

***Clematis vitalba* (Old Man's Beard)
in South Marlborough.**

**History, Ecology, Distribution
and Control Options.**

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Summary

This report is in two parts. Part one discusses the ecology of old man's beard. Part two describes its distribution in south Marlborough and various control options.

Old man's beard is a significant threat to the remaining natural areas of South Marlborough. It is native to UK and Europe. Old man's beard was originally named traveller's joy, was sold as a garden plant and has been present in Marlborough from early in the twentieth century. Old man's beard is self fertile and produces copious seed. The seeds are primarily dispersed by water and wind and can remain viable in the seed bank for up to ten years. Old man's beard stems can grow more than four metres in a season and impact on native plants by shading out light, competing for nutrients and with the weight of plant material caused by its prolific growth leading to a collapse of the canopy. The growth of old man's beard is limited by available light, soil fertility and structure, spring and summer moisture levels and the presence of stock.

In a mail out survey sent to 24 landowners in south Marlborough old man's beard was recognised as a serious environmental weed (but not a threat to production) by 100% of those who responded. Most landowners would like some form of assistance in controlling it. Only one respondent reported having no old man's beard on their property. Old man's beard infestations were surveyed from vantage points on the roadside and within selected properties and the distribution mapped. While old man's beard is scattered over a wide area of south Marlborough there are many areas that are free or very nearly free of any infestations. These include much of the upper Wairau and Awatere and Waihopai Rivers and much of the land east of state highway one. There are large infestations in the lower Wairau and Medway and mid Awatere, Waihopai and Waima Rivers. Various control options are discussed ranging from doing nothing through to the eradication of old man's beard from south Marlborough.

Part One:

The History, Ecology and Limiting Factors of *Clematis vitalba* (Old man's beard) in South Marlborough

Introduction

Old man's beard (*Clematis vitalba*) is a widespread weed throughout much of central New Zealand. It is typically a weed of forest edges and remnants, waste areas, streamsides and shelterbelts and is found to a greater or lesser amount throughout much of Marlborough. It impacts host species by rapidly forming a dense mat over the canopy excluding light, competing for resources and eventually collapsing the canopy by the sheer weight of vegetation. It is a deciduous climber with creamy white flowers in summer and fluffy white seed heads over winter.

In 2003 a study was instigated by the Marlborough District Council to research the impacts and control options available for old man's beard particularly in relation to the area south of the Wairau River in South Marlborough. A recently completed Significant Natural Areas study suggested that many areas of significance were under threat from old man's beard and that the invasion of this weed, in some areas, was still in its early stages.

Part one of this report will investigate through a literature search and by speaking to those working in the field the areas most likely to be at risk from old man's beard in this area.

Historical Background.

Old man's beard was introduced into New Zealand early in the 20th Century as an ornamental climber. While it occurs naturally in Europe and Asia, the New Zealand plants probably originated from the United Kingdom and were sold in nurseries throughout the country. It was advertised in J Lenny and Sons of Invercargill pre 1925 catalogue at 1s 6d each and were described as a 'very hardy, strong grower'¹. It was at this time commonly known as 'travellers joy'.

Plants were introduced to Marlborough very early on with the oldest herbarium record in New Zealand collected from a garden in Picton in 1922. Fourteen years later the first herbarium records of wild plants were made and also contained a specimen from Picton. In the 1940's old man's beard was recorded by Arthur Healy, in several locations from north of Cape Campbell through to Picton and at Kaikoura and Waiau. By the 1970's old man's beard was becoming a serious weed throughout the country and moves were made to change the common name from 'travellers joy' to 'old man's beard' to remove any positive connotations in its public perception.

In 1983-84 the Noxious Plant Council undertook a survey of the distribution of old man's beard throughout the country that showed plants scattered along the east coast and up many of the rivers of Marlborough. Generally old man's beard infestations

¹ William Hales Nelson nursery catalogue from the turn of the century lists *C. flammula* a very similar species that could easily have been mislabelled *C. vitalba*.

throughout the country were most often associated with river systems with wind distributed seed spreading a relatively short distance from the rivers.

Ecology

Much of the research into the ecology of old man's beard in New Zealand was undertaken by CJ West under contract to the former DSIR and was published in 1992 in a report entitled 'Ecological studies of *Clematis vitalba* (old man's beard) in New Zealand'. She studied at two large infestations over 3 years (one in Taihape and one in Rai Valley) the seed fall, seed bank, seed longevity in soil, seedling growth, germination of seed, stem growth, floral morphology, pollination, phenology, productivity, undertook a soil nutrient survey and discussed some aerial spray options.

Seed Production

Old man's beard flowers have both male and female parts present and while they can be pollinated by a number of insects, especially small native syrphid flies, bees and copper butterflies, the most common form of pollination is likely to be wind. As the flowers grow in tight bunches it does not take much movement of air to distribute pollen amongst the bunches. Old man's beard vines are self fertile and so only one isolated vine is required to establish a new population.

Flower buds are produced from late November and plants continue to flower through to March. Green fruit is produced from February to March with the fruit ripening from March to October.

Old man's beard is a prolific seeder and seed production is possible within one to three years, depending on the fertility of the site and exposure to full sunlight. West found a mean of around 65 seeds m² in her seed traps in the Rai Valley although it has been estimated that old man's beard can produce around 30000 viable seed per m² in the canopy.

The seed, when it falls to the ground, can lie dormant for a number of years until conditions are right for germination. There has been no conclusive research into exactly how long seed can remain viable in the soil, however West found that at her Rai Valley study site there were approximately 8 times more seed in the seed bank than fell in the year of her study. This would suggest that old man's beard seed can last for at least five years and possibly as long as ten.

When conditions are suitable for germination many of the seeds in the seed bank will germinate at once leading to a mat of seedlings. Many of these seedlings will not survive however with only about 13% of the seedlings West studied in a site in the Hutt Valley growing to past the early seedling stage.

Dispersal

The ability to effectively disperse genetic material over as wide an area as possible is a prerequisite of any successful species. Old man's beard has the ability to readily disperse both by seed and vegetatively. Seed distribution is predominantly by water and wind although the seed dispersal can be human assisted on machinery and in road metal. The most common means of vegetative spread is as a result of material carried by floods or people disposing of garden waste and, before legislation was imposed, as garden plants.

The seeds, with their feathery styles, appear to be adapted primarily for wind borne dispersal. In periods of strong winds between June and October many thousands of seeds are able to be blown with the wind to establish in suitable areas some distance from the point of origin. Just how far seeds are able to travel with the wind is unknown and would be a worthwhile area of research. Certainly the vast majority of seeds produced only travel a few meters. Even those seeds that are carried a reasonable distance from their parent plant need to fall in a suitable area to allow for seedling establishment.

The dispersal of seeds by wind is a significant means of allowing plants to establish over a wide area, however, the feathery styles also act as efficient flotation devices in water. This then allows the spread of seeds down waterways, which can be deposited in ideal growing situations, several hundred (or potentially thousands) of metres down stream from the parent plant. Periods of high water levels (common from June to October the peak old man's beard seed period) are particularly advantageous to this spread as seeds are deposited in an area where they can be well established before being impacted by the next flood. If a flood does result in pieces of vegetation being broken off then these can readily re-establish in the ideal growing conditions encountered within the flood plains.

An indication of the differing speeds of these two primary methods of dispersal can be seen in several areas in Marlborough. Old man's beard has been present in Picton since 1922. Periods of strong southerly winds from June to October are common in this area. As this coincides with the old man's beard peak seeding period it would be expected that there would be dense infestations to the north. However old man's beard has only recently reached the end of the 'Snout' which is a distance of only 5 or 6 kilometres despite there being several areas that are suitable for seedling establishment. The situation along many of the river systems in Marlborough is quite different with extensive infestations along many kilometres of riverside.

The other means of plant dispersal (seeds in machinery, road metal and as garden plants) are much less common but can have serious implications in terms of control. Material spread in this manner can travel large distances into areas previously thought to be free of old man's beard. This can lead to isolated outbreaks occurring where plants can get well established before being noticed.

The spread of garden plants has more or less stopped due to changes in legislation and public perception. The spread of seeds through road metal and machinery continues to be a significant problem. It will only be overcome when a seed free source of road metal is used and better machinery 'hygiene' is implemented.

Growth Rates

Old man's beard has an extremely high growth rate when compared to most indigenous vegetation. Stems can grow up to four metres in one growing season and have an estimated productivity of 6.3kg/m². This compares with the productivity of a tropical rainforest of 4kg/m² or an average New Zealand sub tropical forest of 1.2kg/m². Given this rate of productivity it is little wonder that it easily out-competes many indigenous species.

Limiting Factors

While old man's beard can be seen growing in a variety of different sites, the ideal growing conditions, where it can be expected to form dense stands, are reasonably specific.

Light is a significant limiting factor in the establishment and spread of old man's beard. While some plants are able to survive in areas of reasonably low light Bungard et al found that growth is checked in areas with less than 3% full sunlight and plants will not survive in areas with less than 1% full sunlight. Maximum growth was achieved in conditions of 100% sunlight while substantial growth was still occurring at 10% of full sunlight. This suggests that seedling growth is likely to be limited in areas with an intact forest canopy.

A further limiting condition to the spread of old man's beard was the soil structure and %base saturation². Soil from several sites throughout NZ where old man's beard was established was tested. All of the sites tested had a high to very high % base saturation (62 to 100%) whereas the majority of New Zealand soils have % base saturation of less than 60%. The majority of sites tested were also comparatively free draining. As discussed in part two of this report old man's beard showed a pronounced dislike for growing in areas where the underlying soil structure comprised relatively infertile greywacke as opposed to the more fertile mudstones and alluvial gravel plains.

Old Mans beard appears to prefer sites with a reasonable amount of moisture available year round. It is often found growing on streamsides or at the bottom of gullies where the presence of moisture is more reliable.

Bungard et al found that old man's beard plants responded with increased growth rates to increased levels of nitrogen. They suggested that a lack of nitrogen in the soil may have a limiting affect on the spread of old man's beard.

As discussed in part two of this report one of the biggest factors limiting the growth and spread of old man's beard in South Marlborough has been the presence of stock. Old man's beard is highly palatable to sheep, cattle, deer and presumably goats and where there is sufficient pressure from these animals old man's beard is practically absent from within the browse tier. Indeed some of the farmers spoken to praised it as a great source of stock food during a drought.

Implications of Limiting Factors

By examining the environmental preferences of old man's beard it is possible to predict the areas that are more likely to be severely affected by old man's beard infestations.

Old man's beard prefers high light situations, fertile, well drained soils with a reasonably high nitrogen content. Freedom from browsing animals is necessary for seedlings to establish as well as sufficient water to allow rapid development in spring and summer.

Accordingly the ideal growing conditions for old man's beard are near waterways where there has been a build up of fertile alluvial soils or mudstone. Preferably stock will be excluded by fencing or the steepness of the terrain. The site would also be near developed farmland that receives regular supplies of nitrogenous fertiliser. The waterway would provide the ideal means of rapid seed dispersal while maintaining sufficient moisture for rapid growth. A remnant of forest with a high edge to volume ratio will

² **Base saturation.** The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity. The higher the % base saturation is the more fertile is the soil.

provide support for the vines while still allowing sufficient sunlight for growth and flowering.

These are the conditions provided by many of remnants of indigenous vegetation that remain in South Marlborough. Many of these areas will eventually be severely modified unless some form of control of old man's beard is undertaken.

Fortunately however there are extensive areas of South Marlborough that because of the soil structure, fertility, grazing pressure, light and moisture levels are unlikely to ever be severely impacted by old man's beard. These include high altitude tussock country, larger areas of mature forest, low fertility beech forests and some of the more arid coastal areas.

As discussed in part two of this report this likely distribution pattern was found to be the case throughout much of the surveyed area.

Part Two:

The Distribution of *Clematis vitalba*, (Old Man's Beard) in South Marlborough.

Introduction

During the summer of 2003/2004 I was employed by the Marlborough District Council (with funding from the Government's biodiversity fund) to undertake a survey of the distribution of *Clematis vitalba* (old man's beard) in Marlborough, south of the Wairau River. Old man's beard had been identified during the Marlborough District Council's Significant Natural Areas survey and the Department of Conservation's Protected Natural Area survey as being the most significant weed threat to many of these sites of ecological significance. The purpose of this survey was to determine the extent of old man's beard in the district so that options for control could be formulated.

The survey consisted of four parts.

1. The initial survey was undertaken by mailing out a questionnaire to all properties covered by the Marlborough District Council's significant natural areas survey. Landowners were asked to mark pockets of old man's beard on a map on their properties and then answer some questions relating to their perception of old man's beard as a weed, what measures they are taking to control it and what support the Marlborough District Council could provide to assist with a control programme on their properties.
2. Meetings were held with appropriate Marlborough District Council and Department of Conservation staff for their recollections of where old man's beard was a problem. Property reports from the Marlborough District Council and Department of Conservation SNA/PNA surveys were also scrutinised for old man's beard records.
3. A roadside survey was undertaken. The survey was undertaken during summer/autumn when the vines were particularly visible due to their white flowers and/or fluffy seed heads. This meant that areas could be surveyed relatively rapidly using binoculars from appropriate vantage points. While this is a useful survey method for rapidly determining general distribution it is unlikely to always record every plant (especially those younger than flowering age) and can only check those areas visible from appropriate vantage points. As the survey was primarily interested in the extent of spread and was related to the Significant Natural Areas it did not cover suburban/urban areas around Blenheim, Seddon or Ward.
4. Finally a more detailed survey was undertaken of some of the more strategic properties. This survey was undertaken on foot and mountain bike and was used to determine the extent of old man's beard up valley systems beyond the road end and around high value significant natural areas sites as identified in the Marlborough District Council SNA survey.

All of the sites where old man's beard was identified are marked on a map, a copy of which is attached as appendix one to this report.

Survey Results

Mail Out Survey.

Of the 24 questionnaires sent out eighteen were returned which at a return rate of 75% shows a high degree of interest from those surveyed. The results of the survey are summarised here with a more detailed analysis attached as appendix 3 to this report. Only one landowner reported no old man's beard on his property. All of the respondents that had old man's beard on their properties saw it as a serious weed to the environment although none saw it as a threat to production as it was eaten by stock. Several landowners were undertaking some limited control although most said that time was the biggest constraint and that they would support any control undertaken by council. The quality of the maps varied with some marking very specific sites and others covering large areas of possible country. Many of the landowners spoken to said they had filled in the maps from memory and that the accuracy may not be the best.

Marlborough District Council and Department of Conservation Staff Meetings.

I attended one meeting with Marlborough District Council weed control staff and had several informal meetings and/or phone conversations with Department of Conservation staff from the South Marlborough and St Arnaud Area Offices. Information about the historic spread of old man's beard and control work being undertaken at present and in the past was made available and discussed. Department of Conservation staff from the South Marlborough Area Office were able to supply information on a recent helicopter survey of the Upper Waima catchment and Woodside Creek Catchment that was extremely useful. The input of both of the Department of Conservation staff, with their emphasis on environmental weeds on reserve land and the District Council staff, who focus more on agricultural weeds and those that are targeted in the Marlborough District Council Pest Management Strategy was invaluable.

Roadside surveys.

Between January and April 2004 more than 3000km were travelled on the roads of south Marlborough mapping the distribution of old man's beard. Although old man's beard was found to be scattered throughout much of the area, significantly there were many areas of important habitat that appeared to be free of or very nearly free of any old man's beard.

Wairau River Catchment.

The survey of this river involved recording old man's beard infestations visible from the North Bank Rd, highway 63, every side road to the south of highway 63 and wherever possible accessing the Wairau River bed itself from stop banks, side roads and fishing access tracks. Where access was only by foot the riverside would be searched up and down stream for approximately one kilometre. This was undertaken from the Wash Bridge to the Wairau Bar.

On the south side of the river there appears to be no old man's beard upstream from the Wairau Valley township where there is a large infestation centred on the old rubbish dump. On the northern side of the river old man's beard extends about one kilometre further upriver to just east of Cat Creek Road. There was no old man's beard visible from any of the side roads south of highway 63.

Department of Conservation staff from St Arnaud reported that in the past there had been two plants upstream of the Wash Bridge but these have both been destroyed. They

were of the opinion that these plants were from seed transported in road gravel as they were found near roads (one was in a cattle stop) after road works had been completed. Department of Conservation staff from South Marlborough Area Office had no records of old man's beard in the Branch or the Leatham River catchments. As part of my survey I noted a creeping plant just below the upper Branch River power station on the western side of the Branch River that had some similarity to old man's beard although it was not flowering or fruiting, as I would have expected. Unfortunately the river was too high because of work being carried out on the dam to cross for a closer look. This plant should be checked and if necessary destroyed as soon as access is possible.

Upstream of the Wairau Valley Township the riverbed and edge are grazed by what appears to be a large flock of feral angora goats that will be limiting the spread of old man's beard in this area. From the old dumpsite at the end of Church Lane to the Waihopai River Bridge there are several scattered clumps with the largest of these being near the gravel extraction site near "the Narrows". The presence of old man's beard at this site could allow the distribution of seed in road metal and machinery throughout the region. The patchy distribution along this stretch of river could be attributed to the fact that stock have access graze to the river bed for much of its length. On the northern side of the river the scattered patches are larger and more frequent, reflecting the different land use (often forestry) and topography.

Downstream of the Waihopai River confluence, on the southern side of the river, there are extensive well established infestations in the Marlborough District Council flood protection land all the way to Spring Creek. The largest gaps in this more or less continuous line of old man's beard occur where the land is managed for grazing and livestock have access right to the riverbed. Below Spring Creek old man's beard is well established wherever there is suitable habitat with low grazing pressure.

Waihopai River Catchment

The Waihopai and its tributary the Avon were surveyed from the road that travels for much of its length within sight of the riverbed.

Old man's beard has a fairly limited distribution on the Avon River. There is one moderately sized infestation in an old garden area at the confluence of the Avon and Tummil Rivers and several patches growing among bracken in gullies on the hills between the Avon and the Waihopai Rivers. These infestations are still probably controllable and much of this catchment is apparently old man's beard free.

In contrast old man's beard is well established in the Waihopai River with extensive populations around the power station and further upstream from Sweets Stream to about one kilometre down stream of Netherwood Station. All of these infestations occur in areas that have been retired from grazing for pine plantation or amenity areas. Downstream of the power station there is another large infestation in the gully between Benhopai and Musgrave Downs. Below here it appears as only scattered plants until the major infestation down stream of the highway 63 road bridge.

Southern Valleys

These comprise the valleys to the south of Blenheim including the Omaka River, Mill Stream, Wards Stream, Fairhall River and Doctors Creek. They were all surveyed from the roads that follow up the valleys. This area is highly developed in agriculture and viticulture and in many cases only small portions of the river systems could be seen. It is

possible that there are other infestations that were not seen during this survey. Generally there seemed to be very little old man's beard visible with the largest established patch on the Omaka River where Tyntesfield Road crosses and a smaller patch near the bridge on Hawkesbury Road. Old man's beard is likely to occur wherever there are suitable conditions between these two points. The only other patch seen in this area was a small patch in a shallow gully on Falveys Rd.

Taylor, Dashwood and Redwood Pass Roads

There was surprisingly little old man's beard seen on any of these roadways despite there being several sites that appeared suitable for old man's beard to establish. Once past the Taylor Dam on Taylor Pass Road there was a scattering of plants near the western end of Maxwell Pass road and a moderately large patch in a scrubby gully just before the ford below Vinegar Point. There was no other old man's beard seen until the Awatere River. Dashwood Pass Road has only one small patch recorded near the bridge at the southern end of the valley below the monument on the hill, while Redwood Pass Road has two small patches in regenerating scrub near the top of Flaxey Gully.

Awatere Valley

The Awatere Valley Road was used to survey much of this river system. Like the Wairau River the Awatere is free of old man's beard for a large portion of the upper river. The furthest upstream old man's beard was noted was just upstream of Awapiri where there is a bridge that crosses the river. This is despite the fact that there appears to be a lot of suitable environment for it to establish in. Downstream of Awapiri there are numerous large infestations around the mouths of most of the side streams and at the foot of many of the mudstone cliffs. These large patches continue downstream to the end of the surveyed area at about Taylor Pass Road. The survey ceased at this point, as like the Wairau, the pattern of scattered patches was likely to continue wherever suitable habitat was found. There were a few isolated patches visible from the road over one kilometre from the river around Camp Hill. It is likely that similar infestations may exist up other side streams but these areas could not be surveyed.

Medway River

The Medway River Catchment contains extensive areas of old man's beard infestation and a considerable amount of time was spent on some of the farms at the head of the valley to determine the extent of the old man's beard. It was in this valley that the highest altitude plant record found during this survey was located at around 780m above sea level below Big Cregan on Glen Orkney Station. Old man's beard is scattered in most suitable sites up the Medway River until between Bullock Head and Deep Streams. Many of the side creeks are similarly infested for the bottom few hundred metres and then give way to scattered plants growing in areas not accessible to stock. Not all properties off the Medway were surveyed although this pattern is likely to be repeated for most of this area. Old man's beard seems to show a preference to areas of mudstone. These areas can have dense infestations of old man's beard whereas similar adjoining areas on the less fertile greywacke rock structure have very few plants. Lower down the Medway there are large areas of old man's beard many of which have extremely difficult access due to the sheer mudstone bluffs.

Flaxbourne River Catchment.

The Flaxbourne River catchment was more difficult to survey than other systems due to the lack of access into the area. However assumptions can be made from the areas where

access was possible and from work done by Department of Conservation staff for the PNA survey.

The first part of the Flaxbourne to be looked at in this survey was in the headwaters that could be accessed from 'Corleggy Station' during the survey of the Medway River catchment. There were several well established patches of old man's beard noted here and so the likelihood of old man's beard being scattered down the Flaxbourne River was high. Access was also gained further down the Flaxbourne and to some of the neighbouring tributaries and creeks from the Peggioh Road. Small but well established patches were noted in Phillips Gully, the headwaters of Needles Creek and in the forest remnant areas of Tachalls Creek.

The Department of Conservation staff reported old man's beard from all of the forested sites they looked at with the exception of site F10 on a side creek draining from the Haldon Hills. Extrapolating from this information it appears likely that old man's beard is scattered throughout suitable habitat areas within this catchment.

Blind River Catchment

This smaller catchment was surveyed from the road that starts as Tetley Brook Road south of Seddon and finishes at Marama Road in the Awatere Valley. This area is intensively grazed with very little habitat suitable for old man's beard to establish. However old man's beard was noted in three locations in Tetley Brook, Nicholls Creek and Stirling Brook. The Department of Conservation PNA survey team noted it in the headwaters of Cattle Creek and Lovells Creek.

Waima (Ure) River

The Waima River has, near the road end, one of the largest almost contiguous infestations of old man's beard in southern Marlborough. In suitable areas where there is limited stock access vines, some of which are over 100mm in diameter, are covering around fifty hectares of regenerating forests. From near the old Blue Mountain Homestead for about two and a half kilometres downstream there are extensive patches that cover the streamside, lower reaches of side creeks and some large faces particularly on the northern side of the river. Upstream from the Blue Mountain Homestead old man's beard is well established in regenerating forest for about one kilometre, particularly on the southern side of the river. This infestation has yet to reach the density of that downstream although given that there is no grazing in this area it is only a matter of time before it does so. Further up the Waima River Department of Conservation staff have, for a number of years, been utilising a helicopter to undertake control and survey work. They found a small number of isolated patches along much of the length of the river.

The side streams that run into the Waima below Headache Stream are similarly infested in their lower reaches although these infestations thin out surprisingly quickly away from the Waima. The exception to this pattern is in the Dunsandel Creek where there are several scattered and well established patches along much of its length.

Downstream from Dunsandel Creek there are only a few scattered patches of old man's beard visible from the road although there is a very old and well established infestation in a gully behind Ngaionui Homestead where apparently in the past the gardens were heavily infested.

Woodside Creek

Near the southern border of the Marlborough District is the relatively small Woodside Creek catchment. None of this area is visible from the roadside and therefore entailed a detailed property inspection to accurately map the extent of old man's beard. Nowhere in this catchment are there extensive infestations rather a scattering of individual plants and small patches. Staff from the South Marlborough Area Office of the Department of Conservation made an inspection of one of the southern tributaries of Woodside Creek (outside of Marlborough District) and confirmed that there are only a few small patches to deal with.

Cape Campbell

This large piece of land northeast of the Flaxbourne River, east of state highway one and to the south of Lake Grassmere is almost entirely free of old man's beard. Much of the land is not visible from the road and so required property inspections to accurately establish the extent of old man's beard. There were two plants found up London Creek and two small infestations, one in the garden of 'The Homestead' and one on the roadside near 'Chancet'. There is a historic record of old man's beard in a gully off Cape Campbell Road but the landowner thought that this had been cleared and none was visible during the survey. While much of this area is unsuitable for old man's beard and grazed there are still a number of suitable sites especially if grazing pressure is reduced.

East of Seddon

This area south of the Awatere River, north of Lake Grassmere and east of state highway one has, like Cape Campbell, only a very small amount of old man's beard present. All of this area was inspected from the road with the only plants visible during this survey being in a patch on Blind River near 'Ardgowan Station'. Like Cape Campbell there is only limited habitat suitable for old man's beard but there are several sites that are at present old man's beard free that could easily become infested.

Southeast of Ward

Due to access difficulties very little of this area was surveyed although a large infestation, associated with the homestead, was seen in Mirza Creek near 'Te Moana' and a small infestation behind the sheds on 'Weld Cone' station. Given the similarity of this area to Cape Campbell and East of Seddon I would expect that while there is probably more old man's beard than in either of those two areas there is still likely to be only small amounts.

Individual Property Inspections

Twelve properties received individual inspections to either determine the extent of old man's beard along the length of a river catchment where this was not visible from the road or to determine control options for high-ranking areas identified during the SNA surveys conducted earlier by the Marlborough District Council. Inspections were carried from vantage points accessed by mountain bike or by foot after discussion with the landowner. The location of old man's beard plants found are shown on the attached map and copies of these reports are attached to this report and will be sent to individual property owners but to preserve landowner confidentiality should not be released to the public.

Discussion

The results of the survey confirm the likely distribution of old man's beard predicted in part one of this report. In particular there was a notable lack of old man's beard in areas

where the substrate was greywacke as opposed to mudstone or alluvial gravels. Often old man's beard would be dense on the mudstone soils and then stop within one hundred metres or so of greywacke becoming dominant.

As a consequence of grazing pressure, soil fertility/structure and moisture levels old man's beard is, at present having only a minor impact on many areas of south Marlborough. These areas include much of the land east of state highway one (in particular Cape Campbell) upstream of Wairau Valley Township in the Wairau Valley, upstream of Netherwood in the Waihopai Valley, most of the Avon Valley, much of the high country between the Avon and the Awatere Rivers, the Awatere Valley upstream of Awapiri and the higher country above the Medway. In these areas, unless there is a change to the three limiting factors of grazing pressure, soil fertility/structure and moisture it is less likely that old man's beard will become a major environmental threat to remaining ecologically important areas. However it is likely that old man's beard will continue to slowly encroach into these areas particularly if stock are excluded or as a result of climate change.

In other areas where the soil structure/fertility, moisture levels and reduced stock pressure combine to create ideal conditions for old man's beard there are dense infestations that are not only severely limiting regeneration of native species but will eventually lead to the collapse of much of the existing native canopy. These areas include pockets in the Wairau Valley below Wairau Valley Township, Waihopai Valley between Netherwood and the power station, the Awatere Valley and side streams below Awapiri, the Medway River and side streams and the mid Waima River and tributaries. All of these areas occur on alluvial river soils or mudstone, normally have good levels of soil moisture and stock access is limited either by the steepness of the terrain or management styles. There are some areas, (Woodside Creek and some locations in the Flaxborne River for example) where it is only due to the presence of stock that an explosion of old man's beard is prevented. In all of these areas if the significant natural areas are to be protected a programme to control old man's beard will need to be given a high priority from the outset as without such a programme the desirable features of the site are unlikely to be sustainable.

In much of the rest of south Marlborough old man's beard populations are scattered and limited to pockets where the three factors of moisture, soil structure and reduced stock pressure combine to allow plants to establish. These sites are likely to be at a lower altitude (below 500m) in streambeds and gullies where stock has only limited access. Unfortunately this is likely to include several of the remaining significant natural areas, as these conditions are also required for the establishment of many native species. Old man's beard is likely to be an ongoing issue within these areas although at a lower level of intensity than the previous sites.

During the course of the survey the presence of two of the bio-control agents (leaf miner and fungus) was noted in every location visited. However at the time of the inspection they were in very low densities and did not appear to be having a great impact. This could possibly be attributed to the drought conditions that this region has experienced over the past seasons and these agents may prove to be more effective in slowing the spread of old man's beard in more normal rainfall years. It is possible however that in much of the south Marlborough the conditions are not ideal for these species and so they may never have a major influence on the old man's beard population.

Options for Controlling the Impact of Old Man's Beard

There are a range of options available for limiting the impact of old man's beard in south Marlborough, from doing nothing, through to the eradication of old man's beard from throughout the area. While the final solution is likely to involve a range of various strategies and programmes the following options are presented to assist in making informed decisions that will lead to the formulation of a workable strategy. The financial costs provided are an educated estimation from the current information available.

Options for control

1. **Do nothing but allow existing bio-control agents to limit the spread of old man's beard.**
2. **Continue to monitor the spread of old man's beard throughout the south Marlborough area.**
3. **Continue to support research and release of new bio-control agents.**
4. **Provide education and advice to landowners who wish to undertake control of old man's beard on their properties.**
5. **Provide assistance (ie chemical and or labour/finance) to landowners who wish to undertake control of old man's beard on their properties.**
6. **Prevent the spread into new areas that are presently free of old man's beard.**
7. **Use contractors/staff to control old man's beard in targeted high value areas.**
8. **Use contractors/staff to reduce the current range of old man's beard.**
9. **Eradicate old man's beard from throughout the south Marlborough area.**

1. Do nothing but allow existing bio-control agents to limit the spread of old man's beard.

Financially this option is the cheapest as it requires no more input from local government. In the areas where landowners had a strong desire to control old man's beard there would be a degree of control, the effectiveness of which would depend on the degree of landowner resources and motivation. In the long term, unless the bio-control agents prove to be extremely effective, old man's beard is likely to continue to spread until all sites where the limiting factors of moisture, soil structure and stock pressure allow its establishment will be infested and degraded.

Financial Cost: \$Nil.

Environmental Cost: Long term loss of biodiversity from the South Marlborough Area.

Environmental Gain: Nil

2. Continue to monitor the spread of old man's beard throughout the south Marlborough area.

Monitoring the spread of old man's beard every five years will enable a picture to be built up of the likely speed of invasion, the potential sites threatened and the rate of collapse of important natural areas. While this is important information the eventual outcome will be as above.

Financial Cost: \$1000 per year.

Environmental Cost: Long term loss of biodiversity from the South Marlborough Area.

Environmental Gain: Better understanding of the ecology of old man's beard.

3. Continue to support research and release of new bio-control agents.

Long term the spread of old man's beard is likely to be significantly slowed by the successful introduction of effective bio-control agents. It is extremely unlikely that old man's beard will ever be eradicated with bio-control agents alone although their presence may be able to enable native species to compete more effectively than at present. The process of finding and establishment of suitable agents may take several years and in the end may not make a significant impact on the spread of old man's beard in this area.

Financial Cost: \$8000 per year.

Environmental Cost: Short term as the bio-control agents establish there could be continued degradation of natural sites with a possible loss of biodiversity from the south Marlborough area. If unsuccessful in the long term there will be a loss of biodiversity from the south Marlborough area.

Environmental Gain: If successful there will, in the long term, be a reduction in the impact of old man's beard on the biodiversity from not only the south Marlborough area but from the throughout Marlborough District.

4. Provide education and advice to landowners who wish to undertake control of old man's beard on their properties.

Several landowners expressed a desire in the mail out survey to receive information on the best means of controlling old man's beard. Providing this information would allow those landowners that wish to control old man's beard to do so more effectively. Educating landowners as to the risks to the environment that old man's beard poses may also inspire some landowners to undertake control on their properties whereas in the past they may not have considered it a priority. Using this as a primary means of control for environmental gain would, however, also imply that the areas where control is most needed coincides with areas where the landowner is most willing to undertake control. Other factors such as the amount of resources and the dedication of the landowner to the job may limit the effectiveness of the control achieved.

Financial Cost: \$1800 per year.

Environmental Cost: Many of the high priority areas will not be targeted leading overall to a loss of biodiversity in the south Marlborough area.

Environmental Gain: In a few areas control of old man's beard will be achieved leading to the maintenance of some significant areas of biodiversity.

5. Provide assistance (ie chemical and or labour/finance) to landowners who wish to undertake control of old man's beard on their properties.

As with the option above many landowners, in the mail out survey, identified this as a desirable means of controlling old man's beard. Again this relies on landowners setting their own priorities for control that will not always be the highest priority in terms of maintaining biodiversity within the south Marlborough area.

Financial Cost: \$10 000? per year.

Environmental Cost: Many of the high priority areas will not be targeted leading overall to a loss of biodiversity in the south Marlborough area.

Environmental Gain: In a few areas control of old man's beard will be achieved leading to the maintenance of some significant areas of biodiversity.

6. Prevent the spread into new areas that are presently free of old man's beard.

To achieve this would require a survey of the areas that are presently free of old man's beard every two years (to prevent the majority of plants setting seeds) and destroying any plants found. This would effectively prevent old man's beard establishing in areas outside the known distribution limits of old man's beard in south Marlborough and so prevent the degradation of sites within this area.

Financial Cost: \$1500 per year for survey. \$1500 per year control work.

Environmental Cost: Many of the high priority areas within the known distribution limits of old man's beard will continue to degrade to a point where biodiversity will be lost. These will include many lowland alluvial sites.

Environmental Gain: All areas outside the current known distribution limits of old man's beard will be maintained free of old man's beard allowing for the maintenance of biodiversity within this area.

7. Use contractors/staff to control old man's beard in targeted high value areas.

This would require prioritising areas for control using an assessment of the values, cost of control and likelihood of success of controlling old man's beard in selected sites throughout the south Marlborough area. This option would allow resources to be used where there is the greatest need or benefit to be gained. While there will always be the likelihood of reinvasion it will be necessary to allow resources for follow up control many years however the cost of preventing old man's beard re-establishing are likely to be significantly lower after the initial knockdown period.

Financial Cost: Depends on selection of priority areas. As a minimum guideline, to maintain those areas free of old man's beard as above plus control old man's beard in the highest ranking SNA/PNA sites \$10 000 per year.

Environmental Cost: Those sites that fall outside the priority ranking system will continue to be threatened by old man's beard with the eventual loss of biodiversity that will entail.

Environmental Gain: All areas outside the current known distribution limits of old man's beard will be maintained free of old man's beard allowing for the maintenance of biodiversity within this area. As well all of the most important sites within in the south Marlborough area will be protected and bio-diversity maintained.

8. Use contractors/staff to reduce the current range of old man's beard.

By establishing a control programme that targeted areas that currently have low density old man's beard infestations it will be possible to shrink the current range of old man's beard to only those areas where there are well established infestations that are beyond control without a large injection of resources. Many of the largest infestations occur around the Waima, Medway, Awatere, Waihopai and Wairau Rivers. In these areas it is unlikely that control can be easily achieved. However it would be more feasible to control the smaller infestations that occur in the side streams and creeks that flow into these larger river systems. In this way the range of old man's beard would be reduced significantly. Many of the high priority SNA sites fall within this area and so would be captured within this programme. As with any control option there would be a requirement for ongoing follow up work to prevent reinvasion.

Financial Cost: Depends on selection of areas. A minimum of \$18 000 per year.

Environmental Cost: Sites that fall within the major infestation areas will continue to be threatened by old man's beard with the eventual loss of biodiversity from those sites.

Environmental Gain: Many of the most important sites within in the south Marlborough area will be protected and bio-diversity maintained. The range of old man's beard will be

reduced allowing for the maintenance of bio-diversity in lower value sites and limiting the spread of old man's beard into sites that are currently free of this weed.

9. Eradicate old man's beard from throughout the south Marlborough area.

Total eradication of any pest species is the ultimate achievement in any pest control operation. While the upfront costs can be huge once a pest is eradicated the ongoing costs to remain pest free are minimal. The major potential risk in any eradication programme is that even after spending the large amounts of money the pest remains and eventually the will to achieve eradication is lost and all the previous resources wasted.

To eradicate any species from within a given area requires the following conditions to be met.

- There must be the desire to see the pest eradicated.
- Sufficient resources must be provided to put every individual at risk and;
- Individuals need to be removed faster than they can repopulate.

Potentially it would be possible to target every old man's beard plant, (south of but excluding the Wairau River), and to remove them faster than they could establish seedlings locally or seeds blow in from adjoining areas. It would require access onto every property that contains old man's beard and permission to control the weed. As old man's beard does not have a significant financial impact within the area it is unlikely that there would be widespread support to spend the amount of money required to achieve eradication.

Financial Cost: A minimum of \$350 000 per year for the first 3 years, then \$50 000 for a further 3 years followed by \$10 000 for the final 3 years. (Total \$1 230 000.) These figure are an estimate made from extrapolating an estimate to control old man's beard in the Waima Catchment.

Environmental Cost: Nil.

Environmental Gain: The most significant weed threatening one of the most biologically diverse regions in New Zealand would no longer be a threat.

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Appendix 1.

Map showing to current distribution of *Clematis vitalba* (old man's beard) in south Marlborough. This map is a 'living document' and sites of old man's beard will be added or removed over time. An updated map is held by the Marlborough District Council.

Appendix 2

Control Techniques

Because old man's beard is widespread throughout much of Marlborough and its seeds are wind and water carried it is unlikely that the eradication of old man's beard from much of this area is possible. Therefore in those areas where significant natural features are at risk from old man's beard infestations it is necessary to establish efficient and effective means of long term control.

Any weed control is a long-term commitment to ongoing control. Because of its large seed bank and the length of time seed is viable in the soil control will need to be maintained at a minimum of every second year for at least ten years after the last seeding plant has been removed.

In planning a control operation it is wise to work from areas of least infestation to the areas of most infestation as that way the spread of the weed is reduced quickly and the largest gains are made for the least amount of resources.

The following techniques have been used successfully elsewhere in the country.

Physical control

Scattered small plants and seedlings can be hand pulled, and larger plants grubbed out with their roots left to dry. As plants can regrow from stem fragments ensure that the stems are not allowed to remain in contact with the soil. This method is suitable for small infestations only.

Chemical control.

Chemical control has been undertaken for many years on old man's beard throughout the country with the following strategies proving most effective.

Where vines are growing up into the canopy cut the vines within 500mm of the ground and if possible paint/spray the cut stumps immediately with an appropriate herbicide mixture ie.

- 1 part Grazon to 20 parts water, or
- 1 part Glyphosate to 4 parts water, or
- Vigilant gel.

If the stems are too numerous cut them closer to the ground, wait until they are actively regrowing and are covered in leaves then spray the new growth with one of the following;

- Grazon: Handgun: 400ml per 100 litres of water, Knapsack: 60ml per 10 litre water;
- Versatill: Handgun: 500ml per 100 litres of water, Knapsack: 125ml per 10 litres of water;
- Escort: Handgun: 35g + 100ml Pulse per 100 litres of water. Knapsack: 5g + 10mls 'Pulse' (surfactant) per 10 litres of water;
- Glyphosate herbicide: Handgun: 2 litres per 100 litres of water. Knapsack: 200ml + 10mls 'Pulse' (surfactant) per 10 litres of water.

In both of the examples above it is a good idea to also cut the vines at head height so that it is easy to tell at a glance which vines have been cut, to allow better access and to prevent any vines missed from using the old vines for support.

Where plants form a thick mat over the ground or on low vegetation spray with one of the above mixtures always ensuring that the 'host plants' underneath are not desirable as it is inevitable that they will receive some herbicide.

Helicopter Control

Where there are isolated pockets of old man's beard in difficult to reach places it is sometimes appropriate to use a helicopter with an attached gun to spray from the air. As the plants are sprayed from above the canopy, care needs to be taken to avoid spraying desirable host plants. There is a risk with this technique that by spraying from above only those plants already in the canopy can be targeted, once the canopy is opened up the seedlings at ground level that are missed quickly reinfest the site often making it worse than it was originally. 'Versatill' at 500ml per 100 litres of water is the preferred herbicide for helicopter spraying as it is somewhat selective and allows the non target plants a better chance of survival.

Grazing

Old man's beard seedlings are palatable to most stock and it is unlikely that seedlings can establish readily in areas that are subjected to regular grazing pressure. This can be used effectively in the short term to prevent the establishment of seedlings in areas where old man's beard has been recently removed from the canopy. Long term however grazing is likely to cause significant damage to the indigenous understorey and lead to the eventual collapse of the canopy. It is important that if stock are to be excluded from previously infested areas that a control regime is instigated to control the inevitable seedling growth.

Bio-control

In the long term the establishment of bio-control agents is likely to provide the best option for limiting the impact of old man's beard over much of the area where old man's beard is already well established. Bio-control works on the principle that the natural enemies of old man's beard will reduce its vigour and slow its spread in the environment. Bio-control agents are extremely unlikely to ever eradicate old man's beard completely but should, if effective, allow many indigenous species to compete more effectively and so maintain their place in the environment. However there are likely to always be sites where it is advantageous to control old man's beard to a level below that able to be achieved by bio-control.

To date there have been three bio-control agents released in Marlborough. They are the old man's beard leaf miner (*Phytomyza vitalbae*) the leaf fungus (*Phoma clematidina*) and the saw fly (*Monophadnus spinolae*)

The leaf miner and fungus were released in 1996 and 1999 respectively and have spread throughout the region. The leaf miner burrows within the leaves of old man's beard deforming the leaves and reducing the area for photosynthesis. It has been estimated that 1 mine per leaf can reduce the growth of a small plant by 17%. Four mines per leaf is considered normal although in many situations 9 or 10 mines per leaf are found. The leaf miner has naturally spread from its initial release sites and is likely to be present throughout much of Marlborough. It is important that leaf miner populations are active

in the spring and summer as it is likely that they will have minimal impact on a plants health if they only attack the leaves just prior to leaf fall in autumn.

The leaf fungus attacks the leaves and to a lesser extent the stems of old man's beard plants. It causes wilting and blackening and can cause severe defoliation. The severity of the infestation depends on the amount of rain in spring and summer. While this fungus has been effective in much of Marlborough its need for a wet spring and/or summer may be a limiting factor in the more arid areas of South Marlborough. It has naturally spread from it initial release sites and is likely to be present throughout much of Marlborough.

The sawfly is the most recent old man's beard bio-control agent to be released in Marlborough. It was released in December 2002 at the Opawa Loop and its spread and effectiveness is still being monitored. In its natural habitat the larvae of this fly hatch inside the old man's beard leaf and proceed to consume several leaves before pupating. The grub has the unusual habit of destroying the vascular system of the petiole before consuming the leaf and so ensures the death of the leaf whether or not it is entirely eaten. The spread of the sawfly is presently being monitored and they may yet have to be assisted into South Marlborough.

Other agents.

Landcare research are currently evaluating a bark beetle (*Xylocleptes bispinus*) for release as a bio-control agent. At this stage there is no time set for release.

Mail Out Survey Results

24 forms were mailed to landowners within the Marlborough District Council SNA survey area. Of these 18 were returned giving a 75% rate of return. As well as answering the following questions respondents were asked to mark on an attached map where they had seen old man's beard on their properties.

1. Do you consider Old Mans Beard to be a problem weed generally?

Yes

No

Comments: *All respondents answered yes to this question except one who said there was no old man's beard on their property.*

2. How much Old Mans Beard is there on your farm? (Please circle and show on map provided)

None present (1) Small amount (11) Fairly common (6) Large amount (2)
Comment: 2 landowners circled both small amount and fairly common.

3. Does Old Mans Beard pose any threat to the productive side of your farming operation and if so how?

1 respondent did not answer this question. All others said it had no impact on farming although 4 respondents said it was a problem in forestry or fenced areas.

4. Do you currently carry out any Old Mans Beard control on your property?

Yes (13)

Why? *Most respondents who answered yes controlled old man's beard in small areas or amenity plantings. Common reasons were "to stop it spreading" and because "we don't like it".*

No (5)

Why Not? *1 property had no old man's beard. 1 said it was not a threat on his property. 3 said lack of time or too big a problem.*

5. Old Mans Beard seed spreads by wind and through waterways. Are you aware of any sites on your property, or the surrounding area, which may act as sources of seed spread – either through wind blown spread, or water borne spread. **If so please label these on the property map provided and show the direction of travel.**

6. If the control of Old Mans Beard became feasible would you support a control programme?

Yes (16)

No

Comments: *2 respondents did not answer this question.*

7. If you were to control Old Mans Beard on your property, what sort of help would be most useful to you?

- *1 respondent did not answer this question.*
- *Most respondents (7) wanted inputs of labour, finance or chemicals.*
- *4 respondents wanted information on how to control old man's beard effectively.*
- *3 respondents wanted a helicopter spray programme instigated and*
- *3 respondents wanted the wide spread release of bio-control agents.*