Assessment Schedule – 2013

Agricultural and Horticultural Science: Demonstrate understanding of land use for primary production in New Zealand (91297)

Evidence Statement

Question ONE: Changing land use

Achievement	Achievement with Merit	Achievement with Excellence
Explains TWO factors that determine why farmers converted their sheep and beef land to forestry, or from forestry to dairying.	**Explains in detail** TWO factors that determine why farmers converted their sheep and beef land to forestry, or from forestry to dairying.	**Justifies** the change in land use by considering the effect on production of negative impacts on the environment, positive effects on economic returns, and technological improvements.

N0	No response; no relevant evidence.
N1	Some writing, but does not explain the factors that determine why farmers converted sheep and beef land to forestry, or from forestry to dairying.
N2	Partial or insufficient explanation of the factors that determine why farmers converted their sheep and beef land to forestry, or from forestry to dairying.
A3	Explains the factors that determine why farmers converted their sheep and beef land to forestry, or from forestry to dairying.
A4	Explains factors that determine, with some supporting data, why farmers converted their sheep and beef land to forestry, or from forestry to dairying.
M5	Explains in detail factors that determine converting sheep and beef land to forestry, or from forestry to dairying. ONE factor explained in detail, the other factor explained.
M6	Explains in detail factors that determine converting sheep and beef land to forestry, or from forestry to dairying. BOTH factors covered in detail.
E7	Justifies the change from forestry to dairying by evaluating how production can be supported by TWO of the following factors: economic, environmental, and technological.
E8	Justifies the change from forestry to dairying by evaluating how production can be supported by ALL of the following reasons: economic, environmental, and technological. Reasons fully explained, with comprehensive evidence.

Q1	Evidence
(a)	Explain what economic and environmental reasons may have contributed to farmers converting their sheep and beef land to forestry • Economic - Forestry was seen as more profitable, due to the higher earnings that could be made in forestry. Demand and prices were high in overseas markets for pine, and therefore farmers converted to forestry to supply this demand. - Wool prices dropped considerably, reducing profits from sheep farming. - Sheep and beef were not getting high prices in the export market. - Farming was no longer subsidised by the government, so production costs were higher. • Environmental - The conversion to forestry removed the problems farmers experienced with soil erosion, such as accelerated sedimentation and nutrient run-off, and degradation of water quality in adjacent or downstream water bodies. The planting of trees provided soil stability and reduced wind erosion. This reduced the problems experienced with downstream erosion debris, which causes rivers to become filled in with silts and gravels, increasing the risk of flooding in heavy rainfall. Explanation in detail • Economic - Sheep and beef production was hard work, and not highly profitable to farm; when the demand for timber was high in overseas markets, many farmers saw forestry as a better investment than sheep and beef. - Adding fertiliser at the time, and the increased labour, was expensive. Replanting the area for forestry was seen as more profitable, as the soils will adequately grow pine for commercial production, allowing increased earning ability and profits. • Environmental - The gradual loss of topsoil affects the general health of the soil, and reduces the fertility and productive capacity of the soil resource – the restoration of which may take hundreds of years (under natural conditions a centimetre of topsoil takes 100 to 400 years to build). The loss of topsoil was reduced once trees were established.

(b)

Explains TWO of the following reasons why farmers would convert from forestry to dairy; economic, environmental, OR technological

- Economic
  - Due to the economic downturn in forestry and the high returns that can be obtained from dairying, many landowners are converting to dairying to gain higher and quicker returns. Forestry requires about 25 years before any income arrives, whereas dairying is effective in about a year, so it has a much quicker timeframe.
  - Land to purchase in this area is cheaper than land in traditional dairy production areas such as the Waikato.
- Environmental
  - Very flat land to rolling hill country makes many properties ideal for dairy production.
  - High wind can cause some damage to trees, and this lessens their value in the export market.
  - The production of fertiliser with trace elements such as cobalt ensures that volcanic areas can now be as productive as other dairying regions in New Zealand.
- Technological
  - Technological improvements have enabled dairy production to develop in areas normally not suited to it. Farms can be extensively irrigated to produce high-quality pasture.
  - A better transport system renders farms that were previously hard to access more accessible to large dairy factories.
  - With a greater understanding of how trace elements work, production of fertiliser containing added trace elements (eg cobalt) ensures that volcanic areas can now be as productive as other dairying regions in New Zealand, and suffer no ill effects from cobalt deficiency.

Explanation in detail

- Economic
  - Converting to dairying means quick returns, due to high commodity prices for exporting of milk products and ever-increasing returns for farmers from the high price of milk solids, rather than long-term returns from low (or potentially low) export timber prices.
- Environmental
  - Flat land is wanted for dairying, as it can be converted more easily, more cleanly, and more efficiently than hill country land. It can also be levelled and contoured to farmers' requirements more effectively. In addition, irrigation can be installed easily in low rainfall areas, and to survive periods of widespread drought.
  - With some land in volcanic areas, soils are deficient in the trace element cobalt, but this problem can be overcome through the application of cobalt-enriched fertiliser. This ensures that the animals' mineral requirements are fully met, and consequently, farming animals for commercial production is now economic, due to the increased earning ability and higher profits.
- Technological
  - Spreading of cobalt via fertiliser has overcome "bush sickness", a disease affecting ruminant animals grazing pastures on volcanic soils.
  - The development of high-volume and efficient irrigation systems ensures that pastures receive the optimum amount of water, thus increasing plant growth and development.

Justify the decision of farmers to change land use from forestry to dairy production. Consider production in terms of: positive effects on economic returns, negative impacts on the environment, and technological improvements

The main reason that farmers are converting to dairying is the currently high dairy prices. The decrease in forestry product prices at present makes the change

	to dairying an attractive one. Conversion to dairying involves a lot of costs. However, this investment can be greatly offset by quick returns due to high commodity prices for exported milk products and ever-increasing returns for farmers from the high price of milk solids. This ensures that a good profit can be made by the farmer. The dairy industry has some negative impacts on the environment; the main issues are greenhouse gas emissions and nutrient enrichment (eutrophication) of waterways. Forests no longer absorb carbon dioxide when the trees are felled (and a carbon sink is therefore lost), while dairying can release huge amounts of greenhouse gases in the form of methane and nitrous oxide from the cows' urine and faeces. Eutrophication is predominantly caused by nitrate and phosphate being lost into surface waters. Surface water erosion increases with forest clearing, and the flow of nutrients into waterways increases. As these are limiting nutrients in many situations, they cause an increase in algal and aquatic plant growth that can be toxic. When organisms die, their decomposition causes a decrease in dissolved oxygen levels, which can kill fish, etc, and result in a change in aquatic community composition. Dairy cows are grazing in situ outside year round, and most of their excreta falls on the paddock in urine patches, where nitrogen loading rates are far in excess of plant uptake. This urine can be nitrified to form nitrous oxide gas (which is emitted from the soil) or nitrate (which is leached, due to its negative charge not being held on the exchange sites in the soil). However, the environmental impacts can be mitigated by reducing the stocking rate and reduced applications of fertiliser. Technological improvements have enabled dairy production to develop in areas normally not suited to it. Farms can be extensively irrigated to produce high-quality pasture, and access to large dairy factories is improved through a better transport system that makes the conversion more successful. The production of fertiliser with added trace elements such as cobalt, ensures that volcanic areas can also be as productive as other dairying regions in New Zealand.

Question TWO: Root crop production

Achievement	Achievement with Merit	Achievement with Excellence
Explains ONE environmental *AND* ONE economic factor why seasonal root crops are more successful in areas such as Ohakune than in other parts of the North Island. *OR* **Explains** ONE advantage *AND* ONE disadvantage of changing the land use to dairying, in terms of the environmental issue, economic returns, *OR* existing workforce considerations.	**Explains in detail** ONE environmental *AND* ONE economic factor why seasonal root crops are more successful in areas such as Ohakune than in other parts of the North Island. *OR* **Explains in depth** ONE advantage *AND* ONE disadvantage of changing the land use to dairying, in terms of the environmental issue, economic returns, *OR* existing workforce considerations.	**Analyses** the advantages and disadvantages of changing the land use, by considering the existing workforce and economic returns of root crop production compared with dairy production.

N0	No response; no relevant evidence.
N1	Some writing, but does not explain the factors that determine why seasonal root crops are successful in areas such as Ohakune.
N2	Partial or insufficient explanation of the factors that determine why seasonal root crops are successful in areas such as Ohakune.
A3	Explains ONE environmental *AND* ONE economic factor why seasonal root crops are more successful in areas such as Ohakune than in other parts of the North Island. *OR* Explains ONE advantage *AND* ONE disadvantage of changing the land use to dairying, in terms of the environmental issue, economic returns, *OR* existing workforce considerations.
A4	Explains with some supporting data, ONE environmental *AND* ONE economic factor why seasonal root crops are more successful in areas such as Ohakune than in other parts of the North Island. *OR* Explains with some supporting data, ONE advantage and ONE disadvantage of changing the land use to dairying, in terms of the environmental issue, economic returns, *OR* existing workforce considerations.
M5	Explains in detail ONE environmental *AND* ONE economic factor why seasonal root crops are more successful in areas such as Ohakune than in other parts of the North Island. *OR* Explains in depth ONE advantage *AND* ONE disadvantage of changing the land use to dairying, in terms of the environmental issue, economic returns, *OR* existing workforce considerations.
M6	Explains in detail ONE environmental *AND* ONE economic factor why seasonal root crops are more successful in areas such as Ohakune than in other parts of the North Island. *OR*

	Explains in depth ONE advantage *AND* ONE disadvantage of changing the land use to dairying, in terms of the environmental issue, economic returns, *OR* existing workforce considerations. BOTH factors covered in detail.
E7	Analyses the advantages and disadvantages of changing the land use by considering the environmental issue, economic returns, and existing workforce considerations of root crop production, compared with dairy production. Comprehensive evidence given for ONE factor, with another factor well supported.
E8	Analyses the advantages and disadvantages of changing the land use by considering the environmental issue, economic returns, and existing workforce considerations of root crop production, compared with dairy production. Comprehensive evidence given for TWO factors.

Q2	**Evidence**
(a)	Explain why seasonal root crops are more successful in areas such as Ohakune than in other parts of the North Island. Consider the environmental and economic factors which make root crop growing in the Ohakune area a preferred option • Environmental - The environment is well suited to growing root crops, due to the flat land and nutrient-rich volcanic soil. However, additional nutrients still have to be supplied regularly, as the soils are easily leached due to the volcanic soil being very free-draining. - The temperature is well suited to root crop production, with a late growing season and a cold winter climate to discourage pests, increasing sugars and crop quality in root vegetables. - Moderate rainfall. • Economic - Prices are good for root vegetables at present, and they can be grown successfully in Ohakune. The land is inexpensive compared with areas such as Pukekohe, making the available profit greater. Transport is easy, with a good road system to current markets, as well as a rail network. Explanation in detail • Environmental - All the above environmental factors ensure that the climate allows for quick growth rates, and ensures reliability in the crops reaching harvestable quality. In particular, the soil conditions need to be fertile and with good structure, which ensures fast plant growth, due to the excellent soil / water / oxygen ratio. Friable soils suit the consistent growth of uniformly high-quality root crops. - The use of machinery in intensive vegetable production is more productive and safer on flat ground. • Economic - The area is marginal for other types of land use, and therefore land prices are cheaper than in other parts of the North Island. Ohakune can produce good quality and large quantities of root crops which fetch good prices in the domestic market. These can be produced economically when compared with other areas, and with the good transport system available, costs are not higher than other areas.

(b)

Explain ONE advantage and ONE disadvantage of changing the land use to dairying, in terms of the environmental issue, economic returns, *OR* existing workforce considerations

- Advantages
  - The grower already has a good knowledge of the soil structure, and would be able to implement fertiliser restrictions quickly and effectively.
  - New Zealand is currently experiencing high prices for dairy products.
  - The grower has access to workers through their market gardens, so should be able to retain some staff to work on the dairy farm.
- Disadvantages
  - The same environmental issues would apply, and would probably increase, if the land use was changed to dairying.
  - Workforce is all skilled for working in market gardens. Skilled workers for a dairy farm would need to be trained or brought into the area.
  - Job losses, due to local people being unskilled for dairy work.
  - Large outlay required for conversion to dairying.

Explanation in detail

- Advantages
  - The grower has an in-depth knowledge of the soil factors, weather conditions, and climate, so they are able to respond to the conditions when changing to dairying – in particular, having a good understanding of the soil factors, and being able to respond to the restriction of the amount of fertiliser that dairy farmers in Ohakune can use on their land to stop them leaching into waterways.
  - Converting to dairying currently provides quick returns, due to high commodity prices for exported milk products and ever-increasing returns for farmers from the high price of milk solids.
- Disadvantages
  - It would be just as difficult, if not harder, to restrict the amount of fertiliser that dairy farmers in Ohakune can use on their land to stop it leaching into waterways.
  - It would be difficult to find skilled dairy workers; this is not a traditional dairy area, so skilled labour would be hard to find. There would be high training costs.
  - Converting a market garden into dairying would have high conversion costs in excess of $2 million.

Analyse the advantages and disadvantages of changing the land use to dairy production. Consider the environmental issue, existing workforce considerations, and economic returns of root crop production, compared with dairy production

The disadvantages outweigh the advantages of changing the land use from market gardens to dairying. The main reason for change was the environmental issue of restricting the amount of fertiliser that growers in Ohakune can use on their land to stop fertiliser leaching into waterways. This issue would not be solved with a change in land use, and may actually become worse, due to effluent produced by the cows. If the grower continues with market gardening, the restriction on fertiliser and nutrients means that different methods will need to be employed to ensure the quality of the product. This may reduce profits, but the cost may be able to be passed on to the consumer.

The potential to employ a workforce for a different land use will be limited, as market gardening predominates in this area, and therefore all the workers are skilled in those jobs. If the farmer was to change his land use to dairying, skilled workers for the dairy industry would need to be trained, which would have a negative impact on profitability to begin with.

The decision to continue growing carrots will be a profit-based one, and as the environmental conditions for root vegetable production are good, it is unlikely

	that a change will be beneficial. Profits will be minimal for the first few years if the land use is changed to dairying. With the costs of conversion and the environmental issues of dairying being similar to those of market garden nutrient management, staying with the original root crop makes more economic sense.

Question THREE: Kumara production

Achievement	Achievement with Merit	Achievement with Excellence
Explains ONE environmental *AND* ONE economic factor why the land is suitable for kumara production. *OR* **Explains** ONE economic and ONE social factor as to why continuing with the same land use is a good decision.	**Explains in detail** ONE environmental *AND* ONE economic factor as to why the land is suitable for kumara production. *OR* **Explains in depth** ONE economic and ONE social factor as to why continuing with the same land use is a good decision.	**Justifies** the continued land use by considering the effect on sustainable kumara production, in terms of economic and social factors.

N0	No response; no relevant evidence.
N1	Some writing, but does not explain the factors that determine why Northland farmers continue growing kumara.
N2	Partial or insufficient explanation of the factors that determine why Northland farmers continue growing kumara.
A3	Explains the factors that determine why Northland farmers continue growing kumara. Reasons cover economic, environmental, *OR* social factors.
A4	Explains with some supporting data, why Northland farmers continue growing kumara. Reasons cover economic, environmental, *OR* social factors.
M5	Explains in detail TWO factors that determine why Northland farmers continue growing kumara production. Reasons cover economic, environmental, *OR* social factors. ONE factor explained in detail, the other factor explained.
M6	Explains in detail TWO factors that determine why Northland farmers continue growing kumara production. Reasons cover economic, environmental, *OR* social factors. BOTH factors explained in detail.
E7	Justifies the continued growing of Northland kumara by evaluating how sustainable production can be supported by economic *AND* social factors. Comprehensive evidence given for ONE factor, with the other factor well supported.
E8	Justifies the continued growing of Northland kumara by evaluating how sustainable production can be supported by BOTH economic and social factors. Comprehensive evidence given for BOTH factors.

Q3	Evidence
(a)	Explain why the land in Northland is suitable for kumara production. Consider the environmental (climate and soil type) and economic factors for continuing to grow kumara in the area • Environmental - The climatic conditions (moderate rainfall, high sunshine hours, cool winters, and warm summers) are ideal for producing kumara. Kumara is a semi-tropical vegetable which thrives in temperatures around 24°C but ceases to grow below 17°C. Northland can provide these temperatures over the summer, producing quality kumara. - The relatively flat topography aids ease of harvest and management of the product. - The soil type is fertile, and so requires little added fertiliser. The Wairoa river is a good source of alluvial soils, which are used for growing kumara. The free-draining sandy loam provides a good soil base for the growth of these vegetables. • Economic - Growers have a workforce and infrastructure for growing and selling kumara. The implications of changing crop are significant in terms of economic impact, as new workers would need to be up-skilled and the outlay for equipment for a new venture is significant. - Good prices can be received for producing kumara, and it makes a good profit for the grower. Explanation in detail • Environmental - The climatic conditions are ideal for producing kumara, and it allows the plants to develop large canopies, increasing photosynthetic activity and kumara growth. Kumara is a semi-tropical vegetable which thrives in temperatures around 24°C, but ceases to grow below 17°C. • Economic - The production of kumara is profitable, mainly due to the environmental factors, and these remain unchanged, so the economic viability is likely to continue.

(b)	Explain why it is a good decision to continue with kumara production in Dargaville. Consider the social and economic factors for continuing to grow kumara in the area • Social - There is a high Māori population that has a traditional relationship with, and knowledge of, kumara-growing. - Kumara production is the dominant land use in the region. - It generates substantial income for the region and provides a large number of jobs, both full-time and part-time, that suit the local population. - The grower's family will be settled in the area, and many have passed through several generations in the same business. - Schools, communities, and services are retained through the continued production of kumara. • Economic - Growers have a workforce and infrastructure for growing and selling kumara. The implications of changing crop are significant in terms of economic impact, as new workers would need to be up-skilled and the outlay for equipment for a new venture is significant. - Good prices can be received for producing kumara, and it makes a good profit for the grower. Explanation in detail • Social - The workforce is skilled in kumara production, and pack houses exist to enable the kumara produced to be packed and distributed. There are skilled workers and communities surrounding the production of kumara in this area. - The large population nearby can provide the necessary workers to ensure a high yield of quality kumara. The local infrastructure is in place to ensure delivery to market, and storage sheds to allow a staggered supply to the market. • Economic The production of kumara is profitable, mainly due to the environmental factors, and these remain unchanged, so the economic viability is likely to continue. Justify the decision of the farmer to continue with the existing land use (producing kumara). Consider how sustaining kumara production in Dargaville is a good decision in terms of: social factors that include the grower's family and the wider community, existing infrastructure, and markets which impact on economic returns The decision to continue growing kumara must be based on the profitability of production of the kumara grown. This is based on the amount which can be grown, the prices received, and the costs incurred in production. Northland has climatic conditions that suit kumara production, and the economic returns make sustainable production viable. Long-term contracts with supermarket chains make a continuous supply both profitable and necessary. Continued production is sustainable due to the profits available, as the environmental conditions and infrastructure are already in place for production of kumara. Social factors are not as significant as the economic returns seen, but they are important in maintaining the production of kumara in this area. Any change to a different land use such as dairying would result in the loss of many jobs, particularly part-time, so it would be desirable on a social basis that any new land use was of a horticultural nature, with a higher labour requirement. Jobs would be retained, people would stay in the area, and services such as doctors and schools would be retained.

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 6	7 – 12	13 – 19	20 – 24