

# **Agricultural and Horticultural Studies**

Victorian Certificate of Education Study Design

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Latoya BARTON  
*The sunset* (detail)  
from a series of twenty-four  
9.0 x 9.0 cm each, oil on board



Tarkan ERTURK  
*Visage* (detail)  
201.0 x 170.0 cm  
synthetic polymer paint, on cotton duck



Liana RASCHILLA  
*Teapot* from the *Crazy Alice* set  
19.0 x 22.0 x 22.0 cm  
earthenware, clear glaze, lustres



Nigel BROWN  
*Untitled physics* (detail)  
90.0 x 440.0 x 70.0 cm  
composition board, steel, loudspeakers,  
CD player, amplifier, glass



Kate WOOLLEY  
*Sarah* (detail)  
76.0 x 101.5 cm, oil on canvas



Chris ELLIS  
*Tranquility* (detail)  
35.0 x 22.5 cm  
gelatin silver photograph



Christian HART  
*Within without* (detail)  
digital film, 6 minutes



Kristian LUCAS  
*Me, myself, I and you* (detail)  
56.0 x 102.0 cm  
oil on canvas



Merryn ALLEN  
*Japanese illusions* (detail)  
centre back: 74.0 cm, waist (flat): 42.0 cm  
polyester cotton



Ping (Irene) VINCENT  
*Boxes* (detail)  
colour photograph



James ATKINS  
*Light cascades* (detail)  
three works, 32.0 x 32.0 x 5.0 cm each  
glass, fluorescent light, metal



Tim JOINER  
*14 seconds* (detail)  
digital film, 1.30 minutes



Lucy McNAMARA  
*Precariously* (detail)  
156.0 x 61.0 x 61.0 cm  
painted wood, oil paint, egg shells, glue, stainless steel wire

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## **IMPORTANT INFORMATION**

### **Accreditation period**

Units 1–4: 2006–2010

The accreditation period commences on 1 January 2006.

### **Other sources of information**

The *VCAA Bulletin* is the only official source of changes to regulations and accredited studies. The *VCAA Bulletin*, including supplements, also regularly includes advice on VCE studies. It is the responsibility of each VCE teacher to refer to each issue of the *VCAA Bulletin*. The *VCAA Bulletin* is sent in hard copy to all VCE providers. It is available on the Victorian Curriculum and Assessment Authority's website at [www.vcaa.vic.edu.au](http://www.vcaa.vic.edu.au)

To assist teachers in assessing school-assessed coursework in Units 3 and 4, the Victorian Curriculum and Assessment Authority publishes an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment.

The current year's *VCE and VCAL Administrative Handbook* contains essential information on assessment and other procedures.

### **VCE providers**

Throughout this study design the term 'school' is intended to include both schools and other VCE providers.

### **Photocopying**

VCE schools only may photocopy parts of this study design for use by teachers.

# Introduction

## **RATIONALE**

The Australian social and economic fabric is reliant on its primary industries. Agricultural and Horticultural Studies provides opportunities for students to experience and understand these industries.

The study allows students to develop and apply theoretical knowledge and skills to real world business and practices. They apply their acquired knowledge and skills to design, develop and manage an agricultural or a horticultural business as a project for part of this study. Agricultural and Horticultural Studies is designed to develop students' understanding of the operations and practices involved with sustainable agricultural and horticultural systems.

The study provides a contextual overview of the scientific, management and operational skills and knowledge required to run a small agricultural and horticultural businesses project. It complements the skills focus of competency training available through VET agriculture and horticulture certificates. The study considers current and future practices. Students are expected to research change and innovation with regard to an agricultural and/or horticultural business.

The broad applied nature of the study prepares students to make decisions about employment or further studies in agriculture, horticulture, land management, business practice and natural resource management.

## **AIMS**

This study is designed to enable students to:

- understand the requirements for, and operation of, a variety of agricultural and horticultural systems;
- understand the activities involved in a variety of agricultural and horticultural operations;
- develop knowledge and skills associated with land, plant and animal management;
- understand the scientific principles of agriculture and horticulture;
- understand the concepts of sustainability as applied to agriculture and horticulture;

- develop an awareness of the innovative practices being applied to a variety of agricultural and/or horticultural businesses;
- develop an awareness of risk management in agricultural and horticultural businesses;
- gain an appreciation of ethical issues related to land, plant and animal management practices.

## STRUCTURE

The study is made up of four units. Each unit deals with specific content and is designed to enable students to achieve a set of outcomes. Each outcome is described in terms of key knowledge and skills.

## ENTRY

There are no prerequisites for entry to Units 1, 2 and 3. Students must undertake Unit 3 prior to undertaking Unit 4. Units 1 to 4 are designed to a standard equivalent to the final two years of secondary education. All VCE studies are benchmarked against comparable national and international curriculum.

## DURATION

Each unit involves at least 50 hours of scheduled classroom instruction.

## CHANGES TO THE STUDY DESIGN

During its period of accreditation minor changes to the study will be notified in the *VCAA Bulletin*. The *VCAA Bulletin* is the only source of changes to regulations and accredited studies and it is the responsibility of each VCE teacher to monitor changes or advice about VCE studies published in the *VCAA Bulletin*.

## MONITORING FOR QUALITY

As part of ongoing monitoring and quality assurance, the Victorian Curriculum and Assessment Authority will periodically undertake an audit of Agricultural and Horticultural Studies to ensure the study is being taught and assessed as accredited. The details of the audit procedures and requirements are published annually in the *VCE and VCAL Administrative Handbook*. Schools will be notified during the teaching year of schools and studies to be audited and the required material for submission.

## SAFETY

This study may involve the handling of potentially hazardous substances and/or the use of potentially hazardous equipment. It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking the study.

### **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**

In designing courses for this study teachers should incorporate information and communications technology where appropriate and applicable to the teaching and learning activities. The Advice for Teachers section provides specific examples of how information and communications technology can be used in this study.

### **KEY COMPETENCIES AND EMPLOYABILITY SKILLS**

This study offers a number of opportunities for students to develop key competencies and employability skills. The Advice for Teachers section provides specific examples of how students can demonstrate key competencies during learning activities and assessment tasks.

### **LEGISLATIVE COMPLIANCE**

When collecting and using information, the provisions of privacy and copyright legislation, such as the Victorian *Information Privacy Act 2000* and *Health Records Act 2001*, and the federal *Privacy Act 1988* and *Copyright Act 1968* must be met.

### **ANIMAL WELFARE**

When students and teachers include animals within their projects or educational activities they must abide by the appropriate code(s) of practice for animal welfare available from the Victorian Department of Primary Industries. These may be accessed via the 'Animal Welfare' page within the 'Animals and Livestock' section of 'Food and Agriculture' area of the Department of Primary Industries' website [www.dpi.vic.gov.au/dpi/index.htm](http://www.dpi.vic.gov.au/dpi/index.htm).

# Assessment and reporting

## **SATISFACTORY COMPLETION**

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's performance on assessment tasks designated for the unit. Designated assessment tasks are provided in the details for each unit. The Victorian Curriculum and Assessment Authority publishes an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment for Units 3 and 4.

Teachers must develop courses that provide opportunities for students to demonstrate achievement of outcomes. Examples of learning activities are provided in the Advice for Teachers section.

Schools will report a result for each unit to the Victorian Curriculum and Assessment Authority as S (Satisfactory) or N (Not Satisfactory).

Completion of a unit will be reported on the Statement of Results issued by the Victorian Curriculum and Assessment Authority as S (Satisfactory) or N (Not Satisfactory). Schools may report additional information on levels of achievement.

## **AUTHENTICATION**

Work related to the outcomes will be accepted only if the teacher can attest that, to the best of their knowledge, all unacknowledged work is the student's own. Teachers need to refer to the current year's *VCE and VCAL Administrative Handbook* for authentication procedures.

## **LEVELS OF ACHIEVEMENT**

### **Units 1 and 2**

Procedures for the assessment of levels of achievement in Units 1 and 2 are a matter for school decision. Assessment of levels of achievement for these units will not be reported to the Victorian Curriculum and Assessment Authority. Schools may choose to report levels of achievement using grades, descriptive statements or other indicators.

### Units 3 and 4

The Victorian Curriculum and Assessment Authority will supervise the assessment of all students undertaking Units 3 and 4.

In Agricultural and Horticultural Studies the student's level of achievement will be determined by school-assessed coursework and an end-of-year examination. The Victorian Curriculum and Assessment Authority will report the student's level of performance on each assessment component as a grade from A+ to E or UG (ungraded). To receive a study score, students must achieve two or more graded assessments and receive S for both Units 3 and 4. The study score is reported on a scale of 0–50. It is a measure of how well the student performed in relation to all others who took the study. Teachers should refer to the current year's *VCE and VCAL Administrative Handbook* for details on graded assessment and calculation of the study score. Percentage contributions to the study score in Agricultural and Horticultural Studies are as follows:

- Unit 3 school-assessed coursework: 33 per cent
- Unit 4 school-assessed coursework: 33 per cent
- End-of-year examination: 34 per cent

Details of the assessment program are described in the sections on Units 3 and 4 in this study design.

# Unit 1: Agricultural and horticultural operations

In this unit students study local agricultural and horticultural operations and the factors that influence these operations, including historical, environmental, social and economic factors. Students apply their knowledge and skills in researching the feasibility and establishment of a small agricultural and/or horticultural business project.

## AREA OF STUDY 1

### Elements of Australian agricultural and horticultural systems

This area of study focuses on the elements that constitute Australian agricultural and horticultural systems, how these influence the location of agricultural and horticultural businesses, and the scientific approach to investigating aspects of agricultural and horticultural systems.

### Outcome 1

On completion of this unit the student should be able to describe and explain the range of elements, including the basic biological aspects, which make up agricultural and horticultural systems, and explain the factors influencing the location of agricultural and horticultural systems.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 1.

### *Key knowledge*

This knowledge includes

- parts of a simple system, including boundaries, inputs, outputs and processes;
- elements that make up agricultural and horticultural systems;
- plants: identification, classification, structure and growth;
- animals: identification, classification, structure and growth;
- the influence of environmental, economic, social and historical factors on the distribution of agricultural and horticultural systems;
- main soil types and growing media;
- climatic and weather data;
- the application of the scientific approach and the importance of controlled experiments.

**Key skills**

These skills include the ability to

- use a simple systems model to analyse an Australian agricultural and/or horticultural system;
- describe the operation of a local agricultural and/or horticultural system;
- describe the basic structure of plants and animals;
- identify and classify plants and animals;
- research and analyse the factors that influence the growth of plants and animals;
- conduct a simple experiment related to plant or animal function;
- measure the characteristics of the main soil types and growing media;
- interpret climatic and weather data;
- analyse the suitability of a location for an agricultural or horticultural system.

**AREA OF STUDY 2****Agricultural and horticultural operations**

This area of study allows students to work individually and in a group to plan and conduct a small business project involving the care of living plants or animals, using the resources and time available to them. Students develop a detailed operational plan for the small business project. In this area of study students' small business projects may be solely agricultural or horticultural or a mixture of both. Examples of suitable small business projects include:

- |   |  |   |
|---|--|---|
| • Managing poultry for fresh eggs or meat market. | • Designing and installing a garden.                 | • Yabby breeding.   |
| • Rearing cattle for the beef market.             | • Maintaining a garden.                              | • Fish breeding.  |
| • Rearing sheep to produce wool.                  | • Growing flowering plants in a glass house.         | • Rearing rabbits for the pet or meat market.               |
| • Milk production.                                | • Container growing of ornamental plants.            | • Horses agistment, grooming and training.                  |
| • Rearing piglets for sale.                       | • Field growing of a vegetable, herb or flower crop. | • Feed lotting animals for meat fibre, egg or milk markets. |
| • Rearing lambs for meat.                         | • Seedling production.                               | • Managing vines to produce a crop of grapes.               |
| • Rearing dairy replacements.                     | • Growing indigenous plants for revegetation use.    | • Managing trees to produce a crop of fruit, seed or oil.   |
| • Turf management/sporting turf management.       | • Hydroponic crop production.                        | • Growing a grain or pulse crop.                            |

**Outcome 2**

On completion of this unit the student should be able to apply and explain management and production skills involved with operating a small agricultural and/or horticultural business project involving the care of living plants or animals.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 2.

### *Key knowledge*

This knowledge includes

- the nature of an agricultural and/or horticultural business;
- the components of a small business;
- the procedures involved in conducting a small business project;
- the agricultural and/or horticultural operations involved with the small business project;
- the relationship between available resources and appropriate business type.

### *Key skills*

These skills include the ability to

- work effectively as a team member;
- identify and compare possible business opportunities appropriate to the available resources;
- research and analyse requirements of specific plants and/or animals;
- select and justify a business project to be undertaken;
- propose a production schedule;
- calculate costs of production;
- predict possible outcomes of the production and sales;
- select and use appropriate production skills;
- safely use tools and equipment appropriate to the business project;
- collect appropriate production data;
- report on the progress of the business project.

## **ASSESSMENT**

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's overall performance on assessment tasks designated for the unit.

The key knowledge and skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and skills should not be assessed separately.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Teachers should select a variety of assessment tasks for their assessment program to reflect the key knowledge and skills being assessed and to provide for different learning styles.

For this unit students are required to demonstrate achievement of two outcomes. As a set these outcomes encompass both areas of study.

Demonstration of achievement of Outcomes 1 and 2 must be based on the student's performance on a selection of assessment tasks. Where teachers allow students to choose between tasks they must ensure that the tasks they set are of comparable scope and demand. Assessment tasks for this unit are:

- annotated visual displays;
- website presentations;
- visual presentations including posters or multimedia presentations;

- tests (short answer, open book);
- short written reports (including laboratory report where appropriate);
- oral reports;
- practical demonstrations;
- production plan, costing and production records.

## Unit 2: Production

This unit focuses on an analysis of production systems in terms of time, and physical, biological, social and economic factors. A scientific approach to investigating aspects of production is also included in this unit. The role of production systems in adding value to products is explored through an agricultural and/or horticultural business.

### AREA OF STUDY 1

#### **Biological factors in agriculture and horticulture**

This area of study focuses on nutrition, reproduction and genetics in plants and animals, and how these relate to agricultural and horticultural systems. The influence of biological factors and role of scientific research on production are also covered.

#### **Outcome 1**

On completion of this unit the student should be able to explain the nutritive and reproductive processes of plants and animals, their application to agricultural and horticultural production systems, and specific biological factors that influence production systems.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 1.

#### *Key knowledge*

This knowledge includes

- animal nutrition, including digestive systems, food composition and growth;
- plant nutrition, including structures, photosynthesis, nutrient needs and growth;
- animal reproduction, including reproductive organs, processes, developmental stages and animal genetics;
- plant reproduction, including reproductive structures, sexual and asexual reproduction, growth cycle and plant genetics;
- the role of nutrition and reproduction of plants and animals in relation to agricultural and horticultural production systems;
- biological factors that improve and decrease production system efficiency, such as nutrient fixing organisms, disease causing organisms, and pests;
- role of basic scientific research methodology to improve efficiency of plant and animal systems.

### *Key skills*

These skills include the ability to

- describe the main structures (anatomical and morphological) associated with plants and animals;
- explain the processes associated with plant and animal nutrition;
- identify the main structures associated with plant and animal reproduction;
- explain the processes associated with plant and animal reproduction;
- describe the principles of plant and animal genetics;
- explain the range of biological factors that could influence production efficiency;
- plan, conduct, analyse and report on a simple experiment involving plant(s) or animal(s).

## **AREA OF STUDY 2**

### **Production systems and processes**

This area of study explores the role of agricultural and horticultural businesses in adding value to products. The student's small agricultural and/or horticultural business project is used to investigate and report on factors related to production processes, risk management and marketing. It includes production and marketing processes, and how they contribute to the value of a product and are influenced by and impact upon the environment in which they operate. In this area of study students' small business projects may be solely agricultural or horticultural or a mixture of both.

### **Outcome 2**

On completion of this unit the student should be able to review and report on the production processes and marketing of a small agricultural and/or horticultural business project, demonstrating how the business adds value to the product and manages risk.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 2.

### *Key knowledge*

This knowledge includes

- inputs (physical and human resources) into agricultural and/or horticultural production;
- production processes and timelines;
- risks involved with production processes, such as health and safety, climate extremes, pest and disease;
- outputs, intended and unintended;
- factors that influence the operation of the business;
- budgeting;
- marketing of agricultural and/or horticultural products.

### *Key skills*

These skills include the ability to

- describe the production process for an agricultural and/or a horticultural product;
- develop a budget to support production processes;
- describe the marketing strategies for an agricultural and/or a horticultural product;
- prepare a timeline and schedule for the operation of a business;

- use appropriate production skills;
- safely use appropriate tools and equipment;
- identify risks in production and monitor and adjust for change in operations;
- evaluate unintended and intended production outcomes;
- suggest modifications to improve the operation.

## **ASSESSMENT**

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's overall performance on assessment tasks designated for the unit.

The key knowledge and skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and skills should not be assessed separately.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Teachers should select a variety of assessment tasks for their assessment program to reflect the key knowledge and skills being assessed and to provide for different learning styles.

For this unit students are required to demonstrate achievement of two outcomes. As a set these outcomes encompass both areas of study.

Demonstration of achievement of Outcomes 1 and 2 must be based on the student's performance on a selection of assessment tasks. Where teachers allow students to choose between tasks they must ensure that the tasks they set are of comparable scope and demand. Assessment tasks for this unit are:

- annotated visual displays;
- website presentations;
- visual presentation including posters or multimedia presentations;
- tests (short answer, open book);
- short written reports (including laboratory report where appropriate);
- oral reports;
- research reports;
- practical demonstrations;
- production records;
- basic business plan.

## Unit 3: Technology, innovation and business design

Technology in this unit refers to the equipment, techniques and processes that can be used to maintain and enhance efficiency and effectiveness of agricultural and horticultural systems. To achieve sustainable agricultural and horticultural systems, operators need to be aware of the available range of equipment and processes that may be used in their business. This includes the currently commonly used technologies and the new or innovative technologies that utilise new ideas. Understanding the capabilities of equipment and application of processes can assist decision making and management practices in agricultural and horticultural enterprises.

This unit focuses on a range of technology that is currently used by commercial agricultural and/or horticultural businesses, and reviews the areas where change and innovation are occurring. The likely impact of new and emerging developments in technology on the business will be reviewed and analysed.

In undertaking this unit students should focus on any one or two commercial agricultural and/or horticultural business(es). The business(es) selected must allow for the study and achievement of the knowledge and skill required for Outcomes 1 and 2. The business(es) selected for study for Outcomes 1 and 2 may be related to the business being planned by the student for Outcome 3 of this unit. The following commercial business areas are suitable for study for Outcomes 1 and 2:

- Intensive animal production.
- Broad acre grazing of animals.
- Broad acre dry land cropping.
- Irrigated cropping.
- Milk production.
- Garden design and construction and/or maintenance.
- Producing crops using hydroponics.
- Glasshouse production of flowers.
- Nursery production of ornamental plants.
- Field growing of vegetables and/or herbs and/or flowers.
- Aquaculture crops.
- Seedling/tube stock production.
- Grape production.
- Fruit or nut production.
- Revegetation contractors.

## AREA OF STUDY 1

### Current technology

This area of study focuses on technology commonly used in agriculture and/or horticulture. Using a case study approach, students also focus on the technologies used by one or two fully commercial agricultural and/or horticultural business(es).

This area of study also includes techniques used by the business(es) operator(s) to modify climate, soil/growing media and topography. It looks at how soil and water resources are managed and pests, diseases and weeds dealt with. It also includes the decision making and management tools that business managers use.

### Outcome 1

On completion of this unit the student should be able to discuss a range of technologies commonly used in agricultural and/or horticultural businesses and by a specific agricultural and/or horticultural business; and the relationship between decision making and the application of technology that may affect outputs of a business.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 1.

#### *Key knowledge*

This knowledge includes

- techniques to modify climate, soil/growing media, and topography;
- soil management techniques;
- water management techniques;
- pests and diseases of plants and/or animals, including nutritional, metazoal and microbial;
- methods of prevention and treatment of pests and diseases in plants and/or animals, including chemical, biological, breeding and integrated pest management;
- weeds commonly affecting production;
- methods of prevention and treatment of weeds;
- decision making and management tools such as record keeping, analysis methods and modelling software.

#### *Key skills*

These skills include the ability to

- describe appropriate techniques to modify climate, water, soil/growing media and topography;
- evaluate the effectiveness of modifying techniques;
- identify the main pests associated with plants and/or animals;
- identify the main causes of plant and/or animal diseases;
- identify and evaluate treatments for pests and diseases in plants and/or animals;
- identify the main weed species affecting a business;
- evaluate treatments to control weeds;
- describe methods of keeping financial and production records associated with a business, which may assist in maintaining or improving outputs.

## AREA OF STUDY 2

### New and emerging technology

This area of study focuses on new technology or emerging technology that has only been adopted by a small number of agricultural and/or horticultural businesses. Students should access recent publications and the Internet to assist in their research. They assess the impact of innovative developments in areas such as biological pest or disease control, genetic manipulation, alternative energy sources, reproduction manipulation, communication innovation, chemical pest or disease control, resource management methods, remote sensing, precision agriculture/horticulture, plant or animal breeding, radiation usage, alternative materials and environment or system modelling.

### Outcome 2

On completion of this unit the student should be able to describe the range and evaluate the predicted impact of innovations that are likely to affect a specific agricultural and/or horticultural business in the near future.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 2.

#### *Key knowledge*

This knowledge includes

- new or emerging techniques to modify climate, soil/growing media and topography;
- new or emerging developments in soil management techniques;
- new or emerging developments in water management techniques;
- new or emerging methods of prevention and treatment of pests and diseases in plants and/or animals;
- new decision making and management tools such as record keeping, analysis methods and modelling software.

#### *Key skills*

These skills include the ability to

- describe current technologies used in a specific agricultural and/or horticultural operation;
- research (using recent publications and the Internet) and analyse new or emerging technologies;
- select and justify appropriate technologies for a specific agricultural/horticultural business;
- evaluate the likely impact of new or emerging technologies.

## AREA OF STUDY 3

### Business design

This area of study focuses on the design of a small business project plan, including aspects of production, marketing and financial planning. Analysis and planning for risk management is also a component of the business project.

Examples of suitable business types for students to develop include:

- Managing poultry for fresh eggs or meat market.
- Rearing cattle for the beef market.
- Rearing sheep to produce wool.
- Milk production.
- Rearing piglets for sale.
- Rearing lambs for meat.
- Rearing dairy replacements.
- Turf production/management.
- Designing and installing a garden.
- Maintaining a garden.
- Growing flowering plants in a glass house.
- Container growing of ornamental plants.
- Field growing a vegetable, herb or flower crop.
- Seedling production.
- Growing indigenous plants for revegetation use.
- Hydroponic crop production.
- Designing and installing a garden.
- Fish breeding.
- Rearing rabbits for the pet or meat market.
- Horses agistment, grooming and training.
- Feed lotting animals for meat fibre, egg or milk markets.
- Managing vines to produce a crop of grapes.
- Managing trees to produce a crop of fruit, seed or oil.
- Growing a grain or pulse crop.

### Outcome 3

On completion of this unit the student should be able to design and implement a business plan for a small commercial agricultural or horticultural business project that involves the management and care of living plants or animals.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 3.

#### *Key knowledge*

This knowledge includes

- the design plan for a small business including production, marketing and financial strategies;
- routine and regular activities that need to be performed to operate the business;
- factors influencing the productivity and sustainability of the business;
- strategies for managing a production system to appropriate quality standards for the business;
- health and safety issues associated with the business.

#### *Key skills*

These skills include the ability to

- research and analyse markets and promotional opportunities for the proposed small business;
- research and analyse alternative production technologies;
- develop budgets and cash flow estimates;
- prepare a business plan, including production, marketing and financial strategies;
- analyse risks and identify hazard minimisation strategies;
- record and analyse data associated with the business;
- use appropriate production skills;
- report on the progress of the business and whether quality standards are being met.

## ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's overall performance on assessment tasks designated for the unit. The Victorian Curriculum and Assessment Authority publishes an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment.

The key knowledge and skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and skills should not be assessed separately.

### Assessment of levels of achievement

The student's level of achievement in Unit 3 will be determined by school-assessed coursework and an end-of-year examination.

#### *Contribution to final assessment*

School-assessed coursework for Unit 3 will contribute 33 per cent to the study score.

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination, which will contribute 34 per cent to the study score.

### **School-assessed coursework**

Teachers will provide to the Victorian Curriculum and Assessment Authority a score representing an assessment of the student's level of achievement.

The score must be based on the teacher's rating of performance of each student on the tasks set out in the following table and in accordance with an assessment handbook published by the Victorian Curriculum and Assessment Authority. The assessment handbook also includes advice on the assessment tasks and performance descriptors for assessment.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Where optional assessment tasks are used, teachers must ensure that they are comparable in scope and demand. Teachers should select a variety of assessment tasks for their program to reflect the key knowledge and skills being assessed and to provide for different learning styles.

Outcomes	Marks allocated*	Assessment tasks
<p><b>Outcome 1</b> Discuss a range of technologies commonly used in agricultural and/or horticultural businesses and by a specific agricultural and/or horticultural business; and the relationship between decision making and the application of technology that may affect outputs of a business.</p>	20	<p>The students performance in each outcome should be assessed using one or more of the following formats:</p> <ul style="list-style-type: none"> <li>• an annotated visual display</li> <li>• a website presentation</li> <li>• a visual presentation including a poster or multimedia presentation</li> <li>• a test (short answer, open book)</li> <li>• a short written report (including laboratory report where appropriate)</li> <li>• an oral report</li> <li>• a research report</li> <li>• a practical demonstration.</li> </ul>
<p><b>Outcome 2</b> Describe the range and evaluate the predicted impact of innovations that are likely to affect a specific agricultural and/or horticultural business in the near future.</p>	20	
<p><b>Outcome 3</b> Design and implement a business plan for a small commercial agricultural or horticultural business project that involves the management and care of living plants or animals.</p>	60	<p><b>Extended coursework task (Part 1)</b> A written business plan <b>and</b> production work and record of production <b>and</b> an interim report on the progress of the small business.</p>
<b>Total marks</b>	<b>100</b>	

\*School-assessed coursework for Unit 3 contributes 33 per cent to the study score.

# Unit 4: Sustainable management

This unit focuses on the management of agricultural and/or horticultural systems within the context of ecological sustainability. It takes a holistic ecological approach to issues associated with land, plant and animal management. Students are expected to apply the principles and concepts of such an approach across a range of agricultural and/or horticultural situations.

## AREA OF STUDY 1

### **Business plan implementation and evaluation**

This area of study focuses on the continued operation of the small business project students commenced in Unit 3. They continue to monitor its progress and record the production skills used in the operation of the small business. Finally, students evaluate the performance of the business against its business plan and make recommendations to improve the sustainability of the business.

### **Outcome 1**

On completion of this unit the student should be able to monitor the continued operation of the small business project commenced in Unit 3 Outcome 3, and evaluate and report on its operation and outcomes in relation to the business plan.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 1.

### *Key knowledge*

This knowledge includes

- production skills appropriate to the operation of the agricultural and/or horticultural business;
- techniques of monitoring performance of the business;
- methods of analysing financial performance of the business;
- techniques of reporting on business activities of the business;
- considerations for improving sustainability of the business.

### *Key skills*

These skills include the ability to

- apply appropriate production skills to the operation of the business;
- select and safely use tools, equipment and materials appropriate to the business;
- record data associated with the business;
- evaluate the business against its business plan;
- analyse financial performance of the business;
- report on the conduct of the business, including factors influencing its productivity, profitability and sustainability, and make recommendations for improvements.

## **AREA OF STUDY 2**

### **Sustainability in agriculture and/or horticulture**

This area of study focuses on concepts of sustainability and how they relate to productivity. Agricultural and horticultural practices have the potential to cause environmental degradation. The ability to identify, rectify and prevent environmental degradation is intrinsic to sustainable practice. This involves an understanding of how ecological and production management practices work together to create sustainable businesses.

### **Outcome 2**

On completion of this unit the student should be able to evaluate resource management practices within agriculture and/or horticulture.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 2.

### *Key knowledge*

This knowledge includes

- agricultural and/or horticultural operations as managed ecosystems;
- ecological principles of management including diversity, biomass, the efficient use of energy and the cycling of matter;
- types of environmental degradation including erosion, mass wasting (for example, landslips), salting, waterlogging, compaction, soil acidity and issues of water quality related to agricultural and/or horticultural businesses;
- techniques for preventing environmental degradation and rectifying degraded land and water.

### *Key skills*

These skills include the ability to

- compare a natural ecosystem with a managed ecosystem;
- explain the principles of ecology relevant to a managed ecosystem;
- recognise types of degraded land and water;
- describe appropriate techniques for rectifying degraded land and water.

### AREA OF STUDY 3

#### Resource management and maintenance

This area of study focuses on resource management practices within agricultural and/or horticultural systems and the role of government agencies in influencing these practices.

#### Outcome 3

On completion of this unit the student should be able to apply and analyse the concepts of sustainability to resource management in agricultural and/or horticultural businesses.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 3.

#### *Key knowledge*

This knowledge includes

- concepts of sustainability;
- strategies for sustainable resource management especially for land and water;
- property management plans and how they are developed;
- government policies and regulations regarding land and water management in agricultural and/or horticultural businesses;
- indicators of environmental health that monitor the impact on the environment of agricultural and/or horticultural businesses.

#### *Key skills*

These skills include the ability to

- review the state and location of physical resources available to a business;
- evaluate the potential of available physical resources to contribute to sustainable production of an agricultural and/or a horticultural business;
- allocate available resources, on a property management plan, to achieve sustainable production operations;
- analyse environmental indicators to determine environmental health of an agricultural and/or a horticultural business.

### ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's overall performance on assessment tasks designated for the unit. The Victorian Curriculum and Assessment Authority publishes an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment.

The key knowledge and skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and skills should not be assessed separately.

**Assessment of levels of achievement**

The student's level of achievement for Unit 4 will be determined by school-assessed coursework and an end-of-year examination.

***Contribution to final assessment***

School-assessed coursework for Unit 4 will contribute 33 per cent to the study score.

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination, which will contribute 34 per cent to the study score.

***School-assessed coursework***

Teachers will provide to the Victorian Curriculum and Assessment Authority a score representing an assessment of the student's level of achievement.

The score must be based on the teacher's rating of performance of each student on the tasks set out in the following table and in accordance with an assessment handbook published by the Victorian Curriculum and Assessment Authority. The assessment handbook also includes advice on the assessment tasks and performance descriptors for assessment.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Where optional assessment tasks are used, teachers must ensure that they are comparable in scope and demand. Teachers should select a variety of assessment tasks for their program to reflect the key knowledge and skills being assessed and to provide for different learning styles.

Outcomes	Marks allocated*	Assessment tasks
<p><b>Outcome 1</b> Monitor the continued operation of the small business project commenced in Unit 3 Outcome 3, and evaluate and report on its operation and outcomes in relation to the business plan.</p>	60	<p><b>Extended coursework task (Part 2)</b> Production work and record of production including pictorial and written material. <b>and</b> An evaluation report of the outcomes of the small business project with recommendations for improvement. Pictorial and written material is included in the report.</p>
<p><b>Outcome 2</b> Evaluate resource management practices within agriculture and/or horticulture.</p>	20	<p>Any one or a combination of the following formats:</p> <ul style="list-style-type: none"> <li>• an annotated visual display</li> <li>• a website presentation</li> <li>• a datashow presentation</li> <li>• a multimedia presentation</li> <li>• a test (short answer, open book)</li> <li>• a short written report (including laboratory report where appropriate)</li> <li>• an oral report</li> <li>• a research report</li> <li>• a practical demonstration.</li> </ul>
<p><b>Outcome 3</b> Apply and analyse the concepts of sustainability to resource management in agricultural and/or horticultural businesses.</p>	20	<p>A short report that refers to a property management plan. <b>or</b> A test (short or extended answer) that refers to a case study and includes a property management plan.</p>
<b>Total marks</b>	<b>100</b>	

\*School-assessed coursework for Unit 4 contributes 33 per cent to the study score.

### **End-of-year examination**

#### **Description**

All outcomes in Units 3 and 4 will be examined. All of the key knowledge and skills that underpin the outcomes in Units 3 and 4 are examinable. Students will not be required to demonstrate practical skills related to the production of the student's small business project, however their knowledge and understanding of these is examinable.

Short and extended responses will be required.

The examination will be set by a panel appointed by the Victorian Curriculum and Assessment Authority.

#### **Conditions**

The examination will be completed under the following conditions:

- Duration: one and a half hours.
- Date: end-of-year, on a date to be published annually by the Victorian Curriculum and Assessment Authority.

- Victorian Curriculum and Assessment Authority examination rules will apply. Details of these rules are published annually in the *VCE and VCAL Administrative Handbook*.
- The examination will be marked by a panel appointed by the Victorian Curriculum and Assessment Authority.

**Contribution to final assessment**

The examination will contribute 34 per cent to the study score.

# Advice for teachers

## **DEVELOPING A COURSE**

A course outlines the nature and sequence of teaching and learning necessary for students to demonstrate achievement of the set of outcomes for a unit. The areas of study broadly describe the learning context and the knowledge required for the demonstration of each outcome. Outcomes are introduced by summary statements and are followed by the key knowledge and skills which relate to the outcomes.

Teachers must develop courses that include appropriate learning activities to enable students to develop the knowledge and skills identified in the outcome statements in each unit.

For Units 1 and 2, teachers must select assessment tasks from the list provided. Tasks should provide a variety and the mix of tasks should reflect the fact that different types of tasks suit different knowledge and skills and different learning styles. Tasks do not have to be lengthy to make a decision about student demonstration of achievement of an outcome.

In Units 3 and 4, assessment is more structured. For some outcomes, or aspects of an outcome, the assessment tasks are prescribed. The contribution that each outcome makes to the total score for school-assessed coursework is also stipulated.

Course arrangements will vary from school to school depending on such aspects as regional location of the school, available resources, expertise of the teacher and teacher/student preferences. The nature of the local agricultural/horticultural systems will influence the examples selected or the field studies selected for learning activities.

The order in which the outcomes are addressed may also vary from school to school. In some units, variation is limited because there is a developmental relationship between outcomes. However, in other cases, the order in which the outcomes are addressed is not important. Knowledge and skills in the small agricultural/horticultural business project developed in all four units may need to be covered throughout a unit rather than as a discrete component over a few weeks.

Wherever possible, teachers are encouraged to integrate practical components with theoretical knowledge in all units to provide opportunities for students to enhance their understanding of key knowledge through practical application of skills.

The order in which the outcomes are addressed may vary from unit to unit. Generally, however, key knowledge and skills associated with two outcomes will be acquired concurrently. For example, in Unit 1, the key knowledge and skills for Outcome 1 (Elements of Australian agricultural and horticultural systems) would be taught concurrently with Outcome 2 (Agricultural and horticultural operations). A similar approach would be appropriate for all units and there may be overlap between the three outcomes in Units 3 and 4. In Unit 3, for example, the key knowledge and skills for Outcome 1 (Current technology) would be taught concurrently with Outcome 3 (Business design). It would also follow that, at times, the key knowledge and skills of Outcome 2 (New and emerging technology) would overlap with key knowledge and skills teaching of Outcome 1, especially if fieldwork were to be incorporated.

### **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**

In designing courses and developing learning activities for Agricultural and Horticultural Studies, teachers should make use of applications of information and communications technology and new learning technologies, such as computer-based learning, multimedia and the World Wide Web, where appropriate and applicable to teaching and learning activities.

A wide range of information and communications technology applications can be used in teaching Agricultural and Horticultural Studies, from using spreadsheets to store and analyse the small business project information to using CD-ROMs to explore a species of plant. The following list provides examples of a range of activities that make use of applications of information and communications technology (further applications related to specific outcomes are provided in the learning activities section):

- use of word processing to design projects, prepare plans and reports
- use of presentation software to accompany an oral presentation outlining current usage of technology in agriculture and/or horticulture
- development of web pages as a tool for presenting research findings
- use of a spreadsheet to prepare a small business project budget
- accessing databases to collect information
- use of a database to store production information
- use of computer-based learning to investigate the theory of plant and animal genetics
- use of global and geographic positioning systems to prepare a whole property plan
- use of CD-ROMs to research plant species or identify plant and animal diseases
- use of multimedia kits to investigate soil properties and plant and animal biology
- use of appropriate software to manage and monitor a small agricultural/horticultural business project.

#### **World Wide Web activities**

Activities that utilise the World Wide Web include:

- a web search to collect information on agricultural and/or horticultural systems, new technologies, environmental degradation
- obtaining current information on weather, commodity prices and technical information that may relate to the small agricultural and/or horticultural business project
- searching university and agricultural and horticultural teachers' web pages to source information from other students and schools

- completing a webquest specific to agriculture and/or horticulture by visiting the global education site (<http://globaleducation.edna.edu.au> )
- emailing to request and collect information, such as item prices for the preparation of a small business project budget
- emailing a manager of a fully commercial agricultural and/or horticultural business.

## GLOSSARY

The glossary is provided as a guide for teachers in preparing courses across Units 1 to 4. The terms have particular application in each unit according to the context selected for study. The examples are included to provide a broad and flexible understanding for the study.

Words	Definitions
<b>Anatomical structures</b>	The parts of an animal or a plant.
<b>Biomass</b>	The quantity of living matter contributed to a given habitat by one or several kinds of organism, and usually expressed as weight for unit area or volume.
<b>Business plan</b>	The scheme of action or procedure a person, partnership or corporation undertakes to sell goods or services in an attempt to make a profit. It usually places the business in perspective regarding its location and history and includes a marketing plan, production plan and financial plan.
<b>Compaction</b>	Relates to the density of the material being considered. For example, soil density is often increased by compaction caused by machinery or animal traffic and by slumping when saturated with water. Hence the term 'a compacted soil'.
<b>Control</b>	To test or verify (a scientific experiment) by a parallel experiment or other standard of comparison.
<b>Controlled experiment</b>	An experiment in which the variables are limited so that the effects of varying one factor at a time may be observed.
<b>Cycling of matter</b>	This refers to the natural cycles of specific types of matter such as the nitrogen cycle, the carbon cycle and the water cycle. These natural cycles interact with the production systems of agriculture and horticulture.
<b>Disease</b>	A disorder in an animal or plant body, or of some organ or part that has an adverse effect; illness; sickness; ailment.
<b>Diversity</b>	Variety, multiformity. An ecosystem with a high level of diversity would contain a larger number of species than one with a low level of diversity.
<b>Ecological sustainability</b>	When the relationship between an organism and its environment may be sustained indefinitely.
<b>Energy</b>	The capacity for doing work. It exists in various forms of kinetic and potential energy. Production systems usually involve the conversion of energy from one form into another.
<b>Environmental degradation</b>	The lowering of the quality and value of the aggregate of surrounding things, influences or conditions occurring naturally or through human processes.

<b>Erosion</b>	The process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves, etc. In agricultural and horticultural systems this is commonly wind or water erosion expressed as gully, tunnel, sheet or hill erosion.
<b>Genetics</b>	The science of heredity, dealing with resemblances and differences of related organisms flowing from the interaction of their genes and the environment.
<b>Growing medium</b>	An intervening substance through which growing takes place. In horticulture it usually refers to the substance supporting a plant's roots.
<b>Growth cycle</b>	A recurring process of development or gradual increase that repeats in the same order and at the same intervals.
<b>Integrated pest management</b>	To bring together as a whole the methods of control of organisms harmful to agriculture. It is the process of monitoring the likelihood of pest or disease problems and, when justified, selecting and applying (a variety of) appropriate solutions.
<b>Marketing options</b>	The alternative choices by which goods are put on the market.
<b>Mass wasting</b>	A reduction of bulk. Landslides and large scale wind erosion and sheet erosion are examples of soil mass wasting.
<b>Metazoal disease</b>	A disease caused by an animal composed of many cells, and hence usually visible to the unassisted eye.
<b>Microbial disease</b>	A disease caused by an organism that is so small as to be invisible or indistinct without the use of a microscope.
<b>Modelling software</b>	Computer software that attempts to relate the level of output of natural or production systems and the input and environmental variables.
<b>Modification techniques</b>	Way of accomplishing change. For example, soil modification techniques include the addition of substances to change pH, fertility, porosity or water-holding capacity and the physical altering of its structure with mechanical implements.
<b>Morphological structures</b>	The form and structure of the whole animal or plant, without regard to function.
<b>Nutrient</b>	A substance that provides nourishment to living organisms.
<b>Nutritional disease</b>	A disease caused by an inappropriate quality or quantity of nutrients being received by an organism.
<b>Pest</b>	Organism harmful to agriculture and horticulture.
<b>Photosynthesis</b>	The synthesis of carbohydrates in chloroplasts from carbon dioxide and water using sunlight energy trapped by chlorophyll, catalysed by various enzymes in the chloroplast; the process by which light energy is converted to chemical energy.
<b>Plant structures</b>	The parts of any living organism which is characterised by the capacity to synthesise food from inorganic substances and by the presence of cellulose in its cell walls, and which is incapable of voluntary motion, has limited response to stimuli, and lacks specialised sense organs and a nervous system.

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<b>Production efficiency</b>	The ratio of work done to the energy supplied when creating something. In a financial sense the ratio of costs to income.
<b>Productivity</b>	The measure of efficiency of production, usually as a ratio of some measure of inputs compared with outputs.
<b>Property management plan</b>	A scheme of action showing the manner of controlling a piece of owned land.
<b>Reproduction, asexual</b>	Reproduction without contribution from male and female gametes.
<b>Reproduction, sexual</b>	Reproduction with contribution from male and female gametes.
<b>Risk management</b>	The manner of controlling exposure to the chance of injury or loss.
<b>Salting (land management)</b>	The accumulation of harmful salts in the soil. The watertable comes close to the surface, the water evaporates and the salts remain.
<b>Soil acidity</b>	The extent to which that portion of the earth's surface in which plants grow (a well-developed system of inorganic and organic material and of living organisms) has a pH less than 7.
<b>Sustainability concept</b>	Sustainability integrates three main goals; environmental health, economic profitability and social and economic equity. It rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs.
<b>System</b>	An assemblage or combination of things or parts forming a complex or unitary whole.
<b>System boundaries</b>	The limits of the system.
<b>System inputs</b>	Things required from outside the system for it to operate.
<b>System model</b>	The relationship between inputs, processes and outputs of a system.
<b>System outputs</b>	Things the system produces that do not remain part of the system.
<b>System processes</b>	The stages involved in producing the outputs from the inputs.
<b>Topography</b>	The relief features or surface configuration of an area.
<b>Treatment</b>	Subjection to some agent or action.
<b>Value adding</b>	The extent to which the value of a finished product exceeds the cost of the raw material components.
<b>Waterlogging</b>	Soaking or saturating with water. In the context of soil, the filling of all the soil pores with water.

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## KEY COMPETENCIES AND EMPLOYABILITY SKILLS

Students undertaking the following types of assessment, in addition to demonstrating their understanding and mastery of the content of the study, typically demonstrate the following key competencies and employability skills.

Assessment task	Key competencies and employability skills
<b>Annotated visual display</b>	Design, planning and organisation, (written) communication
<b>Short written report/research report</b>	Design, planning and organisation, (written) communication
<b>Visual presentations including posters or multimedia presentation</b>	Use of information and communications technology, self management, planning and organisation
<b>Test</b>	Problem solving, summarising and interpreting information
<b>Written business plan</b>	Design, planning and organisation
<b>Production work</b>	Initiative and enterprise, self-management, planning and organisation, problem solving, using technology
<b>Record of production work</b>	Collecting and summarising data
<b>Evaluation report of small business project</b>	Summarising and interpreting information

In completing work for this study, students may demonstrate other key competencies and employability skills, such as working with others and in teams, and using mathematical ideas and techniques.

## LEARNING ACTIVITIES

Examples of learning activities for each unit are provided in the following sections. Examples highlighted by a shaded box are explained in detail in accompanying boxes. The examples that make use of information and communications technology are identified by this icon .

## Unit 1: Agricultural and horticultural operations

### AREA OF STUDY 1: Elements of Australian agricultural and horticultural systems

#### Outcome 1


Describe and explain the range of elements, including the basic biological aspects, which make up agricultural and horticultural systems, and explain the factors influencing the location of agricultural and horticultural systems.


#### Examples of learning activities

use a simple systems model to analyse an agricultural and/or a horticultural system by defining the elements that comprise a natural ecosystem on a mind map and contrast these with the range of elements that make up an agricultural and/or a horticultural system

describe the operation of local agricultural and/or horticultural systems by conducting fieldwork to a range of local operations; develop an annotated visual display that describes the agricultural and/or horticultural system

describe the basic structure of plants and animals by presenting an annotated visual display on the structures


 identify and classify plants and animals by using a range of techniques including charts, texts, CD-ROMs and Internet research

 research the factors that influence the growth of plants and animals using the Internet, analyse these factors and prepare a group presentation for the class

conduct a dissection of a plant to reveal major structures

conduct a simple scientific experiment to analyse the factors that influence the growth of plants and animals


measure the characteristics of the main soil types and growing media

 interpret climatic and weather data by using the Bureau of Meteorology website ([www.bom.gov.au](http://www.bom.gov.au)) to investigate yearly variations in weather features and occurrence of climatic zones

analyse the suitability of a location for an agricultural or a horticultural system by visiting a local operation; investigate the factors that influence the businesses conducted at that location; prepare a fieldwork report that describes factors influencing the location of the operation

set up a number of demonstrations or practical exercises to show a range of soil types and growing media, and illustrate the characteristics of texture, colour, structure, pH, porosity

analyse the weather patterns on TV weather reports in terms of highs, lows, fronts, precipitation, temperature, winds

 use the Bureau of Meteorology website ([www.bom.gov.au](http://www.bom.gov.au)) to gather climate and weather data of a region and to analyse climate and weather patterns

**Detailed example****VISIT A LOCAL AGRICULTURAL AND/OR HORTICULTURAL OPERATION**

Visit a local operation and investigate the factors that influence the enterprise conducted at that location.

During the visit, collect and evaluate the following data to determine which factors have influenced the business. Have particular factors had a greater influence than others?

- Description of business/site being evaluated.
- Area utilised to run the business (map of layout).
- District of Victoria/location of the site.
- Topography – how does this affect the type of business conducted?
- Soil types – pH, texture, salinity, organic matter content – major limitations.
- Water supply, annual rainfall, frequency of frosts and other climatic factors.
- Fences and subdivisions, major roads, railway.
- Facilities and equipment needed to run the business. Specific requirements of the enterprise, e.g. feed, shelter, hot houses.
- Rules and regulations that influence the business. Availability of professional assistance.
- Employment needed to run the business. Contract labour? Permanent labour? Types of jobs undertaken. Availability of labour and skills needed.
- Techniques used to control diseases. Are they successful? Frequency of use?
- Marketing – options available
  - most preferred and why
  - proximity to market
  - competition – supply and demand.

**AREA OF STUDY 2: Agricultural and horticultural operations**

Refer to examples of suitable business types on page 13

**Outcome 2**

Apply and explain management and production skills involved with operating a small agricultural and/or horticultural business project involving the care of living plants or animals.

**Examples of learning activities**

work effectively as a team member by developing a plan for a small agricultural/horticultural business project which involves the care of living plants or animals; carry out the plan and make adjustments as needed throughout the unit

work effectively as a team member by developing a class definition of the components of a business plan through research and interviews

identify and compare possible business opportunities appropriate to the available resources at the site through research of the history of the site and market needs, and the availability of resources to the site



research and analyse the requirements of specific plants and animals; use presentation software such as PowerPoint to present findings

invite a guest speaker from the previous year's class to discuss the process of designing the small business project

select and justify a small business project to be undertaken through preparation of a written business plan that includes: a production schedule, calculation of costs of production, a prediction of possible outcomes of the production and sales

report on the progress of the business through presenting a written report that details production skills utilised, collection of appropriate production data, how tools and equipment were used appropriately and how the progress of the business differed to the plan

develop peer assessment and conduct a class discussion of a range of small business projects to report on the progress of the small business project

### ***Detailed example***

#### SMALL BUSINESS PLAN

1. The small business project should be conducted over the unit and may be continued in Unit 2.
2. The components of a business plan include:
  - production plan
  - marketing strategies
  - financial strategies
  - estimated timeline of activities.
4. Prepare a written business plan that incorporates all areas in detail.
5. Develop a timeline for the development of the small business project activities and include daily, weekly and seasonal tasks.

These can be incorporated into a written report that can then be referred to at review stages of the business.

3. Identify the components of a business plan by researching local operations for how plans are developed. Talk to local nurseries, farmers and business managers to identify key elements of the business plan.
- Notes:**
- Keep the business manageable: small and simple, rather than big and complex.
  - Keep the business within available resources to the particular situation.
  - Start early in the semester to allow for adjustments or failures.
  - Be aware of, and follow, all health and safety and ethical issues relevant to the small business. This may require research to investigate ethical aspects of handling living things ([www.rspca.org.au](http://www.rspca.org.au), [www.dse.vic.gov.au](http://www.dse.vic.gov.au), [www.dpi.vic.gov.au/index.htm](http://www.dpi.vic.gov.au/index.htm) may be good starting points).

## Unit 2: Production

### AREA OF STUDY 1: Biological factors in agriculture and horticulture

#### Outcome 1


Explain the nutritive and reproductive processes of plants and animals, their application to agricultural and horticultural production systems, and specific biological factors that influence production systems.


#### Examples of learning activities

use anatomical models to describe the main structures (anatomical and morphological) associated with plants and animals; draw diagrams of these models

explain the processes associated with plant and animal nutrition through conducting scientific experiments and preparing written practical reports


conduct fieldwork to local suppliers of plant and/or animal products for nutrition; prepare a matrix that analyses the differing needs of the plants and/or animals

 present an annotated visual display that identifies the main structures associated with plant and animal reproduction

 develop a PowerPoint presentation accompanied by diagrams and notes on one specific plant or animal that explains the processes associated with plant and/or animal reproduction; develop an overview by taking notes on other presentations

describe the principles of plant and animal genetics through a series of comprehension exercises using current agricultural and horticultural texts

discuss the main aspects of plant genetics, including recessive genes, dominant genes, genotype, phenotype, simple characteristics, intermediate inheritance

 source dissections using CD-ROMs and real specimens to illustrate the main aspects of plant reproduction, including sexual and asexual reproduction, flower structures, growth cycles – annual, biennial, perennial

explain the range of biological factors that could influence production efficiency such as nutrient fixing organisms or disease causing organisms and pests, through a number of applied exercises

plan, conduct, analyse and report on a simple experiment involving plants or animals; present a scientific practical report on the findings

conduct fieldwork for a business involved in plant or animal reproduction; prepare a short written report on the fieldwork

**Detailed example**

**PLANT AND/OR ANIMAL REPRODUCTIVE SYSTEMS**

Using the following areas as a guide, develop a PowerPoint presentation that describes the main structures associated with plant and/or animal reproduction and explains the processes associated with the production.

- Anatomy of the reproductive system including male and female components (include labelled diagrams of the reproductive system of the specific organism).
- Physiology of reproduction in animals and/or the formation of seeds in plant reproduction.

- Major factors that affect fertility in animals and/or seed viability in plants.

Research using current agricultural and/or horticultural texts, books and journals and the Internet. A range of references including texts, journals and websites need to be included.


The presentation should be accompanied by diagrams and notes. Take notes on the presentation of other class members to gather information on a variety of specific agricultural plants and/or animals.


**AREA OF STUDY 2: Production systems and processes**

**Outcome 2**


**Examples of learning activities**

Review and report on the production processes and marketing of a small agricultural and/or horticultural business project, demonstrating how the business adds value to the product and manages risk.

 prepare a written business plan that describes the production process for an agricultural/horticultural product, incorporates a budget, describes marketing strategies and indicates a timeline and schedule for the operation of the business project

 present a review report (the report may be prepared using word-processing, spreadsheets and databases) at the end of the unit that describes how monitoring and adjustment for change occurred; evaluate the unintended and intended production outcomes and suggest modification to improve the operation

discuss how best to evaluate the success of the small business project

 prepare a short media release on the outcomes of the enterprise for the local paper, school magazine, or local TV station

**Detailed example**

**MEDIA RELEASE**

Students develop a media report that details the outcomes of a small agricultural and/or horticultural business project.

Students may use journals such as the *Australian Farm Journal* or a media program such as 'Landline' to provide ideas on how to present their report.

The report describes:

- the inputs into the production
- production processes and timelines

- risks involved with the production process
- outputs – both intended and unintended
- factors that influenced the operation of the small business project
- budgeting – planned and actual
- marketing of products.

A presentation of the report is made to the class – this may involve an oral presentation and peer evaluation.

### Unit 3: Technology, innovation and business design

For a list of commercial businesses that are suitable for Outcomes 1 and 2, see page 19.

#### AREA OF STUDY 1: Current technology

##### Outcome 1


Discuss a range of technologies commonly used in agricultural and/or horticultural businesses and by a specific agricultural and/or horticultural business; and the relationship between decision making and the application of technology that may affect outputs of a business.

##### Examples of learning activities

describe appropriate techniques to modify climate, water, soil/growing media in a business through conducting fieldwork

evaluate the effectiveness of modifying techniques by using video or other illustrations to outline current techniques to modify climate, for example glasshouses, cloud seeding, frost controls, irrigation

invite an agronomist or soil scientist to explain current techniques to modify soil, for example fertilisers, cultivation techniques, gypsum, mulch crops; evaluate the effectiveness of these techniques

 use the Internet, CD-ROMs, and library references to research the historical impact of a technology on a commercial business


prepare a matrix that identifies the main pests and diseases associated with plants and/or animals associated with commercial businesses; these include nutritional, metazoal and microbial; identify the major causes of the pests and diseases, and evaluate current treatments for the main pests and diseases


conduct demonstrations to illustrate the main plant diseases that affect a commercial business; identify and evaluate the effectiveness of the current treatments for the plant diseases


collect and identify the main plant insect pests that affect a commercial business; identify and evaluate the effectiveness of the current treatments for the insect pests

view a video about the main pests and diseases that affect a commercial business; identify and evaluate the effectiveness of the current treatments for the infectious diseases

conduct experiments to provide pre- and post-treatment data to evaluate the effectiveness of the main control measures for plant and animal pests and disease

 use the Internet and CD-ROMs to research the main weed species affecting a business and evaluate treatments to control weeds

 visit a fully commercial business to identify methods of prevention and treatment of weeds; prepare a virtual fieldwork by using a series of photographs taken at the business, to describe the methods it uses; evaluate treatments to control weeds in a short report accompanying the virtual fieldwork

 use the Internet and CD-ROMs to research methods of keeping financial and production records associated with a business that may assist in maintaining or improving outputs

**Detailed example****PESTS AND DISEASES OF PLANTS AND/OR ANIMALS MATRIX**

Prepare a matrix that identifies the main pests and diseases associated with plants and/or animals associated with commercial businesses.

Students will need to identify the major pests and diseases associated with one or two fully commercial agricultural and/or horticultural business(es). They then prepare a research matrix that incorporates a number of areas.

The major headings of the matrix include:

- type of pest and disease – nutritional, metazoal, microbial
- description of the pest and disease organism
- description of the effects the pest or disease have on agricultural and/or horticultural production
- major causes of the pest and disease
- current prevention and treatment methods (including biological, chemical, breeding and IPM)
- evaluation of current treatment methods
- resources used in conducting research.

**AREA OF STUDY 2: New and emerging technology****Outcome 2**

Describe the range and evaluate the predicted impact of innovations that are likely to affect a specific agricultural and/or horticultural business in the near future.

**Examples of learning activities**

prepare a report that describes current technologies used in a specific agricultural/horticultural operation

conduct fieldwork to a fully commercial agricultural and/or horticultural business; investigate the innovative technologies utilised at the site; prepare a written report that examines the impact of the new and emerging technology in the near future



using recent publications and the Internet, research and analyse new or emerging technologies that relate to a specific agricultural and/or horticultural business

conduct fieldwork for a fully commercial agricultural and/or horticultural business(es) that investigates cutting edge technology that may be adopted in the near future



present a PowerPoint presentation that selects and justifies appropriate technologies for a specific agricultural and/or horticultural business; evaluate the likely impact of new and emerging technologies on the operation



evaluate the likely impact of new and emerging technologies through research and class discussion



evaluate how weather forecasts have been improved from the Bureau of Meteorology website ([www.bom.gov.au](http://www.bom.gov.au)); prepare a short report that identifies the impact this has had on commercial business(es)

**Detailed example**

## EVALUATING THE IMPACT OF NEW AND EMERGING TECHNOLOGIES

Using the Internet, students individually research an area of new and emerging technologies for one fully commercial agricultural and/or horticultural business. Specific areas include:

- biological pest or disease control
- genetic manipulation
- alternative energy sources
- reproduction manipulation, communication innovation
- chemical pest or disease control
- resource management methods
- remote sensing
- precision agricultural/horticultural techniques
- plant or animal breeding
- radiation usage
- alternative materials
- environment or system modelling.

Students are then placed as 'experts' in their area and class discussion is conducted on some of the following areas:

- What is the likely impact of the specific technology in the near future in terms of productivity of the business?
- What are the negative impacts on the business?
- What are the positive impacts on the business?
- Who will benefit most from the technology? How?

Discussion centres on the question: What will be the most significant new technology utilised by agricultural and/or horticultural businesses in the near future?

The 'experts' may be called upon at various times to help with explaining the new and emerging technology, as well as the impacts of that technology.

Students will have their own views based upon their own area of expertise and need to justify why their technology will be the most significant.

Alternatively, the activity may be set up as a class debate.

**AREA OF STUDY 3: Business design**

For a list of small business project types that are suitable for Outcomes 3, see page 22.

**Outcome 3**


Design and implement a business plan for a small commercial agricultural or horticultural business project that involves the management and care of living plants or animals.

**Examples of learning activities**


discuss key factors involved in setting up a business, including the components of a business plan such as budgets and cash flow estimates, production, marketing and financial strategies

design a written business plan including production, marketing and financial strategies

use a fieldwork case study to show the steps in the preparation and design of a business plan for the business; include a budget and cash flow statement as well as production, financial and marketing strategies

 research and analyse alternative production technologies appropriate to the small business project using the Internet

discuss strategies for marketing the business by examining case studies of commercial businesses

 conduct a web search of a range of state and national codes of practice; examine these codes of practice to investigate health and safety issues relevant to the small business project

identify, list and use appropriate production processes whilst conducting the business project and evaluate their effectiveness and efficiency

write a report that describes the progress of the small business project and whether quality standards are being met

**Detailed example**

**DESIGN PLAN OF A SMALL BUSINESS**

The small business project should be conducted over the unit.

The components of a business plan include:

- **production plan** – including research and analysis into alternative production technologies
- **marketing strategies** – including an analysis of markets and promotional opportunities, production presentation and packaging
- **financial strategies** – including budgets and cash flow estimates
- **estimated timeline of events.**

These headings may be incorporated into a written report that can then be referred to at review stages of the business.

1. Identify the components of a business plan by researching local operations for how plans are developed. Talk to local nurseries, farmers and business owners to identify key elements of the business plan.
2. Prepare a written business plan that incorporates all areas in detail.
3. Develop a timeline, using a calendar of events. Include daily, weekly and seasonal tasks.
4. Be aware of, and follow, all health and safety and ethical considerations relevant to the business.

## Unit 4: Sustainable management

### AREA OF STUDY 1: Business plan implementation and evaluation

#### Outcome 1

Monitor the continued operation of the small business project commenced in Unit 3 Outcome 3, and evaluate and report on its operation and outcomes in relation to the business plan.

#### Examples of learning activities

list and apply appropriate production skills to the operation of the business

research and visit business(es) in the local area to assist in the selection and safe use of tools, equipment and materials appropriate to the small business project



record data associated with the business project onto spreadsheet and databases

evaluate in a written report the outcomes of the business project relative to the business plan

discuss examples of business reports

analyse financial performance of the business project through class discussion of all financial reports



use presentation software to present a report on the outcomes of the business project; include factors influencing its productivity, profitability and sustainability and make recommendations for improvements

#### Detailed example

##### PRESENTATION EVALUATING THE OUTCOMES OF THE BUSINESS PROJECT

Use presentation software to present a report to the class.

The report should detail the outcomes of the business project and include discussion under each of the following slide headings:

- factors influencing the business project's **productivity**
- factors influencing the business project's **profitability**
- factors influencing the business project's **sustainability**
- recommendations for improvements.

Each of the above areas needs to be expanded and described in terms of the particular agricultural and/or horticultural business project. Ideally, each area would be linked to the initial business plan.

The report may be accompanied by an oral presentation.

The class may then be called upon to ask five questions related to the outcomes of the business project and comment specifically on the slide headings.

Students would then individually prepare an evaluation of the presentation and respond to questions in a written format.

## AREA OF STUDY 2: Sustainability in agriculture and/or horticulture

### Outcome 2

Evaluate resource management practices within agriculture and/or horticulture.

### Examples of learning activities

conduct fieldwork at local sites to compare a natural ecosystem, for example forest, native grassland, with a managed ecosystem, for example dairy farm, wheat farm, nursery, vegetable garden, local park, recreation reserve; write a fieldwork report that compares similarities and differences between managed and natural systems

examine a local ecosystem to explain the main principles associated with sustainable management, for example biodiversity, biomass, cycling of matter and energy

prepare a table that describes types of degradation, including erosion, mass wasting (for example, landslips), salting, waterlogging, compaction, soil acidity, water quality issues

conduct fieldwork to provide examples of environmental degradation, including erosion, mass wasting (for example, landslips), salting, waterlogging, compaction, soil acidity, water quality issues



research appropriate techniques for rectifying degraded land and water using library and Internet resources

use videos to illustrate techniques to rectify degradation problems, for example tree planting, drainage, ground water pumping, deep ripping, liming, track farming, raised bed technology, water management, nutrient management



use the Internet to examine climate change impacts and greenhouse gas emission issues in agriculture and/or horticulture

### Detailed example

#### RECTIFYING LAND DEGRADATION REPORT

The major types of environmental degradation include:

- erosion
- mass wasting
- salting
- waterlogging
- compaction

- soil acidity
- issues of water quality.

Prepare a written report that covers each of the types of environmental degradation. Use library and Internet resources to research techniques for preventing and rectifying degradation Use the Resources list as a starting point for web searches.

### AREA OF STUDY 3: Resource management and maintenance

#### Outcome 3

Apply and analyse the concepts of sustainability to resource management in agricultural and/or horticultural businesses.

#### Examples of learning activities

research the concept 'sustainability' and the components of sustainability, including social, environmental and economic factors that influence sustainability of an agricultural and/or a horticultural operation

develop a definition of sustainability through class discussion and debate



use presentation software to outline how property management plans are developed for selected agricultural and/or horticultural businesses

collect articles that describe practices consistent with sustainable resource management, for example tree planting, minimum tillage, laser grading, nutrient management, irrigation management, waste disposal systems, Integrated Pest Management; write a review of a range of these articles

discuss the concept of 'environmental health'

demonstrate a range of indicators of environmental health, for example soil characteristics (pH, texture, nutrients, organic matter, microorganism), water table depth, ground water salinity, production levels, presence of weeds and vermin, water quality, operator(s)' level of awareness of sustainability issues, oxygen levels, pollution

invite a representative from a local Landcare group to outline their activities and how they develop sustainable catchment management practices

review government policies and regulations regarding soil and water management in agricultural and/or horticultural businesses and prepare a written essay on the findings



using the Internet, research strategies for sustainable resource management for land and water for an agricultural and/or a horticultural business

develop a matrix that identifies organisations that can aid managers in developing strategies for sustainability; describe how these organisations can help manage for sustainability

**Detailed example**

INDICATORS OF ENVIRONMENTAL HEALTH

Landowners wanting to adopt sustainable land use practices need simple ways of assessing the condition of their land and water resources. The first of these usually being visual observations.

Whilst the initial indicator may be observational, assessing the condition of land and water can be done with a series of indicators of ‘environmental health’.

Such indicators provide information on the state of the land (**Condition Indicators**) and also measure trends or changes in conditions over time (**Trend Indicators**). This information can be compared to some desired state to assess the ‘health’ of the land and water resources, and the sustainability of land use at a particular point in time.

While a wide range of measures are possible, those selected need to be easy to measure and record, and must be measured on a regular basis. Some of the more commonly used indicators include:

- soil structure
- soil texture
- soil pH
- soil fertility
- extent of bare soil
- extent of soil erosion
- area of salt affected land
- extent of mass wasting (landslips, slumps)
- abundance of pest plants and weeds
- abundance of pest animals and vermin
- tree cover
- area of remnant vegetation
- watertable level
- groundwater salinity
- stream water turbidity

For each indicator, a range of thresholds is determined against which each measurement can be assessed. The following table shows the range of thresholds for pH level:

pH value	Assessment
0–4	Too acid for plant growth.
4–5	Too acid for rhizobia.
5–6	Too acid for sensitive plants such as lucern.
6–7	Neutral. Satisfactory for most plants – optimum threshold range for nutrient uptake.
7–8	May be too alkaline for some plants.
8–14	Too alkaline for growth of plants.

By regularly measuring and assessing such indicators, landowners can gain an idea of the present state of their land and water. Over time they can then assess the impact of changes in land management practices.

Activity:

1. Select two condition indicators and carry out measurements on a local property. Research the thresholds for each indicator and comment on the level of health as shown by each indicator.
2. Select two trend indicators and carry out measurements over time on a local property. Research the thresholds for each indicator and comment on the level of health as shown by each indicator.
3. What land management practices may have had an impact on the level of health?
4. What advice would you give to the property owner?
5. Present this advice in a report that communicates the information on the environmental health of the property to the property manager.

### SCHOOL-ASSESSED COURSEWORK

In Units 3 and 4, teachers must select appropriate tasks from the assessment table provided for each unit. Advice on the assessment tasks and performance descriptors to assist teachers in designing and marking assessment tasks will be published by the Victorian Curriculum and Assessment Authority in an assessment handbook. The following is an example of a teacher's assessment program using a selection of the tasks from the Units 3 and 4 assessment tables.

Outcomes	Marks allocated	Assessment tasks
<b>Unit 3</b>		
<b>Outcome 1</b> Discuss a range of technologies commonly used in agricultural and/or horticultural businesses and by a specific agricultural and/or horticultural business; and the relationship between decision making and the application of technology that may affect outputs of a business.	20	After conducting fieldwork based on commercial business(es), a multimedia presentation is prepared that outlines the current technology used at the specific agricultural and/or horticultural site(s) visited and discusses how decision making is influenced by the application of technology.
<b>Outcome 2</b> Describe the range and evaluate the predicted impact of innovations that are likely to affect a specific agricultural and/or horticultural business in the near future.	20	A research report is presented that describes the predicted impact of innovations and evaluates the impact of the innovations.  An oral presentation is developed that examines the impact of innovation in pest and disease control and management.
<b>Outcome 3</b> Design and implement a business plan for a small commercial agricultural or horticultural business project that involves the management and care of living plants or animals.	60	<b>Extended Coursework task (Part 1)</b> A written business plan for a seedling production business. <b>and</b> Production work and record of production detailing how the business plan has been carried out. <b>and</b> An interim report on the progress of the seedling business.
<b>Total marks for Unit 3</b>	<b>100</b>	

Outcomes	Marks allocated	Assessment tasks
<b>Unit 4</b>		
<p><b>Outcome 1</b> Monitor the continued operation of the small business project commenced in Unit 3 Outcome 3, and evaluate and report on its operation and outcomes in relation to the business plan.</p>	60	<p><b>Extended coursework task (Part 2)</b> Production work showing progress of seedling production business, accompanied by pictorial (digital photos, graphs showing outputs of seedling production business) and written material. <b>and</b> An evaluation report that includes an evaluation of the outcomes of the seedling production business with recommendations for improvement. It includes a combination of pictorial and written material.</p>
<p><b>Outcome 2</b> Evaluate resource management practices within agriculture and/or horticulture.</p>	20	<p>A multimedia presentation is prepared that explains the principles of ecology related to a managed ecosystem and investigates land and water degradation and techniques for rectifying degradation.</p>
<p><b>Outcome 3</b> Apply and analyse the concepts of sustainability to resource management in agricultural and/or horticultural businesses.</p>	20	<p>A test (requiring short and extended answers) is undertaken on a case study of an agricultural and/or a horticultural business' property management plan.</p>
<b>Total marks for Unit 4</b>	<b>100</b>	

## SUITABLE RESOURCES

Courses must be developed within the framework of the study design: the areas of study, outcome statements, and key knowledge and skills.

Some of the print resources listed in this section may be out of print. They have been included because they may still be available from libraries, bookshops and private collections.

At the time of publication the URLs (website addresses) cited were checked for accuracy and appropriateness of content. However, due to the transient nature of material placed on the web, their continuing accuracy cannot be verified. Teachers are strongly advised to prepare their own indexes of sites that are suitable and applicable to the courses they teach, and to check these addresses prior to allowing student access.

## GENERAL

### Books

- Acquaah, G 2004 (3rd ed.), *Horticulture: Principles and Practice*, Prentice Hall.
- Adams, CR, Bamford, KM & Early, MP 1998, *Principles of Horticulture*, Butterworth Heinemann, Oxford.
- Adler, M 1996, *Plant Form*, Adland Horticulture, Melbourne.
- Adler, M 1996, *Plant Function*, Adland Horticulture, Melbourne.
- Adler, M 1996, *Plant Identification: Summer/Autumn/Winter*, Adland Horticulture, Melbourne.
- Adler, M 1996, *Plant Identification: Winter/Spring/Summer*, Adland Horticulture, Melbourne.
- Agriculture Department of Tasmania 1984, *Keeping Poultry*.
- Atkinson, K 1999, *Dairy Business Focus Manual*, Department of Natural Resources and Environment, Victoria.
- Barrow, R 1996, *Horticultural Computing*, Adland Horticulture, Melbourne.
- Barrow, R 1996, *Plant Production and Nursery Production*, Adland Horticulture, Melbourne.
- Barrow, R 1996, *Plant Propagation*, Adland Horticulture, Melbourne.
- Brown, L, Hindmarsh, R & McGregor, R 1998, *Dynamic Agriculture Books 1-4*, McGraw-Hill, Australia.
- Cambell, A 1991, *Planning for Sustainable Agriculture*, Lothian, Melbourne.
- Cambell & Bowyer (eds) 1988, *The Scientific Basis of Modern Agriculture*, Sydney University Press, Sydney.
- Cambell, A 1991, *Sustainable Farming*, Rural Press, Australia.
- Casey, M (ed.) 1996, *Wires and Pliers*, Kondinin Group, Belmont, WA.
- Clark, A 1991, *Senior Australian Agriculture*, Pascal Press, Glebe.
- Costermans, L 1991, *Native Trees and Shrubs of SE Australia*, Weldon Publishing, Willoughby, NSW.
- Department of Natural Resources and Environment 2001, *Agricultural and Land Management Fieldwork Kit*, LandLearn, DRNE, Victoria.
- Department of Primary Industries 2004, *LandLearn Resources*, LandLearn Resources CD-ROM, LandLearn, Department of Primary Industries, Victoria.
- Dixon, P (ed.) 1996, *From the Ground Up: Property Management Planning Manual*, National Landcare Program.
- Egan et al. 1996, *Agriculture in Australia*, Oxford University Press, Melbourne.
- Fitzpatrick, D 1994, *Money Trees on Your Property*, Inkata Press, Sydney.
- Gardiner, A 1990, *Modern Plant Propagation*, Lothian, Melbourne.
- Garrett, B (ed.) 1991, *Whole Farm Planning: Principles and Options*, Victorian Department of Conservation and Environment, Benalla.
- Handreck, K 1993, *Gardening Down Under: Better Soils and Potting Mixes for Better Gardens*, CSIRO, Melbourne.
- Happs & Kinnear 1992, *Soil Degradation: An Australian Perspective*, Longman Cheshire, Melbourne.
- Mason, J 2003 (2nd ed.), *Sustainable Agriculture*, Landlinks, Collingwood.
- McEwen, S 2004, *Ecologic: Creating a Sustainable Future*, Powerhouse Publishing, Sydney.
- McMillan, R & Adler, M 1996, *Plant Growth and Environment*, Adland Horticulture, Melbourne.
- McMillan, R 1996, *Investigating the Environment*, Adland Horticulture, Melbourne.
- McMillan, R 1996, *Soils and Growing Media*, Adland Horticulture, Melbourne.
- National Farmers Federation 1997, *Australian Agriculture: The Complete Reference on Rural Industry*, 8th edn, Morescope Publishing, Camberwell.
- Platt, S. J. 2002, *How to plan wildlife landscapes: a guide for community organisation*, Dept of Natural Resources and Environment, Melbourne.
- Powell, E 1986, *Cattle Yards: Design Materials and Construction*, Queensland Department of Primary Industries, Brisbane.
- Preece, J E 1993, *Biology of Horticulture: An Introductory Textbook*, J Wiley & Sons.

Readers Digest 1987, *Illustrated Guide to Gardening*, Readers Digest, Sydney.

Reeve, I & Brouwer, D 1990, *Your Farm's Future*, NSW Department of Agriculture (home study manuals for rural property planning).

Reid, RL (ed.) 1990, *A Manual of Australian Agriculture*, Butterworths, Sydney.

Salinger, J 1985, *Commercial Flower Growing*, Butterworth, Wellington, New Zealand.

Scott, D 1991, *Agriculture and Victoria's Environment*, Office of the Commission for the Environment (Victoria), Melbourne.

Sharp, J 1997, *Sustainable Agriculture – protecting our heartland*, Geography Teachers' Association of Victoria Inc. & Dept of Natural Resources and Environment.

Smith, E 1991, *Managing the Farm*, Rural Press, Australia.

Toogood, Alan 1999, *Propagating Plants – the fully illustrated plant-by-plant manual of practical techniques*, Dorling Kindersley Limited, London.

Victorian Schools Nursery 1988, *Growing with Horticulture*, Cambridge University Press, Melbourne.

Walker, J & Reuter, D J, 1996, *Indicators of Catchment Health: a technical perspective*, CSIRO, Melbourne.

Washusen, R & Reid, R 1996, *Agroforestry and Farm Forestry: Productive Trees for Shelter and Land Protection in NE Victoria*, National Farm Forestry Project Benalla, Landcare FF Group.

Williams, D 1993, *Agriculture in the Australian Economy*, Oxford University Press, Australia.

Wilson, J 1992, *Changing Agriculture: An Introduction to Systems Thinking*, Kangaroo Press, Sydney.

Woffenden, S 1992, *Healthy Houseplants*, Bay Books, New Zealand.

Yates *Garden Guide* 1990, Angus & Robertson, Sydney.

### Books – business project design and development

Barber, F 1986, *Design of Shearing Sheds and Sheep Yards*, Inkata Press, Sydney.

Burnie, G 1996, *A Grower's Guide to Herbs*, Murdoch Books, Sydney.

Hinton, D 1993, *Running a Small Flock of Sheep*, AGMEDIA, Melbourne.

Meadows, G 1996, *A Guide to Cattle Breeds*, South China Printing Co., New Zealand.

Moran, J 1993, *Calf Rearing: A Guide to Rearing Calves in Australia*, AGMEDIA, Melbourne.

Mosig, J 1995, *Australian Yabby Farmer*, AGMEDIA, Melbourne.

Natural Resources Conservation League 1992, *Hydroponics for Schools and the Home Grower*, 2nd edn, Melbourne.

Portsmouth, J 1987, *Commercial Rabbit Keeping*, Nimrod Press, England.

Stromberg, J 1975, *A Guide to Better Hatching*, Stromburg Publishing Company, Iowa, USA.

Wicking, B 1990, *Ducks for Starters: A Practical Guide to Backyard Duck Keeping*, Globe Press, Melbourne.

Wallis, C 1988, *Running a Small Beef Herd*, Victorian Department of Agriculture, AgMedia, Melbourne.

### Books – pests and diseases

Brightling, T 1994, *Stock Diseases*, Inkata Press, Sydney.

Department of Primary Industries, South Australia 1997, *Weeds: The Ute Guide*, Department of Primary Industries, South Australia.

Sainsbury, D 1998, *Animal Health*, Blackwell Science, Oxford.

Wilding, J L, Barnett, A G, & Amor, R L, 1988, *Crop Weeds*, Richardson, Sydney.

## GENERAL

### Journals

*Australian Farm Journal*, Agricultural Publishers Pty Ltd, Melbourne. Available from Australian Farm Journal, PO Box 160, Port Melbourne 3207. Tel 1800 035 351, Fax (03) 9287 0999.

*Computer Software for Agriculture 1995/96*, Dept of Agriculture, NSW. Available from CB Alexander Agricultural College, Tocal, Paterson 2421. A comprehensive directory of software to suit agricultural applications.

*Ecos*, CSIRO Publishing, 150 Oxford Street, Collingwood 3066. Tel 1800 6745 051, Fax (03) 9662 7555.

*Farming Ahead* (monthly), Kondinin Group, 51 Gurwood Street, Wagga Wagga 2650. Tel (02) 6921 4047, Fax (02) 6921 4182.

*Gardening Australia Magazine*

*Practical Hydroponics*, Casper Publications Pty Ltd, Narrabeen 2101.

*Rural Focus* (free 8-page bi-monthly), National Australia Bank Ltd (apply for subscription at NAB branches).

*Rural Research*, CSIRO Publishing, 150 Oxford Street, Collingwood 3066. Tel 1800 6745 051, Fax (03) 9662 7555.

*Stock & Land*, Rural Press, Port Melbourne.

*Successful Horticulture*, The Word Warehouse Pty Ltd, Flinders 3929. Useful publication on current issues in horticulture.

*The Weekly Times*, The Herald & Weekly Times Limited, Southbank, Melbourne.

*Town and Country Farmer*, Town and Country Farmer Publications Pty Ltd, Goorambat 3725.

*Victorian Landcare*, Victorian Farmers Federation, Melbourne.

## AUDIOVISUAL

*Australia: State of the Environment* (IBM).

*Direct Drilling and Soil Structure*, 1986 Division of Resource Management, Western Australia Department of Agriculture (24 minutes).

Available from the Western Australia Department of Agriculture, 3 Baron-Hay Court, South Perth 6151. Tel (08) 9368 3729 Examines the effects of direct drilling on soil structure, especially in breaking up hard-packed layers beneath the topsoil.

*Euclid: Eucalypts of SE Australia* (IBM)1997 Brooker, Connors & Slee, CSIRO Publications.

*Hydroponic Gardening*, 1992 G Evans & Practical Hydroponics.

*Gardening Australia*, ABC TV

Some segments are relevant to various aspects of the course.

*Living Soil*, 1992 J Sharp, Victorian Department of Agriculture, Benalla.

Living in Australia series: *Looking after the Land* (ABC television series).

*Managing Soil Structure*, 1990 Victorian Department of Agriculture and Rural Affairs, Northwest Productions (28 minutes). Available from AGMEDIA. Tel 1800 800 755.

*Managing Soil Structure*, Department of Agriculture and Rural Affairs. Available from AGMEDIA, Northwest Productions.

*On Borrowed Time*, 1990, J Sandilands, The Ian Potter Foundation, Melbourne (3 hours; 2 videos and 52-page booklet). A guide to the Potter Family Farm Plan Project.

*Partnerships with Nature* – Landcare Case Studies Partnership with Nature (BHP Landcare Australia Limited).

*Prime Notes*, vol. 5, 1998 Kondinin Group, Wagga Wagga (see *Farming Ahead* in Journals).

*Rural Property Planning*, 1990 B Matheson, Adelaide College of TAFE (24 minutes plus 158-page folder). Sustainable production.

*Salt of the Earth*, 1990 NSW Film and Television Office (20 minutes). Available from NSW Film and Television Office, Level 6/1 Francis Street, East Sydney 2010. Tel (02) 9380 5599. A review of 100 years on a family farm: effects of cultivation, machinery, floods, droughts and economic problems for the farmers. Also covers issues of desalination, erosion and land degradation.

*Soil Degradation — An Australian Crisis*, 1985 Western Australia Department of Agriculture, Australian Broadcasting Commission (13 minutes). Available from the Western Australia Department of Agriculture, 3 Baron-Hay Court, South Perth 6151. Tel (08) 9368 3729

*Soil Structure Decline in NSW*, 1989 Department of Primary Industries, Queensland (11 minutes). Land management processes that inhibit soil structure decline, the role of organic material in maintaining soil structure, soil conservation approaches used for red and black soils. Available from DPI Publications, GPO Box 46, Brisbane 4001. Tel 1800 816 541, Fax (07) 3239 6509, Email: books@dpi.qld.gov.au

*Soil Structure Decline*, 1985 Western Australian Department of Agriculture, Australian Broadcasting Commission (15 minutes). Available from the WA Department of Agriculture, 3 Baron-Hay Court, South Perth 6151. Tel (08) 9368 3729.

*Sustainable Agriculture: Protecting our Heartland*, 1997 J Sharp, GTAV, Melbourne.

*Victorian Flora Database* (IBM) Department of Conservation & Natural Resources, Victoria.

*Weed Identification*, GRDC/Topcrop Australia, Department of Primary Industry, SA.

Yencken, D & Wilkinson, D 2000 *Resetting the compass – Australia's Journey Towards Sustainability*, CSIRO Publishing, Melbourne.

## GENERAL

### Websites

Ad Links the Australian Agricultural Directory  
[www.aglinks.com.au](http://www.aglinks.com.au)

Ad Soft Wholesale  
[www.agsoft.com.au/index.htm](http://www.agsoft.com.au/index.htm)

Ag Net – Australian Agriculture  
<http://agnet.com.au/>

Australia Agricultural Links  
[www.grahams.com.au/aust-links/a-links-agriculture.htm](http://www.grahams.com.au/aust-links/a-links-agriculture.htm)

Australian Bureau of Agricultural and Resource Economics  
[www.abare.gov.au/](http://www.abare.gov.au/)

Australian Bureau of Statistics  
[www.abs.gov.au/](http://www.abs.gov.au/)

Australian Journal of Agricultural Research  
[www.cis.csiro.au/cis/journals/ajar/index.html](http://www.cis.csiro.au/cis/journals/ajar/index.html)

Australian government Geoscience Australia  
[www.auslig.gov.au/](http://www.auslig.gov.au/)

Bureau of Meteorology  
[www.bom.gov.au/](http://www.bom.gov.au/)

Bureau of Resource Sciences (BRS)  
[www.affa.bov/brs](http://www.affa.bov/brs)

Centre for Resource and Environmental Studies, National University  
<http://cres.anu.edu.au/>

CSIRO  
[www.csiro.au/](http://www.csiro.au/)

CyberFarm  
<http://w3.ag.uiuc.edu/INFOAG/cyberfarm/>

Commonwealth Department of Primary Industries & Energy  
[www.dpie.gov.au/](http://www.dpie.gov.au/)

Department of Primary Industries  
[www.dpi.vic.gov.au](http://www.dpi.vic.gov.au)

Department of Sustainability and Environment  
[www.dse.vic.gov.au](http://www.dse.vic.gov.au)

Department of the Environment and Heritage  
[www.deh.gov.au/](http://www.deh.gov.au/)

Food and Agriculture Organisation of the United Nations (FAO)  
[www.fao.org/](http://www.fao.org/)

Kondinin Group  
[www.kondinin.com.au/](http://www.kondinin.com.au/)

NSW HSC On-Line (online resources to support teaching and learning in Agriculture)  
<http://hsc.csu.edu.au/agriculture/index.htm>

Victorian Information Network  
[www.vicnet.net.au/](http://www.vicnet.net.au/)

Victorian Landcare Gateway  
[www.landcare.net.au](http://www.landcare.net.au)

Victorian WorkCover Authority  
[www.worksafe.vic.gov.au](http://www.worksafe.vic.gov.au)

Weeds Australia  
[www.weeds.org.au](http://www.weeds.org.au)

World Wide Web Sites of Interest to Agriculture  
[www.gennis.com/aglinks.html](http://www.gennis.com/aglinks.html)

World Wide Web Virtual Library: Agriculture  
<http://ipm.www.ncsu.edu/cernag/cernag/cern.html#lists>

## ORGANISATIONS

Australian Dairy Industry  
[www.dairy.com.au/](http://www.dairy.com.au/)

Dept of Sustainability and Environment and Dept of Primary Industries

Information Centre and bookshop

Ground Floor

8 Nicholson Street (corner Victoria Parade)

East Melbourne 3002

Tel: (03) 9637 8325

Fax: (03) 9637 8150

(Resources also available online [www.dse.vic.gov.au/](http://www.dse.vic.gov.au/) – select 'about us' then 'Publications')

Environmental Protection Agency  
40 City Road

Southbank 3006

Tel: (03) 9695 2722

Fax: (03) 9695 2785

[www.epa.vic.gov.au](http://www.epa.vic.gov.au)

Horticulture Australia

Level 1, 50 Carrington Street

Sydney 2000

Tel: (02) 8295 2300

Fax: (02) 8295 2399

[www.horticulture.com.au](http://www.horticulture.com.au)

Victorian Association of Agriculture and Horticulture Educators

[www.vaahe.org.au](http://www.vaahe.org.au)

Victorian Farmers Federation

Level 5, Farrer House

24–28 Collins Street

Melbourne 3000

Tel: 1300 882 833

(03) 9207 5555

[www.vff.org.au](http://www.vff.org.au)