Assessment Schedule – 2020

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

Assessment Criteria

Achievement	Achievement with Merit	Achievement with Excellence
Explains environmental and economic factors that make a region suitable for a ruminant animal.	**Explains in detail** why this region is suitable for a ruminant animal in terms of environmental and economic factors.	**Compares and contrasts** this regions continued use for ruminant animals in terms of political and workforce factors.

Evidence

Question ONE	Evidence
(a) Demonstrates understanding of what environmental and economic factors make a region suitable for selected ruminant animal.	*Example of evidence is for dairy in the Waikato. Other evidence could be used for other regions for sheep, beef or dairy.* **Economic** As dairying has been carried out in the Waikato for generations, significant infrastructure is in place to produce, collect, and process milk. Having the infrastructure already in place has allowed further increases in dairy numbers. The high rainfall and fertile soil mean the cost of production is less, as irrigation and fertiliser requirements are reduced. Year-round grass growth means less needs to be spent on supplementary feed. **Environmental** The Waikato region is flat to rolling, fertile, with good access to water. It has high rainfall and sunshine hours, with mild winter temperatures allowing year-round grass growth. These environmental conditions have allowed dairy farms in the Waikato to have the highest average milk solids production per hectare in the North Island. While excess rainfall in winter / spring can lead to soil pugging, this can be managed with stand-off / feed pads. The heavier soils mean there are less issues with leaching unlike areas such as Canterbury.
(b) Demonstrates understanding of arguments for or against alternative land use based on political and workforce factors.	New Zealand dairy exports are valued at more than $16 billion dollars (2018) and provide direct employment for more than 38 000 people. Dairying also acts as a significant buyer from other supporting industries in New Zealand. The Waikato region has the greatest number of dairy cows in New Zealand with over 1.41 million, and the milk production brings in more than 2.4 billion dollars to the region (2015). Over 13 000 people are employed either on farms or in processing in the Waikato region. Converting to another non-ruminant based land use would come at considerable expense and require extensive retraining of the existing workforce. Converting from one land use to another is expensive. Converting to vineyards can cost up to $50,000 per hectare, while converting to Kiwifruit could cost up to $60,000 per hectare without considering the cost of the Zespri licence to grow the fruit. **Workforce** Remaining in dairy • As dairy has been carried out in the Waikato for generations, there is a large number of people with experience working and supporting the dairy industry. Any conversion would require significant retraining.

	• There are already seasonal worker shortages in horticulture and forestry. Further conversion to these land uses would see an increase in these shortages. In 2019, the kiwifruit industry saw a shortage of 1200 workers. While some could come from the dairy industry, they have a very different skill set and horticulture work tends to be seasonal. • While fewer people are needed in dairy than horticulture, it tends to be year-round work and more highly paid. Converting away from dairy • Converting away from dairy would diversify the employment in the Waikato region. • The Waikato has a university with a strong agriculture and horticulture focus and is able to provide skilled workers who are in demand in the horticultural and forestry industries. • Horticultural land use has a greater potential to provide 'off the farm' employment opportunities in tourism and services. **Political** Remaining in dairy • Dairy is an important export earner for New Zealand and brings in income for the government in the form of taxes. • The dairy industry is a major employer in the Waikato region, especially in more rural areas where employment can be an issue. • Provided the dairy industry can meet the environmental limits set by councils and the government, it is an efficient use of land in the Waikato. • Many horticultural land uses have issues with leaching and runoff, so might also have issues with meeting council nitrogen loading. Market gardens can leach up to three times as much nitrogen as dairy. Converting away from dairy • Reducing dairy numbers is one way for New Zealand to meet its international greenhouse emissions target of CO_2 at 1990 levels. • There is considerable backlash against the dairy industry, especially from those in urban areas, who want the government and councils to impose strict environmental targets (such as N levels), which would force some dairy farmers to convert to other land uses. • Converting to other non-ruminant land uses such as horticulture or forestry, could help diversify New Zealand's exports, making the country's economy more resilient in a global context.

N1	N2	A3	A4	M5	M6	E7	E8
Some writing but does not explain why environmental or economic factors make a region suitable for a selected ruminant animal.	Partial or insufficient explanation of why environmental or economic factors make a region suitable for a selected ruminant animal.	Explains why one environmental or economic factor makes a region suitable for a selected ruminant animal.	Explains why environmental and economic factors make a region suitable for a selected ruminant animal.	Explains in detail what environmental or economic factors make a region suitable for a selected ruminant animal. ONE factor explained in detail.	Explains in detail what environmental and economic factors make a region suitable for a selected ruminant animal. BOTH factors explained in detail.	Compares and contrasts another land use with ruminant animals in terms of political and workforce factors. Comprehensive evidence for ONE factor, with the other factor supported.	Compares and contrasts its continued use for ruminant animals in terms of political and workforce factors. Well supported evidence for BOTH factors.

N0 = No response; no relevant evidence.

Achievement	Achievement with Merit	Achievement with Excellence
Explains why limited water has shaped land use in a named region.	**Explains in detail** how technological and environmental factors will impact upon future land use.	**Analyses** how droughts will impact on future land use in terms of technological and environmental factors.

Evidence

Question TWO	Evidence
(a) *Demonstrates understanding of how limited water can shape current land use.*	*Example of evidence is for Canterbury. Other evidence could be used for other regions, such as Hawkes Bay or Otago.* Due to the prevailing warm, dry, north-westerly winds, and Canterbury being in the rain shadow of the Southern Alps, rainfall is low and evaporation is high, with an annual rainfall of 648 mm a year. Seasonal water shortages during summer, combined with the free-draining soils have, in the past, limited water-intensive land uses such as dairy in the Canterbury region. Without irrigation, intensive dairying is difficult. The low rainfall means that pasture growth is limited, traditionally restricting land users without irrigation to low-intensity land use, such as sheep farming. However, the dry summers are ideal for grain growing, with over half of New Zealand's grain being grown in the Canterbury region.
(b) *Demonstrate understanding of how droughts will impact on future land use in terms of technological and environmental factors.*	In the Canterbury region, climate change is expected to increase temperatures between 0.7°C and 3°C by 2090, with 6–35 extra days where temperatures exceed 25°C. Rainfall is expected to decrease by up to 12% in certain regions of Canterbury, and westerly winds are forecasted to increase. Higher temperatures, less rainfall and greater evapotranspiration are likely to cause increasing pressure on water resources, particularly in North Canterbury. Droughts are likely to become more frequent and more extreme. To maintain current land, users will increasingly rely on irrigation, and to prevent further degradation of the environment, will see tighter restrictions on farming practices. Water-intensive land users, such as dairy and viticulture, might need to either de-intensify to reduce water requirements, or alternatively intensify to be able to make water efficiency technologies more viable and retire land that is unsuitable for water intensive land uses. Certain water-intensive land users might become non-viable in particularly drought-prone areas. **Technological factors** • An increased reliance on irrigation schemes and further development of more efficient water irrigation technologies. This will increase the production cost to farmers. • An increase in the development and use of sensors to ensure water is applied as needed, and where it is needed, to reduce wastage, runoff and leaching. • Development of new drought-resistant grass varieties to cope with the increased numbers of droughts. **Environmental factors** • Due to higher temperatures, minimum flow requirements of rivers are likely to increase, which will reduce the amount of water available to farmers for use in irrigation. This might see a shift away from water-intensive land uses to less water-intensive land uses. • Decreased rainfall and increased wind might see an increase in soil erosion unless carefully managed. • If sufficient water can be sourced through irrigation and water storage, the increased temperatures, longer growing season and fewer frost days, might see an increase in productivity or the potential for new land uses.

N1	N2	A3	A4	M5	M6	E7	E8
Some writing but does not explain why limited water has shaped land use in a named region	Partial or insufficient explanation of why limited water has shaped land use in a named region.	Explains one reason why limited water has shaped land use in a named region *OR* explains why it has prevented certain land uses.	Explains why limited water has shaped land use in a named region *AND* explains why it has prevented certain land uses.	Explains in detail, with reference to technological *OR* environmental factors, why droughts will impact upon future land uses.	Explains in detail, with reference to technological *AND* environmental factors, why droughts will impact upon future land uses. BOTH factors explained in detail.	Analyses how droughts will impact upon future land use, with reference to environmental and technological factors. Comprehensive evidence for ONE factor, with the other factor supported.	Analyses how droughts will impact upon future land use, with reference environmental and technological factors. Comprehensive evidence for BOTH factors.

N0 = No response; no relevant evidence.

Achievement	Achievement with Merit	Achievement with Excellence
Explains economic factors behind urban sprawl.	**Explains in detail** economic factors behind urban sprawl.	**Justifies** a council's decision to either allow or prevent the conversion of farmland to urban land in terms of social and environmental factors.

Evidence

Question THREE	Evidence
(a) Demonstrates understanding of economic factors affecting urban sprawl.	*Example of evidence is for Tauranga. Other evidence could be used for other regions, such as Auckland, Hamilton or Christchurch.* Tauranga's population increased 27% between 2001 and 2013. For a variety of reasons, including spiralling house prices in Auckland, nice climate, and an intensive horticultural industry with access to one of New Zealand's largest ports, Tauranga is seen as a desirable place to live. These additional people need somewhere to live, so land is opened up to development on the edges of the existing city. The urban area of Tauranga increased by 25% between 2001 and 2013. • If land is not opened up to provide housing for the increased population, then house prices and land values will increase, which can lead to houses becoming unaffordable for those who live in urban areas. This can make getting employees more difficult and drives up wage costs. • With an increase in land values in the areas surrounding cities such as Tauranga, other less intensive land uses such as agriculture and horticulture become less profitable, due to increased land values and rates. Due to the increased land values, farmers and growers are more likely to develop land into housing to get a better return from their land.
(b) Demonstrates understanding of social and environmental factors that might influence a council's decision to either allow or prevent land conversion.	Councils have the responsibility of zoning land to ensure the wellbeing of those people who live in their district. They need to ensure that they have sufficient affordable housing to prevent overcrowding and homelessness in their district. Tauranga's population increased by more than 11 000 people between 2013 and 2017. If houses become unaffordable, then businesses can struggle to find workers especially in the lower-paying industries. At the same time, land surrounding cities tends to be some of the most productive food-producing land. Once land has been developed, it is nearly impossible to return to food production. If the food-producing land is developed, food needs to be imported from other regions or overseas, thus reducing food security. If councils allow cities to continue to expand, people's commutes become longer, congestion increases, and the environment suffers due to an increase in impervious surfaces, rubbish, and greenhouse emissions. **Environmental factors** For • With an increase in population, council's income will increase, enabling it to invest in better-quality infrastructure, such as wastewater treatment plants and rubbish disposal. • With greenfield developments, councils are able to insist on high-quality infrastructure such as separated stormwater systems, rain gardens and efficient public transport systems. • Environmentally sensitive land can be locked up into parks and reserves.

	Against • Cities are a very intensive use of land and increase the amount of rubbish and waste produced. This needs to be treated and disposed of. Already, many of New Zealand's major cities are running out of places to put rubbish. • As urban areas sprawl out over rural areas, commute times become longer, and people spend more time in their cars. This increases greenhouse gas emissions. • Cities have large areas of impervious surfaces. This increases runoff and as water flows over roads, it picks up contaminants such as petroleum products and litter, which ends up in streams and the sea. **Social factors** For • Opening up greenfield developments on the edges of cities enables people who would not otherwise be able to afford their own home, to buy houses, or to purchase houses at a lower value, allowing them to have a better standard of living. • Cities with larger populations are able to provide better services, such as hospitals, libraries and entertainment. • Developments provide employment opportunities for builders, tradespeople and supporting services. Against • Greenfield developments reduce the amount of productive food producing land around cities. • Increased commute times result in people spending less time with families and in communities. • Loss of employment for rural workers.

N1	N2	A3	A4	M5	M6	E7	E8
Some writing but does not explain economic factors behind urban sprawl.	Partial or insufficient explanation of economic factors behind urban sprawl region.	Explains an economic factor behind urban sprawl in a selected region.	Explains TWO economic factors behind urban sprawl in a selected region.	Explains in detail an economic factor behind urban sprawl in a selected region.	Explains in detail TWO economic factors behind urban sprawl in a selected region.	Justifies a council's decision to either allow or prevent the conversion of farmland to urban land, in terms of environmental and social factors. Comprehensive evidence for ONE factor, with the other factor supported.	Justifies a council's decision to either allow or prevent the conversion of farmland to urban land, in terms of environmental and social factors. Comprehensive evidence for BOTH factors.

N0 = No response; no relevant evidence.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 12	13 – 18	19 – 24