

"With these actions you can improve the world": Empowering students with innovative learning resources for climate change and ocean acidification

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VIRTUAL MARINE SCIENTIST

Step into the shoes of an ocean acidification (OA) scientist, and design and run your own experiment

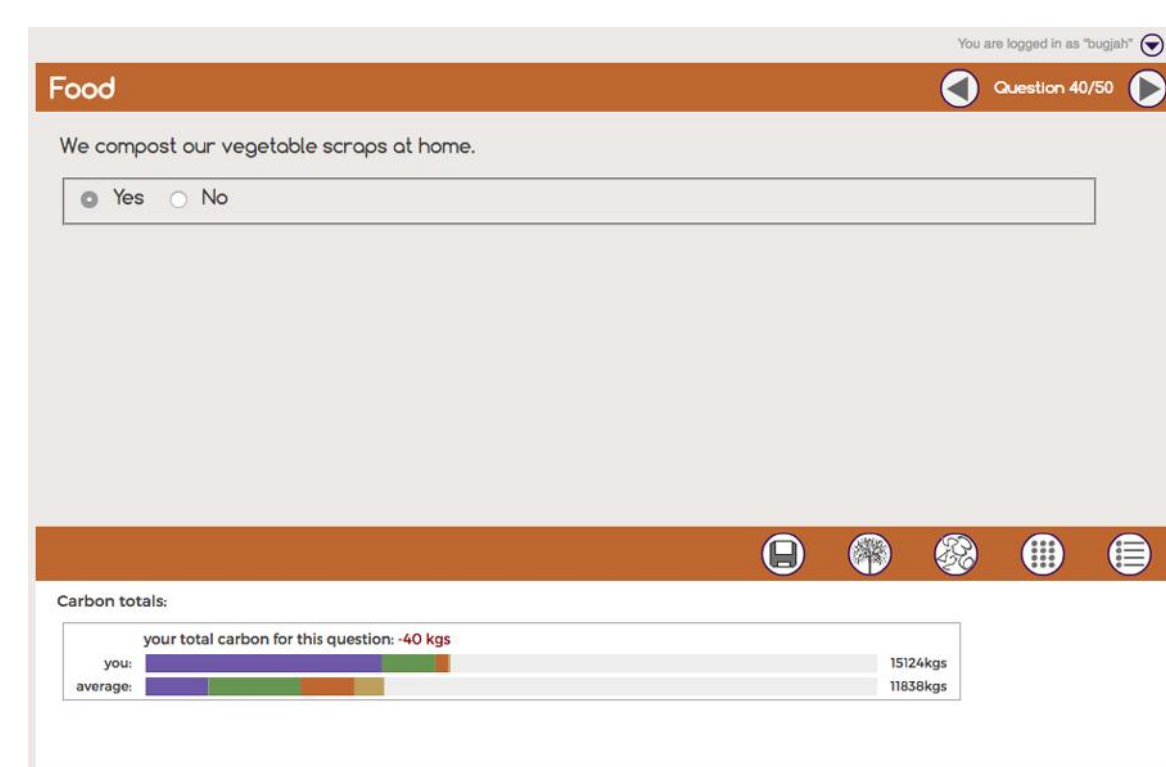


What students will do:
Study the direct and indirect impacts of climate change and OA on mussels by developing their own hypothesis to test experimentally, apply for funding, and design, run and analyze their own experiment.

Students will learn:
*through their own interest and research questions
*the scientific method in practice
*the importance of good experimental design
*an appreciation for state-of-the-art multi-stressor experiments.

CARBON FOOTPRINT CALCULATOR

Student-focused, detailed, validated, fully international



What students will do:
Use our 50-question calculator to see their emissions from transport, home, food and personal purchase choices, and identify steps they are willing to take to reduce their footprint.

Students will learn:
*how their individual behaviors and choices impact the environment
*what changes they can make to reduce their impact
*how we arrived at each calculation
*about other environmental implications of their daily choices.

<http://i2sea.stanford.edu>

ABOUT I2SEA

The Inquiry-to-Student Environmental Action (I2SEA) project is a collaboration among research scientists, media programmers, curriculum specialists, educators and education researchers. The common goal is to produce high-quality, engaging, freely-available climate change and ocean acidification resources for secondary school students and their teachers, and to study how use of these resources contributes to scientific literacy.

OUR RESOURCES

We present here a suggested classroom sequence for these resources, but also encourage teachers to utilize specific resources in their classes in whatever way they may best fit in their own curriculum.

On our web site are numerous resources to help teachers and students use our materials in and out of the classroom, including detailed alignments with climate and ocean literacy standards, as well as national science content standards from the United States (NGSS) and Sweden.

The *Carbon Footprint Calculator* and *Online Discussions* (and planned upgrades) form part of our **International Student Carbon Footprint Challenge (ISCFC)** program. See <http://footprint.stanford.edu> for more info.

FUNDING

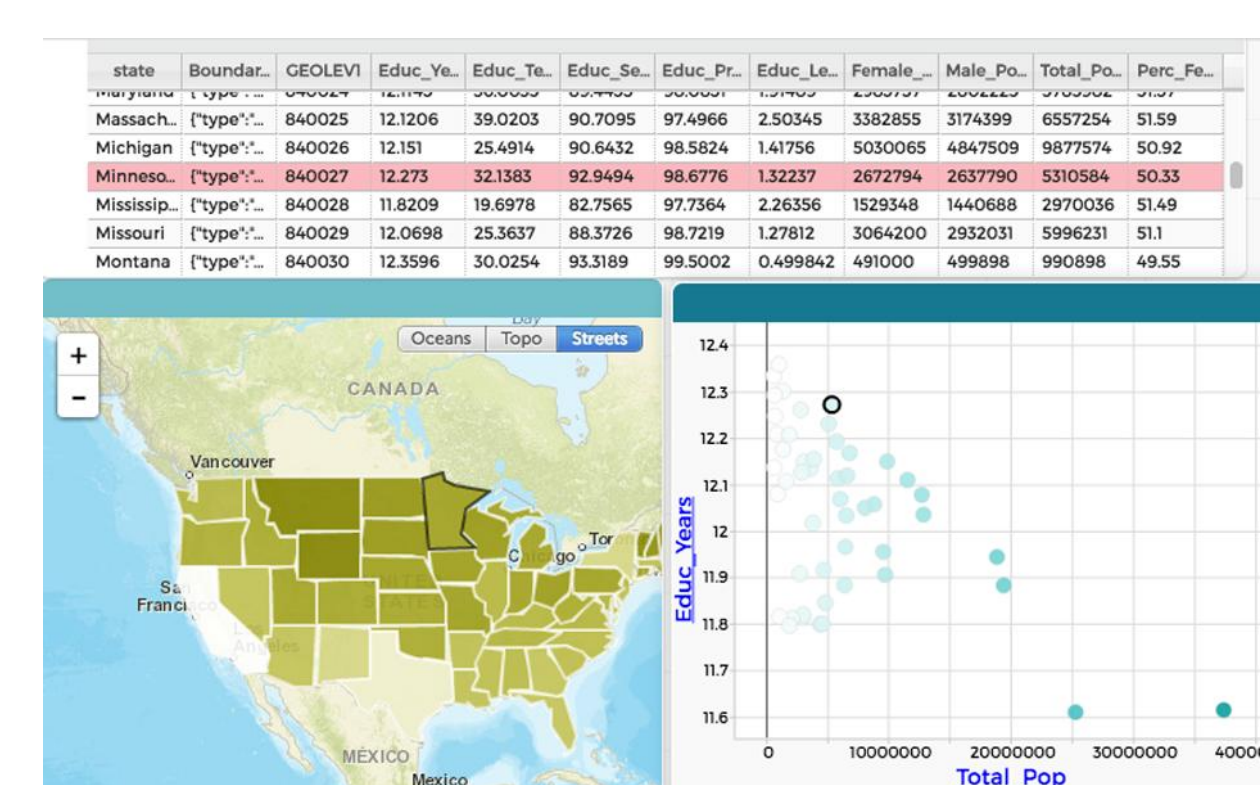
Marcus and Amalia Wallenberg Foundation
Michael and Patricia O'Neill Charitable Trust

I2SEA PUBLICATIONS

Fauville G, Lantz-Andersson A, Mäkitalo A, Dupont S. and Säljö R. 2016. The carbon footprint as a mediating tool in students' online reasoning about climate change. Pp. 179-202 in: *Learning across Contexts in the Knowledge Society*. Erstad, Kumpulainen, Mäkitalo, Schröder, Prullmann-Vengerfeldt, Jöhanndóttir (Eds). Sense Publishers: Rotterdam.
Fauville G, Säljö R, and Dupont S. 2012. Impact of ocean acidification on marine ecosystems: educational challenges and innovations. *Marine Biology*, 160: 1863-74.
Fauville G, Hodin J, Dupont S, Miller P, Haws J, Thorndyke M and D Epel. 2011. Virtual ocean acidification laboratory as an efficient educational tool to address climate change issues. In: W Leal Filho, editor. *The Economic, Social and Political Elements of Climate Change*. Pp. 825-36.

FOOTPRINT DATA VISUALIZATIONS

A powerful, student-driven tool that mines our database of 10's of thousands of student footprints worldwide

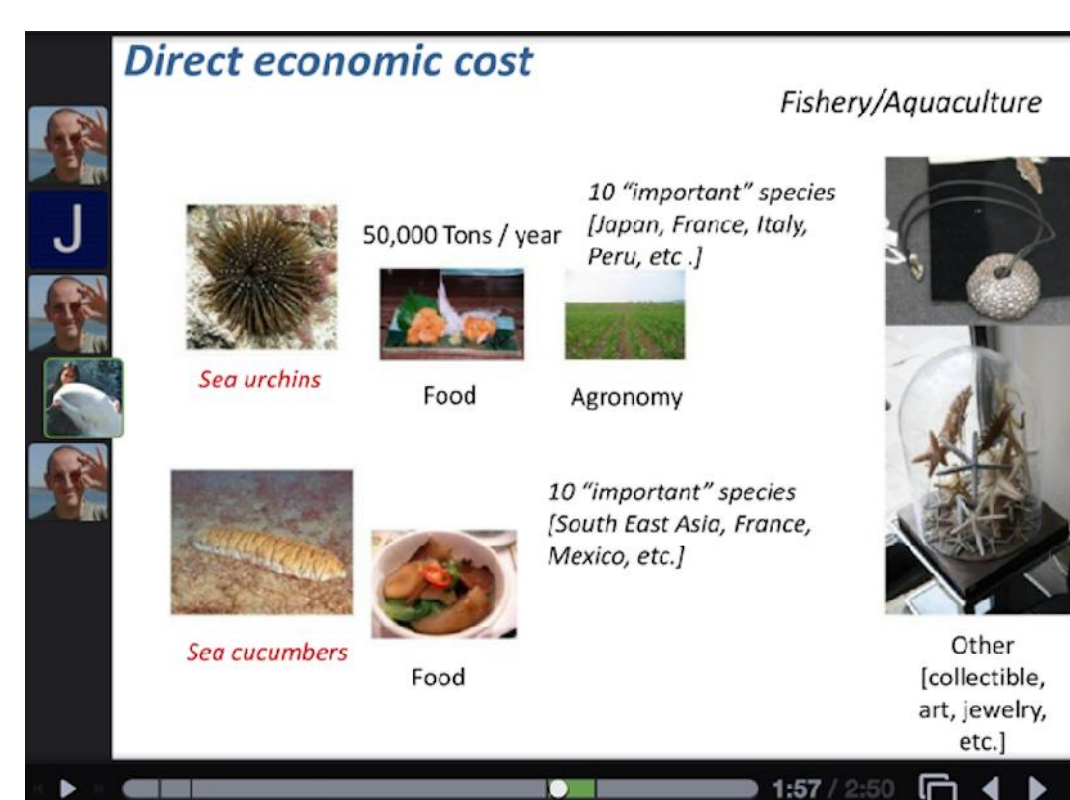


COMING SOON

In partnership with the the Concord Consortium we will utilize their Common Online Data Analysis Platform (CODAP), giving students the opportunity to analyze our global footprint data in tables and graphs. All student data will be fully anonymous, and will allow students to address their own research questions. The possibilities for classroom inquiry are essentially endless.

OCEAN ACIDIFICATION: SO WHAT?

Follow our scientist in his lab to discuss the bigger picture



A great way for teachers to probe their students' learning!

What students will do:
Learn from and interact with a scientist through an online presentation that places the results from *Our Acidifying Ocean* in a global context.

Students will learn:
*about the biological and societal implications of ocean acidification (OA)
*and have the opportunity to formulate and ask their own questions to an OA researcher.

HANDS-ON ACTIVITIES

Let's get our hands (and feet) wet!



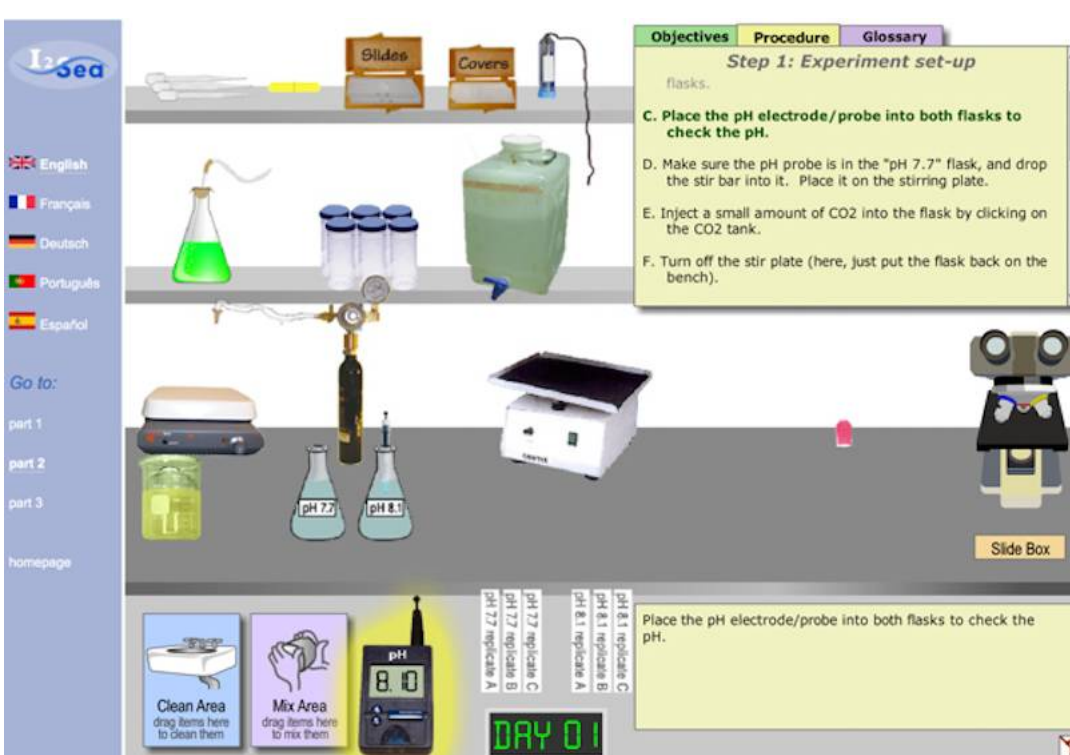
COMING SOON

While virtual learning resources allow your students to do activities that would otherwise be impossible in a classroom setting, we also believe that there is no substitute for actually doing a live experiment.

Protocols for a wide variety of classroom-formatted, hands-on demos and experiments in climate change and OA (as well as tractable field studies) are available online. We will help you identify ones that are scientifically valid and most valuable for you and your students.

OUR ACIDIFYING OCEAN

An interactive tutorial and virtual experiment



Available in 5 languages!

What students will do:
Explore the chemistry of ocean acidification (OA) and its impacts on sea urchin larvae through interactive models, a virtual lab bench, and a microscope measurement tool.

Students will learn:
*about the connection of OA to CO₂
*about the consequences, running and analyzing a virtual experiment to test the impact of a decrease in pH on the development of sea urchin larvae
*the importance of sample size and replication.

PLEDGES

Students target areas for effective footprint reductions, make pledges to do so, and report fulfilling those pledges



COMING SOON

Modern social science research indicates that a primary motivator for environmental action is social norms of behavior: "keeping up with the Joneses." We will provide tools so students can compare their footprint to their peers in their own location and worldwide, and point them to aspects of their lives where they can make effective reductions. Then students make pledges to reduce their footprints, and return to report those successes to the global community. In this way, they can take pride in their successes and motivate others to do the same.

ONLINE DISCUSSIONS

Students around the world engage in on-line discussions about their footprints & together envision personal, local and global solutions to shared environmental challenges



What students will do:
Post and comment on their peers' post in a series of targeted environmental discussion topics.

Students will learn:
*how their footprints compare with their peers worldwide
*what other students' ideas are for reducing our environmental impacts
*that we're all in this together!