Module 1.3 Livestock

Lecturer Support Material
Acknowledgements

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<tr>
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<td>1.2</td>
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</tr>
<tr>
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<td>1.3</td>
<td>Livestock (Core)</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>Sustainable Agricultural Systems (Core)</td>
</tr>
</tbody>
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### Icons

- 📖 Read or research
- ✍️ Write or summarise
- 🌐 Activity or discussion
- 🛠️ Lecturer's suggestions
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Module 1.3 Livestock

Rationale

Raising livestock is practiced by many Papua New Guineans. Most of these farmers are small holders who may grow chickens and try to sell them at the local market, farm trout in the clean fast flowing Highland streams, raise pigs, rabbits, cattle, goats, ducks or sheep. Some people capture and raise indigenous animals such as crocodiles and cassowary. Whatever they grow, they all need to understand and have basic skills in livestock management. This module gives a basic introduction to livestock management looking at a variety of commonly raised animals.

The purpose of this module is to increase students’ understanding and knowledge of raising different livestock by emphasising how this can be done in the context of the primary school. For this reason attention will be given to small livestock more appropriate to the primary school environment. It is envisaged that this module will equip beginning teachers with the skills and knowledge to teach and practice raising livestock in their primary schools using improved methods learnt and practiced in the college.

However, it is recognised that many colleges may not have the resources to teach this module practically, therefore a ‘Livestock Project’ - a practical activity similar to the model school garden in the Crops Module will offer students two types of practical activity. If the college has livestock available, the students can study and learn from these. If no livestock are available, the Livestock Project allows the students to choose a suitable animal and to develop a teaching and learning resource suitable for teaching Grade 6-8.

Objectives

By the end of this module, students will be able to:

- identify and describe different breeds of livestock farmed in Papua New Guinea.
- identify and describe different breeds of livestock suitable for raising in the primary school environment.
- describe and if possible demonstrate the correct procedure for handling and caring for various livestock.
- describe and illustrate how the animals being studied reproduce naturally and artificially.
- describe and prepare livestock feeds.
- describe how livestock products are processed, stored and marketed.
- produce teaching resources in the form of a livestock project suited to teaching students in Grades 6-8.
Topics

1. Types of livestock in Papua New Guinea
2. Animal husbandry
3. Animal reproduction
4. Processing and storage

Suggested teaching activities

• Lecturer presentations
• Field trips
• Guest speakers
• Group discussions and activities
• Livestock Project portfolio.

Suggested assessment activities

• Worksheets
• Tests
• Livestock Project
References


Sutherland J. A. (1972). Introduction to Tropical Agriculture


Topic 1: Introduction and Types of Livestock in Papua New Guinea

Objectives
By the end of this topic, students will be able to:

• name and describe a variety of livestock raised in Papua New Guinea
• identify and describe different breeds of livestock suitable for raising in the primary school environment.
• describe the advantages and disadvantages of native and introduced breeds of livestock.
• begin planning a livestock project.

Resources
• Student Support Material
• Liklik Book
• Guest speaker (Department of Primary Industry)

Scope
This topic introduces the students to the module, its topics and major assignments. Time should be taken to carefully explain the ‘livestock project’ as this is a significant practical aspect of the module. It is an introduction to interest the students to develop specific livestock projects suitable to their area. If a practical project is not possible, the students can be encouraged to research and produce a ‘teaching booklet’ as part of their livestock project on a specific animal suitable for teaching Grades 6-8.

Introduction
There are many good reasons for keeping livestock on a College or School farm or garden. Keeping livestock enables primary school students to gain practical experience of livestock
management and care, such as feeding, housing, breeding, health care, processing and storage, the sale of products finances and record keeping.

The animals and their products can provide food and income for the college or school and their waste products can also be used to improve other parts of the school garden or farm. Raising livestock on school grounds can also be used to develop closer school and community relationships. However, there are some issues you need to consider before deciding to raise livestock at the college or school. Thorough planning, and preparation needs undertaken before animals are bought to the school. This will be examined later in the module.

1.3 Activity 1

Make a list of issues and problems you need to consider before deciding to raise livestock at your college or school and discuss with the class. Discuss how an issue like security could be solved with the cooperation of the community.

This module will give you many general principles, guidelines, and background knowledge for selecting and keeping livestock. It is not intended to be an in-depth study of one particular animal or of livestock management. It will give some specific examples of livestock which are common to Papua New Guinea and which are more easily managed on a school or college farm.

However, through the ‘Livestock Project’ you will be encouraged to research, plan and develop resources for raising one particular animal.

Livestock project

Introduce the Livestock Project to the students.

They are required to select one animal (livestock breed) and to develop a project based on this animal over the length of this course.

Depending on the resources available in or around the college environment choose an appropriate option for the students or allow them to choose.

Option 1: Develop a livestock project using real animals in which the students practice the skills of:
- animal husbandry
- animal reproduction
- processing and storage
- record keeping and finances

If suitable livestock are available in or around the college environment, the students could choose an animal that is suited to their particular area of Papua New Guinea.
Option 2: If there are no livestock available at the college develop a livestock project and produce a teaching booklet suitable for using with Grades 6-8. The booklet will cover the same skills as option 1.

Allow time for questions and discussion.

Read carefully through the instructions for 1.3 Activity 2 Livestock Project (1) – Getting Started. Make sure that copies of the texts Agriculture in Melanesia. Book1 and Organising School Agriculture, Robertson, B and Toben, H. K., (1998) are available for the students.

If necessary work through each section with the students to ensure that they begin their livestock project successfully.

---

1.3 Activity 2 Livestock Project (1) – Getting started

Refer to the texts Agriculture in Melanesia. Book1 and Organising School Agriculture, Robertson, B and Toben, H. K., 1998.

The planning is similar to that used to develop a Model School Garden. We are going to adapt it for raising livestock.

Getting started

Look at the following diagram at Figure 1, which comes from ‘Organising School Agriculture’. It is the beginning of a strategic plan for your school livestock project.

Using the available references develop a plan for a ‘livestock project’.

---

![Diagram of a planning framework showing the relationship between NDOE POLICY, SCHOOL AIMS, LAND, TOOLS AND EQUIPMENT, PLANTS, PROGRAMME, LIVESTOCK, and STAFF.](image)

Figure 1 A Planning Framework
Make notes under each of these main headings: –

**NDOE** - use the Making a Living Syllabus and other NDOE agricultural publications. Note down the NDOE position on livestock and the official position on school agriculture. A paragraph should be sufficient.

**School aims** - you don’t know the school so at this stage, think of some questions you can ask the staff and principal to assist them to develop specific ‘school aims’ that will build a school livestock project appropriate to the needs and environment of the school and community.

**Land** – develop some guidelines about: where the livestock project should be, the amount of land needed and alternatives if there is insufficient land.

**Tools and equipment** – develop an inventory of minimum tools needed if the school has few resources.

**Plants programme** – your school garden should already be well established. If it is not, think again about livestock.

What plants can you grow specifically for your animals?

**Livestock** – your choice of appropriate animals should be made according to the selection criteria developed earlier in this module. Refer to it again. The choice of livestock must be suitable to the school environment and security.

**Staff** – you won’t know the staff and there could be a teacher already in charge of agriculture. It would probably be a useful exercise to prepare a short staff presentation on what you have to offer the school and (if there is already an agriculture programme and possibly a fish pond or chicken house) ways you can support the existing staff and programme.

Keep all planning, teaching resources and activities in a ‘Teaching Portfolio’. This portfolio should be used to keep all CDS materials that are relevant to teaching and working in a Primary School.

---

**Significant livestock in Papua New Guinea**

ℹ️ Ask the students to list all the significant livestock raised in this country.
Record their ideas on the board.
Encourage grouping according to different criteria. For example:
Commercial, traditional, indigenous, exotic and so on.
Now write the following headings on the board and ask the students to divide the list a final time and to provide reasons for their decisions.
Encourage debate and discussion.

<table>
<thead>
<tr>
<th>Suitable for school farms.</th>
<th>Unsuitable for school farms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduce 1.3 Activity 3</td>
<td></td>
</tr>
</tbody>
</table>
1.3 Activity 3

Here is a selection of various animals, which for various reasons are likely to be suitable for raising in the primary school.

Read the descriptions and match each description with the correct animal.

Animals:
Rabbit  Goat
Chicken  Bees
Fish

This animal can survive on very rough land; they are relatively cheap, grow and mature quickly, bread easily, and are not troubled by many diseases. They survive periods of drought better than cattle, produce meat and milk and are popular in many communities. They need a large area of land to browse and graze, and can be destructive if they are not controlled properly.

This animal is also cheap, reproduce very quickly, easy to handle and, although they may be unusual, they are likely to be acceptable to most communities. Require special feed, a lot of attention and good housing.

These animals produce honey, which can be sold to gain an income. They are easy to keep in hives but local advice is always worth getting before starting this project.

These animals are good to keep if you have a clean, secure and constant water supply. They are a good source of protein and income and can be fed a lot of waste materials. Risks come from disease, and theft by birds and people.

These animals are also cheap, reproduce very quickly, easy to handle and, although they may be unusual, they are likely to be acceptable to most communities.

Native and introduced species

Ask the students to list different native animals, which are used to provide food and other products.

Discuss whether these animals are farmed or could be farmed and what this would mean for the local people and conservation of the species.

Ask the class to read the next section, which looks at the advantages and disadvantages...
There are many different types of livestock raised by farmers and gardeners throughout Papua New Guinea. Some of these animals are indigenous or native while others are exotic or introduced. Today both native and introduced species are being raised as farming livestock.

The cassowary, bird of paradise and crocodile are native animals which until recently were not bred but hunted in the wild. Native pigs are common in Papua New Guinea and in recent years, some of these have been domesticated and bred with imported pig breeds. The Barramundi and Fresh Water Crayfish are native fish species and are being farmed in different coastal environments around Papua New Guinea.

The advantages and disadvantages of introduced breeds of pig to the native breed:

<table>
<thead>
<tr>
<th>Areas of specification</th>
<th>Advantages – native breeds</th>
<th>Disadvantages – introduced breeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth rate</td>
<td>Very slow</td>
<td>Fast growth</td>
</tr>
<tr>
<td>Number of litters produced</td>
<td>Half the size of introduced breeds</td>
<td>Higher number of litters produced</td>
</tr>
<tr>
<td>Sow abilities</td>
<td>Excellent mother</td>
<td>Some sows are poor mothers and clumsy</td>
</tr>
<tr>
<td>Forage rate</td>
<td>Very good</td>
<td>Satisfactory and good</td>
</tr>
<tr>
<td>Management skill required</td>
<td>Less</td>
<td>Very high</td>
</tr>
<tr>
<td>Suitable to Papua New Guinea conditions</td>
<td>Well suited</td>
<td>Some are not suited due to sun burn</td>
</tr>
<tr>
<td>Pests and diseases attack</td>
<td>Sometimes but not very serious</td>
<td>Easily attacked and the presence of veterinarian (animal doctor) is necessary.</td>
</tr>
</tbody>
</table>

**1.3 Activity 4 Indigenous and improved chickens**

*Do some individual research into the advantages and disadvantages of introduced breeds of chicken, such as hybrid broilers and layers. Find out as much as possible about the indigenous chicken and summarise your findings by comparing it with the introduced chickens.*

**Selection of animals**

You need to be realistic about your resources, especially the time available (teachers’ and students’ time) before you get livestock for your garden or farm. Choose livestock that you know will be able to manage and look
after – try to predict what will happen during school holidays and how security and protection will be managed.

Selecting and breeding animals to produce high quality livestock with the required characteristics is the ultimate goal of farmers. This will ensure high productivity in any enterprise. The type of breed is therefore, the most important consideration followed by proper selection, care, and management of animals.

**Types of animals – looking at dual purpose chickens and cows**

There are different types of animals according to what they produce.

If you want chickens only for meat, then you must get meat birds called broilers. If you want to produce eggs for selling, then get the eggs-laying type. The young ones are called pullets and the old ones layers.

If it is your aim to produce meat from cattle, then the beef type is what you want. If you want to produce milk, you should purchase the diary type.
Module 1.3 Livestock

For family use, it is good to purchase dual-purpose animals for the following reasons:

- they produce both meat and eggs or meat and milk
- they produce more than ‘native breeds’
- they look after their young better than ‘special breeds’
- they enable people to get both meat and eggs from the same source, which ensures a constant supply of protein in the diet of the people
- there is a continuity and regularity in the supply of protein in the diet from the meat and eggs
- hardy breeds like the Australorp, Rhode Island Red and the Plymouth Rock chickens are adaptable to a broad range of local conditions such as:
  - poor management, usually an extensive or free-range system which is inefficient
  - nutritional feed quality (feed other than commercial feed which has low protein, vitamins and minerals that are unbalanced), and the varying climatic conditions of rain, wind and heat and cold
  - tolerance of diseases and parasites

Although we have only focused on the protein derived from animals, ask the students to think of other beneficial products animals provide. Such as manure, ability to eat weeds and pests, security.

Introduce 1.3 Activity 5, ask the students to choose one of the following breeds in terms of its ability to produce more than one return to the farmer and to prepare a short report.

Goats, ducks, fish (farmed tilapia or barramundi), crocodile

1.3 Activity 5  Dual purpose animals

Choose one of the following animals and prepare a short report on the use or dual purpose farmers can get from them.
- goats
- crocodile
- fish (farmed tilapia or barramundi)
- ducks

Crossbreeds
When two different breeds are mated together, this usually brings out the good qualities of both breeds. The offspring of these are usually better than either of the parents. They are usually stronger and more productive. The crossbreeds are often called hybrids.

What is a hybrid?
Using chickens as an example, hybrids are obtained by mating two or more standard breeds of chickens. The chickens that are raised commercially in Papua New Guinea for meat and eggs are hybrids. They are commonly called Hyline birds. The parents of the meat birds are brown and white. The father is a White Cornish and the mother is a Brown Hampshire. Then the different breeds are crossed, the result is usually an improvement in performance – more meat, faster growth rate or better egg production.

Things to consider when selecting animals
1. Select the type you want – for meat, eggs, or milk.
2. Select the type suitable to your climate – tropical or temperate.
3. Select the breed, which is most suitable for your situation.
4. Select the animal which is most productive – look at records of ancestors and its own too.
5. Select the healthiest animal – visual and blood tests to determine if they are free of disease.
6. Select the animal, which is true to type - has all the characteristics, which belong to its type.
Careful selection of animals is a very important way to improve the quality and production of your animals, but it is not the only way. It must be remembered that an animal can never do better than it is genetically capable. That means that each animal has characteristics, which it gets from its parents. This includes colour, size, and ability to produce. Animals will not produce more than what they have inherited from their parents.

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**1.3 Activity 6  Livestock selection**

1. List and describe five characteristics that you would consider when buying livestock.

2. Define the following terms:
   a. breeding
   b. pure breed
   c. crossbred
   d. hybrid
   e. class of poultry
   f. variety of poultry
   g. dual-purpose breed

3. Why is a dual-purpose breed of animal recommended for Papua New Guinea conditions?

4. Name and describe four popular breeds of chicken.

5. Name and describe three breeds each of the following animals: cattle, pig, chicken and goat that are common in Papua New Guinea.

6. List five tropical breeds of cattle suitable to Papua New Guinea conditions.
Livestock project

Introduce the first task of the livestock project. Adapt it to suit your situation and resources. Explain that the students are to make their animal selection for their project. They should take great care in this selection, as it could become a major part of their assessment.

Make sure that as many of the agriculture references listed at the beginning of this module are available to the students.

Encourage the students to choose an animal or livestock breed that they will develop as a project during this module. It should be an animal that is suited to raising in the school environment.

Try to have the texts available to the students in the class to help them make their choice.

Explain that they are to make a chart showing the main features of their chosen animal. Include:

- description of main body parts and general anatomy. (physiology)
- breeds
- place of origin
- environmental requirements

The chart should be done in at least two colours, have a title and border.

1.3 Activity 7 – Livestock project (2)

This is the second task in your livestock project. It will be the beginning of a teaching resource which you should be able to use in the primary school.

Choose an animal or breed of livestock that you wish to develop as a project through this module.

This first task asks you to make a chart showing the main features of your chosen animal. Include:

- description of main body parts and general anatomy. (physiology)
- breeds
- place of origin
- environmental requirements

The chart should be done in at least two colours, have a title and border.
Topic 2: Animal Husbandry

Objectives
By the end of this topic, students will be able to:

• explain and demonstrate a variety of livestock management systems including:
  - general care and handling
  - housing
  - health care and diseases
  - nutrition and feeding

• identify different types of livestock feed and equipment used to feed animals

• classify different livestock feed

• continue to develop a livestock project for their chosen animal.

Scope
This topic covers the area of animal husbandry or livestock management systems. General information on a variety of livestock, such as techniques for housing, feeding and nutrition, healthcare and diseases will be introduced to students.

Students will continue to develop their livestock project.

Livestock management

Ask the students what they think the term husbandry means. Make a list of all the aspects of husbandry. Explain that four aspects of husbandry will be discussed in this module:

- housing,
- feeding and nutrition,
- diseases and pest and
- keeping records and finances.

Livestock management is the skillful treatment or care of animals. Another word which is used and means the same as management, is husbandry. Management can be thought of as an umbrella term, which includes everything, which we might do or be careful not to do when looking after something.

Elements of management
Four major elements of management will be discussed in this module.

They are:
Module 1.3 Livestock

- housing
- feeding
- diseases and pests
- keeping records and finances

The following table is a summary of important management practices which can be applied to most animal husbandry.
Livestock management overview

<table>
<thead>
<tr>
<th></th>
<th>Purchasing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Always buy from a reliable source, which has a good reputation. Make sure the animals are tested and declared free from disease. Have them vaccinated if possible to prevent them from getting disease.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Provide sufficient space. E.g.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Broilers 0.1m² /bird</td>
</tr>
<tr>
<td>2.2</td>
<td>Sow and litter – 9m²</td>
</tr>
<tr>
<td>2.3</td>
<td>1 cow / ha – unimproved</td>
</tr>
<tr>
<td></td>
<td>Hens 0.5 – 1m² /bird</td>
</tr>
<tr>
<td></td>
<td>12 young / 8 growers – 9m²</td>
</tr>
<tr>
<td></td>
<td>2.5 cows / ha – improved</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Purchasing – where to buy, what to look for</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Provide equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Make them properly so they do not injure any animals or waste feed.</td>
</tr>
<tr>
<td></td>
<td>Provide sufficient space – housing requirements.</td>
</tr>
<tr>
<td></td>
<td>Make sufficient feeding and watering space so there is no crowding.</td>
</tr>
<tr>
<td></td>
<td>Provide equipment – what is needed, how to make, where to buy?</td>
</tr>
<tr>
<td></td>
<td>Make proper storage space and conditions to prevent losses and spoiling.</td>
</tr>
<tr>
<td></td>
<td>Yards and crush are required by law for every cattle project in Papua New Guinea.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Identify animals properly</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Identification proves ownership of the animals. Ear notching, ear tagging, ear or body tattooing or branding may be used.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Keep secure – predator protection, human and animal</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Houses and fences must be strong enough to keep predators out; to keep boars separate or keep boars and other animals from breaking out.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Isolate</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Separate different types until they get used to one another so they don’t fight. Keep people away or have them disinfect their feet so they don’t carry disease in. Separate sick animals so they don’t spread disease to others. Keep old ones and young ones separate so disease is not passed on.</td>
</tr>
<tr>
<td></td>
<td>Keep males away from young females so they are not mated too early. Separate weaned ones from mothers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Check daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Notice any changes in the health or behaviour of the animals.</td>
</tr>
<tr>
<td></td>
<td>Treat any injuries or give medicine quickly when symptoms occur. Help any having difficulty with giving birth.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Cull regularly</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Get rid of sick animals not able to be economically treated or have incurable diseases.</td>
</tr>
</tbody>
</table>
Livestock housing

Discuss the following statement:

Housing animals properly is a fundamental requirement of animal husbandry. A well-housed animal will be a contented animal and therefore more likely to perform for the farmer.

Discuss the reasons why livestock need effective housing.

Explain that this section on housing will look at housing requirements for a variety of animals. Have the students read the next section.

No one design of housing fits all types of livestock under all climatic conditions. The design of housing should always take into consideration the local conditions – is it wet or cold, or dry or windy, most of the year? The animal house must also be suitable for the farmer to carry out daily duties of cleaning the house, and feeding the animals.

The type of animal that is kept by the farmer, also determines the type of house to build. For example, pig’s house must have strong walls, because pigs can push down weak walls. On the other hand, a poultry house need not have durable walls like a pig house.

Why animals need to be housed

Animals need the protection of a house for the following reasons to:

1. Provide shade from the sun and keep them cool.
2. Keep them from getting wet when it rains.
3. Keep them warm when it is cold and windy.
4. Keep them safe from disease and parasites.
5. Keep them from being lost.
6. Keep predators from attacking them.

Importance and benefits

Housing is important especially in the Highlands where it is cold. Pigs will get pneumonia and die if they get chilled and wet. Young animals especially need to be kept warm and dry. Cattle usually do not need housing but it may be necessary on the coast if there are not enough shade trees to keep the sun off. Ducks need shelter from rain, as do rabbits and goats.
1.3 Activity 9– Housing systems for raising animals

Animals can be looked after in many ways. Some of the housing systems used for raising chicken are described in the table below.

For each of the other animals describe the different types of housing that is possible.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickens</td>
<td>Ducks</td>
<td>Pigs</td>
<td>Goats</td>
</tr>
<tr>
<td>1. Semi – intensive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Intensive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Deep litter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The raised floor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The battery cage</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Size of house and floor space required for breeding pigs

Animals must not be too crowded. Crowding may result in stress. An experiment at the Goroka Piggery showed that pigs grow well in a bush house with a very small space. Only 3m x 3m is space enough for: 1 sow and her litter; or 2 sows; or 10 – 12 young pigs; or 6-8 growers.
How to determine the dimensions of chicken houses

1. Select the age of the chickens or type of hens you want to build the house for.

2. Multiply the number of birds you will get times the amount of space each bird requires. That gives you the total area that you will need for the house.

3. If the area is less than 36 m$^2$, think of a number when multiplied by itself will give that area. That number will be the length of one side and the house will be square. However, if the area is more than 36m$^2$, we want to limit the width of the house to 6m, so it is not too difficult to construct – so we simply have to divide by 6, which then becomes the width of the house. The answer becomes the length.

4. **Example A**: What should the dimensions of a house for 100 Broilers? Broilers are kept for 6-8 weeks so they come into the 4-10 weeks period.

The following are the steps:

- 4-10 weeks chickens require 0.1m$^2$ / bird
- multiply $160 \times 0.1m^2 = 16m^2$ = the area of the house
16m² is less than 36m², so think of a number x itself that gives 16 and that \( x = 4 \)

the dimensions = \( 4 \text{ m} \times 4 \text{ m} \)

5. **Example B:** What should the dimensions of a house for 150 light hens be?

- light hens require 0.5m² / bird
- multiply 150 x 0.5 = 75m² area of the house
- 75m² is more than 36m², so simply 75 + 6 = 12.5
- the dimensions then are \( 12.5 \text{ m} \times 6 \text{ m} \)

### 1.3 Activity 10 – Space requirements for chickens

*Use the above information to help calculate the dimensions needed for a house for these chickens:*

**90 broilers**

\[ \quad \times \quad = \quad \text{m}^2 \quad \text{DIM} = \quad \times \quad \]

**120 light hens**

\[ \quad \times \quad = \quad \text{m}^2 \quad \text{DIM} = \quad \times \quad \]

**800 chicks to 4 wks**

\[ \quad \times \quad = \quad \text{m}^2 \quad \text{DIM} = \quad \times \quad \]

**100 broilers**

\[ \quad \times \quad = \quad \text{m}^2 \quad \text{DIM} = \quad \times \quad \]

**25 heavy hens**

\[ \quad \times \quad = \quad \text{m}^2 \quad \text{DIM} = \quad \times \quad \]

**Deep litter**

The best materials for deep litter are; saw dust, wood shavings, coffee hulls, peanut hulls and dry grass. The important thing in using deep litter is to cover the floor of the chicken’s house to make it safe and sanitary. The droppings mix with the litter.

It should be stirred at least once a week. This stops it from getting hard. The droppings will then mix evenly throughout the litter. New litter should be put in every six months or after two batches of broilers. It is important to clean out the old litter before the new batch arrive.

The deep litter is a good source of fertilizer for vegetable gardens.
Housing for ducks

The needs of ducks are different to chickens. Housing for ducks can be provided with a simple bush materials construction. The roof should be rainproof as ducks are not fond of rain and egg production may go down in the rainy period. Ducks lay most of their eggs at night and so eggs should be collected early in the morning to prevent them becoming muddy. Dry nesting places should be provided and there should be shade provided in the duck yard.

Housing for rabbits

Typical pens for crocodile farming
1.3 Activity 11 – Animal housing

1. Look at the illustrations of housing for rabbits, bees and crocodiles. Choose one animal and write a summary of its essential housing requirements.

2. If you were living in a Highlands Province of Papua New Guinea, how would you make a good pig house?

3. Research to find the right conditions for raising fish in a pond.

4. What are the housing needs of goats? – illustrate with a sketch.

Introduce the students to 1.3 Activity 12 Livestock project (4) Housing. If the college has examples of different livestock housing use it and encourage the students to make drawings, measurements etc for their project. This part of the livestock project asks the students to make detailed drawings of the housing needed by their animal. They should also be encouraged to make resource lists and costings.

Refer to CD Module 2.2 Integrated Projects for examples of action plans and resource forms.

1.3 Activity 12 – Livestock project (4) housing

In this activity you are asked to think carefully of the housing needs of your project animal. Use the models presented in this module and research the references to find the right housing.

Your planning must include:

- A detailed drawing/plan of the house/pond/tank that your animal will live in.
- Accurate measurements.
• Lists of resources needed and estimated costs.

An Example of a Resources Planning Form

<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Qty</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

Food and nutrition

Discuss the important aspects of feeding animals, the quality and quantities of food as well as routines for feeding as important principles of animal husbandry. Have the student read the section Food and nutrition.

Providing the right food and nutrients for your livestock is one of the most important parts of animal husbandry. If your animal is well fed with a balanced diet then the chances of diseases and sicknesses affecting your animal will be reduced. If your animal is to produce optimally then the quality and quantity of food is extremely important.

Feeding animals

Ask the students to consider the essential ingredients of a balanced diet for livestock. Compare this with our own need for a balanced diet. What are proteins and what part do they play in growth and development?

Ask the same questions about carbohydrates, minerals, and vitamins. Ask the students to make lists of the food sources of proteins, carbohydrates and minerals and vitamins. Allow students time to write down their own answers before asking people to share ideas in small groups.

Have students complete 1.3 Activity 13.

Use the completed table to assist the students. During class sharing, help the class get a completed table using the answers below to complement student ideas.
## Types of Food

<table>
<thead>
<tr>
<th></th>
<th><strong>Protein</strong></th>
<th><strong>Carbohydrates</strong></th>
<th><strong>Minerals and Vitamins</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>What are they made of?</td>
<td>Compounds called amino acids</td>
<td>Sugar, starch, and fats</td>
<td>Calcium – A-B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Iron B2 – C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cobalt, Sodium D-E</td>
</tr>
<tr>
<td>What do they do? (Function)</td>
<td>Build muscles, skin, hair, feathers, repair muscles and other tissues</td>
<td>Give energy, operate organs, and keep up body heat</td>
<td>Make strong bones, digest and absorb food, form blood cells, and make nerves work</td>
</tr>
<tr>
<td>How much do animals need?</td>
<td>Young animals-20%</td>
<td>Large amount</td>
<td>Small amount</td>
</tr>
<tr>
<td></td>
<td>Growing period- 15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Producing – 17%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special requirements</td>
<td>13 different amino acids are needed</td>
<td></td>
<td>Piglets need iron; chickens need vitamin B to prevent bent toes.</td>
</tr>
<tr>
<td>Examples</td>
<td>Soya beans, peanuts, cowpea, meat meal, fish meal, fresh fish</td>
<td>Sweet potatoes, corn, sorghum.</td>
<td>Greens and fruits, yellow food, Vitamin A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mineral mix for pigs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mineral salt block- cow</td>
</tr>
</tbody>
</table>

### 1.3 Activity 13

*Working in small groups, consider the diagram below. Use the information gathered and shared on the board and any other references available to complete as much of the chart as possible.*

*Be prepared to share your ideas with the rest of the class.*
Home-grown feeds
If you have a small number of animals, it is possible and cheaper to grow your own feed. When there are only twenty chickens, four or five pigs and one or two cows, an average farmer does not need to worry so much about growing a lot of feed. An important thing to remember is to grow some legumes to give a good supply of protein. It is also wise to remember not to give all the protein to your animals and then there is nothing left for your own children.

Soya beans and peanuts must be cooked so that the protein in them can be digested and utilized well. Peanuts contained a lot of oil and should be used in small quantities so that the animals do not get too fat. That means that peanuts should not be the only source of protein. Fish can be grown for animal food. A large fishpond may provide the animals as well as the family with some protein.

Mixing our own rations
Animals will usually produce better if you mix some protein concentrate with the feeds that you grow in your garden. Some mixes are shown in the chart in ‘Handbook for Teaching Agriculture in Papua New Guinea Schools’ Busse, D. (1985) pp144. Cups are used to measure the amounts in the chart but you can use any container if you use the same one for each item.

Different kind of feed you can buy: home-grown and purchased feeds

Poultry concentrate is a purchased feed, which is never fed by itself but is always mixed with what you grow. The other purchased feeds are not mixed with anything else. They are a complete ration.

<table>
<thead>
<tr>
<th>Home-grown feeds</th>
<th>Purchased feeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winged bean, Soya bean, peanut, corn and sweet potatoes</td>
<td>Concentrate</td>
</tr>
<tr>
<td>Pig concentrate</td>
<td>Broiler starter</td>
</tr>
<tr>
<td>Chicken concentrate</td>
<td>Broiler finisher</td>
</tr>
<tr>
<td></td>
<td>Pullet starter</td>
</tr>
<tr>
<td></td>
<td>Pullet developer/Layer</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cattle need good pastures
Kunai and some other grasses are not the best for cattle. Many cattle farmers improve their pasture by planting better grasses and legumes. The three features of improved pastures are:

1. higher feeding value
2. longer growing period
3. increased soil fertility
Good pasture grasses

Para grass, centro sema and crotalaria are all good pasture grasses for cattle and other grazing animals.

Try to identify these grasses – make sketches of them in your book.

The most economical animal feed
A key consideration in the nutrition of farm animals is high efficiency. This means high yields of meat and other products in relation to the quantities of feed consumed. Cattle are not efficient converters of feed to meat. Chickens are eight times better converters of grain to meat than cattle. However, cattle can be raised on land where it is not economical to grow other crops. A good quality pasture is one, which is young and highly digestible, high in protein, energy and minerals with not excessively high water content. Sometimes when the rainfall is very high, the grasses and legumes may contain too much water.

1.3 Activity 14 - Livestock project (5)

Gather as much information as you can about the feeding requirements of your animal. Organise your information under the following headings:

- nutritional requirements
- a balanced diet for the various stages of the animal’s life.
- feed supplements needed.

Use the resources available in the library as well as the teaching texts used with this module to research your project.
Equipment

All equipment used to feed livestock needs to be clean and well maintained. Much of the equipment used and shown below can be made from natural materials.

Ask the students to read this section and answer the discussion questions. When finished ask them to complete 1.3 Activity 15. If possible, have paper and drawing materials for the students to draw the equipment needed for their livestock project.

Equipment for the chicken house

1. **Feeders** – these can be cheaply made of bamboo. Remember not to make the sides down too low or the chickens will scratch the feed out.

2. **Waterers** – these can be made of bamboo and raised off the floor so the deep litter does not get so wet. If they are, put up on a platform with a wire top and a catch basin underneath hardly any water will spill on the deep litter.

3. **Containers for grit** – small stones from river beds can be put in small plastic containers or bamboo box and place in chicken house for birds to use. This helps birds in their digestion and the development of reproductive tract.

4. **Perches** – these can be constructed to keep the manure out of reach of the hens. This can be done by putting chicken wire underneath the poles and along the sides to completely enclose the area under the perches. It must be constructed so the side lifts up for the removal of the manure.

5. **Nests** – these can be made of ply wood or timbers and filled with one quarter full of dried grass or saw dusts. The nest boxes must be cleaned every week with fresh dried grass or saw dusts.
The eggs should be collected every day and records should be kept.

6. **Brooder** – a special box made and placed in the chicken house to keep young day old chicks warm at night. These vary in sizes depending on the number of birds you have.

**Sheep and goat feeding equipment**

In Papua New Guinea, these animals are allowed to forage for themselves. However, in schools and research stations, sheep and goats are housed, and feed on grasses and other type of forage. The feeds are kept on cement floors or on flat forms.

**Rabbit feeding equipment**

Rabbits and guineapigs may be fed from the same type of equipment. Where concentrate feeds are fed, such feeds should be placed in plastic bowls; flat plates are not recommended, since they result in greater feed wastage. The bowls are placed inside the hutch where the rabbits live. Also placed in the hutch, is a little manger, where grasses (fresh or dried) are provided for the rabbits.

- Why would you recommend the free-range system of poultry management to a village farmer? Give two reasons.
- Explain why it is not good to have one feed trough for about 500 chickens?
- List and describe four types of feeding equipment for chickens and pigs.
- What type of feed would you give to guinea pigs and rabbits?
1.3 Activity 15 – Livestock project (6)

List all the feeding equipment needed to raise your livestock from juvenile to mature adult.

Describe the function of each piece of equipment and make an accurate drawing of each.

Use the resources available in the library as well as the teaching texts used with this module to research your project.

Animal diseases, parasites and pests

Write the following words on the board: disease, parasite, pest. In small groups, ask the students to define each term with a definition and example.

Ask the students to read the following and complete the discussion exercises.

Definitions

Disease – any condition, which causes animals to be unhealthy. Narrowly diseases are those caused by microscopic organisms.

Parasites – a small animal, which lives in or on, and gets its food and shelter from some other animal.

Pest – any animal, plant or insect that is in the wrong place at the wrong time.

Tape worm, ticks and lice are three pests which attack and threaten many livestock such as chickens and rabbits.

Make a drawing of each in your books and conduct some basic research.

Use these headings to organise your information:

Name:
Type of animal:
How it feeds
Where it lives
Damage caused
**Effects on animals**
Organisms, which attack animals, do not always cause death. However, they are often responsible for causing animals to produce poorly. Fowl Pox in chickens does not kill very many chickens but later those chickens, will not lay as many eggs.

Another example is pigs infested with intestinal parasites; they will grow very slowly.

**Sizes of organisms**
The tiniest organisms are the viruses, for example, the one that causes Marek’s Disease in chickens. Bacteria are larger than viruses, for example, Anthrax in pigs. Coccidiosis in chickens is caused by protozoa. Those, which we can see with our eyes, are internal parasites, like round worms, and external ones, like lice and ticks.

**Primary and secondary causes of disease**
Primary causes of disease, parasites and pests are the organisms themselves but secondary causes are those, which make it easy for the organism to be present and to do harm. Secondary causes are contributing factors.

**Classification of disease causes**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coccidiosis</td>
<td>Protozoa</td>
<td>Wet litter or muddy pools</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>Bacteria</td>
<td>Cold and wet conditions</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>Worms or bacteria</td>
<td>Dirty house and surroundings</td>
</tr>
</tbody>
</table>

**Prevention**
Prevention is something, which will stop the animals from being attacked by diseases parasites and pests.

Prevention is the most important part of the management of animals. A very good rule to follow in management is: Keep the place where animals are kept clean and dry. Other things, which will prevent animals from being attacked by harmful organisms: Vaccination (never used as a treatment).

Medicine for prevention, e.g., Coccidiostat for chickens, Mecadox prevents diarrhoea in pigs and Ivomec injected in cattle to keep them free from internal and external parasites.

**Treatment**
When animals get a disease, have parasites or are infected with pests many times there are things that can be done to overcome the problem. For example: Coccidiosis, screw and internal parasites are some, which can be treated successfully and economically. Sometimes there may be a treatment available but if the animal is not a very valuable one it is better to kill it because the treatment would be more expensive than the animal is worth. This may be especially true in the case of chickens.
Cure
Some diseases have no cure, e.g., Fowl Pox, Anthrax and Brucellosis. Sometimes the only thing that can be done is to slaughter the animal.

Some common diseases of poultry
Chickens suffer from several diseases; such diseases include Marek’s Disease, Coccidiosis, Fowl Pox, Botulism, Newcastle (Ranikhet) disease, Fowl Cholera, Pullorum and chronic respiratory disease.

Two external parasites are lice and ticks. Among the internal parasites are the worms – round worms, tapeworms, and caecal worms.

1.3 Activity 16

Choose any one of these common diseases of poultry and write a short description of it.

Marek’s Disease, Coccidiosis, Fowl Pox, Botulism, Newcastle (Ranikhet) Disease, Fowl Cholera, Pullorum (BWD) Disease, Chronic Respiratory (CRD) Disease.

List some of the common diseases, parasites, and pests of the following farm animals in the table below:

<table>
<thead>
<tr>
<th>Pigs</th>
<th>Ducks</th>
<th>Goats</th>
<th>Cattle</th>
<th>Fish (Pond)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td>Gill-rot</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td>White spot</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td>Argulus infection</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td>Lernaea infection</td>
</tr>
</tbody>
</table>

- Name four common diseases of cattle and discuss the symptoms and treatment.
- State how you would control a coccidiosis disease in chickens?
- In your own words, describe the gill rot disease of fish and how to control it.
- What are the common symptoms of snuffles disease and what type of animals does it attack?
Read and discuss the following project activities with the class and allow time for groups and individuals to complete the tasks.

1.3 Activity 17– Student livestock project (7)

Make a drawing of the internal organs of your animal (see the example of the pig) use the drawing to show where and how your livestock is affected by parasites, pests and diseases.

Make a simple chart of the parasites, pests and diseases which attack your livestock and the methods of control.

Use the resources available in the library as well as the teaching texts used with this module to research your project.

Keeping records and finances

Financial records, budgets, monitoring and reporting are all very important parts of a project and depending on how well they are done contribute to the success of a project. The examples used in this section refer to a chicken and vegetable project but the basic principles apply to any livestock project.

Introduce this section by discussing the terms: budget, reporting and monitoring. What types of records should a livestock project keep? List these. What is the danger if a project keeps no records? Guide the students through the process of forming budgets. Allow time for peer sharing.

Budget

It is important to determine whether or not a livestock project of any kind will be worthwhile. This means determining the value of the project, in terms of money and other benefits like adding protein to your diet, providing worthwhile employment and learning opportunities as well as income for the school or community. A budget based on the estimated costs and revenue of a project will be needed if any money is to be borrowed.
### 1.3 Activity 18 – Student livestock project (8)

Refer to the sample budget for a vegetable garden project as an example for your livestock budget.

Refer to pages Agriculture in Melanesia Book 1 pp86-87 for more information on budget preparation.

<table>
<thead>
<tr>
<th>A simple sample budget, without cost and revenue figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected revenue from sale of crops</td>
</tr>
<tr>
<td>Sweet potato 1  (amount and price/unit)</td>
</tr>
<tr>
<td>Cabbage 1</td>
</tr>
<tr>
<td>Lettuce 2</td>
</tr>
<tr>
<td>Cucumber 3</td>
</tr>
<tr>
<td>Taro 4</td>
</tr>
<tr>
<td>Other 5</td>
</tr>
<tr>
<td>Total expected revenue 6</td>
</tr>
<tr>
<td>Expected cost</td>
</tr>
<tr>
<td>Seeds 7</td>
</tr>
<tr>
<td>Fertilisers 8</td>
</tr>
<tr>
<td>Compost-making cost 9</td>
</tr>
<tr>
<td>Insecticides 10</td>
</tr>
<tr>
<td>Other materials (strings, stakes, hose etc.) 11</td>
</tr>
<tr>
<td>Rent on land (if any) 12</td>
</tr>
<tr>
<td>Interest on money 13</td>
</tr>
<tr>
<td>Cost of tools etc. (cost/5 yrs) 14</td>
</tr>
<tr>
<td>Labour in person days 15</td>
</tr>
<tr>
<td>Miscellaneous (other small cost) 16</td>
</tr>
<tr>
<td>Total expected cost 17</td>
</tr>
<tr>
<td>Total expected revenue less Total expected cost = Expected profit</td>
</tr>
</tbody>
</table>

*It is very important to calculate the costs of the project first with the children before starting.*

Describe how you will go about keeping your records on a proposed livestock project.

There are three main parts: **Income**: money you take in, **Assets**: value of things you have on hand and **Expenses**: money paid out.

Prepare a simple budget for your livestock project.
Monitoring and reporting system

Revise with the students the place of project monitoring (Refer to CD module 2.2 Integrated Projects)

Monitoring is the process of regularly keeping a check on the operation of a project to make sure that it is following the project plan and is within the budget. Monitoring of a livestock project could involve asking the following questions:

- Is the project generally going well and what can be improved?
- Is it within budget?
- Are people in the community involved?
- Is the project building on some good ideas from the surrounding community?
- Are the students learning new skills and better ways of looking after livestock?
- Are the students active and doing most of the work?
- Are the students receiving the guidance they need?
- Are the animals in good health, is there enough food and what is the state of the housing?
- Is everything going well as planned?

1.3 Activity 19

Prepare a simple checklist of questions for the monitoring of your livestock project.

Discuss the questions with a peer and decide how you will keep a record of the questions and information collected e.g., diary.

Keeping records

Explain that the records below are examples from different livestock projects and can easily be adapted. Encourage the students to discuss in small groups what records would be needed for their projects and how they would keep them.

Records are an essential part of any business. Keeping records is important for farmers even if they are not engaged in a large commercial enterprise. There are many types of records and many reasons for keeping them.

Accurate records are needed to help the farmer to:
1. Determine the profit and loss made.

2. Present evidence of ability to replay loans when seeking additional money from banks or other financial sources.

3. Measure progress from season to season or month to month.

4. Decide what improvements (if any) are needed.

5. Plan for further expansion if needed.

**Type and purposes of farm records**

The following are examples of some of the different records which can be kept of livestock.

1. **History of animals – cattle example**

<table>
<thead>
<tr>
<th>Identification</th>
<th>Date of birth</th>
<th>Dam</th>
<th>Sire</th>
</tr>
</thead>
<tbody>
<tr>
<td>43262</td>
<td>13/9/2000</td>
<td>38725 - Daisy Red</td>
<td>70052 - Mountain Boy</td>
</tr>
</tbody>
</table>

2. **Reproduction records – pig example**

<table>
<thead>
<tr>
<th>Sows Identification</th>
<th>Breeding date</th>
<th>Expected farrowing date</th>
<th>Farrowing date</th>
<th>Number of piglets born</th>
<th>Number of piglets weaned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. **Production records – example of daily production records for a poultry project**

<table>
<thead>
<tr>
<th>Day</th>
<th>No. of hens</th>
<th>No. of eggs</th>
<th>Percent production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Died</td>
<td>Sold</td>
<td>Total</td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. **Financial records**

- Introduce this section with a discussion of profit and loss. What does profit mean and how is it calculated?
- Why is it important to keep accurate records of expenses and income?
- Have the students read the section Keeping records and explain 1.3 Activity 20 providing examples and guidance where necessary.

Animal husbandry is a business. It has inputs and produce (outputs), costs and returns. The wise farmer keeps a careful watch on all items that involve money. Then he/she can tell whether she/he is making a profit.
There are different ways of keeping financial records. A very simple method is shown in Teaching Agriculture in Papua New Guinea Schools. D.Busse (1985), pp 153.

Using a chicken project as an example, to calculate the net profit or loss of a livestock project, you must keep records of all the expenses and income. A broiler project income and expense record for 200 chickens is shown on the table below. Profit or loss is calculated by subtracting all expenses from income related to the broiler project. A positive balance is the net profit and a negative balance shows a loss.

Net profit on the first batch of 100 chickens was K180.88. With the second batch of 200 chickens, net profit was K 431.00. The input cost was almost the same except for feed and labour. The sale price per chicken was the same. The difference was because the chicken house was large enough to take 200 chickens, so raising 100 chickens did not use the full capacity of the house. It is therefore more profitable to raise 200 broilers if the house is large enough.

![Sample page of broiler income and expense record](image)

**Example of a profit and loss statement**

![Sample broiler profit and loss statement](image)

*Source: Agriculture for Melanesia, 1993*
1.3 Activity 20 – Student livestock project (9)

Think of your own livestock project and the financial records you will be keeping.

Design two simple record forms: one to record income and expense and the other to show profit and loss.

Remember this project is part of your students education and so learning opportunities should be taken whenever possible. Keeping financial records is a valuable skill to teach.

Refer to Agriculture for Melanesia Bk1 and Teaching Agriculture in Papua New Guinea Schools.
Topic 3: Animal Reproduction

Objectives
By the end of this topic, students will be able to:

- describe and illustrate the reproduction and fertility cycle of livestock
- handle and care for livestock during and after mating
- continue to develop a livestock project for their chosen animal.

Resources
Student Handbook

Liklik Book

Teaching Agriculture in Papua New Guinea Schools. D. Busse (1985)

Grade 7-8 Syllabuses and Teacher Guides

Scope
This topic examines the general principles of animal reproduction as it applies to livestock. Students will be encouraged to examine the life cycle of different animals and to prepare resources on the life cycle and reproduction of their chosen livestock. For more specific information on animal reproduction, refer to the science curriculum.

Genetics

Ask the students what they understand by the term genetics, GE (genetic engineering). Read and discuss the following learning points with the students.

- Genetics is the study of the similarities and differences between organisms.
- The nucleus of every cell (except gametes) contains two sets of identical chromosomes made of DNA. Cells like this are called diploid. Chromosomes carry genes, the chemicals which determine the characteristics of the offspring.
- Gamete cells are the sperm (from the male) and the egg (from the female). They contain only one set of chromosomes and are called haploid.
- When a sperm fertilises an egg, the new individual formed has one set of chromosomes from each parent.
- When cells divide this is called mitosis, the chromosomes divide, too. The genetic material, which makes up the chromosomes, can join in different combinations; this results in variation – differences between animals.
Genetics is very important in animal breeding because it allows farmers to produce animals with good qualities such as fast growth, resistance to disease or ability to produce a lot of milk or eggs.

Introduce 1.3 Activity 21, which very simply explains how different combinations of chromosomes can form. Ask the students what traits a farmer would look for in potential breeding animals to ensure only the best off-spring resulted. Provide scrap paper and scissors.

1.3 Activity 21 – Sex determination

Resources

- scissors
- card or paper

What to do?

1. Cut out models of farm animals (pigs, goats, chickens,...) and small circles from the paper or cardboard.
2. Place the animals in pairs; one male and one female.
3. With each shape, place two small circles, one of the circles with the male should be marked with a ‘X’, the other with a ‘Y’. Both the circles with the female should be marked with a ‘X’. These circles represent the gametes.
4. Pretend that you are breeding these animals and make combinations with the gametes and predict which sex the offspring will be.

Sex chromosomes
The sex of an animal is determined genetically by two chromosomes called (X and Y chromosomes) in many animal species. The Y-chromosomes contain a gene that determines the production of the testes. Male cells with the diploid member of chromosomes contain one X chromosome and one Y chromosome. Female cells contain two X chromosomes. When a sperm containing a Y chromosome fertilizes an ovum, an XY pattern results and the zygote develops into a male organism.

1.3 Activity 22
What is the importance of genetics in agriculture?
Why do cells divide? How?
How can we make predictions about the offspring of animals by using our knowledge of genetics?

Reproduction in poultry

Cock – has two testes that produce spermatozoa, which are necessary for fertilization. The other function of the testes is to secrete the male hormone (a special chemical in the body), which is responsible for the special male features. However, during mating, spermatozoa are ejaculated into the reproductive tract of the hen.

Hen – only the left ovary is functional. The ovary produces the eggs and secretes the female hormone, which is responsible for the female features. During ovulation, the matured ovum is discharged from the ovary into the female genital track, which consists of several segments. The egg is formed soon after ovulation and that ovulation takes place regardless of fertilization. It therefore, follows that a hen can still lay eggs without mating but such eggs are infertile and cannot be used for hatching.
How the egg is fertilized

The egg is fertilized in the upper part of the oviduct. When the cock mates with the hen, some of the sperm travel up the oviduct and come in contact with the germ on the yolk. Only then can the germ begin to develop into the embryo. The fertilized germ begins to divide and many cell divisions are completed before the egg is laid.

Conditions for incubation

When the germ is laid and cools down, the germ stops dividing. The egg must be made warm if it is going to develop into a chick. The mother hen does this naturally when she begins to sit on the eggs. Her body temperature (39 – 40°C) gives the right amount of heat for the germ in the egg to grow again. If the hen sits on the eggs for 21 days, the embryo (the little chicks inside the eggs) will grow big enough and they will begin to hatch.

1.3 Activity 23 – Livestock project (10)

Use the above description of reproduction in poultry to produce your own reproduction guide for your livestock.

Include a description of the male and female, include drawings as appropriate and describe the special requirements of reproduction.

Sexual behaviour of farm animals

In male animals, sexual behaviour consists of courtship followed by copulation (mating). It is important to bear in mind this division of the male sexual behaviour in order to fully understand sexual behaviour. In female animals, a courtship may not exist; sometimes, it is difficult to observe the female courtship. The active participation of female animal in sexual behaviour is determined by her receptivity and her attractiveness to males. This is not strictly true for all farm animals. Successful copulation depends on the female adopting a copulatory stance for the male to insert his sex organ into the female reproductive tract.

The following are common symptoms of sexual behaviour common to many animals are:

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>• urinates frequently</td>
<td>• vulva swollen and red</td>
</tr>
<tr>
<td>• quick courting</td>
<td>• mounts other females of the same sex group</td>
</tr>
<tr>
<td>• restless</td>
<td>• become restless</td>
</tr>
<tr>
<td>• mounting the opposite sex</td>
<td>• remains steady when there is a firm pressure on its haunch</td>
</tr>
<tr>
<td></td>
<td>• receptive to the male at this time only</td>
</tr>
</tbody>
</table>
1.3 Activity 24

- What are the most obvious reasons for producing young animals?
- What are the major differences between male and female animal reproductive organs?
- Define puberty in animals.
- Explain in your own words, how the sex of an animal is determined?
- What are the exact weeks for artificial brooding of day-old chicks in the highlands and lowlands areas?
- Describe the castration process in a pig and provide four reasons for such an operation.

Life cycle and fertility patterns

Explain to the students that they will be required to do research for their chosen animal as part of their livestock project. Two animals, the chicken and the rabbit have been chosen to illustrate the life cycle and fertility patterns of livestock. Ask what is a life cycle and get examples. Explain that different management practices are needed to care for livestock at different stages of their life cycle. Give examples.

Ask the students what gestation is. Use the following table to give examples. Refer to 1.3 Activity 25 and encourage the students to match the correct number of days with the animal.

<table>
<thead>
<tr>
<th>Types of animals</th>
<th>Number of days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken</td>
<td>21 days</td>
</tr>
<tr>
<td>Pig</td>
<td>114 days</td>
</tr>
<tr>
<td>Rabbit</td>
<td>31 days</td>
</tr>
<tr>
<td>Goat</td>
<td>150 days</td>
</tr>
<tr>
<td>Cattle</td>
<td>283 days</td>
</tr>
</tbody>
</table>
1.3 Activity 25

Match the following gestation periods with the correct animal
Pig, rabbit, goat, cattle, bee.

283 days, 7 days, 150 days, 31 days, 114 days.

The life cycle of a chicken
The cock mates with the hen, before she will produce fertile eggs. The eggs can be incubated, and they will produce chicks after 21 days. The diagram below shows the exact life cycle of the chicken from laying up to fertilization stage.

Life cycle of a chicken

1. Laying Egg
2. Incubation (21 days)
3. Brooding (from day old to 5 weeks)
4. Grouser (15-18 weeks)
5. Point of laying (18-21 weeks)
6. Fertilisation

Life cycle of a rabbit
The gestation period of the doe (female) rabbit is 21 days from the time of mating. On the 27th day, put a nest box into her cage containing some clean finely chopped grass. She should have the cage to herself. The doe will soon begin to make a nest for her young ones. She will pull her own fur to line it. This keeps the litter warm. They are born without fur of their own.
The doe is best left alone at this time. She will kindle (give birth) in the nest box and manage everything herself. On the day after the kindling, you can look inside the nest by moving the fur aside to see.

**Note**

Rabbit farming is becoming a popular enterprise in many institutions throughout Papua New Guinea. They are cheaper to keep than many other animals and produce meat rapidly within a short span of time. Its meat is sold to people within the community, Anderson Foodland and Best Buy stores nation wide. The stocks and equipment can be purchased through the Chemical Company in Madang.

**Successful mating - rabbit**

It is best to take the doe (female) to the buck’s cage, rather than move the buck (male) to the doe. This is because the doe may fight the buck instead of mating with him if she feels threatened by another animal coming into her cage, and the buck may be upset by being moved and refuse to mate.

If the doe is moved to the buck’s cage she is less likely to fight, and mating should take place normally. The animals should be allowed to mate twice, to make sure the doe becomes pregnant.
After 18 days, it is usual to try mating the animal again in case the doe was not made pregnant. This is called a test mating. If the doe is already pregnant, she will refuse the buck if she is not pregnant, she will accept him. The buck is kept in a cage by himself, and the does are taken to him. He can be used for up to 10 does, and can mate successfully up to four times a week.

Using the rabbit and chicken examples, the students are to develop a resource on the life cycle and care and handling of animals before and after mating. Introduce 1.3 Activity 26 by asking the students to write down as much as they know about the life cycle of their livestock. Allow them to work in small groups to assist each other. Ensure the students are familiar with the term gestation, give examples to assist. For each significant stage in the life cycle they are to identify specific husbandry practices to care for the livestock. Again, use the chicken as an example most people should be familiar with.

1.3 Activity 26 – Livestock project (11)

This activity asks you to develop a resource on the life cycle of your chosen livestock. At each stage of the life cycle, describe the specific care that is needed.

Describe the reproductive and fertility cycle for your chosen animal.

You should also be able to describe how to handle and care for your animals before and after mating.

Using drawings and text explain how to care for the male before and after mating, and the female up until the birth of the young.
Topic 5: Processing and Storage

Objectives

By the end of this topic, students will be able to:

- name and discuss the different methods of processing and storage of livestock in Papua New Guinea.
- compare and contrast the traditional and introduced methods of processing and storing of livestock meat.
- complete the final part of their livestock project

Resources

Liklik Book
Library

Scope

This topic discusses various ways of processing and storing livestock products for sale and home consumption. It also looks at some of the traditional and introduced methods of processing and storing commonly used livestock products used in Papua New Guinea. Students will also complete the final part of their livestock project.

Preserving meat and fish

Ask the students to work in small groups (cultural groups would be best) and to describe the different methods for preserving fish and meat. Ask for modern and traditional methods. Question them about why food is preserved. Ask them to read on.

Traditional preservation allowed excess meat and fish to be stored only a few weeks at the most and generally required constant attention during the storage period. Today the traditional methods remain popular because of their special taste.

Traditional smoking

The meat or cleaned fish is cut into convenient sizes and placed on a rack about 60 cm over a fire. Various techniques are used to direct the smoke to the meat. Most ‘smoking’ processes are dry cooking and a medium amount of preservation by smoke occurs. The meat will sometimes keep for up to month but only if it is kept...
in the smoke of the fire.

Traditional salting
Some traditional salting methods for meat and fish will keep indefinitely and their basic techniques are similar to long-term preservation methods. The short term preservation by salting is to drain the meat or fish of all blood, remove all scales from the fish and proceed to rub salt on all surfaces until it is fully absorbed into the flesh and anymore that is added remains on the surface. Meat should be cut into slices 2-3 cm thick. Meat salted in this way is left on a rack in the sun during the day and in a bag of salt at night until it is required for use. As with all salted meat or fish a long soak in fresh water is needed before eating.

Cooking and presenting different types of meat
Meat is cooked to:

- kill bacteria thus making it safer to eat, and increasing its keeping properties
- make it more tender and digestible
- make it more attractive to eat by developing its flavour and changing the colour from red to brown

1.3 Activity 27 – Types of meat

What is meat?

What animal do these different types of meat come from?

- veal
- beef
- ham
- lamb
- pork
- mutton
- T-bone
- bacon

What are some of the indigenous types of meat? Make a list from your area of Papua New Guinea.
On a map of Papua New Guinea have the students present a **Region Recipe Guide**.

Ask them to work in cultural groups and to research and write about:

- **The native animals eaten in their area and to write one recipe they enjoy with that particular meat.**  
  (e.g., it could be cassowary, cuscus, frog, grubs or snake.)
- **The types of introduced meat or fish eaten in their area and to write a typical way of preparing and eating that meat or fish.**

The recipes could be compiled as a recipe book.

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**1.3 Activity 28**

*Work in cultural groups discuss, share ideas and research if necessary and be able to write about:*

- **The native animals eaten in your area.**
- **Write one recipe you enjoy with that particular meat**  
  (e.g., it could be cassowary, cuscus, frog, grubs or snake).
- **The types of introduced meat or fish eaten in your area and write a typical way of preparing and eating that meat or fish.**

---

**Cooking meat**

*Ask the students to brainstorm as many ways they can think of for cooking meat.*

The cheaper, tougher cuts of meat need long, slow moist methods of cooking like stewing or mumuining. This type of meat comes from old animals or muscles of an animal’s body that are often used.

More expensive, tender cuts of meat can be cooked for shorter lengths of time using dry-heat methods of cooking like frying or grilling. This type of meat comes from young animals or from parts of the body that are not used very often.
Seafood

The most common type of seafood is fish. There are two main classes of fish: the vertebrate and the shellfish.

There are two types of vertebrate fish:

1. Non-fatty or white fish, for example barramundi, tuna, trout and cod.
2. Fatty or oily fish, for example mackerel, salmon and eel.

There are two types of shellfish:

1. Crustaceans, for example prawns, crayfish, crabs and lobsters.
2. Molluscs, for example clams, oysters, scallops and octopus.

Uses of seafood

Seafood can be fresh, frozen, canned, smoked dried, boiled, fried, stewed, baked, grilled, poached or steamed.

Choice and storage of seafood

It is important to buy or eat seafood when it is fresh as it ‘goes off’ quickly in a hot climate. This is especially true for shellfish.

Choose fish that has:

- a good fishy smell
- prominent, bright eyes
- bright red gills
- firm flesh

Seafood that is frozen should be covered in plastic or paper and stored in the freezer. Frozen fish has a limited life and should be eaten within 6 months.

Smoked or dried seafood should be stored in a cool, dry place protected from insects.

Tinned seafood should also be stored in a cool dry place. Tins should also not be blown and should be rust free.

A fish recipe to try

Stuff and cook a whole fish. Make the stuffing from onion, tomato, cooked rice or root vegetable, salt and coconut cream. Prepare the fish. Place the stuffing inside. Close the opening with a bamboo skewer. Wrap in banana leaves and boil, bake or steam until cooked. Serve with boiled greens.

An example of meat processing – pigs

In the traditional society

In Papua New Guinea, pigs were not traditionally sold for cash, but were used for payment of obligations from births, marriages and deaths. The pig is used as the medium of payment and barter in the “moka” – pig exchange, in some areas of the Highlands.

Today, most pigs are killed and sold for money.

Slaughtering at the abattoir

When pigs are raised in large quantities, they are usually slaughtered at an abattoir. At Lae, about 40 pigs are killed every week. This number is too small, as the demand of pigs in the country is still very high.

Stunning

The main methods of stunning are:

- mechanical – a captive bolt pistol or other implement is used to stun the animal
- electrical – a pair of tongs is used to apply an electrical charge to the pig’s head and make it unconscious within seconds
- gas – pigs can be led into a tunnel containing 70 – 80 percent carbon dioxide where they lose consciousness within seconds
**Bleeding**

The bleeding is done immediately after stunning the animal. The animal should be suspended by its hind legs, and the blood vessels of the neck completely severed to ensure thorough and complete bleeding.

The blood should be collected in clean vessels. Scalding and removing the bristles is done by immersing the carcass in hot water at 65 to 75 degrees Celsius.

**Evisceration**

Then, a long cut is made down the belly from the breast to the hams. To prevent the meat being contaminated, the entire length should be removed intact. Other internal organs can then be separated and the gut emptied and cleaned away from the rest of the meat.

**Meat hygiene**

The fleshy killed carcass is an ideal breeding ground for bacteria. Hygiene conditions are therefore of paramount importance to prevent infections. At any slaughterhouse, a qualified meat inspector should examine all carcasses. Meat that does not pass inspection is condemned and should be burnt. This is very important so that transmission of disease and parasites from pigs to humans can be avoided.

**Marketing**

The final phase in pig production is the sale and disposal of the end products. The pig is an extremely versatile animal in terms of the number of products, which can be derived from it. The main categories are:

- fresh pork, sausages, chops, filets, steaks for human consumption
- cured bacons and hams
- lard (pig fat) for soap production
- pigskin which can be made into leathers. Live pigskin is often used to graft onto people who have been burnt.
- bristles which are used in hair brushes

**Systems of marketing**

The main systems for marketing pigs are:

- Private sale, which is most common method in the tropics among small-scale producers. The pigs are sold live and the price is generally subject to negotiation.
- Public sales involve taking the pigs to a central market place where they are sold by auction on a live basis to the highest bidder.
- Direct sales to an abattoir or butcher, such a method of selling is more applicable to the larger scale producer.
1.3 Activity 29 – Livestock project (12)

This is the final task of your livestock project. When completed you should have a practical teaching resource to use in the primary school.

Select one processing method that suits your livestock and describe the steps involved so others may also follow the procedure. This could be in the form of an A4 chart/diagram.

Select one storage method most appropriate to your livestock and describe the procedure. Create a chart/diagram describing the steps and present this as a model for others to use.

Have a variety of recipes from different parts of Papua New Guinea that use products from your animal.
# Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antibiotics</strong></td>
<td>Chemical substances capable of destroying bacteria or preventing their growth, e.g. Penicillin.</td>
</tr>
<tr>
<td><strong>Artificial insemination</strong></td>
<td>The removal of semen from a male animal and placing it in the female's reproductive organs.</td>
</tr>
<tr>
<td><strong>Bacteria</strong></td>
<td>The simplest form of non-green organisms, often involved in producing decay or causing disease.</td>
</tr>
<tr>
<td><strong>Boar</strong></td>
<td>Male pig.</td>
</tr>
<tr>
<td><strong>Budget</strong></td>
<td>A statement of how much money will be spent and on what, and how much income is expected, in a certain period.</td>
</tr>
<tr>
<td><strong>Carrying capacity</strong></td>
<td>The number of livestock that can be grazed on a pasture.</td>
</tr>
<tr>
<td><strong>Castration</strong></td>
<td>The breaking or cutting of the cords leading to the testicles in the male so that the animal is unable to breed.</td>
</tr>
<tr>
<td><strong>Chromosomes</strong></td>
<td>Bodies living inside living cells, made up of a number of genes, which decide the organisms characteristics.</td>
</tr>
<tr>
<td><strong>Cross-breeding</strong></td>
<td>Mating different breeds of the same animal together.</td>
</tr>
<tr>
<td><strong>Culling</strong></td>
<td>The sale or slaughter of unwanted animals of poor quality.</td>
</tr>
<tr>
<td><strong>Depreciation</strong></td>
<td>The lowering of value of equipment, as it gets older.</td>
</tr>
<tr>
<td><strong>DNA</strong></td>
<td>Deoxyribonucleic acid. DNA is the basis of chromosomes and determines the characteristics of all living things.</td>
</tr>
<tr>
<td><strong>Drenching</strong></td>
<td>Dosing an animal with liquid medicine from a bottle.</td>
</tr>
<tr>
<td><strong>Dressed chickens</strong></td>
<td>A way of presenting chickens for sale. Dressed chickens are dead, and their features, guts, head and feet have been removed.</td>
</tr>
<tr>
<td><strong>Dual purpose</strong></td>
<td>Serving two purposes.</td>
</tr>
<tr>
<td><strong>Farrow</strong></td>
<td>Sow giving birth.</td>
</tr>
<tr>
<td><strong>Feed conversion ratio (FCR)</strong></td>
<td>The amount of feed an animal eats, compared to the amount of weight it gains, e.g. if a chicken eats 2kg of feed and gains 1kg of weight, its FCR is 2:1.</td>
</tr>
<tr>
<td><strong>Flaying</strong></td>
<td>Stripping the skin or hide off an animal</td>
</tr>
<tr>
<td><strong>Flushing</strong></td>
<td>Feeding additional, high quality feed before and after service to ensure successful mating and healthy offspring.</td>
</tr>
<tr>
<td><strong>Free range</strong></td>
<td>Not fenced in.</td>
</tr>
<tr>
<td><strong>Gamete</strong></td>
<td>A sex cell. Gametes contain half the number of normal chromosomes of the cell.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Genes</td>
<td>Units within chromosomes, which control inherited characteristics, such as height.</td>
</tr>
<tr>
<td>Gestation</td>
<td>Period between conception and birth, during which the young grows in the mother's body.</td>
</tr>
<tr>
<td>Heat</td>
<td>Periodic coming into season of a female animal.</td>
</tr>
<tr>
<td>Hormone</td>
<td>Substances produced inside the body, which control many functions of the animal.</td>
</tr>
<tr>
<td>Hybrid</td>
<td>Offspring produced when two different breeds are mated.</td>
</tr>
<tr>
<td>Immunity</td>
<td>Build-up of resistance to a disease.</td>
</tr>
<tr>
<td>In-breeding</td>
<td>The breeding of closely related animals.</td>
</tr>
<tr>
<td>Kid</td>
<td>Young goat.</td>
</tr>
<tr>
<td>Lactation</td>
<td>The period of milking from when the cow gives birth to when she dries up.</td>
</tr>
<tr>
<td>Litter</td>
<td>Any material, such as wood shavings or sawdust or coffee grounds, used to line the floor of a chicken house.</td>
</tr>
<tr>
<td>Mucous</td>
<td>Slimy fluid.</td>
</tr>
<tr>
<td>Ovulation</td>
<td>The process by which an ovum is released in the female’s body.</td>
</tr>
<tr>
<td>Ovum</td>
<td>Female germ cell or egg which after fertilization develops into a new member of the same species.</td>
</tr>
<tr>
<td>Parasites</td>
<td>Organisms that live in or on the bodies of other animals, such as fleas on dogs and mites on chickens. They cause disease and sometimes death.</td>
</tr>
<tr>
<td>Pedigree</td>
<td>Pure bred and recorded for many generations.</td>
</tr>
<tr>
<td>Pest</td>
<td>Any plant, animal or organism that is in the wrong place at the wrong time. e.g. an Australian in New Zealand.</td>
</tr>
<tr>
<td>Scouring</td>
<td>Upset stomach that results in food passing quickly through the animal.</td>
</tr>
<tr>
<td>Variable costs</td>
<td>Costs of farming, which alter e.g. the amount of feed for chickens, which depends on how old they are and how many you have.</td>
</tr>
<tr>
<td>Vitamins</td>
<td>A group of natural substances occurring in various foods, which are necessary for a normal diet.</td>
</tr>
</tbody>
</table>