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Practitioner's Guide for Effective Non-Restricted Herbicide Techniques to Control and Suppress Invasive Woody Species in Hawai'i

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This herbicide reference guide is intended for private or public non-commercial applicators conducting invasive weed management in the state of Hawai'i. It focuses on selective techniques to treat individual woody tree and shrub species with improved herbicide and species information. This bulletin complements CTAHR Extension Bulletin WC-4 *Woody Plant Control for the Home, Pasture, and Forest* (Motooka et al. 1999) and also builds on the *Summaries of Herbicide Trials for Pasture, Range, and Non-Cropland Weed Control* produced by Phil Motooka from 1998 to 2002 (WC 1, 5, 6, 7, and 9). Some of the herbicides previously shown to be effective are now restricted use, making these active ingredients a less practical management option. This bulletin only lists non-restricted herbicides registered in the State of Hawai'i as of 2012 and provides four basic tables for assisting with management decisions in (i) application techniques, (ii) active ingredient mode of action and use pattern, (iii) target species information, and (iv) maximum target treatment densities.

Fig. 1. Herbicide injected into a stem cut that is just deep enough to expose the cambium.

The application techniques presented in this publication are "tried and true" methods for individual plant treatment, including foliar, basal bark, cut stump, and injection. When performed correctly, these techniques are safe for the applicator and leave a very small footprint on the landscape. We only provide a brief description of the techniques here. To learn more, refer to *Herbicidal Weed Control Methods for Pastures and Natural Areas of Hawaii* (Motooka et al. 2002) and *Herbicide Application Techniques for Woody Plant Control* (Ferrell et al. 2006). Both documents are available on the Web. Practitioners are also encouraged to calibrate their application techniques with water before using an herbicide.

This bulletin makes reference to both chemical names (i.e., active ingredients) and the corresponding product trade names in an effort to promote a better association. Many commercial products have similar active ingredient compositions and should demonstrate equal performance in efficacy. However, different trade name products with the same active ingredient may not have

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the same use patterns listed on the label. The practitioner has a legal obligation to be sure that their intended use pattern is approved on the product label they are using. **Always read and understand the label on the product container to determine if the intended herbicide application is approved and legal**. Every label gives a reminder of this enforcement standard in the form of a misuse statement: "*It is a violation of federal law to use this product in a manner inconsistent with its labeling*." This means that a pesticide user's action or inaction is a "misuse" of the pesticide if the label instructions and restrictions are not followed.

Prohibited acts, according to the Hawaii Pesticides Law – Chapter 149A of the Hawaii Revised Statutes:

- Any pesticide use **inconsistent** with its label
- Pesticide application **dosage**, **concentration**, or **frequency** that is **greater than** label specification
- Pesticide application to a crop, animal, or **site** that is **not specified** on the label
- Employing a **method of application** that is specifically **prohibited** on the label

Table 1. Application techniques for individual treatment of woody tree and shrub weed species

Method	Definition	Herbicide Mix[a]	Calibration	Tools	Pro	Con
Foliar spray (F)	Water-diluted, low-concentration herbicide, high-volume application broadcast directed to leaf surfaces	Active ingredient <1%–10% v/v, surfactant adjuvant <2% v/v, water carrier >90% v/v	Flow rate (fl oz/sec), wand speed[b] (ft/s), spray swath (ft), target rate: 1–3 fl oz /10 ft2	Hose sprayers or backpack hand-pump sprayer (4 gal), flat fan or solid-stream nozzle	Low concentration, affordable equipment, ability to treat large areas	Not practical on large trees, high water use, heavy payload, potential non-target drift injury, dead standing biomass
Basal bark (B)	Oil-diluted, high-concentration herbicide, high-volume application directed at the base of main stems	Active ingredient 10–50% v/v, penetrant oil adjuvant 50–90% v/v	Flow rate (fl oz/sec), stem circumference (in), target rate: 1–2 fl oz/stem	Squirt bottle or small hand-pump sprayer (1 gal), full cone or solid-stream nozzle	Easy application, no water consumption, no non-target injury	Less effective on large trees, dead standing biomass
Cut stump (C)	Oil-diluted or undiluted, high-concentration herbicide, high-volume application directed at the cambium of the cut stump surface	Active ingredient 10–100% v/v, penetrant oil adjuvant 0–90% v/v	Flow rate (fl oz/sec), stem circum. (in), target rate: 1–2 fl oz/stump	Chain saw, squirt bottle or small hand-pump sprayer (1 gal), full cone or solid-stream nozzle	Biomass reduced, no non-target injury	Most labor-intensive, physical injury hazard
Injection[c] (I)	Water-diluted, high-concentration herbicide, low-volume application directed into the cambium of main stems	Active ingredient 10-100% v/v, water carrier 0–90% v/v	Delivery volume (cc), stem circumference (in), target rate: < 1 fl oz/stem	Hatchet or machete, syringe (1–2 cc)	Effective on large trees, easy calibration, light payload, high use efficiency, simple application, no non-target injury	Custom precision equipment, dead standing biomass

[a] v/v = volume product/volume total solution [b] Wand speed is how fast you sweep the nozzle, using a front-to-back or side-to-side arm motion. [c] Injection (I) also known as frill, girdle, or hack and squirt. In some cases oil-diluted formulations have been used with effective results.

Table 2. Effective, non-restricted herbicides for woody arboreal and brush management in Hawai'i

Active Ingredient	Max Rate (lbs ae/acre)[a]	Max Conc. (v/v)	Site of Application[b]
Triclopyr (TCP)	**9**	**100**	**NC, F, RP, TO, AQ**
Details: Triclopyr is in the pyridine carboxylic acid family, with a synthetic auxin mode of action leading to abnormal growth, particularly at the apical points, and eventual death. It is a broadleafed and woody plant-selective herbicide with some sensitivity to warm-season grasses, including kikuyu grass (*Pennisetum clandestinum*). It is effective on many legume species. Registered commercial products are available in amine and ester formulations. Amine formulations are best for water-carrier applications (i.e., foliar and cut injection). Ester-based formulations are more compatible with oil carriers in basal bark and cut-surface applications. Drift injury from foliar applications may be more prevalent with the ester formulations due to the higher potential for volatilization. Registered products include Garlon® 3A (amine at 3 lbs ae/gal, EPA reg. no. 62719-37), Garlon® 4 Ultra (ester at 4 lbs ae/gal, EPA reg. no. 62719-527), Remedy® Ultra (ester at 4 lbs ae/gal, EPA reg. no. 62719-70, Renovate 3 (amine at 3 lbs ai/gal, EPA reg no. 62719-37-67690), Element 4 (ester at 4 lbs ae/gal, EPA reg. no. 62719-040).			
Glyphosate (GLY)	**10.6**	**100**	**NC, F, RP, TO, AQ**
Details: Glyphosate is a glycine amino acid analogue, interrupting EPSP synthase and inhibiting synthesis of aromatic amino acids (i.e., phenylalanine, tryptophan, and tyrosine), leading to a fairly rapid sequence of chlorosis, necrosis, and death. It is a broad-spectrum, non-selective herbicide that is effective on a wide range of species and is particularly effective on grasses. Drift injury to grasses and brush species is a common hazard of foliar over-application. Registered products include Roundup® Pro (3 lbs ae/gal, EPA reg. 524-475), Honcho® (3 lbs ae/gal, EPA reg. no. 524-445), Ranger® Pro (3 lbs ae/gal, EPA reg. no. 524-517), Rodeo (4 lb ae/gal, EPA reg. no. 62719-324), Accord XRT II (4 lb ae/gal, EPA reg. no. 62719-556).			
Imazapyr (IMZ)	**1.5**	**100**	**NC, F, RP, AQ**
Details: Imazapyr is in the imidazolinone family, interrupting acetolactate synthase and inhibiting branched chain amino acid production (i.e., valine, leucine, and isoleucine), leading to a slow development of necrosis and death. Another classic symptom includes massive proliferation of growing points immediately adjacent to the apical region. Similar to glyphosate, it is a broad-spectrum, non-selective herbicide that is particularly effective on grasses, though not on legumes. There is a strong potential for drift injury resulting from foliar over-application. Unlike GLY, IMZ can exhibit residual soil activity resulting in root uptake by neighboring plants and the suppression of seed bank germination. Aquatic applications can only be made by federal or State government entities or by applicators who are licensed or certified and are making applications under a program sponsored by federal or State government entities. Registered products include Stalker® (2 lbs ae/gal, EPA reg. no. 241-398), Arsenal® (2 lbs ae/gal, EPA reg. no. 241-346), Arsenal® AC (4 lbs ae/gal, EPA reg. no. 241-299), Arsenal® Powerline (2 lbs ae/gal, EPA reg. no. 241-431), Polaris® (2 lbs ae/gal, EPA reg. no. 228-534), Polaris® AC (4 lbs ae/gal, EPA reg. no. 228-570), Habitat® (2 lbs ae/gal, EPA reg. no. 241-426).			
Aminopyralid (AMP)	**0.110**	**10**	**NC, RP**
Details: Aminopyralid is in the pyridine carboxylic acid family with a synthetic auxin mode of action leading to abnormal growth, particularly at the apical points, and eventual death. It is a broadleaf-selective herbicide with no known efficacy on grasses but is highly effective on legume and aster species. Unlike TCP, AMP can exhibit residual soil activity resulting in root uptake by neighboring plants, and the suppression of seed bank germination. Registered products include Milestone® (2 lbs ae/gal, EPA reg. no. 62719-519).			

[a] ae=acid equivalent, NC=non crop, F=Forestry, RP=Range and Pasture, TO=Turf and Ornamental, AQ=Aquatic

[b] All aquatic pesticide applications in the state of Hawai'i must submit for a notice of intent (NOI) and permit from the Department of Health under jurisdiction of the Clean Water Act.

Table 3. Effective herbicides and application techniques for selected woody tree and shrub species

Name	Method[a]	Herbicide[b]	Concentration[c]	Rate[d]	Notes
Formosan koa *Acacia confusa*	F	TCP/AMP	4/0.4%	2 fl oz/10 ft²	(F) effective on saplings < 6 ft tall; do not exceed 0.11 lbs AMP/acre; GLY (C) does not mix well with oil adjuvant.
	B	TCP	20%	4 fl oz/10 ft²	
	C	GLY	20%	4 fl oz/10 ft²	
	I	AMP	10%	0.5 cc/2 in	
Black wattle *Acacia mearnsii*	B	TCP	20%	4 fl oz/10 ft²	Do not exceed 0.11 lbs AMP/acre; GLY (C) does not mix well with oil adjuvant.
	C	GLY	20%	4 fl oz/10 ft²	
	I	AMP	10%	0.5 cc/2 in	
Shoe button ardesia *Ardesia elliptica*	F	GLY	4%	2 fl oz/10 ft²	(F) effective on saplings < 6 ft tall.
	B	TCP	20%	4 fl oz/10 ft²	
Bamboo *Bambusa spp.*	F	GLY	4%	2 fl oz/10 ft²	Cut stand, treat 3-ft regrowth.
	F	IMZ	0.5%	2 fl oz/10 ft²	
Ironwood *Casuarina equisetifolia*	F	TCP	4%	2 fl oz/10 ft²	GLY (C) does not mix well with oil adjuvant.
	C	GLY	100%	4 fl oz/10 ft²	
Padang cassia *Cinnamomum burmannii*	I	TCP	100%	0.5 cc/4 in	Method (I) referenced in Motooka et al. 2003.
	I	IMZ	100%	0.5 cc/4 in	
Coffee *Coffea spp.*	F	GLY	4%	2 fl oz/10 ft²	(F) effective on saplings < 6 ft tall.
Eucalyptus *Eucalyptus spp.*	B	TCP	20%	4 fl oz/10 ft²	AMP (I) more effective than TCP.
Albizia *Falcataria moluccana*	B	TCP	20%	4 fl oz/10 ft²	
	C	TCP	20%	4 fl oz/10 ft²	
	I	TCP	100%	0.5 cc/4 in	
	I	AMP	10%	0.5 cc/2 in	
Tropical ash *Fraxinus uhdei*	B	TCP	20%	4 fl oz/10 ft²	GLY (C) does not mix well with oil adjuvant; TCP (I) was not effective.
	C	GLY	20%	4 fl oz/10 ft²	
	I	IMZ	100%	0.5 cc/4 in	
Silky oak *Grevillea robusta*	C	TCP	20%	4 fl oz/10 ft²	AMP (I) most effective.
	I	TCP	100%	0.5 cc/4 in	
	I	IMZ	100%	0.5 cc/4 in	
	I	AMP	10%	0.5 cc/2 in	

[a] Methods (F), (B) and (C) are recommended based on the listed references. Method (I) recommendations are validated by field trials conducted by the authors of this document, unless otherwise indicated in the notes.
[b] For IMZ (B), use Stalker® (EPA reg. no. 241-398).
[c] Concentrations (% v/v) are estimated by the authors to correspond with rates listed in the next column. References may list higher or lower concentrations but do not list the rates of application. The user may adjust these concentrations as needed as long as the amount used does not exceed the recommendation of the label.
[d] The listed rates are for individual target treatments only and would GREATLY EXCEED THE MAXIMUM LABEL RATE with the corresponding concentration if broadcast-applied over the entire acre. THIS WOULD BE A VIOLATION OF THE LABEL. See Table 4 for estimated target treatment densities using these rates.

Table 3, cont'd. Effective herbicides and application techniques for selected woody tree and shrub species

Name	Method[a]	Herbicide[b]	Concentration[c]	Rate[d]	Notes
Haole koa *Leucaena luecocephala*	F	TCP	4%	2 fl oz/10 ft^2	(F) effective on saplings < 6 ft tall.
	B	TCP	20%	4 fl oz/10 ft^2	
	C	TCP	20%	4 fl oz/10 ft^2	
	I	AMP	10%	0.5 cc/2 in	
Miconia *Miconia calvescens*	F	TCP	4%	2 fl oz/10 ft^2	(F) effective on saplings < 6 ft tall.
	B	TCP	20%	4 fl oz/10 ft^2	
Faya tree *Morella faya*	C	TCP	20%	4 fl oz/10 ft^2	GLY (C) does not mix well with oil adjuvant.
	C	GLY	20%	4 fl oz/10 ft^2	
	C	IMZ	20%	4 fl oz/10 ft^2	
Olive *Olea europaea*	F	TCP	4%	2 fl oz/10 ft^2	
	C	TCP	100%	4 fl oz/10 ft^2	
Strawberry guava *Psidium cattleianum*	F	TCP	4%	2 fl oz/10 ft^2	(F) effective on saplings < 6 ft tall.
	B	TCP	20%	4 fl oz/10 ft^2	
	C	TCP	20%	4 fl oz/10 ft^2	
	I	TCP	100%	0.5 cc/4 in	
	I	AMP	10%	0.5 cc/2 in	
Poison devil's pepper *Rauvolfia vomitoria*	F	IMZ	0.5%	2 fl oz/10 ft^2	(F) effective on saplings < 6 ft tall, IMZ (I) more effective than GLY
	I	GLY	100%	0.5 cc/4 in	
	I	IMZ	100%	0.5 cc/4 in	
Umbrella octopus tree *Schefflera actinifolia*	I	GLY	100%	0.5 cc/4 in	IMZ (I) most effective
	I	IMZ	100%	0.5 cc/4 in	
	I	AMP	10%	0.5 cc/2 in	
Christmas berry *Schinus terebinthifolius*	F	TCP	4%	2 fl oz/10 ft^2	(F) effective on saplings < 6 ft tall.
	B	TCP/IMZ	20/5%	4 fl oz/10 ft^2	
	C	TCP/IMZ	20/5%	4 fl oz/10 ft^2	
	I	AMP	10%	0.5 cc/2 in	
African tulip tree *Spathodea campanulata*	B	TCP	20%	4 fl oz/10 ft^2	GLY (C) does not mix well with oil adjuvant, TCP (I) was not effective.
	C	TCP	20%	4 fl oz/10 ft^2	
	C	GLY	20%	4 fl oz/10 ft^2	
	I	IMZ	100%	0.5 cc/4 in	

[a] Methods (F), (B) and (C) are recommended based on the listed references. Method (I) recommendations are validated by field trials conducted by the authors of this document, unless otherwise indicated in the notes.
[b] For IMZ (B), use Stalker® (EPA reg. no. 241-398).
[c] Concentrations (% v/v) are estimated by the authors to correspond with rates listed in the next column. References may list higher or lower concentrations but do not list the rates of application. The user may adjust these concentrations as needed as long as the amount used does not exceed the recommendation of the label.
[d] The listed rates are for individual target treatments only and would GREATLY EXCEED THE MAXIMUM LABEL RATE with the corresponding concentration if broadcast-applied over the entire acre. THIS WOULD BE A VIOLATION OF THE LABEL. See Table 4 for estimated target treatment densities using these rates.

Table 3, cont'd. Effective herbicides and application techniques for selected woody tree and shrub species

Name	Method[a]	Herbicide[b]	Concentration[c]	Rate[d]	Notes
Java plum *Syzigium cumini*	F	TCP	4%	2 fl oz/10 ft²	(F) effective on saplings < 6 ft tall; GLY (C) does not mix well with oil adjuvant.
	C	TCP	20%	4 fl oz/10 ft²	
	C	GLY	20%	4 fl oz/10 ft²	
	C	IMZ	20%	4 fl oz/10 ft²	
Rose apple *Syzigium jambos*	B	TCP	20%	4 fl oz/10 ft²	GLY (C) does not mix well with oil adjuvant.
	C	TCP	20%	4 fl oz/10 ft²	
	C	GLY	20%	4 fl oz/10 ft²	
Australian red cedar *Toona cilliata*	I	TCP	100%	0.5 cc/4 in	All effective at 100 days after treatment; most effective long-term TBD.
	I	IMZ	100%	0.5 cc/4 in	
	I	AMP	10%	0.5 cc/2 in	
Gunpowder tree *Trema orientalis*	B	TCP	20%	4 fl oz/10 ft²	Method (I) referenced in Motooka et al. 2003.
	C	TCP	20%	4 fl oz/10 ft²	
	C	GLY	20%	4 fl oz/10 ft²	
	I	TCP	100%	0.5 cc/4 in	
Gorse *Ulex europaeus*	F	TCP/AMP	4/0.4%	2 fl oz/10 ft²	Organo-silicone surfactant; do not exceed 0.11 lbs AMP/acre.

[a] Methods (F), (B) and (C) are recommended based on the listed references. Method (I) recommendations are validated by field trials conducted by the authors of this document, unless otherwise indicated in the notes.
[b] For IMZ (B), use Stalker® (EPA reg. no. 241-398).
[c] Concentrations (% v/v) are estimated by the authors to correspond with rates listed in the next column. References may list higher or lower concentrations but do not list the rates of application. The user may adjust these concentrations as needed as long as the amount used does not exceed the recommendation of the label.
[d] The listed rates are for individual target treatments only and would GREATLY EXCEED THE MAXIMUM LABEL RATE with the corresponding concentration if broadcast-applied over the entire acre. THIS WOULD BE A VIOLATION OF THE LABEL. See Table 4 for estimated target treatment densities using these rates.

Electronic versions of all pesticide labels registered in Hawai'i may be searched on the CDMS Web site (www.cdms.net) or the Hawai'i Pesticide Information Retrieval System (HPIRS) (http://state.ceris.purdue.edu/doc/hi/statehi.html). These sites also include any Hawai'i Sec 24(c) Special Local Need (SLN) labels.

Disclaimer

Mention of specific brand names of herbicides does not constitute endorsement of these brands or lack of endorsement of brands not listed on the part of the authors, CTAHR, or the University of Hawai'i. While the information offered here is up to date as of the publication of this bulletin, regulation of herbicide use is undergoing constant change. Always follow label instructions when using any herbicide.

Table 4. Treated target densities (per acre) with the different methods at the maximum label rates[a] of the respective herbicides

(F) 2 fl oz/10 ft² at 4%	Foliar Canopy (ft²)					
	10	50	100	200	300	400
TCP	3,600	720	360	180	120	90
GLY	4,240	848	424	212	141	106
IMZ	1,200	240	120	60	40	30
AMP (0.4%)	875	175	87	43	29	22
(B/C) 4 fl oz/10 ft² at 20%[b]	**Basal Diameter (inches)**					
	1	5	10	20	30	40
TCP	13,751	2,750	1,375	688	458	344
GLY[c]	16,196	3,239	1,620	810	540	405
IMZ[d]	4,584	917	458	229	153	115
AMP (4%)[e]	1,670	336	168	84	56	42
(I) 0.5 cc/4 in at 100%	**Basal Diameter (inches)**					
	1	5	10	20	30	40
TCP	21,689	4,338	2,169	1,084	723	542
GLY	25,545	5,109	2,554	1,277	851	639
IMZ	7,230	1,446	723	361	241	181
AMP (0.5 cc/2 in at 10%)	2,636	527	264	132	88	66

[a] Refer to the maximum label rates in Table 2.
[b] Assuming 12-inch swath around the circumference (circumference = diameter * π)
[c] Water-based salt formulations do not blend well with oil carriers and need to be agitated regularly.
[d] Stalker® recommended for better blending with oil carrier.
[e] A registered use pattern according to the Milestone® label; authors do not currently have efficacy data with AMP as a basal application.

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References

Ferrell, J, K Langeland, and B Sellers. 2006. Herbicide Application Techniques for Woody Plant Control. IFAS Extension Bulletin SS-AGR-260. University of Florida. p. 6. http://edis.ifas.ufl.edu/

Hawaii Pesticide Information Retrieval System (HPIRS) database. 2011. http://state.ceris.purdue.edu/doc/hi/statehi.html

Hawaii Pesticides Law-Chapter 149A of the Hawaii Revised Statutes http://hawaii.gov/hdoa/pi/pest/reg

Herbicide Resistance Action Committee. http://www.hracglobal.com/Publications/ClassificationofHerbicideSiteofAction/tabid/222/Default.aspx

Motooka, P. 1999. Summaries of Herbicide Trials for Pasture, Range, and Non-Cropland Weed Control-1998. CTAHR Extension Bulletin WC-8. University of Hawai'i at Manoa. p. 6. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/WC-1.pdf

Motooka, P. 2000. Summaries of Herbicide Trials for Pasture, Range, and Non-Cropland Weed Control-1999. CTAHR Extension Bulletin WC-5. University of Hawai'i at Manoa. p. 7. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/WC-5.pdf

Motooka, P. 2001. Summaries of Herbicide Trials for Pasture, Range, and Non-Cropland Weed Control-2000. CTAHR Extension Bulletin WC-6. University of Hawai'i at Manoa. p. 6. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/WC-6.pdf

Motooka, P. 2002. Summaries of Herbicide Trials for Pasture, Range, and Non-Cropland Weed Control-2001. CTAHR Extension Bulletin WC-7. University of Hawai'i at Manoa. p. 5. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/WC-7.pdf

Motooka, P. 2003.Summaries of Herbicide Trials for Pasture, Range, and Non-Cropland Weed Control-2002. CTAHR Extension Bulletin WC-9. University of Hawai'i at Manoa. p. 4. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/WC-9.pdf

Motooka, P, L Castro, D Nelson, G Nagai, and L Ching. 2003, Weeds of Hawaii's Pastures and Natural Areas: An Identification and Management Guide College of Tropical Agriculture and Human Resources, University of Hawai'i at Manoa. p. 184. http://www.ctahr.hawaii.edu/invweed/weedsHi.html

Motooka , P, G Nagai, L Ching, J Powley, G Teves, and A Arakaki. 1999. Woody Plant Control for the Home, Pasture, and Forest CTAHR Extension Bulletin WC-8. University of Hawai'i at Manoa. p. 4. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/WC-4.pdf

Motooka et al. 2002. Herbicidal Weed Control Methods for Pastures and Natural Areas of Hawai'i, CTAHR Extension Bulletin WC-8. University of Hawai'i at Manoa. P. 36. http://www.ctahr.hawaii.edu/oc/freepubs/pdf/WC-8.pdf

Queensland Department of Primary Fisheries & Industries, 2007 - see following link: http://www.dpi.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-African-Tulip-PP64.pdf

Santos, GL, D Kageler, DE Gardner, LW Cuddihy, and CP Stone. 1992. Herbicidal Control of Selected Alien Plant Species in Hawaii Volcanoes National Park. In CP Stone, CW Smith, and TJ Tunison, (eds). Alien Plant Invasions in Native Ecosystems of Hawaii: Management and Research. Cooperative National Park Resources Studies Unit, University of Hawai'i. 903 pgs.