Sycamore (*Acer pseudoplatanus*) Spread in Northern Southland

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Project and Client

The risk posed by sycamore (*Acer pseudoplatanus*) to Southland was investigated by Landcare Research, for Environment Southland, funded by an Envirolink Medium Advice Grant (ESRC216).

Objectives

- Provide a brief summary of sycamore biology.
- Assess the current and potential distribution of sycamore in the northern hill country of Southland, to determine what values are at risk, and how to minimise any adverse impacts.

Results

Sycamore is widely scattered in northern Southland particularly in the Nokomai area of the Mataura Valley where it forms dense stands. It is found mainly on steep rocky slopes with a southerly aspect. It is invading mainly scrub of exotic weeds and small-leaved native species ('grey scrub') and forest margins. It is not invading beneath the canopy of adjacent beech forest. The potential distribution of sycamore is much greater than the limited current distribution. Sycamore has the potential to impact biodiversity values in northern Southland.

Conclusions and Recommendations

- Because sycamore spread is still at an early stage in northern Southland, but with the potential to invade a range of native scrub and open communities, it should be controlled wherever it approaches susceptible High Value Areas.
- Efforts should be made by all parties to complete and make publicly available the sycamore control experiments undertaken by Landcare Research at Peel Forest.

1. Introduction

The risk posed by sycamore (*Acer pseudoplatanus*) to Southland was investigated by Landcare Research, for Environment Southland, funded by an Envirolink Medium Advice Grant (ESRC216).

2. Background

Sycamore (*Acer pseudoplatanus*) is a deciduous non-native tree that is widespread in New Zealand. As a consequence of sycamore's ability to form dense stands in scrub and beneath the canopy of damaged forest, where it competes with native ground flora and regenerating native woody plants, it is included in several regional pest management strategies (RPMSs) (Table 1).

Table 1 Status of sycamore within current regional pest management strategies

Region	Category
Horizons Regional Council	Site-led species
Greater Wellington	Site-led species
Environment Canterbury	Biodiversity pest
Environment Southland	Surveillance
Chatham Islands Council	Total control

Sycamore is listed as a 'surveillance' pest in Environment Southland's RPMS. One of the RPMS objectives is to assess the risk particular pest plants present to Southland's environment, and the council is committed within its strategy to collecting information on the status of sycamore as a weed. Within northern Southland, sycamore is particularly common, and spreading, in the upper Mataura Valley. This study aims to provide a brief summary of sycamore biology as a background, and to determine the pattern of spread and potential impacts of sycamore invasion in this northern region by making a close study of its distribution and impacts in the upper Mataura Valley.

3. Objectives

- Provide a brief summary of sycamore biology.
- Assess the current and potential distribution of sycamore in the northern hill country of Southland, to determine what values are at risk, and how to minimise any adverse impacts.

4. Methods

Published and electronic information was examined sufficient to provide a background to sycamore ecology.

The upper Mataura Valley was visited with Randall Milne, Environment Southland, during 6–10 March 2009, when the autumn colours of sycamore made it highly visible. Sycamore stands in the Mataura Valley were observed from the junction of the Nokomai Valley Road with State Highway 6, to the limits of visible sycamore down the Mataura River towards Cattle Flat, and up the tributary of the Nokomai River, referred to hereafter as the study area (Fig. 1). The location of several inaccessible stands in this section of the Mataura catchment were reported to us by James Hore and Anton Gibson of Nokomai Station, but they were not all sighted by us.

We observed sycamore and associated vegetation from roads or tracks and marked their approximate location on topo-maps. Discrete stands and individual trees were noted where these occurred some 100s of metres from the nearest potential parent tree. Each stand was scored as having a single tree, or 100s, 1000s, or 10 000 or more trees.

Four plots within the largest areas of sycamore (Stands 1 and 2; Appendix 1) were described using the National Vegetation Survey data sheet to determine what was occurring beneath the sycamore canopy. A beech forest stand immediately adjacent to the sycamore stand was also sampled to determine whether sycamore was invading (summarised in Appendix 2).

In addition, as considerable travel was required through Central Otago and northern Southland to access the study area, I made drive-by observations of sycamore from the highway.

5. Results

5.1 Sycamore biology (see Bibliograpy)

Sycamore is a large-leaved, deciduous tree that grows to 30 m, and commonly lives for 100–500 years. In Britain it reaches altitudes up to 480 m. In many places in Britain and New Zealand sycamore forms monospecific stands. It grows on a wide variety of soils, but suffers from aluminium toxicity on very acid soils. Growth rates of mature trees are high compared with some other species in Britain, and this is probably because of their high leaf area, rather than any greater photosynthetic efficiency. Flowering occurs regularly, and the abundant large seeds (30 mg) are wind dispersed. These must undergo a period of mild desiccation and then chilling before they will germinate. Seeds are dispersed from late winter to early spring. There is no persistent seed bank. However, sycamore has the ability to recover from cut stumps and it forms suckers to a minor degree.

Seedlings make rapid height growth in mild shade and they may benefit from reduced competition from herbaceous species at 50% light. They can grow in as little as 1% light but

become nutrient deficient at such low levels, especially on poor soils. This is partly a function of their weak ability to scavenge nitrogen from dying leaves. In times of moderate drought, assimilates are transferred from leaves to roots, with little overall reduction in total plant weight. Sycamore seedlings are subject to considerable slug predation in England, although the overall impact of this on the ultimate stand density has not been determined. Provided the soils are sufficiently fertile, seedlings can sit on the forest floor for a number of years, growing only very slowly until a light gap occurs. Consequently, the relationship between stem diameter and height, and tree age, is rather weak in sycamore stands associated with established forests (R.P. Buxton, unpubl. data).

5.2 Environment of study area

The environment of sycamore in northern Southland and parts of inland Otago is classified as South-eastern Hill Country and Mountains (mainly Q2) (Leathwick et al. 2003). The climate is cool, with low annual and winter solar radiation, and relatively dry because of the sheltering effect of the Southern Alps. Parent materials are mainly schist, greywacke and tertiary rocks. Soils are generally moderately well drained and comparatively fertile for mountain soils. In Nokomai area the winds are predominantly from the south-west and north-west quarters (J. Hore, pers. comm.).

The pre-Maori vegetation of the study area would have been predominantly *Nothofagus* forest and while much of this remained when Europeans arrived, only small areas of forest now survive in gullies and southerly faces. The dominant vegetation is now improved grassland, developed from tussock grassland, with large areas of scrub. On sunny faces with a history of topdressing this is predominantly matagouri (*Discaria toumatou*). On colder faces and at altitudes above c. 500 m it is predominantly 'grey scrub', sensu Wardle (1991), that is, small-leaved shrubs dominated by *Coprosma* spp., *Melicytus alpinus, Corokia cotoneaster,* and matagouri. Large areas of grey scrub are being invaded by broadleaved species, particularly black mapou (*Pittosporum tenuifolium*) to form 'green scrub'.

European residence in the Nokomai valley dates from the 1860s when the area was taken up as a sheep run (http://www.nokomai.co.nz/the-station.php) and a homestead built in the 1870s. Gold was discovered shortly afterwards and there are workings visible in many places. The present Nokomai homestead in the valley has very large sycamore trees along the driveway. There are also cribs (huts) approximately halfway between the highway and the homestead, and those on the north bank are associated with sycamore stands. All these observations are made to indicate that although the area is relatively isolated, there has been a great deal of human activity in the area for a very long time and that sycamore has been in the area for probably more than 100 years.

Concerning other weeds, broom (*Cytisus scoparius*) is the main woody weed and is dominant over large areas, particularly on steep slopes. Gorse (*Ulex europaeus*) is more localised although there are large stands in some places. Hawthorn (*Crataegus monogyna*) is abundant between the main highway and the cribs and there are large stands in the gullies behind the general vicinity of the Nokomai homestead. Rowan (*Sorbus acuparia*) is present as isolated individuals mainly near the cribs. Sycamore, as will be described in greater detail below, is more abundant overall than hawthorn, but much less abundant than broom or gorse.

5.3 Sycamore in Nokomai study area

The overall distribution of sycamore within the study area is shown in Fig. 1. There are only two stands ranked as being 10 000 trees; on the true right of the Nokomai River near its junction with the Mataura River (Stand 1) and on the true right of the Mataura River opposite the end of the farm track past Paddys Milestone (Stand 2) (Fig. 2). Elsewhere, sycamore occurs mostly as groups of a few hundred to a few thousand trees. Isolated trees are common but they peter out downstream; there is a total of about 50 trees between the southern limit of the last dense stand in the catchment (Stand 6) and the tin shed (E 2168720, N 5502275) and a further 5–100 trees between there and halfway towards the road end from Cattle Flat Station. There are also isolated stands in several gullies well away from the main Mataura–Nokomai valleys. One of these, in the headwaters of Dome Creek, was destroyed (DOC, Southland, pers. comm.).

The majority of sycamore stands are on steep (30°–38°) to very steep (≥ 40°) south- to south-east-facing hill slopes with abundant surface rocks (Appendix 2). In some sites this is coarse and blocky enough to inhibit plant growth and can be described as mobile scree. Aside from that, isolated sycamore trees were rarely found on lower fans or river beds, and always in association with dense scrub of native and exotic species associated with colluvium. Only rarely are sycamores found on the true left bank of the Mataura River below the junction with the Nokomai River, and then usually in gullies. The majority of sycamore trees are between 200 and 300 m a.s.l. and less commonly above 500 m.

In well-developed dense stands with crowns at c. 15 m and mean stem diameters of c. 5–20 cm, there is very little understorey apart from scattered small-leaved shrubs, a few exotic herbs, and occasionally crown fern (Stands 1a–1b, 24b; Appendix 2). In less dense stands, in one case clearly representing the margins of the invasion where there was an older tree of 16-cm diameter surrounded by stems of mostly less than 5-cm diameter, the associated vegetation was mixed scrub of native species and tall dead broom (Stand 24c; Appendix 2).

Sycamore occupies areas of damaged beech forest and some steep-sided gullies, but it is not invading intact beech forest in this catchment. However, it appears to prevent the marginal reinvasion of beech forest into shrub land, which it might otherwise do.

A striking feature of the sycamore stands, especially those towards the southern limit, is that patches formed by old trees surrounded by juveniles can clearly be seen establishing in scrub (Fig. 3). Broom forms an important component of the scrub in many cases. Only occasionally does sycamore establish where dense native ‘grey scrub’ forms a tight canopy, and usually where there is broken ground at the surface. Sycamore is even less commonly associated with ‘green scrub’, that is, where black mapou dominates the canopy. In places, it appears sycamore and green scrub are competing to invade the grey scrub (including broom) before the site is fully occupied.

While it was not the objective of this study to report on trials to kill sycamore, the aerial poisoning trials by the runholder appear to have been partially successful in killing dense stands of sycamore. Observations from a distance suggest sycamore regrowth would eventually reoccupy the site, however. Stand 2 was recently sprayed but it is too early to detect any effect apart from some leaves having fallen at the time of sampling.

It is worth noting that an apparently viable sycamore seed was found approximately 800 m from the nearest adult tree, and sycamore seedlings have been found on Quail Island in Lyttelton Harbour, c. 3 km from potential source trees (C.J. Burrows, pers. comm.).

5.4 Current distribution of sycamore in northern Southland & Otago

Some impression of sycamore in Southland and Otago on South Eastern Hill and High Country Mountains (Q1–Q4) environments (Leathwick et al. 2003) can be gained from the descriptions of the very few scenic reserves in these two regions (Allen et al. 1989; Ward & Monro 1989). Although these may be somewhat out of date, they are the only comprehensive account of reserved land in the region. Of the very few reserves in this environment class, sycamore is absent from the Glen Allen Scenic Reserve west of Kingston and the Te Kere Haka Scenic Reserve, which is an area of scrub and forest forming the backdrop to Kingston. This reserve is close to houses, which are the sort of places sycamore might be expected. Sycamore was still absent at the time of the present study and the bright-coloured conspicuous trees visible from the village transpired to be ash (*Fraxinus excelsior*) (not noted by Allen et al. 1989). A large exotic tree well above the Nokomai cribs was also ash. None of these trees are likely to have been planted and their presence indicates the power of wind dispersal in the region. It would appear that sycamore is absent despite the dispersal opportunities.

Even outside this environment class in Southland there only are two entries for sycamore, Croydon Bush Domain, where it is simply listed as present, and Kerr's Bush protected private land, where 'elderberry and sycamore [are] common along the edges'; Allen et al. (1989) considered that exotic species were not a problem and would be replaced by native species.

In the several reserves on Q1–Q4 environments in western Otago (Ward & Monro 1989) immediately adjacent to northern Southland, sycamore is listed as 'occasional' for Feehly Hill reserve behind Arrowtown. I have not checked the boundaries of this reserve with respect to the current abundant sycamore vegetation on these hillsides but I would expect that some of them are within the reserve, especially since it was mostly scrub of broom, briar (*Rosa rubiginosa*), elder (*Sambucus nigra*), and hawthorn and was still grazed in 1983 (Ward & Monro 1989). Sycamore was not listed as being present on Queenstown Hill in 1983 (Ward & Monro 1989) but it is there now. More typical of sycamore are heavy infestations in highly modified reserves near towns, e.g. Ross Creek Reserve in peri-urban Dunedin (Brian Heenan, pers.comm.).

Drive-by observations of country other than reserves revealed sycamore to have a patchy distribution in northern Southland and western Otago. Apart from being abundant around Queenstown and Arrowtown it reaches great abundance in the Kawarau Gorge, especially near the historic suspension bridge supporting the bungee jump. It was very common on south-facing slopes, but there are a few patches on the north-facing slopes in gullies. From Queenstown south it is in scattered locations all the way to Athol, in the upper Mataura Valley, where it contributes to the backdrop to the town on steep south-facing scrubby hillsides, in association with hawthorn and other shrubs. These stands have clearly arisen primarily through broom. They appear to have originated from similar vegetation to those around Arrowtown, and the descriptions of Ward and Monro (1989) mentioned above would tend to support this.

Fig 1. Location of the study area in the Nokomai area of the Mataura valley. Relative number of trees in the sycamore stands ≥100 indicated by dots; small bright green, 100s; large bright green, 1000s; large dull green, >10,000. The cribs mentioned in the text are indicated by arrows and Nokomai homestead by a red dot. Map published by Land Information New Zealand.

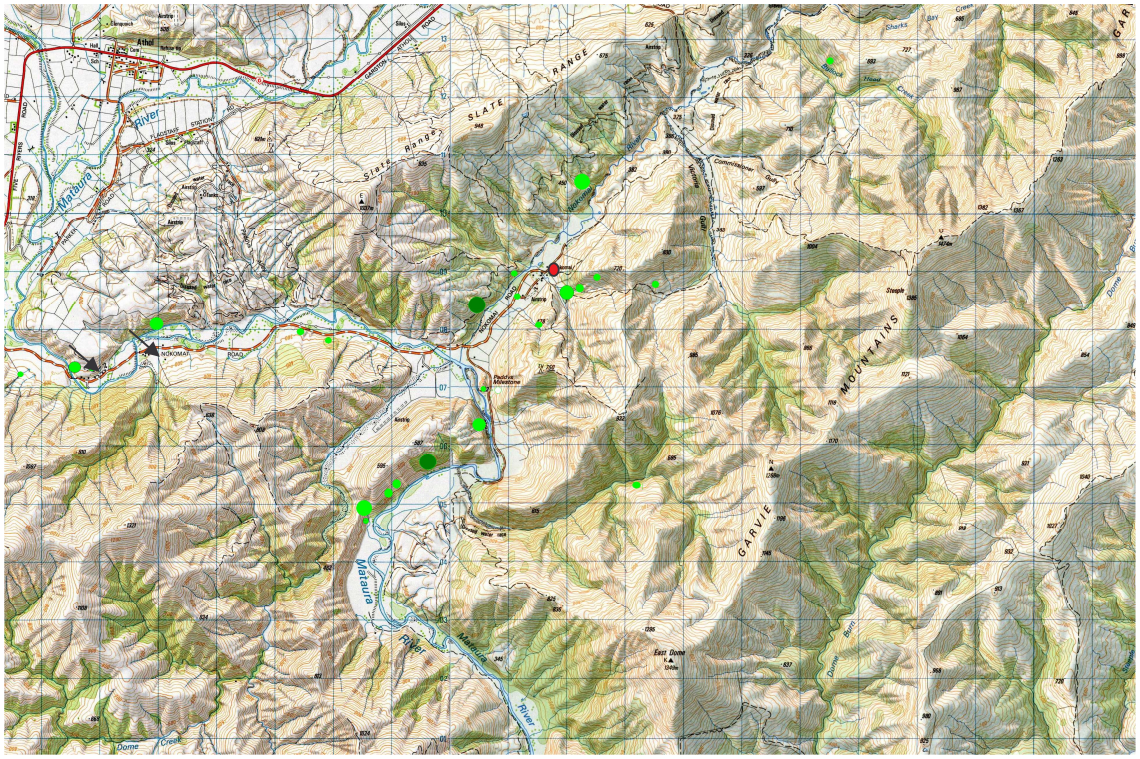

Fig 2. The northern end (a) and southern end (b) of the largest sycamore stand in the Nokomai area. Sycamore is invading a mixture of native "grey scrub" and broom, but is does not invade the adjacent beech forest. Note also the small area of non-invaded "green scrub" in the top left hand corner (arrow) between the beech forest and the sycamore

(a)

(b)

Fig 3. An isolated stand of sycamore invading a mixture of "grey scrub" and broom. "Green scrub" dominated by black mapou is also invading the "grey scrub" with the sycamore in a "race" to occupy the site. Several young sycamore trees indicated by arrows.

6. Discussions and Conclusions

6.1 Sycamore ecology

Sycamore was planted on Nokomai Station probably in excess of 100 years ago and these could possibly be the origin of the present invasions. Further back towards the main highway the oldest plants could have come from plantings near the cribs. Certainly there have been adult trees in the area for a very long time. Overall, the pattern suggests a slow spread south down the Mataura Valley towards Cattle Flat. It is largely confined to steep places and mostly in the presence of 'grey scrub' and two other woody weeds, gorse and broom. Sycamore is not invading intact beech forest and it is certainly not a weed of pastoral land without the precursor of other shrubs because it is suppressed by grazing animals. In view of the large seed supply and potential for long-distance dispersal by wind, sycamore spread seems to be constrained by available suitable habitat for seedling establishment. Grazing pressure has been a factor in limiting the spread of sycamore. Stand 1 for example, which is directly across from the homestead plantings of sycamore, was once a goat farm that reverted to broom when the goats were removed and was later occupied by sycamore (J. Hore, pers. comm.). Grazing probably helps limits the current spread of sycamore to steep rocky slopes.

The landscape in the Nokomai–Cattle Flat area is far from equilibrium and scrub of all types is slowly encroaching over some areas. In places this is complete, with 'green scrub' dominating the vegetation canopy. Such vegetation occurs particularly above 500 m. This vegetation would seem immune from sycamore invasion. Below 500 m, and particularly

between Nokomai Station and Cattle Fat, there are still large areas of grey scrub, gorse and broom. Whether green scrub or sycamore forms the next successional stage seems to depend largely on slope. Where slopes have some stability, green scrub is winning, but on the open sites, sycamore is more likely to be successful.

The woody vegetation communities presently in the study area suggest that without any intervention, the landscape in the study area would reach a state where there was beech forest, green scrub dominated by black mapou, sycamore forest, and unstable areas of scree where grey scrub would probably continue to dominate. The long-term composition of sycamore forest can only be speculated upon, but it would probably provide habitat for at least some shade-tolerant native species from the beech forest such as lancewood (*Pseudopanax crassifolius*).

6.2 Potential distribution of sycamore in northern Southland

Based on climate limitations alone, there is no indication that sycamore has reached anything like its potential distribution in northern Southland, or indeed New Zealand as a whole, for it grows from sea level to about 600 m. In the highly modified and intensively used lowlands it is severely constrained by grazing and is found almost exclusively in association with forest remnants, e.g. Kerr's Bush. In less intensively used landscapes, the wild distribution of sycamore, like many New Zealand weeds, is limited by the density and location of founding populations, such as those at Athol and on Nokomai Station, and the time it has had to spread from these locations.

In northern Southland, as illustrated by the present study area, the few populations noted in side valleys away from the main Mataura Valley point to its potential distribution being much greater. Considering the scattered populations from the Nokomai area all the way through to Cromwell, with an occasional dense distribution such as at Arrowtown, it clearly has a much wider potential regional distribution on Q1–Q4 environments. Judging simply from the absence of sycamore from the early scenic reserve reports around Queentown–Arrowtown compared with its present abundance, and its localised increased abundance in the last 20 years in the Nokomai area, e.g. the ex-goat farm at Stand 1, sycamore spread on these environments has really only just begun. However, while sycamore may be climatically suited to these environments it appears to be currently confined largely to steep rocky places in grazed pastoral landscape in association with ex-grasslands that are being overtaken by scrub, much of it exotic species. In the absence of grazing, and the consequent development of scrub, sycamore would be likely to greatly increase.

6.3 Sycamore threats to biodiversity values in northern Southland

The main impact of sycamore from a biodiversity perspective appears to be its occupancy of grey shrub and other open areas, particularly on unstable south-facing slopes. Although it does not invade forest with relatively intact cover, it does have the capacity to prevent the marginal spread of forest where this abuts open scrub susceptible to sycamore colonisation. The Environment Southland RPMS mentions areas of significant natural habitat called High Value Areas (HVAs). However, without knowing precisely where these are, and whether they contain such vegetation, it is not possible to say whether sycamore currently threatens any specific HVA. What can be said is that if such HVA areas did contain grey scrub, other

open areas, and forest margins, and sycamore was present within a few kilometres, then the areas would be potentially exposed to sycamore invasion. The impact of sycamore invasion would be dependent on the conservation values of such areas.

For example, in the case of the present study area, whether sycamore should be controlled for biodiversity conservation reasons in the Nokomai area depends on the significance of grey scrub to the region, and how much of it is reserved. The significance of 'natural landscape' might also be considered, because sycamore is certainly a conspicuous 'unnatural feature'. Certainly sycamore has the potential to be very much more abundant than it is now.

6.4 Sycamore control

It was not the aim of this study to review sycamore control methods. However, where there is a need to reduce sycamore density for stock movement it does appear the spraying of dense stands conducted on Nokomai Station has had at least some short-term benefit in opening up the stands. Much more intensive management would be needed of such stands if the objective was to control them for biodiversity conservation. Large-scale experiments into sycamore control have been conducted by Landcare Research at Peel Forest, Canterbury, but these have not been finalised or written up, through lack of funds. The results of these experiments would be useful for anyone wishing to control sycamore.

The control of sycamore is potentially more practicable than that of many other weeds for several reasons. It grows, and indeed spreads, relatively slowly. Secondly, adults and juveniles greater than 1.5 m tall are conspicuous in autumn from some distance away, i.e. outlying plants can be detected. Effective control measures are available (not detailed here), although there are issues with regenerating from cut stumps and suckering. And lastly, and most importantly, although sycamore can have a 'seedling' bank in some places, it does not form a persistent seed bank that requires attention for many years after control of the adults.

7. Recommendations

- Because sycamore spread is still at an early stage in northern Southland, but with the potential to invade a range of native scrub and open communities, it should be controlled wherever it approaches susceptible HVA areas.
- Efforts should be made by all parties to complete and make publicly available the sycamore control experiments undertaken by Landcare Research at Peel Forest.

8. Acknowledgements

Randall Milne of Environment Southland accompanied me on the investigation and his help was invaluable. Thanks to B. Hore for access to Nokomai Station and to J. Hore and A. Gibson for sharing their knowledge of the station. This project was funded by the Foundation for Research, Science and Technology through an Envirolink advice grant (ESRC216) to Landcare Research.

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Appendix 1 List of sycamore stands in Nokomai area, Mataura Valley, estimated to have more than 100 trees

Stand	NZMS 260 map sheet	Grid	No. trees	Notes
1	F43	707087	10 000	Main area on true right of lower Nokomai Valley
2	E43	699056	10 000	Largest continuous stands in the Mataura Valley
3	E43	637073	1000	Several semi-discrete patches behind cribs
4	E43	650081	1000	Several semi-discrete patches
5	F43	675126	1000	Large stand in a gully associated with mining
6	E43	686048	1000	Large stand south. Limit of really dense sycamore in an old mining area
7	F43	706065	1000	Sprayed area
8	F43	722086	1000	Gully in patchy scrub. Outlier a further 250 m up gully
9	F43	724105	1000	Many small patches in very broken country
10	E43	623075	100	Upstream of Nevis
11	E43	639073	100	Several semi-discrete patches behind cribs
12	E43	675079	100	Small patch on toe amongst other scrub
13	E43	679078	100	Small patch on toe amongst other scrub
14	E43	688048	100	Stand adult trees on hillside adjacent
15	E43	689052	100	Adult and young trees towards southern end of main infestation photo
16	F43	706070	100	Old and young trees. In bracken and broom
17	F43	708068	100	Scattered trees in thick grey scrub, including gorse and broom
18	E43	711086	100	Large planted trees at homestead
19	F43	715082	100	Few trees in gully with scrub
20	F43	715096	100	Few large trees amongst scrub in gully
21	F43	719086	100	Scattered large trees amongst tall hawthorn scrub
22	F43	726089	100	Small patch on toe of hill slope amongst other scrub

23	F43	73-05-	100	A few in a gully (Anton Gibson, pers. comm.)
24	F43	73-08-	100	Behind homestead (Randall Milne, pers. comm.)
25	F43	76-12-	100	Bullock Creek (Randall Milne, pers. comm.)

Appendix 2 Site and stand characteristics of sycamore sites and an adjacent beech forest site in Nokomai area, Mataura Valley

Stand[1] plot no.	GPS grid	Altitude (m a.s.l.)	Aspect (o mag.)/ Slope (o)	Substrate	Species[2] dbh (cm, mean ± range) mean canopy height (m)	Vegetation[3]
1a	E 2170646 N 5508419/	280	140/35	Sharp colluvium	*Ace pse* 7–16–27 16	Canopy trees *Ace pse*: T2 50%, T3 10%, T4–T6 5%. Shrub layer T4–T6, 5%: mainly *Coprosma propinqua, Cytisus scoparius, Crataegus monogyna, Ribes uva crispa, Melicope simplex, Pseudopanax crassifolius*. Ground layer T5–T6, 10%: *Polystichum vestitum* and scattered exotic herbs and grasses.
1b	E 2170548 N 5508299	280	90/45	Sharp colluvium	*Ace pse* 3–13–18 15	Canopy trees *Ace pse*: T2 30%, T3 20%, T4 10%, T5–T6 5%. Shrub layer T4–T6, 5%: mainly *Coprosma propinqua, Ribes uva crispa, Melicope simplex, Sambucus nigra, Muehlenbeckia australis*. Ground layer T5–T6, 10%: scattered exotic herbs and grasses.
24a (adjacent)	E 2169599 N 5505567	300	130/40	Sharp colluvium	*Not sol* 11–22–37 15	Canopy trees *Not sol*: T2 30%, T3 15%, T4 10%, T5–T6 5%. *Not fus*: T2 5%. Shrub layer T4–T6, 10%: mainly *Corokia cotoneaster, Helichrysum lanceolatum, Muehlenbeckia australis, Rubus cissoides, Coprosma* sp. Ground layer T5–T6, 5%: scattered exotic herbs and grasses. Few *Ace pse* seedlings
24b	E 2169573 N 5505572	300	130/40	Sharp colluvium	*Ace pse* 2–4–6 15	Canopy trees *Not sol*: T2 10%, T3–T4 5%; T5–T6 1%: *Ace pse*: T4 5%, T5–T6 2%. Shrub layer T4–T6, 5%: mainly *Ribes sanguineum, Carpodetus serratus, Griselinia littoralis, Coprosma* sp., *C. propinqua, Rubus cissoides.* Ground layer T5–T6, 5%: *Mycelis muralis, Polystichum richardii.*

24c	E 2169630 N 5505581	280	115/35	Sharp colluvium	*Ace pse* 3–6–16 8	Canopy trees *Ace pse*: T3 30%, T4 20%; T5–T6 2%. *Ace pse*: T4 5%, T5–T6 2%. Shrub layer T4–T6, 14%, mainly *Coprosma propinqua, Ribes sanguineum, Pittosporum tenuifolium, Cytisus scoparius, Rosa rubiginosa, Hebe salicifolia*. Ground layer T5–T6, 8%, scattered exotic grasses and herbs.

[1]Plots (a, b, etc.) are within or near the sycamore stands (1, 2, etc.) indicated in Appendix 1.

[2]*Ace pse* (*Acer pseudoplatanus* sycamore), *Not fus* (*Nothofagus fusca* red beech), *Not sol* (*Nothofagus solandri* mountain beech).

[3]Tier 1, >25 m; Tier 2, 12–25m; Tier 3, 5–12 m; Tier 4, 2–5m; Tier 5, 0.3–2m; Tier 6, <0.3 m.