iHub

Embedding citizen science into K-12 curricula: Empowering youth to help manage the urban forest ecosystem

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Outline

Problem: Providing meaningful learning

Approach: Co-design with differing expertise

Illustration: Citizen Science in formal settings

Preliminary Findings: Evidence of impact

Call to Action

We seek to offer *all* youth the chance to become informed stewards of their urban ecosystems. How can your organization help support this vision?

Lack of Meaningful Learning

Traditional forms of science education often deny students the opportunity to investigate real-world phenomena of interest or solve consequential problems using science and engineering practices (National Research Council, 2012).

Empowerment as a Solution

One potential solution involves empowering future generations of students to become informed stewards of their local urban ecosystem.

Potential of Citizen Science

Citizen science can offer students opportunities to address issues seen as meaningful to their community (Roth & Lee, 2004).

Yet citizen science projects fail to reach all potential students as most lack supports for their integration into formal science classrooms (Trautman et al., 2012).

Many citizen science projects seem less like citizen science than “using citizens to do science” (Lakshminarayanan, 2007).

Research Question

How can a **citizen science** curriculum be deeply embedded within a **formal school setting** to promote **meaningful and empowering** forms of science learning that support the **management of the urban forest ecosystem**?

What is the iHub?

A long-term partnership of Denver Public Schools, UCAR, CU-Boulder, and other local organizations

Seeks to solve problems of practice facing school districts

DENVER PUBLIC SCHOOLS
Discover a World of Opportunity™

UCAR
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH

How the Curriculum Came About

The advent of the Next Generation Science Standards (NGSS) provided an opportunity to develop new science curriculum.

Denver Public Schools asked for the Inquiry Hub to help develop a new Ecosystems unit aligned to the NGSS.

Ecosystems Unit Components

Anchoring Phenomenon

Humans actively manage and change urban ecosystems

Driving Question

What species of trees should we plant and where to increase biodiversity and maximize benefits to human beings and other organisms?

Sub-Phenomena

Trees grow in some areas but not others

Trees are dying in large numbers

Our Design Approach

We engaged in cycles of **co-design**

- Groups with differing expertise working collectively on a common design

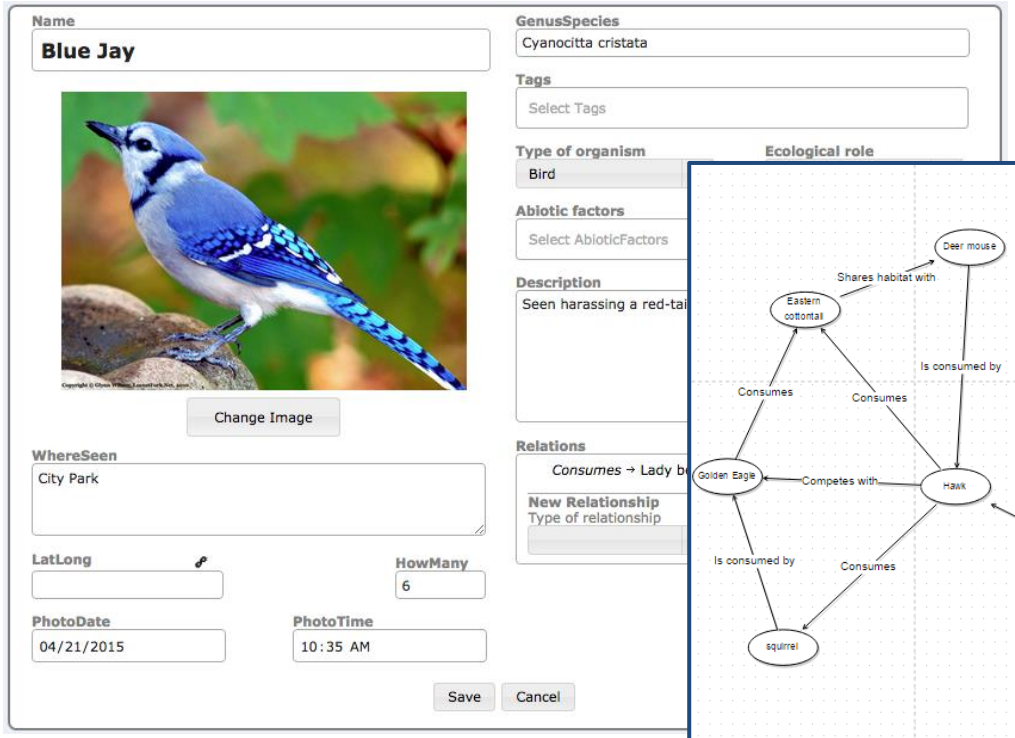
Key participants included:

- Teachers from Denver Public Schools
- Researchers and computer scientists from CU-Boulder and UCAR
- Urban forestry experts from Denver Parks & Rec

Ecosystems Lessons Overview

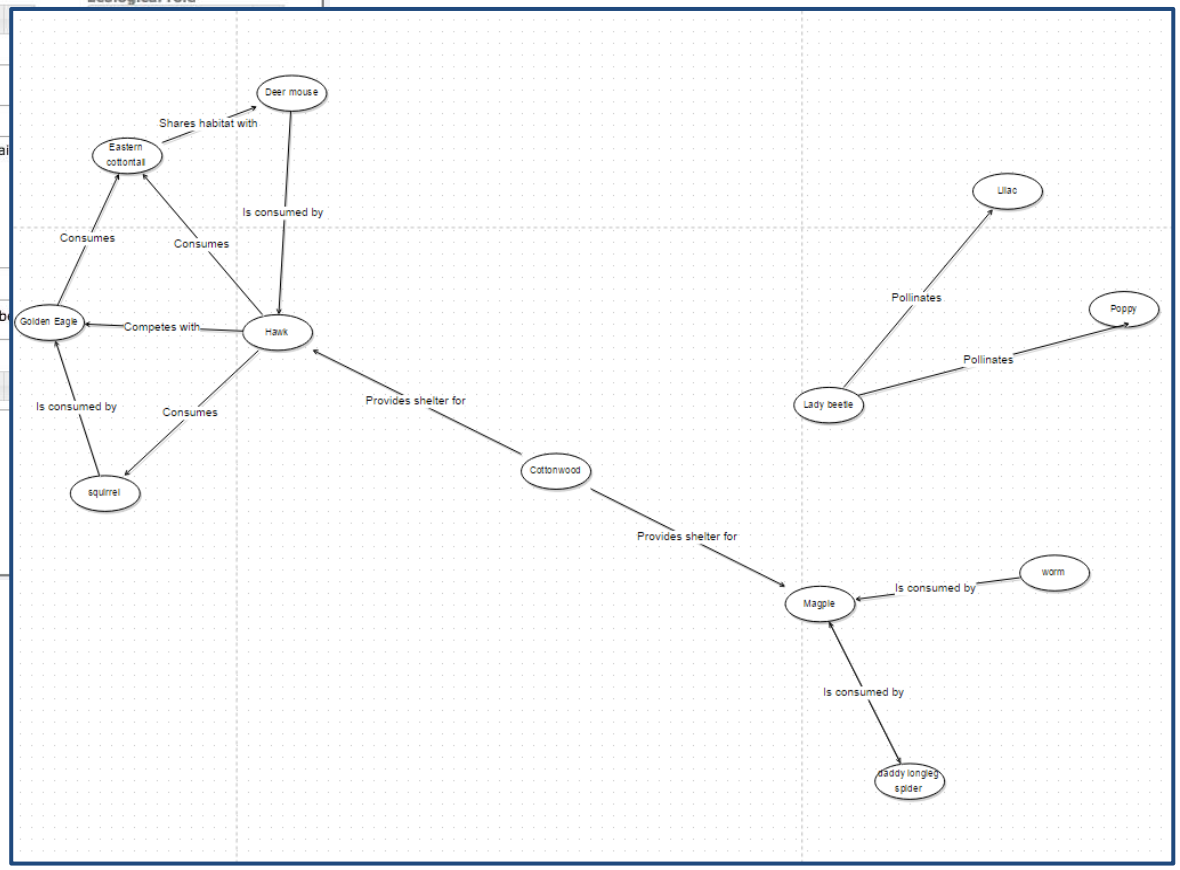
Lessons	Highlights	Big Ideas	Tech Tools
1	Students explore **anchoring phenomenon** of humans managing ecosystems and receive tree **challenge**	Services	
2-3	Students explore **sub-phenomenon** of why trees grow only in certain areas and survey potential planting sites	Abiotic Factors	
4-6	Students explore loss of tree services and biodiversity via **sub-phenomenon** of trees dying from Emerald Ash Borer (EAB)	Interactions Services Biodiversity	**NetLogo** (6 only)
8-10	Students survey local ecosystem to explore potential of **sub-phenomenon** of trees dying en masse from EAB occurring here and create model of local ecosystem	Resilience	**EcoSurvey**
11-12	Students argue for which tree best meets **challenge** (via EcoGuide) and tree order is placed with DPR	Resilience Services	

EcoSurvey



EcoSurvey "Card"

Relationship graph



NetLogo

Interactive computer simulations

Allow for the observation of phenomena that might otherwise be impossible to see in real life

Example of NetLogo simulation:
tinyurl.com/ecosystem-eab

Data Collected During Pilot

Interviews with randomly selected students three times over the course of the unit

Weekly observations of classroom teachers enacting the unit

Examination of student-created artifacts (e.g. final presentation reports to DPR)

Preliminary Claims and Findings

The challenge and sub-phenomena (e.g. EAB) helped create a meaningful experience for students.

Students felt what they learned is useful to the community.

Students effectively applied their understanding of ecosystems concepts.

Preliminary Claims & Findings

Students found what they did in the unit as empowering.

On sharing their work with the community:
"*…they're going to show it to like the community and see like* ***this is what students think about it****, this is what students have – yes…I think it's pretty cool because they get to see like* ***instead of having seen like adults point of view they're getting to see student's point of view*** *and how we took in the information yes.*" (Interview)

iHub

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