



# Arable Land Use in the Gisborne District 2007 - 2015

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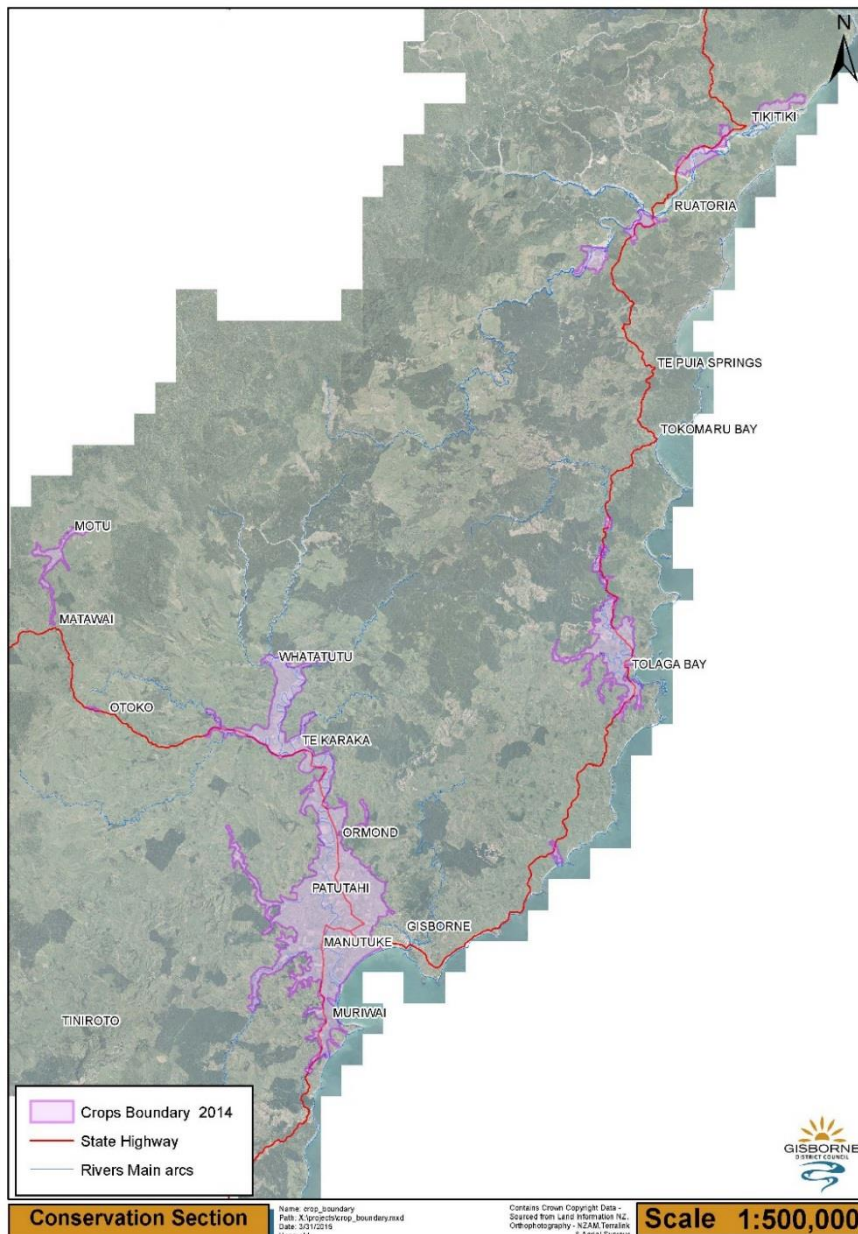
## 1.0 Introduction

Gisborne District Council has completed a survey of the actual land use of the total arable land in the Gisborne District for the 2014/15 season. The surveyed area is approximately 24,000 hectares. This area is a large contributor to the local economy due to the intensive use of horticultural land. The 2014/15 seasons' survey incorporated the arable land which extends up the east coast, including the Whangara, Tolaga Bay, Ruatoria and Tikitiki areas, as well as further west including Motu and Matawai. This land has not been previously surveyed, but is essential to keep an accurate record of horticultural practices in the wider Gisborne region. The survey combines seven seasons of survey data from 2007/08 to 2014/2015. The 2013/14 survey was not carried out due to resource issues. This

report outlines the trends and observations arising from the land use survey in the 2014/15 season.

The survey is being 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 development of Regional Plans including a Freshwater Management Plan. This can be done by knowing the areas and types of each crop, demand for irrigation water and other horticultural purposes. Water demand for irrigation can be forecast which will assist in setting up appropriate policies, objectives, rules and methods for water management.

The survey area is shown in Figure 1 (left) and extends from Muriwai in the south, just past Williams Road, north to Whatatutu and northwest to Motu. The 2014/15 survey area also extends to the areas of arable land up the coast of



**Figure 1: Aerial orthophoto showing average extent of area surveyed 2007-2015**

the Gisborne region, including Whangara, Tolaga Bay, Ruatoria and Tikitiki, as shown in figure 1 above.

## 2.0 Methods

The survey was conducted during the summer seasons for each of the seven seasons 2007/08 to 2014/15 between late December and mid-January, however this season the survey was conducted at the beginning of January, giving slightly different crops due to harvesting times (no peas/beans, for example). This time of year was selected as it is the start of the irrigation season when crop growth is high and when water resources are likely to become vulnerable to over allocation due to climatic factors.

A similar survey method was used as previous year's surveys. The data was collected by systematically driving throughout the Poverty Bay Flats and manually recording observed crop types onto aerial maps obtained using the Geographic information System (GIS), ArcMap 10.3. Each map was organised in the order of the planned route for the days' surveying. Physically visiting each paddock was considered to be the most effective way to obtain the data as aerial photographs are not updated often enough and do not have the same level of accuracy. Crops were then identified and marked on the maps with a letter to denote each different crop.

Once the field work was completed, the data was digitised using ArcMap 10.3 and the total area of each crop was calculated (in hectares).

More extensive data collection has taken place in the 2014/15 survey by incorporating all the arable land around the wider Gisborne Region, including the Poverty Bay Flats, Whangara, Tolaga Bay, Ruatoria and Tikitiki. Data analysis has been made more precise by digitising at a smaller scale to previous years, allowing greater accuracy in identifying the boundaries of each paddock and removing houses, patches of bush and other obstructions from crop polygons.

## 3.0 Results

The results and discussion section compares trends and observations of major crop types across the five summer seasons. The most common crop types observed include:

- pasture/unused land
- maize and sweetcorn
- squash
- grapes
- citrus
- kiwifruit
- pip and stonefruit
- tomatoes

Any significant trends occurring in minor crops are also highlighted.

In 2014/15 the total area of land included in the survey was 23,697.32 ha. Of this area, 36% was in pasture/unused land, 32% was planted in maize and sweetcorn, 9% was planted in squash and 8% was planted in grapes.

Because this is the first year to extend the survey area beyond the Poverty Bay Flats, the results section of this report shall make comparisons between 2007-2013 data and data gathered from *only* the Poverty Bay flats area in the 2014/15 season. This will ensure relevant and accurate conclusions are drawn when discussing changing land-use in the Poverty bay flats area. Graphs have been generated to show results from both the Poverty Bay flats alone as well as the Gisborne Regions total

arable land (shown as a dashed line) for the 2014/15 season. Results from the entire survey area in the 2014/15 season shall also be mentioned, but will not be used in making comparisons with results from 2007-2013 surveys.

It is worth noting that the survey area of *only* the Poverty Bay flats in the 2014/15 season is 1454 ha smaller than the area surveyed in 2012/13. This has slightly altered each crops proportional share of the arable land when comparing to previous surveys. This shall be elaborated on in greater detail in Section 4 of this report.

<b>Crop</b>	<b>2007/08</b>	<b>2008/09</b>	<b>2009/10</b>	<b>2010/11</b>	<b>2011/12</b>	<b>2012/13</b>	<b>2014/15</b>	<b>2014/15 Gisborne Region Total</b>
Pasture/Unused	4,585.99	5,931	6,829.67	6,704.67	6,672.07	5899.46	5584.14	8632.90
Maize/Sweetcorn	4,533.69	5,096	4,443.50	4,696.25	4,791.91	5800.97	5436.23	7564.25
Grapes	2,347.71	2,493	2,299.50	2,222.75	1,719.18	2139.48	1851.06	1849.81
Citrus	1,173.03	1,317	1,402.17	1,392.80	1,410.36	1529.6	1492.15	1494.34
Squash	1,541.99	1,135	1,401.16	1,988.82	1,822.16	1968.09	1573.27	2122.80
Kiwifruit	301.68	357	432.47	433.38	436.2	462.55	457.83	455.97
Tomatoes	425.09	357	504.71	476.14	666.56	221.2	221.66	221.66
Apples/Pears	277.38	217	291.29	259.88	209.3	266.59	202.05	198.97
Lettuce/Cabbage	167.26	137	110.85	122.08	120.08	90.49	64.89	64.89
Plantain							43.54	130.08
Melons	64.36	5	17.75	41.57	14.49	8.28	48.60	48.60
Avocado	38.66	25	41.15	59.93	63.86	92.41	45.82	45.82
Stone Fruit	12.88	92	53.34	79.86	80.08	85.45	41.69	41.69
Grape Nursery							22.39	22.39
Onions	5.15	37	75.72	69.18	20.19	21.31	17.34	17.34
Strawberries	2.71	2	8.7	2.76	9.61	10.53	0.37	0.37
Fejoa							16.73	16.73
Peas/Beans	1.34	7	35.5	18.27	500.91	0	0.00	0.00
Pine Nursery		67	72.9	72.9	73.42	70.49	58.28	58.28
Leafy Turnip							3.74	124.84
Lucerne		35	56.1	78.34	48.63	50.64	168.89	230.49
Lupin							4.03	4.03
Pumpkin							0.29	0.29
Echinacea			7.12	3.6	3.6	4.36	0.00	0.00
Courgettes							2.42	2.42
Chicory							10.12	10.12
Olives							0.87	0.87
Flowers			7.49	6.96	2.87	3.07	0.26	0.26
To be Planted			693.81	478.9	494.07	103.49	311.80	316.44
Persimmon				43.97	20.54	41.55	60.88	60.88
Swedes					36.6	88.03	52.32	62.11
Cauliflower/Broccoli	54.58	67	23.53	41.63	48.19	72.92	19.24	19.24
Tamarillos			34.58	20.37	20.37	24.82	7.83	7.83
Lifestyle						166.68	0.00	0.00
<b>TOTAL</b>	<b>15,533.50</b>	<b>17,377.00</b>	<b>18,843.02</b>	<b>19,315.01</b>	<b>19,285.25</b>	<b>19,231.07</b>	<b>17,776.32</b>	<b>23,697.32</b>

Table 1: Hectares of crop types on the Gisborne Districts Arable land 2007/08 – 2014/15

### 3.1 Pasture/unused

Pasture/unused land continues to be the most dominant crop present on the Poverty Bay Flats. In the 2007/08 season, the total arable land in pasture/unused was 4586 ha (similar to the size of maize/sweetcorn). Over the next four seasons, pasture/unused land grew to 6830 ha in the 2009/2010 season before decreasing to 5950 hectares in the 2012/13 season. A further decrease to 5584 ha (31%) of pasture/unused land is evident on the Poverty Bay flats in the 2014/15 season. With the increased survey area, pasture/unused land occupies 8633 ha (36%) of the total arable land in Gisborne region.

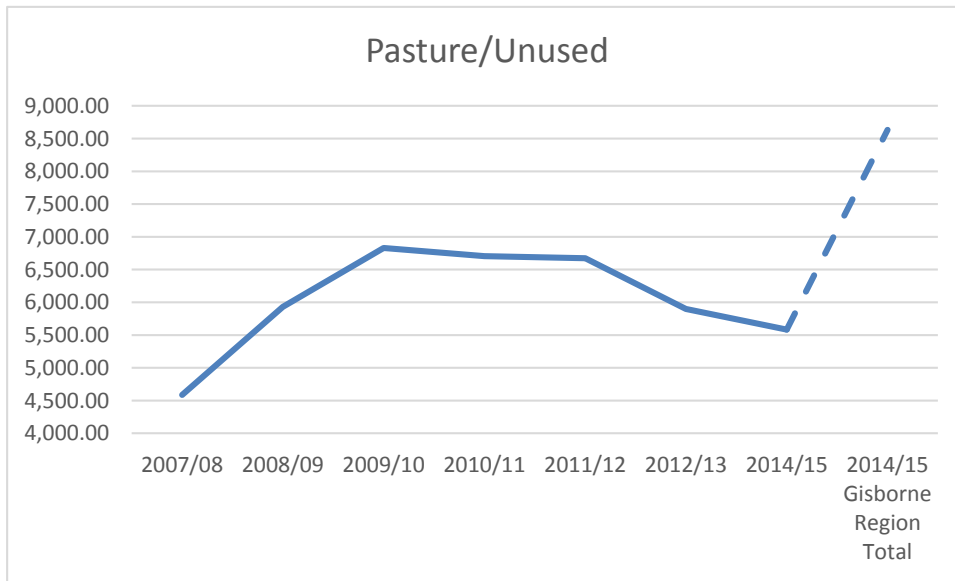


Figure 2: Total hectares of pasture/unused land on Gisborne region's arable land 2007/08-2014/15

### 3.2 Maize/sweetcorn

Maize and sweetcorn collectively make up the second most common crop type on the Gisborne Districts arable land. Total maize/sweetcorn area increased from 24% in 2007/08 to 2008/09 which was followed by a large decrease from 30% in 2008/09 to 23.5% in 2009/10. This is a reduction of 652.50 ha. This figure rose by 1357.47 ha to 5801 ha in the 2012/13 season. In 2014/15 maize and sweetcorn occupies 31% (5436 ha) of the arable land on the Poverty Bay flats, recording a decrease of 365 ha since the last survey was conducted in 2013.

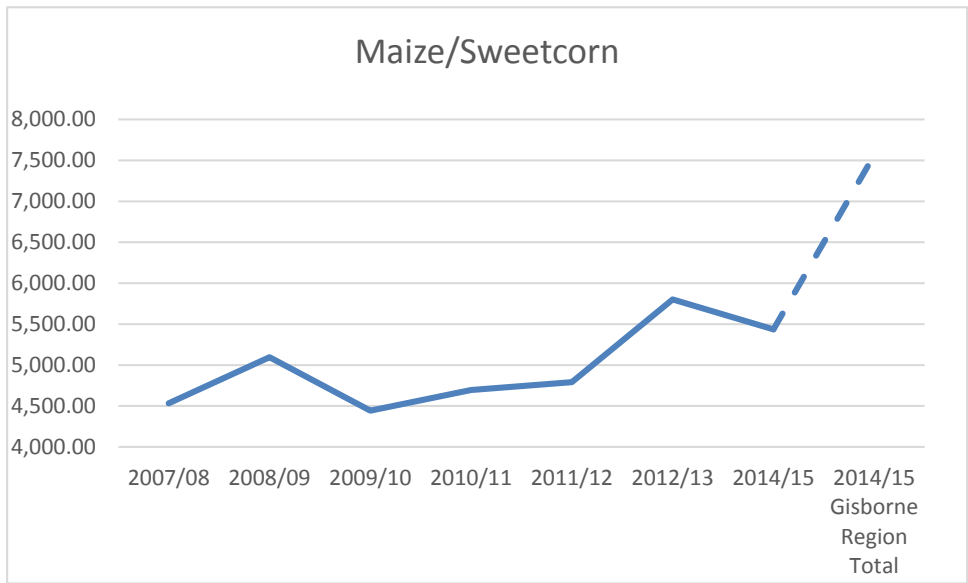


Figure 3: Total hectares of maize/sweetcorn on Gisborne region's arable land 2007/08-2014/15

### 3.3 Grapes

In 2014/15 grapes occupied 1851 ha of the Poverty Bay Flats, making grapes the third most common crop, despite a decrease of 290 ha since the 2012/13 season. Figure 3 below shows grapes have been decreasing since 2008/09 following their peak of 2,493 ha. Over the past three seasons grapes have dropped to 1,719 ha with the biggest drop been from 2010/11 to 2011/12 with a 503 ha decrease.

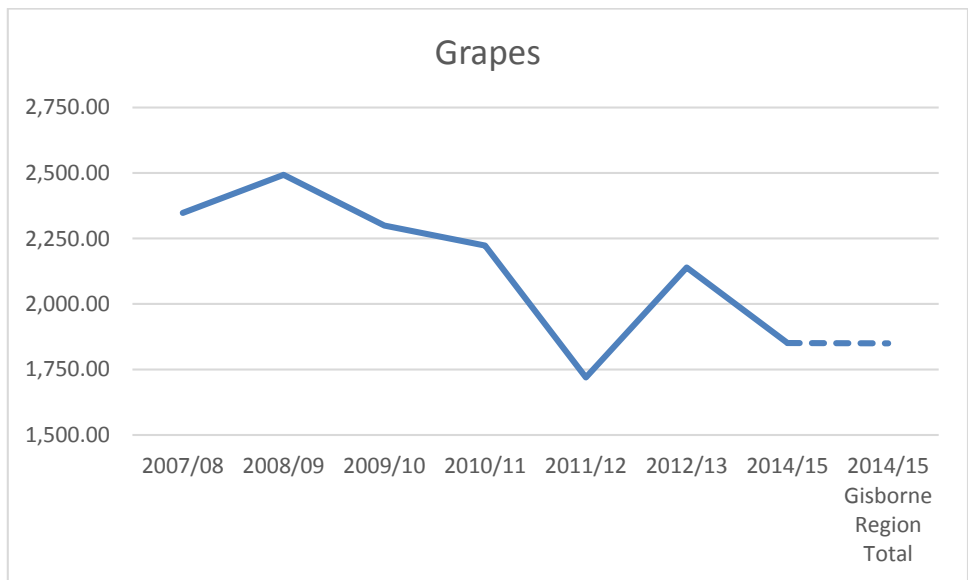


Figure 4: Total hectares of grapes on Gisborne regions arable land 2007/08-2014/15

### 3.4 Squash

Squash is the fourth most common crop, accounting for 9% of the Poverty Bay flats in the 2014/15 season. In 2012/13 squash occupied 1,968.09 ha equating to approx 10% of the total area of the Poverty Bay Flats. Squash production peaked in the 2010/11 season reaching 1,988 ha and remained relatively steady until 2014/15 where, at 1573 ha, it is at its lowest since 2009/10. Figure 4 shows that incorporating the wider Gisborne region into the study, squash production is much



greater, indicating a significant proportion (29%) of Gisborne's squash produce is grown outside the Poverty Bay flats.

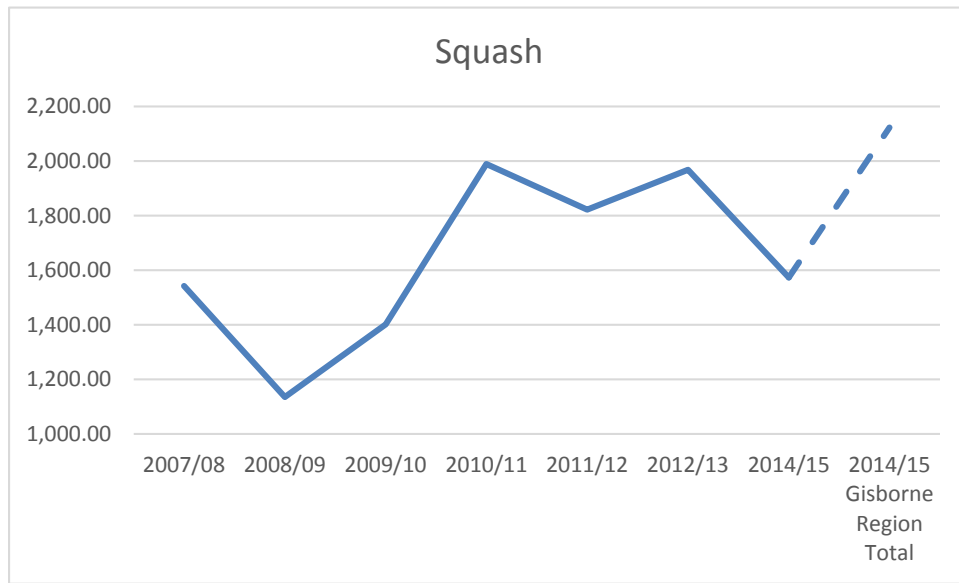


Figure 5: Total hectares of squash on the Gisborne regions arable land 2007/08-2014/15

### 3.5 Citrus

In 2014/15, citrus crops occupied 1,492 ha. Citrus production had been on a steady incline since 2007/08, before peaking in 2012/13 at 1530 ha. The only drop in the area of citrus was during the 2010/11 season where it dropped from 1,402 ha to 1,393 ha, a decrease of only 9 ha. Citrus growth for the total Gisborne region is 1494 ha, revealing almost all citrus is grown on the Poverty Bay flats. Citrus occupies 8% of the Poverty Bay Flats, and 6% of the total Gisborne region's arable land.

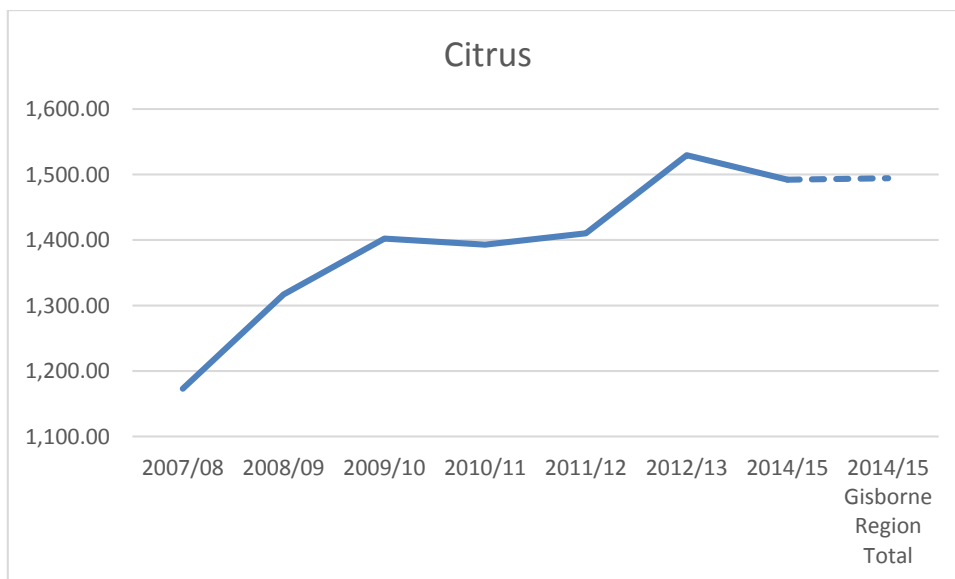


Figure 6: Total hectares of citrus on the Gisborne regions arable land 2007/08-2014/15

### 3.6 Kiwifruit

Kiwifruit currently occupies 458 ha, equating to 2.6%, of the Poverty Bay Flats. Kiwifruit vine coverage rose from 302 ha in 2007/08 to its peak of 463 ha in 2012/13. The largest increase occurred between 2007/08 and 2009/10 where it grew by 130 ha, from 302 ha to 432 ha. This area had remained static for three years with a 26 ha increase this season.

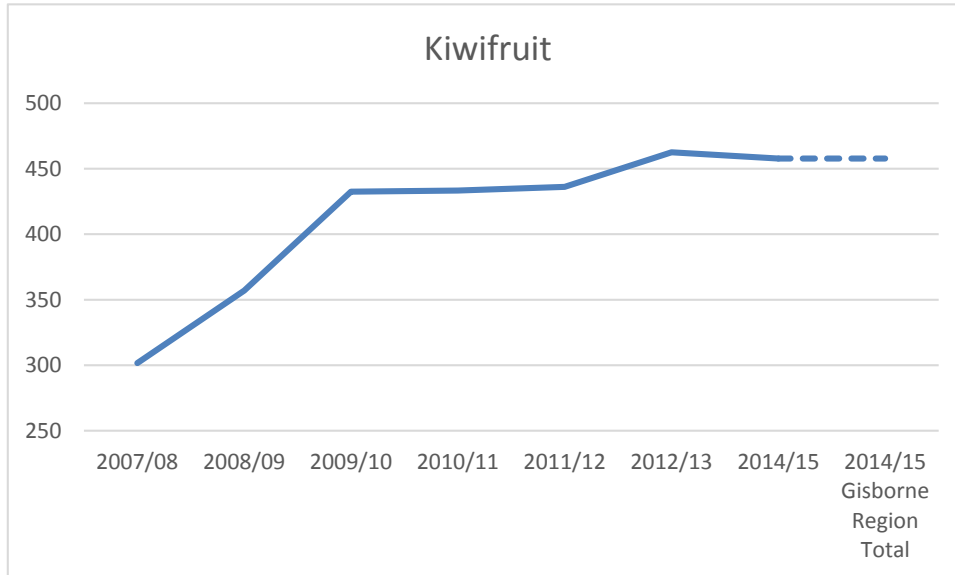


Figure 7: Total hectares of kiwifruit on the Gisborne regions arable land 2007/08-2014/15

### 3.7 Pip and stonefruit

Pip and stone fruit includes apples/pears, avocados and stone fruit. They experienced fluctuating trends but have not changed dramatically between 2007 and 2011/12. Figure 7 below shows the most significant rise occurred between 2011/12 and 2012/13 (112 ha). An equally significant decline occurred this past year where pip and stone fruit decreased from 486 ha to 350 ha on the Poverty Bay Flats. These tree crops currently occupy 350 ha, or 2%, of the Poverty Bay Flats (1.2% of total surveyed area). Assessed individually, apples/pears are the largest contributor to pip and stone fruit, occupying 202 ha or 1.1% of the Poverty Bay flats. Persimmons occupy 61 ha (0.34%), avocados 46 ha (0.26%) and stone fruit occupy 42 ha (0.23%). A declining trend is observed from the 2012/13 season where apples/pears, avocados and stone fruit decreased by 64.5 ha, 46.6 ha and 43.76 ha, respectively. Persimmons have experienced significant growth since 2012/13, increasing from 42 ha to 61 ha. These figures can also be seen in Table 1.

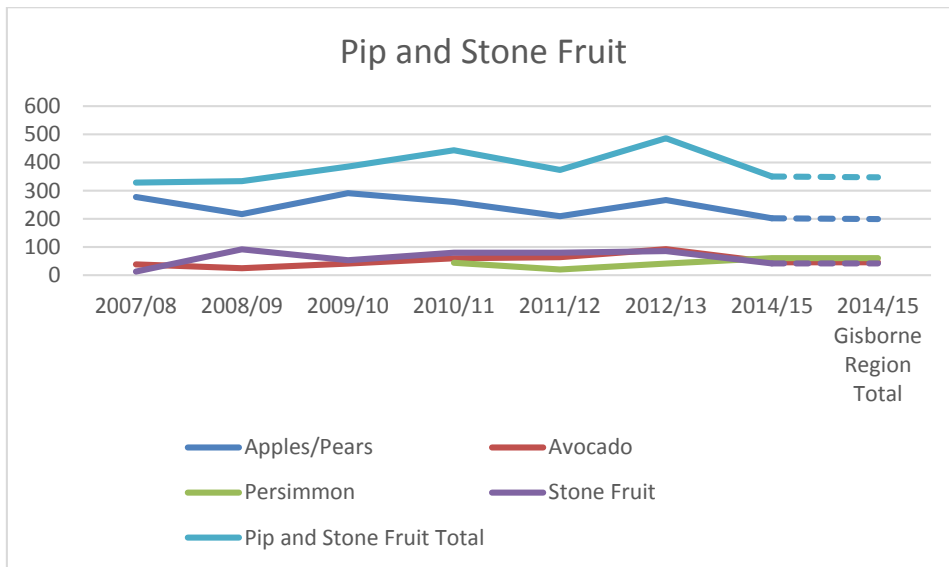


Figure 8: Total hectares of pip and stone fruit on the Gisborne regions arable land 2007/08-2014/15

### 3.8 Tomatoes

Tomato production on the Poverty Bay flats experienced relatively heavy fluctuations between the 2007/08 and 2012/13 season's surveys. Figure 8 below depicts the changing occupation tomatoes have on the Poverty Bay Flats, where they peaked in 2011/12 with 667 ha. This was followed by a dramatic decline of 445 ha to its total of 221 ha in 2012/13. This figure has remained the same in the 2014/15 season for both the Poverty Bay Flats and the wider Gisborne region, revealing all tomato production occurs on the Poverty Bay Flats. Cedenco are responsible for the vast majority of tomato growth in the region. It has been confirmed that a total of 293 ha of tomatoes were grown in the region, with the timing of harvest spanning throughout January and February. The 72 ha difference in the actual area planted and area recorded in the survey may be explained by some tomatoes being harvested before the survey was conducted.

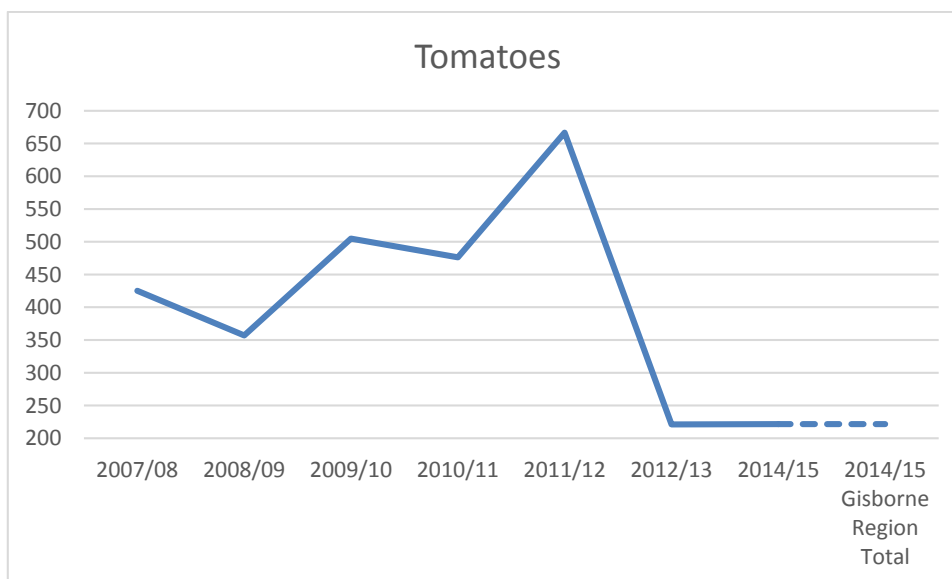


Figure 9: Total hectares of tomatoes on the Gisborne regions arable land 2007/08-2014/15

### 3.9 Minor crops & Processing Vegetables

Minor crops include melons, strawberries, olives, pine nurseries and grape nurseries. These crops range from 0 to 0.32% of the Poverty Bay Flats area. Strawberries represent the smallest proportion of Minor Crops with just 0.37 ha present in the 2014/15 season, and pine nurseries with the largest, at 58 ha. Melons have seen fluctuations throughout the five seasons. Each year there have been highs and lows ranging from 64 ha in 2007/08 to a low in 2012/13 with only 8 ha. These fluctuations can be seen in Figure 11 below. The pine nursery at Puha tends to stay constant, despite a moderate decline of 12 ha since the 2012/13 survey.

Processing vegetables include cauliflower, broccoli, lettuce, cabbage, onions and courgettes. Lettuce and cabbages have the highest area coverage, totalling 65 ha in the 2014/15 season, which has decreased from 90 ha in 2012/13. Similarly, broccoli and cauliflower reduced 54 ha (26%) since 2013/13, now occupying 19 ha. This survey is the first to have recognised the presence of courgettes on the Poverty Bay Flats, recording 2.42 ha. The area planted in onions has remained relatively steady since the 2011/12 season, with a minor decline of 4 ha between 2012/13 and 2014/15. Onions hit a peak during the 2009/10 season where it reached 76 ha up from its lowest from 2007/08 of 5 ha. Cedenco grow all the onions in the district and have confirmed that 21 ha were planted for the 2014/15 season. The survey recorded 17.3 ha, whereby this lower figure may be due to access issues when collecting data.

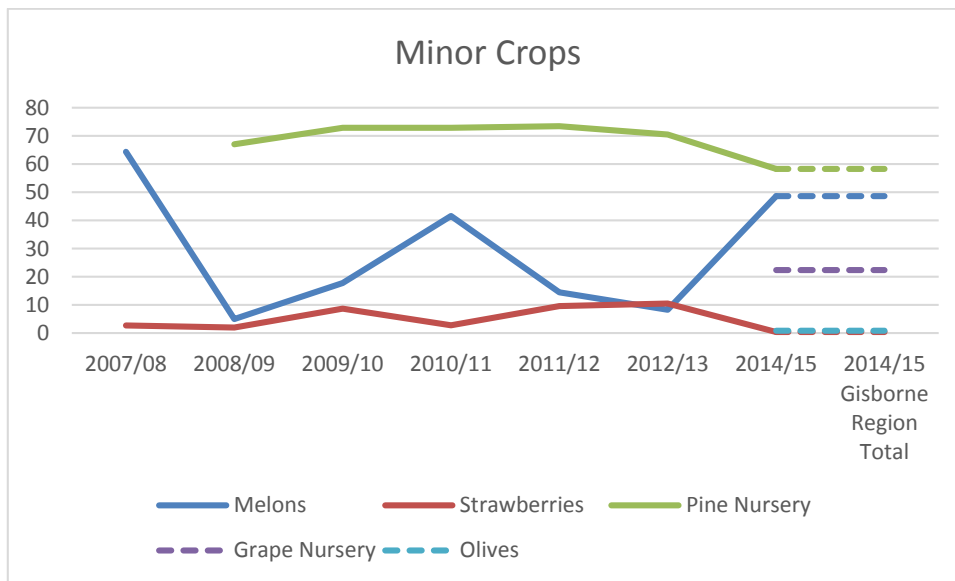


Figure 10: Total hectares of minor crops on the Gisborne regions arable land 2007/08-2014/15

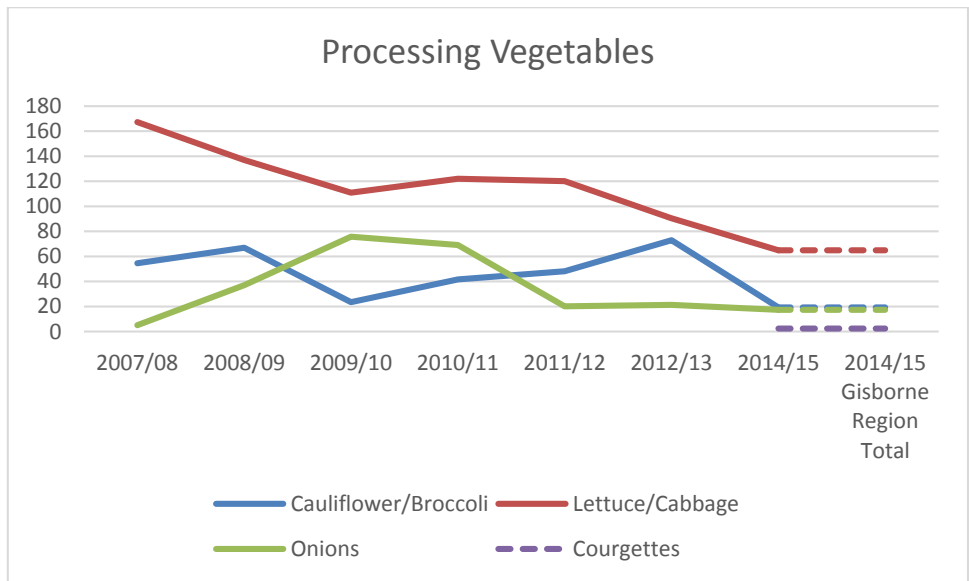


Figure 11: Total hectares of processing vegetables on the Gisborne regions arable land 2007/08-2014/15

### 3.10 Fodder Crops

Fodder crops include Lucerne, plantain, leafy turnip, swedes, chicory and lupin. Lucerne represents the largest proportion of fodder crops, occupying 169 ha in on the Poverty bay Flats and 230 ha on the Gisborne regions total arable land. Thus a significant proportion of Lucerne (27%) is grown outside the Poverty bay Flats. A large increase in Lucerne growth occurred between 2012/13 and 2014/15 from 51 ha to 169 ha, respectively (Poverty Bay Flats only).

This is the first survey to recognize plantain, which has a notable presence in the Gisborne region. Plantain occupies 44 ha on the Poverty Bay Flats, and 130 ha on the total arable land in the Gisborne Region. 67% of Plantain grown is outside the Poverty Bay Flats.

Leafy turnip has a large presence on the arable land outside the Poverty Bay Flats (121 ha) as opposed to a mere 3.7 ha on the Poverty Bay Flats. Swedes decreased from 88 ha in 2012/13 to 52 ha in 2014/15 (62 Gisborne region total).

Lupin and chicory have a small presence in the surveyed area, occupying 4 ha and 10 ha, respectively.

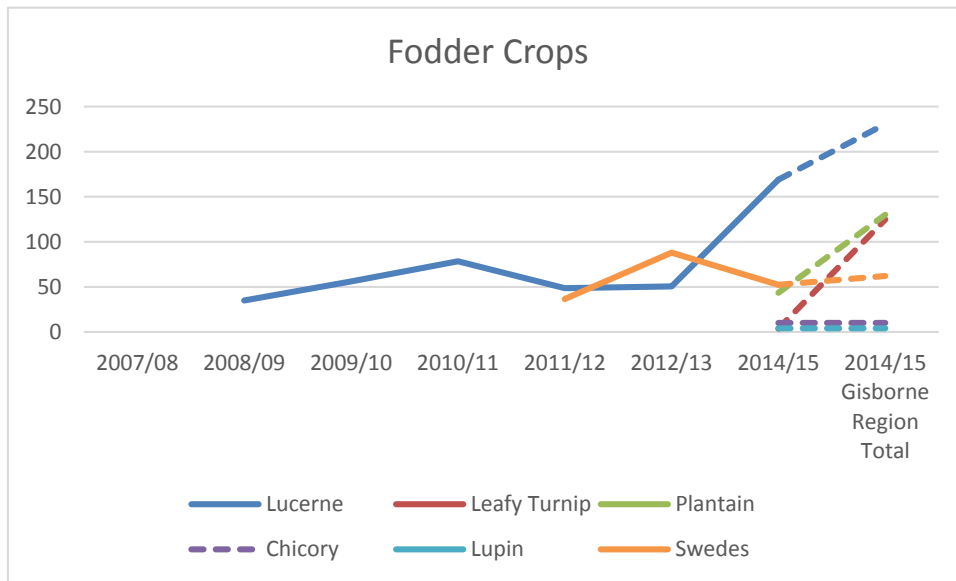


Figure 12: Total hectares of fodder crops on the Gisborne regions arable land 2007/08-2014/15

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## **4.0 Discussion**

### **4.1 Survey Area**

As previously stated, the survey area for the 2014/15 season has extended beyond previous years surveys. It now includes Motu, Matawai, Whangara, Tolaga Bay, Ruatoria and Tikitiki, in addition to the Poverty Bay Flats and other areas previously surveyed. This is a total of 5921 ha of additional surveyed arable land. This is to ensure that all arable land around the Gisborne region is accounted for, providing Council with greater detail relating to the management of crops.

### **4.2 Digitising**

A central concern for the 2014/15 survey was to improve the accuracy of digitising to ensure more true crop area data were produced. A key component of this was altering the method of data collection. In previous surveys a total of 25 maps were printed to represent the entire survey area. This meant crop distinction had to be made on a larger scale which decreased the accuracy when determining the extent of crops and their boundaries.

Data collection in this survey was undertaken using maps with a much smaller scale (1:18,000). Maps at this scale allowed for a more detailed depiction of crop boundaries, as well as the identification of small crops existing within large paddocks of another crop. Similarly, digitising the collected data onto ArcMap was conducted at a small scale (1:6000). This significantly improved the accuracy of crop polygons as features such as patches of bush, houses, small hills and other obstructions could be excluded from the digitised area. In general, this had the effect of reducing the area recorded for each crop from previous surveys. For example, the pine nursery in Puhā, Whatatutu, has not changed in paddock size, yet a notable decrease is seen between the 2013/13 and 2014/15 surveys, from 70.49 ha to 58.28 ha, respectively. This has been achieved simply by digitising only the extent of land that the pine nursery occupies and neglecting the wide windbreak, unused pasture around the crop, and features such as driveways and sheds. Further evidence can be seen by observing the total area of the 2012/13 survey compared with the same (approximate) survey area in 2014/15. By excluding the new survey areas, such as Matawai and Tolaga Bay, we can see the area has decreased from 19231.07 ha to 17776.32 ha - a reduction of 1454.75 ha. While there are some minor additions to the land mass surveyed around areas such as Kanakanaia and Ngatapa, they are not large enough to account for 1454.75 ha.

### **4.3 Crop Trends and Characteristics**

Results from this survey show how crops such as maize/sweetcorn, squash, lucerne and pasture are frequently rotated. Seldom are paddocks used for the same crops season after season. This is due to the nutrient requirements of each crop and how that affects the soils they are planted on. For example, maize/sweetcorn are heavy feeders which depletes the nitrogen and phosphorus in the soil. If they were to be planted in the same paddocks year after year, soils would become infertile and would require extensive treatment at large cost to replenish the soil to the required state. Therefore, prominent growers in Gisborne such as Corson, Cedenco and Pioneer practice effective crop rotation to ensure soils maintain a healthy and effective composition. A rotation may consist of a season of squash, followed by a season of maize/sweetcorn, then planted with lucerne after harvest. This can be grazed and hoed back into the soil, increasing the presence of organic matter and required nutrients.

The crop rotation observed in the 2014/15 survey explains to a moderate extent the fluctuations of the area occupied by crops such as maize/sweetcorn, squash, tomatoes and lucerne. Shifting these crops to different paddocks, which often have vastly different sizes, has resulted in constant

fluctuations in the area they occupy. Other factors are also relevant, and often more influential such as market forces, but it plays a notable role in changing the presence of crops on the Poverty Bay Flats.

While rotation is significant for some crops, it is not so for all. Citrus, kiwifruit and apples/pears, for example, tend to stay in the same locations for longer periods of time, and experience less drastic fluctuations as other crops. This may be due to costs associated with establishing such crops. These crops require a certain amount of infrastructure in order to grow and produce most effectively. Apples/pears, for example, have A-frame structures to assist the tree with growth and maintaining its integrity. Kiwifruit have large rows of posts and wires for the vines to flourish on, in addition to nets which aid in pest control and preventing disease. These additions can often be at a large cost to the grower. It is therefore in their best interest to maintain the crop and its structure season after season. Harvesting of these crops also does not involve invasive procedures such as those on squash, tomatoes and maize/sweetcorn. The fruit can be picked without harming the productive capabilities of the crop so that it can reproduce the following season.

The same argument could be made for the production of grapes in the Gisborne region as they too require substantial infrastructure in order to successfully produce, such as posts and wires. However, results from this survey and previous surveys suggest grape production in the region is more reflective of national grape prices, which shall be discussed in the next section.

As observed in Section 3, large portions of fodder crops are grown outside the Poverty Bay Flats. Leafy turnip, plantain and lucerne exhibit this trend best. This can be due to a number of reasons. Leafy turnip could largely be grown outside the Poverty Bay Flats because it is planted by private land owners for stock feed purposes, rather than harvest and exporting. Fodder crops in the 2014/15 survey also tended to exist on more marginal land (rolling hills, less fertile soil), and are therefore less suitable to be planted in other crops with greater soil nutrient requirements. In addition, the remote location of many of the fodder crops identified makes the land less attractive for companies such as Cedenco, Pioneer and Leaderbrand to plant with other crops due to the added extraction and transportation costs.

Minor crops such as strawberries, melons and olives (see figure 9) were identified only within the Poverty Bay Flats survey area. The (relatively) very small areas of such crops suggests they are grown by private landowners for roadside sales or private fruit stores. They were typically identified in locations relatively proximate to the city, indicating that exposure to thru-traffic is essential to their production and sale.

Maize/sweetcorn growth in the district is comprised of inputs from several companies, including Corson, Pioneer and Cedenco. Maize/sweetcorn paddocks tend to be grouped together with others grown by the same company. These clusters appear to be randomly spaced throughout the district. Cedenco planted 1746 ha of sweetcorn throughout the entire district, while Corson planted 1333 ha of maize in the 2014/15 season.

Cedenco have confirmed that 232 ha of peas were planted in 2014. Planting began in July, and peas were harvested by November, therefore were not recorded in the 2014/15 season's crop survey.

#### **4.4 Market Forces**

The most plausible reason for the 30% (652.50 ha) decrease in maize/sweetcorn between 2008/09 and 2009/10 is a significant drop in prices for corn, maize and grains in global markets. During the financial crises, prices were so low that many growers stopped growing maize/sweetcorn for the following season. Prices have since stabilised and maize/sweetcorn areas began to increase from



2009/10 with a large 1100 ha increase in the 2012/13 season due to high prices and a good growing season. This could also be due to the survey being carried out later than usual; therefore many crops have been harvested and replanted with maize/sweetcorn to finish off the season.

Pasture/unused land covers a high proportion of the Poverty Bay Flats (31%). If economic forces provide incentives for large scale conversion to water intensive crops, this has the potential to have a major impact on water demand in the Waipaoa catchment.

A growing oversupply of grapes for wine has pushed grape prices low enough to make other crop types more profitable for landowners. Combined with the recent loss of local grower contracts with major wine companies (Montana), the shift away from grapes was marked from 2008/09 to 2009/10. However, many growers are undecided as to what crops may replace grapes. There is now a better supply and demand climate in the national industry which saw an increase in grape area planted in 2013 according to Gisborne Wine Growers. National grape price per tonne rose from \$1359 in 2012 to \$1688 in 2013, which is reflected in the increased area of grapes in the 2012/13 season. The decrease of 288 ha from 2012/13 to 2014/15 is perhaps less consequential of a price drop as the projected average grape price for the 2014/15 season is \$1830 per tonne – an increase of \$142 from the previous year.

The decreases in grape presence between 2008 and 2012 are due to low grape/wine prices and competition resulting in large companies such as Montana to pull out vines in the District. Climatic factors also play an influential role in the time of harvest for grapes. Being the long warm, dry summer Gisborne has experienced in 2014/15, grapes were not harvested earlier than expected. The four seasons of decreases (2008-2012) in grape production saw a conversion into maize/sweetcorn, squash, citrus and tomatoes, although many landowners are still unsure as to which crops to plant due to changing prices and uncertainty. This could lead to farmers planting more water intensive crops such as kiwifruit in the future, depending on the PSA disease. The grape market is on the mend again with a better supply and demand situation. Grapes now occupy 10% of the Poverty Bay Flats.

#### **4.5 Water intensity of crop types**

Large scale changes in crop types may have significant impacts on water demand. Certain crops are more water intensive than others while some crops require little irrigation.

Kiwifruit is the most water intensive of the crops on the Poverty Bay Flats with water being essential for successful growth. The amount of water applied to the crop has a direct relationship to the weight of the fruit – less water produces smaller fruit that cannot be sold. The irrigation period typically extends for three months beginning mid/late December to mid/late March. The optimum irrigation amount applied daily is around 50,000 L/ha, but may range from 33,300 to 66,600 L/ha. The majority of kiwifruit orchards around the Poverty Bay Flats are irrigated using surface and groundwater sources.

Irrigation practice for citrus fruits is variable. First Fresh citrus trees are irrigated every three days and the amount of water applied depends on the daily evapotranspiration index ("ET index") published by MetService as well as the size (age) of trees, crop type and diversity, irrigation types (if at all), soil type etc., however there is no difference in the amount irrigated for different types of First Fresh citrus crops. Generally, the optimum amount of water irrigated per day is 25,000 litres per ha. The absolute minimum amount used daily is 10,000 L/ha and the maximum ever used is around 33,300 L/ha.

The results of the survey indicate that we have seen a decrease in the hectares of grapes, citrus, pip and stonefruit since the 2012/13 and that we have also seen a steady increase in kiwifruit. Mature grape plants require no irrigation, so the consequences of replacing them with other crop types, particularly those that are more water intensive such as kiwifruit, citrus/pip and stonefruit and squash could be an increased demand on the catchment's water resources. However, we are currently unable to quantify such a change in demand for water without better understanding the seasonal water requirements for various crop types.

#### **4.6 Changes in climate**

Council has had a programme of work looking at the potential impacts of climate change on various activities within the District since the early 2000s. The technical data is based on the Intergovernmental Panel on Climate Change (IPCC) projections for climate change, which have been subsequently assessed by the National Institute for Water and Atmospheric Research (NIWA) to localise the impacts to the New Zealand situation. The implications for the Gisborne District are assessed in the Savage Report *an Overview of Climate Change and Possible Consequences for the Gisborne District* and also the NIWA Report prepared for Gisborne District Council in June 2012, *Gisborne District Water Resources under Climate Change*.

The key potential climate change effects for the District from the Savage and NIWA Reports are:

- More climatic extremes;
- Drought risk will intensify for areas currently drought-prone;
- Increase in intense rainfall events such that precipitation is lost as run-off;
- Warmer climate favouring the spread and/or introduction of invasive sub-tropical grasses and pest insects.

The flow-on effects of these potential changes on land use on the Poverty Bay Flats could be marked and include:

- Increasing pressure on water resources for both stock and irrigation;
- Irrigation of pasture may be required where it is practical to do so;
- Use of more or new chemical insecticides;
- Climate likely to become increasingly marginal for sheep;
- Increase in animal diseases;
- Hot summer days may cause severe heat stress on animals;
- Soil conservation measures and storage options become more critical to avoid loss of valuable precipitation.

In summary, we are likely to have a less regular or reliable supply of water, however the increased average temperatures are likely to require more water for cropping and agricultural practices.

#### **4.7 Limitations**

There were some difficulties experienced with the survey:

- The inability to sight some crops from public roads meant some crops were excluded from the survey.

- The one-time observation of the flats only provides a snap shot of crop types that are planted on the Poverty Bay Flats. This season's survey was conducted from January 6 to January 23. Several crops can be grown in one year on a single block of land meaning the survey does not capture the seasonal rotations between crops. There can also be several crops planted over the summer irrigating period meaning we may miss potential high water demanding crops at certain times;
- The new method of data collection and digitising has had a significant impact on the results generated from the survey. This makes it difficult to draw comparative conclusions from previous surveys with any confidence. It is difficult to determine whether changing crop areas are due to market forces, industry priorities, land-use change or improved accuracy of crop digitising.
- New areas have been added to the survey area, including Matawai, Motu, Whangara, Tolaga Bay, Ruatoria and Tikitiki. This introduced new challenges when undertaking comparative analyses. Because this is the first survey to introduce these new areas we cannot compare any of the results with previous surveys.

The results are intended to provide a high level, strategic picture of land use change across the Poverty Bay Flats during the irrigation season over time. When supported with additional information on the water intensity of various crop types and information on potential impacts of climate change on water resources, the information will allow Council to manage land use change and water use sustainably.

Despite the limitations outlined above, the results are still valuable for strategic land use monitoring and planning.

#### **4.8 Next steps**

Tracking large scale changes in land use is an important aspect of maintaining a strategic perspective on water management within the Waipaoa and Waiapu catchments. Likewise understanding and managing the potential impacts of climate change on water availability is also important.

In order to identify the point at which water abstraction for irrigation and food production becomes unsustainable we need further information to:

- Compare monitored water levels with changes in land use trends – both surface water and groundwater (this comes after a report was released regarding declining aquifer levels – *Groundwater in the Poverty Bay Flats by GNS Science 2012*);
- Quantify the seasonal water intensity of various crop types found on the Poverty Bay Flats;
- Start to quantify the potential impacts of climate change on water quantity; and
- Continue annual observational survey to monitor land use change for both the Poverty Bay Flats and the extended area from this 2014/15 survey.

## 5.0 Graphs showing use by season

Figure 13: Pie graph showing hectares of crop area for 2007/08

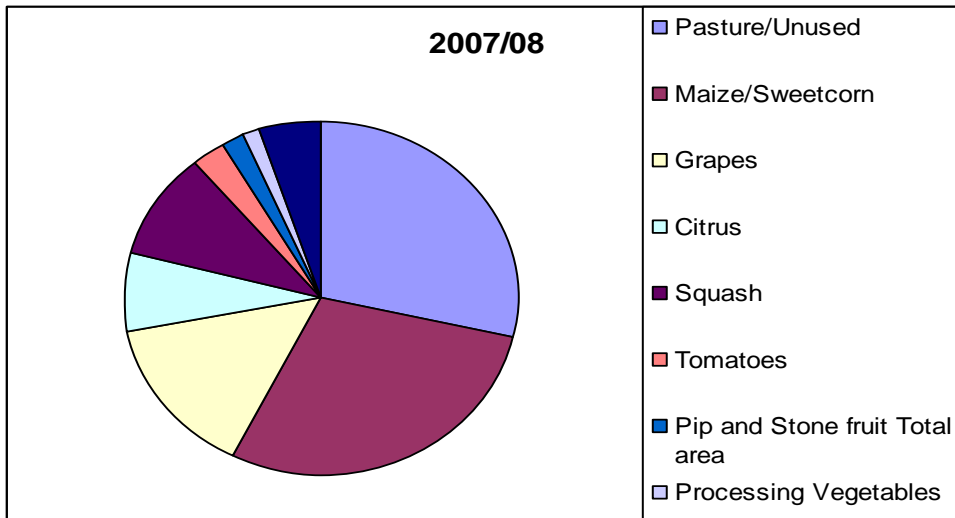


Figure 14: Pie graph showing hectares of crop area for 2008/09

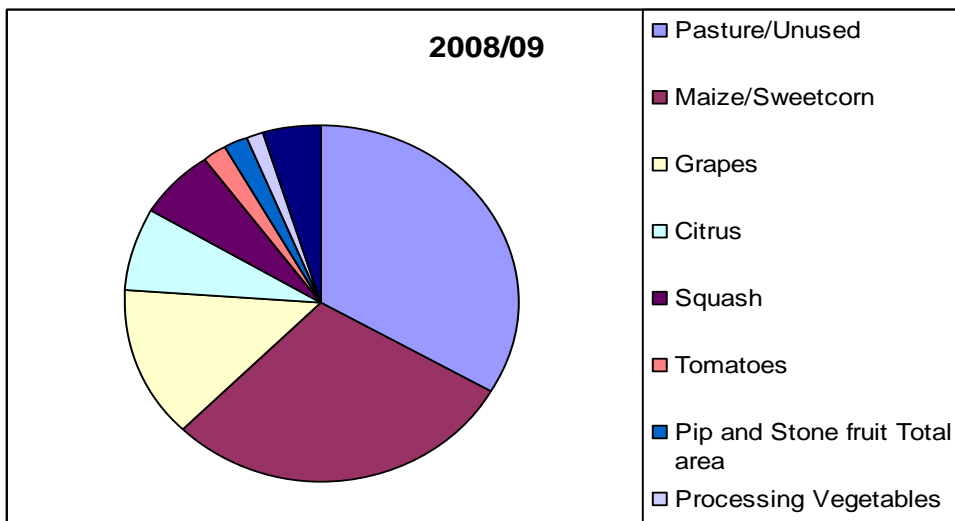


Figure 15: Pie graph showing hectares of crop area for 2009/10

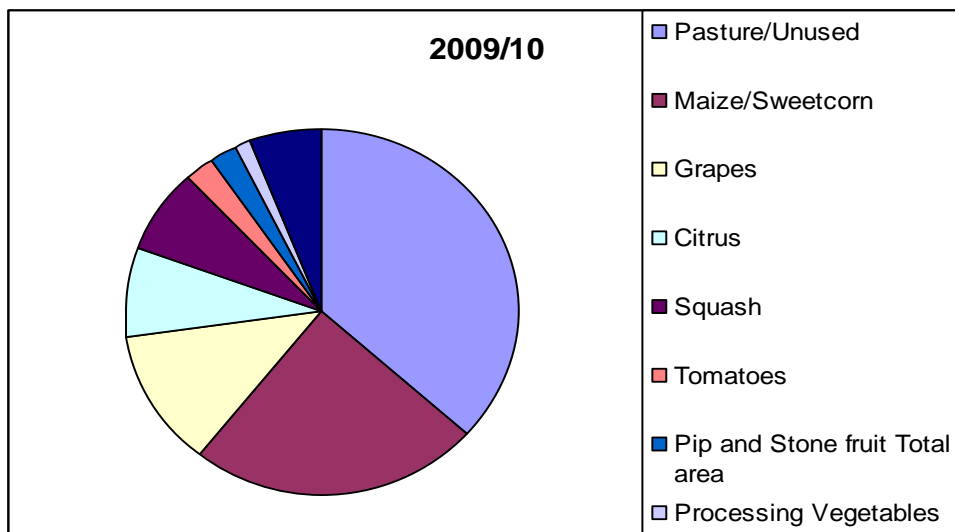


Figure 16: Pie graph showing hectares of crop area for 2010/11

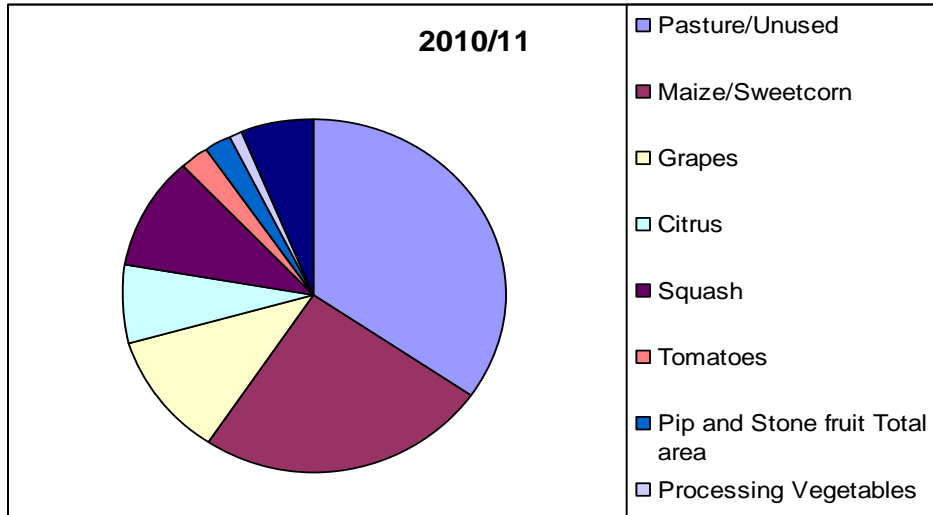


Figure 17: Pie graph showing hectares of crop area for 2011/2012

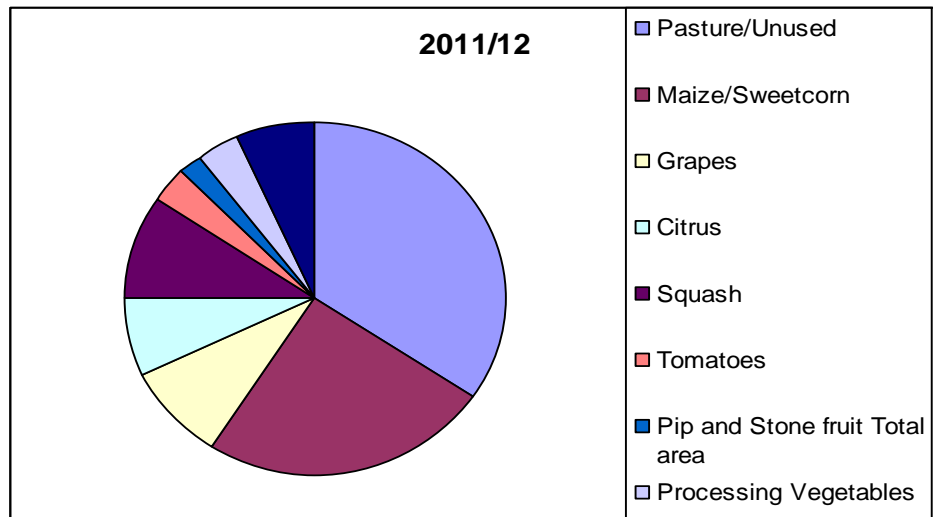


Figure 18: Pie graph showing hectares of crop area for 2012/2013

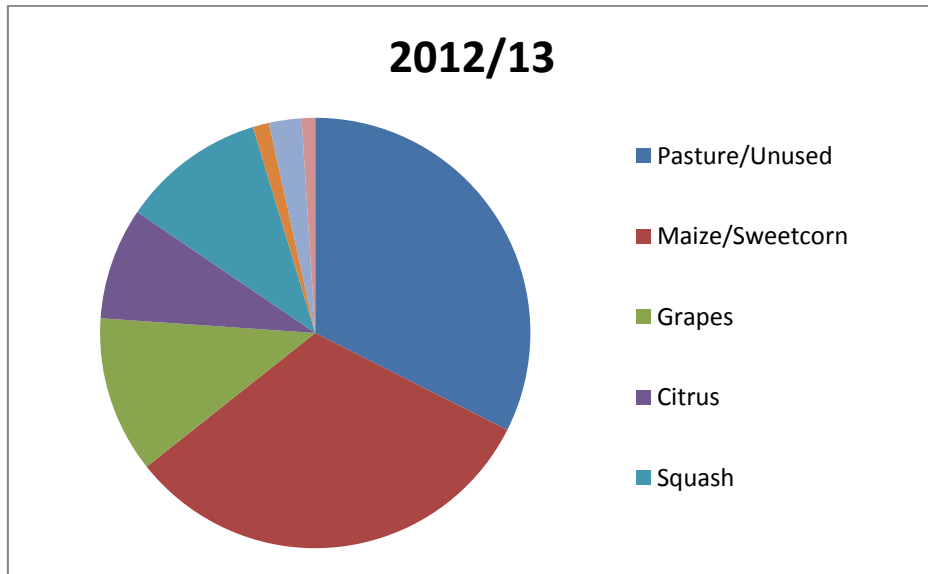


Figure 19: Pie graph showing hectares of crop area for 2014/2015

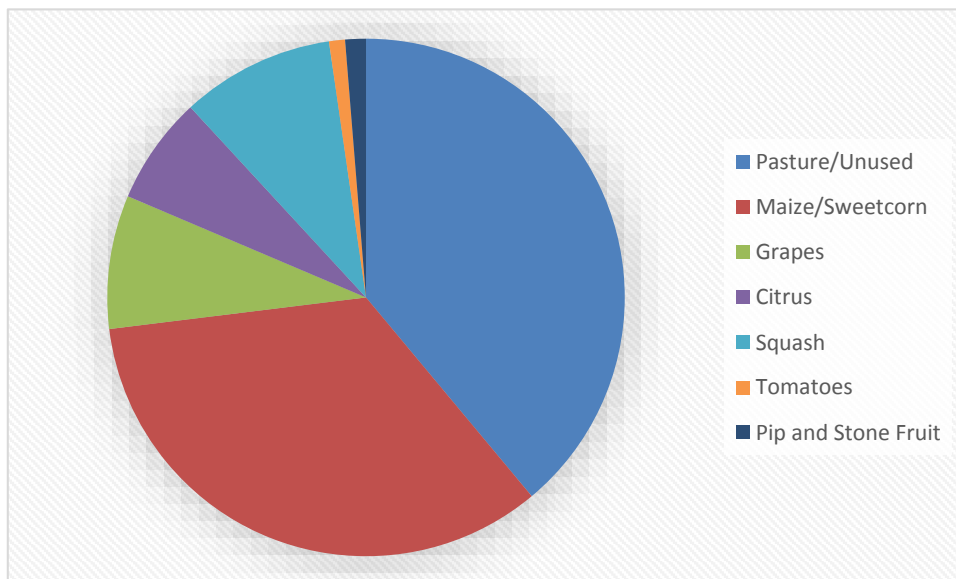




Figure 20: Cedenco Plan



## Cedenco Foods New Zealand Ltd Planting, Harvesting and Processing Season

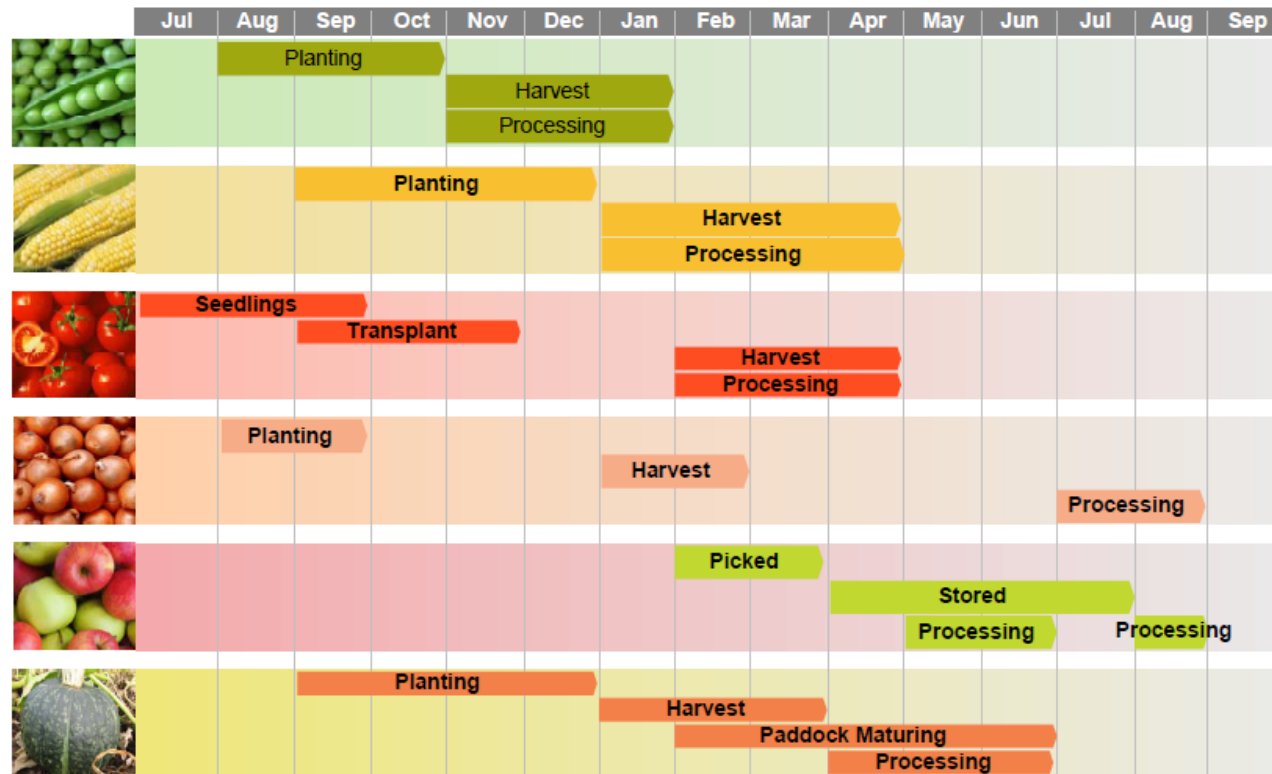




Figure 21: Leaderbrand Harvest Calendar



Harvest calendar

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Fresh Crops</b>												
Broccoli	[Harvest Period: Jan-Dec] [Availability Period: Jan-Dec]											
Buttercup Squash	[Harvest Period: Jan-Apr] [Availability Period: Jan-Apr]											
Lettuce	[Harvest Period: Jan-Dec] [Availability Period: Jan-Dec]											
Prepared Salads	[Harvest Period: Jan-Dec] [Availability Period: Jan-Dec]											
Sweet corn	[Harvest Period: Jan-May] [Availability Period: Jan-May]											
Watermelon	[Harvest Period: Jan-Mar] [Availability Period: Jan-Mar]											
<b>Process Crops</b>												
Buttercup Squash	[Harvest Period: Jan-Apr] [Availability Period: Jan-Apr]											
Sweet corn	[Harvest Period: Jan-May] [Availability Period: Jan-May]											
Tomatoes	[Harvest Period: Jan-May] [Availability Period: Jan-May]											
Wine grapes	[Harvest Period: Feb-Mar] [Availability Period: Feb-Mar]											

Harvest Period [Green Box] Availability Period [Light Green Box]