Community Update - Jan 2023

AltEn Health Study Group

Creighton UNIVERSITY

University of Nebraska Medical Center

University of Nebraska Lincoln

THREE RIVERS PUBLIC HEALTH DEPARTMENT
Dodge, Saunders & Washington Counties

Introduction:

- Ali Khan- Dean, College of Public Health UNMC
- Terra Uhing- Executive Director, Three Rivers Public Health Department

Presentation Outline:

- Judy Wu-Smart, PhD - UNL | Bee Research
- Shannon Bartelt-Hunt, PhD - UNL | Environmental Monitoring
- Elizabeth VanWormer, PhD - UNL | Wildlife Sampling
- John Schalles, PhD – Creighton | AltEn Contaminant Studies
- 1st Q&A
- Jesse Bell, PhD – UNMC | The Effects Of AltEn Contamination On Human & Environmental Health
- Kaleb Michaud, PhD – UNMC | Human Health Effects
- Eleanor Rogan, PhD – UNMC | Neonicotinoid Sampling
- 2nd Q&A

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2022 AltEn Health Study Team Update from UNL Bee Lab

Judy Wu-Smart PhD

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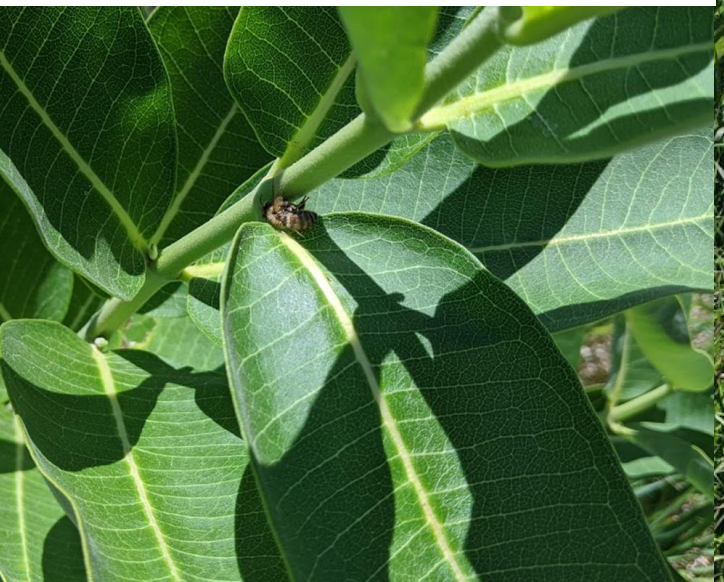
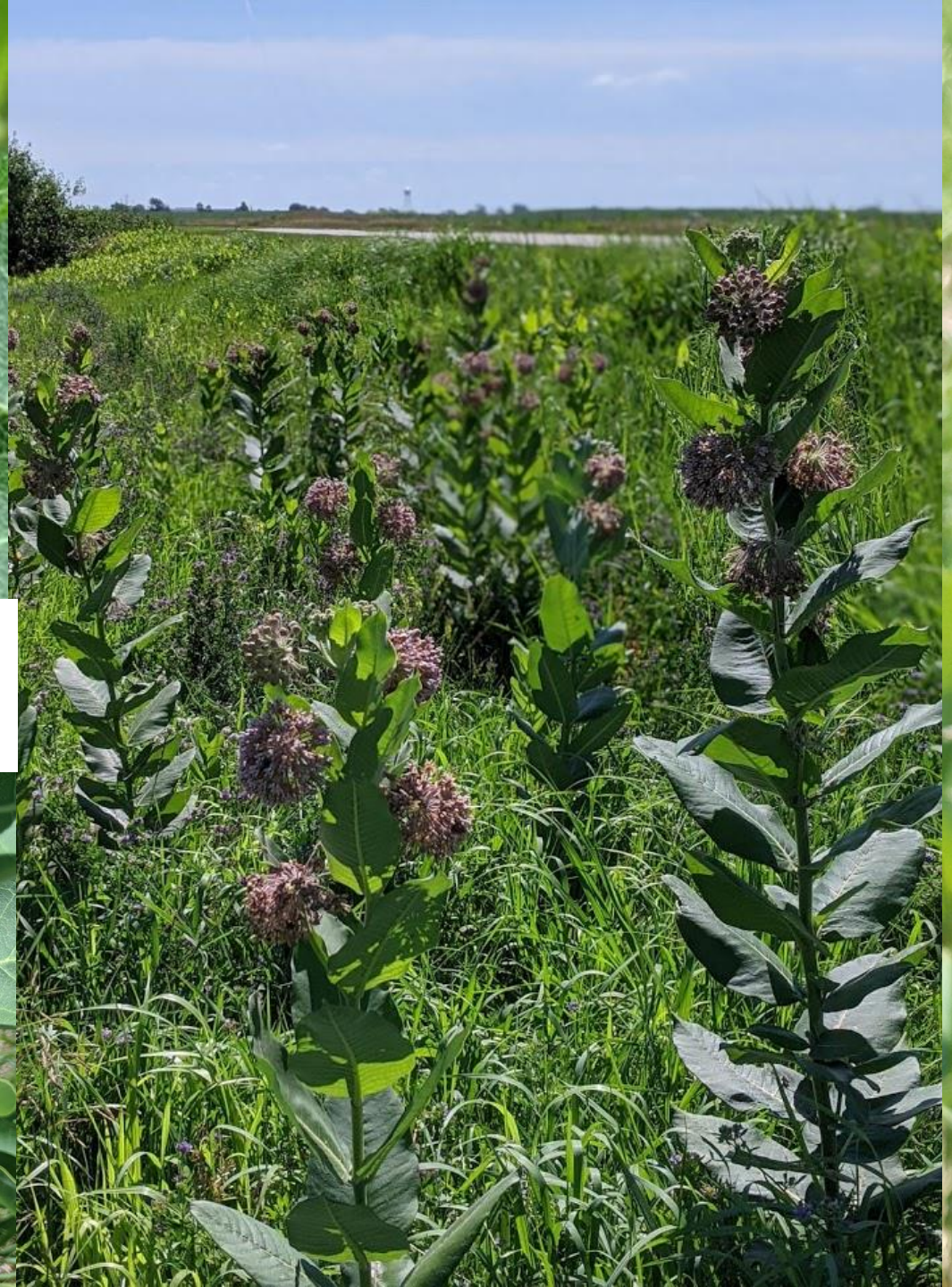
Dead water forager bee collecting plant guttation from milkweeds

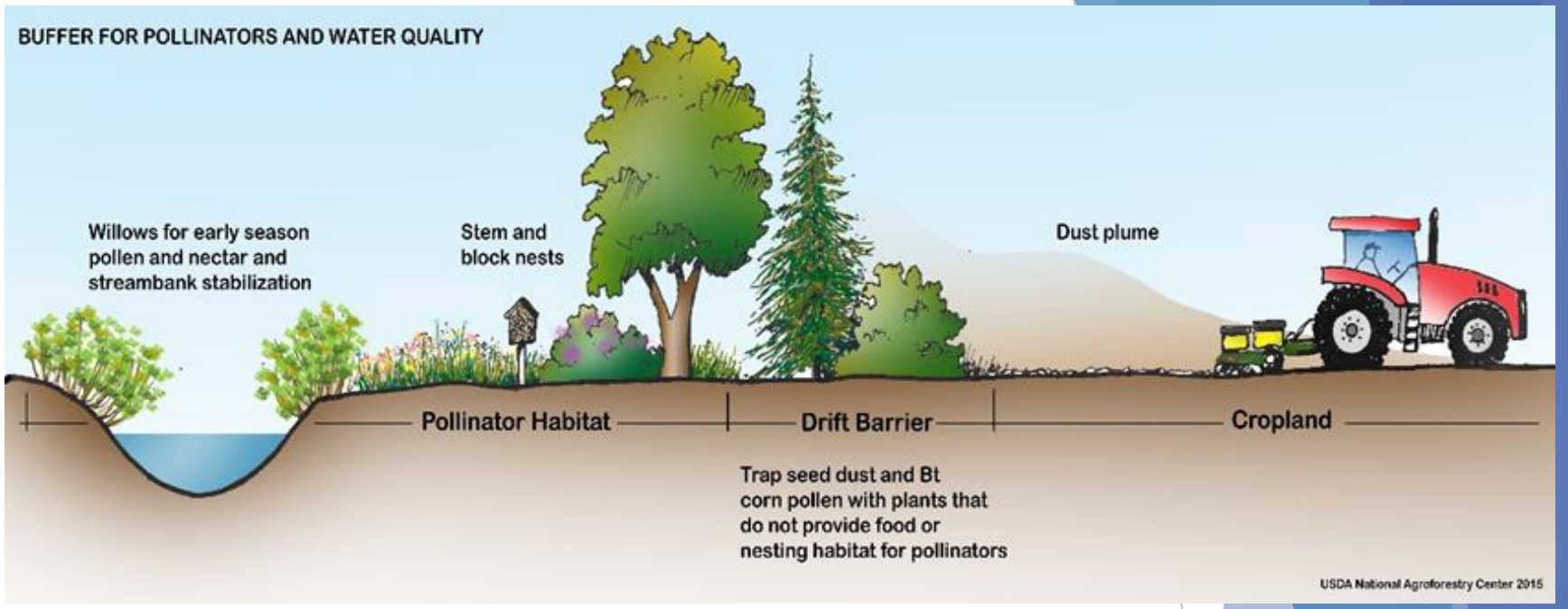




June 2020

2018-2019
sticky trap samples

(Dan Snow: Water Science Lab)



Clothianidin	# per sample	Average (ng/cm²)	Range (ng/cm²)
2018 (n=16)	5-9	25.6	0.09-116.6
Sept 2021 (n=8)	0-5	0.22	0-1.6

Traps behind tree barriers								Clothianidin (ppb)		
Distance south of plant (miles)	# samples	ave							low	high
1.1-1.2	3							214.32	1.27	520.64
2.26-2.34	10							28.04	0.35	169.98
2.64-2.87	8	0.99	0.06	2.9	2.55-2.87	9		3.73	0.13	27.94

Fewer pesticides and lower levels found in air-borne (dust) samples after AltEn closed

High bee losses at apiaries near AltEn pollution

ENREC Fire shop apiary

ENREC Agronomy apiary

Weekly dead bee trap collection June 25, 2020

Low losses at all our other apiaries (Lincoln and Nebraska City)

Omaha apiary (North)

Lincoln apiary (South)

Weekly dead bee trap collection June 26, 2020

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From 2017-2020:

- 54 hives across 6 apiaries
- 1-3 miles away (South/SE of facility)
- **0% survival** by August/Sept

0% overwintering survival

In 2021

- 6 “contaminated” + 2 “control” apiaries
- **30% overwinter survival** (7 alive/23 total)

In 2022

- 28 new + 12 overwintered colonies
- 10 “contaminated” and 2 “control” apiaries
- **69% survival** (Fall 2022) (22 alive/32 total)
- **% Overwinter survival?**

Are there lingering environmental impacts on colony functions?

- Four observation hives at two different locations
- ~100 painted bees added twice a week
- Observations three times a week

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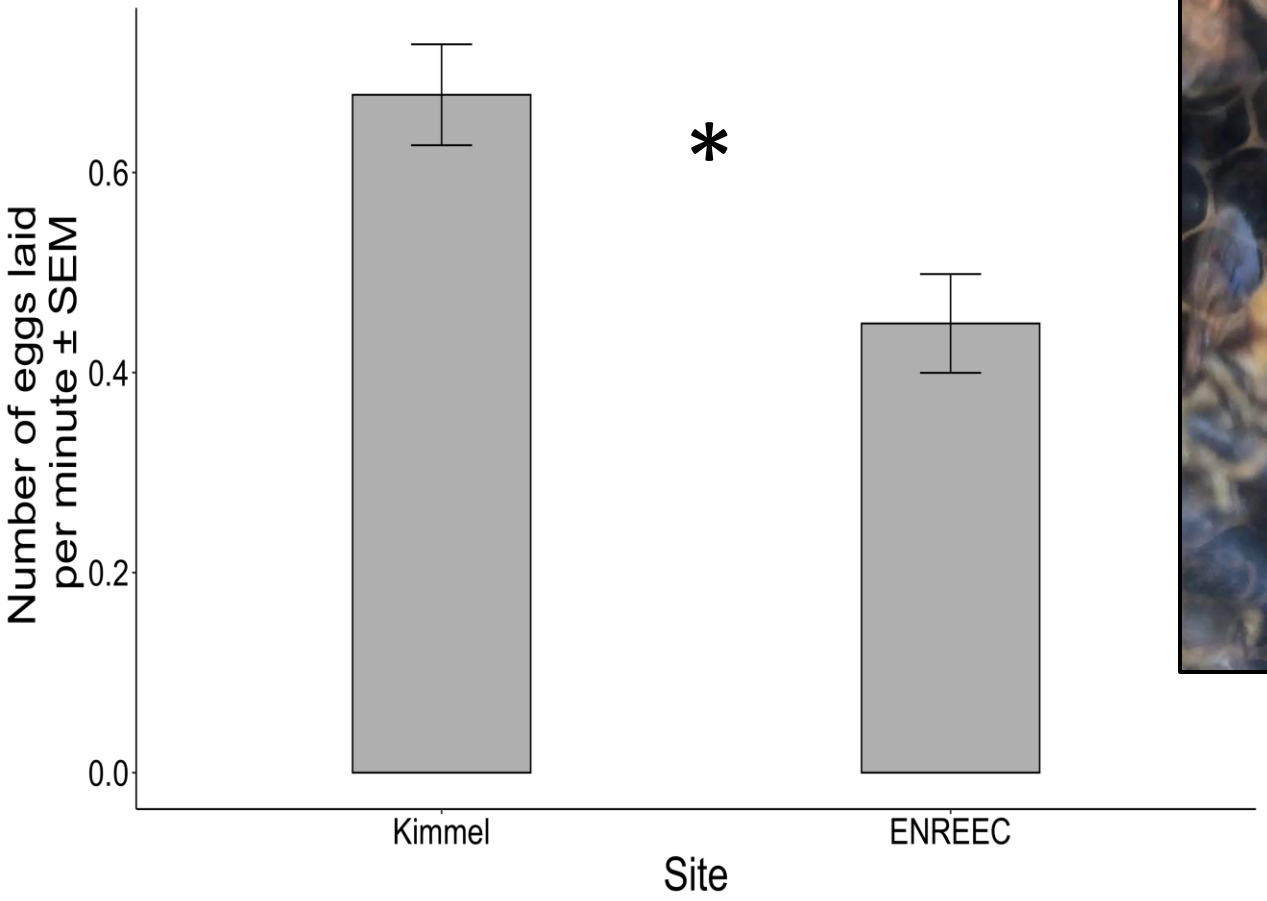
Critical hive behaviors were impacted

Impacted tasks: caring for offspring, food processing, foraging, and egg-laying



$F_{1,3} = 10.49$, $p = 0.048$

- Lays ~1000 eggs/day
- Lives 2-3 years
- Critical for hive survival

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Persistence of residues in landscape?

Impacts of chronic exposure?

Clothianidin (ug/L or ppb)

2020 Samples	high	average	n
Wildflowers	42.8	13.3	6
In-Hive Pollen	284.5	109.2	10
In-Hive Nectar	1.8	0.2	8

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NOAEL

LOAEL

Sub-lethal effects

Lethal levels/ Not Cancer-inducing

Changes in weight

↑ Susceptibility To diseases

Respiratory issues

Stillbirths

Tremors

Impaired motor functions

Delayed sexual maturity

NOAEL: No observable adverse effect level

LOAEL: Lowest observable adverse effects level

What are the benchmarks for "safe" levels?

- Chronic exposures (air, water, soil, plants)?
- Impacts of chemical mixtures?

Will there be long-term impacts on other systems?

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2022 AltEn Environmental Monitoring

Shannon Bartelt-Hunt, PhD

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Environmental Monitoring

- Our team has collected surface water monthly between March and November 2022 using two methods – grab samples and passive samplers
- Sampling stations along Johnson Creek and an unnamed tributary will help characterize how run-off from land treated with waste products affects surface water
- Passive samplers accumulate chemicals over 3-4 weeks and increase our ability to measure low levels of pesticides and fungicides

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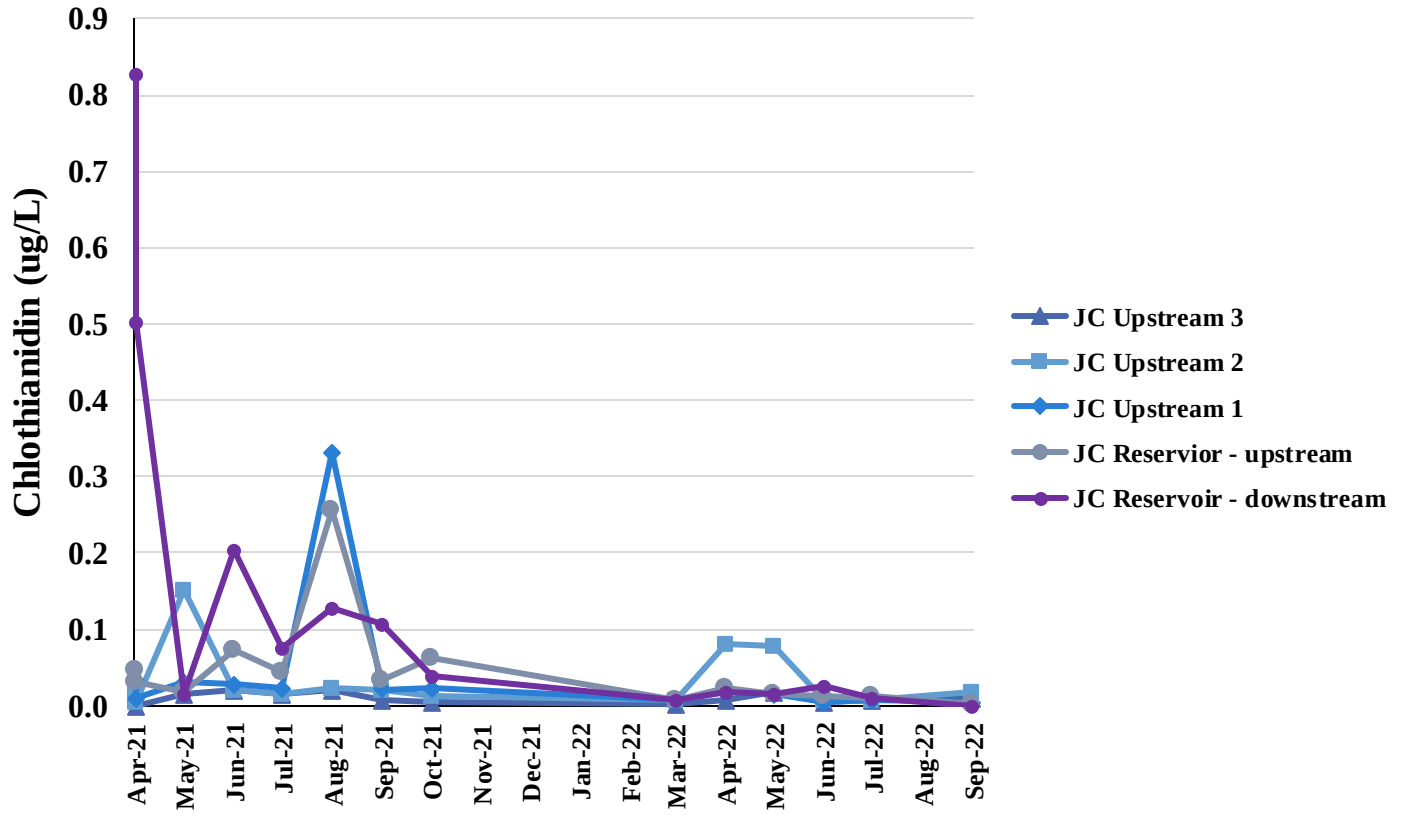
Surface Water Monitoring - September 2022

Chemical	Present in Johnson Creek Grab Samples in Sept 2022	Present in Johnson Creek Passive Samples in Sept 2022
Imidiacloprid	Yes	Yes
Imidiacloprid desnitro	Yes	Yes
Imidiacloprid urea	Yes	Yes
Thiamethoxam	Yes	Yes
Thiamethoxam urea	Yes	Yes
Clothianidin	Yes	Yes
Metalaxyl	No	Yes
Azoxystrobin	Yes	Yes
Picoxystrobin	No	Yes
Pyraclostrobin	No	Yes
Trifluoxystrobin	No	No

Summary of Surface Water Sampling

- Concentrations in 2022 have generally been 1-2 orders of magnitude lower than those detected in April 2021
- Results suggest that pesticide loading to area streams is decreasing over time



Partnerships with the USGS

- UNL is partnering with the United States Geological Survey's Drinking Water and Wastewater Infrastructure Integrated Science Team
- One group is measuring the occurrence of over 400 chemical and microbial contaminants in well water from households near AltEn
  - Another team is sampling and evaluating the impact to aquatic organisms in area streams
- Results of testing will be available in approximately 1 year

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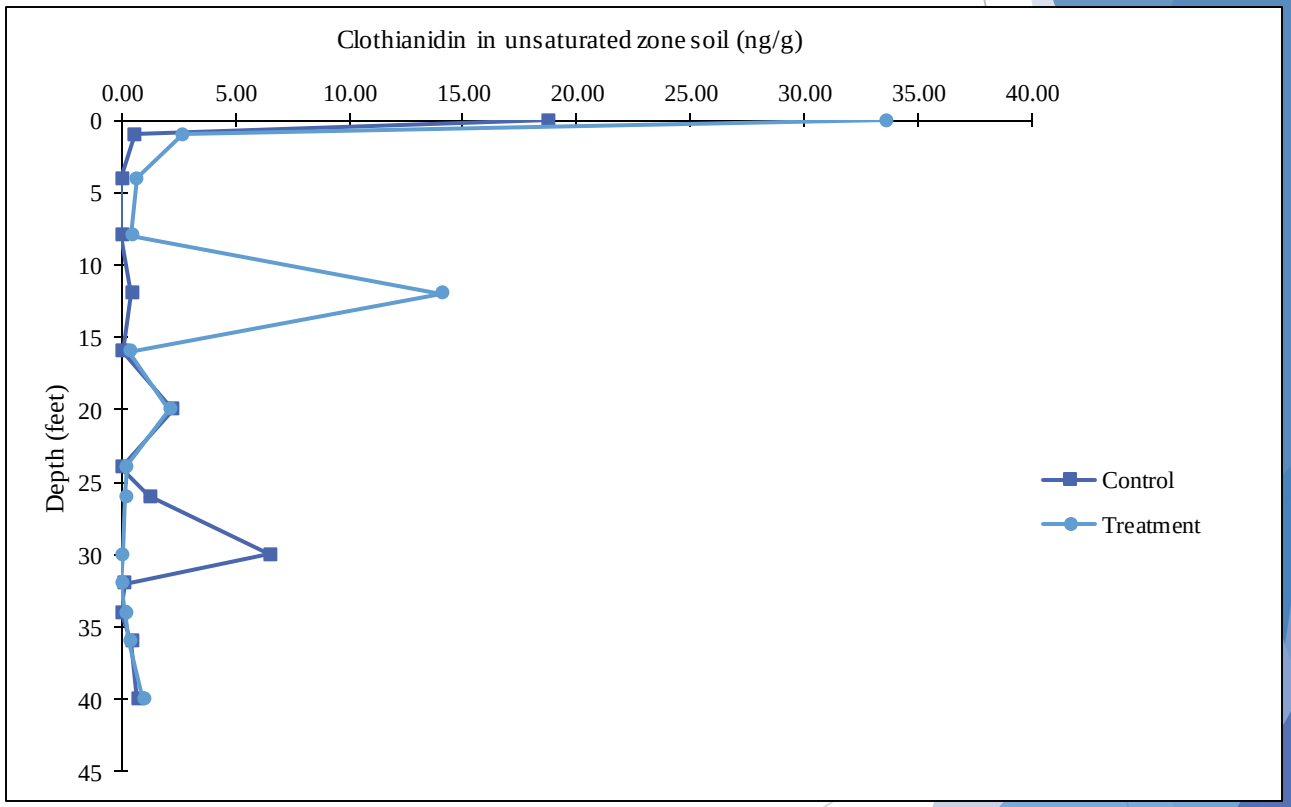
Deep soil coring at ENREC

- Deep soil cores were drilled on the ENREC property and tested for pesticide residues
- Results compare subsurface levels of residues in fields receiving wetcake (treatment) to an adjacent area with no wetcake application (control)
- We are interested in finding additional locations in the region where wetcake and wastewater were land applied to investigate pesticide transport to deeper soil



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Updates on wildlife sampling & One Health training

Liz VanWormer, UNL School of Veterinary Medicine & Biomedical Sciences, School of Natural Resources

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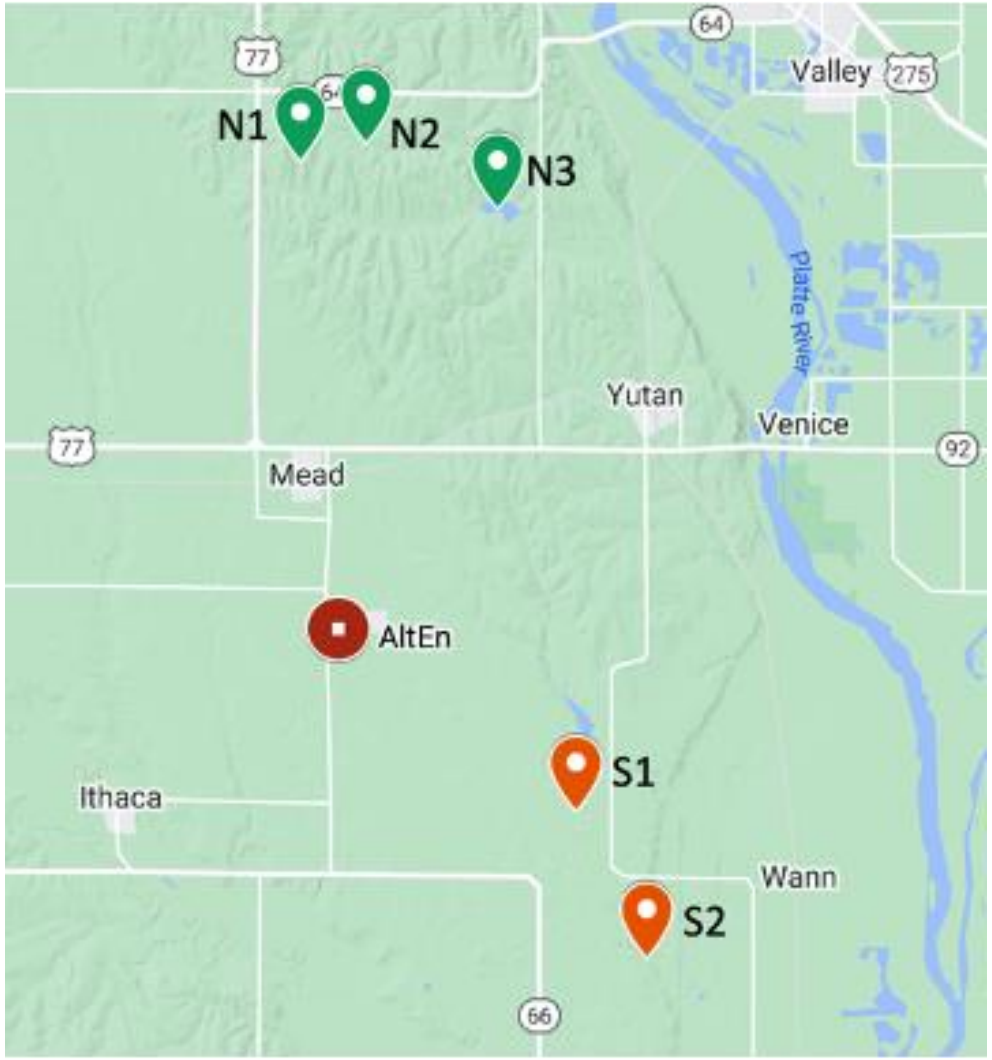
Bullfrog sentinels of pesticide exposure:

- Invasive species, widely-distributed
- Tadpole sampling (8 sites in 2021) with different levels of connection to AltEn
- 83 tadpoles collected at 5 sites, 43 tested
- Collaboration with Dennis Ferraro, UNL School of Natural Resources
- Tissues tested for pesticide residues at our partner USGS lab (Michelle Hladik)

Bullfrog tadpole sampling results



- 166 agrochemicals tested
- 2 neonicotinoid and 8 fungicide pesticides or their degradation products detected
- Neonics/degradation products only detected at a site downstream of AltEn (S2)
- For the majority of fungicides/degradation products, the highest levels were detected at a site downstream of AltEn (S2)

USGS public data release: https://doi.org/10.5066/P9NAY0GM

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FUTURE DIRECTIONS:

- Expanded site sampling in Spring 2023
- Histopathology collaboration to assess impacts on tadpoles
  - Collaboration with Mary Drozd, UNL

Songbird sentinels of pesticide exposure

- Red-winged blackbirds monitored across a spatial grid of sites in the Mead landscape
  - High - low pesticide contamination areas
- Collaboration with Larkin Powell, UNL School of Natural Resources

Egg sampling & nest monitoring in 2021-2022

- Nests identified, 1 red-winged blackbird (RWB) egg collected per nest
  - Brown-headed cowbird egg collected when present in a RWB nest
- Nests monitored weekly during 2021 breeding season to assess egg numbers, hatching, chick fledging
- 2021: 145 eggs sampled (33 analyzed)
- 2022: 58 eggs sampled
- Eggs in the process of being analyzed for pesticides at our partner USGS lab (Michelle Hladik)

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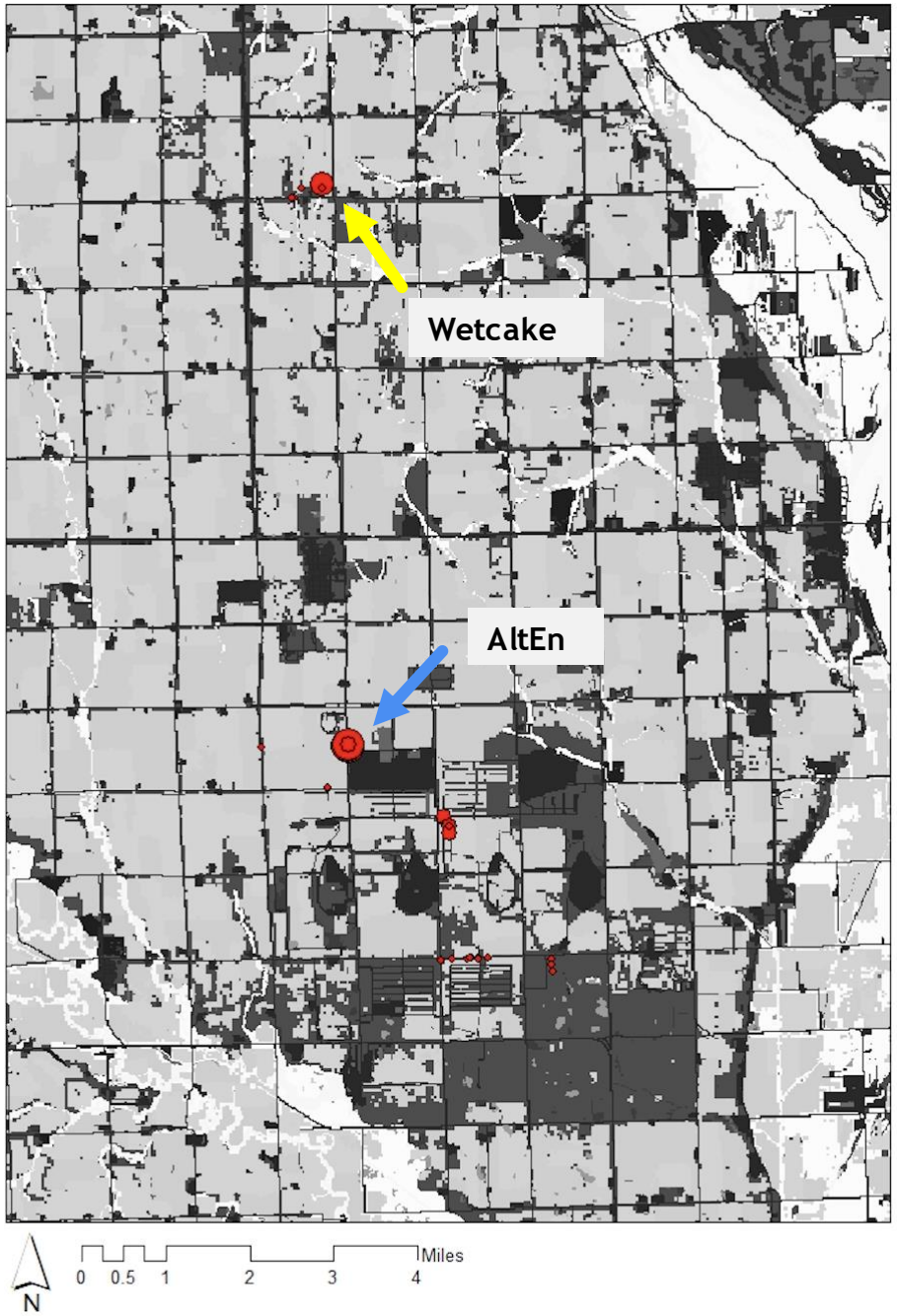
Egg sampling preliminary results (2021)

- Key findings
  - Songbird eggs are an effective sentinel for pesticide residue in this environment
  - Highest concentrations of pesticide residues detected in samples:
    - Bordering AltEn
    - In close proximity to a site that housed an undistributed wetcake pile



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Summary:

- Pesticide residues detected in songbird eggs and tadpoles
- Highest pesticide levels detected close to AltEn, along water flow paths connected to AltEn, and near wetcake piles
- One Health research and student training ongoing to expand the study in 2023

One Health undergraduate field training program

Creighton University - AltEn Contaminants Studies

Drs. Marie Adomako, Pierce Greenberg,

Joe Phillips, John Schalles & students

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Creighton University - AltEn Contaminants Studies

- **Hands in the Dirt**
  - Testing the soil for AltEn contamination and remediation potential
- **Feet in the Stream**
  - Monitoring stream community responses to AltEn contamination
- **Eyes in the Sky**
  - Using drone and satellite images to examine environmental change and impacts in Saunders County

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Hands in the Dirt

- Soil bacteria near and around AltEn may be impacted by field application of waste, backing up or flooding of wastewater, etc.

- We have begun testing soil on sites upstream and downstream from AltEn.

- Plans to test whether soil with AltEn contamination can be remediated by natural soil bacteria.

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Soil sampling sites along AltEn runoff corridors on November 2, 2022

Feet in the Stream

- We are interested in whether invertebrate animals (ex. worms & insects) downstream from AltEn, versus upstream controls, have been impacted by site run-off.
- We set rock traps to collect the samples of invertebrates and monitor how many of which kinds are present.
- The diversity and numbers of invertebrates over time reflects the health of a stream.

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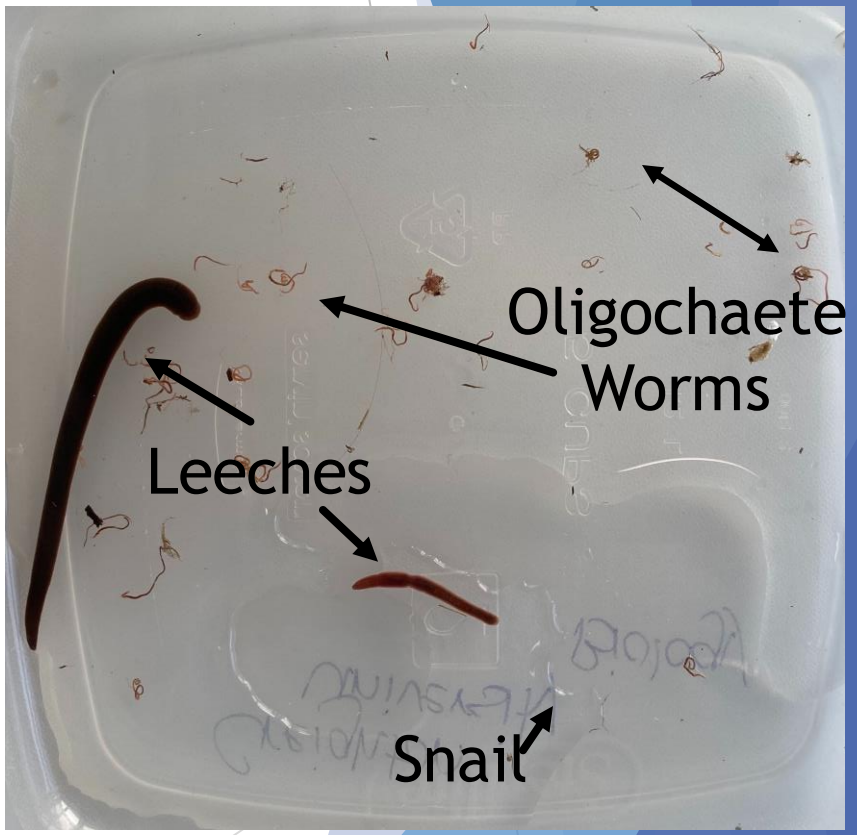
Rock cages before deployment (11/2/2022)

Johnson Creek at Road 7 Stream & Reservoir (11/23/2022)

Captured Stream Animals (upper Johnson Creek) (11/16/2022)



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Eyes in the Sky

- Drone imagery collected since 2021 show important changes happening on the AltEn site.

- We will also analyze images from public and private satellites that can show us environmental conditions before AltEn, during AltEn's operation, and after it's closure.

- We will share information on an interactive **StoryMap** website.

Consolidated wetcake Pile (foreground) and wastewater lagoons (upper left)

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1st Q & A Session:

- **Guidelines**
  - Please raise your hand and wait to be called upon, this allows everyone to be heard.
  - Feel free to direct your questions to the appropriate presenter (a list of names and topics is below)

- Judy Wu-Smart, PhD - UNL | Bee Research
- Shannon Bartlet-Hunt, PhD - UNL | Environmental Monitoring
- Elizabeth VanWormer, PhD - UNL | Wildlife Sampling
- John Schalles, PhD – Creighton | AltEn Contaminant Studies

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University Of Nebraska Assessment Of The Effects Of AltEn Contamination On Human And Environmental Health

Jesse E. Bell, PhD
Claire M. Hubbard Professor of Water, Climate, and Health Program
Director of the Water, Climate and Health Program
Department of Environmental, Agricultural, and Occupational Health
College of Public Health
University of Nebraska Medical Center

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UNMC Environmental Health Risk Perceptions Survey-2022

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Survey Methodology

- Environmental, Agricultural, & Occupational Health at UNMC, Creighton University, and Bureau of Sociological Research (BOSR) at UNL
- Public health concerns from AltEn ethanol plant- 977 residents
- Mail-based or paper survey and a Qualtrics web survey (Feb 16th- May 26th,2022)
- AltEn situation, livestock health, household members' health, respondents' health, and demographic questions
- Biological samples or speak to health specialist

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Survey Results

- Response rate ~ 37.8%
- Household information
  - 85.4% - owned a house
  - 44% - two household members
  - 61.2% - 35-65 year of age
  - Drinking water source- 55.34% (private well), 45% (bottled water)
- Public information
  - 80.61% - aware of AltEn and 75% were worried

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Survey Results

- Concerns with exposure
  - 81.70% surface water
  - 81.05% well water
  - 72.33% air quality
- Household health information
  - 17.21% - chronic conditions since 2015
  - 8.08% - health issues related to AltEn
    - No – 54.47%; Unknown – 25.71%

Survey Results

- Household health information
  - Chronic long-term conditions
    - 4.15% Respiratory, 2.18% Cardiac, 1.31% Cancer, 1.31% Endocrine
  - Breakdown of health issues believed to be connected to AltEn
    - 9.15% Respiratory, 4.14% Allergy, 1.96% Neurological, 1.74% cancer
- Household needs
  - 66.67% - addressed concerns about AltEn
    - Cleaning/addressing the contamination
    - Concerns about environmental issues
    - Monitoring

Main Conclusions

- Majority of people are worried about the situation at AltEn
- A small percentage of people think their health issues are associated with AltEn, but many are uncertain
- The primary community concerns/needs dealing with AltEn is addressing the situation and monitoring

Human Health Effects

Kaleb Michaud, PhD

Professor

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NEBRASKA.TV

Dangerous conditions arise again at AltEn Ethanol Plant

"When is enough enough?

JOURNALSTAR.COM

'I am terrified' — AltEn study finds pesticides in Mead woman's home

The sample taken from Jody Weible's dining room showed the presence of 11 of the 14 pes...

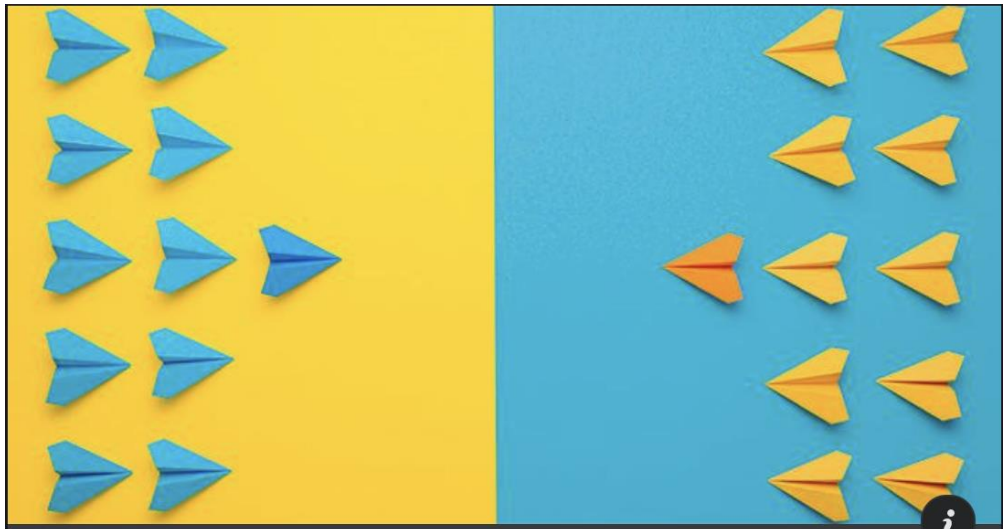
THEGUARDIAN.COM

'We want it back to what it was': the US village blighted by toxic waste

Can a $100m cleanup operation save Mead, Nebraska, from putrid pesticide-laced waste t...

KETV.COM

KETV investigates Mead's AltEn ethanol plant: What went wrong, clean-up efforts and more

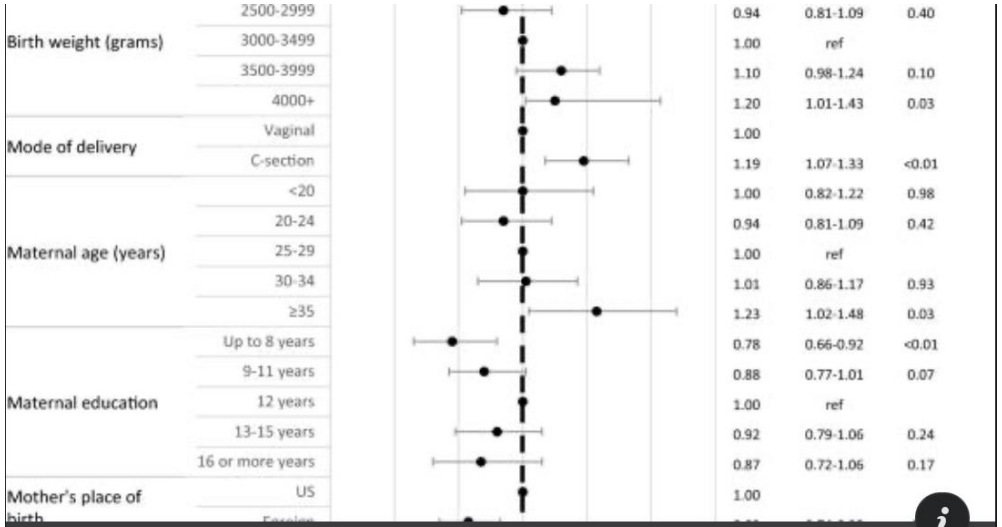


HEALTHPAYERINTELLIGENCE.COM

Medicare Advantage Beneficiaries Have Better Diabetes Patient Outcomes

GOODMENPROJECT.COM

Five Years After Flint Water Crisis, Mental Health Problems Persist



NATURE.COM

Outdoor artificial light at night, air pollution, and risk of childhood acute lymphoblastic leukemia in the California...

NEWS.VA.GOV

Fast facts about new toxic exposure screening for Veterans - VA News

Medical Registry

Enrollment – by household

Online only – text/email

Questionnaires – every year, 6 months, and monthly – what works best?

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Next steps

- Finalize ethics review
- Enrollment – community leaders, door to door, etc – what do you recommend?

Long term

Need high participation of community

Early and long term

Neonicotinoid Sampling in Houses in Mead, Kennard and Omaha

Eleanor G. Rogan, PhD
Interim Chair
Department of Health Promotion
College of Public Health
University of Nebraska Medical Center

Muhammad Zahid, PhD, MPH
Research Assistant Professor
Environmental, Agricultural & Occupational Health
College of Public Health
University of Nebraska Medical Center

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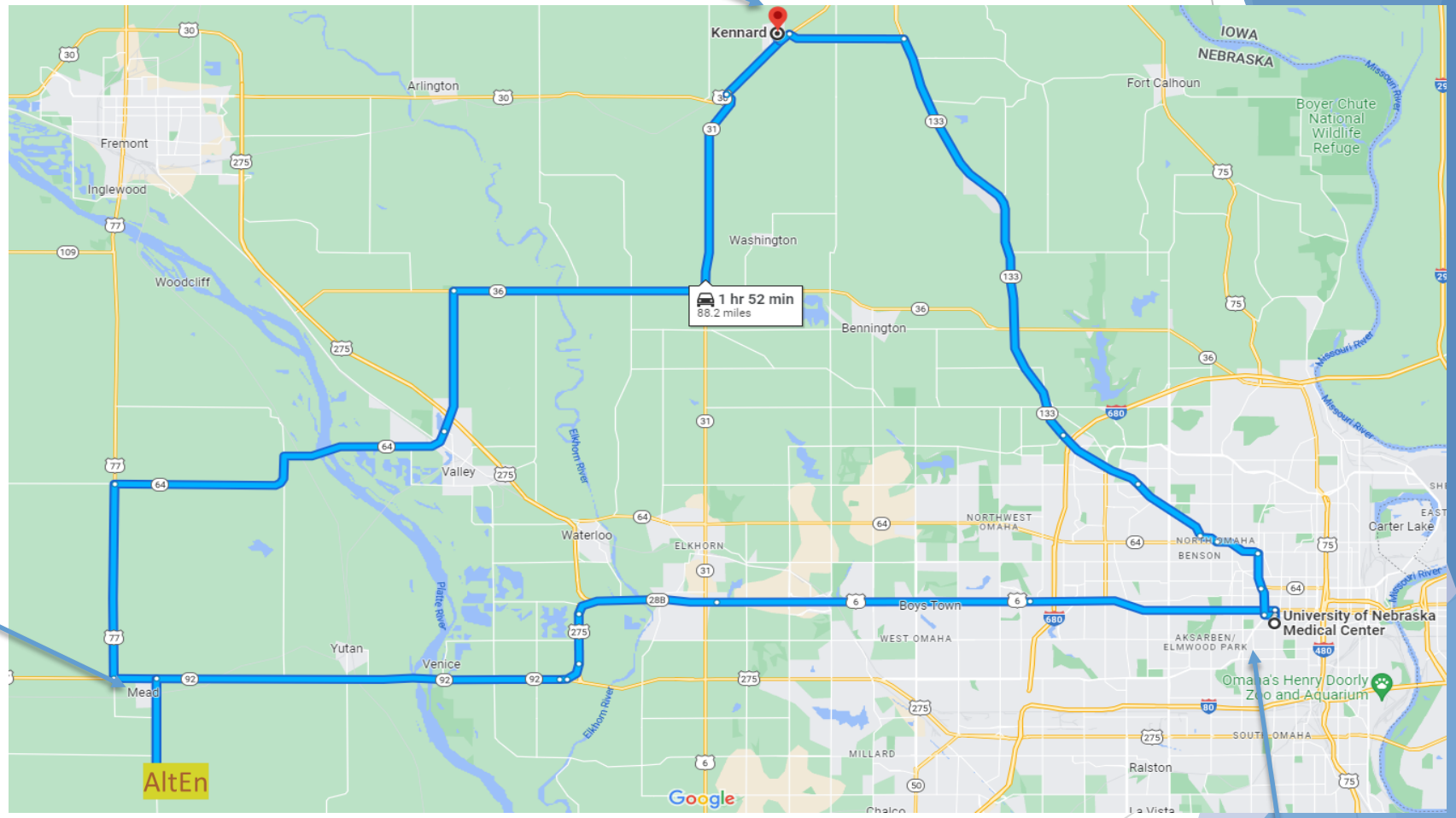
Kennard

3 house swipe and air samples (Inside and outside)



Mead

11 house swipe and

10 air samples (Inside and outside)

Omaha

3 house swipe and air samples (Inside and outside)

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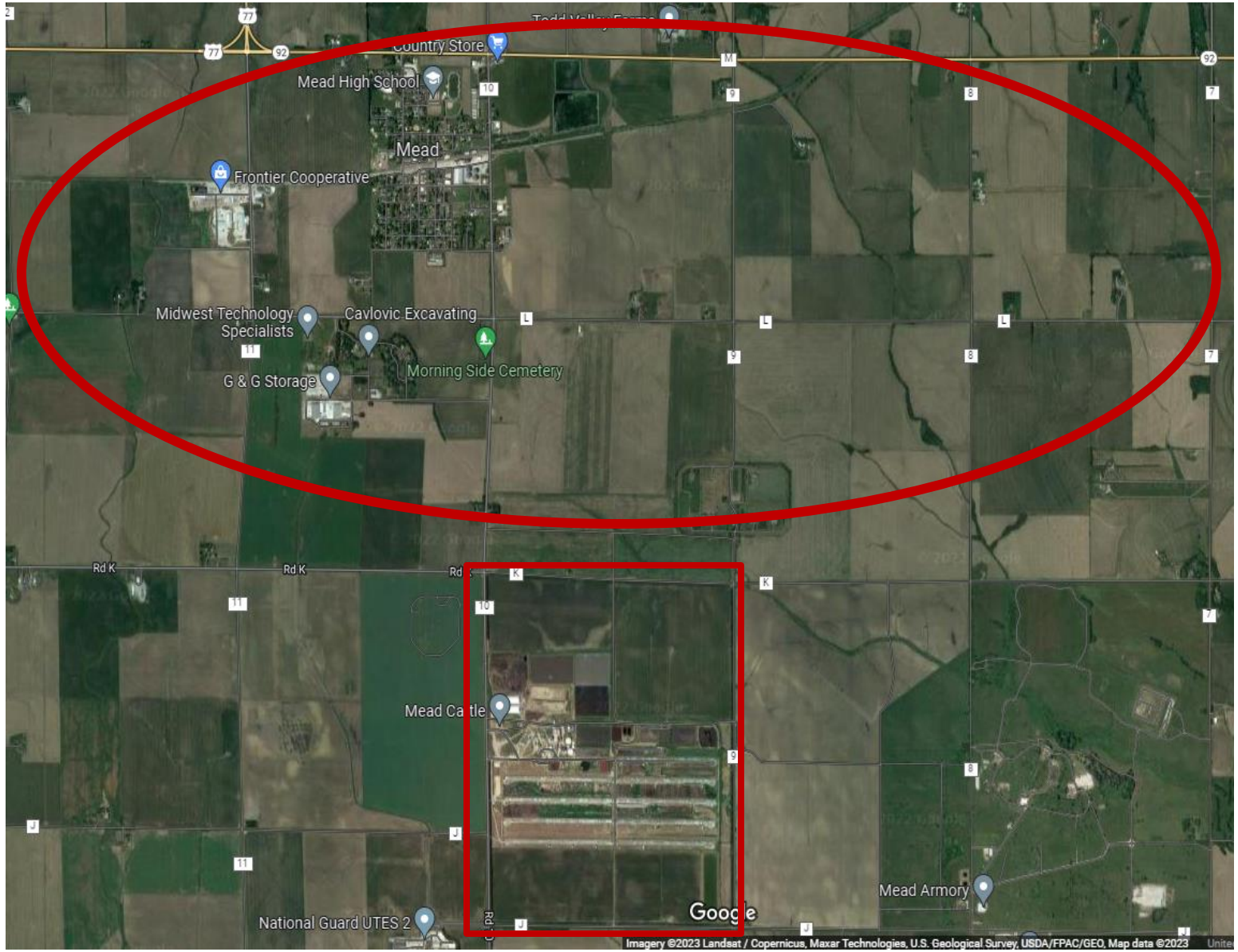
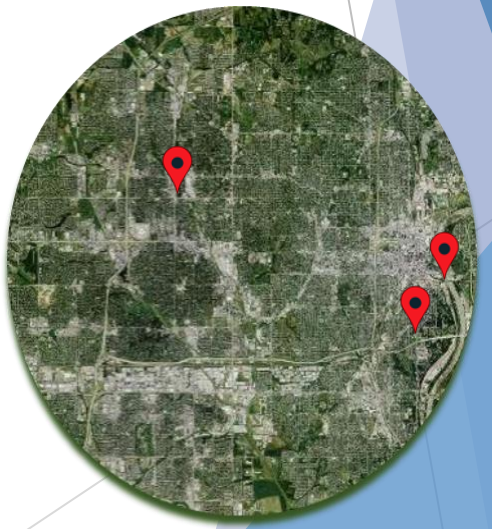


11 house swipe & 10 air samples (inside and outside)

Mead

Kennard

3 house swipe and air samples (inside and outside)



Omaha

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Sampling & Analysis

SASS®2300 WETTED-WALL AIR SAMPLER

- The swipe and air samples were analyzed at the UNL Water Sciences Laboratory by UPLC-MS/MS.
- A total of 21 compounds were analyzed – 13 neonicotinoids, 1 organophosphate and 7 fungicides.

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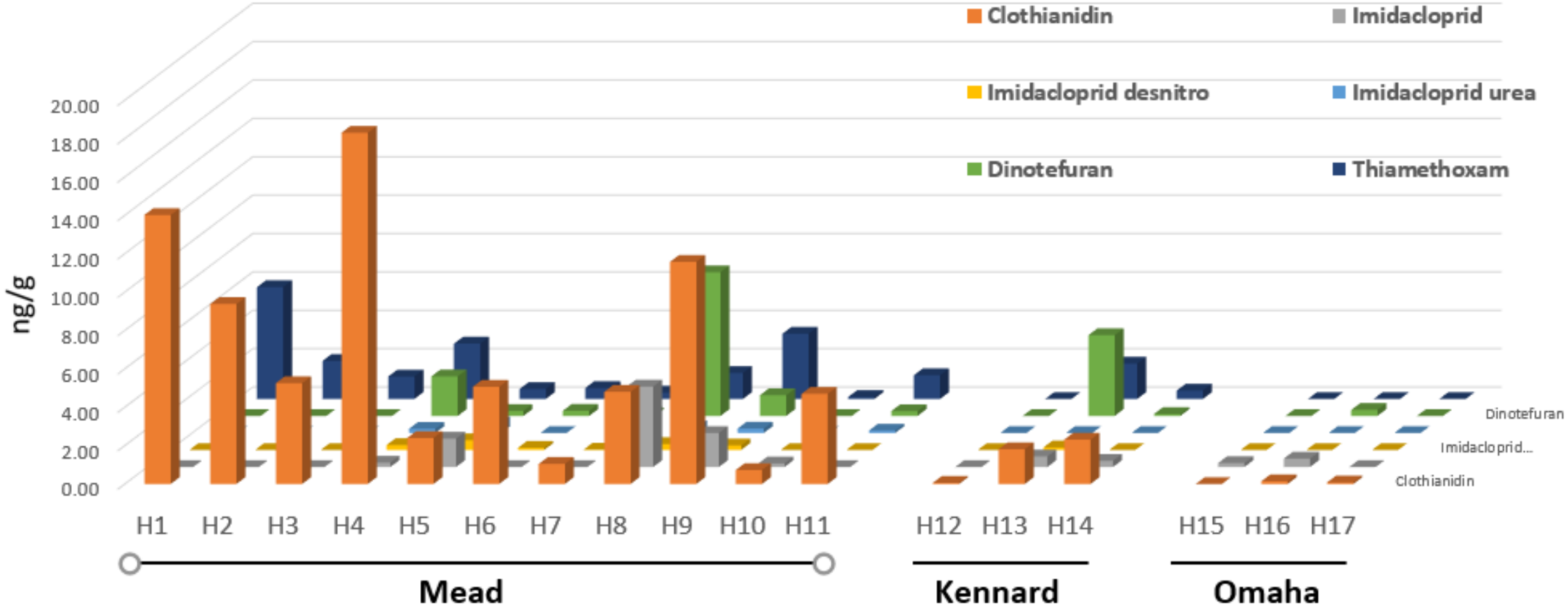
Detection of Neonicotinoids in Mead, Kennard and Omaha Residential Indoor Swipe Samples



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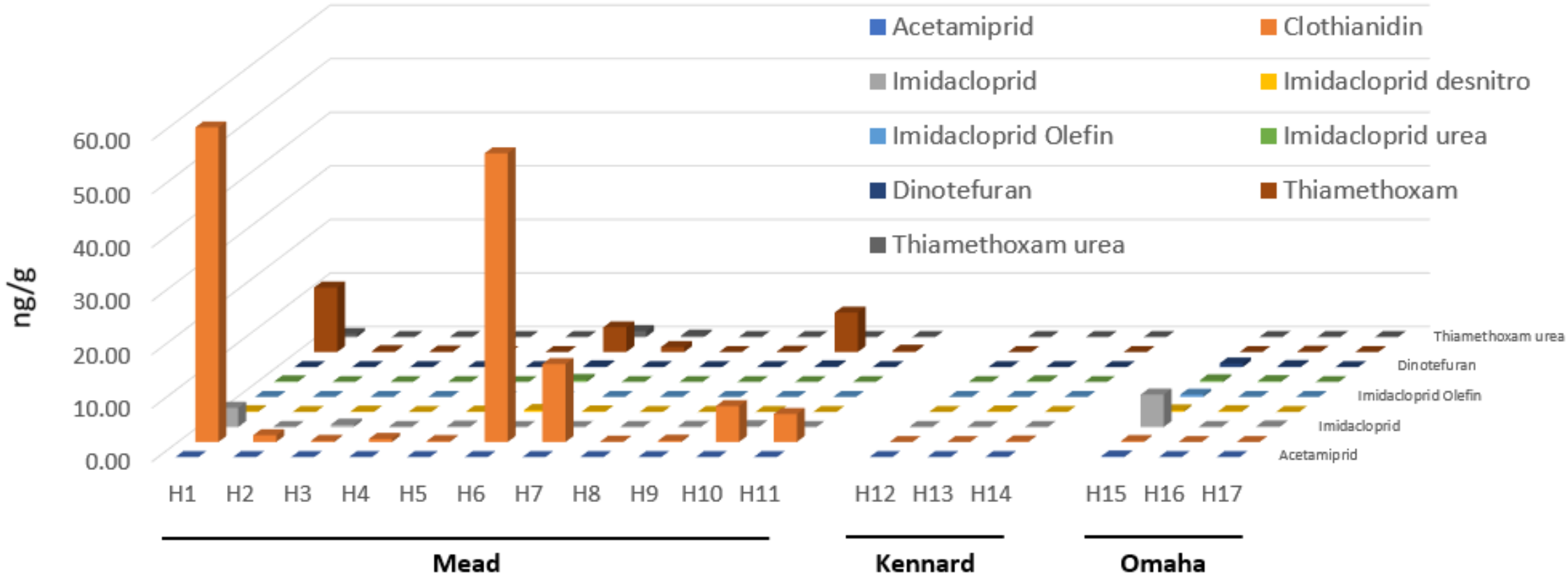
Detection of Neonicotinoids in Mead, Kennard and Omaha Residential Outdoor Swipe Samples



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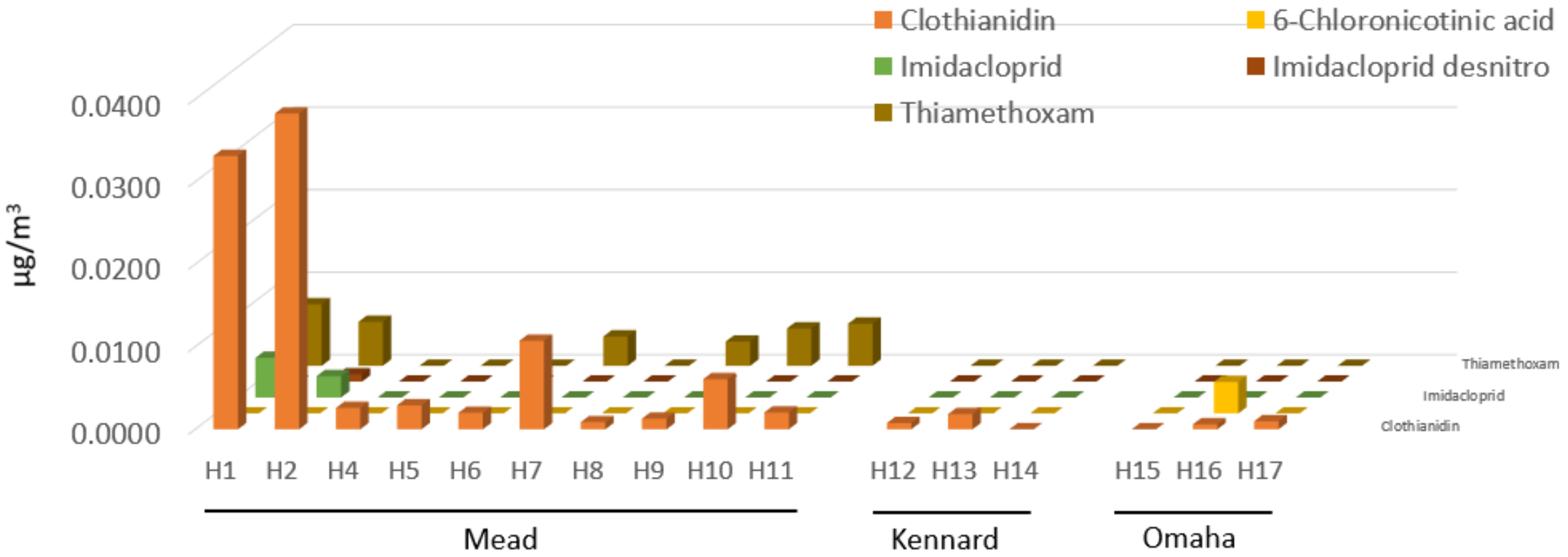
Detection of Neonicotinoids in Mead, Kennard and Omaha Residential Indoor Air Samples



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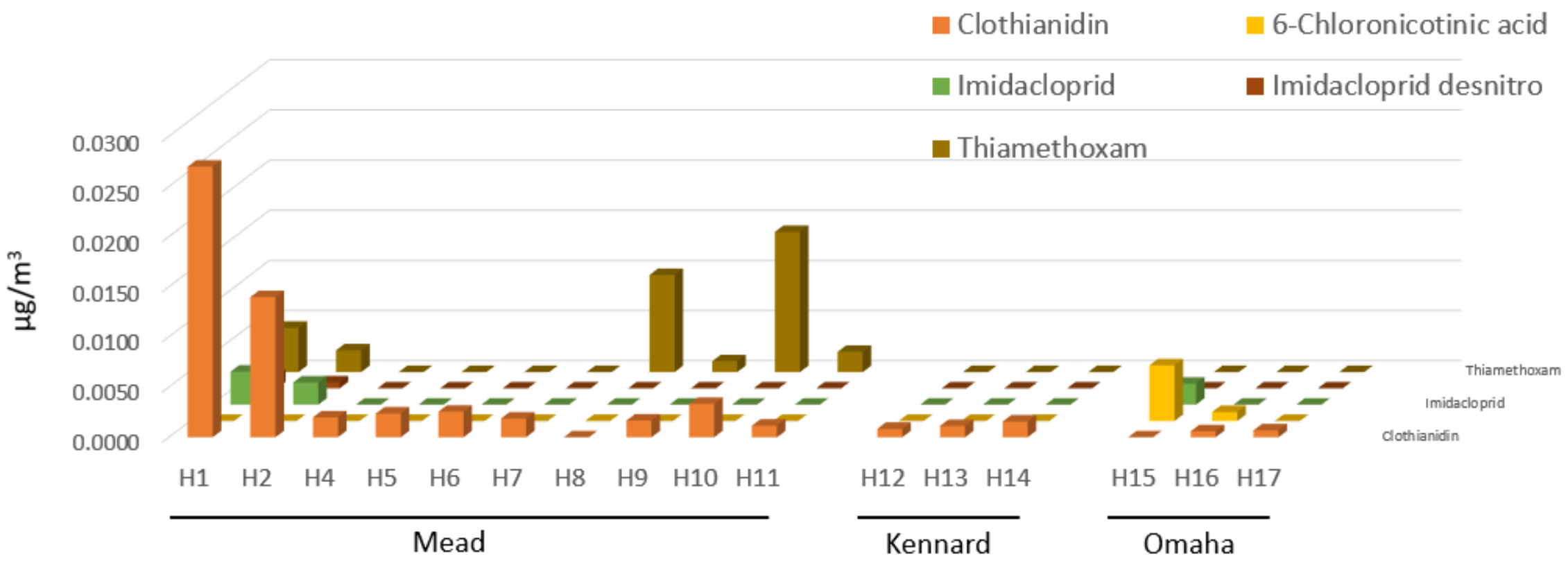

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Conclusions from these House Samples

These preliminary results indicate that neonicotinoids were detected on a surface inside all of the 11 homes tested in Mead, while the Kennard levels were even lower, and Omaha homes had virtually no detectable neonicotinoids.

Some of the Mead homes had detectable levels of neonicotinoids on an outside surface, but virtually none of the Kennard or Omaha homes had any.

Air samples inside and outside all of the Mead homes had detectable levels of neonicotinoids, while the air inside and outside Kennard and Omaha homes showed little to no levels.

Clothianidin

Location	Parts per billion (ppb)
EPA Human No Effect Limit	9,800
AltEn lagoon wastewater (NDEE)	31,000
AltEn wetcake (NDEE)	427,000
Dust inside a Mead house (8/2022)	18.31
Dust outside a Mead house (8/2022)	58.72

Clothianidin levels in air around the AltEn site

	March - 2021	August - 2022	September - 2022
AltEn - east side	0.4728	0.0069	0.0099
AltEn - north side	0.2280	0.0041	0.0049
AltEn - west side	4.9706	0.0058	0.0112
AltEn - south side	0.9598	0.0049	0.0031

The unit is $\mu g/m^3$

U.S. federal agencies have not published any information on safe (or hazardous) human exposure levels for neonicotinoids.

The Centers for Disease Control and Prevention (CDC) surveys a representative sample of the U.S. general population3-years and older for a variety of health conditions and exposures on a 2-year cycle. In the 2015-2016 cycle, this included neonicotinoids. About half (49%) of the people had detectable levels of neonicotinoids in a urine sample. These were presumed to be the result of ingesting contaminated produce.

Overall Conclusions

In a preliminary study, 11 houses in Mead were found to have detectable levels of neonicotinoids at significantly higher levels than in Kennard and Omaha.

There is no information available to know whether long-term exposure to low levels of neonicotinoids poses a risk to people's health.

Overall Summary

- Repeated studies since 2020 show decreased bee deaths and levels of contamination of surface water. This suggests that the mitigation measures with the closure of AltEn may be reducing environmental contamination.

- The AltEn Health Study Team continues to take a broad approach to understand the impact of these contaminants in the environment, animals and humans. Long term environmental and animal studies may provide insights into human health risks.

- The AltEn Health Study Group has found extensive chemical contamination in the environment, multiple insects and animals, and human dwellings. More study is needed to understand the animal and human health impact of this exposure.

Q & A Session:

- **Guidelines**
  - Please raise your hand and wait to be called upon, this allows everyone to be heard.
  - Feel free to direct your questions to the appropriate presenter (a list of names and topics is below)

- Judy Wu-Smart, PhD - UNL | Bee Research
- Shannon Bartlet-Hunt, PhD - UNL | Environmental Monitoring
- Elizabeth VanWormer, PhD - UNL | Wildlife Sampling
- John Schalles, PhD – Creighton | AltEn Contaminant Studies
- Jesse Bell, PhD – UNMC | The Effects Of AltEn Contamination On Human & Environmental Health
- Kaleb Michaud, PhD – UNMC | Human Health Effects
- Eleanor Rogan, PhD – UNMC | Neonicotinoid Sampling

Creighton University | University of Nebraska Medical Center | University of Nebraska Lincoln | Three Rivers Public Health Department – Dodge, Saunders & Washington Counties

One Health brings together people with diverse backgrounds, skills, and perspectives to improve the health of humans, animals (wild and domestic), plants and our shared environments.