

# 11 Manawatu–Wanganui’s Ecological Footprint

## 11.1 Profile of the region

On Census night in 2001 the region had a resident population of 220,089 people, making the region the sixth-largest in terms of population nationally. Between 1996 and 2001 the region’s population reduced by 8682, or 3.8 percent of the population. This represents the single largest population loss of any region in the country during this period. Most of the decline was experienced in rural parts of the region. The Palmerston North and Wanganui urban areas account for 112,104 people or 50.9 percent of the 2001 population regionally. The region’s population density is estimated to be 10.43 people per square kilometre, which is below the New Zealand average in 1998 reflecting the region’s rural nature.

The Manawatu–Wanganui region is the second largest by area in the North Island and, overall, the sixth largest in New Zealand. The region covers an area of 2,221,500 ha or 8.1 percent of the country. The region stretches from north of Taumarunui to just south of Levin in the west, and from Cape Turnagain to Owhanga in the east. It is bounded internally by the Waikato, Taranaki, Hawke’s Bay and Wellington regions. The region has three major rivers: the Whanganui, Rangitikei and Manawatu. The Manawatu River is the only river beginning on the east coast that empties its waters on the west. The region has a variety of landforms, ranging from the rugged volcanic plateau and block faulted Tararua and Ruahine ranges to the extensive coastal sand dunes. The volcanic plateau encapsulates Mt Ruapehu (2797 metres), the tallest mountain in the North Island. Mt Ruapehu, Mt Ngauruhoe (2291 metres) and Mt Tongariro (1968 metres) dominate the volcanic plateau and are all active volcanoes. The volcanic plateau is made primarily of pumice soils that lack essential trace elements. This includes the Tongariro National Park, a designated World Heritage site.

The 1997–98 GDP of the Manawatu–Wanganui region is estimated to be \$5.3 billion or 5.4 percent of New Zealand’s GDP. Manawatu–Wanganui is one of the most important pastoral farming areas in New Zealand. Agriculture occupies an estimated 72.5 percent of all land in the region, significantly higher than the national average of 60.1 percent (Statistics New Zealand, 1998). Sheep, beef and mixed livestock farming is predominant (LQ 2.32). The flat fertile soils suit intensive sheep farming and cropping (particularly potato and barley); and hill country, as exists in the Rangitikei region, suits semi-intensive sheep and beef farming. The region also has a comparative advantage in textile and apparel manufacture (LQ 1.65) with wool and semi-wool carpet manufacturing plants located at Foxton, Feilding and Dannevirke. The region has three military bases and the largest proportion of people serving in the armed forces nationally. It is not surprising therefore that the central government sector (which includes defence) has a location quotient of 2.25. Relative to the nation the region also has a comparative advantage in the education sector (LQ 1.40) mainly due to the presence of Massey University.

## 11.2 Overall ecological footprint and comparison with other regions

Manawatu-Wanganui has an ecological footprint of 879,520 ha. This represents 8.2 percent of New Zealand's total ecological footprint, the sixth largest ecological footprint of any region. This is higher than Bay of Plenty region (618,260 ha) but lower than Otago region (1,019,050 ha).

On a per capita basis, the Manawatu-Wanganui region's ecological footprint of 3.80 is significantly higher than the New Zealand footprint of 3.08 ha. This means that the average Manawatu-Wanganui resident requires 23.4 percent more land to sustain their lifestyle than does the average New Zealander. This figure occurs because the region has slightly lower than average agricultural productivity. The productivity of agricultural land is a significant factor in determining the region's footprint size because land embodied in food (and other agricultural products such as textiles) is a major component of a person's ecological footprint.

Manawatu-Wanganui's useful land area is 1,833,120 ha, indicating that the region has an ecological surplus of 953,600 ha. This is the fourth largest ecological surplus of any region. In per capita terms, each Manawatu-Wanganui resident has an ecological surplus of 4.1 ha.

## 11.3 Ecological footprint disaggregated by land type

The agricultural land component of the Manawatu-Wanganui region's ecological footprint is estimated to be 636,820 ha (refer to Table 11.1). On a per capita basis, this amounts to 2.75 ha per person or 72.4 percent of the region's footprint. An estimated 84.9 percent of this land type is made up of within region land. In relative terms, this is a slightly higher share than the New Zealand average of 79.6 percent. This is explained by lower than average agricultural yields in areas near the volcanic plateau and in the region's hill country. A further 92,930 ha of agricultural land is embodied in purchases of goods and services from overseas.

**Table 11.1 Manawatu-Wanganui'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 | 541,220                 | 2,670                                    | 92,930                       | 636,820         | 2.75                       | 72.4                    |
| Forest land       | 25,650                  | 2,290                                    | 7,680                        | 35,620          | 0.15                       | 4.1                     |
| Degraded land     | 94,590                  | 310                                      | 5,380                        | 100,280         | 0.43                       | 11.4                    |
| Energy land       | 76,530                  | 1,890                                    | 28,250                       | 106,670         | 0.46                       | 12.1                    |
| Total             | 737,990                 | 7,160                                    | 134,240                      | 879,390         | 3.80                       | 100.0                   |

The forest land component of the region's ecological footprint consists of 35,620 ha or 4.1 percent of the footprint. Relative to the nation where 6.4 percent of the footprint consists of forest land, this component is significantly less. This suggests that Manawatu-Wanganui residents purchase less wood-based products than New Zealanders on average. An estimated 25,650 ha (72.0 percent) of this land originates from within the region, 7680 ha (21.5 percent) from other nations and the remaining 2290 ha (6.5 percent) from other regions. The forest land component of the footprint does not include the hypothetical land employed in sequestering CO<sub>2</sub> emissions.

The degraded land component of the ecological footprint accounts for 100,280 ha or 11.4 percent of the region's footprint. Of this land type an estimated 94.3 percent is within-region land. This encapsulates primarily land occupied by residential homes and local businesses (other than farming and forestry). An additional 5380 ha of degraded land is embodied in goods and services purchased from overseas by Manawatu-Wanganui residents.

The energy land component of the region's footprint consists of 106,670 ha. On a per capita basis this equates to 0.46 ha per person or 90.2 percent of the national average. Most of the energy land consists of within-region land (76,530 ha) with a lesser but significant share embodied in goods and services purchased from overseas (28,550 ha). The remaining 1890 ha are embodied in products purchased from other regions.

## 11.4 Ecological footprint disaggregated by goods and services purchased

### 11.4.1 Purchase of Manawatu-Wanganui produced goods and services ( $P_1+P_2 \dots P_n$ )

The purchase of manufacturing sector products by Manawatu-Wanganui residents accounts for 426,360 ha (48.5 percent) of the region's ecological footprint (refer to Table 11.2). The vast majority of this land is embodied in manufactured goods produced locally (397,880 ha), in particular processed food products. Smaller quantities of land (24,760 ha) are also embodied in manufactured goods purchased by the region's residents from overseas.

**Table 11.2 Manawatu-Wanganui'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                | 69,450                  | 20                                       | 1,690                        | 71,150          | 0.31                       | 8.1                     |
| Forestry                   | 2,190                   | 70                                       | 30                           | 2,290           | 0.01                       | 0.3                     |
| Fishing and hunting        | 10                      | 40                                       | 10                           | 60              | 0.00                       | 0.0                     |
| Mining and quarrying       | 60                      | 10                                       | 30                           | 100             | 0.00                       | 0.0                     |
| Manufacturing              | 397,880                 | 3,720                                    | 24,760                       | 426,360         | 1.84                       | 48.5                    |
| Utilities and construction | 24,740                  | 840                                      | 5,070                        | 30,650          | 0.13                       | 3.5                     |
| Services                   | 206,490                 | 1,050                                    | 27,960                       | 235,500         | 1.02                       | 26.8                    |
| Domestic final demand      | 37,170                  | 1,560                                    | 74,680                       | 113,410         | 0.49                       | 12.9                    |
| <b>Total</b>               | <b>737,990</b>          | <b>7,300</b>                             | <b>134,230</b>               | <b>879,520</b>  | <b>3.80</b>                | <b>100.0</b>            |

Significant quantities of land are also embodied in service sector products consumed by Manawatu-Wanganui residents. On a per capita basis, this amounts to 1.02 ha or 26.8 percent of the region's footprint. At a first glance, this figure appears very high but can be explained by backward linkages to the farming, forestry, and mining 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. Most of this land is embodied in service sector commodities that are produced locally (206,490 ha) with smaller amounts from overseas (27,960 ha). In this way, the land embodied in service sector purchases by Manawatu-

Wanganui residents (1.02 ha per capita) is approximately 27 percent higher than the New Zealand average (0.80 ha per capita).

Purchases from other sectors by Manawatu-Wanganui residents are much smaller than for manufacturing and service sector products. Such purchases accounted for 104,250 ha or 11.9 percent of the region's ecological footprint. This figure is primarily made up of agricultural product purchases (71,150 ha) along with purchases of utility and construction products (30,650 ha).

#### **11.4.2 Purchase of goods and services produced outside Manawatu-Wanganui ( $D_1+D_4$ )**

Manawatu-Wanganui residents also purchased products imported into the region, accounting for 76,240 ha of the region's footprint. The bulk of this land is derived from international sources. This includes land embodied in goods purchased from local retailers that were made overseas but sold with an additional mark-up. In this way, land embodied in items such as motor vehicles, computers, household appliances and imported food products is included in this figure.

### **11.5 Ecological Balance of Trade and ecological interdependencies**

Imports into the Manawatu-Wanganui region economy embody 197,510 ha of land, while exports from the region embody 1,195,810 ha (refer to Table 11.3). In this way, the region's economy has a large Ecological Balance of Trade surplus, exporting nearly 6.1 times more embodied land than it imports.

**Table 11.3 Manawatu-Wanganui'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) |
|--------------------------------|--|---|--------------------------------|
| <b>Interregional trade</b>     |  |   |                                |
| Agriculture                    | 140  | 239,170   | 239,030                        |
| Forestry                       | 1,210  | 2,040   | 830                            |
| Fishing and hunting            | 200  | 0   | -200                           |
| Mining and quarrying           | 50   | 0   | -50                            |
| Manufacturing                  | 7,000  | 15,230  | 8,230                          |
| Utilities and construction     | 860  | 790   | -70                            |
| Services                       | 1,230  | 27,030  | 25,800                         |
| Domestic final demand          | 1,560  | 0   | -1,560                         |
| Interregional Balance of Trade | 12,250   | 284,260   | 272,010                        |
| <b>International trade</b>     |  |   |                                |
| Agriculture                    | 12,920   | 233,810   | 220,890                        |
| Forestry                       | 460  | 35,230  | 34,770                         |
| Fishing and hunting            | 60   | 250   | 190                            |
| Mining and quarrying           | 120  | 350   | 230                            |
| Manufacturing                  | 57,820   | 609,740   | 551,920                        |
| Utilities and construction     | 5,190  | 140   | -5,050                         |
| Services                       | 34,010   | 32,030  | -1,980                         |
| Domestic final demand          | 74,680   | 0   | -74,680                        |
| International Balance of Trade | 185,260  | 911,550   | 726,290                        |
| Total Balance of Trade         | 197,510  | 1,195,810   | 998,300                        |

### 11.5.1 Exports and imports by economic sectors

Sales of manufactured products by the Manawatu-Wanganui economy were estimated to include 624,970 ha of embodied land. Land embodied in exports of manufactured products made up 62.6 percent of the region's total ecological trade surplus. The vast majority of land embodied in manufactured products (609,740 ha) is destined for other nations. This land is primarily embodied in processed agricultural products, including processed sheep and beef meat, processed horticulture produce and textiles.

The Manawatu-Wanganui region is also a significant net exporter of land embodied in agricultural products with similar quantities heading offshore (233,810 ha) as going to other New Zealand regions (239,170 ha). This includes land embodied in but not limited to wool, livestock sales and cash crops such as carrots and maize. Overall the region exports more than 36 times the embodied land in agricultural products than it imports.

Purchases by the region's service sector embody 35,240 ha of land. By comparison, service sector embodied land exports equate to 59,060 ha. This gives the region's service sector a positive Ecological Balance of Trade of 23,820 ha. All other sectors of the region's economy have close to neutral trade balances, with the exception of the utilities and construction sector which is a net importer of 5120 ha of embodied land.

### 11.5.2 Exports and imports by type of land

Manawatu-Wanganui is a large net producer of agricultural land (refer to Table 11.4). International exports (829,080 ha) outweigh international imports (135,640 ha) by 6.1 times. Much of the land embodied in the region's exports is associated with sheep, beef, dairy, crops produce and in wool. On an interregional basis, the region is also a significant net exporter of agricultural land (249,220 ha).

**Table 11.4 Manawatu-Wanganui'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) |
|--------------------------------|-------------------------------|-------------------------------|-----------------------|
| <b>Interregional trade</b>     |                               |                               |                       |
| Agricultural land              | 5,100                         | 254,320                       | 249,220               |
| Forest land                    | 3,990                         | 3,110                         | -880                  |
| Degraded land                  | 560                           | 20,990                        | 20,430                |
| Energy land                    | 2,610                         | 5,840                         | 3,230                 |
| Interregional Balance of Trade | 12,260                        | 284,260                       | 272,000               |
| <b>International trade</b>     |                               |                               |                       |
| Agricultural land              | 135,640                       | 829,080                       | 693,440               |
| Forest land                    | 9,500                         | 46,690                        | 37,190                |
| Degraded land                  | 9,740                         | 7,270                         | -2,470                |
| Energy land                    | 30,370                        | 28,520                        | -1,850                |
| International Balance of Trade | 185,250                       | 911,560                       | 726,310               |
| Total Balance of Trade         | 197,510                       | 1,195,820                     | 998,310               |

The remaining land types in the Manawatu-Wanganui region all have relatively small trade surpluses compared with the agricultural land embodied in the region's exports: forest land (36,310 ha), degraded land (17,960 ha) and energy land (1380 ha). Degraded land embodied in products sold by the Manawatu-Wanganui region to other regions is however quite high (20,990 ha). This is partially explained by the region's comparative advantages in military/ defence and education/research institutions that occupy extensive land areas.

### 11.5.3 Overall picture

Figure 11.1 provides a summary of the overall flows of embodied land through the Manawatu-Wanganui regional economy. The production of agricultural products for international exports dominate with 911,550 ha being exported to other nations. By comparison, exports to other regions of embodied land are considerably smaller at 284,260 ha. Although the Manawatu-Wanganui region has a strong export orientation, the region's predominantly urban population also requires a considerable quantity of land to support its existence (879,520 ha). Overall, exports of embodied land (1,195,810 ha) outweigh embodied land imports (197,510 ha) by nearly 6.1 times. The Manawatu-Wanganui region is therefore a large net provider of ecological capital to other regions and countries.

**Figure 11.1 Flows of embodied land through the Manawatu-Wanganui economy**

