkins and Hardie (1989).

Behaviour	Area (cm^2)	
	Mean	Range
Standing	475	428 – 592
Ground scratching	856	655 – 1217
Turning	1272	978 – 1626
Wing stretching	893	660 – 1476
Wing flapping	1876	1085 – 2606
Feather ruffling	873	609 – 1362
Preening	1151	800 – 1977

The average space used by hens performing the behaviours shown ranged from 475cm^2 to 1876cm^2, although the top end of the range was 2606cm^2. All of the behaviours, with the exception of standing, require more space than the standard allowance of 600cm^2 of 'usable' space per bird in 'enriched' cages within the EU. Therefore, the current space allowance in 'enriched' cages fails to provide birds with adequate space to carry out many normal behaviours.

It is important to emphasise that the measurements given in the table above are measurements of the space used by hens, not necessarily the space needed by them. The amount needed will be significantly higher than the values in the table, as pointed out by Dawkins and Hardie (1989). This stands to reason. For example, a caged hen may physically occupy 1876cm^2 of space when wing-flapping, but the bird may actually need more than this to avoid hitting the sides of her cage (Baxter, 1994).

A study by Bradshaw and Bubier (1990) looked at the preferences of hens for different sized enclosures and their propensity to carry out wing-flapping behaviour. It found that an enclosure of 6420cm^2, which is three times greater than the area used to wing-flap, inhibited this behaviour in hens. Instead, the birds preferred an enclosure giving 13550cm^2 of space for wing-flapping. The researchers concluded "Hens have a perception of the space required to wing-flap that is larger than the length of the outstretched wings". AHAW (2005b) notes "Certain behaviours, notably wing flapping and flying, are rarely or never observed in cages, even at low stocking densities… it seems that they are prevented by spatial restriction, even at allowances that exceed the current recommendation."

The performance of other comfort behaviours, such as stretching and tail-wagging is also inhibited in cages. Hens that have been kept in cages where they are unable to perform comfort behaviours exhibit 'rebound behaviour' and perform them for much longer when subsequently given more space (Nicol, 1987a). Research has demonstrated the benefits of increasing space allowance in 'enriched' cages in terms of increased behavioural repertoire and freedom of movement (Appleby *et al*, 2002). Within 'enriched' cages, increasing spatial allowance, from 762cm^2 to 3048cm^2 per bird, allows increased performance of comfort activities such as tail-wagging and wing/leg stretching, and also increased locomotion (Albentosa and Cooper, 2004).

The limited space in 'enriched' cages prevents hens from performing many important basic behaviours

Keppler and Fölsch (2000) found that hens show extensive locomotive behaviour when given the opportunity to do so and conclude that hens in cages are extremely limited in their locomotive behaviour. Inactivity in caged hens contributes to bone weakness (see Section 4.2).

Experiments have shown that caged hens will make a great deal of effort to gain access to additional space (Cooper and Albentosa, 2003). Faure (1986) found that a group of four hens trained to peck repeatedly at a key to increase cage size would work to maintain a cage size of around 6000cm^2 (1500cm^2 per bird).

The EU Animal Health and Welfare Panel concludes "An increase in space from 450 to 750cm^2 per bird (as required by the EU Directive for furnished cages) appears to be beneficial for welfare… However, the behavioural repertoire is still restricted compared with birds in non-cage systems" (AHAW, 2005a).

The limited height in 'enriched' cages also imposes severe restrictions on the birds' behavioural expression. Higher cages (60cm compared to 40cm) lead to stronger humerus bones as a result of more frequent comfort behaviours (Moinard *et al*, 1998). A study of experimental cage heights of 30cm, 42.5cm and 55cm found that increasing cage height also reduced the rate of cage pecking, a stereotypic behaviour that can be seen as "a sign of frustration" (Nicol, 1987b).

Dawkins (1985) found that hens in cages with unrestricted height will make use of vertical space up to a height of 56cm and that hens show a preference for higher cages. Perches in cages are normally set around 7cm above floor level to allow eggs to roll underneath them. As hens may spend a considerable proportion of their time on perches, cage height should be measured not from the floor, but from the perch. Based on Dawkins' research, this would translate to a cage height of 63cm (56cm + 7cm), significantly higher than the 45cm required by the Laying hens Directive.

The requirements of laying hens for space and for an appropriate social environment are intrinsically linked (Keeling, 1995). Hens would naturally live in small groups with a stable

hierarchy so we might expect that they would prefer to live in small groups where they can recognise all individuals. Lindberg and Nicol (1996) found that hens showed a strong preference for a group of five hens over a group of 120. However, they chose the larger group in a large space over the smaller group in a small space, indicating that small groups are only preferred if they are provided with sufficient space.

Hens are unlikely to be able to enjoy the benefits of small group sizes in the restrictive environment of the 'enriched' cage. Hens in cages suffer from chronic stress because they are unable to form normal social relationships with other hens. Forcing hens into such close proximity disrupts normal social interaction and they will continually strive to get further apart. The continuous awareness of other hens and constant attempts to regulate social spacing provide evidence of social conflict and indicate that hens are stressed by being housed so close together (Baxter, 1994). Assessments of spatial preference have demonstrated that, unlike hens in non-cage systems, hens in 'enriched' cages adopt a more even spatial distribution, suggesting that hens in 'enriched' cages at 600cm^2 floor space per bird are attempting to maximise their personal space allowance (AHAW, 2005b).

Some free-range systems use multiple small houses, providing the ideal combination of ample space and small social group size. It is also possible to use partitions within larger houses to allow birds to establish stable social groups by forming smaller sub-groups in different parts of the house.

Multiple small houses with free-range access provide hens with the ideal combination of ample space and small social group size

Although hens may prefer small group sizes if given sufficient space, they appear to adapt well to living in larger groups. Aggressive behaviour is infrequent in large flocks compared to that reported in small to medium-sized flocks, possibly due to hens not recognising other individuals as familiar or unfamiliar (Hughes *et al*, 1997). When kept in large groups, the majority of birds may adopt a low-aggression tolerant social strategy (Estevez *et al*, 2004). Therefore, some individual hens might experience reduced social stress in larger flocks (Cooper and Albentosa, 2003). Even low levels of aggression in non-cage systems can be reduced further by housing male birds within flocks (Oden *et al*, 1999).

The minimum space allowance in non-cage systems is 1111cm^2 per bird (9 birds/m^2). In reality, the birds have much greater usable space than birds in 'enriched' cages due to increased use of the vertical dimension provided by perches or platforms. Also, the total area available to the birds is much greater than in 'enriched' cages and the uneven distribution of birds creates regions of lower stocking density within the shed, enabling birds to display a much greater behavioural repertoire, including wing-flapping, walking, running, fluttering, flying and escape

behaviour from other hens. Keppler and Fölsch (2000) found that hens in aviaries and free-range systems show extensive locomotive behaviour, moving distances of 1800m and 2500m per day, respectively.

Savory *et al* (2006) conclude "Any space allowance of less than about 5000cm^2 per hen imposes at least some constraint on free expression of behaviour". Only non-cage systems with free-range access provide this amount of space, coupled with the environmental complexity of an outdoor environment, which allows free expression of the hens' full range of natural behaviours.

Free-range systems provide hens with the space and environmental complexity to allow free expression of their full range of natural behaviours

The 600cm² of 'usable' space per bird and a height of 45cm in 'enriched' cages fail to allow sufficient space for hens to perform many important basic behaviours. The greater space allowance in non-cage systems allows hens to display a much broader behavioural repertoire.

4. Addressing key welfare concerns in 'enriched' cages and non-cage systems for laying hens

4.1 Feather pecking and cannibalism

Feather pecking can be a major welfare problem in laying hens and can occur in both cages and non-cage systems. The risk of feather pecking is generally greater in hens kept in larger groups than in smaller groups (Bilcík and Keeling, 2000; Nicol *et al*, 1999). Feather pecking can be gentle or severe. Severe feather pecking can cause feather damage and result in denuded areas. If pecking of these denuded areas continues it can lead to wounding and the development of cannibalism. Cannibalism can also result from vent pecking (Savory, 1995).

A beak-trimmed chick

In order to control feather pecking and cannibalism, hens are often beak-trimmed. This involves removing around a third of the beak of young chicks and can cause both acute and chronic pain due to tissue damage and nerve injury (Cheng, 2006). It is therefore important that housing systems for laying hens can be designed and managed to control feather pecking and cannibalism without resorting to beak-trimming.

Evidence suggests that feather pecking is redirected ground pecking behaviour associated with foraging and dustbathing (Blokhuis, 1986; Huber-Eicher and Wechsler, 1997; Vesterguard and Lisborg, 1993). It therefore stands to reason that design and management aimed at providing opportunities for hens to forage and dustbathe is likely to reduce the incidence of feather pecking. This has been confirmed by a number of studies.

Hens that are provided with food in the form of mash rather than pellets are less likely to feather peck, as mash takes longer to eat so the hen spends more time engaged in eating. Aerni *et al* (2000) state "High rates of feather pecking and pronounced feather damage were only found in hens housed without access to straw and fed on pellets". They conclude "In order to avoid problems with feather pecking, it is recommended that laying hens are provided with foraging material and fed on mash". El-Lethey *et al* (2000) similarly conclude "Provision of foraging material and food form have significant effects on both feather pecking and indicators of stress, suggesting that feather pecking in laying hens is associated with stress". Hartini *et al* (2002) found that the way in which food is presented, in particular that it is time consuming to eat, appears to be more important than dietary deficiencies in triggering cannibalism.

Providing adequate litter, maintained in a friable state, has been shown to reduce the incidence of feather pecking. For example, Zimmerman *et al* (2005) found that the use of nipple drinkers rather than bell drinkers and an improved litter management strategy contributed to a reduced level of feather pecking.

The provision of perches can reduce feather pecking and the height of the perches is important. Wechsler and Huber-Eicher (1997) found significantly less feather damage in hens kept in pens with high rather than low perches. They recommend that housing systems for laying hens should contain adequate foraging material and high perches to avoid welfare problems with feather pecking and feather damage.

Environmental enrichment can reduce the incidence of feather pecking. Norgaard-Nielson *et al* (1993) found that providing cut straw in the laying environment reduced feather pecking. Similarly, McAdie *et al* (2005) found that the addition of simple string devices to the pens of non-beak-trimmed birds decreased feather pecking. Friere *et al* (2003) also recommend the provision of refuge areas where birds can avoid pecking.

Conditions in the rearing environment are also important to reduce the future tendency of hens to feather peck. Norgaard-Nielson *et al* (1993) found that rearing with access to sand or peat for dustbathing reduced the later tendency to feather peck. Huber-Eicher and Sebö (2001) found that early access to litter (from one day of age) increased foraging behaviour and reduced feather pecking. Similarly, Nicol *et al* (2001) showed that early experience with litter stimulated ground pecking and dustbathing and reduced the chance of feather pecking in later life. Gunnarsson *et al* (1999) found that providing perches in the rearing environment significantly reduced the risk of cannibalism during the laying period.

Vegetation on the range provides cover and encourages hens to make full use of the outside area

In free-range systems, increased use of the range is strongly associated with a reduced risk of feather pecking and vent pecking (Pötzsch *et al*, 2001). Green *et al* (2000) found that less than 50% of the flock using the outdoor area on a fine sunny day was a significant risk factor for feather pecking, whilst Nicol *et al* (2003) found that the risk of feather pecking was reduced nine-fold in flocks where more than 20% of birds used the range on sunny days.

A number of measures can be used to encourage birds to make full use of the range. Nicol *et al* (2003) found that use of the range was increased by the presence of trees and/or hedges on the range. Laying hens show reduced signs of fear if the flock also contains cockerels (Oden *et al*, 2005) and this may encourage birds to range. Bestman and Wagenaar (2003) recommend keeping cockerels with layers, providing vegetative or artificial cover on the range and limiting flock size to around 500 birds to stimulate birds to use the outdoor range. It is also important to ensure that there are sufficient popholes to make it easy for hens to find their way out. In some systems, the whole length of the shed can be opened to encourage birds to go outside.

Designing systems so that the whole length of the shed can be opened encourages birds to range outside

It is widely acknowledged that some strains of hens are much less likely to engage in feather pecking and cannibalism than others. McAdie and Keeling (2000) point out "It has been repeatedly documented that feather pecking differs between strains of hens... It has also been demonstrated that feather pecking traits can be selected for or against." The UK Farm Animal Welfare Council (FAWC) has stated that genetic selection can reduce feather pecking and cannibalism "significantly and substantially" (FAWC, 1997). Hocking *et al* (2004) concluded that there is a strong genetic basis for feather pecking and cannibalism and that these behaviours are not strongly related genetically to other behavioural traits. Therefore, "It should be possible to select birds that exhibit the normal range of behaviours but that do not have a propensity for feather pecking and cannibalism."

Whilst pointing out that "genetic tools" cannot provide the entire solution to feather pecking, Preisinger (2000) looks to the future with optimism: "If future stocks with a low propensity for feather pecking, which are currently being developed, are housed in well designed and properly managed systems, poultry farmers will be able to control feather pecking without the need for beak trimming."

In order to control feather pecking and cannibalism without resorting to beak-trimming, the following measures should be adopted:

- **Strains of hen that are less likely to feather peck should be used and selective breeding should be used to further reduce the propensity of hens to feather peck;**
- **Feed should be provided in a form that is time-consuming to eat;**
- **In both the rearing and the laying environment, a sufficient quantity of appropriate litter material should be provided and maintained in a dry friable state to provide opportunities for foraging and dustbathing behaviour;**
- **High perches and environmental enrichment should be provided in both the rearing and laying environment;**
- **Refuge areas should be provided where birds can escape from pecking by other hens;**
- **Partitions should be provided in large houses to allow birds to form smaller sub-groups;**
- **In systems with outdoor access, ample popholes should be provided, consideration should be given to keeping cockerels with the hens and cover should be provided on the range to encourage hens to make full use of the outside area.**

The genetic factor can be addressed in all systems. However, many of the environmental factors cannot be applied in 'enriched' cages. It would be difficult to provide escape areas within the limited space in 'enriched' cages and we have already seen how the foraging, dustbathing and perching requirements of hens are not adequately provided for in 'enriched' cages (See Section 3). Birds in non-cage systems have more opportunities to hide and escape from feather pecking than birds in 'enriched' cages. Research suggests that feather condition is as good or better in aviary birds compared with birds in 'enriched' cages (Zoons, reported in Rodenburg *et al*, 2005).

Guedson *et al* (2006) recorded unacceptably high mortality (>40%) in non beak-trimmed hens in 'enriched' cages due to cannibalism. Feather pecking and cannibalism may be expected to be particularly problematic in the larger designs of 'enriched' cages. According to one expert, "Group sizes of sixty tend to be associated with a relatively high incidence of feather pecking. A group of sixty, tightly-stocked in a furnished cage could combine the maximum of motivation with the maximum of opportunity" (Prof. John Webster, personal communication).

If hens with a low propensity to feather peck are used and the above design and management practices are adopted, it should be possible to control feather pecking and cannibalism in non-cage systems without resorting to beak-trimming. Case studies of free-range systems for laying hens across the EU, carried out by CIWF, demonstrate how breed choice and preventive management practices can enable farmers to successfully use non beak-trimmed birds. Two Swedish farms used a white strain of hen that is less likely to feather peck and kept cockerels with the hens. They experienced few problems with feather pecking and achieved mortality rates of 2-3% and 5-6%, respectively, with non beak-trimmed birds (beak-trimming is prohibited in Sweden). One UK farm used systems where the whole length of the shed can be opened to encourage birds to go outside and used the Columbian Blacktail breed of hen, which ranges well. The farm overcame initial problems with feather pecking by slightly reducing group size and stocking density, achieving excellent feather condition and a mortality rate of 1.5% with non beak-trimmed birds (Arey, 2004).

Feather pecking and cannibalism can be controlled in non-cage systems without resorting to beak-trimming, through the use of appropriate strains and selective breeding to further reduce the hens' propensity to feather peck, and through the adoption of a range of preventive management practices. Preventive management is dependent on providing birds with opportunities for foraging, dustbathing and perching, which are not adequately provided for in 'enriched' cages.

4.2 Bone strength and fractures

Bone fractures are a major welfare problem in laying hens

The high rate of egg production in modern laying hens puts enormous demands on the birds' calcium reserves, leading to osteoporosis. There is a generalised loss of structural bone throughout the skeleton that starts when the hens begin to mature sexually and continues throughout the period of egg production, resulting in progressively weaker bones and increasing fracture risk. Osteoporosis is the major factor predisposing laying hens to the severe welfare problem of bone fractures (Whitehead, 2004). Inactivity contributes to bone loss so the severity of osteoporosis is increased if hens are kept in cage systems where their movement is restricted (Whitehead, 2004).

Leyendecker *et al* (2005) found that bone strength was consistently higher for hens kept in an aviary compared to those in 'enriched' cages. Humerus strength was higher for hens kept in 'enriched' cages compared to those in conventional battery cages but no differences for tibia breaking strength were found between conventional and 'enriched' cages. However, Guedson *et al* (2004) found that quality of the humeral bone was not significantly improved in 'enriched' cages compared to conventional cages. Keppler and Fölsch (2000) found that hens in cages are extremely limited in their locomotive behaviour compared with birds in aviaries and free-range systems and concluded that a high locomotion level is important for preventing osteoporosis.

Bone fractures can be a major welfare problem in all housing systems. The weakened bones of caged hens by the time they are taken for slaughter result in many fractures when they are removed from the cages. Although the greater freedom of movement in non-cage systems improves bone strength it can also create more opportunities for accidents, which can result in many birds having old healed fractures by the end-of-lay. Table 4.1 shows the results of one study comparing the proportions of new and old breaks found in hens from different systems.

Table 4.1: Fracture incidence after depopulation of hens from different housing systems. Source: Gregory *et al* (1990).

Fracture incidence (%)	Housing system		
	Cages	Perchery	Free-range
New breaks	31	10	14
Old breaks	5	25	12
Total	**36**	**35**	**26**

Worryingly, recent data suggest that the problem of bone fractures is getting worse. Friere *et al* (2003) found 73% of aviary birds had old keel bone breaks. Wilkins *et al* (2004) found a high prevalence of old keel and furculum bone breaks, ranging from 50 to 78% in flocks from indoor floor housing and free-range systems. Rodenburg *et al* (2006) found the incidence of keel bone breaks to be 57% in 'enriched' cages and 88% in non-cage systems (aviaries and floor housing systems).

Genetic selection of commercial layers for increased egg production has resulted in much weaker bones compared with traditional breeds (Budgell and Silversides, 2004). Hocking *et al* (2003) concluded that eggshell quality is maintained in genetically selected lines at the expense of bone strength and density.

Bone quality can be improved through selective breeding. Whitehead and Fleming (2000) selected hens for resistance or susceptibility to osteoporosis. After three generations of selection, the resistant and susceptible lines differed by 19% for keel bone mineral density, 13% for humerus breaking strength and 25% for tibia breaking strength and showed a six-fold difference in fracture incidence under commercial breeding conditions.

In order to minimise the risk of bone fractures the following measures should be adopted:

- **Traditional breeds should be used and/or selective breeding should be used to improve bone strength in commercial strains;**
- **Hens should be kept in systems where they are able to exercise to maintain bone strength;**
- **Systems should be well designed to reduce the risk of accidents.**

All of these factors can be addressed in non-cage systems. However, even with selective breeding to improve bone strength, the limited space in 'enriched' cages means that birds are unable to exercise to maintain bone strength.

The EU Animal Health and Welfare Panel recommends: "In order to minimise bone weakness, all systems for housing hens should provide sufficient space for walking, wing-flapping, and other activities necessary to maintain bone-strength and minimise risks of fracture" (AHAW, 2005a).

The current high incidence of bone fractures in all systems is unacceptable and should be addressed as a matter of urgency, through the use of traditional breeds and/or selective breeding of commercial strains. Even with selection to improve bone strength, the limited space in 'enriched' cages means that birds are unable to exercise to maintain bone strength. Non-cage systems provide birds with much greater freedom of movement and opportunities for exercise.

4.3 Mortality

Aerni *et al* (2005) conducted a systematic review of mortality in aviaries and found that mortality rates and the prevalence of cannibalism were the same in aviaries and conventional cages. Weber *et al* (2003) recorded mortality levels of 8.7% in 'enriched' cages and 11.7% in a floor pen system.

Weitzenbürger *et al* (2005) compared two hen types in three designs of 'enriched' cages and found mortality rates between 4.0 and 5.2%. Guedson *et al* (2006) compared beak-trimmed and non beak-trimmed hens in conventional cages and two designs of 'enriched' cages. They found low mortality (<5%) in beak-trimmed hens but unacceptably high mortality (>40%) in non beak-trimmed hens due to cannibalism.

A large survey of egg producers in the UK recorded mortality rates ranging from 3 to 12% (average 8%) in non-cage systems (both indoor and free-range) (NFU, 2003). Abrahamsson *et al* (1998) found mortality in an aviary system in Sweden normally ranged from 3.4 to 7.8% but in some flocks was much higher (up to 20.9%). CIWF carried out a number of case studies of free-range systems for laying hens across the EU and found that the majority of farms studied (7 out of 9) had a mortality rate of between 1.5 and 6.0% (two farms had higher mortality rates up to 20%) (Arey, 2004).

Outbreaks of infectious disease or severe feather pecking and cannibalism can result in occasional higher mortality levels in any system. We have already seen how problems with feather pecking and cannibalism can be minimised in non-cage systems (Section 4.1).

The figures presented here demonstrate that with good management, low levels of mortality can normally be achieved in both 'enriched' cages and non-cage systems.

5. Overall comparison of welfare in 'enriched' cages and non-cage systems

Table 5.1 summarises the main differences in design between 'enriched' cages and non-cage systems. Non-cage systems provide much greater space, freedom of movement, environmental complexity and more satisfactory provision of litter and perches than 'enriched' cages.

Table 5.1: Major differences in design between 'enriched' cages and non-cage systems. Source: Rodenburg *et al* (2005).

	'Enriched' cages	Non-cage systems
Group size	Small	Large
Freedom of movement	Limited	Yes
Space allowance per bird	750cm^2	1111cm^2
Space allowance per group	Small	Large
Complexity of environment	Medium	Complex
Litter	Limited amount	Large amount
Perches	Low	High
Access to different tiers	No	Yes (aviaries); No (floor housing)

This report demonstrates that well designed and managed non-cage systems can meet the requirements of hens for nesting, foraging, dustbathing, perching and space. 'Enriched' cages cannot adequately provide for these requirements.

Feather pecking and cannibalism can be controlled in non-cage systems without resorting to beak-trimming, through the use of appropriate strains and selective breeding to further reduce the hens' propensity to feather peck, and through the adoption of a range of preventive management practices. Preventive management is dependent on providing birds with opportunities for foraging, dustbathing and perching, which are not adequately provided for in 'enriched' cages.

Selective breeding of hens to increase egg production has resulted in bone weakness. The high incidence of bone fractures in all systems is unacceptable and should be addressed through the use of traditional breeds and/or selective breeding of commercial strains as a matter of urgency. Even with traditional breeds or selection to improve bone strength, the limited space in 'enriched' cages means that birds are unable to exercise to maintain bone strength. Non-cage systems provide birds with much greater freedom of movement and opportunities for exercise.

Outbreaks of infectious disease or severe feather pecking and cannibalism can result in occasional higher mortality levels in any system. However, with good management, low mortality levels can normally be achieved in both 'enriched' cages and non-cage systems.

Table 5.2 (overleaf) summarises the findings of this report. It is clear that 'enriched' cages do not have the potential to meet many of the welfare requirements of hens or address some key welfare concerns, now or in the future. By contrast, non-cage systems do have the potential to meet the welfare requirements of hens and address key welfare concerns.

Table 5.2: Summary of the current and future potential of 'enriched' cages and non-cage systems to meet the welfare requirements of laying hens and address key welfare concerns.

	'Enriched' cages currently	'Enriched' cages future potential	Non-cage systems currently	Non-cage systems future potential
Able to satisfy nesting requirements?	**No** - competition limits duration of nesting behaviour	**Possible** if use selective breeding to extend period of day when birds lay	**Yes**	**Yes**
Able to satisfy foraging requirements?	**No** - limited foraging opportunities	**No** - limited foraging opportunities	**Yes**	**Yes**
Able to satisfy dustbathing requirements?	**No** - birds still sham dustbathe	**No** - birds still sham dustbathe	**Yes**	**Yes**
Able to satisfy perching requirements?	**No** - perches too low	**No** - perches too low	**Yes**	**Yes**
Able to satisfy space requirements?	**No** - many basic behaviours not possible	**No** - many basic behaviours not possible	**Yes** - especially free-range systems	**Yes** - especially free-range systems
Able to provide appropriate social group size?	**Yes** but limited space means birds cannot interact normally	**Yes** but limited space means birds cannot interact normally	**Possible** in small group free-range or in large group houses by providing partitions	**Possible** in small group free-range or in large group houses by providing partitions
Able to achieve low levels of feather pecking and cannibalism without beak-trimming?	**Possible** in small cages; **No** in large cages	**Possible** in small cages; **No** in large cages - even with selective breeding, birds' requirements for foraging and dustbathing are not met	**Possible** with appropriate strains and good management	**Yes** with selective breeding to reduce the hens' propensity to peck and good management
Able to achieve low levels of bone fractures?	**No** - current level of fractures unacceptable	**No** - even with traditional breeds or selective breeding, birds are unable to exercise to maintain bone strength	**Possible** with traditional breeds and good system design; The current level of fractures with commercial strains is unacceptable	**Yes** with selective breeding to improve bone strength and good system design
Able to achieve low mortality levels?	**Yes** with good management	**Yes** with good management	**Yes** with good management	**Yes** with good management

Many of the welfare problems in 'enriched' cages are inherent in the system. The limited space and height mean that many of the behavioural requirements of the hens are not met. Because space is the limiting factor, attempts to improve one resource are likely to impinge on others. For example, if the nesting area were increased to reduce competition, this would necessarily reduce the area available for other facilities, such as the litter area, which is already too small to meet the birds' requirements for foraging and dustbathing. Welfare problems in non-cage systems are not inherent in the system and can be addressed through good design and management.

Rodenburg *et al* (2006) conducted an on-farm comparison of the welfare of laying hens in 'enriched' cages and non-cage systems. They found that birds in non-cage systems showed more foraging and walking and were less fearful (as indicated by their shorter tonic immobility response) than birds in 'enriched' cages. More keel bone breaks were found in non-cage systems than in 'enriched' cages. There was no difference in plumage condition between systems. Overall, they concluded that their results indicate the welfare of laying hens is better in non-cage systems than in 'enriched' cages.

The evidence in this report demonstrates that well designed and managed non-cage systems provide higher standards of welfare than 'enriched' cages and that 'enriched' cages fail to meet the welfare requirements of hens. CIWF therefore calls on the EU to strengthen the Laying Hens Directive to prohibit the use of 'enriched' cages as well as conventional battery cages.

6. Economics of changing to non-cage systems

CIWF believes that the Laying Hens Directive should be strengthened to prohibit the use of all cage systems for laying hens. The EU egg industry is concerned that this would lead to a substantial increase in production costs which, coupled with a reduction in import tariffs that could be agreed as part of World Trade Organisation (WTO) negotiations, would lead to an increase in imports of cheap eggs that do not meet EU welfare standards. The industry's fear is that there will be an increase, not in the import of shell eggs, but in the import of egg products (especially dried egg products) used in processed foods. Changing to more humane non-cage systems will entail a cost but this report will show how this cost can be met without harming the livelihoods of EU egg producers.

6.1 The cost of changing to non-cage systems

Based on data in the European Commission's socio-economic report (European Commission, 2004), it costs €0.66 to produce 12 battery eggs, €0.82 to produce 12 barn eggs and €0.98 to produce 12 free-range eggs. So 12 free-range eggs cost €0.32 more to produce than 12 battery eggs, and 12 barn eggs cost €0.16 more to produce than 12 battery eggs. This means that one free-range egg costs 2.6 Eurocents more to produce than a battery egg, and a barn egg costs 1.3 Eurocents more to produce than a battery egg. Table 6.1 (overleaf) sets out the costs of producing eggs in various systems.

Table 6.1: Egg production costs in various systems based on the European Commission's socio-economic report. Source: European Commission (2004).

	Cost of producing 12 eggs* (Eurocents)	Cost of producing 1 egg** (Eurocents)
Cost of producing conventional battery eggs	66	5.5
Cost of producing barn eggs	82	6.8
Cost of producing free-range eggs	98	8.1
Extra cost of producing free-range eggs rather than battery eggs	32	2.6
Extra cost of producing barn eggs rather than battery eggs	16	1.3

* Figures for producing 12 eggs obtained by taking three quarters of the figures for producing 1 kg of eggs (16 eggs) given in the Commission's report.

** Figures for producing 1 egg obtained by dividing by 16 the figures for producing 1 kg of eggs (16 eggs) given in the Commission's report.

CIWF believes that farmers should not be left to bear the higher production costs themselves. The increased costs can be met by a combination of government support and consumers paying a little more for eggs. For individual consumers the extra price of eggs should amount to just a few eurocents per week.

The average per capita consumption in the EU-25 is around 220 eggs per year (including processed eggs) (European Commission, 2004). This means that EU consumers could change from battery to barn eggs for just 5.5 Eurocents each per week and from battery to free-range eggs for only 11 Eurocents each per week. This is provided that the retailers charged no more extra for barn and free-range eggs than is needed to cover the additional cost of producing them.

The above production cost figures include building and equipment costs. The capital costs involved in changing to new systems are eased by the fact that the Laying Hens Directive gives farmers a very generous phase-out period of 12 years (Council Directive 1999/74/EC). During that time, most battery cages will come to the end of their working life and will in any event need to be replaced. Moreover, farmers can be helped with the capital costs of change under the Common Agricultural Policy's Rural Development Regulation (Council Regulation (EC) No. 1658/2005).

The Commission's report concludes that if costs were to increase by 20%, which it says is the type of percentage increase in terms of variable costs that producers are likely to face as a result of switching to free-range, the industry will potentially suffer a loss of producer surplus of €354 million (EU-25) (European Commission, 2004). This appears to be a substantial sum. If, however, this increased cost were borne not by farmers but by consumers paying a little extra for eggs, each EU citizen would only have to pay less than €1 extra per year, as the human population of the EU-25 is around 460 million.

Although the industry makes much of the fact that changing to barn and free-range systems will increase production costs, it fails to point out that those increased costs are more than compensated for by the higher prices that producers obtain for barn and free-range eggs.

As a result, the margins achieved by producers for barn and free-range eggs are appreciably higher than those available for battery eggs. The Commission's socio-economic report shows that margins for free-range eggs are around twice as high as those for battery eggs (European Commission, 2004). Table 6.2 (opposite) shows the gross margins for battery, barn and free-range eggs.

Table 6.2: Gross margins for battery, barn and free-range eggs shown by the European Commission's socio-economic report. Source: European Commission (2004).

	Battery eggs	Barn eggs	Free-range eggs
Gross margin per 1 kg eggs (i.e. 16 eggs) (Eurocents)	19.5	25.0	38.0

It may be that, if barn and free-range production were to increase, the premium prices (and hence the better margins) for these eggs would be to some degree reduced. However, skilful marketing should help to preserve better margins for producers of non-cage eggs because many consumers are willing to pay more for eggs produced in humane systems.

6.2 Willingness of consumers to pay more for non-cage eggs

The presumption that changing to more humane non-cage systems will be costly for farmers is based on the assumption that consumers will not be willing to pay extra for eggs from non-cage systems and therefore that (i) farmers will have to bear the additional costs alone and (ii) consumers will turn to imported eggs produced in cages.

In fact this assumption is not correct: there is strong evidence that an increasing proportion of consumers are willing to pay extra for non-cage eggs. This is demonstrated by the fact that over the last decade there has been a substantial increase in the proportion of the EU laying hen flock kept in non-cage systems. The share of the EU laying hen flock kept in non-cage systems rose between 1993 and 2003 from 3.56% to 11.93% (European Commission, 2004). Preliminary data for 2005 indicate that over one fifth of laying hens in the EU-25 are now kept in non-cage systems (European Commission, 2006). Countries with the highest proportions of laying hens in non-cage systems in 2003/4 were Sweden (50%), Austria (45%), the Netherlands (45%), Denmark (38%), the UK (30%) and Ireland (30%). The number of laying hens in non-cage production systems has increased steadily between 1995 and 2004 by an average of 174% for those countries with complete data (Eurogroup for Animal Welfare, 2006).

Moreover, the recent Eurobarometer survey on the welfare of farmed animals found that a majority of EU-25 citizens state that they are willing to pay more for eggs sourced from an animal welfare friendly production system. 25% of respondents state that they can accept a 5% price increase, 21% an increase of 10%, and 11% are prepared to accept an increase of 25% or more. These figures reflect the fact that, in answer to another question in the survey, 58% of respondents rated the welfare of laying hens as very or fairly bad (European Commission, 2005).

The fact that consumers are willing to buy eggs from non-cage systems despite the higher price of such eggs is seen from the Commission's socio-economic report, which states that in the Netherlands, Sweden, Denmark and the UK close to 50% of eggs sold at the retail level are sourced from non-cage systems and that in Germany and Austria the percentage is around 25% (European Commission, 2004). Between 1995 and 2003, consumption of eggs from cage systems has dropped whilst consumption of eggs from non-cage systems has increased substantially (Eurogroup for Animal Welfare, 2006).

In the UK, surveys carried out in 2003 and again in 2005 reveal a significant fall in the proportion of battery eggs sold by several major retailers, with many reporting that over 50% of their shell egg sales are now from non-cage systems (Pickett and Burgess, 2004; Pickett, 2006). The detailed figures are shown in Table 6.3 (below).

Table 6.3: Proportion of shell eggs (both own label and branded) from cage, barn and free-range systems sold by selected UK supermarkets. Source: Data supplied by supermarkets in response to CIWF surveys (Pickett and Burgess, 2004; Pickett, 2006).

	2003 Survey			2005 Survey		
Supermarket	Cage	Barn	Free-range	Cage	Barn	Free-range
Asda	66%	5%	28%	43%	0%	57%
Co-op	59%	0%	41%	34%	0%	66%
Marks & Spencer	0%	0%	100%	0%	0%	100%
Tesco	40%	36%	24%	43%	16%	41%
Waitrose	0%	10%	90%	0%	18%	82%

6.3 Imports

The EU-15 has for many years been self-sufficient in eggs with a small exportable surplus and the ten Member States who joined the EU in 2004 have also been self-sufficient in eggs for many years (European Commission, 2004)[1].

It has, however, generally been assumed that the increase in production costs arising from changing to more humane non-cage systems would lead to an increase in imports. The fear is that there would be an increase, not in the import of shell eggs, but in the import of egg products (especially dried egg products) used in processed foods. However, the Commission's report indicates that the increase in imports is likely to be smaller than anticipated. The report states that a 20% increase in costs (the type of percentage increase in terms of variable costs that producers are likely to face as a result of switching to free-range) will lead to an increase in imports of up to 3-4%. The report stresses "This does not, however, significantly affect the overall scenario results because the rise in imports is from a very low base or, to put this differently, because the quantity of eggs currently traded is very small in relation to the size of the overall egg market" (European Commission, 2004).

Experience in Switzerland suggests that imports need not necessarily increase as a result of prohibiting all cage systems. The Commission's report clearly states that overall imports did not increase as a result of the prohibition of all cage systems in Switzerland. Following the ban, egg product imports increased but at the same time the share of imported shell eggs fell sharply. Thus "the overall balance on the market between imported and domestically produced eggs has remained broadly stable with around 50% of total egg consumption being derived from each source" (European Commission, 2004).

6.4 Positive policies of certain retailers and food service operators

Retailers, food manufacturers and food service operators have an important role to play in limiting the quantity of imports produced in systems that do not meet EU welfare standards, by pledging to use and supply only non-cage eggs.

A number of major retailers already have an express policy of only selling free-range eggs or of not selling battery eggs. Some retailers apply this policy not just to shell eggs but also to eggs used in baked goods and processed products such as ready-made meals, quiches and ice cream.

In the UK, Marks & Spencer sells only free-range shell eggs and uses only free-range eggs in their entire range of baked goods, processed products and ready-made meals. Waitrose sells only non-cage shell eggs and uses only free-range eggs in their processed products and

1 Data for the two new Member States who joined the EU in 2007 are not included in this report.

ready-made meals. As of 1 January 2007 (with one minor exception) all Austrian supermarkets no longer sell battery eggs. Many retailers in the Netherlands, including Albert Heijn and Schuitema (subsidiaries of Ahold), Laurus (including Edah, Konmar and Super de Boer), Dirk van den Broek (including Bas van der Heijden and Digros), Aldi and Lidl sell only free-range shell eggs. Three Belgian supermarkets: Makro, Colruyt and Lidl, no longer sell battery eggs.

The Commission's report states that Sweden's move away from conventional battery cages has been aided by the decision by the four largest retailers (who between them account for 98-99% of the Swedish retail market) to stop stocking conventional battery eggs (European Commission, 2004).

Some major operators in the food service sector also have a policy of only using free-range eggs. In the UK, McDonald's (Europe's largest food service operator) uses only free-range eggs in their breakfasts and sauces. In addition, Pizza Express, Ask, Zizzi and Pret a Manger use only free-range eggs, as does J. D. Wetherspoon, one of the UK's largest food service operators.

6.5 Strategy for prohibiting all cage systems and also safeguarding EU egg producers

CIWF urges the European Commission and the EU egg industry to develop a strategy that would enable producers to change to more humane non-cage systems. This strategy would need to be composed of a number of interlocking components, including the following elements:

- **Consumers, retailers, food manufacturers and the food service sector**

The Commission should take the lead in bringing together all the key players – the industry, consumer bodies, retailers, food manufacturers and the food service sector – and persuade them of the desirability of supporting a ban on all cage systems in the EU.

An EU-wide public information campaign should be implemented well in advance of the cage ban in order to encourage consumers to support this important welfare reform by buying non-cage eggs; the Eurobarometer survey shows that a majority of EU consumers are willing to do this (European Commission, 2005).

Supermarkets should be encouraged to adopt a policy of only selling non-cage eggs and of only using such eggs in processed products. As indicated earlier, a number of supermarkets have already implemented such a policy.

The key role that can be played by supermarkets is stressed by the Commission's socio-economic report. It states that "change will be very much market driven" and that in particular "the attitude of retailers and consumers could be highly important in that (potentially consumer-led) moves away from caged eggs by retailers with a substantial market share would have a significant impact on the sector" (European Commission, 2004).

The Commission's report also points out that retailers were instrumental in ensuring that the Swiss transition to a system with no cage production progressed as planned. The report states that Switzerland's move to only using non-cage systems "was greatly enhanced by the fact that from the early 1990s onwards the two dominant supermarket chains in Switzerland (Co-op and Migros) saw it as a major means of enhancing their marketing strategy and image to provide consumers with eggs from alternative systems. They thus invested heavily in the promotion of eggs produced in alternative systems and thereby contributed to a change in consumer demand patterns" (European Commission, 2004).

It is essential that the food processing and food service sectors are urged to play their part in enabling producers to change to more humane non-cage systems. Around 24% of EU eggs are used in food processing and 20% go to the food service sector, whilst 56% are sold through the retail sector (European Commission, 2004). EU egg producers do not in general believe that shell eggs would be imported in large quantities if all cage systems were prohibited. They are, however, particularly concerned that food manufacturers and food service operators would import egg products (particularly dried egg products) from hens kept in cages.

Food manufacturers, food service operators and retailers should be encouraged to fulfil their corporate social responsibility (CSR) in this field by committing themselves to only sourcing eggs and egg products produced to EU welfare standards. To do otherwise would be to undermine a welfare reform enacted by EU legislators and wanted by the majority of EU citizens. This does not mean that food manufacturers and food service operators cannot import, but imported eggs and egg products must be produced to equivalent welfare standards.

Many large companies have already adopted corporate social responsibility policies. A European Commission Communication on CSR defines it as "a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis" (European Commission, 2002). The Commission Communication stresses that CSR practices can contribute to the objectives of EU policies and in particular to sustainable development. "Triple bottom line" reporting, in which not only economic but also environmental and social performance are featured, is increasingly recognised as good practice.

Key food manufacturers and food service operators have already adopted CSR policies; these primarily focus on social and environmental issues. They should now be encouraged to follow the example of those companies that have extended their CSR policies to include animal welfare. CIWF believes there is both an ethical case and a business case for so doing. In particular, they should be persuaded that playing their part in enabling producers to switch to more humane non-cage systems is in their long-term interest as it will have a favourable impact on their business. It will enhance their reputation and, if skilfully marketed, help win new customers.

- **Public Procurement**

The public sector provides meals and food in hospitals, schools, prisons, staff canteens and to the armed forces. The public sector should be encouraged to only source and provide eggs and egg products that have been produced to EU welfare standards. It would be inappropriate, if the EU legislature prohibited all cage systems on welfare grounds, for the EU (and Member States') public sector to undermine that ban and the EU farmers who would be obliged to comply with it, by sourcing imported eggs and egg products produced in a way that is unlawful in the EU.

- **Support under the Common Agricultural Policy (CAP) Rural Development Regulation**

The Commission's socio-economic report stresses that government support was instrumental in ensuring Switzerland's smooth transition to a system with no cage production. Government-funded programmes provided substantial investment subsidies for the transition to alternative production systems (European Commission, 2004).

The Rural Development Regulation (RDR) enables Member States to help egg producers with the costs of moving to alternative systems (Council Regulation (EC) No. 1698/2005). Support with part of the capital costs of change can be given under the RDR's "Modernisation of Agricultural Holdings" measure. Moreover, a partial contribution can be made for up to five years to the additional running costs incurred under the RDR's "Meeting Standards" measure.

- **World Trade Organisation (WTO)**

The EU should seek to make progress on animal welfare at the WTO negotiations and in particular should try to ensure that it is in a position to safeguard EU egg producers from being undermined by cheap imports of eggs from hens kept in systems banned in the EU. The EU should seek positive outcomes in the following areas:

Green Box: The EU should re-energise its efforts to secure inclusion in the Green Box of payments made by WTO members to contribute to the additional costs incurred by farmers in meeting good animal welfare standards. Such payments would be non-, or at most minimally, trade-distorting provided that the additional costs stem *directly* from the higher standards in question.

Sensitive products: Agreements on market access include some flexibility for 'sensitive' products. The EU should commit itself to including egg product lines in its list of sensitive products. Sensitivity classification will enable the EU to apply a lower tariff reduction than would otherwise be the case. The EU egg industry believes that classification of egg product lines as sensitive would be helpful in safeguarding them from imports of egg products from hens kept in cages.

Labelling: EU law requires eggs and egg packs produced in the EU to be labelled with the farming method (Council Regulation (EC) No 5/2001). A much weaker labelling regime is, however, applied to imported eggs. This is because the EU feared that applying the same mandatory labelling scheme to imported eggs as to EU eggs would not be consistent with the WTO Agreement on Technical Barriers to Trade (TBT).

There are sound legal grounds for the view that the application of the same mandatory labelling regime to imported eggs as to EU eggs would not in itself constitute discrimination and would be compatible with the TBT provided that the EU takes a number of steps to ensure that it is acting in accordance with the TBT. Such steps include acting in accordance with the principles of transparency and good faith. The Commission should now give fresh consideration to the question of whether the existing requirement to label eggs and egg packs with the farming method could be fully extended to imported eggs in a manner that is compatible with the TBT.

CIWF believes that the strategy outlined above would allow the EU to prohibit the use of all cage systems for the housing of laying hens without harming the livelihoods of EU egg producers.

CIWF believes the EU egg industry can change to more humane non-cage systems without harming the livelihoods of EU egg producers

7. Conclusion and recommendations

- Well designed non-cage systems currently provide for the nesting requirements of the majority of hens. In the long term, non-cage systems have the potential to meet the nesting requirements of all hens by providing a range of nestbox designs. The limited space in 'enriched' cages means that even where the nest site is attractive to the majority of hens, competition for the nest site prevents some hens from fully expressing nesting behaviour.
- Well managed non-cage systems can meet the birds' requirements for foraging and dustbathing. Opportunities for foraging are limited in 'enriched' cages and hens' requirements for dustbathing are not met.
- Non-cage systems can meet the perching requirements of hens. The limited height in 'enriched' cages means that the perches are unable to satisfy the birds' requirements for a perceived safe roosting site at night.
- The 600cm² of 'usable' space per bird and a height of 45cm in 'enriched' cages fail to allow sufficient space for hens to perform many important basic behaviours. The greater space allowance in non-cage systems allows hens to display a much broader behavioural repertoire.
- Feather pecking and cannibalism can be controlled in non-cage systems without resorting to beak-trimming, through the use of appropriate strains and selective breeding to further reduce the hens' propensity to feather peck, and through the adoption of a range of preventive management practices. Preventive management is dependent on providing birds with opportunities for foraging, dustbathing and perching, which are not adequately provided for in 'enriched' cages.
- The high incidence of bone fractures in all systems is unacceptable and should be addressed through the use of traditional breeds and/or selective breeding of commercial strains as a matter of urgency. Even with selection to improve bone strength, the limited space in 'enriched' cages means that birds are unable to exercise to maintain bone strength. Non-cage systems provide birds with much greater freedom of movement and opportunities for exercise.
- With good management, low levels of mortality can normally be achieved in both 'enriched' cages and non-cage systems.
- The evidence in this report demonstrates that well designed and managed non-cage systems provide higher standards of welfare than 'enriched' cages and that 'enriched' cages fail to meet the welfare requirements of hens.
- CIWF urges the EU to strengthen the Laying Hens Directive to prohibit the use of 'enriched' cages as well as conventional battery cages.
- Changing to more humane non-cage systems will entail a cost but the strategy outlined in this report shows how this cost can be met without harming the livelihoods of EU egg producers.

This report demonstrates that 'enriched' cages do not have the potential to meet many of the welfare requirements of hens or address some key welfare concerns, now or in the future. CIWF therefore calls on the European Union to strengthen the Laying Hens Directive to prohibit the use of all cage systems for the housing of laying hens.

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Heather Pickett

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