CARCD 72nd Annual Conference
"Dynamic Partnerships, Relevant Results"
November 2017 – Sacramento, CA

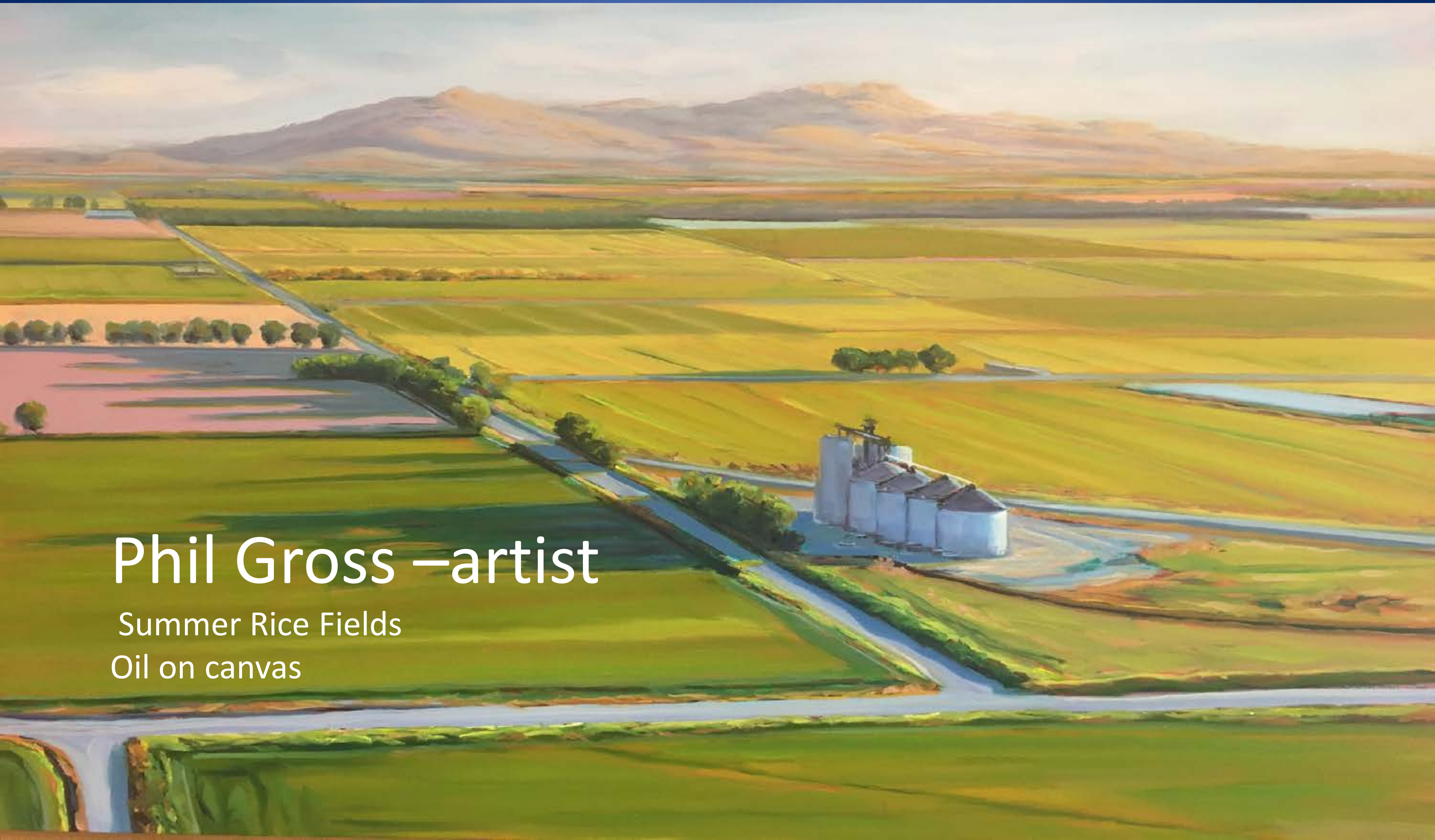
RESOURCE

CONSERVATION DISTRICTS

Pesticide Solutions – Let's Brainstorm

RCD Annual Meeting, November 17, 2017

Debra Denton, PhD



Phil Gross –artist

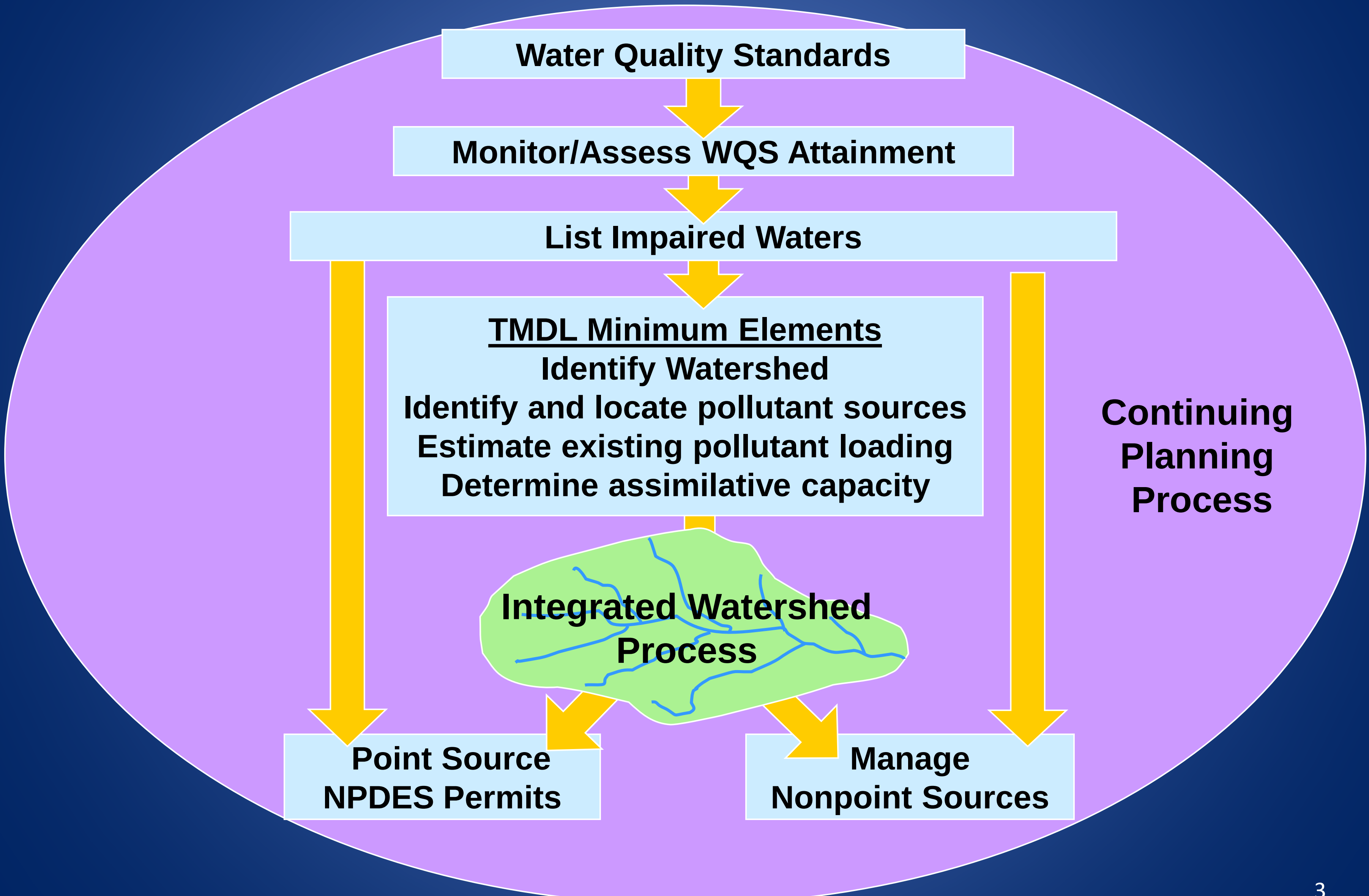
Summer Rice Fields

Oil on canvas

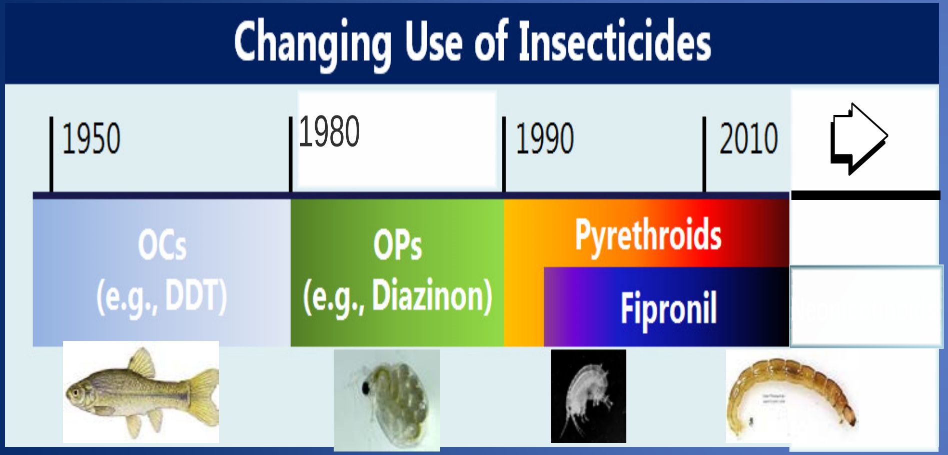
Brainstorm

- Clean Water Framework
  - Water quality -- pesticide impairments
- BMPs
  - Agricultural ditch work
  - Recent work and future work
- Strategic BMP placement
  - RCDs are the key to the successful implementation

Clean Water Act Framework



Changing Pesticides Over Time

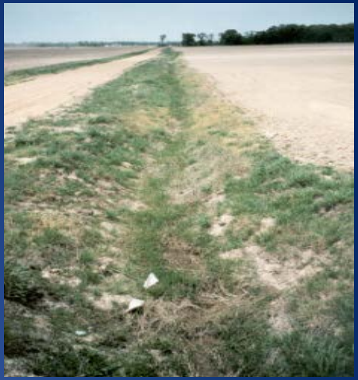


- Changing insecticides
- Need to address BMPs that are effective with water soluble pesticides and very hydrophobic ones like pyrethroids

Vegetated Drainage Ditches

- Why ditches?
  - They are already part of the agricultural landscape for drainage and irrigation supply
  - Strong body of work by USDA-ARS – Dr. Charlie Cooper and Dr. Matt Moore from MS Delta area.
- Key elements:
  - Temporarily retains storm water or irrigation runoff
  - Incorporates vegetation to enhance:
    - Settling of sediment and adsorbed constituents
    - Adsorption and uptake of dissolved constituents by plants
  - Vegetation capable of surviving submerged and dry periods

Drainage Ditches



--Already in place in the agricultural production landscape

--Historically served as means for water transport

--Actually served as sites for contaminant transfer and transformation

Ditch Experiments

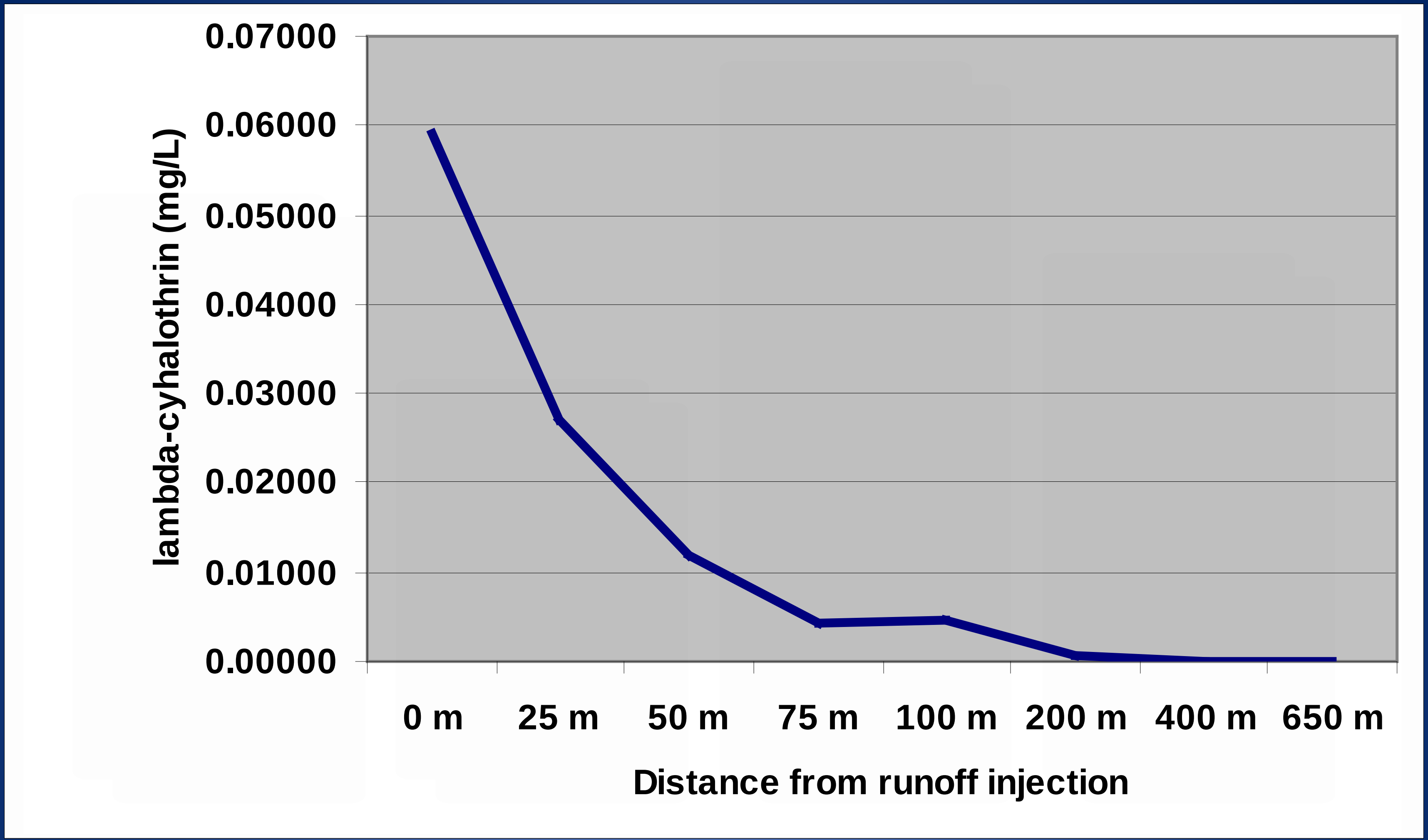
Beasley Ditch – 1998

	Atrazine	Lambda-cyhalothrin
3 h post event	47% in plants 48% in water	97% in plants 3% in water
24 h post event	59% in plants 12% in water	97% in plants 0% in water
28 d post event	86% in plants 0% in water	97% in plants 0% in water

Ditch Experiments

Thighman Ditch - 1999

	Bifenthrin	Lambda-cyhalothrin
3 h post event	99% in plants 1% in water	95% in plants 1% in water
24 h post event	99% in plants 0% in water	98% in plants 1% in water
14 d post event	99% in plants 0% in water	94% in plants 0% in water
Mean overall % after 99 d	81% in plants 18% in sediment	87% in plants 12% in sediment



Degradation of lambda-cyhalothrin in Thighman Ditch water during the first 24 h following runoff simulation, 1999.

Moving from MS to CA

Jeanette Wrysinski

Yolo RCD

Lead PI for 1st work in CA

Issues in adapting Ditches to California

- Summer rain vs summer dry/irrigated
- Permanent vs transient ditches
- Harvest equipment/access requirements
- Non-weedy vegetation types
- Upstream sediment capture to extend life
- Long-term vegetation maintenance

Project Overview

- Phase I: Research, analysis, modeling
  - One site, intensive study
  - Determine optimal ditch parameters to mitigate organophosphate and pyrethroid insecticides
- Phase II: Field toxicity testing, demonstration/validation
  - Multiple sites, landowner production fields
  - Validate (under field conditions) ditches as a management practice for mitigation of organophosphate and pyrethroid insecticides runoff


Ditcher for making
the V ditches

Project Phase I

- 3 constructed ditches – all 116 m length
  - U-shaped (compare to Mississippi)
  - V-shaped/vegetated
  - V-shaped/un-vegetated
- Water Control Structures (flashboard risers)
- Runoff holding pond
- Controlled water delivery system
- Controlled pesticide/sediment delivery system


Measuring plant density


GLASS


Sampling in V-unvegetated ditch for Phase I work

Debra Denton and Matt Moore

Pesticide water ½ lives and ½ distances in ditches

	U-ditch	V-unvegetated	V-vegetated
Cis-permethrin ½ life (h)	4.1	3.5	2.4
Trans-permethrin ½ life (h)	4.1	3.7	3.4
Diazinon ½ life (h)	6.4	4.5	4.5
Cis-permethrin ½ distance (m)	169	50	22
Trans-permethrin ½ distance (m)	124	55	21
Diazinon ½ distance (m)	1155	158	55

Aerial application to tomato field for Phase II work


Tomato field in Yolo Co.
Permethrin – furrow irrigation

Flash board risers to allow more infiltration time; multiple components to the practice


Yolo RCD, UC Davis, USDA and EPA team

USDA – NRCS Specs

- Incorporated into a Specification of a Standard Practice
  - 607a Drainage Field Ditch
- Definition and purpose
  - Establishing and maintaining vegetative cover in agricultural ditches
  - Protect and improve the quality of the environment by decreasing pesticide concentrations from agricultural fields
  - Applies to areas where vegetation is needed to reduce pesticide concentrations from field runoff and where such control can be achieved by using this practice alone or combined with other conservation practices
- Need an advocate at NRCS State Office to get this specification added back

Cover Practice 327
Conservation

Building on the Knowledge

- UC Davis in working with CA Department of Pesticide Regulation, USDA-ARS in Salinas, Central Coast RCDs
  - Conducting more trials for additional pesticides
  - Contact Byrn Phillips of UC Davis

- Ditches may need to be combined with end of ditch treatment including:
  - Compost
  - Granulated activated carbon (GAC) – good promise for chlorpyrifos
  - Need trials with more water soluble pesticides – neonicotinoids (e.g., imidacloprid)

Agricultural Drainage Work in Central Coast Area

See Anderson and Phillips papers
Working with CDPR and RCDs in Central Coast

Literature summary

Constituent	Mobility Class	Removal (%)	Author
Carbamates Mesotrione Triazines S-Metoloachlor	Moderate to high	27 99 97-100 91	Anderson et al. 2011 Otto et al., 2016 Bouldin et al., 2005 Moore et al., 2001 Otto et al., 2016 Tyler et al., 2013
Imidacloprid Piperonyl butoxide Fipronil	Moderate	72-100 100 Xx-100	Mahabali & Spanoghe, 2013 Anderson et al. 2011 Anderson et al., 2017
Organophosphates	Low	<10-97	Anderson et al. 2011 Gill et al., 2007 Moore et al., 2008 Moore et al., 2011 Phillips et al., 2017 Zhang & Zhang, 2011
Organochlorines Pyrethroids	Very low	87-85 33-100	Anderson et al. 2011 Anderson et al., 2017 Bennett et al., 2005 Bouldin et al., 2005 Cooper et al., 2004 Denton et al., 2008 Mahabali & Spanoghe, 2013 Moore et al., 2001 Moore et al., 2008 Moore et al., 2011

Conclusions

- Project objectives:
  - These vegetative practices are effective with reducing pesticides and sediment before entry into receiving waterbodies (proactive approach)
- Project success relies on:
  - Building upon previous work from USDA
  - RCDs are essential to the success with diverse team of landowners to toxicologists/chemists to modelers
- Products:
  - Hands on demonstrations with RCDs – technical transfer
  - Model application for farm specifics
- Where to strategically place these vegetative in combination practices?

5 M Concept

- Monitoring
  - Where/when/what
- Modeling
  - Pesticide usage updates
- Movement
  - Water movement
  - BMP placement
- Management decisions
  - Placement of BMPs
  - DPR regulations
  - Label changes
- Money
  - Efficiency gained with effective/strategic monitoring

Acknowledgments

- Dr. Charlie Cooper (1948-2016)

- Dr. Matt Moore
- Jeanette Wrysinski, Yolo County Resource Conservation District
- Diane Holcomb, NRCS - State Resource Conservationist (retired)

Contact Information

Debra Denton, USEPA Region 9

916-341-5520

denton.debra@epa.gov

Matt Moore, USDA

Matt.Moore@ARS.USDA.GOV

https://www.ars.usda.gov/southeast-area/oxford-ms/national-sedimentation-laboratory/water-quality-and-ecology-research/people/matthew-moore/

Bryn Phillips
Department of Environmental Toxicology
University of California, Davis
Granite Canyon Laboratory
831-624-0947www.granitecanyon.org

References

- Moore, M.T., Cooper, C.M., Smith, S. Jr., Bennett, E.R., and Farris, J.L. Drainage ditches: New conceptual BMP's for non-point source pollution and TMDL development. Proceedings of the 7th Federal Interagency Sedimentation Conference, pp. 65-71. 2001.

- Moore, M.T., Bennett, E.R., Cooper, C.M., Smith, S. Jr., Shields, F.D. Jr., Farris, J.L., and Milam, C.D. Transport and fate of atrazine and lambda-cyhalothrin in an agricultural ditch in the Mississippi Delta, USA. Agriculture, Ecosystems and Environment, 87:309-314. 2001.

- Bouldin, J.L., Milam, C.D., Farris, J.L., Moore, M.T., Smith, S. Jr., and Cooper, C.M. Evaluating toxicity of ASANA XL (esfenvalerate) amendments in agricultural ditch mesocosms. Chemosphere. 56(7):677-683. 2004.

- Bennett, E.R., Moore, M.T., Cooper C.M., Smith S., Shields, F.D., Drouillard, K.G., Schulz, R. 2005. Vegetated agricultural drainage ditches for the mitigation of pyrethroid-associated runoff. Environmental Toxicology and Chemistry. 24(9):2121-2127.

References

- Lydy MJ, Belden JB, Wheelock CE, Hammock BD, Denton, DL. 2004. Challenges in regulating pesticide mixtures. Ecology and Society. 9(6):1
- Moore, M.T., et al. 2005. Drainage Ditches. Water Encyclopedia. John Wiley and Sons Inc.
- D. Denton DL, Moore MT, Cooper CM, Wrysinski J, Williams WM, Miller JL, Reece K, Crane D, Robins R. 2008. Mitigation of permethrin in irrigated runoff by vegetated agricultural drainage ditches in California. In: Synthetic pyrethroids: fate and effects. Eds: Gan J, Spurlock F, Hendley P, Weston D.
- Moore MT, Denton, DL, Cooper CM, Wrysinski Y, Miller JL, Reece K, Crane D, Robins P. 2008. Mitigation assessment of vegetated drainage ditches for irrigation runoff in California. Journal Environmental Quality. 37:486-493.
- Moore, M.T., et al. 2010. Nutrient mitigation capacity in Mississippi Delta, USA drainage ditches. Environmental Pollution 158, 175–184.
- Moore, et al. 2011. Use of vegetated agricultural drainage ditches to decrease pesticide transport from tomato and alfalfa fields in California, USA. Environmental Toxicology and Chemistry *30*, 1044–1049.
- Moore, M.T., Kröger, R., Farris, J.L., Locke, M.A., Bennett, E.R., Denton, D.L., and Cooper, C.M. From vegetated ditches to rice fields: Thinking outside the box for pesticide mitigation. In: Goh, K.S., Bret, B.L., Potter, T.L., Gan, J. (Eds.) Pesticide Mitigation Strategies for Surface Water Quality. American Chemical Society Symposium Series 1075. pp. 29-37. 2011. (Book chapter).