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Noxious Times

A Quarterly Publication of the California Interagency Noxious Weed Coordinating Committee

In This Issue

NFWF Pulling Together Grants Available

PTI Grants designed to help create Weed Management Areas

The pre-proposal deadline for the National Fish and Wildlife Foundation's 2005 Pulling Together Initiative Grants is Friday, October 29, 2004. The request for proposals is available online at www.nfwf.org/programs/pti.htm. This year, applications are able to be submitted electronically through the NFWF's online application system.

Pulling Together Initiative grants are designed to build capacity at the local level to manage invasive weeds by supporting the creation of cooperative Weed Management Area partnerships. These grants bring together local landowners, citizen groups and weed experts to develop and implement strategies for managing weed infestations.

PTI grants are financed with funds from the U.S. Fish and Wildlife Service, the United States Forest Service, the Bureau of Reclamation, the Department of Defense, the Animal and Plant Health Inspection Service and the National Parks Service. Grant recipients are required to match federal funds with in-kind or

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Senate Bill 144 Nears House Vote

Craig's Bill still resides in House Agriculture Committee

Senate Bill 144, the Noxious Weed Control Act of 2003, which began the legislative process over a year and half ago on the Senate floor, is closer to being voted on by the House of Representatives. The bill was heard in the House Resources Committee and has moved on to the House Agriculture Committee where it is currently in debate. If passed by the House Agriculture Committee it should be heard in a meeting of the full House later this year.

S.144, which has been amended and titled, The Noxious Weed Control Act of 2004, has gone through significant changes since its 2003 introduction. The original bill, which was sponsored by Senator Larry Craig (R-Idaho), now contains

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Chairperson's Message

Bobbi Simpson, National Parks Services

Being Chair of CINWCC I've become especially aware of the importance and strength of working in partnerships. Big efforts like the production of the state weed plan or the Cal-IPC group would not be possible without the joint effort of all important groups in California. My own program involves coordination of the individual National Parks within California and the use of a specially trained team which moves from park to park to address high priority weed control needs.

The Weed Management Areas are very valuable in pulling together diverse interest groups at the local level to look at common weed control projects and needs. Many of our National Parks work closely with their Weed Management Area and recently internal funding was made available to foster this collaboration.

As we move forward in our efforts to make serious progress against invasive weeds I believe we need to strengthen all of our partnership activities. This not only allows for progress to be made along a united front, but it should inspire and reward each and every one of us to approach our work with more support and commitment.❖

Noxious Times **is a publication of the California Interagency Noxious Weed Coordinating Committee. The committee was formed in 1995 when 14 federal, state, and county agencies came together under a Memorandum of Understanding to coordinate the management of noxious weeds. The committee's mission is to facilitate, promote, and coordinate the establishment of an Integrated Pest Management partnership between public and private land managers toward the eradication and control of noxious weeds on federal and state lands and on private lands adjacent to public lands.**

The *Noxious Times* newsletter intends to help the committee achieve its goals of coordination and exchange of information by providing land managers throughout the state with information on weed control efforts, news, and successes.

Noxious Times **is published quarterly by staff of the Integrated Pest Control Branch at the California Department of Food and Agriculture. We welcome submissions for our upcoming issues. Please send to: CA Department of Food and Agriculture, ATTN: Noxious Times, 1220 N Street, Room A-357, Sacramento, CA 95814 or e-mail: noxtimes@cdfa.ca.gov**

If you have a colleague whose name you would like to add to our mailing list, please send mailing information to the address above.

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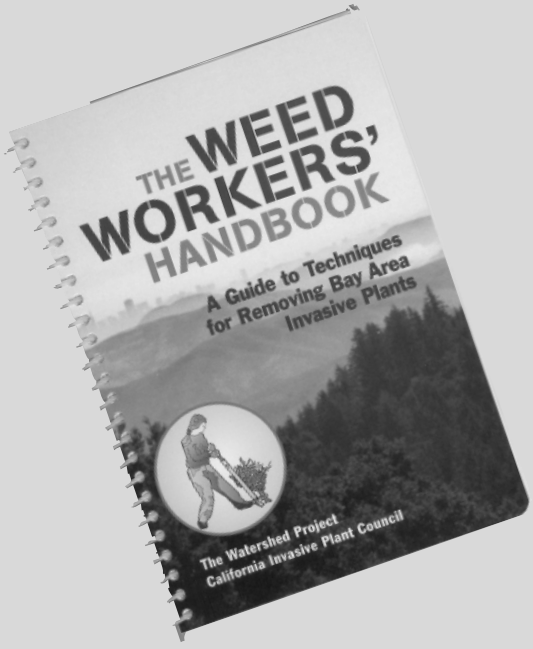
Cal-IPC Helps to Combat Invasive Plants in the Bay Area

In conjunction with the Watershed Project, the California Invasive Plant Council has published The Weed Workers' Handbook, A Guide to Techniques for Removing Bay Area Invasive Plants. The Handbook, which is designed for volunteers and coordinators alike, features 120 pages of color illustrations and guidelines.

The Handbook, which covers 35 species that are considered invasive in the San Francisco Bay Area, gives the reader details about each plant such as its appearance, reproductive cycle, impact on surrounding areas, treatment and disposal options, follow-up procedures and interesting facts. Each description is also accompanied by a detailed color drawing, so that the plant can be easily identified in the field.

The Handbook is also a helpful guide for organizing volunteer weed projects. The first chapter in the book covers why invasive plant control and eradication is important, not only in the Bay Area but all over the world. The following three chapters are devoted to how to plan, communicate and coordinate volunteer efforts. There is also a chapter that strictly deals with the tools and techniques of control efforts. This chapter includes color drawings of tools that can be used in manual control efforts along with a description of the types of target plants and factors that must be taken into consideration.

Copies of the first printing of the Handbook are available from Cal-IPC at no charge, ($3 is requested for shipping and handling). On larger orders, prices can be negotiated. Please call Cal-IPC at (510) 843-3902 for more information.❖



The Weed Workers' Handbook

Created By:
The California Invasive Plant Council &
The Watershed Project
Available free of charge plus $3 shipping and handling

To order:
visit www.cal-ipc.org, call (510) 843-3902
or send check or credit card information to:
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"When environmental restoration is most successful, it also improves our hearts and cultivates an enduring relationship with nature...Done properly, environmental restoration restores far more than just the land"
- Richard Nilsen, from Helping Nature Heal

Amended AB 2631 Awaits Governor's Signature

Editors Note: Status of bill is as of print date. For most recent status, go to, http://www.leginfo.ca.gov/bilinfo.html.

Davis based Assembly-woman Lois Wolk, in an effort to coordinate invasive species eradication in the State of California, has proposed Assembly Bill 2631. The significantly amended version of AB 2631, passed the State Assembly in early June. On June 29, AB 2631 passed from the Senate Committee on Natural Resources and Wildlife to the State Senate floor by a five to three vote. After being briefly suspended due to Section 77, the bill has since been passed by the Senate and is now enrolled and on the Governer's desk awaiting his signature.

Earlier versions of AB 2631 were met by opposition from the California Farm Bureau Federation and the California Cattlemen's Association. However, many ammendments were made to the bill which made it less likely to impact existing agricultural pest management programs.

Over the course of the amendments, the main goal of the bill, the formation of the Invasive Species Council and advisory committee, has remained the same. The council would consist of 11 directors or representatives from various state agencies and the advisory committee would consist of 10 members from the government, agricultural, environmental and resource industries. The main goal of the council is to develop a statewide invasive species plan and make recommendations for the control, maintenance, early detection and rapid response to invasive species.

The council would be charged with creating an invasive species action plan on or before January 1, 2007. The plan must be approved by the governor and legislature and then must be updated and re-approved every four years. The comprehensive first draft of the plan must cover:

- The goals and objectives of the Invasive Species Council.
- A review of existing prevention and permitting plans, programs, statutes and regulations.
- An economic impact report of invasive species on California's economy, environment and health and human services.
- Develop new funding requirements for resources such as mapping, monitorin and coordination.
- Create identification guidelines for new, potential invasive species and pathways.
- Create new educational programs and materials for the media and public.

Along with the development of the Invasive Species Council, the bill also calls for the creation of the Invasive Species Management Fund. The fund would allow the council to apply for grant money and receive state and federal funds. The fund also allows for independent contractors and organizations to apply to the Invasive Species Council for grant money.

If approved, the guidelines of the bill will expire at the end of the fiscal year in 2007 and have to be re-approved to continue on into 2008.❖

Proposed Agencies for Invasive Species Council

Department of Food & Agriculture
Department of Resources
Department of Forestry & Fire Protection
CALTRANS
Department of Water Resources
Department of Boating & Waterways
State Lands Commission, Marine Facilities Division
Coastal Conservancy
California Bay-Delta Authority (CALFED)
Department of Pesticide Regulation

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amendments submitted by Representative Richard Pombo (R-Tracy). S.144 passed unanimously through the Senate in 2003, at the same time when similar legislation, HR 119, failed to make it through the House.

In the bill's amended form, the USDA and the Secretary of Agriculture are able to annually distribute $50 million from 2005 through 2009 for noxious weed eradication efforts at federal, state and local levels. The original version of S.144 proposed distribution of $100 million annually through the Department of the Interior from 2002 through 2006.

Senate Bill 144 stipulates that if passed the USDA must develop a program that provides financial assistance to States to distribute funds to eligible weed management entities for the control and eradication of noxious weeds. In the amended version of s.144 money is available to BLM, USFS and recognized Native American tribes to be used on both public and private land with the landowner's consent. Unlike the original version, money is not available to the National Parks Service.

States would apply to the USDA to receive money from s.144 funds. Once requests are received the USDA must consider the severity of the State's problem as well as other efforts that the State has made in addressing the problem of noxious weeds. They must also evaluate the extent and ability of that State to use s.144 funds to leverage non-Federal funds. Special circumstances such as recognized weed management entities established within Native American tribes may result in more money allocated to States with special programs.

Each State is responsible for reporting their progress in eradication, education, control, mapping, monitoring and management to the USDA. These factors will determine how the USDA will distribute the money in the coming year.

The legislature has limited s.144 so that money can not to be used to control or eradicate animals or pests and may not be used to protect agricultural commodities other than livestock and animal or insect based product.

In the original and amended version, a noxious weed is defined by section 403(10) of the Plant Protection Act, "…any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), poultry, or other interest in agriculture, irrigation, navigation, the natural resources…" Supporters of this bill concede that this definition is less restrictive than the definition used in the Federal Noxious Weed Act and has helped it gain support from organizations like the California Cattlemen's Association and the Idaho Department of Agriculture.❖

PTI Grants continued from page 1

cash contributions from state, local and/or private partners by at least a one to one ratio. Each year around forty PTI grants, ranging from $20,000 to $60,000 annually are awarded and typically are renewed for three to four consecutive years.

Grant pre-proposals and proposals are reviewed by a national steering committee composed of weed management experts from government, industry, academia and non-profit organizations. Lora Martens at the NFWF office in San Francisco is available to review pre-proposals and proposals before submission to the national NFWF office. Martens can be contacted at (415) 857-0166 or by email at lora.martens@nfwf.org.

During the nine years the the NFWF has been awarding PTI grants, California has typically received six to ten grants. The purpose of PTI Grants is to provide federal agencies the means to become full partners with state and local agencies, private landowners and other interested parties to developing long-term weed management projects using the integrated pest management strategy.❖

State Weed Lists Now Available Online

The Center for Invasive Plant Management has posted information and updated weed list for the western states. The list can be accessed from their website at:

www.weedcenter.org/inv_plant_info/2004_weedlist.htm

The Ecotoxicology of Surfactants Glyphosate Based Herbicides

Editors Note: This article is one of the first attempts to review the ecotoxicology of surfactants used with glyphosate. CDFA does not specifically endorse any product by inclusion in this article.

This is a follow-up to the Summer 2002 article titled "Glyphosate-Based Aquatic Herbicides. An Overview of Risk" By Susan Monheit, CDFA-IPC

Aquatic weeds are a nuisance to many land managers in California, who must implement control programs to protect land use. For instance, the California Department of Food and Agriculture (CDFA) coordinates a purple loosestrife control project in the Sacramento-San Joaquin River Delta. Purple loosestrife can reduce biodiversity, degrade fish and wildlife resources, impact water quality, and impede water flow. The CDFA has found several efficient and cost-effective methods for control of purple loosestrife, including the release of biological control agents, physical removal, and the use of glyphosate-based aquatic herbicides[1] tank mixed with surfactant.

Depending upon site-specific factors, the use of aquatically registered, glyphosate-based herbicides with an appropriate surfactant may be the most environmentally compatible control method available. In a previous article, Susan Monheit reviewed the use and ecotoxicology of glyphosate (Monheit, 2002). The purpose of this article is to review the use and ecotoxicology of the surfactants commonly mixed with glyphosate at aquatic sites.

Exposure and Risk

Risk is an assessment of the potential for adverse effects that result from some activity. Adverse effects from exposure to herbicides or surfactants may include acute toxicity (illness, death) or chronic toxicity (such as teratogenic or carcinogenic effects). It is important to reiterate that toxicity is not risk. Risk is a combination of toxicity and exposure. In order to evaluate risk, it is necessary, but not sufficient, to evaluate toxicity. Toxicity needs to be evaluated in context with exposure. The balance of this paper will discuss the toxicity of surfactants within the context of an environmentally relevant dose.

Aquatic Toxicity

It is widely acknowledged by the scientific community that certain inert ingredients can contribute to the toxicity of herbicide formulations or herbicide/surfactant mixtures to selected aquatic organisms (Buehl and Faerber, 1989; Giesy et al., 2000; Paveglio et al., 1996; Syracuse Environmental Research Associates, Inc., 1996). In some cases the toxicity of the inert ingredient may be greater than the toxicity of the active ingredient (Solomon and Thompson, 2003). The United States and European Toxicity Classification labels for chemical stressors to aquatic organisms, given in Table 1, help put acute aquatic LC_{50}[2] toxicity data (Table 2) into a lay context. Unfortunately, there are not a large number of published papers on surfactant toxicity. In addition, many of the published indicators of toxicity, such as the LC_{50} values, are not put into context by comparing them to estimates of potential exposure. This makes it difficult to assess risk. The following section reviews some published ecotoxicity data that was put into context by the respective authors.

Nonylphenolethoxylate (NPE) - Based Surfactants

The United States Department of Agriculture (USDA) Forest Service (Region 5) looked extensively at the risk of non-ionic, NPE-based surfactants used in herbicide applications (Bakke, 2003). The Forest Service reviewed the toxicity and risk of NPE surfactants as a group. While they did not present data for individual surfactant products, the Forest Service did identify R-11 Spreader Activator® (R-11®) (Wilber-Ellis Company), Activator 90® (Loveland Industries), X-77 Spreader® (X-77®) (Loveland Industries), and Latron AG-98 (N) Intermediate®(Rohm & Haas Company) as NPE surfactants (specific brands are listed for illustration and example only. Mention of a specific brand name is not intended to be a recommendation of the brand. Failure to mention a specific brand is not intended to be a lack of recommendation for the same).

The Forest Service found no

[1]Such as Rodeo® (Dow AgroSciences) and Aquamaster® (Monsanto).

[2] LC_{50} = Lethal concentration of test substance that causes 50% mortality of the test species.

Used with

By: Susan Monheit, CDFA
J. Robert Leavitt, CDFA &
Joel Trumbo, CDFG

evidence that typical exposures of the NPE surfactants would lead to dose levels of concern for humans, or terrestrial or aquatic wildlife (Bakke, 2003). Normal operation exposure doses of 3.1 parts per billion (ppb[3]) to 31.2 ppb were found to be protective of "all aquatic organisms" (Bakke 2003). Short exposure time, dilution, binding to sediments, and the break down of metabolites[4] and/or contaminants all act to reduce exposure. For fish, calculated levels of exposure in Forest Service applications were at least 30 times lower than the 1,000 ppb protective level described in the literature (Bakke, 2003).

In the 1980s, Monsanto Company measured the toxicity (in aquatic systems) of a variety of surfactants commonly used for aquatic herbicide applications. In unpublished studies, Monsanto measured the 96-hour acute bioassay values (LC_{50}) for rainbow trout (*Oncorhynchus mykiss*) with the NPE surfactant R-11® and other commonly used non-NPE surfactants. Surfactant LC_{50} values ranged from 4.2 ppm to >1,000 ppm (Martin Lemon, Monsanto Company, personal communication). An LC_{50} of 3.8 ppm for the surfactant R-11 places it in the "moderately toxic" category (see Table 1).

The California Department of Fish and Game (CDFG) Aquatic Pesticide Laboratory has also performed surfactant bioassays.

1) In a risk assessment of the aquatic herbicide Rodeo® and the surfactant R-11®, the CDFG performed bioassays on the aquatic invertebrate *Ceriodaphnia dubia*, and larval leopard frogs (*Rana pipiens)*. In this study, the herbicide mixture was applied directly to the surface of a pond, rather than to emersed vegetation, producing atypically high concentrations of these compounds in water. Water samples collected one hour after application contained mean concentrations of glyphosate, NPE and nonylphenol (NP) (the breakdown product of NPE), of 1.83 ppm, 1.10 ppm and 0.02 ppm respectively (Trumbo, 2003). The 96-hour toxicity test using larval leopard frogs produced an LC_{50} value of 6.5 ppm for glyphosate and 1.7 ppm for NPE (tested as a Rodeo®/R-11® mixture). Therefore, the toxicity of the mixture (glyphosate plus surfactant) to larval frogs was likely due to R-11® and not Rodeo®. Other LC_{50} values for surfactant R-11® reported by the CDFG include 5.7 ppm for *C. dubia*, 1.1 ppm for fathead minnows (*Pimephales promelas*), and 3.9 ppm for Sacramento splittail (*Pogonichthys macrolepidotus*) (Trumbo, 2003).

Table 1 Toxicity Classification For Aquatic Species

USEPA Toxicity Classification	European Toxicity Classification (Aquatic)	Acute Aquatic LC50 or EC50[12] (ppm)
Practically Nontoxic	--	>100
Slightly Toxic	Harmful	>10, ≤100
Moderately Toxic	Toxic	>1, ≤ 10
Highly Toxic	Very toxic	≥0.1, ≤1
Very Highly Toxic	Very Toxic	<0.1

[12] EC_{50} = concentration to induce 50% malformation (or other effect) in test organisms.

2) The CDFG also evaluated the risk of using glyphosate and surfactant R-11® for the control of giant cane (*Arundo donax*) on non-target aquatic fauna. Bioassays using herbicide/surfactant mix were performed on fathead minnows, and larval frogs. Bioassays using the surfactant separately were performed on bluegill sunfish (*Lepomis macrochirus)*, and rainbow trout. The 96-hour LC_{50} values for glyphosate/R-11® tank mix were 17.9 ppm for fish and 31.5 ppm for frogs (CDFG, 1998). An unpublished literature value of approximately 4.0 ppm for the 96-hour LC_{50} for R-11® in bluegill sunfish and rainbow trout (CDFG, citing Monsanto 1983a and 1983b) was evaluated in comparison to actual

[3] ppb = micrograms per liter.

[4] The toxicity value for the surfactant R-11® metabolite nonylphenol (NP) is 0.13 parts per million (ppm) (based on 96-hour LC_{50} tests), which puts NP in the "highly toxic" category (see Table 1, Article 1). NP, however, is formed primarily from the biodegradation of NPE under anaerobic conditions such as those in sewage treatment ponds (Staples et al., 1998) and is not likely to form under aerobic conditions (USDA Forest Service Risk Assessment: Alkylphenols & Ethoxylates Research Council 1998, 1999a, 1999b; Jonkers et al., 2001; Tanghe et al., 1999; Staples et al., 1999). The conditions under which surfactant R-11® would be used with riparian formulations of glyphosate to control emergent or near shore vegetation such as purple loosestrife, would be well-ventilated and subject to minimal, if any, production of this toxic metabolite.

[5] ppm = parts per million = milligrams per liter.

Table 2 Acute Aquatic Toxicity Values for Selected Surfactants Currently Registered for Use in California (unless otherwise noted)

Surfactant Product / *Test Species*	Test Duration	LC50 (ppm)	Mixture w/Rodeo®	Safety Factor[13]	Reference
NPE-Based Surfactants					
R-11®					
Rainbow trout	96 Hr	3.8 ppm			WSDA&E, 2004
Water flea (Daphnia magna)	48 Hr	19 ppm			WSDA&E, 2004
Water flea (Ceriodaphnia dubia)	24 Hr	5.7 ppm	3.1/2.8 ppm		Trumbo, 2003
Fathead minnow	24 Hr	1.1 ppm	2.8/0.9 ppm		Trumbo, 2003
Sacramento splittail	24 Hr	3.9 ppm	5.5/2.1 ppm		Trumbo, 2003
Leopard frog	96 Hr	-	6.5/1.7 ppm		Trumbo, 2003
Bluegill sunfish (1983a) *Rainbow trout (1983b)*	96 Hr	~4.0 ppm	17.9 ppm	100 fold safety margin for surfactant, Safety Factor = 307	CDFG, 1998
Rainbow trout	96 Hr	3.8 ppm	-		Monsanto, 1983b
Bluegill sunfish	96 Hr	4.2 ppm			Monsanto, 1983a
Larval frog	96 Hr	-	31.53 ppm		CDFG, 1998
X-77®					
Rainbow trout	96 Hr	4.2 ppm			WSDA&E, 2004
Water flea (D. magna)	48 Hr	2 ppm			WSDA&E, 2004
Bluegill sunfish	96 Hr	5.0 ppm		10.6	Haller & Stocker, 2003

Table Continued on Page 9

[13] Safety Factor calculated by dividing the LC_{50} value by the environmental field concentration.[14] Anionic = carries a net negative charge in neutral solution.

environmental sample concentrations of 0.013 ppm for R-11®, after aerial herbicide applications. This makes the safety margin for use of R-11® surfactant a minimum 100 fold, when the surfactant was applied directly to water. Furthermore, no significant mortality was observed in larval frog tests with undiluted water samples collected from waterways directly adjacent to the applications. The author concluded, "the information produced from this study indicates that Rodeo® with R-11® applied aerially to control giant cane poses no significant acute toxicity hazard to non-target fish and frog species" (CDFG, 1998).

3) In another study, the CDFG conducted water quality assessments of glyphosate plus R-11® along a stream, pond and dead-end slough for seven days immediately following treatment application (Trumbo, 2002). No toxic effects to the test species, fathead minnow, were observed with water collected from either the stream, or the dead-end slough. No glyphosate or breakdown products of glyphosate and R-11® were detected in samples from these waters. A low, but statistically significant mortality (30%) was observed in fathead minnows in bioassays with water from the pond. Chemical analyses of pond water drawn one hour after herbicide application found detectable residues of glyphosate (850 ppb) and two surfactant breakdown products, NPE (400 ppb), and NP (12.5 ppb). Comparing sample analyses from the pond site to known toxicity values for glyphosate, NPE, and NP indicates that the surfactant R-11®, or its contaminant metabolite NP, was likely responsible for the observed toxicity, rather than the herbicide glyphosate. Glyphosate concentrations in the sample were at least two orders of magnitude below the LC_{50} value for fish, while surfactant concentrations (NPE and NP) were approximately 10% of the LC_{50} values for fish (Trumbo, 2002).

In a study performed by the San Francisco Estuary Institute (SFEI)[6], glyphosate combined with the NPE surfactant R-11® was monitored at three field locations for aquatic toxicity. No toxicity was found to be associated with any of the glyphosate herbicide applications (SFEI, 2004, pp 63). While risk quotients[7] for glyphosate alone were

almost always well below levels of concern (LOC)[8], the risk quotients calculated from field concentration data of the NPE surfactant R-11® consistently exceeded both acute and chronic LOC for the standard test species fathead minnow, and the listed species Delta smelt (*Hypomesus transpacificus*). Toxicity values for R-11® were in the "moderately toxic" range according to United States Environmental Protection Agency (USEPA) classifications (see Table 1). The toxicity values for R-11® were 1.1 ppm (LC_{50}), and 0.34 ppm (no observed effect concentration-NOEC) for fathead minnows, and 0.10 ppm (NOCE) for Delta smelt. The risk quotients for Delta smelt also exceeded 1.0 ppm, indicating the need for further investigation.

Preliminary laboratory research conducted by the SFEI on four aquatic pesticides with and without NPE-based surfactants (in a "worst case scenario exposure") showed the surfactants R-11® and Target Pro-Spreader Activator® (TPA) (Target Specialty Products) to be potential endocrine disruptors. Exposure by the surfactants R-11® and TPA (without glyphosate) caused a 23 and 12 fold increase, respectively, in vitellogenin expression relative to untreated controls in juvenile rainbow trout (SFEI, 2004, pp 69-71). The production of the protein vitellogenin in male fish may be indicative of exposure to estrogenic

Table 2 cont.d, Acute Aquatic Toxicity Values for Selected Surfactants Currently Registered for Use in California (unless otherwise noted)

Surfactant Product / *Test*	Test Duration	LC50 (ppm)	Mixture w/Rodeo®	Safety Factor	Reference
Agri-Dex®					
Rainbow trout	96 Hr	>1000 ppm			WSDA&E, 2004
Rainbow trout	96 Hr	1000 ppm			Helena Technical Data Sheet, 2004
Bluegill sunfish	96 Hr	1000 ppm			Helena Technical Data Sheet, 2004
Water flea (D. magna)	48 Hr	1000 ppm			Helena Technical Data Sheet, 2004
Water flea (D. magna)	48 Hr	>1000 ppm			WSDA&E, 2004
Class Act Next Generation® (not currently registered in California)					
Rainbow trout	96 Hr	447 ppm			WSDA&E, 2004
Water flea (D. magna)	48 Hr	377 ppm			WSDA&E, 2004
Competitor® (not currently registered in California)					
Rainbow trout	96 Hr	95 ppm			WSDA&E, 2004
Water flea (D. magna)	48 Hr	>100 ppm			WSDA&E, 2004
Induce®					
Bluegill sunfish	96 Hr	9.0 ppm		19.1	Haller & Stocker, 2003
Li-700®					
Bluegill sunfish	96 Hr	60.8 ppm			Haller & Stocker, 2003
Bluegill sunfish	96 Hr	60.8 ppm		132.2	Haller & Stocker, 2003
Bluegill sunfish	96 hr	210 ppm			SERA 1997, Rudy Lapurga, Li-700® Product Safety Data Sheet
Juvenile rainbow trout	96 hr	130 ppm			SERA 1997, Rudy Lapurga, Li-700® Product Safety Data Sheet

Table 2 continued on page 11

[6] The San Francisco Estuary Institute's (SFEI) Aquatic Pesticide Monitoring Program (SFEI, 2004) conducted two years of research and monitoring to provide the state with information on 1) the fate and transport of pesticides applied to aquatic systems, 2) impacts to beneficial uses, 3) the bioaccumulation potential, and 4) sediment accumulation potential of eight different pesticides and associated surfactants. This information will be used to develop the general National Pollution Discharge Elimination System permit to regulate discharges of aquatic pesticides to surface waters in California (Phase 2 Report).

[7] Risk quotients for aquatic organisms are calculated by dividing the estimated environmental concentration by a known toxicity reference value (i.e.: LC_{50}) for that chemical.

[8] LOC = a ratio of contaminant concentrations to toxicity values below which adverse effects are not expected.

compounds[9]. However, Kubena (1998) reported that surfactant R-11®, at continuous exposure and concentrations greater than would be expected in the environment, did not induce vitellogenin in rainbow trout, and was, therefore, not a potential endocrine disrupter (Solomon and Thompson, 2003 citing Kubena, 1998). The SFEI plans further studies in 2004 that will address the endocrine question with environmentally relevant concentrations of surfactants.

Another indicator of risk is adverse effects reports following field use. Surfactant R-11® has been used in the field in California and other Western states for over 20 years. To the knowledge of the manufacturer there have never been any reports of adverse effects to fish or other aquatic species from these field applications (Scott Johnson, Wilbur-Ellis Company, personal communication). This would indicate that, in real-world situations, surfactant R-11® is rapidly diluted or dissipated to concentrations that are not ecologically significant[10].

The environmental fate of aerial applications of glyphosate and X-77® (NPE surfactant) applied to smooth cordgrass (*Spartina alterniflora*) was studied in Willapa Bay, Washington (Paveglio et al., 1996). The toxicity of the tank mix was evaluated by comparing Willapa Bay seawater sample concentrations with toxicity values (LC_{50}) derived from bioassay tests. After aerial applications of the tank mix to mudflats, the investigators found very low levels of glyphosate in seawater (mean concentration ranged from 3.15 ppb to 25.6 ppb for three different sampling locations), and no detectable surfactant. Measured glyphosate concentrations were 23,000 to 56,000 fold less than the 96-hour LC_{50} values for a Rodeo®/X-77® mixture reported by Mitchel et al., (1987) for rainbow trout, coho (*Oncorhynchus kisutch*) and chinook (*Oncorhynchus tshawytsha*) salmon. No toxicity evaluation could be made for the surfactant since it was not detected. Simenstad et al., (1996) studied the response of benthic invertebrates to the same tank mix that Paveglio et al., (1996) examined. Neither short-term (14-day) or long-term (28 or 119-day) population effects were observed in any of 19 indicator taxa following the use of the glyphosate/surfactant mix. Solomon and Thompson, (2003) compared measured deposition concentrations of Li-700® (Loveland Industries) to published values of toxicity to aquatic animals, including fish, and concluded, "this surfactant presents an insignificant acute risk to aquatic organisms." They also concluded that the ecological risk from other surfactants, such as Induce® (Helena Chemical Company) or X-77®, if applied at similar application rates, would also be less than significant.

In a pilot study challenging

Adjuvants and Surfactants

Adjuvants are a group of chemicals that can be added to spray solution herbicides to improve performance of the overall mixture. Some adjuvants enhance the activity of the active herbicidal ingredient (activator adjuvants), while others act to reduce physical problems associated with environmental conditions and herbicide application (USDA, 2002; Green and Foy, 2004) such as wind, rain fastness, foaming, and water quality (utility adjuvants). Activator adjuvants include surfactants, wetting agents, sticker-spreaders, and penetrants, lubricants, emulsifiers and oil dispersants. Utility adjuvants include acidifiers, buffering agents, water conditioners, anti-foaming agents, and drift control agents (Colorado State University Fact Sheet No. 0.564; USDA, 2002).

In the United States, these non-pesticidal components of the formulations are called "inerts" (Green and Foy, 2004). The term "inert" has created a great deal of confusion, because adjuvants are not necessarily benign. In addition to increasing the herbicidal effect of the active ingredient, they can have toxic properties in and of themselves.

The name SURFACTANT comes from a contraction of the phrase *SURFace ACTive AgeNTS*. They work by improving mixing, spreading, spray retention, and adsorption (penetration of the cuticular wax) characteristics of the herbicide mix. Surfactants can be grouped into categories by their ionic behavior in solutions (anionic[14], cationic[15], amphoteric[16], or non-ionic[17]) (UK Marine SAC, 2004), or by other components (non-ionic surfactants, crop oil concentrates[18], nitrogen surfactant blends[19], esterified seed oils[20], and organo-silicone surfactants[21]) (Colorado State University, 2002). With the exception of POEA[22] (the cationic surfactant formulated into certain terrestrial glyphosate herbicide formulations[23]), non-ionic surfactants are the most common type of surfactants used. The manufacturers of the aquatic and riparian glyphosate-based herbicides recommend the addition of a non-ionic surfactant to the tank mix to improve efficacy.

[9] "Vitellogenin is an egg yolk precursor protein expressed only in female fish and is normally dormant in male fish. However, when male fish are exposed to estrogenic Endocrine Disrupting Chemicals (EDC) the vitellogenin gene is expressed in a dose-dependent manner. Hence the vitellogenin gene expression in male fish has been used as a molecular marker of exposure to estrogenic EDCs." (USEPA 2004).

[10] Wilbur-Ellis Company also points out that it is the unreacted "free" NP that represents the greatest risk from NPE surfactants in aquatic situations, and that only trace amounts of NP are found in their R-11® product.

[15] Cationic = carries a net positive charge in neutral solution.

[16] Amphoteric = contains both positively and negatively charged groups, but has a net charge of zero in neutral solution.

[17] Non-ionic = does not ionize in solution and therefore carries a net charge of zero. However, non-ionic surfactants do have a water-soluble end (usually due to a chain of epoxy groups) and a water insoluble end (usually due to an aliphatic chain or aromatic groups, or both).

[18] Crop Oil Concentrates = formulated combinations of vegetable oil and surfactant.

[19] Nitrogen Surfactant Blends = formulated combinations of surfactant and ammonium nitrate (or similar product).

[20] Esterified Seed Oil = fatty acids from vegetable oils that have the acid end "capped" with methanol, ethanol, or similar short chain alcohol.

[21] Organo-silicone Surfactant = surfactant containing silicone in place of one or more carbon atoms.

[22] POEA = polyethoxyethylated tallow amine.

[23] Roundup® (Monsanto) brand glyphosate herbicide.

juvenile amphipods (*Eohaustorius estuarius*) with sediment mixed with glyphosate and the three surfactants R-11®, X-77® and Li-700® the glyphosate plus R-11® was the most toxic formulation (Solomon and Thompson, 2003 citing Kubena, 1998). However, the concentrations used were much higher than measured in the field, so it is difficult to quantify the risk in actual field situations from this data.

Non-NPE Based Surfactants

To minimize the potential for adverse effects to non-target aquatic organisms, the Washington State Department of Agriculture and Ecology (WSDA&E) recommended that a review be conducted to consider allowing the use of less toxic spray adjuvants for aquatic weed control[11]. The surfactants currently under consideration for registration for aquatic use by the State of Washington are Agri-Dex® (Helena Chemical Company), Dyne-Amic® (Helena Chemical Company), and Kinetic® (Helena Chemical Company); Class Act Next Generation® (Agriliance); and Competitor® (Wilbur-Ellis). The 96–hour LC_{50}'s for rainbow trout for these products range from >1,000 ppm (practically non-toxic) (Table 2) to 13.9 ppm (slightly toxic) (Table 2). The 48-hour LC_{50}'s for water flea (*Daphnia magna*) for these products range from >1,000 ppm (practically non-toxic) to 60 ppm (slightly toxic) (Table 2). "Aquatic acute toxicity studies indicate that these products are less toxic to fish and aquatic invertebrates than R-11® and X-77®. In addition, studies by the University of Washington indicate that Agri-Dex® is less toxic to Pacific oysters (*Crassostrea gigas*) than R-11® or Li-700®" (Smith and Grue, 2002). These products are also less hazardous to the applicator than Li-700®, which is corrosive (WSDA&E, 2004). While lower in toxicity, Li-700® carries the warning word DANGER on its label due to the corrosive nature of the product.

Table 2 cont.d, Acute Aquatic Toxicity Values for Selected Surfactants Currently Registered for Use in California (unless otherwise noted)

Surfactant Product / *Test Species*	Test Duration	LC50 (ppm)	Mixture w/Rodeo®	Safety Factor[13]	Reference
Li-700®					
Water flea (D. magna)	48 Hr	190 ppm			SERA 1997, Rudy Lapurga, Li-700® Product Safety Data Sheet
POEA or MON 0818					
Bluegill sunfish	96 Hr	1.6 ppm			Haller & Stocker, 2003
Rainbow trout	96 Hr	0.65 ppm			Giesy et al., 2000 (Folmar et al., 1979)
Silicone-based Surfactants					
Dyne-Amic®					
Bluegill sunfish	96 Hr	26.9 ppm		38.4	Haller & Stocker, 2003
Rainbow trout	96 Hr	23.2 ppm			WSDA&E, 2004
Water flea (D. magna)	48 Hr	60 ppm			WSDA&E, 2004
Kinetic®					
Bluegill sunfish	96 Hr	19.8 ppm		42.1	Haller & Stocker, 2003
Rainbow trout	96 Hr	13.9 ppm			WSDA&E, 2004
Water flea (D. magna)	48 Hr	60.7 ppm			WSDA&E, 2004

In another study, results of *in-situ* bioassays of wetlands treated with an aquatic formulation of glyphosate and Li-700® suggest that the herbicide and surfactant mixture did not pose a risk to aquatic invertebrates at application rates used to control purple loosestrife. Test organisms evaluated included duckweed (*Lemna gibba*), water flea, rainbow trout, and free-living water column and benthic invertebrates. However, the same study showed reduced growth of duckweed 48 hours after exposure to the glyphosate/surfactant mixture (Gardner and Grue, 1996).

Polyethoxylated tallow amine (POEA)

The surfactant POEA is used in formulations with glyphosate to formulate the products sold as terrestrial herbicides. Nonetheless, aquatic toxicological data is available for this compound, and can be a valuable benchmark of surfactant toxicity. In a review of recent toxicological data, Giesy et al., (2000) found POEA to be more

[11] The surfactants currently registered for use in Washington State are X-77®, R-11®, and Li-700®.

toxic to fish than glyphosate (Monheit, 2002). The lowest (and therefore most conservative) published aquatic LC_{50} value for POEA is 0.65 ppm for the rainbow trout (Folmar et al., 1979), which is at the higher end of the toxicity range for surfactants (Monheit, 2002) (see Table 1). Acute toxicity values (LC_{50}) for POEA to fish range between 1.0 ppm to 3.0 ppm for bluegill sunfish and fathead minnows, to 0.65 ppm to 7.4 ppm for rainbow trout (Giesy et al., 2000). Solomon and Thompson (2003) reviewed the ecotoxicology data for aquatic animals (including fish) in the open literature and in the USEPA database. They concluded that "For all data, generally speaking, the technical product was less toxic than glyphosate + MON 0181 [POEA]." However, the authors, basing their conclusions on a study of glyphosate plus POEA in forest use in Canada, considered the real-world risk from this formulation to be small.

Table of Surfactant Toxicity Values

While herbicide stereochemistry and active site specificity may be the ultimate determinate in whether or not a compound in a mixture is toxic (Baratt, 2000), classical toxicity assessments such as aquatic bioassays can give us some index of relative toxicity. Toxicity data of select surfactants, derived from laboratory and field bioassay tests, are listed in Table 2. The *Safety Factors* listed were derived by comparing LC_{50} values with calculated environmentally relevant concentrations (Haller and Stocker, 2003). The larger the safety factor, the less toxic the herbicide.

Summary

The issue of risk to non-target aquatic organisms due to the use of surfactant products in herbicide tank mixes is not simple. The issue is further complicated by the relatively small amount of data available on the toxicity of these compounds in mixture at environmentally relevant concentrations.

It is apparent from the literature that the NPE-based surfactants, while effective, are also more acutely toxic than other types of surfactant products. Based on the data available, the crop oil concentrates (i.e. Agri-Dex®), esterified seed oils (i.e. Hasten® [Wilber-Ellis Company]), and silicone surfactants (i.e. Dyne-Amic®, Kinetic®) are less acutely toxic than the NPE-based surfactants. However, when placed into perspective, waters treated with glyphosate mixed with NPE surfactants (with the possible exception of R-11®) predominately showed no toxic effects at environmentally relevant concentrations. The concentrations of glyphosate detected were very small, and the concentrations of surfactants are often undetectable after dilution in the actual waterways where the herbicide was applied.

Clearly, there is no substitute for the toxicological evaluation of herbicide mixtures. The dearth of relevant toxicological information on herbicide mixtures in environmentally relevant contexts underscores the need for a toxicological assessment component in management programs for aquatic weeds.❖

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References cont.'d on page 14

California Interagency Noxious Weed Coordinating Committee-UPDATES
May 10, 2004

David Dyer, NRCS-USDA

There is a new publication put out by the Department of Transportation: The Nature of Roadsides. Bonnie Harper-Lore super active advocate of native plants (USDOT)

NRCS has $500,000 going into the development of another plant materials center in the Bishop area with an invasive plant focus. The current emphasis for NRCS projects/proposals/funding is on water quantity/quality, carbon sequestration and climate change dynamics. Linking exotics with these emphasis areas has been successful (for example Tamarisk, YST).

Ann Dennis , CalFlora

The online data submission system has been resurrected and is now being supported by both a user-fee system and grants. The cost is 10$ for individuals and 150$ for professionals/agencies and a negotiable fee for a number of employees from the same agency. Some concern expressed about limiting it to paying customers. Concerns were well received and feedback was solicited. Currently public libraries and K-12 schools are receiving the service for free and if the person using the system is under 12 it bypasses the user-fee requirement.

Cheri Rohrer ,US FS-USDA

Her position title is in flux – She will be moving from the Range Management Staff to the Ecosystem Conservation Staff. They are going through a change in personnel structure and she soon will be the Invasive Program Manager. She is working on developing an all-taxa invasive issues team.State and private forestry program areas have different missions.

The National Forest Systems is a special wing of the USFS that provides money to private landowners that address forest ecosystem issues. Forest Service is working on getting the invasive issues dealt with under the same branch.The Vallejo Regional Office earmarked $700,000 for invasive plant issues in 2006. NEPA will be pivotal in the Forest Services' ability to apply those funds.

Steve Schoenig , CDFA

Steve indicated that the Forest Service Regional Office in Vallejo has allocated funds for weed management areas in targeted areas: $440,000 to southern California Weed Management Areas to qualify for invasive/fire / forest issues. $272,000 for Tahoe basin to augment and accelerate the work they are doing. This will involve hiring a full time outreach coordinator and on the ground control work. $111,000 for ongoing high priority weed eradication projects.The recent NRCS Conservation Innovation Grant is new funding opportunity with NRCS that includes weed work related to restoration. The NRCS has previously funded brochures through theEQUP/ education funding program. This program no longer exists. Steve suggested we might want to have Mark Parsons or Diane Holcolm of NRCS present the NRCS funding program platform to us that the next meeting. NRCS EQUIP program pays for seeding. Weed control is handled through the conservations practice as pest control.

Pulling Together Initiative is still being floated every year. This funding source has to be matched at a minimum of 50-50. They usually fund 30-40 projects across the country. This year 7 WMA's applied and got 3-4 year 50k grants. A few years ago Steve got funding from CalTrans and Pulling Together Initiative to map Yellow Starthistle. Part of the Purple Loosestrife monitoring money was also obtained through PTI.

CalFed dollars are supporting a variety of projects focused on the SF Bay and Delta. Overall spending is low for invasives.

Currently there are between 200-300 WMA's across the country.

Conservation Reserve Program: NRCS has a program that takes cropland out of production when there is a need to stabilize the area. The owner must leave it fallow and the use of herbicide use is not allowed. Some Resource Conservation Districts (RCDs) are tax supported. One of the more successful ones is in Riverside, Ca. They have a million+ budget per year. They have picked up the Riverside Agricultural Research Station Salinity Lab through a lease arrangement and have done a fairly robust remodel of the facility to accommodate the RCD. Other notables RCD's include Western Shasta, Yolo RCD, and Santa Monica Mountains RCD. Theses RCD's came up with money to get Watershed coordinators. Apparently 108 RCD's applied for 35 watershed coordinators. It would be nice to have Invasive Plant Coordinators as such. Cal Dept of Conservation has Conservation Grants that mainly go to RCDs. Kern WMA's has received a $100k grant in the past for yellow starthistle.Resource Conservation Districts are like weed management Areas - but they have a broad conservation mission. A major mandate of NRCS

is to work with the Resource Conservation Districts.

Center for Integrated Plant Management (Weedcenter.org) has $5k per year weed grants – several WMA's have been successful in getting these grants. This could be tapped by non-profits too (perhaps CalFlora).

Cynthia Roye, California State Park System

Currently new funding is not available. A variety of parks have received some funding for projects, however rolling it forward to the state level takes a fair amount of coordination. CSP is assimilating a resource condition assessment that began in 2002 this year. The effort has enabled them to get rough evaluations of 19 criteria of which 5 were weed related (management units identified, species presence noted, % coverage were included, and level of effort required to control species).

Doug Johnson, Director Cal-IPC

Brochures (Don't Plant a Pest!) have been a big hit. They are currently offering brochure sponsorship opportunities to Agencies etc (agencies can sponsor 1000 brochures for $500 and the agency will get recognized as a partner on the back of the brochure.). Packs of 100 for brochures are popular orders.

Craig Bill S144 Hearing of subcommittee: Steve Schoenig was invited to testify a couple of weeks ago. Senator Craig from Idaho is sponsoring it. Seems to be a positive sign they are conducting hearings. This bill is designed to supply Weed Management Areas with funding (100 million dollars).

CalTrans has a project they are currently working on at Devils slide (South of SF on 101) taking out bunch of pampas grass. They also have a mitigation grant program for both northern and southern California.

Currently CalIPC is working with California Society for Ecological Restoration SERCAL and California Native Grass Association to offer joint memberships and possibly one day offer combined conferences. CalIPC is also working with the Nursery industry and the National Landscapers Association..

Susan Ellis , CDFG

The algae, *Caulerpa taxifolia* has been targeted for funding. Project is underway in San Diego. They should know of the success rate after this fall growing season. This was funded through a proposition 13 initiative (many millions).

Bobbi Simpson, NPS

Bobbi discussed the focus of the NPS Cooperative Conservation Initiative and solicited ideas for partnering.

The California Exotic Plant Management Team has just received word that their proposal for $165,000 for satellite teams was granted. This funding pot is very similar to the CIG/NRCS funding pot except we have to do work on NPS land. The NPS can supplement the reduction of neighboring properties work by concentrating on like-species. Mietek Kolipinski of the NPS Regional Office was successful in getting $50,000 for a project entitled, "Barring Non-Native Plant Invasions into California's National Parks by Human Activities". Kimberly DeBriansky a Master's Degree Candidate, California State University at Hayward is also working with Mietek on this project.

IDEAS for future meetings:

The State Weed Mgmt Plan should be out in 4-6 weeks. Dan Dyer suggested we figure out how to help address the "CINWCC-identified" action items in the plan. Possibly taking the plan and focus on the chapter. Mostly would be nice to develop action items. Extending the length of the meeting to incorporate a speaker would be necessary. It was suggested to make the meeting from 10am-3pm.

The number of meetings per year was set at 4 and it was discussed how important it is to have agenda set and meeting set early. It was suggested to hold an occasional meeting in the SF Bay area. Bobbi will investigate a venue.

One meeting would be held jointly with Caliwac and one would fall during the Weed Awareness Week in Sacramento. Bobbi will send out request for members ability to attend based on several dates. The optional dates for the next meeting are August. 17,19 or 25.

The Wolks AB 2631 bill to establish a California Interagency Invasive Weed Council is still being considered. Amendments were made to the originally proposed bill.The council would essentially have an Advisory Committee that would take the recommendations from the Council.

Bobbi asked if folks would consider changing the name – broadening it to the California Interagency Invasive Weeds Coordinating Committee. The only obstacle would be to revise the MOU. General consensus was that it is probably time to do that anyway and it could possibly inspire more participation from agencies.❖

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Non-indegenious Aquatic Species Alert System

In July 2004 the United States Geological Survey launched the Non-indigenous Aquatic Species (NAS) system. The NAS program allows users to register and receive e-mails of new aquatic introductions into the United States.

There are three different alerts on the NAS system. Once users register with their name and e-mail address, they are able to sign-up for any combination of the three available watches.

State Watch: Once users specify their state(s) of interest, the NAS system sends alerts about any new species that are introduced into the selected state(s). The System will not inform users if a species moves into a new county or drainage within the selected state. Users will also not be informed of reintroduced species is detected in their selected state.

Group Watch: The group watch alerts users when a non-indigenous species from a chosen group is found for the first time in the United States, a state, county or drainage (HUC-8). Users will not be informed if a species from their selected group is collected from an area that has previous recorded the species. The NAS System will not inform users if a species in their selected group moves to a new location within a drainage.

Species Watch: Using the species watch, the NAS System alerts users when a selected species expands into a state, drainage (HUC-8) or county within a state where the species has never been previously recorded. The system will not alert users if the selected species is found in an area with previous records. Users will also not be alerted if the selected species is found in a new location in an infested drainage (HUC-8).

To sign up for the NAS system visit:http://nas.er.usgs.gov/AlertSystem/ . If you have any additional questions please contact Pam Fuller at the USGS NAS Program Center for Aquatic Resource Studies at (35) 264-3481 or e-mail her at Pam_Fuller@usgs.gov. ❖

Upcoming Events

2004 Annual Meeting and Conference for California Association of Resource Conservation Districts (CARCD). Embassy Suites Hotel, San Luis Obispo, CA November 17-20.
The conference, "Building our Future: Natural Resources in California" will offer training, networking and information about natural resources issues. Highlights will include a land use panel, water quality and forestry and fuel reduction sessions. For more information about the conference, visit: www.carcd.org/conf2004/conf2004

9th Annual Nevada WMA conference October 12 (optional) 13-14, (workshops) 15 (field trip) Gold Coast Hotel and Casino, Las Vegas, NV
Optional Pesticide Applicator's Workshop Tuesday, October 12, 2004, 9am-5pm; (4 general, 1 safety and 1 law CEU for NV)
Additional cost: $40
Cooperative Weed Management Area Workshop, Tuesday, October 12, 2004 8-5, no charge
For more information about the conference or field trip please contact Dawn Rafferty, Noxious Weed Program Coordinator
(775) 688-1180 ext 269, (775) 688-1178 FAX or 350 Capital Hill Avenue Reno, NV 89502
For more information about the pesticide application workshop contact Larry Hughes at 775-782-9835.
For more information about the WMA workshop please contact Dawn Rafferty at 775-688-1180 ext 269.

3rd International Conference on Invasive Spartina, November 8-10, US EPA Region 9 Headquarters: 75 Hawthorne St. San Francisco, Ca
This convention provides a forum for the best and most recent Spartina research from around the world including experiences from marsh managers and technical experts. The abstracts deadline is Friday, September 24th. To receive a call for papers, invitations or registration materials visit: **www.spartina.org/2004conference** or e-mail contact information to: **conference@spartina.org**

57th Annual Meeting of the California Weed Science Society, January 10-12, 2005, Double Tree Hotel, Monterey, California.
For more information, visit the CWSS web site at: **www.cwss.org**

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