Orchard Weed Management Update

Brad Hanson
UC Cooperative Extension
Weed Science Specialist

University of California
Agriculture and Natural Resources

UCDAVIS
DEPARTMENT OF PLANT SCIENCES
College of Agricultural and Environmental Sciences

Sutter-Yuba Walnut Day
Yuba City, CA
3-5-25

T&V weed science team

- Seth Watkins – Staff Research Associate
  - Orchard/ vineyard herbicide efficacy and crop safety evaluations, IR4 program
- WRIC staff
  - Weed Research and Information Center – extension and program support
- Matt Fatino – postdoc
  - Broomrape management in processing tomato
- Pershang Hosseini – postdoc
  - Sanitizer impacts on branched broomrape seed viability
- Tong Zhen – PhD student
  - Electric weed control in organic orchard and berry crops
- Stephen Chang – MS student
  - Aquatic herbicide impacts on irrigated crops
- Val Galetti – MS student
  - Experimental herbicide performance in tree nuts
- Deniz Inci – postdoc in Al-Khatib lab
  - Impacts of rice herbicide drift on fruit and nut tree crops of the Sacramento Valley

Core T&V research and extension areas

- Herbicide-related
  - Evaluation of herbicides registered in orchards and vineyards
  - Herbicide discovery and characterization with industry partners
  - Orchard herbicide fate in the environment (PREs, glyphosate, glufosinate/metabolites)
  - Impacts of off-target herbicides on tree and vine crops
- Less herbicide
  - Cover crops and reduced herbicide intensity programs
  - Organic weed control devices for orchards and vineyards
- Regulatory
  - Impacts of ESA on herbicide labels. Extension to industry.
- General support: industry and UCCE resource for herbicide and weed management info in perennial production systems

Herbicide Registration on California Tree and Vine Crops - *(reviewed April 2023 - UC Weed Science)*

	Herbicide- Common Name *(example trade name)*	Site of Action Group[1]	Almond	Pecan	Pistachio	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum / Prune	Avocado	Citrus	Date	Fig	Grape	Kiwi	Olive	Pomegranate
			----- tree nut -------				- pome -		---------- stone fruit ---------												
Preemergence	**dichlobenil** *(Casoron)*	L / 20	N	N	N	N	**R**	**R**	N	**R**	N	N	N	N	N	N	N	**R**	N	N	N
	diuron *(Karmex,Diurex)*	C2 / 7	N	**R**	N	**R**	**R**	**R**	N	N	N	**R**	N	N	**R**	N	N	**R**	N	**R**	N
	EPTC *(Eptam)*	N / 8	**R**	N	N	**R**	N	N	N	N	N	N	N	N	**R**	N	N	N	N	N	N
	flazasulfuron *(Mission)*	B / 2	**R**	N	**R**	**R**	N	N	N	N	N	N	N	N	**R**	N	N	**R**	N	**R**	N
	flumioxazin *(Chateau)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	NB	N	NB	**R**	N	**R**	**R**
	indaziflam *(Alion)*	L / 29	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	**R**	N
	isoxaben *(Trellis)*	L / 21	**R**	**R**	**R**	**R**	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	NB	**R**	NB	NB	NB
	mesotrione (*Broadworks)*	F2/27	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	**R**	N	**R**	N	N	N	N	N	N
	napropamide *(Devrinol)*	K3 / 15	**R**	N	N	N	N	N	N	N	N	N	N	N	N	N	N	**R**	**R**	N	N
	norflurazon *(Solicam)*	F1/ 12	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	**R**	N	N	N
	orthosulfamuron *(Craze)*	B / 2	**R**	**R**	**R**	**R**	N	N	NB	NB	NB	NB	NB	N	N	N	N	**R**	N	N	N
	oryzalin *(Surflan)*	K1/ 3	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**
	oxyfluorfen (*Goal, GoalTender)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	**R**	**R**	**R**	**R**	**R**	**R**
	pendimethalin *(Prowl H2O)*	K1/ 3	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	NB	**R**	**R**	**R**	**R**
	penoxsulam *(Pindar GT)*	B / 2, E/14	**R**	**R**	**R**	**R**	N	N	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	**R**	**R**
	pronamide *(Kerb)*	K1/ 3	N	N	N	N	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	N	N
	rimsulfuron *(Matrix)*	B / 2	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
	sulfentrazone *(Zeus)*	E / 14	N	N	**R**	**R**	N	N	N	N	N	N	N	N	**R**	N	N	**R**	N	N	N
	simazine *(Princep,Caliber 90)*	C1/ 5	**R**	**R**	N	**R**	**R**	**R**	N	**R** [2]	**R**	**R**	N	**R**	**R**	N	N	**R**	N	**R**	N
	trifluralin *(Treflan)*	K1/ 3	**R**	**R**	N	**R**	N	N	**R**	N	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
Postemergence	**carfentrazone** *(Shark EW)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	clethodim *(SelectMax)*	A / 1	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	NB	N	NB	N
	2,4- D *(Embed Extra, Orchard Master)*	O / 4	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	N	N
	diquat *(Diquat)*	D / 22	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
	fluazifop - p- butyl *(Fusilade)*	A / 1	NB	**R**	NB	NB	NB	NB	**R**	**R**	**R**	**R**	**R**	NB	**R**	NB	NB	**R**	N	NB	NB
	glyphosate *(Roundup)*	G / 9	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	glufosinate *(Rely 280)*	H / 10	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	**R**	N
	halosulfuron *(Sandea)*	B / 2	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	paraquat *(Gramoxone)*	D / 22	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**
	pelargonic acid *(Scythe)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N
	pyraflufen *(Venue)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	NB	**R**	**R**	**R**	**R**	**R**	**R**
	saflufenacil *(Treevix)*	E / 14	**R**	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	**R**	N	**R**	N	N	**R**	**R**
	sethoxydim *(Poast)*	A / 1	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	NB	**R**	NB	NB	**R**	N	NB	NB
Organic	**ammonium nanoate** *(Axxe)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N
	ammoniated fatty acids *(Final- San-*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	caprilic/Capric acid *(Suppress)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	**R**	**R**	N	**R**
	d- limonene *(AvengerAG)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
	eugenol *(Weed Slayer CA)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**

Notes: R = Registered, N = Not registered, NB = nonbearing. This chart is intended as a general guide only. Always consult a current label before using any herbicide as labels change frequently and often contain special restrictions regarding use of a company's product.

Updated annually. Available online - easiest way is to find it is on the UC Weed Science blog or on WRIC site.

CA walnut herbicide use

	Top active ingredients (2022)	2014 treated acreage	2018 treated acreage	2022 treated acreage
1	glyphosate	311,248	350,089	312,526
2	oxyfluorfen (Goal, Goaltender)	166,155	181,724	164,451
3	glufosinate (Rely)	16,285	129,396	123,883
4	clethodim (SelectMax)	7,589	8,390	101,916
5	saflufenacil (Treevix)	70,229	69,517	79,594
6	indaziflam (Alion)	35,103	55,910	63,257
7	rimsulfuron (Matrix)	22,395	41,280	46,357
8	pendimethalin (Prowl H2O)	29,253	31,854	26,999
9	flumioxazin (Chateau)	14,061	14,256	21,948
10	2,4-D	27,221	21,742	21,251
11	penoxsulam (PindarGT)	12,352	15,563	14,538
12	carfentrazone (Shark)	14,362	11,074	12,572
13	paraquat (Gramoxone)	74,907	56,291	12,266
14	pyraflufen (Venue)	10,513	12,519	10,705
	Total walnut acreage:	365,000 (2015)	440,000 (2019)	420,000 (2023)

Highlights: herbicides

Recent

- Pyroxasufone (reg support)
- Tiafenacil (reg support)
- Glyphosate/glufosinate soil fate data
- Rice herbicide drift characterization
- Florpyrauxifen

Ongoing

- Three experimental PREs
  - Incl. tetflupyrolimet
- Chemigation
- Early stage POSTs (PPO herbicides)
- Herbicide synergist product (pending)

Highlights: less herbicides

Recent

- Cover crop research, soil health goals
  - Wauters, Gaudin, Hodson et al.

Ongoing

- Electrical weed control
  - Organic herbicides vs EWC
- Reduced herbicide program discussions
  - Orchard economics
  - Orchard sustainability goals

Highlights: regulation-related

Recent

- Info to CDPR and to CWB reps on proposed regulatory changes (mainly diuron and paraquat recently)
- CA focus on ESA-related weed science society committee

Ongoing

- Paraquat proposed regulations (again)
- Endangered Species Act
  - Input at federal level
  - Extension at CA level

Endangered Species Act (ESA) - Potential Label Changes

Brad Hanson, UC Davis

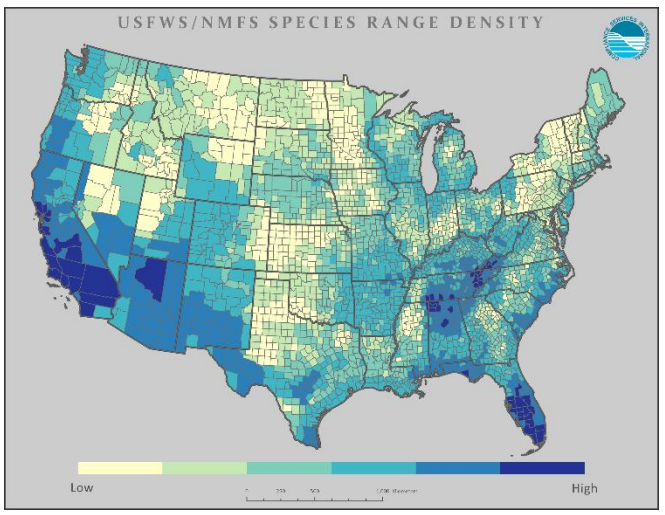
Special thanks to:
Lynn Sosnoskie, Cornell University
Mark VanGessel, University of Delaware
Dr. Bill Chism, EPA, OPP retired, Chair, WSSA Endangered Species Act Committee

What is the Endangered Species Act (ESA)

- The ESA was first passed in 1973
  - Requires government agencies to ensure any actions they take will not threaten any species that have been federally listed as endangered or threatened or their designated critical habitats
- The agencies that enforce the ESA are the U.S. Fish and Wildlife Services or the U.S. National Marine Fisheries
- Either of those two agencies evaluate the action (i.e., pesticide registration) and then delivers a “biological opinion,” which determines if the proposed action would cause jeopardy or adverse effects to any listed species or their habitat
- If harm could occur, the agency has to modify their action to avoid harm

ESA: EPA (or Courts) Have Three Registration Choices

- Option 1: Remove pesticide from the U.S. marketplace
  - Any pesticide that could impact listed species or critical habitat could have its registration removed
- Option 2: Restrict its use to only crops/sites in counties or states without listed species or critical habitat
  - Map of counties with listed species
- Option 3: Add mitigations to protect species
  - Minimizes the number of impacted users, allows use in many crops/ sites and areas



Every county in the US has at least one ESA-listed species and impacts are local. These need to be addressed locally by the end user.
Darker the color the greater density of species

EPA Released the Final Herbicide Strategy in August 2024

- Kudos to OPP for reading, considering, modifying, and greatly improving the herbicide strategy.
  - They received over 1,000 comments
  - Over 200 unique comments (not generic letters)
- This is the EPA version
- The State Lead Agencies still have to address compliance which may cause future changes
- *Things could change due to state law*
  - *For example, the herbicide strategy allows drift on to managed areas that the farmer does not control but some states do not allow any drift off the treated field*

Whooping crane
National Audubon Society
Migrate from Alberta Canada to Texas

Timeline:
When Could ESA Language Be on Labels?

- Earliest label changes
  - 2025 for newly registered herbicides (first ones are getting close in federal process now)
  - 2026 for herbicides in registration review
    - Minimum time frame is May to July 2025
    - More likely to see changes by early 2026
- Up to 15 years to see this on all labels (registration review cycle)
- The Herbicide Strategy is not “self implementing”
  - All individual labels will have to be changed
- Similar strategies are coming for insecticides, fungicides, and rodenticides

ESA: Compliance and Will It Go Away?

- Consequence of not complying with ESA.
  - State Lead Agencies are in discussions with EPA on this topic

- Will it go away: is this an administrative thing that will go away with a new party in charge
  - Any modifications would require bipartisan support (e.g. consider Congress's history with Federal Budget)
  - The ESA has been successfully functioning for 50 years, since 1973, in other parts of government

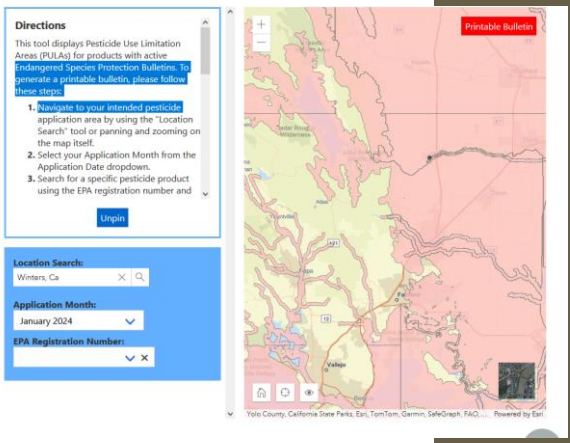
Final Herbicide Strategy: Changes to Protect Listed Species and Their Critical Habitat

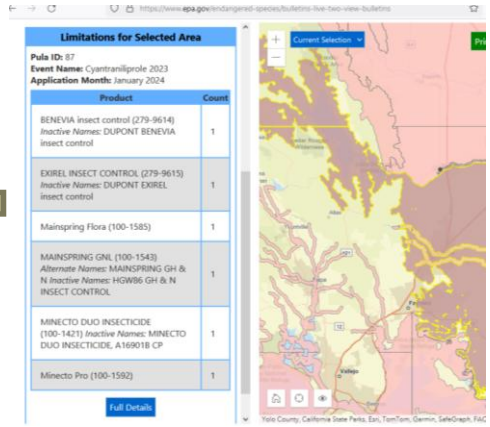
- Some labels could have three types of changes to reduce:
  - Spray drift
  - Runoff/Erosion
  - Impacts to specific geographic locations where listed species or their critical habitat are found, Pesticide Usage Limitation Areas (PULAs)

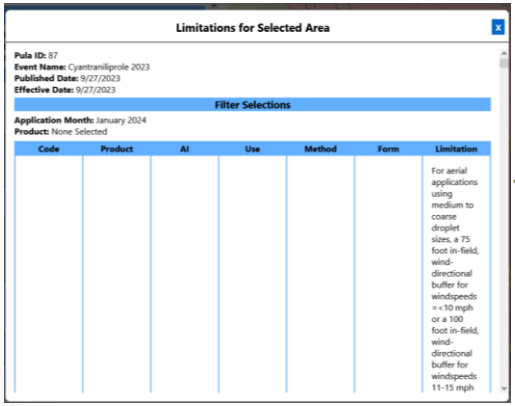
Herbicide Strategy: Finding Required Mitigations

- For conventional agricultural uses, mitigations will have to be determined for each field, not an entire farm
- Mitigations may appear on up to three places
  - On the product label
    - Generally found under Directions For Use. "Endangered Species Requirements" or "Endangered Species Protection Requirements"
  - Label may direct user to Bulletins Live! Two (BLT) webpage https://www.epa.gov/endangered-species/bulletins-live-two-view-bulletins
  - Label may direct user to Mitigation Menu webpage https://www.epa.gov/pesticides/mitigation-menu

Bulletins Live! Two







Spray Drift Mitigation

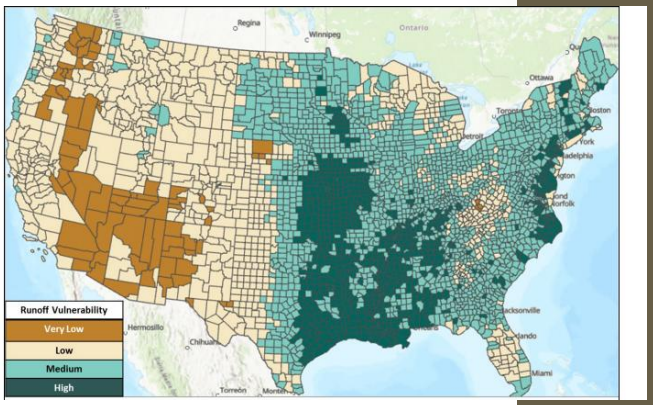
- Baseline Mitigations: common measures will be added to labels and impacts will reflect these mitigations
  - Restrict maximum windspeed to 10 to 15 mph
  - Prohibit applications during temperature inversion
  - Maximum release height for aerial and ground applications
  - Boom length restrictions and swath displacement for aerial applications
  - Orchards airblast (PGRs) - Directed sprays and turn off outer nozzles at last row

Herbicide Strategy: Mitigation to Reduce Runoff/Erosion

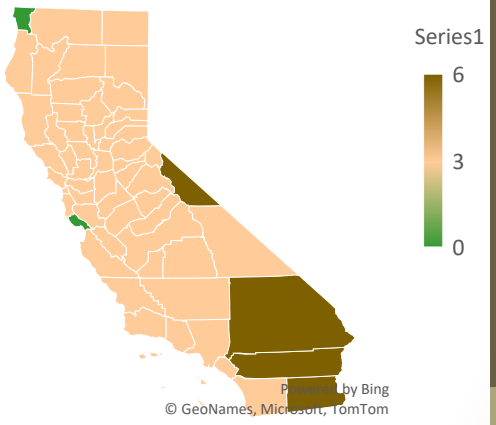
- The label may require mitigation measures to reduce runoff/erosion
- Designed to protect habitat up to 1,000 ft downslope
- Mitigation points necessary are on a 0 to 9 scale
- Directions For Use on label may direct the user to the mitigation menu webpage lists ways to reduce runoff/erosion and the number of points assigned to that practice
- https://www.epa.gov/pesticides/mitigation-menu
- Mitigation Relief Points Figure 9 map of contiguous U.S. will show this
  - 462 counties across 12 states with very low potential for runoff = 6 points
  - 780 counties across 37 states with low runoff potential = 3 points
  - 1536 counties across 44 states with medium runoff potential = 2 points

Mitigation Relief Points (Figure 9 Map of Contiguous U.S.)

- For counties with medium, low, and very low runoff potential the impacts may be overestimated. Therefore, the EPA Assigned Relief Points based on runoff vulnerability. EPA Mitigation Menu has a map and list of counties.
  - Very Low vulnerable areas get 6 points (dark brown)
  - Low vulnerability areas get 3 points (light brown)
  - Medium vulnerability areas get 2 points (light green)
  - High vulnerability areas get 0 points (dark green)
- Mitigation relief for runoff impacts applies to approximately 80% of cultivated agriculture acres and 95% of specialty and minor crop production acres.



California Mitigation Relief Points



Most of CA would start with 3 runoff mitigation points

Runoff/Erosion Example Points for Terrestrial Areas from Draft Herbicide Strategy

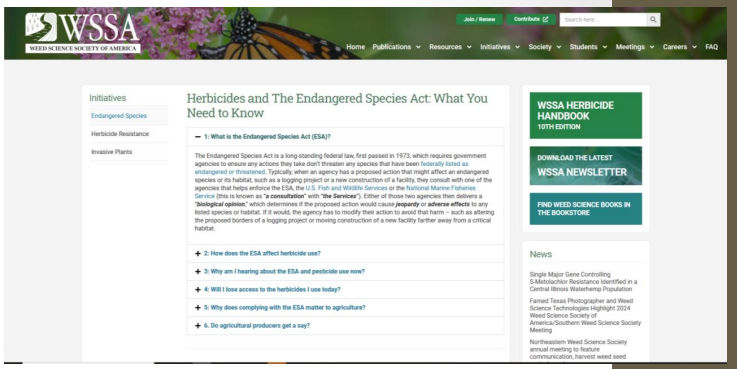
Crop	2,4-D	Dicamba	Diuron	Metolachlor	Oxyfluorfen	Paraquat	Pendimethalin	Trifluralin
Alfalfa	NA	NA	9	NA	NA	0	3	5
Citrus	3	NA	9	NA	5	0	3	5
Corn	6	6	6	6	7	0	3	5
Cotton	NA	6	6	6	5	0	3	5
Grapes	3	NA	9	NA	7	0	5	5
Other Orchards	6	NA	9	NA	5	0	3	5
Other Grains	6	3	6	1	NA	0	3	5
Rice	NA	NA	NA	NA	NA	0	NA	NA
Soybeans	6	6	NA	6	5	0	NA	5
Vegetable/ Ground Fruit*	6	6	6	6	5	0	3	5
Wheat	6	6	6	NA	NA	0	NA	5

Metolachlor / s-metolachlor = points range from 1 to 9 depending on PULA area (aquatic areas are higher).
MCPA, Metribuzin, Propanil, Thiobencarb not shown. NA = not applicable because not registered.

Erosion/Runoff Mitigation Measures: Categories Considered

- Application parameters
  - Annual application rate reduction, partial field treatment, soil incorporation
- Field Characteristics
  - Low Slope (≤ 3% slope), permeable sandy soils
- In-field Mitigation Measures
  - Management of irrigation water, cover crops, or reduced tillage
- Adjacent to Field Mitigation Measures
  - Grassed waterways, vegetated filter strips (VFS) between field and habitat
- Systems that Capture Runoff and Discharge
  - Water retention systems such as ponds or sediment basins
- Other Mitigation Measures that don't fit into these categories
- Areas with potential populations are more than 1,000 feet down-gradient from application areas
- Conservation Program and Runoff/Erosion Specialists/Mitigation Tracking

WSSA Webpage – Enhanced Communications



- Many growers and pesticide applicators have little knowledge of the ESA, do not think their state has these species, and do not understand the potential implications for pesticide usage.
  - https://wssa.net/endangered-species/
- ESA Communication/Education Materials for applicators, growers and users
  - One page ESA description for Pest Management Guides written by APS, ESA & WSSA
  - Working on a 2-page Herbicide Strategy description
  - Create a Repository for Materials on WSSA Webpage
  - Information to increase awareness in growers/users such as presentations, standard definitions, fact sheets, and etc.
- Lists and Locations of T & E species
  - Links to FWS and NMFS lists of species and habitats
  - Communicate information on listed species and their habitat
  - Definitions of ESA terms

Endangered Species Websites

Rusty patch bumblebee

EPA Endangered Species Main Page

- https://www.epa.gov/endangered-species

EPA Bulletin Live! Two (BLT)

- https://www.epa.gov/endangered-species/bulletins-live-two-view-bulletins

EPA Mitigation Menu

- https://www.epa.gov/pesticides/mitigation-menu

Fish and Wildlife Service (includes maps)

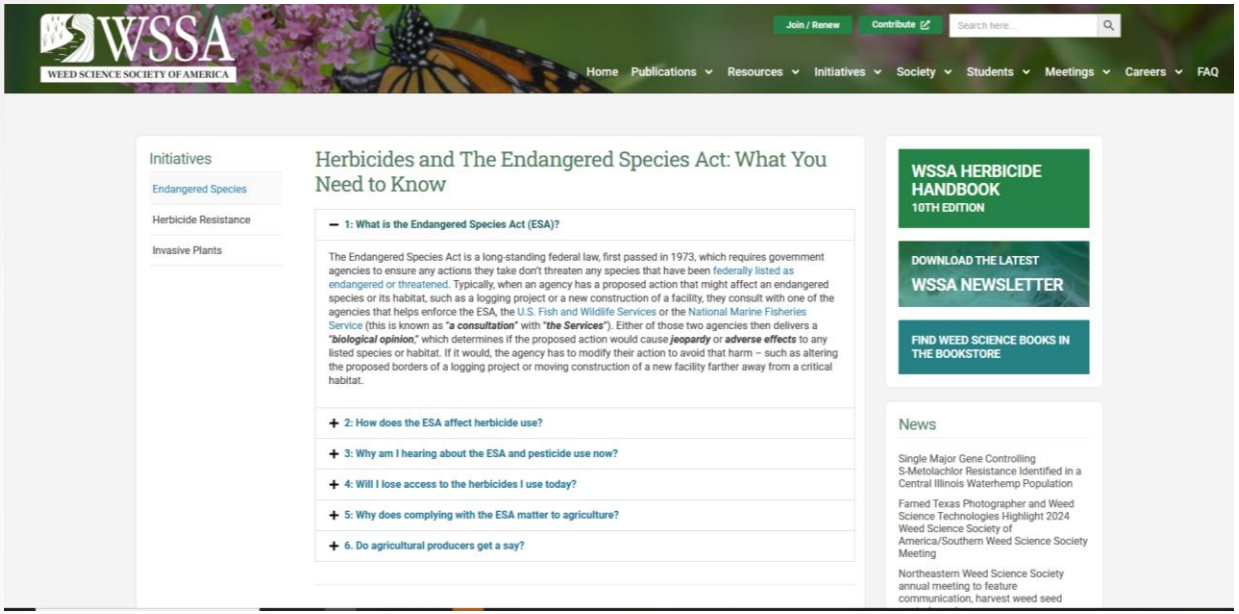
- https://ecos.fws.gov/ecp/

National Marine Fisheries Service Species Mapping

- https://www.fisheries.noaa.gov/resource/map/national-esa-critical-habitat-mapper

Weed Science Society of America

- https://wssa.net/endangered-species/



https://wssa.net/endangered-species/

Brad Hanson
bhanson@ucdavis.edu
http://hanson.ucdavis.edu

UC Davis Weed Research and Information Center
http://wric.ucdavis.edu/
http://ucanr.org/blogs/UCDWeedScience/

California WALNUTS

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Agriculture and Natural Resources

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Herbicide Registration on California Tree and Vine Crops - *(reviewed April 2023 - UC Weed Science)*

	Herbicide- Common Name *(example trade name)*	Site of Action Group[1]	Almond	Pecan	Pistachio	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum / Prune	Avocado	Citrus	Date	Fig	Grape	Kiwi	Olive	Pomegranate
			----- tree nut -------				- pome -		---------- stone fruit ---------												
Preemergence	**dichlobenil** *(Casoron)*	L / 20	N	N	N	N	**R**	**R**	N	**R**	N	N	N	N	N	N	N	**R**	N	N	N
	diuron *(Karmex,Diurex)*	C2 / 7	N	**R**	N	**R**	**R**	**R**	N	N	N	**R**	N	N	**R**	N	N	**R**	N	**R**	N
	EPTC *(Eptam)*	N / 8	**R**	N	N	**R**	N	N	N	N	N	N	N	N	**R**	N	N	N	N	N	N
	flazasulfuron *(Mission)*	B / 2	**R**	N	**R**	**R**	N	N	N	N	N	N	N	N	**R**	N	N	**R**	N	**R**	N
	flumioxazin *(Chateau)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	NB	N	NB	**R**	N	**R**	**R**
	indaziflam *(Alion)*	L / 29	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	**R**	N
	isoxaben *(Trellis)*	L / 21	**R**	**R**	**R**	**R**	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	NB	**R**	NB	NB	NB
	mesotrione (*Broadworks)*	F2/27	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	**R**	N	**R**	N	N	N	N	N	N
	napropamide *(Devrinol)*	K3 / 15	**R**	N	N	N	N	N	N	N	N	N	N	N	N	N	N	**R**	**R**	N	N
	norflurazon *(Solicam)*	F1/ 12	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	**R**	N	N	N
	orthosulfamuron *(Craze)*	B / 2	**R**	**R**	**R**	**R**	N	N	NB	NB	NB	NB	NB	N	N	N	N	**R**	N	N	N
	oryzalin *(Surflan)*	K1/ 3	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**
	oxyfluorfen (*Goal, GoalTender)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	**R**	**R**	**R**	**R**	**R**	**R**
	pendimethalin *(Prowl H2O)*	K1/ 3	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	NB	**R**	**R**	**R**	**R**
	penoxsulam *(Pindar GT)*	B / 2, E/14	**R**	**R**	**R**	**R**	N	N	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	**R**	**R**
	pronamide *(Kerb)*	K1/ 3	N	N	N	N	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	N	N
	rimsulfuron *(Matrix)*	B / 2	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
	sulfentrazone *(Zeus)*	E / 14	N	N	**R**	**R**	N	N	N	N	N	N	N	N	**R**	N	N	**R**	N	N	N
	simazine *(Princep,Caliber 90)*	C1/ 5	**R**	**R**	N	**R**	**R**	**R**	N	**R** [2]	**R**	**R**	N	**R**	**R**	N	N	**R**	N	**R**	N
	trifluralin *(Treflan)*	K1/ 3	**R**	**R**	N	**R**	N	N	**R**	N	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
Postemergence	**carfentrazone** *(Shark EW)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	clethodim *(SelectMax)*	A / 1	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	NB	N	NB	N
	2,4- D *(Embed Extra, Orchard Master)*	O / 4	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	N	N	**R**	N	N	N
	diquat *(Diquat)*	D / 22	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
	fluazifop - p- butyl *(Fusilade)*	A / 1	NB	**R**	NB	NB	NB	NB	**R**	**R**	**R**	**R**	**R**	NB	**R**	NB	NB	**R**	N	NB	NB
	glyphosate *(Roundup)*	G / 9	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	glufosinate *(Rely 280)*	H / 10	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	**R**	N
	halosulfuron *(Sandea)*	B / 2	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	paraquat *(Gramoxone)*	D / 22	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	**R**	**R**	**R**	**R**
	pelargonic acid *(Scythe)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N
	pyraflufen *(Venue)*	E / 14	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	NB	**R**	**R**	**R**	**R**	**R**	**R**
	saflufenacil *(Treevix)*	E / 14	**R**	N	**R**	**R**	**R**	**R**	N	N	N	N	N	N	**R**	N	**R**	N	N	**R**	**R**
	sethoxydim *(Poast)*	A / 1	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	NB	NB	**R**	NB	NB	**R**	N	NB	NB
Organic	**ammonium nanoate** *(Axxe)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N
	ammoniated fatty acids *(Final- San-*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**
	caprilic/Capric acid *(Suppress)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	N	**R**	**R**	N	**R**
	d- limonene *(AvengerAG)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	N	**R**	N	N	**R**	N	N	N
	eugenol *(Weed Slayer CA)*	NC	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**	**R**

Notes: R = Registered, N = Not registered, NB = nonbearing. This chart is intended as a general guide only. Always consult a current label before using any herbicide as labels change frequently and often contain special restrictions regarding use of a company's product.

Updated annually. Available online - easiest way is to find it is on the UC Weed Science blog or on WRIC site.