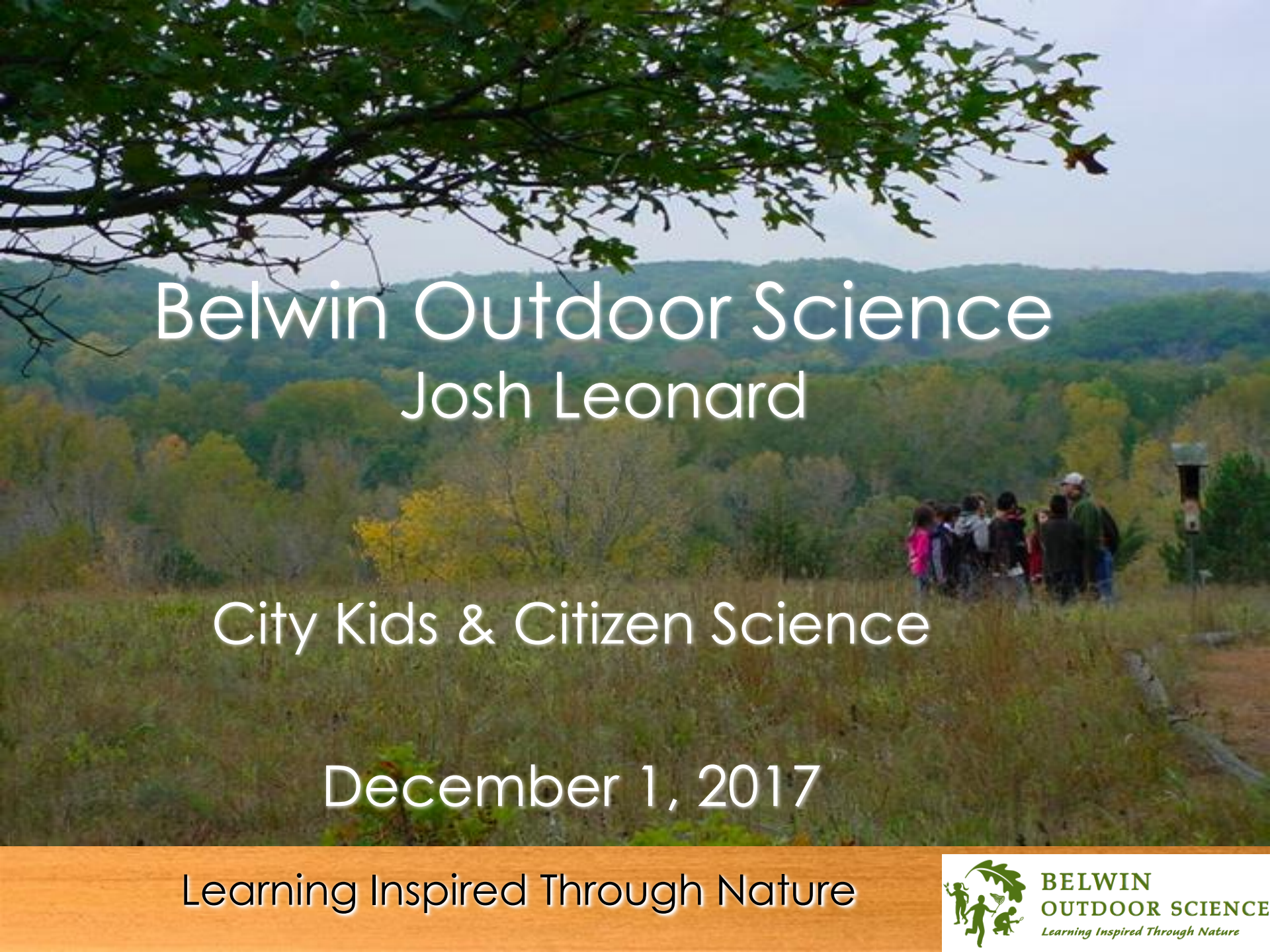


Belwin Outdoor Science

Josh Leonard

City Kids & Citizen Science

December 1, 2017

Learning Inspired Through Nature

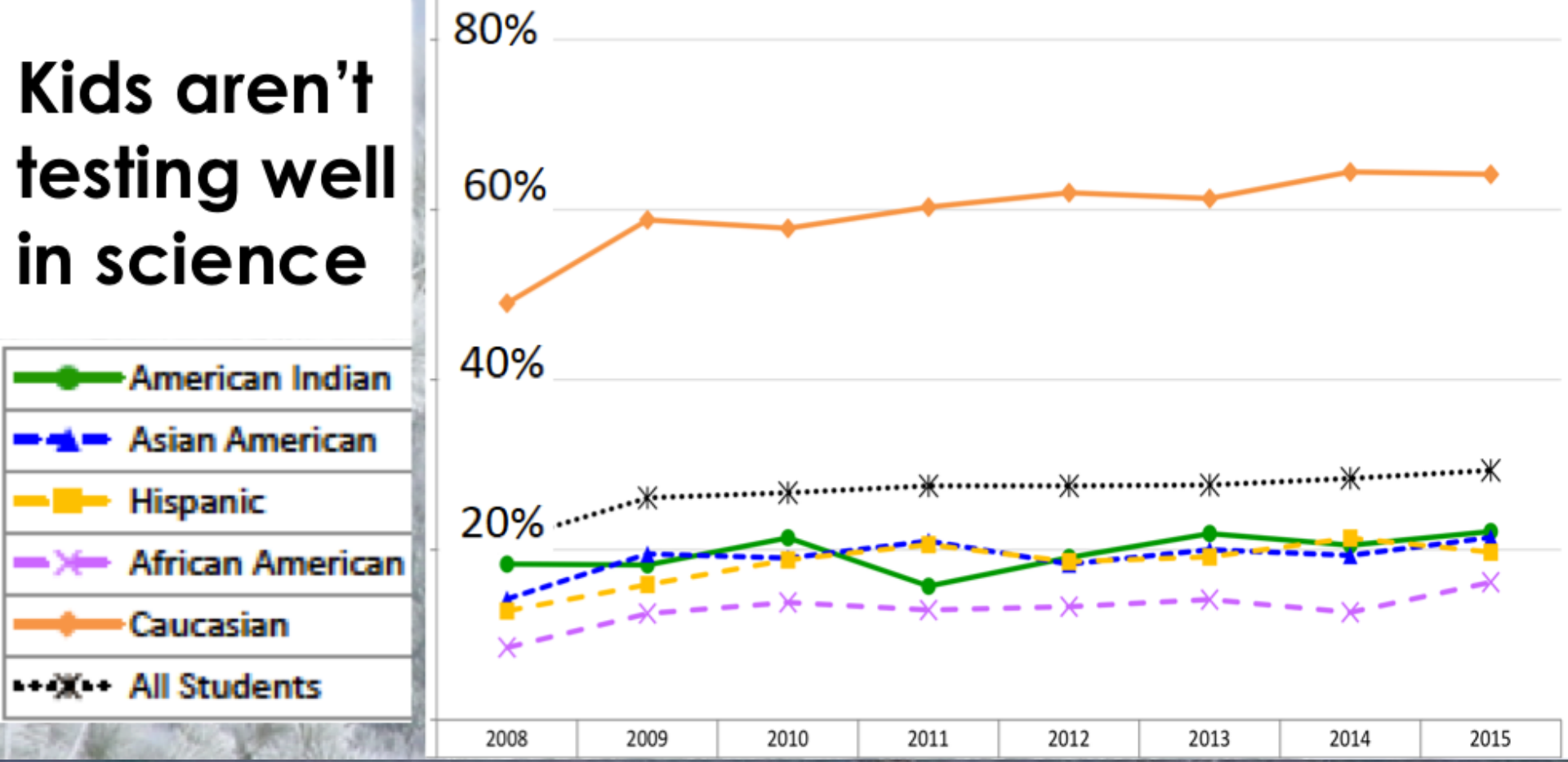
BELWIN OUTDOOR SCIENCE
Learning Inspired Through Nature

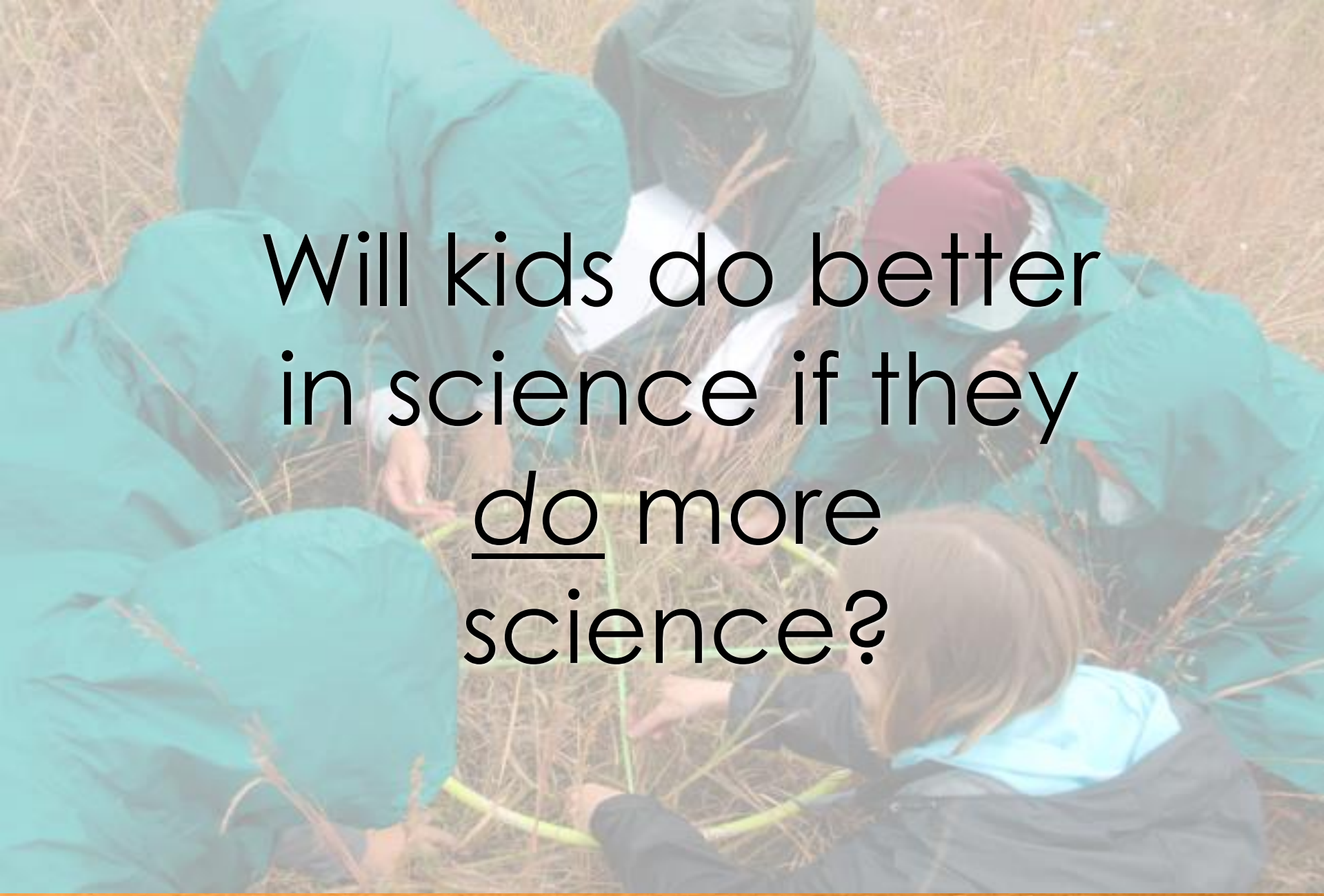
Kids love doing science!

BelwinOutdoorScience @Belwin625 · 17 Mar 2015

Eastern Heights 3rd graders helped install the prairie frost tube. How deep did frost go this winter? Over 4 feet!

Kids aren't testing well in science




Will kids do better
in science if they
do more
science?

With so many choices, where to start kid science?

nature's notebook
A project of the USA-NPN

Minnesota Bumble Bee Survey

Journey North

eBird

The Great Sunflower Project

ODONATA CENTRAL

CoCoRaHS

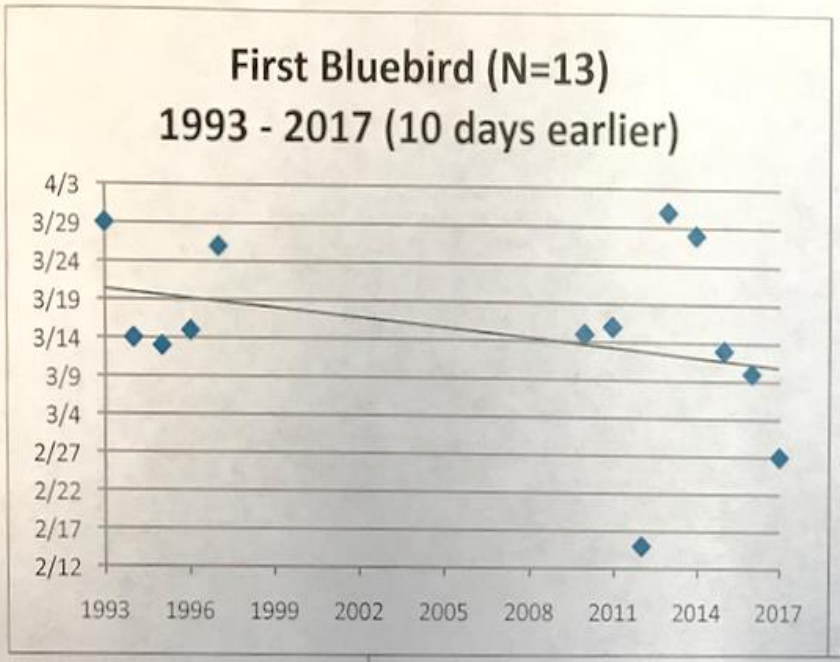
Bluebird Recovery Program of Minnesota

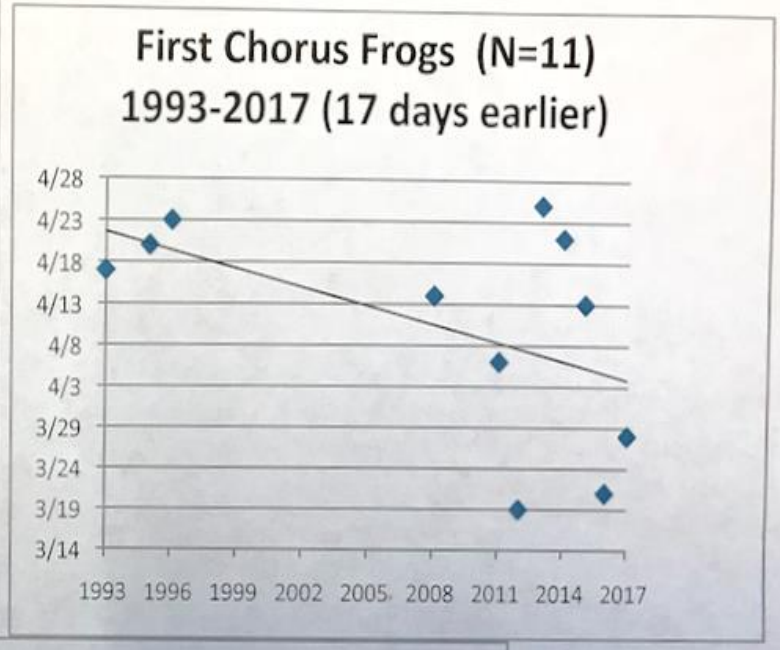
Learning Inspired Through Nature

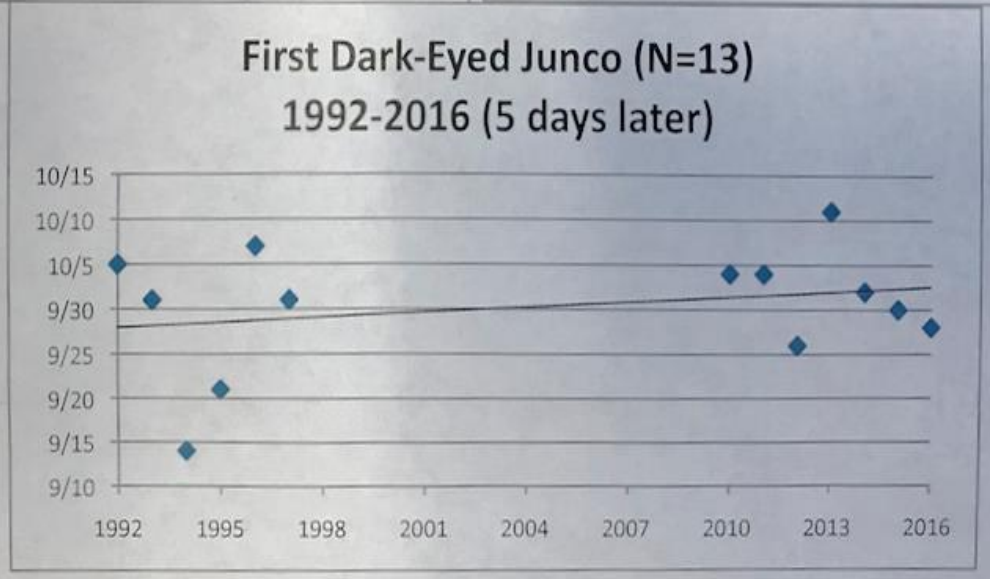
BELWIN OUTDOOR SCIENCE
Learning Inspired Through Nature

Step I: Don't!

1.







R SCIENCE
Through Nature

Step 2: easy. rain gauges

Investment

$42

1.5 hour startup

1x / day

easy! frost tubes

Investment

- $30
- 5-hour startup
- 1x / week

easy. tulips

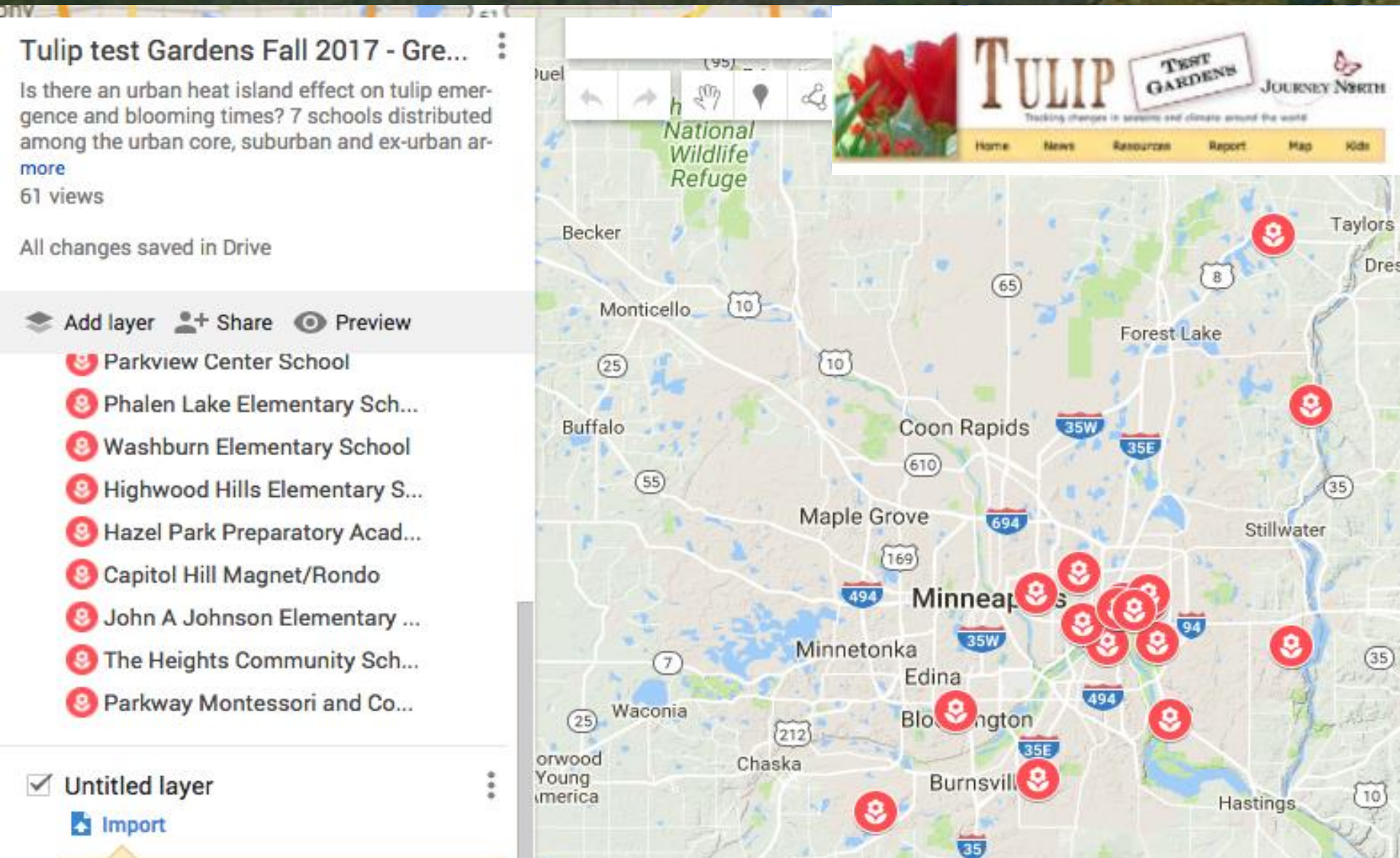
Investment

$32

2-hour startup

3x / year

layer it up - tulips



Step 3: moderate. eBird

Pros	Cons
Best CitSci App	Need Binoculars
Best CitSci Data Analysis	More knowledge = better experiences

UNIVERSITY OF MINNESOTA

Monarch Larva Monitoring Project

Learning Inspired Through Nature

BELWIN OUTDOOR SCIENCE

Learning Inspired Through Nature

tor Gardens

Learning Inspired Through Nature

BELWIN OUTDOOR SCIENCE
Learning Inspired Through Nature

Step 4: Challenge! Dragonflies

Mite Parasitism of Damselflies and Dragonflies

G. Elseth, S. Peterson, P. Jacobson, D. Androli, L. Wester, P. Spengler, J. Leonard

Heating makes some prairie flowers early bloomers

Andrew Arlt, Juliane Chapman, Greg Elseth, Nancy Geving, Amy Johnson, Josh Leonard, Mila Velimirovich-Holtz

Driven 2 Discover, Citizen Science for Teachers 2015

Introduction

A phenological study was conducted in July 2015 of observable reproductive phases in the annual life cycle of nine prairie plants in the Cedar Creek Ecosystem Science Reserve BAC (Biodiversity and Climate) study. Previous research of phenological data have shown phenophases in some organisms to be shifted earlier in the spring due to earlier spring thaws[1].

This study aimed to determine how prairie species varied in their responses to potential future climate change (3-5° C) compared to current ambient temperatures. Heat-treated plot species were expected to respond sooner than ambient temperature plots. Changes in the phenology could create mismatches in timing of interdependent species[2].

Methods

Nine scientists collected phenophase data at Cedar Creek Ecosystem Science Reserve in the BAC program. The scientists were divided into four groups with each group focusing on 2-3 specific plants.

Data were gathered on July 10, 2015 by teams of scientists counting and categorizing the number of plants in six different phenological stages: leaves, flower buds, open flowers, fruits, ripe fruits, and recent fruit drop. The plot size for each count was 1 x 2 meters and the heat treatment increased the plot temperature by 3-5 degrees C. Chi Square and t-Tests comparing each plant species under heat treatment and ambient conditions were

Results

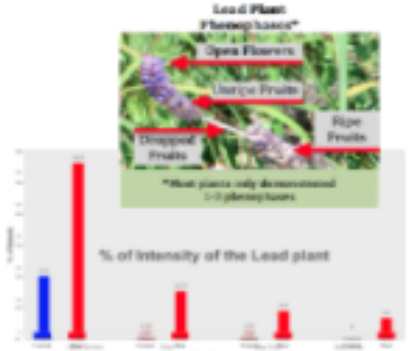
1. Heat treatment caused reproductive phenophases in lead plant, lupine, and purple prairie clover to occur earlier (responders).

2. Heat treatment did not cause reproductive phenophases in switch grass, yarrow, bush clover, and blazing star to occur earlier (non-responders).

Table 1. T tests and P values based on average percent per phenophase of native Minnesota prairie plants that are either responders or non-responders of heat treatments.

Response to Heat Treatment	Common name (species)	Picture	Phenophase	t-ratio	p-value
Responder	Lead Plant (Amorpha canescens)		Flower Bud Open Flower Fruits Ripe Fruits Fruit Drop	-7.63 -3.14 -3.66 -3.75 -3.23	.001 .011* .002* .002* .003*
Responder	Prairie Lupine (Lupinus perennis)		Fruits Ripe Fruits Fruit Drop	-3.46 -3.58 -3.56	.003 .002 .002*
Responder	Purple Prairie Clover (Dalea purpurea)		Flower Bud Open Flower	-3.63 -3.66	.002* .002*
Non-Responder	Switch Grass (Panicum virgatum)		Flower Bud	-.271	.788
Non-Responder	Yarrow (Achillea millefolium)		Flower Bud Open Flower Fruits Ripe Fruits	-1.17 -.000 -1.62 -1.06	.265 1.00 .135 .310
Non-Responder	Tall Blazing Star (Liatris aspera)		Flower Bud	-.985	.333
Non-Responder	Bush Clover (Lespedeza capitata)		Flower Bud	-1.08	.307

* P values less than .05 is significant data and allows us to reject our null hypothesis in the Bradley paper "Yarrow and lupine were non-responders."



Big Idea

Temperature changes associated with climate change could affect the reproductive phenology in prairie plant communities. These changes may cause population dynamics within the communities to shift over time.

Conclusions

*Heat treatment caused reproductive phenophases in lead plant, lupine, and purple prairie clover to occur earlier (responders).

Lupine phenophases may have occurred prior to the sampling time. Bradley et al. found lupine to be a non-responder[1].

*Heat treatment did not cause reproductive phenophases in switch grass, yarrow, bush clover, and blazing star to occur earlier (non-responders).

Plants may have other triggers, such as photoperiod (light amount).

Small sample size limited ability to include white prairie clover and butterfly weed).

Butterfly weed seemed to occur in greater abundance outside our sampling area in the heat treated area. Bradley et al. found butterfly weed to be a responder[1].

Future Research:

*Heat may increase competitive advantage between responders and non-responders.

Do these shifts limit nutrient availabilities?

*Plant pollinator's interactions impact seed production, but mismatches in phenology decrease success[2].

Do these shifts create differences in plant success?

Further information

Information about phenology and phenophases can be obtained from MN Phenology Network.
www.usanpn.org/mnpn
To participate in citizen science using

Acknowledgments

We thank the following for their assistance with the our study

Christopher Buyarski
Rebecca Montgomery
Gillian Roehrig

Work cited

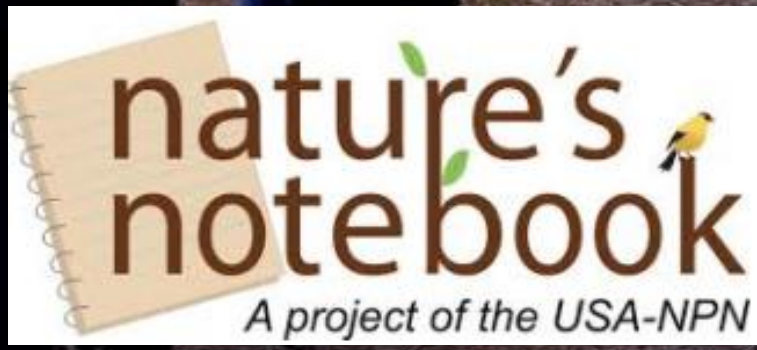
Phenology. easy. Chilling Experiment

Learn

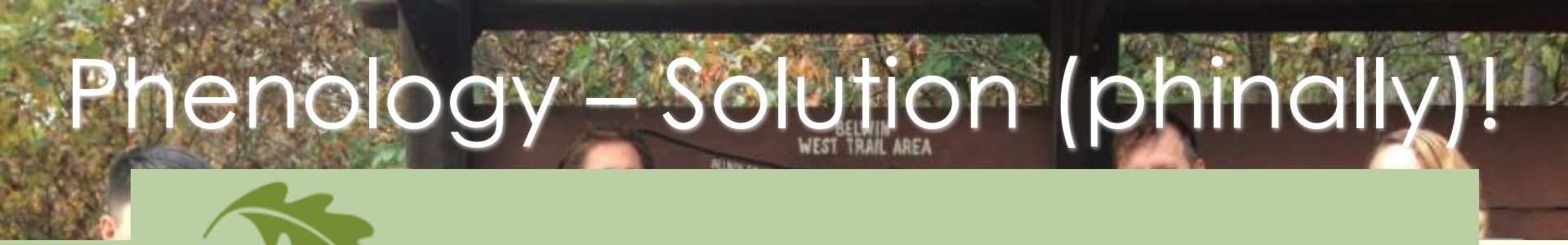
Major obstacles

Entering student observations into CitSci apps

- Creating an Account
- Student contact info
- Internet access in the field
- Sharing observations
- Student accuracy



Phenology – Solution (phinally)!



STUDENT VIEW | REGISTER NEW STAFF | USER LIST | LOG OUT

CE

< BACK

Data for Class 1

PLANTS | MAMMALS | BIRDS

BUR OAK | RED OAK | PIN OAK | QUAKING ASPEN

COMMON BUCKTHORN | PAPER BIRCH | COMMON MILKWEED

Bur Oak	Site 1			Site 2			Site 3		
	Y	N	?	Y	N	?	Y	N	?
Breaking Leaf Buds									
Leaves									
Increasing Leaf Size									
Colored Leaves									
Falling Leaves									

Happy Scientists!

Thank you UMN D2D2 Program!

Rob Blair
Karen Oberhauser
Sarah Weaver
Chris Buyarski
Rebecca Montgomery
Andrea Lorek Straus