Teaching about the Magnificent Monarch:

Resource Recommendations for Conservation Educators

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ASSOCIATION of FISH & WILDLIFE AGENCIES

A Project of the Association of Fish and Wildlife Agencies' North American Conservation Education Strategy.

Funded by a Multi-state Grant of the Sport Fish and Wildlife Restoration Program

December 2017

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Association of Fish and Wildlife Agencies
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Developed By Colorado Parks and Wildlife

Preface

In June of 2014, the Obama administration created a presidential memo calling for the restoration of pollinator and monarch butterfly habitat (Thogmartin, et.al., 2017). Shortly after, the executive committee of the Association of Fish and Wildlife Agencies, a non-profit professional organization comprised of the leadership teams of federal, state, and provincial wildlife management agencies in North America, issued a resolution calling for action to protect monarch habitat (Association of Fish & Wildlife Agencies, 2014). The United States Fish and Wildlife Service (USFWS) was also petitioned in August of 2014 to add the monarch to the threatened species list (Thogmartin, et.al., 2017). Based on this petition, the USFWS believed that the case was compelling enough to open a status review for the species and the decision about listing will happen in June 2019 (USFWS, 2016).

In response, the Conservation Education Strategy Subcommittee of the Education, Outreach, and Diversity Committee of the Association of Fish and Wildlife Agencies' applied for and received a 2016 Multi-state Conservation Grant Program grant to complete the project titled *Expansion and Implementation of the North American Conservation Education Strategy's Outdoor Recreation Adoption Model (Natural Pathways to Recruitment)*. This grant included funding to create this resource recommendation to ensure that conservation educators have the best-available resources for teaching about the conservation of monarch butterflies.

Resources were reviewed by professional conservation educators from across the United States using criteria developed from the *Guidelines for Excellence: Environmental Education Materials*. These guidelines were originally developed and adopted by the North American Association for Environmental Education (NAAEE) in 1993 as part of the National Project for Excellence in Environmental Education.

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Acknowledgments

Acknowledgments:

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December 2017

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This project was undertaken as part of the Global Field Program, a Master of Arts in Biology degree program completed by Tabbi Kinion through Miami University.

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Introduction

The monarch butterfly is one of the most recognizable insects in North America. For many, this is thanks to classroom teachers using these charismatic lepidopterans as the means to teach about life cycles. From caterpillar, to chrysalis, to adult butterfly, students across the continent have formed a connection to this insect through up-close, in-class observations and investigations. Using monarch butterflies in environmental education lessons brings science to life in a way that connects to students' day-to-day life and allows them to see science happening before their eyes.

Unfortunately, in recent years North American monarch populations have been in decline. In June of 2014, the Obama administration created a presidential memo calling for the restoration of pollinator and monarch butterfly habitat. Shortly after, the executive committee of the Association of Fish and Wildlife Agencies (AFWA), a non-profit professional organization comprised of the leadership teams of federal, state, and provincial wildlife management agencies in North America, issued a resolution (2014-1) calling for action to protect monarch habitat. The United States Fish and Wildlife Service (USFWS) was also petitioned in August of 2014 to add the monarch to the threatened species list. Based on this petition, the USFWS believed that the case was compelling enough to open a status review for the species and the decision about listing will occur in June 2019 (USFWS, 2016).

In response to the need for a concerted effort around monarch butterfly conservation, the AFWA Conservation Education Strategy group responded by securing a multistate conservation grant that included funding to create this resource.

The members of the AFWA Conservation Education Strategy group engaged wildlife educators across the country to gather every readily available education resource about monarch butterflies that could be found. More than 40 documents were submitted for review. Based on feedback gathered at the 2017 AFWA Annual Conference during the Education Working Group meeting, the list was narrowed to 25 resources to review.

Reviewers were solicited from the conservation education community and represent conservation education professionals from 20 states. Their reviews and feedback were compiled, averaged, and analyzed leading to the following list of recommended resources.

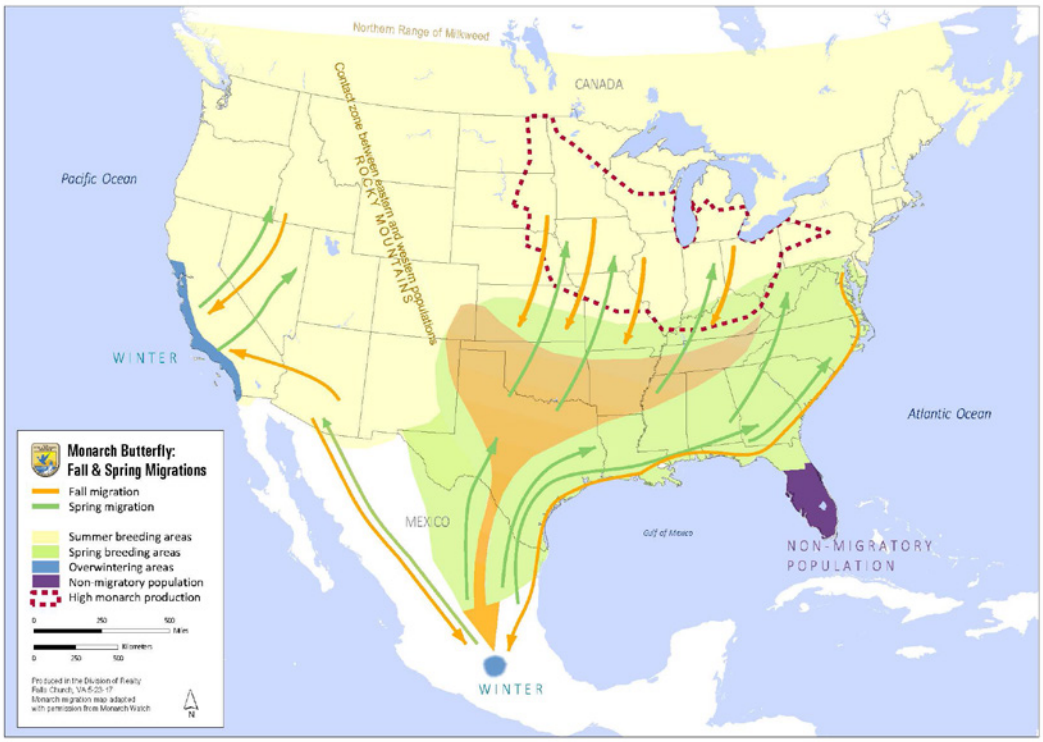
This guide is designed for classroom teachers and non-formal wildlife educators to support high-quality conservation education efforts that align with academic standards as well as the AFWA Conservation Education Core Concepts and Framework (Appendix A). The resources included in this guide represent the best-available resources for educators to use when teaching about monarch butterflies.

To best support educators in their efforts to incorporate monarchs into their programs, this guide also includes: a list of organizations leading the charge in monarch conservation; connections between monarch curriculum and Next Generation Science Standards (NGSS); an overview of the AFWA Conservation Education Core Concepts; and a list of other resources available from the AFWA Conservation Education Strategy.

Monarch Decline and Conservation Need

To understand the causes behind the monarch population decline, it is important to first uncover the complex, multi-generational, annual migration cycle of the species. While most people are familiar with the butterfly life-cycle, the migration cycle undertaken by the monarch butterfly is a little-known natural phenomenon that ranges across North America.

First, there are two distinct populations of monarch butterflies *(Danaus plexippus spp.)* in North America. Western monarchs range west of the Rocky Mountains and winter in the forests of coastal California. Thanks to habitat loss and climatic factors, if trends continue, this population is at a 72% likelihood of reaching quasi-extinction (meaning that the wild population drops to less that 1,000 individuals) in the next 20 years. The situation for the western subspecies may be even more dire than the situation for the eastern monarchs thanks to significant habitat losses in wintering and breeding grounds. However, the population of western monarchs has always been dramatically smaller than the eastern population. Therefore, most of the attention on monarch conservation is focused east of the Rocky Mountains.



The eastern monarch subspecies ranges from east of the Rocky Mountains to the east coast and north into Canada. These monarchs congregate by the millions in southern Mexico during the winter months, particularly in forests that include their preferred wintering tree, the oyamel fir *(Abies religiosa)*. In late winter, the overwintering butterflies mate and start their migration north to the southern United States where they lay their eggs on emerging milkweed *(Asclepias syriaca)* plants before dying. Upon maturation, the next generation continues the migration north and the population expands out to southern Canada and both sides of the Appalachian mountain range. Multiple generations of butterflies occur throughout the summer months in these breeding grounds. In late August, the final summer generation of unmated butterflies migrate up to 4000 km back to Mexican wintering grounds where millions of monarchs congregate in a small area. These same butterflies survive the winter to mate in late winter, starting the cycle over again.

Thanks to this complex life cycle and extensive range, there are many possible causes for the decline of the eastern monarch population and many potential points of vulnerability. It is likely that a host of causes is leading to the decline of the population. Some of the proposed causes of decline include:

- Loss of breeding habitat due to genetically-modified, herbicide-resistant corn and soy plants being planted in agricultural fields where, once the glyphosate herbicides are applied, milkweed is eradicated.
- Increased land development that has removed milkweed from breeding habitat.
- Severe weather events, linked to changes in the climate, have impacted both breeding and wintering grounds.
- Decrease in available wintering grounds in Mexico.
- Increase in the prevalence of diseases that affect butterflies.
- Increased agricultural applications of neonicotinoid insecticides (often used near municipalities for mosquito control) that also kill monarch larva and adults.

Proposed solutions to these issues center around habitat conservation for monarch butterflies. At the forefront, most experts call for a concerted effort to increase the number of milkweeds planted in breeding grounds. To illustrate how important this augmentation is, Thogmartin, et.al, (2017) estimated that the amount of milkweed plants in Iowa declined by 58% between 1999 and 2010. During this same timeframe, it is also believed that the overall loss in milkweed in the midwest has decreased monarch reproduction by 81%. Milkweed conservation alone will not be sufficient to preserve the annual monarch migration. Conservation of wintering habitat and mitigating the impacts of climate change will be critical to ensuring the future of the massive migration phenomenon.

The annual migration cycle of the monarch butterfly in North America may become a phenomenon of the past without conservation efforts. Part of conservation is ensuring that the public understands and participates in these efforts. The Association of Fish and Wildlife Agencies Conservation Education Strategy exists to assist educators in engaging students in conservation through high-quality education resources.

PHOTO CREDIT: USFWS

Review Methodology

The resources reviewed for this project were suggested by the members of the Association of Fish and Wildlife Agencies (AFWA) Conservation Education Strategy mailing list along with extensive internet searches. More than 40 documents about monarch butterflies were compiled for review. Based on feedback gathered at the Education Subcommittee meeting during the 2017 AFWA Annual Conference, the list was narrowed to 25 viable resources to review.

The 25 resources reviewed are categorized into: monarch butterfly curriculum and lesson plans; using live monarchs in the classroom; resources to encourage building pollinator gardens on school grounds; and citizen science opportunities for students. The remaining resources included reports, informational web pages, and children's books and were not included in this resource review. The AFWA Education sub-committee felt that these types of resources were beyond the scope of this project.

PHOTO CREDIT: USFWS

Reviewers were solicited from the conservation education community and represent conservation education professionals from 20 states. Reviewers were randomly assigned to a set of five resources to review.

Each reviewer received an email that contained a list of the resources they were asked to review, the recommendation criteria (see the next section), and a link to a Google form where they would complete each review. Reviewers were given two weeks to complete the process.

The reviews and feedback were compiled, averaged, and analyzed to determine the highest-scoring resources. Based on these scores and the reviewers' overall reactions and feedback, only the top-rated resources were included in this recommendation document. While there are many more quality resources for teaching about monarch butterflies, this list represents the current best-of-the-best of the free and easily available resources for educators.

Recommendation Criteria

Reviewers were asked to review each of their randomly assigned resources using criteria based on the North American Association for Environmental Education's (NAAEE), Guidelines for Excellence - EE Materials (2004). The complete document is available at: https://naaee.org/sites/default/files/gl_ee_materials_complete.pdf

The six categories that reviewers were asked to rate each resource on represent the key characteristics of high-quality environmental education materials outlined by the NAAEE team of experts that created the guidelines document. Each category was scored on a scale from 1 (least_) to 5 (best_). The scores from each reviewer were compiled and averaged to calculate the overall resource rating.

Reviewers were asked to look over each of their randomly assigned monarch butterfly education resource and rate it based on the following:

1. Fair and Accurate - How fair and accurate do you believe the resource to be? Resource should be well-researched, accurate, and balanced.
Rank 1 - 5 (1 - Not fair and accurate, 5 - Extremely fair and accurate)

2. Depth of Knowledge - What is the depth of knowledge that this promotes? Resource should foster awareness of the natural and built environment, promote understanding of environmental concepts, and these concepts are developmentally appropriate for the target audience.
Rank 1 - 5 (1 - Does not foster awareness and/or not developmentally appropriate, 5 - Fosters awareness and understanding and developmentally appropriate)

3. Skill Building - Does the resource promote skill building? Resource should encourage critical and creative thinking, and/or applying skills to issues.
Rank 1 - 5 (1 - Does not promote skill building, 5 - Promotes skill building in one or more areas)

4. Action Orientation - Does the resource have an action orientation? Resource should promote civic responsibility and encourage learners to solve problems and take action.
Rank 1 - 5 (1 - Does not promote action, 5 - Promotes action)

5. Instructional Soundness - Is the resource instructionally sound? Resource should be written in a way that promotes an effective learning environment for students.
Rank 1 - 5 (1 - Not instructionally sound, 5 - Instructionally sound)

6. Usability - Is the resource usable? Resource should be well designed and easy to use.
Rank 1 - 5 (1 - Not usable/unclear methods, 5 - Very usable)

Finally, reviewers were asked if they would include the resource in a recommendation for educators as an effective tool for teaching about monarchs and to describe the resource in one sentence.

Scores were compiled and the following resources represent the highest-rated resources that the reviewers agree are the best resources to recommend to educators.

Recommended Resources

Curriculum Guides and Classroom Lessons

The Monarch Mission:

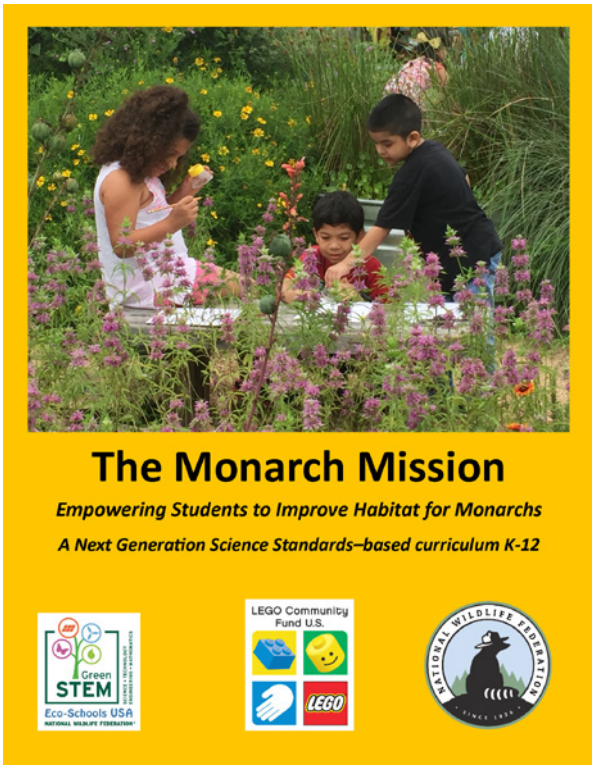
Empowering Students to Improve Habitat for Monarchs
A Next Generation Science Standards-based Curriculum K-12

Created by: National Wildlife Federation, 2016

Found at: https://nwf.org/monarchmission

Overall score: 4.9 ★★★★★

Fair and Accurate - 4.8
Depth of Knowledge - 4.6
Skill Building - 5
Action Orientation - 5
Instructional Soundness - 4.8
Usability - 5



Target grade levels: Lessons for Kindergarten - High School (K-2, 3-5, MS, & HS)

Reviewers said:
The Monarch Mission by NWF is a well-rounded resource for K-12 students and teachers that promotes and encourages scientific studies on habitat needs and causes of decline in monarch habitats.

This is an excellent opportunity to incorporate both indoor and outdoor education with a very hands-on, engaging curriculum.

Overview:
National Wildlife Federation (NWF) in partnership with the Lego Community Fund, U.S. published this comprehensive curriculum guide for teachers to complement NWF's Eco-schools USA and Schoolyard Habitat programs. Built using the Next Generation Science Standards as a guide, the interdisciplinary lessons and activities are focused on project-based learning and Green Science, Technology, Engineering, and Math (STEM) teaching techniques.

Monarch Butterfly Lessons

Created by: Missouri Department of Natural Resources, Youth Education & Interpretation, 2017

Found at: https://dnr.mo.gov/education/monarchs/

Overall score: 4.5 ★★★★½

Fair and Accurate - 4.6
Depth of Knowledge - 4.6
Skill Building - 4.2
Action Orientation - 4.4
Instructional Soundness - 4.6
Usability - 4.4

Target grade levels: Middle School

Reviewers said:
The Missouri DNR's Monarch Butterfly Lessons offer students a chance to research and understand an issue and develop potential solutions.

The Monarch Butterfly Lessons for 6th-8th grade are well thought out, rich in resources and supporting content while allowing for student voice and direction.

Overview:
While the number of activities are limited, Missouri DNR's Youth Education & Interpretation group provided the only middle-school-specific resource we reviewed. The activities provide developmentally-appropriate, interdisciplinary activities aligned to Next Generation Science Standards and the website provides a wealth of resources to support educators and students.

Butterfly Activity Guide

Hosted online by: United States Forest Service

Originally Created by: National Wildlife Federation and American Zoo and Aquarium Association, 2001

Found at:
https://www.fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/documents/BFCI/BFCI_ActivityGuide.pdf

Overall score: 4.4 ★★★★½

Fair and Accurate - 4.8
Depth of Knowledge - 4.4
Skill Building - 4.3
Action Orientation - 4.6
Instructional Soundness - 4.3
Usability - 4.3

Target grade levels: Kindergarten - Middle School

Reviewers said:
The Butterfly Activity Guide provides easy to follow, in-depth studies about butterflies while also promoting the need for butterfly conservation.

Great intro to butterflies and pollination.

Overview:
This guide provides activity ideas to promote butterfly conservation and understanding. While not monarch-specific, this resource provides solid activities that apply to all species of butterflies.

Monarchs on a Mission

Created by: Nebraska Game and Parks Commission, 2017

Found at: http://outdoornebraska.gov/monarchsonamission/

Overall score: 4.4 ★★★★½

Fair and Accurate - 4.4
Depth of Knowledge - 3.8
Skill Building - 4.2
Action Orientation - 4.6
Instructional Soundness - 4.2
Usability - 4.8

Target grade levels: Kindergarten - High School

Reviewers said:
Easy to use and easy to understand lesson plans that are a great introduction to monarch conservation and awareness.

While this dual monarch/pollinator resource is targeted to citizens of Nebraska, the activities are applicable to a broader audience.

Overview:
Nebraska Game and Parks Commission is committed to pollinator preservation. In response, the activities and resources were created to support formal and non-formal educators teach about monarchs and other pollinators. The activities and posters are easily adapted to other states and regions in North America.

PHOTO CREDIT: USFWS

Monarchs and More:
An Inquiry and Arthropod Based Curriculum

Created by: University of Minnesota Monarch Lab, 2000-2017

Found at: https://monarchlab.org/education-and-gardening/curricula

Overall score: 4.2 ★★★★☆

Fair and Accurate - 4.5
Depth of Knowledge - 4.3
Skill Building - 3.8
Action Orientation - 3.8
Instructional Soundness - 4.5
Usability - 4.5

Target grade levels: Kindergarten - 2nd grade, 3rd - 6th grade, and Middle School

Reviewers said:
This resource provides complete lessons that are clear and leave room for creative augmentation while learning about the monarch butterfly.

The Monarchs and More curriculum guides are a compilation of grade-level appropriate lessons with detailed background information on all aspects of monarch biology and ecology.

Overview:
The University of Minnesota Monarch Lab provides educational tools, workshops, and expertise through different programs designed to promote and facilitate inquiry-based education through original curricula and research opportunities. These 4th edition curriculum guides help teachers facilitate inquiry-based education focused on monarch butterfly conservation. On the website there are many samples of activities and supporting resources available to educators for free. To access the entire guides, there is a link to the store where you can buy the complete resources as well as a variety of monarch-focused educational support items.

PHOTO CREDIT: USFWS

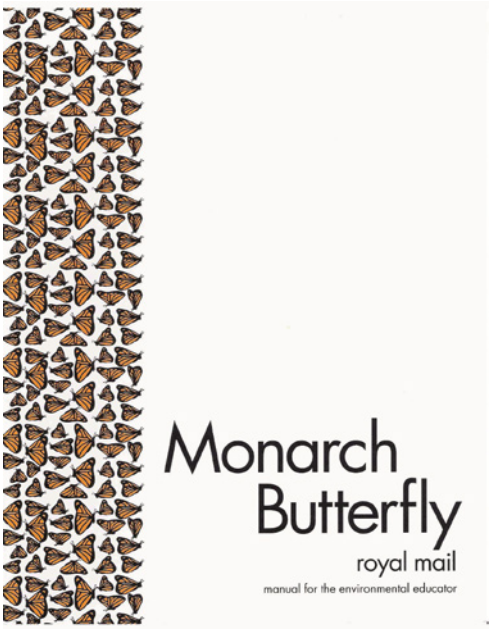
Monarch Butterfly - Royal Mail
A Manual for the Environmental Educator

Hosted online by: United States Forest Service

Originally Created by: Protección de la Fauna Mexicana (Profauna A.C.) and funded in part by the United States Fish and Wildlife Service, 1999 (digitized in 2012)

Found at:
https://www.fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/documents/royal_mail/monarch_pub.pdf

Profauna A.C. link to updated activities (in Spanish):
http://www.profauna.org.mx/monarca/maestro/comousar.html



Overall score: 4.2 ★★★★☆

- Fair and Accurate - 4.3
- Depth of Knowledge - 4
- Skill Building - 4
- Action Orientation - 4
- Instructional Soundness - 4.3
- Usability - 4.5

Target grade levels: Kindergarten - High School

Reviewers said:
This is a solid interdisciplinary curriculum about many aspects of monarchs, covering everything from life cycle and habitat to history and migration patterns.

A wonderful resource that provides information on monarchs from a perspective in Mexico where monarchs overwinter as well as providing ideas that can be incorporated into curricula designed for those of us in the United States and Canada.

Overview:
Written to inspire conservation of monarch butterflies during the migration months of September through November, this comprehensive resource stands up to the test of time. The English version is a scanned PDF file of the 1999 original resource. The version on the Profauna A.C. website is updated and can easily be translated into English.

Flight of the Butterflies in 3D
Educator Guide

Created by: SK Films; Maryland Science Center, Monarchs in the Classroom; and funded by National Science Foundation, 2012

Found at: http://www.flightofthebutterflies.com/in-the-classroom/

Overall score: 4.2 ★★★★☆

Fair and Accurate - 4.6
Depth of Knowledge - 4.2
Skill Building - 4.4
Action Orientation - 3.8
Instructional Soundness - 4.2
Usability - 4

Target grade levels: Kindergarten - High School

Reviewers said:
Flight of the Butterflies is an educator's guide that can be used in the classroom cross curricula. It engages students hands on to give them a deeper understanding of the life cycle of monarch butterflies and why their migration is endangered.

This resource provides the framework for an interdisciplinary exploration of monarch butterflies that can be adapted to all grade levels.

Overview:
Designed as a teacher's guide to complement SK Films, *Flight of the Butterflies in 3D*, this resource is designed to deepen students' engagement and understanding after viewing the IMAX® film. Resource features an in-depth discussion of the natural history and decline of the monarch and the lessons can be used in complement to the film or without seeing the film.

Live Monarchs in the Classroom

Butterfly Science

Sustainability Lesson Clearinghouse

Created by: Green Education Foundation

Found at:
http://www.greeneducationfoundation.org/institute/lesson-clearinghouse/558-Butterfly-Science.html

Overall score: 3.9 ★★★★☆

- Fair and Accurate - 4.7
- Depth of Knowledge - 4.2
- Skill Building - 4.3
- Action Orientation - 1.8
- Instructional Soundness - 4.3
- Usability - 4.3

Target grade levels: Preschool - 3rd Grade

Reviewers said:
This well designed butterfly curriculum for young learners is interactive, thorough and engaging.

This is a really great pre-K to 3rd grade resource that incorporates observation and the scientific process into a diverse and fun learning experience about butterflies.

Overview:
Designed for the youngest students, this guide provides early childhood teachers the resources and supporting lessons to raise butterflies in the classroom. The students record their daily observations of the growth and changes in the butterflies and use their observations to chart progress.

PHOTO CREDIT: USFWS

Monarch Watch in the Classroom

Created by: Monarch Watch - nonprofit organization based at the University of Kansas

Found at: http://monarchwatch.org/

Overall score: 3.6 ★★★½☆

Fair and Accurate - 4.2
Depth of Knowledge - 3.7
Skill Building - 3.7
Action Orientation - 3.5
Instructional Soundness - 3.2
Usability - 3.3

Target grade levels: Kindergarten - High School

Reviewers said:
This curriculum is a great way to introduce students to the process of scientific investigation and enables them to contribute to real world monarch studies.

The Monarch Watch website provides great background information and support for classroom activities.

Overview:
Monarch Watch provides a variety of ways that students and teachers can get involved in monarch conservation. From resources to teach about raising monarchs in the classroom, monarch tagging and monitoring projects, to milkweed planting projects, the resources and curriculum ideas tend to be hands-on and experiential.

PHOTO CREDIT: USFWS

Gardening for Monarchs

Schoolyard Butterfly Gardens

Created by: Monarch Joint Venture

Found at: https://monarchjointventure.org/images/uploads/documents/Schoolyard_gardens.pdf

Overall score: 4.3 ★★★★½

Fair and Accurate - 4.8
Depth of Knowledge - 3.5
Skill Building - 4
Action Orientation - 4.8
Instructional Soundness - 4
Usability - 4.8

Target grade levels: Kindergarten - High School

Reviewers said:
The Schoolyard Gardens resource comprehensively guides students and educators in the most direct action they can take on behalf of monarch conservation.

A great resource to help you and your students get that butterfly and pollinator garden started.

Overview:
This simple resource sheet is one of a series from the Monarch Joint Venture. This particular guide is filled with best practices and ideas for creating a garden that will host monarchs and other pollinators.

Build a Butterfly and Pollinator Garden

Created by: United States Fish and Wildlife Service, 2017

Found at: https://www.fws.gov/midwest/news/PollinatorGarden.html

Overall score: 4 ★★★★☆

Fair and Accurate - 4.7
Depth of Knowledge - 3.3
Skill Building - 3.3
Action Orientation - 4.8
Instructional Soundness - 3.2
Usability - 4.5

Target grade levels: Kindergarten - High School

Reviewers said:
This is a quick and accessible introduction to planting a pollinator garden.

Butterfly gardens are a great way to take science outside the classroom and develop a place for children to learn observation skills first hand.

Overview:
USFWS created this simple and easy-to-follow guide for creating a pollinator and butterfly garden in seven easy steps. This is a great place to start for anyone considering adding this outdoor component at their school and includes links to more in-depth resources.

PHOTO CREDIT: USFWS

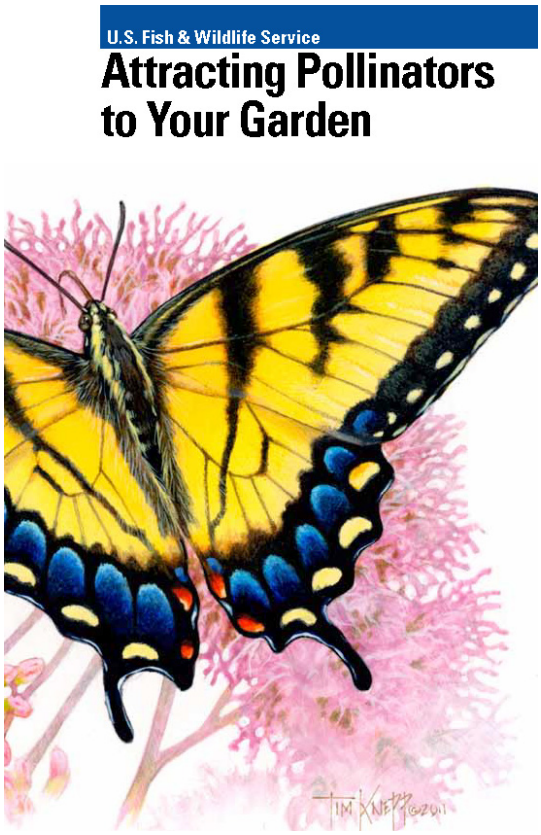
Attracting Pollinators to Your Garden

Created by: US Fish and Wildlife Service, 2011

Found at: https://www.fws.gov/pollinators/pdfs/pollinatorbookletfinalrevweb.pdf

Overall score: 3.7 ★★★½☆

- Fair and Accurate - 4.8
- Depth of Knowledge - 3.5
- Skill Building - 2.3
- Action Orientation - 4.3
- Instructional Soundness - 3.5
- Usability - 4



Target grade levels: Kindergarten - High School

Reviewers said:
A quick start-up guide to how you can attract pollinators to your garden.

Great resource for teachers to introduce students to pollinators, their importance, and getting their students involved in place-based education.

Overview:
This short booklet is designed to help educators and enthusiasts plant the correct plants that will attract pollinators to their flower gardens. It can also be used as a simple resource for students to learn more about pollination.

Citizen Science Opportunities

Driven to Discover

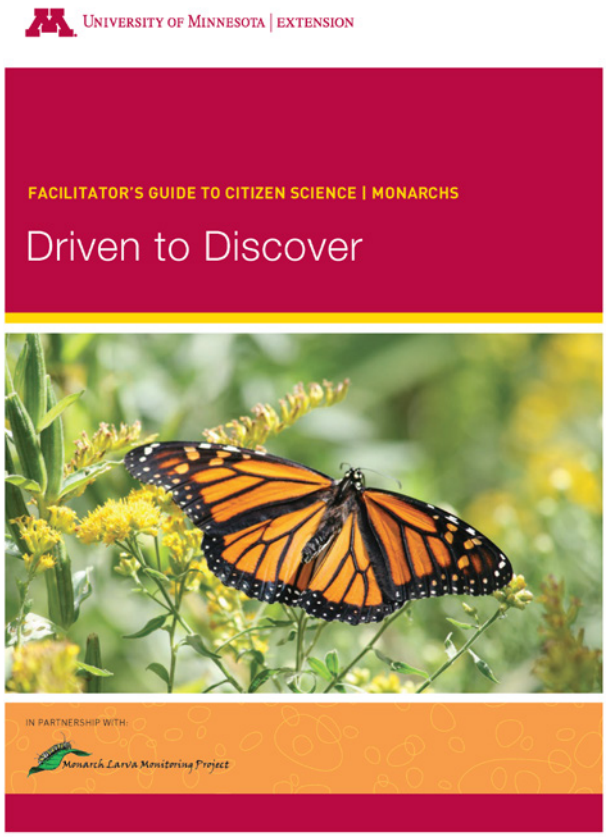
Facilitator's Guide to Citizen Science - Monarchs

Created by: University of Minnesota Extension, 2015

Found at: https://monarchlab.org/education-and-gardening/curricula

Overall score: 4.9 ★★★★★

Fair and Accurate - 5
Depth of Knowledge - 5
Skill Building - 5
Action Orientation - 4.6
Instructional Soundness - 5
Usability - 5



Target grade levels: 4th grade - High School

Reviewers said:
The gold standard for monarch butterfly curriculum.

This is one of the easiest to follow, all-encompassing guides on citizen science that I have seen.

This guide is a must read for anyone interested in pursuing a citizen science project with a group of youth (or adults). Driven to Discover is very clearly written and helps the facilitator build upon knowledge and skills that the students are gaining as they move forward with their project.

Overview:
This program is designed around an inquiry-based curriculum for afterschool and summer programming for youth ages 10 - 14. The curriculum uses nationally-known citizen science programs as the basis for teaching youth how to engage in science the way scientists do. The Facilitator's Guide is an excellent basis for any type of citizen science program and is accompanied by a student version of the guide.

Journey North - Monarch Butterflies

Created by: Journey North

Found at: http://www.learner.org/jnorth/monarchs

Overall score: 4.6 ★★★★½

- Fair and Accurate - 5
- Depth of Knowledge - 4.8
- Skill Building - 4.8
- Action Orientation - 4.5
- Instructional Soundness - 4.5
- Usability - 4.5

Target grade levels: Kindergarten - High School

Reviewers said:
An engaging, real-time look at monarch migration where students become citizen scientists and conservation stewards.

Journey North provides all of the information and resources for teachers/educators to confidently teach students about monarch butterflies and their migration.

Overview:
Using the resources provided by Journey North, students are able to report monarch butterfly sightings each fall and spring in order to help scientists learn more about monarchs. Students are also able to track migration on real-time migration maps. There are a wide variety of resources, journal ideas, and lesson ideas collected to build an interdisciplinary unit alongside the monitoring activities.

Monarch Watch Research Projects for Students

Created by: Monarch Watch - nonprofit organization based at the University of Kansas

Found at: http://monarchwatch.org/class/studproj/index.htm

Overall score: 4.1 ★★★★☆

Fair and Accurate - 4.3
Depth of Knowledge - 4.3
Skill Building - 4.3
Action Orientation - 3.7
Instructional Soundness - 3.8
Usability - 3.8

Target grade levels: Middle School - High School

Reviewers said:
Provides opportunities for classrooms to help scientists answer real relevant questions in monarch research.

Very in-depth, scientific exploration of monarch behavior and migration.

Overview:
Students are able to get involved in real-life, ongoing monarch research through Monarch Watch tagging and monarch larva monitoring. There are also guides for conducting monarch research in the classroom.

PHOTO CREDIT: USFWS

Monarch Conservation Organizations

The following organizations represent the national and international leaders in monarch conservation efforts. These websites provide background information and resources for students and educators to learn more and get further involved in monarch conservation.

Journey North - Monarchs - http://www.learner.org/jnorth/monarchs
Track the annual migration of the monarch butterfly.

Monarch Butterfly Fund - https://monarchconservation.org/
The Monarch Butterfly Fund is meeting the challenge of preserving monarch butterflies and their spectacular migration through a conservation strategy that fosters healthy ecosystems and sustainable communities through partnerships, forest conservation, scientific research and monitoring, education and outreach, and sustainable development.

Monarch Joint Venture - https://monarchjointventure.org/
The Monarch Joint Venture is a partnership of federal and state agencies, non-governmental organizations, and academic programs that are working together to support and coordinate efforts to protect the monarch butterfly migration across the lower 48 United States.

National Wildlife Federation (NWF) - https://nwf.org
NWF hosts information about monarchs, butterfly conservation, creating pollinator gardens, and ways for kids and adults to get involved in preserving monarchs.

Natural Resources Conservation Service (NRCS) -
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/plantsanimals/pollinate/?cid=nrcseprd402207
NRCS is working with agricultural producers in the Midwest and southern Great Plains to combat the decline of monarch butterflies by planting milkweed and other nectar-rich plants on private lands.

North American Butterfly Association (NABA) - http://www.naba.org/
A membership-based not-for-profit organization working to increase public enjoyment and conservation of butterflies in North America. Promotes butterfly gardening and hosts annual butterfly counts.

Protección de la Fauna Mexicana (Profauna A.C.) - http://www.profauna.org.mx/
Civil Association (non-profit) conservation organization based in Coahuila, Mexico dedicated to the conservation of natural resources. Focuses on conservation of monarch wintering areas. Website is published in Spanish.

United States Fish and Wildlife Service (USFWS) - https://www.fws.gov/savethemonarch/
The USFWS has created the Save the Monarch campaign to encourage monarch conservation.

United States Forest Service (USFS) -
https://www.fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/conservation/index.shtml
The USDA Forest Service Conservation and Management of Monarch Butterflies: A Strategic Framework will guide the USFS to effectively and efficiently use available resources and engage public and private partnerships in taking action for the conservation of the monarch butterfly.

United States Geological Survey (USGS) - Monarch Conservation Science Partnership - https://www.umesc.usgs.gov/management/dss/monarch.html
The Monarch Conservation Science Partnership is a USGS-led group of scientists, managers, and conservation organizations who perform science related to the conservation of monarch butterflies.

University of Kansas - Monarch Watch - http://www.monarchwatch.org/
Monarch Watch is a non-profit education, conservation, and research program based at the University of Kansas that focuses on the monarch butterfly, its habitat, and its spectacular fall migration.

University of Minnesota - Monarch Lab - https://monarchlab.org/
The Monarch Lab aims to combine real science with techniques that work for both teachers and students. Within the Monarch Lab, there are opportunities for formal and informal educators to be guided in instructing their students to learn science in ways that reflect the scientific process and methods scientists use to understand the natural world.

Xerces Society for Invertebrate Conservation - https://xerces.org/
The Xerces Society for Invertebrate Conservation is an international nonprofit organization that protects wildlife through the conservation of invertebrates and their habitats.

PHOTO CREDIT: USFWS

Connecting Monarchs and the Next Generation Science Standards

The Next Generation Science Standards (NGSS Lead States, 2013) were created based on the *Framework for K-12 Science Education - Practices, Crosscutting Concepts, and Core Ideas* (National Research Council, 2012). NGSS is a national set of standards that many state department of education boards have adopted outright and several other states have adopted very similar sets of science standards.

The following is an excerpt of the life science performance expectations that naturally align with monarch butterfly curriculum recommended in this guide. The complete standards and more details can be found at https://nextgenscience.org/.

Standard	Grade Level	Discipline	Core Idea	Performance Expectation
K-LS1-1	**Kindergarten**	Life Science	1. From Molecules to Organisms: Structures and Processes	1. Use observations to describe patterns of what plants and animals (including humans) need to survive.
1-LS3-1	**1st Grade**	Life Science	3. Heredity: Inheritance and Variation of Traits	1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
2-LS4-1	**2nd Grade**	Life Science	4. Biological Evolution: Unity and Diversity	1. Make observations of plants and animals to compare the diversity of life in different habitats.
3-LS1-1	**3rd Grade**	Life Science	1. From Molecules to Organisms: Structures and Processes	1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
3-LS2-1	**3rd Grade**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	1. Construct an argument that some animals form groups that help members survive.
3-LS4-2	**3rd Grade**	Life Science	4. Biological Evolution: Unity and Diversity	2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

Standard	Grade Level	Discipline	Core Idea	Performance Expectation
3-LS4-4	**3rd Grade**	Life Science	4. Biological Evolution: Unity and Diversity	4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
4-LS1-1	**4th Grade**	Life Science	1. From Molecules to Organisms: Structures and Processes	1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
5-LS2-1	**5th Grade**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
MS-LS1-4	**Middle School**	Life Science	1. From Molecules to Organisms: Structures and Processes	4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5	**Middle School**	Life Science	1. From Molecules to Organisms: Structures and Processes	5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS2-1	**Middle School**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2	**Middle School**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Standard	Grade Level	Discipline	Core Idea	Performance Expectation
MS-LS2-4	**Middle School**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
HS-LS2-1	**High School**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2	**High School**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-7	**High School**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS2-8	**High School**	Life Science	2. Ecosystems: Interactions, Energy, and Dynamics	8. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.
HS-LS4-4	**High School**	Life Science	4. Biological Evolution: Unity and Diversity	4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-5	**High School**	Life Science	4. Biological Evolution: Unity and Diversity	5. Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
HS-LS4-6	**High School**	Life Science	4. Biological Evolution: Unity and Diversity	6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

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Appendix A: Association of Fish and Wildlife Agencies Conservation Education Core Concepts

These Core Concepts reflect the knowledge, actions and values that further the North American Model and were developed as part of the Conservation Education Strategy.

Conservation Education Strategy Mission
To unify and strengthen conservation education efforts of the Association of Fish and Wildlife Agencies (AFWA) member agencies and partners in a manner that effectively advances the AFWA Strategic Plan and the North American Model of Fish and Wildlife Conservation.

Conservation Education Strategy Vision
Conservation Education becomes an effective, dynamic means for the AFWA, its members and partners to achieve the AFWA Strategic Plan through an informed and involved citizenry that:

I. Understands the value of our fish and wildlife resources as a public trust.
II. Appreciates that conservation and management of terrestrial and water resources are essential to sustaining fish and wildlife, the outdoor landscape, and the quality of our lives.
III. Understands and actively participates in the stewardship and support of our natural resources.
IV. Understands and accepts and/or lawfully participates in hunting, fishing, trapping, boating, wildlife watching, shooting sports, and other types of resource-related outdoor recreation.
V. Understands and actively supports funding for fish and wildlife conservation.

Core Concepts for Conservation Education

I. Understands the value of our fish and wildlife resources as a public trust.
   A. In North America fish and wildlife are public trust resources managed by governmental agencies.
   B. Sustainable natural resources depend on the support of an informed and responsible citizenry.
   C. Regulations are necessary for natural resources conservation.
II. Appreciates that conservation and management of terrestrial and water resources are essential to sustaining fish and wildlife, the outdoor landscape, and the quality of our lives.
   A. The health and well-being of fish, wildlife, and humans depend on the quality of their environment.
   B. Fish and wildlife can be conserved and restored through science-based management which considers the needs of humans as well as those of fish and wildlife.
III. Understands and actively participates in the stewardship and support of our natural resources.
   A. A person's culture affects his or her view and use of fish and wildlife and their habitats.
   B. The distribution and abundance of fish and wildlife provide significant economic benefits.
   C. Everyone impacts fish and wildlife and their habitats and as human populations grow, impacts on natural resources increase.
   D. Unlike other organisms, only humans have the capacity and responsibility to consider the effects of their actions on their environment.
IV. Understands and accepts and/or lawfully participates in hunting, fishing, trapping, boating, wildlife watching, shooting sports, and other types of resource-related outdoor recreation.
   A. Regulated hunting, fishing, and trapping are important tools for managing some wildlife populations and habitats.

B. Fish and wildlife-based resources provide recreational benefits directly to participants and increase advocacy for conservation
C. Responsible users of fish, wildlife, and the outdoors respect the rights and property of others.

V. Understands and actively supports funding for fish and wildlife conservation.
A. Within the U.S., state fish and wildlife management is funded primarily through hunting, fishing and trapping licenses and through federal excise taxes collected from the sale of hunting, target shooting, and fishing equipment and motorboat fuels.
B. Wildlife-based activities, such as hunting, fishing, viewing, and photography provide people with millions of days of outdoor recreation each year and generate billions of dollars for the economy.
C. The future of fish and wildlife conservation requires additional funding from a broad-based constituency.

PHOTO CREDIT: USFWS

Appendix B: Other Resources Available From the Conservation Education Strategy

Connecting More Americans to Nature

When young people connect regularly with nature, the outcomes are profound. Children are happier, healthier from the exercise, effects of attention-deficit disorder are reduced and they score higher on standardized tests when natural environments are integrated into school curricula. State fish and wildlife agencies nationwide provide educational opportunities that can help bridge the gap between formal school settings and the great outdoors and all offer outdoor skills training in non-formal settings.

Endorsed by the 50 state agencies, and winner of 2010 Conservation Education Award from The Wildlife Society, the ***North American Conservation Education Strategy*** (CE Strategy) delivers unified, research-based Core Concepts and messages about fish and wildlife conservation, translated into K-12 academic standards to shape students' environmental literacy, stewardship and outdoor skills.

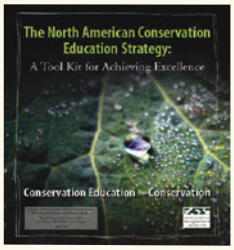
Launched in 2004, the CE Strategy is our blueprint for identifying what every citizen should know, feel and do related to fish and wildlife conservation, including the sustainable enjoyment and use of those resources.

NORTH AMERICAN CONSERVATION EDUCATION STRATEGY RESOURCES

With funding provided through a Multistate Conservation Grant of the Sport Fish & Wildlife Restoration Program, state conservation education experts have developed a variety of reseached-based resources to help support agencies' and even non-governmental organizations' fish and wildlife programs.

These resources are available for download from the Association of Fish & Wildlife Agencies' website at **www.fishwildlife.org** in the Focus Area section, Conservation Education.

The North American Conservation Education Strategy: A Toolkit for Achieving Excellence



This kit includes the many research-based products developed by the Association of Fish and Wildlife Agencies (AFWA) as part of the CE Strategy, including the mission, vision, goals and underlying principles of the North American Conservation Education Strategy.

Conservation Core Concepts, Top CE Core Concepts Poster

Developed by biologists and conservation education educators from state fish and wildlife agencies and non-governmental organizations, these concepts clearly state what every American should understand about the conservation of fish and wildlife and related resources.

The poster highlights key messages for the top 11 fundamental, over-arching concepts.

Benchmarks for Conservation Literacy

The Benchmarks for Conservation Literacy identify what students should know and be able to do at the 5th, 8th and 12th grade levels to guide them on their way to becoming involved, responsible, conservation-minded citizens.

The Benchmarks were developed with input from professional educators in the formal and non-formal sectors. They can be used in program development and as an assessment tool.

Conservation Education = Conservation

Field Investigations Guide: Using Outdoor Environments to Foster Student Learning of Scientific Processes

This guide helps K-12 teachers introduce their students to the methodologies used for scientific field research and guide them through the process of conducting field studies. It demonstrates how to use descriptive and comparative methodologies for field studies.

K-12 Conservation Education Scope & Sequence: An Educator's Guide to Sequential Learning about Fish and Wildlife

A set of expectations that describe what students should know and be able to do in three grade bands—K-5, 6-8 and 9-12—in the areas of science, social science and health and fitness. The Scope & Sequence translates the Core Concepts into content standards and performance expectations.

Stewardship Education Best Practices Planning Guide

Stewardship is an important part of fish and wildlife agency conservation education programs. Based on research and evaluation, this guide provides recommendations for strengthening and developing natural resources stewardship aspects of your programs.

Fostering Outdoor Observation Skills

The first step in conducting field investigations is learning to observe. Fostering Outdoor Observation Skills helps teachers take their students beyond the classroom to help their students connect with the natural world and help them learn to read the "book of nature."

Landscape Investigation Guidelines: Challenging K-12 Students to Engage in Social Science Inquiry by Applying Spatial Thinking to Real World Situations

Fish, wildlife and other natural resources are integral parts of our landscapes. The Landscape Investigation Guidelines provide a model for student investigations of their landscapes in ways that meet K-12 social science and geographic standards.

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Sustainable Tomorrow: A Teachers' Guidebook for Applying Systems Thinking to Environmental Education Curricula for Grades 9-12

This publication shows how to use systems concepts and tools to apply systems thinking to environmental education curricula. It uses lessons from Project WILD, Project WET, and Project Learning Tree, all commonly used environmental education resources, to demonstrate how to apply a systems approach.

Schoolyard Biodiversity Investigation Educator Guide

Students often learn about the biodiversity of far off places. This Guide provides them the opportunity to learn about the biodiversity in their own schoolyards. It is targeted to elementary and middle schools.

Outdoor Skills Education Handbook: A Guide for Developing and Implementing School-Based Outdoor Skills Education

This handbook is designed to help fish and wildlife agencies and NGOs work with schools to deliver outdoor skills through health or physical education courses. It includes everything you need to know about communicating with school administrators, correlating to standards and more.

CE Strategy White Papers

Indicators and Data Sources for Assessing the State of Outdoor Recreation Participation, Environmental Literacy and Civic Participation and Stewardship in America: This white paper provides baseline data on conservation education and outdoor recreation participation in the United States.

Benefits of Outdoor Skills to Health, Learning and Lifestyle: A Literature Review: This comprehensive literature review documents the extent to which positive impacts of outdoor skills education have been researched and substantiated. It includes abstracts for 99 documents and groups findings into themes including healthy lifestyles; outdoor skills education as a tool to increase outdoor recreation participation; constraints to hunting and fishing participation; and more.

Alignment of Outdoor Skills with National Standards and the Framework for 21st Century Learning: This white paper explores the connections between outdoor skills and formal education. It includes correlation of 143 lessons or units from 12 outdoor skills programs to national standards in health, physical education, and agriculture education.

Visit **www.fishwildlife.org** *in the Focus Area section, Conservation Education, to download any of these publications.*