Integrated Approaches to Mitigating Pesticides in Agricultural Runoff

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Water Boards

USGS

SWAMP Surface Water Ambient Monitoring Program

EPA United States Environmental Protection Agency

Overhead sprinklers frequently cause runoff.

Insecticide History

Changing Use of Insecticides

1950	1960	1970	1980	1990	2000	2010	2020

Organochlorines (e.g., DDT)

Organophosphates (e.g., Chlorpyrifos)

Pyrethroids (e.g., Bifenthrin)

Phenylpyrazoles (e.g., Fipronil)

Neonicotinoids (Imidacloprid)

Ceriodaphnia

Hyalella

Chironomus

Chlorpyrifos LC50s	**54 ng/L**	**86 ng/L**	**290 ng/L**

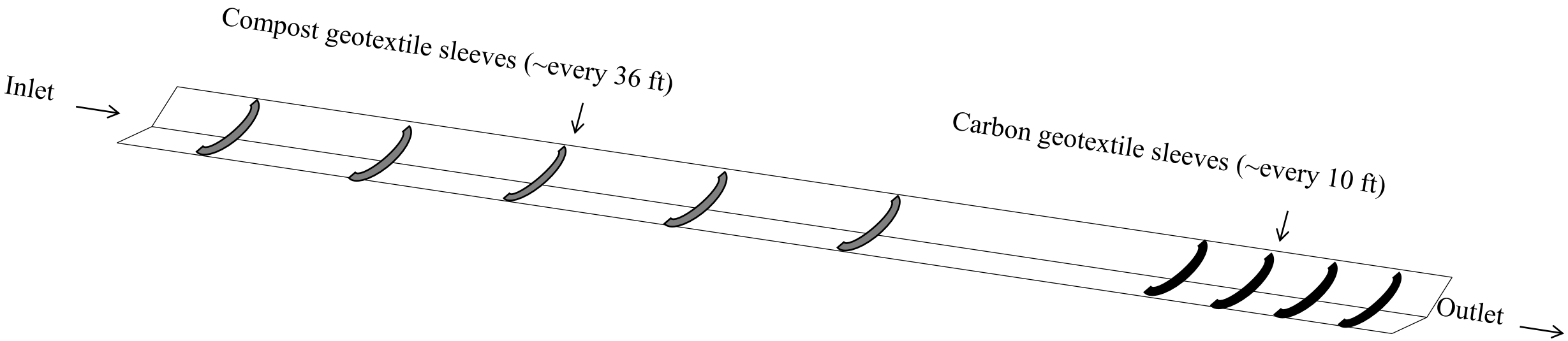
Solubility & Persistence of Representative Insecticides

Chemical	Log K_{ow}	K_{oc} (mL/g)	Soil Half Life (aerobic)	Water Half Life (photolysis)	Water Half Life (hydrolysis)
DDT	6.0	2,000,000	2 – 15 Years	Weeks – Years	Weeks – Years
Chlorpyrifos	4.7	6,070	7 – 120 Days	21 – 28 Days	35 – 78 Days
Bifenthrin	6.0	240,000	3 – 8 Months	9 – 14 Months	Months – Years
Imidacloprid	0.6	132 - 400	104 – 228 Days	<3 Hours	33 – 44 Days

BMP's for runoff treatment:

- Sediment-Bound Insecticides:
    - Retention ponds (or other ways to slow down water)
    - Use of Polyacrylamide (PAM) to reduce suspended sediments
- More Water-Soluble Insecticides
    - Apply tailwater to non-cropped areas
    - Carbon filtration
- Both
    - Integrated Vegetated Treatment Systems

BMP's for runoff treatment:



- Year 1: Test vegetated ditch with compost and carbon (GAC vs. biochar) using simulated irrigation runoff with suspended sediments, imidacloprid and permethrin.
- Year 2: Test above with addition of PAM and sediment trap using runoff from two acres of conventional lettuce treated with imidacloprid and permethrin.

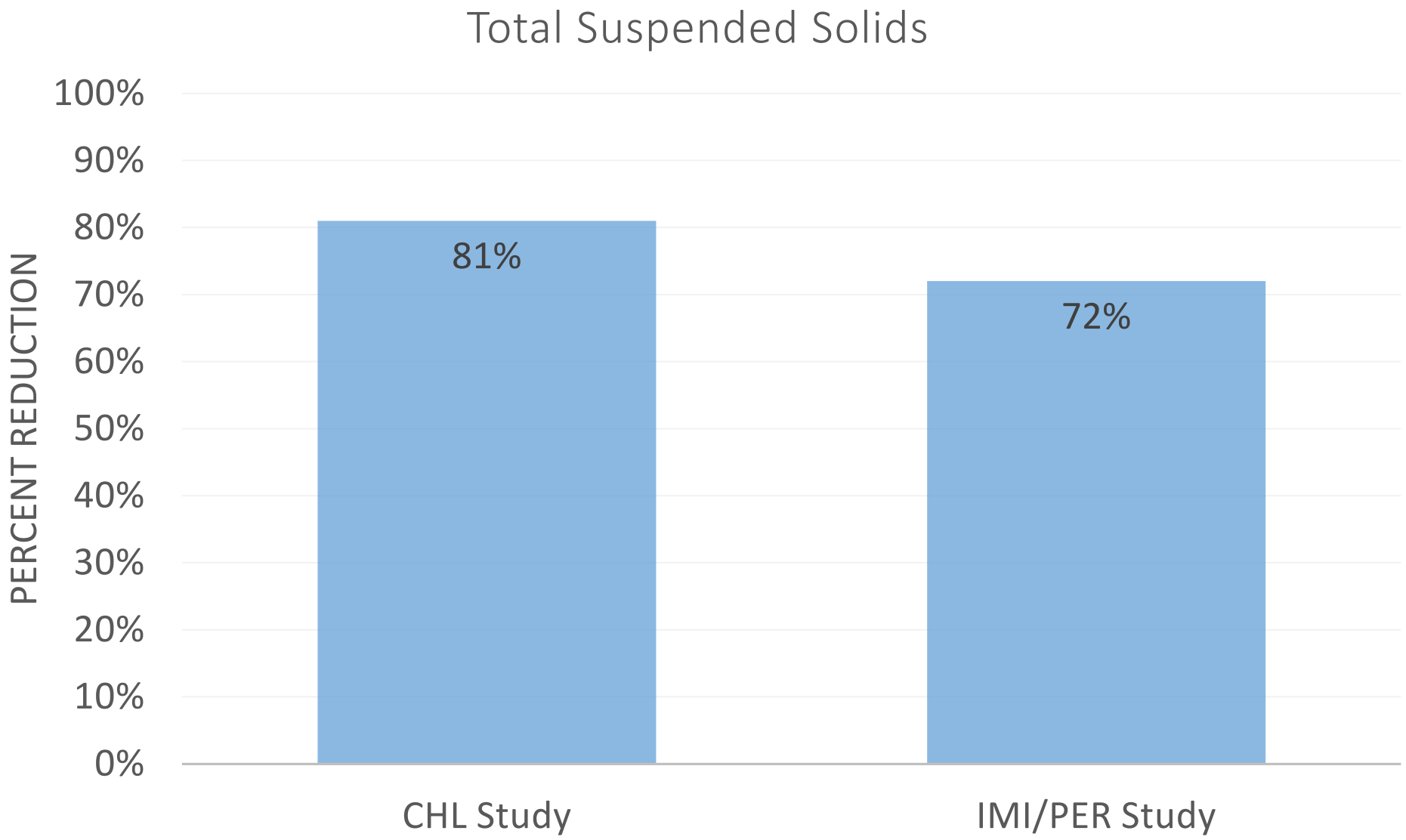
Vegetated ditch with red fescue

Geotextile sleeves filled with carbon

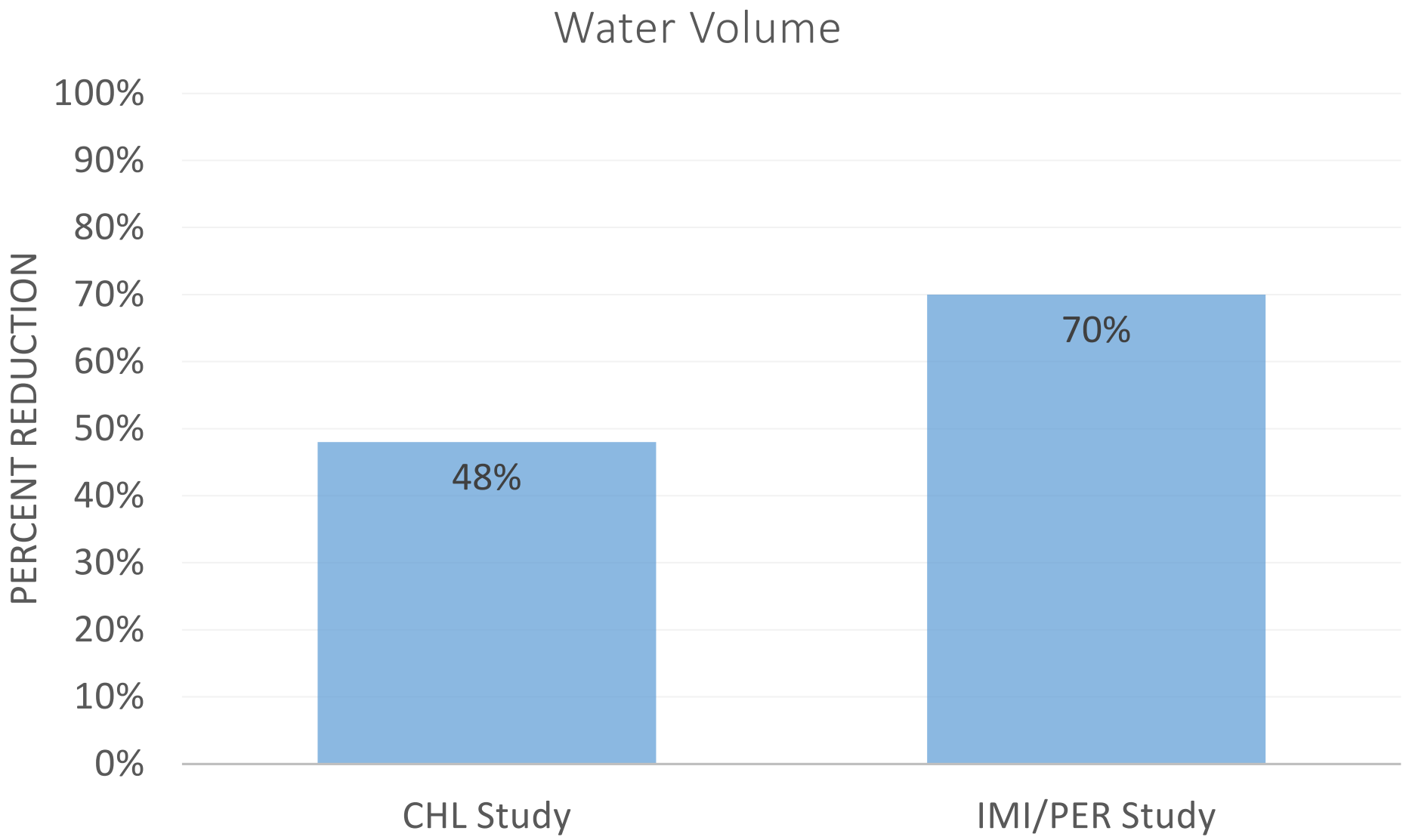
Sediment trap prevents large particles from clogging ditch

Polyacrilamide (PAM) for suspended sediment reduction

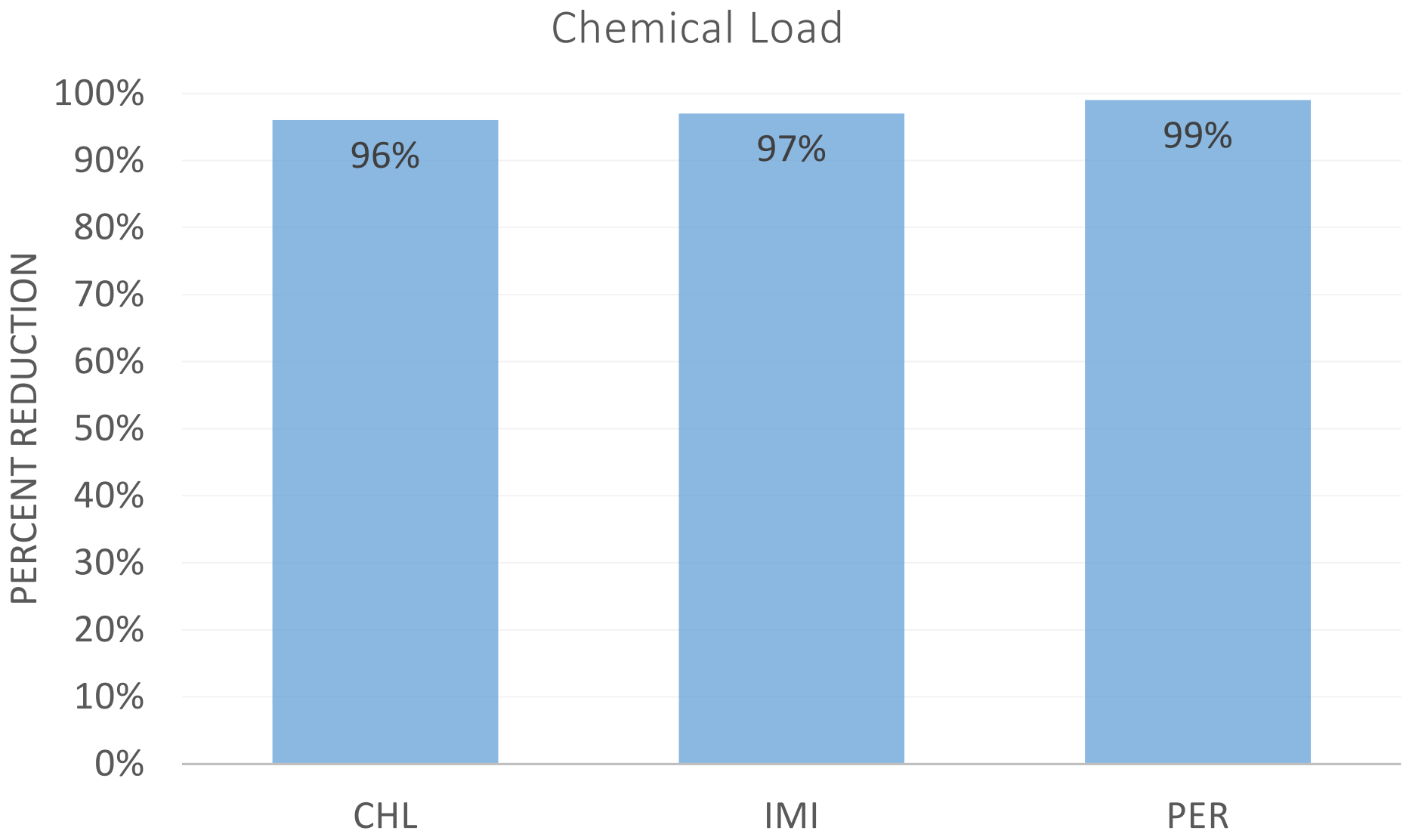
Suspended Sediment Reduction



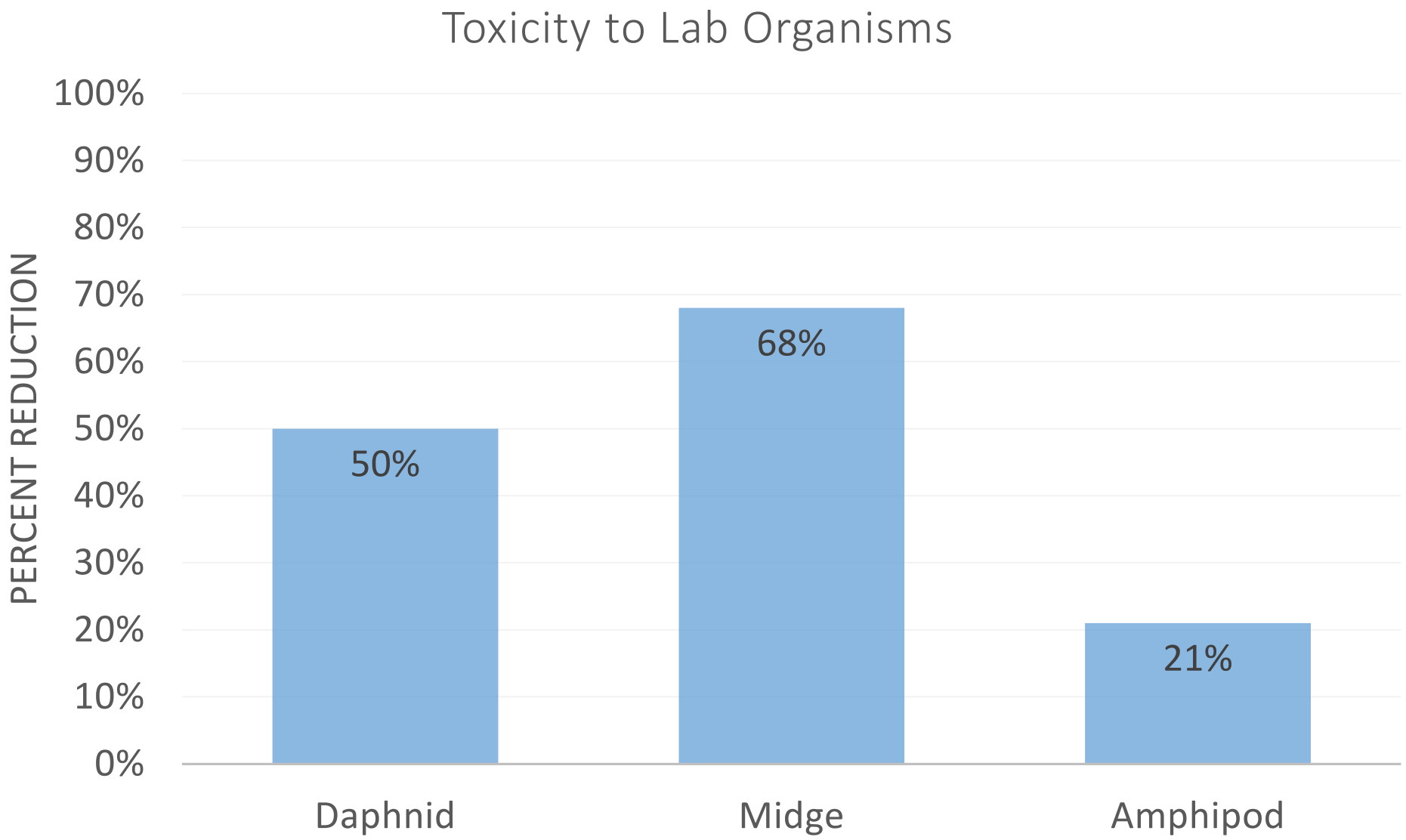
Water Volume Reduction



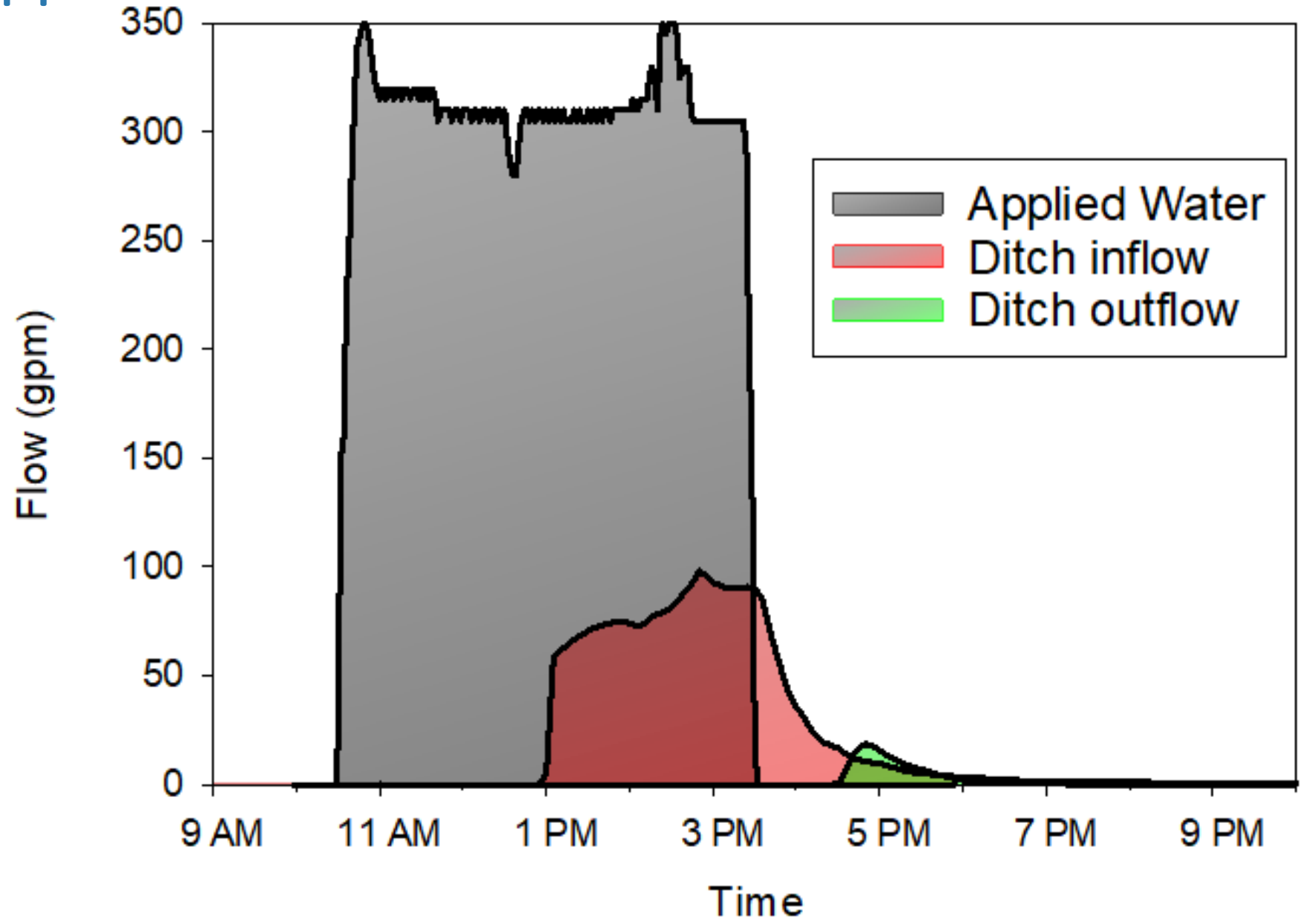
Chemical Load Reduction



Toxicity Reduction



Water Application and Runoff from Lettuce Field



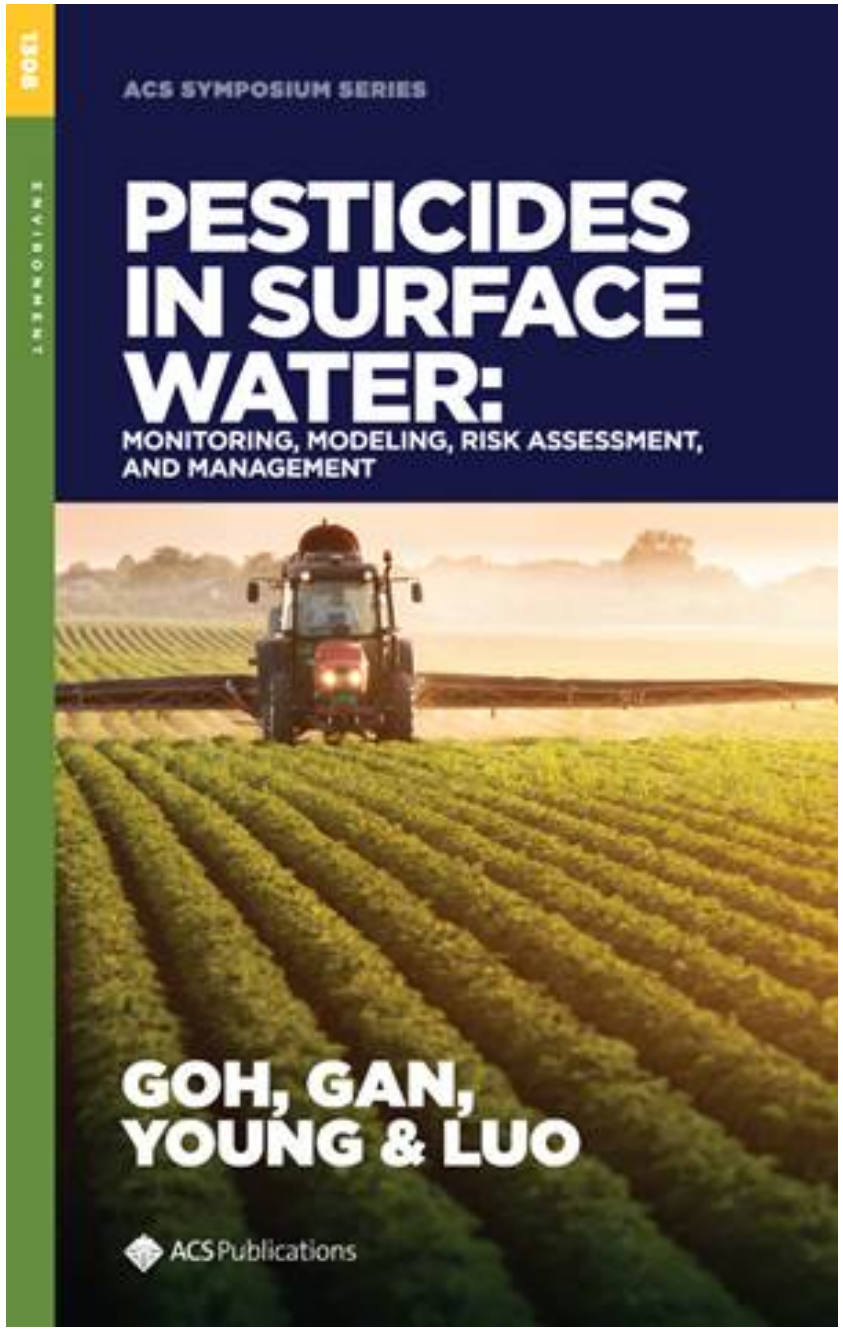
Pond Systems

Carbon Filtration

Carbon Filtration

Large-Scale Recharge Basin

Constructed Wetlands



Chapter 26

Best Management Practices for Mitigating Pesticides in Runoff from Vegetable Systems in California

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