



Engineering in the Garden

What are the lessons about?

The purpose of these lessons is to expose children to the engineering design process while they investigate insect populations in a garden setting. The setting could be flowerbeds, vegetable gardens, herb, butterfly and/or rain gardens. Students begin by investigating both beneficial and harmful insects in the garden(s). Then, students design, test and modify strategies to both attract beneficial insects and deter harmful insects. Based on their findings, students plan and carry out garden insect maintenance for the season.

How to carry out lessons:

- A. Students make observations of insects in the garden using hand lenses, field guides and their science notebooks. They may also take population samplings using quadrat studies to determine the concentration of certain insects around certain vegetation. This may also be done during different times of day. Students collect data in tables or charts in their science notebooks and use the field guide to determine beneficial and harmful insects. Beneficial insects may include honeybees, ladybugs and lacewings. Harmful insects may include the Colorado Potato Beetle, Asian Beetles, aphids and the non-insect gastropod; the slug. Students make detailed observations over several days, during various times of day and weather. They may also collect the insects in small containers to observe them in a controlled setting.
- B. After making observations and cataloguing insect populations, students work in groups of 2 or 3 to design and test one way to attract a beneficial insect and one way to deter a harmful one. Students make their plans in their science notebooks based on various materials that are available. The attractants and/or deterrents may be chemical based or physical. Provide students with parameters that keep both them and the environment safe.

For example, here are some possible designs.

Deterrents:

1. slugs –
 - a. cups of beer, vinegar, or yeast/water mixture buried flush with the ground
 - b. small overturned, slightly propped plastic, clay, or glass containers
 - c. orange peels
2. squash bugs –
 - a. diluted solutions of vinegar, salt water, Coke, sprayed on bugs

Attractants:

1. ladybugs –
 - a. raisins or other fruit in various shaped homes (tubes, boxes, etc.)
2. butterflies –
 - a. oranges
 - b. butterfly houses of student design

- C. Students plan, build/make, test, redesign, test, redesign based on their findings over several weeks. Students are reminded that the goal is for them to establish a system or process that they can maintain over the growing season that attracts their beneficial insect and deters the harmful one, while keeping the environment safe for humans, the plants growing and the soil there.
- D. After students work through the design process for both the attractant and deterrent, they share their findings with the group to get feedback on how the designs can be improved. Students are encouraged to collect data all along the way by keeping an estimated population count in quadrat studies, in tables/charts in their notebooks and/or taking photographs over time, etc.
- E. As students achieve their most effective designs, they can develop and carry out a long-term plan to maintain their attractants and deterrents over the growing season.

Possible Lesson Extensions:

- A. Contact a local university extension, garden center or DNR office to get advice or share findings.
- B. Publish designs in a newsletter, newspaper, blog, garden guide etc.
- C. Challenge students to design the most environmentally friendly and cost effective attractant or deterrent.

Helpful Websites:

<http://www.organicgardening.com/learn-and-grow/meet-beneficial-insects>

<http://urbanext.illinois.edu/firstgarden/>

<http://www.pbslearningmedia.org/resource/thnkgard.sci.ess.pests/think-garden-garden-pests-and-helpers/>

<http://www.extension.org/pages/9925/state-and-provincial-master-gardener-programs:-extension-and-affiliated-program-listings#.UzoZsmR4ZKp>

<http://www.gardenforever.com/>

SAFETY FIRST

Always take precautions when working with any chemicals or tools in the garden. Label bottles clearly and monitor students carefully. Be aware of any allergies that the students may have. Always have a first aid kit with you in the garden, as well as a cellphone in case of an emergency.