ELEMENT STEWARDSHIP ABSTRACT
for

Rubus discolor, (*Rubus procerus*)

Himalayan Blackberry

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The Nature Conservancy
Element Stewardship Abstract
For *Rubus discolor*, (*Rubus procerus*)

I. IDENTIFIERS

Common Name: Himalayan blackberry

General Description:
The following description of Rubus discolor is taken from Munz and Keck (1973).

Rubus discolor is a robust, sprawling, more or less evergreen, glandless shrub of the Rose Family (Rosaceae). The shrubs appear as "great mounds or banks" (Bailey 1945), with some of the canes standing up to 3 m tall. Other canes are decumbent, trailing or scandent up to 20-40 feet long (Bailey 1923), frequently taking root at the tips. The primocanes are pilose-pubescent, becoming nearly glabrous with age. These are very strongly angled and furrowed, bearing well-spaced, heavy, broad-based, straight or somewhat curved prickles 6-10 mm long. Primocane leaves are 5-foliolate, glabrous above when mature and cano-pubescent to cano-tomentose beneath. There are hooked prickles on the petioles and petiolules. The leaflets are large and broad with the terminal leaflet roundish to broad oblong. Leaflets are abruptly narrowed at the apex, unequally and coarsely serrate-dentate. Floricane leaflets are 3-5 foliolate and smaller than on the primocanes.

The inflorescence is a large terminal cluster with branches in the lower axils. The peduncles and pedicels are cano-tomentose and prickly. The flowers are white or rose colored, 2-2.5 cm across, with broad petals. Sepals are broad, cano-tomentose, conspicuously pointed and soon reflexed, approximately 7-8 mm long. The roundish fruit is black and shiny, up to 2 cm long, with large succulent drupelets. The fruit ripens late compared with native blackberries and over a considerable interval (Bailey 1945), from midsummer to autumn (Bailey 1923).

II. STEWARDSHIP SUMMARY

III. NATURAL HISTORY

Habitat:
Contrary to its common name, Himalaya-berry is a native of western Europe (Munz and Keck 1973). There is no botanical evidence to show that it is native of the Himalayan region. It may have found its way there as a cultivar (Bailey 1923). Rubus discolor was probably first introduced to North America in 1885 as a cultivated crop as well (Bailey 1945). By 1945 R. discolor had become naturalized along the West Coast. It also occurred in nursery and experiment grounds along the East Coast and in Ohio (Bailey 1945) by this time. R. discolor occurs mainly in areas with an average annual rainfall greater than 76 cm, at altitudes up to 1800 m, and on both acidic and alkaline soils (Amor 1972). It forms impene¬trable thickets in wastelands, pastures, and forest plantations (Amor 1973). It grows along roadsides, creek gullies, river flats, fence lines (Parsons and Amor 1968), and right-of-way corridors. R. discolor tends to prefer wet sites even in relatively wet climates (Amor and Stevens 1976).

Reproduction:
Rubus discolor is a part of the Rubus fruticosus aggregate.

VEGETATIVE REPRODUCTION
Rooting at Cane Tips: R. discolor can form roots at cane apices. Amor (1974a) observed canes growing to a height of 40 cm before they arched over and trailed on the ground. Daughter plants developed where these canes rooted, forming only on first-year canes. All canes produced berries in the second year and

then died, senescence commencing near the middle and at the apices of canes without daughter plants. Re-entry of canes into the center of the thicket resulted in an impenetrable mass of prickly canes within 2-1/2 years. Individual canes may only live 2-3 years, yet reach a density of 525 canes per square meter. A large quantity of litter and standing dead canes develops in old thickets (Amor 1972).

Canes of R. discolor can grow to lengths of up to 7 m in a single season. At one site observed by Amor (1974a), the mean horizontal projection of 50 first-year canes was 3.3 m. Ninety-six percent of these canes had daughter plants at their apices. Lateral branches on some canes had also formed daughter plants.

Adventitious Shoots on Lateral Roots: The root crown on R. discolor can be up to 20 cm in diameter, from which many lateral roots grow at various angles. One measured root had a maximum depth of 90 cm but was more than 10 m long (Northcroft 1927). Adventitious shoots (suckers) are occasionally formed on the roots and may emerge from a depth of 45 cm. Blackberries also readily propagate from root pieces and cane cuttings (Amor 1974a). In less than two years a cane cutting can produce a thicket 5 m in diameter (Amor 1973).

SEXUAL REPRODUCTION

Seed Production: Himalaya-berry thickets can produce 7000-13,000 seeds per square meter (Amor 1974a). When grown in dense shade, however, most species of blackberry do not form seeds. Good seed crops occur nearly every year (Brinkman 1974).

Each seed contains two ovules, but one usually aborts (Kerr 1954). The seeds are contained in berries, which consist of a number of loosely adhering drupelets. Berries ripen and turn black during the summer on canes more than one year old. Each drupelet contains one seed.

Seed Dispersal: Dispersal of Rubus seeds by birds has been reported by several authors (Amor 1974a). Passage of the seed through the digestive tract of birds may improve germination. Dispersal may also be accomplished by omnivorous mammals such as foxes, as suggested by numerous authors with respect to Australia (Brunner et al. 1976, Amor and Stevens 1976). The prompt invasion of cutover lands by Rubus indicates that the dispersed seeds remain viable in the soil for several years (Brinkman 1974).

Germination and Seedling Establishment: Blackberry seeds germinate mainly in the spring, but there is little germination of seed in the first spring after the seed is formed (Kerr 1954). Brinkman (1974) reported 33 percent germination in un-aged R. discolor seeds. A three year field trial showed only 10 percent germination in Rubus discolor (Amor 1972).

In Australia R. discolor seedlings receiving less than 44 percent of full sunlight did not survive (Amor 1974a). The slow growth of seedlings and their susceptibility to shading suggest that few seedlings would be expected to survive in dense pastures or forest plantations. Blackberry thickets are also poor sites for seedling development. Amor (1972) counted less than 0.4 seedlings per square meter near thickets. The establishment of šR. discolor seedlings depends on the availability of open habitats such as land neglected after cultivation, degraded pastures, and eroded soils along streams (Amor 1974a). Although seedlings show the potential for rapid growth under laboratory conditions, they grow much slower in the field and are easily surpassed by the more rapid growth rate of daughter plants.

Rubus discolor colonizes areas initially disturbed and then neglected by humans. It is a perennial weed which is difficult to control due to its ability to regenerate from sections of root stock. The production of dense thickets, especially in wet areas, may hinder medium- to large-ized mammals in gaining access to water. Himalaya-berry may also displace native plant species. Seeds can be widely dispersed by berry-eating birds.

Himalaya-berry occurs on TNC's Santa Rosa Plateau and McCloud River preserves in California.

IV. CONDITION

V. MANAGEMENT/MONITORING

Management Requirements:
With proper management, areas infested with R. discolor can be restored to more desirable vegetation. Mechanical removal or burning may be the most effective ways of removing the mature plants. Subsequent treatment with herbicides should be conducted cautiously for two reasons: (1) R. discolor often grows in riparian areas and the herbicide may be distributed to unforeseen locations by running water, and (2) some herbicides promote vegetative growth from lateral roots. Himalaya-berry re-establishment may be prevented by planting fast-growing shrubs or trees, since the species is usually intolerant of shade. Regrowth has also been controlled by grazing sheep and goats in areas where the mature plants have been removed.

Monitoring is needed to determine the effectiveness of management practices.

Detailed observations focused on the vegetational change of the affected area over time will help to determine what method of control would be most efficient.

No quantitative monitoring studies of Himalaya-berry were discovered in this research. Since it is not considered a major agricultural weed in California, there has been little interest or funding available for detailed sampling programs. Monitoring efforts so far have been only qualitative in nature: Has it invaded a site? Does it re-establish itself following control treatment?

Weed control involves three fundamental objectives: prevention, eradication and control.

From a practical viewpoint, methods of weed management are commonly categorized under the following categories: physical, managerial, biological and chemical controls, and prescribed burning (Watson 1977). Physical methods include both manual and mechanical means. Managerial methods include the encouragement of competitive displacement by native plants and prescribed grazing. Biological control is usually interpreted as the introduction of insects or pathogens which are highly selective on a particular weed species. Chemical control includes both broadcast and spot application. Prescribed burning includes both broadcast burning and spot treatment with a flame thrower.

The most desirable approach is that of an integrated pest management plan. This involves the optimal integration of appropriate control strategies to control weeds. This approach is generally accepted as the most effective, economical and environmentally sound, long-term pest control strategy (Watson 1977). In cases where more than one control technique is used, the various techniques should be compatible with one another. Broadcast herbicide application, for example, may not work well with certain managerial techniques (i.e., plant competition).

PHYSICAL CONTROL
The physical control methods discussed below, manual and mechanical, produce slash (i.e., cutting debris) that can be disposed of by several techniques. If cut before seeds are produced it may be piled and left for enhancement of wildlife habitat (i.e., cover for small mammals). Debris may be fed through a mechanical chipper and used as mulch during revegetation procedures. Particularly with Rubus, care should be taken to prevent vegetative reproduction from cuttings. Burning slash piles is also an effective method of disposal.

MANUAL METHODS
Manual methods use hand labor to remove undesirable vegetation. These methods are highly selective and permit weeds to be removed without damage to surrounding native vegetation.

The Bradley Method is one sensible approach to manual control of weeds (Fuller and Barbe 1985). This method consists of hand weeding selected small areas of infestation in a specific sequence, starting with the best stands of native vegetation (those with the least extent of weed infestation) and working towards those stands with the worst weed infestation. Initially, weeds that occur singly or in small groups should be eliminated from the extreme edges of the infestation. The next areas to work on are those with a ratio of at least two natives to every weed. As the native plants stabilize in each cleared area, work deeper into the center of the most dense weed patches. This method has great promise on nature reserves with low budgets and sensitive plant populations. More detailed information is contained in Fuller and Barbe (1985).

Hand Pulling: This method may be used to destroy seedlings and young plants up to 1 m tall. Seedlings are best pulled after a rain when the soil is loose. This facilitates removal of the rooting system, which may resprout if left in the ground. Plants should be pulled as soon as they are large enough to grasp but before they produce seeds.

Hand Hoeing: Plants can be destroyed readily while they are still small by hand hoeing, either by cutting off their tops or by stirring the surface soil so as to expose the seedlings to the drying action of the sun. The object of hoeing is to cut off weeds without going too deeply into the ground and doing damage to the roots of desirable vegetation.

For plants up to 4 m tall a claw mattock is effective for removing the root crowns. The dirt around the root is loosened by the claw, and the plant is pulled out in the same way that a claw hammer is used to pull out nails.

Cutting: Manually operated tools such as brush cutters, power saws, axes, machetes, loppers and clippers can be used to cut R. discolor. This is an important step before many other methods are tried, as it removes the above-ground portion of the plant. In addition, for a thickly growing, multi-stemmed shrub such as R. discolor, access to the base of the shrub may not only be difficult but dangerous where footing is uncertain.

An advantage of cane removal over foliage herbicides is that cane removal does not stimulate sucker formation on lateral roots. Amor (1974b) provides evidence that herbicides such as picloram and 2,4,5-T are not considerably more effective than cane removal. However, removal of canes alone is insufficient to adequately control Rubus discolor, as the root crown will simply resprout and produce more canes.

Hand Digging: The removal of rootstocks by hand digging is a slow but sure way of destroying R. discolor, a weed which resprouts from its roots. The work must be thorough to be effective as every piece of root that breaks off and remains in the soil may produce a new plant. Such a technique is only suitable for small infestations and around trees and shrubs where other methods are not practical.

MECHANICAL METHODS

Mechanical methods use mechanized equipment to remove above-ground vegetation. These methods are often non-selective in that all vegetation on a treated site is affected. Mechanical control is highly effective at controlling woody vegetation on gentle topography with few site obstacles such as root stumps or logs. Most mechanical equipment is not safe to operate on slopes over 30 percent. It is also of limited use where soils are highly susceptible to compaction or erosion or where excessive soil moisture is present.

Chopping, Cutting or Mowing: Rubus discolor plants may be trimmed back by tractor-mounted mowers on even ground or by scythes on rough or stony ground. Unwanted vegetation can be removed faster and more economically in these ways than by manual means and with less soil disturbance than with scarification. However, these methods are non-selective weed eradication techniques. They reduce the potential for biological control through plant competition and may open up new niches for undesirable vegetation. Wildlife forage is eliminated, cutting down on the general habitat value of the area. Another disadvantage of cutting, chopping or mowing is that perennial weeds such as Himalaya-berry usually

require several cuttings before the underground parts exhaust their reserve food supply. If only a single cutting can be made, the best time is when the plants begin to flower. At this stage the reserve food supply in the roots has been nearly exhausted, and new seeds have not yet been produced. After cutting or chopping with mechanical equipment, Rubus may resprout from root crowns in greater density if not treated with herbicides.

PRESCRIBED BURNING

Broadcast Burning: Large areas of weed infestation may be burned in order to remove the standing mature plants. This may be accomplished with a pre-spray of herbicides, to kill and desiccate plants, or without such spraying for notably flammable species. Used alone, this method will not prevent resprouting from root crowns. Burning is best followed by (1) stump herbi¬cide treatment, (2) subsequent burning to exhaust soil seed bank and underground food reserves, and/or (3) revegetation with fast©growing native species. Other considerations for the use of prescribed burning include the time and cost of coordinating a burn and the soil disturbance resulting from firebreak šconstruction.

MANAGERIAL CONTROL

Biological Competition: Sowing native plant species which have the potential to out-compete weedy exotics for important resources is usually a preventive method of weed control. In some cases later successional plants may be encouraged to take root among the unwanted vegetation.

In most cases Himalaya-berry prevents the establishment of other native plants and must be initially removed. Following physical removal or burning of mature plants, root crowns must be treated to prevent resprouting. Seedlings of native plant species usually cannot establish fast enough to compete with sprout growth from untreated stumps.

Some plant species inhibit the establishment or growth of other plants through the effects of allelopathy (i.e., biochemical interference by metabolic products). Native species with such properties may be propagated in treated areas to control re-establishment of blackberry, but as allelopathy is occasionally a trait of noxious weeds, it is wise not to replace an old problem species with a new one.

Prescribed Grazing: Amor (1974a) described the effects of grazing by various animals on Himalaya-berry as follows: In an ungrazed area, 96% of the plants produced daughter plants; in areas grazed lightly by horses the number dropped to 11%; in areas grazed by cattle only 1% of all plants had daughter plants; and no plants had daughter plants in areas grazed by sheep.

In New Zealand the recognized method of Rubus control in the past has been the farming of large numbers of goats. This method has been effective in preventing canes from totally covering large areas (Wright 1927, Featherstone 1957). Crouchley (1980) mentions that blackberry is readily eaten by goats throughout the year, even when there is an abundant supply of pasture and other plants.

In many areas of California the use of Angora and Spanish goats is showing promise as an effective control for Himalaya-berry (Daar 1983). In Cleveland National Forest goats are herded for firebreak management of brush species on over 79,000 acres of land. Goats are less costly to utilize than mechanical and chemical control methods. They can negotiate slopes too steep to manage with machines and do not pose the environmental dangers inherent with herbicides (Andres 1979).

A pioneer in the use of goats for weed control in urban settings is Richard Otterstad, owner of Otterstad's Brush Clearing Service (718 Adams St., Albany, CA 94706, (415) 524-4063). The primary weed control "tools" utilized by Otterstad's company are Angora goats and light-weight flexible fencing reinforced with electri¬fied wire. Angoras are preferred over Spanish goats because their smaller size makes them easier to transport (Otterstad uses a pickup truck). Dairy goats were abandoned when Otterstad found them to be "goof-offs" when it came to eating (Daar 1983).

Goats prefer woody vegetation over most grasses or forbs, although Angoras have a higher tolerance for non-woody species. Since goats will trample or browse virtually any vegetation within a fenced area, any desirable trees or shrubs must be protected. Experience has shown that goats are most cost-effective when used to clear or suppress brush regrowth of one to four years old rather than to do initial clearing of dense tall, mature stands of vegetation. When faced with mature brush, goats will defoliate twigs and strip off bark but will leave standing the plant's main superstructure which is too old and tough to tempt them. Sheep are more selective than goats in their food choices but function well in grazing down a variety of plants. Thus sheep grazing may be a practical alternative to mowing. It is impor¬tant to properly manage sheep grazing due to soil compaction problems if sheep are allowed to graze an overly damp area. Sheep are valuable not only for weed control but also for their contribution of fertilizer to the soil and additional income from the sale of their wool. However, exotic seeds may be initially introduced from sheep droppings.

Chickens, surprisingly enough, are known to effectively digest (and destroy) all weed seeds passing through their crops and can thoroughly graze back vegetation in areas of up to one acre in size. Releasing chickens into an area after the mature plants are removed allows them to scratch and peck out weed seeds and potentially reduce the weed seed bank in the soil (Andres 1979).

BIOLOGICAL CONTROL

The USDA will not support the introduction of herbivorous insects to control Himalaya-berry due to the risk these insects may pose to commercially important Rubus species. Please notify the California Field Office of The Nature Conservancy of any field observations in which a native insect or pathogen is seen to have detrimental effects on Rubus species. These reports will be used to update this Element Stewardship Abstract. Management techni¬ques which may encourage the spread of species-specific agents may be desirable in controlling Himalaya-berry.

CHEMICAL CONTROL

Detailed information on herbicides is available in such publications as Weed Science Society of America (1983) or USDA (1984) and will not be comprehensively covered here. Publications such as these give specific information on nomenclature, chemical and physical properties of the pure chemical, use recommendations and precautions, physiological and biochemical behavior, behavior in or on soils, and toxological properties for several hundred chemicals.

Herbicides may be applied non-selectively (i.e., broadcast applications) or selectively (i.e., spot treatments). Both types of treatments have advantages and disadvantages and will be discussed separately.

Broadcast Herbicide Application: Broadcast application of herbicides has become the mainstay of most weed control efforts today. This may be due to the illusion that it is a "quick fix" method of eradicating undesirable vegetation. Most herbicides so applied are non-selective and will kill most, if not all, of the vegetation sprayed. Those species which survive the treatment may, after repeated sprayings, form an herbicide-resistant vegetation cover, thus creating a more difficult problem to deal with. Such broadcast spraying may also kill off native plants which have the ability to out-compete exotic weeds.

Herbicides should be applied only when the plants are in full leaf. Results are poor if the plants are sprayed prior to this stage. The best results occur when plants are sprayed after seed-set (Matthews 1960).

Broadcast herbicide application may be most effective where the weed infestation is very dense and needs to be killed and desiccated prior to burning. It may also be useful following the removal of mature plants so as to reduce the soil seed bank.

Picloram (Tordon) is effective (Patterson 1964, Pengelly and Ferguson 1964, Patterson 1965, Amor 1974b), but one application may not always be sufficient (Patterson 1964, Amor 1975a). Picloram

suppresses cane regrowth but stimulates the development of adventitious shoots (Amor 1974b). Foliage spraying is more effective in the summer than winter (Amor 1975a).

Many other herbicides have been used in an attempt to control Himalaya-berry with varying degrees of effectiveness. Fosamine is not as effective for killing Rubus discolor, but it is more effective in controlling regrowth (Shaw and Bruzzese 1979). Neither Fosamine norglyphosate (Dempsey 1981, Park and Lane 1983) provide long-term control of R. discolor. Blackberry control has also been accomplished with dicamba (Amor 1970), aminotriazole (Amor 1975a), amitrole-thiocyanate (Boyd 1964, Amor 1972) and triclopyr ester (McCavish 1980).

Spot Chemical Methods: Spot chemical methods consist of various techniques for manually applying herbicides to individual plants or small clumps of plants (such as stump resprouts). These methods are highly selective as only specific plants are treated. They are most efficient when the density of stems to be treated is low. In applying herbicides it is recommended that a dye be used in the chemical mixture to mark the treated plants and thus minimize waste.

Jones and Stokes Associates (1984) reviewed a variety of spot chemical techniques. The following is an excerpt from this report, listing techniques in order of increasing possibility of herbicide exposure to the environment or to humans in the vicinity of treated plants.

1) Stem injection: Herbicides are injected into wounds or cuts in the stems or trunks of plants to be killed. The herbicide must penetrate to the cambial tissue and be water-soluble to be effective. The chemical is then translocated throughout the plant and can provide good root kill, which is important in order to prevent resprouting.

2) Cut stump treatment: Herbicides are directly applied to the cambial area around the edges of freshly cut stumps. Application must occur within 5-20 minutes of cutting to ensure effectiveness. McHenry (1985) suggests late spring as the best season to do this. In early spring sap may flow to the surface of the cut and rinse the chemical off. At other times of the year translocation is too poor to adequately distribute the chemical. Applications may be made with backpack sprayers, sprinkling cans, brush and pail, or squeeze bottles. Picloram should not be used for this technique as it is known to "flashback" through root grafts between treated and untreated plants and may damage the untreated individuals.

3) Basal/Stem sprays: High concentrations of herbicides in oil or other penetrating carriers are applied, using backpack sprayers, to the basal portion of stems to be killed. The oil carrier is necessary for the mixture to penetrate bark and enter the vascular system. This method gives good root kill, especially in the fall when vascular fluids are moving toward the roots. This method may be easier to use with small diameter stems than the two previous techniques.

4) Herbicide pellets: Pelletized or granular herbicides are scattered at the bases of unwanted plants. Subsequent rainfall dissolves the pellets and leaches the herbicide down to the root system. Picloram granules are most effective in the winter and spring (Amor 1970) and should be applied prior to the end of the winter rains so as to allow the herbicide to penetrate to the root zone. Premature application, with a great deal of rain yet to fall, may leach the picloram below the root zone. Mowing of the top growth prior to the application of granular picloram improves control effectiveness. The presence of litter may retard the infiltration of the chemical into the soil (Amor 1970). Because picloram persists in the soil, is highly toxic to other plants and is costly, it is most suitable for small infestations (Amor 1975b).

Rubus discolor is difficult to control due to its variety of reproductive tactics. It may reproduce by seed, rooting at cane apices, suckering of lateral roots, and from pieces of roots and canes. It becomes established in disturbed and subsequently neglected areas.

Himalaya-berry rarely invades undisturbed sites because seedlings are easily outcompeted by other plants. Rooting at cane apices may be prevented by grazing, cultivation or herbicides. Cultivation or herbicides may be the only effective means of removing the root system, which must be killed to prevent regrowth.

VI. RESEARCH

Management Research Programs:
1) What methods may be used to prevent dispersal of seeds by birds?
2) Which method of propagation is the more significant, daughter plants or seedling establishment?
3) Is it possible to selectively treat Himalaya©berry when it grows in a mixed native and exotic berry thicket?

VII. ADDITIONAL TOPICS

VIII. INFORMATION SOURCES

Bibliography:

CITED REFERENCES

Amor, R.L. 1970. Comparison of granular herbicides for the control of blackberry (Rubus fruticosus L. agg.) regrowth in non-arable pasture. Pp. 673-676 in Proc. 11th Intl. Grassland Congress, Surfers' Paradise, Australia. 13-23 April.

Amor, R.L. 1972. A study of the ecology and control of blackberry (Rubus fruticosus L. agg.). J. Austral. Inst. Agric. Sci. 38(4):294.

Amor, R.L. 1973. Ecology and control of blackberry (Rubus fruticosus L. agg.): I. Rubus spp. as weeds in Victoria. Weed šRes. 13:218-223.

Amor, R.L. 1974a. Ecology and control of blackberry (Rubus fruticosus L. agg.): II. Reproduction. Weed Res. 14:231-238.

Amor, R.L. 1974b. Ecology and control of blackberry (Rubus fruticosus L. agg.): III. Response of R. procerus to mechanical removal of top growth and to foliage applied herbicides. Weed Res. 14:239-243.

Amor, R.L. 1975a. Ecology and control of blackberry (Rubus fruticosus L. agg.): IV. Effect of single and repeated applica¬tions of 2,4,5-T, picloram and aminotriazole. Weed šRes. 15:39-45.

Amor, R.L. 1975b. Ecology and control of blackberry (Rubus fruticosus L. agg.): V. Control by picloram granules. Weed Res. 15:47-52.

Amor, R.L. and P.L. Stevens. 1976. Spread of weeds from a roadside into sclerophyll forests at Dartmouth, Australia. Weed šRes. 16:11-118.

Andres, L. 1979. Unpublished manuscript. Copy on file with the California Field Office of The Nature Conservancy, 785 Market Street, 3rd Floor, San Francisco, CA 94103.

Bailey, L. 1923. Certain cultivated Rubus. Gentes Herbarium 1(4):196-197.

Bailey, L. 1945. The genus Rubus in North America. Gentes Herbarium 5(1):851-854.

Bell, J.E. 1955. Weed problems of the Waikato. Pp. 7-12 in Proc. 8th New Zealand Weed and Pest Control Conference.

Boyd, P.G. 1964. Field observations with thiocyanate-activated amitrole. Pp. 115-118 in Proc. 17th New Zealand Weed and Pest Control Conference.

Brinkman, K.A. 1974. Rubus. Pp. 738-743 in C.S. Schopmeyer (ed.), Seeds of woody plants in the U.S. Agriculture Handbook No. 450. U.S. Govt. Printing Office, Washington, D.C.

Brunner, H., R.V. Harris, and R.L. Amor. 1976. A note on the dispersal of seeds of blackberry (Rubus procerus) by foxes and emus. Weed Res. 16:171-173.

Cornwell, M.J. and M.S. Christie. 1984. Preliminary results with DPX-T67376 for control of gorse and blackberry. Pp. 197-199 in Proc. 37th New Zealand Weed and Pest Control Conference.

Crouchley, G. 1980. Regrowth control by goats - plus useful meat returns. N.Z. J. Agric. 141(5):9-14.

Daar, S. 1983. Using goats for brush control. The IPM Practitioner 5(4):4-6.

Dempsey, G.P. 1981. The failure of fosamine and glyphosate to give long©term control of blackberry in Northland. Pp. 152-155 in Proc. 34th New Zealand Weed and Pest Control Conference.

Featherstone, C.I. 1957. The progress of chemical weed control in Hawke's Bay. Pp. 7-12 in Proc. 10th New Zealand Weed and Pest Control Conference.

Fuller, T.C. and G.D. Barbe. 1985. The Bradley Method of eliminating exotic plants from natural reserves. Fremontia 13(2):24-26.

Johnston, W. 1955. Control of difficult scrub weeds. Pp. 61-64 in Proc. 8th New Zealand Weed and Pest Control Conference.

Jones and Stokes Associates. 1984. Transmission right-of-way vegetation management program: analysis and recommendations. Prepared for Seattle City Light. Copy on file with the California Field Office of The Nature Conservancy, 785 Market Street, 3rd Floor, San Francisco, CA 94103.

Kerr, E.A. 1954. Seed development in blackberries. Can. J. Botany 32:654-657.

Matthews, L.J. 1960. Weed identification and control: broom. N.Z. J. Agric. 100(3):229.

McCavish, W.J. 1980. Herbicides for woody weed control by foliar application. Pp. 729-737 in Proc. 1980 Brit. Crop Protect. Conference -Weeds.

McHenry, J. 1985. Extension Weed Specialist, University of California, Davis, Cooperative Extension. Personal communication. May 1985.

Moffatt, R.W. 1965. A summary of investigations with picloram on certain scrub weeds. Pp. 17-23 in Proc. 18th New Zealand Weed and Pest Control Conference.

Moffatt, R.W. 1966. Picloram granules for woody weed control. Pp. 90-95 in Proc. 19th New Zealand Weed and Pest Control Conference.

Munz, P.A. and D.D. Keck. 1973. A California flora and supplement. Univ. California Press, Berkeley.

Northcroft, E.G. 1927. The blackberry pest. I. Biology of the plant. N.Z. J. Agric. 34:376-388.

Park, O.L. and P.M.S. Lane. 1983. Blackberry control with glyphosate. Pp. 200-202 in Proc. 37th New Zealand Weed and Pest Control Conference.

Parsons, W.T. and R.L. Amor. 1968. Comparison of herbicides and times of spraying for the control of blackberry (Rubus fruticosus). Austral. J. Exper. Agric. and Animal Husbandry 8:238-243.

Patterson, T.M. 1964. Departmental trials with "Tordon." Pp. 68-73 in Proc. 17th New Zealand Weed and Pest Control šConference.

Patterson, T.M. 1965. Departmental trials with picloram. Pp. 24-31 in Proc. 18th New Zealand Weed and Pest Control Conference.

Pengelly, R. and R.H. Ferguson. 1964. Overseas and New Zealand field results with "Tordon." Pp. 222-228 in Proc. 17th New Zealand Weed and Pest Control Conference.

Rae, S.J. and T.M. Patterson. 1975. Scrub weed control with thiazafluron. Pp. 67-69 in Proc. 28th New Zealand Weed and Pest Control Conference.

Richardson, R.G. 1975a. Foliar penetration and translocation of 2,4,5-T in blackberry (Rubus procerus). Weed Res. 15:33-38.

Shannon, P.W. and J.M. Leslie. 1982. Chemical control of blackberry in Northland. Pp. 166-168 in Proc. 35th New Zealand Weed and Pest Control Conference.

Shaw, K.A. and E. Bruzzese. 1979. The use of fosamine for control of two Rubus species. Pp. 189©192 in Proc. 7th Asian-Pacific Weed Sci. Soc. Conference.

Skinner, H.R.W. 1954. Scrub control. Pp. 90-92 in Proc. 7th New Zealand Weed and Pest Control Conference.

Taylor, R.L. and J. Patterson. 1969. Control of scrub weeds with 2,4,5-T plus dicamba. Pp. 178-179 in Proc. 22nd New Zealand Weed and Pest Control Conference.

USDA. 1984. Pesticides background statements. Vol. I. Herbicides. Agricultural Handbook No. 633. U.S. Govt. Printing Office, Washington, D.C.

Upritchard, E.A. 1969. Formulations of picloram with 2,4,5-T for brushweed control. Pp. 180-186 in Proc. 22nd New Zealand Weed and Pest Control Conference.

Watson, H.K. 1977. Present weed control and projections for the year 2001. Unpublished manuscript. Copy on file with the California Field Office of The Nature Conservancy, 785 Market Street, 3rd Floor, San Francisco, CA 94103.

Weed Science Society of America. 1983. Herbicide handbook.

Wright, R. 1927. Goats and noxious weeds control - elimination of blackberry, gorse and bracken on a taranaki farm. N.Z. J. Agric. 25(5):295-297.

OTHER (UNCITED) REFERENCES

Balneaves, J.M. 1981. The use of 2,4,5-T in forestry in the South Island, New Zealand. N.Z. J. Forestry 26(2):232-244.

Elliott, I.L. 1955. Pasture management and weed control. Pp. 42-43 in Proc. 8th New Zealand Weed and Pest Control šConference.

Elliott, D.A. 1976. The use of herbicides in releasing operations at Kaingaroa Forest. Pp. 283-292 in C.G.R. Chevasse (ed.), The use of herbicides in forestry in New Zealand. N.Z. Forest Res. Service, For. Res. Inst. Symp. 18.

Matthews, L.J. 1982. Pasture weeds of New Zealand. Pp. 387-393 in šW. Holzner and N. Numota (eds.), Biology and ecology of weeds. W. Junk Publishers, The Hague.

Richardson, R.G. 1975b. Regeneration of blackberry (Rubus procerus) from root segments. Weed Res. 15:335-337.

Richardson, R.G. 1976. Changes in the translocation and distribution of 2,4,5-T in blackberry (Rubus procerus) with time. Weed Res. 16:375-378.

Richardson, R.G. and R.L. Amor. 1975. Effect of 2,4,5-T and picloram on the regeneration of blackberry (Rubus procerus) from root segments. Weed Res. 15:227-231.

Rolston, M.P., M.G. Lambert, and D.A. Clark. 1981. Weed control options in hill country. Proc. N.Z. Grassland Association 43:196-203.

Watt, G. and J. Tustia. 1976. The economics of herbicides in New Zealand plantation practice. Pp. 293-301 in C.G.R. Chevasse (ed.), The use of herbicides in forestry in New Zealand. N.Z. Forest Res. Serv., For. Res. Inst. Symp. 18.

Yeates, J.S. 1955. Weeds on the sheep farm: the scope and limitations of chemical control. Sheepfarming Annual 1955:99-109.

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