CHAPTER SEVEN

Shattered Hills

It is 600 km from the East Cape of the North Island to the middle Wairau valley in Marlborough at the north-eastern tip of the South Island. It may seem odd to treat these widely separated localities within the one soil landscape region, but a number of similarities in climate and soil parent material make it reasonable to do so.

Contribution of Climate and Geology to Landscape

In summer, motorists travelling from the Hutt Valley to the Wairarapa are usually confronted with a dramatic change in the colour of the landscape once over the Rimutaka hill. The green pastures of the Kaitoke basin give way to the tawny, dry plains and hills beyond Featherston at the eastern foot of the Rimutaka Range. Whereas the Hutt Valley and Featherston each have a moderate annual rainfall of 1400 mm, this drops to 800 mm a mere 10 km out onto the Wairarapa Plains near Martinborough. In the Wairarapa most rain falls in winter, and spring and summer rainfall can be quite unreliable. Summer day temperatures often rise above 30°C and the prevailing north-westerly winds, having shed their moisture on the forested mountain ranges to the west, are hot and dry enough to desiccate the landscape rapidly. Consequently, soils are often very dry in summer and farmers face the risk of droughts.

This pronounced summer dryness is the common climatic factor throughout most of the region — especially on the Heretaunga Plains in Hawke's Bay, the Wairarapa Plains between Masterton and Martinborough, and in the Wairau valley near Blenheim (Plate 7.1). Another climatic factor is the occasional heavy rainstorms from the south or south-east. These storms are considered to have had a major influence in setting up cycles of erosion through widespread destruction of forest vegetation on the eastern slopes of the Raukumara, Huiaiau, Kaweka and Ruahine Ranges.

Two geological features have also had a profound influence on the evolution of the region's landscapes. Firstly, the region is strongly faulted, with splinter faults of the Alpine Fault causing the pronounced north-east/south-west trend of the Wairau and Awatere valleys in Marlborough, and the Wellington Fault marking the western margin of the region as far north as the Mohaka River in the North Island. This north-east/south-west trend of the axial ranges, inland valleys and coastal hills can be thought of as parallel wrinkles or furrows caused by the collision of two of the great plates that make up the Earth's surface. As the Pacific Plate moves north-west it is sliding under the Indian-Australian Plate, compressing it like a concertina (Fig. 7.1).

The second important geological feature is the heterogeneous nature of the parent rocks. The higher axial ranges consist of older greywacke and argillite rocks, and the plains have been built up from aggradation gravels deposited as fans, river terraces and floodplains through the erosion of these ranges during the late Quaternary. Most of the coastal hill country, however, consists of a complex mixture of softer rocks of Tertiary and late Cretaceous age — marine sandstones and siltstones, and bands of harder, upstanding limestone. Scattered throughout are pockets of more erodible Tertiary rocks — mudstone, greensand and conglomerates.

Plate 7.1 (opposite)

View south-east across the Wairau River towards Blenheim and the Wither Hills. This landscape of contrasts — intensively cropped recent alluvial soils hemmed in by dry hill country — is typical of the East Coast-Marlborough region.
The block diagram of Fig. 7.1 shows the effect of the converging Pacific and Indian-Australian Plates upon landform and geological structures. The Pacific Plate consists of denser oceanic crust and is sliding under the lighter continental crust in a subduction zone. Some of this material is remelted and periodically ejected within the Taupo Volcanic Zone (see Chapter 2). Because the two plates are converging obliquely they are also tending to slide past each other, giving rise to faults and periodic earthquakes. The intense folding and faulting of the axial ranges and the lowlands and coastal ranges of Hawke’s Bay and the Wairarapa is due to the compression of this eastern margin of the Indian-Australian Plate by the Pacific Plate as it wedges beneath it.

All of these climatic and geological factors have predisposed the hill country of the region to widespread erosion. Forest removal or deterioration has been a significant triggering factor in historic times. There is also plenty of evidence of erosion on a large scale long before human habitation: a landscape of shattered hills associated with deep-seated weaknesses in the material underlying the soils, the rapid rate of uplift, and the impact of severe storms.

Within this long, narrow soil landscape region there are, however, many contrasts: both soft and hard rocks; wet areas in the western foothills and dry eastern hill country; calcareous parent rocks in the east, silica-rich rocks in the west; and a mantle of tephra in the north-west. Above all, the region is one vast area of relatively dry and unstable hill country separated by much smaller areas of alluvial plains. The intensive horticulture of the plains and the extensive sheep farming of the hill country provide the greatest land-use contrasts within the region.

Gisborne-East Cape

The Gisborne-East Cape area has many agricultural advantages: warm soil temperatures, relatively fertile soils, and a higher rainfall than the rest of the east coast of the North Island. Yet a century of settlement of the land by Europeans has been one long, hard struggle with the most unstable landscape in New Zealand. The soft rocks of the hill country made roading so difficult that even by the beginning of this century there was still no continuous road north of Gisborne. Instead, wool was lightered out to ships standing off beach-head settlements like Tolaga, Tokomaru and Waipiro Bays.

This Gisborne-East Cape hill country of highly erodible Tertiary mudstones and shattered argillites is drained by two major rivers, the Waipau and the Waipaoa. The Waipau drains the north-eastern slopes of the Raukumara Range through its two main tributaries, the Tapuaeroa (Plate 7.2) and the Mata; it flows north-east past Ruatoria and Tikitiki while the Waipaoa flows south-east to Gisborne and Poverty Bay. Both rivers have built up their floodplains at a spectacular rate following major deforestation in their headwaters during the last 60 years.

The Gisborne Plains (Plate 7.3) around the lower Waipaoa River cover an area of over 20 000 ha, nearly 90 percent of which consists of young alluvium. These recent alluvial soils (see p.125) are all derived from the soft, calcareous sedimentary
Plate 7.2
Looking eastwards down the Tapuaeroa valley towards Ruatoria and the Waiapu River (flowing from right to left to the coast beyond Tikitiki). This zone of intensely folded and fault-crushed sandstones and siltstones is very unstable, the smoothed landscape showing how massive flows of shattered rock and soil have flowed down into the valley in the past. The jagged peak of Taitai on the right is one of several local spectacular erosion remnants of harder Cretaceous sandstone. Although there are some deep gullies and severe aggradation of the riverbed, the landscape gives the appearance of being well grassed compared with the more unsightly, but shallower, slipping shown in Plate 7.12 of the Tertiary siltstone hill country of eastern Wairarapa.

Plate 7.3
The Gisborne Plains, looking east across the lower Waipaoa River to Gisborne and Poverty Bay. Most of the flood-prone Waipaoa soils within the stopbanks are used for fat lamb and beef production or maize cropping. In the foreground and middle distance are a mosaic of Matawhero, Waihirere and Makaraka soils. Around 1500 ha of these better soils produce vegetables (sweetcorn, tomatoes, peas and beans) for the large Gisborne canning industry. Vineyards have been established on Matawhero and Waihirere soils since the 1920s, and vines supplying both wine and dessert grapes now cover 1600 ha. The kiwifruit boom has also been felt in the Gisborne district with 600 ha now established. The climate and soils are probably suitable for a wide range of subtropical fruits; oranges, mandarins and avocados are well established and there is much interest in new tree crops such as persimmons, sweet chestnuts, pecans, macadamias and varieties of walnuts.
The Waihirere soils are typical recent alluvial soils covering 4000 ha of the higher, flood-free surfaces of the Gisborne Plains. They are old enough to have developed a distinct black topsoil and yellowish subsoils. These highly fertile soils were once used mainly for fattening stock from the surrounding hill country, and dairying. Today they are important for cropping of maize and process vegetables (sweet corn, peas, beans and tomatoes).

Plate 7.4

'Tarndale slip', a classic example of the reason why Mangatu forest was established to control erosion in the headwaters of the Waipaoa River where faulting has led to potentially unstable crush zones in the argillite rocks. Both this argillite and mudstone (the other main rock type in eroding East Coast hill country) contain large amounts of smectite clays, which act as a cement during dry periods. When rainfall penetrates deeply, the smectite acts as a lubricant by swelling and forcing the rock particles apart, and even moderate slopes can become unstable.

Plate 7.5

rocks of the upper catchment and together probably constitute the most naturally fertile large group of alluvial soils in the country.

Most of the cropping and horticulture on the Gisborne Plains and in Tolaga Bay occurs on Waipaoa, Matawhero and Waihirere soils. The Waipaoa soils are the youngest, having formed in the flood deposits which have accumulated since serious accelerated erosion began in the headwaters of the Waipaoa in the early 1930s. They are rather unusual compared with most of New Zealand's recent alluvial soils in that they contain high quantities of lime-bearing sediments. As a consequence they are slightly alkaline, contain high concentrations of calcium, and are dominated by smectite clays which cause the soils to swell when wet and shrink when dry, leading to poaching, caused by stock trampling in winter, and cracking in summer. They contain most nutrients (except for magnesium) but are too young to have built up significant organic matter. The Matawhero and Waihirere soils occur on the higher floodplain surfaces and are only rarely flooded (Plate 7.4). They are deep, friable and well drained with distinct organic topsoils. They cover 8000 ha and are the best all-purpose soils of the plains, because of their free drainage, good aeration and ample supply of most nutrients.

High winter water tables influence another 8000 ha of the plains and have caused the formation of gleyed recent alluvial soils (Makaraka, Makauri and Kaiti soils) which require drainage for intensive uses. Some of the Kaiti soils are in Maori ownership and for many years have been successfully used for growing kumara tubers.

The fertility of the Gisborne Plains is largely at the expense of the surrounding eroding hill country. The most dramatic accelerated erosion phase began in 1932 when aggradation increased 5- to 10-fold; in the next decade there were approximately 30 major floods which threatened Gisborne and severely disrupted agricultural development on the plains. The headwater tributaries of the Waipaoa were choked with soil and rock debris up to 10 m deep, forming rivers of mud during high rainfall (Plate 7.5). The triggering factor was forest removal but the underlying cause was the combination of climatic and geological factors discussed earlier.
The initial response of the local community was predictable, in line with that in other parts of New Zealand where river flooding was a major hazard. The lower reaches of the Waipaoa were controlled in a comprehensive flood-control scheme established during the 1950s. Then attention focused on the cause in the headwaters rather than the effect in the lowlands. From 1963–7 a task force investigated the whole erosion problem – not only in the Waipaoa headwaters but throughout 700,000 ha of the East Cape hill country as far north as Hicks Bay. When government accepted their recommendations it made a landmark decision in New Zealand's history of land use. In the short term 150,000 ha of 'critical headwaters' were to be retired from agricultural use and planted in exotic forests. These forests would be dual purpose: protection against further erosion and, ultimately, production of a timber crop from land that would otherwise lie idle. In the long term, the East Cape Project should have far-reaching effects in protecting the Gisborne and Ruatoria lowlands against flooding, increasing the rural population and economic activity in the centres servicing the lower hill country ('pastoral foreland'), and in establishing a major wood export industry which will probably require the construction of a new port.

Lowland and Inland Basins of Hawke’s Bay and the Wairarapa

Further south, an inland trough extends for 260 km north-east/south-west from Napier to Palliser Bay (Plate 7.6). At its northern and southern extremities it widens out into the 20–30 km wide Heretaunga and Wairarapa Plains; inland, a string of small basins occur around the rural towns of Waipukaurau, Dannevirke, Woodville and Pahiatua. Although the more elevated parts around Eketahuna are wetter (1400 mm annual rainfall), most of the land within the trough is in the rain-shadow of the western and eastern ranges and receives only 800–1200 mm per year.

Many of the soils within this inland trough are in alluvium of very mixed origins – greywacke and argillite eroded from the Kaweka, Ruahine and Tararua Ranges in the west and siltstones, mudstones and limestones from the coastal ranges to the east. Tephras from the Taupo Volcanic Zone mantle much of the north-western Hawke's Bay, including the upper catchments of the Ngaruroro and Tukituki Rivers. Consequently many of the alluvial soils of the Heretaunga and Ruataniwha/Takapau Plains also contain water-sorted tephra.  

Plate 7.6
Looking north-east from Palliser Bay into the Wairarapa Plains at the southern end of the inland trough of the eastern North Island. Lake Wairarapa is a shallow ponding area for the Ruamahanga River drainage system which discharges into the bay (bottom right). The greywacke Rimutaka and Tararua Ranges stand up on the western side of the West Wairarapa Fault which marks the western margin of the lowland trough. In the foreground, old marine beaches have been uplifted and dissected by short streams draining the steep eastern side of the Rimutaka Range.

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The central portion of the Heretaunga Plains, looking eastwards from above Twyford across Hastings and Havelock North to the limestone ridge culminating in Te Mata Peak. The expansion of municipalities like Hastings, Havelock North and Taradale, and the establishment of more permanent crops like the orchards and vineyards in the foreground, have led to the displacement of traditional process cropping southwards towards Otane and Waipukurau.

Nearly 12,000 ha of the Heretaunga Plains are now used for horticultural crops: 5000 ha in vegetables, 4000 ha in fruit trees (mainly apples but also 1000 ha of peaches, nectarines and pears) and 1500 ha of vineyards. Some of the vegetables — onions, asparagus, cauliflower and pumpkins — will probably supply fresh markets; most of the peas, beans, sweet corn, tomatoes and beetroot will be processed.

The Heretaunga Plains contain the most important group of recent alluvial soils in Hawke's Bay (Plate 7.7). They cover 35,000 ha, mostly the former floodplains of the Tutaeakuri and Ngaruroro Rivers. Both rivers had flooded regularly and most of the soils of the plains were poorly drained. It was not until the completion of river-control schemes in the late 1950s and the subsequent widespread artificial drainage of the soils (successfully lowering the water table to a depth of about 1 m during spring) that agricultural use of the plains intensified rapidly. Today almost one-third of the Heretaunga Plains is used for horticulture and it is the largest fruit-growing district in New Zealand.

The soils of the Heretaunga Plains are a mosaic varying in their topographic position and susceptibility to flooding, drainage characteristics, depth, and fineness of alluvium over gravels. Where the greywacke alluvium on the active floodplain is gravelly and stony, the soils (Tukituki) are shallow and excessively drained. The Twyford soils on the river levées are loamy textured (over sandy subsoils), fertile, well drained and have a moderate to low capacity for storing plant-available water. The Hastings soils are the deep, loamy or clayey soils on that part of the floodplain no longer subject to flooding; they are not as well drained but are fertile soils with a very high capacity for storing plant-available water (Plate 7.8). At higher levels on the intermediate terraces the layer of fine alluvium is thinner and often derived from a mixture of tephra and greywacke overlying greywacke gravels at a depth of 25–75 cm. These are the Takapau soils, which have very friable topsoils and a lower bulk density (Plate 7.9).
The Hastings soils are recent alluvial soils covering 15,000 ha of the Heretaunga and Ruatanihga Plains and the valley bottoms of the coastal hill country southwards from Cape Kidnappers. They have a well-defined topsoil, and are slower draining than the associated Twyford soils. In their natural state they are best suited to shallow-rooted crops, such as vegetables; with drainage they are suitable for orchards and today are the main orchard soils of the plains.

The Takapau soils are widespread on the drier parts (less than 1000 mm annual rainfall) of the Heretaunga, Ruatanihwa-Takapau and Wairarapa Plains. Like the Kawhatau and Ashhurst soils they occur on the stony intermediate terrace remnants of the youngest of the cold-climate floodplains formed after the last major period of loess deposition (Chapter 6). They consist of 25-75 cm of very friable, sandy-textured alluvium (from a mixture of tephra and greywacke) over greywacke gravels and stones. The profile shown is one of the deeper representatives, even excluding the cap of roadworks spoil. They are excessively drained, have only a low capacity to store plant-available water and, if cultivated, their fluffy topsoils are susceptible to wind erosion. They are excellent soils for pastoral farming, although they have a high requirement for phosphate fertiliser because of their high level of the clay mineral allophane. On the Heretaunga Plains, with shelter and trickle irrigation, they are used for permanent horticultural crops, such as grapes and stonefruit. The Takapau soils grade into Kopua soils (stony volcanic loams) closer to the Ruahine and Tararu Ranges where the annual rainfall increases to 1200-1500 mm.

The Matapiro soils are distinctive dense grey soils formed in loess (from greywacke and some tephra) mantling the rolling landscapes of the drier parts of Hawke's Bay (Plate 7.11). The texture of the soil is silty clay throughout and the very hard fragipan, here shown at 65-90 cm depth, has a pronounced horizontal, platy structure to it. Note the effect of worms in giving the top of the B horizon a speckled appearance due to the downwards transfer of casts of dark, organic-rich topsoil when the soil is moist. Matapiro soils have high levels of plant nutrients but are slow draining and lack good storage of plant-available water because of their very compact subsoils. Consequently, their productivity is limited by drought. The clay fraction is dominated by the kaolin group minerals — kaolinite and halloysite.
The upsurge in horticulture on the Heretaunga Plains has heightened the demand for irrigation water from what is one of New Zealand's best artesian water supplies (serving the domestic and industrial needs of Hastings city). Yet the district is on the horns of a dilemma in relation to water and land use; water use and recharge of the aquifer are finely balanced and the aquifer is liable to pollution from groundwater because of the highly permeable gravels which cover the recharge area of the plains. Ideally, urban expansion of Hastings and Taradale should be onto the gravelly soils, thereby avoiding the horticulturally important soils in the deep, finer alluvium; but runoff from industry might then pollute the aquifer. Obviously care is also needed with crop irrigation to avoid the leaching of agricultural pollutants (especially nitrates) through the soil and into this aquifer.

The floodplain and lower river terraces of the Heretaunga Plains are surrounded by higher landforms which have been covered with loess, as outlined for the Manawatu (Chapter 6). These dense grey soils (see Chapter 6) are the Waipukurau soils on the high river terraces and Matapiro soils on the rolling landscapes (Plates 7.10 and 7.11). This is the pastoral heart of Hawke's Bay, 40 000 ha of downlands and terracelands which traditionally fatten the sheep and cattle bred in the hill country. Cropping on these soils is generally associated with the production of export lamb — winter feed crops, barley crops during pasture renewal, or lucerne for stock meal production.

This pattern of recent alluvial soils surrounded by dense grey soils on the higher terraces and downlands is repeated throughout the inland trough to the south. On the Ruataniwha-Takapau Plains many of the alluvial soils are used for cereal cropping. With the trend towards orchards and more permanent horticulture on the Heretaunga Plains, however, the process-vegetable industry now looks to the Ruataniwha-Takapau Plains to supply 60 percent of its process-pea requirements, and the demand for beans, tomatoes and asparagus is likely to increase. On the Wairarapa Plains many of the alluvial soils are shallow and stony, suitable for sheep and cattle production. There are only relatively small pockets of better soils some of which are used for pip fruit and berry fruit (Greytown) and small-scale viticulture (Martinborough).

Where the local climate is wetter the soils become more friable, brown coloured, and freer draining — as in the Manawatu region (Chapter 6). Consequently, the loessial Matapiro and Waipukurau soils of the rolling downlands and high terraces grade into Matamau and Dannevirke soils respectively; likewise, the stony Takapau soils of the intermediate terraces grade into Kopua soils. The Matamau, Dannevirke and Kopua soils occur as a mosaic within the wetter parts of the inland trough, extending south from Takapau through Dannevirke, Woodville, and Pahiatua to Eketahuna. These are the soils once covered by the Seventy-Mile Bush, the formidable barrier to overland travel between Wellington and Hawke's Bay which was cleared by Scandinavian settlers in the 1870s–80s.

Today these well-structured soils make the area important for sheep and cattle farming, with up to 20 stock units/ha. Like much of rural Taranaki, it was once dotted with many small dairy factories, as dairy farming became well established in the wetter areas adjacent to the Ruahine and Tararu Ranges. Most of the dairy factories have since gone or been amalgamated. However, dairying still plays a major role in the district's economy even though there are only half as many herds as there were in the 1930s.

Coastal Hill Country of Hawke's Bay-Wairarapa

Between the inland trough and the South Pacific Ocean lies nearly 1 million ha of dry hill country, extending from Cape Kidnappers in Hawke's Bay to Cape Palliser at the southernmost point of the Wairarapa (and the North Island). Except for the wetter Puketoi Range and the Aorangi Mountains, most of this area receives only 1000 mm annual rainfall and experiences the usual pronounced seasonal dry period. Apart from Ngaumu State Forest (exotic) and Haurangi State Forest Park (indigenous) most of the area is in pasture, carrying sheep and cattle at an average stocking rate of only 5–7 stock units/ha. The soils of this vast area of hill country have not been mapped in detail and are not well understood. In the Wairarapa, steeplands predominate, while in Hawke's Bay the hills have soils similar to the dense grey soils of the rolling country (Fig. 1.6a).
Soils developed in siltstone are the most widespread, although there are significant areas of soils in mudstone which are fertile but exhibit problems of deep-seated mass movement similar to those in the East Cape-Gisborne area (Plates 7.2 and 7.5). Because it is relatively unspectacular in comparison, the ubiquitous shallow slip erosion of the siltstone hills is easily overlooked (Plate 7.12).

Dense grey soils occur on the loess-covered high terraces and rolling land of Hawke’s Bay, Wairarapa and Marlborough, where the climate is seasonally dry and annual rainfall low (700–1000 mm). The landscape shown is for the Seaview soils in the lower Awatere valley of Marlborough but the terraces, downlands and smooth, dissected hills are almost the same as for the Matapiro soil landscape of central Hawke’s Bay or the Wharekaka soil landscape of the eastern part of the Wairarapa Plains.

These hillslopes in the eastern Wairarapa hill country show both the extent of shallow soil slipping and the effect of this upon pasture growth. Periodically the soil slips, exposing the underlying siltstone; since forest clearance, over 40 percent of these hill soils have eroded and the youngest slips are still bare. After five years, pasture growth on the truncated soil (Plate 7.14) is still only 20 percent of that on the undisturbed soil (Plate 7.13). Even after 20 years the soil is still recovering its former ability to store moisture and nutrients, for pasture production has increased to only around 75 percent of the level on the undisturbed soil.

Low annual rainfall (1000 mm) and strong north-westerly winds lead to summer soil moisture deficits. Hillsides usually start drying out in October and pasture growth has ceased by February. Soils with a north-westerly aspect (right side of spur crest in photograph) dry out earlier than those on the more sheltered, shadier south-easterly slopes (left side of spur crest).
These two contrasting soil profiles have developed in the siltstone hill country of eastern Wairarapa (Plate 7.12) on a south-easterly 25 degree slope. The soil on the stable site (Plate 7.13) has 20 cm of dark A horizon over a pale silt loam textured horizon which, with increasing depth, becomes darker and heavier in texture. The adjacent truncated soil (Plate 7.14) is on a site where the soil slipped away eight years before; the vegetation and thin A horizon only developed in the previous two to three years. Most of the soil is therefore a C horizon of weakly weathered siltstone, with mottles and grey veins which indicate where water has penetrated.

Yet the loss of plant production may be even more significant because slip erosion is so widespread and recolonisation of the bare ground is slow in this dry climate. The undisturbed soils have a distinct topsoil and a moderate plant-available water capacity, much of which is lost with erosion and only slowly restored as the soil develops again on the exposed sandstone (Plates 7.13 and 7.14).

Plate 7.15
Tunnel-gully erosion of the loess-covered Wither Hills on the eastern side of the lower Wairau valley. This spectacular erosion seriously limited pastoral farming and the eroded sediment constituted a threat to the main population centre of Blenheim. Bulldozers were successfully used to smooth out the gullies and overgrazing is now carefully avoided.
Marlborough Lowlands
The Marlborough lowlands consist of the floodplains, river terraces and downlands of the Wairau and Awatere valleys.* At the time of European settlement in the late 1840s these dry lowlands were covered in short tussock induced by Polynesian burning, whereas the Marlborough Sounds hill country was still in beech forest, and podocarp/broadleaf forest covered the coastal hills south of the mouth of the Clarence River. The lower Wairau valley near Blenheim is similar in size to the Heretaunga Plains but the climate is drier (600–700 mm annual rainfall), winters are a little cooler, and more severe droughts are experienced (Plate 7.1). The plains are mainly recent alluvial soils from greywacke, comparable to those of the Heretaunga Plains in that they are a mixture of deep, fine alluvium and gravels but they lack a tephra component. In the past, dryland farming or mixed arable farming (cropping and export-lamb production) has been the main use of the unirrigated soils.

In recent years, however, the distinct agronomic and horticultural advantages of the lowland Marlborough climate – high sunshine (2200–2400 hours), hot summer temperatures (average daily maximum of nearly 24°C) and low humidity – have been recognised. The climate and soils are suitable for stone fruit such as sweet cherries and apricots; winter chilling is adequate and harvest time is usually dry. Garlic has been an exclusive Marlborough crop until recently, partly because of the ease of natural drying. Process vegetables (peas, sweet corn and beans) cover nearly 1000 ha and Marlborough produces most of New Zealand’s vegetable seeds (around 600 ha, mainly beans, peas and onions), again because of the advantage of the hot, dry summers for harvesting seed in good condition. It is the establishment of nearly 1000 ha of vineyards (Plate 14.2), however, that has transformed the land-use pattern of the lower Wairau Plains within the last decade. All the grape plantings have been classical varieties for quality wine production, and the ideal climate and soil have produced grapes with high sugar levels and less disease problems than in the more humid localities of the North Island.

As in Hawke’s Bay and the Wairarapa, the plains are fringed with high terraces and rolling downlands where loess has covered the underlying gravels and sedimentary rocks (siltstone, sandstone, conglomerate and limestone). The Wither Hills on the eastern margin of the Wairau valley consist of this weakly consolidated material (loess over conglomerate) which is very susceptible to erosion, particularly of the spectacular tunnel-gully form (Plate 7.15). Loess has also partly mantled the higher terrace lands flanking the Awatere River (Plate 7.16) and the rolling lands extending south-east between Seddon and Ward. These soils are all dense grey soils; Seddon soils (Plate 7.17) on the high terraces have up to 2 m of loess overlying greywacke gravels, and the associated Seaview, Ward, and Sedgemere soils and Flaxbourne hill soils on the rolling downlands and hills have loess over various sedimentary materials. Now that wind, sheet and tunnel-gully erosion are better controlled, most of this dry downland country is successfully managed for sheep and cattle production. A small amount of vegetable and seed production occurs on the Seddon soils of the Awatere valley.

These Marlborough lowlands are delightfully different from the rest of New Zealand. They are isolated by high mountain ranges and lie in the trough of the active Wairau and Awatere Faults; they are close to the coast, yet almost continental in their extremes of summer and winter temperatures. Sheltered from the north-westerly gales of Cook Strait by the rugged Marlborough Sounds, and from the cold southerly storms by the Kaikoura Ranges, this corner of Marlborough, in terms of its climate and land use, is a world apart from Wellington only 50 km away across storm-swept Cook Strait.

* The hill country of the Marlborough Sounds is covered in Chapter 8 and the steepland of inland Marlborough in Chapter 10.
The Awatere River and its terraces, looking south-west (upriver) from below the town of Seddon (centre, left). The intermediate terraces are mainly gravelly alluvium (Dashwood soils) but the higher terraces and rolling lands have accumulated a significant depth of loess. Seddon soils (Plate 7.17) have developed in thick loess (more than 1 m) on the terraces which are older than 10,000 years. The site of the Seddon profile shown in Plate 7.17 is on the higher terrace at the eastern (Seddon) end of the bridge.

The Seddon soils are typical weakly weathered and weakly leached dense grey soils formed in greywacke loess on the high river terraces of the lower Awatere valley in Marlborough (Plate 7.16). At this site, 2 m of loess sits on top of a band of alluvial gravels over sandstone. Seddon soils have high nutrient levels but may be subject to wind erosion if cultivated. They are suitable for intensive pastoral farming, cash cropping, and some horticultural uses.
Distinguishing features of recent alluvial soils

PARENT MATERIALS AND LOCATION – recent alluvial soils occur on floodplains and lower terraces of rivers. They are formed from predominantly sandy and silty material (alluvium) eroded from the rocks of the catchment, sorted, and deposited in layers during flood events. Recent alluvial soils cover around 800,000 ha and occur in all districts and climatic zones of New Zealand.

PROFILE CHARACTERISTICS – although recent alluvial soils vary widely in the nature of the parent rock of the alluvium, their youthfulness is their common characteristic. Generally, insufficient time has passed since the alluvium was deposited for a well-structured B horizon to form; development is limited to an A horizon (which is thicker in soils which are flooded less frequently) and a coloured B horizon.

TEXTURES VARIABLE – often sandy loam but silt loam where alluvium is finer or older; clay content low, usually 10 – 25%. Stones and gravels are often present in the subsoil.

STRUCTURES WEAKLY DEVELOPED – topsoils weakly to moderately developed crumb or granular; subsoils very weakly developed medium blocky or massive.

FRIABLE CONSISTENCE in topsoils but sandy layers in subsoils may be very friable to loose.

BULK DENSITIES – medium in topsoils (1.0 –1.2 T/m³) but can be high in subsoils (1.3 –1.6 T/m³).

PLANT-AVAILABLE WATER CAPACITY – medium to high in topsoils (20 – 30% of soil volume); medium in subsoils (14 –20% of soil volume).

FREE-DRAINING SOILS – although some have periods of waterlogging due to temporary rise in local level of groundwater.

CLAY MINERALS – primarily mica and other weakly weathered species.

SOIL CHEMISTRY VARIABLE – depending on parent rocks of alluvium; most are only slightly acidic (pH 6.0 – 6.5) and are naturally fertile because of their high content of available nutrients from weathering primary minerals. Retention of phosphate low.

USES OF RECENT ALLUVIAL SOILS

Some of the recent alluvial soils which are deep and free from flooding are the most versatile and naturally fertile soils in New Zealand. Consequently they have a wide range of uses, not only for dairying but also for arable crops, market gardening, horticulture, specialist timbers and sports fields. Where the soils are sandy and stony, the shortage of soil moisture limits their use for some shallow-rooted crops.

Where periodic flooding is a problem the soils are suitable for dairying and, especially in urban areas, playing fields and recreation areas such as golf courses and parks.

The physical properties of recent alluvial soils, particularly their texture and drainage, are of considerable economic importance to the cropping industry. Crops such as peas or beans may ripen more quickly on the lighter textured, freer-draining soils. It is an obvious harvesting disadvantage to the highly mechanised process-vegetable industry if the presence of two or more different soils in a paddock leads to differential ripening of the crop. Consequently the process-crop grower needs detailed soil information so that paddocks can conform to the soil pattern and the planting of the different crops can be synchronised. On the other hand, differential ripening of crops can be an advantage to a market gardener who can spread the harvesting of a crop by the judicious use of the soils.