Grasslands as the Integrating Context to Teach STEM

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Haven’t we always taught STEM (Science, Technology, Engineering and Mathematics)?

- Not just science knowledge
- Interdisciplinary thinking
- Real world application

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Why emphasize STEM?

• In US today: 26 million STEM jobs and growing
• STEM mastery = scientific literacy
<table>
<thead>
<tr>
<th>Observing</th>
<th>Planning and Investigating</th>
<th>Interpreting</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Observe</td>
<td>• Plan an investigation</td>
<td>• Categorize, order and classify</td>
</tr>
<tr>
<td>• Compare</td>
<td>• Use tools</td>
<td>• Organize</td>
</tr>
<tr>
<td>Questioning</td>
<td>• Develop solutions</td>
<td>• Infer</td>
</tr>
<tr>
<td>• Question</td>
<td>• Design solutions</td>
<td>• Evaluate</td>
</tr>
<tr>
<td>• State a problem</td>
<td>• Problem solve</td>
<td>• Research a problem</td>
</tr>
<tr>
<td>Communicating</td>
<td>• Measure</td>
<td>• Interpret, analyze and reason</td>
</tr>
<tr>
<td>• Model/Graph/Use</td>
<td>• Draw/Design</td>
<td>• Interpret data</td>
</tr>
<tr>
<td>• Using numbers</td>
<td>• Build/Construct</td>
<td></td>
</tr>
<tr>
<td>• Summarize/Relate</td>
<td>• Collect data</td>
<td></td>
</tr>
<tr>
<td>• Demonstrate</td>
<td>• Invent/Implement</td>
<td></td>
</tr>
<tr>
<td>• Demonstrate</td>
<td>• Developing Solutions</td>
<td></td>
</tr>
<tr>
<td>• Communicate to</td>
<td>• Redesign</td>
<td></td>
</tr>
<tr>
<td>others</td>
<td>• Optimize</td>
<td></td>
</tr>
<tr>
<td>• Collaborate</td>
<td>• Optimize</td>
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</tbody>
</table>
The 7 most important STEM skills to teach our Kids

- Statistics
- Data-driven decision making
- Argumentation
- Problem-solving
- Intellectual curiosity
- Creativity
- Flexibility
Why teach STEM outdoors?

• So much opportunity in your own neighborhood
• It makes STEM relevant to our kids

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Using the meadow to teach

“Environmental education, by its nature, draws on and impacts many disciplines, such as science, math, history and political science. It also is readily identifiable as a critical component of citizenship education, science literacy and career development.”

-David Sobel
Case studies using grasslands to teach STEM
Hands-on lessons lay the pathway to STEM success
WM High Acres Landfill and Recycling Area (NY)

- Rochester Institute of Technology students study birds in several studies (including grasslands) as part of MAPS (Migratory Avian Productivity Survey)
WM High Acres Landfill and Recycling Area (NY)

- Younger students use Project WILD lessons and activities
How can Project WILD and Project Learning Tree help?

- Designed by teachers
- For formal and informal educators
- Aligned with standards and STEM
- Training is available
Do you need a lesson?

Project Learning Tree
- Invasive Species
- The Web of Life
- Field Forest and Stream

Project WILD
- Bird Song Survey
- Dropping in on Deer
- Seed Need
Cross-pollinating:

Interdisciplinary studies engage students and encourage critical thinking and communication
ArcelorMittal Burns Harbor (MI)

- HS students conducted soil and quadrat studies
- Collected and compared data from various areas
- Emphasis on “doing science”
- Encouraged to think about restoration processes
Active assessment for active science

Collaborative learning

<table>
<thead>
<tr>
<th>Students cannot work together, can’t finish task</th>
<th>Students work separately or leave someone out</th>
<th>Students appear to share ideas, knowledge, and tasks</th>
<th>Students work together with a high degree of competency</th>
<th>Students work together with a high degree of competency and reach out to assist others</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</table>

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Active assessment for active science

Data collection (applying science and math to the real world)

<table>
<thead>
<tr>
<th>Students are unable to complete data tables</th>
<th>Students complete data tables with additional guidance</th>
<th>Students show competency in completing data tables</th>
<th>When asked, students can explain what their data points mean</th>
</tr>
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Schools: Make sure your project supports standards-based learning

- Next Generation Science Standards
- Common Core
### Example: Meadow Soils Study

<table>
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<tr>
<th>Next Gen Cross-cutting Concept</th>
<th>Lesson</th>
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<tr>
<td>Patterns: Observed patterns in nature guide organization and classification, and prompt questions about relationships and causes underlying them.</td>
<td>Learners take soil test from various sites and compare samples, encouraging them to think critically about how the restored environment compares to the less-disturbed environment—and what might be done to restore the soils.</td>
</tr>
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Using the outdoors to teach STEM provides learning opportunities that can help bridge the achievement gap for resource poor communities.
Marathon, Savage Branch (KY)

- Aligns with NGSS
- Plantings and monitoring projects
- Uses Project WILD and other lessons to develop data collection and deductive reasoning skills while exposing them to the nature of their region
Closing the achievement gap through outdoor education (from SEER study, 2001)

• Better performance on standardized measures of academic achievement in reading, writing, math, science and social studies
• Reduced discipline and classroom management problems
• Increased engagement and enthusiasm for learning
Ideas and Resources to make your STEM ambitions take flight!
PPG Monroeville (PA)

- Students collect data in observation journals
- Pre- and post-visit activities; inquiry-based
- Linked to schools in Mexico
Diversity rules:
Deep roots in a community help any project to thrive.
Boeing Pollinator Prairie (KS)

Master Gardeners train community volunteers to care for this small pollinator meadow-inspired garden.
Using citizen science to add the “Technology” to STEM meadow projects

Bumble Bee Watch
Vermont Bumble Bee Survey
BeeSpotter (IL, OH, IN)
Bumble Booster (NE)

Lost Ladybug Project
Firefly Watch Project
Cricket Crawl
i- Naturalist
Add more tech to your lesson–

Project NOAH (Networked Organisms and Habitats)
Need even more great lesson ideas?

Nature’s Partners free curriculum from www.pollinator.org

Get field equipment, guides or story books from www.acornnaturalists.com