Cherry trees in Mount Cook National Park

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The Perceived Problem

Prunus avium L. (bird cherry, sweet cherry) (Rosaceae) has spread from nucleus plants near the Hermitage, Mount Cook, into natural vegetation nearby. Its continued spread is seen as a potential threat to the integrity of native woody plant communities, especially scrub, in the Hooker and Tasman Valleys. It is a vigorously growing plant which is tall enough at maturity to overtop many of the species in shrub and low forest communities. In such communities it could form cherry forests where, because of its spreading branch habit, native plants would be suppressed. The concern is that if the present infestations are not contained, ultimately this species could alter the character of the woody vegetation through a large part of Mount Cook National Park.

BRIEF FOR THIS STUDY

I was asked to:

1. Evaluate the existing and potential ecological impact of sweet cherry on the communities within which it is establishing.

2. Provide an evaluation of the communities involved and place them in a regional context.

3. Evaluate the range and extent of sites suitable for cherry establishment within the Park.

4. Comment on the existing control techniques and operations, given the above.

History of Cherries at Mount Cook

Hereafter I will usually refer to *Prunus avium* as "cherry" or "cherries". There are no precise records of the introduction of cherries to Mount Cook National Park. However, in the early 1950s at least six old cherry trees were present at Foliage Hill (Fig 1) (personal observation). These trees could have been at least 50 years old then, judged by the size of their stumps, which are still present (Table 1). Their planting may have been associated with activities at the original Hermitage site at White Horse Hill. Cherries were often planted in the Canterbury high country in the 19th Century, by European settlers.

Cherry trees were also planted near the site of the second Hermitage at Glencoe Stream, probably during amenity and home garden developments in the

1930s. These have only recently been killed. The trees at Foliage Hill were cut down at the instigation of L.W. McCaskill, in 1959 (D. Morse personal communication). The motivation for this was that it was thought to be inappropriate for introduced trees to be growing in a National Park. There may also have been concern about spread of the species, by bird-dispersal of seeds. In the 1950s fruit from the cherry trees were used for pies etc. for the Hermitage dining room.

An increase in cherry trees in the Lower HookerValley was recorded by plotting of areas of infestation on an operational weed management map for Mount Cook National Park, dated 1974-78. However, this is not accurate. Coloured slides from the Mount Cook National Park Headquarters files, dated 1975 (B5 243), 1977 (B5 255), 1979 (B5 274) and 1980 (B5 276) show the main area of cherry occurrence, Ollivier Fan, in autumn and provide a good record.

A carefully plotted record of the main areas of infestation and outlying individuals or small groups (in relation to the annual control measures) is marked on maps drawn up by P Axford for 1991-92, 1992-93,1993-94 (Figs 2, 3,4).

Photographs of the Ollivier Fan in 1992, 1993 clearly show the extent of the cherry infestation, evident from the vivid contrast of their red or orange autumn colour with the native evergreen species (Fig 5).

P Axford (personal communication) indicates that, in April 1992 and 1993, at the base of the Sealey Range on the south side of the Mueller Fan 20 or more large cherry trees, some possibly 40 years old, were found and cut down. The largest were 10 or more metres tall and about 25cm-30cm in diameter near the base. These trees probably originated from seeds derived from the older trees at Foliage Hill. In January 1954 1 climbed into one tree at Foliage Hill to eat cherries. Kereru sat in adjacent trees feeding, then flew across to the Sealey Range. The nucleus of infestation on the Ollivier Fan (where one tree was aged by me at 36 years) could have originated also from Foliage Hill, or from trees at the top of the Mueller Fan. Further south the young cherry trees present in Governors Bush and on the Kitchener Fan and other places near the present Hermitage probably originated from the old trees in the gardens there.

Present Extent of Cherries In Mount Cook National Park

Areas where cherries now occur in Mount Cook National Park are noted in Figure 1. In only one area, Ollivier Fan, is there a dense infestation (see Table 2 for records of densities in two 5 x 5m quadrat samples there). On adjacent Mueller Fan there are some moderately dense patches with perhaps 10 to 50 small to medium-sized (up to 2m tall) plants per hectare. Elsewhere, on Mueller Fan, as far as I could see in 2 1/2 days searching, occurrence is quite sparse, with perhaps one to five small to medium-sized plants per hectare.

In the areas that were well-covered by the cherry-killing exercises in 1991-94 small plants up to about 50cm high are commonly present and there are scattered plants up to about 5m tall. The local abundance of the small plants is spatially highly variable. Areas without any cherries are extensive and the densest patches are near sites of large plants which have now been killed.

Only very sparse occurrences were seen in Governor's Bush, Kitchener Fan, and Foliage Hill.Very few young trees are present on the lower HookerValley flats, among *Discarta* patches. R. Bellringer reports (personal communication) that a few scattered plants have been found in the area between the two Hooker swing bridges.

The landforms and soils on which cherries are present include: old moraines with mature loessic soils (White Horse Hill, Foliage Hill, Glencoe); alluvium with shallow young soils (Lower Hooker flats, Kitchener Fan); alluvial - colluvial fans with very shallow, young, mainly organic soils (Ollivier and Mueller Fans); young moraines with shallow, young, mainly organic soils (Mueller Glacier terminal moraines); and hillslope colluvium with loessic soils and rejuvenation through movement and local redeposition (old soils rejuvenated to some degree) (Governors Bush, slopes of Sealey Range).

The site of the densest infestation, Ollivier Fan, has a very rough bouldery substrate, very well-drained and disturbed at times by shifts in the stream course during flooding and deposition of fresh alluvium. Also, on this site there is disturbance to differing degrees each year, and deposition of fresh colluvium by snow avalanche. There is very little loess or fine alluvial material in these soils; the soil matrix is almost all organic detritus derived from the plants inhabiting the fan. This material covers the surfaces of boulders and fills the interstices between them. The plants present in the vegetation on this and other sites are noted later (though the composition in two 5 x 5 m quadrats is included in Table 2).

Altitude limits for almost all cherries at Mount Cook are at about 900m above sea level. One colony was found at about 1000 metres on the Sealey Range slopes north of the Ollivier Fan (P Axford, personal communication).

The Ecology of *Prunus avium*

Knowledge of various aspects of the ecology of *P. avium* is highly relevant to future decision making about it at Mount Cook National Park.

PLANT FORM, SEASONAL PHENOLOGY, REPRODUCTION

The plant is a winter-deciduous, single or multi-stemmed small tree which can grow up to 15m tall, but is usually shorter. At Mount Cook it is seldom more than 10m tall. As a sapling or pole it has a slender or erect form. Mature

trees may have quite wide branch spread (up to 5-8m). In April, as temperatures decline, the foliage turns red, orange or yellow and is shed. Flowering and fruit-set is in late October - early November at Mount Cook. New foliage appears at the same time, or immediately after. The flowers are usually insect pollinated but silvereyes visit them for nectar and probably effect some pollination. Fruit are ripe in January at Mount Cook. Trees of 1.5 to 2m height may produce some flowers and fruit. Large trees may each produce several thousand fruit.The long-stalked fruit are borne in clusters of 2-10, on short shoots, along the upper stems.

The fruit are drupes, each with a single seed enclosed by a hard endocarp (stone) which is surrounded by a juicy, fleshy pericarp, very attractive to frugivorous birds. At Mount Cook kereru and blackbirds (the most important frugivore and seed disperser) swallow the fruit whole, digest the flesh and void the stones (which I will hereafter refer to as seeds). Song thrushes and possibly starlings may eat some fruit. Silvereyes often peck the flesh without swallowing seeds, but they may eat some small fruit. Blackbirds disperse most of the seeds at Mount Cook.They are known to feed in trees with ripe fruit until none remain. Kereru, (very scarce at Mount Cook), probably are the only long-distance (1 or 2km) dispersers. Blackbirds seldom fly more than a hundred metres or so without defecating.

Seeds can be very abundant on the ground beneath bird-perch trees. Densities of the order of 6 intact seeds per m^2 were observed in November 1994 (Table 3). Fresh seeds of *P. avium* are dormant and require a period of cold treatment to induce germination (which is hypogeous - the stones remain underground). In nature this happens over the winter following seed shed. Seed from a January crop may germinate in the following November; this was observed in mid November 1994 at Mount Cook.

No definitive information is available for New Zealand conditions about the maximum longevity of dormant *P. avium* seeds buried in the soil. Seeds definitely older than one year were seen (Table 4). Elsewhere these "seed-bank" seeds are known to survive for a few years. The recently germinated seedlings which I excavated had almost all emerged from seeds of the 1994 season. However, a few had emerged from somewhat weathered and whitish stones which must date from earlier years. Dormant seeds in old whitish, weathered stones and also in yellowish-brown, unweathered stones (presumed to date from the 1994 seed crop), were buried about 4-5 cm deep in organic soil (Table 4). Burial is effected by surface soil wash and also probably through the litter - disturbing activities of blackbirds. Re-excavation of buried stones is apparently effected in the same ways. One site for new seedlings, observed at Mount Cook, was on, or closely adjacent to, the bases of *Polystichum vestitum* (fern) tussocks. The dead, rotting fronds appear to be a good medium for germination and for growth of young seedlings. Almost all new cherry seedlings otherwise were seen on patches of bare litter under scrub or forest canopies (sometimes in interstices between boulders). Stem lengths of new seedlings (hypocotyl and epicotyl) are about 5 to 7.5 cm.

PLANT GROWTH IN RELATION TO SHADING AND OTHER HABITAT CONDITIONS

Growth of young cherries in shaded situations appears to be slow (Table 5). Small plants 10-50 cm high have short internodes with opposite buds (each representing a year's growth). Such plants are common under scrub or forest canopies. These small plants can be referred to as suppressed juveniles. Some are 5 or more years old.

In some other sites in scrub or forest the canopies are not so dense as to prevent direct sunlight from reaching the ground for at least part of the day. Spindly young cherry trees often project through the canopy in these (Table 2).

Although some of the cherry trees at Mount Cook occur in open sites, or in large gaps in the scrub vegetation, most are associated with some form of woody cover (probably related to deposition of seeds from bird perches). Like many other opportunist woody species, which grow most vigorously in well lit sites, *P. avium* appears able to tolerate a degree of shading, while remaining in a juvenile form.This means that a population of suppressed juveniles is ready to exploit conditions as they become more favourable (e.g. gaps formed by the death of canopy plants, or breakage of branches of canopy plants). A situation at Mount Cook which appears to favour *P. avium* is the additional light reaching the ground through the winter deciduousness of the widely distributed native tall shrub or low tree species *Hoheria lyallii*.

Cherry seedlings emerge and cherry saplings gain new leaves before the *Hoheria* adults unfurl their leaves. It is notable that the densest patches of cherry infestation often have a large amount of *Hoheria* present. The large cherry trees at the top of the Mueller Fan were all associated with an area of *Hoheria* prominence in the forest there.

Substrate conditions in the shrub and forest communities where cherries occur are highly variable. As noted earlier, under scrub and forest canopies the usual habitats for seedling establishment are in litter patches with no plant cover, or at the base of *Polystichum vestitum* tussocks (where the fronds are pressed down by winter snow). Few juvenile cherries occur where the subcanopy field layer is dense (e.g. a close cover of *Polystichum* plants).Very few cherries were seen in open dense grassland areas. However, some establish in open herb covered areas with some bare soil, e.g. in spaces between boulders, or in *Coriaria sarmentosa* patches.The *Coriaria* leaves are winter-deciduous and new leaves do not sprout until mid-late November. In open grassland the only other common place for cherry establishment is in patches of *Discaria toumatou*. Both *Coriaria* and *Discaria* have root nodules with a nitrogen-fixing organism. The soil enrichment from these sources may be beneficial to cherries. It has been established in other studies (Molloy 1964) that gravelly substrates in Canterbury are quite well supplied with phosphorus and cations.

GROWTH RATES OF CHERRY PLANTS AT MOUNT COOK

Over 30 cherry plants were cut down, their heights and diameters near the stem base measured and their ages determined. The small plants (<30 cm high) had indistinct annual growth layers, but those of larger plants were very distinct. The plants examined in this way were chosen to represent a range of heights and diameters; the sample came from the Ollivier and Mueller Fans.

Young unbrowsed plants

These were all from sites beneath a low forest canopy of *Phyllocladus alpinus, Griselinia littoralis,* with occasional *Podocarpus hallii* and *Hoheria lyallii.* In this moderately to strongly-shaded habitat type the plants are spindly and have leaning stems, possibly through directional light effects or winter snow pressure. The ages determined from apparent annual growth layers (Table 5) are probably unreliable because almost all of these plants had indications - the occurrence of internodes with opposite buds and bract scars above them - which suggest that they could be older by 1, 2, or 3 years.This lack of clear growth layers in young plants probably should be considered when determining the ages of larger plants. It is concluded that growth is slowed by the shaded habitat condition.These suppressed juveniles probably could survive for at least a decade in this state.

Young browsed plants

Many plants, both in shaded and unshaded habitats, show signs of one or more episodes of browsing (Table 5). In the denser scrub and forest situations hares are probably responsible. In open situations hares and rabbits could be involved, but hare droppings were seen in many places. Again the growth layers were obscure in smaller plants. Many cherry juveniles, thus, are being browsed and recovering.

Older plants

It had been anticipated that there would be a reasonably clear relationship between height and age of the well-grown cherry trees. However, the data in Table 6 show that this is not the case. In the different height classes, the data are ordered according to the ages of the plants. Especially in plants less than 3m high there is a surprising similarity of ages (9-13 years) for plants of widely different height and diameter. This must reflect wide differences in optimality of growing conditions from site to site.There is a faint indication that plants from sites with relatively dense vegetation grow higher, faster, than those in more open sites (they have apparently grown up through canopy gaps).Very tall spindly trees occur in places in Governor's Bush. The early 1980's appear to have been a very good time for cherry establishment.

Older, taller trees quite evidently have grown rapidly. A 36 year old tree, 7m high with a 26 cm diameter near the base, reflects a high rate of productivity.

VEGETATIVE PROLIFERATION BY CHERRIES

Cherries are able to survive physical damage (including being cut off near ground level) by sending up sprouts from the stem base. Browsed saplings continue to produce new sprouts. One small plant browsed annually for many years, by hares or rabbits, had a stem diameter of 1.8 cm and 16 annual growth layers, though it was only 25 cm tall (Table 5). Plants knocked over by winter snow avalanche produce vertical shoots at intervals along the prostrate stem. Root sprouts are also found, but none were seen that were more than 30-40 cm distant from the stem. They seem to develop in response to damage to roots by erosion of the substrate.

NATURAL CONTROLS OF CHERRY GROWTH AND REPRODUCTION

The vigour of cherries may be checked by some natural factors. Snow avalanche damage does this in the upper part of the Ollivier Fan. Browsing effects, especially by hares, were noted above. They are widespread among young saplings either in relatively open or quite dense scrub and forest on the Ollivier and Mueller Fans. Browsing is one factor preventing cherry establishment in open grassland. Several plants which had been almost completely defoliated were seen in November 1994. However, apparently most, if not all, plants damaged in this way recover. Frost damage of new leaves was also quite common in cherry trees in exposed sites at Mount Cook in November 1994.

The quantities of seeds available to develop new generations of cherries are limited in various ways. A snowfall affected the flowers, of cherry trees considerably in November 1994 (P Axford personal communication). Counts of fruit clusters showing apparently sound green fruit and those that had been harmed in various ways are given in Table 7. It appears, thus, that abortion of ovules through unknown causes, eating of ovules by birds or insects (none of the latter were seen) and frost damage (recognised by the browning of the fruit) can diminish the seed crop considerably. Nevertheless more than 50% of green fruit on each of the sampled trees had survived up to mid-November. It is expected that almost all of these would survive until fruit-ripening.

After seed-dispersal the seeds on or under the ground surface are subject to other natural hazards. It was noticeable that many of the 1994 seed crop seeds on the ground had been opened (Table 3). The cause is unknown; rats, mice or wetas may be involved. Seeds buried in the soil might be attacked by arthropods or fungi. Counts of numbers of sound and damaged buried seeds are included in Table 4. The numbers are indicative only, as the sample was small.

In spite of these various natural hazards the numbers of sound seeds that survive to germinate and give rise to established juveniles is still very high in the Mount Cook National Park setting. Some of the natural pests and diseases of cherries in lowland Canterbury (Table 8) appear to be totally lacking at Mount Cook. It could be worthwhile to investigate the cherries near Pukaki and at Burkes Pass to see whether any of these diseases or pests occur there,

with a thought of introducing them at Mount Cook to assist in bio-control of the cherries. However, it would be important to establish whether any native plants could be harmed by these organisms (which, except for *Stereum purpureum*, *Pseudomonas syringae* and possible *Erwinia amylovora,* are thought to be confined to woody members of the Rosaceae).

Impacts

ECOLOGICAL IMPACT OF CHERRIES ON NATIVE PLANT COMMUNITIES AT MOUNT COOK, PRESENT AND FUTURE

In spite of the abundance of cherries in some shrub-covered areas at present there is not much evidence of competition between the invaders and adjacent native shrubs to the detriment of the latter. This is because the cherries are still young, with slender growth form. However, if the cherries on Ollivier Fan were to grow to maturity they would form dense stands with the canopies of individual trees touching. This would undoubtedly be detrimental to the adjacent native shrubs. By contrast with the shrubs, cherries have a growth rate which is probably at least twice as fast (an exception may be *Hoberia lyallii* which probably is faster than other native species, but nevertheless is relatively slow).

The other component of the threat to native communities posed by cherries is the very prolific nature of their reproduction. The densities of sound seeds on the ground, listed in Table 3, and the numbers of surviving good fruit (from samples of small branches) (Table 7) are indicative of the huge quantities of seeds being produced. *P. avium* is a very fecund species. This means that there will be a steady increase in the density of cherries wherever they are already established in scrub vegetation.

In forest (6 m high or more) cherries are not so much of a threat because canopy gaps are small, so that it is difficult for the cherries to expand their canopies. In sites with *Hoheria* cherries might increase but they would be less likely to do so in dense *Phyllocladus - Griselinia.* In tall dense forest with *Podocarpus hallii* or *Nothofagus menziesii* cherries would also have a limited potential for spread. Nevertheless, in the denser, taller woody vegetation, cherries could occupy gaps and become a significant component of the vegetation.

THE SPECIFIC PLANT COMMUNITIES IN WHICH CHERRIES OCCUR AT MOUNT COOK

Nearly all of the woody plant communities below about 900m a.s.l. in the lower Hooker Valley have some cherry plant invasion. The broad composition of the vegetation is indicated in Table 9 (see Wilson 1976 for more detailed composition and mapping).

As noted above there are differing degrees of potential threat to the native communities in the short term (10-30 years). The more open, lower, woody communities are the most vulnerable.

REPRESENTATION OF THE AFFECTED VEGETATION TYPES

The vegetation types already invaded by cherries are among the best representatives of their types in MCNP - some of them, however, are also present in the lower Tasman Valley. Invasion of these communities to a greater or lesser degree in the lower Hooker Valley is serious in the regional context, since woody vegetation (especially the tall scrub and forest communities) is of rather limited extent in MCNP

I am not familiar with the Ohau Valleys to the south. Further north in the Rangitata and Rakaia catchments there are *Podocarpus hallii* and *Phyllocladus alpinus* vegetation resembling, but not identical with that at Mount Cook. Likewise lower scrub vegetation is also represented in those valleys, but the composition differs. *Nothofagus menziesii* forest, in pure form, is a scarce commodity in Canterbury. Thus a good case can be made for concern about the cherry problem in MCNP because some very good vegetation, of limited extent in MCNP and not well represented in any other South Island National Parks, as far as I am aware, is affected.

POTENTIAL FOR SPREAD OF CHERRIES BEYOND THE LOWER HOOKER VALLEY

Unchecked, cherries could eventually spread to: the area between the Hermitage and Birch Hill Station, in the Tasman Valley; all of the moraines of the Mueller Glacier and flanks of the Mt. Wakefield ridge; possibly to the lower Hooker Glacier moraines; the west side of the Tasman Valley from the Hooker River bridge at least as far as the Tasman Glacier moraines and Blue Lakes. This expansion to occupy all of the potentially suitable terrain might take 30-50 years if no more efforts are made to control cherries. The expansion of cherries to about 1000m altitude on the Sealey Range means that this must be assumed to be the potential upper limit, *at least*.

Control Techniques and Effectiveness

CURRENT EFFORTS

During the 1980's efforts made to control cherries in MCNP were sporadic and not very effective. The magnitude of the infestation prompted compre-

hensive planning and a "killer" policy began to operate in 1991. The extent of the cherry infestation was mapped, and systematic coverage of affected areas by poisoning large plants and hand-pulling smaller ones was carried out in autumn (April) each year from then onwards (Fig. 3, 4, 5). At that time the weather is stable and the trees are clearly visible because of the bright colours of the foliage. In winter the leafless plants are harder to distinguish from *Hoheria* (and herbicide uptake would be less effective). Spring (November) is usually very wet at Mount Cook (but, theoretically is the best time because herbicide uptake would be optimal and because plants are killed before they shed their seed crop). Plants are visible then too, when flowering and putting out new leaves. Early summer (December) would be appropriate also, before fruit ripening, but it is always a very busy time for other tasks.

Essentially the control measures for larger saplings is to cut them off near the base and spray herbicide on the cut surface with a squirt bottle. For poles and mature trees gashes are made around the stem and herbicide squirted into these. The application technique seems to be very effective and good control (avoiding spray drift to non-target plants) can be achieved. A team of operators traverses the area with the aim of getting all the cherries.

The herbicides used were: 1991-92 tordon + dieselene; 1992-93 and thereafter the systemic sulfanyl urea (Escort), 10 g/l in water.

I have covered a considerable amount of the area where control operations have been done. All trees that have been treated are dead. Some from the April 1994 control exercise have produced rather sickly leaves (Nov. 1994) but P Axford tells me that trees that did this in previous years subsequently died. I saw no evidence whatsoever that treated plants had resprouted from the base.

In the treated areas occasional sapling-sized cherries have escaped observation and many small plants up to 50 cm high or so are still present; the rough terrain and thick vegetation cover make this inevitable. I saw very little evidence of spray-drift to non-target plants from the 1994 operation. However, in areas treated in 1993 or earlier, on the Ollivier Fan, I found two patches where substantial numbers of native shrubs had been killed by herbicide (in one site more than 50 plants, 8 species). Considerable care is needed to ensure that this does not happen again.

Peter Axford is to be congratulated on the dedication and energy with which he has pursued the very onerous task of dealing with cherry control. Given the resources available, the efforts so far have been very effective in diminishing the populations of visible young cherry trees on the areas treated.

THE FUTURE

Are the control efforts likely to be effective in the long term? This question has to be answered by reference to the ecology and phenology of *Prunus avium*. Without doubt, by continued vigorous effort all (except possibly a

few elusive specimens) of the larger cherry plants can be found and killed. The problem really lies with small juveniles and the ungerminated seed and seedling crops. If no more seed crops enter the seed banks there would still be seedlings emerging for at least another year, probably more. The suppressed juvenile populations in scrub and low forest are already numerically huge. There will be an ongoing need for mop-up control measures into the foreseeable future as these plants grow to flower producing size. However, if it is decided to continue the "killer" policy, the most urgent need is to remove all plants that are presently big enough to bear fruit. Almost all of these are on the Ollivier Fan and preferably they should be killed before the fruit ripen in January 1995.

The effort and expense needed to continue the cherry control will be great, but if the momentum is not kept up everything done before will have been wasted.

Summary and Conclusions

Prunus avium is a very prolific fruiter with bird-dispersed seeds which germinate in spring. Some seeds may remain in soil seed banks for at least two years. Plants as small as 2m high can produce some fruit. Large plants can produce thousands. Natural hazards kill some seeds, but a high proportion (probably at least 25%) of the seeds produced each year survive to germinate. Some years may be better than others for establishment of young plants.

Small suppressed juvenile plants, difficult to detect, may remain for 5 or more years in shaded sites. Some will eventually grow to a size large enough to bear fruit. *P. avium* grows rapidly and can overtop vegetation of 8m height or more. Eventually, by branch spread and canopy closure, it can be expected to suppress adjacent native plants. It has the potential to spread through a large part of MCNP, in the Hooker and Tasman Valleys.

The only extensive natural bio-controls for *P. avium* in MCNP at present are killing of seeds by fungi and unknown vertebrates or insects and browsing of young plants, mainly by hares. The plants recover.

P. avium is highly visible in autumn, but the best time to kill the trees is in late spring - early summer when flowers and foliage are fairly easily discerned (and before fruit are ripe). Control measures used at present are generally effective, though labour intensive.

It appears to me that the Department of Conservation has two alternative options with respect to cherries in MCNP

1. Do nothing - let the cherry invasion take its course.

2. Carry out an all-out cherry control effort, a bit more intensive than at present, and done in Nov-Dec (preferably in 1994), to kill all fruiting

trees. Then continue monitoring each year into the foreseeable future for any plants which stick their heads up and kill them in Nov-Dec. This latter would be needed for at least another 10 years I think, but could probably be handled by one person. Also investigate possibilities for introduction of natural enemies which reduce fruit yield, especially micro-organisms such as shot hole, brown rot and also pear slug sawfly.

Addendum

WHY DO WE HATE CHERRIES?

Here I sound a slight note of ambivalence about cherries. There are some incongruities in our attitudes to the cherries in Mount Cook National Park. The campaign to kill cherries appears to be based on three premises:

1. They are vigorous invasive plants which may change the character of the vegetation they are invading.

2. They are very visible (at least in autumn).

3. They can be killed relatively easily (but not necessarily eliminated easily, as I have noted above).

The incongruities are that many other plants are invasive in MCNP but are not receiving the same attention. Also there are many invasive animals. By the letter of the law considerable efforts should be made to deal with all of these organisms. In the areas affected by cherries these adventive plants are widespread: gooseberry, raspberry, currant, *Aquilegia,* foxglove, *Hieracium* sp., sweet vernal', browntop', yorkshire fog, cocksfoot. The conclusion I come to is that they aren't attacked for two reasons: they aren't so conspicuous; they would be very difficult to control, for various reasons. The conspicuousness factor in fact also applies to introduced grasses on the Hooker Flats, which include two (marked' above) and *Festuca rubra* and *Poa pratensis*. The grasses have almost completely replaced native species over a vast area. Of course it would be impossible to eradicate them. Another extensively distributed adventive plant, russell lupin, is highly visible near the Hermitage, is spreading more widely and eventually can be expected to occupy the entire Tasman riverbed downstream (thus interfering with native plant communities and birds such as wrybills and dotterels) but is very difficult to control. If the cherry killing effort is to be sustained, I suggest that equivalent effort should be put into finding adequate means for clearing russell lupins from MCNP - they are probably the greater pest problem.

Then there are the foreign animals, which include various bird species, hares, rabbits, stoats (I saw one beside our accommodation!), cats. At the least, the rabbit population on the Hooker Flats should be dealt with (and the cats and stoats if possible). Also, how much effort is being made to eliminate thar and chamois from MCNP?

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Table 1: Diameters of Stumps of Old Cherries at Foliage Hill, Killed in Early 1960s

Diam (cm) 30, 30, 32, 38, 40 x 32, 43

Table 2: Occurrence of *Prunus avium* in Two 5 x 5 m Quadrats, Ollivier Fan.

Quadrat A			Quadrat B	
Species	**Height(m)**	**No of individuals**	**Height (m)**	**No of individuals**
Hoheria lyalli	2-2.5	16	4-6	2
Aristotelia fruticosa	1-1.5	20	2 - 2.5	8
Griselinia littoralis	1.-1.5	5	2.5 - 3	8
Hebe salicifolia	1-2	11	3	4
Coprosma propinqua	1.5	8	2-2.5	4
Ribes uva-crispa (gooseberry)	0.5	1	0.5	1
R. rubrum (currant)	0.6	7	-	-
Pseudopanax colensoi	2	1	0.5	1
Discaria toumatou	-	-	4	8
Hymenanthera alpina	-	-	2	2
Pittosporum tenuifolium	-	-	1.5	1
Podocarpus hallii	-	-	2.5	1
P. nivalis	-	-	0.4	1
Rubus schmidelioides		1	-	-
Muehlenbeckia complexa		1	-	-
Herbs, ferns (presence only)				
Polystichum vestitum		✓		✓
Digitalis purpurea		✓		✓
Aciphylla scott-thomsonii		✓		
Holcus lanatus		✓		
Anthoxanthum odoratum		✓		
Hieracium sp		✓		
Blechnum penna-marina		✓		
Prunus avium	New seedling <0.5	5 10		3 6
	0.5-0.9	2		3
	1-1.9	3		5
	2-2.9	9		1
	3 or more	5		7
Largest 3, 3, 3, 3.5, 3.5) Total Plants		34	(3.8, 4, 4.5, 5.8, 7)	25

Table 3: Condition of Seed Samples From Ground Surface

Mueller Fan, dense tall scrub, under Griselinia 1m^2 area				
Intact seeds	Seeds shrivelled	Seeds attacked by fungi	Total	
7(47%)	5	3	15	
Ollivier Fan, open short scrub, under Hoheria 1m^2 area				
6 (24%)	12	7	25	
Ollivier Fan, dense tall scrub, under *Podocarpus hallii*				
Whole Collection				
Complete stones	Half stones (opened, possibly by animals)	Damaged stones (opened by animals	Total	
102	56 (=28 stones) minimum number	9	167	
Subsample of Complete Stones				
Intact Seeds	Seeds shrivelled	Seeds attacked by fungi	Seed attacked by nematode	Total
0	14	10	1	25

Table 4: Condition of Seed Samples Which Had Been Buried 3-5cm Below Soil Surface.

Mueller Fan, dense tall scrub, under *Griselinia*			
Intact Seeds	Seeds Shrivelled	Seeds attacked by fungi	Total
1 (20%)	4	0	5
Ollivier Fan, open, short scrub, under *Hoheria*			
8 (32%)	12	5	25

Table 5: Ages and Sizes of Some Small (< 0.5m tall) Unbrowsed and Browsed Cherry Plants.

Unbrowsed[1] (all from shaded sites)			
Plant	Height cm?	Stem diameter near base, mm	Age
1	8	1	2
2	8	1.5	2
3	20	2.5	2(?3)
4	12	1.5	2
5	11.5	1	?(obscure)
Browsed (from shaded and open sites)			
6	13	4	3
7	22	3	3
8	13	3	3
9	45	5	4
10	23	4	4
11	31	5	5
12	23	5	5
13	20	5	6
14	6	5	12
15	25	18	16

[1] Judged by the number of intemodes on the main stem with opposite or sub-opposite buds, these plants are older by 1,2 or 3 years; possibly all trees are older by a few years than the ages observed from the annual growth layers.

Table 6: Ages and Sizes of Some Sapling and Pole Cherry Plants

Plant	Height Class(m) 0.5-0.9	Height (m)	Diameter near base (cm)	Age
1		0.6	05	4
2		0.7	1.0	10
3[1]		0.9	1.2	12
	1-1.9			
4		1.7	1.3	6
5		1.0	0.8	11
6		1.6	2.0	12
	2-2.9			
7		2.2	2.3	9
8		2.5	3.5	9
9		2.0	1.7	10
10		2.0	1.7	11
11[1]		2.9	1.5	11
12		2.2	4.0	13
	3 or more			
13		3.2	5.0	11
14[2]		3.6	5.2	13
15		6.0	8.0	23
16[1]		4.3	9.0 x 6.5	30
17[1]		7.0	26.0	36

[1] Shaded site (the rest were from semi-shaded sites)
[2] Open site

Table 7: Counts of Green Fruit From Samples of Mount Cook Cherry Trees.

	Sound Fruit	Aborted (possibly frosted)	Definitely frosted	Eaten	Total
Tree Sheltered Site					
A	16 (57%)	3	1	8(28%)	28
B	54 (70%)	1	21 (27%)	1	77
Exposed Site					
C	46 (53%)	25 (29%)	15 (17%)	0	86
D	27 (61%)	11 (25%)	6 (14%)	0	44

Table 8: Organisms Which Harm *Prunus avium* in Lowland Canterbury

Organism	Other Hosts	Part Affected[1]	Effect
Virus			
Shot hole *(necrotic ring spot virus)*	peach, apricot, plum, rose	L,W	in orchards can reduce fruit yield 20-50%; tree survives.
Bacteria			
Bacterial canker *(Pseudomonas syringae)*	peach, apricot, plum, rose, pear, citrus, lilac, ornamental annuals, perennials	W	in orchards can reduce fruit crop yield up to 80%; can kill 10-75% of trees
Fire blight *(Erwinia amylovora)*	peach, apricot, plum, pear, apple, quince, co-toneaster, possibly some non-Rosaceae	W	reduces fruit yield substantially; can kill trees
Fungi			
brown rot *(Sclerotinia fructicola)*	peach, apricot, nectarine, plum	F,W	in orchards can reduce fruit yield 50-70%; some-times kills trees
silver leaf *(Stereum purpureum)*	peach, apricot, nectarine, plum, apple and some non-Rosaceae	L,W	reduces fruit yield substantially; can kill trees
Insect			
pear slug sawfly *Caliroa limacina*	peach, pear, plum, hawthorn	L	reduces vigour of plant and thus affects fruit yield; tree survives

[1] L leaves, W branches, stems, F flowers

Table 9: The Main Plant Communities in Which Cherries Occur at Mount Cook

Physiognomic Vegetation Type	Important Associate Species	Nearest Type Described in Wilson (1976)
Shrub in herb communities	Important Associate Species	Nearest Type Described in Wilson (1976)
Grassland with shrub patches	Discaria, Anthoxanthum, Festuca rubra	qdi
Herb patches (in mosaic with scrub)	Coprosma rugosa, Coriaria, Hieracium, grasses	qdi
Scrub Communities		
Mixed short scrub, immature soils	Hoheria, Aristotelia fruit., Discaria, Coprosma prop., Hebe salicifolia, Polystichum etc.	10e or 10f
Mixed short scrub, mature soils	Phyllocladus, Halocarpus bid., Podocarpus niv., Coprosma spp., Dracophyllum long., Polystichum etc.	10b, e
Tall Scrub or Forest Communities		
Mixed tall scrub grading to tall forest	Phyllocladus, Griselinia, Hoheria, Podocarpus hall., Polystichum etc.	10g, 11
Silver beech forest	Nothofagus menz., Hoheria, Griselinia, Podocarpus hall. etc.	12

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