

**PROGRESS REPORT (JANUARY - JUNE, 1998):
RESIDUES OF FORESTRY HERBICIDES IN PLANTS
OF INTEREST TO NATIVE AMERICANS (PHASE II)**

**R. Segawa, C. Ando, and C. Ganapathy
Environmental Hazards Assessment Program
Department of Pesticide Regulation**

**P. Lee, D. Tran, J. White, and J. Hsu
Center for Analytical Chemistry
California Department of Food and Agriculture**

I. BACKGROUND

The use of native plant materials is a tradition among Native American tribes in California. Native Americans may be exposed to forestry herbicides through the use of plant materials. These unique exposure scenarios are not characterized in the risk assessment of these herbicides. The U.S. Forest Service uses three herbicides for site preparation and release operations in conifer tree plantations in California's national forests: glyphosate, hexazinone, and triclopyr. The U.S. Forest Service has requested the assistance of the Department of Pesticide Regulation (DPR) in assessing exposure of Native Americans to forestry herbicides. In order to estimate the potential exposure, the residue concentrations of forestry herbicides must be determined.

DPR is determining the residues of forestry herbicides in plant materials in two phases. DPR has completed phase one to develop sampling and analytical methodology, and to conduct pilot sampling (Segawa, et al., 1997). This report describes the progress of phase two with the following objectives: 1) determining the dissipation rate of herbicides in selected plants and 2) determining the off-site movement of herbicides in selected plants in areas adjacent to herbicide applications.

II. STUDY PLAN

At each national forest DPR consulted with the local California Indians and the U.S. Forest Service, and developed a plan for conducting phase two. Briefly, DPR

plans to study four application methods: Pronone® 10G (hexazinone) by air, Velpar® L (hexazinone) by ground, Accord® (glyphosate) by ground, and Garlon® 4 (triclopyr) by ground. DPR will determine dissipation rates for each of these application methods in four plants/plant parts: bracken fern roots (*Pteridium aquilinum* var. *pubescens*), buckbrush shoots (*Ceanothus cuneatus*), golden fleece foliage (*Ericameria arborescens*), and manzanita berries (*Arctostaphylos* spp.). Dissipation samples will be collected every four to eight weeks for 36 weeks following treatment. Off-site samples will be collected at four distances from 5 to 100 feet from the edge of the treated area. The laboratory will validate analytical methods for each of 12 plant/herbicide combinations (completed).

III. STATUS OF HERBICIDE TREATMENTS

For 1998, U.S. Forest Service personnel in the Stanislaus National Forest began herbicide treatments in March and are using all four application methods DPR is monitoring. Personnel in the Sierra National Forest began herbicide treatments in April and are using two of the application methods DPR is monitoring, Velpar® L by ground and Accord® by ground. Personnel in the Eldorado National Forest began treatments in June and are using two of the application methods DPR is monitoring, Accord® by ground and Garlon® by ground.

IV. STATUS OF DISSIPATION MONITORING

For each of the four application methods and four plants, DPR will monitor four sites (64 total sites). As of June 30, 1998, DPR has initiated dissipation monitoring for 41 of the 64 sites (Table 1a-d), an increase of 13 sites since the last report (January, 1998). Due to an extended rainfall season, monitoring has not been initiated for most of the glyphosate and triclopyr sites for this year. These sites will likely be treated and monitoring initiated in the next few weeks.

Since the last report, DPR has collected and analyzed 61 dissipation samples. Results of the dissipation sampling and laboratory analyses from all 209 samples completed as of June 30, 1998, are shown in Tables 2 - 5. Herbicide concentration in plant samples varies greatly, ranging from no detectable amount to 212 parts per million (ppm). Samples collected so far in 1998 are within the same range of those collected in 1997. Because many of the sites sampled in 1997 still had detectable residues at the last scheduled sampling period (36 weeks after treatment), sampling

has been extended at selected sites. Two buckbrush samples collected approximately 60 weeks after treatment both contained approximately 0.22 parts per million of hexazinone. Additional sampling is scheduled.

V. STATUS OF OFF-SITE MONITORING

For each of the four application methods, DPR will monitor six sites (24 total sites). AS of June 30, 1998, DPR has initiated off-site monitoring for 16 of the 24 sites (Table 1), an increase of eight sites since the last report (January, 1998).

Since the last report, DPR has collected and analyzed 47 off-site samples. Results of the off-site sampling and laboratory analyses from all 142 samples completed as of June 30, 1998, are shown in Table 6. None of the 47 samples collected since the last report contained detectable amounts of herbicides. To date, herbicides were detected in four (501-120, E121, Musick 071, R041) of the 16 sites sampled and six of 142 samples.

REFERENCES

Segawa, R., A. Bradley, P. Lee, D. Tran, J. White, J. Hsu, and K. Goh. 1997. Residues of Forestry Herbicides in Plants of Interest to Native Americans: Phase One - Development of Methodologies and Pilot Sampling. Report EH 97-01. Department of Pesticide Regulation.

Table 1a. Sampling sites for phase two - Glyphosate (Accord®)

Forest/District	Stand	Date Treated	Buckbrush	Bracken Fern	Golden Fleece	Manzanita	Off-Site
Sierra/Pineridge	Musick 71	4/29/97					buckbrush
Sierra/Pineridge	Jose 138	5/1/97	X	X		X	
Eldorado/Pacific	501-120	5/28/97			X		deer brush
Eldorado/Georgetown	320-31	6/17/97		X			
Stanislaus/Groveland	027-038	3/19/98		X			
Stanislaus/MiWok	1171932	6/13/98	X		X		
Stanislaus/MiWok	1171750	6/20/98					deer brush

Table 1b. Sampling sites for phase two - Hexazinone (Pronone®)

Forest/District	Stand	Date Treated	Buckbrush	Bracken Fern	Golden Fleece	Manzanita	Off-Site
Stanislaus/MiWok	Walton 33-176	3/15/97	X		X	X	
Stanislaus/MiWok	Walton 33-138	3/15/97					bracken fern
Stanislaus/Groveland	16-33	3/17/97	X		X	X	
Stanislaus/Groveland	25-55	3/17/97		X			bracken fern
Stanislaus/MiWok	Ruby E26	3/18/97	X				
Stanislaus/MiWok	Ruby R41	3/19/97			X		deer brush
Stanislaus/MiWok	Ruby R42	3/19/97		X			
Stanislaus/MiWok	Ruby E116					X	
Stanislaus/MiWok	11720442	3/18/98					deer brush
Stanislaus/MiWok	11730191	3/19/98	X				
Stanislaus/MiWok	11708407	3/21/98			X		deer brush

Table 1c. Sampling sites for phase two - Hexazinone (Velpar®)

Forest/District	Stand	Date Treated	Buckbrush	Bracken Fern	Golden Fleece	Manzanita	Off-Site
Stanislaus/Groveland	27-8	3/13/97	X	X	X	X	deer brush
Stanislaus/MiWok	Ruby E29	3/13/97			X		
Stanislaus/MiWok	Ruby E121	3/15/97	X			X	buckbrush
Stanislaus/Groveland	27-33	3/5/98					deer brush
Stanislaus/Groveland	27-54	3/11/98					deer brush
Stanislaus/Groveland	27-19	3/12/98		X			
Sierra/Pineridge	336-149	4/21/98	X		X		buckbrush

Table 1d. Sampling sites for phase two - Triclopyr (Garlon®)

Forest/District	Stand	Date Treated	Buckbrush	Bracken Fern	Golden Fleece	Manzanita	Off-Site
Stanislaus/Groveland	27-02	5/25/97	X				
Stanislaus/Groveland	26-69	5/27/97		X		X	
Eldorado/Pacific	501-120	5/28/97			X		deer brush
Eldorado/Georgetown	320-31	6/17/97		X			
Stanislaus/MiWok	1171932	6/13/98	X		X		
Stanislaus/MiWok	31602102	6/19/98	X		X		
Stanislaus/MiWok	1171750	6/20/98		X			deer brush

Table 3. Hexazinone (Pronone®) dissipation results. The table shows the concentration range if more than one site sampled, or a single concentration if one site sampled.

Time After Treatment (wks)	Hexazinone (ppm)			
	Bracken Fern Roots (2)*	Buckbrush Shoots (3)*	Golden Fleece Foliage (3)*	Manzanita Berries (3)*
0	ND ¹ - ND	0.11 - 0.98	ND - 0.37	no berries
4	0.07 - 0.10	ND - ND	ND - 0.80	no berries
8	ND - 0.20	0.27 - 1.0	0.17 - 0.93	ND - 0.14
12	ND - 0.15	0.18 - 0.92	0.021 - 0.68	ND - ND
20	ND - 0.36	0.22 - 0.46	ND - 0.10	ND - ND
28	ND - 0.10	ND - 0.45	ND - ND	ND - ND
36	ND - 0.15	0.33 - 0.96	0.18 - 0.62	ND - ND
60	no results	0.22	no results	no results

* Number in parentheses indicates the number of replicates or treatment sites sampled.

¹ND = none detected

reporting limit for hexazinone in bracken fern is 0.07 ppm

reporting limit for hexazinone in buckbrush is 0.10 ppm

reporting limit for hexazinone in golden fleece is 0.10 ppm

reporting limit for hexazinone in manzanita is 0.05 ppm

Reporting limit is the lowest concentration that can be reliably detected.

Table 2. Glyphosate (Accord®) dissipation results. The table shows the concentration range if more than one site sampled, or a single concentration if one site sampled.

Time After Treatment (wks)	Glyphosate (ppm)			
	Bracken Fern Roots (2)*	Buckbrush Shoots (1)*	Golden Fleece Foliage (1)*	Manzanita Berries (1)*
0	ND ¹ - 1.0	154	55	79
4	1.9 - 2.5	31	3.3	58
8	ND - 0.44	21	3.6	55
12	ND - 0.66	35	0.67	14
20	ND - 0.41	48	0.42	39
28	ND - 0.58	3.9	0.13	20
36	ND	1.6	0.14	no berries

* Number in parentheses indicates the number of replicates or treatment sites sampled.

¹ND = none detected, reporting limit for glyphosate is 0.1 ppm. Reporting limit is the lowest concentration that can be reliably detected.

Table 4. Hexazinone (Velpar®) dissipation results. The table shows the concentration range if more than one site sampled, or a single concentration if one site sampled.

Time After Treatment (wks)	Hexazinone (ppm)			
	Bracken Fern Roots (1)*	Buckbrush Shoots (2)*	Golden Fleece Foliage (2)*	Manzanita Berries (2)*
0	ND ¹	2.6 - 75	32 - 212	no berries
4	ND	0.51 - 5.7	0.67 - 30	no berries
8	ND	0.23 - 1.6	0.68 - 3.0	ND - 0.14
12	ND	0.44 - 0.70	0.19 - 0.31	ND - 0.34
20	ND	0.15 - 1.1	ND - ND	ND - 0.08
28	ND	0.11 - 0.16	ND - ND	ND - ND
36	ND	0.10 - 0.26	ND - 0.38	ND - 0.17
60	no results	0.23	no results	no results

* Number in parentheses indicates the number of replicates or treatment sites sampled.

¹ND = none detected

reporting limit for hexazinone in bracken fern is 0.07 ppm

reporting limit for hexazinone in buckbrush is 0.10 ppm

reporting limit for hexazinone in golden fleece is 0.10 ppm

reporting limit for hexazinone in manzanita is 0.05 ppm

Reporting limit is the lowest concentration that can be reliably detected.

Table 5. Triclopyr (Garlon®) dissipation results. The table shows the concentration range if more than one site sampled, or a single concentration if one site sampled.

Time After Treatment (wks)	Triclopyr (ppm)			
	Bracken Fern Roots (2)*	Buckbrush Shoots (1)*	Golden Fleece Foliage (1)*	Manzanita Berries (1)*
0	0.10 - 0.10	12	1.7	2.7
4	ND ¹ - 0.21	2.7	2.3	1.9
8	ND - 0.10	1.3	1.2	3.9
12	ND - ND	1.2	1.1	1.4
20	ND - 0.33	3.5	1.1	3.4
28	ND	0.99	0.34	3.9
36	ND	0.58	0.13	2.6

* Number in parentheses indicates the number of replicates or treatment sites sampled.

¹ND = none detected

reporting limit for triclopyr in bracken fern is 0.03 ppm

reporting limit for triclopyr in buckbrush is 0.10 ppm

reporting limit for triclopyr in golden fleece is 0.07 ppm

reporting limit for triclopyr in manzanita is 0.03 ppm

Reporting limit is the lowest concentration that can be reliably detected.

Table 6. Off-site monitoring results. Results shown as the number of samples with detectable amounts of herbicides at various distances from the edge of the treatment area.

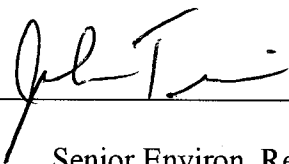
Herbicide	# of sites	# positive samples/# samples collected			
		5 - 15 ft	20 - 40 ft	50 - 70 ft	80 - 100 ft
glyphosate	2	1/6	2/6	0/6	0/6
hexazinone (Pronone)	5	1/13	0/13	1/13	0/12
hexazinone (Velpar)	5	0/12	0/12	0/12	1/12
triclopyr	1	0/3	0/3	0/3	0/3

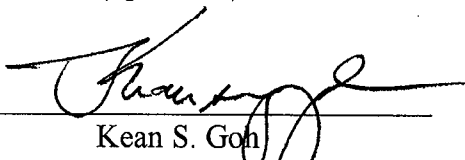
Document Review and Approval
Environmental Hazards Assessment Program
Department of Pesticide Regulation
1020 N Street, Room 161
Sacramento, CA 95814

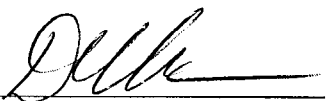
Document Title: Progress Report: Residues of Forestry Herbicides in Plants of Interest to Native Americans (Phase II)

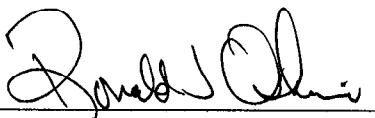
Author(s): R. Segawa et al.

Document Date: July 1998

APPROVED:  Date: 7/20/98
Senior Environ. Res. Scientist
(Specialist)

APPROVED:  Date: 8/4/98
Kean S. Goh
Ag. Program Supervisor IV

APPROVED:  Date: 8-5-98
Doug Okumura
Branch Chief

APPROVED:  Date: 8/6/98
Ron Oshima
Assistant Director