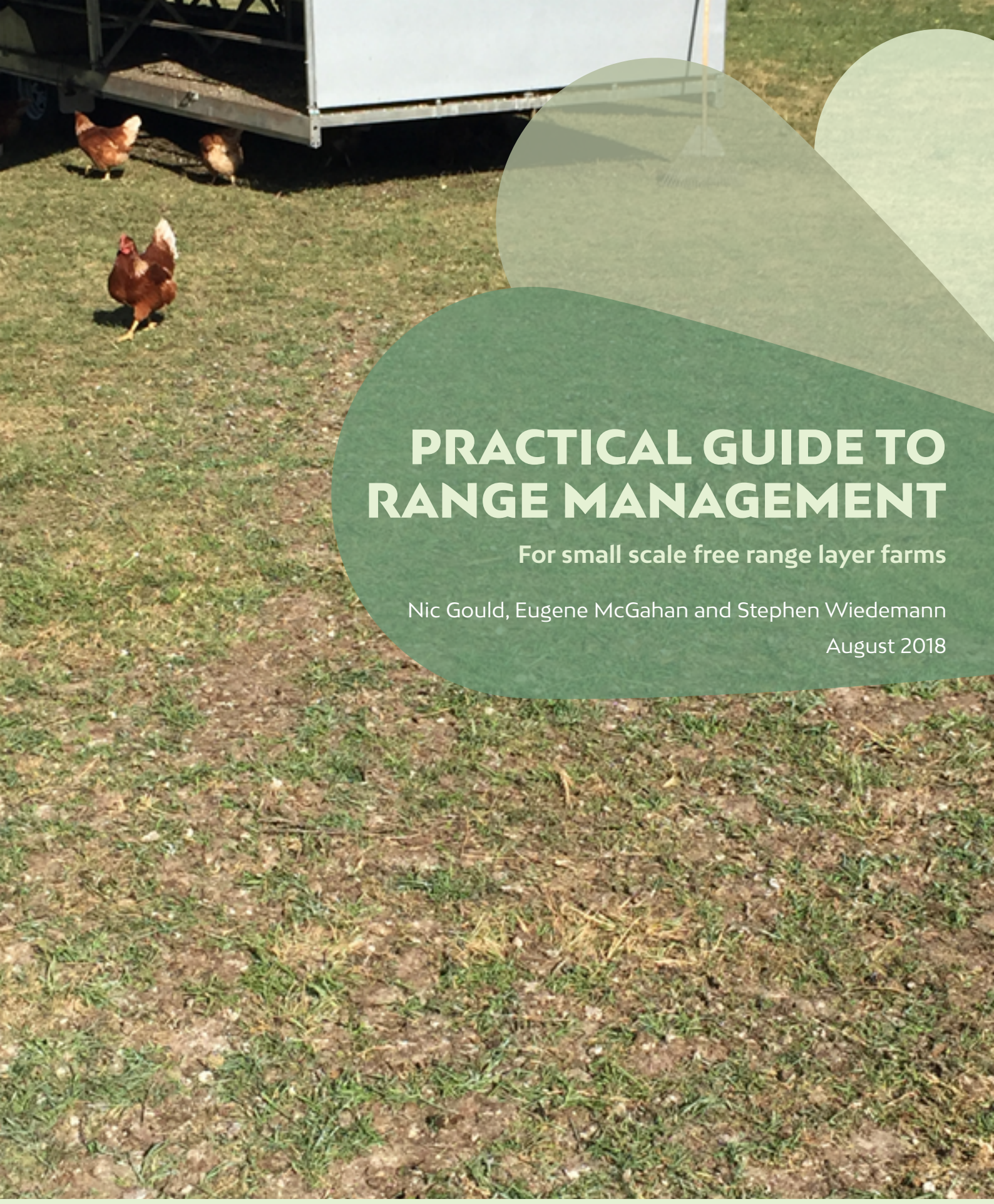

PRACTICAL GUIDE TO RANGE MANAGEMENT

For small scale free range layer farms

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1 INTRODUCTION

This guide is intended to provide practical information to improve the environmental management of range areas. The guide has been developed for producers on small scale free range layer farms (i.e. < 1000 birds) using mobile housing systems and low stocking densities. The principles outlined in this guide can be extended to larger operations using mobile housing systems, though care must be taken to consider the potential additional impacts.

The topics covered include reducing impacts to:

- community amenity / air quality (odour, noise, dust, light),
- land, and
- surface and groundwater.

For more information on planning and regulation, producers should consult the Egg Industry Environmental Guidelines (Edition II, McGahan et al., 2018).

2 DESIGNING A LOW RISK FARM

Most small-scale farms aim to operate at "low risk". To achieve this, they need to be appropriately sited and managed. Section 2.2 will discuss recommendations around siting layer farms and range areas, while the remainder of this guide contains information on managing range areas to reduce risk.

2.1 Key Recommendations

The key recommendations of this guide are that:

1. Layer farms and range areas are sited appropriately.
2. The site operates at low outdoor stocking density (i.e. < 1500 birds per ha).
3. Mobile houses are moved frequently (every 2-3 days)

   OR

   Housing is moved at least once per fortnight,

   AND

   manure is collected from beneath bird housing
4. Houses are not located on the same ground in any 12-month period.
5. The range is managed to maintain at least 50% ground cover.

Sites with an increased risk of environmental impact (due to poor site selection, high stocking density, or infrequent rotation) should consider additional management measures, such as runoff management, vegetative filter strips, manure collection and disposal / spreading (see Section 4).

2.2 Location and Design of Layer Farms and Range Areas

It is important to locate the production area, including range areas and associated bird housing, where local conditions will not increase risks. Some important considerations for the location of farms and range areas are given in Table 1 *(NOTE: It is not a requirement to meet all site considerations, but better site and range location results in better outcomes and lower risk)*. The recommended distances between range areas, sensitive receptors and watercourses are shown in Figure 1. Failure to meet the recommended distances in Figure 1 can result in the need to obtain additional approvals.

Table 1. Important location considerations

IMPORTANT ASPECTS OF LOCATION SELECTION INCLUDE:	Y/N
IS FARM LOCATED:	
In a zone where intensive livestock farming is permitted?	
Not within 500m of an existing commercial poultry farm*?	
Not within a drinking water catchment*?	
Not in areas of high rainfall?	
IS RANGE LOCATED:	
On sites with slopes <10%?	
Away from drainage lines or gullies?	
On sites which are not subject to flooding or waterlogging?	
In areas where groundwater is >2m from the surface, or protected by an impermeable layer? **OR** On soils with low permeability (if groundwater is close to surface <2m)?	
On soils which do not have high phosphorus levels?	
On soils with good soil phosphorus buffering capacity?	

Failure to meet these location requirements can result in the need to obtain additional approvals.

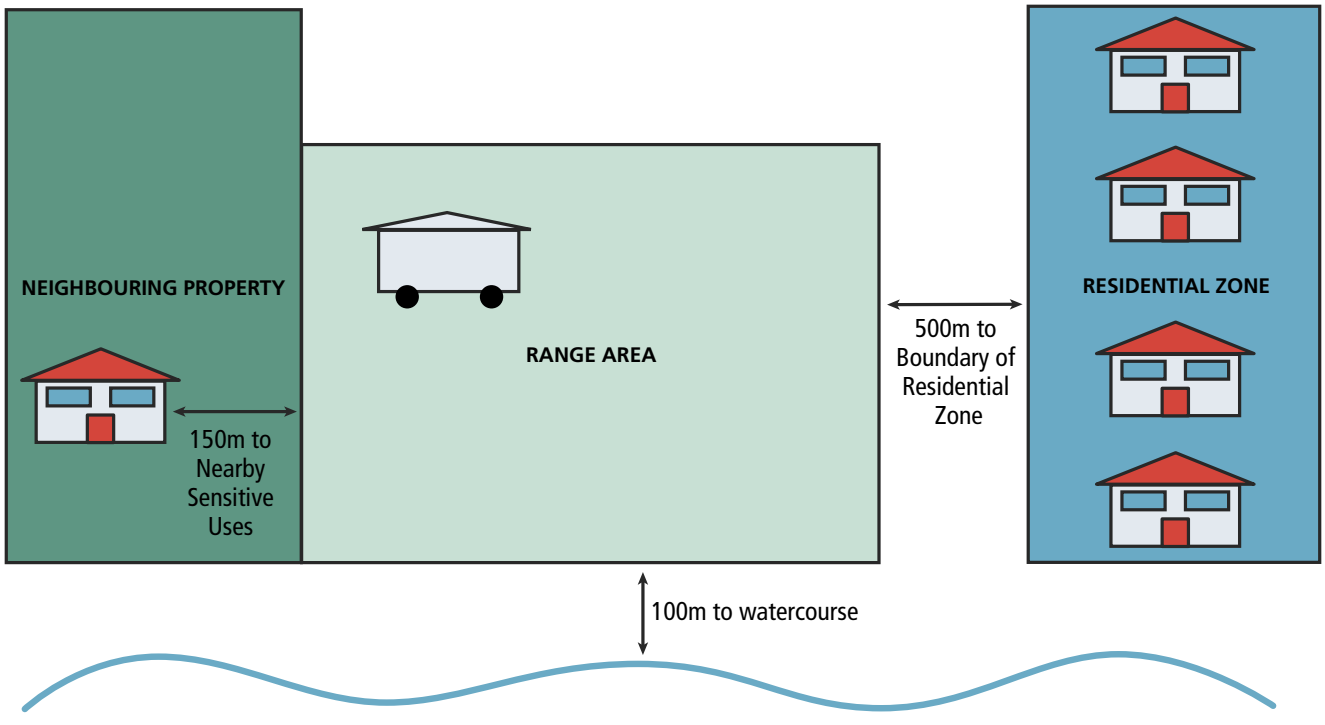

Figure 1. Recommended separation distances for < 1000 birds

3 MANAGEMENT OF POTENTIAL IMPACTS

The major sources of potential impacts, as well as the key variables and important management measures are shown below. While adhering to the key recommendations of this guide (see Section 2.1), sites with an increased risk of environmental impact (due to poor site selection, high stocking density, or rotation frequency < once per fortnight) should consider additional management measures, such as those mentioned in the following tables.

Table 2 discusses impacts to community amenity, while Table 3 discusses impacts to land and water. As can be seen in these tables, range management plays an important part in minimising any potential impacts. See Section 4 for details on how to implement important management considerations.

Table 2. Management measures for community amenity impacts

Source	Key variables	Management measures
ODOUR		
Manure and dead birds.	Location of housing and range areas	Maintain an appropriate distance between odour sources (bird housing, spreading areas) and potential sensitive receptors*.
	Disposal and handling of dead birds	Collect, store and dispose of dead birds to avoid uncontrolled anaerobic decomposition.
DUST		
Range areas	Location of range areas	Maintain an appropriate distance between range areas and potential sensitive receptors*.
	Groundcover	Maintain at least 50% groundcover.
	Surrounding vegetation	Plant vegetative environmental buffers if there is no barrier between the farm and potential sensitive receptors.
NOISE		
Vehicle / machinery movements and operating noise	Timing, frequency and duration of vehicle movements.	Reduce traffic movements at night. Perform routine tasks during daylight hours.
	Location of housing, range areas, and farm infrastructure.	Maintain an appropriate distance between operational areas and potential sensitive receptors*.
	Surrounding vegetation	Plant vegetative environmental buffers if there is no barrier between the farm and potential sensitive receptors.
	Vehicles and machinery noise emission levels	Maintain machinery (e.g. mufflers).
LIGHT		
Night operations (movement of birds / housing etc)	Timing of operations	Minimise night -time operations.
	Surrounding vegetation	Plant vegetative environmental buffers if there is no vegetative barrier between the farm and receptors.

See Figure 1 for examples of appropriate separation distances to receptors.

Table 3. Management measures for land and water impacts

Source	Key Variables	Management Measures
LAND, SURFACE WATER AND GROUNDWATER		
Manure and erosion	Frequency of housing movement	Regularly move bird housing to limit manure deposition and denuding of groundcover.
	Groundcover	Maintain >50% groundcover.
	Manure collection practices	Collect manure from under housing and / utilise appropriately.
	Stormwater management	Employ appropriate erosion and sediment control measures (e.g. use vegetative filters, avoid water convergence, grass waterways).

4.1 Managing Manure

AIM: Avoid excessive nutrient build-up of nutrients in the soil and encourage even distribution of nutrients across the range.

It is estimated that ~75% of manure deposited by hens on small scale free range farms falls directly under the house, with a further 10% estimated to be deposited in the 2m adjacent to the bird housing. This results in a nutrient distribution pattern similar to Figure 2.

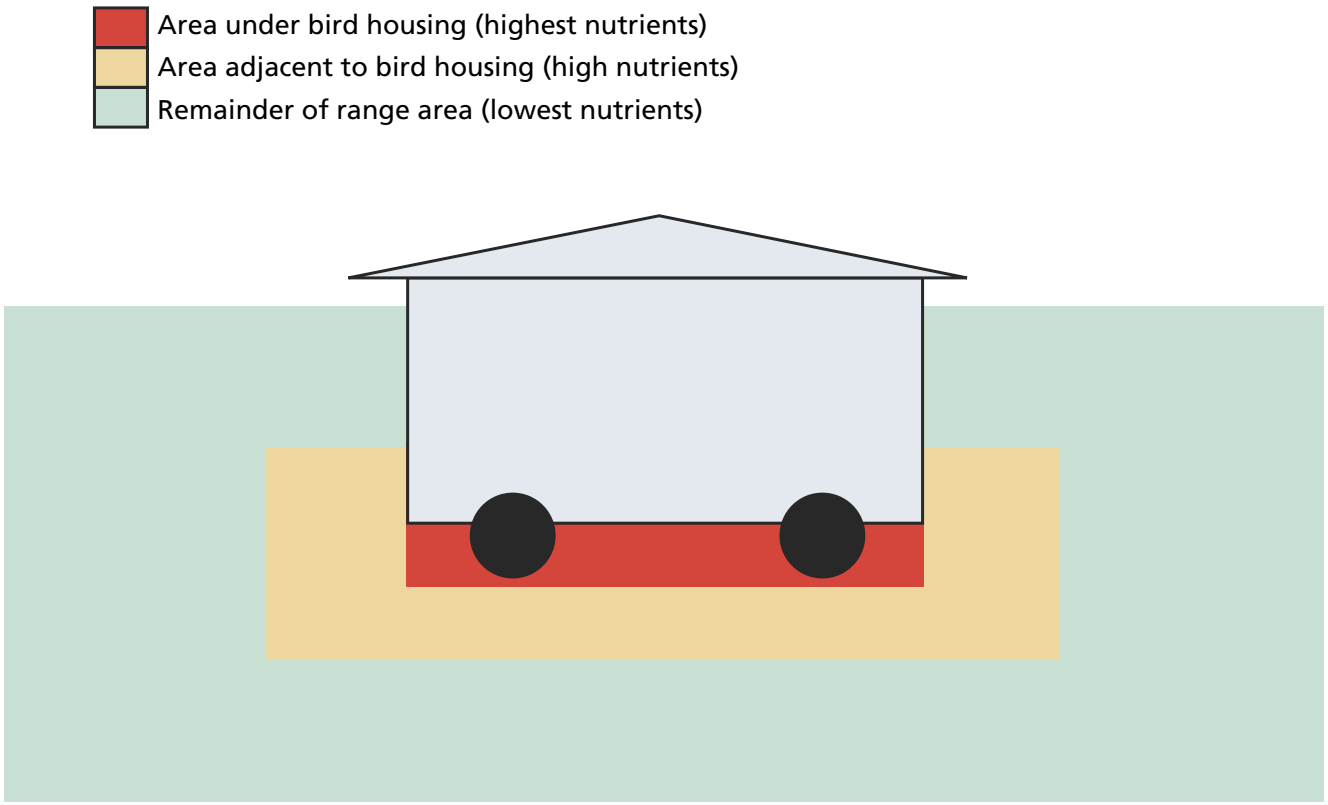

Figure 2. Nutrient hotspots associated with bird housing

Nutrient levels below mobile housing will rapidly exceed annual plant uptake capacity, resulting in an accumulation of nutrients in the soil, increasing the risk of loss to the environment. Evenly spreading the manure produced by a 350-500 bird housing unit annually would provide suitable phosphorus for about 50 ha of grazed pasture production, and approximately 1/5 of the required nitrogen. The same amount of manure would provide sufficient phosphorus for 4 ha of cereal hay production, and almost 1/4 of the required nitrogen.

Image 1. Manure deposition under the house (2 days in this location).

Image 2. Moving the house short distances every few days results in more even nutrient distribution.

To avoid excessive nutrient build-up:

- avoid returning housing to the same location within a 12-month period,
- regularly move bird housing (every 2-3 days)

  or

- move bird housing fortnightly **and** collect manure from under bird housing (see Section 4.1.2.).

4.1.1 Frequency of Housing Movement

How often and how far the house is moved results in different nutrient deposition patterns. The following examples compare high frequency house movement, with low frequency house movement.

High Frequency (2-3 days) House Movement

The house is moved a small distance on a regular basis, every 2-3 days. Manure deposition remains the highest under the house, however as it is only in one location for a short period of time the total amount of manure deposited in one spot is limited. Birds will also exhibit foraging and dust-bathing behaviours in the area where the house has been moved from which helps to break up and distribute the manure.

Moving the house in a planned rotation across the range will result nutrients being spread across the whole of the range area, as shown in figure 3 (not to scale). This will also help to protect pasture cover.

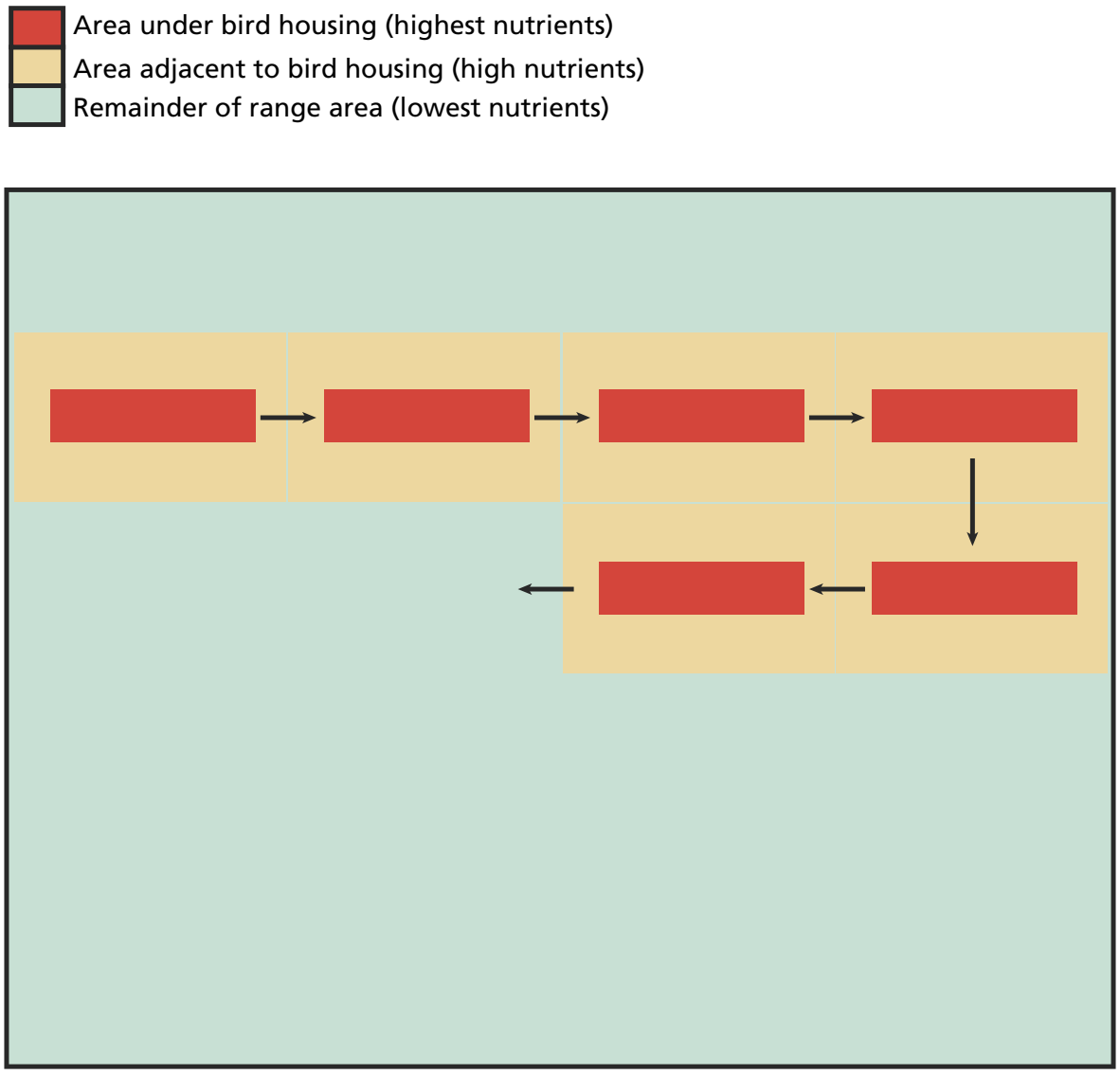

Figure 3. Overlapping manure distribution zones

Low Frequency (Fortnightly) House Movement.

In this example, the house sits on one site within a range area for 2 weeks and is then moved to a new range. Manure is not spread evenly across the range, with areas receiving large amounts of nutrients and other areas none.

When compared to movements every 3 days, fortnightly movement results in ~5 x higher nutrient loads (see Figure 4), quickly exceeding plant uptake capacity. This greatly increases the risk of loss to the environment and requires additional management to reduce risk.

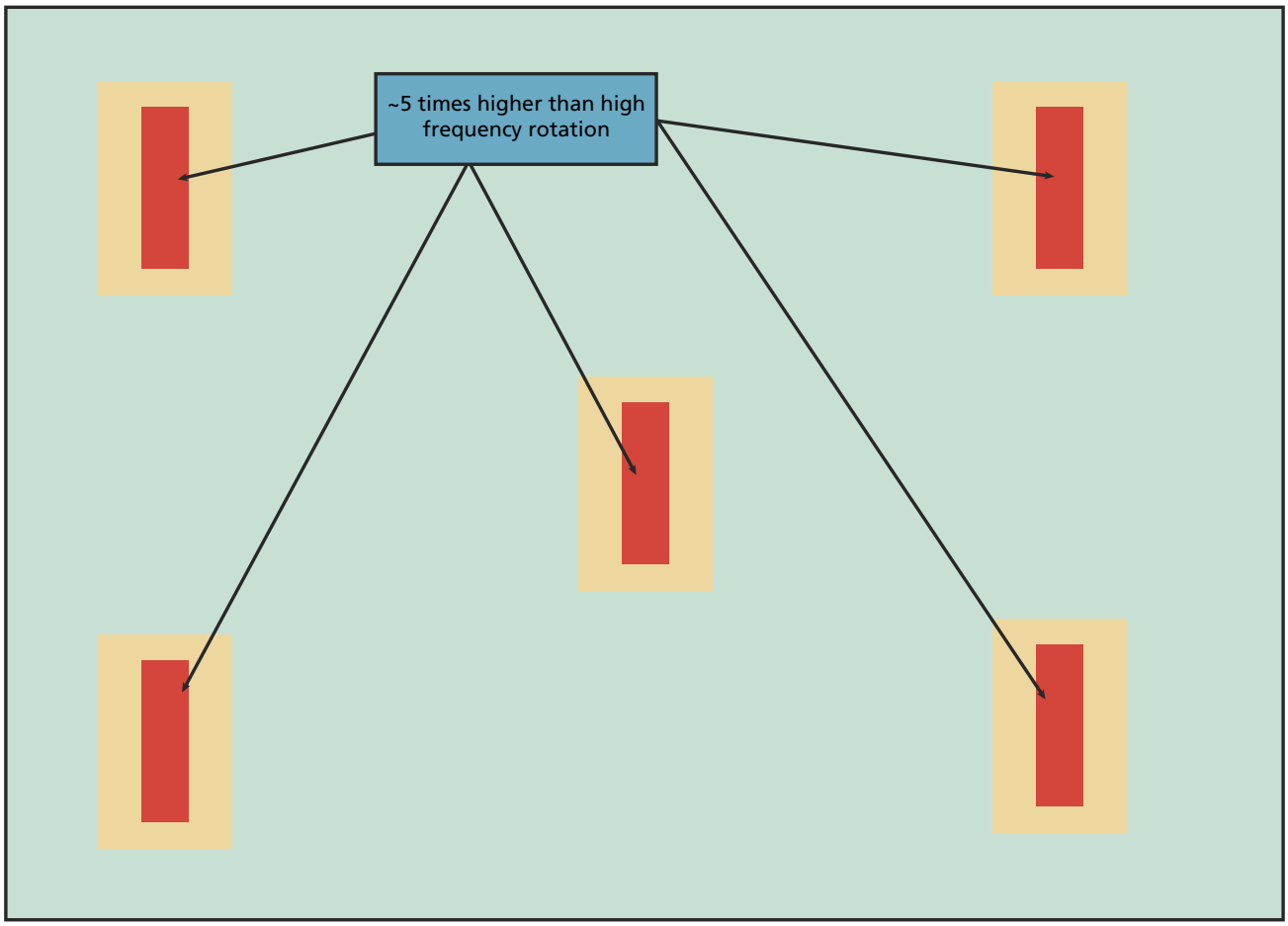

Figure 4. Concentrated manure distribution zones

4.1.2 Manure Collection for Higher Risk Farms

On farms with low rotation frequency, short return periods (<12 months), or increased risk of nutrient runoff (high slope, low groundcover, etc.) additional management measures may be necessary, such as collecting and spreading manure. Collected manure should be sold or used in a sustainable manner by matching application rates to plant requirements.

Some strategies for collecting manure include:

- Locating housing on 'hard pad' areas, with manure collected with a scraper once the housing unit has been moved off the area.
- Using tarps or metal sheets under the housing unit to collect manure deposits.
- Use of traditional poultry shed bedding materials such as straw or sawdust, the spent bedding and captured nutrients can then be collected and removed.

4.2 Managing Impacts of Range Enrichment

AIM: *Provide shade and shelter while maintaining ground cover and avoiding nutrient build up.*

Shade and shelter on the range are important to protect birds from predation and heat stress. Encouraging ranging behaviour can reduce the impact of birds on pastures and nutrient build up under housing. However, high levels of manure deposition can also occur in enriched areas and require appropriate management. Exclusion fencing and rotation of access throughout the year can help to ensure that manure deposition is sustainable, and groundcover is maintained.

Image 3. Mobile artificial shade structures allow rotation of manure deposition areas

Artificial shade structures can make manure and groundcover management easier than on ranges which are treed. When designing and managing enrichment on the range some important considerations include:

- designing mobile structures that are easy to move,
- regular movement of mobile shade structures or enrichment to distribute nutrients more evenly across the range, and by
- placing fixed artifical shade structures on compacted pads to facilitate manure collection, and roofing with impermeable materials to prevent nutrient loss in runoff.

4.3 Maintaining Groundcover

AIM: *A minimum of 50% groundcover in areas used by birds.*

Hens are hard on pastures. High traffic areas near housing and enrichment areas are associated with lower levels of groundcover. The dust bathing behaviour of birds can quickly result in potholes in the range area. Due to the removal of topsoil in potholes, maintaining groundcover can present additional difficulties. Maintaining groundcover is an important factor to reduce nutrient loss, erosion, dust, and weed growth.

Options to maintain adequate levels of groundcover include:

- regular rotation of range areas,
- regular relocation of mobile infrastructure,
- low stocking density,
- irrigation of range when rainfall is deficient,
- repairing of potholes with additional topsoil,
- sowing of appropriate pasture species,
- fencing off denuded areas allow plant recovery, and
- spreading artificial groundcovers (such as straw or stone) in denuded areas.

4.4 Reducing Sediment and Nutrient Runoff

AIM: Reduce runoff that causes erosion and nutrient movement off site.

Overland flow of stormwater runoff can cause erosion and transport manure nutrients into nearby waterways, causing environmental impacts. The risk of sediment and nutrient runoff is affected by site selection factors including rainfall, slope, soil type and ground cover.

Options to reduce runoff include:

- excluding runoff from entering range / spreading areas by using contour banks, swales etc.,
- maintaining groundcover through good paddock rotation,
- maintaining cross-slope grassed corridors on sloping sites,
- spreading hay / straw in denuded areas to protect the soil from rain impact,
- using rock / gravel groundcover where groundcover is difficult to maintain,
- directing runoff from range / spreading areas to vegetative filter strips,
- designing drainage channels to slow flow rates – wide / flat grassed drains, swales, contour banks etc., and
- repairing eroded areas.

4.5 Planting Vegetative Filter Strips

AIM: Reduce the nutrient and sediment content of runoff from range / spreading areas.

Directing stormwater runoff across a strip of well maintained (>80% groundcover) grass will reduce sediment and nutrient load in the runoff. Ideal grasses for a vegetative filter strip (VFS) are runner-developing, non-clump forming grasses that can effectively reduce nutrient and sediment concentrations in the runoff.

Establishment and maintenance of a VFS should include:

- plant VFS where it will intercept runoff from range or spreading areas,
- exclude livestock and traffic from VFS areas, and
- maintain high levels of grassy groundcover (water, reseed and slash for weeds as necessary).

More detail on how VFSs operate, their effectiveness and how they should be designed can be found in the Egg Industry Environmental Guidelines (Edition II – McGahan et al., 2018).

4.6 Planting Vegetative Environmental Buffers

AIM: Reduce offsite amenity impacts by providing vegetative buffers.

Vegetative Environmental Buffers (VEBs) are densely planted strips of trees, or other suitable vegetation, which act as a buffer to reduce the visual, odour, noise, dust and light impacts of a farm.

VEBs are often most effective when planted close to areas which produce the odour, noise, dust or visual impacts. This may be difficult to achieve on free range farms as a large area is used due to the regular rotation of bird housing locations. VEBs can be planted on the boundaries of the range area, or property boundaries as shown in Figure 5.

Some tips for planting an effective VEB are:

- Locate VEBs between impact sources and receptors (e.g. the downwind boundary of the production area and any 'line of sight' to highly trafficked areas such as nearby properties or roads).
- Use a fast-growing tree species to provide rapid screening and buffering capacity
- Plant slower growing, more durable trees in the second row, to replace fast growing trees.
- Plant a row of shrubs or smaller species to provide a buffer against ground level winds.

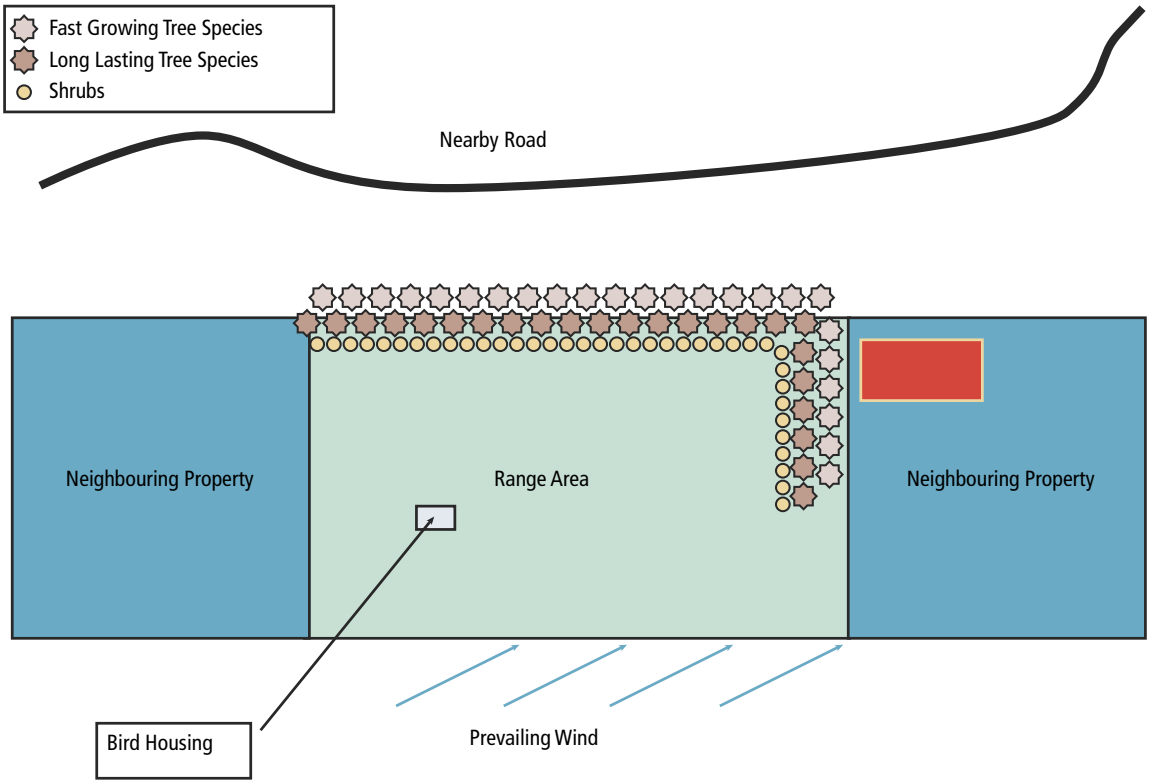

Figure 5. Location and design of a vegetative environmental buffer (VEB)

5 RANGE MANAGEMENT OPTIONS

The following table shows important management actions which should be considered by producers in order to reduce their impacts.

Table 4. Important considerations for reduced environmental risk

Management options	Y/N
GENERAL RECOMMENDATIONS	
Are farms and range areas sited to reduce risk? (See Section 2.2)	
Does the site operate at low outdoor stocking density (1500 birds/ha or less)?	
Is the range area maintained to ensure > 50% groundcover? (See Section 4.3)	
MANURE MANAGEMENT	
Is bird housing moved every 2-3 days. OR Is manure collected from under bird housing and sustainably used? (See Section 4.1)	
Are housing locations planned to ensure even distribution of nutrients? (See Section 4.1)	
Are locations used for bird housing subject to a 'no-return' period of at least 12 months?	
ADDITIONAL OPTIONS FOR HIGH RISK FARMS	
Is overland flow directed away from areas of high nutrient levels? (See Section 4.4)	
Are erosion and sediment control measures enacted to slow overland flow and reduce sediment loss? (See Section 4.4)	
Is a vegetative filter strip of >10m (maintained in good condition, >80% groundcover) provided to intercept flow from range / spreading areas? (See Section 4.5)	
Are vegetative environmental buffers used to screen the visual impacts, dust, odour, noise and light of the site? (See Section 4.6)	
Is manure collected from under bird housing and sustainably used? (See Section 4.1.2)	

6 PRACTICAL EXAMPLES

The following case studies were undertaken on range areas with diverse landforms including alluvial flats and sloping ridge country, for hens in flocks of 400.

6.1 Case Study 1: Compacted Tracks for the Movement of Mobile Bird Housing Units

6.1.1 The Problem

Regularly moving the mobile house is critical to managing nutrient loads and maintaining pasture cover. Sheds located on an incline can be difficult to move in severely wet conditions.

6.1.2 The Solution

Hard pad tracks installed on sloping ridge country. This solution allowed the farm owner to:

- move the house as needed to manage ground cover
- collect the manure that was deposited beneath the shed for use elsewhere

The pads were created using either an excavator or bull dozer. The total cost averaged approximately $200-$300 per range.

6.1.3 The Outcome

The pasture cover on the range area improved due to the ability to better control the timing of movements of the bird housing. An unexpected benefit is that the hens dust bathe on the gravel pad areas, reducing pot holes across the range area. These two outcomes reduce the need to remediate the range areas.

By collecting the manure that is deposited on the hard pads this limits nutrient build up and hot spots meaning the house can be rotated over the same range area more frequently. Additionally, the manure that is removed from the hard pads is used to fertilise the nearby vegetable production enterprise.

Image 4. Compacted tracks allowing regular housing movement and manure collection.

Image 5. Compacted tracks reduce impacts on surrounding areas

6.2 Case Study 2: Improving Nutrient Distribution with Mobile Shade Structures

6.2.1 The Problem

Manure deposition on pasture provides valuable nutrients, however achieving good distribution and avoiding hot spots is difficult. Shade and shelter on the range area is critical for bird welfare, but results in 'hot-spots' of high manure deposition and increased risk of nutrient loss and impacts to the environment.

6.2.2 The Solution

Mobile shade and shelter structures can allow for better control of nutrients. The mobile structures allow the farmer to move the structure to:

- manage ground cover,
- direct bird movement on the range,
- encourage the birds to range further, and
- reduce the risk of nutrient rich, muddy areas on the range.

Image 6. Mobile artificial shade structures allow rotation of manure deposition areas.

The shade shelters were constructed using galvanised C-section steel purlins, RHS, 4 wheel barrow wheels (2xcastor wheels) and shade cloth. Each shelter has 2 bell drinkers with hoses connected to a mobile water tank.

The total cost per shelter including all drinkers and connections is approximately $1500 per shelter. Each shelter provides approximately 40 sqm of shade with enough shelters in each range to provide at least one square metre of shade per 3 birds. In this case, there is at least 160 square metres of mobile shade.

Importantly they are designed to be able to be moved by a single person by hand, over short distances.

They include –

- 2 castor wheels at the front and 2 fixed wheels at the back for ease of movement
- Draw bar – for towing by tractor or quad to move long distances
- Fold up wings – to allow the structure to be moved through gates to new range areas.
- Drinking station – 2 bell drinkers with hose connections
- Tall enough to allow for easy human access to clean drinkers
- Perches and climbing spaces inside to allow for additional bird stimulation

Image 7. Mobile shade structure with 'wings' fully extended

6.2.3 The Outcome

After several prototypes the owner has a structure that is durable, lightweight and easy to move and provides good shade and shelter.

The structures draw the hens away from the house, and they range further. By strategically moving the structure throughout the range the nutrients are directed to different areas. Similarly, hens and their manure can be directed away from risk areas – i.e. muddy patches, drainage lines or boundaries.

The next phase of innovation will be to include a simple heat exchanger concept to ensure all water entering drinkers is maintained at a cool temperature to help the birds keep cool during the summer months.

Unlike fixed structures, whether natural or manufactured, the mobile structures reduce the prospect of hot spots with the additional bonus of providing shade, shelter and water for the birds.

7 FURTHER READING

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