GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

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- 5 GREEN Issues and Solutions
- 1-8 weeks per topic
- Entire class works together

**G** GET CONNECTED
**R** REUSE : RECYCLE RETHINK
**E** ENCOUNTER WATER
**E** EAT GREEN
**N** NOTHING WASTED

Issue | Solutions

## AMBASSADOR

### 1 STRATEGY

- Timing: 2-3 Days
- After each of the GREEN sections, before each event
- Entire class works together

### 2 EVENT MODULES

- Timing: 1 Month
- Class works in Teams
- Following each of the GREEN sections

### 3 FOLLOW UP

- Timing: 2- 3 days
- After each event
- Teams and Class

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- Timing: 3-5 days
- Individuals

**1** Action Plan → Talking Points Worksheet → Assign Team Roles


**EVENT**

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GREEN AMBASSADORS
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# TEACHER FLOW

## Green Ambassadors Curriculum

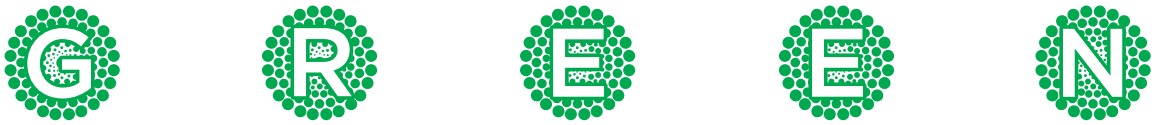
## OVERVIEW

This curriculum has been designed to take a full year. Over the course of the year students will explore five **G.R.E.E.N** issues and solutions, one at a time. For each letter they will complete the **AMBASSADOR** portion of the curriculum and create an event as a way of assessing their knowledge. You can choose to spend a couple months focusing on one individual letter and throwing one event, or take all year and have five events.

## G.R.E.E.N.

Students will become G.R.E.E.N experts by exploring environmental issues and creating solutions.

- **Get Connected:** Becoming an Expert on Systems Thinking and Permaculture
- **Reuse Recycle Rethink:** Becoming an Expert on Composting
- **Encounter Water:** Becoming an Expert on Water Conservation and Catchment
- **Eat Green:** Becoming an Expert on Sustainable and Organic Food Production and Consumption
- **Nothing Wasted:** Becoming an Expert on Sustainable Lifestyles: Alternative Energy, Transportation and Natural Products.




GET CONNECTED | REUSE : RECYCLE RETHINK | ENCOUNTER WATER | EAT GREEN | NOTHING WASTED

**Tips and Reminders**

- The G.R.E.E.N curriculum is designed to serve as a guide to environmental teaching, not as step-by-step lesson plans. There is a surplus of great green curriculum that you should use to help you customize and develop your own lesson plans.
- While it is important to explore green issues, the most successful and impactful lesson will be focused on finding creative solutions.
- Students will become inspired about "being green" through hands-on involvement and creating solutions; it is not enough for them to just hear or see the solutions.
- Make the lessons relevant to your geographic area. Focus on issues that concern your students and their families.
- Standards: The national standards covered by each G.R.E.E.N unit are listed at the beginning of the unit. These activities are aligned to Math and Science standards (AMBASSADOR curriculum aligns with English, History/Government and Sustainability). Select the activities that best compliment your lessons/topics. You can also easily align them to the sustainability standards.

## AMBASSADOR


After becoming an expert on one of the G.R.E.E.N solutions, students will take action by producing an event to share what they have learned with the community.

**Tips and Reminders**

- The AMBASSADOR curriculum is split into three major components: Strategy, Event Modules and Follow Up.
- Unlike the G.R.E.E.N curriculum serves as a step-by-step guide for students, as they will be the ones leading this portion of the curriculum.

- **Preparation**: Make a copy of the Marketing and Talking Points worksheets for everyone in the class. Make one copy of each event module for each team and keep each module in a folder that remains in the classroom. Review each performance task and think about how you will assign teams (based on interest, performance, etc.). Break people from their normal or comfortable groups. Note: The Event team should be assigned to class leaders and communicators. This is the most difficult module and this team will hold it together. Game and Fundraising are easier modules.

**A. STRATEGY (2-3 days)**

To get started, guide your students through the following worksheets **together as a class** to define the purpose of each project and event. Being thorough and detailed during this phase will ensure a successful event.

- **Action Plan:** Ensures that groups understand they are working together towards the same event and with the same goals.
- **Talking Points Worksheet:** Helps students define the content of their event so that it is consistent across groups. Talking points should be based upon facts and solutions they discovered during the relevant G.R.E.E.N unit.

**B. TEAM ROLES (1 day)**

As a teacher you will use the Team Roles worksheet to assign your class to teams of 3-6 people. Prior to assigning teams you should read the performance tasks for each team so you have an idea of who to assign to which team. Together in class, fill out the Team Roles worksheet and post it in class.

- Event*
- Presentation*
- Public Outreach*
- Design*
- Lesson
- Fundraising
- Photo Story
- Game
- Video

If you do not have enough students to assign to every team the (*) teams are absolutely necessary. You can also assign two modules to each team but they will need additional time. To gain familiarity and comfort with the AMBASSADOR curriculum consider having

the entire class focus on a single team module such as Lesson Plan or Photo Story. As the class becomes more comfortable with the curriculum, you should produce an event with all or most of the modules.

**C. Event Modules (2-6 weeks)**
Put the class in their teams and provide them with a copy of their Event Module Packet. (We recommend keeping each module in a folder that stays in the classroom.) Together as a class walk them through each component of their module by reading the summaries below (mostly consistent across each team). As you introduce each component it is very important to have teams read their component out loud together.

- **Performance Task**
  Overview and checklist of the team's task as well as the materials they will need.
- **Packet/Worksheet**
  Step-by-step guide for before, during and after the event. (There are teacher tips for guiding each team through their packets below).
- **Rubric**
  Shows students what they will be graded on as a TEAM. Teams should review the rubric before getting started.
- **Feedback**
  Helps teams collect feedback from the people that attend the event or see the final production. If the class is producing an event together the Event team should be responsible for collecting one comprehensive Feedback form. These should also be used during rehearsals and practice and reviewed by teams to improve the final event.
- **Results**
  Helps students tally the feedback and record the impact their team made. This should be completed after the event and will be used to grade their project.
- **Reflection**
  Helps students reflect on their contribution and results as well as brainstorm about how they can improve the next event. This should also be completed after each event.

**D. Event**
This is where the magic happens. Students are able to share what they have learned with a real audience. Make it part of everyone's grade to have two guests attend the event (track this on the guest sign-in sheet).

E. **Follow Up**
This is where each student's experience transforms into knowledge. In addition to completing the following forms and getting graded, students should send thank you notes to everyone that helped make the event possible.

- **Results**
  Have students complete this in their teams by tallying their feedback and recording the impact their team had on the overall event. Use this sheet to grade their projects.
- **Reflection**
  Have students reflect on their contribution and results as well as brainstorm about how they can improve for their next event. Hold a class discussion for them to share their reflections and set a strategy for making the next event even better.

**Grading**:
The rubrics allow you to grade students by TEAMS. Rubrics grade each team on their output in addition to their teamwork. You may want to find additional ways to grade students individually. There are extra lines on each rubric for you to add other elements you feel are important. Because there will be a lot going on during the presentations and events, we recommend you grade as much as possible during practice and rehearsals.

**Mentors:** Bringing in mentors will enrich the student's learning and enhance the quality of the event. Invite an event planner to help the Event team or a videographer to coach the Video team. Anyone that has experience or something to contribute will make the experience less stressful for you.

## AMBASSADOR STANDARDS

**National K-12 Standards**
This curriculum aligns to many of the National English, Science and History standards. Here is a sampling of the English, Sustainability and Civics and Government Standards it connects to.

**English**
**NL-ENG.K-12.4 COMMUNICATION SKILLS**
Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.

**NL-ENG.K-12.5 COMMUNICATION STRATEGIES**
Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

**NL-ENG.K-12.6 APPLYING KNOWLEDGE**
Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts

**Sustainability**
**EfS Standard 1** – Students understand and are able to apply the basic concepts and principles of sustainability.(i.e., meeting present needs without compromising the ability of future generations to meet their needs)

**EfS Standard 2** – Students recognize the concept of sustainability as a dynamic condition characterized by the interdependency among ecological, economic, and social systems and how these interconnected systems affect individual and societal well-being. They develop an understanding of the human connection to and interdependence with the natural world.

**EfS Standard 3** – Students develop a multidisciplinary approach to learning the knowledge, skills, and attitudes necessary to continuously improve the health and well-being of present and future generations, via both personal and collective decisions and actions. They are able to envision a world that is sustainable, along with the primary changes that would need to be made by individuals, local communities, and countries in order to achieve this.

**National Standards for Civics and Government**
What are the Roles of the Citizen in American Democracy?

- What is citizenship?
  - The meaning of citizenship in the United States. Students should be able to explain the meaning of citizenship in the United States.
- What are the rights of citizens?
  - Personal rights. Students should be able to evaluate, take, and defend positions on issues regarding personal rights.
- What are the responsibilities of citizens?
  - Personal responsibilities. Students should be able to evaluate, take, and defend positions on issues regarding the personal responsibilities of citizens in American constitutional democracy.
  - How can citizens take part in civic life?
- The relationship between politics and the attainment of individual and public goals. Students should be able to evaluate, take and defend positions on the relationship between politics and the attainment of individual and public goals.

## TIPS FOR WORKING WITH AMBASSADOR TEAMS

### General

- Use the Performance Task checklist to check in with each team on important milestones before, during and after the event.
- Teams should be interacting and communicating with each other throughout the entire planning process. (For example, the Event team should be interviewing each team and the Public Outreach and Design teams should connect to invite people.

### 1. EVENT TEAM

This team will really need your support. They are the leaders and facilitators of the event. They should be working with and leading all other teams to ensure a successful event.

### Inspire

Share with the team, separate from the class, that they are the leaders of the event and were chosen to be there for a reason. Remind them they are setting an example for the rest of the class and that this is a great résumé building experience. It will also help them throw great parties outside of class!

### Support

- **Approval:** This team will need approval from you on a regular basis. Check in with them regularly.
- **Venue:** Double check they have secured an appropriate venue.
- **Team Interviews:** This team is tasked with interviewing other teams to figure out what they will be doing during the event (and recording it in their packet). Review this with them to help them assess what team will need the most support.
- **Agenda/Map/Invitation:** Review and approve their map and agenda before they share it.
- **Invitations:** The Event team should work with the Public Outreach and Design teams to extend invitations.
- **Food:** If they decide to have food (a good idea) they may need some help finding appropriate stores/restaurants that will donate food that is healthy, local and organic. Encourage them to make food and share recipes with guests or have them connect with the Fundraising team to sell food at the event.
- **Sustainability:** Remind them they should be setting an example of how to have a low-impact event. Review the principles in their packet with them.
- **Team Roles:** Check with them to ensure they are filling their roles:
  - Someone from this team will be the emcee for the event.
  - They are also responsible for assigning teams (led by one of them) to: (a) set up, (b) clean up, (c) check-in and (d) organize food the night of the event. They should assign people whose team responsibilities are not event intensive (i.e., the Design and Lesson teams).
  - A Task Master will be responsible for checking the class in for the event using the Task Master Sign In Form.
- **Rehearsal:** This team will coordinate a rehearsal prior to the event. Make sure they plan, communicate and prepare everyone for this.
- **Week of Event:** They are responsible for printing the agenda, sign in sheets and feedback forms for the sign-in table.
- **After the Event:** This team is responsible for sending thank you notes to everyone that helped make the event possible, including people that donated, purchased items or attended.

**2. PRESENTATION TEAM**
This team will provide the substance of the event and should consist of good researchers and communicators.

**Inspire**
Let them know they are a key element and that the event hinges on them giving a grand performance. They will deliver the most important message of the event.
Show them some examples of creative, original and effective presentations.
Encourage students to watch presentations on TED (Technology, Entertainment, Design - http://www.ted.com) for examples of confident, inspiring, socially and environmentally conscience presentations.

**Support**
- Remind them they should be experts on their issue/solutions and ready to answer audience questions.
- Share with them that the only reason people should give presentations is to move or inspire action (not just to share information), therefore how they deliver the presentation is just as important as the information they give.
- Before they work on their presentation have them write down the qualities of an effective/in-effective presentation.
- **Approval:** Review and approve main points and storyboard before they create their slides. You should also approve their final presentation before rehearsal/practice.
- **Practice:** They should practice their presentation twice and incorporate feedback from the class (using the Feedback Form). The first practice should focus on content, the second on delivery.

**3. PUBLIC OUTREACH TEAM**
This team will be in charge of all the messages that reach the public leading up to the event. They should be outgoing and well-spoken.

**Inspire**
- Have students review effective newspaper and magazine articles and let them know this is their goal. Bring in a poster board ahead of time and tell them that you will use it to display all the news coverage they get.
- Have each of them bring in a copy of a newspaper/magazine/blog that they would like to see their class covered in (relevant and realistic). Have them identify contact information for the editors of the relevant column (to add to their media list later on).
- Let them know they will be asked to use Facebook and Twitter as part of their grade!

**Support**
- **Press Release**: Share examples of effective press releases. Check in with them on the interviews they conduct to get quotes for their press release (remind them that this is also a good opportunity to invite those people to the event). Review, approve and help them send the final press release (at least 2-3 weeks before the event). They should be calling each contact before sending an email. Make sure you are copied on the email when it is sent.
- **Building a media list**: Explain that publications have different editors for different kinds of stories. Have them research past articles to help find the right editors.
- **Invitations:** This team is responsible for inviting the public. They should work with the Design team to make fliers for posting around the neighborhood and at local markets/cafes.
- **Social Networking**: Have a conversation about proper conduct on Facebook and Twitter. If your school does not allow school access, it will be required “homework.” They should use a school or club account for these, not their personal accounts. Check the calendars, blogs, Facebook and Twitter accounts they create and post to.
- **Week Before Event**: If press plan to attend the event have them practice their talking points and Q&A with each other.

**4. DESIGN TEAM**
This team is for your students who are artistically inclined and computer literate. They may need help merging their artistic skills with their writing skills to make a powerful project.

**Inspire**
- Bring in fliers, ads and designs that inspire you. Encourage them to look at www.Good.is for examples of good, informative design.

**Support**
- **Ideas:** Ask each person to bring in designs they like. Have them discuss what they like about each design with the team. Most importantly, have them identify and discuss what message each design is trying to communicate and whether it is effective. Have them identify the five most important characteristics of effective printed marketing materials.
- **Purpose**: Help the team decide on the purpose of their materials and what other team(s) they will support with their design (e.g., Public Outreach team with invitations and fliers, Event team with signage and agenda).
- **Design**: Unless they are using images, painting or creating collages, they will most likely need to create their designs on the computer. Adobe InDesign or Photoshop are best for this (but require knowledge and software). Google SketchUp is free but also requires knowledge. PowerPoint and Keynote are better than Word and fairly easy to learn. Consider having a graphic design college student come in to help them.
- **Approval:** Approve all materials they will be printing or posting online for grammar, correct event information and effectiveness.
- **During the Event:** Aside from displaying their photos this team will have time for additional roles during the event. Have them connect with the Event team to fill other roles (greeting, set up, clean up, food, etc.)

**5. LESSON TEAM**
This team will share your solutions with younger audiences. They should be energetic, creative and good with kids.

**Inspire**
- Tell the team they get to be the teachers and inspire other students. Tell them the story of how/why you become a teacher. Explain that they get to outdo all of the boring teachers they have had in their life and show you how they best like to learn.

**Support**
- **Planning**: Have students observe their teachers. Ask them what they like and what they should avoid in their own lessons. Ask them what qualities an effective lesson plan has. Do you think your teachers' lessons are effective? Why? Why is it important to have a plan when you step in front of a class?
- **Activity**: Let them know this is the most important element of their lesson. It should be interactive and fun. This is where and how the learning should occur (not in the lecture).
- **Standards**: Double check that lesson plan links to a science & sustainability standard.
- **Arranging a Lesson**: They may need help arranging to deliver their lesson(s) at an elementary school. Confirm with the teacher and make sure they get permission from their own teachers if they are missing class to deliver the lesson. Escort the students to the school but have them take the lead when they arrive.
- **Practice**: They should practice their lesson and activity for the class at least twice. They should have all materials necessary. Focus the first time on content and the second on delivery.
- **During the Event**: They may choose to give their lesson at the event if appropriate or they can set up a table/booth for people to stop by beforehand. If they do not have a booth have them connect with the Event team to help with greeting, set up, clean up or food.

### 6. FUNDRAISING TEAM

**Inspire**
- Let them know because of their efforts the class will get to share a solution beyond the school walls. The class should decide what and with whom they want to share (e.g., a composter for the local elementary school).

**Support**
- **Ideas**: Have them involve the class in deciding what (in the community) the money will go towards (e.g., installing a composting bin at the local elementary school
- **Items**: Help them brainstorm ideas of what to sell. It should be something that solves a green issue (like native plants, composter or fork pouches) or something that promotes a solution (like a t-shirt or hat with a message on it). It should be sustainable, functional, people should want to buy it and it should make more money that it costs. Raffles are always fun and easy.
- **Approval/Purchasing:** Students will need your approval on their Fundraising proposal. Make sure it will make money and that the item(s) are useful. They will also need your help arranging funds if they are buying anything.
- **Before the Event**: They need a sign that explains what the money will be raised for.
- **During the Event**: Students must keep track of every item sold (with signatures from each buyer).

### 7. PHOTO STORY TEAM

**Inspire**
- Bring in photos you love that also tell a story. Ask them to bring in their favorite photos and have them tell you why they are inspiring. Chris Jordan's work is a good example (http://www.chrisjordan.com/). Ask the students what is effective about the images or series of images and have them discuss how they were taken.
- Remind your students that a picture is worth a thousand words. Ask them how they can help others visualize the issue and solution. Is there a shocking statistic they can illustrate?

**Support**
- **Preparation/Approval**: Have the students share their ideas with you before they create their storyboard. Approve their storyboard before they take the photos. Their storyboard should include the location and time of day for each photo.
- **Equipment**: Help the students get access to a digital camera, a computer and a color printer. Consider having a photographer come in one day to give them some pointers.
- **Shooting**: They should take LOTS of photos. Help them review their photos and pick the best ones. Once they have picked their top choices have the class vote on them
- **Sharing**: Help them get creative in the way they share their photos. Mount them, project them with music, etc. Also, make sure they work with the Public Outreach team to share the photo story online.

### 8. GAME TEAM

**Inspire**
- Explain to students they will be providing the fun, interaction and laughter for the event.
- Bring in a couple of games for them to play. Have them write what they like/don't like. Have them recall childhood games that do not require many props (ex: Duck-Duck-Goose).

**Support**
- **Planning**: What are the characteristics of an effective game? What do they get people to do?

- **Creating the Game**: Ask how the students will create a way to gauge what was learned from playing the game. Request they create a game you can keep and use as an example (or to play) in the future.
- **Practice**: The game should be played by the class and revised based on feedback.

**9. VIDEO TEAM**

This is a hard task for many but easy for those who are cinematically inclined. Be sure to put someone with video experience on this team.

**Inspire**

- Inspire the team with the idea that they will not only be entertaining guests at the event, but also sharing an important message with people around the world. They have the chance to shape culture as we know it by posting online. Let them know that if it is good they can submit it to a youth or environmental film festival.
- Select a short video that effectively presents an issue and solution to show them what they could be creating. A short PSA (public service announcement) is a great way to show how to effectively pass a message in 30 seconds.

**Support**

- **Ideas**: Have the team watch short films on environmental or social issues (The Story of Plastic Bottles and Alec Loorz's iMatter are good examples). Here is a link to what ECHS students have created: http://greenambassadors.org/main/multimedia. Have them write what makes them effective or ineffective and what elements they think went into them (script, graphic design, photos).
- **Planning:** Tell students their goal is to learn how to plan all the things they will have to do to produce a video. Help them understand that most of the work comes in planning and pre-production (script writing, storyboard, casting, practice).
- **Approval**: Have teams share their storyboards and script with you and another team or the class before filming. You should also approve their rough and final cuts before they are shared with the class or public respectively.
- **Mentor/Equipment**: Line up a mentor who has considerable experience in filming and editing to come and support this team and/or bring equipment/editing software. The mentor should provide support after they have their idea, script and storyboards prepared.
- **Posting/Sharing**: Make sure they have posted the video online. Suggest they work with the Public Outreach team to share the link on Facebook/Twitter and with relevant media outlets.

GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

**SYLLABUS**
**Green Ambassador Class in Community Organizing**

| **Teachers:** | **Email:** | **Office Hours:** |
|---|---|---|
| **Location:** | **Times:** | |

**Contact: Program Overview**

Green Ambassadors is a service-learning, project-based, college-prep course. In this course, you will become an agent of change engaged in learning about local environmental issues and solutions. You will learn community organizing skills and how to empower your own communities (school, parents, neighbors, friends, peers) to understand environmental issues and implement solutions through events and presentations.

**General Program Objectives**

- Students will understand and evaluate a variety of sustainability issues and solutions.
- Students will learn how to plan and deliver presentations, lessons and events that engage a community in sustainability issues and solutions.
- Students will act as agents of positive change as they provide direct and valuable services to their own communities.

**Year-Long Course Content: Description**

The "Issues and Solutions" sections of the course address: (a) Get Connected (b) Reuse · Recycle · Rethink (c) Encounter Water (d) Eat Green and (e) Nothing Wasted.

The specialized Green Ambassadors curriculum includes training in ten areas of communication and community activation: 1. Event Production, 2. Creating and Delivering Presentations, 3. Filmmaking, 4. Photo Story Creation, 5. Design and Production of Marketing Materials, 6.Social Media & Marketing, 7. Fundraising, 8. Public Relations, 9. Designing and Delivering Elementary Lessons and 10.Games as Learning Resources.

**Required Materials**

1” Binder Reader (provided to you in class, which will remain in the classroom), recycled paper (use paper that has only been used on one side), recycled pen or pencil, and your energy and enthusiasm to make a difference.

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**SYLLABUS**
**Green Ambassador Class in Community Organizing**

Course content relates to three subject areas:

1. **Science and Technology**: Concepts and principles that underlie sustainable practices and technologies in the zones of transportation, water management, agriculture, recycling, energy production, energy efficiency, etc.
2. **Language Arts and Communications**: The production of coherent, comprehensive and effective communications in the forms of writing, speaking, slide-based presentations, photography and video.
3. **Social Science:** An understanding of types of community organizations (local government, business, non-profit, educational) and their roles, as well as the relationships of local, state, and federal level agencies and organizations, as applied to the production of events that successfully disseminate sustainability solutions.

## Learning Objectives

### *Sustainability Issues and Solutions*

- Students understand systems as collections of interacting elements and can analyze some natural and manmade systems to determine their own carbon footprint.
- Students understand the characteristics of healthy soil and can make compost.
- Students understand why water should be conserved and how to do so at residential level.
- Students can differentiate between sustainable and non-sustainable food production and consumption practices and explain the basis of that differentiation.
- Students understand why energy should be conserved and can describe several methods of doing so at a residential level, including analysis of payoff time for investment into energy-conserving products and technologies.
- Students can explain the environmental impact of personal transportation choices.

### *Communication and Community Activation*

- Students believe they have a responsibility to contribute to the wellbeing of their community and work to gather and share knowledge that supports the wellbeing of their community.
- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes by using film, presentation, marketing, event production, social marketing, fundraising, public outreach and lesson planning.

GREEN AMBASSADORS
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**SYLLABUS**
**Green Ambassador Class in Community Organizing**

Course Content: First Semester Schedule

| **Course Content: First Semester Schedule** | |
|---|---|
| **Weeks 1 - 4:** | Get Connected: Systems Thinking, Permaculture, Carbon Footprint |
| **Weeks 5 - 7:** | Reuse · Recycle · Rethink: How to turn trash into soil |
| **Weeks 8 - 17:** | How to Be a Green Ambassador: Students divide into groups to learn how to effectively share environmental solutions. |
| **Week 18:** | **BENCHMARK:** Host a community event on Reuse · Recycle · Rethink Evaluation and Reflection on the event. |
| **Course Content: Second Semester Schedule** | |
| **Weeks 1 - 4:** | Encounter Water |
| **Weeks 5 - 6:** | How to Be a Green Ambassador: Students divide into groups to learn how to effectively share environmental solutions. |
| **Week 7** | **BENCHMARK:** Host a community event on encountering water. Evaluation and Reflection on the event. |
| **Week 8 - 12:** | Eat Green |
| **Weeks 13 - 14:** | How to Be a Green Ambassador: Students divide into groups to learn how to effectively share environmental solutions. |
| **Week 15:** | **BENCHMARK:** Host a community event on Eat Green. Evaluation and Reflection on the event. |
| **Weeks 16 - 18:** | **BENCHMARK:** Nothing Wasted, How to Be a Green Ambassador. Host a smaller community event about the solutions. |

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**Course Grading**

| *%* | ***Description*** |
|---|---|
| 10% | Warm Ups |
| 40% | Benchmark |
| 20% | Homework |
| 30% | In class work and participation. |

A = 90% B = 80% C = 70%

Students must successfully complete all performance tasks and participate in all community events to pass the class.

**Attendance Policy**

Be on-time every day and for every meeting. 3 tardies = 1 absence. 15 minutes late is counted as an absence. 10 or more classes missed = course failure.

# GREEN AMBASSADOR
## agent of change

On the _____ day of _____ the year _____

_____

is recognized as a community leader and
agent of sustainable change

Congratulations on the successful completion of the Green Ambassador Program. You demonstrate expertise in sustainable practices and your service for the community and the environment serves as an example for all. We wish you a future of lifelong learning and success.

GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

_____ _____

Signed by Of

GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

# GREEN ACTION PLAN

## ISSUE

What issue will you solve (specific to your class/campus/community)?

## SOLUTION

How will you get "hands-on" to turn your issue into a solution?

## GOAL

What will you accomplish?
Goals should be S.M.A.R.T.
Specific, Measurable, Achievable, Realistic, Timely

## HEADLINE

If, at the end of your project, your favorite newspaper/magazine wrote an article on your project, where would it be publicized? What would it say?

## OBJECTIVES

How will you accomplish your goal? These steps should involve your hands more than your mouth.

1
WHAT?

WHO? .....
BY WHEN? .....

2
WHAT?

WHO? .....
BY WHEN? .....

3
WHAT?

WHO? .....
BY WHEN? .....

## NAME

What will you call your project (this is your tagline, make it clever and catchy)

## NEEDS

What do you need to make this project happen?

## RESOURCES/PARTNERS

Who can help you make this happen? (Think about teachers, administrators, parents, local organizations, etc). What do you already have that will help you make this possible?

## FUTURE

How will you make sure your project will keep going after the first month, after this class, after you graduate?

GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

# GET CONNECTED

## G.R.E.E.N Teacher's Guide

**ESSENTIAL QUESTION:**
**How am I connected to everything on this planet?**

**Students will gain an understanding of composting as a solution to household waste and lowering their personal eco-footprint.**

- Approximate Time: 3 weeks
- Benchmark: Using the Green Ambassadors curriculum, students will produce an event to share what they've learned about Recycling Organics and encourage others to compost.

## STANDARDS

**National Science Standards:**

**12CLS4.2** Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.

**12CLS4.3.** Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

**12FSPSP3.1** Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.

**12FSPSP3.2** The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.

**12FSPSP3.3** Humans use many natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

**12FSPSP4.1** Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans. [See Content Standard C (grades 9-12)

**12FSPSP4.2** Materials from human societies affect both physical and chemical cycles of the earth.

**12FSPSP4.3** Many factors influence environmental quality. Factors that students might investigate include population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.

**National Education for Sustainability K-12 Student Learning Standards**

**Grades 9-12, EfS 1.1: Intergenerational Equity** – Students forward an ethical argument on how sustainable resource use today can lead to basic human needs (e.g.: food, water, energy and shelter) being met for future generations (e.g.: 100 years in the future).

**Grades 9-12, EfS 2.2: Respect for Limits** – Students collect data in order to investigate and analyze how personal consumption patterns affect the sustainability of natural and human communities.

**Grades 9-12, EfS 3.1: Personal Responsibility** – Students identify and commit to a personal sustainability action and they write about the results of that action. (e.g.: using public transportation, reducing and recycling).

**National Council of Teachers of Mathematics Principles and Standards for School Mathematics**

Instructional programs from pre-kindergarten through grade 12 should enable all students to:

- Compute fluently and make reasonable estimates.
- Recognize and apply mathematics in contexts outside of mathematics.
- Understand measurable attributes of objects and the units, systems, and processes of measurement.
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

## OVERVIEW OF GUIDING QUESTIONS

1. What does it mean to be Green? What does it mean to be an Ambassador?
2. What is a system? What is my role in the ecosystem?
3. What is wrong with my current system?
4. What solutions create a healthy system? How do we share these solutions?

## RESOURCES

**Handouts**

- Getting Connected Exercise Packet
- Create a Syllabus
- "Story of the Planet" speech by Jordan Howard
- Escape from Affluenza – http://www.docstoc.com/docs/27512067/PBS-Affluenza-Video-Worksheet/
- Ecological Footprint Handou – http://www-heb.pac.dfo-mpo.gc.ca/community/education/lessonplans/ecofootprint/downloads/ecofootprint_handout_e.pdf

**Films/Videos**

- Story of Stuff – http://www.storyofstuff.com/
- Rap on Permaculture – http://www.youtube.com/watch?v=_5LjKhlJucw
- Affluenza
- No Impact Man
- Home
- 11th Hour

**Websites**

- Oh Deer Lesson Plans – http://www.eduref.org/Virtual/Lessons/Science/Ecology/ECL0043.html
- Community System Lesson Plan – http://hubpages.com/hub/Community-Systems-Lesson-Plan
- How Much Garbage Does One Person Create in a Year – http://www.wisegeek.com/how-much-garbage-does-a-person-create-in-one- year.htm)
- Team Building Activities – http://wilderdom.com/games/InitiativeGames.html
- Ecological Footprint Calculators
  http://www.footprintnetwork.org/en/index.php/GFN/page/personal_footprint/
  http://www.myfootprint.org/en/visitor_information/
  http://www.earthday.net/footprint/flash.html
  http://www.ecologicalfootprint.com/
  http://www.footprintofnations.org/Global%20Footprint%20Calculator/GFPCalc.html

**Guest Presenters/Field Trips**

- Trip to permaculture center or project (i.e. Quail Springs or Strawberry Flags)
- Permaculture Expert
- Action for Climate Education (ACE) assembly or presenter (http://www.acespace.org/)

**Books**

- The Lorax
- Facing the Future

**Materials**

- Markers
- Paper
- Internet access
- Recycled cardboard boxes (to use as poster boards)

## GET CONNECTED HERO

**Michelle Obama: Sustainable Systems**

Michelle Obama was born January 17, 1964. She grew up in a working class family in which education was very important. After high school, she was accepted at Princeton University for college. There were not many black students at Princeton at the time, but Michelle excelled through hard work, graduating with honors. She received her graduate degree at Harvard Law School, and then worked in a private law firm where she met her husband, Barack Obama. Inspired by the memory of her father, she gave up her lucrative corporate position in 1991 to help people from the Chicago community where she was raised. She took a series of positions in city government, non-profit organizations, education and healthcare.

After her husband was elected President in 2009, Michelle turned the White House into a national example of sustainable agriculture. She tore up part of the White House Lawn and planted an organic garden, setting an example that has encouraged many Americans to grow their own gardens. She has endured heavy criticism from the pesticide and fertilizer industries that expressed disappointment by her decision to make the White House garden organic.

The White House garden was designed as a system, borrowing concepts from permaculture. For example, the garden harnesses the natural relationships between plants and animals to create a sustainable garden syste. Bees are kept to pollinate the flowers and bright flowers are planted to attract predatory insects like ladybugs and praying mantises that eat pests, preventing the use of harmful pesticides. The First Family, the White House staff and a class of 5th graders from a nearby school share the work of maintaining the garden. With this project, Michelle Obama has demonstrated that there are alternatives to industrial agriculture, which is a major source of pollution. She has also shown the country that eating a sustainable, healthy diet starts at home. She is a wonderful role model because of her persistence and devotion to helping her community and her willingness to get a little dirty in the name of protecting the planet.

# 1. WHAT DOES IT MEAN TO BE GREEN? WHAT DOES IT MEAN TO BE AN AMBASSADOR?

**Summary**

Students will use the documentaries of Green Ambassadors as resources to become familiar with the idea of being green and the importance of being an ambassador for these solutions. Students will show their understanding by creating a presentation to demonstrate ways they can be 'green' in their own lives.

**Activity Ideas**

**1) The Story of the Planet**

a) Read the speech written by Green Ambassador youth leader Jordan Howard and discuss:

- What annoys Jordan about being green?
- What does being "green" mean for Jordan?
- Why did Jordan become an Ambassador?
- What is an Ambassador?
- Why does change have to start with you?

**2) Rap on Permaculture**

a) Watch the short "Rap on Permaculture" video (http://www.youtube.com/watch?v=_5LjKhlJucw) and explore the issues and solutions being raised by the movie. You might have to watch it a few times for students to grasp and understand it.

b) Discuss:

- How water, food and energy are connected; how does one relate to the other?
- What does being green look like?
- Read "Get Connected" Michelle Obama's story.

**3) iMatter: Student Goals and Accomplishments**

a) Discuss the importance of goal setting and short vs. long term goals.

b) Have students participate in goal setting by writing:

- A goal for being green
- A goal for being a good student
- A goal for being an ambassador
- A goal for life

c) Watch student produced films/projects, including:

- "A Day in the Life" and other student-produced films on www.GreenAmbassadors.org
- "iMatter" by Alec Loorz (http://www.youtube.com/watch?v=n6lpld1bc4g)

d) Discuss some of the student's accomplishments and what kind of goals these students might have had/have.

e) Have students revisit and revise their goals and determine how they will align their accomplishments in this class with their goals.

f) Have students answer this question: If, at the end of my life, they were to write one sentence about why "iMatter," what would it read?

**4) "A Day in My Life" Presentation**

a) Have students create a 10-15 slide presentation about a day, week, or weekend in their life. The slides must contain at least 3 examples of ways they could 'green' their life.

b) Give students a handout on creating and delivering presentations. Model an effective presentation and discuss effective slides. Observe student comfort level in presenting and creating slides (are they best with design and photos, research and content or delivery). Use these observations to set personal goals with students and to creating dynamic groups throughout the curriculum.

**Assessment**

- Student syllabus: Read and signed by their parents
- Goal setting and sign off
- "Green My Life" slides and presentation

## 2 WHAT IS A SYSTEM? WHAT IS MY ROLE IN THE ECOSYSTEM?

**Summary**

Through presentations, explorations, students will understand how to identify systems and think systemically.

**Activity Ideas**

**1) Classroom as a System**

a) Discuss the classroom as a system. What are the inputs (i.e. students, lights, paper), what are the outputs? (i.e. education)

b) What makes the classroom healthy? What makes the classroom unhealthy?

c) What can they do to create a healthy environment and set those as the classroom norms. What are the consequences for causing an unhealthy system?

d) Write them up on a poster board and constantly refer to them.

**2) Community as a System**

a) Community Guilds Map

- Explain that in permaculture, within each community there is a guild—or a group of things that work well together. For example: in your community the lumberyard, the builder and the painter make a good "home building" guild. The quintessential example of a guild is the Native American Three Sisters Garden: corn provides a trellis, beans provide nitrogen for the other plants, and the squash serves as groundcover to the soil, keeping it cool, moist, and alive. Together, they make a meal with protein and fiber.
- Have students draw a map of a guild within their community or home. Who and what are the working parts? How do they interact with each other? What does each element provide for the other? Could one survive without the other?

b) Have students complete the following activity on stopping violence within a community system: (http://hubpages.com/hub/Community-Systems-Lesson-Plan)

- Once students understand a community system, each will be able to identify when and why a community system confronts violence. Then they will be able to identify a community system that perpetuates violence, how to make violence stop, and why a community system works.

**3) Ecological Systems**

- Play the game, OH DEER (http://www.eduref.org/Virtual/Lessons/Science/Ecology/ ECL0043.html)
- Have students look at an ecosystem on the school campus, draw a sketch of it and write how it relates to what you just experienced in the "OH Deer" game.

**Assessment:**

- Discussion and activity participation
- Draw and share a community guild map
- School ecosystem drawing/write-up

## 3 WHAT IS WRONG WITH MY CURRENT SYSTEM?

**Summary**

Through observation and reflection, students will examine the biggest issues with our current system of consumerism and convenience.

**Activity Ideas**

**1. What is wrong with our current system?**

a. The Story of Stuff

- Have students watch The Story of Stuff, a great 20-minute animation of the consumerist society.
- Have student's share what their biggest "Golden Arrow" urges are.
- Have students share one experience they've had with both "perceived obsolescence" and "planned obsolescence."
- See other curriculum resources (www.storyofstuff.org)

b. Alliance for Climate Education

- Invite a guest presenter from ACE (Alliance Community Education, http://www.acespace.org/) to talk about the issues of global climate change.
- Discuss the issue of global climate change as well as the presenter's skills and methods. What worked well? What engaged you? What lost your interest?

c. Affluenza

- Have students watch Affluenza, a PBS program on the high social and environmental costs of overconsumption and materialism.
- Complete the Affluenza worksheet (http://www.docstoc.com/docs/27512067/PBS-Affluenza-Video-Worksheet/).

**2. Picture This**

a. Show Chris Jordan's Photography Collection, which depicts the consumption of our "system"

- "Running the Numbers: An American Self Portrait"
- "Running the Numbers II: Portraits of Global Mass Culture" (http://www.chrisjordan.com/)

b. Look at Good Magazine's infographics (http://www.good.is/departments/transparency/)

- Review the "How Far Our Food Travels" (http://www.good.is/post/transparency-how-far-your-produce-travels/) and "How Carbon Emissions Have Changed" (http://www.good.is/post/transparency-the-change-in-carbon-emissions/) graphics.
- Have students select and share their favorite infographic on the site.

c. Discuss the difference that a statistic makes when you can SEE IT and the importance of visual representation.

**3. What is my role in our current system? How can I change my role?**

a. Personal Ecological Footprint Survey

- Have every student take an "ecological footprint quiz" online (or in PDF format if you don't have access to computers in your classroom).
- Explain what an ecological footprint is, how it is measured, how much room we have on planet earth, and why we need to reduce it.
- Before they take the quiz, have students determine how much land they think they need and why.
  - Have students share or graph what they scored in each area. Determine the highest areas for the class as a whole.
  - Have students compare their footprint to the average footprint from a developing country. Have them reflect on why there is such a large difference.

b. Personal Ecological Footprint Exercise

- Have students complete the Get Connected Student Exercise Activity 1: "What's My Carbon Footprint" activity to identify ways in which ecological footprints can be lowered.

**4. What is my school's impact on our current system?**

a. School's Ecological Footprint Survey

- Search, "School Ecological Footprint" to select the most appropriate guide for your and your students to determine your school's ecological footprint.

b. School's Ecological Footprint Exercise and Poster

- Have students complete the Get Connected Student Exercise Activity 1: "What's My School's Ecological Footprint" activity to identify ways in which they can lower the school's ecological footprint.
- As part of the exercise, students will work in groups to create a poster to use to encourage the school to take actions that will reduce its ecological footprint.

**Assessment:**

- Affluenza worksheet
- Personal Carbon Footprint Survey
- Get Connected Student Exercise Activity 1: "What's My Carbon Footprint"
- Get Connected Student Exercise Activity 1: "What's My School's Carbon Footprint"
- School Ecological Footprint Poster

## 4. WHAT SOLUTIONS CREATE A HEALTHY SYSTEM? HOW DO WE SHARE THE SOLUTIONS?

**Summary**

Students will learn about actions they can take to be a healthy part of their school and community systems.

**Activity Ideas**

**1. What is permaculture?**

a. Share the ethics of permaculture with the students

- Care of the Earth
- Care of People
- Setting Limits to Population & Consumption

b. Find a reading, PowerPoint, or short movie on teacher tube that will explain permaculture

c. Find a guest speaker to deliver this message to the students.

**2. Map Your School**

a. Have students create and draw a map of the school. Assign one element to each group and then make a collective map. Have students pay special attention to inputs/outputs and systems:

(1) Water: Where is water coming from? Where does water flow on campus (the lowest points on campus?) Where and how does water drain off of campus?

(2) Waste: Where is trash collected throughout campus? Where is ALL the trash gathered and stored?

(3) Recycle: Where can you recycle on campus? Where is ALL recycling material gathered?

(4) Energy: Where are alternative uses of energy being created?

(5) Gardens/Life: Where are the school gardens? Where is the habitat for different kingdoms to live?

**3. School Tour**

a. Watch the video, Tour of Environmental Charter High School. (find on www.echsonline.org)

b. Have students break into teams and identify 3 projects they could start on campus to make their school system healthier (related to or separate to the video).

c. In groups, have students create a tour of their school that showcases the ecological and healthy events that are happening on campus or that they'd like to have happen.

- The tour should include the words: ecological, habitat, permaculture (and reference what permaculture principles are being demonstrated on campus). It should include the facts from the School Ecological Footprint and offer solutions during the tour that will educate others about what is being done, but also what could be done to make it healthier.
- There should be one slide for each element or project (or potential project).
- Each slide should show photos and a description of what it is.
- In the "notes" section, have student's write "talking points" of what they'd say if they were giving a tour.

d. Prepare the students for their tours:

- How and where do you start the tour? How do you introduce yourself? How do you speak? How do you make it interactive? How do you ask questions? How do you stay positive? How do you close the tour and ask for questions?

e. Play "How not to give a tour" Charades

- Hand out cards of things you don't want students to do. Have each person act out the "not to do" as the class guesses what it is. (talking away from the crowd, talking quietly, talking to friends, not the group, ignoring and passing by trash, not knowing the path to walk, etc.)

f. Have each team give their "campus tour" to another class or group of students.

g. Have tour recipients fill out a feedback form.

h. Have students reflect on the tour

- How do you think you performed as a tour guide?
- What did you learn from your audience?
- What was the best question someone asked?
- What question couldn't you answer? What is the answer to that question?
- Did you enjoy giving the tour?

i. Consider making school tours a part of regular guest visits.

**4. Green Job:**

a. Read Pandora Thomas' story and discuss how one can get paid doing what they love and doing something good at the same time.

**Assessment**

- School Map
- School Tour: Group Slide Show
- School Tour: Group Tour (and recipient feedback on whether it included the elements you made mandatory)

## GREEN JOB | GET CONNECTED

**Pandora Thomas**

**Curriculum Manager, Environmental Service Learning Initiative Director:**

Pandora Thomas has always felt the need to give back to other people. This desire led her to become a teacher after a college career spent studying Religion, Peace, Women and Black Studies. Ever since she was a child, she felt a deep spiritual connection to the earth and the people and animals that share it. So, as an elementary school teacher, she began to look for ways to incorporate environmental studies and multiculturalism into her lessons. During the summer, she taught classes on farming and gardening.

To continue her education, she went to graduate school first in New York and then in Boston, learning about social justice and urban and environmental planning. In grad school, Pandora began to understand how permaculture and green building techniques could be used to improve the lives of underprivileged people, while helping the planet at the same time. Since then, she has devoted herself to increasing opportunities for environmental education in all types of communities.

School gave Pandora many of the skills she needed to succeed, including research, networking, working with others, community building, teaching and mentoring. However, she also sought hands-on opportunities to round out her education. For example, she has completed internships that involved building green schools, working with an Afro-Venezuelan community in Venezuela, working at the Bronx Zoo's summer camp for girls and living at The Farm, an alternative community in Tennessee. Her life is a wonderful example of how many interesting and exciting experiences you can have with a green career.

In her role as an environmental educator, Pandora places city college students at internships with green companies, so that they can gain the experience they need to make a difference in the world after college.

She also trains students in ecological literacy, writes curriculum and trains other environmental educators. Pandora loves her job because it gives her the opportunity to interact with so many people and touch so many lives, and because it allows her to make a difference.

Pandora believes that planning for a green career is great, but only shows half the picture. She explains, "More important than green jobs are green experiences that enables people to love themselves and the land. Green jobs can give you money, but if the attitudes don't change, then people will continue to exploit the earth's resources and make it hard for us to continue to live on this planet. A green job can help someone do something good for the world, while reconnecting them back to the earth's cycles as well."

# THE STORY OF THE PLANET

**Speech Written by Jordan Howard, Green Ambassador Youth Leader, November 2009**

**Opening**

Today you have heard lots of stories about the future of the planet…some scary, some hopeful, some full of promise.

As bad as some of the predictions sound, we don't have to accept them. We don't have to be victims.

I'm here to tell you that the story of our planet can have the ending that WE choose. And it begins with each one of us rewriting our own story and the story of the planet… and making it green.

I know it's possible because I've rewritten MY story and that has changed MY life and is beginning to change others' stories as well. I'm seeing that when we ACT local we do IMPACT global. Thank you to Mayor Villaraigosa's office and Million Trees LA for allowing me to share my story with you today.

Four years ago when I entered high school, my story was pretty typical.

Shopping, hanging out with friends, popularity, and more shopping. It was all about me. Yes, I went to Environmental Charter High School, but the environmental aspects of the school were the furthest from my mind. I led the resistance to the green movement in class. I was always the only student questioning the importance of the environmental education. But the story I was writing didn't work for me.

Forced to take the Green Ambassadors class my sophomore year, I learned that I was only resistant because, in the past, I was only fed one side of the story, the negative effects. I was quickly inspired by solutions. Bags made of corn, energy harnessed from the sun, cars powered by electricity, organic food actually tasting good. There are solutions to all of our problems. We KNOW exactly how to live sustainably in the world.

That's when I learned it was my job as an ambassador, as a GREEN ambassador to educate people on these solutions and how to live a green lifestyle. And by rewriting MY story, by changing MY lifestyle and the choices, how I interacted with the planet, would make a difference and would soon inspire others to do the same.

Now, I'd like to tell you three stories, three stories that are shaping our current planet, right now.

**Plastics**

The first story started out to be a happily-ever-after story. In the 1950's, American technology created a strong, durable product. The plan was to make our lives more convenient. But, that product, plastic, soon became a menace to the environment – its dangers far outweighing its benefits. To give you an idea of the problems:

- Plastic is not biodegradable – it never breaks down completely, but remains in the environment forever.
- Today in the United States, 93 million plastic water bottles are thrown away every single year. 93 million… that's enough to reach the moon and back…38 times.
- Plastic wrappers, bottle caps, straws, bags, bottles, toys that aren't sent to the landfill end up in our oceans – and threaten nearly 200 different species a year. That includes: whales, dolphins, seals, turtles, and sea birds.

Many die, but for others like this turtle Maywest, the plastic becomes part of their body.

When Maywest was young, she swam into this plastic. Because she is a turtle, help her remove the plastic from around her, because the plastic stayed and her body developed around it.

Plastic should only be reserved for items that we use for a long time – like computers, cell phones, chairs, ipods.

**So what can we do?**

- Remember we're rewriting stories today. Last spring, I organized and led a group called Rise Above Plastics or R.A.P., a student speakers series that was created in partnership with The Algalita Marine Research Foundation, Surfrider Foundation, and the Green Ambassadors.
- I trained over 20 youths to rise above plastics, and then inspired them to join together and facilitated their speaking tour to educate over 1000 teens, adults, and younger children through 35 presentations, all over Los Angeles about the harms of disposable plastics on the environment.

We saw people consuming disposable plastics not as a problem, but as an opportunity to teach them. RAP is not done rewriting the story of plastics; we have begun training new members and will train youth from other schools to deliver RAP to other schools across the state.

The bulk of our presentation is about solutions. The most important thing you can do is Rise above disposable plastics! Choose alternatives: reusable bags, reusable bottles or canteens, REFUSE straws or buy a stainless straw and reuse it. REFUSE Styrofoam containers at restaurants and bring your own Tupperware.

**Trees**

Your choices can make a huge impact and change the way we use plastic – if you refuse to use plastics, production will SLOW and eventually STOP.

My next story is a happy story.  The story of trees.

The benefits of trees are really obvious:

- Trees beautify a home, a neighborhood, a city, a country.
- Trees provide shade and comfort.
- Trees are natural vacuum cleaners, absorbing carbon dioxide in the air and lowering the effects of global warming.
- Some trees even provide fruit.
- Trees hold our planet together and help restore our aquafiers (link it to water and find a fact)

I want to introduce you to a star of this story, Felix Finkbeiner, an amazing 11 year-old from Germany. Two years ago, Felix learned about Waangari Mathai, one of MY eco heroes, who started the Green Belt Movement in Kenya.  Through this movement, Waangari Maathai has planted 30 million trees in 12 African countries.

Felix knew if Wangari Maathai could plant 30 million trees, he could handle 1 million in Germany. After learning about Wangari Maathais' story, Felix wanted to re-write the story of youth in Germany.

Felix initiated a program in Germany, Plant for the Planet, which aims for schools to plant one million trees in Germany.  Felix travels to different schools around the country, giving presentations about the importance of tree planting and inspiring students to have tree-planting events in their schools.  So far, youth from all over Germany have planted more than 530,000 trees.  And now, Felix has taken his movement global, planning to have youth from all over the planet plant one million trees in their own countries. This story began with one person and is having a powerful global impact.

The good news is you don't have to wait for Felix and Plant for the Planet to get to Los Angeles, Million Trees LA is here now.  Million Trees, an amazing organization initiated by Mayor Villaraigosa, plans to plant one million trees all over Los Angeles during the next several years.

Partnering with businesses, community groups and youth, Million Trees will provide trees to the areas of LA that need them most.  Today,  A Million Trees are here at this conference with trees for you to take home. Plant them in your backyard or donate them to your school.  And sign up for one of their tree planting events.  There isn't a better feeling than planting a tree. I know, because we planted sixty fruit trees at our school. We even went door-to-door in our community and planted fruit trees with our neighbors.

One person's story is a chapter, but if we want to change the world's story, we need to write a book. I want to tell you about the story of a group approach. We all have different strengths and are experts at different skills. When working in a group, everyone is able to focus on their strengths and passions, but still works towards one vision.

**Green Ambassadors**

The Green Ambassadors is a youth environmental group from Environmental Charter High School that empowers youth through service learning projects. The mission of Green Ambassadors is so broad and so powerful, that there is a place for everyone.

We have green adventures for people who like to step outside of their comfort zone and learn beyond L.A...

• A fashion program for people that love to make their own clothes...

• Our Rise Above Plastics program for people who love presenting and spreading messages...

• Our artists paint murals conveying environmental messages ...

• Our seniors are planning a green prom... (pause)

There are many groups that you can join. They are fun, they give you an opportunity to learn from and work with others who care about the planet...and you can make your story more powerful.

Whether you want to get involved with an organization or start your own, you have a chance to be a Green Ambassador and begin rewriting your story and the story of the planet now...The most important way to change a story is to spread the story... We have to make sure we are continuously spreading solutions. Use reusable bottles, bike or walk to school, use reusable bags at the mall, refuse straws at restaurants, support your local farmers' market. And encourage your friends to follow you.

I know if you're here with your school...you were probably told to keep your phone on silent or put it away while you're here at the conference. But now, I want everyone to take out your phone. I want you each of you to send one of these earth positive messages through text, Facebook, Myspace, AIM, Yahoo, or Twitter. So pick one of these solutions and send it to at least one person. And ask them to send it on.

(PAUSE while everybody sends texts)

Wow. We just sent 5,000 earth positive messages in less than 3 minutes. We asked our friends to change their story. I don't know about you, but the world feels a little more positive already.

Now, before I go, I'd like to get back to my story. Of course, I'm still writing it, but I want you to know that because I made a choice to write my story green, amazing things have happened.

If it wasn't for Green Ambassadors, I would never have directed an award-winning short film. I would never have met Hilary Clinton, Jon Bon Jovi, or Eric Garcetti.

I would never have been on Planet Green or Nickelodeon. I would never have been featured in a book called, "Girls Gone Green," I would have never spoken in the UCLA lecture halls.

I would never have spoken at a press conference as an advocate for electric cars.

I would never have had the chance to be led by my mentors.

If Green Ambassadors hadn't encouraged me to change my story, I wouldn't be talking with you today ... encouraging you to change your story.

Here is my website www.jordaninspires.com and email, Jordan@jordaninspires.com. Email me and let me know how changing your story changes your life, because believe me, it will.

**Overview**

1 What's my carbon footprint?
2 What's my school's carbon footprint?

## 1 What's is my carbon footprint?

As humans, almost everything we do adds C02 to the atmosphere - from driving and eating to taking a breath. If we wish to continue living on this planet, experts say we need to reduce our C02 emissions. Since we all need to breathe, we should not cut our carbon emissions by holding our breath, but there are other things we can do to lower our impact on the only planet that we have.

There are many places online that will help you compute your carbon footprint. This activity will help you better understand how that is done, by guiding you through the computation of a carbon footprint for a few aspects of your life.

### A. **Driving**

Burning one gallon of gas produces about 20 pounds of $CO_2$[1].

To find the carbon footprint for driving, you first find the number of gallons used, then multiply this by 20 to get the total pounds of $CO_2$ produced. To find the number of gallons of gas that is burned by driving a car for a week, use this formula:

| Gallons of gas used = (number of miles driven)/(gas mileage of the car) |
|---|

To find the carbon footprint of driving for a week, use this formula:

| Pounds of $CO_2$ = 20 x gallons of gas used –OR-<br>= 20 x (number of miles driven)/(gas mileage of the car) |
|---|

***Example***:

A car gets 30 miles per gallon of gas mileage. It is driven 300 miles a week. What is the weekly carbon footprint?

Pounds of $CO_2$ = 20 x (number of miles driven)/(gas mileage of the car)
= 20 pounds $CO_2$ per gallon of gasoline x 300 miles/30 mpg
= 20 x 10
= 200

***Compute (and show work)***:

[1] http://www.epa.gov/oms/climate/420f05001.htm

a) The average U.S. car gets 20 miles per gallon and is driven approximately 300 miles per week. How many pounds of CO2 does it produce each week?

b) You are trying to convince your parents to buy a hybrid that gets 45 miles per gallon. If they still drove 300 miles per week, how many pounds of CO2 would they produce?

c) How many pounds of C02 will you save by driving a hybrid?

d) You decide that you will skateboard to school to reduce your family travel to 200 miles per week. How many pounds of C02 is your family now producing?

e) How many pounds of C02 will you save by skateboarding to school?

## B. **Water Usage**

Every gallon of water you use requires a certain amount of energy. Some of this energy is used to transport water to your house. Some is used to heat water, and some is used to treat wastewater.

Exactly how much energy it takes for your water usage depends on where you live. For example, if you live in Southern California, it takes a lot more energy to get water to your house than if you live in the Pacific Northwest, because you get less rain and a lot of that water has to come all the way from Northern California.

Producing that energy releases CO2, so each gallon of water that you use has its own carbon footprint. For example, one estimate is that each gallon of hot water used produces about 2 pounds of $CO2$[2].

a) Hot water comes out of the tap or shower at a rate of about 2.5 gallons per minute. To find the total amount of hot water, use this formula:

| Hot water used = 2.5 gallons per minute x number of minutes the water is running |
|---|

***Examples***:

A hot shower lasts 10 minutes. How many gallons of hot water are used?

Hot water used = 2.5 gallons per minute x 10 minutes
= 25 gallons

Your hot water faucets run about 20 minutes each day. How many gallons of hot water are used?

Hot water used = 2.5 gallons per minute x 20 minutes
= 50 gallons

***Compute***:

One family's hot water use each day is as follows:

[2] http://www.rivernetwork.org/resource-library/carbon-footprint-water. See page 32. If reducing hot water usage by 4.4 billion gallons reduces CO2 emissions by 38 million metric tons, then each gallon of hot water used produces a little under 2 pounds of CO2.

- 30 minutes of hot showers every day
- 30 minutes of hand washing a day
- 60 gallons a day of hot water in their dishwasher and clothes washer.

How many gallons of hot water are used each day? _____

b) To find the carbon footprint of the hot water that's used, use this formula:

| Pounds of CO2 = 2.0 pounds CO2 per gallon x number of gallons of hot water |
|---|

***Compute***:

How many pounds of CO2 does this family produce per day from using hot water? Per week?

C. **Lights**

A 100-watt light bulb, left on for ten hours, uses 1 kilowatt-hour of electricity, which has a carbon footprint of about 1.5 pounds of CO2[3]. (That's an average—the actual carbon footprint of a kilowatt-hour of electricity depends on how that electricity was produced, whether by burning coal, natural gas or some other means.)

a) To find the total amount of electricity used by the light bulbs in your home for a day, use this formula:

| Total electricity in kilowatt-hours =<br>(total wattage of all light bulbs) x (average number of hours the bulbs are on)/1000 |
|---|

***Example***:

There are sixteen 75-watt light bulbs in a house, and they are left on for an average of 5 hours a day.

Total electricity used per day = 16 bulbs x 75 watts/bulb x 5 hours/1000 watt-hours per kilowatt-hour = 6 kilowatt-hours.]

b) To find the carbon footprint for that electricity, use this formula:

| Pounds of CO2 = 1.5 pounds CO2 x total kilowatt-hours |
|---|

***Example***:

[3] http://www.stewartmarion.com/carbon-footprint/html/carbon-footprint-kilowatt-hour.html

The production of 6 kilowatt-hours of electricity releases 9 pounds of CO2.

***Compute***:

a. How much electricity is used by twenty-four 60-watt light bulbs left on for an average of 6 hours each day? = _____ kilowatt-hours

b. How much CO2 is being released = (show work) _____

c. You go to the hardware store and find a 30-watt light bulb. How much CO2 does this light bulb release in a kilowatt hour?

d. How much C02 will you save by convincing your parents to replace one of your 60-watt light bulbs with a 30-watt bulb?

_____

D. **Fast Food**

The production, distribution and cooking of food generates greenhouse gases that can be measured in terms of the equivalent pounds of CO2 released. For example, growing fruits and vegetables releases considerably lower amounts of CO2 than raising beef.

The carbon footprint of a fast-food cheeseburger has been estimated to be about 10 pounds[4] of CO2 and CO2-equivalent greenhouse gases.

a) To calculate the carbon footprint of your cheeseburger consumption, use this formula

| CO2 released = 10 pounds per cheeseburger x number of cheeseburgers eaten |
|---|

***Example***:

A family of four eats 8 fast-food cheeseburgers a week. What is the carbon footprint of that activity?

Carbon footprint = 10 pounds/cheeseburger x 8 cheeseburgers = 80 pounds of CO2

The family decides to do practice “Meatless Monday” and reduces their cheeseburger consumption by half. How many pounds of CO2 do they save?

_____

E. **Putting it all together**

You can use this formula to find your families’ weekly pounds of CO2. Survey your family and home to determine each of the following factors.

| Estimated week partial carbon footprint = (20d/m + 2g + 1.5 wh + 10c) |
|---|

[4] http://openthefuture.com/cheeseburger_CF.html

d = # of miles driven per week

m = mileage of car (estimate 25 miles per gallon if you don't know)

g = gallons of hot water used per week (most people use about 600 gallons of water each week)

w = total wattage of light bulbs in your house

h = number of hours a light bulb is usually turned on in a week (estimate 20 hours per week if you don't know)

c = number of cheeseburgers eaten per week

Use this formula and the other formulas above to answer these questions:

1) Estimate your family's weekly pounds of CO2 using the formula above.

2) Multiply by 52 to find your pounds of CO2 per year.

3) Which is better, in terms of reducing your family's annual CO2 emissions?
   a. Eating 50 less cheeseburgers a year?
   b. Changing all of the light bulbs in your house to 13-watt fluorescent bulbs?
   c. Driving 1000 less miles per year?
   d. Using 100 less gallons of hot water each week (5200 less gallons per year)

## 2 What's My School's Carbon Footprint? Before and After

Summary: Student teams will create posters urging fellow students and faculty to change their habits to reduce the school's CO2 Carbon Footprint. They will create before and after posters that demonstrate the difference they were able to make.

## A. Determining the Carbon Footprint of the School

As a class, use one of many available online school carbon footprint or ecofootprint calculators to determine the school's total carbon footprint. Be sure to use a calculator that displays the *categories* of contribution to the total carbon footprint. Fill that data in below. Note that, depending on the calculator, you may not have numbers for each of the given categories, or you may have to add additional categories.

| Category | School Carbon Footprint |
|---|---|
| Energy Use | |
| Water Use | |
| Travel | |
| Paper and Printed Material | |
| Food | |
| **TOTAL** | |

## B. Graphing Your School's Carbon Footprint

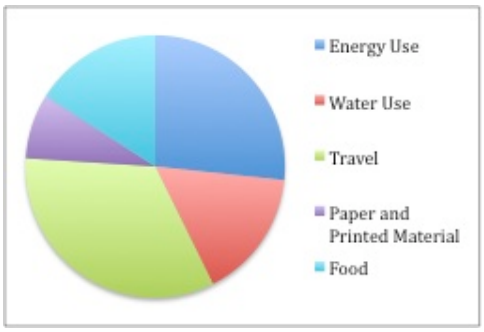
### 1. Determining Percentages

Determine percentages for each category by tallying the total and dividing each category by that total

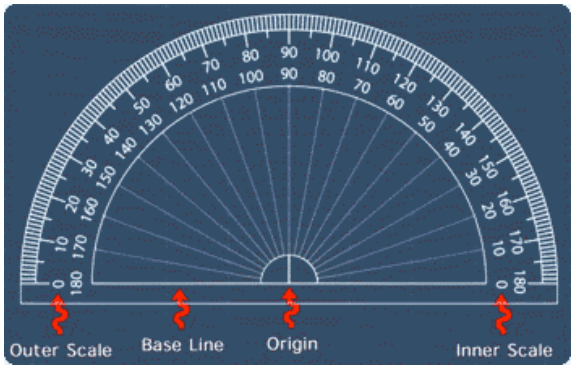
| Category | School Carbon Footprint | Percentage (category/total) |
|---|---|---|
| Energy Use | | |
| Water Use | | |
| Travel | | |
| Paper and Printed Material | | |
| Food | | |
| **TOTAL** | | |

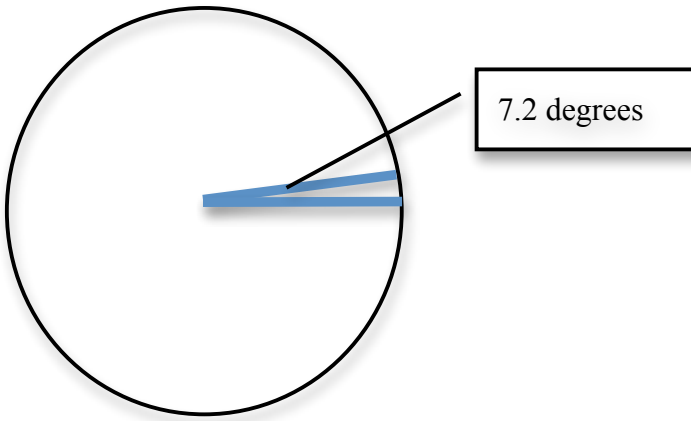
### 2. Determining Degrees

As a class, follow the steps to create a circle graph showing the total carbon footprint and the contribution from each category. Examples shown here:



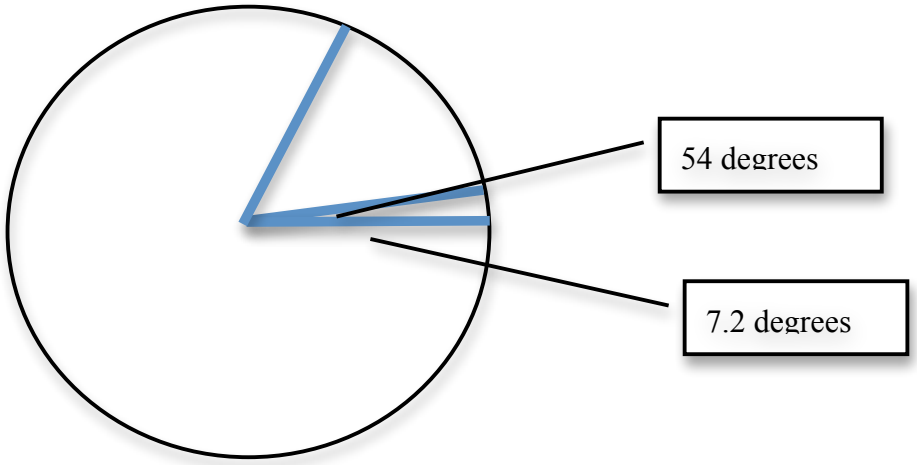

3. **Graphing Results**
   A. Use the inner scale of a protractor to measure the degrees and mark off the first slice of the "pie" on your circle. In the example of showers equal to 2% of all water usage, that would look like this:




   B. Repeat with the next category. <u>When you measure this angle, start with the last line you draw as the baseline of the new angle.</u>

   For example, if the category of "laundry" was calculated as 15% of total use, the next piece of the piece would be 15% of 360 degrees, or 54 degrees. The graph would then look like this:




   C. Repeat with all categories. By the time you are finished, you should have gone all the way around the circle, back to your starting point.

## C. Action Plan

1. Your team will now compare your school needs to the national average of a typical school across the United States or another school around the same size.

2. Go through each category and make a plan of what your school can do to reduce your footprint in that category and what percentage you can reduce it by. Your goal should be to reduce your overall footprint by at least 10-25%.

| Category | Action | Percentage of reduction |
|---|---|---|
| Energy Use | | |
| Water Use | | |
| Travel | | |
| Paper and Printed Material | | |
| Food | | |
| **TOTAL** | | |

3. For each category, write a statement of why that action will result in that reduction.
4. List the actions that should be taken in order of importance and effectiveness. Consider how much it would reduce the footprint and how easy, difficult or expensive it is to implement.

## D. Before and After

Now, you will create a bar graph for each category with a bar that represents before and a bar that represents after. Compare what your school's carbon footprint would look like if they implemented your actions and compare it to your original graph.

**A.** Follow the steps you used to create your original bar and pie graphs.
**B.** Create a poster that displays your footprint with and without reducing the footprint. Be sure to display the action that needs to be taken for each category.
**C.** For extra credit, calculate the cost savings that the school would realize from implementing one of the recommended actions.

## E. Campaign the School to Take Action

As a class, vote on the most powerful and convincing poster and present it to the administrators and student council (or the school board) and talk to them about what they can do to lower your school's impact on the planet and reduce the school's energy budget.

GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

# REUSE, RECYCLE, RETHINK

## G.R.E.E.N Teacher's Guide

**ESSENTIAL QUESTION:**
**Is our current way of living sustainable?**

**Students will gain an understanding of composting as a solution to household waste and lowering their personal eco-footprint.**

- Approximate Time: 3 weeks
- Benchmark: Using the Green Ambassadors curriculum, students will produce an event to share what they've learned about Recycling Organics and encourage others to compost.

## STANDARDS

**National Science Standards:**

**12CLS5.6** As matter and energy flows through different levels of organization of living systems--cells, organs, organisms, communities--and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.

**12CLS4.3** Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

**12FSPSP3.1** Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.

**12FSPSP3.2** The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.

**12FSPSP3.3** Humans use many natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

**12FSPSP4.1** Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans. [See Content Standard C (grades 9-12)

**12FSPSP4.2** Materials from human societies affect both physical and chemical cycles of the earth.

**12FSPSP4.3** Many factors influence environmental quality. Factors that students might investigate include population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.

**National Education for Sustainability K-12 Student Learning Standards**

**Grades 9-12, EfS 1.1: Intergenerational Equity** – Students forward an ethical argument on how sustainable resource use today can lead to basic human needs (e.g.: food, water, energy and shelter) being met for future generations (e.g.: 100 years in the future).

**Grades 9-12, EfS 2.2: Respect for Limits** – Students collect data in order to investigate and analyze how personal consumption patterns affect the sustainability of natural and human communities.

**Grades 9-12, EfS 3.1: Personal Responsibility** – Students identify and commit to a personal sustainability action and they write about the results of that action. (e.g.: using public transportation, reducing and recycling).

**National Council of Teachers of Mathematics Principles and Standards for School Mathematics**

Instructional programs from pre-kindergarten through grade 12 should enable all students to:

- Compute fluently and make reasonable estimates.
- Recognize and apply mathematics in contexts outside of mathematics.
- Understand measurable attributes of objects and the units, systems, and processes of measurement.
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

## OVERVIEW OF GUIDING QUESTIONS

1. Is there an "away"?
2 Is there waste in nature?
3 How can my trash be part of the solution?

## RESOURCES

**Handouts**

- Create a composting survey to give to the students pre/post unit
- Recycling Organics Eco-Hero (Professor Wangari Muta Maathai)
- Recycling Organics Green Job (Laura Allen Greywater Guerrillas)
- "Conquest of Land Through 7000 Years" (available online)
- Composting manual for students to reference (either online or at a local agency)
- Research articles about landfills in the area and how they are overfilled

**Books**

- Composting in the Classroom: Scientific Inquiry for High School Students
- Urban Homestead
- "Going to Green" (Unit 3)
- "Cradle to Cradle"

**Presentations/Videos**

- "Dirt, the Movie"
- "Dirty Jobs, San Francisco Dump"
- Find a Power Point about composting online
- Get the Green Ambassador compost movie and watch from youtube; find others such as http://video.about.com/gardening/compost-video.htm

**Materials/Supplies**

- A compost bin or a place to compost near your classroom (if indoors, 5 gallon food grade buckets, newspapers, coffee grinds and red wiggler worms)
- Disposable form made of plant material (potato, corn, sugar)

**Guest Presenters**

- Compost Expert

**Field Trip**

- Arrange a field investigation to a landfill at least 3 weeks before you plan on going; ask if the landfill will reimburse the bus expense for the field trip

## REUSE · RECYCLE · RETHINK HERO

**Professor Wangari Muta Maathai**

**Founder, Green Belt Movement, Kenya**

Professor Wangari Muta Maathai was born in Kenya in 1940, a time when opportunities for African women were few and far between. This did not hold Maathai back. After earning degrees at colleges in the United States and Germany, Professor Maathai earned her doctorate in Nairobi in 1971. She became the first woman to lead the Department of Veterinary Science at the University of Nairobi and later became the first female associate professor at that school.

Professor Maathai's life's work has been the creation of the Green Belt movement, which empowers women to improve their lives and the lives of others in their community by planting trees. How does planting trees empower African women? To understand that, you have to understand how the loss of trees affects communities in rural Kenya. Trees are a source of fuel for cooking, and they provide wood for building shelters. Most importantly, trees protect important sources of fresh water and help keep fertile soil from being swept away. Deforestation makes it difficult to obtain basic necessities like food and water.

Soil suitable for agriculture can only be maintained if the surrounding ecosystem is healthy. Maathai understood this principle, and she also understood the power of community action to change the status quo. By planting trees, the women were able to reverse this negative impact and conserve soil. Equally important, they became empowered to fight for the future of their communities and the environment. The Green Belt movement has planted more than 30 million trees since it was founded, and protected forests and urban greenspace from unscrupulous development. The movement is not well-liked by the Kenyan government, and Professor Maathi herself has been beaten for leading peaceful protest. In 2004, Maathi was awarded a Nobel Peace Prize for her inspiring strength and willingness to peacefully stand for what is right.

## 1. IS THERE AN "AWAY"?

**Summary**

Through presentations, film, readings and field investigation, students will become familiar with key environmental and economical issues related to our consumer society. Students will show their understanding by showing their understanding there is no "away."

**Activity Ideas**

1. **How much do I know?**

   Do a pre/post survey to determine what your students know about waste and composting. Give the same survey after the unit is complete to determine if eco-literacy has increased.

2. **What waste are we creating?**

   Do a trash audit with your students. Searching "Trash Audit" on Google will provide you with a plethora of resources. A fun one is to have students carry all of the trash they create with them in a bag for 3 days. You can also have students keep track of the amount of trash created in your classroom.

   a. Have students tally what kind of trash they are producing/their family/the school.

   b. Compare the percentage that is recyclable/compostable/avoidable.

   c. Use this as a baseline to gauge whether actions taken make a difference.

**3. Where does our TRASH go?**

Take a trip to a local landfill. Research local landfills, call far in advanced, ask if they will support you with a bus, and ensure there is a way for the students to have studied landfills prior to the trip. Have them write interview questions to ask the landfill manager and have them reflect upon the experience afterwards.

a. If a field investigation is not feasible, watch, "Dirty Jobs, San Francisco Dump" to provide students with basic understanding of a landfill.

b. Research online, pre/post questions for students to have on hand.

c. Discuss recycling and how most cities only recycle 5-50% of what is given to them or ship it away.

**4. What happens if we continue at this current rate?**

a. Have students find an article about their own landfill, when it is scheduled to fill up and what will happen afterwards. What if the next landfill was slated to be set up in their neighborhood?

b. Have students reflect on the issue of the idea of "away." If there is an "away," what is happening to our planet and what will happen if we keep consuming and trashing the same way?

**Assessment:**

- Pre survey
- Trash audit participation
- Reflection/essay on "What 'Away' Means"

## 2. IS THERE WASTE IN NATURE?

**Summary**

Through hands-on activities, guest presenters, lectures and readings students understand that nature is not as wasteful as humans.

**Activity Ideas**

**1. Trash as Treasure**

a. Have students write their definition of "trash."

b. Explore:

- Trash As Art
  - Research and show students art projects from repurposed materials.
  - Gather materials or have students gather materials, and create out of what most think of as "trash."
  - Introduce reDiscover art center and other centers that use "trash" to create something new.
  - Bring in products that are normally made of plastic, but that have been made of corn or other plants.
- Downcycling vs. Upcycling
  - Share the difference between recycling and upcycling.
  - Have students research http://www.terracycle.net/ and start a terracycling project on your own campus as a fundraiser.
- "Cradle to Cradle" and Extended Producer Responsibility
  - Share an article, video, or have students read about William McDonough.
  - Research and share information on the impact of Extended Producer Responsibility. (effective in Germany)

c. Reflection: Have students rewrite their definition of "trash."

**2. Spudware Soil Experiment**

a. Do an experiment comparing a "potato" fork (Spudware) to a normal potato cut up to be the same size as the fork. Bury both of them to see how quickly they decompose and discuss why it might take longer for one to break down than the other.

**3. "Dirt! The Movie"**

a. Show segments of the movie and discuss "why dirt is important"

1. What happens if we continue to destroy our soil?
2. How important is the health of our soil for the health of the planet?
3. Show the segment, "God made dirt and dirt don't hurt" segment for students to understand that we need soil and it is not that "dirty."

**4. "Conquest of Land Through 7000 Years"**

a. Read the article and discuss "what will happen if we continue to destroy our soil?"

4. What happens to a society that does not take care of its soil?
5. List 3 empires that have fallen, because they did not take care of their soil and what could they have done differently to prevent that from happening?

b. Find a video or PowerPoint presentation that focuses on the importance of soil.

**Assessment:**

- Art project using repurposed materials
- "Trash" definition and reflection

## 3. HOW CAN MY TRASH BE PART OF THE SOLUTION?

**Summary**

Through hands-on experimentation and exploration of the cold hard facts, students will learn and experience the benefits of composting.

**Activity Ideas**

1. What is Composting?

a. Bring in an expert to help you show your students how to compost/set up a compost bin on campus (see #3 below).

b. If you can't find an expert, there are numerous resources (presentations, movies and manuals) that will help students understand what composting is and how it works.

2. Is Composting Worth It?

a. Have students list 3 benefits of composting using research you've done in class. Have them list 3 reasons not to compost (i.e. they live in an apartment, they don't have a garden, etc.)

b. Have students complete Reuse, Recycle, Rethink Student Exercise Activity 1: Is Composting Worth It? to determine how composting impacts our ecosystem.

c. Explore the different types of composting and discuss the benefits of each:

- Vermicomposting, bin composting, grass recycling, industrial composting, aerobic vs. anaerobic

d. Discuss how this knowledge changes their reasons not to compost.

**3. I can compost**

a. Have your students explore the composting options in the city/neighborhood. (Does the city automatically pick organic matter up? Can you have them? Is there a garden in the neighborhood that will let you compost there?)

b. Carbon Nitrogen balance: talk about the importance of the balance of carbon and nitrogen and discuss how you keep your compost healthy.

c. Compost Recipe: Have students complete Reuse, Recycle, Rethink Student Exercise Activity 2, "What is the Recipe for Composting," to understand how composting works and the steps they need to take to complete the process.

d. Field work: Have every student compost. Make it an assignment to set up composting on campus and have every student partake in composting through either: bringing in organic matter, turning the compost, or watering it. (This can be done easily in or outside of your classroom using buckets and worms).

e. Give extra credit to those students who get their families to start composting at home.

**4. What do I do with compost that I make?**

a. Review all the things that can be done with the compost that is created. Discuss how nature recycles our waste to create more.

**5. Post Survey**

a. After students complete the survey, pass back their first survey, have them grade both surveys and then have them graph their results.

**Assessment:**

- Reuse, Recycle, Rethink Student Exercise Activity 1: Is composting worth it?
- Reuse, Recycle, Rethink Student Exercise Activity 2: What is the Recipe for Composting?
- Hands-on composting participation
- Post Survey

## REUSE · RECYCLE · RETHINK JOB

**Laura Allen**

**Co-founder, Greywater Guerrillas**

Water, like soil, is a precious natural resource, but so much of it simply goes down the drain. Greywater systems help homeowners conserve water by salvaging wash water from sinks, bathtubs and washing machines. This water may not be drinkable, but it can be used for other things like irrigating plants.

Laura Allen is the co-founder of Greywater Guerrillas, a group that educates people about the need to conserve water and shows them the nuts and bolts of constructing your own greywater system. Laura was inspired to start harvesting greywater when she got a higher-than-normal water bill. As she thought about it, she realized she had no idea where the water that came out of her faucet was coming from. That just didn't feel right, so she and her housemates decided to take the initiative and try to build their own greywater system to conserve water.

Laura took a plumbing class at a nearby college, and used her new knowledge to construct her first greywater system. She continued to study methods for conserving and reusing greywater, improving her own greywater system all the while. She co-founded Greywater Guerrillas to help other people set up greywater systems of their own.

On the job, Laura uses skills such as math, writing and public speaking skills. However, she says that the single most important skill she learned in school was how to educate herself. Laura's work involves organizing and hosting greywater workshops and classes, as well as helping people with their greywater systems. She gives advice when needed, either over the phone or via email. She also helped work for greywater-friendly changes to the California State Code.

According to Laura, greywater recycling is a growing field that desperately needs more young people. So do other fields related to water conservation, such as rainwater harvesting. Laura feels that green jobs are important because they help people support themselves and their families without harming the planet.

She believes, "Jobs that are focused on making money at the expense of the earth and other living things are hurting everyone in the long run, and poor people are more greatly impacted in the short term. Green jobs are a pathway to financial sustainability, as well as being sustainable for the earth. There is so much to be done in redesigning our society by focusing our priorities on healthy employment for people that also create a healthy planet. "

**Activities**



## 1 Is Composting Worth It?

Here's a simple math activity that will help you estimate how composting can reduce a community's carbon footprint.

The US Department of Agriculture estimates that a family of four throws out about 122 pounds of food waste each month[1].

Question: *Based on this estimate, how much food is wasted by a community of 25,000 families in a year?*

Calculation:

When food scraps are thrown into a landfill, they decompose in such a way as to produce methane, a greenhouse gas that is much more potent than carbon dioxide in terms of its ability to trap heat in the atmosphere.

Because of this, for every 1 ton of food scraps that are separated from the trash and composted instead of going to the landfill, the equivalent of 6 tons of CO2 is prevented from being released into the atmosphere.[2]

Question: *By how many tons could the community of 25,000 reduce its CO2 footprint by composting all food waste instead of sending it to a landfill?*

Calculation:

[1] http://www.huffingtonpost.com/wendy-gordon/eat-leftovers-compost-tri_b_476647.html
[2] http://www.zwinc.org/scraps_gas.html

## 2 What is the Recipe for Composting?

You will learn why it's important to mix different kinds of materials together when making compost, how to decide which materials should be mixed with other materials, and how to estimate how much of each kind of material should be mixed.

Material that you compost always contains two substances: carbon and nitrogen. In order for the bacteria that does all of the composting work to operate well, you want your compost mixture to have a C:N ratio of about 30:1—that is, you want about 30 times as much carbon in the mix as you have nitrogen, in terms of weight.

This activity will help you understand this ratio better, and to make decisions about how much of each kind of material to put together in order to create a mixture that will compost well.

This table lists several materials and shows how much carbon and nitrogen are found in each.[3] Please note that these are approximate values only.

| Material | Pounds | Pounds of C | Pounds of N | C:N Ratio |
|---|---|---|---|---|
| Vegetable Waste" | 10 | 0.5 | 0.04 | |
| Food Waste" | 10 | 1.1 | 0.08 | |
| Dairy Cow Manure" | 10 | 0.8 | 0.06 | |
| Grass (loose)" | 10 | 0.9 | 0.06 | |
| Coffee Grounds" | 10 | 0.5 | 0.04 | |
| Horse Manure" | 10 | 1.2 | 0.04 | |
| Fruit Waste" | 10 | 0.9 | 0.03 | |
| Leaves loose-dry" | 10 | 3.6 | 0.08 | |
| Straw Wheat" | 10 | 1.9 | 0.04 | |
| Newsprint" | 10 | 1.7 | 0.03 | |
| Office Paper" | 10 | 2.1 | 0.02 | |

1. Compute the C:N ratio of each material. To do this, divide the pounds of carbon by the pounds of nitrogen, and round your answer to the nearest whole number. The ratio is written as a comparison of that number to 1. For example,

   C:N ratio of food waste:

   1.1÷.08 = 13.75

   Round to nearest whole number is 14

   C:N ratio is 14:1

   Fill in the C:N ratio for each material in the table.

[3] http://www.klickitatcounty.org/SolidWaste/fileshtml/organics/compostCalc.htm

2. Suppose you have 10 pounds of food waste. The C:N ratio is about 14:1. If you want to put it into your compost, you should also add some material with a high C:N ratio, so that together the ratio is around 30:1.

   For example, if you added 10 pounds of leaves to your 10 pounds of food waste, you could find the C:N ratio of the mixture like this:

   a) Total carbon = carbon in food waste + carbon in leaves

   = 1.1 pounds (C in food waste) + 3.6 pounds (C in leaves)

   = 4.7 pounds

   b) Total nitrogen = nitrogen in food waste + nitrogen in leaves

   = .08 pounds (N in food waste) + .08 pounds (N in leaves)

   = .16 pounds

   c) Compute C:N ratio of the mixture:

   C÷N = 4.7÷.16 = 29.375

   C:N = 29:1

3. Compute the C:N ratio of these combinations:
   a) 10 pounds of food waste and 10 pounds of newsprint
   b) 10 pounds of horse manure and 10 pounds of straw
   c) 10 pounds of coffee grounds and 10 pounds of fresh leaves

4. Would any of these mixtures make good compost? Explain your answers.
   a) 10 pounds of food waste and 10 pounds of grass
   b) 10 pounds of leaves and 10 pounds of newsprint
   c) 10 pounds of food waste and 10 pounds of ground coffee

5. (Optional) Figure out some mixtures of materials that would make good compost. Explain your calculations.

GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

# ENCOUNTER WATER

## G.R.E.E.N Teacher's Guide

**ESSENTIAL QUESTION:**
**How do we ensure that we have enough water for the future?**

**Students will gain an understanding of the issues we face with regard to water quality and availability. They will also learn how they can become advocates for water conservation and solutions.**

- Approximate Time: 3 weeks
- Benchmark: Using the Green Ambassadors curriculum, students will produce an event to share what they've learned about Encountering Water and encourage others to conserve.

## STANDARDS

**National Science Standards:**

**12FSPSP3.1** Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.

**12FSPSP3.2** The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.

**12FSPSP3.3** Humans use many natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

**12FSPSP4.1** Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans. [See Content Standard C (grades 9-12)

**12FSPSP4.2** Materials from human societies affect both physical and chemical cycles of the earth.

**12FSPSP4.3** Many factors influence environmental quality. Factors that students might investigate include: population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.

**National Education for Sustainability K-12 Student Learning Standards**

**Grades 9-12, EfS 1.1: Intergenerational Equity** – Students forward an ethical argument on how sustainable resource use today can lead to basic human needs (e.g.: food, water, energy and shelter) being met for future generations (e.g.: 100 years in the future).

**Grades 9-12, EfS 2.2: Respect for Limits** – Students collect data in order to investigate and analyze how personal consumption patterns affect the sustainability of natural and human communities.

**Grades 9-12, EfS 3.1: Personal Responsibility** – Students identify and commit to a personal sustainability action and they write about the results of that action. (e.g.: using public transportation, reducing and recycling).

**National Council of Teachers of Mathematics Principles and Standards for School Mathematics**

Instructional programs from pre-kindergarten through grade 12 should enable all students to:

- Compute fluently and make reasonable estimates.
- Recognize and apply mathematics in contexts outside of mathematics.
- Understand measurable attributes of objects and the units, systems, and processes of measurement.
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

## OVERVIEW

1. **What do we know about water? What should we know about water?**
2. **Where does our water come from (in California)?**
   **What factors influence how much water is available to us?**
3. **How do we use water?**
4. **What happens to water after we use it? What are some issues of water?**
5. **How can we conserve water?**
6. **How do we make a water catchment system to conserve water?**
7. **How can we harvest rainwater to supply some of our water needs?**
8. **How can using a rainwater save water, electricity and reduce greenhouse gas emissions?**

## RESOURCES

**Handouts**

- Encounter Water Student Exercise Packet

**Films/Videos**

**Water Availability, Quality and Conservation**

- Surfrider's The Real Story of Water (http://vimeo.com/10328536)
- Life Straw (http://www.youtube.com/watch?v=QJKdIAm_P-c)
- GOOD's Water: How it's Used, and the Strains on this Vital Resource (http://www.youtube.com/watch?v=ReiCp1YGrJs)
- Shifting Baselines in the Surf (http://www.youtube.com/watch?v=rQnifCd1M-0)
- Flow The Film

**Water Catchment**

- ECHS's Water Harvesting Film (http://www.youtube.com/watch?v=u4kaAw8_qm4)
- HGTV's How to Build a Rain Barrel (http://www.youtube.com/watch?v=MGFDlkJOdaM

**Websites**

- Discovery Education's "Water, Water Everywhere" Lesson Plans
- EPA's animated "Thirstin's Question and Answer Game"
- Bell Museum's Watershed Game

- GOOD's "Walk this Way Transparency," an infographic on reducing your water footprint
- EPA and Education & the Environment Initiative (EEI) Curriculum (http://www.calepa.ca.gov/Education/EEI/Curriculum/Default.htm)
- NOAA's "Water Cycle Game"
- Environmental Working Group's Tap Water Analysis (http://www.ewg.org/tap-water/home)

**Plastics**

- 5 Gyres (www.5gyres.org)
- Rise Above Plastics (RiseAbovePlastics.org) and (http://riseaboveplastics.blogspot.com/)
- Save My Oceans (http://savemyoceans.com/)
- Altaglita's Ship to Shore Education (http://www.algalita.org/ship-2-shore-education.html)

**California Specific**

- Where Does My Water Come From (http://water-ed.org/watersources/)
- California Water Crisis (http://www.calwatercrisis.org/)
- Metropolitan Water District of Southern California (http://www.mwdh2o.com/)
- California State Water Project (http://www.water.ca.gov/swp/)
- Aquafornia (www.aquafornia.com)
- LA Sewer Treatment Virtual Tour (http://www.lasewers.org/treatment_plants/hyperion/tour/index.htm)

**Guest Presenters/Field Trips**

- Presenter from your local water agency or water-focused organizations
- Local entrepreneur that makes water catchment systems or other conservation products
- Trip to local watershed upstream and downstream (consider a pickup or restoration project)
- Trip to local aquarium
- Participate in Algalita's "Ship to Shore" Blog (follow expeditions to the gyres)

**Materials**

- Materials to "Make a Water Catchment System" are listed in the "Encounter Water Exercise Packet"

## ENCOUNTER WATER HERO

**Brad Lancaster**

**Author of Harvesting Rainwater**

Brad Lancaster has spent most of his adult life teaching others about sustainable living. He has been a permaculture consultant since 1993, creating permaculture designs that focus on energy and water conservation. There's no need to wonder whether or not his commitment to sustainable living is authentic: in the middle of downtown Tucson, Arizona, a city built in the middle of the desert, Brad Lancaster lives almost completely off the grid.

To power the house he shares with his brother, Rod, Lancaster uses solar panels. To keep the amount of energy needed to a minimum, the brothers use passive heating and cooling techniques, like opening the windows to cool the house down at night. Even though they live in a desert, they use hardly any water from the local water company. Most of their water needs are met through harvesting rainwater and recycling rainwater.

The world has a limited supply of fresh water, especially in desert areas like Southern Arizona. That's why Lancaster's permaculture techniques involve harvesting more than food. Simple landscaping techniques, like creating hollows to trap rainwater, make it easy to harvest rainwater as well. Greywater recycling techniques keep water used in showers or sinks from going down the drain. "Instead of being taken to a water treatment plant with other, dirtier water, this water can be diverted to water your plants as you shower," says Lancaster.

The average family in Brad's hometown uses over 240,000 gallons of water each year. About 30 percent is used to water outside plants or grass. Watering those plants with rainwater or greywater instead of fresh water means that there is more drinking water to go around. That's why teaching other people how to harvest rainwater is so important to Lancaster. In addition to sharing his knowledge as a consultant, he has also published two books on the subject, "Rainwater Harvesting for Drylands" volume 1 and 2. The third volume is scheduled for release in 2010.

Brad Lancaster's self-reliance, responsibility and willingness to practice what he preaches, serves as an inspiration and model for everyone.

## 1. WHAT DO WE KNOW ABOUT WATER? WHAT SHOULD WE KNOW ABOUT WATER?

**Summary**

Students will interact with a variety of online resources to establish a baseline of their understanding and start to introduce the issues related to water.

**Activity Ideas**

**1. What Do We Know About Water?**

- Have students take 3 minutes and write down three things they know about water (facts, issues).
- As students share their answers, write them on the board and then have students vote to rank them in order of importance, locally vs. globally.

**2. What Do We Want to Know About Water?**

- Ask students to take a few minutes and write down some questions they have about water. Share responses and list them on the board; guide the discussion as necessary to ensure that it includes at least these questions:

- Where does our water come from? How much water do we use, how much water do we need? How do we know our water is safe to drink? What happens to water before we get it?

**3. Explore Water Issues**

- Use a general resource that provides a good overview and starts to answer some of the student's questions (you will research issues in more depth in unit 4)
  - Recommendations: 1) Surfrider's "Real Story of Water" 2) GOOD's Water: How it's Used, and the Strains on this Vital Resource (http://www.youtube.com/watch?v=ReiCp1YGrJs)
- Have students take notes and remind them that at the end of the water unit, they will be making a poster that includes this information and the answers to their questions.

**4. How Much Water Do We Need?**

- Discuss: As a population increases, what happens to our water?
- Estimate: How much water do you use a day?
- Do: Water Population Data Module Exercise from Discovery Education's "Water, Water Everywhere" Lesson Plans

**5. How Much Water Do I Think I Use?**

- *Students will reference the following information for Essential Question #3*
- Estimate: Have students try to figure out how many gallons of water are used in their household in 24 hours (i.e., this morning, everyone showered and drank a glass of water with breakfast, I washed my face and hands when I got home from school, we ran the dishwasher after dinner, altogether we used 30 gallons of water).
- Survey: Have students get answers to the following questions
  - Do you have any water saving devices in your household (low flow toilets or showerheads)?
  - How many showers does your family take per week?
  - How many loads of laundry does your family do per week?
  - Do you wash dishes by hand or in the dishwasher? How many times per day/per week?
  - Does your family water a lawn? What about a garden or plants? How many times a week and for how long?

**Assessment**

- Water question participation and write-up
- Video notes
- Online activity completion
- Water Use Estimation and Survey

## 2. WHERE DOES OUR WATER COME FROM? WHAT FACTORS INFLUENCE HOW MUCH WATER IS AVAILABLE TO US?

**Summary**

Students will use various resources to trace the local water supply back to the source. They will better understand the demands on the water supplies (environmental, agricultural, and urban uses), explore how water is treated before and after consumption and what energy resources are required to deliver water to our homes.

(The information below provides information on tracking Southern California's water supply. See your local water agency and non-profit resources for readily available information on your area).

**Activity Ideas**

1. Water Poster and Presentation
   - Explain to students that they will be creating a poster that explores one of the following issues related to water and that they will use the poster to teach the class about the issue. They will also use the poster at the end of the unit as they create an event to help the community understand more about water and take action to conserve water. Have students use information from the videos and further research the topic online. Ensure they cite at least 2 valid references for their information. Poster topics (split them us so that all are covered)
   - Topic 1: Where Our Water Comes From (sources of water for our homes)
   - Topic 2: How We Use Our Water (what affects how much water is available for our use as residents)
   - Topic 3: How Our Water Is Treated (what happens to our water before we use it at home)
   - Topic 4: How Much Energy Our Water Needs (energy required to deliver water to our homes and make it safe for use).
   - Have students test the effectiveness of their posters by presenting them to the class. Have them revise the poster based on feedback to ensure it is clear and effective.

**Resources**

- Los Angeles Water Source and Usage (http://www.ladwp.com/ladwp/cms/ladwp000509.jsp)
- Where Does My Water Come From (http://water-ed.org/watersources/)
- California Water Crisis (http://www.calwatercrisis.org/)
- Metropolitan Water District of Southern California (http://www.mwdh2o.com/)
- California State Water Project (http://www.water.ca.gov/swp/)
- Aquafornia (www.aquafornia.com)
- California Water Use Map (EEI): http://www.calepa.ca.gov/Education/EEI/Curriculum/Default.ht
- Taking Charge of the Bay Delta (EEI): http://www.calepa.ca.gov/Education/EEI/Curriculum/Default.htm

**Assessment**

- Water Poster and Presentation

## 3. HOW MUCH WATER DO WE USE? WHAT DO WE USE IT FOR?

**Summary**

Students will gain a better understanding of how much water we use and for what as they calculate their estimated monthly household water usage.

**Activity Ideas**

1. **Refresh**
   - Review the estimates that students made of their household water in the assignment from Lesson 1.
   - Get some low and high estimates, and talk about some of the differences in the assumptions students made in making those estimates.
   - Explain to students that in this lesson, they will use a form to make a much more accurate estimate of household water use.
2. **Calculate Household Water Use**
   - Have students work in pairs to complete the following in their "Encounter Water Student Exercise Packet Activity 1 & 2." Explain that although they are working in pairs, they are each responsible for calculating their own household's usage (use their partner for questions and support).
     - #1 "Calculate Your Household Water Usage"
     - # 2 "Graph Your Household Water Usage"

**Assessment**

- Encounter Water Student Exercise Packet Activity 1
- Encounter Water Student Exercise Packet Activity 2

## 4. WHAT HAPPENS TO WATER BEFORE WE USE IT? WHAT HAPPENS TO IT AFTER WE USE IT? WHAT ARE SOME OF THE ISSUES RELATED TO WATER?

**Summary**

Students take a tour (or virtual tour) of a water treatment plant to better understand the process that our water undergoes before it arrives at our homes and what happens to it after it leaves.

**Activity Ideas**

1. **Why isn't all of our "freshwater" so "fresh?"**
   - Explore: Even though most of the Earth's surface is water, only 1% of it is fresh, usable water. 97% of the Earth's water is salt water, which contains too many minerals for humans to use untreated. 2% of our water is "locked up" in ice caps and glaciers, leaving only 1% as usable fresh water.
   - Play: NOAA's "Water Cycle Game"
   - Watch: GOOD's "Drinking Water" http://www.good.is/post/transparency-drinking-water/
2. **Watersheds and Groundwater Contamination**
   - Explore: watersheds, point source and non-point source pollution, run-off, storm drains
     - Bell Museum's Watershed Game

- Find a recent news article about the effects of wastewater when released into the environment, and read it as a class (or distribute it and have students read individually).
  - In discussion of the article, make sure students understand that whatever they flush down the toilet or put down their sinks does not "disappear"; that water eventually goes back into the environment and unless it is properly treated, the contaminants in the water can have damaging effects on plants and animals in the environment.
- Research: What is the Clean Water Act? Read about surface water and ground water issues and solutions in your area.

**3. What Happens to Water Before it Gets to Us**

- Discuss the process that water goes through before it gets to your tap, what can be found in it, is it safe, how does it rank against other cities?
  - Resources: Tap Water Analysis and Rankings (http://www.ewg.org/tap-water/home)
- Explore: water filters as a solution (what are the different types of filters and benefits of each).
- Activity: Do a blind folded taste test of tap water vs. filtered water vs. bottled water and do a cost |analysis of a gallon of each.
- Read: an article on pharmaceuticals found in tap water.

**4. What Happens to Water After It Leaves our House**

- Explain the difference between storm drains (untreated) and sewers (treated).
- Explore: reclaimed water use in your area (how much gets used and what for).
- Discuss: Desalinization and the related costs and energy.
- Activity: Take a tour of a local water treatment plant. If that is not possible, take a virtual tour or arrange a guest speaker.
- LA Sewer Treatment Virtual Tour (http://www.lasewers.org/treatment_plants/hyperion/tour/index.htm)

**5. Water Are the Issues We Have with Water Around the World**

- Arrange a guest speaker (and or watch a video and do activities) to explore on any/all of the following:
- Clean Water
  - Watch: Life Straw film (http://www.youtube.com/watch?v=QJKdIAm_P-c)
- Water Rights
  - Watch: Flow, The Film (or trailer)
- Water Pollution
  - Watch: "Shifting Baselines in Sand" film (online)
- Plastic Pollution, Bottled Water
  - Discuss: Great Pacific Garbage Patch, Cost of Bottled Water, Issues with BPA and Phthalates.
  - Watch: "The Story of Bottled Water" (http://storyofstuff.org/bottledwater/)
  - Watch: Take Part's "Use Less Plastic" (http://vimeo.com/11064723)
  - Watch: Tapped The Film
  - Explore: 5gyres.org
  - Explore: www.RiseAbovePlastics.org

**6. Pledge Photos (Share Solutions)**

- Pledge: Have students pledge to do something that is a solution to one of the issues they've explored (not use plastic bottles, not throw their pills in the toilet, not dump oil in the street).
- Have them write their pledge and take a picture of them with it (miniature white boards are great).
- Share: Have them get someone in their family or someone in another class take a pledge of their own and take a picture to bring to class. Require that they share a fact in order to get them to pledge.
- Post the photos of all the solutions on a bulletin board and/or share them on the Web.

**Assessment:**

- Movie/lecture/guest speaker notes
- 2 Pledge Photos (one for self, one for friend/family)

## 5. HOW CAN WE CONSERVE WATER?

**Summary**

Students understand how and why to conserve water as they estimate and graph how much water could be saved in their own household through various water conservation techniques.

**Activity Ideas**

**1. What are Some Ways to Save Water?**

- Discuss different ways that we can save water
- Look at: GOOD's "Walk this Way Transparency," an infographic on reducing your water footprint (http://awesome.good.is/transparency/web/trans0309walkthisway.html).
- Look at: http://www.bewaterwise.com/ and http://www.ladwp.com/ladwp/cms/ladwp001257.jsp
- Explore your local laws and ordinances related to water use and conservation. For example, in Los Angeles, you can only water between certain hours on certain days and it is illegal to hose down your driveways. (http://www.ladwp.com/ladwp/homepage.jsp).

**3. Calculate Your Conservation Capacity**

- Have students work in pairs to complete #3 "Conserve Your Household Water" in their "Encounter Water Student Exercise Packet." Explain that although they are working in pairs, they are each responsible for calculating their own household's conservation capacity (use their partner for questions and support).
- After figuring out how much they can save, they will revisit the graphs they created in exercise #2 and regraph their usage with their conservation efforts.

**4. Grey Water**

- Explore: Grey water systems, what they are, how they work, what their benefits are and the amount of water they'll help us save.
- Speaker/Trip: Have someone come in and speak about grey water systems or tour a home/business that has a functioning grey water system.

**Assessment**

- Encounter Water Student Exercise Packet Activity 3

## 6. HOW DO WE MAKE A WATER CATCHMENT SYSTEM TO CONSERVE WATER?

**Summary**

Students will become familiar with the parts and assembly needed to make a rain barrel to capture water. They will be able to explain the steps in creating a rain barrel, materials required, and the differences in various rain catchment systems.

Materials: Rain Barrel for model and LCD Projector

**Activity Ideas**

1. **How can a Big Blue Bucket Save Water?**
   - Review previous lessons covered with a short warm up: "How can a big blue barrel save water, electricity, and reduce climate change?"
   - Have students share their answers in pairs and have each pair write one answer on the board. Discuss reasons for each answer and transition into explaining that today we are going to learn how to make a rain barrel.
2. **Water Catchment Scavenger Hunt**
   - If you have rain barrels on and around campus, have students complete the Encounter Water Student Exercise Activity 4.
3. **Rain Barrel Diagram**
   - Using the sample rain barrel, have students draw their own rain barrel on a reusable one-sided sheet of paper. Explain that the drawing needs to include every part that they see.
   - Once students have completed their drawings as a class, come up with terms to describe each part. Some terms such as 'flower pot' or 'filter' are flexible. Other terms, such as spigot, should be given to students and defined for them. Go through identifying each part on the real rain barrel and have each student then write the term next to the part on their drawing.

| DRAWING | NAME OF PART ON DRAWING WITH CONNECTING LINE |
|---|---|
| BUILDING INSTRUCTIONS | |

   - Have students leave room for building instructions (layout should look like this):
   - Have students view Green Ambassadors create Rain Barrels: http://www.youtube.com/watch?v=u4kaAw8_qm4 and HGTV's version of a Rain Barrel http://www.youtube.com/watch?v=MGFDlkJOdaM
   - Students will view two videos showing how to build a rain barrel. In each video, the teacher should highlight when they should add an instruction being shown in the video to their instructions. It may be helpful to show the video twice. The first just to observe and watch, and the second to identify important steps in creating the barrel.

**Assessment:**

- Encounter Water Student Exercise Packet Activity 4
- Drawing along with Encounter Water Student Exercise Packet Activity 5

## 7. HOW CAN WE HARVEST RAINWATER TO SUPPLY SOME OF OUR WATER NEEDS? HOW CAN USING RAINWATER SAVE WATER, ELECTRICITY AND REDUCE GREENHOUSE GAS EMISSIONS?

**Summary**

Students will build a water catchment system and calculate how much rainwater could be harvested from their roofs based on square footage and annual rainfall, then estimate the amount of water that could be harvested in their state.

**Activity Ideas**

1. **Rainwater as a Resource**
   - Ask if they can think of ways that they could actually use rainwater to fulfill some of the needs for water in their households. Guide discussion to the realization that if they could collect the rainwater that falls on the roof of their home, they should use it to water indoor and outdoor plants.
2. **Harvesting Rainwater: Encounter Water Student Exercise Packet Activity 6**
   - Have students complete exercise 5 for their own household, working in pairs to troubleshoot, ask questions or double check answers.
   - Explain the basic mathematics involved in the calculation: multiplying the square footage of their roof by the number of feet of rainwater that falls on their roof each year gives the total volume of water that falls on the roof annually.
   - Have students imagine that the floor of their classroom is the roof of their house, and then calculate how much water there would be if the classroom had two feet of water in it. (Area of the classroom in square feet x 2 feet of depth = number of cubic feet of water on the floor).
   - Next, walk students through the process of how they will determine the approximate area of the roof by finding the total square feet of all of the rooms in one floor of the house.
   - Students will determine the square footage of their home by either calculating square footage of rooms or by calculating the perimeter of the building they live in.
3. **Save Water and Money with a Water Catchment System: Encounter Water Student Exercise Packet Activity 7**
   - Have students compute how much water and money they could save by using a water catchment system.

**Assessment**

- Encounter Water Student Exercise Packet Activity 6
- Encounter Water Student Exercise Packet Activity 7

## ENCOUNTER WATER JOB

**Scott T. Mathers**

**Owner: Hey! Tanks LA**

Brad Lancaster has spent most of his adult life teaching others about sustainable living. He has been a permaculture consultant since 1993, creating permaculture designs that focus on energy and water conservation. There's no need to wonder whether or not his commitment to sustainable living is authentic: in the middle of downtown Tucson, Arizona, a city built in the middle of the desert, Brad Lancaster lives almost completely off the grid.

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## Activities

1 Calculate Your Household Water Usage
2 Graph Your Household Water Usage
3 Conserve Your Household Water
4 Water Catchment Scavenger Hunt
*for schools that have catchment systems already
5 Build a Water Catchment System
6 Harvest Rainwater
7 Save Water and Money with a Water Catchment System

## 1 Calculate Your Household Water Usage

**List all of the ways you can think of that you use water in your home.**

_____ _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____

**Calculate the water usage for all of the people in your household[1]:**

***A. Showers, baths and toilets***

How many showers do all the people living in your household take?
Per day: _____ showers Per week: _____ showers

1. How long (how many minutes) do the showers usually take?

_____ minutes per shower

2. Standard showerheads usually flow about 4 gallons per minute. Restricted flow showerheads usually flow about 1.5 gallons per minute. Use this data plus your answers to questions #1 and #2 to calculate the total amount of water used each week for showers in your household. Show your work here:

[ ] gallons of water per week for showers for the household

3. How many baths do all the people living in your household take?

_____ baths per week

[1] "Household" means whoever lives in your house and uses resources of your house.

4. A bath takes about 30 gallons of water. What is the total amount of water used each week for baths in your household? (Show your work here.)

   ☐ gallons of water per week for baths for the household

5. How many times do all of the people in your household flush the toilet?

   Per day: _____ flushes  Per week: _____ flushes

6. Standard toilets normally use about 5 gallons per flush. Low-flow toilets use about 2 gallons per flush. Use this data plus your answers to the question above to calculate the total amount of water used each week for toilets in your household. Show your work here:

   ☐ gallons of water per week for toilets for the household

***Brushing teeth and washing hands***

7. How many times a day do all of the people of your household brush their teeth?

   Per day: _____ tooth brushings  Per week: _____ tooth brushings

8. On an average, about how many minutes does the water run in the sink while people are brushing their teeth?

   _____ minutes per tooth brushing

9. Standard faucets usually have a flow rate of about 3 gallons per minute. Faucets with aerators have a flow rate of about 1.5 gallons per minute. Use this data plus your answers to the questions above to calculate the total amount of water used each week for showers in your household. Show your work here:

   ☐ gallons per week for tooth brushing for the household

10. How many times a day do all of the people living in your household wash their hands?

    Per day: _____ hand washings  Per week: _____ hand washings

11. On an average, about how many minutes does the water run in the sink while people are washing their hands?

_____ minutes per hand-washing

12. Standard faucets usually have a flow rate of about 3 gallons per minute. Faucets with aerators have a flow rate of about 1.5 gallons per minute. Use this data plus your answers to the questions above to calculate the total amount of water used each week for washing hands in your household. Show your work here:

[ ] gallons per week for washing hands for the household

***Washing Dishes: Automatic***

13. How many times a week do you run the dishwasher (if you don't have a dishwasher, skip the next question).

_____ dishwasher operations per week for the household

14. The average dishwasher uses 15 gallons per load. Use this information and your answer to the question above to calculate how much water you use per week running the dishwasher. Show your work here:

[ ] gallons per week for automatic dishwasher

***Washing Dishes: By Hand***

15. How many times are dishes washed by hand?

Per day: _____ dishes washed by hand Per week: _____ dishes washed by hand

16. On an average, about how many minutes does the water run in the sink while dishes are being washed. _____ minutes per hand dish washings

17. Standard faucets usually have a flow rate of about 3 gallons per minute. Faucets with aerators have a flow rate of about 1.5 gallons per minute. Use this data plus your answers to the questions just above calculate the total amount of water used each week for dishwashing in your household. Show your work here:

[ ] gallons per week for hand dishwashing for the household

***Laundry***

18. How many loads of laundry are washed per week by all the people living in your household?

_____ loads of laundry per week

19. An average load of laundry takes about 60 gallons of water. An efficient washer uses approximately 25 gallons of water per load. What is the total amount of water used each week for laundry in your household? (Show your work here.)

[ ] gallons of water per week for laundry

***Outside Watering***

20. How often do the people in your household water the lawns each week?_____

21. How many minutes each time? _____ minutes per lawn watering

22. Lawn sprinklers typically use about 15 gallons a minute of water. Use this information and your answers to the questions above to compute the total amount of water used each week to water your lawn. Show your work here.

[ ] gallons per week for lawn watering

23. About how many minutes per week do people in your household use outside hoses for other purposes (watering plants, cleaning the sidewalk, washing your car, etc.)

_____ minutes per week for other outside water use

24. A hose typically has a flow rate of around 10 gallons per minute. Calculate the total amount of water used each week for other outside watering. Show your work here:

[ ] gallons per week for other outside water use

***TOTAL***

25. Add up all of the numbers in the boxes to find your household's total water use per week.

[ ] gallons per week for all uses

## 2 Graph Your Household Water Usage

In order to get a clearer picture of how your household uses water, you can create a pie graph:

1. Compute the percentage of total water use for each type of water use you calculated. To find the percent, divide total water use per week into the quantity you calculated for each category of water use per week, and multiply the answer by 100.

   For example, if your *total* water use per week is 2000 gallons, and the amount of water used in the category of "*showers*" is 200 gallons, you would calculate the percentage like this:

$$percent = \frac{\text{amount of water used in one category}}{\text{total amount of water used}} \; x\,100 \; = \; \frac{200}{2000} x\,100 \; = \; 2\%$$

2. Find the size of the piece of the "pie" for each category by taking the appropriate percentage of 360 degrees.

$$2\% \text{ of } 360 \text{ degrees} \; = \; 7.2 \text{ degrees}$$

Math: .02 X 360= 7.2 degrees

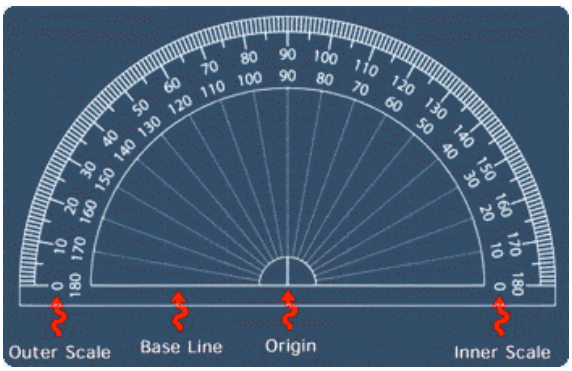
- Percentages are what each section actually represents.
- Degrees are used to determine how much of the pie graph should be allotted to that activity.
- When creating your graph make sure that you label each section with the correct category name and percentage.
- Each category should be a different color. Your graph should contain a key for each category represented.

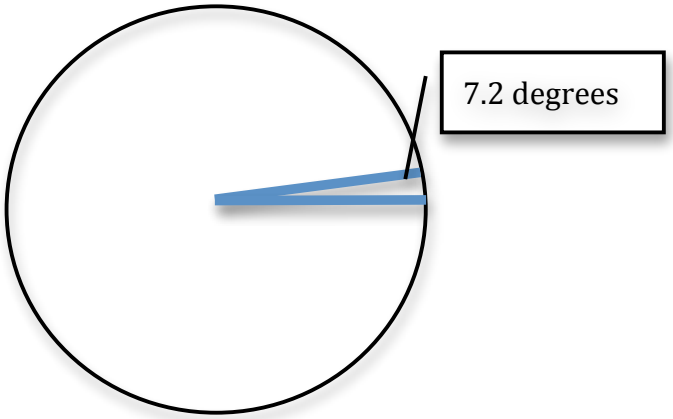
Use this table to record your calculations:

Total Weekly Water Use (from above): ☐

| **Category** | **Percent** | **Degrees** |
|---|---|---|
| Showers | | |
| Baths | | |
| Toilets | | |
| Brushing teeth | | |
| Washing hands | | |
| Dishwasher operation | | |
| Hand dishwashing | | |
| Laundry | | |
| Lawn Watering | | |
| Other outside water use | | |

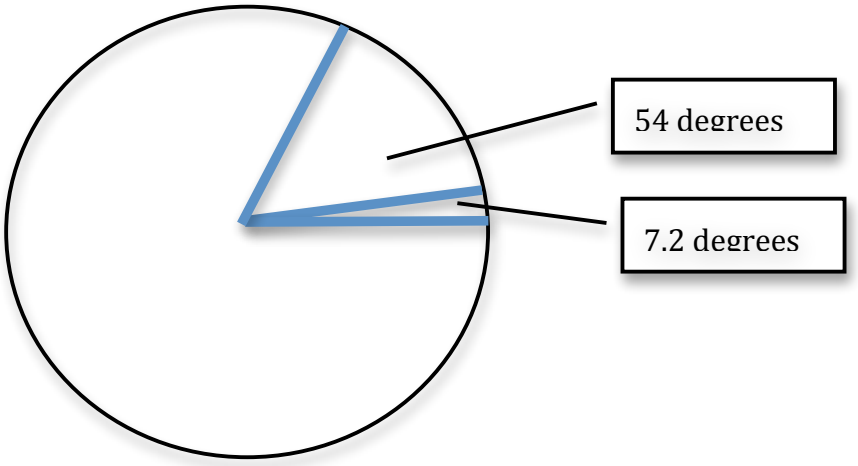
3. Next, you will use the inner "degree" scale of a protractor measure to mark off the first slice of the "pie" on your circle. If the example of showers equals 2% of all water usage, that would look like this:




4. Repeat with the next category. <u>When you measure this angle, start with the last line you draw as the baseline of the new angle.</u>

   For example, if the category of "laundry" was calculated as 15% of total use, the next piece of the piece would be 15% of 360 degrees, or 54 degrees. The graph would then look like this:




5. Repeat with all categories. By the time you are finished, you should have gone all the way around the circle, back to your starting point.

## 3 Conserve Your Household Water

### My Household Water Use

Complete this worksheet using information from the worksheet *Calculate Your Household Water Usage.*

How much water could you save each week?

1. If you captured the water that usually goes down the sink while you're waiting for it to get hot to wash your hands, and used that to water your plants?

   a) # of times hands are washed per week: a) _____

   b) how long the faucet runs while the water gets hot (if you're not sure, assume 1/2 minute) b) _____

   c) flow rate of faucet (if you're not sure, assume 5 gallons per minute) c) _____

   Show work here:

   ☐ gallons per week saved

2. If you didn't allow the water to run while you're brushing your teeth?

   a) # of times teeth are brushed each week: a) _____

   b) how long the faucet runs while teeth are being brushed (if you're not sure, assume 2 minutes) b) _____

   c) flow rate of faucet (if you're not sure, assume 5 gallons per minute) c) _____

   Show work here:

   ☐ gallons per week saved

3. If you were able to wash less loads of laundry a week by washing only full loads and wearing clothes twice before washing?

   a) # of loads you could save per week (if you're not sure, assume 1 load) a) _____

   b) # of gallons of water used per load of laundry (if you're not sure, assume 60 gallons) b) _____

   Show work here:

   ☐ gallons per week saved

4. If everyone in your household took shorter showers?

   a) # of showers taken per week a) _____

   b) # of minutes saved (assume each shower is two minutes shorter) b) _____

   c) flow rate of showerhead (if you're not sure, assume 4 gallons per minute) c) _____

   Show work here:

   ☐ gallons per week saved

If you installed low-flow showerheads in all of the showers in your house, so that each shower required less water?

   a) # of showers taken per week a) _____

   b) # of minutes per shower (assume each shower is one minute shorter) b) _____

   c) How much water is saved per minute by low-flow rate of showerhead (if you're not sure, assume you save 3 gallons per minute) c) _____

   Show work here:

   ☐ gallons per week saved

5. If you watered your lawn one less time per week?

   a) # of minutes the water runs during a watering a) _____

   b) flow rate of watering system (if you're not sure, assume 15 gallons per minute) b) _____

   Show work here:

   ☐ gallons per week saved

6. If you put a one-gallon plastic container in the tanks for all of your toilets to reduce (by one gallon) the amount of water used every time anyone flushes the toilet?

   a) # of times the toilet is flushed per week a) _____

   Show work here:

   ☐ gallons per week saved

7. If you fix a faucet that is leaking one gallon per hour? Show work here:

   ☐ gallons per week saved

8. Add all of the numbers in the boxes to find the total gallons of water saved per week:

   ☐ gallons per week saved, total, per household

9. There are about 12 million households in California. How much water could be saved each week if every household in California did all of these things? Show work here:

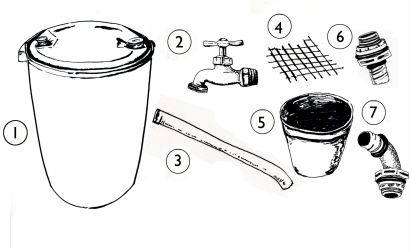
   ☐ gallons per week saved, total, for state of California

## 4 Water Catchment Scavenger Hunt

***For schools that already have catchment systems**

Scavenger Hunt: Draw a rough school map and label each number below in the correct location on the map.

1. Find Full Rain catchment systems that have NO connection to a rain gutter.
    a. Explanation: At Environmental Charter High School, some rain catchment systems are used to collect spillover water from the water purifier in our office. Rain catchment systems can also collect water from air conditioners or just used to store excess rainwater collection. This site also provides an example of how rain catchment systems can be daisy-chained.
2. Find a Rain Catchment System with lots of roof shingle residue in the flowerpot.
    a. Explanation: Not all roofs are equal. Roofs with old shingles may collect residue in the flowerpot filter and may need to be cleaned from time to time. Look at water samples from metal roofs as compared to shingle roofs.
3. Find a rain barrel near bikes.
    a. Explanation: At Environmental Charter High School, there is a rain barrel hidden behind the sheds near the biker rack. Discuss the advantages and disadvantages to having rain barrels that you may not see frequently.
4. Find a location that should have a rain catchment system but does not?
    a. Explanation: Discuss why some locations may be better than others when deciding where to put a barrel, i.e., proximity to gardens, slope, gutter drainage, etc.
5. Find a rain catchment system that **was** collecting water from an air conditioner.
    a. Explanation: See #1.
6. Find a catchment system that does not physically connect to a rain gutter.
    a. Explanation: All of the rain catchment systems at ECHS have no physical connection to the gutter. If a barrel tips, no damage occurs to the gutter. Likewise, it's easy to move a barrel.



## 5 Build a Water Catchment System

Materials:

- 55-gallon plastic food barrel
- ¾" spigot
- ½" hose
- Wire mesh
- 6" diameter plastic flowerpot
- 90° ½ hose barb

Tools:

- Marker
- Tin snips
- ⅝" and ⅞" paddle bit
- Jigsaw
- Drill
- Measuring tape
- Wrench
- ½" and

Step 1: Have your barrel and your flowerpot to place it upside down. Once it is placed at an equal distance between the two white caps over the seam line, trace your pot on the barrel.

Step 2: Use the circle you just traced as a guide to draw another circle inside that circle that will be ¼" smaller. Then cut out the smaller circle with a saw (you might want to drill a hole to get it started).

Step 3: Use your snips to cut a piece of wire mesh almost the size of the bottom of the flowerpot. Fold the corners of the wire mesh and place it at the bottom of the flowerpot. Fill the flowerpot with ¾" gravel.

IMPORTANT: Make sure you **DO NOT** leave any open space or gaps.

Step 4: Mark a dot on the barrel 4" from the bottom. Place this dot in the center of the larger top hole. This is where the spigot will go. With the dot as guide, drill a hole with ⅞" paddle bit.

Step 5: Tap the hole with a ¾" tap (make sure to only turn it a few times). Try making it as straight as possible. Lay down the barrel while drilling and tapping.

Step 6: Screw the spigot into the hole you just tapped. Use a large wrench to make sure it is tight enough. When the outside ring begins to squish, STOP!

Step 7: Using a ⅝" paddle bit, drill a hole about 2" from the top of the barrel. Follow with a ½" hose barb into the hole. Slip a few feet of hose into the barb.

Placement: Since the barrel weights over 400 lbs when full, it is key to place it on a hard surface and make sure it is level. Building a "sandbox" out of treated lumber is also good. It also raises your water supply.

Suggestions: If you wish to have more than one barrel, you can "daisy chain" them. This is when you connect the barrels together.

These are the simple steps to building your very own water catchment system! Now that you know, take the steps and start saving water!

## 6 Harvest Rainwater at Home

1. What is the annual average rainfall in your location, in inches? (Do your research)

   _____ inches of rainfall per year

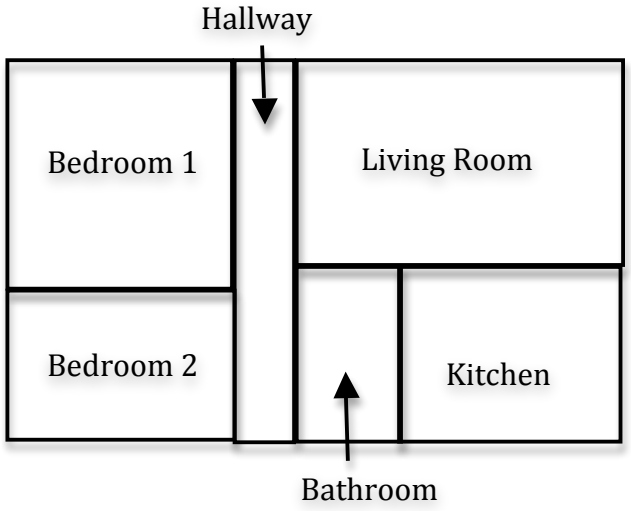
2. Divide this by 12 to get the number of feet of average rainfall in your location.

   _____ feet of rainfall per year

3. Estimate the area of the roof of the building you live in, in square feet. One way to do this is to determine the total amount of floor space in your house (for the bottom floor only, if your house has more than a story). This is done in three steps:

   a) Measure the length and width of each room in feet. If your roof also covers your garage, be sure to include that, as well.
   b) Multiply those two numbers to get area of the room in square feet.
   c) Add all of those values for all of the rooms to get the total square feet.

***Example calculation:***




| Room | Length | Width | Area |
|---|---|---|---|
| Bedroom 1 | 16 feet | 12 feet | 192 square feet |
| Bedroom 2 | 10 feet | 12 feet | 120 square feet |
| Hallway | 26 feet | 4 feet | 104 square feet |
| Living Room | 14 feet | 20 feet | 280 square feet |
| Bathroom | 12 feet | 8 feet | 96 square feet |
| Kitchen | 12 feet | 12 feet | 144 square feet |
| | | **Total Area** | 936 square feet |

***Your Calculation***

| Room | Length | Width | Area |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
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| | | | |
| | | | |
| | | | |
| | | **Total Area** | |

4. Multiply the feet of rainfall by the square feet of your roof to get the average number of cubic feet of rainwater that could be collected from your roof each year.

   _____ cubic feet of water per year

5. Multiply by 7.5 to get the average amount of gallons of water that could be harvested from your roof each year. (There are 7.5 gallons in a cubic foot of water)

   _____ gallons per year

6. There are about 12 million households in California. If every household harvested that much rainwater, how many gallons of water would that be each year?

   _____ gallons per year for state of California

7. In California, 1000 gallons of water costs about $1.50. Divide your answer to #6 by 1000, then multiply that answer by $1.50 to get an approximate value of the water that could be harvested from all of the roofs of households in the state.

   _____ gallons per year for state of California

8. There are several ways in which the amount of water that could be harvested from your roof might be lower or higher than the amount of water that could be harvested in other communities in California. Explain some of them.

9. Thinking about your answer to the question above, do you think that actual amount that could be harvested is less than, or greater than, the amount you have estimated? Explain your answer.

## 7 Save Water and Money with a Water Catchment System

A water catchment system uses a barrel to harvest water that falls on the roof of a structure and travels through the gutter system to the barrel. Use this worksheet to determine how much water the barrel will hold and how much money you can save with it.

1. Measure the height and radius in inches, then divide each by 12 to get the measurements in feet. To find the radius, measure the diameter of the barrel (the greatest distance across the top) and divide by 2.

   ***H = height in inches/12*** = _____ *feet*

   ***R = radius in inches/12*** = _____ *feet*

2. Compute the volume in cubic feet by multiplying:

   ***Volume of barrel in cubic feet = 3.14 x $R^2$ x H***

   Volume in cubic feet = _____

3. Multiply by 7.5 to get the number of gallons held.

   ***Capacity in gallons = Volume in cubic feet x 7.5***

   Capacity in gallons = _____ x 7.5 = _____

4. Every time you use a barrelful of harvested water instead of water from the hose, you save money. Find out what water costs in your community by contacting your water company. Usually this cost will be given per "HCF" or "Hundred Cubic Feet". Divide by 100 to get the cost in cubic feet.

   ***Cost per cubic feet = Cost-per-HCF/100.***

   Cost per cubic feet = _____/100 = _____

5. Now multiply by the volume of your barrel, in cubic feet, to find out how much a barrelful of water is worth:"

   ***Money saved per barrel = Cost per cubic foot x volume of barrel in cubic feet***

   Money saved per barrel = _____ x _____ = _____

6. Suppose the total cost of your water catchment system is $15.00. How many barrelfuls of water would you need to harvest to pay for your system?

   **Number of barrelfuls needed = (cost of water catchment system)/(money saved per barrel)**

   Number of barrelfuls needed = _____/_____ = _____

GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

EAT GREEN

G.R.E.E.N Teacher's Guide

**ESSENTIAL QUESTION:**
**How does what I eat affect my own health and the sustainability of the planet?**

**Students will gain an understanding of eating local, organic and whole foods vs. packaged and processed foods.**

- Approximate Time: 3 weeks
- Benchmark: Using the Green Ambassadors curriculum, students will produce an event to share what they've learned about Eating Green.

## STANDARDS

**National Science Standards:**

**12FSPSP3.1** Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.

**12FSPSP3.2** The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.

**12FSPSP3.3** Humans use many natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

**12FSPSP4.1** Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans. [See Content Standard C (grades 9-12)

**12FSPSP4.2** Materials from human societies affect both physical and chemical cycles of the earth.

**12FSPSP4.3** Many factors influence environmental quality. Factors that students might investigate include: population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.

**National Education for Sustainability K-12 Student Learning Standards**

**Grades 9-12, EfS 1.1: Intergenerational Equity** – Students forward an ethical argument on how sustainable resource use today can lead to basic human needs (e.g.: food, water, energy and shelter) being met for future generations (e.g.: 100 years in the future).

**Grades 9-12, EfS 2.2: Respect for Limits** – Students collect data in order to investigate and analyze how personal consumption patterns affect the sustainability of natural and human communities.

**Grades 9-12, EfS 3.1: Personal Responsibility** – Students identify and commit to a personal sustainability action and they write about the results of that action. (e.g.: using public transportation, reducing and recycling).

**National Council of Teachers of Mathematics Principles and Standards for School Mathematics**

Instructional programs from pre-kindergarten through grade 12 should enable all students to:

- Compute fluently and make reasonable estimates.
- Recognize and apply mathematics in contexts outside of mathematics.
- Understand measurable attributes of objects and the units, systems, and processes of measurement.
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

## OVERVIEW OF GUIDING QUESTIONS

1. Where Does Our Food Come From?
2. What Am I Putting In My Body?
3. How Does My Community Affect My Health?
4. How Can I Create a Sustainable Food System?

## RESOURCES

**Handouts**

- Eat Green Student Exercise Packet
- Francis Moore Lappe, 12 Myths of World Hunger (http://www.foodfirst.org/en/pubs/backgrdrs/1998/s98v5n3.html)
- "Two Buckets to Teach Sustainability"

**Films/Videos**

- Food, Inc.
- Dirt
- The Meatrix
- Bill Nye the Science Guy, Breakfast
- Jamie Oliver's TED talk (www.ted.org)
- Jamie Oliver's Food Revolution
- The Power of Community, How Cub Survived Peak Oil

**Websites**

- Growing Power: http://www.growingpower.org/o http://www.footprintofnations.org/Global%20Footprint%20Calculator/GFPCalc.html

**Guest Presenters/Field Trips**

- Local Organic Farmer
- Farmers market
- Grocery Store
- Community Outing for "Mapping Community Food Access Activity" Books
- Omnivore's Dilemma, Young Readers Edition
- The Town That Food Saved

**Books**

- Omnivore's Dilemma, Young Readers Edition
- The Town That Food Saved

**Materials**

- Protractor

*What's in my PB&J*

- Smucker's Uncrustable Peanut Butter and Jelly Sandwich

*Sipping Sugar*

- 5 familiar drinks (i.e. soda, red bull, fruit juice…)
- 5 colored plates
- White sugar
- Teaspoon

*Create a Truth Label*

- Markers, paper

*Two Buckets to Save the World*

- 2 buckets (2-5 gallons) per team of 4
- Bamboo
- Soil
- Organic plants (vegetables or herbs)
- Yogurt containers
- Twist ties
- Electric drill
- Aquaponic system

*Make Your Own Meal*

- Local organic fruits, vegetables and foods

## EAT GREEN HERO

**Will Allen**

**Founder, CEO of Growing Power**

Healthy communities are nourished in part by healthy, nutritious foods. However, it can be difficult to find affordable fresh fruits and vegetables in the inner city. A diet high in junk food leads to health problems, which makes life even tougher for people who are all too often already living in poverty. Will Allen's mission is to help urban communities produce their own food, as well as to help improve food distribution networks inside major cities.

Will Allen was born on a farm in 1949. After high school, he left the farm to attend the University of Miami, where he graduated in 1971. He played professional basketball in Europe, then went to work for Procter and Gamble. In 1993, he left Procter and Gamble to purchase the last remaining farm in Milwaukee. He got local youth to pitch in, and began developing the urban farming techniques that fuel Growing Power, his nonprofit organization. Growing Power uses permaculture techniques like composting. Waste is turned into fertilizer for plants, and in the future, they hope to convert methane into energy.

Another important aspect of Growing Power's urban farming efforts is community involvement. By encouraging neighbors to work together in the garden, Allen encourages them to work together to address other community issues as well. By growing food close to where it will be eaten, Growing Power helps reduce the amount of fuel used for transportation and therefore the amount of harmful gases released into the atmosphere. In 2008, Allen received a $500,000 "genius grant" to expand the work he has done with Growing Power. He was also named a MacArthur Foundation Fellow.

Growing Power now has two farms in and around Milwaukee, as well as numerous community gardens. They have also expanded into Chicago and set up a system to connect small, sustainable family farmers with urban residents, called the Rainbow Farmers Cooperative. "I'd like to see Growing Power transform itself into a five-story vertical building being totally off the grid with renewable energy, where people can come and learn, so they can go back to their communities around the world and grow healthy food," he explained in a 2008 article in the New York Times

## 1. GUIDING QUESTION: WHERE DOES OUR FOOD COME FROM?

**Summary**

Using documentaries Food, Inc., Dirt, and The Meatrix, and the article The 12 Myths of World Hunger as resources, students will become familiar with key environmental, economic and health issues related to food production. Students will show their understanding by creating graphs that represent current food production practices.

**Activity Ideas**

1. **Watch Food, Inc. and explore one or more of the issues raised in the accompanying Discussion Guide, produced by the Center for Ecoliteracy (http://www.foodincmovie.com/spread-the-word.php)**
   - Local vs. International food production
   - Issues of eating higher on a food chain
   - Organic Productions vs. Industrial Farming

2. **Watch Bill Nye the Science Guy's, Breakfast.**

   Have students watch with these questions in mind and have a discussion following the video.

   - How does eating organic bacon help penguins?
   - Why does it take _ gallon of gasoline to produce 8 oz. of frozen orange juice?
   - What problems are caused by growing coffee trees as a monoculture - that is, not mixed in with other trees and plants?
   - What is a "food mile" and why should we care?

3. **Explore Good Magazine's "How Far Your Produce Travels" interactive graphic.**

   http://www.good.is/post/transparency-how-far-your-produce-travels/

4. **Watch Meatrix (http://www.themeatrix.com/).**

   Have students discuss "what is not sustainable about factory farming?" in groups and share their answers in a class discussion. You can also find activities in "The Meatrix Teacher's Guide."

5. **Read the article based on Francis Moore Lappe's "12 Myths of World Hunger,"**

   (http://www.foodfirst.org/en/pubs/backgrdrs/1998/s98v5n3.html) and have students discuss how organic, local production of food can feed our world.

6. **Watch Dirt, the Movie and have students discuss how soil health affects food and our health.**

**Eat Green Assessments**

1. **Eat Green Student Exercise Activity 1: Carbon and Calories**
   - Students will graph the carbon footprints of various types of foods and their calories to examine which types of food provide the most calories for the least amount of CO2 produced.
2. **Eat Green Student Exercise Activity 2: "I'll Have 77 Mega joules of Filet, Please"**
   - Students will examine the amount of energy that is required to produce certain types of food.

## 2 GUIDING QUESTION: WHAT AM I PUTTING IN MY BODY?

**Summary**

Through presentations, explorations, and the creation of "truth food labels," students will learn that the food we put in our bodies is not exactly what we think it is.

**Activity Ideas**

1. **Watch Jamie Oliver's TED talk (www.TED.org), which explores the following issues:**
   - Deaths related to eating food
   - Packaged food
   - Portion sizes
   - Health care and obesity
   - Sugar

   Have students take notes on the three most important issues Jamie's presentation addresses. After watching, break students into groups and give them 10 minutes to decide and present to the class what the three most important issues were and why.

**2. Root Down LA's "What's In my PB & J"**

- Bring in a Smucker's Uncrustables PB&J sandwich
- Have one student read aloud the ingredient list

  BREAD: ENRICHED UNBLEACHED FLOUR (WHEAT FLOUR, MALTED BARLEY FLOUR, NIACIN, REDUCED IRON, THIAMIN MONONITRATE, RIBOFLAVIN, FOLIC ACID), WATER, HIGH FRUCTOSE CORN SYRUP, YEAST, PARTIALLY HYDROGENATED SOYBEAN OIL AND/OR SOYBEAN OIL, CONTAINS 2% OR LESS OF: WHEAT GLUTEN, SALT, DOUGH CONDITIONERS (MAY CONTAIN ONE OR MORE OF: DIACETYL TARTARIC ACID ESTERS OF MONO AND DIGLYCERIDES (DATEM), MONO AND DIGLYCERIDES, ETHOXYLATED MONO AND DIGLYCERIDES, SODIUM STEAROYL LACTYLATE, CALCIUM PEROXIDE, ASCORBIC ACID, AZODICARBONAMIDE, L-CYSTEINE), YEAST NUTRIENTS (MAY CONTAIN ONE OR MORE OF: MONOCALCIUM PHOSPHATE, CALCIUM SULFATE, AMMONIUM SULFATE), CALCIUM PROPIONATE (MAINTAIN FRESHNESS), CORNSTARCH, ENZYMES (WITH WHEAT). PEANUT BUTTER: SELECT ROASTED PEANUTS, DEXTROSE, VEGETABLE MONOGLYCERIDES (FROM PALM OIL), SALT. GRAPE JELLY: GRAPE JUICE, HIGH FRUCTOSE CORN SYRUP, CORN SYRUP, PECTIN, CITRIC ACID, POTASSIUM SORBATE ADDED AS A PRESERVATIVE.
- Have the class keep score for each ingredient they don't know or can't pronounce.
- Ask "what is in a PB&J sandwich and what's up with all these other ingredients?"

**3. Root Down LA's "Sipping Sugar"**

- Place five familiar drinks on a table at the front of the room (i.e. soda, Red Bull, fruit juice, Starbucks)
- Have a student come to the front and arrange the drinks in order from what they think has the most sugar to what they think has the least. Ask the class if they think this is correct and offer another volunteer the chance to correct it.
- Have a third volunteer read sugar amounts on the back of the labels and put the drinks in their true order. Point out serving size and its relation to grams of sugar. Many drinks say they contain 20 grams per serving, for example, but the bottle contains 1.5 or 2 servings.
- Place a colored plate in front of each bottle. Ask a student to measure out the amount of sugar in that drink and pour it on the plate. 1 tsp = 4 grams of sugar

**4. Create a Truth Label for Foods**

- As a class, look at the typical information offered on a food label.
- Have each student create and design a truth label that includes information they think we should know about our food to present to the class. For example:
  - How much water was required to make it
  - How much energy was required to make it
  - How many miles it traveled to make it to market
  - What pesticides were used (and related health warnings)
  - How much CO2 was emitted in the production
  - Who owns the company that makes the food
  - Fair trade and wages

**Assessment**

1. **Eat Green Student Exercise Activity 3: Diets then and Now**

   Students will compare pre and post-fast food diets by graphing where our calories come from now and where they came from 50 years ago.

2. **Eat Green Student Exercise Activity 4: Cost of Fast Food**

   Students will graph the correlation between the % of overweight teenagers and the % of meals eaten at fast food restaurants over the years.

**Additional possible assessments**

3. **Determine the percent of calories supplied in a typical Los Angeles teen's diet from sugar, fat, complex carbohydrates, corn syrup, packaged food, versus the typical diet of someone from Havana, Cuba.**

   Create pie charts for both scenarios; (data and worksheets would need to be discovered)

4. **Compare actual fast food calories in meals such as: McDonalds, TGI Fridays, Jack in the Box, Subway, In N' Out etc....**

   Have students determine why one fast food restaurant would be healthier than another and why?

## 3. GUIDING QUESTION: HOW DOES MY COMMUNITY AFFECT MY HEALTH?

**Summary**

Students will learn how culture, community and convenience affect their food choices and health.

**Activity Ideas**

1. **Lunch Audit (adapted from Food Choices, E2)**

   Have students assess their cafeteria/lunch offerings:

   - List all the different areas that food is found on campus and the approximate percentage that eat at each, including bringing their own.
   - Survey where students go if they can leave campus (determine the top 3 restaurants)
   - Write notes about each area/restaurant, noting how and where the food is prepared, who vends it, where it comes from and how it is packaged.
   - Record the nutritional offering of the most popular/commonly sold item at each station, vendor or restaurant (fat/calorie/sugar content, nutritional offering)
   - Record how much waste is created on campus each lunch.
   - Record any other notes about the food being eaten by students at lunch.
   - Have a class discussion or presentation.

2. **Does my Community Support My Health? Mapping Community Food Access**

   - Using Google maps or a printout, post a map of the neighborhood with the school in the middle;
   - Have students name where they can get food in the community (markets, restaurants, fast food, gas stations) and mark them on the map as they call them out.
     - Use a red pen for restaurants/stores that sell unhealthy/processed foods
     - Use green pen for those that sell mostly healthy/fresh foods
   - Google map restaurants, fast food, gardens, markets, etc. using a projector for anything the students have missed or may not know about.

- Compare the number of red vs. green dots.
- Discuss how many red vs. green resources there are. Ask students what effect they think this has on the community's health. What additional resources are needed in the community to improve our own and our planet's health?
- Repeat the activity for a school with a higher income level and discuss how and why the results vary.

**3. Neighborhood Food Audit**

- Walk the class to a nearby street with a food establishment (convenient store, market, restaurant). If there are several, split them up into teams for each.
- Have the students explain to the restaurant/market staff what they are doing and ask permission to audit.
- Have each group record something similar to the chart below for each establishment (or different foods within the same establishment), noticing the ease/difficulty of finding whole foods and the difference in cost.
- Have the class discuss how convenience and speed impacts our health.

| **WHOLE FOODS** | | **PROCESSED FOODS** | |
|---|---|---|---|
| Item | Price | Item | Price |
| #1 | | #1 | |
| #2 | | #2 | |
| #3 | | #3 | |
| # of people sitting and eating in the establishment: | | | |
| # of people taking food/drinks to go: | | | |

**4. Watch The Power of Community, How Cuba Survived Peak Oil and discuss how and why the oil shortage has impacted the following in Cuba and if it is better or worse:**

- Eating habits
- Food production
- Lifestyles

**Assessment**

A. Students will turn in their completed work and participate in a classroom discussion to ensure they understand that if they want to change their food choices they have to change their community.

## 4. GUIDING QUESTION: HOW CAN I CREATE A SUSTAINABLE FOOD SYSTEM?

**Summary**

Through a hands-on activity, students will learn how growing and cooking our own food and eating locally creates a sustainable food system.

**Activity Ideas**

**1. Grow Your Own Food, Anywhere**

- Have students read the "Two Buckets will Save the World" handout and work in teams to create a self-watering container system that makes it easy to grow organic produce almost anywhere.
- Have students calculate the economic benefits of growing your own food by comparing the prices of the "whole foods" in their food audit from unit 3 to the cost of their self-contained system.

**2. Visit a Farmers Market**

- Take a field trip to a local farmer's market
- Have students prepare 3 interview questions for farmers about how the food is grown, where it comes from, etc.
- Take photos and have students write blog entries about their visit to benefit the school and the community.

-OR-

- Split class into teams and give each team $5 to shop for a items to make a class lunch, giving each team a specific shopping category.

**3. Make Your Own Meal**

- Have student bring in a favorite recipe that requires 5 fresh ingredients or less (see: http://www.farmfreshtoyou.com/recipes/) or have them create a new one.
- Select the best recipes and have students plan a meal that incorporates every color of the rainbow, and includes greens, a whole grain and protein.
- Visit a farmers market to buy the items or have each student bring one local, organic item from the list.
- Have students work in teams to prepare the recipes and invite the principal or administrator to attend the feast, have each student talk about the nutritional value and/or the location of each item.

4. Grow with Aquaponics

- Read about Aquaponics at Growing Power (http://growingpower.org/aquaponics.htm)
- Watch films about Aquaculture/Aquaponics (http://www.earthsolutions.com/Farm-in-Box-Aquaponics_c_214.html)
- Start an Aquaponics system on campus and monitor the health of food and fish (Farm in a Box has cheap, effective solutions)
- Have students reflect on how and why Aquaponics re-creates our food system, as we know it.

**Assessment**

Whatever activity you choose to do, have an assessment ensuring that students are learning from being part of the solution.

## EAT GREEN JOB

**Urban Farmer and Farm Manager: Claudia Abbott-Barish**
**Founder, CEO of Growing Power**

Claudia Abbott-Barish became interested in sustainable farming in college, when she learned that creating parks and other protected areas results in negative consequences for native people that hunt and live off the land. After realizing that sustainable agriculture provides a way for native people to support themselves and remain connected to the land, she started teaching sustainable agriculture to rural South Africans. Shortly after, she returned to America to grow her own food on a family farm. She then moved to England to work on a project called Transition Initiative to help local communities become more self-sufficient by using less fossil fuels and reducing pollution by growing their own food.

Claudia was then inspired to share her knowledge with urban communities that she felt had been left out of the self-sufficiency movement. She knew that if local agriculture was going to truly provide a solution to our environmental problems, it would have to work for everyone. She has since moved back to San Francisco and teaches sustainable agriculture with MyFarm, a program that benefits urban farmers and city dwellers through community-supported agriculture (CSA).

Claudia went to a Quaker school for most of high school, and the close-knit environment helped increase her self-confidence. She also spent a year on a mixed forest/farm as part of an alternative high school program, which fueled her early interest in environmentalism and sustainability. This program also taught her the value of thinking outside the box. She went to college in Scotland, where she felt somewhat stifled by the traditional, unimaginative ways of thinking she found there. Still, she says, the experience was beneficial because, "without such a staunch example of how I didn't want to think, I mightn't have reached so much further out of the box presented to me."

What's it like being an urban farmer? Claudia spends most of her day tending to the plants: planting, weeding, managing pests and harvesting their vegetables. She also packages vegetables and herbs into CSA baskets that are given to participants. In addition, she manages other urban farmers and coordinates plantings to make sure that there are always enough fresh vegetables and herbs to supply the CSA program.

## TWO BUCKETS TO SAVE THE WORLD

This project allows any student to experience the joy and power of growing their own food, particularly those in urban areas that may not otherwise have the facilities or resources to garden.

Summary: You will create a self-watering container planter system using two 3-5 gallon buckets. It is recommended to break your class into groups of 3-4 students. The system is comprised of:

- 2 stacked buckets: the inner, top bucket holds the soil and plant; the bottom, outer bucket holds the water
- Bamboo wicking system: the water is delivered to the plant through a wicking system (Picture 1) that draws the water up into the plant roots when needed.
- Plants

**Benefits**

The benefits of this self-watering system are numerous. It is water-efficient because the plant only draws up water as it needs it and less is lost to evaporation. It saves time and effort because, not only is it easy to build, but also once it's built it needs to be watered much less often than a traditional garden, usually once every week or two. This also makes it easier if you are gone for long periods, on vacation or just forgetful. The self-watering system doesn't require weeding and many people have found that these container systems produce plants that out-grow and out-produce plants grown in traditional gardens. It is economical because

it uses cheap or recycled materials that can be used year after year. Plus it only takes up a small amount of space and is portable, making it easy to grow anywhere, including an apartment, in front of a classroom or school building without a typical garden area.

**What to Plant**

The plants you choose should be dependent on the season, your local climate, the length of time you can devote to this project, and preference. (Explain what you mean by preference.) Tomatoes grow especially well in this self-watering container, but you can grow many types of vegetables, herbs, or even flowers. Consider growing a salad (carrots, tomato, onion) or pizza garden (tomato, peppers, basil). It is recommended to plant seedlings, not seeds. Check with local gardening resources for specific planting and harvesting time information for your area and avoid plants that are really root intensive or might grow out of the bucket system, like watermelon. Allow students to have a choice in what they plant, so that they will have more ownership over their project.

**Possible Exercises/Discussion**

Think of your class as a community. In an ideal scenario, you'd be growing/raising all the food your community needs. Do you have enough food to feed your community? Realistically your local agricultural system is based on an unsustainable scenario. So where will the food come from? (Food will have to be trucked in from outside the community). What are the consequences? (Reduced productivity of the farmland causes social, psychological, and economic hardship for farmers, and the increased cost of food causes economic hardship for community, plus their money is no longer staying within and supporting their community). Now zoom out to view the bigger picture. What can you do as a world population to make your food resources more sustainable? How can you keep our resources diverse and productive over time? What are the benefits of everyone growing their food sustainably? For your own family? For your community? For the world? What are the social, economic, and environmental consequences on a world level if we don't move to sustainable agriculture?

**Student Instructions for Making a Self-Watering Container System**

*Items needed:*

- Two recycled, food-grade five-gallon buckets per team of 3-4 students
- One 16-ounce recycled yogurt container or plastic cup
- One 17-inch bamboo stick or a similar length hollow tube or pipe
- Organic potting mix (one bag)
- One cup of dry organic fertilizer
- Automatic drill with 1/4-inch drill bit
- Keyhole saw and/or a utility knife

**Notes: The five-gallon buckets that you use for this project need to be food-grade. Do not use buckets that were used for paint. You can often find free food-grade buckets at local restaurants, bakeries or on Craigslist. You need to use potting soil for this project. Regular garden soil does not work as well.**

**Instructions:**

1. Drill or cut holes in the bottom of one of the five-gallon buckets: one large hole for the 16-ounce container to sit in (which will act as the wicking chamber); one medium hole for the bamboo stick or tube (which will deliver water to the bottom reservoir bucket); and approximately 20 small holes for drainage.
   A. To determine how large of a hole to cut for the wicking chamber to sit in, you will need to find out the height of the water reservoir. An easy way to do this is to place one of the five-gallon buckets into the other and place them in front of a light source. On the outside of the outer bucket, mark the location of the bottom of the inside bucket, then measure the distance from the bottom of the outside bucket to this mark. Measure this same distance on your yogurt container or plastic cup, and measure the diameter of that container at this spot. Add 1/8 of an inch to this measurement and that will be the diameter of the large hole.
   B. Turn your unmarked (inside) five-gallon bucket upside down, and draw a circle in the center on the bottom of the bucket, with the diameter you determined in step 2. Drill a series of 1/4-inch holes around the perimeter of this circle. Use a keyhole saw or utility knife to cut the hole out.
   C. Measure the diameter of your bamboo stick or tube. Add 1/8 of an inch to this measurement to give you the diameter of the medium hole. This hole should be near the outside edge of the inside bucket (the one you just cut the large hole in). Cut the hole the same way as above.
   D. Drill approximately twenty 1/4-inch holes in the remaining area of the bottom of this bucket. These will be drainage holes that will allow water to seep out of the soil.
2. On your yogurt container or plastic cup, cut four vertical slits using your utility knife. These slits should be spaced evenly around the perimeter. Do not put any holes in the bottom of this container. This will act as the wicking chamber for the water once it is filled with potting mix.
3. Drill an overflow hole into outer bucket (the five-gallon bucket without any holes) so that the inner bucket will not be sitting in water. Drill a 1/4-inch hole approximately 1/4 of an inch below the mark you made in step 2.
4. Place the five-gallon bucket that is full of holes into the bucket with the overflow hole.
5. Cut one end of your bamboo stick or tube at an angle and place the angled end into the medium hole at the bottom of the inside bucket and down into the water reservoir area of the outside bucket. The top of the stick or tube should be 2-3 inches above the top edge of the buckets. The angled end prevents the tube from clogging.
6. Fill your yogurt container or cup with potting mix and place it into the large hole so that the bottom of the container is in the water reservoir area. The top of the container may stick up into the inside bucket, but this okay.
7. Fill the inside five-gallon bucket with potting mix, compressing the mix along the way.
8. Plant your seeds or transplant in the center.
9. Make a shallow, circular channel in the soil around the perimeter of the plant. Sprinkle a cup of dry, organic fertilizer into this trench.
10. Pour water through the bamboo stick or tube into the reservoir chamber of the bottom bucket (you may want to use a funnel to make this process easier) until water begins to flow through the overflow hole.
11. Place your self-watering container somewhere sunny (even if it is on pavement) and watch your plant grow!

## Activities



# 1 Carbon and Calories

**Guiding Question: How does what you eat affect the polar ice caps?**

By the end of this lesson you will:

- Graph and analyze data
- Answer questions related to graphs

Every food you eat has its own carbon footprint: the amount of CO2 that was released into the atmosphere as that food was grown and processed, and transported to the place you bought it.

Every food you eat also contains calories: that's the energy content of the food. Your body needs a certain amount of food energy every day in order to stay alive and active. When you consume more calories than you need, the extra calories can be stored as fat. When you consume less calories than you need, your body can use the stored fat for the calories it needs, which might cause you to lose weight. If there is not enough stored fat your body will start to "burn up" its own muscles for energy.

You can see why it is important that you get enough calories in your food and that you do not take in more calories than your body needs to be healthy.

Follow these steps to create a graph that compares the carbon footprint and calories of several different kinds of foods.

Here are estimates of the carbon footprints for one pound of various kinds of foods in the industrial system*:

| Food (lbs) | Calories | Pounds CO2 |
|---|---|---|
| Beef | 1237 | 13.3 |
| Ham (pork) | 893 | 4.8 |
| Poultry | 751 | 3.5 |
| Cheese | 1845 | 8.5 |
| Potatoes | 350 | 0.64 |
| Eggs | 709 | 1.95 |
| Milk | 272 | 0.95 |
| Apples | 236 | 0.55 |
| Strawberries | 145 | 0.3 |
| Brown bread | 1182 | 0.75 |

1. According to this data, please answer these questions.

| | |
|---|---|
| Which food has the highest carbon footprint per pound? _____ | Why do you think? |
| Which food has the lowest carbon footprint per pound? _____ | Why do you think? |
| Which food has the highest calories per pound? _____ | Why do you think? |
| Which food has the lowest calories per pound? _____ | Why do you think? |

* Data in this cart is derived from information provided at http://timeforchange.org/eat-less-meat-co2-emission-of-food. Students should understand that such data is always based on estimates and assumptions, and that other assumptions might lead to much different data. What is most important about this activity is to understand that foods do have their own carbon footprints and that the calorie content vs. carbon footprint of foods can be compared in this manner.

Using the chart on the following page, graph the carbon footprint of each food. Put a data point on the graph for every kind of food. For example: the data point for milk is shown (272 calories on the horizontal axis, .95 pounds CO2 on the vertical axis). Then answer these questions:

2. Which part of the graph shows foods with high CO2 footprints and high calories?

3. Which part of the graph shows foods with low CO2 footprints and low calories?

4. Which part of the graph shows foods with low CO2 footprints and high calories?

5. Which part of the graph shows foods with high CO2 footprints and low calories?

6. An average male needs about 2500 calories a day to live and be active. If you wanted to get those calories in such a way as to produce the least amount of CO2, which foods would you eat?

GREEN AMBASSADORS
*A Program of Environmental Charter Schools*

# NOTHING WASTED

## G.R.E.E.N Teacher's Guide

**ESSENTIAL QUESTION:**
**What are the reactions of my actions?**

**Students will learn that electricity production is one of the largest contributors to carbon in the atmosphere. They will learn to understand that the energy we use and how we use it (the technology) can lower our carbon footprint. Students will use math and science in a field investigation, do an energy audit, and convince their school or parents to reduce their carbon footprint by changing habits or technology.**

- Approximate Time: 3 weeks
- Benchmark: Using the Green Ambassadors curriculum, students will create a sustainable tour of their school.

## STANDARDS

**National Science Standards:**

**12CLS4.3** Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

**12FSPSP3.1** Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.

**12FSPSP3.2** The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.

**12FSPSP3.3** Humans use many natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

**12FSPSP4.1** Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans. [See Content Standard C (grades 9-12)

**12FSPSP4.2** Materials from human societies affect both physical and chemical cycles of the earth.

**12FSPSP4.3** Many factors influence environmental quality. Factors that students might investigate include population growth, resource use, population distribution, overconsumption, the capacity of technology to solve problems, poverty, the role of economic, political, and religious views, and different ways humans view the earth.

**National Education for Sustainability K-12 Student Learning Standards**

**Grades 9-12, EfS 1.1: Intergenerational Equity** – Students forward an ethical argument on how sustainable resource use today can lead to basic human needs (e.g.: food, water, energy and shelter) being met for future generations (e.g.: 100 years in the future).

**Grades 9-12, EfS 2.2: Respect for Limits** – Students collect data in order to investigate and analyze how personal consumption patterns affect the sustainability of natural and human communities.

**Grades 9-12, EfS 3.1: Personal Responsibility** – Students identify and commit to a personal sustainability action and they write about the results of that action. (e.g.: using public transportation, reducing and recycling).

**National Council of Teachers of Mathematics Principles and Standards for School Mathematics**

Instructional programs from pre-kindergarten through grade 12 should enable all students to:

- Compute fluently and make reasonable estimates.
- Recognize and apply mathematics in contexts outside of mathematics.
- Understand measurable attributes of objects and the units, systems, and processes of measurement.
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

## OVERVIEW OF GUIDING QUESTION

1. **Where does energy come from?**
2. **How do I know how much energy I am using?**
3. **What technology will lower my energy bill and save money at the same time?**
4. **How do I get others to reduce their energy consumption?**

## RESOURCES

**Handouts**

- Nothing Wasted Living Student Exercise Packet

**Films/Videos**

- Kilowatt Ours: http://www.kilowattours.org/ (must purchase if you use)
- Who Killed The Electric Car? (can watch online for free or purchase)

**Books**

- The Going to Green Academic Curriculum, a textbook on sustainability
- NEED (National Energy Education Development Project) Curriculum Guide: http://www.need.org/curriculum.php
- Green My Parents

**Websites**

- Kilowatt Ours Curriculum: http://www.kilowattours.org/
- Solar School House: http://www.solarschoolhouse.org/
- Research Solar Lesson Plans and you will find a plethora of resources

**Guest Presenters/Field Experiences**

- Travel to a Power Plant
- Travel to a house powered by solar energy
- Visit an electric car company or speak with an owner of an electric car
- Travel to a local energy resource center

**Materials**

- School Electric Bill (ask for this in advanced so students can have access to this information)

## NOTHING WASTED HERO

**William Kamkwamba and Catching Wind**

William Kamkwamba was born in Malawi in 1987. Although he was a smart kid who loved to learn, he was forced to drop out of school before he was 14 years old. High school tuition was $80, which was more than his family could afford to pay. However, William continuing learning through books he checked out from his local library.

After he saw a picture of a windmill in a science book, he decided to build one from scratch. Building an actual working windmill would be an admirable science project for any 15 year old, but William didn't even have access to proper building materials. How did he manage to build his windmill? He improvised, using bicycle parts, pulleys and plastic pipes. Simply by looking at a windmill design in a book, he was able to build a working windmill that could produce 12 watts of power. It was enough to power some light bulbs and a radio.

Everyone who had laughed at him before was amazed when his windmill actually produced electricity. He built more windmills, and became a local celebrity. Then, as word of his accomplishment spread beyond Malawi, he became an international celebrity and was invited to speak at the Technology Entertainment Design (TED) conference in 2007. Now, he is working on a windmill design that would supply enough clean, renewable power to supply his village's irrigation pumps. He also has sponsors who are paying for him to go to school, and has written a book called, "The Boy Who Harnessed the Wind."

Permaculture is all about sustainable development. To truly have sustainable agriculture, you need a sustainable source of power. Our current reliance on fossil fuels is not sustainable. William Kankwamba's ultimate vision of building windmills to power his country demonstrates a way to provide accessible, sustainable power for everyone. His story also demonstrates that you can live a "green" life no matter where you are, even if you don't have access to much technology.

## 1. WHERE DOES ENERGY COME FROM?

**Summary**

Students explore the renewable and non-renewable sources of energy and the consequences of using energy from these sources.

**Activity Ideas**

**1. How do my lights turn on?**

- What is the difference between Renewable Energy vs. Non-renewable Energy
  - Review the NEED curriculum to find the best lessons for your students to understand where energy is coming from (http://www.need.org/curriculum.php)

**2. How can I get energy from a different source?**

- Watch the movie "Kilowatt Ours" and discuss the issues of deriving our energy from coal. http://www.kilowattours.org/
- Have students complete one of the activities from the "Kilowatt Ours" curriculum.
- Nothing Wasted Student Exercise Packet Activity 1: Solar Panels
  - Have students complete the exercise to determine if using solar panels will save them money; discuss the answers and present their extra credit projects to the class.

**3. How does my car move?**

- Review the Transportation Topic in the NEED Curriculum (http://www.need.org/curriculum.php) and have students do one of 10 activities to understand the different ways we power our cars.
- Watch, "Who Killed the Electric Car" and discuss the benefit of using alternative energy for our transportation.
- Have students explore electric cars on the market and discuss what car they would purchase for their own use or design their own electric car.
- Nothing Wasted Student Exercise Packet Activity 2: Transportation Calculations
  - Students will get a better understanding of how math can be used to understand and solve problems related to transportation costs and energy use.
  - Discuss alternatives to driving. Discuss the history of public transportation; how and why it transformed into private transportation (e.g., single car transit on highways). Discuss Bike Share programs (e.g., Amsterdam)
- Take a field trip on a local subway or bus, or give extra credit to anyone that takes public transportation that week.

**Assessment**

- Nothing Wasted Student Exercise Packet Activity 1: Solar Panels
- Nothing Wasted Student Exercise Packet Activity 2: Transportation Calculations

## 2. HOW DO I KNOW HOW MUCH ENERGY I AM USING?

**Summary**

Students will gain a better understanding of their personal and household energy consumption by conducting a home energy survey and reporting their findings to the class.

**Activity Ideas**

**1. How much energy do we use at school?**

- Nothing Wasted Student Exercise Packet Activity 3: Energy Audit Part 1
  - Arrange the class into teams, and have each team conduct a lighting energy audit for another kind of room in your school: classroom, library, office, hallways, etc.
  - Consider assigning two teams the same room so that their answers can be compared.
  - Consider having someone come in and work with the students to conduct an energy audit for the classroom (lighting companies, energy non-profit organization).
  - Discuss ways to reduce energy use at school. What is the most feasible option?

**2. How much energy is my home using?**

- Nothing Wasted Exercise Packet Activity 3: Energy Audit Part 1
  - In class, have students complete Nothing Wasted Student Exercise Packet Activity 3: Energy Audit Part 1 for their home instead of the school.
- As homework, have students complete Nothing Wasted Student Exercise Packet Activity 3: Energy Audit Part 2 for their home.
- Discuss the answers and have students determine how much money the school would be saving from making changes on their campus.

**Assessment:**

- Nothing Wasted Student Exercise Packet Activity 3: Energy Audit Part 1 (for school)
- Nothing Wasted Student Exercise Packet Activity 3: Energy Audit Part 1 (for home)
- Nothing Wasted Student Exercise Packet Activity 3: Energy Audit Part 2 (for home)

## 3. HOW CAN I LOWER MY ENERGY BILL AND SAVE MONEY AT THE SAME TIME?

**Summary**

Students will research habits and technology that help us save money on electricity. Based on their energy audits, students will determine what can be done differently at school to save energy and money.

**Activity Ideas**

1. **What habits can I change to save energy?**
   - Research and discuss how and why lighting energy consumption contributes to carbon emissions. Record what you have learned.
   - Research how much energy our regular classroom and household items consume (i.e. projector, hair dryer, dryer, dishwasher drying mode, etc).
   - Have students make a list of the Top 10 ways to save energy and money without buying anything and post in class (i.e. turn classroom lights on when sunlight is enough, hang clothes to dry, let hair dry naturally, unplug technologies when not in use). Have them write one that they are committed to doing for the year and take a picture of them with their commitment on the classroom wall.
2. **What technology will help me save energy?**
   - Have students research various technologies that will help us save money. Have them each share one new technology with the class and discuss the benefits and feasibility of each for home and school.
     - i.e. incandescent and LED technology, online energy monitors, low-energy refrigerators, surge s trips, etc.)
   - Read new ideas on saving money and energy from the "Green My Parents" book
   - Research, record and discuss energy incentives and alternatives are offered by your local power provider (i.e. rebates for new low-energy appliances, alternative energy source program opt-ins, etc).

**Assessment:**

- Check students notes to ensure they have properly researched all of the questions above and cited all their sources.
- Students research and present one new energy-saving technology to the class.

## 4. HOW DO I GET OTHERS TO TAKE ON THE SOLUTION?

**Summary**

Students will write a proposal convincing the school to switch their exit sign to save them money and energy.

**Activity Ideas**

1. **Make a Plan**
   - Nothing Wasted Student Exercise Packet Activity 4: Your Plan

     Have students write a proposal to the principal or school board summarizing ideas on how the school can save money by saving energy (or a company)

     – List the proposed new habits and benefits for changing habits.

     – List proposed new technologies and the benefits of switching technology.

     i. Estimate the amount of energy and money that would be saved by your plan.

     ii. Estimate the cost savings that will be realized with each new technology or habit.

     iii. Include an action plan of how and when each habit will be changed (and encouraged/enforced) or technology applied.

     iv. Note how much carbon reduction will happen because of your proposal.

     v. Include the cost of implementing each element in the plan and how long it would take to pay for itself in energy savings.

     vi. Propose a date that you will return to follow up on the implementation.

2. **Test the Plan**

   Have students test their proposal by delivering it to another team in the class

   - Have the team evaluate the plan and presentation for feasibility and professionalism.

3. **Present the Plan**

   Present the best proposal to school administration

   - Have the class vote on the best proposal to present to make happen at school.
   - Arrange a time for the class to present the best proposal to the principal or school board.

4. **Put the Plan in Action**

   If the principal or school board decides to implement any of the ideas, be a part of making it happen.

**Assessment:**

- Nothing Wasted Student Exercise Packet Activity 4: Your Plan
- Presentations of Plans to Principal or Board

## 5. WAS IT WORTH MY ENERGY?

**Summary**

Students will determine if it was worth their own time and energy to do this project; answering the question "Was it worth it?"

**Activity Ideas**

1. Have students record answers to the following questions:
   - Do you think the final recommendation is a better solution for your school and the environment? Explain.
   - Do you think the school will make any of the changes you propose? Why or why not?
   - How could you have been more persuasive in your proposal? Presentation?
   - Why do good ideas sometimes not get implemented? Where or how else have you seen a really good idea not get implemented and what got in the way?
   - What does persistence mean? What does it look like?

**Assessment**

Have students write their evaluation of the process and reflect as a group to envision how they could have done things differently.

## NOTHING WASTED JOB

**Mike DiGiovanni, Green Builder**

Mike Giovanni is a supply chain manager for a green builder in California. He oversees the construction of solar-powered homes that beat California's energy code requirements by an impressive 35%. Eventually, he hopes to bring green building to the masses by building affordable homes that consume 50 to 75% less energy than standard homes.

For Mike, the road to a green career was not always smooth. Although he majored in Natural Resource Conservation, he ended up taking a supply chain management position (which means he does the cost analysis that company uses to make decisions) for a conventional builder after college in order to support himself and his family. Deeply unhappy, he realized that if he was going to bring about change in the world, he needed to change his own life first.

Mike took the knowledge he had gained working for a conventional construction company and brought it to a company that builds energy-efficient green homes. These homes help homeowners use less energy, reducing the amount of greenhouse gases in the atmosphere and helping America become less dependent on foreign oil. They also conserve water, especially important in California.

Mike's career is fast-paced, and he uses skills he learned in his math, science and business classes frequently, especially algebra and geometry. His career as a green builder has been full of exciting moments, especially breaking ground on the nation's largest single location standard solar-powered community.

Mike says that green building is an excellent career for young people to consider because there is so much potential for them to create change. The building industry needs fresh, creative ideas to help it become more sustainable, and a career as a supply chain manager offers an excellent chance to make a difference, simply because you have so much influence over the company's purchases.

Mike also offers excellent advice for any young person who wants to make a difference. He says, "There are green jobs out there, but we can green our existing jobs. If you are passionate about the environment, bring that to whatever else you love and are good at, so we make all jobs green."

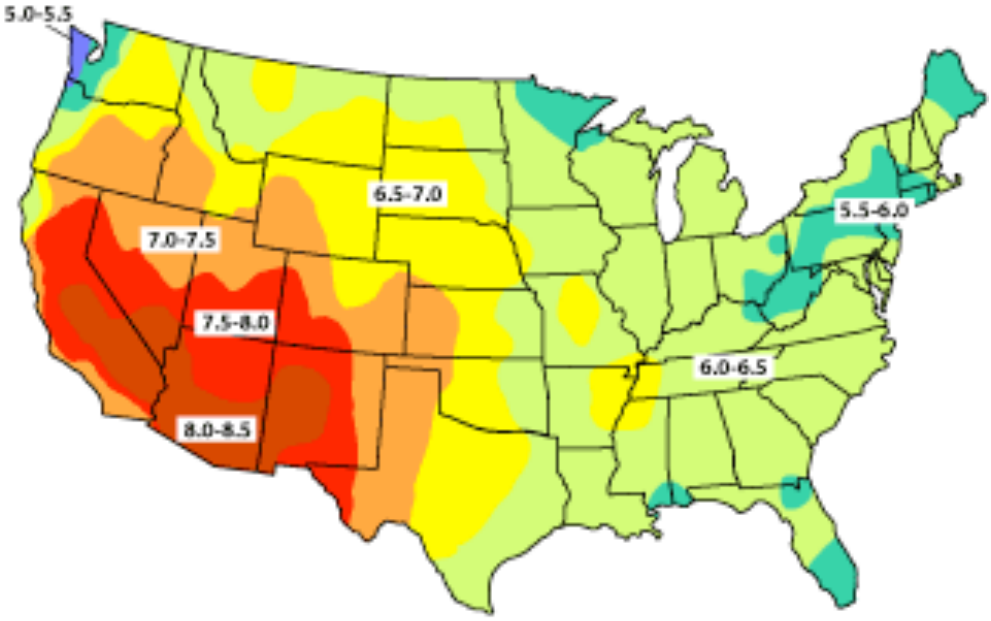
## Activities



## 1. Solar Panels

Solar panels are devices that convert the energy of sunlight into the energy of electricity. Complete these steps to understand the factors that might affect a decision to install solar panels on a house.

The amount of energy that falls on the roof of a house in the form of sunlight depends on the location of the house. If you live near the equator, for example, sunlight usually falls more directly on the roof than if you live far north or south of the equator. If the sky is often cloudy, that will also reduce the amount of sunlight energy.




This map, from the US Department of Energy's website,[1] shows the amount of sunlight energy per day (in kilowatt-hours) that falls on a flat surface with a 1 meter square area in various locations in the United States. The energy used by a light bulb over a period of time is found by multiplying the power requirement of the bulb by the number of hours the bulb is on. If the power is measured in watts, then the unit of energy will be watt-hours. Commonly, however, energy is measured in units of kilowatt-hours (abbreviated as kwH). Since 1 kilowatt-hour = 1000 watt-hours, you must divide the number of watt-hours by 1000 to find the energy in kilowatt-hours.

Suppose that you live in Nebraska, which receives 6.5 to 7.0 kilowatt-hours of sunlight energy per square meter each day (on average). Since one square meter is about 10 square feet, that means that for every 10 square feet of flat area in your yard or on your roof, there would 6.5 to 7.0 kilowatt-hours of solar energy each day.

Suppose also, for the sake of these questions, that your household needs about 1200 kilowatt-hours of electrical energy per month.

[1] http://www1.eere.energy.gov/solar/pv_cell_light.html

**Questions**

1. If you could collect **ALL** of the solar energy that falls on your flat roof in Nebraska that has an area of of 20 feet by 20 feet, how much would that be per day? Is that enough solar energy to provide all of the electrical energy needs for your household?

   Show your calculations:

2. Solar panels do not turn all of the sunlight energy that falls on them into electricity - depending on the type of panel, the amount of electricity that is produced is likely to be 10% to 15% of the total amount of energy in the sunlight. If you covered an area of 20 x 20 feet with solar panels, would that be enough to provide all of the electrical energy needs for your household?

   Show your calculations:

3. Suppose you are paying 15 cents per kilowatt-hour for electrical energy. How much is the energy that would be provided by your solar panels worth, each month?

   Show your calculations:

4. If it costs you $20,000 to install those solar panels, would you do it?

   Explain your reasoning.

**Extra Credit:**
Do research to find out what it would cost to install a solar panel power system on your roof, how much energy it would produce, and how much in savings that would be worth. You can find “solar energy calculators” on the Internet to help you.

Explain the results in a presentation to your class.

## 2. Transportation Calculations

Solve problems related to transportation costs and energy use.

**Mileage**

***Example Calculation***

A family is choosing a new car that they expect to use for 5 years. A Toyota Camry gets 25 miles per gallon (mpg); a Toyota Prius gets 40 miles per gallon (mpg) but costs $3,000 more. If the car will be driven for 15,000 miles a year, and gasoline costs $3.00 per gallon, which car would be the wisest purchase after 5 years?

A. 15,000 miles per year X 5 years = 75,000 miles

B. Camry (25 mpg car): (75,000 miles)/(25 miles per gallon) X $3.00 per gallon = $9,000 (cost of gas)

B. Prius (40 mpg car): (75,000 miles)/40 miles per gallon) X $3.00 per gallon = $5,625 (cost of gas) + $3,000 price tag = total cost of $8,625

*Your calculation*

You are choosing a new car that you expect to drive for 8 years. Research a car you would want to drive that gets 30 miles per gallon (mpg), another car that you would want to drive that gets 45 miles per gallon, but costs $5000 more (if possible, this might take some time, but find one that is around $5000 more). If the car will be driven for 15000 miles per year, and gasoline costs $3.00 per gallon, which car would you buy?

Show work:

A. Car A_____: 30 mpg car _____= ____ gallons per year. Cost of Gasoline for 1 Year: $_____

B. Car B_____: 45 mpg car: _____ = ____ gallons per year.
Cost of Gasoline for 1 Year: $_____

Gasoline savings per year (A vs. B) =

Gasoline savings over 8 years =

Is it worth it to pay initially $5000 more for your car that gets better gas mileage? Explain:

**Ride Sharing or Carpooling**

***Example calculation:***

A group of 8 people is planning a driving trip of 1,000 miles. Should they take 3 cars, each of which gets 35 miles per gallon, or one van, which gets 16 miles per gallon?

Cars: (1,000 miles)/(35 miles per gallon) = 28.6 gallons per car.

Total gas = $3.00 x 28.6 gallons = 85.7 gallons

Van: (1,000 miles)/(16 miles per gallon) = 62.5 gallons.

*Your calculation*

30 high school students are going to an event that is 50 miles away. Is if better to take one bus, which gets 8 miles per gallon, or 7 cars, each of which gets 35 miles per gallon?

Show work:

Is it better to take one bus or 7 cars, please explain?

**Speed**

***Example calculation:***

A car gets 30 miles per gallon when driven at 55 miles per hour, and 25 miles per gallon when driven at 65 miles per hour. On a 300-mile trip with gas costing $3.00 per gallon, how much traveling at the lower speed saves gas and money?

At 55 miles per hour, gasoline used = (300 miles)/(30 miles per gallon) = 10 gallons, or $30.

At 65 miles per hour, gasoline used = (300 miles)/(25 miles per gallon) = 12 gallons, or $36.

*Your calculation*

A car gets 30 miles per gallon when driven at a speed of 60 miles per hour, and 24 miles per gallon when driven at a speed of 75 miles per hour. On a 500-mile trip with gas costing $3.00 per gallon, how much gas and money are saved by traveling at the slower speed?

Show work:

Is driving slowly a solution to saving gas? Explain:

# 3. Energy Audit

**What is a Lighting Energy Audit?**

An audit is an examination of something in order to find out more about it. ("Examination" means, "studying something very closely".)

Many times, audits occur to ensure something is the way it is supposed to be. For example, a business might do an audit on how money is being spent. The owners want to be sure that money is being spent the way it is supposed to be spent.

Sometimes audits are done to find out how to improve the way people do things, or to find out how to make something work better.

The purpose of a Lighting Energy Audit is to improve the efficiency of lighting in a building. When you conduct an energy audit, you will be trying to answer these questions:

1) ***About how much energy is being used for lighting?***
2) ***How could energy be saved in lighting, while making sure that the building has enough light for the people in it?***

**Why Would Someone Do a Lighting Energy Audit?**

It takes a lot of electrical energy to light a big building. That energy costs money. That means that wasting energy also wastes money.

Saving money is not the only reason to conserve electrical energy. Most of the energy used by people in the United States comes from burning fossil fuels.

A building lighting energy audit can help you discover ways to save a lot of energy, a lot of money, and burn a lot less fossil fuels.

**Part 1: Energy Use and Cost**

A. Look up at the ceiling lights in the room. They are probably either fluorescent tubes or incandescent bulbs; both are called **lamps**. How many are there?

A. Number of lamps = _____

B. What is the wattage of one of the lamps? You may need to ask one of your school's maintenance staff to tell you.

B. Power required by one lamp = _____ watts

C. What is the total power requirement of all of the lamps?

C. Power required by all lamps = A x B

=____ _/_____ watts

D. How many hours are the lamps left on in a day and in a month?

D. Monthly usage = 20 x daily usage

= 20 x _____ hours

= _____ hours

(Assumes lights are on 5 days a week for 4 weeks per month)

E. The energy used by a light bulb over a period of time is found by multiplying the power requirement of the bulb by the number of hours the bulb is on. If the power is measured in watts, then the unit of energy will be watt-hours. Commonly, however, energy is measured in units of kilowatt-hours (abbreviated as kwh). Since 1 kilowatt-hour = 1000 watt-hours, you must divide the number of watt-hours by 1000 to find the energy in kilowatt-hours.

E. Energy required by all lamps for a month = (C x D)/1000

=_____ kwh

F. Now you need to find out what your school pays for electrical energy. Ask to see the electrical bill for the past month. On that bill, find the total cost for electrical energy and the total kilowatt-hours (kwH) used. Divide to find the cost per kilowatt-hour.

F. Rate for electrical energy = (monthly cost of electricity)/(kwh used in a month)

= _____/_____

= $_____ dollars per kwH

G. Now you can find the cost of electricity for the lighting in your room.

G. Cost of lighting in one room for one month = E x F

= $_____

H. Multiply to find the cost for all rooms.

H. Cost of lighting for all rooms = G x (number of rooms)

= $ _____

Part 2: Saving Energy and Money

***Example calculation***

Jefferson Academy currently pays $800 a month for electrical energy for lighting. They have been told that they could reduce their lighting bill by 20% if they install more efficient fluorescent bulbs at a total cost of $6,000. But they would have to take out a loan for the $6,000, with a monthly interest rate of $40.00. Compute the monthly cost savings of the upgrade:

A. Energy cost savings = 20% of $800
= $160

A. Subtract from those savings the monthly interest payment, to find actual savings.

B. Actual monthly savings = Energy cost savings – monthly interest
= $160 - $40
= $120

B. How long would it take to pay the loan with the month saved?

C. Payback time = (loan amount)/(actual monthly savings)
= $6000/$120
= 50 months

Since they could repay the loan in a little more than four years, this seems like a good idea.

## 4 *Your Plan*

**Type your group's plan and recommendations to incorporate the following:**

A. Hook: State why your school needs to change their current energy situation.

B. List the proposed new technology and the benefits of switching technology.

C. List the proposed new habits and benefits for changing your school's energy habits.

D. Share research on how you could save money on the electrical energy used by the lights in your school, and share a plan and/or timeline for accomplishing this.

   a. Your timeline might include replacing current lamps with more efficient ones, or installing automatic dimming systems to turn the lights down when there is plenty of daylight coming into a room. You might begin by choosing just one room as an example and break down the costs and savings of the lighting conversion.

   b. Your timeline might include a request to have all teachers trained to turn their lights off before they leave a classroom, and state how much money in energy costs that would save.

E. Estimate the amount of **energy and money** that would be saved by your complete plan. Your estimate need not be exact, but it should be reasonable and you should be able to explain it to others.

F. Calculate the **cost** of your plan and how long it would take to pay for it.

G. Present your plan to your class. As a class, work together to select the best plan to present together to your school administrators.