Assessment Schedule – 2016

Agricultural and Horticultural Science: Analyse a New Zealand primary production environmental issue (91532)

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
"Analyse" involves: • explaining the environmental issue arising from the primary production management practices • explaining potential courses of action to mitigate the negative impacts of the management practices • Recommending sustainable production practices.	"Critically analyse" involves: • explaining, in detail, the environmental issue arising from primary production management practices • evaluating potential courses of action to mitigate the negative impacts of the production management practices • Recommending sustainable production management practices that best address the issue.	"Comprehensively analyse" involves: • justifying courses of action to support sustainable production management practices that best address the issue, including environmental, economic, political and / or social considerations.

Sample evidence
A 1997 study by economists suggested that the total annual value provided by New Zealand's indigenous biodiversity could be more than twice that of New Zealand's gross domestic product (GDP). The loss of 5–10% of the annual direct benefits from indigenous biodiversity is equivalent to about $500 million to $1,000 million per year. In comparison, the government currently spends $166 million annually on biodiversity management. Maintaining the genetic diversity of these species internationally is crucial to their ongoing resilience to environmental change and usefulness for our primary industries. In addition to our productive systems being underpinned by healthy ecosystems, our "clean and green" environment is a major selling point in itself, and will reap increasing rewards in the 21st century. New Zealand primary producers target customers who enjoy high-quality products that come from a healthy and unpolluted environment. This is also the foundation of our tourism industry. However, our increasingly demanding international clients expect the green image to be backed up by reality. Apart from the value of biodiversity in sustaining our present quality of life, to many people biodiversity has intrinsic value – the value of the variety of life in itself. For Māori, indigenous biodiversity is an integral aspect of their world-view, and they have a special role and responsibilities as kaitiaki of our indigenous biodiversity. The responsibility of humans towards other living things, and our obligations to future generations, provide a strong moral basis for their conservation and underlie the requirements of the Convention on Biological Diversity. There are several laws in place in New Zealand under which biodiversity offsetting may be relevant. The relevance of biodiversity offsetting and its applicability will be different under each Act. Resource Management Act 1991 – Promotes the sustainable management of natural and physical resources on private and public land. Crown Minerals Act 1991 – Promotes the prospecting for, exploration for, and mining of Crown-owned minerals for the benefit of New Zealand. The Access Arrangements provisions regulate access to land for mining activity, including on public conservation land. Conservation Act 1987 – The concessions regime governs the majority of activities that can or cannot take place on public conservation land.

PART A

Explain how agricultural OR horticultural production management practices have impacted on the biodiversity of the local environment in New Zealand.

Loss of habitat

New Zealand pioneers cleared large areas of land to create farms for settlement, and to provide timber for building. This resulted in the removal of native forests even on land that was only marginally grazable. Consequently, virgin bush and large Rimu, Totara, or Kauri trees are now rare and considered "special" when they are found. Due to the resulting loss of succession habitat, it will take a long time to re-establish these kinds of forests, and therefore our native species of indigenous birds have also experienced loss of habitat and food sources.

Monoculture

Modern farmers have continued to maintain the land as cleared swathes of monoculture pasture or softwood forestry for economic profit. A dairy farmer or sheep and beef farmer may decide some land is too steep to graze, but will usually invest in pine plantation to return money as a long-term investment. Of course, it is now easier to keep the land as pasture, as the cost of fencing to exclude stock from rejuvenating bush is prohibitive (considering the loss of returns), as well as the necessary pest control (possums) to prevent TB in the future.

Pollution of the environment

Shortcuts to land management (dumping effluent into streams, open cast mining, indiscriminate spraying, etc) have poisoned land and waterways, affecting species beyond the farm gate.

Introduced species competing for habitat and food

Magpies, Opossum, Koi Carp, gorse, wild pine, Jasmine, Old Man's Beard, stoats, rabbits, deer, etc.

Drainage of wetlands

The negative social impacts of losing our biodiversity stretch beyond the obvious.

Some native species are already lost, or nearing extinction, never to be seen and enjoyed again. In the last 800 years, humans and introduced pests have caused the extinction of:

- 32% of indigenous land and freshwater bird species
- 18% of endemic sea bird species
- three out of seven frog species
- at least 12 invertebrate species, such as snails and insects
- one fish, one bat, and possibly three reptile species
- possibly 11 plant species.

The cultural significance of these species to Māori as food, clothing, decoration, etc is lost.

New Zealand is targeted by its competitors, who want us to fail as a "clean, green" producing nation, and will advertise our failing ecology internationally.

Loss of export markets = loss of income = loss of jobs.

Sample evidence

PART B

Justify a course of action that could be carried out by a producer to potentially mitigate the negative impacts of the management practices on the biodiversity of the local environment for your selected agricultural or horticultural production system.

Some examples of courses of action:

Riparian margins

Riparian margins are possibly the easiest and best management practice for farmers and growers to maintain a sustainable environment. Not only do they reduce pollution of nutrients and sediment into waterways, but they provide habitat for birds, small mammals, and other organisms. Because a riparian margin should run the entire length of streams and rivers, they provide a "green corridor" from the upper bush to the sea for migration of animals, and therefore increase biodiversity.

Setting aside land

Not all land is profitable for arable farming. The usual option is to plant it in pine trees, but another option is to fence it off and allow it to regenerate back to native bush. It can also be gifted back to the crown and earmarked as conservation land. There are over 4,000 QEII covenants in New Zealand at the moment, with an average size of about 30 hectares.

Marine reserves and national parks

Protected areas where the natural ecosystem is allowed to re-establish.

Crop rotation

Planting the same crop in the same place year after year (or season after season) limits biodiversity. Crop rotation, on the other hand, will encourage (limited) biodiversity, as different crops are cycled through the soil. Crop rotation usually reduces the need for spraying.

Natural shelter

A natural shelter belt (using trees rather than wind cloth) provides habitats for birds, etc. If native plants are used, this will also add to New Zealand's native biodiversity.

Biological controls

Using sprays and other chemicals will affect some non-target species. Biological (tested and approved) controls are focused on target species only.

With greater biodiversity, natural predators (like falcons and hawks) will be present to control birds, rats, etc.

Wetlands reintroduced

Some councils provide incentives for farmers to remove drains from old wetlands, to enable them to re-establish. When land is provided for growing succession plants (higher species over pasture), these will provide natural shelter for stock against wind, etc during lambing and calving, etc (e.g. sheep seeking shelter from wind behind tussock grasses or small shrubs).

Heirloom species storage

For example, the Svalbard Global Seed Vault is storing heirloom (old) seeds to preserve a biodiverse collection of plant species to cover the possibility of an ecological or environmental disaster.

Other examples:

Biodiversity has been evolving since the beginning of life. It provides us with fresh air, clean water, and fertile soil, and is the basis of the interconnected web of life on Earth.

Biodiversity is essential for the survival of all species, including humans. It is the source of our food, medicines, and industrial raw materials. Our economic prosperity is dependent on it, from agriculture to tourism. In fact, the value of biodiversity – providing these ecosystem services – has recently been calculated at US$33 trillion per year, world-wide. This figure is put into context by the fact that the world's annual GDP is approximately US$48 trillion.

In New Zealand, farmers have a key role in maintaining and enhancing biodiversity on their land, while doing their best to manage pests, diseases, and weeds in a sustainable way. A new way of describing farmers' role in this context, which is being used in Europe and is open to active debate, is as "photosynthesis managers" and "ecosystem service providers"!

The many values to individuals and to society of biodiversity include:

- commercial production benefits
- directly: food, medicines, and clothing
- indirectly: pollination, biological control, and more productive soils, etc
- other direct economic benefits (e.g. enhanced land values, tourism)
- aesthetic benefits (people enjoy viewing species and the ecosystems in which they live)
- "existence value", which is the value we place on knowing species and ecosystems remain in existence.

Actions for enhancing biodiversity and gaining consequent benefits on a farm can include:

- Monitor insect and weed populations before spraying, as a spray may not be necessary.
- Choose selective pesticides to minimise environmental impact.
- Target the problem pest.
- Avoid organophosphates and other broad spectrum pesticides, which can needlessly kill harmless and potentially beneficial insects and spiders.
- Encourage earthworms, as they provide many benefits.
- Minimise or eliminate cultivation, to avoid damage to earthworm populations and the soil's physical and biological properties.
- Choose machinery carefully to minimise its impact on the soil.
- Retain crop residues and mulches to improve the soil's nutrient levels, organic matter, and structure.
- Rotate crops to create a balance of species living on the farm.
- Use pasture to provide a restorative phase for soil organic matter and structure.
- Retain habitats for insects and spiders with grass and diverse plant species along fence lines and in shelterbelts.
- Include native plants in mixed shelterbelts, paddock corners, and woodlots.
- Adopt good practice to ensure successful plant establishment and management in shelterbelts and woodlots.

Flowering plants for beneficial insects

Many beneficial insects that are useful in the biological control of pests need pollen and nectar sources. The pollen provides protein, and the nectar energy. Farmland can be relatively poor in these sources, especially in the spring. Flowering gorse hedges and tagasaste (tree lucerne) are two valuable sources at this time, especially for bees. Native and non-native biodiversity can be added in the form of flowering plants in paddock margins. A well-researched example is buckwheat. The flowers of this plant are numerous and shallow, so they provide an abundant and easily accessible source of nectar and pollen. Insects such as ladybirds, hover flies, and parasitic wasps use buckwheat in large numbers, and biological control of pests can be enhanced as a result. Research in orchards, vineyards, and cereals has shown that buckwheat can enhance biological control of pests in these systems by enhancing the numbers, fecundity, and longevity of beneficial insects. Buckwheat is an annual plant; perennial options include the common, non-native, garden flower alyssum. Natives which can be useful in this way include many species of Hebe.

Other examples from Kowhai Farm, Canterbury:

Bumble bee motels

These are an attempt to provide additional nest sites for bumble bees. There are 80 “motels” around the paddock margins of Kowhai Farm, many of which have active nests in summer. Along with the planting of spring-time nectar and pollen sources for bumble bees, these motels enhance one important aspect of non-native biodiversity on farmland – pollinators.

Weta motels

Hollowed-out, untreated pine blocks are used to simulate the cavities found in mature trees that are used by weta. Weta are a group of insects related to grasshoppers that are endemic to New Zealand. It will take many years for the newly planted trees to become old enough to develop cavities, so by using these motels the successional process is accelerated until cave or tree weta colonise the trees. The motels make useful refuges for other groups such as endemic spiders that shelter and breed in them.

Wooden discs

Similarly, discs or blocks of untreated pine can be used to simulate the fallen branches found in mature native forests. These discs harbour native and endemic invertebrates such as predatory spiders and ground beetles, as well as snails, slugs, earthworms, flatworms, harvestmen, slaters, and even endemic skinks (a type of lizard). The changes in populations of these animals can be monitored by carefully lifting the discs and counting the individuals. The larger animals can be marked to assess their movements.

Grade Score Descriptors

N1	N2	A3	A4	M5	M6	E7	E8
Attempts to describe examples of the decline in biodiversity that agricultural and horticultural production systems in general may contribute to, but several errors are apparent in the description.	Describes examples of the decline in biodiversity that a **selected** agricultural and horticultural production system may contribute to, providing some accurate information. *OR* Describes a course of action that a producer could use to mitigate the negative impacts on biodiversity.	Describes examples of the decline in biodiversity that **selected** agricultural and horticultural production systems may contribute to. *AND* Attempts to explain possible courses of action that could be implemented to mitigate the negative effects on biodiversity.	Explains the decline in biodiversity that agricultural and horticultural production systems may contribute to, with reference to economic *OR* social factors. *AND* Provides examples of possible courses of action that could be implemented to mitigate the negative effects on biodiversity for agricultural or horticultural production systems.	Explains how **a selected** agricultural or horticultural production system impact on declining biodiversity, with reference to BOTH the economic and the social factors. *AND* Provides examples of possible courses of action that could be implemented to mitigate the negative effects on biodiversity for agricultural or horticultural production systems. *OR* **Attempts to recommend a** course of action, with consideration of ONE of the following: the social *OR* the economic impacts of the recommendation.	Explains the **selected** agricultural or horticultural production system's impact on declining biodiversity, with reference to BOTH economic and social factors. *AND* Provides examples of possible courses of action that could be implemented to mitigate the negative effects on biodiversity for **your selected** agricultural or horticultural production system. *AND* **Attempts to recommend a** course of action, with consideration of ONE of the following: the social, *OR* the economic impacts of the recommendation.	Explains the **selected** agricultural or horticultural production system's impact on declining biodiversity, with reference to BOTH economic and social factors. *AND* Provides examples of possible courses of action that could be implemented to mitigate the negative effects on biodiversity for **your selected** agricultural or horticultural production system. *AND* Partially justifies the recommended course of action, with some consideration of BOTH the social and the economic impacts of the recommendation.	Explains the **selected** agricultural or horticultural production system's impact on declining biodiversity, with reference to BOTH economic and social factors. *AND* Provides examples of possible courses of action that could be implemented to mitigate the negative effects on biodiversity for **your selected** agricultural or horticultural production system. *AND* Comprehensively justifies the recommended course of action with **detailed** consideration of BOTH the social and the economic impacts of the recommendation.

N0 = No response; no relevant evidence.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 2	3 – 4	5 – 6	7 – 8