

6 Waikato's Ecological Footprint

6.1 Profile of the region

Waikato is the fourth largest region in New Zealand covering 2,497,340 ha. It is a geographically diverse area encompassing the rugged Coromandel Peninsula, the fertile Hauraki Plains and those surrounding the Waikato River, the hilly west and King Country areas and the volcanic plateau in the south.

The Waikato region also ranks fourth in terms of population with 357,726 people at the 2001 Census. Waikato has a large Maori population, with 21.3 percent identifying themselves as Maori, which is the second highest of any region behind Gisborne. Waikato's population is relatively youthful, having the second lowest median age of any region. Although the Waikato has experienced steady population growth over the last decade, there has been some significant outward migration from the region particularly to the neighbouring Bay of Plenty region.

The Waikato region has a relatively high population density of 14.02 people per km² ranking sixth out of the 16 regions. Overall, 76 percent of the population is urban with a large concentration of people living in the Hamilton urban area which had a population of 158,046 at the 1996 Census.

Agricultural production, and more particularly dairy farming, is the driving force of the Waikato economy. The contour as well as the favourable climate and soils of the Waikato make it one of the most well suited areas in the world for dairy farming. Over the last decade there has been steady growth in dairy cow numbers in the region with the region now having 37 percent of New Zealand's dairy herd. The processing of milk into a wide variety of value-added products is also critical to the Waikato economy. Most of this production of dairy products is focused on nine large factory sites that are by world standards technologically advanced and very efficient. The location quotients for both dairy farming (LQ 3.96) and dairy processing (LQ 2.77) reflect the importance of dairying to the region. There is also a relatively high location quotient for sheep, beef and mixed livestock farming (LQ 1.33).

Plantation forests cover approximately 12 percent of the Waikato region and represent about a quarter of New Zealand's plantation forests. Most forestry is situated around Taupo and South Waikato. The income and jobs generated from forestry production and processing in the Waikato is very significant. All of the forestry related sectors in the Waikato economy have high location quotients: forestry and logging (LQ 1.91), wood and wood products (LQ 1.43) and pulp and paper manufacturing (LQ 1.63).

The Waikato region also contributes significantly to New Zealand's electricity generation and distribution infrastructure. Within the region there are 12 hydroelectric, one thermal (Huntly) and five geothermal power stations. This represents nearly three-quarters of the North Island's generation capacity.

Service sector activity, other than health and community services (LQ 1.07), local government (LQ 1.08) and education (LQ 1.16), is relatively weak in the Waikato region. There are nevertheless particular strengths in education (mainly through the presence of Waikato University) and in scientific research with several key scientific research centres being located in the region.

6.2 Overall ecological footprint and comparison with other regions

Waikato has an ecological footprint of 1,048,860 ha. This represents 9.75 percent of New Zealand’s total ecological footprint, the third largest of any region in New Zealand behind Auckland and Canterbury.

On a per capita basis the Waikato, at 2.87 ha per person, has the ninth largest ecological footprint out of all 16 regions. This represents 6.81 percent less than the national average of 3.08 ha per person. The highly productive land of the Waikato is a major factor in explaining the relatively low ecological footprint for the Waikato (ie. it takes less Waikato land to produce the same amount of product). On the other hand, the Waikato is not a highly urban region (like Auckland and Nelson), which would otherwise decrease its ecological footprint even further. If the Waikato were more urban, it would benefit from economies of scale and efficiencies of land use.

According to the ecological footprint calculation, 1,048,860 ha of land is required to support consumption by the Waikato population. In contrast, there are 2,018,917 ha of useful land available, meaning that the Waikato has more than enough land to sustain its current level of consumption. In fact, the Waikato would need to increase its consumption 1.92 times before it would overshoot the availability of useful land. Overall, in net terms, this means the Waikato is ecologically self-sufficient and actually has an ecological surplus of 970,057 ha of useful land. This situation is typical of rural regions such as the Waikato.

6.3 Ecological footprint disaggregated by land type

The agricultural land component of the Waikato ecological footprint consists of 572,380 ha (refer to Table 6.1). This represents 54.6 percent of Waikato’s ecological footprint. Not surprisingly, most of this agricultural land (411,570 ha) is sourced from within the Waikato. There is little need to import agricultural based products into the Waikato given the abundance of fertile land available to produce such products within the Waikato. Only a small amount (22,280 ha) of agricultural land is drawn from other regions in New Zealand mainly from Gisborne, Hawke’s Bay, Manawatu–Wanganui, Otago and Canterbury. A significant amount (138,500 ha) of agricultural land is embodied in products imported from overseas. The agricultural land component of the Waikato footprint (54.6 percent), on a percentage basis, is considerably smaller than the New Zealand average (68.8 percent). This undoubtedly is explained by the high productivity of Waikato land, meaning that it generally requires less land to produce the same amount of product.

Table 6.1 Waikato’s ecological footprint by land type, 1997–98

Land type	Within region land (ha)	Land from other New Zealand regions (ha)	Land from other nations (ha)	Total land (ha)	Total land (ha per capita)	Total land (% of total)
Agricultural land	411,570	22,280	138,530	572,380	1.57	54.6
Forest land	104,690	310	13,060	118,060	0.32	11.3
Degraded land	130,020	9,340	9,160	148,520	0.41	14.2
Energy land	159,570	3,070	46,960	209,600	0.57	20.0
Total	805,850	35,000	207,710	1,048,560	2.87	100.0

The forest land component of the Waikato ecological footprint consists of 118,060 ha. This represents only 11.3 percent of the Waikato ecological footprint. Nearly all of the forest land (104,690 ha) is drawn from within the region – to be expected given that the Waikato has about one-quarter of New Zealand’s plantation forests, and all of the forest processing sectors have relatively high location quotients for the Waikato. Most of the remainder of this forest land component consists of land embodied in wood-based products imported from overseas.

The degraded land component of the ecological footprint makes up 14.2 percent (148,520 ha) of the Waikato ecological footprint. Most (130,020 ha) of this degraded land is drawn from commodities produced from urban-based businesses within the Waikato. The degraded land embodied in products imported either from other regions (9340 ha) or other countries (9160 ha) is relatively insignificant.

The energy land component of the Waikato ecological footprint is 209,600 ha. This represents 20.0 percent of the Waikato ecological footprint, which is higher than the national average of 16.6 percent. Most of (159,570 ha) Waikato’s energy footprint can be attributed to direct and indirect energy use within the Waikato economy rather than energy embodied in products imported into the region. All of this points to relatively inefficient energy use in the Waikato. This in part could be explained by the relatively spread-out nature of the settlement within the region requiring more transport energy use per person.

6.4 Ecological footprint disaggregated by goods and services purchased

6.4.1 Purchase of Waikato produced goods and services ($P_1 + P_2 \dots P_n$)

The purchase of manufacturing sector products accounted for 437,560 ha of embodied land in Waikato’s ecological footprint (refer to Table 6.2). This amounts to 41.7 percent of the entire ecological footprint of the Waikato region. The Waikato is self-sufficient in producing these manufactured goods (primarily food) within the region. Only a small amount of land (55,350 ha) is embodied in manufactured products imported to the region.

Table 6.2 Waikato’s ecological footprint by economic products, 1997–98

Economic products consumed	Within region land (ha)	Land from other New Zealand regions (ha)	Land from other nations (ha)	Total land (ha)	Total land (ha per capita)	Total land (% of total)
Agriculture	49,600	250	1,930	51,780	0.14	4.9
Forestry	4,850	0	50	4,910	0.01	0.5
Fishing and hunting	30	10	20	60	0.00	0.0
Mining and quarrying	320	10	50	370	0.00	0.0
Manufacturing	382,210	19,740	35,610	437,560	1.20	41.7
Utilities and construction	66,360	80	9,430	75,880	0.21	7.2
Services	245,620	1,390	42,420	289,420	0.79	27.6
Domestic final demand	56,870	13,800	118,210	188,880	0.52	18.0
Total	805,850	35,280	207,730	1,048,860	2.87	100.0

The purchase of service sector products accounted for 289,420 ha of the embodied land in the Waikato ecological footprint. This amounts to 27.6 percent of the entire ecological footprint of

the Waikato region. Most of these service sector products (insurance, finance, retail margin) are drawn from direct and indirect land from within the Waikato. Only a very insignificant amount of land (1390 ha) is embodied in service sector products purchased from other regions. Surprisingly, however, service sector products purchased by Waikato consumers have a much higher overseas embodied land content (42,420 ha). This probably results from the land embodied in computers, printed material and so forth imported from overseas used as inputs into the Waikato service sector.

The land embodied in other products purchased by Waikato consumers is much smaller than that for manufacturing and service sector products: agricultural products (51,780 ha), forestry products (4910 ha), mining and quarrying products (370 ha) and utilities and construction products (75,880 ha).

6.4.2 Purchase of goods and services produced outside the Waikato (D₁+D₄)

Consumers in the Waikato also purchase products from outside the region which accounted for 132,010 ha of land. This represents 12.57 percent of the entire Waikato ecological footprint. Most (118,210 ha) of these purchases are for products such as computers, motor vehicles, household items and consumables imported from overseas for direct use by householders. There is only a small amount of land (13,800 ha) embodied in consumer products imported from other regions in New Zealand directly used by Waikato households.

6.5 Ecological Balance of Trade and ecological interdependencies

The land embodied in imports into the Waikato economy is 341,520 ha whereas the land embodied in exports from the Waikato economy is 1,780,350 ha (refer to Table 6.3). This results in a positive Ecological Balance of Trade for the Waikato economy of 1,438,830 ha, meaning that overall it is a net provider of land to other regions and countries.

6.5.1 Exports and imports by economic sectors

The Waikato economy is based on land-oriented export industries. This is reflected in the pattern of exports and imports by economic sectors in the Waikato. Much embodied land (442,350 ha) is exported to other regions in New Zealand. This represents agricultural products that are directly exported out of the Waikato to other regions for further processing. Even more land (891,580 ha) is embodied in agricultural products (mainly dairy products) that are further processed in the Waikato and then exported internationally. There is also a significant amount of land embodied (205,700 ha) in the international exports of forestry products from the Waikato.

In overall terms, the Waikato is therefore a net exporter of land embodied in agricultural products (569,610 ha) forestry products (203,490 ha) and manufacturing products (806,910 ha). These manufactured products are almost entirely derived from land based raw materials (logs, milk, wool, sheep, cattle) that have been further processed. The net balances of trade for the other sectors in the Waikato economy are much smaller with imports and exports in broad terms tending to cancel each other out. For instance, the service sector imports 51,280 ha of embodied land into the region (purchase of equipment, computers, services) but it also exports 41,480 of

Interregional trade			
Agricultural land	45,070	447,640	402,570
Forest land	540	44,580	44,040
Degraded land	9,790	8,060	-1,730
Energy land	4,210	15,340	11,130
Interregional Balance of Trade	59,610	515,620	456,010
International trade			
Agricultural land	193,430	868,460	675,030
Forest land	19,010	263,250	244,240
Degraded land	16,600	17,530	930
Energy land	52,860	115,480	62,620
International Balance of Trade	281,900	1,264,720	982,820
Total Balance of Trade	341,510	1,780,340	1,438,830

A similar picture exists with forest land with the Waikato also being a net exporter of forest land (288,280 ha). Although a small amount of forest land is imported into the region (19,550 ha), this is far outweighed by the exports of forest land (307,830 ha). With forest land, the international exports are more important (203,230 ha) compared with the interregional exports (44,580 ha).

With energy land, the Waikato imports a considerable amount of products that require energy for their production, having an energy land component of 57,070 ha. Nevertheless the exports of energy intensive goods (eg. dairy products) means that there is an even greater amount (130,820 ha) of energy land embodied in Waikato exports.

The imports (26,390 ha) and exports (25,590 ha) of degraded land are small and, in any case, more or less balance.

6.5.3 Overall picture

Figure 6.1 provides a summary of the overall flows of embodied land through the Waikato economy. This diagram indicates that even though the local household consumption of land by Waikato residents is significant (1,048,860 ha), the Waikato economy is dominated by the exports of land to outside the region (1,780,350 ha). The Waikato is therefore a net provider of land to other regions and nations as reflected in its positive Ecological Balance of Trade of 1,438,830 ha. Waikato is therefore a producer of ecological capital for use by other regions and nations.

Figure 6.1 Flows of embodied land through the Waikato economy

