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BUILDING THE TEACHER'S NOTEBOOK:

STEM-Learning through Science-Based Nature Journaling (for Middle- and High School Teachers)

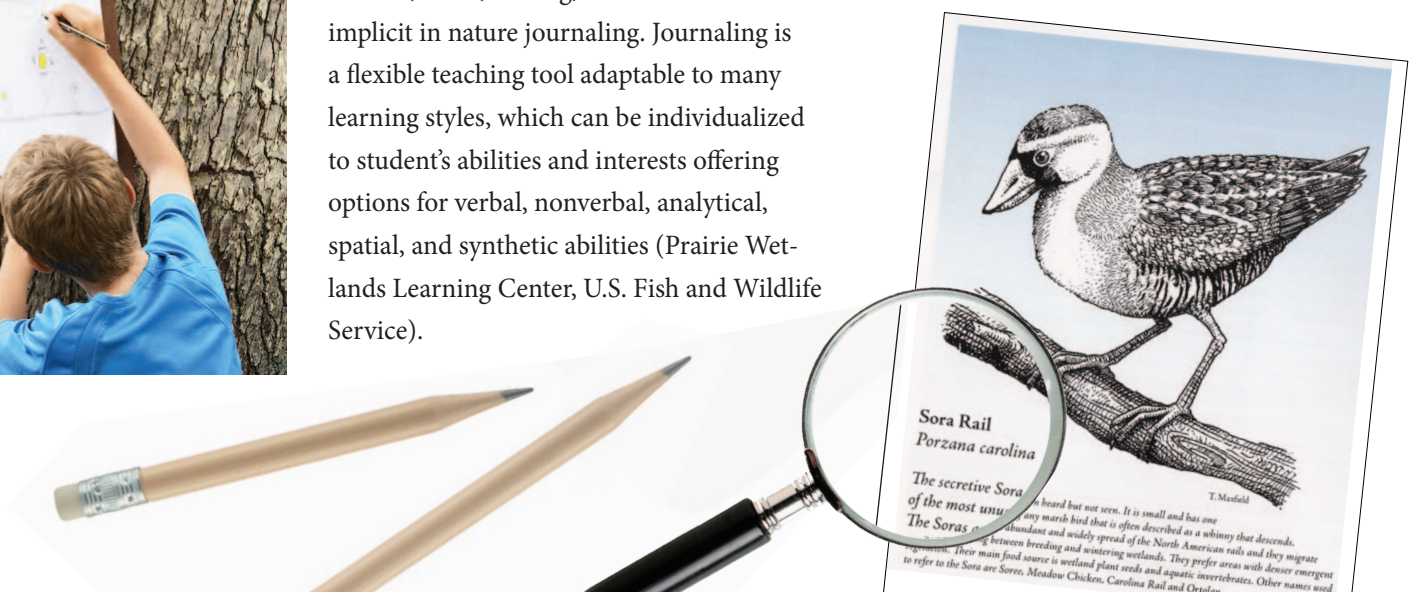
1.0 INTRODUCTION

Nature journaling is the process of keeping place-based, personal records of events, observations, and experiences in the outdoors (Hofmann and Passineau, 2005). Keeping a field journal develops and reinforces the most important science process skills – observation and documentation. The process of journaling hones observation and generates questions. In fact, students are able to lead their learning with their own questions which helps them develop and test hypotheses, as well as propose management decisions.

Science, math, writing, and art are all skills implicit in nature journaling. Journaling is a flexible teaching tool adaptable to many learning styles, which can be individualized to student's abilities and interests offering options for verbal, nonverbal, analytical, spatial, and synthetic abilities (Prairie Wetlands Learning Center, U.S. Fish and Wildlife Service).

Nature journaling marries objective information such as scientific observations about weather, wildlife, vegetation, cultural and historical information, natural phenomenon, and seasonal changes with personal expression used to document and interpret what is observed. Students think more deeply, reflect, infer meaning and draw connections and conclusions.

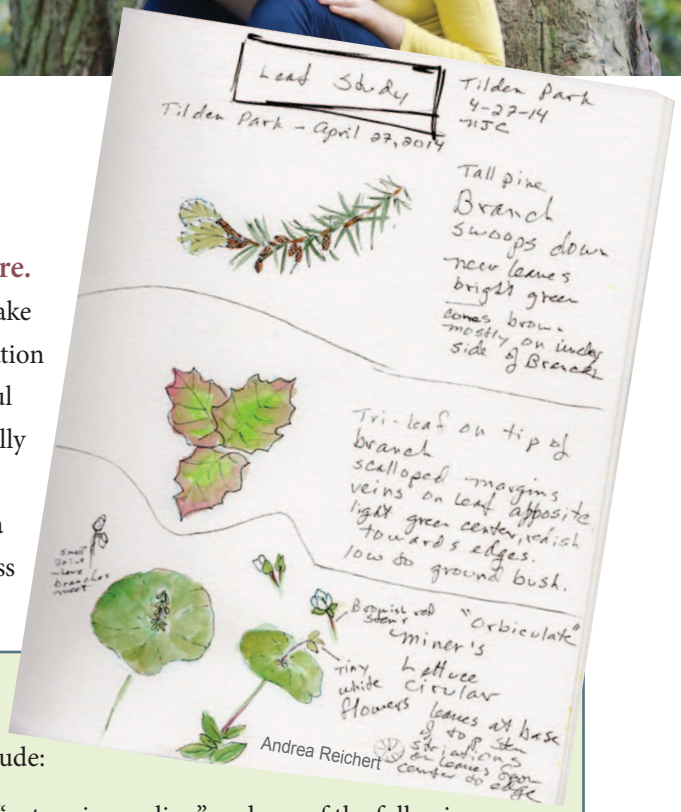
Like other things, nature journaling as a tool for learning requires explicit examples and details about expectations, assessment, and outcomes. This guide is meant to lay out these specifics.



2.0 GETTING STARTED

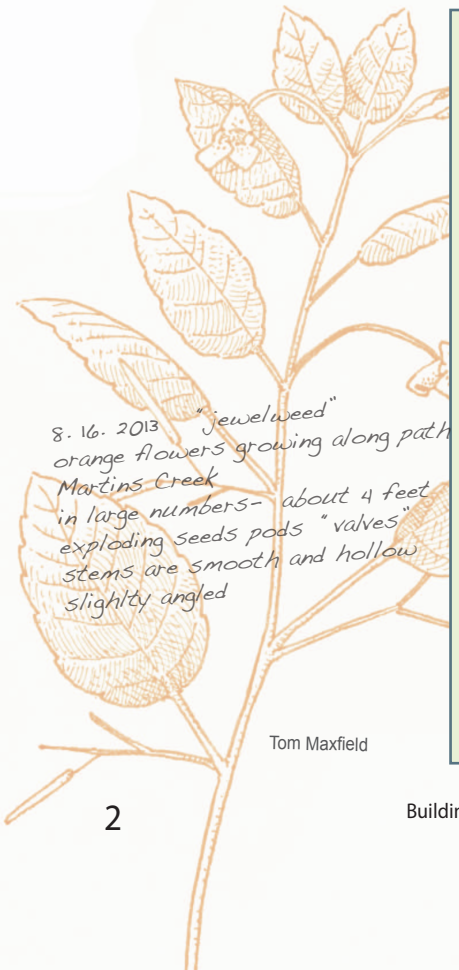
It's important to show students examples of nature journaling so they know what the expectations are.

Students will have varying abilities so make sure that the focus is on accurate observation and documentation, rather than beautiful drawings, for example. A non-artist is fully capable of making a general sketch with labels to show what is important just as a non-scientist is able to record and process observable data.

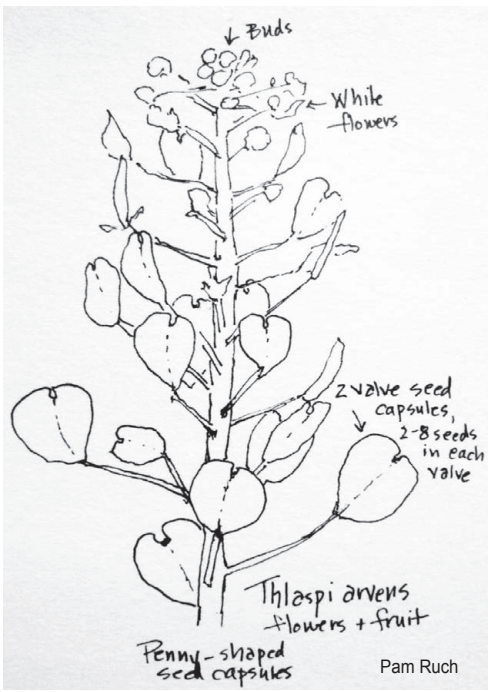


As an overview, some examples, you can share with your students include:

- Do a search on Google Images of "nature journaling" and any of the following: Charles Darwin, Henry David Thoreau, Joseph Grinnell, Aldo Leopold, Gene Stratton-Porter, John Muir, and Rachel Carson.
- For an example of a nature blog (which is a journaling form), see Drew Lanham's blog (http://wildandincolorblogspot.com)
- For examples specific to drawings, see this website by John Muir Laws, called *Nature Stewardship Through Science Education and Art*: http://www.johnmuirlaws.com/
- For an overview of what a journal might contain, see this *2006 Introduction to Nature Journaling* from the Smithsonian: http://www.smithsonianeducation.org/educators/lesson_plans/journals/smithsonian_siyc_fall06.pdf
- For a close look at Darwin's journals, see Darwin Online: http://darwin-online.org.uk/content/frameset?itemID=CUL-DAR158.176&viewtype=side&pageseq=1
- A website called *Notes from Nature* is dedicated to transcribing written nature journals into digital format: http://www.notesfromnature.org



Careful observation forces one to look more closely and search for details that might otherwise be overlooked. The context of the observations are important. Sketching something or trying to describe it with exacting language makes students better observers. Journaling can be used as a way of recording observations, comparing observations between journalers or time periods, and as a way to think through the natural history of an area. What does the land look like? What species are present? Why? Journaling promotes not only close observation, but also strengthens and refines cognitive skills by developing critical thinking skills through the construction of hypotheses to explain what has been observed. Messiness is to be expected since there is a drafting quality to nature journaling. Field notes can be transferred to a journal where observations and interpretations can be transcribed and worked out on paper.



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2.1 JOURNALING TOOLS AND TECHNIQUES

Students and teachers may choose from a wide variety of journaling techniques. John Anderson from the College of the Atlantic tells students to, "Write for your great granddaughter who has found your journal in the attic and wants to see if she can duplicate your observations." It can be helpful if teachers take notes along with students. Ask students to think about themselves as the teacher and ask them to note everything they think would be important to point out to their students.

Some basic rules of thumb:

1. Notes, drawings and recorded data result from direct observation;

2. Observations are recorded at the time of observation, not later;

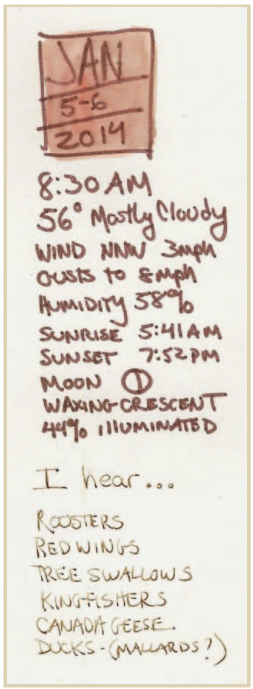
3. Anchor observations in time, date, conditions, and habitat. This also allows one class to compare their observations to another class on a different day or year;

4. Always include basic information: date, time, weather conditions, and evidence of human impact/disturbance;

5. Drawings are meant to be informative to the person drawing. Simple is fine. Drawing can be a useful form of expression for those with limited English proficiency. The goal is not to make pretty pictures, but instead to accurately observe and record data. For many tips on drawing, see the California Native Plant Society Publication called *Opening the World Through Nature Journaling: Integrating Art, Science & Language Arts*: http://www.cnps.org/cnps/education/curriculum/owtj_dl/cnps_curriculum-otwtnj.pdf;

6. Encourage comparing and contrasting in journals; and

7. Ask students to look for telling details by using field guides to determine what's important. Often, to get meaningful details, students just need to ask themselves – "What does this remind me of?" There are also many online resources that accept photos and provide "ask the expert" help to identify plants and wildlife (see list on page 6).



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Journaling tools can include binoculars, pencils, erasers, colored pencils, a ruler, hand lens and other things that may be used to produce sketches, descriptions, and rubbings from leaves or other materials found in nature. Maps (hand-drawn or pasted in), tables, measurements, and questions can also be part of a journal. Students can use cell phones or other devices to take pictures in the field to add to the journals which can be kept online or in written format. Field guides can also be helpful resources for identifying plants, birds, animals, and insects.

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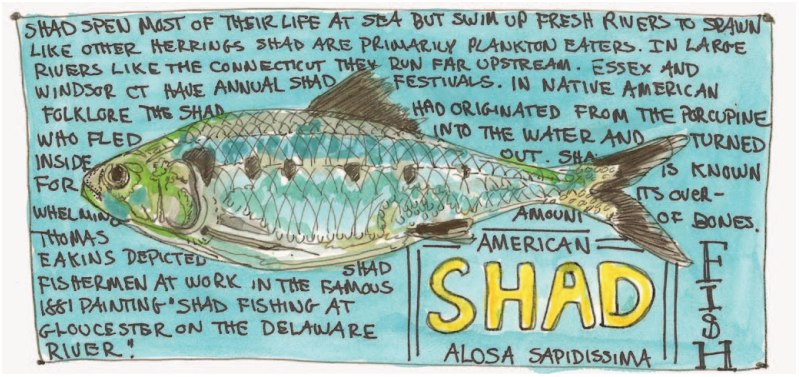

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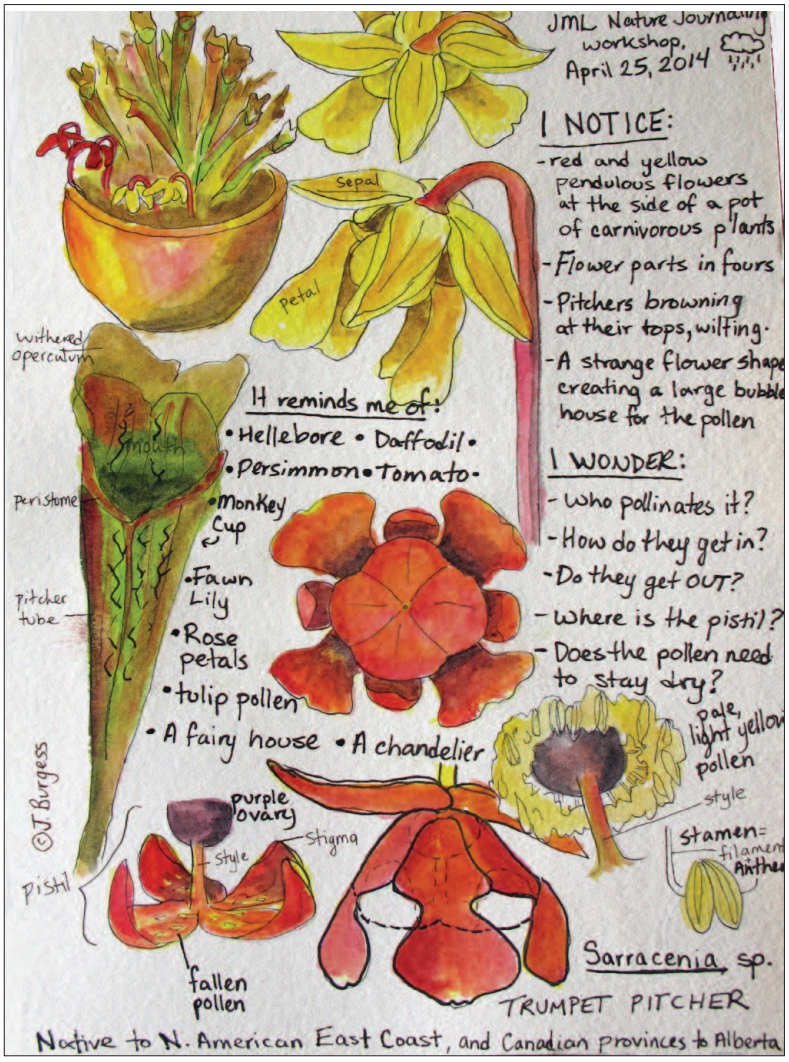

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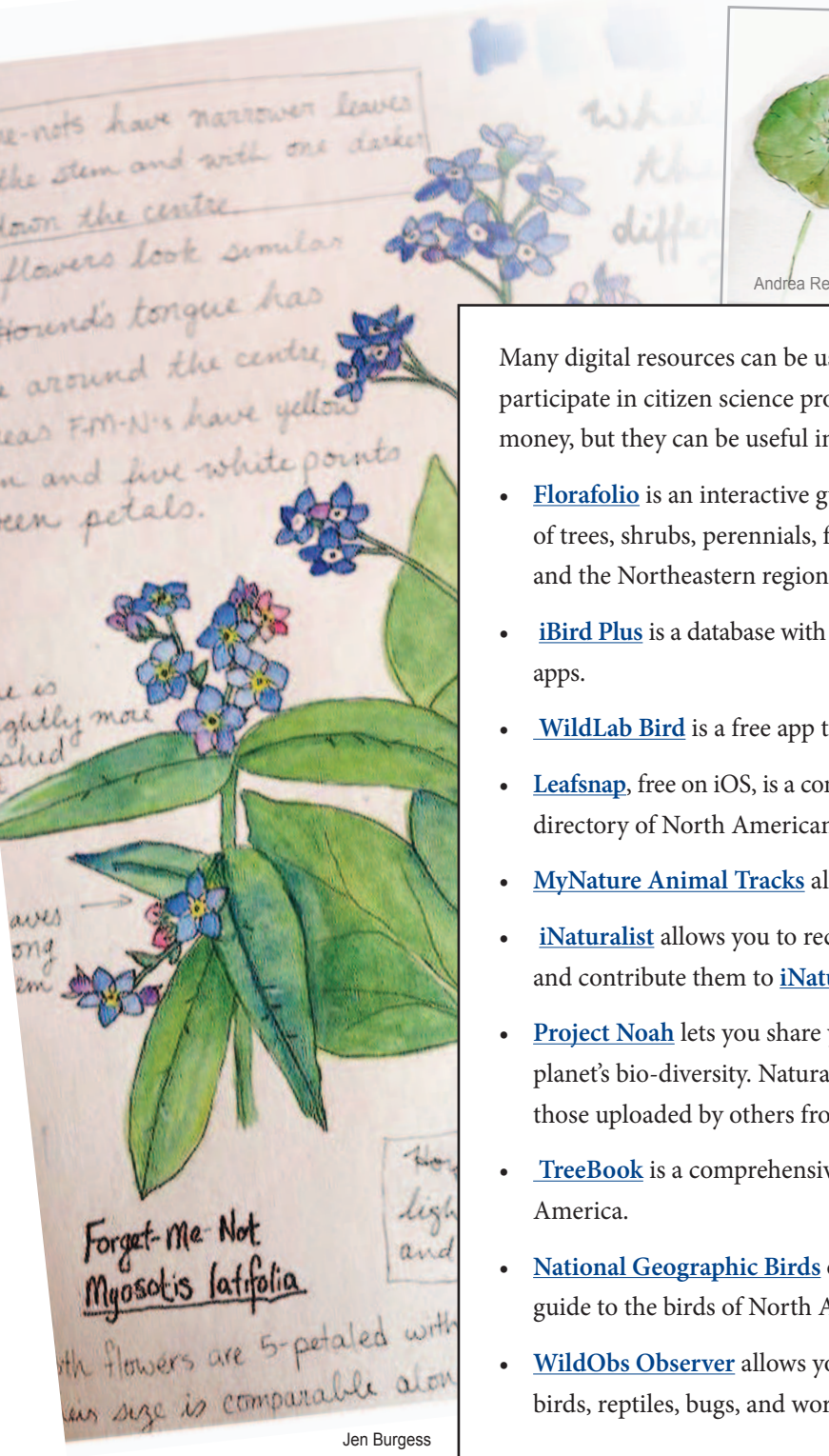

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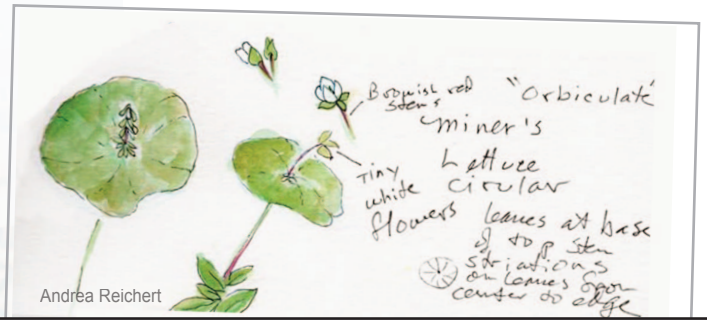


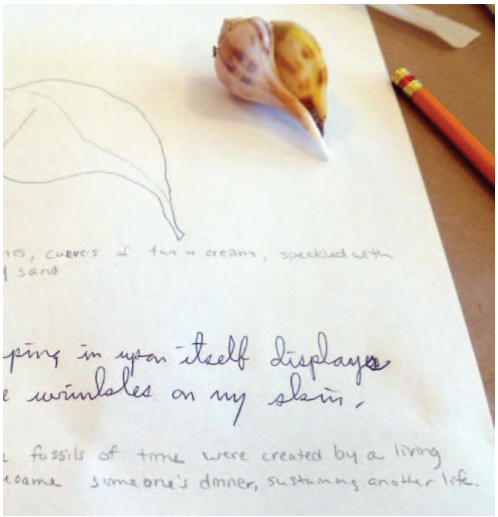
Many digital resources can be used in the field to identify species or as a way to participate in citizen science projects through journaling. Some of these apps cost money, but they can be useful in the field:

- Florafolio is an interactive guide that allows users to focus on the stunning variety of trees, shrubs, perennials, ferns, vines, and grasses indigenous to Eastern Canada and the Northeastern region of the US.
- iBird Plus is a database with a total of 938 species, more extensive than other bird apps.
- WildLab Bird is a free app that can identify 200 species of birds.
- Leafsnap, free on iOS, is a comprehensive nature-guide app that features an extensive directory of North American plants.
- MyNature Animal Tracks allows users to identify any animal track in your area.
- iNaturalist allows you to record your observations from the natural world for free and contribute them to iNaturalist.org, a social network for naturalists.
- Project Noah lets you share your wildlife encounters and help document our planet's bio-diversity. Naturalists can upload their own wildlife photos or review those uploaded by others from across the globe.
- TreeBook is a comprehensive guide to 100 of the most common trees in North America.
- National Geographic Birds offers an innovative, beautiful, and interactive field guide to the birds of North America.
- WildObs Observer allows you to check out more than 1,000 species of mammals, birds, reptiles, bugs, and worms.

2.2 CLASS DISCUSSION

Provide an opportunity for students to share journal entries so they can see the diversity of observations. Students can share what they're most comfortable with: a drawing, a description, or a series of observations.

Ask students to discuss their interpretations of what they see. Teachers may even break students into groups to discuss specific items and then have the groups share those with the class. It is often helpful for the instructor to follow up the student discussion with their own observations and interpretations. Students can then amend their journals to enrich their own observations and foster new questions.



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2.3 EVALUATION

Students can help design the rubric to help increase their understanding of expectations. Here's one example of rubric that could be used to evaluate a nature journaling exercise:

	SCALE			
TASK	MARKS POSSIBLE	EXEMPLARY	COMPETENT	DEVELOPING
1. Includes and identifies observations, analysis and interpretation	5	Notebook contains continuous, detailed, independent observations of the natural world that support rigorous analysis and sophisticated interpretation. Text clearly separates observation from analysis and interpretation.	Notebook contains infrequent independent observations; analysis and/or interpretations present but not detailed.	Independent observations lacking; little analysis or interpretation of natural world present.
2. Identifies source of the above information	5	Clearly identifies source of information for all entries (visiting lecturers, reference books, independent observations).	Intermittently identifies source.	Rarely or never identifies source.

	SCALE			
TASK	MARKS POSSIBLE	EXEMPLARY	COMPETENT	DEVELOPING
3. Will the journal be useful as a natural history reference?	5	Complete list of major taxa (birds, plants and other interesting natural history) detailed for each location visited. Behavior (phenology, interactions) also noted.	Most dominant taxa noted; few independent sightings or behavior of species not mentioned by instructor.	Species lists lacking or incomplete; no independent sightings of either new species or new behavior.
• Organization (titles/ labels)	5	Clearly identifies location of observation, all pages numbered with a table of contents.	Organization generally clear, a few entries ambiguous or observations mislabeled.	Consistent lack of organization, missing page numbers or table of contents, few labels.
• Consistency	5	Uniform throughout.	Mostly consistent.	Not present.
• Format (minimum data for each entry, Latin names underlined, etc.)	5	Maintains high standard of formatting including minimum data for each entry throughout journal.	Inconsistent standard.	Format lacking.
4. Includes both verbal and visual descriptions.	5	Notebook includes ample examples of natural history phenomena recorded in BOTH visual and verbal descriptions. Drawings and diagrams.	Many entries use only one form of recording.	One mode or another (visual or verbal) largely absent from notebook.
5. Overall aesthetic	5	Overall appearance of notebook engages reader and reflects considerable effort made by the student; lettering and other aspects of "page design" used attractively; drawings detailed and impassioned.	Notebook easy to read and engaging but no obvious sign of extra effort.	Minimal effort made to present notebook in engaging fashion.

(adapted from: Farnsworth, Baldwin, and Bezanson, 2014)

3.0 IDEAS FOR NATURE JOURNALING PROJECTS:

There are many nature journaling projects you can do with your middle- and high school students. A few ideas are listed below. In general, it is helpful to talk generally about the topic of choice beforehand. The list below includes links to resources that will support journaling activities.

1. Phenology – Phenology is the recurring phenomena that indicate the changing seasons – temperature, weather, sunrise/sunset, plant growth, animal and bird migration, etc.

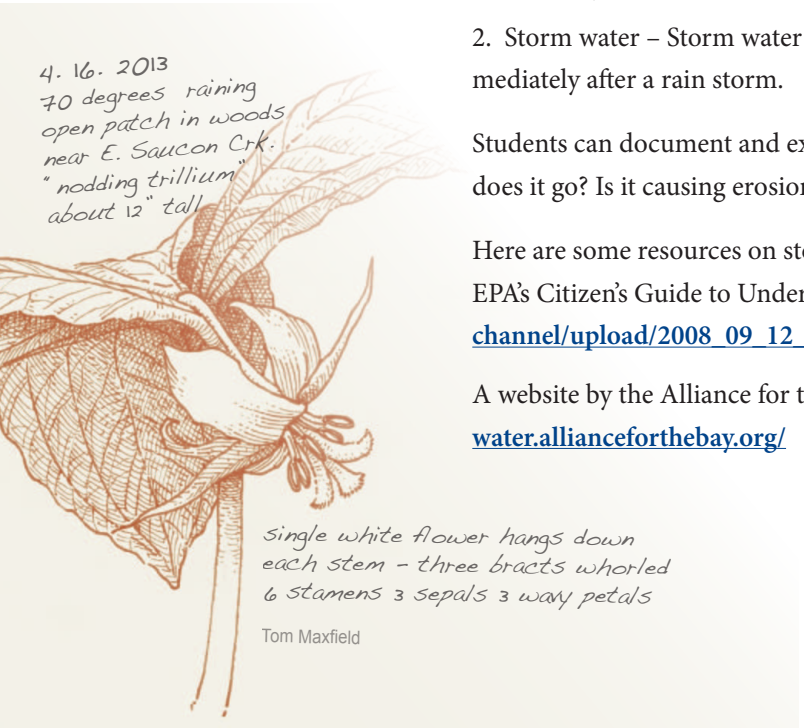
Students can document plant and bird species and compare those to past records. Here's a resource local to the Eastern Pennsylvania called the Eastern Pennsylvania Phenology Project: **http://lgnc.org/research/phenology** and a national one from the National Phenology Network: **https://www.usanpn.org/education/9-12** . For bird observations, see page 6 for previously mentioned, **iNaturalist** and **Project Noah**.

2. Storm water – Storm water is the water on the ground surface that results during and immediately after a rain storm.

Students can document and examine how storm water is handled on school property. Where does it go? Is it causing erosion? How could it be better managed?

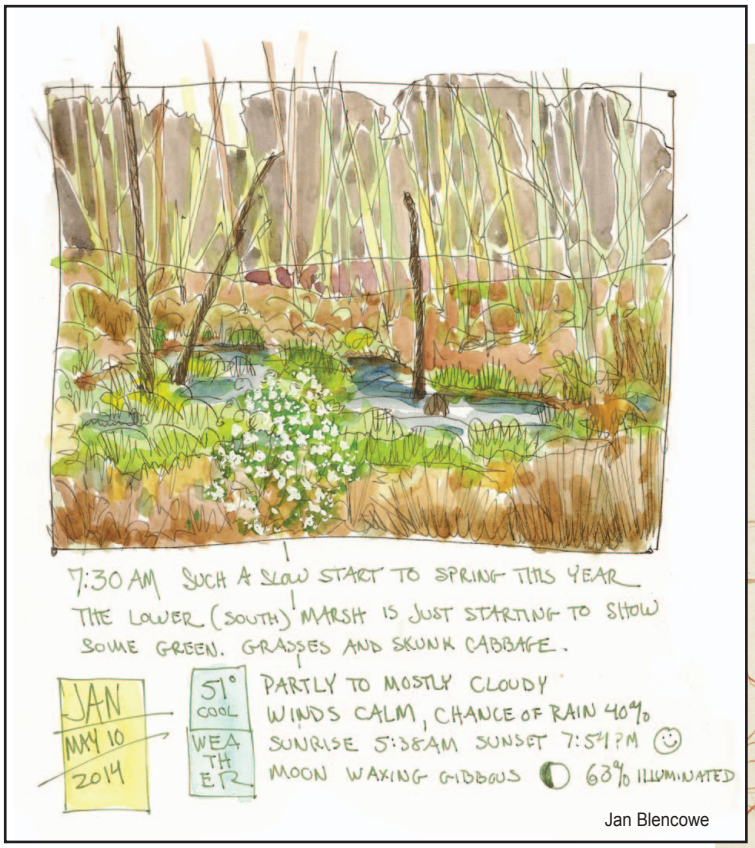
Here are some resources on storm water:
EPA's Citizen's Guide to Understanding Stormwater: **http://water.epa.gov/action/weatherchannel/upload/2008_09_12_weatherchannel_after_the_storm-read2.pdf**

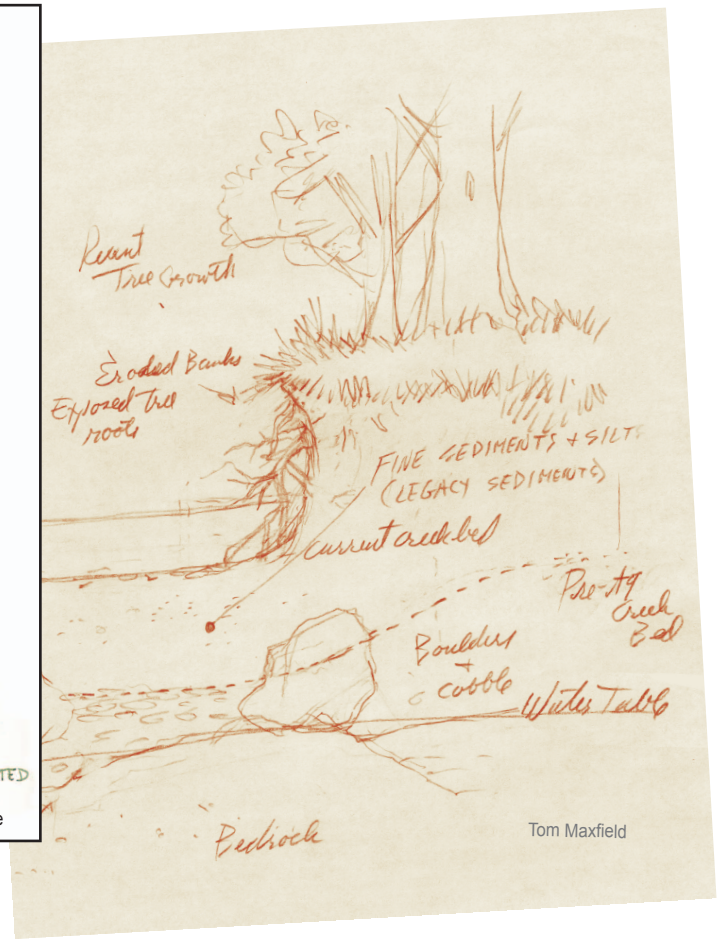
A website by the Alliance for the Chesapeake Bay about reducing stormwater: **http://stormwater.allianceforthebay.org/**



3. Streamside Science – Streamsides offer a great location for observing many things such as wildlife, different plant life, manmade influences, etc.

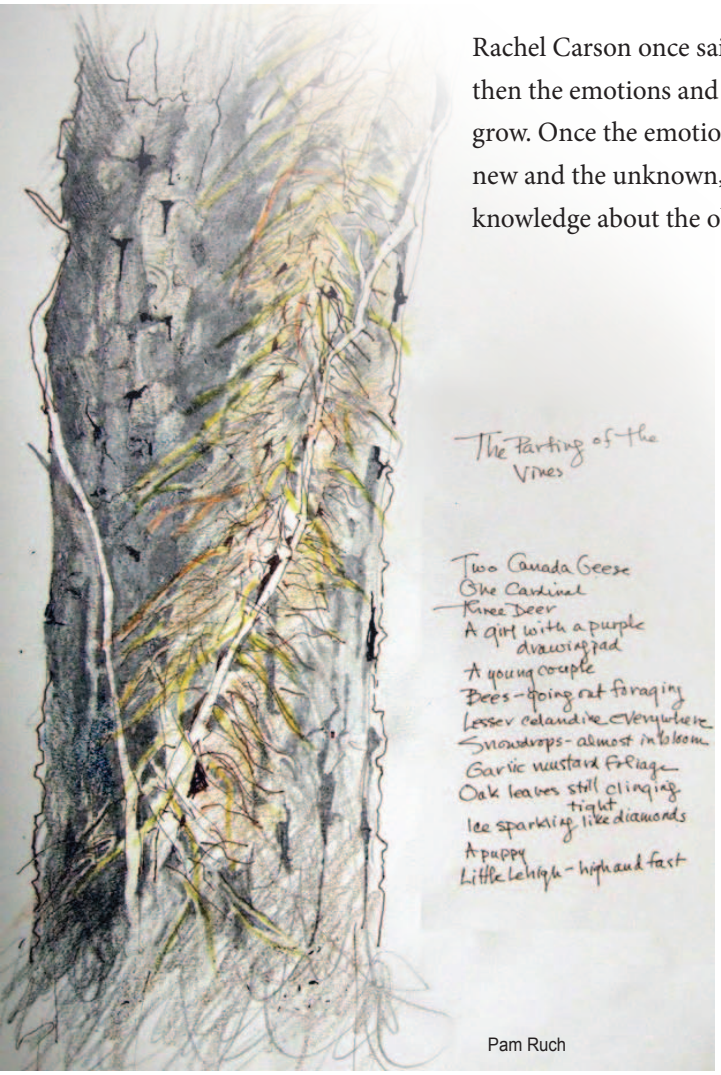
Students can evaluate the health of a streamside buffer or compare and contrast different sections of stream. Here's a good brief overview of streamside buffers from Penn State 4-H called, Riparian Buffers: Making our Riparian Areas Strong: http://extension.psu.edu/4-h/leaders/publications/BUFFers.pdf





4.0 SUMMARY

The use of nature journaling for science learning is a way for teachers to engage their students in a form of record keeping, observation, and interpretation that requires both intellectual and sensory skills. It is a teaching method that is accessible to all students and can open doors for students that self-identify with science or not.



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Rachel Carson once said, "If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are fertile soil in which the seeds must grow. Once the emotions have been aroused—a sense of the beautiful, the excitement of the new and the unknown, a feeling of sympathy, pity, admiration or love—then we wish for knowledge about the object of our emotional response. Once found, it has lasting meaning."

CITATIONS:

Alliance for the Chesapeake Bay, *Reduce Your Stormwater*, http://stormwater.allianceforthebay.org/.

Eastern PA Phenology Project, 2010, http://lgnc.org/research/phenology

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To follow the work of these journalers:

Nature Journal Illustrations by Jan Blencowe www.janblencowesketchbook.com
Pam Ruch http://www.helpinggardenersgrow.com/ http://artofnaturejournaling.com/

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