

Arable Land Use in the Gisborne District

– Summer Crop Survey

Summer Season 2016/2017

GDC Science Report 01/2017



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1.0 Introduction

The Gisborne District Council has completed a survey of the actual land use of the arable land in the Gisborne District for the 2016/2017 summer season. The surveyed area is 23948.87 hectares. This report outlines the trends and observations arising from the land use survey in the 2016/2017 season.

The 2016/2017 season's survey followed a similar method to previous summer crop surveys, which will be described in greater detail in section 2.0. The 2016/2017 summer crop survey covered a large proportion of the Gisborne District, extending from Motu to Te Araroa.

The survey is carried out to provide information on the area and types of crops that have been grown throughout the region. This data will then be used to assist in the management of the region's physical resources. Water demand for irrigation can also be forecasted which will assist in water quantity management.



Figure 1: Melons grown at Ormond.

2.0 Survey Area

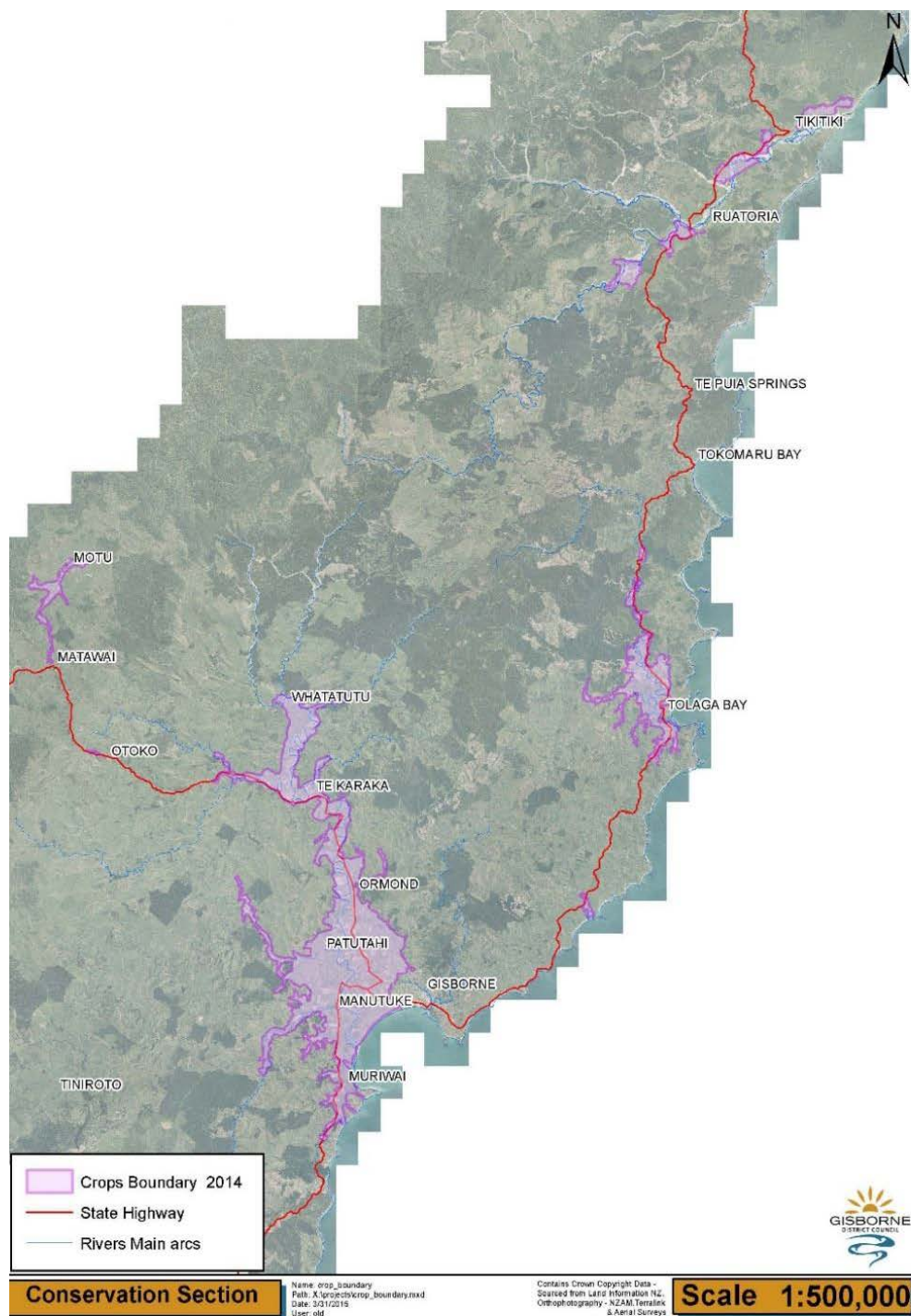


Figure 2: Aerial orthophoto showing average extent of area surveyed 2007 – 2017.

The survey area is shown in Figure 2 extends south to Muriwai, covers north to Whatatutu, and northwest to Motu. The survey continues up the coast of the Gisborne region, including Whangara, Tolaga Bay, Ruatoria and Tikitiki, going as far as Whakaangiangi Road near Te Araroa.

A significant portion of the summer crop survey occurs on the Poverty Bay Flats due to the intensive cropping activities that occurs there. Prior to the 2014/15 summer crop survey the survey area did not exceed the Poverty Bay Flats, however now that the survey area extends to the rest of the district it is essential to distinguish the Poverty Bay Flats from the remainder of the region to ensure accuracy when comparing trends. The 2014/2015 and 2015/2016 survey defined the Poverty Bay Flats according to the Turanga Ecological Unit (figure 3).

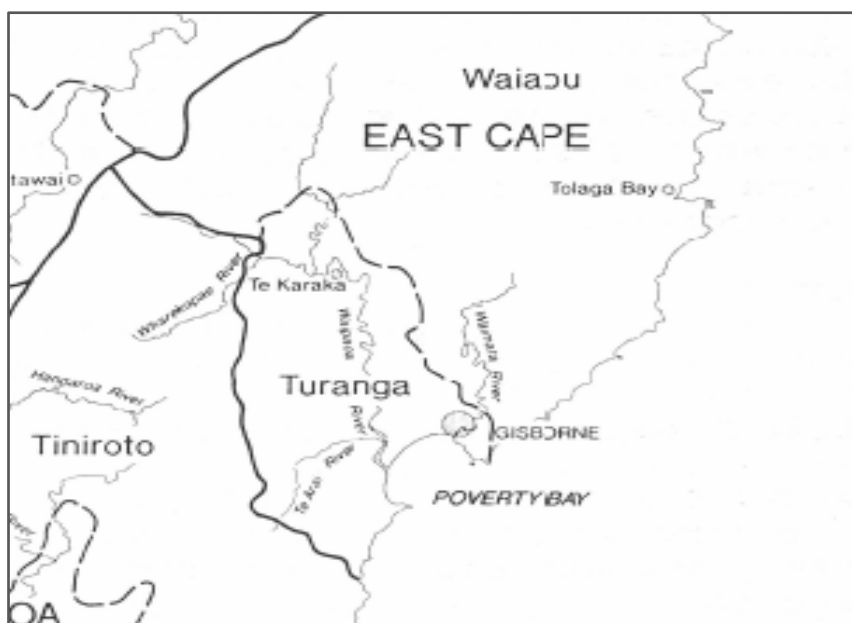


Figure 3: Turanga Ecological Unit (Clarkson, 1991, p3)

The 2016/2017 crop survey has adapted the Turanga Ecological Unit to create a boundary of the Poverty Bay Flats (figure 4). This boundary was created with the intention of increasing the accuracy of the total cropped area within the Poverty Bay Flats as the survey area of the Poverty Bay Flats has fluctuated significantly throughout the previous surveys (see table 2).

3. Methods

The 2016/2017 summer crop survey was conducted at the beginning of January 2016, the same time of year as the previous survey. January is generally the beginning of the harvesting period which can extend through to April for many vegetables. Kohlrabi is not included in the survey because these crops are harvested in winter. It is important to note that vegetables such as peas are harvested in November and December and are usually processed by the time the survey begins.

A slightly different method was used as previous year's surveys. Data was collected by systematically driving throughout the Poverty Bay Flats and manually recording observed crop types using Arc Collector software on a hand held tablet. This is the first year that this method has taken place rather than recording the crop types onto printed aerial maps.

Summer Crop Survey - Poverty Bay Flats Boundary

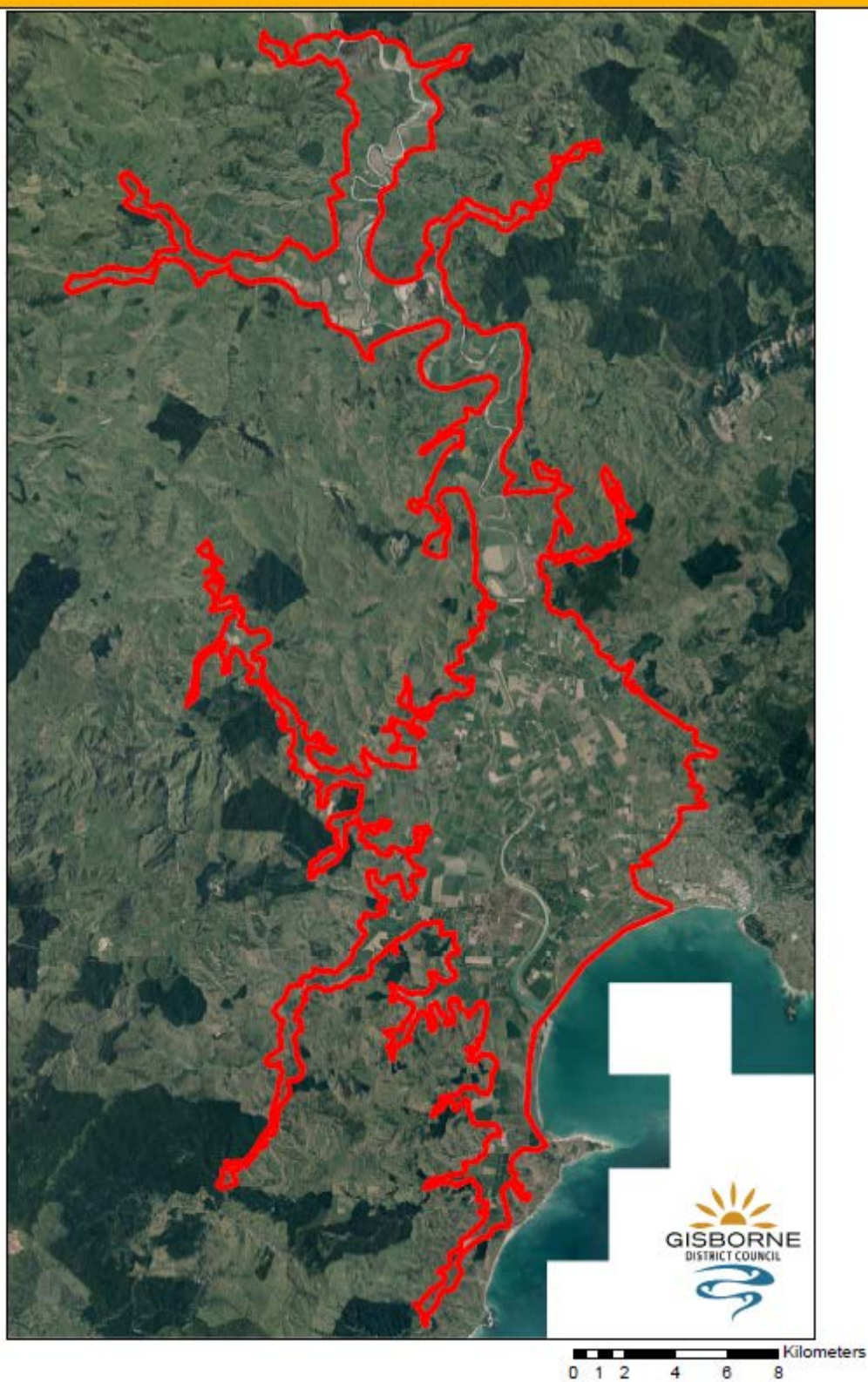


Figure 4: Poverty Bay Flats Boundary

In previous surveys, the recorded information would be digitised once the survey was completed using ArcMap. Using this software has significantly reduced the time taken to compile the crop survey results as it is completely digitised whilst in the field.

Photos were taken of crops that were difficult to identify, allowing for the image to be amplified and identified later in the office. Difficulties associated with crop identification were often a result of the distance from the road and site restrictions (e.g. shelter belts and other crops). Crops that were not able to be identified were recorded as 'Other', along with other minor crops.

The survey began on 11th January and finished on 25th January 2016. Once the field work was completed, the data was digitised in the field and the total area of each crop was able to be calculated. Although the crop survey covers the entire district, some areas that were least likely to have crops were left out. This decision was based on previous surveys and the land use and topography of most rural areas.

More extensive data collection has taken place since the 2014/15 surveys by incorporating all the arable land around the wider Gisborne region, including the Poverty Bay Flats, Motu, Matawai, Whangara, Tolaga Bay, Ruatoria, and Tikitiki. The precision of data analysis has been improved by digitising at a smaller scale compared to previous years, allowing greater accuracy in identifying the boundaries of each paddock and removing houses, sheds, patches of bush and other obstructions from mapped areas.

4.0 Results

The results and discussion section compares trends and observations of major crop types. The Arable Land Use in the Gisborne District Report (2007 – 2015), made comparisons between 2007 – 2015 data, so to avoid repetition this report will focus on fresh trends and observations of major and minor crop types that are presented by the 2016/2017 data. The total area of land included in the 2016/17 survey was 23948.87 ha. The survey area of the Poverty Bay Flats was 17857.52 ha. As this is only the third year the crop survey has extended beyond the Poverty Bay Flats, the results section of this report differentiates between data gathered from the Poverty Bay Flats and data gathered from the wider region. This ensures relevant and accurate conclusions are drawn when discussing changing land-use in the Poverty Bay Flats area. The Poverty Bay Flats will be discussed first, followed by the wider Gisborne Region. As the survey continues, trends will become clearer in the regions outside of the Poverty Bay Flats. All crop survey data can be found in table 2.

The most common crops that were found on the Poverty Bay Flats were:

- Pasture/Unused land
- Maize/Sweetcorn
- Squash
- Grapes
- Citrus
- Kiwifruit
- Pip & Stonefruit

The survey area of the Poverty Bay Flats in the 2016/2017 season was 17857.52 ha, a slight increase of the area surveyed in 2015/2016 of 17727.26 ha. The summer crop survey area accounts for 69.87% of the Poverty Bay Flats outlined in figure 3, which has a total area of 25,558.63 ha.

4.1 Crop Types

This survey used the same format for crop types as previous years. The identification of pasture followed the practice of previous surveys that referred to pasture and grass as a crop type named pasture/unused. This practice continued even though the 2015/2016 survey did not differentiate between 'unused' land, meaning land that was fallow, and land that was established in pasture. Pasture/Unused consists of grass that is suitable for grazing, typically ryegrass, or ryegrass and white clover, or grasses with no predominant legume or herb. Crops to be planted were identified by bare soil being tilled or cultivated soil ready for sowing or planting, although sometimes it was difficult to identify between fallow land and land to be planted. This crop type accounted for 778.91 ha in the Poverty Bay Flats and 17.32 ha for the remainder of the Region. This survey also singled out additional fodder crop types which were not distinguished in surveys prior to the 2015/2016 survey. These crop types included plantain/chicory, plantain/clover, forage rape, fodder beet and kale. These varieties are all included as fodder crops in the results section.

4.1.1 Pasture/Unused

Pasture/Unused land continues to be the most dominant crop present on the Poverty Bay Flats. In the 2016/17 season the total arable land in pasture/unused was 5,596.81 hectares, a slight increase from the 2015/2016 survey which reported a total of 5,584.59 hectares (Figure 4). Pasture accounts for 36.23% of all crops recorded in the Poverty Bay Flats. Within the increased survey area outside of the Poverty Bay Flats, pasture/unused land occupies another 3080.18 ha, providing a total for the Gisborne region of 8676.99 ha.

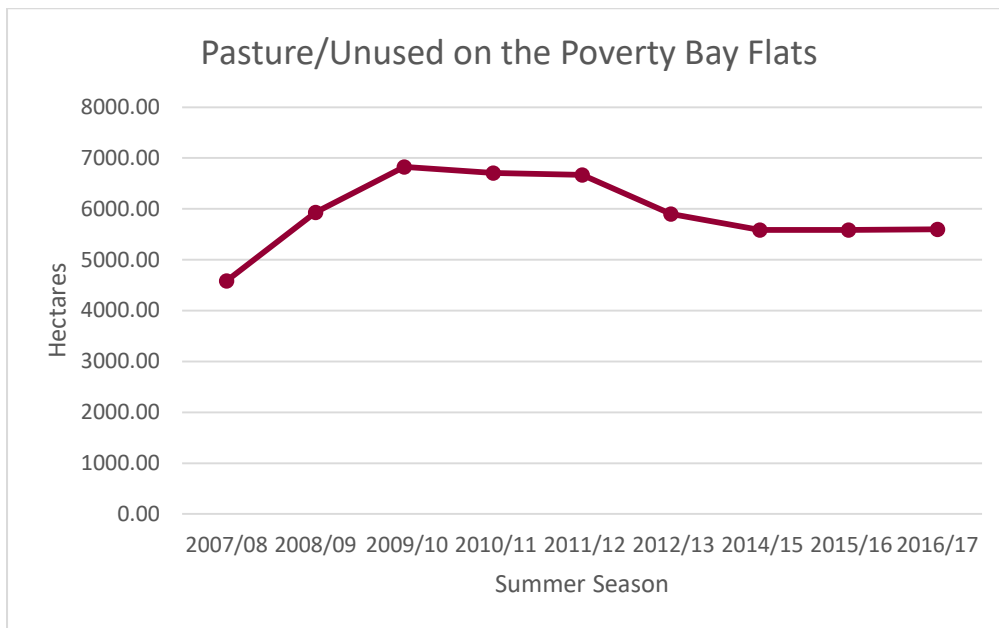


Figure 4: Total hectares of pasture/unused land on the Poverty Bay Flats arable land 2007/08 – 2016/17.

4.1.2 Maize/Sweetcorn

Maize and sweetcorn collectively make up the second most common crop type on the Poverty Bay Flats and the entire Gisborne region. Maize and sweetcorn account for 26.15% of all crops recorded on the Poverty Bay Flats covering a total area of 4770.42 hectares for the 2016/17 season. This figure is 240.96 ha less than the previous year (Figure 4). 1492.49 ha of maize/sweetcorn was grown outside the Flats, which has decreased from 1552.83 ha from the previous survey. The total maize and sweetcorn grown in the Gisborne Region during the 2016/17 summer crop survey was 6262.90 hectares.

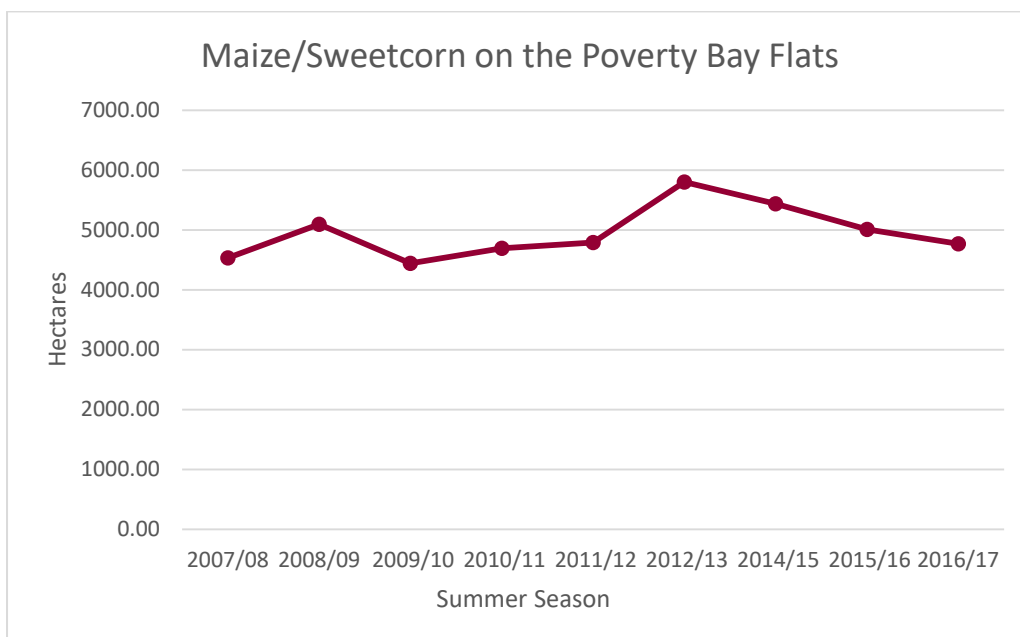


Figure 5: Total hectares of maize/sweetcorn on the Poverty Bay Flats arable land 2007/08 – 2016/17.

4.1.3 Grapes

In 2016/17 grapes occupied 1702.41 ha of the Poverty Bay Flats, making grapes the third most common crop in the Poverty Bay Flats. Grapes have successively declined since the 2012/13 summer season. Grapes have decreased a total of 126.76 ha since 2015/16 and a total of 437.07 ha since 2013/12. Grapes now occupy 7.12% of all crops recorded in the Poverty Bay Flats. Majority of the grapes in the Gisborne region are grown on the Poverty Bay Flats as only 2.48 ha of grapes are grown outside the Poverty Bay Flats.

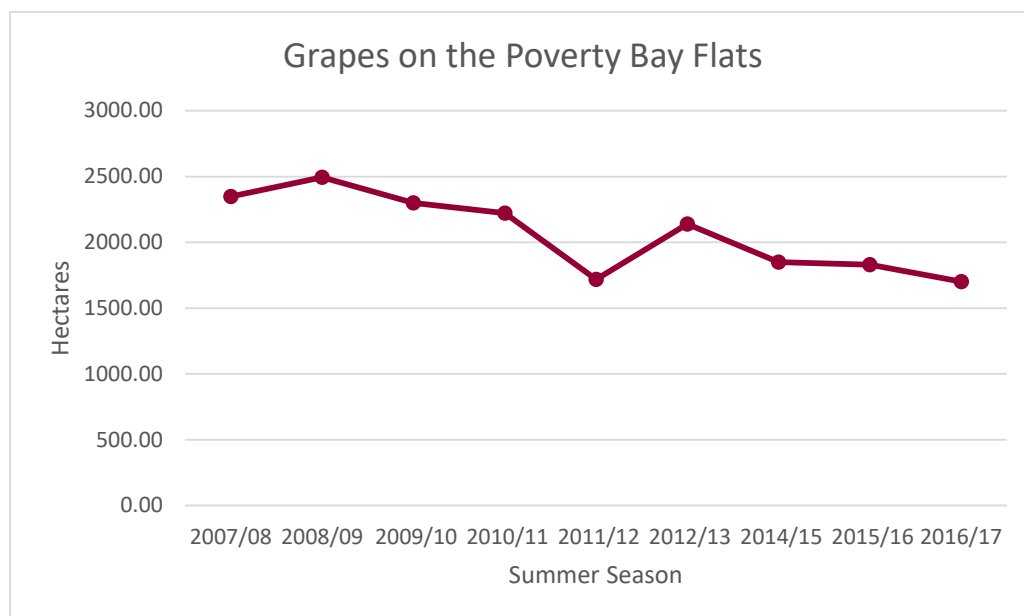


Figure 6: Total hectares of grapes on the Poverty Bay Flats arable land 2007/08 – 2016/17.

4.1.4 Squash

Squash covered 1480.26 ha of the Poverty Bay Flats making it the fourth most common crop on the Poverty Bay Flats in the 2016/2017 season. As demonstrated by figure 7 the area of the Poverty Bay Flats planted in squash varies from season to season, although it generally seems to be decreasing. A large area of squash, 555.01ha was grown outside the Poverty Bay Flats, a decrease from 692.68 ha from last season.

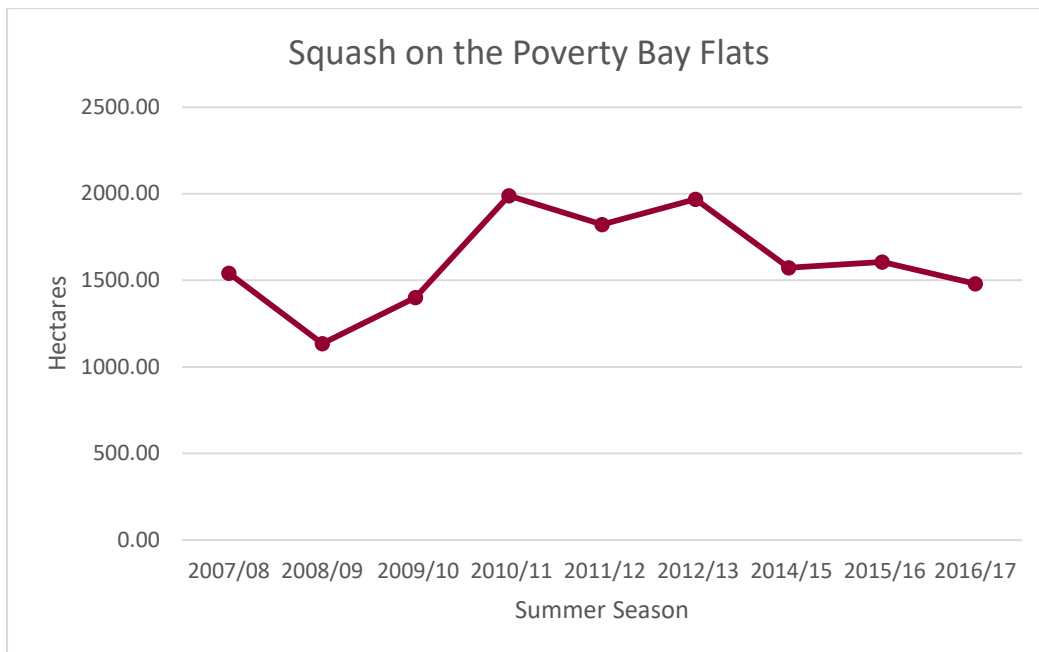


Figure 7: Total hectares of squash grown on the Poverty Bay Flats arable land 2007/08 – 2016/17.

4.1.5 Citrus

Citrus occupies 1471.59 hectares of the Poverty Bay Flats, and 1513.77 hectares of the total Gisborne region's arable land. As demonstrated in Figure 8, the area planted in citrus in the Poverty Bay Flats steadily increased from 2007/08, peaking in 2012/13 at 1530ha and then declining to the current figure. Although citrus on the Poverty Bay Flats has decreased in the past three seasons the amount of citrus in the wider Gisborne region has increased from 2.19 ha in 2014/15 to 42.18 ha in 2016/17.

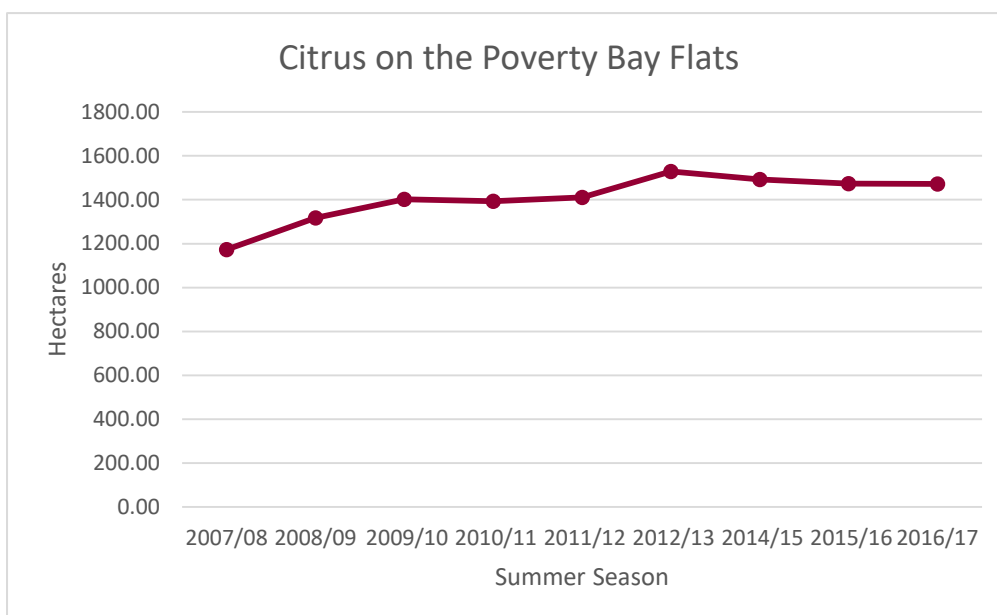


Figure 8: Total hectares of citrus grown on the Poverty Bay Flats arable land 2007/08 – 2016/17.

4.1.6 Kiwifruit

Kiwifruit currently occupies 433.50 ha of the Poverty Bay Flats. This has shown a decrease from 501.85 ha that was recorded in 2015/16. This observation is most likely due to a mixture of both kiwifruit removal and misidentification of kiwifruit in previous crop surveys as we corrected multiple kiwifruit orchards that were wrongly identified. The total amount of kiwifruit recorded outside of the Poverty Bay Flats was 2.74 ha which has remained the same since the previous survey. Kiwifruit is discussed in greater detail in the section 5.0.

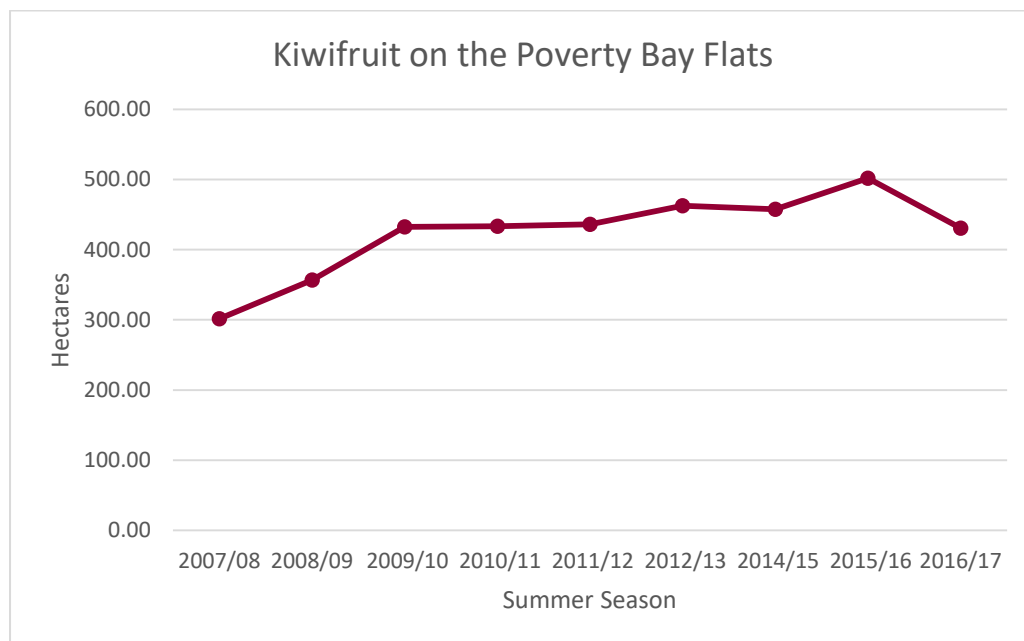


Figure 9: Total hectares of kiwifruit grown on the Poverty Bay Flats arable land 2007/08 – 2016/17.

4.1.7 Pip and Stone-fruit

Pip and stone fruit varieties on the Poverty Bay Flats include: apples/pears, tamarillos, avocados, stone-fruit, persimmon and pomegranate. Combined these crops occupy 466.55 ha of the Poverty Bay Flats, which has increased from the 2015/16 total of 357.78 ha. The trend of total pip and stone-fruit on the Poverty Bay Flats is shown in figure 10.

Among the pip and stone fruit found on the Poverty Bay Flats, apples and pears remain the largest contributor with a total of 242.46 ha, this figure mainly consists of apples rather than pears. Apples and pears has increased by a total of 56.35 ha since the last survey. The varieties of pip and stone fruit found on the Poverty Bay Flats and their respective areas are shown in figure 11. Persimmon covers the second highest area of the pip and stone fruit crops. Persimmons had a total area of 105.68 ha, a significant increase from 29.67 ha from the previous survey, which is most likely due to incorrect crop identification in previous surveys rather than an increase in persimmons growing in the region. Avocados have shown a slight increase from 51.54 ha in 2015/16 to 57.15 ha. The presence of avocados has remained fairly constant with the exception of a slight peak in 2012/13.

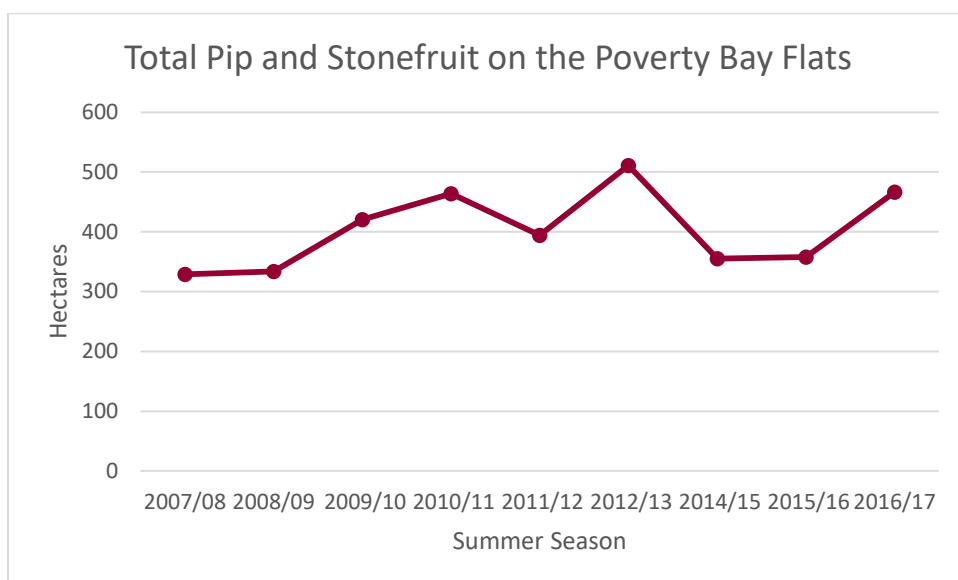


Figure 10: Total pip & stonefruit grown on the Poverty Bay Flats 2007/08 – 2016/17.

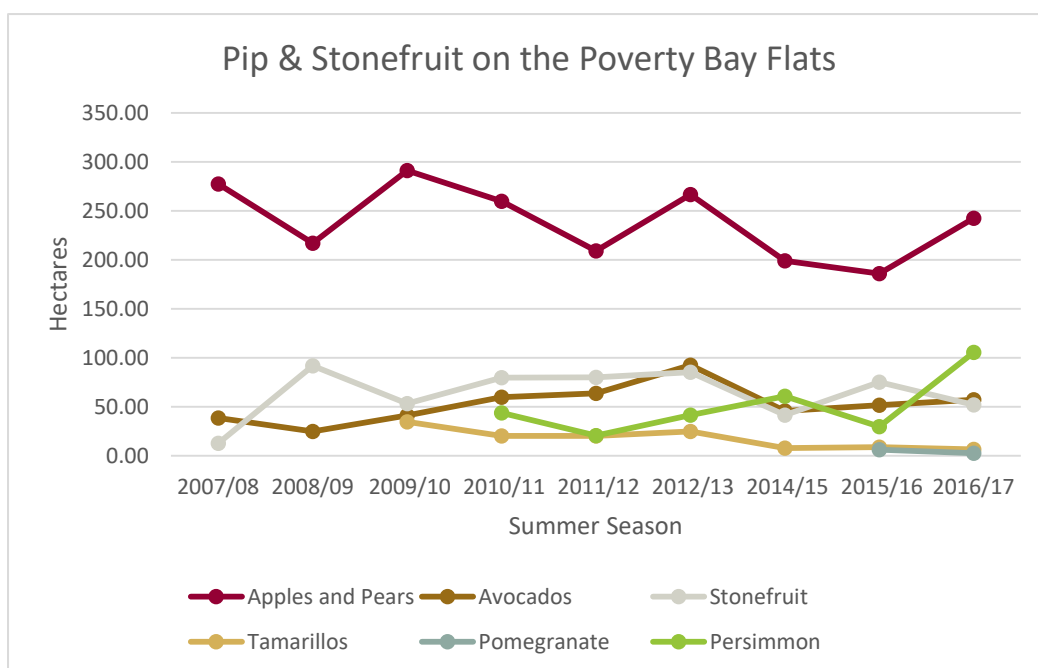


Figure 11: Pip & stonefruit grown on the Poverty Bay Flats 2007/08 – 2016/17.

Stone fruit, tamarillos and pomegranate have all exhibited a decrease in area from the last crop survey. Stone fruit has shown the largest decrease from 72.21 ha to 51.87 ha. This decrease could also be also be partially attributed to crop identification. Tamarillos decreased from 8.94 ha to 6.69 ha and has seen an overall decline since 2007/08. Pomegranates also declined from 6.31 ha to 2.69 ha, this decrease is due to a recording issue with the previous survey. It is therefore likely that there was no change in pomegranates. This is only the second year Pomegranate has been found in the crop survey. No pip or stone fruit was found outside of the Poverty Bay Flats.

4.1.8 Tomatoes

The area of tomatoes on the Poverty Bay Flats continues to fluctuate (Figure 12). The 2016/17 summer crop survey recorded a total of 207.16 ha. Tomatoes have been in overall decline since 2011/12, however this survey has recorded a slight increase from the previous season. Although tomatoes have seen a significant decrease in production since the beginning of the crop survey they still remain one of the most common crops on the Poverty Bay Flats. Tomato growth on the Poverty Bay Flats is shown in figure 12 below. No tomatoes were found outside of the Poverty Bay Flats.

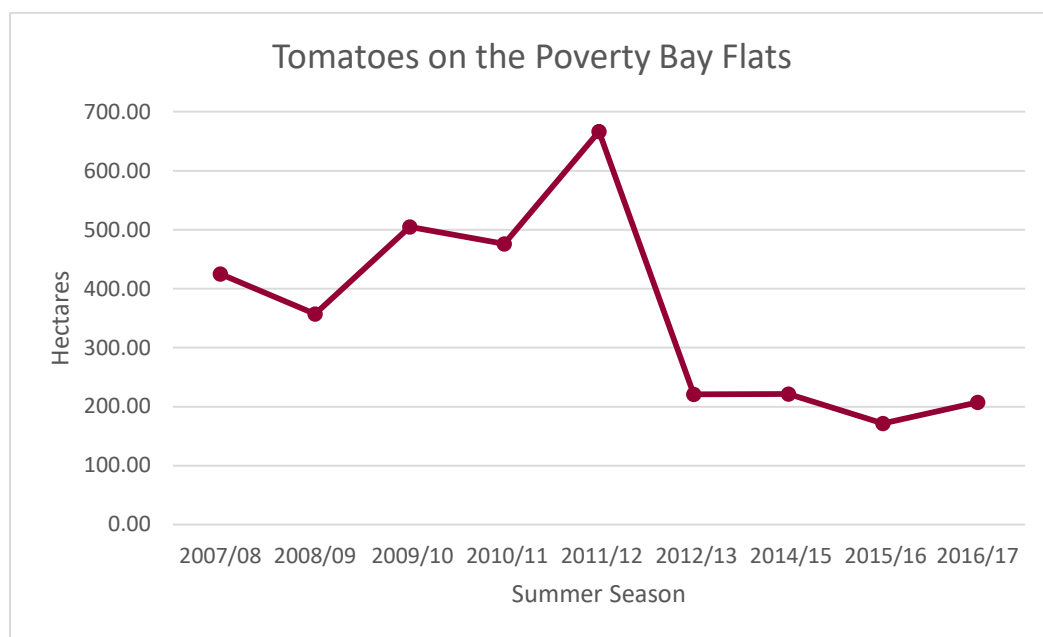


Figure 12: Total hectares of tomatoes grown in the Poverty Bay Flats 2007/08 – 2016/17.

4.1.9 Fodder Crops

Fodder crops included in the survey are:

- Chicory
- Clover
- Fodder Beet
- Forage Rape
- Kale
- Leafy Turnip
- Lucerne
- Plantain
- Plantain/Chicory
- Plantain/Clover

The presence of fodder crops on the Poverty Bay Flats has increased significantly since 2011/12 (see figure 13). This year's survey reported a total of 488.51 hectares of fodder crops within the Poverty Bay Flats, this has increased from 473.42 hectares during 2015/16. Along with the area, the range of fodder crops found in the Poverty Bay Flats has also increased, as shown in figure 11. The most common fodder crops on the Poverty Bay Flats were Lucerne and plantain. Lucerne covered the largest area of the fodder crops with a total area of 164.84 ha. Plantain, when all plantain varieties (i.e. plantain/chicory and plantain/clover) are accounted for contribute a total of 145.08 ha within the Poverty Bay Flats. This season along with the 2015/16 season seem to exhibit the highest variation between fodder crop types as they have the highest amount of fodder crop types present.

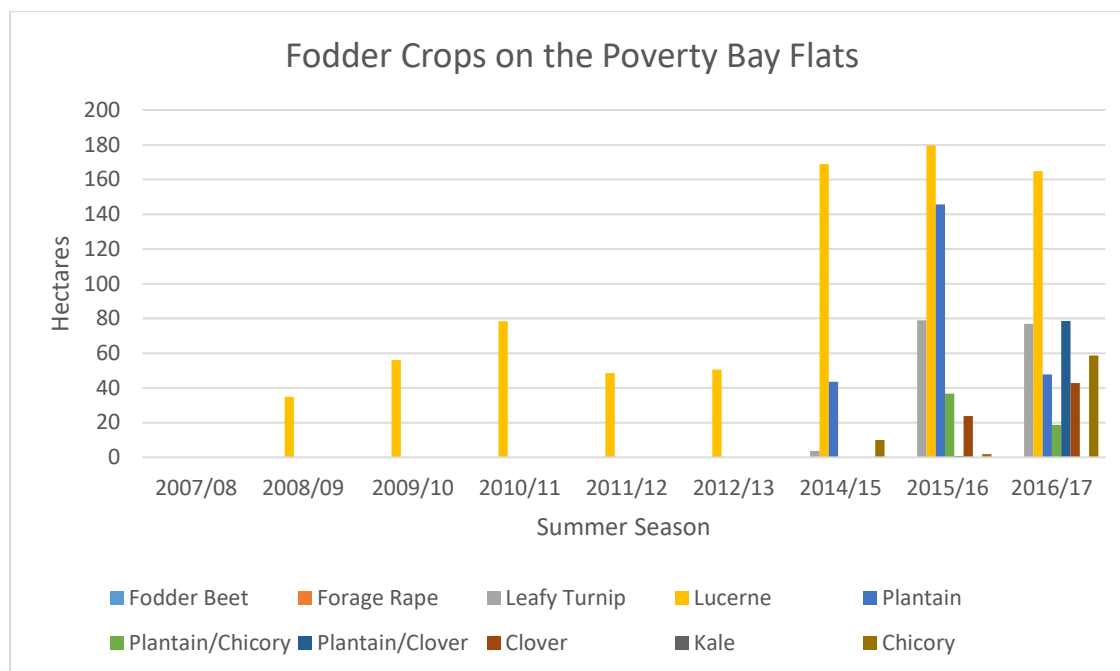


Figure 13: Total hectares of fodder crops grown on the Poverty Bay Flats 2007/08 – 2016/17.

Other than Lucerne and plantain, leafy turnip and chicory were common among fodder crops on the Poverty Bay Flats. Swedes and Oats were not recorded this year, both on the Poverty Bay Flats and outside of the Poverty Bay Flats. Fodder beet, forage rape, and kale were not recorded on the Poverty Bay Flats but were found in the wider Gisborne region. Figure 14 compares the fodder crops in and outside of the Poverty Bay Flats. Generally, fodder crops were found in higher amounts outside of the flats with the exception of Lucerne, Plantain/Chicory, Plantain/Clover and Clover. Lucerne was found in much higher amounts in the Poverty Bay Flats compared to the remaining Gisborne region, while leafy turnip was found in much higher amounts outside of the Poverty Bay Flats.

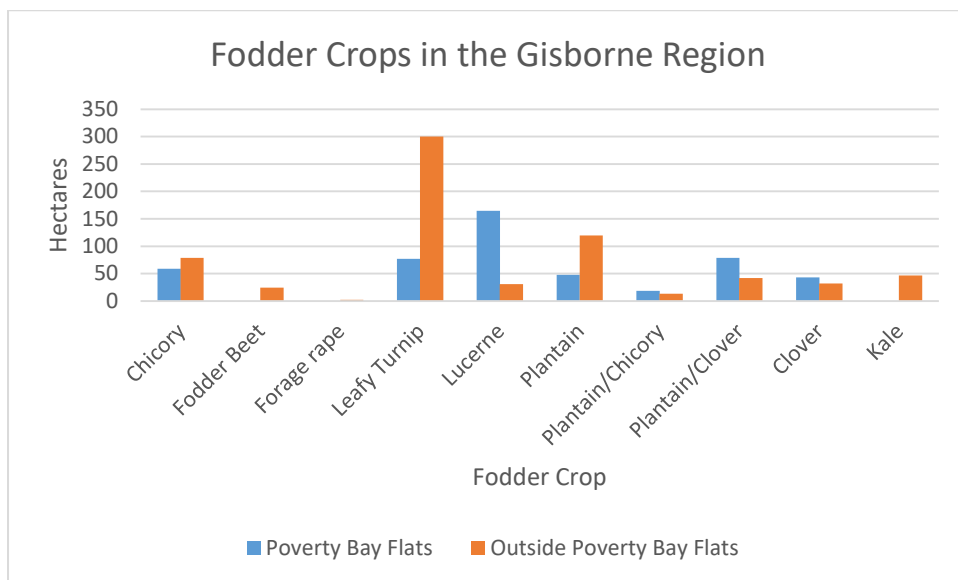


Figure 14: Fodder crops grown on the Poverty Bay Flats vs Outside the Poverty Bay Flats.

4.1.10 Minor Crops

Minor crops include melons, strawberries, olives, feijoas and plant nurseries. As demonstrated by Figure 15, minor crops have generally fluctuated throughout past seasons. Melons generally have the largest proportion of minor crops but fluctuates heavily between seasons. Melons have increased from last season to 79.95 ha, this is a large increase from 34.56 ha in 2015/16. Feijoas have the second largest proportion of minor crops. Feijoas have shown less fluctuation than melons as they exhibit an overall increasing trend. Since feijoas have been recorded in the summer crop survey in 2014/15, the amount of feijoas has increased from 16.73 ha to 44.68 ha. The 2016/17 summer crop survey is the first survey that has recorded feijoas outside of the Poverty Bay Flats. 7.44 ha of feijoas were recorded in a new orchard in the East/Tolaga/Tokomaru region, making the total feijoa area for the Gisborne Region 52.12 ha.

Olives have also shown an increase since they were first recorded in 2014/15. This year's survey recorded a total of 4.95 ha of olives in the Poverty Bay Flats. Olives were also recorded in the East/Tolaga/Tokomaru and East Cape/Ruatoria regions, increasing the Gisborne Region total to 7.33 ha. Strawberries have shown fluctuation throughout the years however since 2012/13 they have been in decline. Only 1.6 ha of strawberries were recorded on the Poverty Bay Flats. As there were no strawberries recorded outside of the Poverty Bay Flats this figure is also equal to the total for the Gisborne region.

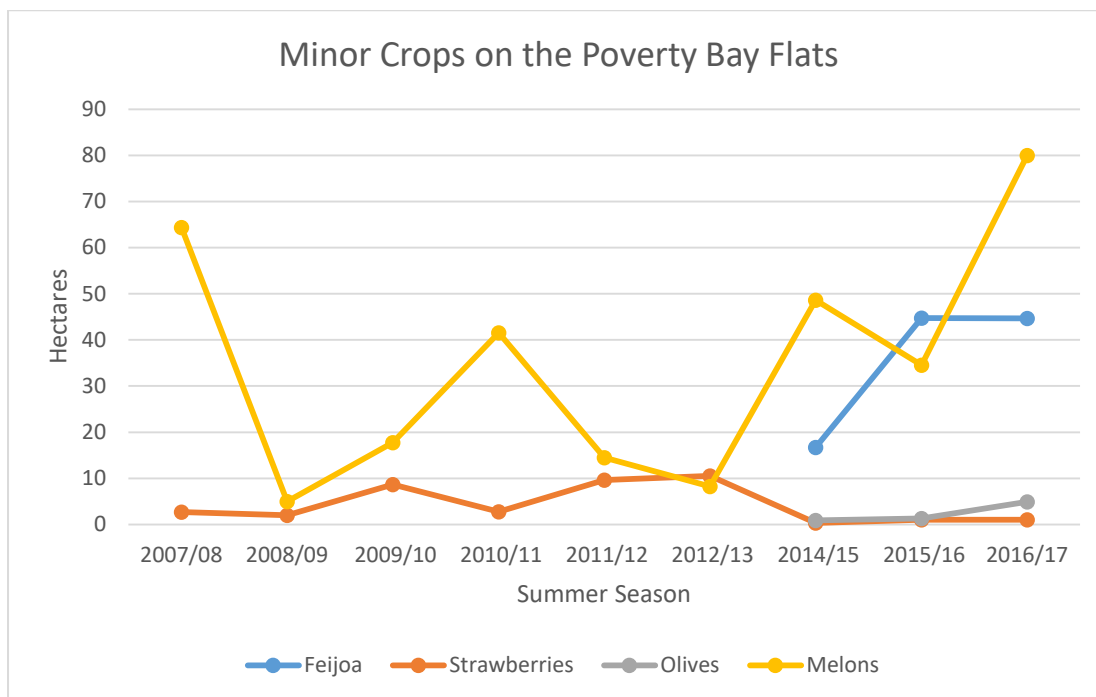


Figure 15: Total hectares of minor crops grown on the Poverty Bay Flats 2007/08 – 2016/17.

Information on plant nurseries is shown in figure 16. Pine nurseries had the highest area of 40.20 ha which has increased from 27.22 ha in 2015/16. Both grape and poplar/willow nurseries have decreased. Grape nursery decreased from 32.50 ha to 22.39 ha between 2015/16 and 2016/17 while poplar/willow nursery decreased from 12.01 ha to 0.64 ha. This is due to the change in Poverty Bay Flats boundary as the total recorded poplar/willow nursery area for the Gisborne region remains 12.01 ha. Majority of the poplar/willow nurseries were found in Tiniroto.

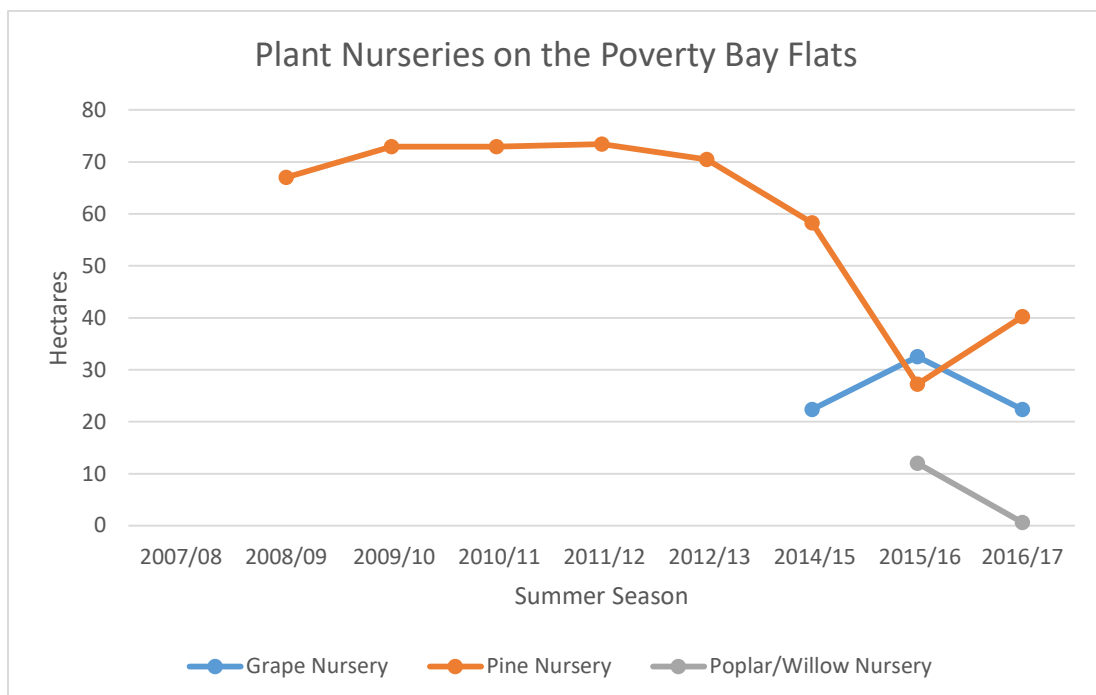


Figure 16: Total hectares of plant nurseries grown on the Poverty Bay Flats 2007/08 – 2016/17.

4.1.11 Processing Vegetables

Processing vegetables include cauliflower, broccoli, lettuce, cabbage, onions, peas, beans, and courgettes. The processing vegetables recorded in the 2016/17 crop survey are shown in figure 17. At the time of the 2016/17 crop survey the total amount of processing vegetables observed was 154.24 ha. A significant portion of this figure was represented by lettuce and cabbage which had a total area of 119.79 ha. This figure is extremely close the total lettuce/cabbage recorded for the 2015/16 survey, which was 119.20 ha. Cauliflower and broccoli covered the second highest area of 32.73 ha which had decreased from 62.3 ha from 2015/16. Courgettes and onions had a significantly lower presence on the Poverty Bay Flats. Courgettes covered an area of 1.39 ha and onions had an area of 0.33 ha. Courgettes had a similar figure to the previous survey while onions were not present during the 2015/16 survey.

No peas or beans were recorded in the survey. Peas and beans are generally harvested prior to the crop survey so they are usually not recorded in the survey. Cedenco grows a large proportion of peas in the Gisborne area and has advised that 406 ha of peas were grown in Gisborne during the 2016/17 summer season. This figure is very similar to the area Cedenco planted during the previous survey. Other processing vegetables such as potatoes or pumpkins were not recorded within the Poverty Bay Flats, these crops are generally not present during the crop survey or are found in very low quantities. No processing vegetables were found outside of the Poverty Bay Flats.

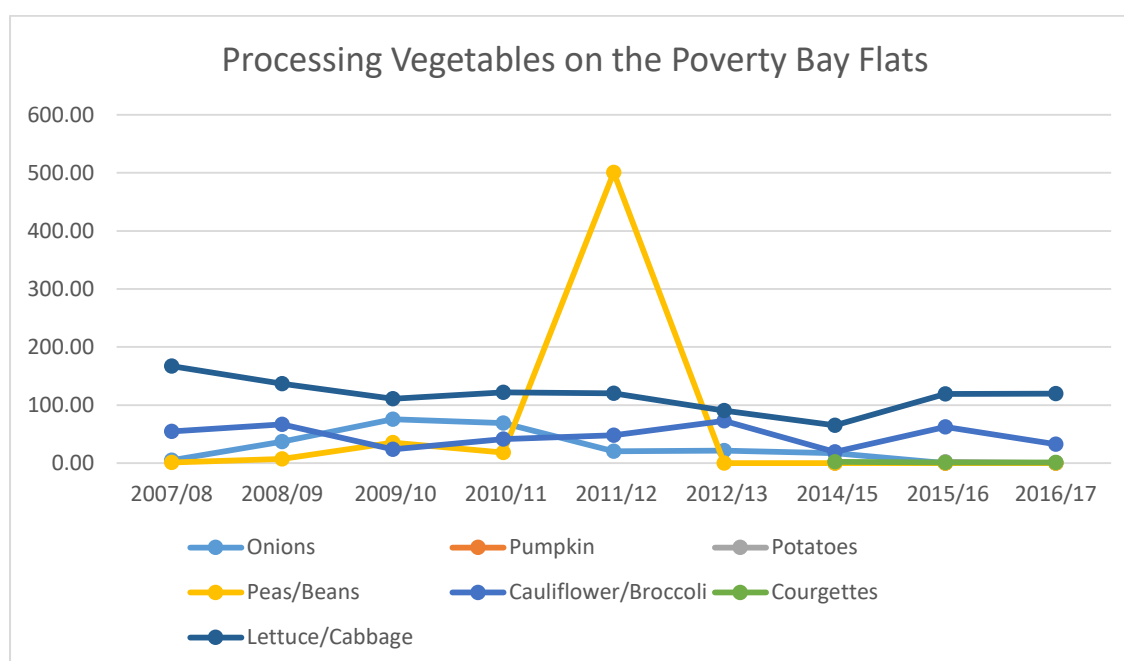


Figure 17: Total hectares of processing vegetables grown on the Poverty Bay Flats 2007/08 – 2016/17.

4.1.12 Other Crops

The total of 'other' recorded crops for the entire Gisborne region was 146.81 ha. Majority of the 'other' crops were unknown crops that were difficult to identify. Most crops were difficult to identify due to visibility issues, usually caused by being too far away to correctly identify the crop. Visibility issues were also caused by visual impairments such as shelter belts. Crops were sometimes difficult to identify because the plants were too small. In both cases, photos were taken to try identify the crop by enlarging the photo or comparing to other crops. In some cases this method was efficient in identifying crops which were then rectified. The unknown crops that remain in the 'other' crops are the crops that could not be identified using photos. Fodder crops that were difficult to identify were also included in the 'other' section. Fodder crops can look very similar making it difficult to identify with confidence. Fodder crops that we could not identify with confidence, along with fodder crops that were too far away to see were included in the 'other' crops. Minor crops such as berries and wheat were also included in the 'other' section. A research crop with multiple plant types was also included in the 'other' section as it was too difficult to identify the multiple plants in the small section. Table 1 below lists the crop type and corresponding areas.

Other crops were found on the Poverty Bay Flats, East/Tolaga/Tokomaru, East Cape/Ruatoria and Motu/Matawai. Figure 18 shows the number of 'other' crop sites in each location. Poverty Bay Flats had the highest number of sites of 'other' crops and highest area. East Cape/Ruatoria and Motu/Matawai both had one site but East Cape/Ruatoria had the lowest area.

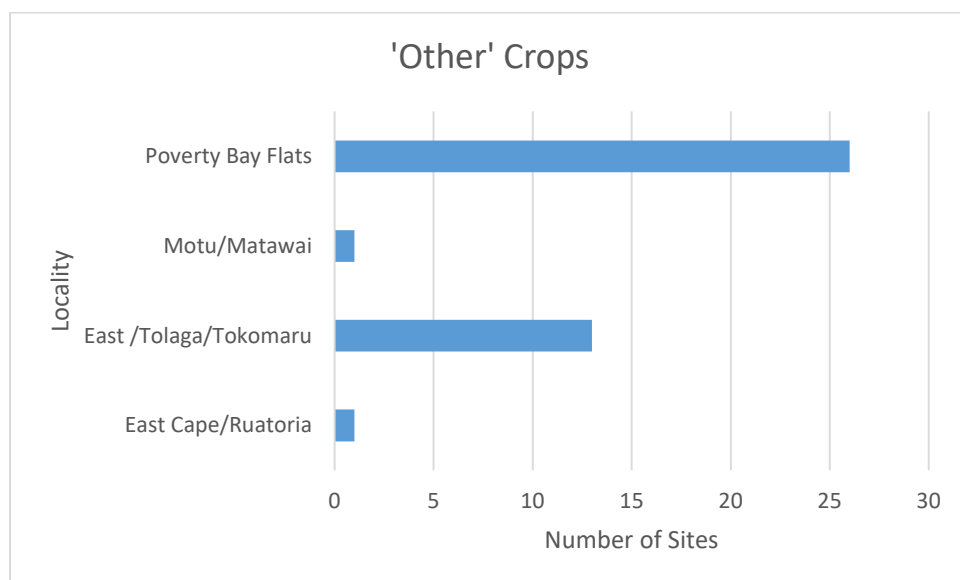


Figure 18: 'Other' crops for the Gisborne Region 2016/17.

Table 1: 'Other' crops for the Gisborne Region 2016/17.

Crop Type	Area (ha)
Fodder	55.70
Berries	0.08
Wheat	2.81
Unknown	88.14
Research Crop	0.09

4.1.13 Gisborne Region

The wider Gisborne region has been included in the summer crop survey since the 2014/15 summer season. This section refers to trends observed over the entire region since the survey of the wider Gisborne region began. A total of 23,948.87 hectares was surveyed in the Gisborne region in 2016/17. This figure is similar to the 2015/16 and 2014/15 seasons which had 23,669.50 ha and 23,832.90 ha respectively.

The graph below (Figure 23) shows the changes from the 2014/15 season to the 2016/17 season of the most common crop types grown in the Gisborne Region. These major crop types in the Gisborne Region are:

- Pasture/Unused
- Maize/Sweetcorn
- Squash
- Grapes
- Citrus
- Kiwifruit
- Leafy Turnip

Pasture/unused has remained the most major crop type within the Gisborne region. The 2016/17 survey has recorded the highest area in pasture/unused since the survey of the wider Gisborne region began. Maize and sweetcorn has been the second most major crop type recorded in the Gisborne region since 2014/15. Maize and sweetcorn has declined every year since the 2014/15 summer crop survey. In 2014/15, the total maize/sweetcorn recorded in the Gisborne region was 7564.25 ha, which declined to 6262.90 ha in 2016/17. Although maize/sweetcorn has declined in the past three surveys it still covers a significantly larger area than most other major crop types.

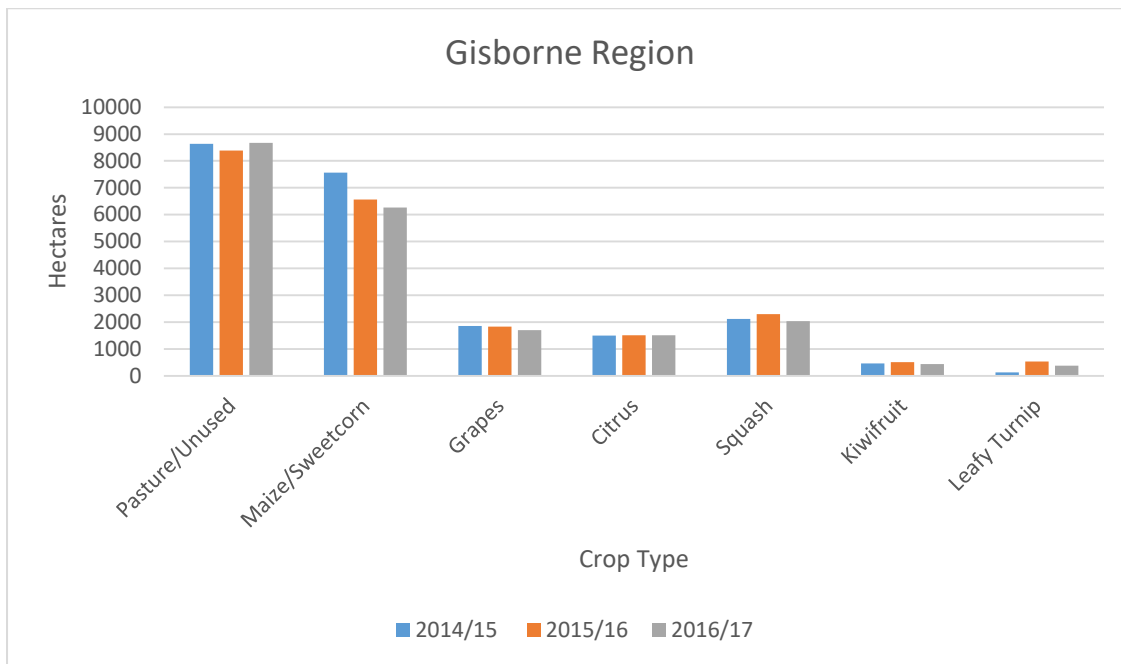


Figure 19: Total hectares of common crops in the Gisborne Region 2014/15 to 2016/17.

Squash is the third most major crop type recorded from the Gisborne region. Squash in the Gisborne region peaked in 2015/16 with a total of 2299.18 ha but has declined to 20135.27 ha in 2016/17. This is the lowest recorded value for squash in the Gisborne region since 2014/15.

Grapes are the fourth most major crop type in the Gisborne region. Grapes have declined each year from 2014/15 to 2016/17. The total area of grapes for the Gisborne region has declined from 1851.06 ha to 1704.87 ha between 2014/15 and 2016/17. The decline in grapes has predominately occurred within the Poverty Bay Flats while grapes found in the wider Gisborne region has shown a slight increase from 0.55 ha in 2015/16 to 2.48 ha in ha.

Citrus is the fifth most common crop type in the Gisborne region. Most of the region's citrus is grown within the Poverty Bay Flats. Citrus on the Poverty Bay Flats has shown a slight decrease since 2014/15 however it has been relatively steady in the last two seasons. Although citrus on the Poverty Bay Flats has decreased, the recorded citrus for the Gisborne region has shown a slight increase. This is due to an increase of citrus outside of the Poverty Bay Flats. Citrus outside of the Poverty Bay Flats experienced a large increase between 2014/15 and 2015/16, from 2.19 ha to 40.62 ha. Citrus outside of the Poverty Bay Flats further increased during 2016/17 to 42.18 ha. Although citrus increased outside of the Poverty Bay Flats this year the overall citrus has declined showing that citrus is now declining more in the Poverty Bay Flats than it is increasing outside of the flats.

Kiwifruit is the sixth most common crop in the Gisborne region. Kiwifruit has shown a long term increasing trend since the crop survey began on the Poverty Bay Flats in the 2007/08 summer season. Kiwifruit in the Poverty Bay Flats has shown a decline between 2015/16 and 2016/17, this decline is discussed further in section 5. The total area of kiwifruit in the Gisborne

Region is 433.50 ha. 2.74 ha of kiwifruit is grown outside of the Poverty Bay Flats which has remained the same from 2016/17.

4.2.0 Location

The area surveyed outside the Poverty Bay Flats was 6,091.35 ha which was categorised into four areas:

- East Cape/Ruatoria
- East/Tolaga/Tokomaru
- Motu/Matwai
- Tiniroto

These areas are discussed in greater detail in sections below.

4.2.1 East Cape/Ruatoria

The total surveyed area for the East Cape/Ruatoria region was 2414.74 ha. The crop types found in this region are shown in figure 19. The major crop type found in this region was pasture/unused. Pasture/unused was significantly larger than any other crop type found in this region with a total of 1799.83 ha. Maize/sweetcorn was the second most abundant crop found in this region with a total of 275.09 ha. Baleage was the third highest recorded crop type at 106.99 ha. The remaining crops found in the East Cape/Ruatoria region were predominately fodder crops. Leafy turnip was the most abundant with 62.13 ha and Plantain/Chicory was the least abundant with 1.70 ha. The remaining crops in figure 19 were found in much lower quantities.

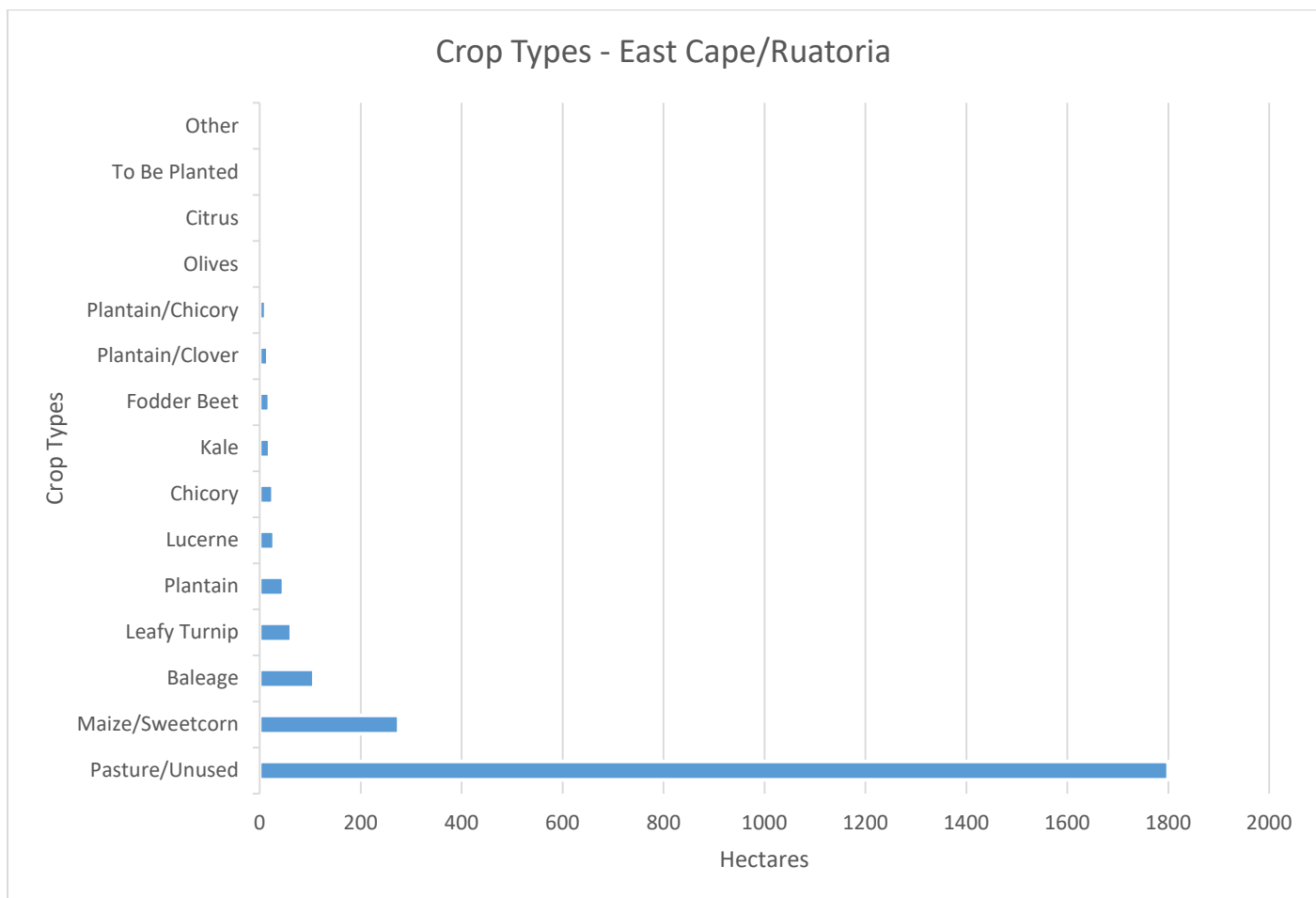


Figure 20: Crops for the East Cape/Ruatoria Region 2016/17.

4.2.2 East/Tolaga/Tokomaru

The totalled surveyed area for the East/Tolaga/Tokomaru region was 2690.10 ha. The crop types found in this region are shown in figure 20. Maize/Sweetcorn was significantly higher than the remaining crop types, covering a total of 1217.40 ha. Pasture covered the second highest area of 623.47 ha followed by squash with 555.01 ha. Fodder crops were also common in this area, although they were found in much lower quantities compared to maize/sweetcorn and squash. Chicory, leafy turnip and Plantain were the most common fodder crops in the area which were found in similar areas. Other fodder crops were also found but at significantly lower proportions. Other crops found in even smaller proportions were olives, pinenuts, grapes, kiwifruit, baleage, feijoa, to be planted, citrus and other. In this area the 'other' crops were predominantly fodder crops that were too far away to be identified with confidence.

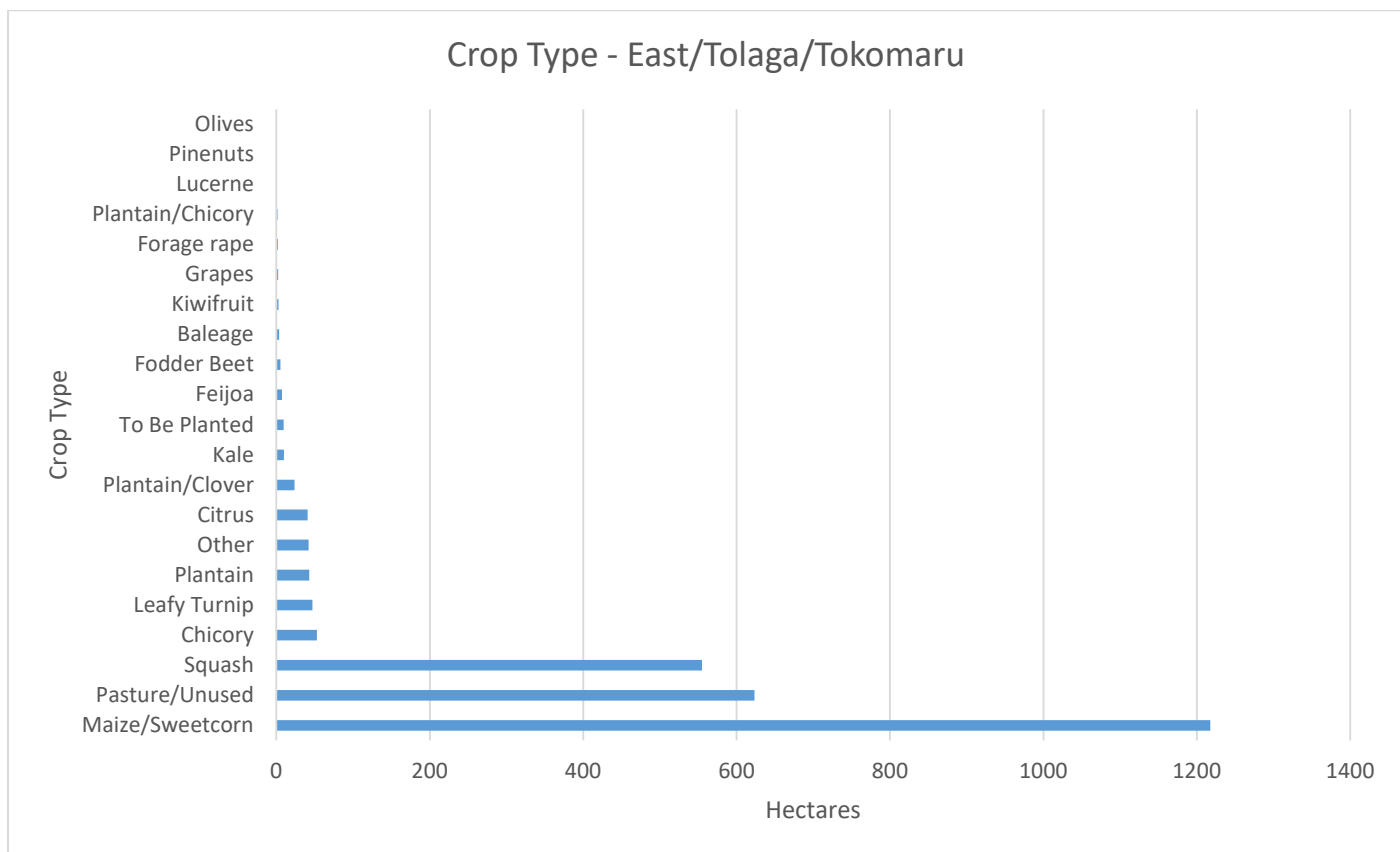


Figure 21: Crops for the East/Tolaga/Tokomaru Region 2016/17.

4.2.3 Motu/Matawai

The totalled surveyed area for Motu/Matawai was 865.337 ha. The crop types found in this region are shown in figure 21. Motu/Matawai had a much lower range in crop types that were found compared to the regions discussed above. The largest crop type was Pasture/Unused with 656.88 ha. The remaining crop types were predominately fodder crops. Leafy turnip had the highest area of 178.49 ha, this was the highest recorded value of leafy turnip out of all the areas surveyed. Other fodder crops found in this area were plantain (5.09 ha), plantain/clover (2.39 ha) and Lucerne (1.66 ha). Other crops found were baleage, to be planted and other.

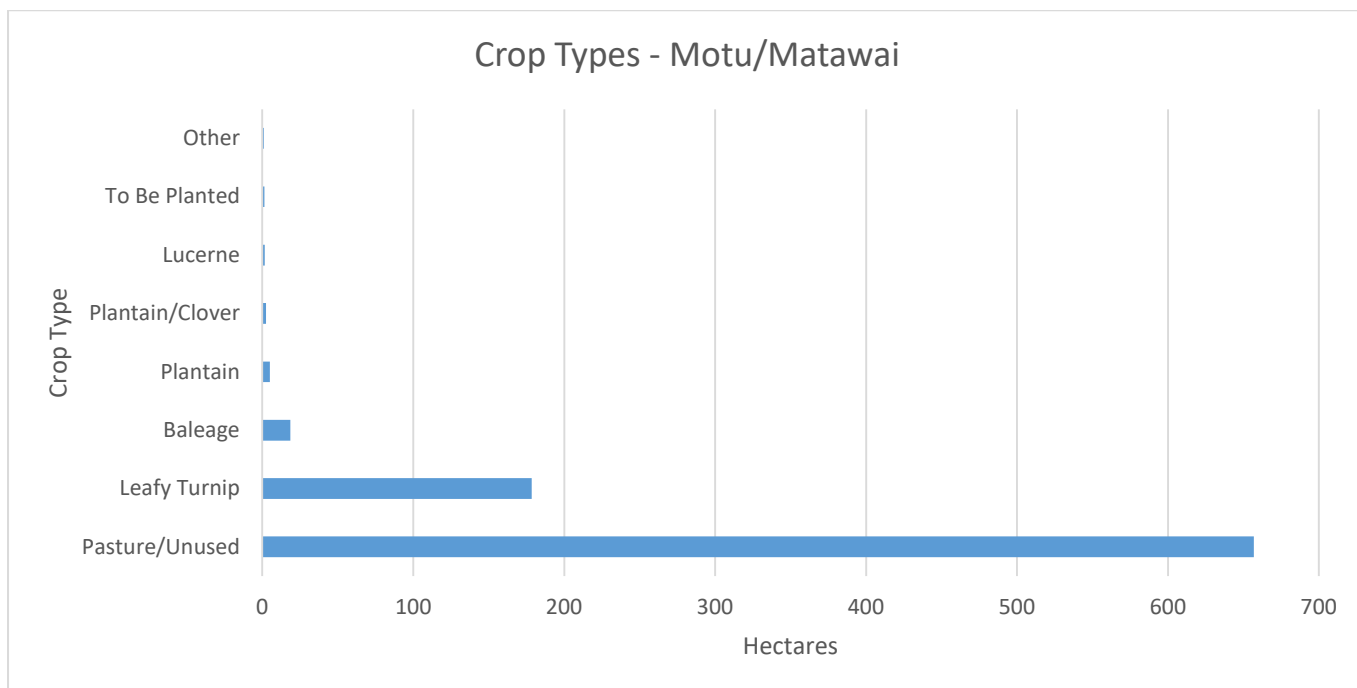


Figure 22: Crops for the Motu/Matawai Region 2016/17.

4.2.4 Tiniroto

The total surveyed area for this region was 118.18 ha. This was the smallest surveyed area in the 2016/17 summer crop survey. The crop types found in this region are shown in figure 22. Crops found in this area were mostly fodder crops. The major crop type was clover with 31.88 ha. Plantain was the second major crop type with 25.08 ha. Other fodder crops included kale with 16.71 ha and leafy turnip with 12.77 ha. Other crop types found in this area were baleage, poplar/willow nursery and to be planted. Please note that pasture/unused was not recorded for this area.

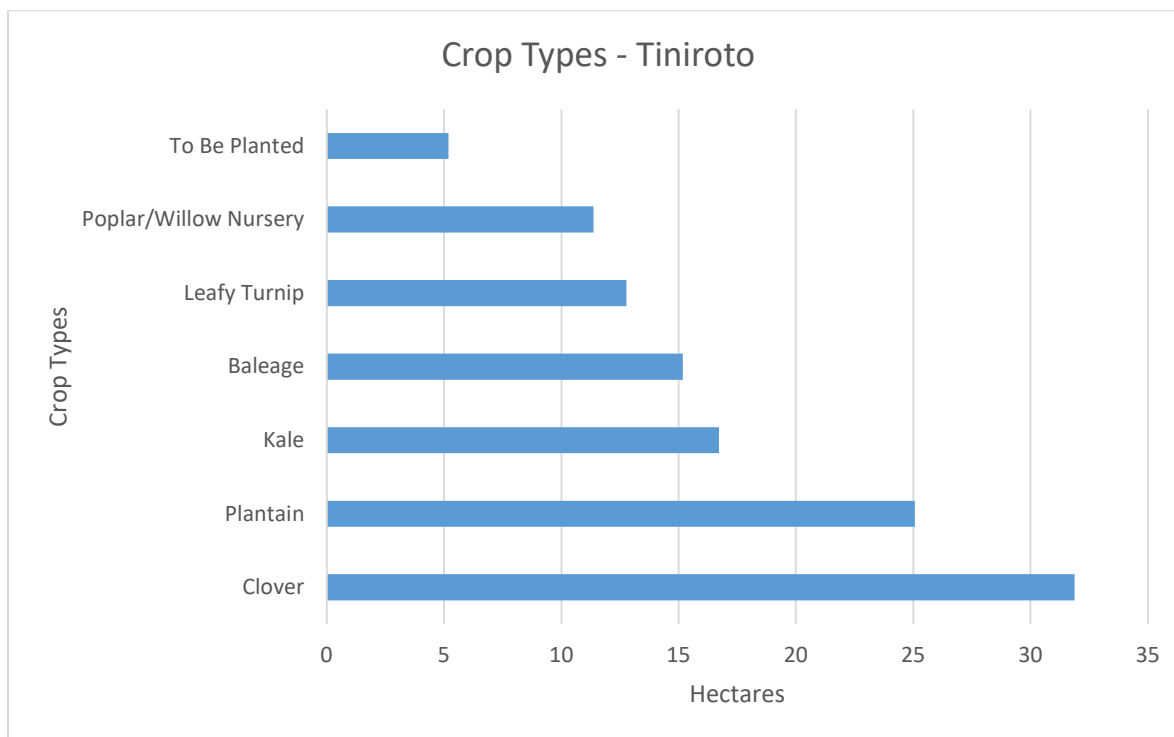


Figure 22: Crops for the Tiniroto Region 2016/17.

5.0 Discussion

5.1 Survey Method

As stated in section 3.0, this was the first year that the crop survey was done using a different data collection method. Traditionally, the crop survey is completed by systematically driving through the region and manually recording crops onto aerial maps. This information was then digitised using ArcMap to visualise and to calculate the area of the crops. This year crops were recorded using a hand held tablet rather than recording on aerial maps. The software used to collect the crop data was Arc Collector. Using Arc Collector we were able to edit the GIS layer from the previous crop survey. Editing the previous layer allowed the survey to be completed a lot faster as most crops remained the same as the previous year. If the crop type had changed but the paddock shape remained the same, we could easily change the crop type without drawing in a new paddock every time. This method also reduced the time of the survey as the digitising was done in the field so no further work needed to be completed after the survey.

The summer crop survey is generally conducted in the beginning January. Prior to 2014/15 the survey was conducted anywhere from late December to mid-January. The time of the summer crop survey significantly impacts the results, as the survey only supplies a 'snapshot' of what crops are present during the time of the survey. As most crops have different harvesting times it is difficult to include all crops grown throughout the summer, for example peas/beans are harvested before Christmas and are generally left out of the survey. As it is not possible to include all crops due to differing harvest periods, it is essential to keep the survey dates consistent to get a more conclusive result. Early January is a desirable time to

complete the survey as this is generally the start of the irrigation season when crop growth is high and water resources are likely to become vulnerable to over allocation due to climatic factors.

The 2016/17 crop survey was completed from the 11th-25th of January, this was equal to 11 working days. As digitisation is completed in the field this survey was significantly quicker than digitising after the survey is completed. Digitising the crop survey information from aerial maps can take a significant time, ranging from 2-3 weeks. The 2016/17 crop survey could have been completed quicker using Arc Collector however two days of work had to be repeated due to loss of data. These problems have been resolved, so next year this should not be a problem.

5.1.2 Digitising

Digitising has a large impact on the accuracy of the crop survey. The scale at which digitising occurs can significantly alter the area information of the recorded crops. Using a smaller scale allows a detailed description of crop boundaries, by increasing the view of the paddocks and removing features such as patches of bush, houses, sheds, shelter belts, river edges, and other obstructions. This is crucial in keeping the areas reported in the crop survey as accurate as possible.

This was the first year that digitising was completed in the field. The survey was conducted using the software Arc Collector on a hand held tablet which allowed digitising in the field. From 2014/15, data collection has been undertaken on paper aerial maps with a scale of 1:8,000 which gave a detailed description of crop boundaries. Prior to this the surveys were completed at much larger scales, significantly decreasing the accuracy of crop boundaries. Using Arc Collector we were able to zoom in much further to the desired level where accurate crop boundaries could be drawn with confidence.

5.2 Crop Survey Area

As previously stated, the 2016/17 summer crop survey is the third survey to extend the Poverty Bay Flats collecting data throughout the entire Gisborne Region. The survey area is outlined in figure 2 in section 2. The extended area ensures that arable land around the Gisborne region is accounted for, providing Council with greater detail relating to the management of crops.

As there is data from multiple crop surveys of the Poverty Bay Flats alone, it is necessary to distinguish between the data taken from the Poverty Bay Flats and the whole Gisborne region. The Poverty Bay Flats provides a significant portion of the region's crops so it is important to keep monitoring the trends in crop growth for this area.

To keep trends as accurate as possible, the Poverty Bay Flats needs a recognisable boundary. This boundary needs to remain consistent throughout all future surveys. As stated in section 2 the previous survey adopted the Turanga Ecological Unit as a boundary for the Poverty Bay Flats. For this survey, a more precise boundary was developed, which is shown

in figure 4. This boundary was developed in hopes of reducing the fluctuation in the survey area of the Poverty Bay Flats. The highest fluctuations in the Poverty Bay Flats survey area occurred from 2007/08 to 2012/13. This fluctuation is believed to be a result of the scale of data collection and lower digitising accuracy associated with these surveys which is discussed in previous reports, and in the section below. Since the data collection has occurred at smaller scales, the fluctuation in survey area of the Poverty Bay Flats has significantly decreased however it is not constant, suggesting that all arable land may not be included in the survey. This is most likely due to visual impediments and inconsistent recording of pasture/unused land. Due to time pressures with the survey pasture/unused land was sometimes left out, however we now have the software to complete the survey quickly so in future all arable land should be included. To gain a better insight into the land use of arable land of the Poverty Flats, all arable land must be recorded.

5.3 Crop Trends and Characteristics

Although the survey area for both the Poverty Bay Flats and the Gisborne region have increased, there seems to be a decrease in the major crops grown in these places. Trends in permanent crops as well as frequently rotated seasonal crops are discussed below. To avoid repetition of the 'Arable Land Use in the Gisborne District 2007-2015' Report (Gisborne District Council, 2015), trends from the last three years will mainly be discussed.

5.3.1 Major Permanent Crops

Major permanent crops that are found within the region are grapes, citrus, and kiwifruit. Other common permanent crops include pip and stone-fruit. Majority of these crops are grown on the Poverty Bay Flats however some crops have been found in areas in the wider Gisborne region. This discussion mainly focuses on the Poverty Bay Flats due to the large quantity of crops grown there.

Grapes account for the largest area of permanent crops on the Poverty Bay Flats. Gisborne is a prominent wine producing region in New Zealand. For many years Gisborne has been the third largest wine producing region in New Zealand, following Marlborough and Hawke's Bay. Wine production in Gisborne significantly decreased in 2011/12, this was the first year grapes were recorded below 2,000 hectares. Since then wine production in Gisborne has significantly decreased, and according to New Zealand Winegrowers Annual Report (2016) Gisborne is now the fourth largest producing region, now followed by Central Otago.

This survey revealed that there was a total of 1702.41 ha of grapes occupying the Poverty Bay Flats, this is the lowest recorded value since the crop survey began in 2007/08. The decline in grapes was the lowest between 2014/15 and 2015/16 where there was only a small decrease of 20.64 ha. 2016/17 saw a decrease of 126.76 ha despite seeing new plants during the survey. As the wine export industry continues to grow, the reduction in grapes on the Poverty Bay Flats could be a result in over demand in the local market. According the

New Zealand Winegrowers Annual Report (2016), wine production in both Gisborne and Hawke's Bay have both been in gradual decline since 2012. While these regions have decreased production, all but one of the other wine producing regions have shown long term trends of increased production. As a result of this, the total wine production for New Zealand has also exhibited a long term increasing trend.

Citrus covers the second largest area of permanent crops in the Poverty Bay Flats. Prior to 2014/15 citrus fluctuated between surveys however it is now in gradual decline. Since 2014/15, citrus on the Poverty Bay Flats has decreased by 20.56 ha. Although citrus has increased in the wider Gisborne region, the Gisborne region total citrus has declined. This indicates that citrus on the Poverty Bay Flats is decreasing faster than it is growing out in the wider Gisborne region.

Kiwifruit is the third most common permanent crop in the Poverty Bay Flats. Kiwifruit has increased continuously from 2007/08 to 2015/16. The highest recorded area of kiwifruit was recorded in 2015/16 with 501.85 ha. This year's survey was the first to record a decrease in kiwifruit. This decrease was partially due to the removal of kiwifruit plants. On some occasions the plants had been removed but not the infrastructure, suggesting the possibility of future planting. The remaining decrease however, was largely attributed to kiwifruit being misidentified as persimmons in past surveys. A total of 53.69 ha of persimmons were incorrectly recorded as kiwifruit in the previous survey. The low values of persimmons in previous surveys could suggest that this could have been a recurring problem. Persimmons commonly grow on infrastructure similar to kiwifruit which may have caused confusion in past surveys. This issue was rectified during this survey. This correction resulted in a significant decrease in kiwifruit recorded in the survey along with a significant rise in persimmons. By correcting the recorded value of kiwifruit (from 2015/16 survey), the actual decrease in kiwifruit is 17.40 ha, which is much lower than what is mentioned above.

New kiwifruit infrastructure was also observed and was recorded as 'to be planted', therefore a possible increase in kiwifruit in the future is highly likely. The kiwifruit export market accounts for NZ \$1billion (NZ Trade & Enterprise, 2016), which may explain the increase of kiwifruit since the crop survey began in 2007/08. Kiwifruit is the most water intensive crop in the Gisborne region, so increasing kiwifruit increases the water demand of the area significantly. Establishing new kiwifruit plants also require water which will also increase the water demand in the Poverty Bay Flats.

Apples/pears is the largest contributor to the pip and stone-fruit category. Apples/pears has increased by a total of 56.35 ha since the 2015/16. Although new plants were observed during the survey, the increase is again partially due to correcting incorrect statistics from previous surveys.

Persimmon has shown a significant increase during this year's survey due to issues discussed above. The area of persimmons recorded grew from 29.67 ha in 2015/16 to 105.68 ha, however no young persimmon trees were observed. This highlights the error associated with crop identification. This year recorded the highest persimmon area of all previous crop surveys, the area of 105.68 ha is significantly higher than all previous values. As discussed above, a significant amount of persimmons were incorrectly identified as kiwifruit in the

previous surveys. A total of 21.83 ha of persimmons were recorded as citrus, stone fruit and seasonal crops while 0.48 ha of persimmons were not recorded at all.

It is difficult to say whether persimmons have increased over the past three years or if it is due to a recording issue. Gisborne produces 28% of persimmons grown in New Zealand (NZ Persimmon Industry Council, 2015), so the current figure is much more representative of this statement.

5.3.2 Major Seasonal Crops

Some seasonal crops are frequently rotated between seasons which can create fluctuations of the area occupied by crops each year. Crops that are frequently rotated are, maize/sweetcorn, squash and tomatoes. Fluctuation in these crops is the highest for squash and tomatoes. The past three seasons have shown that there is at least 2000 hectares of squash grown annually in the region. The variation of squash production in the past three seasons has not exceeded 300 ha. Squash is New Zealand's fourth largest horticulture export product and Gisborne supplies about 38% of the total squash exported (NZ Buttercup Squash Industry, 2016). Fluctuations in squash production have been observed in both the Poverty Bay Flats and the wider Gisborne region.

Maize/sweetcorn continues to be the second highest crop type in the Gisborne region. Other than pasture, maize/sweetcorn is significantly higher than the other crop types. Maize/sweetcorn is often rotated, however not to the extent of squash as trends are more identifiable. Maize/sweetcorn production in the past three years has seen a decrease, this is seen both in the Poverty Bay Flats and the wider Gisborne region. The largest decrease in maize/sweetcorn production in the Gisborne region occurred between 2014/15 and 2015/16 where a total decrease of 1,000.04 ha was observed. Significant decrease was observed in both the Poverty Bay Flats and the wider Gisborne region, although most decrease was found throughout the wider Gisborne region. Maize/sweetcorn in the Gisborne region has decreased further by 301.31 ha between 2015/16 and 2016/17. This makes the total decline in maize/sweetcorn for the past three seasons equal to 1301.35 ha.

Tomatoes have fluctuated significantly since the crop survey began. The most fluctuation occurred between 2007/08 to 2011/12. Tomato production then significantly decreased in 2012/13 to 221.60 ha. Production has fluctuated closely around this figure since.

Fodder crops have also increased in the Gisborne region, particularly in areas outside the Poverty Bay Flats. Fodder crops are crops grown for animal consumption. Fodder crops are used for summer and winter feed, and to increase overall productivity of the pastoral system. Fodder crops can supplement pastures and allow quality feed to be available for livestock during shortages, as a drought protection, and when demand for feed is high, such as for finishing lambs. With aerial spraying it is possible to plant fodder crops on land that would have been difficult to access with machinery. Fodder crops have proven to increase productivity during higher temperatures when pasture becomes dry and loses sustenance, therefore climate can have a significant impact on fodder crop growth.

Pasture/unused land accounts for 8,676.99 ha in the Gisborne region, with 5,596.81 ha located in the Poverty Bay Flats. These figures represent of the arable land in the area although it has not all been recorded due to time pressures. It would be ideal if future crop surveys included all arable land included in the survey area, this could now be made possible with the introduction of Arc Collector which significantly reduces the time it takes to complete the crop survey.

5.4 Water Demand and Crops

The water intensity of crops has a direct relationship upon the demand for water, particularly when establishing new crops, at harvesting times, and in dry hot summers. Climate and biological influences also affect the demand for water, whether it is through irrigation requirements in the absence of rain, spraying fertilisers to boost soil nutrients, or spraying insecticides to combat the spread of insects.

The Makauri Gravel Aquifer is the principal aquifer (Barber, 1993) supplying approximately 50% of the groundwater used on the flats (Gordon, 2001). This water is used for irrigating a diverse range of permanent and seasonal crops and the aquifer's static water levels are showing a long-term decline.

The Gisborne District Council is responsible for the sustainable management of water resources and is encouraging conservation and the most efficient use of water. Restrictions on water allocation and water conservation measures are necessary to protect present and future resources. However, restrictions on water allocation also puts pressure on existing horticulture and agriculture to deal with climate changes and variable market forces. Even if existing growers changed crop types to drought resistant crops, irrigation to establish crops is usually required. Growing for commercial purposes, again, usually requires irrigation at some stage in crop development. Relying upon rainfall is too great a risk for large investments, especially when research indicates weather extremes are more likely in the future.

As discussed in a previous summer crop survey report (Arable Land Use in the Gisborne District 2007-2015) a warmer climate can lead to extreme weather, drought risk, and intense rainfall events that lose precipitation as run-off, and provides a favourable niche for the spread of pest insects and sub-tropical grasses.

The summer crop survey is important in providing an insight into the potential water demand for horticultural purposes. The summer crop surveys have revealed an increase in water intensive crops over a number of years. The increase of crops such as kiwifruit, tomatoes, lettuce, and melons significantly increases the demand for water. This is a difficult situation for the Gisborne Region as water resources are limited. The sharp increase in water demand has also been largely assisted by the warmer weather. The increase in demand for water for irrigation along with the decline in water resources could explain the decrease observed in many crop types. The water shortage and increase in water demand could potentially lead to further decrease in crops in the future.

Limitations and Benefits

The crop survey provides multiple benefits to the region. The results of the crop survey provide a great insight to land use changes across the Poverty Bay Flats and the wider Gisborne region. The crop survey is essential for tracking water demands during the irrigation season, especially for the Poverty Bay Flats where intensive cropping occurs. The crop survey can also provide economical information regarding the Gisborne region as horticulture and agriculture have significant contributions to the region's economy.

The largest limitation of the crop survey is the visibility of crops. The crop survey only includes crops visible from public roads and can miss crops that are not visible from the road, whether they are too far away or blocked by obstructions such as shelter belts. Visibility can also result in crop identification issues. As previously discussed in section 5.1, the survey provides a one-time observation only, therefore the survey does not capture every crop that is grown for the season. Although there are some factors that are out of our control (such as harvest periods and visibility), the crop survey has increased in accuracy and consistency via the survey method.

5.5.1 Crop Identification

This crop survey has found multiple issues relating to crop identification. Identification issues can arise from visibility issues as previously discussed. Plant identification has increased in accuracy with the use of a folder containing photos of possible crop types. However it can still be difficult to identify the plant as it moves through multiple stages of growth.

While completing the crop survey many incorrect crop identification issues were corrected from the previous surveys. These issues have been discussed above. As a consequence persimmons significantly increased even though no new plants were observed. Persimmons have been significantly under represented for many years, this survey has recorded a value more representative of the persimmons growing in Gisborne. Stone-fruit was also over represented in previous surveys, as it was often recorded as apples and other pip fruit. This problem stresses the importance for correct crop identification.

Accurate identification of fodder crops was also difficult to complete as they can look very similar. When crop identification was difficult, photos were taken and then analysed in the office. If the crop could not be identified it was recorded as 'other'. This was done for all crop types. Fodder crops were difficult to identify when the crop had been eaten out, in this case it was also recorded as 'other'. Brassica fodder crops were the most difficult to identify as they are very similar. In this case it is worthwhile considering to record brassica as one crop type.

Clover was also sometimes confused with pasture. As clover is generally included in pasture it was sometimes difficult to determine the proportion of clover needed to justify the 'clover' label. For the sake of consistency between crop surveys, clover was included this year,

however a systematic method of recording clover is needed if this crop type is included in future surveys.

Although some crop identification issues have been resolved in this survey, they cannot all be resolved due to visibility issues associated with carrying out the survey from the roadside. The crop survey therefore aims to provide the best representation of crop growth as close to the actual land use as possible.

6.0 Conclusion

The 2016/17 crop survey was conducted between the 11th and 25th of January. This was the ninth summer crop survey to be completed for the Poverty Bay Flats and the third for the wider Gisborne region. Long term trends can now be visualised due to the consistent completion of the crop survey. The Poverty Bay Flats is the most intensively cropped area in the Gisborne region and has a significant impact on the total crop production of the Gisborne region. The crop survey has revealed the major crops grown on the Poverty Bay Flats. These crops are pasture/unused, maize/sweetcorn, squash, grapes, citrus, tomatoes and pip/stone-fruit. Seasonal crops such as squash and maize/sweetcorn have fluctuated throughout the years and are frequently rotated. Both squash and maize/sweetcorn have declined this season, this could partially be due to rotation however as they have both declined it is also most likely due to external factors. Tomatoes exhibit moderate fluctuation between seasons, no significant change was recorded this year. Permanent crops such as grapes, citrus, kiwifruit have decreased from the previous survey. Grapes and citrus have shown long term decline. Citrus has been in gradual decline in the Poverty Bay Flats since 2012/13 while grapes has shown a greater decline for the same period. This is the first year to report a decrease in kiwifruit, however there is potential for this to grow in future seasons as new infrastructure has been observed during the survey. The decline in the major crops could have resulted by multiple factors. Climate and market forces typically drive the production of crops in the Poverty Bay Flats. A mild winter followed by a dry summer is expected to have a large impact on horticultural production in the Poverty Bay Flats and the entire Gisborne region. High water demand has also put pressures on crop production. An increase in water intensive crops has significantly increased the water demand on the Poverty Bay Flats.

There has been an increase in fodder crops in both the Poverty Bay Flats and the Gisborne region between 2015/16 and 2016/17. This is also most likely a result of the dry summers and increased demand for stock feed. The most common fodder crops were Lucerne and leafy turnip. Lucerne had the highest area on the Poverty Bay Flats while leafy turnip had the highest area for the total area outside of the Poverty Bay Flats along with the total Gisborne region. As expected, the wider Gisborne region had the most fodder crops and the least commercial crops.

Crop production is effected by multiple external factors. The decline in major crops such as maize/sweetcorn, grapes, citrus and kiwifruit are largely attributed to market forces, climate and water demand. These factors vary year to year so it is crucial to continue monitoring crop production as these factors change in the future. It is also important to monitor production as the Makauri aquifer, one of Gisborne's major irrigation sources continues to decline. This could significantly impact crop production in the region.

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8.0 Figures

Table 2: 2016/17 Crop survey Results

Table 2: Detailed Area of Poverty Bay Flats and the Gisborne region																
	Hectares		Hectares										Hectares		Hectares	
	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Poverty Bay Flats	Gisborne Region	Gisborne Region	Total Outside Poverty Bay Flats	Motu / Matawai	
	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	
Pasture/Unused	4585.99	5931.00	6829.67	6704.67	6704.67	6704.67	6704.67	6704.67	6704.67	6704.67	6704.67	6704.67	6704.67	6704.67	6704.67	
Maize/Sweetcorn	4533.69	5096.00	4443.50	4694.25	4791.91	5800.97	5899.46	5584.14	5584.59	5596.81	5584.14	5584.59	5596.81	5584.14	5584.59	
Grapes	2347.71	2493.00	2299.50	2222.75	1719.18	2139.48	1849.81	1829.17	1702.41	1702.41	1829.17	1702.41	1702.41	1829.17	1702.41	
Citrus	1173.03	1317.00	1402.17	1392.80	1410.36	1529.60	1492.15	1473.31	1471.59	1471.59	1492.15	1473.31	1471.59	1492.15	1473.31	
Squash	1541.99	1135.00	1401.16	1988.82	1822.16	1968.09	1573.27	1606.32	1480.26	1480.26	1573.27	1606.32	1480.26	1480.26	1573.27	
Kiwifruit	301.68	357.00	432.47	433.38	436.20	442.55	457.83	501.85	430.76	430.76	457.83	501.85	430.76	430.76	457.83	
Tomatoes	425.09	357.00	504.71	476.14	666.56	221.20	221.66	171.70	207.16	207.16	221.66	171.70	207.16	207.16	221.66	
Onions	5.15	37.00	75.72	69.18	20.19	21.31	17.34	0.00	0.33	0.33	17.34	0.00	0.33	0.33	17.34	
Pumpkin							0.29	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	
Potatoes								2.39	0.00	0.00	2.39	0.00	0.00	0.00	0.00	
Pear/Beans	1.34	7.00	35.50	18.27	500.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Cauliflower/Broccoli	54.58	67.00	23.53	41.63	48.19	72.92	19.24	62.30	32.73	32.73	19.24	62.30	32.73	32.73	0.00	
Courgettes							2.42	1.27	1.39	1.39	2.42	1.27	1.39	1.39	0.00	
Lettuce/Cabbage	167.26	137.00	110.85	122.08	120.08	90.49	64.89	119.20	119.79	119.79	64.89	119.20	119.79	119.79	0.00	
Melons	64.36	5.00	17.75	41.57	14.49	8.28	48.60	34.56	79.95	48.60	34.56	79.95	0.00	0.00	0.00	
Swedes					36.60	88.03	52.32	0.00	0.00	0.00	36.60	88.03	52.32	0.00	0.00	
Apples and Pears	277.38	217.00	291.29	259.88	209.30	266.59	193.97	186.11	242.46	242.46	186.11	242.46	242.46	0.00	0.00	
Avocados	38.66	25.00	41.15	59.93	63.86	92.41	45.82	51.54	57.15	57.15	45.82	51.54	57.15	0.00	0.00	
Stonefruit	12.88	92.00	53.34	79.86	80.08	85.45	41.69	75.21	51.87	51.87	41.69	75.21	51.87	0.00	0.00	
Tamarillos			34.58	20.37	20.37	24.82	7.83	8.94	6.69	6.69	7.83	8.94	6.69	0.00	0.00	
Pomegranate								6.31	2.70	0.00	6.31	2.70	0.00	0.00	0.00	
Strawberries	2.71	2.00	8.70	2.76	9.61	10.53	0.37	1.06	1.06	1.06	0.37	1.06	1.06	0.00	0.00	
Feijoa							16.73	44.72	44.68	44.68	16.73	44.72	44.68	0.00	0.00	
Olives							0.87	1.28	4.95	0.87	1.28	4.95	0.87	0.00	0.00	
Perisimon				43.97	20.54	41.55	60.88	29.67	105.68	105.68	60.88	29.67	105.68	0.00	0.00	
Peanuts							1.52	1.33	0.00	0.00	1.52	1.33	0.00	0.00	0.00	
Echinacea			7.12	3.60	3.60	4.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Flowers			7.49	6.96	2.87	3.07	0.26	0.26	0.87	0.87	0.26	0.26	0.87	0.00	0.00	
Chamomile							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
To Be Planted			693.81	478.90	494.07	103.49	311.80	377.45	778.91	778.91	311.80	377.45	778.91	778.91	311.80	
Grape Nursery							22.39	32.50	22.39	22.39	32.50	22.39	22.39	0.00	0.00	
Pine Nursery			67.00	72.90	73.42	70.49	58.28	27.22	40.20	40.20	58.28	27.22	40.20	0.00	0.00	
Poplar/Willow Nursery							12.01	0.64	0.00	0.00	12.01	0.64	0.00	0.00	0.00	
Chicory							10.12	1.98	58.67	58.67	10.12	20.54	137.60	0.00	0.00	
Fodder Beet								0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Forage rape								0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Leady Turnip							3.74	79.03	76.99	76.99	124.84	539.55	377.28	121.10	172.29	
Lucerne		35.00	56.10	78.34	48.63	50.64	168.89	179.63	164.84	164.84	179.63	195.46	61.60	129.28	5.00	
Oats							2.86	0.00	0.00	0.00	2.86	0.00	0.00	0.00	0.00	
Plantain							43.54	145.64	47.88	130.08	262.45	167.29	86.54	88.37	28.44	
Plantain/Chicory							36.74	18.69	0.00	36.74	32.35	0.00	0.00	0.00	0.00	
Plantain/Cliver							0.80	78.52	0.00	80.58	120.32	0.00	76.20	3.58	79.78	
Cliver							23.88	42.94	0.00	27.88	74.81	0.00	4.00	4.00	31.88	
Lupin							4.03	2.86	0.00	4.03	2.86	0.00	0.00	0.00	0.00	
Other								102.83			146.81			43.99	41.96	
Baleage								11.01			155.22			144.21	3.58	
Kale											46.48			46.48	10.02	
Lifestyle																
Total	15533.50	17377.00	18843.02	19315.01	19285.25	19231.07	17776.32	17727.26	17787.52	17787.52	17776.32	17727.26	17787.52	17787.52	17787.52	

Summer Crop Survey - Poverty Bay Flats

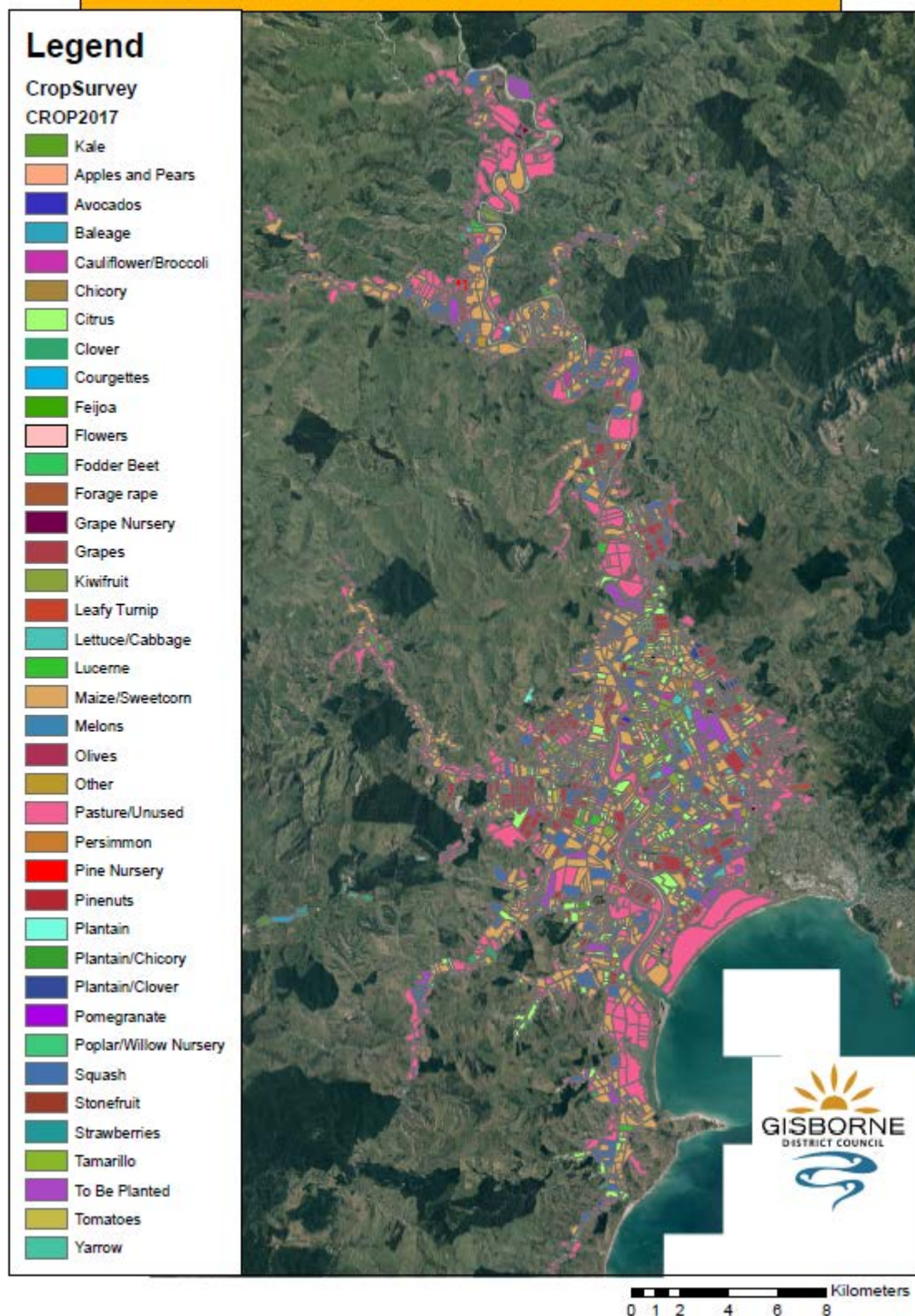


Figure 24: Crop Survey Data – Poverty Bay Flats

Summer Crops 2017 - Motu/Matawai

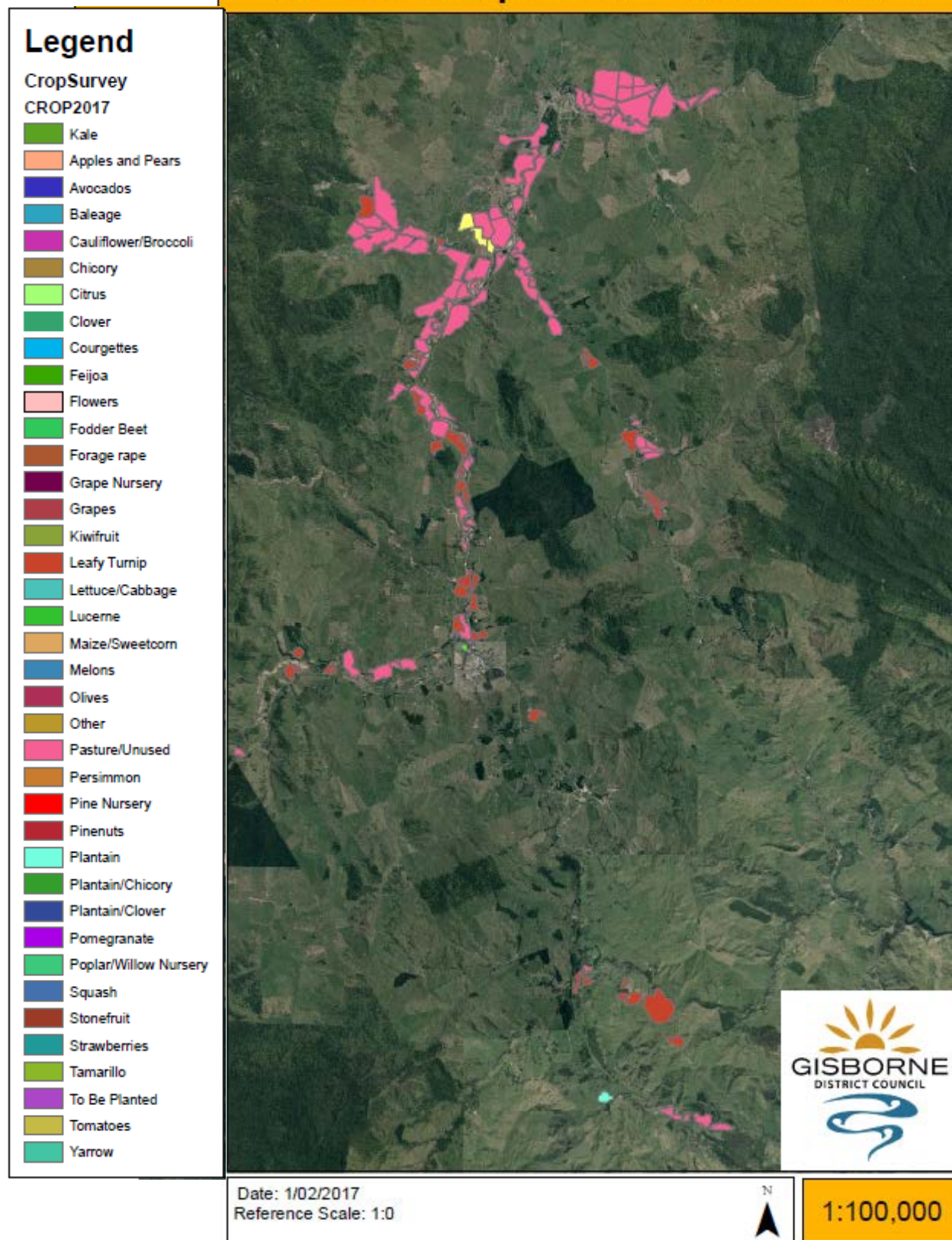


Figure 25: Crop Survey Data – Motu/Matawai

Summer Crops 2017 - East Cape/Ruatoria

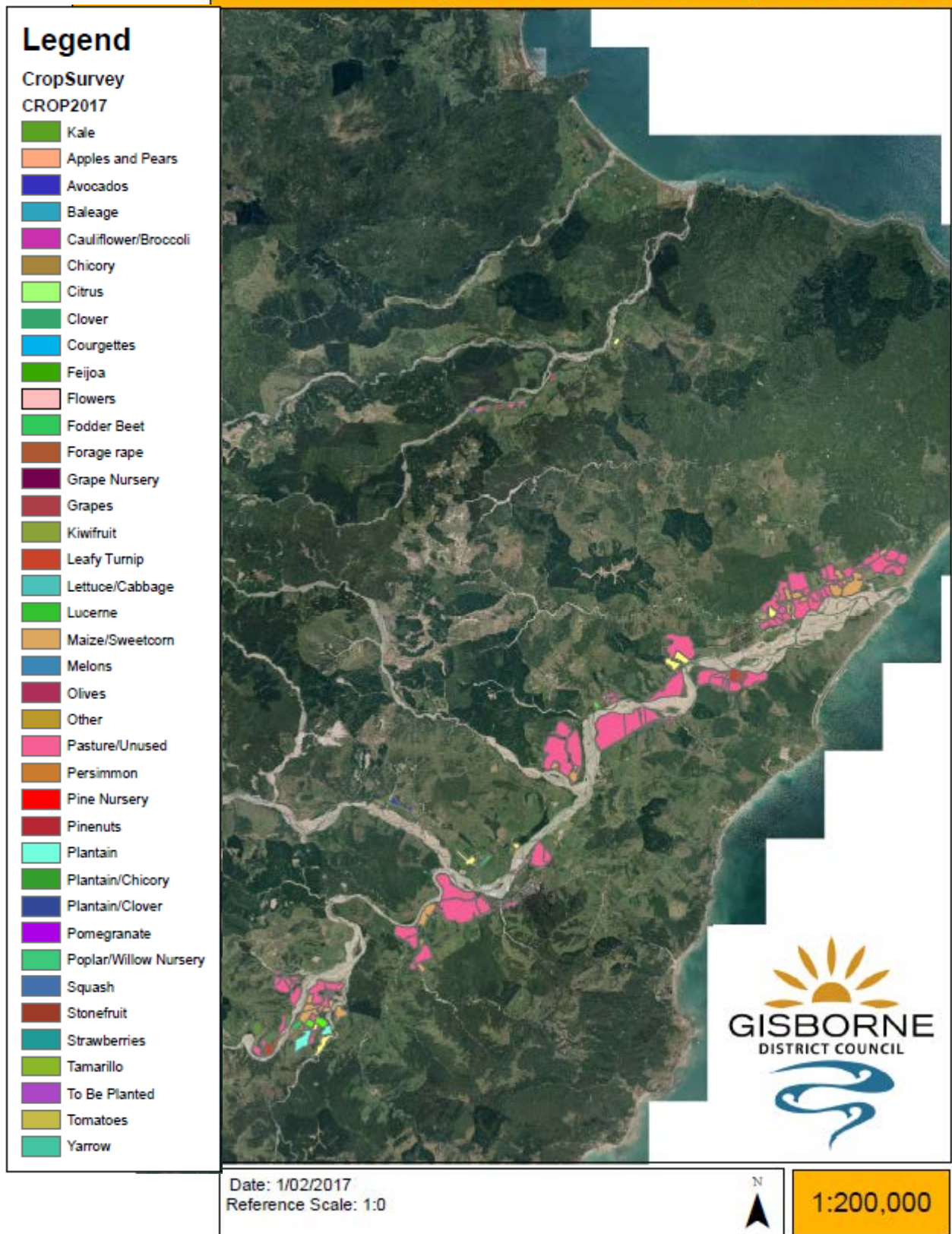


Figure 26: Crop Survey Data – East Cape/Ruatoria

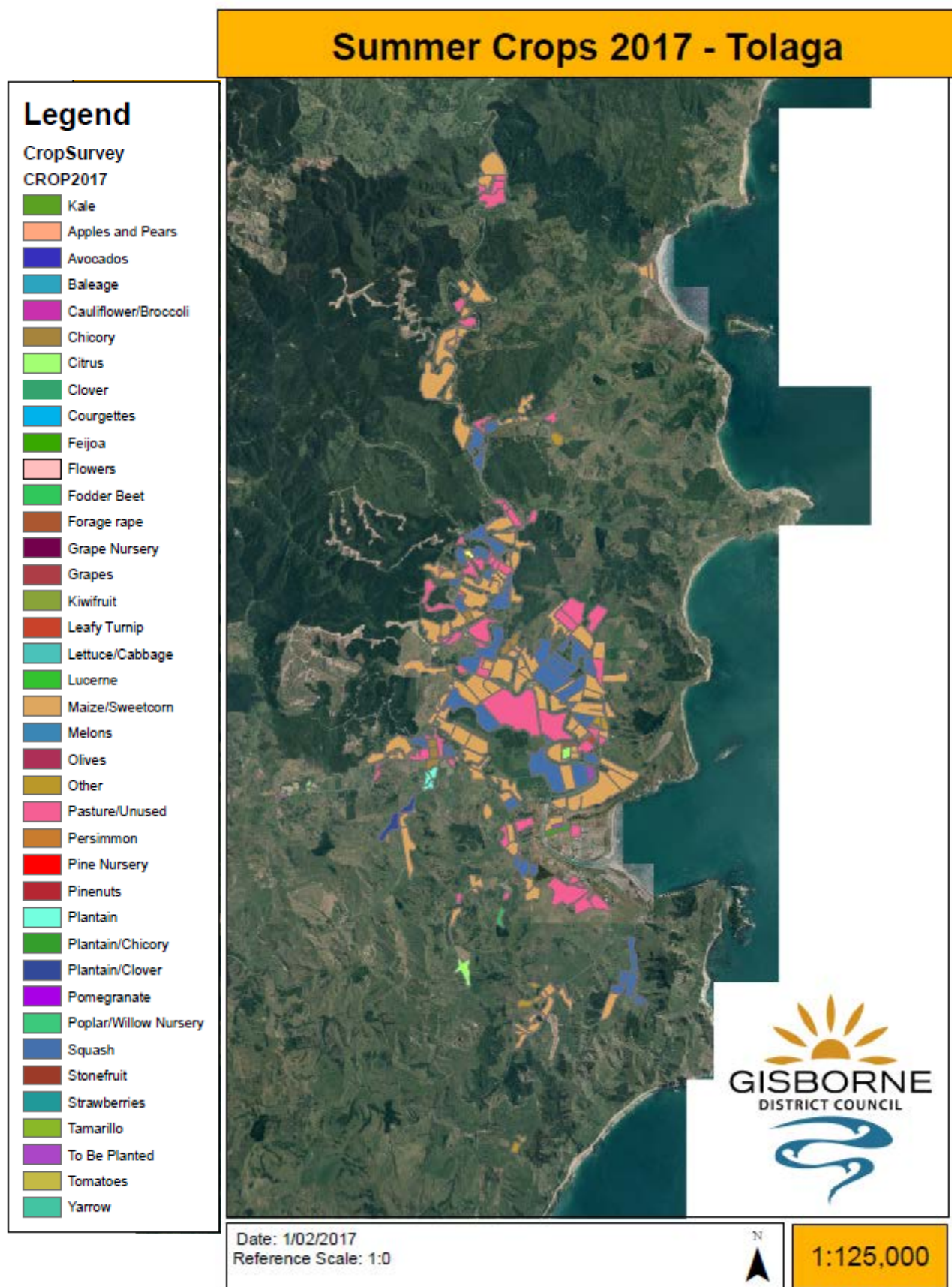


Figure 27: Crop Survey Data – Tolaga

Arable Land Use in the Gisborne District 2016/17