Douglas fir – the next wave of wildings

Reporting recent spread of wilding Douglas fir in the southern South Island

Key Messages

1. This paper identifies warning signs of the 'next wave' of wildings. This is being caused by Douglas fir (Dfir) planted in Southland and Otago from the late 1990s to the early 2000s. Failure to recognize and take early and effective action against this will nullify the efforts of the last two decades dealing with 'first wave' of legacy conifer plantings.

2. From the descriptions of the sites in this paper it should be evident that there is a high risk of wilding spread risk from a number of known Dfir seed sources in Otago and Southland. The potential extent of spread from these plantings is illustrated in Fig.1. This shows that new Dfir seed sources are located on or close to land classed as having "very high vulnerability". (The term is defined in the report: Methods for the prioritization of wilding conifer sites across New Zealand. Wildlands 2016). The area of this high risk land class in the southern South Island covers almost 2M hectares.

1 Mid Dome
2 Hector Mtns
3 U Mataura
4 West Dome
5 Redcliff
6 Te Anau Downs
7 Queenstown
8 Skippers
9 Teviot
10 Glendhu
11 Waipori
12 Blue Mountains
13 Silver Peaks
14Trotters Gorge
15 Pig Root
16 Naseby

Fig. 1. Vulnerability of land cover to wilding spread from Wildlands 2016 showing the location of 16 known Dfir seed source sites (see the key on the RHS) in Southland and Otago. The 'very high vulnerability land class is shown in red.

3. The majority of the Dfir seed sources in the South Island were planted during a 'boom period' between the late 1990s and early 2000s and will have been coning for at least 10 years now. (See Fig. 2.) These were often planted in high country areas where land was available, and trees would grow rapidly. It is this age class of trees that pose the greatest spread risk today. Since the mid-2000s there has been a significant falloff in Dfir

plantings in part due to stricter rules around wilding risk and the use of the Wilding Tree Risk Calculator. This means in future that there should be fewer new seed sources. Longer term the risk could be eliminated altogether if the proposed development of a sterile clone (i.e. trees designed not to produce viable seed) was realised.

Figure 16: Distribution of Douglas-fir forest area by age class and island, as at 1 April 2022

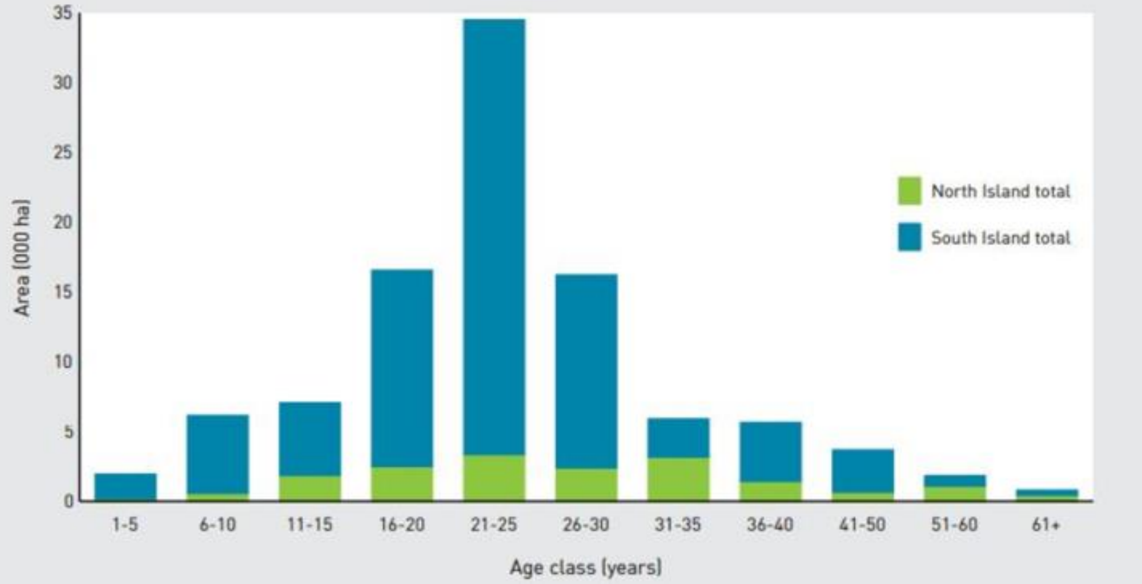

Fig. 2. Distribution of Dfir by age class. MPI website.

4. Dfir spread is relatively easy to control if the risk is recognised early and if timely action is taken. Any delay will lead to exponential increases in control costs over time.

   i. Dfir can produce cones at less than 10 years of age but only begins producing significant quantities of viable seeds between 15 and 20 years old. Compared to Pinus contorta this gives a considerably greater period of time to find and destroy Dfir before it can initiate further spread

   ii. In the case of fringe spread (up to 1km from source), where the cause of wilding spread can be readily established, there are cost effective ground control options as well as aerial herbicide boom spraying.

   iii. Fringe spread, should be addressed by the owner of the seed source and any directly affected neighbours. Resolving responsibilities and liabilities for control should be possible through negotiation and agreements between the parties. Failing that legal and/or regulatory measures may be required.

   iv. With distant spread (>1km from source) individual trees can be easily seen in open landscapes where aerial surveillance by helicopter is very effective. These trees can be readily destroyed before reaching coning age for example using the aerial basal bark spraying (lancing) method from a helicopter. Aerial drones and remote sensing/AI will almost certainly contribute to this in future the as these technologies mature.

v. Responsibility for distant spread can be more difficult determine and thus negotiate an equitable remedy. In this case a more holistic and collaborative approach needs to be taken involving central government, local government, owners of seed sources and affected stakeholders. In this way costs of control can be spread over a range of beneficiaries and exacerbators.

5. Efficient and effective landscape scale surveillance will be a critical over the long term to ensure that Dfir spread is identified and dealt with in a timely way. This will require a highly strategic approach to risk management which ideally should be coordinated and monitored nationally. Technology innovation and application will be a key factor in this.

6. Although examples from the southern South Island have been used to illustrate the looming problem it is inevitable that similar warning bells will also be ringing in many other areas of New Zealand - wherever Dfir has been planted. This will be a national problem.

7. We have the tools we need to prevent the 'next wave' of wildings. Now we need to generate the awareness that will initiate and drive a strategic long term approach and using those tools in the timeliest and most cost effective way to save history from being repeated.

Introduction

There is a new wave of wilding conifer spread that is now starting to become widely recognised particularly in the southern South Island. It relates to the widespread planting of Douglas fir (Dfir) mainly for commercial forestry purposes in the early 2000s. These trees have been coning now for up to 10 years. Given the number of new seed sources, rates of spread and proximity to vast areas of highly vulnerable hill and high country land, this latest generation of wildings may dwarf the impacts of those of earlier legacy plantings from 1950s -1980s. The first wave of legacy wildings has already cost New Zealand well in excess of $150M for control management. The next wave coming may well exceed this unless effective preventative policies and management measures are urgently put in place.

The aim of this paper is to raise awareness of this new wilding threat in order to prevent repeating the mistakes of the past. If the initial warning signs of earlier legacy wilding conifer spread had been recognised in the 1990s and prompt action taken, then we may not have required the national Wilding Conifer Control Programme we have today.

I am focusing on the emerging problems in the southern South Island where I have direct knowledge. I am aware that similar issues are present in many other parts of New Zealand but have not yet been recognized or brought to attention.

The impetus for this paper came from a quarterly meeting of the Mid Dome Wilding Trees Charitable Trust in September 2024. Here Environment Southland staff and those from the

Project Manager, Boffa Miskell Limited, said they are now finding Dfir seedlings routinely during P contorta control and maintenance practically everywhere they look in the programme area. These were not present a few years ago and they see this as a serious new problem arising just as the programme is starting to get wilding Pinus contorta under control.

This led to the realisation that an uncontrolled Dfir infestation on the ranges at Mid Dome has the potential to spread downwind across thousands of hectares of the Garvie Mountains and eastward to the Clutha River and beyond into Central Otago.

It also led to the realisation that there are many similar Dfir infestations starting to develop across Southland and Otago which threaten vast areas of hill and high country. These lands are under low intensity land use or protected for conservation purposes and offer no resistance to invasion by Dfir.

A number of examples of these sites are briefly described below. (Fig. 3.) These show how widespread the problem is in the southern South Island, and why it is necessary to raise awareness of the potential impacts this will have on up to two million hectares of vulnerable land if allowed to continue.

Locations of Douglas Fir Spread in Southland and Otago

1 Mid Dome
2 Hector Mtns
3 U Mataura
4 West Dome
5 Redcliff
6 Te Anau Downs
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13 Silver Peaks
14Trotters Gorge
15 Pig Root
16 Naseby

Fig 3. Map below showing the location of some of the known of sites of Dfir spread in Southland and Otago.

Southland Region

1. **Mid Dome**

Wilding conifer control has been undertaken at Mid Dome since the early 1990s. Wilding spread arose from legacy soil conservation plantings of P contorta and minor P mugo from 1950s-1980s. In 2006 the Mid Dome Wilding Trees Charitable Trust (the Trust) was formed, and the work programme has involved around 70,000ha of land. Great progress has been made with the removal of high altitude seed sources and now work is mostly focussed on the maintenance of 25,000 ha of the worst affected land west of the Mataura River. This work has cost over $20M to date. The Trust is now extremely disappointing to learn that over the last few years wilding Dfir which was very rarely seen is now starting to appear everywhere that work is being done on Pinus contorta. This suggests that Dfir will become the major long term problem at Mid Dome and beyond if it is not effectively managed.

It is believed that the seed sources are most probably located upwind on northern Southland Plains involving shelter belts, wood lots and amenity plantings. It is also suggested seed could be coming from planted forests at West Dome and the Upper Mataura. This means that Douglas fir seeds could be travelling several kilometres if not 10s of kilometres to Mid Dome. See Fig.4.

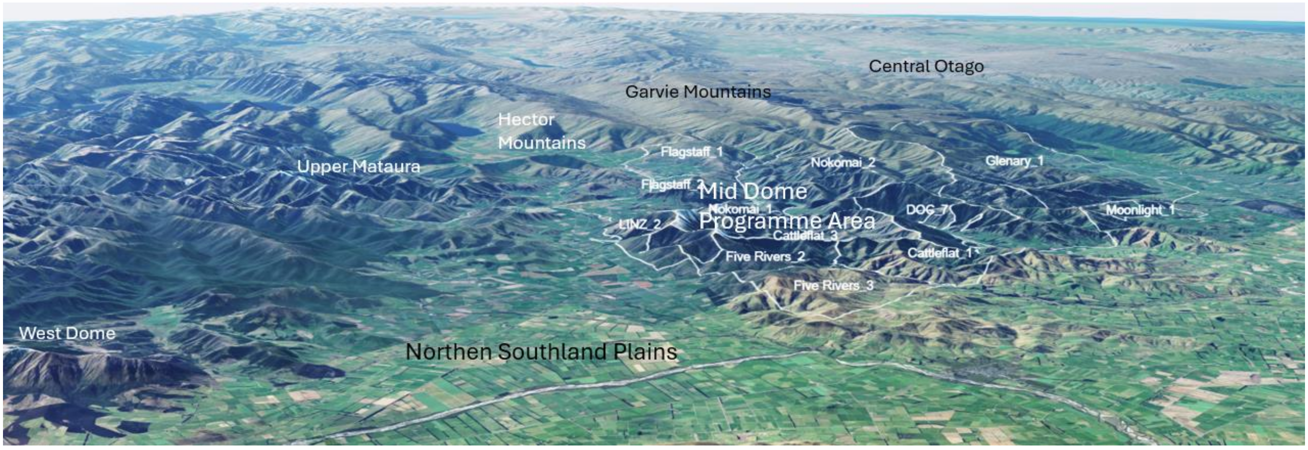


Fig. 4. Google Earth view of Mid Dome looking northeast

However, there are also two 40ha blocks of planted Dfir block in the Nokomai Valley within the programme area, which are now likely to be coning and could be involved as well.

During almost 20 years of concerted effort the Mid Dome Trust has always contended its focus is solely on the original legacy species planted for soil conservation purposes (i.e., P contorta, P mugo). Accordingly, it has no desire to deal with Dfir which is starting to come in from seed sources outside of the control area.

It is also noted that over 100ha of Dfir has recently been planted on the southern margin of the programme area which has the potential to cause infestations on large areas to the north. These areas had been cleared of Pinus contorta and responsibility for wilding maintenance had been handed back to the respective landholders. Fig.5.

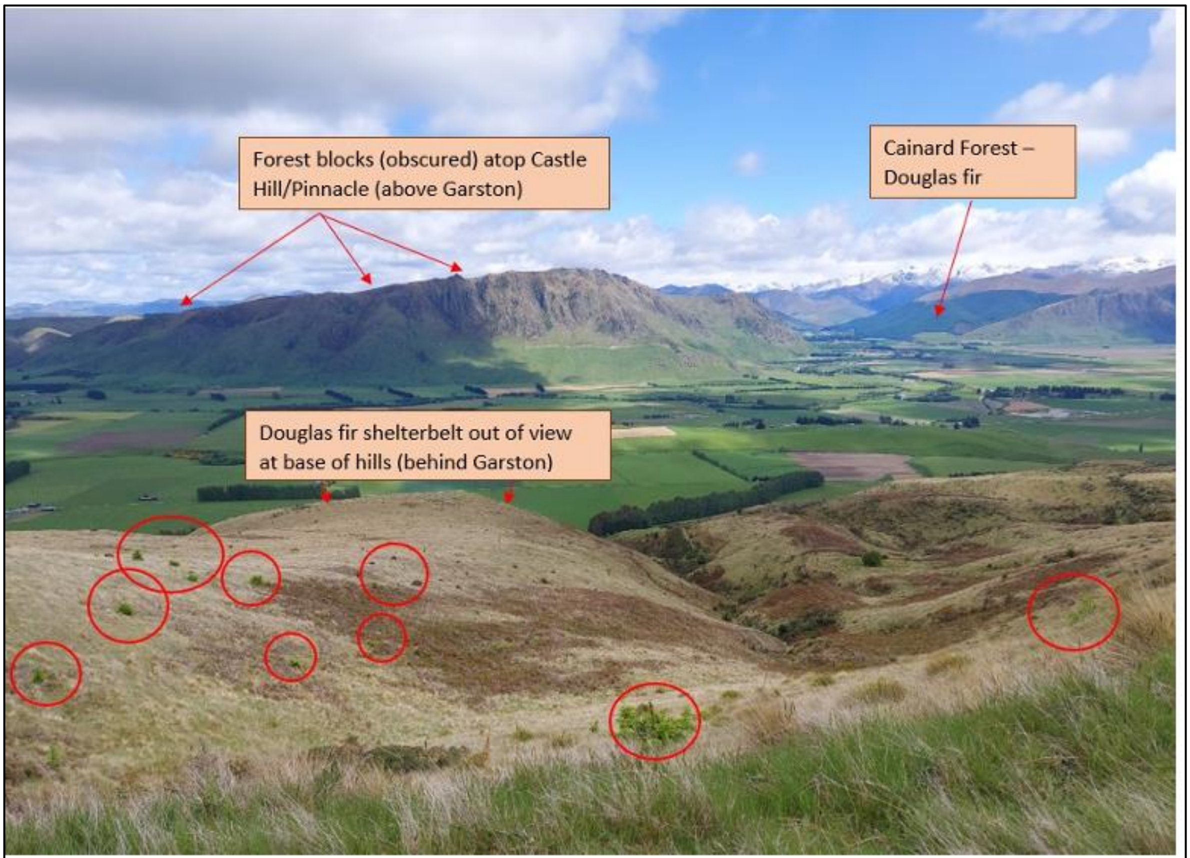
Fig. 5. Three year old planted Dfir planted on the southeastern edge of the Mid Dome Programme area. Photo Peter Russell.

2. **Southern Hector Mountains**

The southern Hector Mountains southeast of Lake Wakatipu have been identified by personnel involved in current wilding control as a new and rapidly growing 'hot spot' for Dfir spread.

Nevis Road

Recently on the Nevis Road, NE of Mid Dome above Garston, abundant Dfir seedlings have been noted on higher altitude slopes and ridge tops. This is at the north end of the Flagstaff MU. The potential sources for this are small plantations and shelter belts around Garston and/or the large scale Dfir plantings in the Upper Mataura valley. See Fig. 6.



Wilding conifer reinfestation (red circles) on the Nevis Road, in the Flagstaff operational area. Possible sources (but impossible to track the exact origins) the forestry block (centre right), three forests in a high wind 'take-off' zone (centre left) or a large shelterbelt at the base of the hills (out of sight). Photo source: J Hazley, November 2022.

Fig. 6. The image above is taken from the Mid Dome Wilding Conifer Management Strategy 2023 – 2033.

Lorne Peak Station – Hector Mountains

A few km to the north of the Nevis Road Matthew Taylor from Lorne Peak Station has reported significant infestations of Dfir seedlings on his high country property. He believes the most likely sources of this are Upper Mataura Dfir forests. (Fig. 7.)

Until recently there has been no evidence of Dfir spread onto the Hector Mountains. This is despite the presence of Dfir trees in shelter belts and small plantations on the valley floor to the west for many decades. Instead, it appears that this new spread may relate to the large Dfir forests planted in the early 2000s further to the west in the Upper Mataura Valley area. These lie at up to 900m in altitude, are subject to strong prevailing winds and started to produce seed in the last 10 years.

Fig. 7. Photo from Matthew Taylor showing Dfir seedlings on Lorne Peak Station between Garston and Kingston with the Upper Mataura Dfir forests in the background to the west.

3. Upper Mataura Valley – Eyre Mountains

In the early 2000s up to 3000 ha of Dfir was planted on hill and high country in and around the Upper Mataura Valley above Fairlight. A resource consent was granted in 2022 to plant a further 2300 ha out in Douglas fir, hybrid pines and Pinus radiata on Mataura Valley Station but this has not been exercised yet.

Wilding Dfir spread was first noted on the braided bed of the Mataura River below the confluence of Roberts Stream about 10 years ago which has required control. In February 2018 significant fringe spread was observed above mature Dfir forest in Waterwheel Creek at around 900m altitude. See Fig. 8. It is understood that the forest owner has undertaken wilding removal work as and where possible.

Fig. 8. Fringe spread from coning Dfir in Waterwheel Creek, Cainard Forest. Feb 2018. Photo Richard Bowman.

Seed from the Dfir forests in the Upper Mataura has the potential to affect a very large area of land downwind to the east. As with P contorta a Mid Dome (20km to the south) this could extend over the Hector and Garvie Mountains to the Clutha River and beyond. See Fig. 9.

Fig.9. Google Earth image. View from above the Upper Mataura Dfir forests looking south east

4. West Dome – Eyre Mountains

There are extensive commercial forestry plantations around West Dome and in the Acton Stream valley about 10km north of Mossburn on the southern edge of the Eyre Mountains. Exotic conifer forest lies directly against native beech forest and native shrublands on West Dome and in the Acton Valley. See Fig. 10.

Fig. 10. West Dome and the Acton Valley forests looking southwest. Photo Richard Bowman.

These forests contain both Pinus radiata and Douglas fir and provide a seed source which has the potential to spread into the southern Eyre Mountains. While the forestry areas are buffered to the north and east by native beech forest subalpine tussock grassland is present less than 10km to the north. Once established on the tussock tops Dfir spread could continue throughout the Eyre Mountain Conservation Park (65,000ha). See Fig. 11.

From an aerial inspection in 2017 there was clear evidence of fringe spread of Douglas fir on the eastern flanks of West Dome up to several hundred metres from the exotic forest edges. Historically DOC has undertaken some control of wildings on Conservation land on West Dome but has been restricted by lack of resources. There is also a significant risk that dryland beech forests to north and east of West Dome could be invaded by shade tolerant Dfir. There are a growing number of examples elsewhere in New Zealand where Dfir has started to infiltrate dry land beech forest. It may overtop the native canopy to ultimately displace native forest ecosystems.

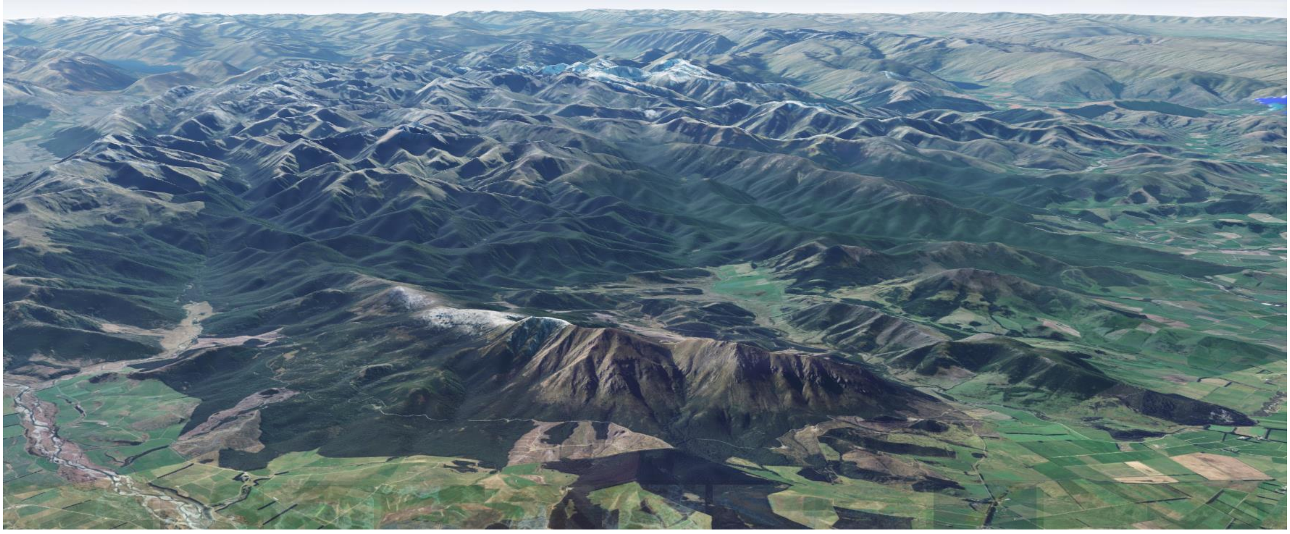


Fig. 11. Google Earth view of West Dome and the Acton Valley (centre foreground) looking northeast across the Eyre Mountains Conservation Park. Northern arm of Lake Whakatipu in top LH corner.

5. Redcliff Creek – Takitimu Mountains

There are substantial mature Dfir plantations on the western flanks of the Takitimu Range in Western Southland. These have recently become recognised as wilding seed sources affecting adjacent iwi land - Te Kōawa Tūroa o Takitimu - in Redcliff Creek. This land is managed by the Te Waiau Mahika Kai Trust for traditional food gathering and ecological restoration. It has been heavily impacted by spread from Dfir forests which exist on either side of it. (Fig. 12.) The predominant source is the 2500ha Trinity Forest to the north planted in the late 1990s. There are several other forests with Dfir on southwestern side of the Takitimu mountains.

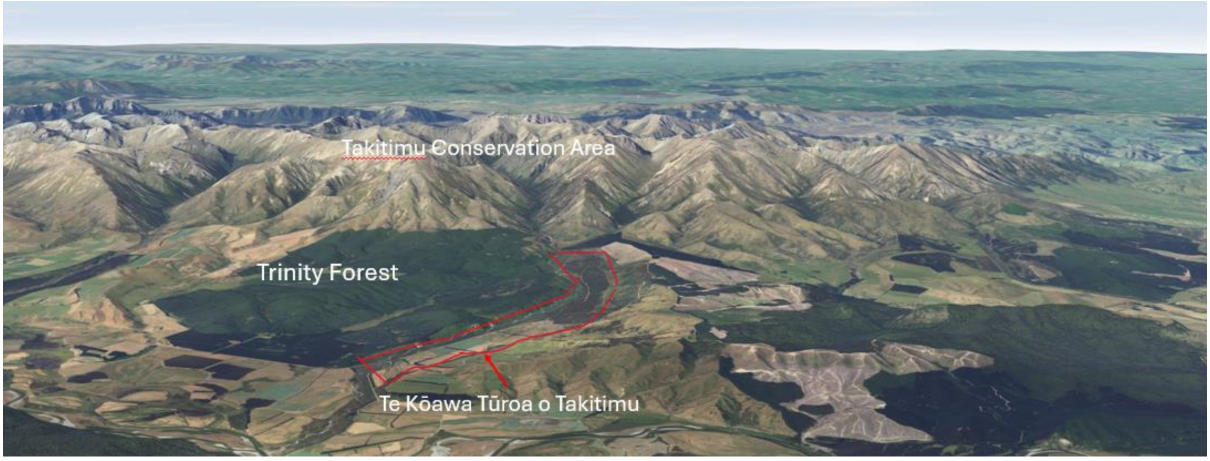


Fig.12. Google Earth view of the Te Koawa Turoa o Takitimu site looking east across the Takitimu Mountains.

While the current spread problems are being dealt with on Te Koawa Turoa o Takitimu land there is also clear evidence of fringe spread of Dfir from the forests along the western flanks of the Takitimu Range. This is being managed where possible by DOC and some forestry companies.

However, in time it is inevitable that distant spread will take place and wilding Dfir will establish in the highly vulnerable subalpine native grasslands and beech forests in the Takitimu Conservation area to the west.

6. Te Anau Downs

Over the last decade several hundreds of hectares of Dfir have been planted on farmland between Te Anau Downs on the eastern shores of Lake Te Anau and the Dunton Range to the east which forms part of the Livingstone Mountains.

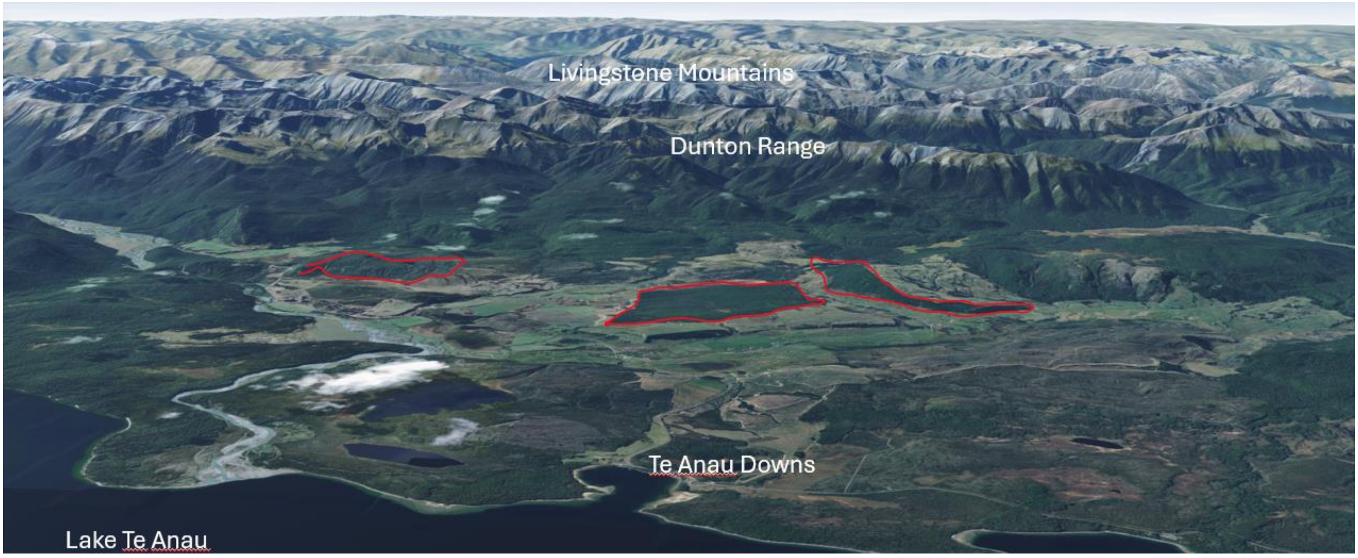


Fig. 13. Dfir plantings outlined in red east of Lake Te Anau. Google Earth view looking east.

The full extent and age of the plantings is not known but it is expected that they will become a significant seed source within a decade. Although buffered to the east by native beech forest it is quite possible in time that strong prevailing westerly and north westerly winds will take Dfir seed further east into the subalpine tussock grasslands of the Livingstone Mountains.

Otago Region

7. Queenstown

The Queenstown area contains some of the most well established and prolific wilding conifer infestations in New Zealand. While Corsican pine, Scots pine, Contorta pine and larch are involved Dfir is seen today as the most aggressive and widespread wilding species. Important seed source areas include the Whakatipu lake faces from Bob's Cove to Queenstown Hill, Mount Dewar and the Coronet Forest. (See Fig. 14) Wilding control has been led by the Whakatipu Wilding Control Group (WCG) since 2009 during which time over $26M has been spent on the 6 Management Units (MUs) it works on. Spread is generally to the west with the prevailing wind. However, seed sources on the north side Lake Whakatipu are generating seed that crosses the lake and is causing infestations on the south side around 5km away. Here on the upper faces of Cecil Peak and surrounding land over 32,000 wilding trees have been removed since 2016.

Fig. 14. Wilding conifer seed source areas around Queenstown outlined in red. Google Earth view toward the north.

Dfir grows particularly well in this area and spread has been and can still be extremely rapid across the tussock high country. There are also examples there of Dfir invading native beech forest. (Fig. 15.) For this reason, the Queenstown area demonstrates clearly just how aggressively and quickly Dfir can spread across landscapes when the conditions are favourable.

Fig. 15. Examples of Douglas fir invasion of Mountain beech forest in the Queenstown area. In LH photo dark green forest is Dfir and lighter forest is native beech. Photos Whakatipu Wilding Conifer Control Group.

A major control milestone was achieved with the harvest of the 172 ha Coronet Forest immediately west of Arrowtown. This began in 2022 and is now almost complete. Dfir was planted in the mid-1980s from 400m- 800m in altitude. Over the last 20 years there has been increasing evidence of Dfir spread on the land behind Arrowtown and further east across the Crown Range and the upper Cardrona Valley. Local wilding control managers are of the view that this spread has come from the Coronet Forest where seed has travelled more than 10km to the east and established at altitudes of up to 900m. The WGC is also actively removing other potential wilding seed sources (including shelter belts, woodlots and amenity trees) wherever possible throughout Whakatipu Basin.

Enormous progress has been made with the control of wildings the WCG's management area since 2009. However, due to extent and maturity of the infestations and the constraints of operating in an important tourism area several more decades of control will be needed to neutralise all the infestations.

8. Skippers

The remote Skippers area is set in a rugged gorge formed by the Shotover River about 20km due north of Queenstown. It is historically famous for gold mining. In the early days Dfir was planted creating a major seed source that threatened to spread eastward toward tens of thousands of hectares of tussock high country in the Harris Mountains. Infestations from these sources if left uncontrolled could extend across to the Cardrona Valley and to Lake Wanaka.

Major wilding control work has been done there since 2008. In May 2024 the Whakatipu Wilding Control Group (WCG) announced an impressive and hard-won milestone after 16 years of consistent effort. The Shotover Management Unit was moved into a 'maintenance-only phase' of controlling wilding pines. This had involved weeding out pest trees over an area of approximately 67,000 hectares and represents a significant wilding management achievement. (See Fig. 16.)

Fig. 16. Skippers wilding seed sources as seen from Maori Point showing the infestation in 1972 and post control in 2022. Photos Richard Bowman.

The Skippers example demonstrates that even long established Dfir seed sources within remote, rugged and highly vulnerable terrain can be effectively neutralised if the correct measures are taken.

9. Teviot Forests

In the early 2000s there were three large blocks Dfir totalling around 2740ha planted on a plateau, up to 900m altitude, between Roxburgh and Teviot in the Clutha Valley and Lake Onslow to the east. (See Fig. 17.)

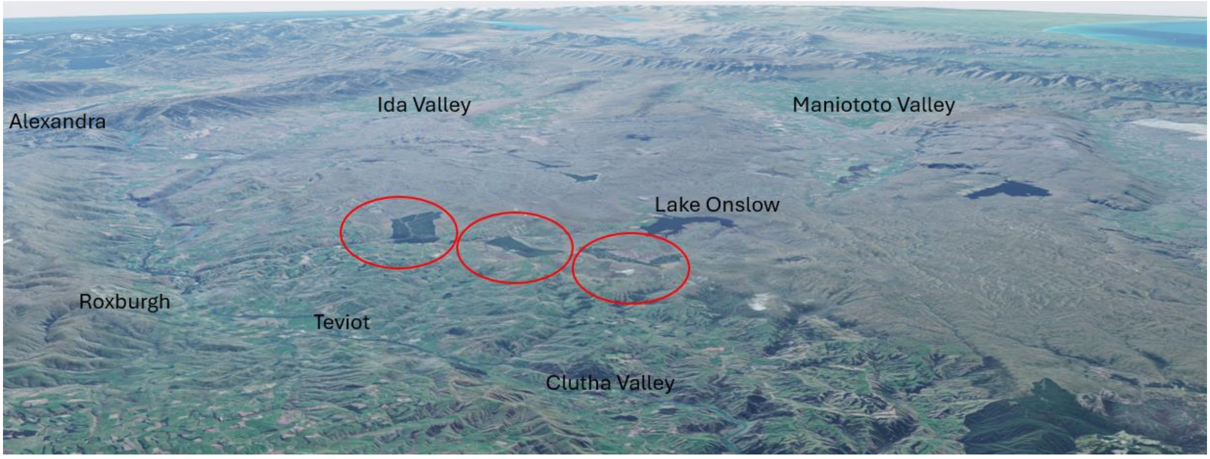


Fig. 17. Location of the Teviot Forests (circled in red) looking NE

These forests have been producing seed for over five years now and fringe spread is evident up to 1km from forest margins. (See Fig. 18.) Distant seed spread by the prevailing westerly and north westerly winds from these forests has the potential to affect hundreds of thousands of hectares of tussock grassland across the Lammerlaw Ranges including the headwaters of the Taieri River.(See Fig. 19.) Pete Oswald Programme Manager for the Central Otago Wilding Control Group and DOC advise that distant Dfir spread has already been identified from the Teviot forests.

Fig. 18. Aerial view of dense fringe wilding spread from one of the Teviot Forests June 2022. Photo Richard Bowman

Fig. 19. Southeastern most Teviot Forest block looking SE across the Lammerlaw Ranges and the head waters of the Taieri Catchment. June 2022. Photo Richard Bowman.

10. Glendhu/Lawrence Forests

There are extensive, long established commercial forests northeast of Lawrence which include Dfir. These border onto the Waipori River Catchment and further northeast with the high tussock-clad plateau of the Lammerlaw Ranges. (See Fig. 20.) Some fringe spread is evident toward the north and east. There is no direct evidence yet of large scale distant spread, but DOC has expressed concerns about the risk. It has also carried out control in the 21,000 ha Te Papanui Conservation Park to the north as resources allow.

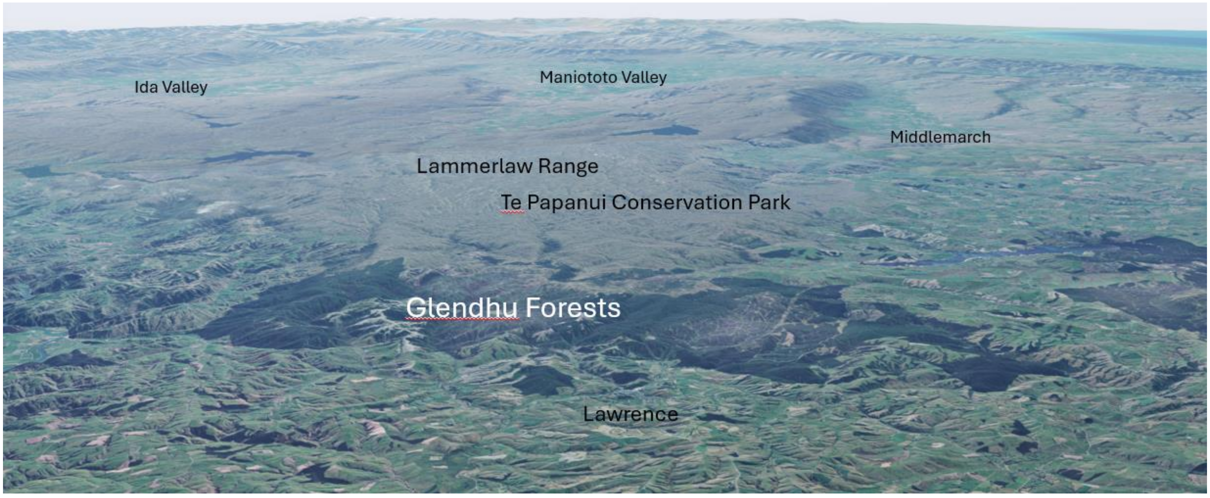


Fig. 20. Google Earth view across the Glendhu Forests north toward the Lammerlaw Ranges

11. Waipori Forests

The Waipori Forests are long established and similar to the Glendhu Forests. (See Fig. 21.) They contain Dfir and DOC has reported local wilding spread in and around them. It has managed this on its own land as resources have allowed. The Waipori Forests are buffered on their north, west sides and south by developed farmland. However, on the east with the direction of the prevailing winds distant spread could be expected on the undeveloped Maungatua Range.

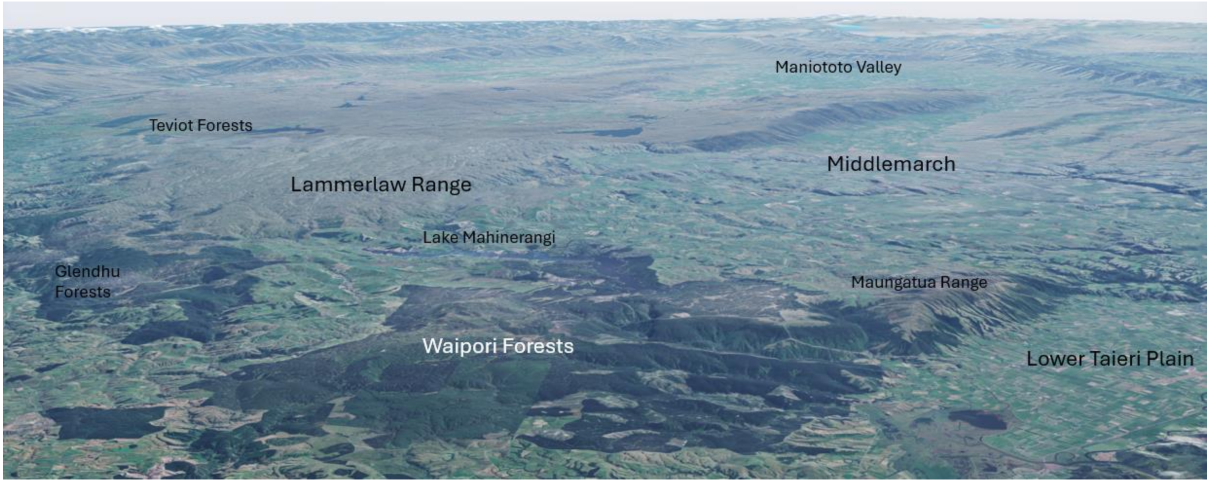


Fig. 21. Google Earth view of Waipori Forests looking toward the northwest.

12. Blue Mountains

There are a number of large, long-established exotic conifer forests on and around the Blue Mountains. (Fig. 22.) These rise to 1000m in altitude west of the Clutha River in West Otago. There are also significant areas of native beech forest and open tussock tops on the main ridge the range. DOC has identified Dfir spread on the tussock tops and attempted to manage this as resources allow. (Fig. 23.)

The Blue Mountains forests are entirely buffered by developed farmland on all sides. However, there are vulnerable tussock grasslands and shrublands east of the Clutha River which lie less than 10km downwind from potential Dfir seed sources in the Blue Mountains. It is thought that P contorta infestations known east of the Clutha in the Beaumont area were sourced from the Blue Mountains.

Fig. 22. Google Earth image of the Blue Mountains Forests looking northeast.

Fig. 23. Wilding conifer spread (light green) onto open native tussock grasslands in the Blue Mountains

13. Silver Peaks

There are extensive, long established exotic commercial forests in the Silver Peaks area west of Dunedin. (See Fig. 24.) This dissected range of hills rises to 1000m asl. There are numerous blocks of P radiata and Dfir planted amongst areas of native beech forest, shrubland and tussock grassland. There is evidence of wilding Dfir spread within the Silver Peaks area. (See Fig. 25.) DOC and some of the forest companies have attempted to control this.

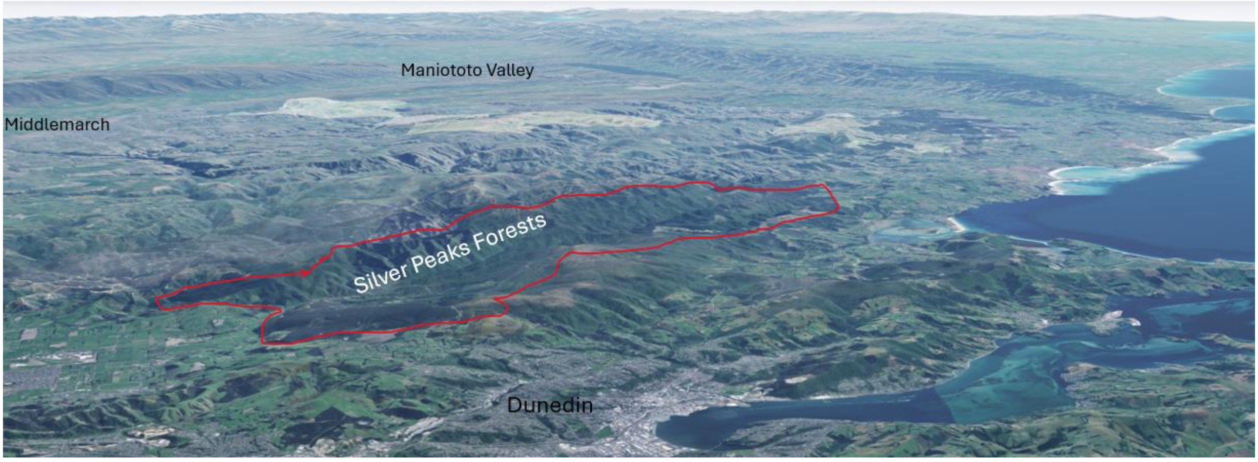


Fig. 24. Google Earth view of the Silver Peaks area looking northwest.

Fig. 25. Aerial view from a helicopter of wilding Dfir spreading through native tussock and shrubland in the western Siver Peaks area. Photo Phil Murray.

The position of Silver Peaks suggests that spread from the prevailing west and northwest winds will have little effect on adjacent farmland and densely settled land to the east. The main impacts appear to be on grazing or conservation land within the Silver Peaks area itself. However, there are large areas of vulnerable grassland to the west and north that are under low intensity grazing that could be affected by wilding spread by strong winds from the east or southwest. So far there is no known evidence of this yet.

14. **Trotters Gorge – Herbert Forest**

Again, there are extensive commercial forests in far east Otago on the southern end of the Kakanui Range extending from Trotters Gorge northwest to Herbert. (See Fig. 26.)

Fig. 26. Google Earth view of eastern Kakanui Range showing Trotters Gorge and Herbert Forest looking northwest.

Both P radiata and Dfir have been planted there interspersed with native beech forest and shrublands and against tussock grasslands to the west. DOC has reported wilding Dfir in the Trotters Gorge area where it has reserves for public use. Given the prevailing westerly/nor westerly winds there is little risk of spread across developed farmland to the east and south. However, as is the case elsewhere there can be wind events from the southwest and east which could carry seed into the vulnerable areas of the Kakanui Ranges.

15. **Pig Root**

A 4000ha commercial forest was planted in the upper Shag River catchment in the last two decades. (See Fig. 27.) It contains Dfir and there is fringe wilding spread taking place known on all four sides of the plantation. On one adjacent grazing property at the north end of the plantation the farmer has undertaken control as and where he is able, and some assistance has been provided by the adjacent forest owners as well as by the national wilding conifer control programme.

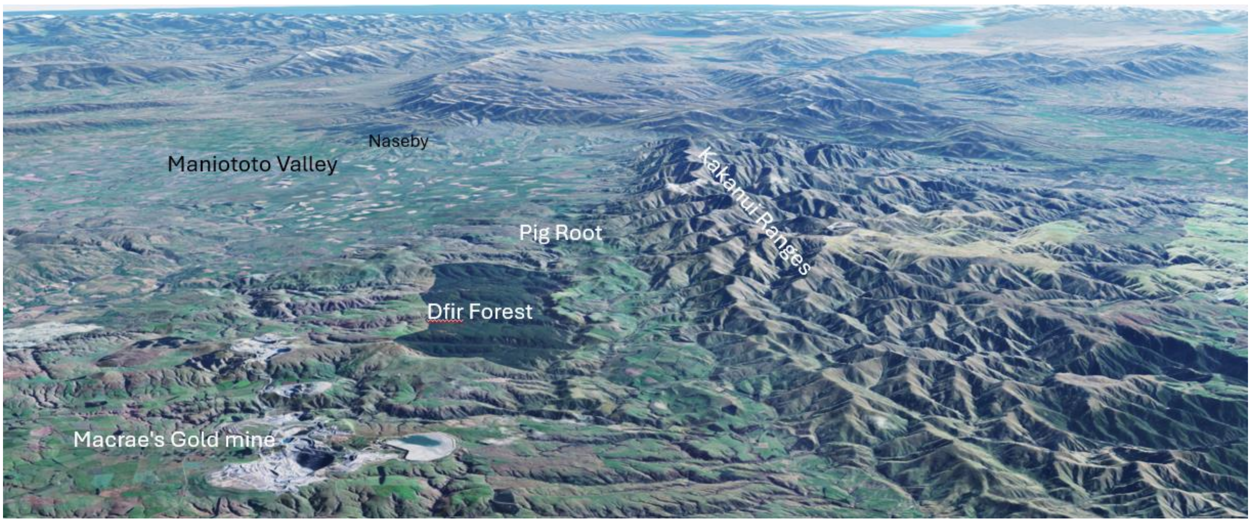


Fig 27. Google Earth view of the Upper Shag Valley looking northwest

It interesting to note that wilding spread is occurring the north side plantation indicating that fringe spread (< 1km) can occur against the direction of the prevailing north westerlies. Most of the farming within a 20km radius of the forest is extensive grazing which will be susceptible to wilding spread from this source. See Fig. 28.

Fig. 28. Wilding Dfir fringe spread adjacent to planted forest in the Pig Root area northeast of the Shag River. Photo Pete Oswald

16. Naseby

Naseby forest in the northern end of Maniototo Valley is one of the oldest plantation forests in the country where planting began in 1900. The main conifer species planted there were Corsican pine and Douglas fir. The forest also contains smaller amounts of Ponderosa pine, larch, and radiata pine. It covers an area of approximately 2700 ha. (Fig. 29)

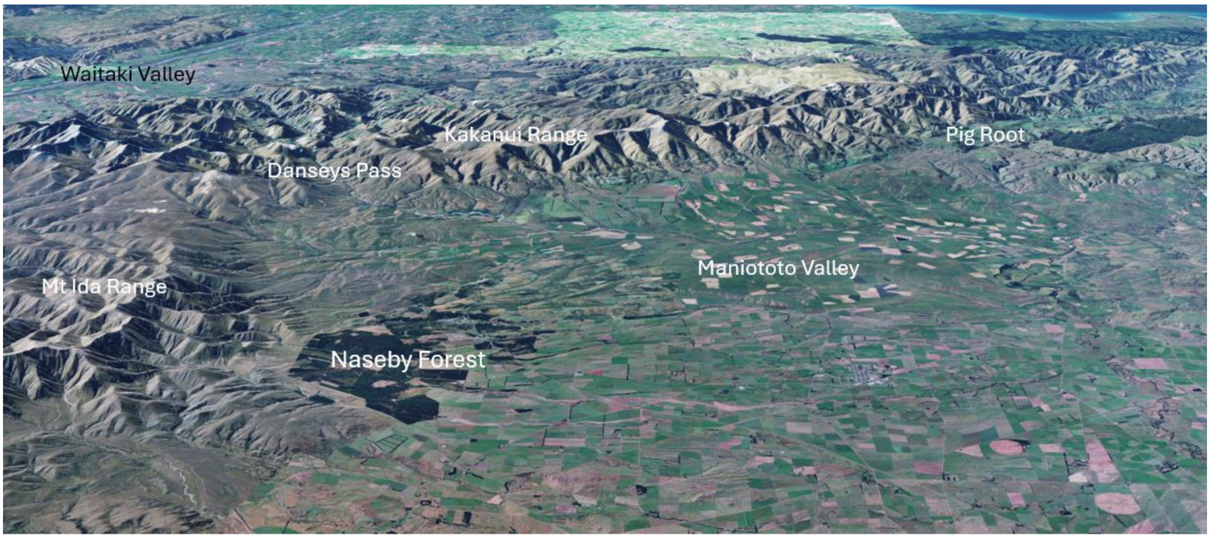


Fig. 29. Google Earth view of the Naseby Forest looking east across the Kakanui Range

There has been a long history of managing wilding conifer spread to the north and east of Naseby Forest. In particular along the faces of the Mt Ida and Kakanui Ranges. P contorta has probably been the most common spread species but Dfir is significant in the Dansey's Pass area and to the east. It is presumed that the Dfir seed came from the Naseby Forest but a small plantation on the Dansey's Pass Road may also have been a contributor. This forest has now been removed. If not controlled, then Dfir has the potential to spread across the Kakanui Ranges as far as the Waitaki Valley to the northeast.

Richard Bowman

21 January 2025