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Pressures: consumption and production

Part 2 introduced the three major driving forces that operate in the Auckland region. It showed how social, economic and environmental changes are linked, often resulting in pressures on the environment.

Environmental pressures come from individual and collective consumption and production consumption of natural resources in order to create various types of goods and services, and production of air pollutants, solid and liquid wastes.

This part explores the main types of consumption and production in the Auckland region, and their implications for the environment.

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Pressures – consumption and production

Contents 3.0

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Photo: Market gardens, Auckland. (Source: ARC).

Pressures: consumption and production

Introduction to pressures

The three major driving forces in the Auckland region are population growth, economic activity and growth and increasing consumption. These have led to pressures on the environment because, as explained in Part 2, production and consumption usually generate some form of adverse effect.

The specific pressures arising in the Auckland region result from the following types of human activities:

- use of the land and marine area for buildings, transport, primary production and recreation
- consumption of water to meet domestic, agricultural and industrial needs
- generation of air pollutants, liquid and solid wastes
- capture, storage, transport and use of energy
- transportation of people, goods and services into out of and around the region.

Pressures can affect a range of ecological, cultural and social values. This part describes and quantifies the extent of these pressures on the environment in the Auckland region.

Land use, land use change and intensification

Key findings

- Pasture is the most extensive type of land cover in the Auckland region, covering just under 50 per cent of the land area. Most land in the Auckland region is used for sheep and beef farming followed by dairying and rural residential (lifestyle).
- The urban area covers about 10 per cent of the land, and 70 per cent of the urban area is residential.
- Between 1987 and 2006, the residential density of the urban area increased 24 per cent to 25.7 people per hectare. Most of this population growth was accommodated by a 23.7 per cent expansion of the urban area from 40,000 to 49,500 hectares. Loss of prime agricultural land to urbanisation over this period occurred at an average rate of 333.4 hectares per year.
- The impervious surfaces within the Auckland Metropolitan Urban Limits (Figure 2 in Part 1) increased from 39 per cent in 2000 to 42 per cent in 2008.
- Livestock numbers (including dairy cows) are declining. However, the average size of dairy herds, and stocking rates, are increasing.
- There has been a loss of orchards in the Auckland region but an increase in market gardening. Overall, horticultural land use increased by 210 hectares between 2002 and 2007.
- Rural subdivision continues to occur, and fragmentation of rural land is most intense around the Metropolitan Urban Limits in the south-east and in the northern coastal areas.
- An average of 8.9km of streams are subject to stream bed disturbance (on a scale that requires a consent) each year.

Introduction

The way that land is used is one of the most important determinants of the nature and extent of the environmental pressures faced in the Auckland region. Land uses (e.g. horticulture, housing and industry) give rise to environmental pressures, either directly or indirectly. For example, land uses can:

- result in large areas of impervious surfaces that increase the amount of stormwater and its contaminant load
- involve regular land disturbance, leading to increased sediment discharge
- result in soil loss or degradation
- have long-term impacts on traffic generation (e.g. increased traffic as a result of a major new retail centre) leading to increased vehicle emissions
- lead to the introduction of exotic plants and animals that may modify native ecosystems and landscapes.

Although most land uses are associated with a level of continuous pressure on the environment, changes from one type of land use to another can produce specific short-term or one-off pressures. For example, the transformation of rural land to urban often leads to a pulse (increase) in sediment flushed into the aquatic environment, as well as loss of native vegetation and, possibly, aspects of historic heritage (see Indicator 6 and 7 in Chapter 5.2).

Another type of pressure results when existing land uses are intensified. Within the Auckland region, land uses are constantly changing and evolving in response to the driving forces discussed in Part 2. Not only does the Auckland region experience changes in the types of land use activities undertaken (e.g. changes from horticulture to residential) but it also experiences changes in the intensity of land uses.

In summary, land use, land use change and intensification have a wide range of implications for the environment. These are discussed in the following sections.

Land use monitoring programmes

The ARC does not maintain a formal or systematic monitoring system of land use pressures. However, it subscribes to a number of key external databases including the Land Cover Database (LCDBII), Agribase and Agricultural Production Survey. These collect data using different methods and at different dates and, therefore, are not always comparable. Nevertheless, these databases and other data sources allow us to investigate particular pressures when required, in order to develop and evaluate our policy responses. We also monitor land availability within the Metropolitan Urban Limit (MUL) to ensure an adequate land supply for residential and business use and development.

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Pressures: consumption and production

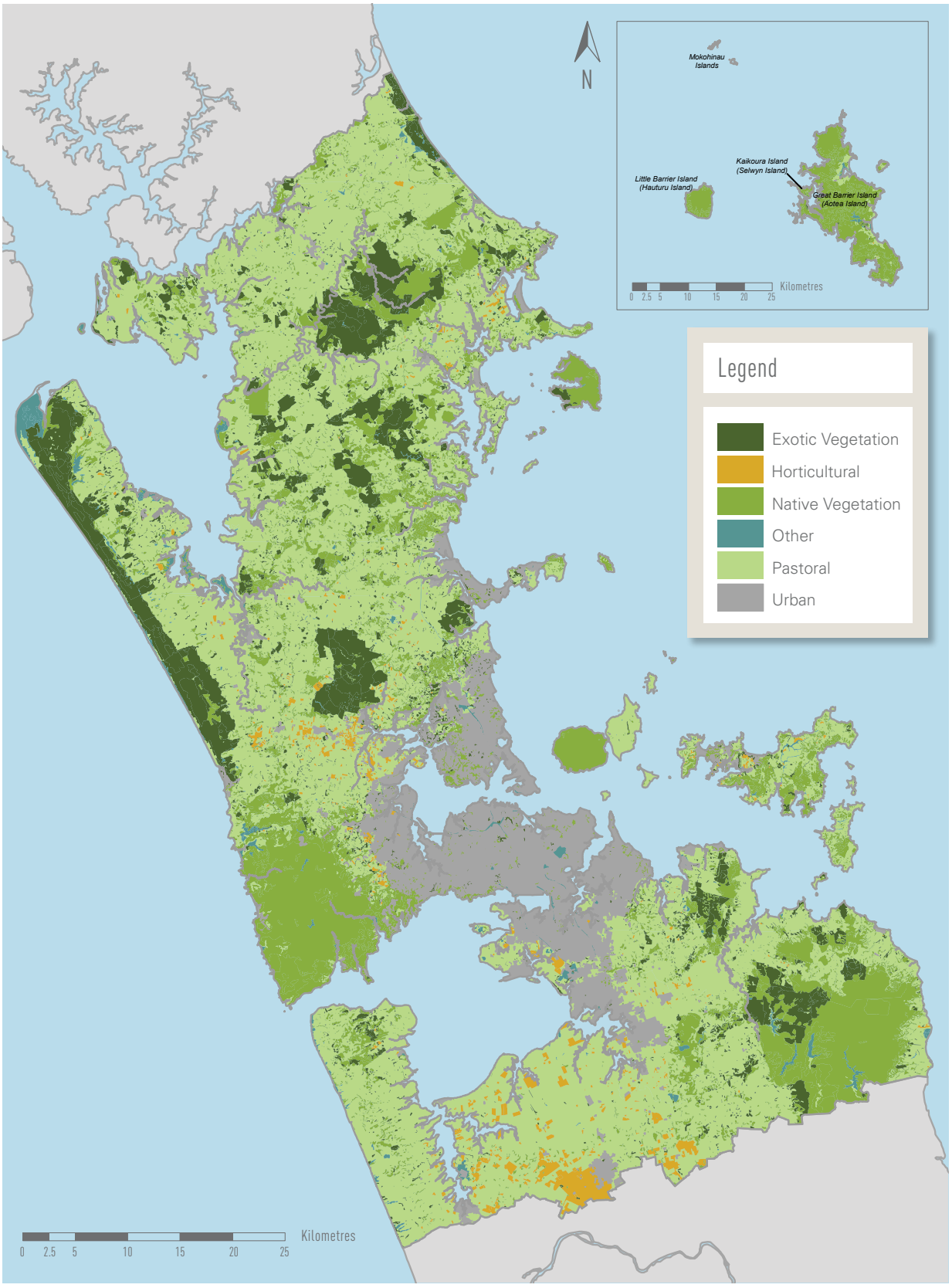

FIGURE 1 Land cover classified by dominant class: urban, pastoral, horticultural, exotic vegetation, native vegetation and other. (Other includes lakes, rivers, mines, landfills, etc.), 2004. (Source: MfE).

Pressures: consumption and production

Land cover and land use

Indicator 1: Land cover

Satellite imagery was used to classify land cover into six classes. The 2002 land cover data are the most recent available for the Auckland region. Figure 1 shows that in total, urban land cover (including settlements outside the main urban area) accounted for about 50,000 hectares or 11 per cent of the total land area in 2002. Pasture is the most extensive type of land cover (49.6 per cent) but it declined by about 2,000 ha (0.8 per cent) between 1997 and 2002.

The amount of land used for horticulture (1.8 per cent) has remained relatively static over the last decade although horticultural land use has varied, with losses in some areas countered by gains in others. Planted forest increased slightly to 10.8 per cent between 1997 and 2002 but fluctuations are likely to occur due to harvesting and planting cycles.

In 2002, native vegetation accounted for 27 per cent (about 134,700 hectares). This represented a decrease of about 170 hectares since 1997.

Indicator 2: Land use

The type of land cover is a good indicator of the activities being undertaken on the land (and, therefore, the types of land use pressures created) but is not, by itself, sufficient to convey the true nature and intensity of these pressures.

TABLE 1 Urban land uses in the Auckland region, 2004. (Source: Market Economics Ltd., 2008).

Urban land use	Land use activity	% of Auckland region
Industrial	Food and beverage production	0.2
	Chemical, plastic and non-metallic mineral product manufacturing	0.2
	Metal products, machinery and equipment manufacturing	0.3
	Other manufacturing	0.3
Commercial	Wholesale and retail trade, accommodation, restaurants and bars	0.3
	Finance, insurance, property and business services	0.1
	Government administration and defence	0.1
	Education, health, personal and community services	1.3
	Transport services	0.6
	Other services	0.3
Residential	Residential	7.2
Total % of urban land cover		**11**

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Pressures: consumption and production

Rodney district contains the most extensive areas of dairy, sheep-beef and livestock farming (60 per cent), followed by Franklin district (23 per cent) and Manukau district (9 per cent). Franklin district contains 82 per cent of the region's market gardens, making it an important area for this type of land use activity. Just under half of the horticulture (market gardening, orchards, floriculture, nursery, viticulture and cropping) occurs within the Franklin district. Rodney district also contains a considerable amount of land used for horticulture (28 per cent) with orchards, floriculture, nurseries and viticulture dominant (Table 2).

TABLE 2 Total farmed area (hectares) by rural land use activity and territorial authority. (Source: Agribase 2009).

Land use activity	Rodney District	North Shore City	Waitakere City	Auckland City	Manukau City	Papakura District	Franklin District	Total
Market gardening	320	4	41	4	101	39	2,316	**2,825**
Orchards	825	13	262	14	85	119	439	**1,757**
Floriculture	140	2	38	5	49	24	77	**335**
Nursery	171	0	87	0	58	36	50	**402**
Viticulture	281	0	63	462	38	3	8	**855**
Cropping	458	0	37	5	132	74	633	**1,339**
Dairy	25,166	0	52	0	2,290	373	19,709	**47,589**
Sheep-Beef	98,074	445	2,334	8,620	16,234	3,843	26,933	**156,484**
Other livestock	3,816	95	277	70	1,088	363	2,214	**7,923**
Lifestyle	10,814	868	2,332	705	1,531	1,120	3,782	**21,154**
Unknown	6,287	133	566	554	1,633	915	2,774	**12,862**

Urbanisation

Development associated with population and economic growth has transformed land for housing, economic, social and cultural purposes, as well as for transport networks and other infrastructural requirements.

Between 2001 and 2005, the number of dwellings increased by about 8,800 each year. Our current population projections suggest that an estimated 240,000 additional dwellings will need to be built by 2035.

Historically, much of the urban growth occurred on the urban fringes. Developing rural land for urban use affects both the natural and physical environment and the existing urban area. Effects include removal of vegetation cover, alteration of the existing topography and landforms, increased pressure on streams, and congestion on transport routes.

The landform modifications and earthworks undertaken during urbanisation often result in degradation or complete removal of the soil. Although the uplifted soil is often relocated and reused, its productivity can be degraded due to structural changes and compaction.

For these reasons, changes in the type and density of housing is a useful indicator of the impact of urban growth on the environment, as increased density reduces the need for expansion of the urban area into rural areas.

Indicator 3: Change in urban housing and density

Pressure to develop rural land has been strong over the last decade and is likely to continue in the future; however, there have been some changes to Auckland's urban form. Traditionally, housing stock in the Auckland region has been dominated by detached houses.

In 2006, 75.6 per cent of the occupied dwellings were detached houses and 23.9 per cent were flats or apartments (up from 21.1 per cent in 2001). The majority of the 98,450 occupied flats and apartments were in low-rise buildings (52 per cent were in one storey, 37 per cent in two or three storey and 10 per cent in higher rise buildings), had one or two bedrooms (70 per cent) and were located mainly in the North Shore, Auckland and Manukau cities.

In 2006, 16 per cent of the population in the Auckland region lived in flats and apartments. Around 18,000 higher-density homes have been built since 2001, making up about one third of the new housing stock between 1996 and 2006.

From 1990 to 2009 the overall density of the urban area is estimated to have increased from 20.7 to 25.7 people per hectare, a 24 per cent increase over 19 years (Figure 2).

Pressures: consumption and production

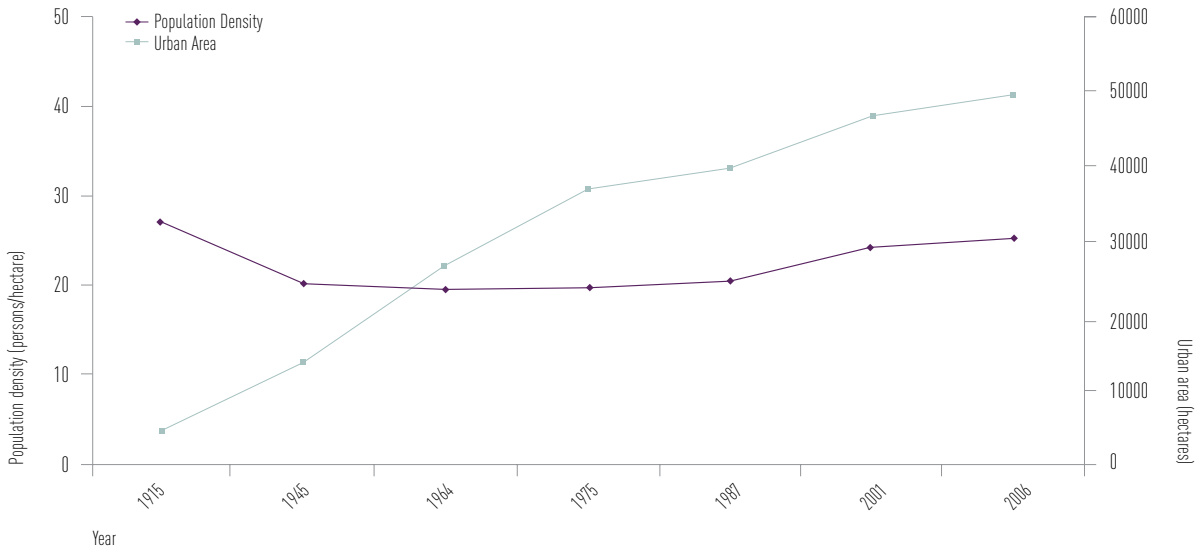

FIGURE 2 Changes in the population density and size of the urban area in the Auckland region, 1915-2006. (Source: ARC).

Indicator 4: Location of housing development

The other indicator of pressure on the 'greenfield' environment is the amount of housing development occurring at the urban fringes compared to existing urbanised areas.

For the overall distribution of housing growth and increasing numbers of dwellings on the urban fringes and in the central business district (CBD) between 2001 and 2006 (Figure 3). This shows that, despite the changes in housing preferences and housing densities discussed in Indicator 3, in absolute terms the greatest number of new dwellings continue to be at the urban fringes.

Most of the urban population growth between 1987 and 2006 was accommodated by a 23.7 per cent expansion of the urban area from about 40,000 to about 49,500 hectares (Figure 2).

Indicator 5: Soil loss to urbanisation

The productive capability of land is assessed using the Land Use Capability (LUC) classes. The classes are a measure of the land's capacity for sustained productive use and take into account physical limitations, soil conservation needs and management requirements. There are eight classes, ranging from Class I (flat land with good soil and few limitations) to Class VIII (land with severe physical limitations).

In the Auckland Regional Policy Statement (ARPS), Class I land is referred to as 'elite' while 'prime agricultural land' collectively covers Class I, II and III land. The loss of soil in these classes represents land well suited to agricultural or horticultural use, but also land that is attractive for residential development.

Between 2001 and 2006, urban development replaced elite land at a rate of 23.9 hectares per year; an increase from 4.5 hectares per year between 1987 and 2001. Prime agricultural land was lost at a rate of about 333 hectares per year: an increase from 228 hectares per year between 1987 and 2001.

Overall, this represents a 5 per cent loss of elite land and a 4.9 per cent loss of prime agricultural land between 1979 and 2006. (Table 3).

TABLE 3 Conversion of prime agricultural land to urban use between 2001-06. (Source: Landcare Research and ARC).

LUC class	Hectares in urban area (2001-06)	Rate (hectares/yr)
I	119.4	23.9
II	941.1	188.2
III	606.4	121.3
Total	**1666.9**	**333.4**

Indicator 6: Extent of impervious surfaces

Aerial photography and satellite imagery were used to estimate the extent of impervious surfaces within the Metropolitan Urban Limits and urban expansion areas defined in the Auckland Regional Growth Strategy (ARGS). Information from 2000 and 2008 was used to allow the changes over time to be assessed. (Table 4 and Figure 4).

In both surveys, Auckland City had the highest extent of impervious surfaces but there was little change between 2000 and 2008. Similarly, there was little or no change in North Shore City and Waitakere City. In contrast, Manukau City and Papakura district both showed large increases (10 per cent) in impervious surfaces between 2000 and 2008 and these can be seen clearly in Figure 4. As a result, the overall extent of impervious surfaces in the Metropolitan Urban Limits and urban expansion areas increased from 39 to 42 per cent.

In some cases, the extent of impervious surfaces decreased from 2000 to 2008 due to the establishment of parks, open spaces and a growth in urban vegetation following large scale subdivision where bare soil is planted.

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Pressures: consumption and production

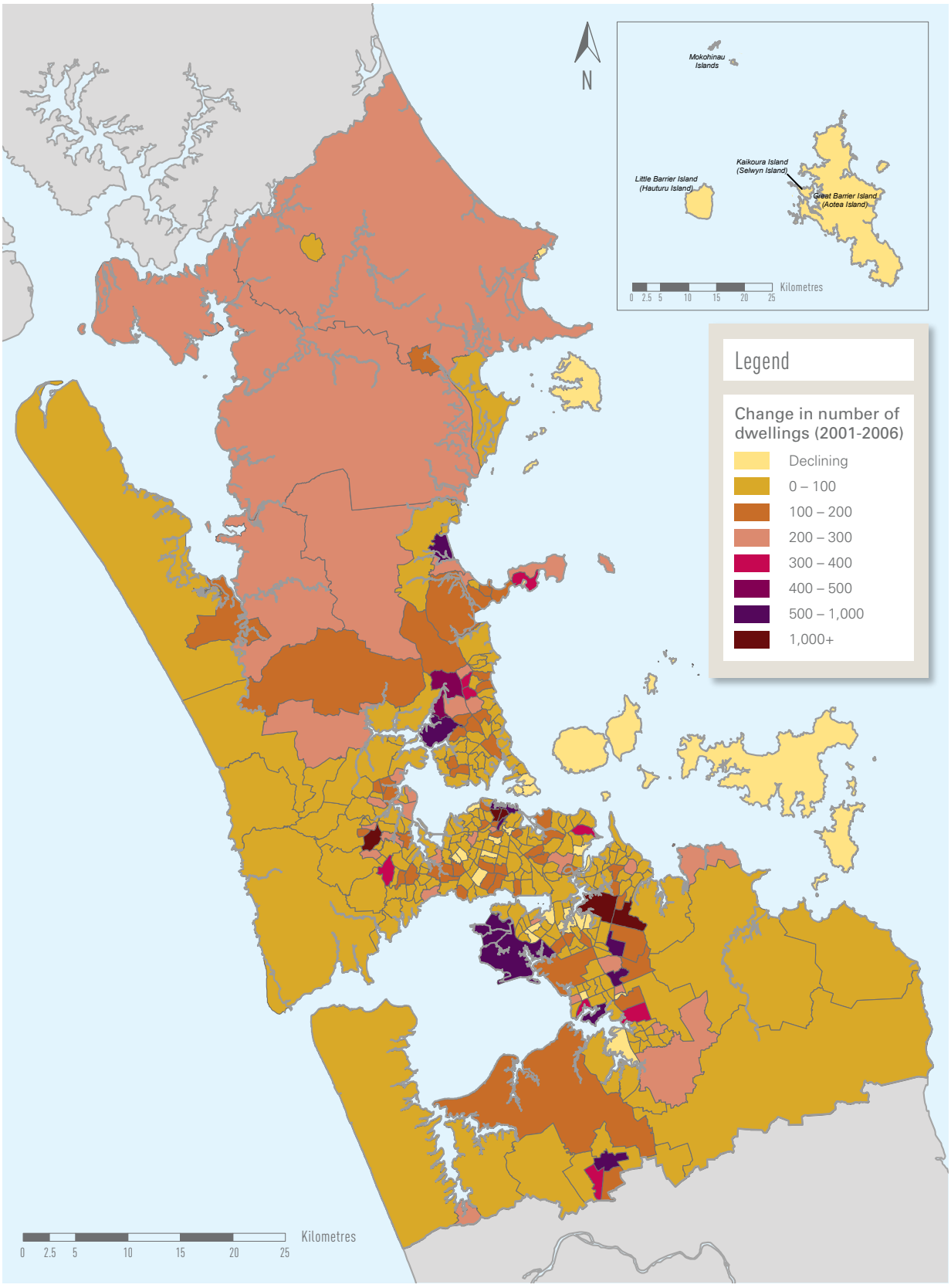

FIGURE 3 Changes in the numbers of dwellings by Census Area Unit, 2001-06. (Source: Statistics New Zealand).

Pressures: consumption and production

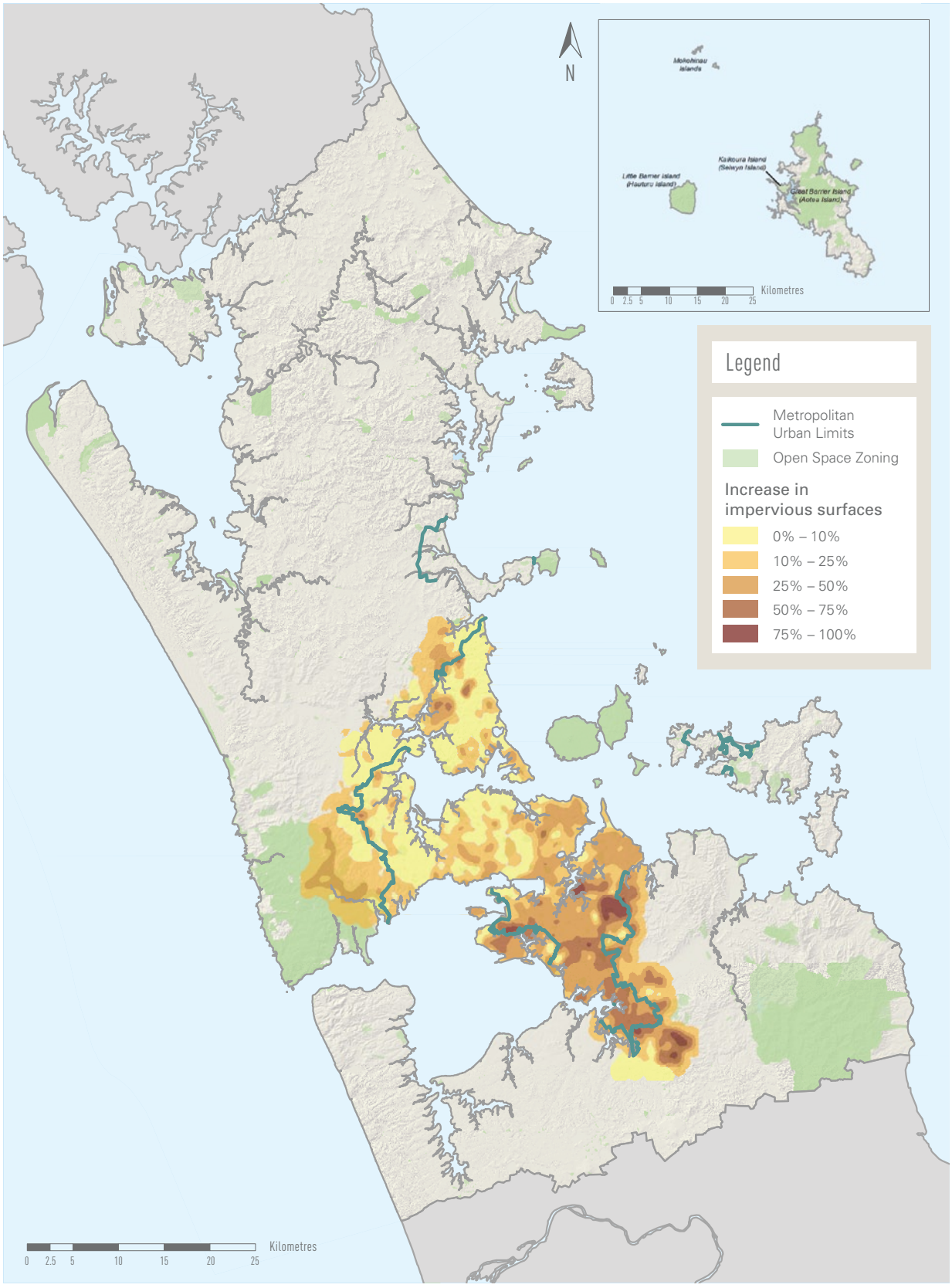

FIGURE 4 Increases in the extent of impervious surfaces in the Metropolitan Urban Limits and urban expansion areas. (Source: Landcare Research and ARC).