

Alignment of Potential Monarch Waystation Activities with High School NGSS*

Some Questions to Explore: How can we attract monarchs and other pollinators to our Waystation?
 What plants are growing in our Waystation? What are their needs?
 What pollinators do we observe in the Waystation? What is their behavior?
 How can we use the Waystation blog to connect with other Waystations?
 Where do monarchs go when they migrate?
 Why do monarchs need Waystations?
 How does the structure and function of pollinators and plants facilitate pollination?

Grade level/subject: High School Science

NGSS (Next Generation Science Standards) Performance Expectations

HS – LS 2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
 HS - LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
 HS - LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
 HS - LS 2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
 HS - LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment & reproduce.
 HS - LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

What NGSS Dimensions do Waystation projects support?	Potential student activities for Waystation projects
<p><i>Science & Engineering Practices</i></p> <p>S1. Ask questions and define problems. S2. Develop and use models. S3. Plan and carry out investigations. S4. Analyze an interpret data. S5. Use mathematics and computational thinking. S6. Construct explanations and design solutions. S7. Engage in argument from evidence. S8. Obtain, evaluate, and communicate information.</p>	<ul style="list-style-type: none"> • Schools create blog posts about their Waystation and the pollinators observed. Use claims, evidence, reasoning format for blog posts. • Students observe, record, and identify plants and pollinators in their school garden. Use resources on http://www.monarchwatch.org/waystationnetwork • Students design and conduct research on questions that arise from their observations. Use claims, evidence reasoning format to present their findings. • Use classroom iPads and other devices <ul style="list-style-type: none"> ○ Use cameras to photograph milkweed and other plants and pollinators in the Waystation. <ul style="list-style-type: none"> ▪ How many visitors to a given flower in 5 minutes? How many types of insects in a designated area in 5 minutes? ▪ Conduct experiments to compare and contrast types of flowers and insects ▪ Compare and contrast which plants attract more monarchs and pollinators, and form hypothesis as to why
<p><i>Disciplinary Core Ideas</i></p> <p>LS1.A: Structure and function LS2.A: Interdependent relationships in ecosystems LS2.B: Cycles of Matter and energy transfer in ecosystems LS2.C: Ecosystem dynamics, functioning, and resilience ETS1.B Developing possible solutions</p>	

<p><i>Crosscutting Concepts</i></p> <ul style="list-style-type: none"> Cause and effect Structure and function Matter and energy Patterns Stability and change 	<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Conduct a scientific experiment involving various milkweed or flower species <ul style="list-style-type: none"> ○ Use compass apps to vector migrating monarchs ○ Use citizen science apps (Ex. citsci.org; iNaturalist) • Students raise monarchs and observe, document and graph their life cycle. (Ex. Quantify energy biodynamics of food eaten by larvae) <ul style="list-style-type: none"> ○ http://monarchwatch.org/rear/index.htm • Students tag migrating monarchs and track migration using models, maps & Monarch Listserv. (http://monarchwatch.org/tagmig/tag.htm) (http://www.learner.org/jnorth/maps/monarch.html) • Students read and analyze monarch research. <ul style="list-style-type: none"> ○ http://monarchlab.org/biology-and-research/research/ ○ http://monarchjointventure.org/our-work/list/category/research-and-monitoring ○ http://monarchjointventure.org/news-events/list/category/recent-research ○ https://eeb.ku.edu/orley-r-taylor ○ http://www.bio.tamu.edu/index.php/texas-am-department-of-biology-2/faculty-christine-merlin/ • http://www.monarchnet.org/literature-cited • Use the Monarch Watch challenge questions as a foundation to a research project (http://monarchwatch.org/class/challeng.htm) • Students model interactions of organisms and the effect of environmental conditions on monarch populations. • Students investigate human impacts on monarchs and other pollinators, formulate resolutions and create a final product/plan incorporating resolution
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