# 17 Canterbury's Ecological Footprint

## 17.1 Profile of the region

At 4,553,681 ha, Canterbury is New Zealand's largest region in terms of land coverage. In terms of population and GDP output it ranks second behind Auckland and marginally ahead of the Wellington region.

Geographically, the region is expansive and diverse with perhaps four distinctive landscapes: the Southern Alps on the western flank, rolling foothills of the Alps, the Canterbury Plains based on alluvial fans and Banks Peninsula which has volcanic origins. This physical endowment provides the basis for much of the economic activity of Canterbury, ranging from farming activity through to downstream manufacturing and nature-based tourism.

Over half (52 percent) of the South Island population lives in Canterbury, mostly in the Christchurch metropolitan area. Over the last two census periods (from 1991-2001) Canterbury has experienced steady population growth, reaching 481,131 in the 2001 Census. Current projections estimate that the population will increase to 533,600 by 2021 (15.6 percent increase). The population density of 10.75 people per square kilometre is close to the New Zealand average, reflecting the urban-rural mix of Canterbury which is a microcosm of the New Zealand situation.

Canterbury has a strong agricultural base particularly in sheep and beef farming (LQ 1.37), and other farming (LQ 5.11) ie. cropping, deer, pig and other livestock. It has the largest number of sheep of any region in New Zealand and a dominance in pig farming in part due to Canterbury being a major grain producing region.

The manufacturing base in Canterbury is also strong and diverse, (70 percent) based mainly in urban Christchurch but with significant pockets of activity in Ashburton (5 percent) and Timaru (8 percent). Much of this strength is derived from the further processing of raw materials from the primary sector, including meat and meat product manufacturing (LQ 1.40), manufacturing of food (LQ 1.24), textile and apparel manufacturing (LQ 1.59), and wood and wood products (LQ 1.06). Light manufacturing industries with a technological focus, such as machinery and equipment manufacture (LQ 1.37), transport equipment (LQ 1.26) and chemical products (LQ 1.20) also record activities above the national average.

Canterbury is an important region in terms of electricity generation, producing 24 percent of New Zealand's electricity from hydroelectric plants in the Waitaki Basin, Lake Coleridge and Highbank.

Tourism is also important to the Canterbury economy with Christchurch being the main gateway for international tourists into the South Island. Beyond Christchurch, the Southern Alps with Mt Cook and Arthur's Pass National Parks are significant tourism attractions. International tourists made 800,000 trips to the Canterbury region, spending $724 million in 2002 (McDermott Fairgray Group Ltd, 2001). This makes Canterbury the second most important tourism region behind Auckland.

## 17.2 Overall ecological footprint and comparison with other regions

Canterbury has an ecological footprint of 1,737,840 ha, 16.16 percent of New Zealand ecological footprint. It is the second highest ecological footprint of any region in New Zealand behind Auckland.

On a per capita basis, Canterbury has an ecological footprint of 3.75 ha per person. On this basis, it is the sixth largest ecological footprint of any region in New Zealand and above the New Zealand average of 3.08 ha per person. Canterbury, in overall terms, has slightly less productive land than the New Zealand average, which pushes its ecological footprint just above the New Zealand average. The urban-rural mix (and resultant population density) in Canterbury is similar to the national average, which means that any urban efficiencies (and their effects on the ecological footprint) will probably be the same as the national average.

According to the ecological footprint calculation, 1,737,840 ha of land is required to produce the commodities which the Canterbury population consumes. These are in contrast 3,636,071 ha of useful land available, meaning that Canterbury has more than enough land to sustain its current level of consumption. In fact, Canterbury would need to increase its consumption, 2.09 times before it would overshoot the availability of useful land. Overall, in net terms, this means that Canterbury is self-sufficient and actually has an ecological surplus of 1,898,230 ha of useful land. This is the largest ecological surplus of any region in New Zealand.

## 17.3 Ecological footprint disaggregated by land type

The agricultural land component of the ecological footprint consists of 1,302,510 ha (refer to Table 17.1), 75.0 percent of the Canterbury ecological footprint. Most (1,028,480 ha) of this agricultural land is appropriated from within the region, not surprising given the abundance of agricultural land in the Canterbury region. Only a relatively small amount (59,270 ha) of agricultural land is appropriated from other regions in New Zealand. Agricultural land appropriated from overseas (214,400 ha) is more significant than obtained from other regions in New Zealand.

**Table 17.1 Canterbury'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 | 1,028,840 | 59,270 | 214,400 | 1,302,510 | 2.67 | 75.0 |
| Forest land | 26,890 | 4,650 | 18,630 | 50,170 | 0.10 | 2.9 |
| Degraded land | 143,820 | 1,580 | 12,470 | 157,870 | 0.32 | 9.1 |
| Energy land | 157,040 | 3,920 | 66,240 | 227,200 | 0.47 | 13.1 |
| Total | 1,356,590 | 69,420 | 311,740 | 1,737,750 | 3.57 | 100.0 |

The forest land component of the ecological footprint consists of 50,170 ha, only 2.9 percent of the total Canterbury footprint. On a per capita basis, this forest land appropriation is 0.10 ha per person for Canterbury, half of the national average of 0.20 ha per person. The low use of forest land in Canterbury and comparatively high use of agricultural land is suggestive of some substitution effect involving agricultural land displacing forest land for some uses.

The degraded land component of the ecological footprint consists of 157,870 ha. This represents 9.1 percent of Canterbury's ecological footprint. Most of degraded land is appropriated from urban Christchurch and to a lesser extent from urban centres such as Timaru and Ashburton. Comparatively little degraded land is appropriated from other regions (1580 ha) or from overseas (12,470 ha).

The energy land component of the ecological footprint is 227,200 ha. This represents 13.1 percent of Canterbury's ecological footprint. On a per capita basis, this amounts to 0.47 ha energy land per person, compared with a national average of 0.51 ha energy land per person. The fact that most of this energy land is appropriated within the region combined with the fact that Canterbury's per capita energy land is below the national average indicates that Canterbury is slightly more energy efficient than the national average.

## 17.4 Ecological footprint disaggregated by goods and services purchased

### 17.4.1 Purchase of Canterbury produced goods and services ($P_1$+$P_2$ ... $P_n$)

The purchase of manufacturing sector products accounted for 822,940 ha of embodied land in Canterbury's ecological footprint (refer to Table 17.2). Most of this land was drawn from within the region. Canterbury manufacturers only appropriated relatively small amounts of land from other regions (64,350 ha) and other nations (63,760 ha) in providing these products. The land embodied in manufacturing products purchased by Cantabrians represents 47.4 percent of Canterbury's ecological footprint.

**Table 17.2 Canterbury'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 | 160,380 | 360 | 9,110 | 169,850 | 0.35 | 9.8 |
| Forestry | 2,680 | 520 | 60 | 3,260 | 0.01 | 0.2 |
| Fishing and hunting | 30 | 0 | 30 | 60 | 0.00 | 0.0 |
| Mining and quarrying | 220 | 70 | 90 | 370 | 0.00 | 0.0 |
| Manufacturing | 694,830 | 64,350 | 63,760 | 822,940 | 1.69 | 47.4 |
| Utilities and construction | 53,540 | 1,570 | 12,990 | 68,090 | 0.14 | 3.9 |
| Services | 354,330 | 860 | 67,240 | 422,430 | 0.87 | 24.3 |
| Domestic final demand | 90,580 | 1,780 | 158,480 | 250,840 | 0.51 | 14.4 |
| Total | 1,356,590 | 69,510 | 311,740 | 1,737,840 | 3.57 | 100.0 |

The purchase of service sector products accounted for 422,430 ha of the embodied land in the Canterbury ecological footprint. This amounts to 24.3 percent of the entire ecological footprint of the Canterbury region. Most of these service sector products (insurance, finance, retail margin) are drawn from land within the Canterbury region (354,330 ha). Very little (860 ha) land from other regions is embodied in service sector products purchased by Cantabrians although there is a significant amount of overseas land (67,260 ha) involved.

The land embodied in other products consumed by Cantabrians is much smaller than that for manufacturing and service sector products: agricultural products (169,580 ha), forestry products (3200 ha) fishing and hunting products (60 ha), mining and quarrying products (370 ha) and utilities and construction products (10,096 ha).

### 17.4.2 Purchase of goods and services produced outside Canterbury ($D_1$+$D_4$)

Cantabrians purchase products from outside the region, accounting for 160,260 ha of appropriated land. Most of these purchases appropriate land from overseas (158,480 ha) such as householders purchasing products such as imported motor vehicles, computers, foodstuffs and various household items. There is only a small amount of appropriated land from other regions in these purchases (1780 ha).

## 17.5 Ecological Balance of Trade and ecological interdependencies

The land embodied in imports into the Canterbury regional economy is 653,620 ha. Whereas, the land embodied in exports from the Canterbury economy is 2,559,420 ha (refer to Table 17.3). This results in the Ecological Balance of Trade of the Canterbury economy being 1,905,780 ha, ie. it is overall a net provider of land to other regions and nations.

**Table 17.3 Canterbury'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 | 2,200 | 217,960 | 215,760 |
| Forestry | 6,510 | 0 | -6,510 |
| Fishing and hunting | 10 | 0 | -10 |
| Mining and quarrying | 180 | 0 | -180 |
| Manufacturing | 164,490 | 36,440 | -128,050 |
| Utilities and construction | 1,580 | 700 | -880 |
| Services | 1,060 | 2,600 | 1,540 |
| Domestic final demand | 1,780 | 0 | -1,780 |
| Interregional Balance of Trade | 177,810 | 257,700 | 79,890 |
| **International trade** | | | |
| Agriculture | 55,380 | 644,690 | 589,310 |
| Forestry | 690 | 37,160 | 36,470 |
| Fishing and hunting | 1,350 | 2,850 | 1,500 |
| Mining and quarrying | 240 | 670 | 430 |
| Manufacturing | 159,610 | 1,506,590 | 1,346,980 |
| Utilities and construction | 13,190 | 260 | -12,930 |
| Services | 86,870 | 109,490 | 22,620 |
| Domestic final demand | 158,480 | 0 | -158,480 |
| International Balance of Trade | 475,810 | 2,301,720 | 1,825,910 |
| Total Balance of Trade | 653,620 | 2,559,420 | 1,905,800 |

### 17.5.1 Exports and imports by economic sectors

In net terms, Canterbury exports a massive amount (1,905,800 ha) of land outside the region. In fact, it is a net exporter of more land than any other region in New Zealand.

The Canterbury agricultural sector exports 862,650 ha of land in agricultural products (wool, live animals, horticultural produce) destined for regional markets (215,760 ha) and for international markets (589,310 ha). The manufacturing sector exports even more embodied land (1,543,030 ha) although there are also significant imports of land into the manufacturing sector (324,100 ha). Many of the agricultural products are further processed and then exported in a value-added form from the region. The strongest outward flow of these manufactured goods is internationally with only relatively small flows to other regions in New Zealand.

Apart from the agricultural and manufacturing sector, the other trade flows to and from the Canterbury economy are relatively small and tend not to be driven by export markets.

### 17.5.2 Exports and imports by land type

Canterbury is a very large net provider of agricultural land to other regions and nations. Even though it appropriates 507,870 ha of agricultural land through imports, it exports a massive 2,383,730 ha of appropriated agricultural land (refer to Table 17.4). The overall effect, is the net export of 1,875,860 ha of agricultural land. Much of the prosperity of the Canterbury economy is indeed based on this ability to produce from its land resources, large volumes of agricultural products for export to international markets.

**Table 17.4 Canterbury'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 | 157,220 | 251,770 | 94,550 |
| Forest land | 12,270 | 550 | -11,720 |
| Degraded land | 2,260 | 2,090 | -170 |
| Energy land | 6,080 | 3,290 | -2,790 |
| Interregional Balance of Trade | 177,830 | 257,700 | 79,870 |
| **International trade** | | | |
| Agricultural land | 350,650 | 2,131,960 | 1,781,310 |
| Forest land | 24,020 | 54,550 | 30,530 |
| Degraded land | 23,080 | 22,450 | -630 |
| Energy land | 78,050 | 92,750 | 14,700 |
| International Balance of Trade | 475,800 | 2,301,710 | 1,825,910 |
| Total Balance of Trade | 653,630 | 2,559,410 | 1,905,780 |

The trade flow patterns for forest land, degraded land and energy land tend on the other hand to be driven by local demand within the Canterbury economy. There are significant imports of consumer and intermediate consumption goods which appropriate forest land (36,290 ha), degraded land (25,340 ha) and energy land (84,130 ha). On the export side, some forest land (55,100 ha), degraded land (24,540 ha) and energy land (90,040 ha) is embodied in the export of products from the Canterbury economy.

### 17.5.3 Overall picture

Figure 17.1 provides a summary of the overall flows of embodied land through the Canterbury regional economy. The production of agricultural products for international exports dominates with 2,301,720 ha being exported to other nations. The export to other regions is in comparison much smaller at 257,700 ha. Even though the Canterbury economy has a strong export orientation, there is a considerable population base particularly in urban Christchurch, which means that the flows of embodied land required for household consumption are also high at 1,737,840 ha. Given the coincidence of these two strong drivers (international exports and household consumption) in one region, Canterbury has the largest flux of embodied land of any region in New Zealand.

Exports of embodied land (2,559,420 ha) outweigh imports of embodied land (653,620 ha). This gives Canterbury the largest positive Ecological Balance of Trade of any region in New Zealand at 1,905,800 ha. Canterbury is therefore New Zealand's largest net provider of ecological capital to other regions and nations.

**Figure 17.1 Flows of embodied land through the Canterbury economy**