

# MONTSERRAT CENTRE HILLS FERAL LIVESTOCK ACTION PLAN



**Prepared by**

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## Acronyms

DEFRA	-	Department of Environment, Food and Rural Affairs
DMCA	-	Disaster Management Coordination Agency
DOA	-	Department of Agriculture
DOE	-	Department of Environment
EHD	-	Environmental Health Department
FERA	-	Food and Environment Research Agency
GOM	-	Government of Montserrat
LD	-	Legal Department
MAHLE	-	Ministry of Agriculture, Lands, Housing and the Environment
MAPS	-	Montserrat Animal Protection Society
MNT	-	Montserrat National Trust
MTB	-	Montserrat Tourist Board
MUL	-	Montserrat Utilities Limited
MVO	-	Montserrat Volcano Observatory
RMPF	-	Royal Montserrat Police Force
RSPB	-	Royal Society for the Protection of Birds

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## *Executive Summary*

Invasive species are widely acknowledged as a primary threat to biodiversity, ecosystem functions and sustainable livelihoods, and the impact of invasive species is more pronounced on small islands. Feral livestock, in particular, pigs, goats and cattle are no exception and on small islands can have severe impacts including; direct predation of threatened species, alteration of vegetation communities, erosion, deterioration of water quality, and socioeconomic impacts such as the destruction of farmed crops.

Three years of work towards the development of the Montserrat Centre Hills as a Protected Area to maintain the exceptional biodiversity interest and high economic values, identified feral livestock as a serious threat to the Centre Hills. Feral Livestock originating animals released during previous volcanic eruptions or historic escapes were breeding and anecdotal information suggested populations were increasing. With funding from the UK Government's Darwin Initiative a research programme was initiated by the Government of Montserrat with Technical Support from the UK Government's Food and Environment Research Agency. Findings confirmed that populations of feral animals posed a significant threat to the values of the centre hills. Pigs were less abundant than expected probably due to population limitation from traditional hunting, conversely, goats, cattle and donkeys were more abundant than expected with large populations in and around the Centre Hills.

This provided compelling evidence that management strategies needed to be developed, and expert opinion from FERA guided the process of developing the Action Plan. The action planning made the assumption that total eradication of feral animals was not feasible, due to recruitment from farmed livestock and due to restrictions on visiting the south of the Montserrat. Accordingly two objectives to mitigate these constraints were identified; to reduce the populations of feral animals and to reduce the recruitment of farmed livestock in to the feral population.

Six result areas were then identified, focussing on managing feral livestock, improving management of loose farmed livestock, research and monitoring, improving legislation

and policy, undertaking out reach and awareness and developing capacity. These were used as the basis for developing actions in a participatory workshop held in February 2010 in Montserrat. The workshop drew on specialist expertise and local knowledge to find approaches that are feasible, effective and socially acceptable to manage feral livestock. The process identified key actions over a five year period, with detailed actions for the first year of the project. Of particular importance are the testing of management actions and measuring their effectiveness. The plan will be revised at the end of the first year in light of these findings.

## **Introduction**

### ***Biological and Social Impact of Feral Livestock***

Livestock populations become feral on islands either through deliberate release to provide a self sustaining source of food for travellers or from animals that have escaped husbandry. Domestic livestock being discussed in this context are feral cattle, pigs and goats. Of these both pigs and goats in particular are recorded as being among the world's worst invasive species (Lowe *et al.* 2000) and are widely distributed throughout all continents and on island archipelagos in all major oceans except in Polar regions. The feral range of all three species is increasing.

As a result of centuries of domestication, all three species have developed traits that also contribute to their success as invasive species. They are able to breed at an earlier age than their wild ancestors, often within their first year. They can breed more frequently, often annually, and can breed all year round, whilst their ancestors had more restricted breeding seasons. Domestication also developed traits in all three species such as rapid growth, and the ability to withstand drought conditions and other harsh environmental conditions. As a result of these characteristics, feral livestock are still valued as an important source of protein in the regions they have been introduced to. Small offshore islands in particular often lack alternative sources of game.

All three species can have wide impacts on the ecosystems they are introduced to. They impact negatively on endemic plant species and communities, either directly through structural damage and herbivory, or through habitat alteration (Campbell & Long 2009; Sanders *et al.* 2008; Wardle *et al.* 2001). In addition, feral pigs are recognised as potentially important predators of ground based vertebrates (Atkinson 2001).

Aside from their ecological impacts, feral livestock pose a number of socio-economic threats. They are potential reservoirs of disease that could impact upon truly domestic



livestock and people (Meng, Lindsay & Sriranganathan 2009; Ward, Laffan & Highfield 2007), and they also damage the topsoil (Campbell & Long 2009; Bayne, Harden & Davies 2004; Keegan, Coblenz & Winchell 1994). Also they could introduce health threats by damaging and fouling water sources (Jay et al. 2007). Feral pigs are also potential predators of the young of other livestock.

### ***Feral Livestock on Montserrat***

In Montserrat, the volcanic eruptions of 1995 resulted in the loss of more than half of its rainforest, the habitat for many threatened native species. The Centre Hills hold the largest intact forest area remaining on Montserrat and is of global biodiversity importance, supporting many key endemic species including the critically endangered Montserrat Oriole, *Icterus oberi*, Montserrat Orchid, *Epidendrum montserratense*, Montserrat Galliwasp, *Dipoglossus montisserati* and Mountain Chicken, *Leptodactylus fallax*.

Following the eruption, 60% of the island is now in an exclusion zone where human entry is restricted, so most residents live in villages situated on the low, northwestern flanks of the Centre Hills. The displacement of people into just one third of the island has placed a greater pressure on land. The agricultural method of rearing loose goats and sheep on the hillside is still practiced widely, and because the land is limited this is leading to an increase in the number of livestock encroaching on the Centre Hills. When residents were evacuated livestock often remained behind, since that time feral populations of Goats, Pigs and Cattle have become established in the exclusion zone and are becoming more apparent in the body of the Centre Hills. It is likely that there is flow between the loose and the feral populations which further exacerbates the problem.

The aim of the monitoring research was to assess the distribution and estimate relative densities of feral livestock populations in and around the Centre Hills. Quantifying the relative size and spread of the feral livestock problem provides information on which to

base this action plan. Furthermore, baseline data can be compared with data collected during and after the control actions proposed within this plan to evaluate their effectiveness in reducing the relative density of feral livestock.

#### Methods for Feral Livestock Monitoring

A feral livestock monitoring network was established in and around the Centre Hills. 23 unbaited Infra red camera traps (Moultrie Gamespy i40) were deployed into locations throughout the area. These cameras record a clip and picture when an animal walks past and can be left in the field continually monitoring for months. Cameras were semi-systematically placed to achieve a wide and even surveillance effort, but were located on animal trails wherever possible. Steep cliffs, the number of available cameras, and the activity of the volcano restricted the location of the cameras.

In addition to the unbaited cameras 7 Boar Operated System (BOS) feeding stations were placed along the Southern boundary of the Centre Hills. These feeders were monitored by cameras in order to find out group size. Only one of these stations was fed from and so the remaining 6 were treated as camera locations. A camera was also placed at an old Rice Mill in the South of the Island, because feral livestock could feed on the rice that is still stored in the silos this was treated as a baited camera location.

#### Methods for Loose Livestock Monitoring

Data on crop damage caused by loose livestock and loose animals impounded were compiled. A loose livestock team of the Department of Agriculture makes daily patrols around the island to look for loose animals that may be causing damage. Animals are brought to a Government maintained pound where they can be claimed by their owner, after fees have been paid or sold on by public auction if no owner comes forward. A weekly livestock count was undertaken along the 13km main road. This was carried out in the evening time and the number, age, and location of livestock were recorded along with each animal's status as loose, tethered, or fenced.

### Additional Monitoring

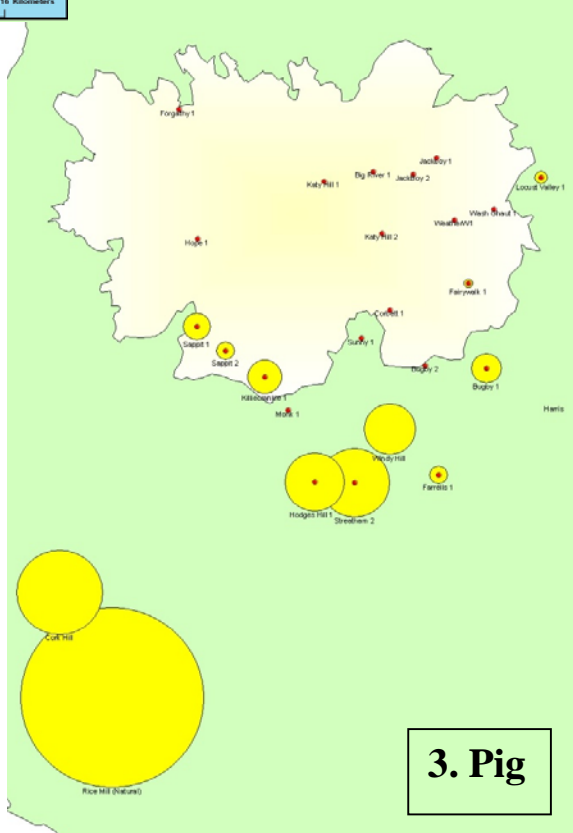
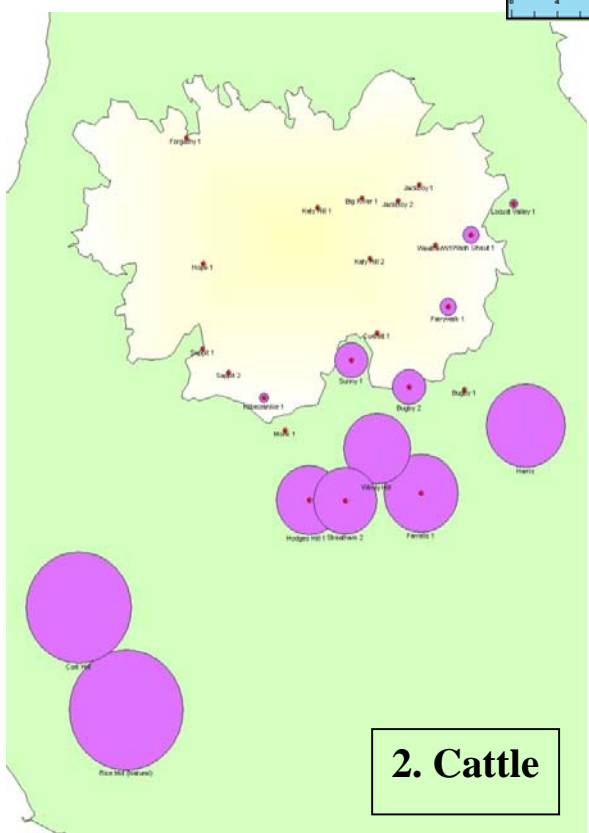
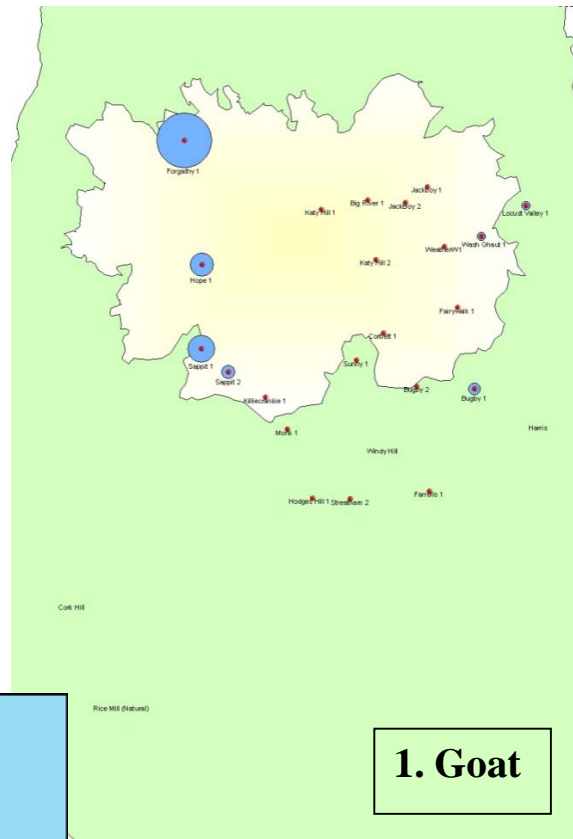
- Spring Monitoring: signs of animal activity were recorded when spring sites were visited by Montserrat Utilities Limited – Water Division.
- Aerial observation: the Montserrat Volcano Observatory submitted ad hoc reports and photographs of feral livestock within the Volcanic Exclusion Zone.
- Forest patrols: forest rangers informed the project on key areas to monitor and regions where they were observing signs of feral livestock

### Results

The unbaited cameras ran for a total of 1998 camera trap days (July 2009 to February 2010), recording 8,280 video clips and photographs which corresponded to a total of 224 feral livestock visits, cattle (n=106), pigs (n=56), goats(n=50) and donkeys (n=12). The distribution varied between species with goats seemingly concentrated on the north-western flanks of the Centre Hills and cattle and pigs concentrated south of the Centre Hills and around the fringe areas (figure 1). Overall activity within the Centre Hills was low with 7 cameras recording no feral livestock visits. The old rice mill (southern most camera) received the highest visitation rates both for cattle (102 visits/100 days) and pigs (216 visits/100 days).

No feral livestock activity was reported around any of the spring sites by the inspectors. The findings of the camera network were supported by the forest rangers observations in most cases, but the number of cattle observed was unexpectedly high. MVO aerial observations confirmed that there are groups of feral livestock particularly cattle roaming throughout the exclusion zone in groups of up to 30 individuals.

Figure. 1. Maps showing the relative distributions of 1. goat 2. cattle and 3. pig populations both in the Centre Hills (light coloured area) and surrounding areas to the south. The size of the circle is proportional to the number of visits/camera/100 days recorded at that camera location. A small dot indicates a camera that did not record any feral livestock activity during its deployment.



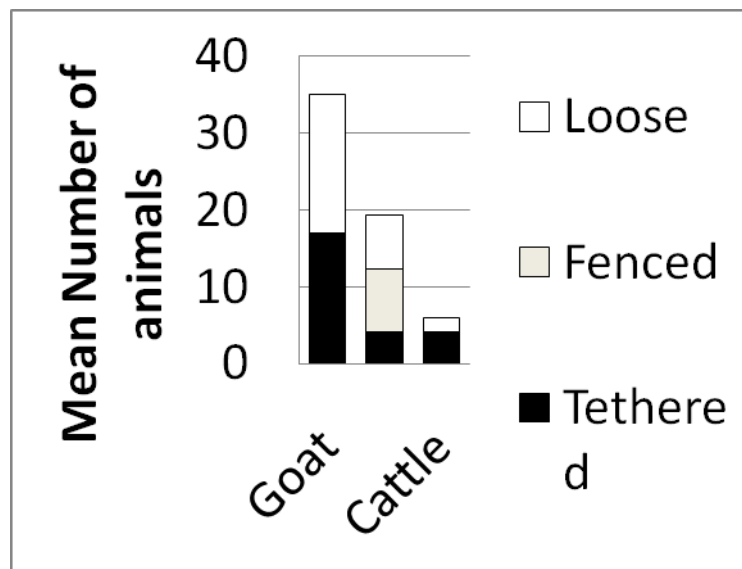
## Loose livestock

Monitoring of the loose livestock problem in urban areas showed that some individual are incurring significant financial loss due to crop damage (table 1).

Year	Number of cases reported	Average Value EC\$*	Total Value EC\$
2008	33	524	17,300
2009	10	579	5,800

*Table 1. This table shows the number of cases of livestock damage reported to the Department of Agriculture. It is likely to underestimate the actual damage caused. \* EC\$= East Caribbean Dollar*

The loose livestock count averaged a count of 60 animals on each transect. Of the livestock observed during the counts a large proportion were not tethered or fenced but in a loose state (Figure 2). The counts showed that livestock are concentrated around the villages of Lookout, Drummands and Brades with relatively less livestock farther south.



*Figure 2 shows the mean number of livestock that were observed on each livestock count. Goats were kept in greatest quantity and were also more likely to be loose than either sheep or cattle.*

Over the past three years more goats have been impounded than sheep cattle or pigs (table 2).

<b>Year</b>	<b>Goats</b>	<b>Sheep</b>	<b>Cattle</b>	<b>Pig</b>	<b>Total</b>
2007	158	74	10	0	242
2008	114	78	4	5	201
2009	135	60	0	0	195

*Table 2. This table shows the numbers of goat, sheep, cattle and pigs that were impounded between 2007 and 2009. These were animals either rounded up by the loose livestock team or members of the public.*

Of the animals that were impounded during this period 94% carried no tether rope when they were caught. This either reflects the loose management system that is commonly practiced, or possibly indicates that feral populations sometimes come into the urban areas. The distribution of where these animals were caught was mapped and is included in an annex. This distribution closely matches the data from the loose livestock transect counts.

## Discussion

The results from the monitoring of feral livestock confirmed that feral goats, pigs and cattle are present in the Centre Hills. Originally it was thought that feral cattle were present in low numbers, but cattle were recorded approximately twice as frequently as either pigs or goats.

The cameras showed that the distribution of the feral populations varies between species. Populations of pigs and cattle occur in the southern and eastern flanks of the Centre Hills, but are concentrated in the southern exclusion zone. The area to the south of the Centre Hills holds the highest concentrations of feral pigs and cattle and it is fortunate that this remains the area where they are most densely concentrated as this is likely to limit the damage currently incurred within the Centre Hills. Populations of feral goats are concentrated on the western flanks of the Centre Hills and seem to relate more closely to the practice of rearing loose livestock than to populations that were abandoned in the South. It is possible that in periods of low volcanic activity most of the abandoned sheep and goats from the south were

caught and taken back into domestication, which would explain the current distributions of feral goats.

The fact that seven cameras within the Centre Hills area did not record any feral livestock is encouraging. Coupled with the relatively low rates of visitation network wide, these seven cameras indicate that the feral livestock problem is still manageable. It is hypothesised that the extent of the feral population so far has been limited by the short period of time that the populations have existed, local hunting, volcanic activity and a pig cull in 2003. However, the potential rate of population growth is high and the size of the Centre Hills is relatively small, if hunting effort were to decrease or volcanic activity to render large portions of the south uninhabitable for feral livestock the number of feral animals living within the protected forest area may increase dramatically. Therefore, the data on feral livestock provides a compelling justification for this action plan to reduce their impact within the Centre Hills.

### ***Summary of Management options***

Eradication of all feral livestock is as yet not a viable option as this large sections of Montserrat are inaccessible due to volcanic activity thus leaving refugia for viable subpopulations to persist and breed. In addition, feral livestock are also an important source of locally produced meat and income. Any management activity would need to incorporate two broad aims;

- 1.) to improve the husbandry and economic value of domestic livestock to reduce the recruitment rate of domestic animals into the feral population, and
- 2.) to manage the feral population to within acceptable thresholds. These two options have been outlined in tables 1 and 2 below.

A number of techniques are currently used globally within each of the two broad aims. These techniques and the advantages and disadvantages of each have been identified.

Table 3. The options for improved husbandry of domestic livestock

Technique (non-lethal)	Advantages	Disadvantages	Species	Comments
Improve husbandry	Long term benefit May increase local meat consumption	Initial cost Reluctance to maintain equipment and sustain cost of feeding livestock Requires land available to keep livestock	All 3	Requires extensive socio-economic research and information. Dissemination
Domesticating feral animals	Humane Increase domestic stocks	Labour-intensive Removes only a few animals Requires land available to keep livestock	All 3	The availability of land to keep livestock on Montserrat needs to be assessed
Fencing hotspots	Humane Can be adopted to protect area from impact of all feral livestock	Expensive to establish and maintain Prevents natural movements of native species	All 3	Storms and hurricanes can hamper maintenance
Fertility control	Humane	Expensive due to trapping and restraint Slow-acting at population level	All 3	Can be evaluated for species like donkeys

Table 4. The options for feral population management

Technique (lethal)	Advantages	Disadvantages	Species	Comments
Ground hunting	Inexpensive Efficient with high densities Ongoing with shotguns Can rely on volunteers/hunters	Requires specialised equipment Requires specialist rifle and safety training May provide excess of meat that cannot be consumed locally	All 3	Potential to test shooting at baiting stations
Aerial hunting	Can cover large areas, especially in exclusion zone Efficient with high densities	Expensive Not useful in forested areas Requires specialist training	All 3	
Trapping	Easy to implement Can provide Judas animals	Expensive with low densities Traps must be checked once/day	Pigs, goats	
Corral trapping	Easy to implement and maintain once set up Can trap large groups	High set up effort and cost Prone to human interference	All 3	
Snaring	Inexpensive Efficient with high densities	Humaneness Non-targets species can be affected Requires specialist skills and monitoring	Pigs, goats	Humaneness needs to be further investigated
Poisoning	Inexpensive Can cover large areas Effective even at low densities	Livestock cannot enter human food chain Non-targets and water can be affected Poison handlers need to be trained Numbers killed difficult to assess	Pigs, goats	



## **Action Plan**

### ***Goal***

Ensure that populations of feral livestock do not degrade the biodiversity values, economic values, social benefits and integrity of the Centre Hills.

### ***Objectives***

#### ***Objective 1***

Feral and loose livestock populations in and around the Centre Hills are managed using effective, practical, humane and cost efficient measures over the lifetime of the plan

#### ***Objective 2***

Feral and loose livestock management measures have sufficient resources and the support of stakeholders to ensure effective implementation.

## ***Results***

### ***Result 1: Feral Livestock Management***

The populations of feral livestock are at a level where they do not have a negative impact on the values of the Centre hills

### ***Result 2: Loose Livestock Management***

Livestock do not contribute to feral animal populations

### ***Result 3: Monitoring and Research***

Information is available on the effectiveness of the management actions

### ***Result 4: Legislation and Policy***

The legislation and policy enable the Action Plan implementation

### ***Result 5: Outreach and Awareness***

- a) Decision makers and the wider population are aware of and support the need for the Action Plan
- b) The action plan is a regional model for feral livestock control

### ***Result 6: Resourcing and Capacity***

Sufficient resources and skilled staff are available to implement the Action Plan

*Actions*

<i>Result</i>	<i>Action</i>	<i>Priority</i>	<i>Time scale</i>	<i>Organisations responsible</i>	<i>Funding</i>
1. The populations of feral livestock are at a level where they do not have a negative impact on the values of the Centre hills	<p><b>1.1. Hunt with fire arms and dogs</b></p> <p>1.1.1 Continue hunting teams            1.1.2 Agree a hunting programme            1.1.3 Maintain police permission            1.1.4 Maintain DOA permission            1.1.5 Management decisions will be based on monitoring data (See section 3)</p>	High	Ongoing	DOE and DOA	
	<p><b>1.2 Trap with corral traps</b></p> <p>1.2.1 Purchase materials and identify suitable location for traps            1.2.2 Construct 1-2 corral traps            1.2.3 Test 1-2 corral traps baited with food or decoy animals</p>	High	Ongoing and review impact	DOE and DOA	
	<p><b>1.3 Liaise with existing hunters</b></p> <p>1.3.1 Maintain relationship with hunters through official hunting and trapping teams            1.3.2 Investigate and implement an appropriate identification scheme for DOE hunting teams            1.3.3 Maintain safety protocols</p>	High	Ongoing	DOE and DOA	

<i>Result</i>	<i>Action</i>	<i>Priority</i>	<i>Time scale</i>	<i>Organisations responsible</i>	<i>Funding</i>
2. Livestock do not contribute to feral animal populations Seek updates from DOA	<b>2.1 Implement and enhance ongoing loose livestock tagging and registration scheme</b>	High	2011	DOA	
	<b>2.2 Implement demonstration farm at Barzys</b>	High	Ongoing	DOA	
	<b>2.3 Increase value of livestock through better management and introduction of improved breeds</b>	High	Ongoing	DOA	
	2.3.1 Improve availability of local meat	High	Ongoing		
	2.3.2 Develop meat hygiene facility	High	Building 2012		
	2.3.3 Increase farm business capacity	Medium	Ongoing		
	<b>2.4 Improve the handling of loose livestock</b>	High	2010 – 2011	DOA	GOM
2.4.1 Train and equip the loose livestock team	High	June 2010 – March 2011			
2.4.2 Upgrade the animal pound facilities	High	Ongoing			
<b>2.5 Culling of loose livestock</b>	High	Ongoing	DOA	GOM	

<i>Result</i>	<i>Action</i>	<i>Priority</i>	<i>Time scale</i>	<i>Organisations responsible</i>	<i>Funding</i>	
3. Information is available on the effectiveness of the management actions	<b>3.1 Monitor Feral livestock</b>	High	Periodic and fixed in time	DOE		
	3.1.1 Undertake game camera monitoring and Forestry patrols	High	Ongoing	DOE		
	3.1.2 Record and analyse data from Government hunting					
	3.1.3 Collaborate with MUL water division to review water quality	Low	Ongoing	DOE and MUL		
	3.1.4 Collaborate with MVO to collect ad hoc data on livestock within the exclusion zone	Low	Ongoing	DOE and MVO		
	<b>3.2 Monitoring of owned livestock</b>	High	Ongoing	DOA		
	3.2.1 Collate data on crop damage and animals shot by loose livestock teams work	High	Ongoing	DOA		
	3.2.2 Collect and review data from the animal pound	High	Ongoing	DOA		
	3.2.3 Conduct loose livestock transects	High	Periodic and fixed in time	DOA		
	<b>3.3 Data management</b>				DOE	
	3.3.1 Identify and appoint data coordinator / manager	High	2011	DOE/DOA		

<i>Result</i>	<i>Action</i>	<i>Priority</i>	<i>Time scale</i>	<i>Organisations responsible</i>	<i>Funding</i>
4. The legislation and policy enable the Action Plan implementation	4.1 <b>Review relevant legislation including:</b> - Animal trespass and pound legislation - Public Health Ordinance	High	2012	DOA, DOE, EHD and LD	
	4.2 <b>Improve capacity for enforcement of applicable laws</b>	High	Ongoing	Various	
	4.2.1 Provide education and training for project team	High	Ongoing	DOA DOE EHD	
	4.2.2 Negotiate Service Agreement between DOE, DOA and Police	High	Ongoing	DOE, DOA and RMPF	

<i>Result</i>	<i>Action</i>	<i>Priority</i>	<i>Time scale</i>	<i>Organisations responsible</i>	<i>Funding</i>
5. (a). Decision makers and the wider population are aware of and support the need for the Action Plan.	<b>5.1 Inform politicians on the feral livestock problem and this action plan</b>	High	Ongoing	DOE/DOA	
	5.1.1 Draft information paper	High	Ongoing	DOE/DOA	
	5.1.2 Regular update meetings with Minister for MAHLE	High	Ongoing	DOE/DOA	
	5.1.3 Organise a field trip for Minister	Medium	Ongoing	DOE	
	<b>5.2 Encourage better animal husbandry by livestock owners</b>	High	Ongoing	DOA	
	5.2.1 Raise awareness through DOA staff extension visits to livestock farmers	High	Ongoing	DOA	
	5.2.2 Facilitate peer to peer sessions through organising group discussions	High	Ongoing	DOA	
	<b>5.3 Inform crop farmers, livestock producers and property owners of their rights and responsibilities under the legislation</b>	High	Ongoing	DOA	
	5.3.1 Educate through radio announcements, newspaper articles and face to face meetings	High		DOA	
	<b>5.4 Increase awareness of feral livestock and the action plan in the general public</b>	High	Ongoing	DOE/DOA	
	5.4.1 Raise awareness of and commitment to the action plan through media communications (radio, newspaper, TV)	High	Ongoing	DOE	
	5.4.2 Raise awareness of rights and responsibilities under legislation	High	Ongoing	DOE/DOA	
	<b>5.5 Educate youth on the impacts of feral livestock</b>	Medium	Ongoing	DOE	
5.5.1 Integrate information on feral livestock into other educational activities					
<b>5.6 Build a relationship between the hunting community and the DOE, DOA and Police</b>	High	Ongoing	DOE		
5.6.1 Communicate best practices in slaughter and meat handling through meetings and radio DOA to comment	High	Ongoing	DOA		

(b). The action plan is a regional model for feral livestock control.	<b>5.7 Disseminate results regionally and internationally</b>	High	Ongoing	FERA RSPB DOE	
<i>Result</i>	<i>Action</i> 5.7.1 Produce and circulate Feral Livestock management handbook	<i>Priority</i> High	<i>Time scale</i> 2011 onwards	<i>Organisations responsible</i>	<i>Funding</i>
6. Sufficient resources and skilled staff are available to implement the Action Plan	<b>6.1 Acquire and maintain the following materials and equipments:</b> 5.7.2 Present results at conferences and through papers  - Fire arms, ammunition and other hunting equipments - Trap materials and baits/ hormones - Health and safety equipments	High  High High	Ongoing High  Ongoing  April – June 2010 April – June 2010	DOE  DOE DOE	



	<b>6.2 Undertake training</b>	High	Ongoing	Various	
	6.2.1 Train Ministry personnel in fire arms use, including additional training in hunting and culling	High	Ongoing	DOE/ DOA/ FERA/ RMPF	
	6.2.2 Train project team in slaughtering techniques and meat hygiene	High	Ongoing	DOA	
	6.2.3 Train project team in trapping methods	High	2011	DOE and local hunters	
	6.2.4 Train loose livestock team on trapping and restraint methods for loose livestock	High	Ongoing	DOA	
	6.2.5 Train data coordinator/manager in handling project data and communication	High	Ongoing	DOE	
	<b>6.3 Establish action plan costs and seek necessary funding</b>	High	Ongoing	DOE, DOA support from RSPB and FERA	
	6.3.1 Establish costs of implementing the Action Plan (years 1-3)	High	2011		
	6.3.2 Identify appropriate funding agencies and submit project applications	High	Ongoing		



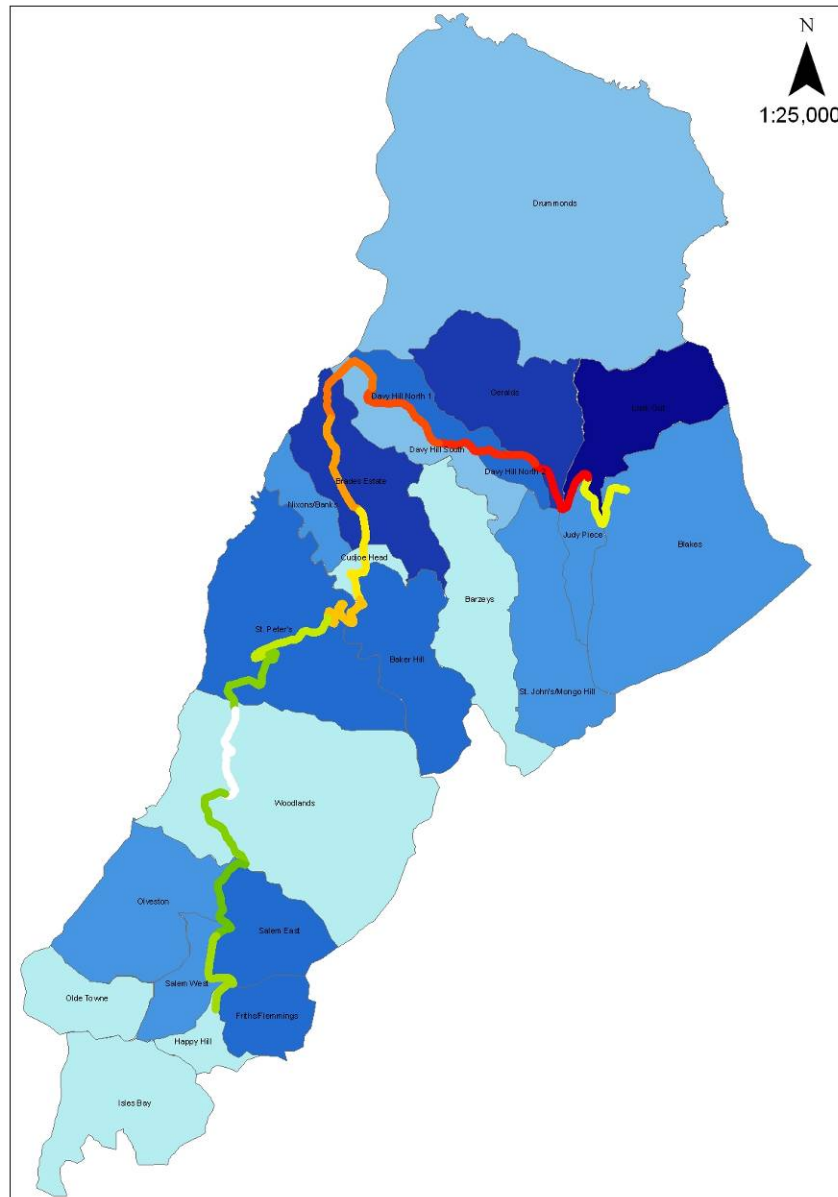
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## Annexes

Annex 1. Map of Montserrat showing where loose animals impounded originated from.



The map (habited regions of Montserrat) is divided into the different residential districts and its colour is representative of the relative number of animals impounded between 2007 and 2009. A dark colour indicates a greater number of animals impounded. The multi-coloured line indicates the concentration of livestock as observed by the livestock transect. The two data sources closely match.

