Field tests of dust product performance and environmental safety at Hagerman National Wildlife Refuge, Texas

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Fugitive dust is a widespread problem that compromises safety, degrades roads, and damages the environment

Motivation for dust control

Objectives of USFWS/USGS collaboration

- To better understand potential environmental impacts of chemical dust control
- To identify products or product categories with low risk of environmental harm for use in sensitive habitats such as wildlife refuges
- To identify environmental best practices

Project design

Phase One

Aquatic toxicity screening

Screen products across multiple categories and vendors for aquatic toxicity using standardized tests with a representative vertebrate, the rainbow trout

Phase Two

Expanded species tests

Select several products of low toxicity for expanded tests with additional invertebrate, vertebrate, and plant species

Phase Three

Experimental field tests

Confirm environmental safety of selected products through field applications with subsequent monitoring of roadside plant and animal communities

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Phase Three objective

- Evaluate performance and environmental safety of selected products when applied under realistic conditions in the field

Phase Three product selection

Products for Phase Three field tests were selected based on four criteria:

1. Classified as practically non-toxic in laboratory tests
2. Appropriate for the Hagerman NWR setting as determined by respective vendors
3. Requiring an application procedure that was feasible, based on available equipment and Refuge staff
4. Agreed upon by Refuge management

Phase Three field site

Hagerman National Wildlife Refuge

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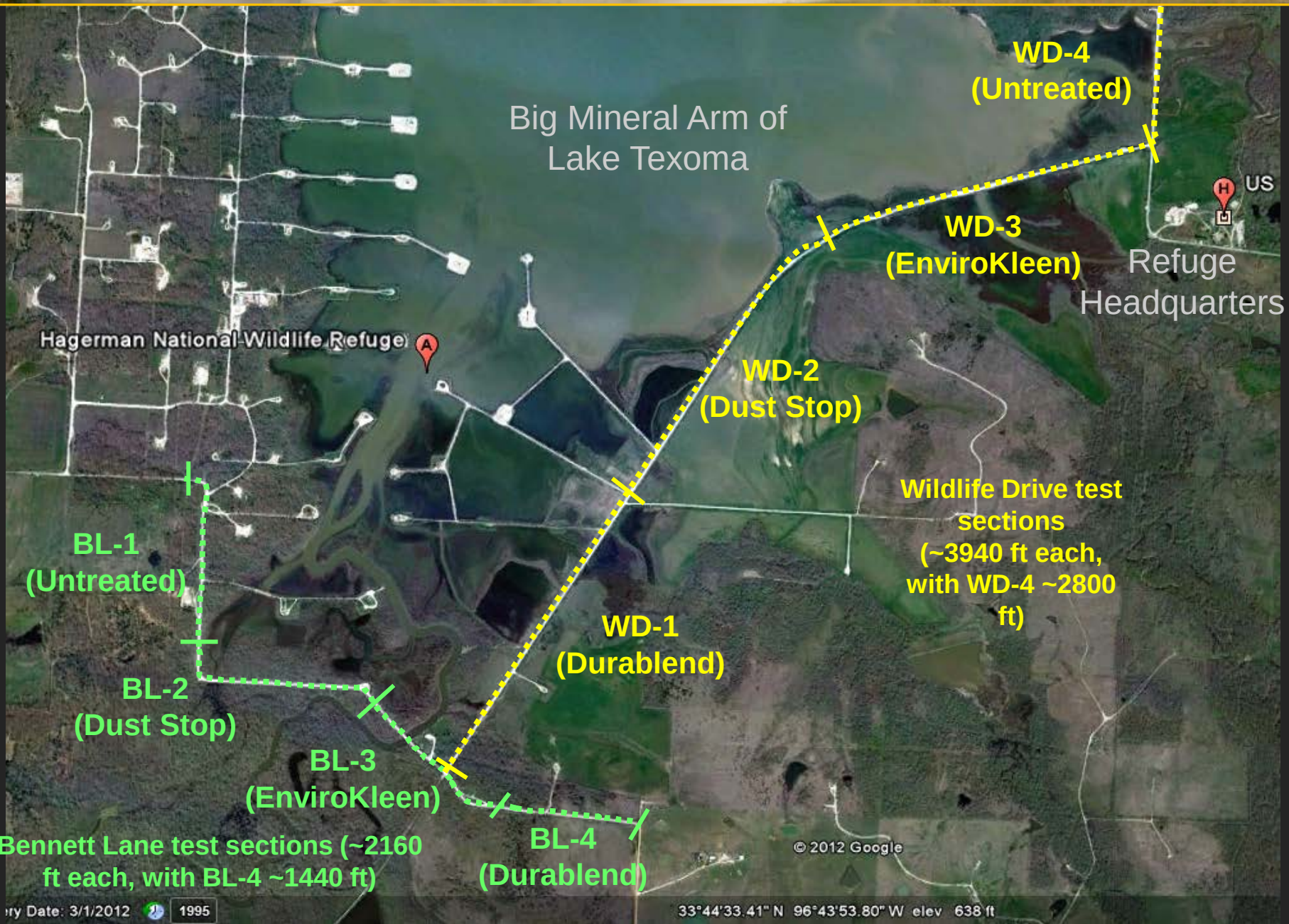
Phase Three Hagerman test layout



Product applications July 8-13, 2012

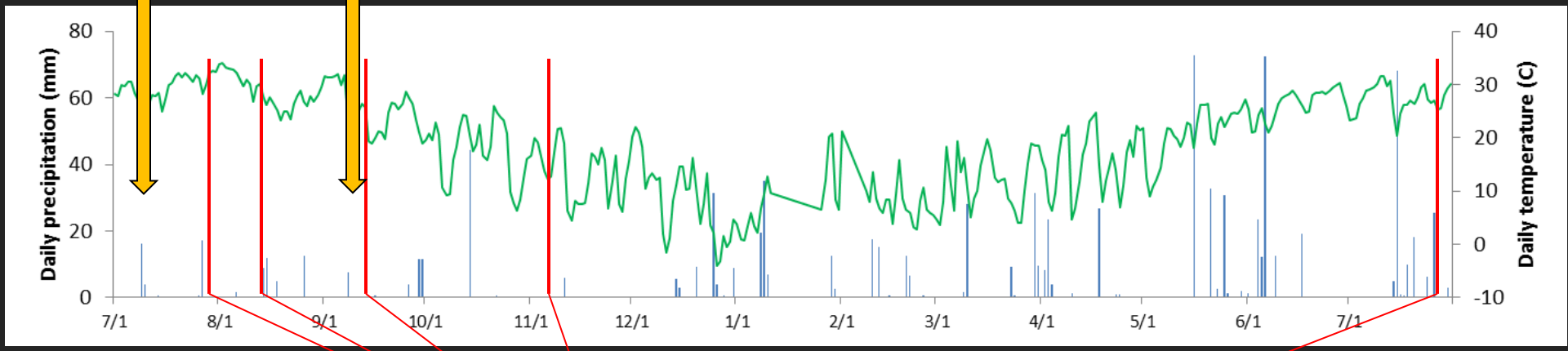
Project timeline

Weather conditions and major project events during the monitoring period

July 1, 2012-July 31, 2013

Initial product applications

EnviroKleen maintenance application



Sampling periods
(performance and environmental)

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Product evaluation—performance

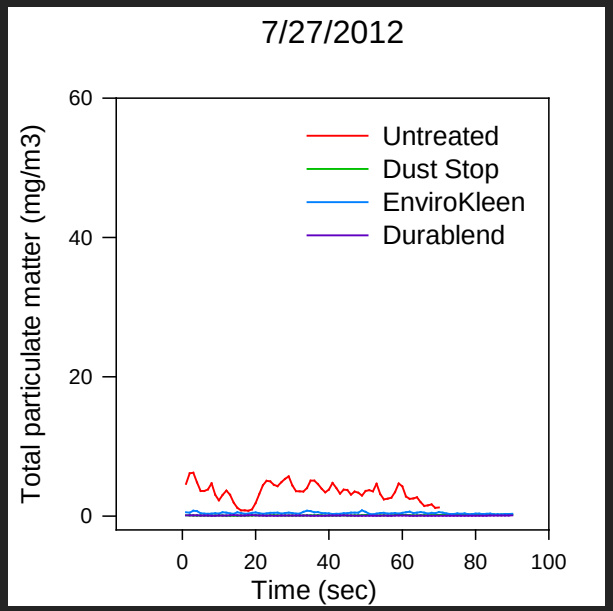
DustTrak DRX measurements

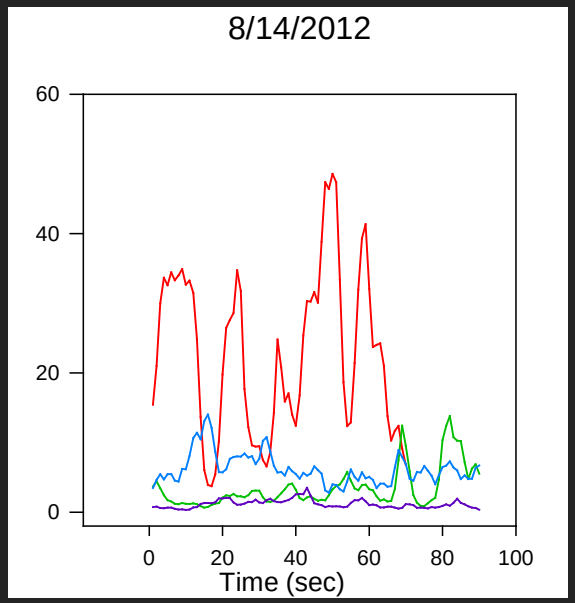
- Truck-mounted
- Simultaneous measurements of PM1, PM2.5, PM10 and total particulates

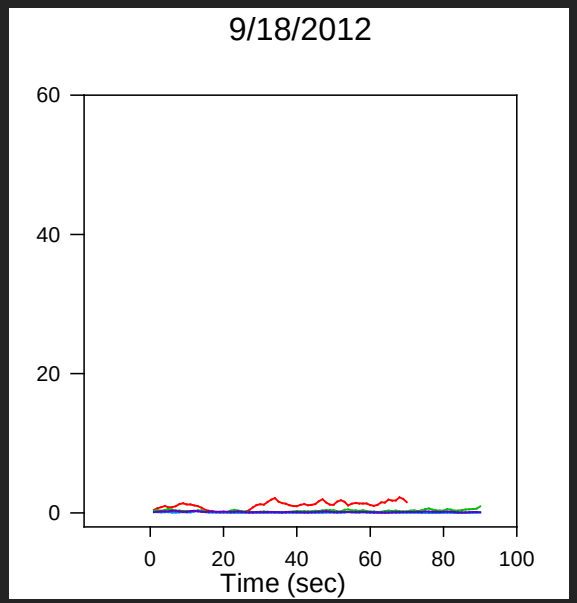
Surface condition

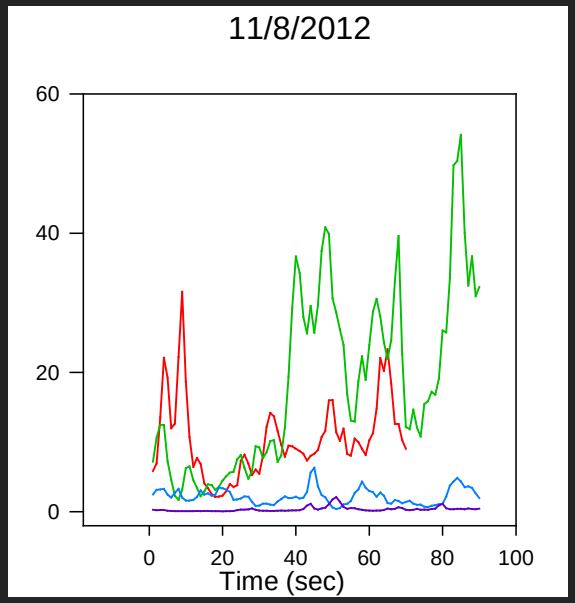
- Observational and objective rating

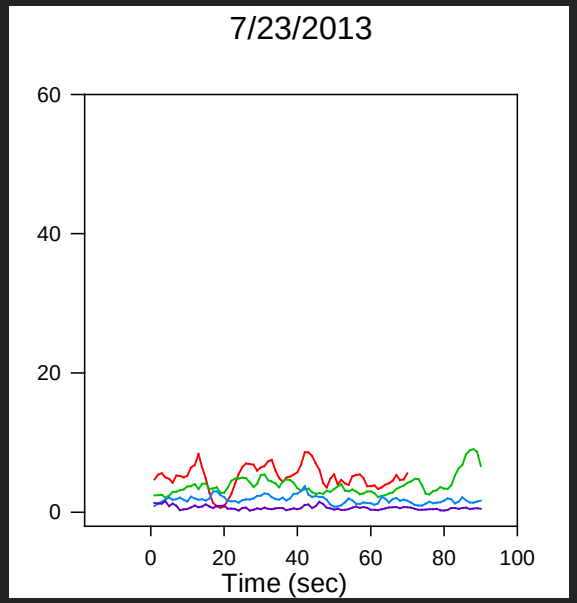
Performance endpoints—dust











Total particulate matter (mg/m^3) while driving on Wildlife Drive sections at five sampling dates.

Each section was driven three times under standard conditions and measurements averaged.

All Y-axes normalized for comparison

Performance endpoints—surface condition

Surface condition observations

All products created harder, smoother surfaces with minimal loose material, relative to the untreated section

Performance endpoints—surface condition

Surface condition objective ratings (excluding dust)

11/8/12

	Section	Wash Boarding	Raveling	Rutting	Potholing	Normalized score	Ranking
Bennett Lane	Durablend	10.0	8.3	7.0	7.7	82.5	3.0
Bennett Lane	EnviroKleen	10.0	8.3	9.0	9.3	91.5	1.0
Bennett Lane	Dust Stop	9.7	9.0	8.0	8.7	88.5	2.0
Bennett Lane	Untreated	8.7	7.3	7.7	8.3	80.0	4.0
Wildlife Drive	Durablend	9.3	8.3	6.7	8.0	80.8	3.0
Wildlife Drive	EnviroKleen	9.7	8.3	8.3	9.3	89.0	2.0
Wildlife Drive	Dust Stop	10.0	8.3	9.3	8.3	89.8	1.0
Wildlife Drive	Untreated	*	*	*	*	*	*

*recently regraded

Objective Rating System modified from Appendix B, FHWA-CFL/TD-08-005

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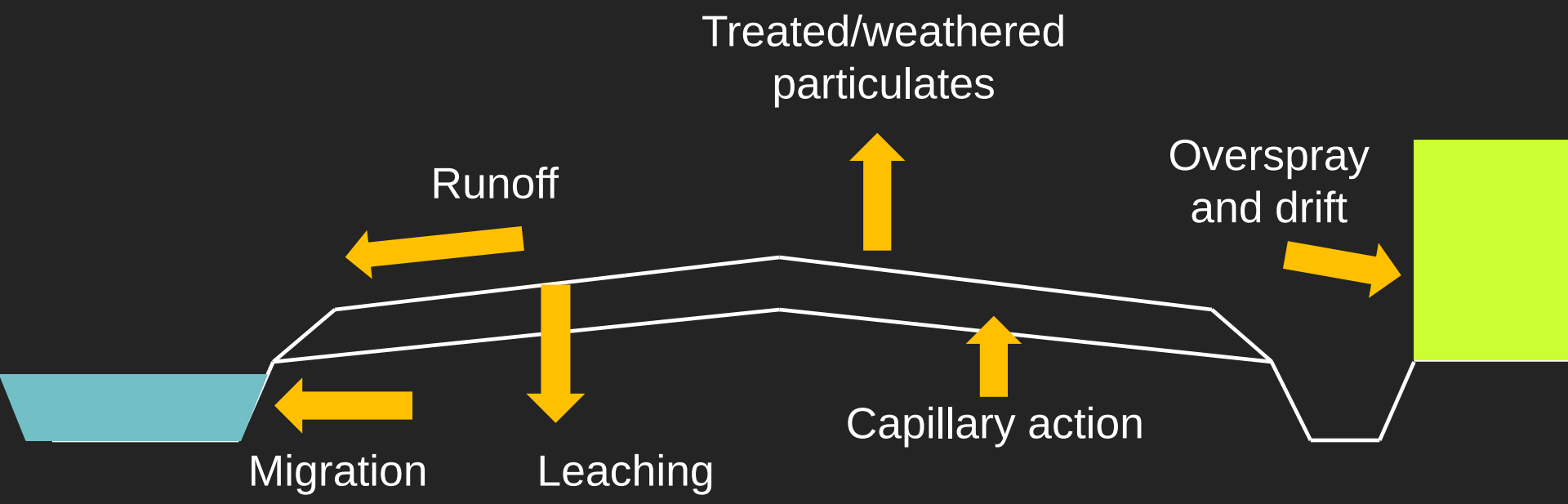
Environmental endpoints—ecological pathways



Possible receptors

Birds
Mammals
Herptiles
Invertebrates
Plants
Fish

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Modified from SD LTAP 2000 and Steevens et al. 2007

Product evaluation—environmental safety

Central challenge:
To evaluate environmental endpoints in a meaningful way without disrupting normal Refuge activities

Selected potential environmental issues

- Product overspray
- Vegetation impacts
- Runoff from treated sections

Environmental endpoints—overspray

7/12/12

No overspray observed during applications

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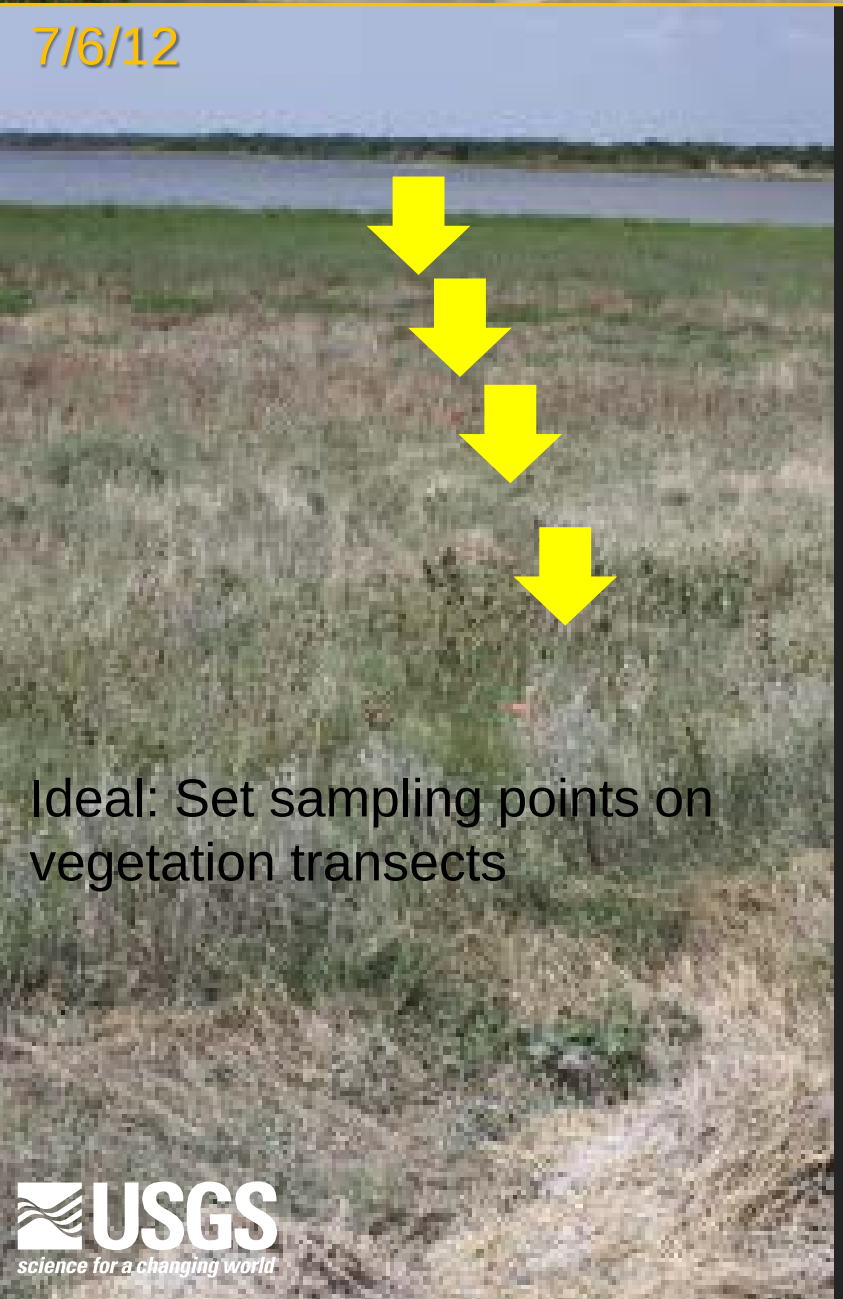
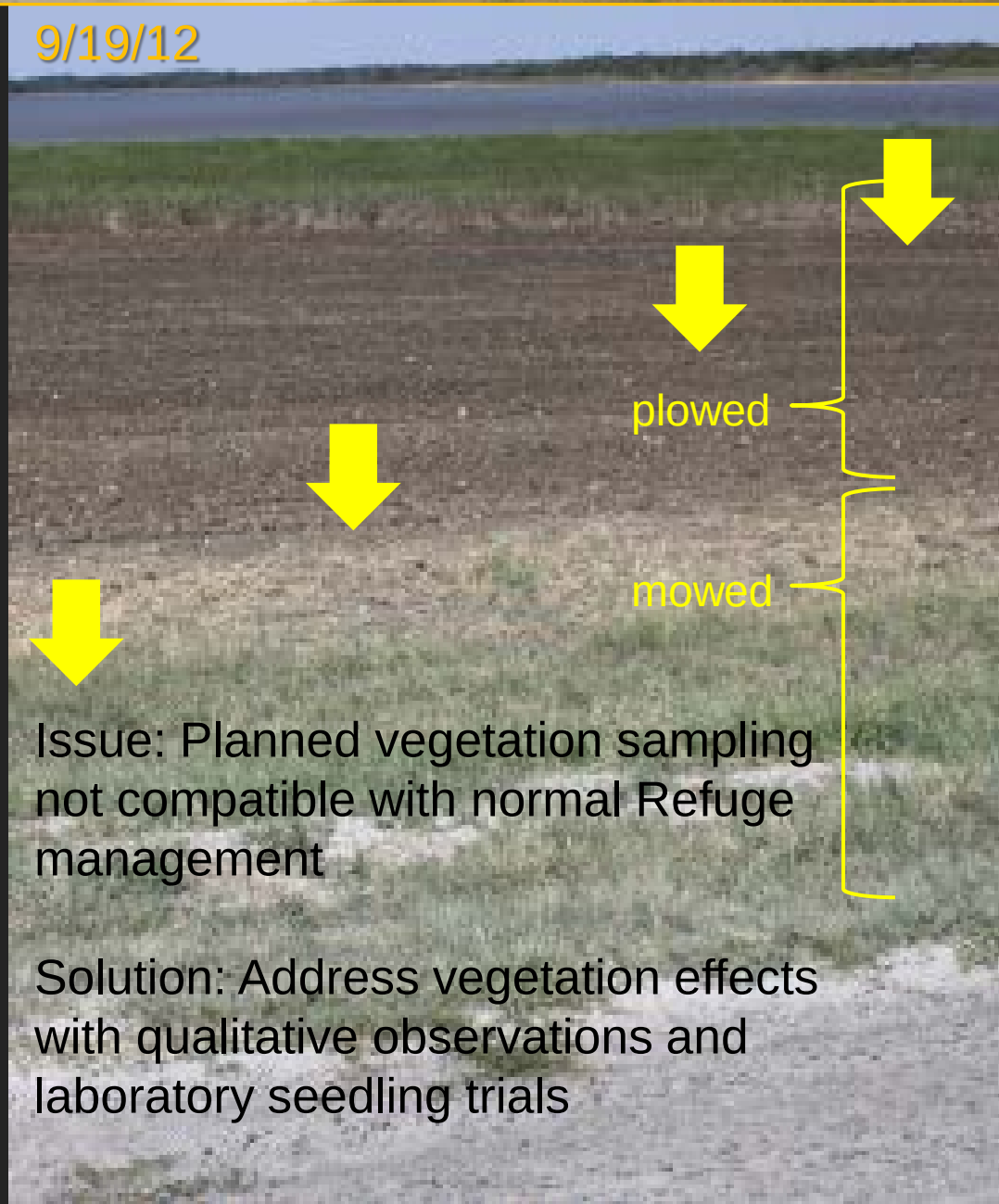
Environmental endpoints—vegetation impacts



Ideal: Set sampling points on vegetation transects



Issue: Planned vegetation sampling not compatible with normal Refuge management

Solution: Address vegetation effects with qualitative observations and laboratory seedling trials

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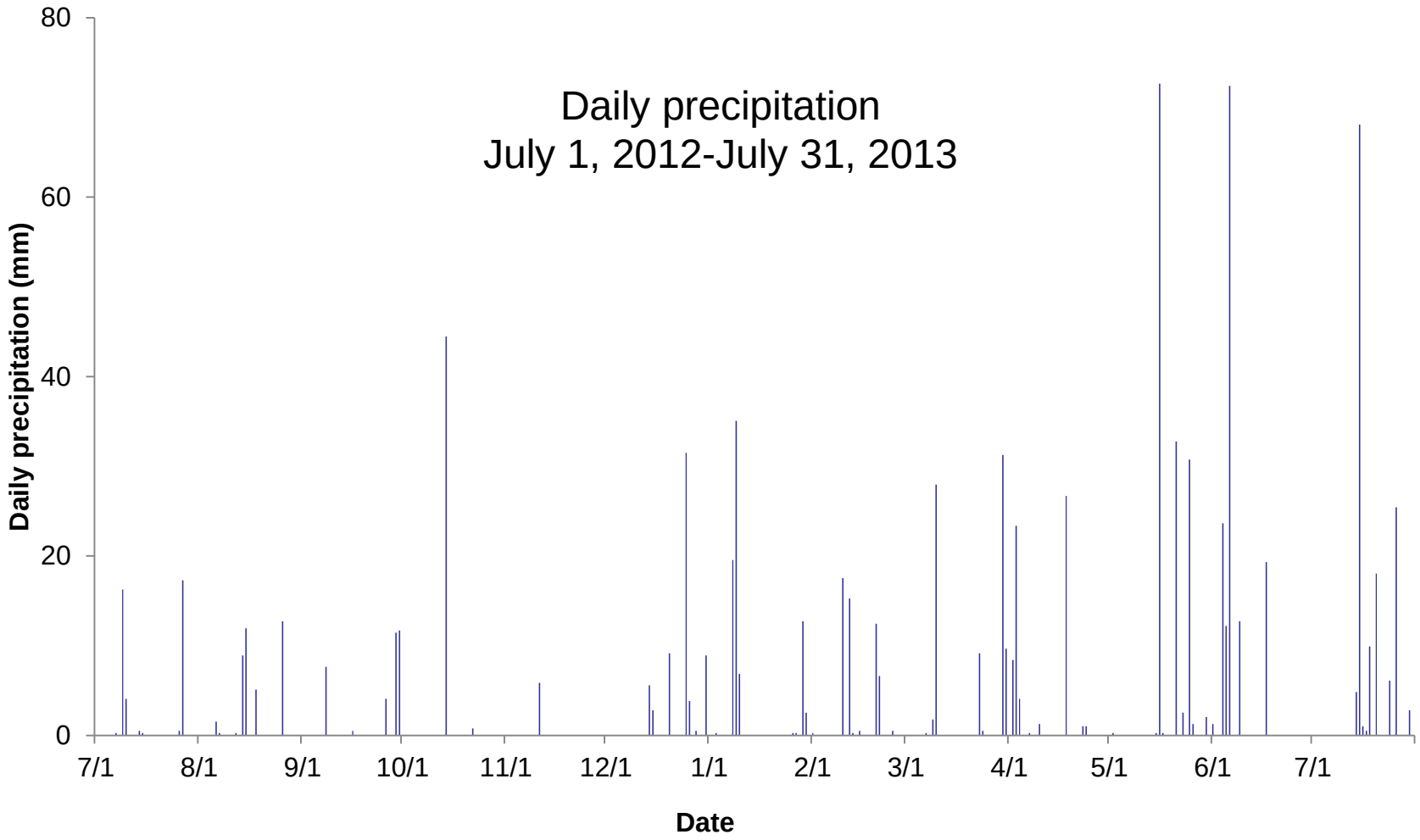
Environmental endpoints—runoff

Ideal: Collect runoff in field from treated sections and transport to lab for toxicity tests and water chemistry

Issue: Rainfall unpredictable and collection systems not feasible in Refuge setting



Environmental endpoints—runoff

Reality: Collect treated aggregate from each section and transport to lab for leaching, toxicity tests and water chemistry

Photo credit: Roger Surdahl

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Continuing work

No overspray ob

- Aggregate sample analysis (fines content, etc.)
- Analysis of particulate matter including size fraction
- Treated aggregate samples in leaching tests
- Three additional Refuge sites under consideration

- Ideas for the future: experimental dusting studies, load estimates, terrestrial invertebrate toxicity tests

Photo credit: Roger Surdahl

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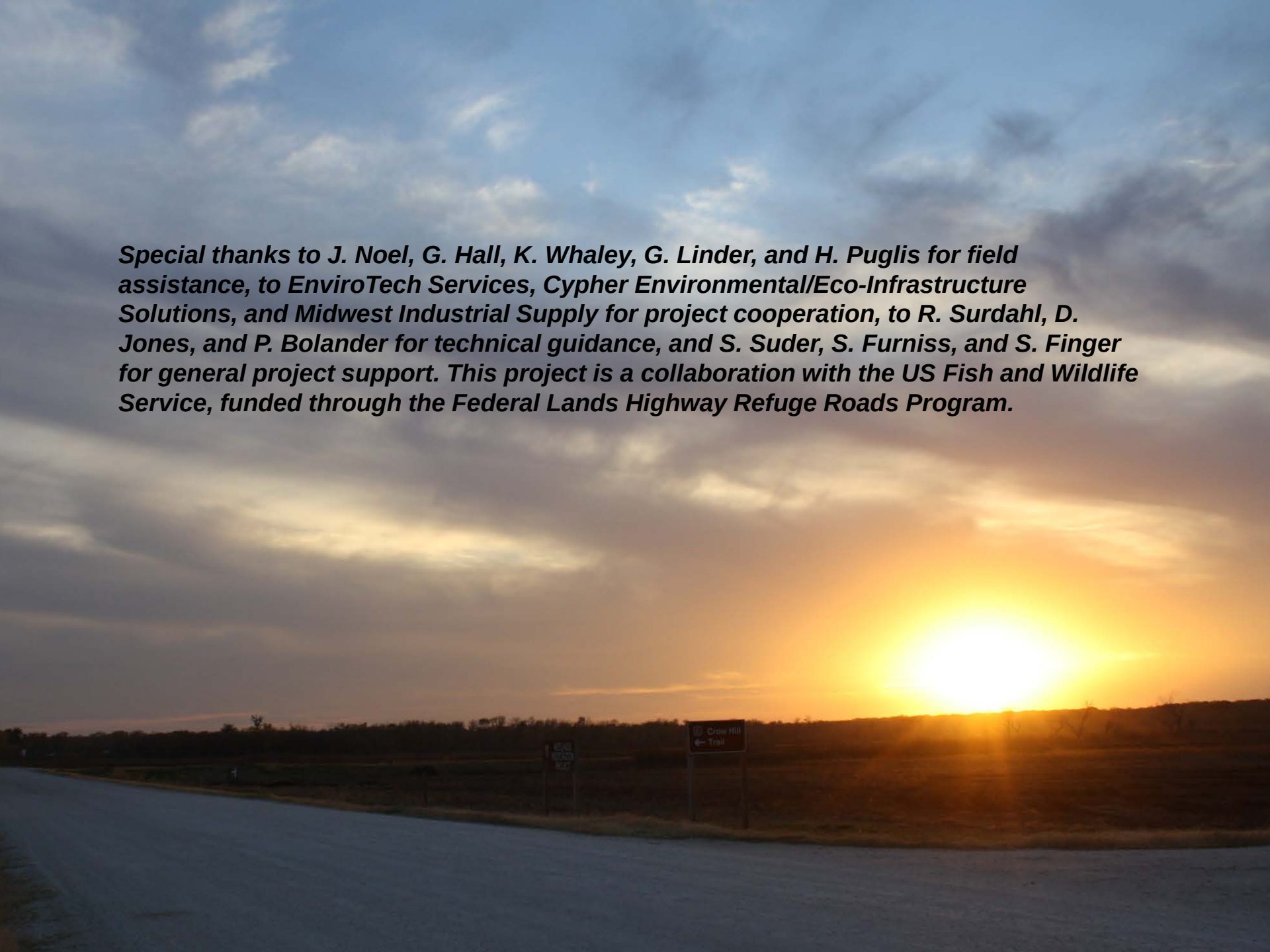
Conclusions

No overspray observed during applications

- All three low-toxicity products chosen for field tests improved the road surface and generally suppressed dust on Wildlife Drive, relative to the untreated section
- No adverse environmental effects of application were observed for vegetation or aquatic organisms in the field. Laboratory tests are ongoing
- The mobile-mounted DustTrak DRX aerosol monitor provided practical, replicated measurements of particulate matter mass and size fraction of road dust for comparisons among sections
- Dust control performance and surface condition preservation were not always tightly linked
- Dynamic biological monitoring plans were required for compatibility with Refuge activities and site-specific conditions



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