MINERALSWESTCOAST

Prospects for the future

ANALYSING THE WEST COAST'S MOST PRODUCTIVE INDUSTRY

PROSPECTS FOR THE FUTURE

Analysing the West Coast's most productive industry

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Contents


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PREAMBLE

Minerals West Coast is a charitable trust that advocates in the interests of the West Coast mining industry. The trust was formed in 2005, and since then has been governed by a group of voluntary trustees all of whom have a direct interest in the sector and the region.

This document has been written to brief the reader on the value of the sector to the West Coast region, the geological prospects for future resource development, the relationship between the mining industry and biodiversity, and the place of coal in New Zealand's economy amid growing public concern about climate change.

Throughout this document, facts and figures will be given supporting all analysis and opinion. These facts and figures are referenced with footnotes from sources and studies independent of the mining industry, and a full bibliography of supporting evidence is included.

Minerals West Coast wishes to thank all of those who gave their time and expertise to the completion of this document, especially those who did so voluntarily.

A RICH HISTORY

Not even eight centuries ago, our species arrived in these islands now known as Aotearoa, New Zealand. This was the last major landmass Homo sapiens colonised, the final leap of Polynesian migration through the Pacific Ocean.[1] Before long, the now prized mineral, pounamu, was discovered, admired, and put to use. Te Tai Poutini, the West Coast, carved its place in the young country as a land rich in minerals. By the late 14th century, greenstone was being sourced, carved, transported, and traded throughout the North and South Islands. [2] It doesn't matter whether Te Waipounamu means the Waters of Pounamu, or is a contraction of Te Wahi Pounamu, the Place of Pounamu. Clearly, the whole island was renowned for the mineral wealth of its western reaches.

Five centuries later, the region was held in low regard in the new British colony. In April, 1864, The Press wrote that it hoped no money would be wasted on a route to a region 'whose occupation will likely be delayed many years', and the Lyttleton Times lumped the Coast in with Stewart Island, suggesting both be used as a central penal establishment for long term convicts.[3] Months later in June that year, gold was found near Kumara, in the Hokonui River[4], and from there the Coast grew.

Coal resources were found the same year, driving the province's early economic development. Without coal mining it is likely there would have been little development of the region.[5] This is not just due to coal itself. From the 1880s, the coal industry developed infrastructure like the river harbours in Greymouth and Westport, as well as rail links and roads through the mountains to Canterbury by 1923.[6] This infrastructure allowed other industries to follow. In the town centre of Hokitika, stands a statue of an early pioneer pointing to the Kaniere gold fields. An engraving on the statue reads – "where the vanguard camps today, the rear shall rest tomorrow".

Notwithstanding the high risk high reward nature of all commodities in our small trading nation, annual coal production in New Zealand grew steadily through the 20th century, peaking in 2006, at 5,673,531 tonnes a year. More coal has been produced on the West Coast than anywhere else in the country.[7] The region also sits alongside the Coromandel and Otago as one of New Zealand's leading producers of gold, renowned within the industry for its alluvial mining operations.

1 (Australian Broadcasting Corporation, 2014)
2 (Nathan, 2016)
3 (May, 1962)
4 (May, The West Coast Gold Rushes, 1962)
5 (Sherwood, 2019) page 138
6 (Sherwood, 2019) page 138
7 (Sherwood, The Geology and Resources of New Zealand Coalfields, 2019)

LOOKING TO THE FUTURE

As the world enters the twenty-twenties, West Coasters believe one of their key industries is in grave danger. There is uncertainty over access to public conservation lands and waters, which hold significant mineral potential. The government is changing the Crown Minerals Act and plans to introduce a National Policy Statements for both Indigenous Biodiversity and Freshwater Management. A ban on coal use will render much of New Zealand's food production uneconomic.

Mining was once the region's sole industry. It cleared the path for others. It now sits with farming, forestry, tourism, and conservation as a valued provider of jobs and income. By industry, it pays the highest wages and has the highest labour productivity. Mining is a fiancially high-risk, high-reward industry of identifying prospects, and then realising their potential. This document examines the industry's future supporting West Coast communities, economies, and environments. We ask for policy makers and the public electing them to consider this region's future in their decisions.

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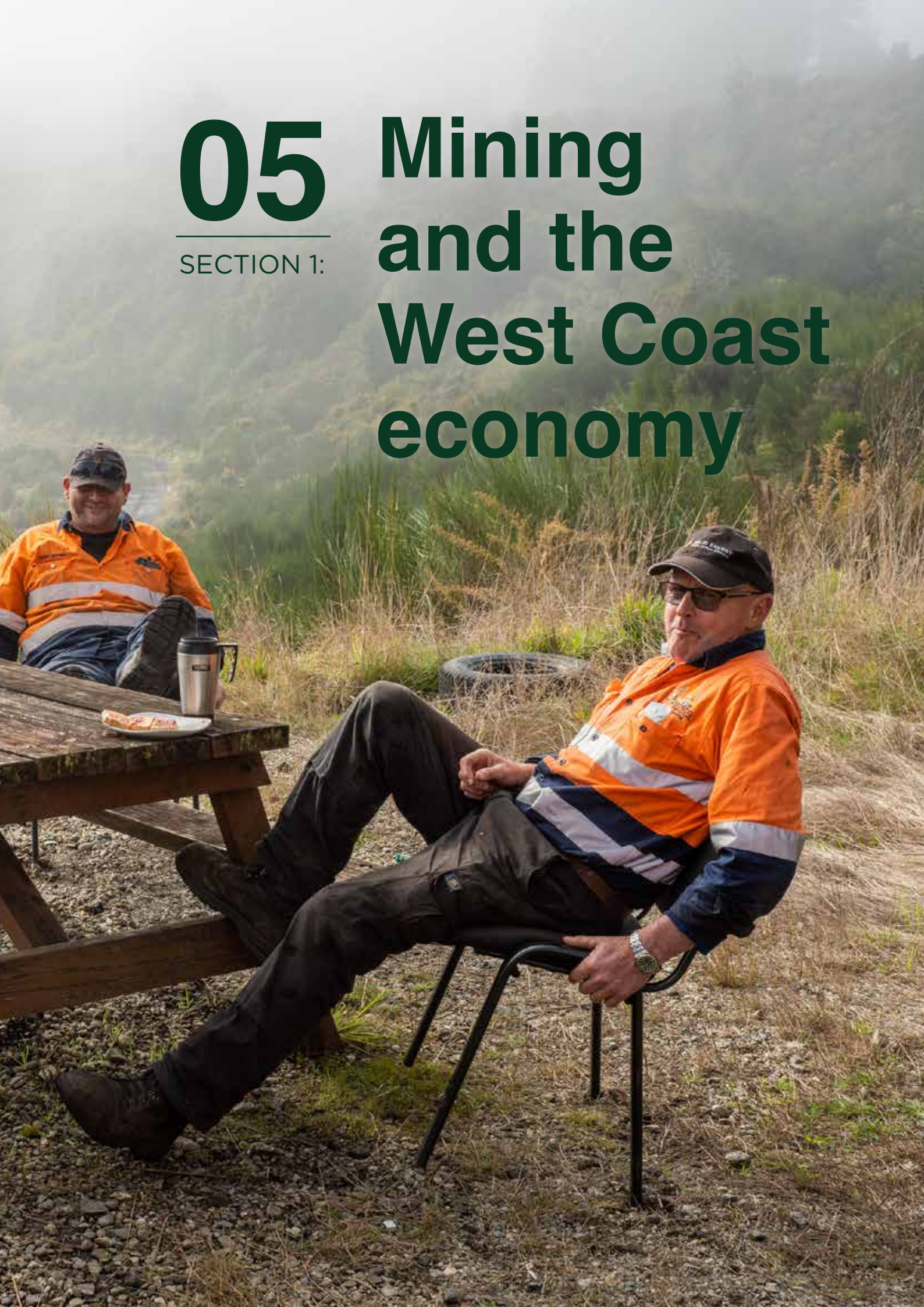
SECTION 1:

Mining and the West Coast economy



MINING BUILT THE WEST COAST ECONOMY

If asked what they know about how the West Coast makes an income, the average New Zealander could give many answers, but most – it not all – would mention mining. This is not surprising. It is an industry as old as New Zealand's human history.

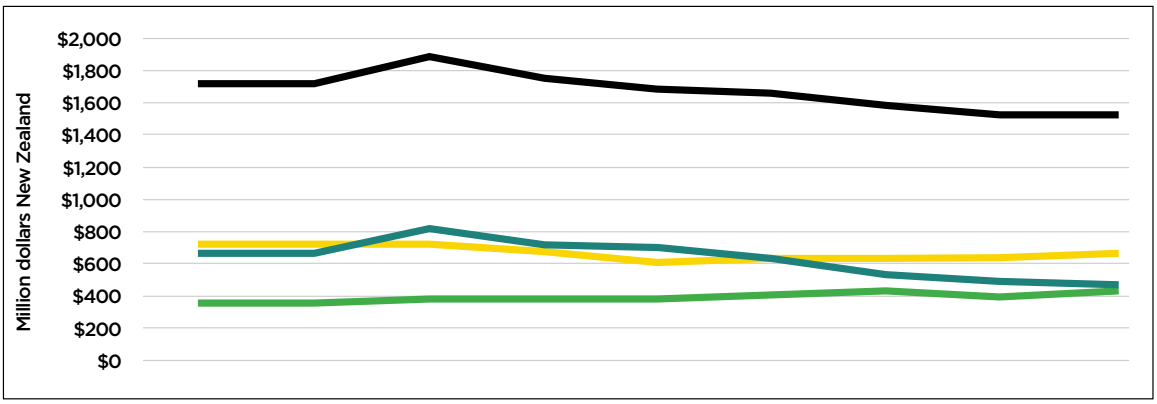
Early Māori surveyed the alpine passes, established the 'pounamu trails'[8], and became the first geologists, miners, transporters, and traders of West Coast minerals. When Pākehā later arrived, the routes to the region were well established. Resident Māori led Pākehā to the first significant finds of both gold and coal in 1864. The region's modern mining industry was born, as was the region itself, even if only as a scattering of canvas shanties.

MINING ON THE WEST COAST TODAY

The West Coast economy has diversified. The graph below shows the four main earners for gross regional product up the year 2018, as classified by Infometrics in 2010 prices.

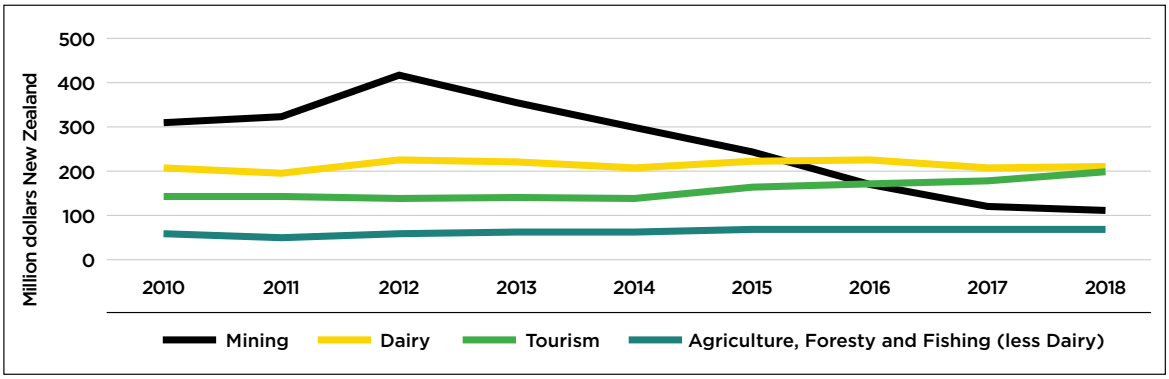
As the graph shows, gross regional product has been declining steadily since 2012. This has been underpinned by a decline in mining and has not been offset by modest growth in other sectors. In this time the region has endured the sell down of Solid Energy, the Pike River disaster, and OceanaGold's Globe Progress mine closing and going into site restoration and rehabilitation. This downturn has been felt most acutely in Grey and especially Buller, while Westland's economy has grown. The reasons for this are discussed in greater detail below.

GROSS REGIONAL PRODUCT (MILLION DOLLARS NZ AT 2010 PRICES)



	2010	2011	2012	2013	2014	2015	2016	2017	2018
West Coast	$1,720	$1,727	$1,887	$1,762	$1,681	$1,662	$1,582	$1,522	$1,517
Grey	$711	$706	$706	$677	$604	$624	$622	$630	$644
Westland	$348	$353	$369	$378	$382	$399	$422	$406	$415
Buller	$661	$668	$812	$707	$695	$639	$539	$486	$458

EARNINGS FROM KEY INDUSTRIES



	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mining	$308,7	$324.3	$415.7	$355,9	$295.5	$243.6	$170.3	$117.7	$106.8
Dairy	$204.7	$194.8	$224.8	$219.6	$207.2	$221	$224	$207.5	$210.5
Tourism	$139.9	$141.3	$136.4	$139.2	$137.4	$161.6	$170.3	$176.3	$198.5
Agriculture, Foresty and Fishing (less Dairy)	$55	$49.5	$54.3	$60.9	$62.5	$66.4	$66.3	$67	$65.4

The above graph, based on data from Infometrics, shows the four main contributors to regional income today. During the last boom in the mining industry, underpinned largely by high prices for coking coal and Reefton's Globe Progress hard rock gold mine, mining was for many years the largest contributor to gross regional product.

Dairy is largely at capacity – the size of our region's dairy herd is unlikely to grow materially, and as a commodity industry taking its price from the global dairy auction, growth in productivity will be incremental.

As for tourism, visitor numbers to New Zealand have indeed grown, but the most recent season for the 2019/2020 summer includes lengthy closures of both the Tranz Alpine and State Highway 6, along with the Covid19 pandemic with which New Zealand and the world will be grappling for years. If or when tourism returns to its previous levels, it is worth noting major shocks are never far away, and even in a good year, the sector's value at a regional level is questionable, due to the inherently low wages and productivity.

While these Infometrics figures are the best numbers available, they are not bullet-proof. For example, when a contractor from outside the Buller District visits to carry out contract work at Stockton Mine, or a corporate client visits Westland Milk in Hokitika, should their visit's food and hotel expenditure be credited to the tourism industry, or mining and dairy? At present, all such expenditure is credited, incorrectly, to the tourism industry.

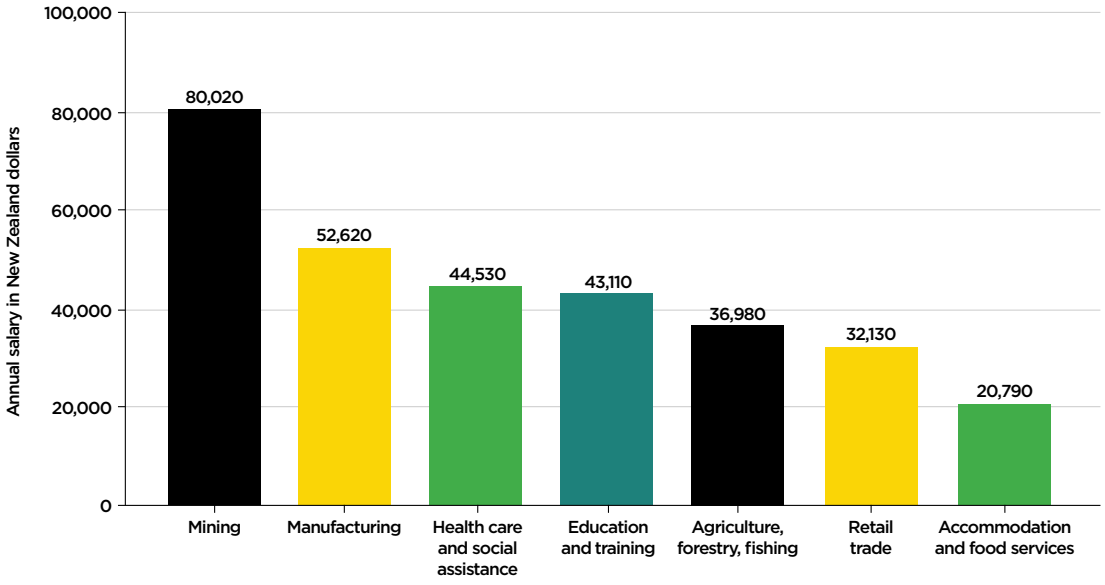
8 (Taonui, 2007)

MINING BRINGS HIGH PRODUCTIVITY AND HIGH WAGES

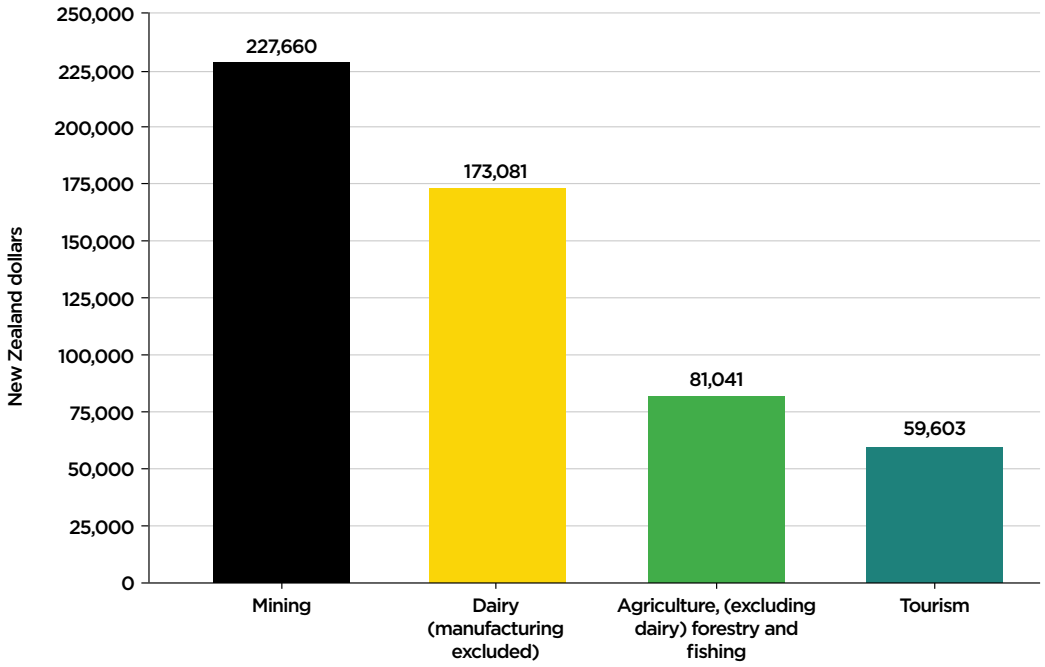
New Zealand's labour productivity growth has underperformed for decades and has fallen further since the Global Financial Crisis.[9] Poor labour productivity growth is why our GDP per capita remains 30% below the average of the top half of the OECD. In New Zealand, the hours worked per person have been consistently high, while labour productivity (output per hour worked) has been low.[10]

Every new job in a high productivity, high wage sector makes our region and our country richer, every new job in a low productivity, low wage industry, makes the West Coast and New Zealand on average, poorer. Productivity and wages in 2018 are shown below.

WEST COAST MEDIAN SALARY COMPARISON 2018



GROSS REGIONAL PRODUCT PER JOB FILLED 2018



COAL AND GOLD PRODUCTION WEST COAST TO 2018

Coking coal for steel production

Displayed on the next page are coal production figures over the past decade. These graphs are based on Ministry of Business, Innovation, and Employment figures.

Coking coal, used for making steel, is found in commercial quantities nowhere in New Zealand but the West Coast. The markets internationally are, unsurprisingly, underpinned by steel production. New Zealand's coal exports from 1989 to 2017 were almost exclusively of West Coast coking coal for steelmaking to markets primarily in India and Japan, and also to Australia, Korea, China, South Africa, and Brazil.

As the graph for coking coal production figures illustrates, the market boomed through the late 2000s and early 2010s, but fell into sharp decline, leading to the government sell down of Solid Energy. Mines like the Spring Creek underground were put into care and maintenance in 2012, before being abandoned completely in 2017[11].

Prices for coking coal on the export market have since recovered, and in the year 2018 exports increased by five percent, reversing a trend of seven years of decline. This is can be attributed to the privatisation and revitalisation of Solid Energy's assets following the sale to new owners[12] and operators of the mines. There has also been an increase in demand and consequent recovery of prices.

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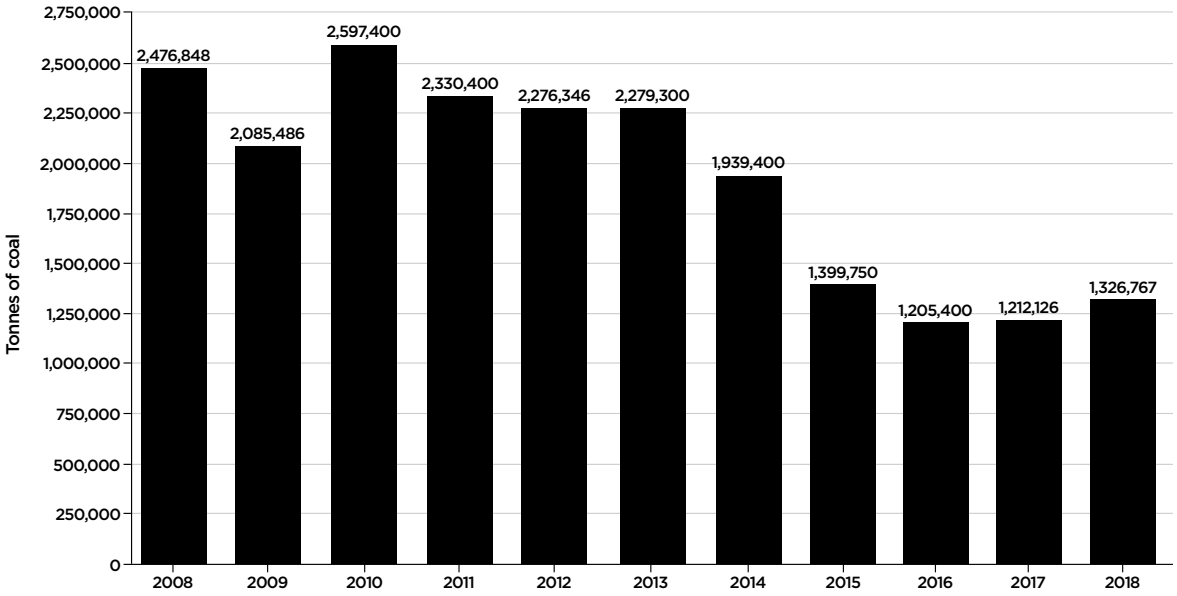
9 (New Zealand Productivity Commission, 2019)
10 (New Zealand Productivity Commission, 2019)
11 (Sherwood, 2019)
12 (Ministry of Business, Innovation & Employment, 2019)

Thermal coal for the domestic market

Thermal, or heat generating coal, mined in the region is used both within the West Coast and largely around the upper half of the South Island for food processing and production in the dairying, red meat, and hot house horticultural sectors, but also in space heating in schools, hospitals, and universities, and, to a far lesser extent, domestic use in some households. Demand from these coal users can vary, and this is reflected in production figures.

It is worth noting that without coal our other main industry – agriculture – would be economically impossible. Coal, like any fuel, is an economic enabler, and in the absence of a supply of natural gas, food production in the South Island has no large scale economic alternative to coal. New Zealand's coal use is outlined in detail in Section 4 of this document.

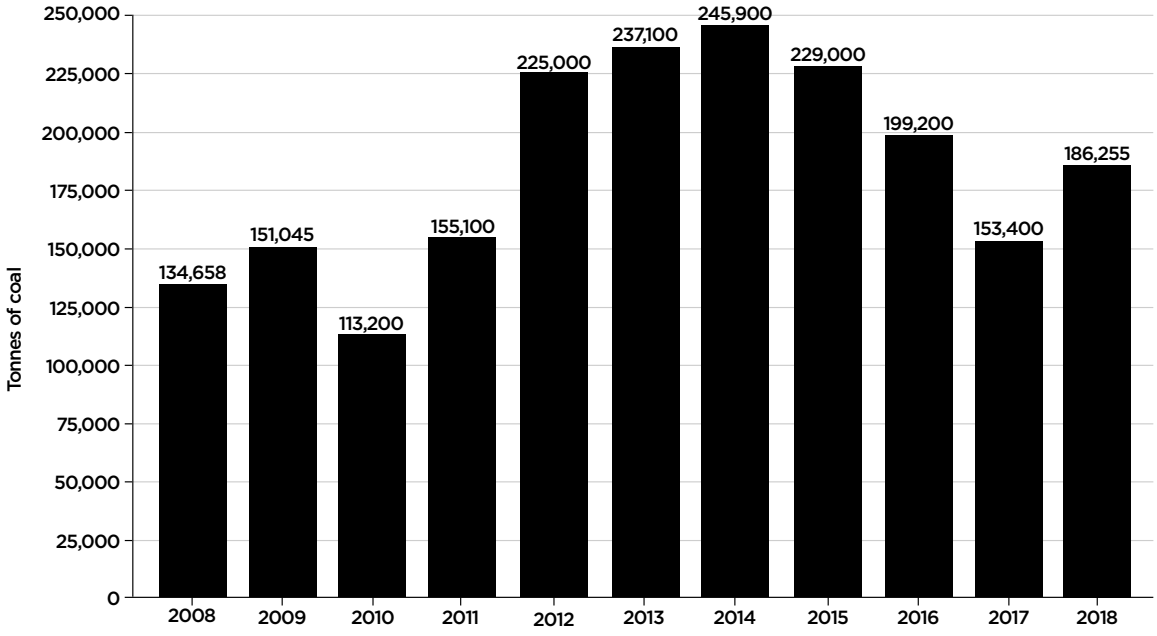
TONNES OF BITUMINOUS (COKING) COAL PRODUCED ON THE WEST COAST OVER THE PAST DECADE



Figures sourced from Ministry for Business, Innovation and Employment

Compiled by Minerals West Coast

TONNES OF SUB-BITUMINOUS (THERMAL) COAL PRODUCED ON THE WEST COAST OVER THE PAST DECADE



Figures sourced from Ministry for Business, Innovation and Employment

Compiled by Minerals West Coast

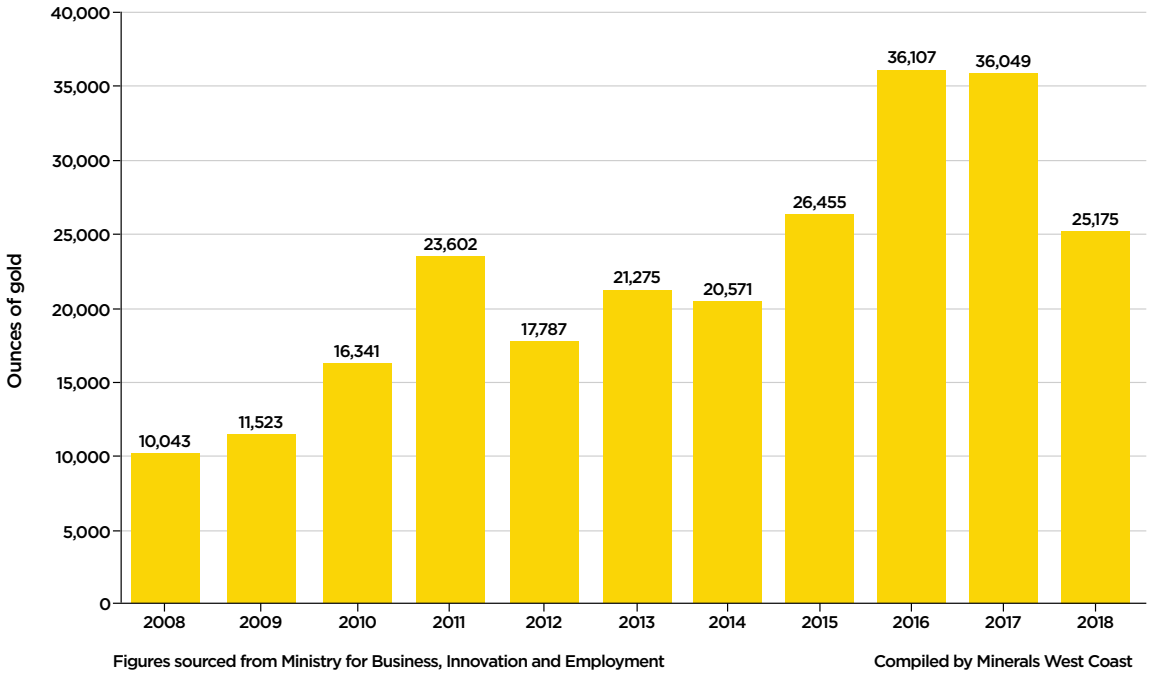
ALLUVIAL GOLD PRODUCTION ON THE WEST COAST

While production levels for alluvial gold can vary with the gold price, the New Zealand dollar, availability of land, and variable costs like fuel, production has been constant over the past ten years, with some years achieving particularly high production levels.

Alluvial mining operations on the West Coast today range in scale, from individual operations through to larger ventures employing up to 20 people on one mine site.

Minerals West Coast estimates that at the time of writing 150 – 200 people are employed directly working on alluvial gold mines throughout the Buller, Grey, and Westland districts, and that these operations in turn employ other support companies such as engineers, heavy diesel maintenance, parts suppliers, and consultancy businesses.

ALLUVIAL GOLD PRODUCTION ON THE WEST COAST OVER THE PAST DECADE (OUNCES)



Figures sourced from Ministry for Business, Innovation and Employment

Compiled by Minerals West Coast

HARDROCK GOLD PRODUCTION

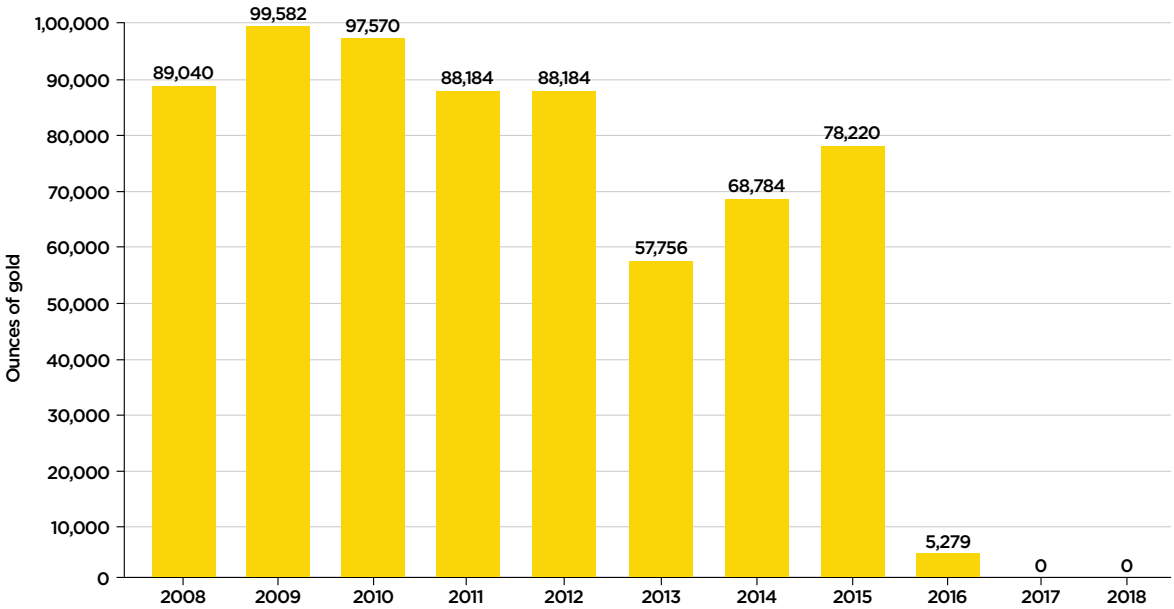
OceanaGold's Globe Progress mine came to fruition after over a decade of exploratory work, and pit development began in 2005.

This work spanned about ten years, with mining ending in 2015. Over the decade the mine produced 610,000 ounces of gold, and employed about 200 full time staff, in addition to contractors and suppliers who supported the operation.

Geologists and explorers remain interested in the Reefton area's potential for hard rock gold production, noting that there is likely to be more gold to be discovered in the region.[13]

Indeed, in December 2019 the government, through the Provincial Growth Fund pledged a $15,000,000 loan in support of a proposal to assist with the re-establishment of the Blackwater gold mine, with annual production forecast at 60,000 ounces of gold per year.[14]

HARD ROCK GOLD PRODUCTION ON THE WEST COAST AT GLOBE PROGRESS, REEFTON, OVER THE PAST DECADE (OUNCES)



Figures sourced from Ministry for Business, Innovation and Employment

Compiled by Minerals West Coast

13 (Napp, 2019)
14 (RNZ, 2019)

TOURISM HASN'T LIVED UP TO ITS PROPONENTS' PROMISES

For decades in New Zealand a perception has endured the primary sector – whether mining or farming – is inherently a driving cause of environmental destruction. This is not to deny the impact of these sectors, which is well documented. What has been come to be accepted as almost common-wisdom is that tourism is an environmentally and economically preferable alternative.

Indeed, when explaining a surprise ban on mining on conservation land in late 2017, the newly appointed conservation minister implied mining had had its day.

"Tourism on the West Coast is now responsible for more jobs than the mining sector. It's crucial that we protect the very thing that draws visitors - unequalled beech and rimu forests, river valleys and a network of huts and tracks."[15]

This 'swords to ploughshares, spears to prune hooks', argument is not a new one. In a report titled 'Pristine, popular…imperilled?' the Parliamentary Commissioner for the Environment noted this longstanding viewpoint, and its shortcomings.

'Tourism is often touted as a relatively benign, non-consumptive industry. Compared with industries like mining or indigenous forestry, there is little extraction of finite resources. However, looking back on the development of the country's tourism

15 (Radio New Zealand, 2017)
16 (Parliamentary Commissioner for the Environment, 2019)

industry, many environmental and cultural impacts can be identified. Tourism's development has involved the dispossession of Māori land, increased pressure on biodiversity as rail, roads and other infrastructure have been created, and the deliberate introduction and dispersal of destructive exotic plants and animals.' [16]

It is true that tourism now employs more people on the West Coast than mining and provides employment opportunities, but this doesn't mean it is a preferable industry economically, socially, or environmentally, even if it is politically preferable to some groups.

It is also true the tourism industry can create communities dependent on a transient population, seasonal and low-paid work, displacement of people, crowding, and intrusion.

To return to the issue of productivity, when productivity growth is lower, wage growth tends to be lower too, meaning some families need to work long hours to achieve decent incomes. The result is they have less time to spend with family and in the community.

TOURISM EMPLOYMENT HAS GROWN WHERE MINING HASN'T DECLINED

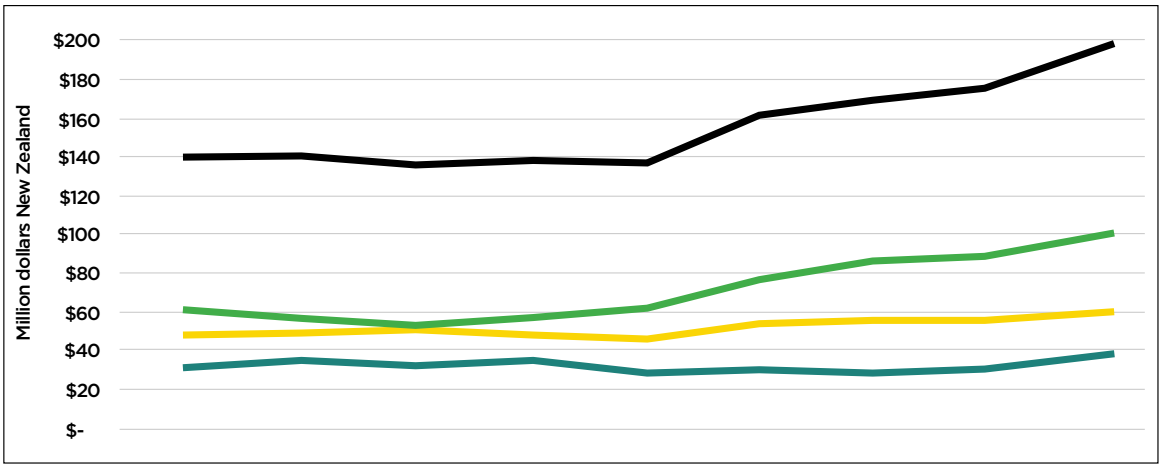
Tourism growth within the West Coast over recent years has largely been in the Westland District. The demise of Solid Energy, closure of its uneconomic mines, and efficiencies achieved following privatisation have been the main driver behind mining job losses in the Buller and Grey Districts, along with the explosions and subsequent closure of Pike River Mine in late 2010, and the closure of Reefton's Globe Progress mine, when gold resources were deemed uneconomic based on the gold price at the time. Mining stopped and rehabilitation began.

The above statement from the conservation minister regarding tourism employment surpassing that of the mining industry is misleading. Job numbers in both the mining and tourism sectors have fallen since 2010 in the Buller and Grey Districts. If there is a link here, it is that commercial visitors to the region previously coming in for work at mines are no longer doing so, and as such the food and accommodation sectors in those districts no longer receive the same levels of patronage.

Conversely, mining and tourism job numbers have both increased in Westland. This is perhaps due to relatively buoyant gold prices, as all mining employment in Westland is in gold mining.

Prior to 2016 when the Kaikoura earthquakes closed State Highway 1 and diverted traffic to the West Coast, the highest number for tourism employment was in 2010 at the height of the last mining boom.

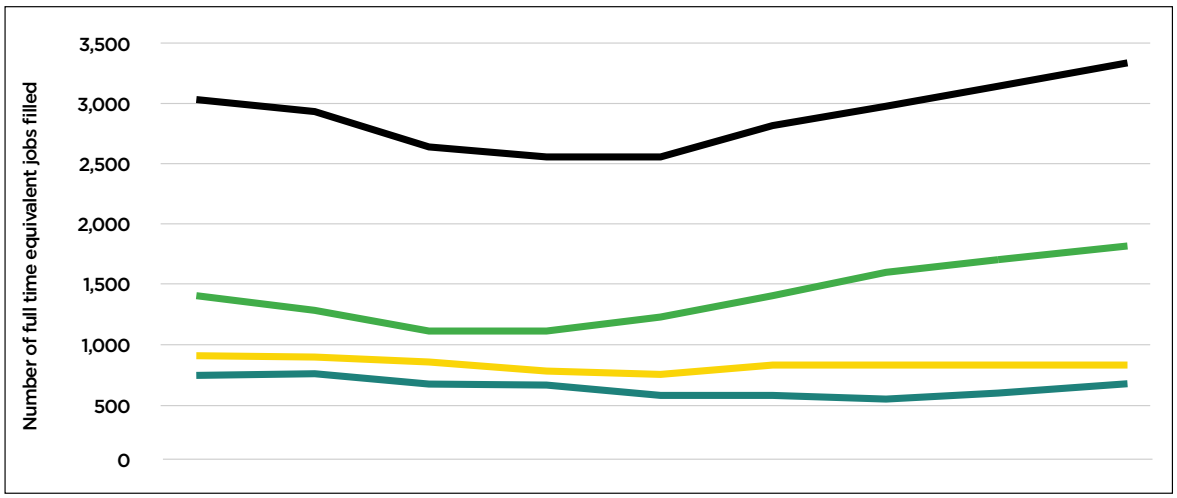
TOURISM GROSS REGIONAL PRODUCT (MILLION DOLLARS NZ AT 2010 PRICES)



	2010	2011	2012	2013	2014	2015	2016	2017	2018
West Coast	$140	$141	$136	$139	$137	$162	$170	$176	$198
Grey	$48	$49	$51	$48	$46	$54	$54	$55	$60
Westland	$61	$57	$53	$56	$62	$77	$87	$89	$101
Buller	$31	$35	$32	$35	$29	$30	$29	$31	$38

West Coast Grey Westland Buller

TOURISM EMPLOYMENT ON THE WEST COAST



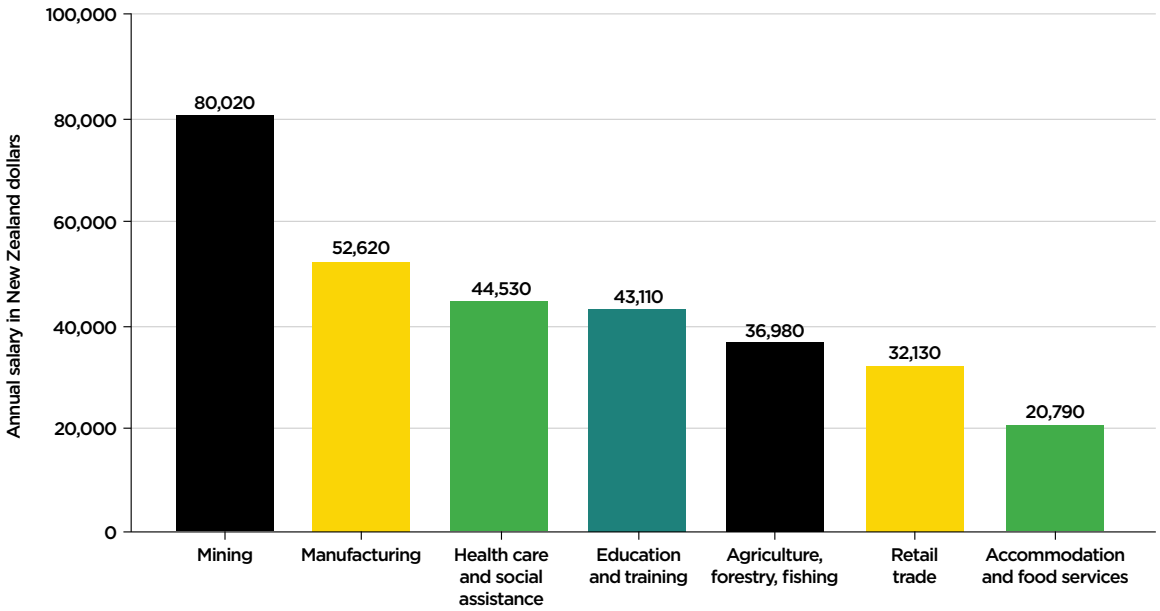
	2010	2011	2012	2013	2014	2015	2016	2017	2018
West Coast	3,035	2,938	2,640	2,552	2,548	2,826	2,988	3,155	3,322
Grey	904	896	862	780	748	836	833	843	838
Westland	1,392	1,280	1,108	1,110	1,224	1,419	1,609	1,714	1,815
Buller	739	761	670	662	576	571	546	597	669

West Coast Grey Westland Buller

Tourism's contribution to gross regional product has also increased, but again, of the $58,000,000 growth in GRP in tourism since 2010, $40,000,000 of growth occurred in Westland, while Grey and Buller growth was $12,000,000 and $7,000,000 respectively.

Again, wage comparisons are most telling. Displayed again below are median wages. Accommodation and food service jobs, along with retail trade – i.e. tourism jobs – pay the lowest median wage in the region. Mining pays the highest. Every new digger operator on a mine makes the region, on average, wealthier, every new tour guide or barista makes the region, on average, poorer.

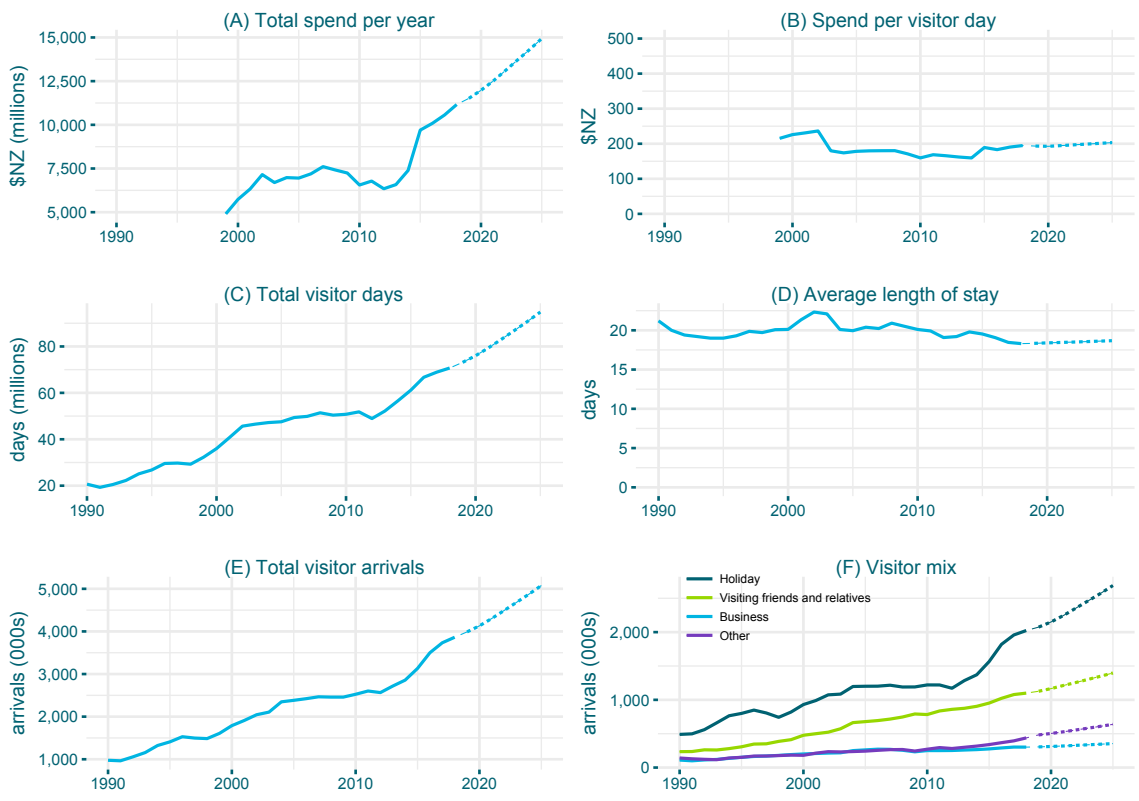
WEST COAST MEDIAN SALARY COMPARISON 2018



MOVING UP THE VALUE CHAIN HAS NOT HAPPENED AND LIKELY WON'T

Presented with these figures those who say tourism is an economic saviour for the West Coast argue all the region needs to do is chase the 'high end' of the market, and go for value over volume. This has proven as diffcult for the West Coast as it has for New Zealand. Visitor numbers to New Zealand have grown substantially over the years, from about 1,000,000 people in 1990, to 3,900,000 in the year ending October 2019.[17] Despite central government and industry efforts over several decades, tourism has become an industry of volume not value, with the average per visitor spend per day and length of stay in New Zealand having fallen since the early 2000s and projections showing flatness in both these measures. Prior to the Covid19 epidemic, visitor numbers were projected to skyrocket in the coming five years.[18] If this trend were to reestablish, the infrastructure burden for New Zealand, particularly smaller communities like those on the Coast, will increase, for ever diminishing returns.

PAST GROWTH IN TOURISM AND FUTURE PROJECTIONS



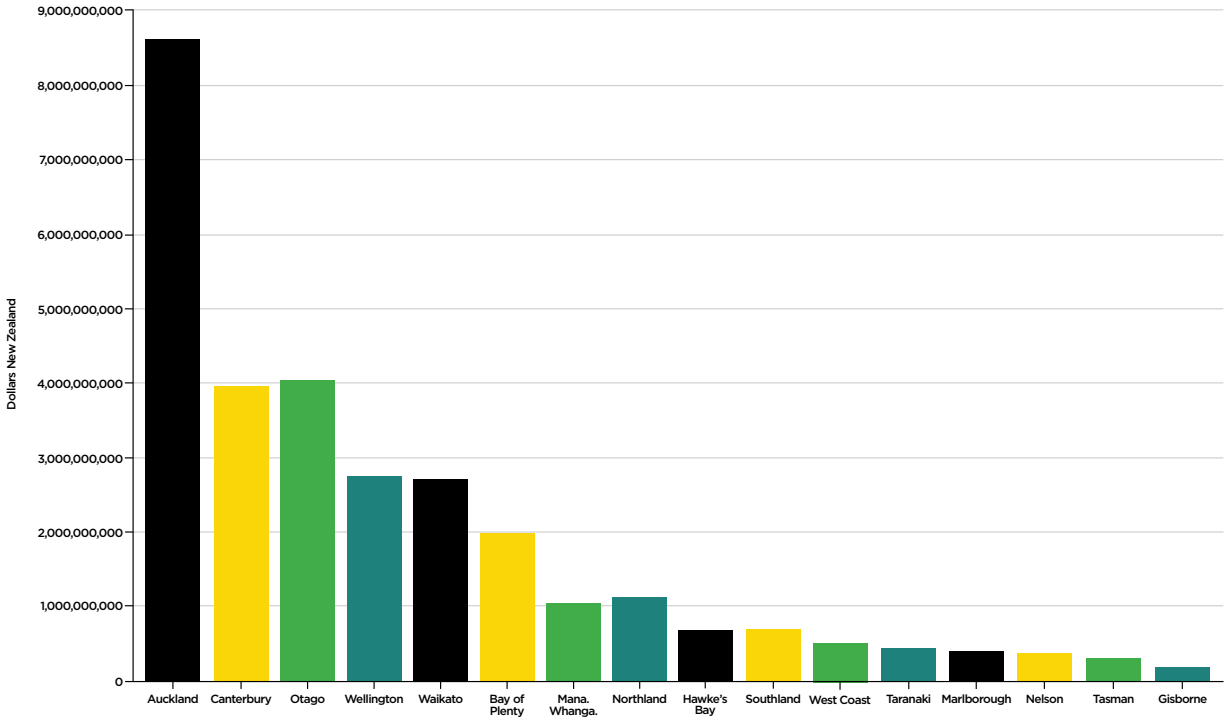
Source: Ministry of Business, Innovation, and Employment[18]

17 (Stats NZ, 2019)
18 (Ministry of Business, Innovation, and Employment, May 2019)

REGIONS OF NEW ZEALAND OUTSIDE THE MAIN CENTRES GET A SMALL SLICE OF THE PIE

Even within the flat projections at a national level, and despite the West Coast boasting some of New Zealand's major tourist attractions, and State Highway 6 being a major link in the South Island tourism loop, the West Coast ranks 12th out of 17 regions when tourism spending is broken down into a regional level. In the year ending October 2019, the West Coast received a mere 1.6% of the total national tourism spend. By comparison, 55% of the tourism spend in New Zealand takes place in Auckland, Canterbury, and Otago. It would seem it is not conservation land, but urban landscapes with high end retail, expensive hotels, international airports, and rental car agencies that attract tourism revenue.

TOURISM SPENDING BY REGION YEAR ENDING OCTOBER 2019



Indeed, Aucklanders and Wellingtonians have the most positive perceptions of tourism, and West Coast and Queenstown residents express the greatest concern about the industry's pressures.[19] At 43 guest nights per capita, the West Coast bears the burden more than any other region in New Zealand.[20]

19 (Cropp, 2019)
20 (Ministry of Business, Innovation, and Employment , 2019)

LOCAL BUSINESS'S TAKE ON THE LOCAL ECONOMY

The West Coast is reliant on primary production. This is not surprising. The region accounts for 0.7% of the national population, but 8.6% the country's land. The land provides minerals, food, and timber, the Tasman Sea supports a small but vibrant fishery, and the scenery provides Kodak and Instagram moments.

Official statistics have their place, but sometimes equally if not more telling can be the opinions of local businesses, be they car dealerships, clothing retailers, or hoteliers reliant upon people visiting the region for business or pleasure. Minerals West Coast spoke to three such business owners.

Ross Brown, Greenfield Motors, Greymouth

"They [miners] all get paid well. They're reasonable paying jobs. They'd come in here, the guy that's in his thirties... 'I can afford to pay that ute off, cause I'm on a hundred thousand dollars a year, I want a new ute, I don't want a second-hand one', and they do, and that's what happens, and they just, honestly mate, one month there we sold fifty-four cars for the month, now we probably average about twenty, haven't even done that this month."

"People say 'well, there's twice as many people are employed on the Coast in tourism as there was in mining'... who cares? You could have a hundred times more people, but, how many coffee baristas do you need? They're all student sort of people, or backpackers. They don't have any disposable income. Most of their income is gone just on the essentials of living life. Existing. They can't afford things. You see them in the workshop, trying to get warrants on their cars, 'Oh, I've got to buy a tyre?' Jesus mate, it's a hundred and twenty bucks!"

Marilyn Wilson, owner and operator of the Bella Vista, Westport

"I'm not good at giving percentages or anything like that, but it wasn't till downturn hit, the Solid Energy thing, that I think we realised, because in the summers and that we were really really busy, and we thought it was tourism, but when the mining thing happened, and a lot of those subcontractors stopped coming, we realised it wasn't totally tourists, and because of where Westport is and people have to come in to us, and go back out, it's not like they're just passing through, and so, since then, we certainly just haven't had the summers we used to have."

"There hasn't really been much growth in international visitors since then. I haven't done a comparison from back then till now, cause just, you know, it gets depressing. We're out on a limb, and we're not like the glacier country, we don't have any big attractions really to draw people in. The ones that do come here enjoy the area and things like that, they always find plenty to do".

John Gilshnan, Alf Harrison's Menswear, Greymouth

"We certainly noticed a decline in trade from way back then (1980s) into today. That's been mainly because of a decline in the mining industry really. Always had the fishery industry, always had the freezing works. That's been going ever since we got here. They employ a lot of people. But gold and coal mining, particularly coal mining, we've seen a lot of the high earners leave the district. Those skills have gone. Those people received good pay packets, they spent wisely when they came in here, but they certainly spent".

"The tourism industry perhaps supports the hotels, the motels, food outlets, restaurants, that sort of thing around town. But those places don't pay high wages to their staff. So those people, although they're employed, they're not high earners. In turn, they're not big spenders. It's also affected the sports clubs and that, you know with the miners who've gone away from here, some of them are struggling a bit too. The tourism thing, it's all very well for them to say that we should be looking to tourism to make our income, but it's not that easy. Staff are backpackers, they come and go."

SECTION SUMMARY

Mining remains an invaluable part of the West Coast economy, and as an industry, when it flourishes or diminishes, the West Coast will do the same.

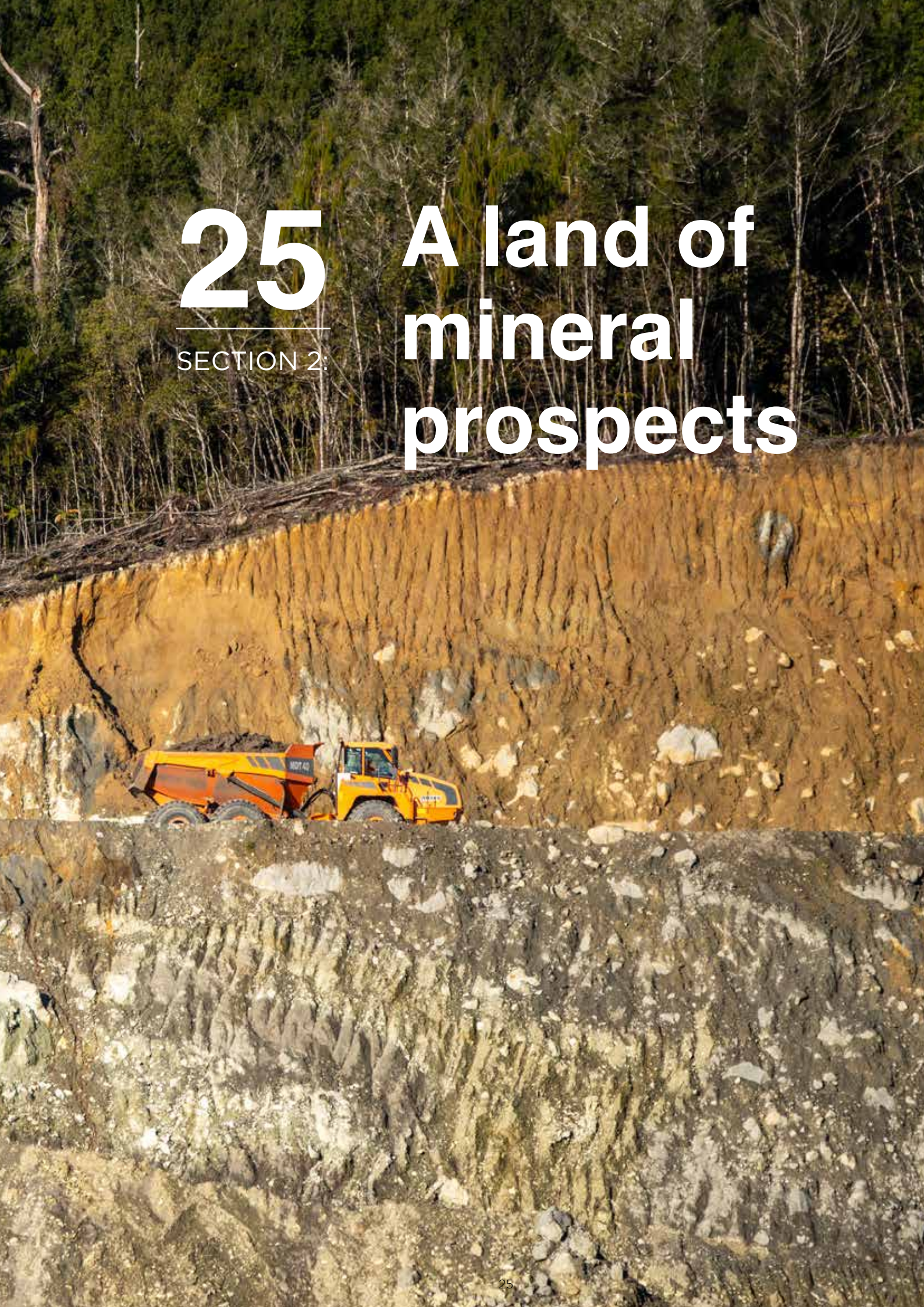
Other industries have increased proportionally as the region's economy has contracted, largely due to a reduction in mining. The entire pie has shrunk, and so other sectors seem bigger by comparison. Modest growth in these other sectors, while growth, nonetheless, has not been enough to offset this downturn.

The economy is interconnected at a regional, national, and international level – many coal miners rely on food processors as customers, food processors in turn rely on a vibrant food service and retail sector to ensure demand for their products, and food service and hospitality providers rely on both holiday makers and commercial visitors to underpin their businesses.

There is no reason mining can't play a significant role in the West Coast economy – our resources of metallurgical coal for export and thermal coal for domestic use remain in demand, and gold has proved a valuable resource for millennia. There are prospects for diversifying what we mine on the West Coast, and this is discussed in the next section.

Mining is one industry that stands out above the other sectors on the West Coast for its ability to pay high wages and increase productivity and in turn living standards.

For the industry to be viable in the long-term, people need to be confident time spent prospecting and exploring will be worthwhile ventures and that resources will be allowed to be developed once they are identified, within realistic social and environmental parameters.



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SECTION 2:

A land of mineral prospects

A LAND OF MINERAL PROSPECTS

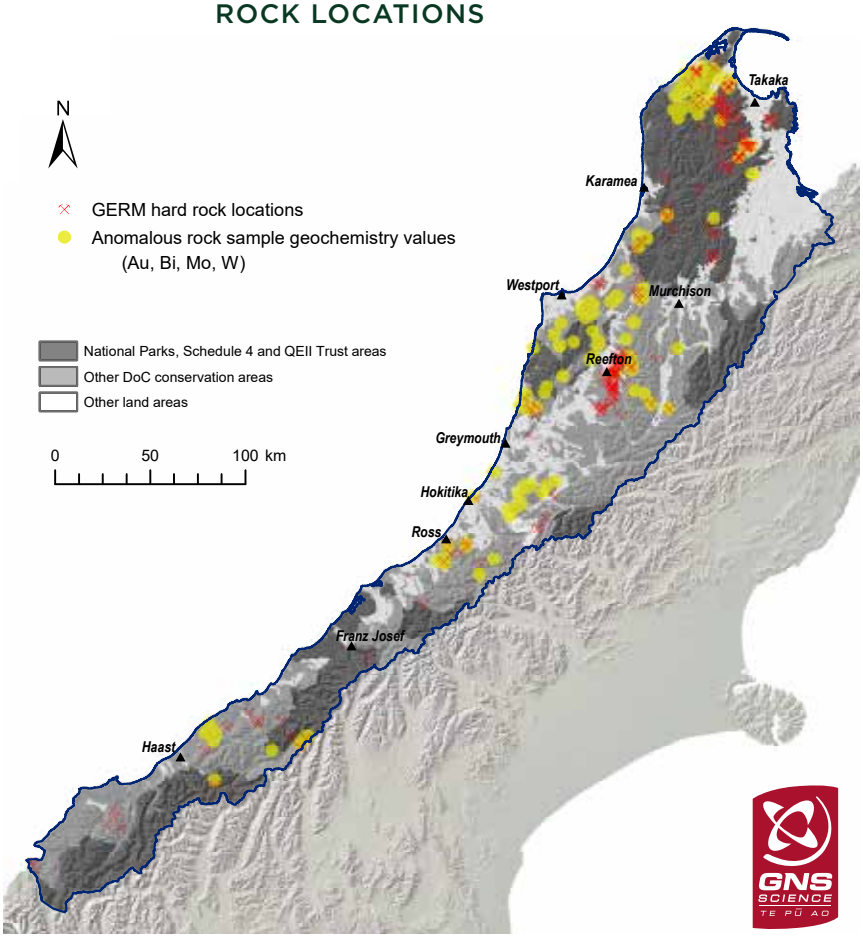
Among early Polynesians and Classical Māori, Te Tai Poutini was renowned for its pounamu resource. Pākehā flocked to the region for the opportunities in mining gold and coal. Early Cantonese settlers came to the 'New Gold Mountain', a name given to Australasian diggings on both sides of the Tasman, in contrast with San Francisco, the Old Gold mountain.[21]

Today, the mineral resources, discovered or otherwise, still offer promise for those who seek opportunities in the region.

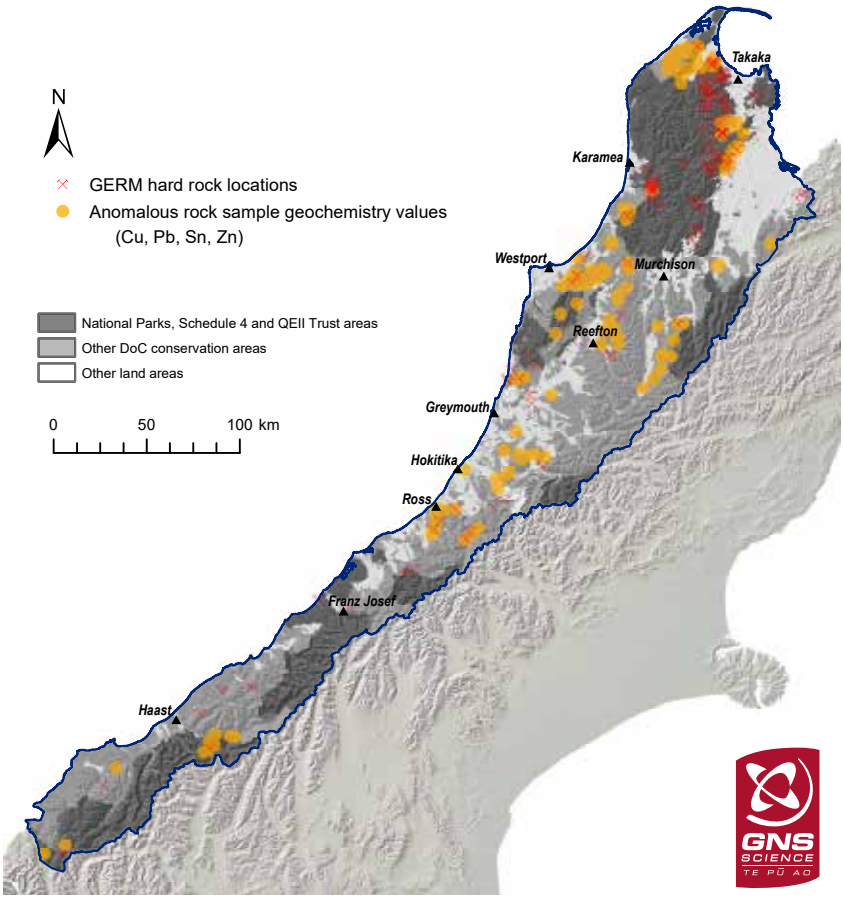
A series of maps was prepared by GNS Science on behalf of Minerals West Coast assessing the region's metallic mineral resources. Another, defining the coal resources of the West Coast, is also included.

As is shown in the maps in this section, there are prospects for resources for minerals New Zealand and the world needs. This provides the resources to those who need them and can provide the West Coast with welcome highly paid employment and income for the region.

GEOLOGICAL RESOURCE MAP (GERM) HARD ROCK LOCATIONS



21 (新西兰175年华人移民史：“金山阿伯”的沧桑岁月, 2017)
22 (Matthew Hill, 2020)
23 (Matthew Hill, 2020)



These two maps show the hard rock locations of gold, as well as potential occurences or prospectivity of bismuth, molybdenum, and tungsten, and copper, lead, tin, and zinc within the West Coast and in neighbouring regions.

As with all these maps the dark grey shows areas where granting of mining permits is forbidden under Schedule 4 of the Crown Minerals Act, and covenanted areas of private land. The light grey shows areas of conservation land where an access agrrangment could be granted provided regulatory requirements were satisfied.

Matthew Hill, of GNS, explains that by and large, there is an overlap of gold with the other metals that have mineralised in the same area.

"These basically show a map of historic gold mines – mineral occurences for more than at least a sniff of gold. Whether it was mined or not, gold was found there."[22]

"If you look at the gold map, look at where the gold values are high, pretty much every sample ever taken on the West Coast was taken for gold, it's what they were looking for."[23]

"There are two different ways gold and other metals are produced, the first one, is they come through in what we call intrusion related gold systems. We don't have a lot of good mineral resources for that, but that's where you may find gold, copper, and bismuth granites. The other type is orogenic gold, which is what we more likely find on the West Coast".

West Coast based geologist, John Youngson, says while in recent times hardrock goldmining in New Zealand has been done at a large scale, there is scope for small,

boutique hardrock mining operations on the West Coast. He says access to the resource is complicated due to its location within conservation areas, but that these barriers are not insurmountable.[24]

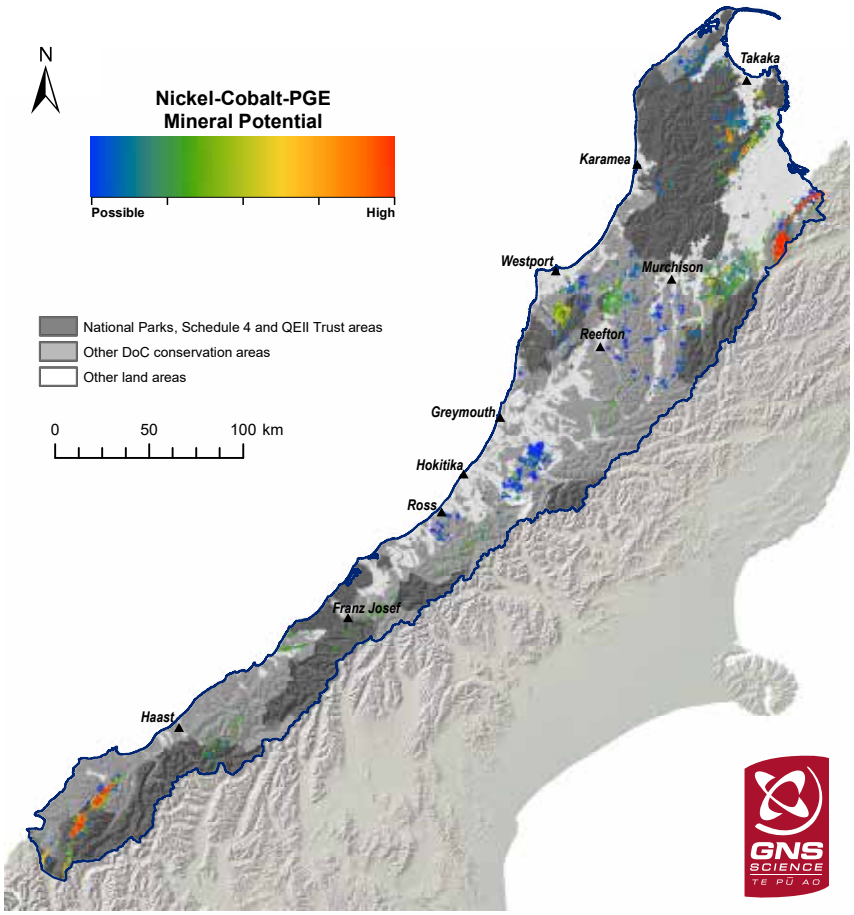
Matthew Hill says copper, lead, tin, and zinc commonly also occur in (magmatic) intrusion-related mineral deposits, in volcanic sediments, and also in mineral deposits formed from hydrothermal fluids emanating from oceanic crust locally on the seafloor and in other places.

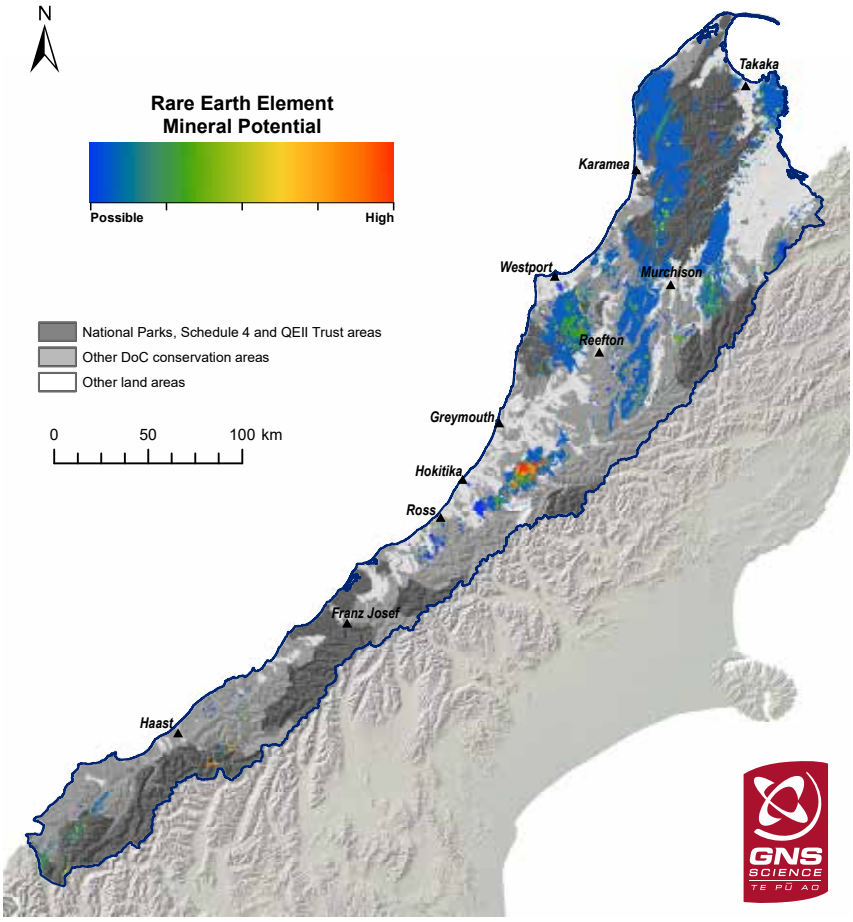
He says there is scope for recovery of some of these minerals in tandem with goldmining, especially rare earth elements.

"If you're an alluvial miner on the West Coast, you've only ever mined for gold, your tailings could be full of rare earth elements, that had never been extracted before, because demand was low or because the technology to process them economically or in an environmentally friendly way was still being advanced."

John Youngson agrees, rare earth elements are the most likely proposition for diversifying minerals produced on the West Coast, as copper, bismuth, and tungsten are all unlikely to be found in alluvium in any commercially viable sense.

"Copper, bismuth, lead, zinc and the like really need to mined from hard rock deposits, and we don't have many of those at an ore grade level outside of Schedule 4. Gold is almost indestructible, whereas copper oxidises and can break down and decay. Tungsten is very brittle and once exposed, will be ground into powder and pulverised among the alluvium as it works its way down rivers and such."





NICKEL, COBALT, PLATINUM GROUP ELEMENTS, AND RARE EARTH ELEMENT MINERAL POTENTIAL

Matthew Hill explained to Minerals West Coat the meaning of the blue to red scale on the maps above.

"The blue shows the possibility for economic deposits. The big thing about the blue areas is that we need more information about them. We know they're the right source rock, but we don't have a lot of knowledge of the geochemistry, and other enrichment processes of the intrusion to say whether they have more REE potential or less, so, they require more research but are worth looking into."

"You can see in the Hohonu area, inland of Greymouth and Hokitika, an area of blue through to red on the REE map. It's largely outside of Schedule 4. The reason that's red is that it's been explored in the past but it's also had modern exploration over the area. The big thing with rare earths in New Zealand, is that its an underexplored opportunity. We've got a map of where the potential source rocks are, but the alluvial deposits downstream are also important and are enriched in REE eroded from these rocks. This is an area worthy of more research".

24 (Youngson, 2020)
25 (Youngson, 2019)

Youngson, agrees the Hohonu granites could hold rare earth elements, but says whether they're ore grade deposits remains to be seen, and agrees more work needs to be done assessing downstream deposits.[25]

"In the mineral sands, the same areas where there are alluvial gold deposits, there are potentially minerals holding rare earth elements. Especially on the beaches. Nature's already done all the work – the minerals are exposed. Nature's mined it off the hillsides, crushed it in the rivers, and concentrated it in alluvium deposits and in the beach sands. Minerals that hold rare earth elements can be found in the same placer deposits as gold in black sand. It's more of a processing proposition than a mining proposition".

WEST COAST COALFIELDS

Coal is a crucial energy source for New Zealand's production of food and essential materials, and a vital and non-substitutable ingredient for steel manufacturing. The resource has long been part of the West Coast economy, whether through its production in the Buller and the Grey, or its use in providing energy to dairy product manufacturing in Westland.

The main coalfields in the West Coast region are Buller, Greymouth, Pike River, Inangahua, Reefton, and Garvey Creek.[26] The coalfields and the properties of the deposits are shown on the next page. This map was authored by Stu Henley and was sourced from the Australasian Institute of Mining and Metallurgy's Monograph 33.

Annual coal production for the region has varied over the years, but last year was about 1.5 million tonnes. The New Zealand government estimates in ground coal resources on the West Coast to be about 500m tonnes.[27] The Buller and Greymouth coalfields have by far the largest resources.

It is important to note however that much of this will not be economically recoverable and should not be treated as an indication of the industry's longevity in the region. Some 136 million tonnes of coal have been produced from West Coast coal fields, and most of the easily mined coal has been extracted.

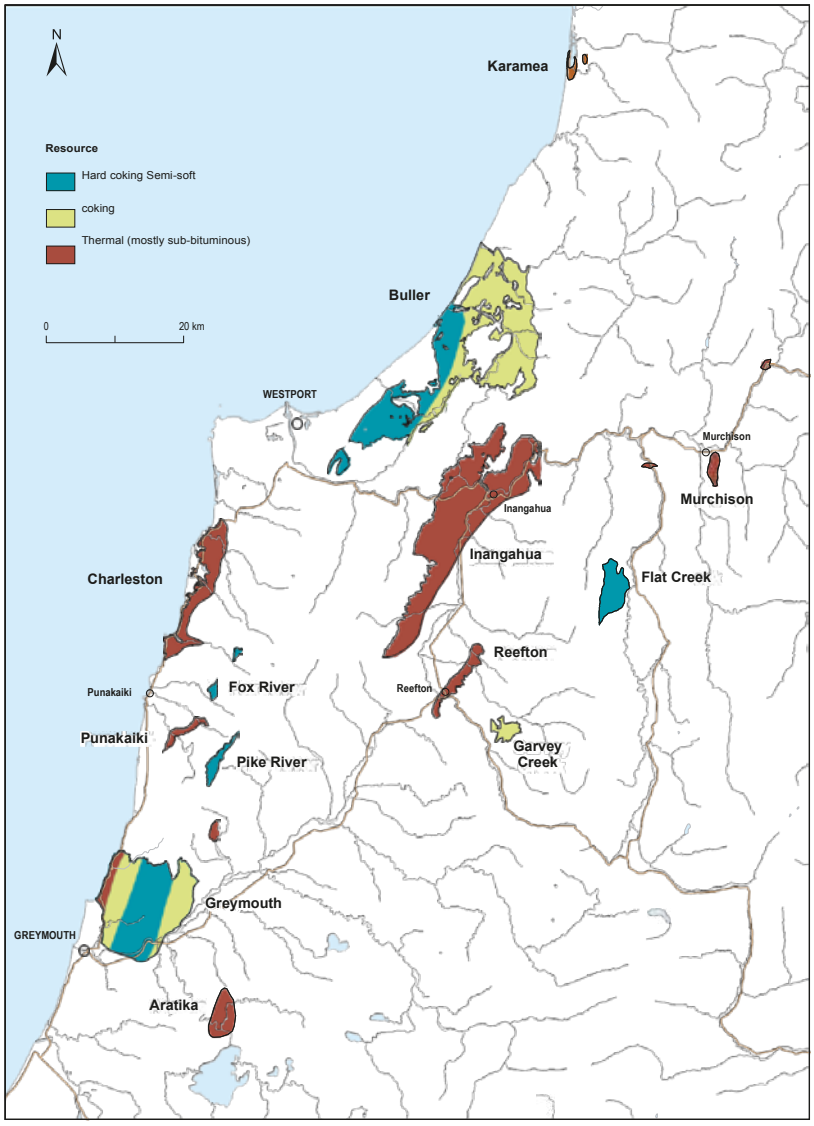
Current production is for two markets which are quite distinct. Two thirds of production is for export, mainly as coking coal with additional small quantities going to specialist markets. Export production is predominantly from the Stockton mine complex in the Buller coalfield, with smaller amounts being exported from the Greymouth coalfield.

The viability of the West Coast coal export industry is dependent on global and local influences. International coking coal prices fluctuate, and below a certain level New Zealand production cannot compete with lower cost producers, as occurred in 2012.

The most significant local influences on exports are coal transport costs to the Port of Lyttleton, and access to resources. In Greymouth coal field, almost all of the remaining resources can only be accessed by underground mining. For commercial and regulatory reasons, there has been very little underground production since 2015 and no underground coal mines now operate in New Zealand. In the Buller coalfield, most remaining resources are open castable. The Stockton mine has another 12 years of reserves. New land access arrangements and resource consents will be required to mine additional reserves on conservation and other public land. The tension between economic and environmental objectives is highly politicised.

The other third of West Coast production is for domestic use, with dairy factories being the main consumers. None is used for electricity generation. There are no realistic alternatives to coal for large-scale thermal users in the South Island, and West Coast coal is therefore of significant importance to the domestic economy. Thermal coal is mined in varying amounts from all of the West Coast's producing coal fields: Inangahua, Reefton, Garvey Creek, Buller and Greymouth. While some of these coalfields are at a mature stage of development, there are sufficient thermal resources for the foreseeable future.

26 (New Zealand Petroleum and Minerals, 2017)
27 (New Zealand Petroleum and Minerals, 2017)



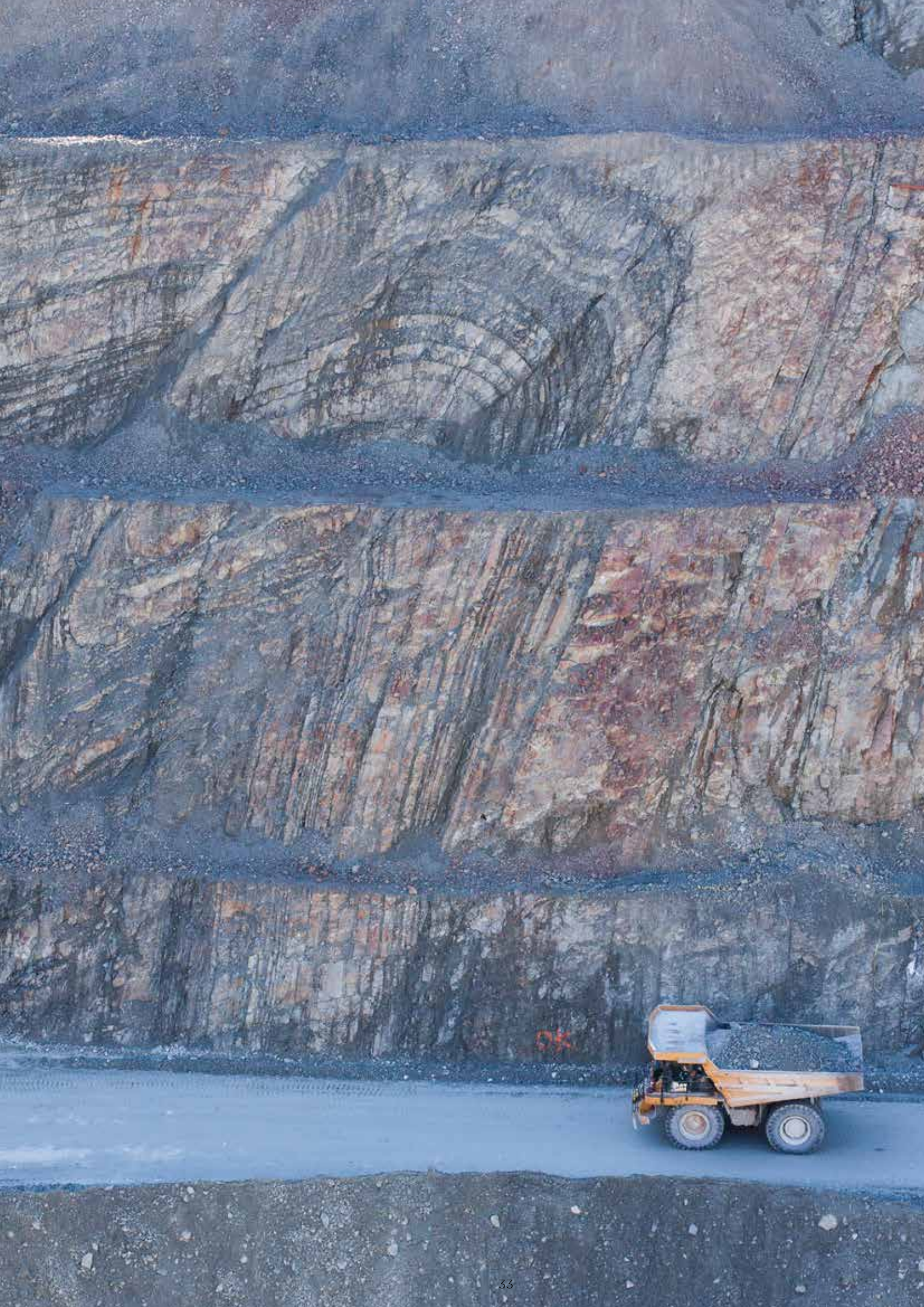
SECTION SUMMARY

The West Coast, compared with the rest of New Zealand, is relatively well endowed with mineral resources.

Developing mines that can economically recover these resources has always carried a high level of financial risk, and in turn can deliver a significant financial reward for successful miners.

Whether the mining industry continues to produce traditional resources such as gold and coal or diversifies in the future to mine other minerals will depend on market demand, technological developments, and the risks investors are willing to take.

The social, environmental, and health and safety parameters within which the industry operates will always be determined by regulators. New Zealand, as a developed country has sound and modern legislation in these areas compared to other many other jurisdictions.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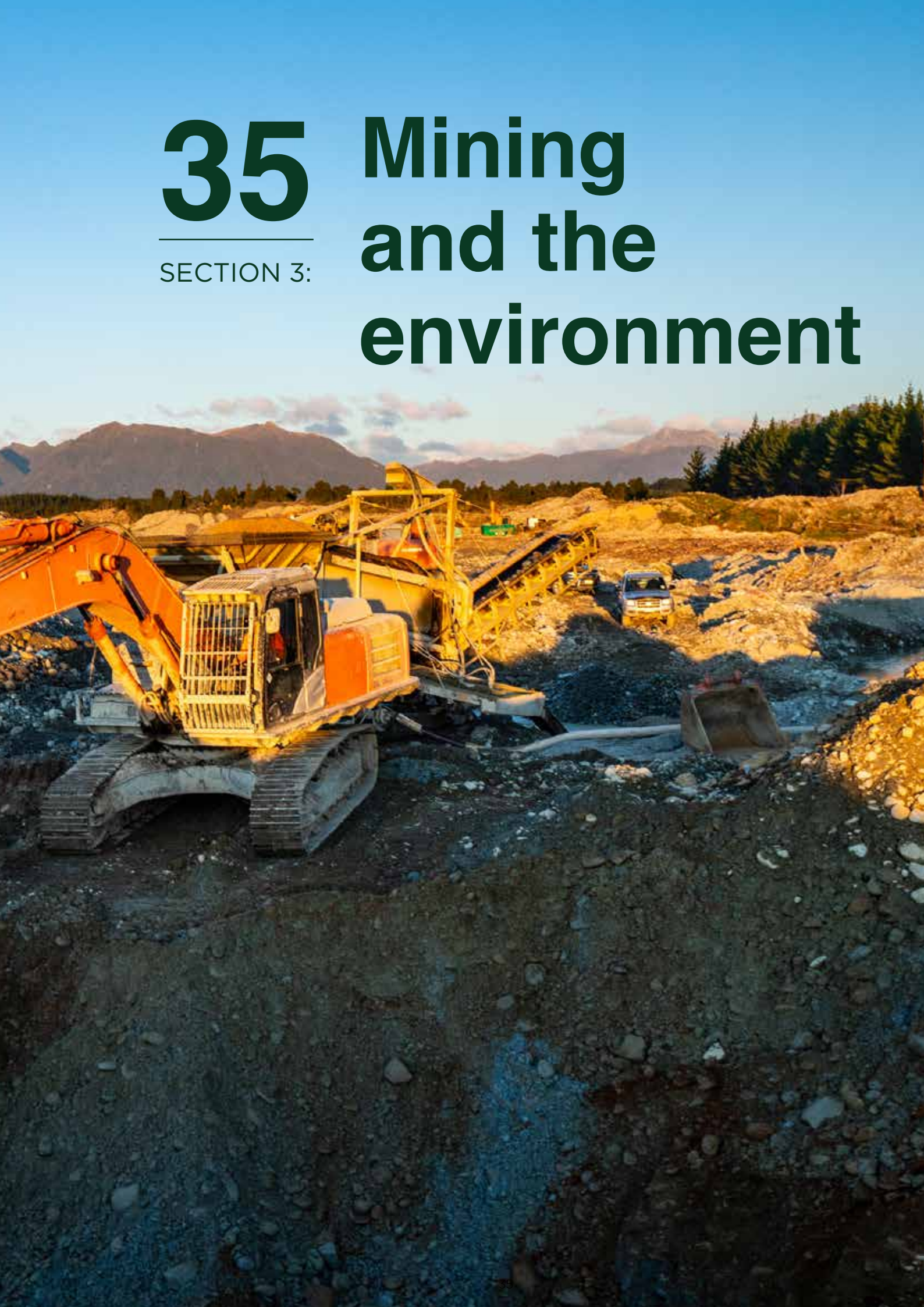
SECTION 3:

Mining and the environment



NEW ZEALAND'S UNIQUE ENVIRONMENT

Long before the first seven waka, the Zeehaen, or the Endeavour arrived in the South Pacific, the land that became these islands set sail from Gondwana land 80 million years ago. By 65 million years ago the fledgling landmass was well removed from the former super continent and took the animals and plants of the day as its passengers.[28] This included insects, amphibians, land snails, reptiles and birds. Some of our bird species and our two remaining bats flew here after this separation. With the exception, however, of three bat species, there were no land mammals present in New Zealand before humans arrived.[29] Pre-human New Zealand has been described as "a land without teeth".[30] All this changed, of course, when we humans arrived about 1280 CE.[31]

PARADISE LOST

Habitat destruction and the proliferation of introduced mammals are two of the most significant drivers of biodiversity decline. Since the arrival of humans millions of hectares of forests have been burned or felled, more than 90% of our wetlands have been drained, and once abundant species are now extinct. This comprises at least 75 animal and plant species including 59 birds[32], three frogs[33], four insects[34], two reptiles[35], and seven plants.[36] Stories of paradise lost because of human flaws are as old as humanity itself – the Garden of Eden the most prolific in Western societies today – but what is beyond any doubt in New Zealand is that to date we have lost many of our native species and we will likely lose more. Looking solely at birds, of the 168 remaining native bird species (93 of which are endemic), 80% are at risk of extinction and 33% are at serious risk.[37] In areas without pest control kiwi are reducing at such a rate that they will be extinct within two human generations.

28 (Cooper, 1993) (Augee, 2000)
29 (King, 2005)
30 (The Meaning of Trees, 2013)
31 (Landcare Research, 2009)
32 (Hugh A. Robertson, 2016)
33 (Donald G. Newman, 2013)
34 (R. A.B. Leschen, 2012)
35 (Rod Hitchmough, 2015)
36 (Peter J. de Lange, 2017)
37 (Parliamentary Commissioner for the Environment, 2017)

ECONOMICS UNDERPINS WHETHER BIODIVERSITY IS DIMINISHED OR ENHANCED

When native species have prospered or perished, or introduced pests have been controlled or run rampant, or land use has changed, economics has been the main driver. This issue needs to be viewed more broadly than money and considered as the allocation of resources humans need.

The first wave of humans to arrive, the Polynesian ancestors of the Māori, brought with them kiore (Pacific rats), and kurī (dog) for food or companionship.[38] Kiore, which ate eggs, reduced tuatara populations to a point they were gone from the mainland once Pākehā settlers began to arrive in Aotearoa[39], and many bird species had declined in number or disappeared altogether.

With an initially abundant supply of moa on our land and seals lining our coasts, these were the most easily exploited resource of food – the largest moa weighed up to 250 kilograms.[40] After two centuries of hunting, the nine different moa species went extinct about the 16th century, with no remains found in middens dating any later than 1550.[41] This is recognised as the most rapid extinction of a large animal species caused by humans.[42]

For early Māori living as hunter gatherers, hunting removed seals from where they had previously inhabited the coastline. Estimates put the pre-human seal population about 2.5-3 million New Zealand fur seals[43], which were 'an obvious prey'[44]. Early Pākehā hunted seals to meet international demand for seal skins. Māori and Pākehā sealing collectively reduced the population[45] to about 10,000 individuals, or 0.4% of the original population before seals were granted protection.

Following the signing of Te Tiriti o Waitangi in 1840, new settlers began introducing farm animals for food production, and demand for timber from our native forests increased. Auckland grew, as did the appetite for kauri. Canterbury grew, as did demand for West Coast rimu. In the 1880s refrigeration technology opened up new global markets for meat and dairy goods, and international markets contributed further to forest clearance[46] driven by forces far from our shores.

38 (Parliamentary Commissioner for the Environment, 2017)
39 (Department of Conservation, 2020)
40 (Morten Erik Allentoft, 2014)
41 (Worthy, 2015)
42 (Morten Erik Allentoft, 2014)
43 (Harvie, 2017)
44 (Phillips, 2006)
45 (Harvie, 2017)
46 (Parliamentary Commissioner for the Envrionment, 2019)

DEFORESTATION OF NEW ZEALAND

1280 CE ***1840 CE*** ***Today***

Deforestation happened with the two major arrivals of humans. The first, following Polynesian discovery in 1280, largely a result of hunting and as clearance for agriculture, and the second, following British colonisation of New Zealand in 1840, and the predominant driver being demand for farmland, in part driven by government policy.

The impact has been the deforestation of New Zealand to a point where only a third of New Zealand's original forest cover remains, with much of the remainder hugging the fault line of the Indo-Australasian and Pacific Plates running southwest to northeast, and the majority of forests in the flat and low lying areas of the country under pasture, pine, or pavement – the landscapes to which New Zealanders ascribe the greatest economic value.

THE WEST COAST

Of the biodiversity remaining in New Zealand today most is on public land within the conservation estate, and to a lesser extent on private land. Conservation land makes up a third of New Zealand's land mass, an area of 8,838,470 hectares. About 21.5% of this area is on the West Coast, second only to Southland, with 21.6%. The West Coast however has the largest area of conservation land relative to private land, with 81.5% of the region under Department of Conservation management.

This includes a World Heritage Area, and parts or all of Kahurangi, Paparoa, Arthur's Pass, Westland Tai Poutini, and Mt Aspiring National Parks. This amounts to five of the 13 national parks in the whole country, and the largest number in one region.

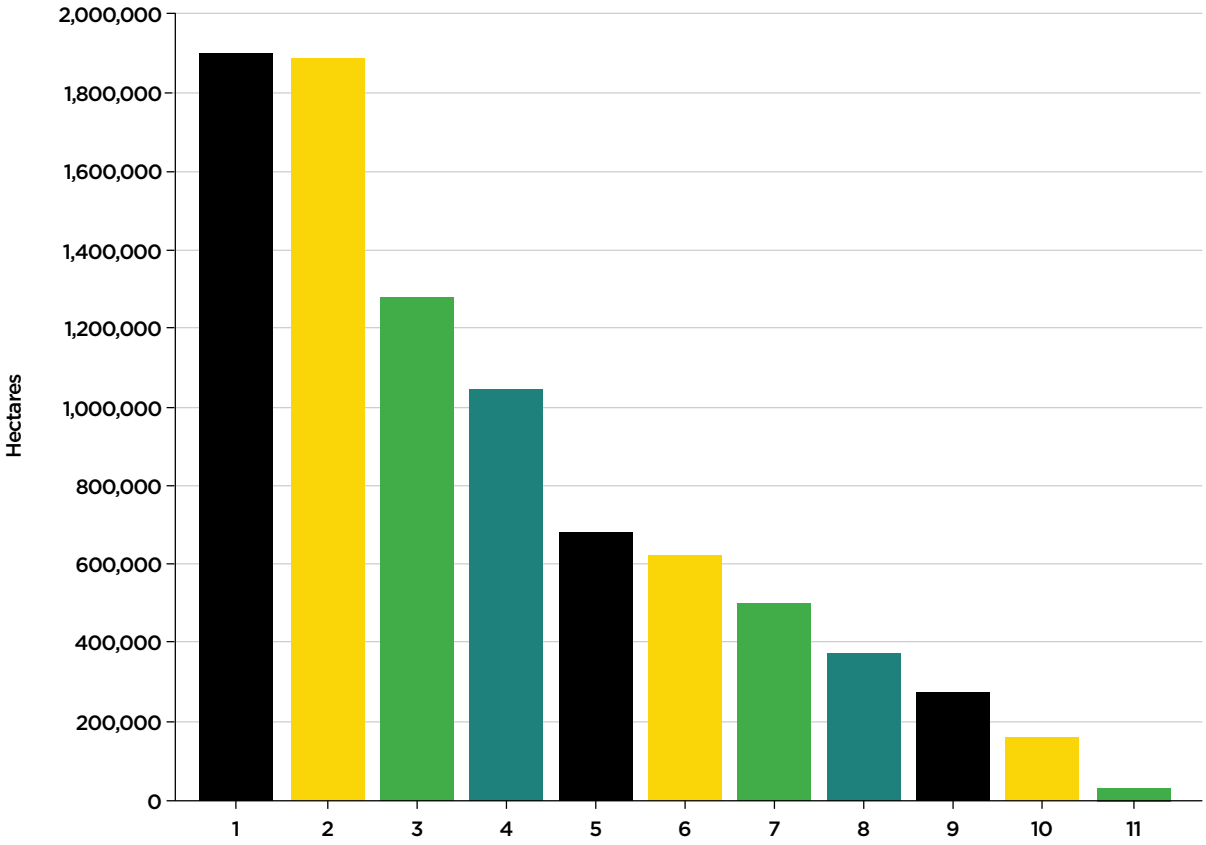
47 (Maseyk. F, 2014)
48 (Maseyk. F, 2014)

As well as having a large area within the conservation estate, biodiversity across both public and private land is more intact on the West Coast than in any other part of the country.

The region has the highest level of habitat representation in New Zealand.[47] A large proportion of the protected areas on the West Coast occur as continuous sequences of eco-systems, crucial for providing corridors for species to spread from area to area.

Nationwide, wetlands have been reduced to 10% of their former cover. Of the remainder, a third is on the West Coast, more than in the entire North Island.[48]

CONSERVATION LAND IN DIFFERENT NEW ZEALAND REGIONS



Number	Conservancy	Hectares	Number	Conservancy	Hectares
1	Southland	1,909,010	7	Taranaki/Whanganui/Tongariro	511,460
2	West Coast	1,898,560	8	Wellington/Hawke's Bay	378,480
3	Nelson/Marlborough	1,288,960	9	Waikato	281,060
4	Canterbury	1,051,400	10	Northland	163,780
5	Otago	689,580	11	Auckland	37,640
6	East Coast/Bay of Plenty	628,540			

THE MINING INDUSTRY AND BIODIVERSITY

In the context of all previous extinctions and the deforestation that has occurred across much of New Zealand as a direct or indirect result of human activity, it is understandable some people feel further loss is unacceptable, but there are several factors worthy of consideration.

The first of which is that mining's overall contribution to habitat loss within the human history of Aotearoa New Zealand is very small compared to the impact of other activity, be it forest clearance for hunting and agriculture during the era of early Polynesian settlement, clearance for farming and demand for timber during early British settlement, or the urbanisation and urban sprawl that followed. This is not because miners are more benign than hunters, farmers, or property developers, but in simple terms the relative scarcity of minerals that gives them the very value they command means the impact of mining is by its nature also confined.

Mining's impact can be temporary. Some habitats and ecosystems are comparatively rare or are incapable of recovering from a disturbance, others however are more common or able to be restored following mine closure if best practice is used.

The above photo shows older mature trees which can be seen just above/behind the red pecked line, while all the vegetation below is regenerating forest that has grown back since mining ended in the early 1900s.

The above picture was taken within the regrowth shown on page 40. These include kahikatea, rimu, different coprosma species, broadleaf, as well as flaxes, ferns and mosses.

The pictures below are taken within one area of OceanaGold's Globe Progress Mine as part of their environmental restoration work following the closure of the mine in Victoria Forest Park, but in some areas, as in the photos below, restoration began during the mining operations.

Prior to application of topsoil or planting of seedlings

Topsoil and wood slash applied. Photo taken November 2013

Vegetation growth to date since replanting carried out six years earlier. Photograph taken on the 25th November 2019

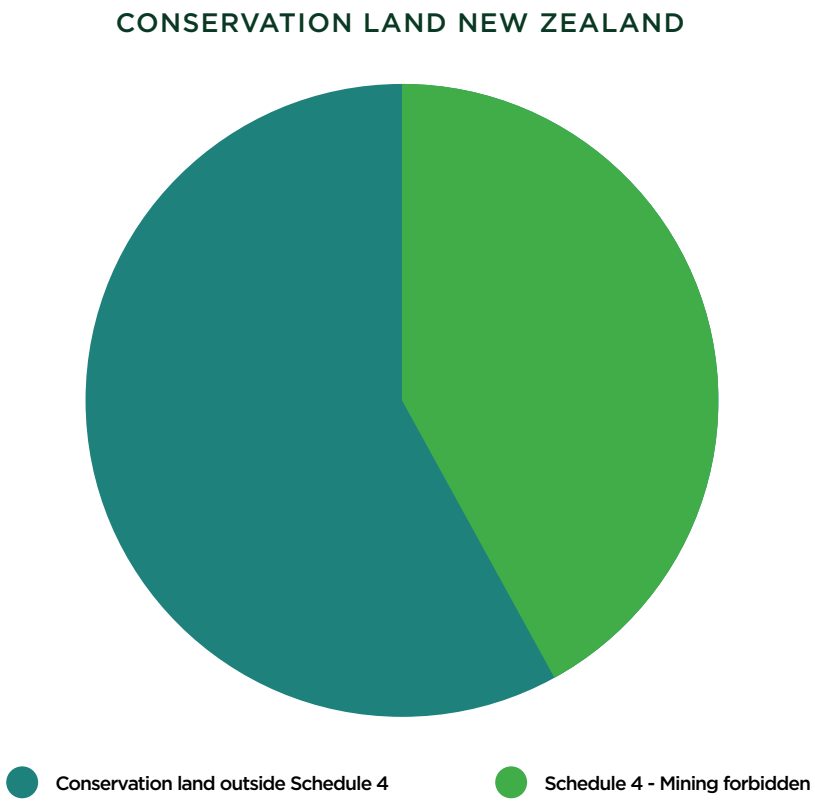
MINING ON THE CONSERVATION ESTATE

Some New Zealanders understandably feel uneasy about any further loss of habitat, genuine or merely perceived. Images of bulldozers and diggers clearing forest and digging up the earth in areas we have set aside for protection would seem counterproductive to protecting New Zealand's biodiversity, but things aren't always simple.

In 2010 the then National-led government proposed 'unlocking New Zealand's mineral potential', and in doing so considered 'opening up' areas of New Zealand listed in Schedule 4 of the Crown Minerals Act, which forbids mining in certain areas. Some of these are obscure, but unsurprisingly what drew the most public attention was the prospect of mining in areas such as National Parks, which are listed under Schedule 4. This idea was abandoned in July 2010 after vocal opposition.

Of the total conservation estate, land listed on Schedule 4 makes up about 3.7 million hectares, or 42%. Of the remaining 58%, access agreements may be granted if the Department of Conservation is satisfied the applicant will operate within the statutory requirements of the relevant legislation.

As of 2018, about 3,512 hectares had approved access arrangements with miners who held mining permits under the Crown Minerals Act.



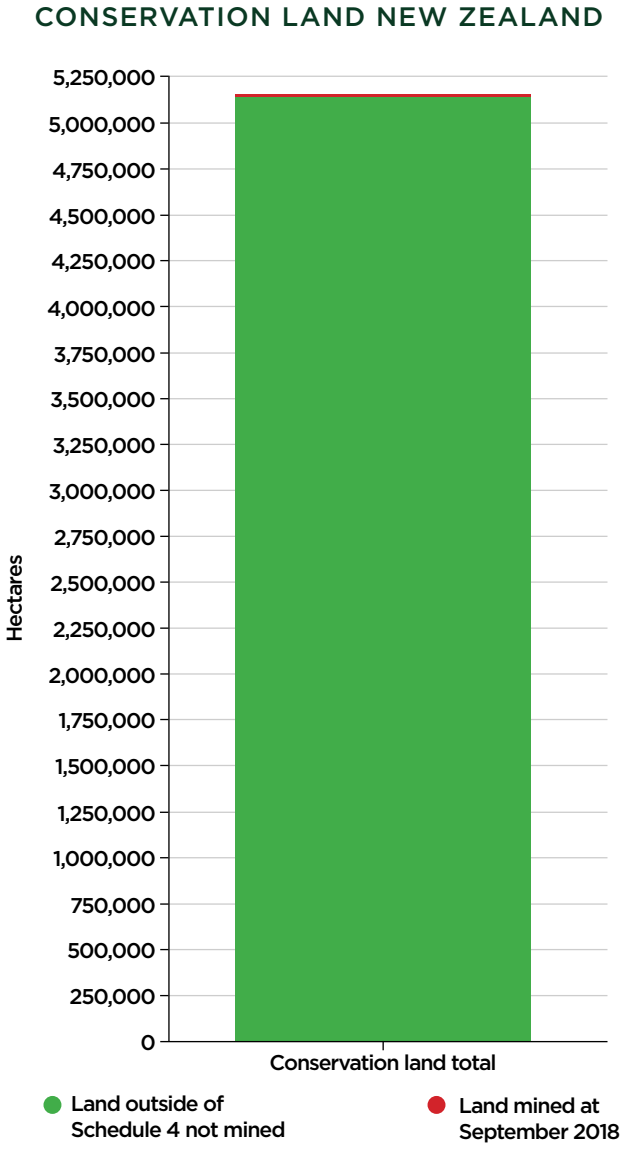
A small footprint aside, in November 2017 the newly elected government announced via the newly appointed Governor-General that there would be no new mines on conservation land.

Commenting on the surprise decision, which had not been mentioned in the election campaign, the newly appointed conservation minister explained to reporters and in turn the public that *"New Zealanders expect to our conservation lands and their wild landscapes and indigenous plants and wildlife protected from being dug up by bulldozers and diggers."*[49]

Six months on, with little progress made, one environmental lobby group leader said *"We were delighted when the Government announced that it was ending mining on conservation land. But six months down the track we're still losing New Zealand's native species to giant holes in the ground"*[50]

As the figure (right) shows, mining's impact is very, very small in the context of the entire conservation estate, and the above comments are largely emotive and ideological assessments of the issue, and therefore misleading.

The minister's sentiment seems to be that biodiversity should be protected, and few would argue with that point. The question to put to that assertion is whether or not mining will be beneficial to protecting biodiversity, or whether it will be detrimental.



49 (RNZ, 2017)
50 (Ensor, 2019)

AN OBJECTIVE ASSESSMENT OF MINING ON CONSERVATION LAND

Following public backlash to the proposal to remove some areas from Schedule 4 of the Crown Minerals Act, the Parliamentary Commissioner of the time, Dr Jan Wright, assessed the wider issue of mining on conservation land outside of Schedule 4 – the 58% of the conservation estate shown in the graph on page 42. Broadly speaking, Dr Wright concluded commercial use of some areas of the conservation estate, including mining, doesn't preclude protecting our native species – in fact, it may even help.

Dr Jan Wright wrote *"there is indeed potential for a win-win, the greatest threat to New Zealand's unique biodiversity is not mining but introduced pests, both plants and animals. Without active pest management, kiwi chicks have a one-in-twenty chance of making it to adulthood. And many of our most precious species would fact almost certain extinction. Provided conservation takes precedence, some mining operations could well provide a net conservation benefit".*[51]

Dr Jan Wright's assertion again came back to economics. Economics again, as always, plays a part. The allocation of a finite number of resources to a seemingly infinite number of needs means difficult decisions are necessary. In her words *"Current and projected funding will not be enough to stop pests wiping out much of our unique biodiversity. Commercial use of the conservation estate offers an opportunity to address some of that funding shortfall."* [52]

And almost a decade on from that report being written, the projections seem to have proven correct. The conservation minister freely admits pest-control is underfunded. *"We are only controlling predators using 1080 over 10-12% of the conservation estate. We need to do it over a much larger area. If I had the funding, that would be a priority for investment"* [53]

51 (Parliamentary Commissioner for the Environment, 2010)

52 (Parliamentary Commissioner for the Environment, 2010)

53 (Bracewell-Worrall, 2019)

THE IMPACT OF INTRODUCED PESTS

The issues here are manifold, and the number of pest species, even merely animal species, make tackling the problem challenging, and in turn, costly. New Zealand's coastal areas, forests, and alpine landscapes face threats from possums, rats, stoats, mice, rabbits, feral cats, wasps, deer, pigs, goats, thar, to name but a few animal species. The Department of Conservation also lists over 300 exotic weed species.[54]

54 (Weed busters, 2020)

WHAT MINING GENERATED SUPPORT MEANS FOR PROTECTING NATIVE SPECIES

In the context of the information above, a series of case studies have been prepared below with input from Bathurst Resources, OceanaGold, The Ecology Company, and the Department of Conservation.

The first case study examines the conservation work made possible in the Heaphy Management Area as a result of compensation for Bathurst Resources' Escarpment Mine on the Denniston Plateau.

The second looks at Te Maruia Waka Huia, an integrated species management programme in the Maruia area near Reefton, supported by compensation from OceanaGold's Globe-Progress Mine near Reefton.

The third case study examines an opportunity unrealised – a proposed 35-year pest control programme over an area greater than 10,000 hectares tied to Stevenson Mining's proposed coking coal project at Te Kuha Mine near Westport.

The fourth and final case study examines recent work carried out with funding from the West Coast Mining Compensation Fund – a fund that combines the resources gained through compensation from the collective of smaller mines operating throughout the West Coast Conservancy.

ESCARPMENT AND HEAPHY COMPENSATION PACKAGE[55]

In August 2011 Buller Coal Limited, a subsidiary of Bathurst Resources, secured from Buller District Council and West Coast Regional Council resource consents to develop an opencast coal mine, Escarpment Mine, on the southern end of the Denniston Plateau, north of Westport. The decision was appealed to the Environment Court. The decision was released in March 2013. There was a significant disagreement between the parties to the appeal about the relative costs and benefits of the proposal. The main point of contention was the adverse effects on biodiversity and the ecological benefits achievable by best practice post-mining rehabilitation of the site.

Present within the proposed mining area was significant vegetation, as well as significant habitat for assemblages of invertebrates, 36 bird species, three lizard species, one snail species (Powelliphanta patrickenisis) and threatened and at-risk liverworts, ferns, and vascular plants. The total mine footprint was about 186 hectares, including a 157 hectare opencast pit. The land where mining was to take place was largely administered by the Department of Conservation but included some also administered by Land Information New Zealand. Along with resource consents, an access arrangement was required from the Department of Conservation to allow access to public conservation land.

At the time the access arrangement was granted, the conservation minister of the day explained the decision as follows:

"There will be some permanent and irreversible effects on the area's natural and historic resources, but I consider some potential adverse effects will be partially safeguarded against through a combination of rehabilitation conditions, environmental quality limits, bonds and insurances…I consider that the partial safeguards and, in particular, the proposed compensation package will promote the objectives of the Conservation Act…the proposed compensation package is substantial and would achieve significant conservation benefits. It will enable a large amount of predator and pest control work to be carried out in other areas managed by the Department. This work will promote in a significant way the objectives of the Conservation Act and will be beneficial to the health of affected flora, fauna and ecosystem habitats in the areas where work is to be undertaken. It will fund not only biodiversity enhancement work over approximately 25,000 hectares in the Heaphy River catchment for 35 years, and similar work over approximately 4,500 hectares on and surrounding the Denniston Plateau for 50 years".

Heaphy was selected due to its high conservation values, its location within the iconic Kahurangi National Park, the ability to build on 20 years of possum control, its proximity to other high value areas that could be improved by future projects, and the link to the Buller District, as all visitors to the Heaphy pass through Buller.

The package includes possum control, control of pigs and browsing animals, stoat and rat control, forest health monitoring, protection and enhancement for kaka and whio populations, and bat surveys, over a total area of about 25,000 hectares.

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55 This case study is informed by information from Bathurst Resources and the Ecology Company. What is written here has been prepared by Minerals West Coast, who accept all responsibility for any errors or omissions.

TE MARUIA WAKA HUIA[56] – SUPPORTED BY OCEANAGOLD

Te Marui Waka Huia, or the treasure box of Maruia, is an integrated species management plan over a core area of approximately 5,000-6,000 hectares. The programme has been operating since 2009, partially funded by OceanaGold through compensation paid to the department for impacts at Globe Progress Mine. The managed area comprises mixed ecosystems from alpine to montane beech forest and frost flats and braided rivers.

Beech trees themselves are not especially vulnerable to pests, but plant and animal species in beech forests are. Plants like mistletoe have disappeared from many forests with no pest control because of the impacts of possums.

The Department of Conservation says since the programme's inception in 2009, a reasonable predator control programme has been established, as well as some species-based programmes with the aid of funding from OceanaGold as part of its access arrangement. The issue however is as funding support from mining decreases the programme will be more dependent on direct Department of Conservation funding with some reliance on local and volunteer support.

Goats are culled each year in the Maruia Valley south of the main highway, through to Lake Christabel, the Westbank and Station Creek to prevent invasion and spread of wild goats. Aerial and ground based hunting are used – OceanaGold funding is used for ground control only.

A combination of different types of self-setting traps within the management area is capable of suppressing rat, stoat, and possum numbers outside of mast years. This reduces the impact of predation, benefitting birds such as kaka and protects plants like mistletoe from browse. Large scale landscape aerial 1080 operations through Battle for Our Birds/Tiakina Ngā Manu help to maintain low possum numbers throughout the entire block and are also used during beech mast years when trap networks would be rendered ineffective for stoat and rat control.

Weed control in the area has been funded by compensation for mining and is complemented by weed control at a larger scale from other funding sources, including the efforts of local farmers. Invasive plant species are controlled every year, and target species include, but are not confined to broom, gorse, willow, Russell lupin, and Spanish heath.

56 This case study is informed by information provided to Minerals West Coast from OceanaGold and West Coast staff within the Department of Conservation. What is written here has been prepared by Minerals West Coast, who accept all responsibility for any errors or omissions.

Iconic animal species in the area include whio, kaka, and the long-tailed bat. In addition to support for Te Maruia Waka Huia, funds have been set aside for kaka study and management. Species targeted within Te Maruia Waka Huia programmes include long-tailed bats. This support covers some costs for monitoring at two colonies, namely an intensive summer programme of catching bats using harp traps and placing transmitters on female lactating bats. These are then tracked to roost sites in a bid to catch the bats in roosts to gauge population variances. This work also helps identify home range of the colony to inform animal pest management strategies.

Past funding paid for the bat traps and associated equipment, and now provides funds for transmitters to be purchased and staff time to conduct the work. The work stream for bats covers around 4-6 weeks during summer depending on bat breeding habits which can be affected by seasonal climate changes.

TE KUHA MINE[57] – AN OPPORTUNITY UNREALISED

In 2017 Buller District Council and the West Coast Regional Council granted Stevenson Mining resource consents to develop Te Kuha Mine, an opencast coal mine proposal immediately north of the Buller River. Resource consents are not land access, which can only be granted by the landowner. For the proposed mine 13 hectares of conservation land was required, within a mine with a total footprint of about 144 hectares. Access to the area of conservation land was declined. The proposed mine site's habitat hosts threatened and rare plants, bryophytes (ferns, mosses, liverworts), large-bodied invertebrates, birds, lizards, and naturally uncommon ecosystems. Bird species present include great-spotted kiwi, fernbirds, and the South Island robin. There are also two threatened species of lizard.

Ecologists representing Stevenson Mining Ltd, the Buller District Council, and the opponents to the project all agreed upon the high ecological values of the proposed mine area and surrounds, as well as the proposal's ecological impacts. All parties agreed that the methods to avoid, remedy and mitigate impacts were best practice, including direct transfer of vegetation. Several areas would have been rehabilitated within the first five years of the mine life, and these were to be used for trials to improve rehabilitation through planting. Where each party disagreed was the outcome of those methods and in turn the overall ecological impacts.

Stevenson Mining proposed a programme of salvage and relocation, and creation of habitat within rehabilitated sites, as well as habitat enhancement within and around the mine area. Also proposed was plant, pest and predator control within the footprint and in 497 hectares surrounding the mine, including coal measures vegetation, to maintain local ecosystems and maximise reinvasion of natural species as affected areas recovered.

The company also proposed an "offset and compensation package" addressing significant impacts that would persist after rehabilitation, such as loss of habitat, loss of individuals, fragmentation of habitat, and loss of ecological connectivity for years or decades until ecosystems were again fully functional. The proposed 'Orikaka Management Plan' would have protected native and endangered species over 10,458 hectares for 35 years. This encompasses all conservation land north of the Buller River and west of Cascade Creek north to the Denniston Biodiversity Enhancement Area.

Among the species present in the Orikaka that would benefit were the great-spotted kiwi, South Island kaka, South Island robin, whio/blue duck, long-tailed bat and South Island fernbird. The Orikaka forests are located on a more fertile and productive geology than the Brunner Coal Measures at Te Kuha and bird population numbers there would likely increase significantly if the proposed pest control were effectively implemented. This is a "like for like" exchange for the species which occur at Te Kuha and could be considered an offset. For species like long-tailed bats, kaka, and whio,

57 This case study is based on information supplied to Minerals West Coast from ecologist Gary Bramley of the Ecology Company, who has provided consultant services to Stevenson Mining Ltd. What is written here has been prepared by Minerals West Coast, who accept all responsibility for any errors or omissions.

it is not like for like and would represent compensation. The main advantage of this proposal is that the ecological values are similar to the Te Kuha site and it includes areas of pakihi (regenerating indigenous vegetation on impoverished soils) as well as tall forest. It is also located closer to Westport township and could allow local people to experience the biodiversity gains first-hand.

OTHER CONSERVATION WORK FUNDED FROM SMALLER MINING OPERATIONS[58]

There are many mining ventures on the West Coast operating at a much smaller scale than larger companies such as Bathurst Resources or OceanaGold.

Contributions from these operations is consolidated and put into the West Coast Mining Compensation Fund, which in the 2018-19 year allowed an extra $255,500 of spending for natural heritage management.

This allowed for separate operations in areas of the West Coast controlling plant and animal pests, as well as targeted care for different bird and snail species. This work has included weed control by ground and aerial methods over a combined area of 4,687 hectares. Weed species controlled include banana passionfruit, blue morning glory, Darwin's barberry, gunnera, old man's beard, pampas, purple loosestrife, willow and yellow flag iris, gorse, broom, blackberry, lupin, and raspberry.

Work protecting the whio (blue duck) populations has been carried out in two sites. In Buller's Oparara security site, the whio population is protected by linear riverside traplines, and an annual species census is undertaken. The traps are cleared ten times each year, and four walk-through whio surveys are carried out.

In the Styx-Arahura-Taipo security site in Westland, the whio population is protected by linear riverside traplines. Three captive pairs are part of a breeding programme at a site in Canterbury. Chicks are raised in safety, and once fully grown are hardened in a special facility and brought back to the West Coast for release into the security site. The traplines are checked and cleared ten times each year. In January and March 2019, 32 birds were released into the security site.

Preventing the spread of Himalayan thar beyond their northern range of the Whitcombe/Rakaia catchments remains a concern. In the 2018-19 year funds from the West Coast Mining Compensation Fund allowed 100 hours of searching in the Haupiri area, where an escaped population is located about 60 kilometres north of where the Department of Conservation has designated a northern 'cut-off' for the thar population. One pregnant female and two yearling thar – one male, one female – were shot.

58 This case study is informed by information provided to Minerals West Coast from Department of Conservation staff in the West Coast region. What is written here has been prepared by Minerals West Coast, who accept all responsibility for any errors or omissions.

SECTION SUMMARY

It is Minerals West Coast's view that the works discussed at the end of this section are vital for the protection of our endangered and treasured species, many of which are just hanging on to survival. Whether the large projects made possible by the industry's big end of town like Bathurst or OceanaGold, or whether from the combined funds of compensation payments for access arrangements for the West Coast's smaller mining operations, every dollar of extra funding helps.

There are areas of the conservation estate where mining may not be appropriate and where the measures proposed to avoid, remedy, mitigate, offset, or compensate will not result in a net-gain to biodiversity values in New Zealand. This is best assessed on a case by case basis.

As Jan Wright noted in 2010, funds generated from commercial use of the conservation estate can and do help in the fight against introduced plant and animal pests. This is not limited to mining. Ski fields are common on the conservation estate – including iconic drawcards like the Remarkables, Treble Cone, and Coronet Peak – as are high country stations, farming on river flats, beehives, and tourism concessions.

Mining, while having a significant impact on the affected areas for the duration of the mine, is a temporary use of land, and given the wealth generated, can make a major contribution to funding conservation efforts, as is outlined above.

Our endangered species do not have the luxury of time. In areas without pest control – which is the vast majority of the country – kiwi will be extinct within two human generations.[59] Whatever we can do to buy time for many species in a similar or worse position is worthy of consideration.

As is outlined above, there are fewer thar, rats, possums, stoats, and weeds on our conservation estate, because mining operations were allowed, and there are more long-tailed bats, kaka, tui, whio, and other birds than there would have been without funds generated from mining.

59 (Department of Conservation, 2016)


MDT 40
MOXY

55

SECTION 4:

Coal, emissions, and the New Zealand economy

ACTION ON CLIMATE CHANGE

'After 25 years' debate about how to make progress there appears to be a widespread desire to do something.

What that 'something' involves has to be responsible in terms of the risks that are being run, must be delivered within a time frame that is manageable and take account of the country's unique emissions profile.'

- Simon Upton, Parliamentary Commissioner for the Environment[60]

The above is taken from a report largely focused on land use change and agricultural emissions, particularly methane, but these words are relevant also to New Zealand's future as a producer and consumer of fossil fuels, and our unique emissions profile.

Coal receives greater attention than any other fossil fuel from some New Zealand advocates for action on climate change. Proponents of a ban on production and use of coal, or severe limitations of the same through tools like the New Zealand Emissions Trading Scheme, should consider what the economic implications of such polices will mean for the global climate.

An important starting point for deciding upon which 'somethings' we should do is an understanding of New Zealand's greenhouse gas emissions.

NEW ZEALAND'S RISING EMISSIONS

This country's emissions have risen since 1990 but have been flat since about 2008.

After years of debate, the consensus behind the need to do 'something' has been reached. The question about what that something is remains a difficult one to answer.

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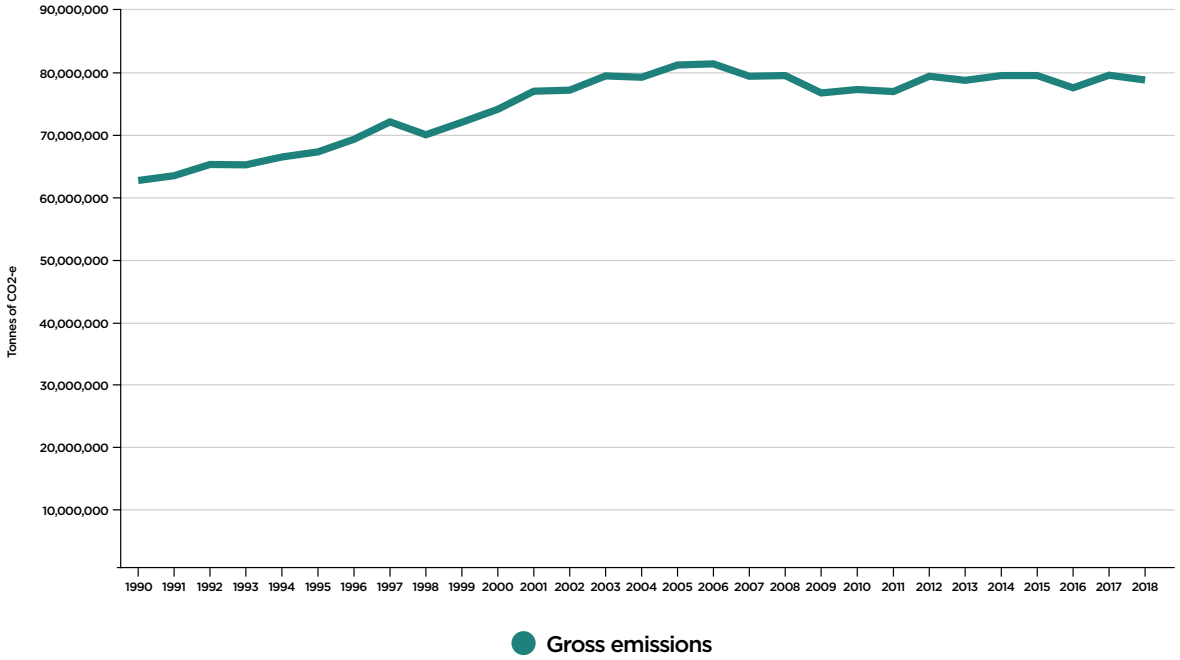
60 (Parliamentary Commissioner for the Environment, 2019)
61 (Ministry for the Environment, 2019)

NEW ZEALAND'S GREENHOUSE GAS EMISSIONS (TONNES OF CO_{2-E}) 1990-2018

Based on Ministry for the Environment figures



GROWTH PATTERN OF DIFFERENT GAS EMISSIONS

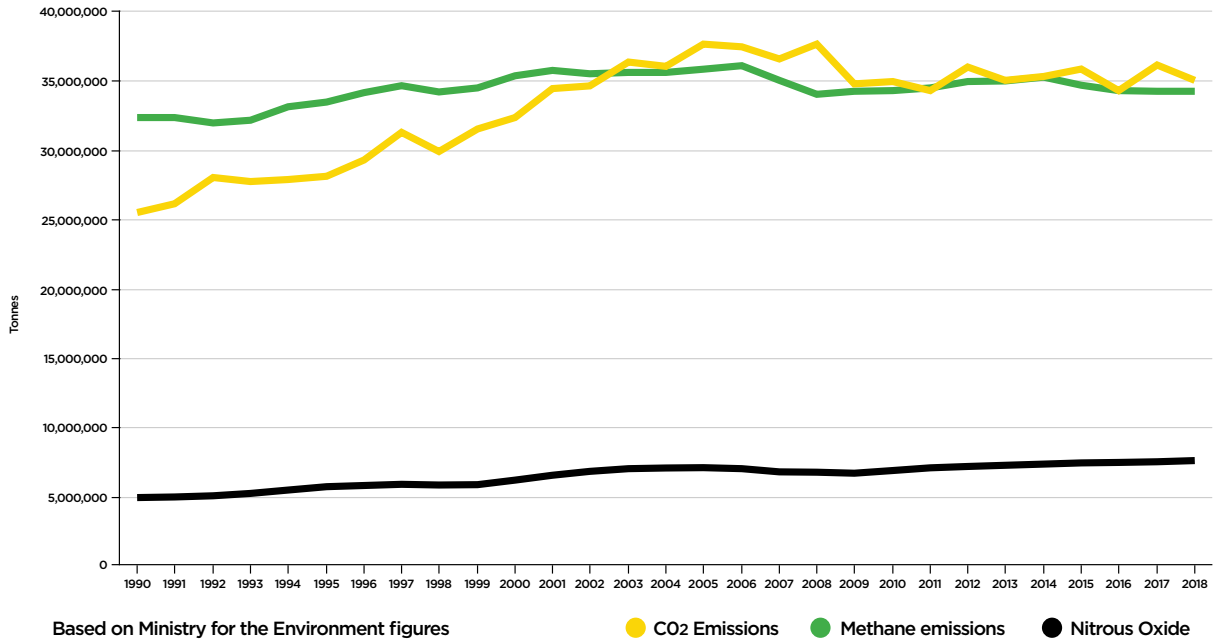
Agricultural gases are effectively half of the country's emissions, comprised in descending order of methane, nitrous oxide, and manure.[61] It is worth noting however, it is not methane emissions that have risen significantly since 1990, but carbon dioxide emissions – see page 58. Nitrous oxide, also attributed almost entirely to agriculture, has increased as a contributor to New Zealand's emissions but nowhere near to the extent that CO_2 has. Carbon dioxide emissions have increased from 25,000,000 tonnes in 1990 to 35,000,000 tonnes in 2018 – an increase of 40% above 1990 levels. Methane emissions have increased 6% above 1990 levels, and nitrous oxide emissions have increased 54%, albeit from a very low base.

New Zealand's emissions are unusual for two important reasons: our high number of ruminants relative to people, and our electricity is largely generated from low carbon sources. For almost every other country in the OECD, this is not the case.

The renewable and fossil fuel inputs into our electricity grid vary annually, but in 2018 renewables accounted for 84% of New Zealand's electricity[62], compared to the OECD average of 25%, which puts us at the third highest in the world after Norway and Iceland, both of whom have an abundance of hydropower and geothermal, respectively. As well as an abundance of renewables, our countries share low population densities, unlike the vast majority of the world. The Kate Shepherd-ANZAC soldier-Edmund Hilary myth that leads some people to think that we can be a world leader on climate change action is laudable but flawed. We are unlike almost all other countries.

62 (Ministry of Business, Innovation, and Employment

NEW ZEALAND'S GREENHOUSE GAS EMISSIONS 1990-2018



ELECTRICITY GENERATION

New Zealand's production of electricity is among the world's lowest in CO_2 emissions, but the proportion of renewable electricity generated in any given year is weather dependent.[63] This is due to the amount of water flowing into the hydro system, and how windy it is.[64]

Fossil fuels are used most when supply from renewables like hydro and wind drops, or when demand rises. Run-of-river hydro, wind, and geothermal cannot be stored, and are all "use it or lose it" electricity sources.[65] Supplying New Zealand when demand is high, or river and lake levels are low, falls on fossil fuel generation. On a winter day, for example, carbon dioxide emitted from power plants is 50% higher than on a summer day.[66] From late at night till early morning, electricity demand is at its lowest. Most people are sleeping, and few people are working. At this time however, renewable sources continue generating when there is no demand – rivers run, geothermal fluids percolate the surface of the earth, and wind blows even when such generation exceeds demand.[67]

Each day however, as people wake up, take showers, boil water, toast bread, and industry swings into operation, demand increases and fossil plant fires up, burning gas, coal, or diesel to meet that demand. The amount of CO_2 emitted over the year for electricity correlates directly with demand for it.[68]

ELECTRICITY GENERATION IN NEW ZEALAND 1975-2017

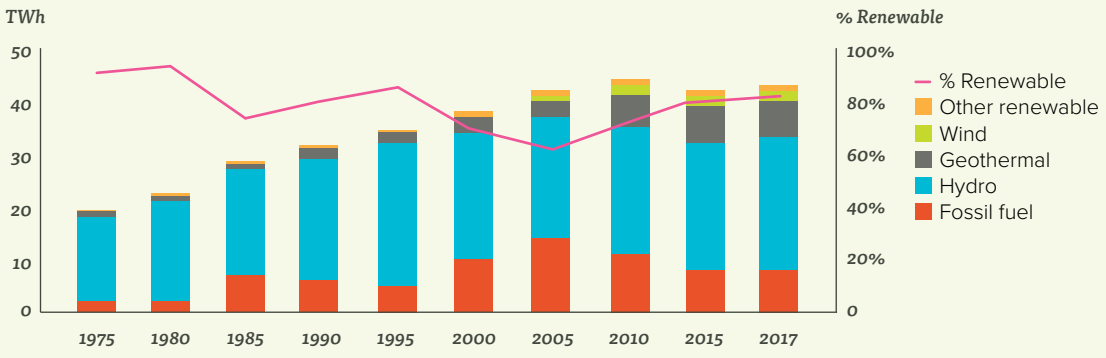


***Figure 2.3:** Electricity generation in New Zealand, 1975-2017*
Source: MBIE (2019b, 2018)

Sourced from ICCC Accelerated Electrification Report April 2019

63 (Interim Climate Change Committee)
64 (Interim Climate Change Committee)
65 (Wright, 2012)
66 (Wright, 2012)
67 (Wright, 2012)
68 (Wright, 2012)

EMISSIONS FROM ELECTRICITY GENERATION NEW ZEALAND

As the graph below shows, emissions vary for electricity generation in New Zealand, but have been trending down over the past fifteen years, largely due to the growth in geothermal and wind generation. Coal is not a major source of electricity in New Zealand, and consequently within the electricity sector its contribution to emissions is small. This should not give anyone the impression coal's contribution to New Zealand's electricity supply is expendable, as, along with gas, it is vital to backing up our weather dependent renewables. Some years, as has been the case recently, there are disruptions to gas supply. With less than ten years of reserves remaining[69], and an effective ban on new exploration, coal is the only viable thermal backstop in the long-term. The graph on the opposite page, prepared by the Major Gas Users Group, shows New Zealand's forecast gas production, where supply is picked to fall below demand as early as 2022.

ELECTRICITY EMISSIONS 1990-2017

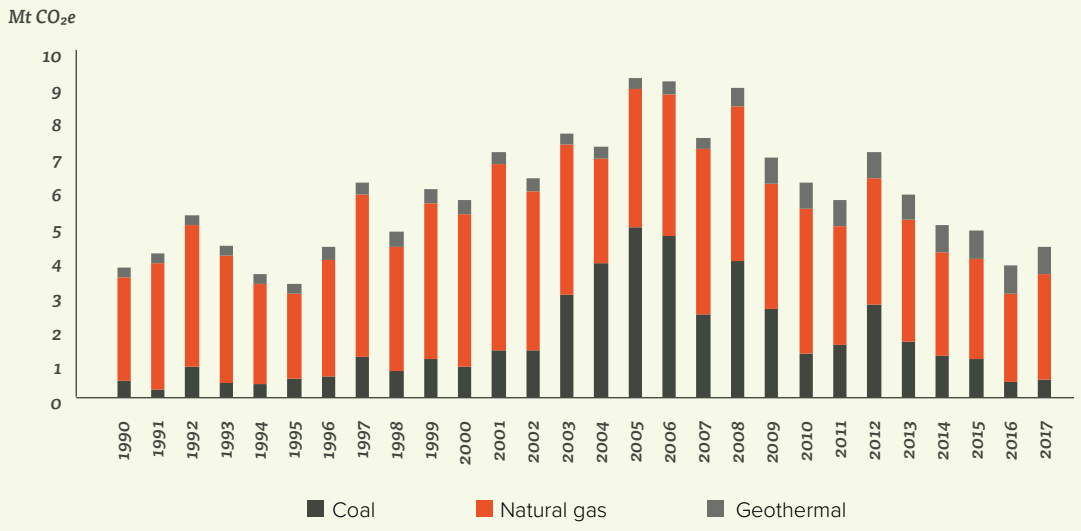
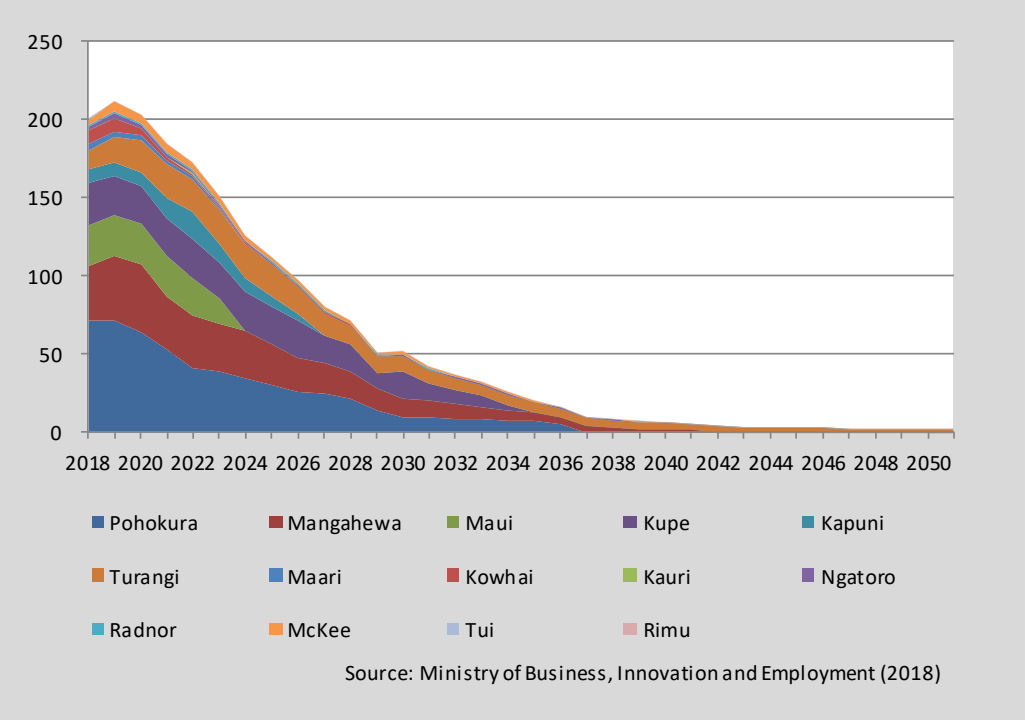


***Figure 2.6:** Electricity emissions, 1990-2017*
Source: MfE (2019a)

Sourced from ICCC Accelerated Electrification Report April 2019

69 (PEPANZ)

GAS PRODUCTION PROFILE (FORECAST) TO 2050 - PJ



Major Gas Users Group[70]

NEW ZEALAND'S ENERGY EMISSIONS HAVE INCREASED AND EVOLVED SINCE 1990

As a result of New Zealand's electricity supply being sourced largely from renewables, the majority of our carbon dioxide emissions stem from transport, manufacturing and construction, industrial processes and product use, and to a lesser extent, electricity.

New Zealand's energy emissions are dominated by transport emissions. Road transport emissions, predominately made up of private vehicle use, have increased by 102% since 1990.[71] Process heat emissions have also grown since 1990, having increased by 34% in the same period.

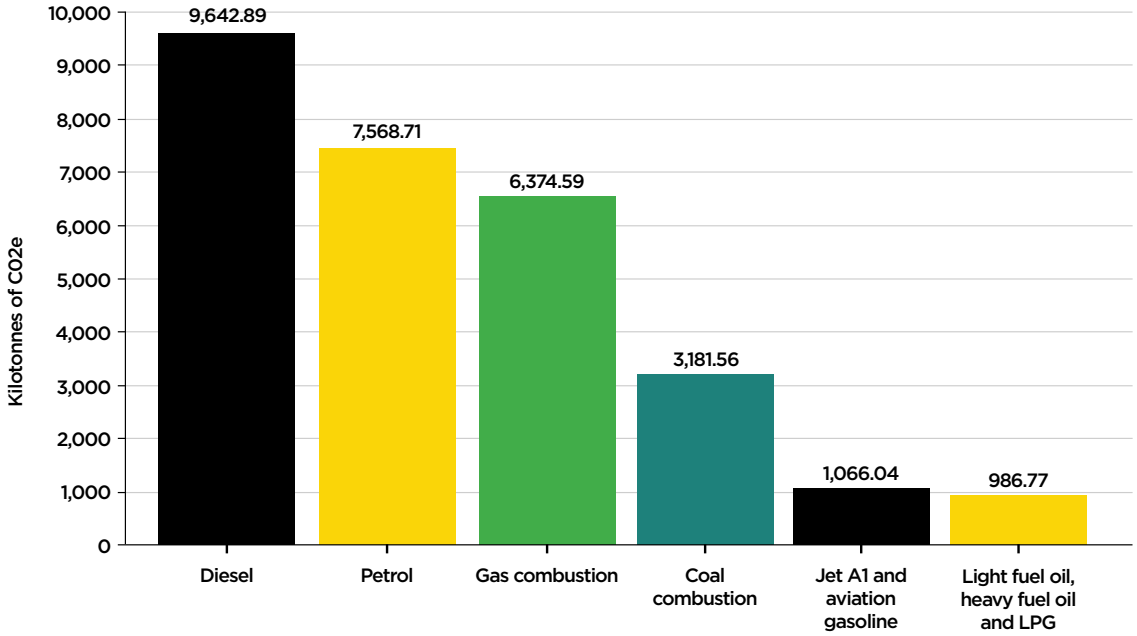
Coal-related emissions more than doubled during the 2000s due to electricity demand far exceeding renewable supply, but then fell sharply. Coal related emissions are now at similar levels to the start of the 1990s[72].

70 (Major Gas Users Group, 2019)
71 (Ministry for the Environment)
72 (Concept Consulting)

The graph below gives some indication, but it should be noted the coal related emissions from New Zealand's only steel mill are not included as coal is not a fuel for heat or energy in the steel making process, but a necessary and non-substitutable chemical ingredient, and is classified under industrial processes and product use emissions, not energy emissions.

To give some indication, in 2018 coal used as a reductant in iron and steel production accounted for as much as 1,694,400 tonnes of $CO_{2\text{-e}}$.[73] This means across process heat, electricity, and IPPU, annually coal makes up 4,875,960 tonnes of $CO_{2\text{-e}}$, or 6.1% of NZ emissions. Fuel associated with air transport is comparatively low, because only domestic air transport is included. If international emissions are included, the figure would be much larger – in 2018, Air New Zealand alone emitted 3,588,728[74] tonnes of $CO_{2\text{-e}}$ – a greater footprint than coal use if steel production is excluded, and making it New Zealand's largest emitting business unit.

FOSSIL FUEL EMISSIONS IN NEW ZEALAND 2018



Figures sourced from Ministry of Business, Innovation, and Employment, compiled by Minerals West Coast

A DISPROPORTIONATE FOCUS ON PROCESS HEAT AND ELECTRICITY EMISSIONS – PARTICULARLY COAL

Whether in the form of calls for Fonterra to 'quit' coal as if it were a nasty habit like smoking or demands for government subsidies for solar power to displace coal use at Huntly Power Station – which it can't – sentiment towards coal can at times be misinformed and sometimes overstates the issue. Coal is a fossil fuel, along with other fossil fuels it contributes to Aotearoa New Zealand's greenhouse gas emissions. As in shown on page 62, this contribution is much smaller than that of petrol, diesel, and gas. It is worth looking at why we use coal in New Zealand, and why, if we want the things that coal produces, it is difficult to simply stop using it without rendering production of food and essential materials effectively impossible in many parts of New Zealand in the absence of viable alternatives. Indeed, during the near total closure of New Zealand in the level 4 lockdown during the Covid19 pandemic of 2020, coal mines were deemed an essential industry.[75]

73 (Ministry for the Environment, 2020)
74 (Air New Zealand, 2018)
75 (Frykberg, 2020)

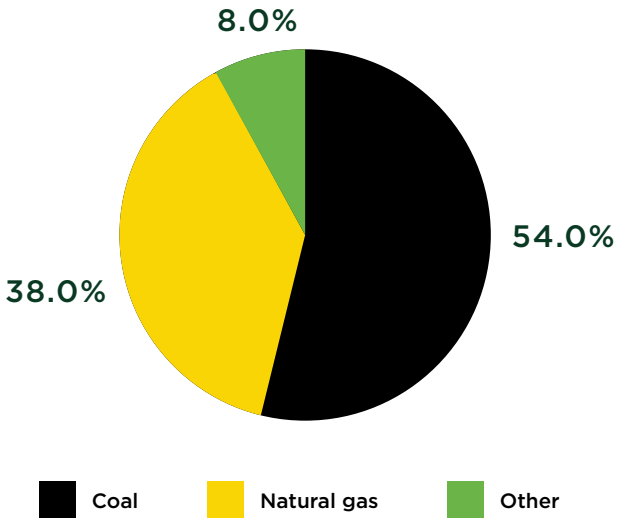
ENERGY ENABLES OUR NATION'S ECONOMY

Coal and natural gas can both be considered economic enablers. Without them, New Zealand's economy would struggle to function. Our economy depends on food production, which would not be economically viable at a national scale without coal or gas with technology available today. About 55% of all process heat in New Zealand comes from coal or natural gas.[76] Other industrial emissions stem from IPPU (industrial processes and product use), largely within metal and non-metallic mineral manufacturing. The energy component of New Zealand's main coal users is worth understanding.

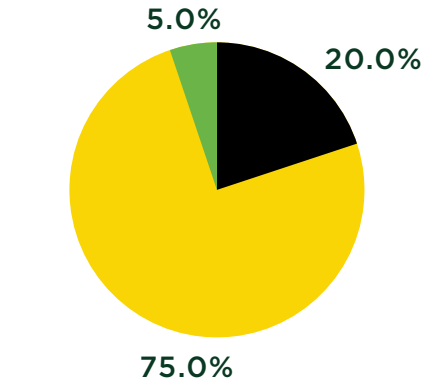
DAIRY MANUFACTURING

One of the biggest coal users in New Zealand is dairy processing, which in 2016 consumed 28.4 petajoules. New Zealand has some of the largest milk processing plants in the world, some consuming up to 180,000 tonnes of coal a year.[77] In 2016, coal met 54% of the energy demand from dairy manufacturing, the balance is met by natural gas (36%) and a mix of geothermal, diesel, and LPG (8%).[78] The South Island is much more coal reliant, with the fuel meeting 89% of the island's dairy manufacturing demand in 2016.[79] In general coal is used in the absence of gas. It takes about one tonne of coal to produce one tonne of milk powder.

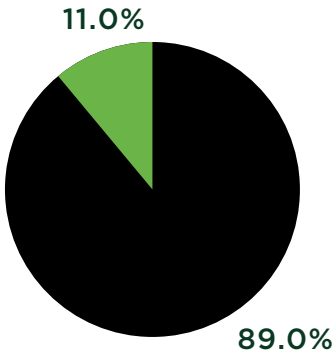
DAIRY MANUFACTURING ENERGY CONSUMPTION 2016 (total 28.4 petajoules)



DAIRY MANUFACTURING ENERGY CONSUMPTION 2016 NORTH ISLAND (total 14.8 petajoules)



DAIRY MANUFACTURING ENERGY CONSUMPTION 2016 SOUTH ISLAND (total 13.6 petajoules)



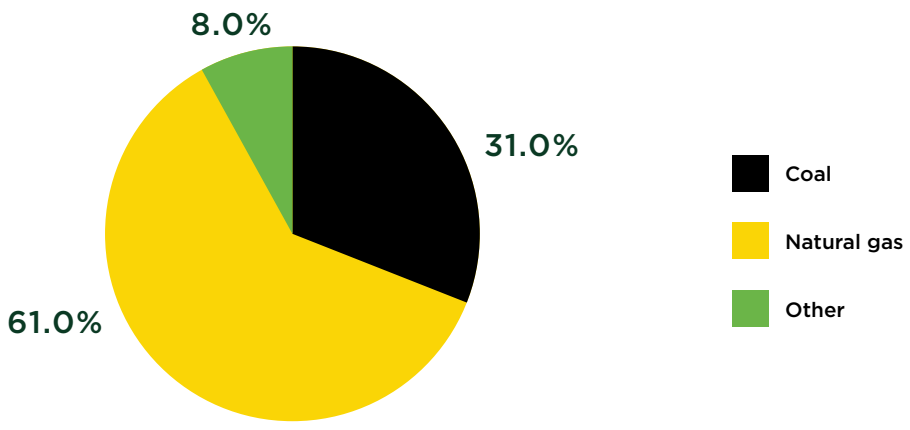
76 (Ministry of Business, Innovation, and Employment, 2019)
77 (Sherwood, 2019)
78 (Ministry of Business, Innovation, and Employment, 2019)
79 (Ministry of Business, Innovation, and Employment, 2019)

MEAT AND MEAT PRODUCT MANUFACTURING

New Zealand's meat industry is much more modest in scale than the dairy industry, and this is reflected in its more modest energy demand. In 2016 meat and meat product manufacturing consumed 5.2 petajoules.

Of the coal consumed by the sector, 80% of this was consumed in the South Island where the sector has no option of switching to natural gas. The 8% 'other' comprises LPG, fuel oil, and wood.

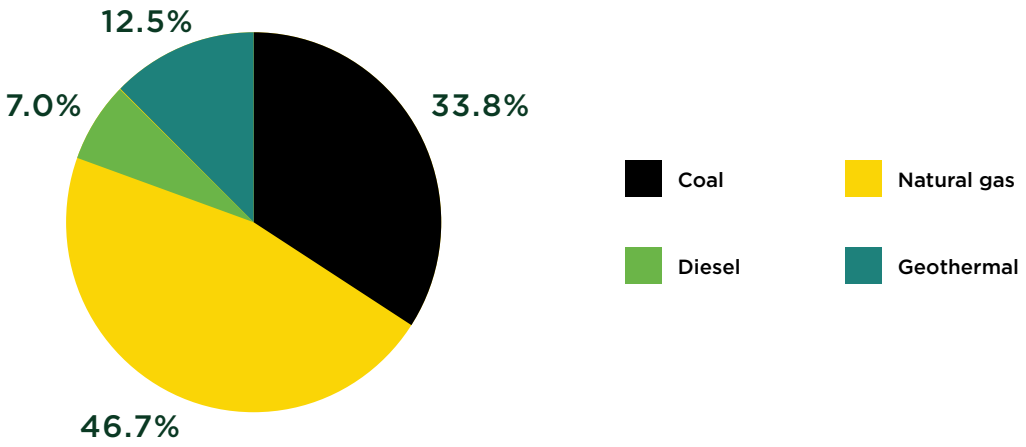
MEAT AND MEAT PRODUCT MANUFACTURING ENERGY CONSUMPTION 2016 (5.2 PETAJOULES)



INDOOR CROPPING

Growing crops in hothouses in New Zealand takes place in both the North and South Island, producing tomatoes, cucumbers, chillies, eggplants, capsicums and lettuce. A third of the sector's energy needs are met by coal (again largely in the South Island) but the largest supply of energy comes from natural gas, and a smaller portion of demand is met by geothermal and diesel.[80]

INDOOR CROPPING ENERGY CONSUMPTION 2016 (total 3.4 petajoules)



COAL AND PRODUCTION OF ESSENTIAL MATERIALS

Coal is also critical for the production of materials used in almost every aspect of our built environment. Whether walkways, cycleways, or motorways, cement and steel will be a component.

Steel's presence in our daily lives is such that it's easy to forget we have it. From teaspoons to turbines, it is hard to imagine life without it. Whether the Auckland Harbour Bridge, a steel wire across a gorge in New Zealand's backcountry, or the tools to cut the track to it – steel is everywhere.

A crucial point to understand with coal and its use in the manufacturing of steel is that it is not a source of fuel, it is an ingredient.

80 (Process heat in New Zealand, 2019)

DOMESTIC STEEL PRODUCTION

New Zealand's domestic production of steel is concentrated in one company's ownership and takes place at Glenbrook Mill. The mill has capacity to consume up to 800,000 tonnes of coal per year.[81] It is worth noting that this is a unique process[82], as conventionally steel is made from raw iron ore with coking coals, or bituminous grade, but the Glenbrook operation uses subbituminous, or non-coking coals.

The plant was specifically designed for Waikato coals, and has particular specifications for carbon and sulphur content, energy content, and reactivity.[83] Other coals within specification allowances can be substituted. For about the past ten years a mix of domestic and imported coals have been used.[84]

New Zealand is both an importer and exporter of steel and steel products, but on balance our consumption of the material is about 850,000 tonnes per year[85], with half of this supplied by domestic production and half supplied from imports, but many of these imported products are those not manufactured in New Zealand, for example hot rolled structural sections, large diameter structural pipes, sheet piling, reinforcing strand or special flat products.[86]

COAL EXPORTS FOR STEEL PRODUCTION

The West Coast is the sole region in New Zealand that produces coking coal. Coking coal is that of a bituminous grade that can be used to make coke, a key ingredient for manufacturing steel, which cannot be produced from raw materials without a carbon component.

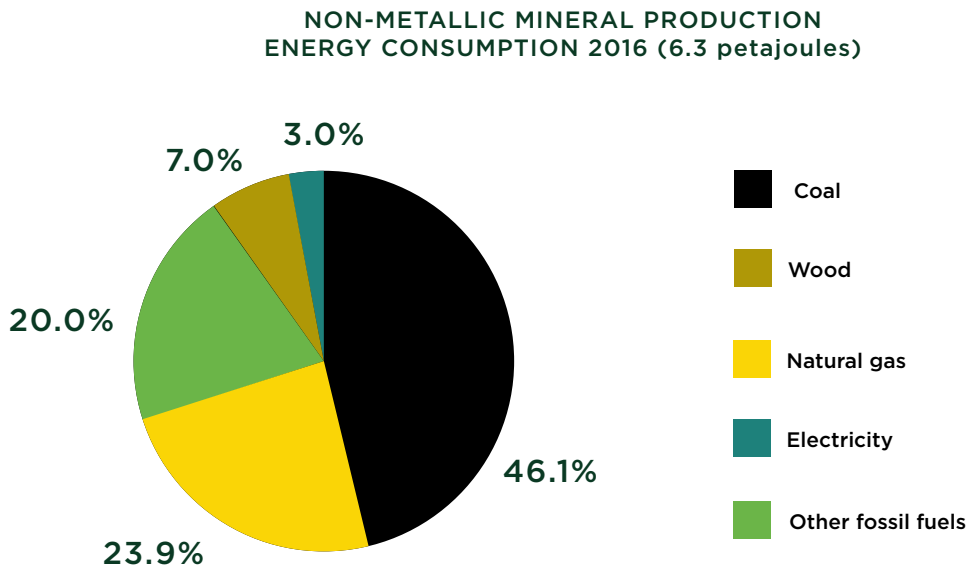
The West Coast production of coking coal for export to steel manufacturers is modest by world standards but nonetheless a welcome part of the region's economy, particularly in the Buller and the Grey districts. Coal exports began in the 1970s[87], and peaked in 2007 at 2.7 million tonnes.[88] Last year exports were close to 1.5 million tonnes.[89]

The main export markets today are in the Asia-Pacific region, such as Japan, India, Korea, and Australia.

81 (New Zealand Steel, 2020)
82 (New Zealand Steel, 2020)
83 (Sherwood, 2019)
84 (Sherwood, 2019)
85 (Fletcher Building, 2016)
86 (Fletcher Building, 2016)
87 (Sherwood, 2019)
88 (Ministry of Business, Innovation, and Employment, 2020)
89 (Ministry of Business, Innovation, and Employment, 2020)

PRODUCTION OF NON-METALLIC MINERALS

For the production of materials such as cement, lime, glass, and ceramics massive amounts of energy are vital to achieve the required temperatures. For example, temperatures of 1500°C are required for furnaces to turn raw materials into glass, and to turn limestone, clay, and other materials into clinker using rotary kilns.[90] For the chemical transformation of limestone into lime products, furnaces require temperatures of about 1,000°C.[91]



COAL IS NOT EASILY REPLACED

It is worth noting that while coal's role in New Zealand's energy profile has diminished over the years, anybody who thinks it is a case of "finishing the job" in terms of reducing our coal use to zero is suffering under an unfortunate illusion.

From 1840 onwards, New Zealand's use of coal grew significantly due to its role in transport, powering steam engines in rail and sea freight and transport. It powered much of New Zealand's heavy industrial production.

Today, coal's contribution to New Zealand's primary energy supply is much more modest. In 2018 it accounted for 6% of New Zealand's primary energy supply, compared to 28% of global primary energy supply.[92]

In some cases, like transport, it has been displaced by fossil fuels like petrol and diesel – the steam engine of trains and ships has given way to the combustion engine.

In the electricity sector, coal has been displaced by both renewables, like hydro, wind, and geothermal, and to a lesser extent by other fossil fuels like natural gas.

As is outlined above, food production and processing rely on coal, and the dairy, meat, and horticultural sectors have few if any technologically or economically viable alternatives. Where coal is not used in these sectors it is only due to the availability of gas, which, although having half the carbon intensity of coal, makes a greater contribution to New Zealand's CO_2 emissions stemming from energy.

Domestic and global steel production have no alternatives. There is no commercially viable technology worldwide for manufacturing virgin iron and steel without a carbon input – it is intrinsic in the steelmaking process.[93]

New Zealand is no longer self-sufficient in cement. Two decades ago, almost all demand was met with domestic production from two plants, now there is only one meeting 60% of our needs[94], with the balance coming from Japan, and a carbon content estimated to be 20% higher than the domestically produced product.[95]

Whether through bans on coal use such as was proposed by the government in late 2019, or through a carbon unit price in the New Zealand Emissions Trading Scheme, the danger of pushing carbon-intensive industries offshore to other countries – many of which have no carbon price – cannot be dismissed by those who wish to do 'something', without being clear on what that 'something' is, and what it will achieve in practice. The best of intentions can't ignore the possibility of the worst outcomes.

A collection of industry perspectives is laid out below, outlining their use of coal, and issues with switching to other sources of fuel or energy. The alternatives put forward for industrial process heat most often are electricity and wood waste/biomass. These comments are a combination of excerpts from policy submissions or personal communications and show a common thread through all users as to why these so-called 'alternatives' are not feasible at a large scale, and won't be for many years.

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90 (Ministry of Business, Innovation, and Employment, 2019)
91 (Ministry of Business, Innovation, and Employment, 2019)
92 (Our World in Data, 2020)
93 (Our World in Data, 2020)
94 (Evans)
95 (Evans)

FONTERRA

Fonterra has stopped using coal at two of its sites – Stirling in Otago, and Te Awamutu, in the central North Island. Stirling produces cheese, and as such has lower temperature requirements. Te Awamutu has access to a cheap supply of wood pellets, which have a much lower moisture content (5%) on average than then wood chip (50-60%).

As the cooperative outlined in a submission on process heat in 2019, there are significant barriers to further reduction in coal use.

Of electricity, the cooperative highlighted the main issues with electricity as the inability to supply the required load to sites, the cost of electricity generation, and the lack of available technology to supply the required heat load.[96]

"...without including externalities, electricity is significantly more expensive than coal and natural gas fuels...previous investigation into electrification our Edendale plant, in Southland, estimated that we would have increased the site's operating costs by about 50 percent and this would also have required an investment from Fonterra of about $160 million in upgrading the electrical supply to the site."[97]

As well as cost, complexities with electricity supply and fluctuations in price lead to aversion to its use.

"...the relatively simple supply arrangements and longer term pricing of coal contracts allow us to plan and manage our energy costs with more predictability. With electricity we face more exposure to market price fluctuations and more complex contractual choices. For example, the spring 2018 Pohukura gas field shut resulted in a significant increase in electricity prices which have continued into 2019."[98]

Of biomass the biggest issues identified were considered to be lower energy density, transport costs and associated emissions, and security of supply.

"Dairy farms and dairy factories don't tend to be where there are a lot of trees and emission reductions can be quickly eroded – or turn negative - the further biomass has to be trucked."[99]

"The lower energy density of biomass compared to coal means we may have to look at co-firing for our larger factories and invest in significant storage capacity at those sites."[100]

"One of the challenges for Fonterra will be matching a reliable supply of biomass at our required quality and volume at our larger manufacturing sites."[101]

96 (Fonterra, 2019)
97 (Fonterra, 2019)
98 (Fonterra, 2019)
99 (Fonterra, 2019)
100 (Fonterra, 2019)
101 (Fonterra, 2019)

WESTLAND MILK

Westland Milk is one of the largest employers on the West Coast, employing about 500 people at its Hokitika processing plant. It is also the single largest coal user on the West Coast, and in peak season is capable of processing four million litres of milk a day.[102]

Environmental manager for Westland Milk, Chris Pullen, explained to Minerals West Coast in plain terms why coal is the fuel of choice for the milk processor.

"What's the obvious thing to do? Look for the closest source of energy that's cost effective. That's the secret. Coal is by far the most cost-effective energy source we have on the West Coast."

Woodchip

"On the West Coast, we get five metres of rainfall. Woodchip absorbs moisture. In order for us to get that type of heat and energy in our boilers, we'd have to have a fairly significant setup to dry the woodchip, but we'd have to use three times the amount of woodchip, for example, we'd need about three tonnes of woodchip to replace one tonne of coal. We haven't got enough woodchip on the Coast to supply that, so we'd have to get our woodchip from elsewhere. We'd have to get that in from elsewhere in New Zealand. That'd be Taupo, or Nelson. What do you think the carbon footprint would be for that? If you look into, certainly transport is responsible for a lot of emissions in New Zealand."

Electricity

"To get a forty-eight kilowatt boiler running on electricity, what would that mean? We're going to take more electricity off the grid. That means we'd need more from our hydroelectricity network, which means we may need to build more power schemes, so…by the same token as the diesel for the trucks, what does it take to supply that electricity? Is there going to be an emissions reduction? Actually, if we have to get it from electricity? And can that electricity produce what we need, cost effectively, and supply the tonnage of products we then export over the world?"

Geothermal

"If we had a supply of geothermal within a kilometre or two of the factory it'd be a very viable option. Unfortunately, the sources of heat we've identified are miles away. The nearest is eighteen or nineteen kilometres. It's generally along the base of the mountain ranges, and we're sitting on the coastal plains here. If you wanted to create hot pools, stuff like that, fine for that. But for a boiler this size, geothermal that far away is not great for the supply of heat. It could be used at source for generation of electricity, but even then, it may come up wanting."

102 (Sherman, 2019)

MEAT INDUSTRY ASSOCIATION

The Meat Industry Association in its 2019 submission on a technical paper on process heat emissions outlined similar issues as Fonterra.[103] The MIA represents 99% of New Zealand red meat production and export, collectively employing 25,000 people in 60 processing plants which are predominately in rural areas.[104] As an industry it burns about 63,000 tonnes of coal per year.[105]

In its submission the MIA noted *"coal and gas are used because it is an effective heater at processing plants that are in rural or relatively isolated areas. In the South Island there is no natural gas. Any solution away from coal and gas needs to consider improved electricity reticulation to processors in rural areas."*[106]

It gave many reasons for electricity not being a viable switching option.

"To shift to electricity would result in very large amount of electricity needed; and… economically unviable increase(s) in costs. One company states that electricity costs are 3-4 times the costs of its current thermal fuels."[107]

"Some processors have looked at electrifying more of their operations, but the present network and lines companies do not have the reticulation in place. In many cases, local network infrastructure is already near peak capacity."[108]

"One large processor stated that if it was to go to completely electric power (and abandon coal and gas), the electric power demand would double, as well as result in significant capital cost to change over. One processing plant, for example, uses almost 10,000 tons of coal a year, at almost $2.5 million. To change to electricity, the cost would be $4.6 million a year."[109]

The MIA also cites price variation and reliability, or lack thereof, as issues for meat processers.

"Volatility in electricity prices have not helped convince processors to move to electricity…in the long-term, given increases in electricity demand and limited generation growth, the price of electricity is likely to increase."[110]

For wood based biomass, the issues raised are similar to those raised by other sectors.

"Woody biomass is used in the industry but is limited by the cost and transport difficulties of the supply, because wood handling systems take up more space than other boiler fuels, and because biomass boilers do not react well to load change…at least one processor has looked at converting some heating to wood from a nearby forest, but the problems are ensuring ongoing reliable supply of wood."[111]

103 (Meat Industry Association, 2019)
104 (Meat Industry Association, 2019)
105 (Meat Industry Association, 2019)
106 (Meat Industry Association, 2019)
107 (Meat Industry Association, 2019)
108 (Meat Industry Association, 2019)
109 (Meat Industry Association, 2019)
110 (Meat Industry Association, 2019)
111 (Meat Industry Association, 2019)

HORTICULTURE NEW ZEALAND

For certain fresh produce in New Zealand, a stable temperature in a hothouse is vital. Heating these growing areas with gas or coal affords New Zealand with fresh tomatoes, capsicums, cucumbers, zucchinis, cucumbers, herbs, and lettuce all year round, and produces a surplus of some of these goods for export.

In a 2020 submission on process heat, Horticulture New Zealand highlighted the threats certain policy – be it a proposed ban on coal use or the Emissions Trading Scheme – pose to the sector.

"The importance of process heat in the covered crop industry cannot be understated and as a consequence, the process heat is an important as part of our domestic food supply, as well as related economic activity and employment."[112]

Horticulture New Zealand's opinions on biomass and electricity as alternatives to coal or gas are very similar to other food producers. Biomass was considered cumbersome and risky[113], and there was concern about security of supply.

Practical challenges were raised, for example it was estimated a ten hectare greenhouse would require ten truck and trailer loads per day of wood fuel and would need sufficient storage space on site for the amount required to meet demand.

In the case of electricity, cost, network capacity constraints, and vulnerability in supply were all considered barriers.

Horticulture New Zealand stated quite plainly the impacts of either a coal ban or an increase in carbon costs would have in the absence of an alternative saying[114]:

"Until cost-effective alternative heating sources are available, an increase in the emissions costs will not drive emissions reductions but will put some growers out of business."

"...indoor growers disappearing from the industry resulting in reduced domestic food security and more imports...."

112 (Horticulture New Zealand, 2020)
113 (Horticulture New Zealand, 2020)
114 (Horticulture New Zealand, 2020)

"Smaller growers in particular, without viable alternative sources of heating, they will be forced to go out of business, and will not be able to sell their businesses as a going concern because there will not be willing buyers."

An NZIER document outlining the impacts of the ETS on horticultural producers, drew attention to the toll the price of carbon is taking on the sector already, and the danger of the price increasing.

"At an ETS charge of $25 per tonne the industry is finding it difficult to survive. Smaller players are exiting the industry while medium to large scale businesses are contemplating their future. At $35 per tonne most players will reduce their heating to a minimum. All covered crops businesses will reduce labour. At $50 per tonne of carbon, importing will be the main activity."[115]

NEW ZEALAND STEEL

In the face of higher net costs within New Zealand arising from the Emissions Trading Scheme, New Zealand Steel would likely close steel making operations.[116]

While one of New Zealand's three main coal users, the company said in its submission its emissions were 'not by choice'.[117]

"There is currently no commercially viable technology for manufacturing virgin iron and steel worldwide that does not use carbon. Similar to methane emissions in the agriculture sector, it is simply not a choice whereby we can switch to a lower carbon emitting product or supplier. Carbon is an intrinsic requirement of the steelmaking process."[118]

The steel manufacturer drew attention to the fact that many nations in the world do not yet impose a cost on carbon.

"In competing in the current global environment, New Zealand Steel cannot afford to be impacted by significant costs that other steel manufacturers do not face."[119]

The manufacturer pointed out its relatively limited choices.

"The majority of New Zealand Steel emissions arise from the use of coal as the only viable carbon source in the production of steel. Therefore, our business planning has only two realistic options:

Option one: Maintaining iron and steel manufacturing at Glenbrook, with a drive for least-cost production

If this is not economically viable due to costs imposed on the business, then:

Option two: Having an active contingency plan for the closure of our primary operations - more than half the New Zealand Steel business, likely affecting 800 – 1,000 direct jobs."[120]

115 (New Zealand Institute of Economic Research)
116 (New Zealand Steel, 2016)
117 (New Zealand Steel, 2016)
118 (New Zealand Steel, 2016)
119 (New Zealand Steel, 2016)
120 (New Zealand Steel, 2016)

PRODUCTION OF CEMENT AND LIME

Manufacturing of products such as lime and cement is also an inherently energy intensive – and consequently carbon intensive – process. Substitution options are also limited. Both of these sectors are exposed to significant competition internationally, and as a result once productions costs reach a certain point within New Zealand, their products will no longer be competitive with imports.

Graymont, for example, is a global company supplying lime and limestone products. It operates two sites in the North Island, and one in the South Island.[121] Lime is indispensable for many industrial processes and applications, including steel making, as well and glass, paper, and construction.

Graymont says for its New Zealand operations its thermal energy is sourced from coal, waste oil, natural gas, and electricity, but that natural gas use is constrained to only one of its plants.[122]

The company says providing adequately high process heat from renewable energy is a major challenge for some manufacturing. The calcination of lime to make cement, for example, requires very high heat (in excess of 850°C), making the use of electricity impractical.[123] Graymont says there is no technology available that would enable use of electrical energy as this heat source.

The company says there is scope for biomass, as along with waste and other renewable sources it can produce high process heat of up to 1,300°C, yet, to be cost competitive with fossil fuels, such technology requires "major technology and supply chain improvements".[124] Graymont has extensively tested the use of biomass at one of its plants in Canada. The main challenges were the lower energy density of biomass, the variability in price, quality of the feedstock and problems to ensure continuous and reliable supply.[125]

New Zealand' sole cement producer, Golden Bay Cement, satisfies 60% of domestic demand. In a policy submission[126], Golden Bay Cement noted electrification of cement clinker kilns to turn them into arc furnaces is not technically possible.

121 (Graymont, 2019)
122 (Graymont, 2019)
123 (Graymont, 2019)
124 (Graymont, 2019)
125 (Graymont, 2019)
126 (Golden Bay Cement, 2019)

With regard to biomass, the company says for the past fifteen years it has increasingly substituted biomass in place of coal, but that those substitution rates have been maximised.[127] It highlights seasonal variations in moisture content as another issue posing process restrictions, but that in more recent years widespread use of biomass has led to a scarcity of supply and as a result a higher price. Its substitution of biomass for coal has dropped in recent years, from 35% to 21%, largely due to lack of available wood waste.[128]

It is worth noting however, at the time of writing, Golden Bay Cement's plans to use shredded tyre waste are progressing. This substitution could reduce their coal consumption by about half. In recent times the company has been consuming about 70,000 tonnes of Australian-sourced coal a year[129], but the waste tyre project could reduce this coal use by up to 50%.[130]

127 (Golden Bay Cement, 2019)
128 (Freeman, 2019)
129 (Freeman, 2019)
130 (Freeman, 2019)

ELECTRICITY

The carbon intensity of New Zealand's largely renewable electricity generation fluctuates with reduced contribution from low carbon forms of generation – such as geothermal, hydro, or wind generation – and increased demand from consumers – in mornings and evenings when there is demand for lighting, hot water, and cooking appliances, or in winter, for heating. It is at these times when the most fossil generation is needed. Hydro power, wind, and geothermal are largely 'use it or lose it', they cannot be stored when a surplus is produced, nor ramped up when there is a shortage.

There is talk of government investment in an over-supply of renewable generation, by a very large degree, but that would come at great cost for relatively little emissions benefit.

Genesis Energy is the owner of the thermal units at Huntly, which comprise a mix of gas, coal, and diesel burners. It announced in February 2018 a plan to end coal use completely by 2030, saying it was the right time for the whole industry to plan for a future without coal.[131] The company chief executive stated in a press release:

"New Zealand has one of the cleanest electricity sectors in the OECD and already has an 85% renewable electricity system. While coal, as a fuel, only makes up a small portion of total grid electricity generation, New Zealand now needs a plan to move away from a dependency on it."

He went on to say other fuels would be needed to ensure the security of electricity supply.

"...in a largely weather dependent renewable future gas fired thermal generation will, for many years to come, remain a key enabler by ensuring a reliable supply while keeping costs manageable for consumers."

Following the 'ban' on gas exploration, New Zealand's security of supply for the fuel has been thrown into doubt, and as a result Genesis Energy has admitted cutting coal from the electricity system will become more difficult.

131 (Evans K. , 2018)
132 (Ritchie, 2018)
133 (Ritchie, 2018)
134 (Hickman, 2018)
135 (Hickman, 2018)

In October 2018 Marc England told Genesis shareholders the plan to exit coal by 2030 that had been announced in February 2018 was made based on continued availability of gas as a fuel.[132] He said:

"By introducing significant uncertainty over gas supplies, particularly in the 2030s, it becomes much harder to remove coal from the electricity system"[133]

Indeed, even without the ban, gas supply can be unpredictable. In November 2018, due to a *'trifecta of low hydrology, planned thermal outages..., and impaired gas production',* Huntly's stockpile of coal reached some of its *'lowest levels ever seen'*[134]*.*

In a statement, Genesis reiterated its commitment to a transition away from coal, but also said *'the current market conditions are a reminder the challenge the industry faces in finding an affordable alternative to coal to provide sufficient hydro and wind firming and back up for gas constraints and plant outages'*[135]

SECTION SUMMARY

Climate change is one of the most pressing environmental issues of our time. Addressing it will not be easy, and slogans like ‘leave coal in the hole’ do nothing to increase people’s understanding of the complexity of the problems, nor the solutions.

Coal is, at the time of writing, the fuel of choice for many industries in parts of New Zealand. This is due to cost, efficacy, and ease of storage and transport, and not out of love or sympathy for coal miners. Tens of thousands of New Zealanders working in manufacturing and processing jobs are benefactors of the availability of the cheap and reliable energy that it provides – the number of people employed mining coal is small by comparison.

Not only does New Zealand live in a global economy, it also lives in a global climate. Coal emissions are a small and static part of our emissions profile. Any policies

prejudicial towards coal, whether through our carbon price going up faster than that of our trading partners or through interventionist measures like a ban on coal use or production will put New Zealanders out of business or employment, and result in carbon intensive activities simply taking place offshore and New Zealand importing more of what we need with a population ever less capable of paying for imports.

There are opportunities for New Zealand to reduce emissions – developments in genetics to reduce livestock emissions, using our clean electricity to electrify our light vehicle fleet, greater use of public transport, or even people simply cycling and walking more, and, in time, developing low emissions sources of energy.

Minerals West Coast would argue coal should be treated for what it is – vital to our economy, hard to replace, and a small and static component of New Zealand's gross emissions profile. It is far from the easiest place to start in a bid to reduce New Zealand's overall carbon footprint, of which it is a small component.

Conclusion

What the state of the mining industry will be ten or twenty years from now is difficult to say. The West Coast, while no Eldorado, is a land of resources and resourceful people. The opportunities and the opportunists that characterise the region will be able to do so into the future if they are allowed.

Minerals West Coast hopes this document goes some way to demonstrating the role mining can play in adding value to the economy at a regional and national level, that the opportunities for further resource development exist, and that investors need only the freedom to capture those opportunities in a way that is in keeping with what is beneficial to our land and our people. As has been shown, this industry does not need to be seen as an enemy to the landscapes and species our country holds dear but can indeed foster their conservation for future generations.

Policy changes would go some way to ensuring the mining industry's success into the future, and that is an area where greater engagement from regulators could result in better outcomes for all. Coal, as was outlined in the final section of this document, has a role to play in Aotearoa New Zealand for the foreseeable future. Until technological innovations allow, anti-coal sentiment and legislation is a meaningless and economically dangerous distraction in the context of the wider challenge in our fight against climate change. A problem relocated is not a problem resolved.

The mining industry offers the West Coast prospects for the future, all the sector is asking is for some leeway to forge our own path and see where these opportunities lead.

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