

Incorporating a citizen science project, *Nature's Notebook*, into a pre-service teacher preparation course

Course: TTE 350 Schooling in America

Instructor: Dennis Rosemartin

Course overview: This course deals with the nature of the teaching profession, the history of education, equality and equity of educational opportunity, the nature and functions of schools in society, school reform proposals, moral dimensions of schooling, finance and governance issues, and alternatives to traditional schooling.

NOTE: This example demonstrates the utility of implementing citizen science into a non-science based course, to highlight a subject matter area, in this case, teaching environmental education in the public school system.

Theme 1: History of Schooling

Purpose: Examine how the purpose of education and the function of schools have evolved in the United States from the Colonial to the Modern era.

Unit 4: Environmental Education (EE)

Purpose: Discuss the goals of EE and how they are in conflict with the current education and schooling paradigm.

Lesson 3: Citizen Science

Purpose: Learn about a citizen science project that can be incorporated into a school curriculum.

| | |
|---|-------------------------|
| Day 1: EE curriculum analysis and introduction to citizen science | Time: 50 minutes |
| Objectives: (1) Understand the goals of EE and how it has evolved (2) Understand what citizen science is and how it can help meet EE goals. | |
| Materials: -Articles Stapp, W. B., et al. (1969). The concept of environmental education. <i>The Journal of Environmental Education</i> , 1(1), 30-31. Stevenson, R. B. (2007). Schooling and environmental education: contradictions in purpose and practice. <i>Environmental Education Research</i> , 13(2), 139-153. Mayer, A. (2010). Phenology and citizen science. <i>BioScience</i> , 60(3), 172-175. -Reading homework questions -Project Wild curriculum (K-12 activity books) -Curriculum analysis worksheet -USA National Phenology Network (NPN) fact sheet | |
| Activities: (1) Reflection and discussion about EE experiences in elementary, high school, or college education (2) Analysis and discussion of Project Wild curriculum using goals and objectives discussed in Stapp (1969) and Stevenson (2007) articles (3) Presentation on the history and evolution of EE including introduction to citizen science | |

Homework: Read Mayer (2010) article and NPN fact sheet, complete reading homework questions

Day 2: Presentation, NPN education coordinator LoriAnne Barnett | **Time:** 50 minutes

Objective: (1) To understand the benefits of using citizen science projects to enhance classroom learning objectives (2) Understand how to implement Nature's Notebook into the classroom, in different subject areas including science, music, social studies, etc.

Materials:

- Citizen Science in the Classroom Powerpoint
- Phenophase cards for opening activity and discussion

Activities:

- Deliver introductory talk
- As an introduction, break class into groups of 3 or 4 by having everyone match the phenophase indicated on the card with others who have the same species. Have students discuss:
 1. Things they may know about the species
 2. Things they may know about the lifecycle depicted on the card
 3. What they know about the species and phenophase using their "lens" or field of study. How could that phenophase be important to them, other than scientifically?

*NOTE: Students may have a hard time discussing these topics, especially those who are non-science majors. The point is to encourage conversation and direct them to understand how the phenophases, or life cycle stages may be important to someone other than a science major. The value is the understanding that this activity can be applicable in more than one field of study. Students do not need to be scientists to explore the outdoors or collect scientific data. Other skills employed include observation, listening, hypothesizing, drawing, composition, etc.

Day 3: Nature's Notebook | **Time:** 50 minutes

Objective: Learn the procedures and protocols for collecting data for Nature's Notebook

Materials:

- Species description sheets
- Data sheets, clip boards, pencils

Activities:

- (1) Explain materials, procedures, and protocols
- (2) Group planning time (4 students per group)
- (3) Go to site (Krutch Garden) and collect data

Day 4: Reflection | **Time:** 30 minutes

Objective: Reflect and discuss the benefits, limitations, and barriers to including EE or

citizen science projects in a school setting

Materials:

- Reflection questions worksheet
- Nature's Notebook completed data sheets

Activities:

- (1) Write responses for the reflection questions (individually)
- (2) Share and discuss responses (whole class)

Lessons learned:

Students seemed to grasp the concept of citizen science but conducting Nature's Notebook in one day was not sufficient to understanding or gaining an appreciation for this citizen science project. Most students stated that they had not spent too much time outdoors and were not familiar with many of the common local species of plants in Krutch Garden, a site that they walk by every day.

Future explorations of the class will include more focused delivery of "How to Observe" for Nature's Notebook and how that relates to various subject areas. Activities will include other hands-on examples of using the skills outlined above.

USA npn
National Phenology Network



contact us

education@usanpn.org

<http://www.usanpn.org/participate/observe>

A collaboration that offers the Tucson community
opportunities to learn and engage in phenology

Citizen *Science* Projects in the Classroom

Citizen *Science* in the Classroom

- Get in groups based on the SPECIES of your cards
- Once you find the 3 or 4 people who are in your species group, discuss:
 - Things that you might know about the species
 - Things that you might know about the life cycle of your species
 - Using your “lens”, what do you know?



Citizen Science in the Classroom

Project Overview

- ✓ *Intro to Citizen Science Projects*
 - Real-world Applications
 - Case Study: *Nature's Notebook*
 - How to Engage



Intro to Citizen Science



- Public Participation in Scientific Research (PPSR) *From Cornell Lab of Ornithology*
Citizen science, volunteer monitoring and other forms of organized research projects in which members of the public engage are included in the field
- Meet science & research goals
- Invasive plants, birds, bees/pollinators, earthquakes, infectious disease, astronomy, weather, wildlife, acid rain, oil spills, wildlife, rainfall, archaeology, pollution, “old weather” *From: <http://www.scientificamerican.com/citizen-science/>*

Intro to Citizen Science

- Scientists create research project
- Scientists collect data
- Scientists employ citizens to expand breadth of data collection
- Scientists and citizen scientists analyze data



Intro to Citizen Science

How does it fit?

- A “lens” for learning all subjects
- Cooperative learning
- Active vs. passive engagement
- Explorations
- Real world problems



- Enhances observation skills
- Data accuracy, personally meaningful projects
- Hypothesis design, data collection, data analyses

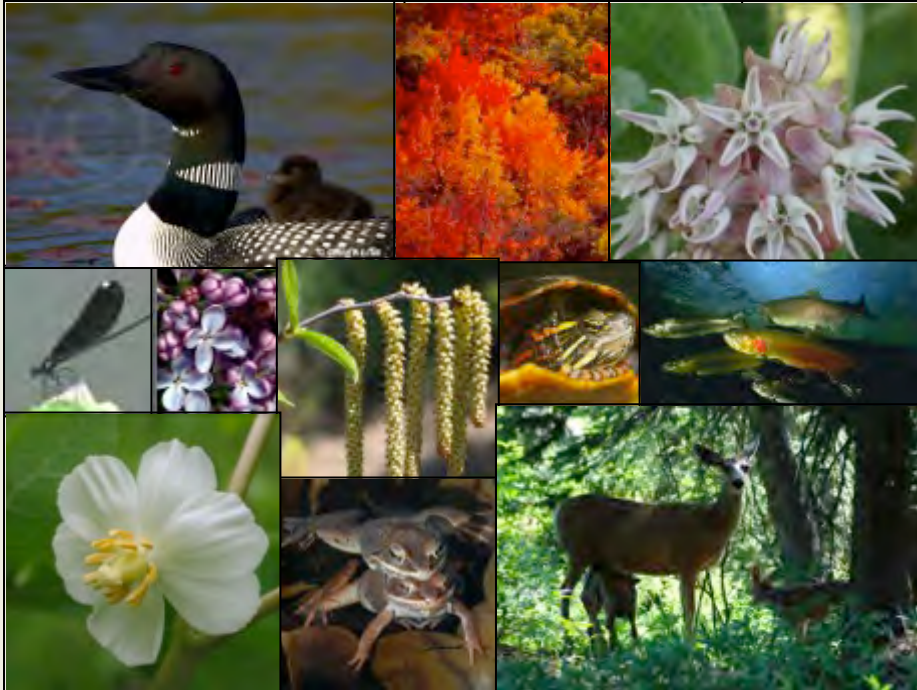
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Real-World Application



What is phenology?

- Nature's calendar
- Blooms and buds
- Hibernation, migration, and emergence
- Relation to weather and climate

Phenology is:

Phenology refers to recurring plant and animal life cycle stages, or phenophases, such as leafing and flowering, maturation of agricultural plants, emergence of insects, and migration of birds.

Real-World Application

Why is it used?

- Know when to put out bird feeders
- Know when to plant your garden
- Know when to harvest citrus

How can we be involved?

- Science and climate literacy
- Outdoor experiences
- Participate in scientific process



Real-World Application

Who observes phenology?

- Famous historical figures
- Historical data sets
- Gardeners
- Youth
- Scientists



Benefits?

- Explore Science
- Experience Nature
- Use your senses
- Spend time with family

Real-World Application

Fouquieria splendens

What does this species look like?

Ocotillo is a winter- and drought-deciduous, spiny, succulent shrub, growing 9 to 30 feet tall, with six to 100 erect, whip-like branches. Its small, red to orange flowers have both male and female parts, and are grouped into showy clusters at the ends of its long branches. The flowers are insect- and bird-pollinated.

Ocotillo is found in desert plains and valleys, and up onto rocky slopes, in woody scrub, scrub-grassland, oak woodland, and riparian communities. It grows on dry, well-drained sandy or rocky soils in sand and sandy loam textures, often of granitic or limestone origins, and often on shallow soils. It tolerates calcareous soils, drought, and high temperatures.



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Why observe this species?

Ocotillo is a USA-NPN regional plant species. Regional species are ecologically or economically important but are distributed more locally than calibration species. The NPN integrates these observations to understand better plant responses within the different geographic regions of the nation.

Phenophase: *An observable stage or phase in the annual life cycle of a plant or animal that can be defined by a start and end point. Phenophases generally have a duration of a few days or weeks. Examples include the period over which newly emerging leaves are visible, or the period over which open flowers are present on a plant.*

Do you see...

Breaking leaf buds

Leaves

Increasing leaf size

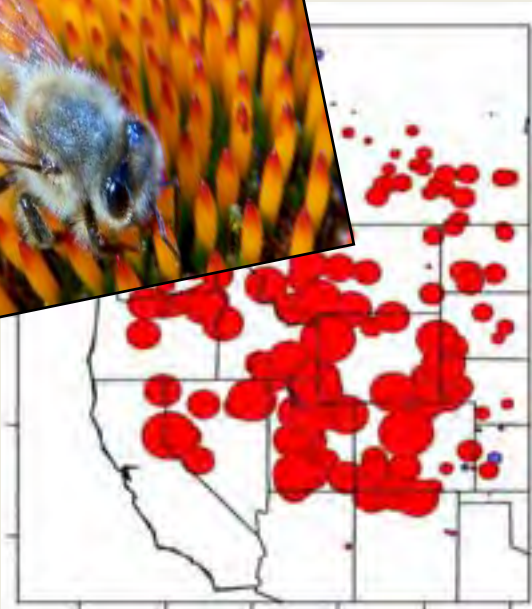
Flowers

Open flowers

Fruits

Ripe fruits

Recent fruit drop



Applications of Phenology Data

- Resource management
- Conservation
- Agriculture
- Ecosystem services
- Science
- Health
- Decision-support tools

Value of phenology

Phenology data helps us understand how plants, animals and landscapes respond to environmental variation and climate change.

Real-World Application

Recent and unusual rise in global temperature

- Understand plant & animal response
- Record early/late spring & fall events
- Ecosystem shift
- Multiple and long-term observations



Citizen *Science* in the Classroom

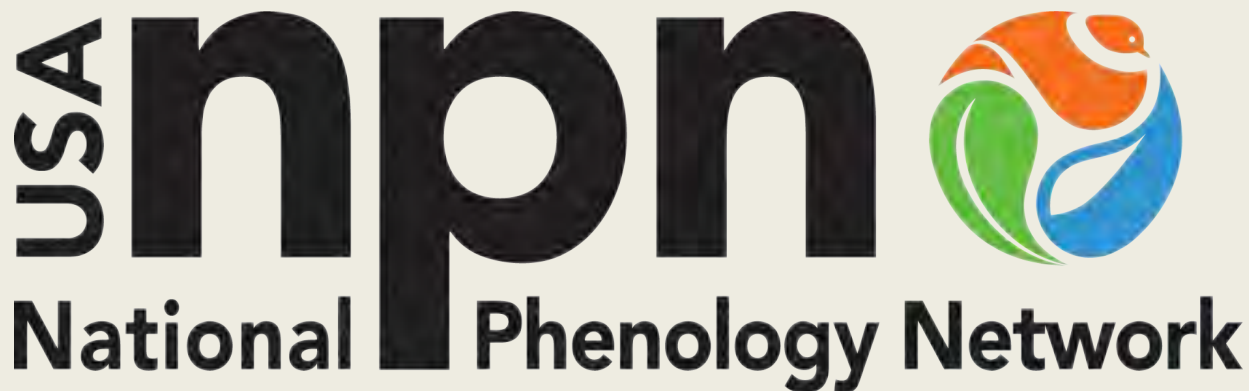
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- Real-world Applications
- ✓ *Case Study: Nature's Notebook*
 - How to Engage



Case Study: *Nature's Notebook*

Promote an understanding of plant and animal phenology and how that relates to environmental change



- Encourage everyone to observe phenology to understand our dynamic world
- Make data available to scientists, resource managers, and decision-makers



What's *Nature's Notebook*?

A national plant and animal phenology observation program.

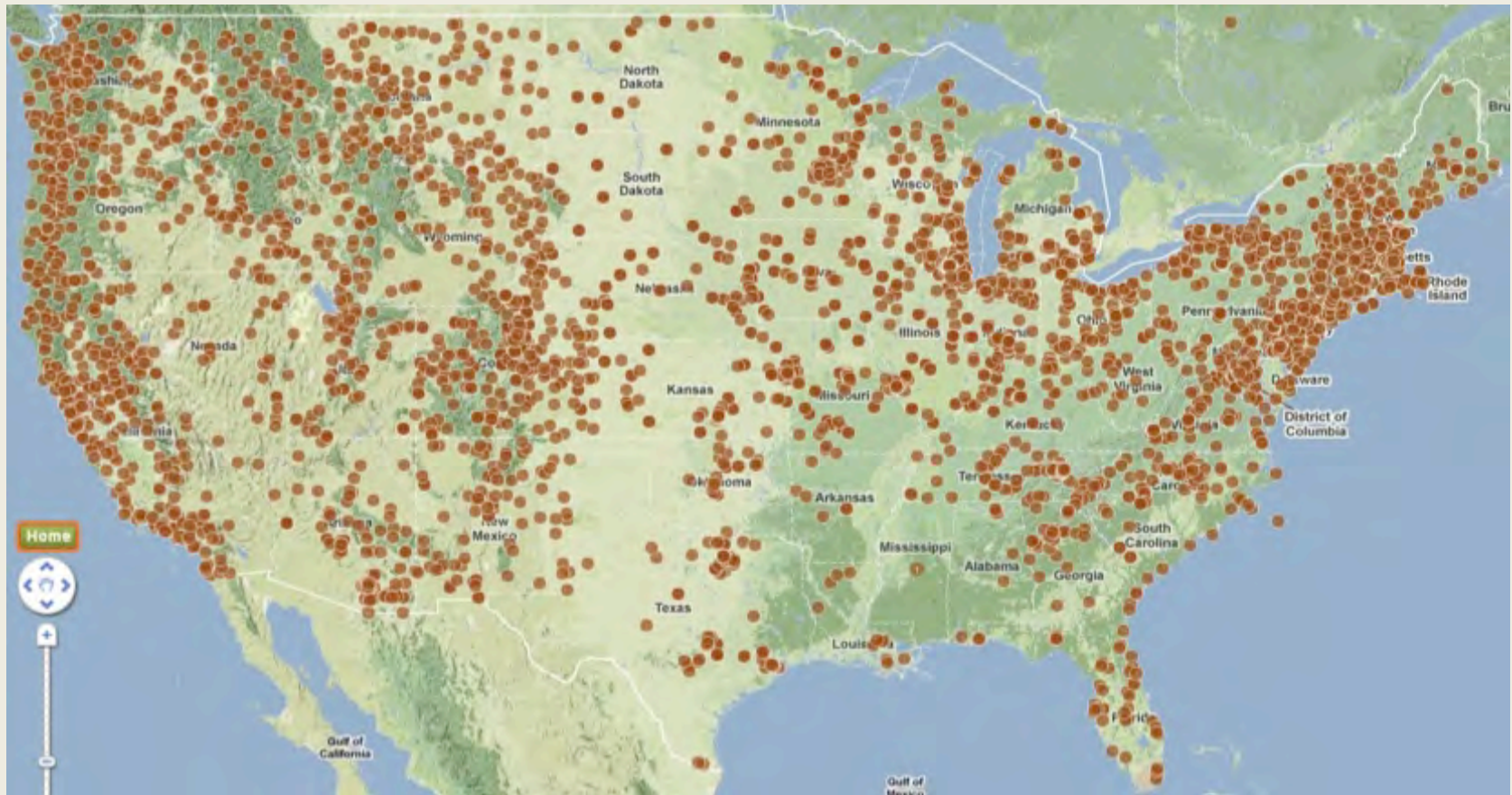
Thousands of passionate citizen scientists across the US share their observations with researchers, resource managers and others who use this information to understand our changing planet, make scientific discoveries, and create new tools.



USA National Phenology Network

200 plant species and 160 animal species

3160 observers at 4412 sites observing 5459 individual organisms



Case Study: *Nature's Notebook*

1. Select a site
2. Mark your site and plants
3. Select plant and animal species to monitor
4. Record your observations of animals and plants
5. Report your data online



www.usanpn.org/participate/guidelines

Case Study: *Nature's Notebook*

Site: _____
 Year: _____
 Observer: _____



A project of the USA-NPN



Taking the Pulse of Our Planet
 More information: www.usanpn.org/how-observe
 Contact: nco@usanpn.org

Trees and shrubs

(Broadleaf evergreen)

Species: _____
 Plant Nickname: _____

| Do you see...? | Date: |
|----------------------|--------------------------|
| Breaking leaf buds | 2 x 7 |
| Leaves | 2 x 7 |
| Increasing leaf size | 2 x 7 |
| Flowers | 2 x 7 |
| Open flowers | 2 x 7 |
| Fruit | 2 x 7 |
| Seed pods | 2 x 7 |
| Harvested fruit | 2 x 7 |
| Other observations | <input type="checkbox"/> |

Comments: _____

Trees and shrubs

(Deciduous (no leaf color or fall))

Species: _____
 Plant Nickname: _____

| Do you see...? | Date: |
|----------------------|--------------------------|
| Breaking leaf buds | 2 x 7 |
| Leaves | 2 x 7 |
| Increasing leaf size | 2 x 7 |
| Flowers | 2 x 7 |
| Open flowers | 2 x 7 |
| Fruit | 2 x 7 |
| Seed pods | 2 x 7 |
| Harvested fruit | 2 x 7 |
| Other observations | <input type="checkbox"/> |

Comments: _____

Cacti

Species: _____
 Plant Nickname: _____

| Do you see...? | Date: |
|--------------------|--------------------------|
| Flowers | 2 x 7 |
| Open flowers | 2 x 7 |
| Fruit | 2 x 7 |
| Seed pods | 2 x 7 |
| Harvested fruit | 2 x 7 |
| Other observations | <input type="checkbox"/> |

Comments: _____

Songbirds



Species: _____

| Do you see...? | Date: |
|-----------------------|--------------------------|
| Active individuals | 2 x 7 |
| Feeding | 2 x 7 |
| Foraging movements | 2 x 7 |
| Roosting postures | 2 x 7 |
| Call or song | 2 x 7 |
| Singing notes | 2 x 7 |
| Nesting | 2 x 7 |
| Nest building | 2 x 7 |
| Food introduction | 2 x 7 |
| Introduction of young | 2 x 7 |
| Other observations | <input type="checkbox"/> |

Comments: _____

Do you want to use
Nature's Notebook
 at home?

Visit
www.usanpn.org
 to get started!



Follow these four simple steps to get started observing.

- 

1 Learn about the plants and animals you will observe.
 Find out which species in your area are on the list - learn more about them and the phenophases - look for
- 

2 Learn how to observe.
 Learn how to select a site, select your plants and animals, and record your observations.
- 

3 Sign up to be an observer!
 Register as an official participant and set your username and password. All you need is an email account and internet access.
- 

4 Log in to Nature's Notebook.
 Make sure you are ready to register your site and the plants and animals you will observe, and start recording! As you collect data during the season, log in to your account at Nature's Notebook and enter your observations.

Case Study: *Nature's Notebook*



Local Species

Honey mesquite
Desert ironwood
Blue paloverde
Yellow paloverde

Local Species

Jojoba
Saguaro
Creosote bush
Velvet mesquite



Case Study: *Nature's Notebook*



Classroom/home

- Backyard observations
- Trail observations
- Share your data set
- Data analysis
- Join the conversation

“HAVING A REASON AND A MECHANISM FOR PAYING ATTENTION TO THE NATURAL WORLD AROUND ME ENRICHES MY LIFE.” —
HANS

Case Study: *Nature's Notebook*

Community – University Engagement

- Answers to questions
- Joint participation in research

Research

- Contribute to long-term data set
- National Climate Assessment
- Partner with scientists to create and answer questions

Place-based Education

- Native plants
- Familiar places

Science Literacy

- Scientific process
- Arboretum and demo garden tours



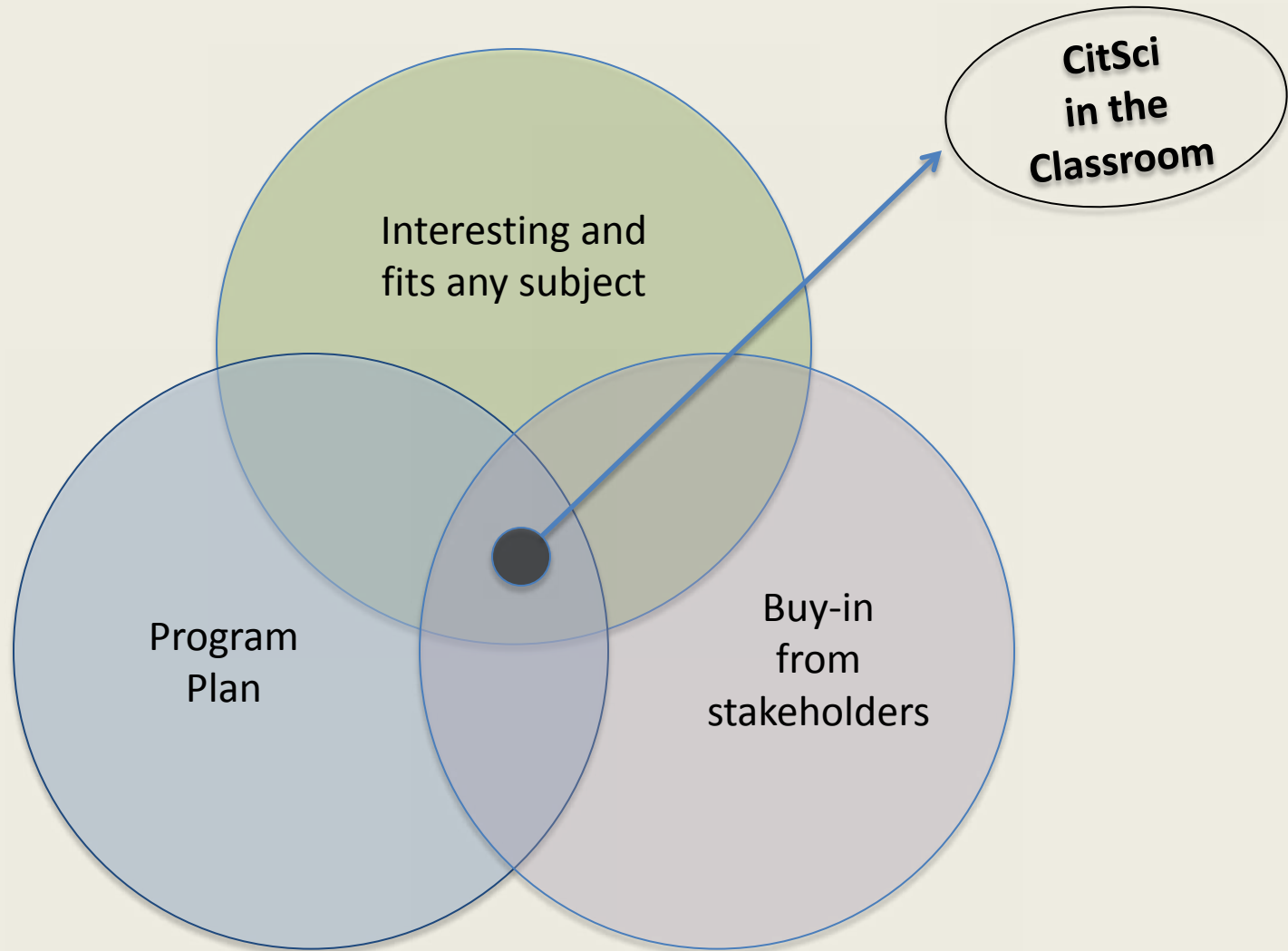
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How to Engage



How to Engage

Develop a PLAN:

1. Stakeholder buy-in?
2. Subject area?
3. Project goals, objectives, purpose, value?
4. One-time, woven into many subjects?
5. Resources?
6. Data entry?
7. Volunteers?
8. Time frame?
9. On-going maintenance?
10. Evaluate success annually? What does success mean?



Back up PLAN?

Roadblocks?

Citizen Science in the Classroom

- *Things that you might know about the species*
 - *Things that you might know about the life cycle of your species*
- Walk outside to the site
 - Find one of the phenophases in action
 - Look for potential hazards





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Citizen *Science* Projects in the Classroom



Planting Memories: Santa Barbara Edition

A memory matching game filled with plants that grow in our own backyard

Welcome to the *Planting Memories* card matching game! We designed this game to provide a fun way for learning to recognize native plants that grow in the Santa Barbara area and their phenological phases (**phenophases**). Phenology is the study of the timing of plant and animal life cycle events. For example, as plants grow throughout the year, they go through different phenophases; they produce emerging leaves, buds, open flowers, and fruits. To learn more about phenology and how you can use your knowledge of plant phenophases to collect scientific data for the USA National Phenology Network's citizen science program, please visit <http://www.usanpn.org/participate/observe>

We would like to thank the kids in the Nature Sleuths program at the Boys and Girls Club West Side Clubhouse in Santa Barbara for helping to inspire this game and test it out with us. Special thanks also go to fantastic botanical photographers who generously shared their photos, to BonTerra Consulting for helping us with printing costs, and to Conor Saunders for his design and artistic expertise.

We hope you enjoy the game!
Alisa Hove and Sara Healey

How to Play

Players: 1-6 people

Deck: a deck of 56 Planting Memories native plant cards

Goal: to collect the most pairs of cards. When all of the pairs have been found, the player with the most cards wins.

Game Setup: shuffle the cards and then lay each card face-down on a flat surface.

Playing the Game:

- The youngest player goes first. Then play proceeds in a clockwise direction.
- On each turn, a player turns over two cards (one at a time) and makes sure that everyone can see what those cards look like.
- The player keeps the cards if they match both the **plant species and plant phenophase**. If a player successfully matches a pair of cards, then he/she gets to have another turn.
- If a player turns over two cards that do not match, then those cards are turned face-down again and the next player can take his/her turn.



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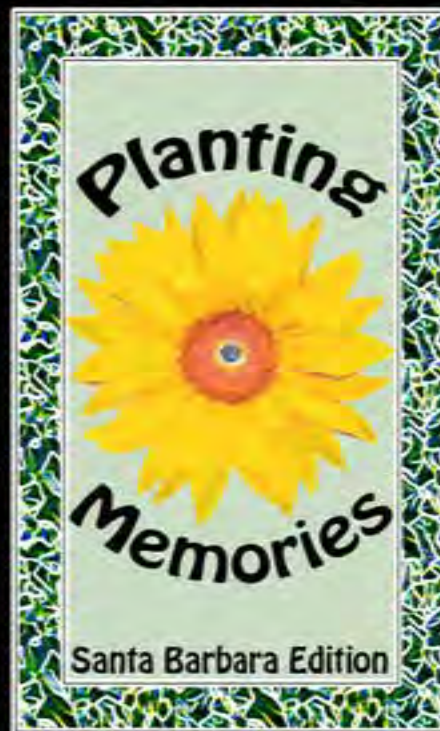
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California Fuschia Buds
© 2002 Hartmut Wisch



California Fuschia Emerging Leaves
© 2006 Matt Below



California Fuschia Full Flowering
© Charles Webber, California Academy of Sciences



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