

7 Bay of Plenty's Ecological Footprint

7.1 Profile of the region

The Bay of Plenty region is the third-fastest growing region in New Zealand with the resident population increasing by 6.7 percent between the 1996 and 2001 censuses. At census night 2001 the resident population was estimated to be 239,412 or 6.4 percent of the nation's people. The majority of the population growth has occurred on the western half of the region, particularly Tauranga and Western Bay of Plenty districts. Respectively these districts were the second (16.9 percent) and eighth (9.3 percent) fastest growing districts in the country in the last intercensal period. By comparison, the eastern Kawerau and Whakatane districts showed negative population growth. The region has an estimated population density of just over 18 people per square kilometre, significantly higher than the national average.

One of the main reasons for this growth has been internal migration. For example, between 1991 and 1996 the Bay of Plenty showed the highest net internal migration gain of a region in the country (Statistics New Zealand, 1998h). Climatic conditions are a key factor attracting people, particularly the elderly, to the region. Nevertheless, the Bay of Plenty region also has higher than New Zealand average numbers of children.

The Bay of Plenty region occupies a total land area of 12,447 square kilometres. The region is characterised by volcanic activity. It has numerous volcanoes, hot pools and geysers. The eastern boundary of the region follows the Bay of Plenty coastline while the west, south and southeast boundaries are formed respectively by the Waikato, Hawke's Bay and Gisborne regions.

The Bay of Plenty economy has a comparative advantage in tourism, forestry, horticulture and dairy farming. Tourism is the region's most prominent industry. The accommodation, restaurants and cafe sector has a location quotient of 1.13. Rotorua is the main tourist destination in the region, with geothermal wonders, Maori culture and easily accessible outdoor pursuits as the key attractions. The region accounts for more than 10 percent of total guest-nights nationally (Statistics New Zealand, 1998h). Forestry and logging (LQ 3.37), wood and wood product processing (LQ 1.93), and paper and paper product processing (LQ 4.61) are also major industries in the region. The Norske Skog Tasman Pulp Mill in Kawerau is the major forest processing site. The Bay of Plenty region has an estimated 30 percent of the central North Island forests and includes the Kaingaroa State Forest. Nearly all of the forest milled is radiata pine. Favourable climate, soil, topography and a well-established roading system are key factors behind the success of forestry in the region. The region's temperate climate sustains a significant horticultural industry (LQ 2.47). More than 75 percent of the country's kiwifruit production is undertaken in the Bay of Plenty. Other sub-tropical fruit grown include tangelos, nashi, avocado, feijoas, tamarillos and passionfruit. Dairy farming, (LQ 1.21), is a growing industry. The 1997–98 GDP of the Bay of Plenty region is estimated to be \$5.6 billion or 5.7 percent of the national GDP.

The port of Tauranga is the major exit point for the region's processed wood products. It is the largest port in New Zealand by volume of cargo loaded. With the so-called 'wall of wood' (the projected maturity of significant tracts of forest) expected in the near future, it is predicted that timber volumes across the port will increase substantially.

7.2 Overall ecological footprint and comparison with other regions

The Bay of Plenty region has an estimated ecological footprint of 618,260 ha, or 5.75 percent of New Zealand's total ecological footprint. This is the seventh largest ecological footprint of any region in New Zealand. By comparison, Bay of Plenty's ecological footprint is smaller than the Manawatu–Wanganui region (879,520 ha) but greater than the Northland region (477,120 ha), its two nearest neighbours in ecological footprint terms.

Per capita, Bay of Plenty's ecological footprint is the sixth smallest out of all regions at 2.59 ha per person. This means that Bay of Plenty residents have a similar per capita ecological footprint to Hawke's Bay residents (2.63 ha). The region's per capita ecological footprint is, thus, in relative terms, smaller than the average New Zealander's. On a per capita basis, a Bay of Plenty resident requires only 84.1 percent of that required to sustain an average New Zealander. This is a consequence of the region's agricultural land having higher than average yields per hectare. Given the region's comparative advantage in intensive farming activities requiring highly fertile land such as dairy farming, horticulture and fruit growing this would seem plausible.

The area of useful land available in the Bay of Plenty region is estimated to be 925,530 ha, giving the Bay of Plenty region an ecological surplus of 307,270 ha. The Bay of Plenty region's ecological footprint accounts for 66.8 percent of total available useful land. This is the 11th largest ecological surplus of any region in New Zealand, equating to 1.3 ha per Bay of Plenty resident.

7.3 Ecological footprint disaggregated by land type

The agricultural land component of Bay of Plenty's ecological footprint consists of 372,770 ha, or 60.3 percent of the region's footprint (refer to Table 7.1). An estimated 56.6 percent of this land is appropriated from within the region. This is lower relative to the nation but is largely explained by the region's higher agricultural yields per hectare. Despite the region's higher land productivities across all farming activities the region's sheep, beef and mixed livestock industry is unable to meet local demand. This has resulted in such products being appropriated from nearby regions with surpluses, in particular Gisborne and Manawatu–Wanganui regions. Some 69,020 ha of agricultural land is embodied in purchases of products made in other regions.

Table 7.1 Bay of Plenty'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	211,000	69,020	92,750	372,770	1.56	60.3
Forest land	50,120	300	8,110	58,530	0.25	9.5
Degraded land	56,720	6,200	5,990	68,910	0.29	11.1
Energy land	87,050	1,840	29,120	118,010	0.50	19.1
Total	404,890	77,360	135,970	618,220	2.59	100.0

The forest land component of the ecological footprint consists of 58,530 ha, 9.5 percent of Bay of Plenty’s ecological footprint. Most of this land is appropriated from within the region although slightly less than 15 percent is embodied in goods and services purchased from other nations. The forest land component of the ecological footprint does not include the hypothetical land planted in trees required to sequester CO₂ emissions.

The degraded land component of the ecological footprint makes up 11.1 percent (68,910 ha) of Bay of Plenty ecological footprint. This consists mostly of land occupied by local businesses (excluding farming and forestry businesses) and residential properties. A further 17.7 percent of degraded land is embodied in the purchases made by Bay of Plenty residents from other regions and nations.

The energy land component of the Bay of Plenty’s ecological footprint is 118,010 ha, 0.5 ha per capita or 19.1 percent of the region’s footprint. In relative terms this is 15 percent higher than the nation. This suggests that local industries supplying goods and services to households are more energy intensive than their counterparts nationally. Overall, 73.8 percent of energy land is appropriated from within the region with an additional 24.7 percent embodied in goods and services produced from international sources.

7.4 Ecological footprint disaggregated by goods and services purchased

7.4.1 Purchase of Bay of Plenty produced goods and services (P₁+P₂ ... P_n)

The purchase of manufacturing sector products by Bay of Plenty residents accounted for 266,980 ha, representing 43.2 percent of the region’s ecological footprint (refer to Table 7.2). The vast majority of this land is embodied in manufactured goods produced locally (177,090 ha) in particular processed food products. Significant quantities of land (66,800 ha) are also embodied in manufactured goods purchased by the region’s residents from elsewhere within the country, in particular Gisborne and Manawatu–Wanganui regions. On a per capita basis, each Bay of Plenty resident consumes 18.2 percent less land embodied in manufactured goods (1.12 ha per person) than the average New Zealander does (1.37 ha per person).

Table 7.2 Bay of Plenty’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	35,190	1,120	1,640	37,950	0.16	6.1
Forestry	2,280	0	30	2,310	0.01	0.4
Fishing and hunting	10	0	10	30	0.00	0.0
Mining and quarrying	40	10	30	80	0.00	0.0
Manufacturing	177,090	66,800	23,090	266,980	1.12	43.2
Utilities and construction	30,890	140	6,750	37,770	0.16	6.1
Services	121,390	960	28,000	150,350	0.63	24.3
Domestic final demand	38,010	8,380	76,400	122,800	0.52	19.9
Total	404,890	77,420	135,960	618,260	2.59	100.0

Significant quantities of land are also embodied in service sector products consumed by Bay of Plenty residents. This equates to 150,350 ha of the region's ecological footprint or 0.63 ha per Bay of Plenty resident. At a first glance this figure appears very high but can be explained by backward linkages to primary sectors in the economy. Thus, while a service sector business may physically occupy only a small land area, the products that it purchases from other industries (such as food, paper, equipment, machinery etc) may contain substantial amounts of embodied land. Over 80 percent of land embodied in service sector products is appropriated from within the region with smaller amounts encapsulated in services purchased from abroad.

Purchases from other sectors by Bay of Plenty residents are much smaller than for manufacturing and service sector products. Such purchases accounted for 78,140 ha or 11.9 percent of the region's ecological footprint. This figure is primarily made up similar quantities of land embodied in agricultural products (37,950 ha) and utility and construction products (37,770 ha).

7.4.2 Purchase of goods and services produced outside Bay of Plenty (D₁+D₄)

Bay of Plenty residents also directly purchase products from outside the region. This accounts for 84,780 ha of the region's footprint. The vast majority of this embodied land is derived from international sources (76,400 ha). This includes land embodied in goods purchased from retailers that were made overseas, but sold locally with additional mark-up. Land embodied in items such as motor vehicles, computers, household appliances and imported food products is included in this figure. In relative terms, the land embodied in purchases made directly by households from abroad equates to 0.32 ha per capita, comparable with the New Zealand average of 0.33 ha per capita.

7.5 Ecological Balance of Trade and ecological interdependencies

Imports into the Bay of Plenty regional economy embody 288,860 ha of land, while exports from the region embody 731,000 ha. In this way, the region's economy has a large positive Ecological Balance of Trade, exporting 2.5 times more embodied land than it imports (refer to Table 7.3).

Table 7.3 Bay of Plenty’s Ecological Balance of Trade by economic sector, 1997–98

Economic sector	Imports purchased by the economic sector (embodied ha)	Exports sold by the economic sector (embodied ha)	Balance of Trade (embodied ha)
Interregional trade			
Agriculture	7,340	30,710	23,370
Forestry	110	41,290	41,180
Fishing and hunting	10	180	170
Mining and quarrying	50	0	-50
Manufacturing	92,500	18,590	-73,190
Utilities and construction	150	1,630	1,480
Services	1,220	2,390	1,170
Domestic final demand	8,380	0	-8,380
Interregional Balance of Trade	109,760	94,790	-14,970
International trade			
Agriculture	10,790	180,920	170,130
Forestry	2,140	115,150	113,010
Fishing and hunting	870	1,680	810
Mining and quarrying	140	270	130
Manufacturing	48,080	312,260	264,180
Utilities and construction	7,070	130	-6,940
Services	33,610	25,800	-7,810
Domestic final demand	76,400	0	-76,400
International Balance of Trade	179,100	636,210	457,110
Total Balance of Trade	288,860	731,000	442,140

7.5.1 Exports and imports by economic sectors

Over half of the land embodied in imports (140,580 ha) into the Bay of Plenty region is encapsulated in goods and services purchased by the manufacturing sector. Although this may appear high it is comparatively small when compared with the region’s exports of land embodied in manufactured products (330,850 ha). A significant proportion of the land exported overseas is embodied in processed food products, particularly dairy products and fruits.

A significant amount of land is embodied in agricultural products that are exports from the Bay of Plenty region (211,630 ha). This is primarily land embodied in agricultural products sold overseas (180,920 ha) and is partially explained by the region’s large fruit exports (eg. kiwifruit). Lesser quantities of agricultural land (39,710 ha) are embodied in sales to other regions, including livestock and horticultural produce destined for processing in other regions.

The Bay of Plenty service sector is a significant importer of embodied land (34,830 ha). The vast majority of this land (33,610 ha) is embodied in goods and services purchased by the service sector from international sources. The service sector uses paper products, equipment, furniture, and other capital items that have a high embodied land content. Some of this embodied land is re-exported in products sold, in turn, by the region’s service sector. Sales of service sector products from the Bay of Plenty account for 28,190 ha of embodied land.

Overall, the service sector has a relatively small negative Ecological Balance of Trade of 6640 ha.

7.5.2 Exports and imports by type of land

Bay of Plenty is a net producer of agricultural land (refer to Table 7.4). International exports (355,560 ha) outweigh international imports (120,770 ha) by 2.9 times. Much of the land embodied in the region's exports is associated with horticultural products. On an interregional basis, the region is a significant net importer of agricultural land (68,210 ha). This includes significant imports of land embodied in sheep and beef products which are land intensive compared with other farming products such as those produced by dairying.

Table 7.4 Bay of Plenty's Ecological Balance of Trade by land type, 1997–98

Economic sector	Land embodied in imports (ha)	Land embodied in exports (ha)	Balance of Trade (ha)
Interregional trade			
Agricultural land	100,560	32,350	-68,210
Forest land	470	50,450	49,980
Degraded land	6,370	1,180	-5,190
Energy land	2,360	10,810	8,450
Interregional Balance of Trade	109,760	94,790	-14,970
International trade			
Agricultural land	120,770	355,560	234,790
Forest land	13,760	185,390	171,630
Degraded land	11,030	6,820	-4,210
Energy land	33,530	88,440	54,910
International Balance of Trade	179,090	636,210	457,120
Total Balance of Trade	288,850	731,000	442,150

The region's economy is also a major net exporter of land embodied in forest products (221,610 ha), exporting over 16 times more forest land than it imports. With the region's proximity to the vast central North Island forests and the presence of the pulp mill at Kawerau, this is perhaps not surprising.

Although the quantity of energy land embodied in trade flows in the Bay of Plenty economy is smaller than both agriculture and forest land, it is still important. The energy land embodied in products exported internationally (88,440 ha) exceeds energy land imported from overseas (33,530 ha) by slightly more than 2.6 times. In terms of degraded land, the region has a small Ecological Balance of Trade deficit of 9400 ha.

7.5.3 Overall picture

The flow of embodied land through the Bay of Plenty economy is shown in Figure 7.1. This diagram shows that the Bay of Plenty region is largely driven by overseas demand for its products and is therefore a significant net exporter of embodied land. Exports to other nations account for 636,210 ha, an area slightly larger than the Bay of Plenty region’s ecological footprint of 618,270 ha. Furthermore, the land embodied in international exports is 6.3 times larger than the land embodied in international imports. In embodied land terms, the region therefore has a positive Balance of Trade of some 442,140 ha.

Figure 7.1 Flows of embodied land through the Bay of Plenty economy

