CEES has three core missions: research, education outreach, and environmental stewardship.

The research done at CEES is applied (i.e. it has practical application - it is not strictly theoretical) and focuses on water quality issues.

Education outreach involves bringing STEM activities/environmental education programs (at no charge) to middle school and high school students using the Center’s mobile STEM lab. The Center also does outreach directed towards the general public at fairs and festivals and other events.

Environmental stewardship occurs through the Center’s Service Learning program.

CEES is a grant-funded center. In other words, the main work of the Center is made possible predominantly through grants, donations, and other charitable gifts. University funding is minimal.
Environmental Service Learning:
Education & Community Service

Providing opportunities for environmental stewardship and experiential learning.

Engaging in dialog about environmental issues.

Introducing regional natural areas.

Introducing groups that maintain these areas.

Introducing issues to stimulate changes in behavior as well as critical thinking about humanity’s role as an agent of change.

Restoring and improving of natural areas.

Mitigating and preventing pollution.

Building a sense of community.

The idea is that the Service Learning program provides opportunities for all of the above.

IMPROVE WATER QUALITY
Here are the opportunities available this term . . . . .

Spring 2018
Sodalis Nature Park

Indiana State University

LOCATION: Plainfield - southwest side of Indianapolis

Project 1
Invasive Honeysuckle Removal
Saturday, March 3
8:30 AM - 12:00 PM
Backup Date: Sunday, March 4 (AM)

Project 2
Invasive Honeysuckle Removal
Saturday, March 3
12:30 PM - 4:00 PM
Backup Date: Sunday, March 4 (PM)
LOCATION: Lilly ARBOR – Porto Alegre St. between 10th Street and New York Street bridges

**Project 3**
Trash Clean Up
Friday, March 23
9:30 AM - 1:00 PM

**Project 4**
Trash Clean Up
Saturday, March 24
9:30 AM - 1:00 PM
Grassy Creek Park

**Project 5**
Invasive Plant Removal
Friday, April 6
9:30 AM - 1:00 PM

**Project 6**
Invasive Plant Removal
Saturday, April 7
9:30 AM - 1:00 PM

**LOCATION:** north side of Indianapolis near 30th St. and German Church Rd.
Broad Ripple Park

LOCATION: north side of Indianapolis near 62nd and Westfield Blvd.

Project 7
Invasive Honeysuckle Removal
Friday, April 13
9:30 AM - 1:00 PM

Project 8
Invasive Honeysuckle Removal
Saturday, April 14
9:30 AM - 1:00 PM
Special Projects: GBBC

Special Project: Citizen Science: Great Backyard Bird Count

Project 9 February 16 (Friday) & Project 10 Feb. 17 (Saturday)
8:00 AM – 12:00 PM (??)

Location: TBD

This project involves bird identification. An identification guide to common Indiana birds will be provided on the CEES website.

If you can ID Pokemon, you can ID birds.

Instructor approval is required for the GBBC events. If you want to participate in one, discuss it with your instructor: once you have registered, your instructor will be contacted for verification.

Getting the Merlin Bird app for your phone would be helpful – it's free.

Check out the All About Birds website: https://www.allaboutbirds.org/guide/search/

Instructor approval is required.
How to Sign Up: go to www.cees.iupui.edu

From the Service Learning menu, select Fall 2018 Events.
On the Fall 2018 Events page, select Register for an event.
Register for a Service Learning Event

Spring 2018 Events: Projects are not yet OPEN.

If you want to attend an event that has closed, select "waitlist" (under the Project menu) and select a project from the Waitlist menu. You will be notified if space becomes available.

Please only register for one event UNLESS you have special circumstances that allow you to register for additional events (multiple classes, class requires more than one event, or enrolled in G199). The site will allow you to enroll in multiple projects if you have special circumstances; just sign up for each event separately.

Additional projects may be added during the course of the semester: check the project page occasionally for updates. If additional events are added, instructors of participating courses will be notified.

You may not register for a friend. Terms and Conditions do apply. You will be asked to read the Assumption of Risk and Photo Release, give authorization and provide an electronic signature at the end of the registration page.

The information being collected in this registration form will be used for internal purposes only. We ask that you provide as much information as possible so that we may better understand and create a program that is more inclusive and effective for everyone, regardless of age, race/ethnicity, or gender.

**You will receive an email confirmation for each registration. If you do not receive an email, you likely have entered your email incorrectly or it went to your junk mail folder. Please check this before contacting us.**

**Instructor**

**Read Terms & Conditions**

**Assumption of Risk**

**Electronic Signature**

**Confirmation**

Please make sure your email address is correct!

To ensure sufficient space for all who wish to participate, students are limited to registering for ONE project – unless special circumstances apply.

Additional projects will be added as needed, so check the 2018 Events page occasionally to see if new projects have been added.

If space permits, students will be allowed to register for multiple projects. Your instructors will be alerted if this occurs.
Online Project Confirmation

Once you have successfully registered, you will receive an email confirmation that looks something like this.

You have registered for a service learning event. PLEASE READ THIS MESSAGE CAREFULLY

Standard “boilerplate” – specifics do not apply to all projects.

Example: 25 is not the set number of participants in all projects; some projects accommodate more people, some less.

To avoid overbooking, projects are “closed” before they are completely filled.

To avoid overbooking, projects are “closed” before they are completely filled. Wait listing is used to fill projects to capacity.

If you do not receive a confirmation notice, you probably made an error when entering your email address.

If you have questions, please email cees@iupui.edu. You should receive a reply within 48 hrs. (usually sooner) M-F.
Additional Information

Participants are taken on a first come first serve basis, so please sign up in advance – projects do fill up!

Submit online registration information ONLY once.

- If you make a mistake, email cees@iupui.edu with corrections.

If you need to cancel, do so in advance via email at cees@iupui.edu and reschedule.

- If you do not contact us and do not show up for your scheduled project, you can lose your place for other service learning projects.
Additional Information

You must complete the entire work day (3.5 – 4 hours) to receive credit.

- reflective essay & surveys

**Project cancellations** will be posted 24 hours before the start of a work day (when possible): check Events, Confirmation Pages, Facebook, your email.

- event is automatically moved to the rain date (usually the following **Sunday**)
- **time may change** – watch your email

A time change is likely if there were events are scheduled for BOTH Friday and Saturday.
What Does CEES Provide?

• Water (½ L bottle per person)
  You may bring more water.
  You may wish to bring a thermos with a warm beverage.

• snack (of the granola bar variety)
  You may want to bring more food.

• tools & gloves
  CEES will provide all tools necessary to do the work. This includes loppers (for honeysuckle removal), trash bags & trash tongs for trash removal, clip boards, writing implements, etc. CEES will also provide work gloves. You may bring your own tools and gloves, but they are your responsibility. **Tools that have a cutting surface that is always exposed (i.e. hand saws, chain saws) are not permitted.**

CEES does not provide transportation to/from the work site!

We encourage you to carpool to off-campus locations.
What to Wear:

Required:

- **long pants and close-toed, close-heeled shoes**

- denim = good; knits = bad

- avoid tight fitting pants in cold weather

- **footwear**

  - full coverage and ankle protection

  - **boots (mud, hiking, snow)** are generally a good idea

  - thin-soled shoes . . . not good

Suggestions:

- **dress in layers** in cold weather

- long sleeves = more protection

  - warm weather - thorns, biting insects

- **sun protection**

- insect repellent

Proper footwear is very important: keep your feet dry; protect against dangers such as broken glass, sharp metal.

Open-toed or open-heeled footwear, such as sandals or flip-flops, is not appropriate; students with appropriate footwear will not be allowed to participate.

Dress for protection against thorns, poison ivy, etc.

Wear clothing that can be easily washed.

Wearing a skirt/kilt is fine, as long as you wear long pants underneath it.

Sun protection includes eyes and head, as well as neck, arms, and shoulders.

Poison Ivy – a plant to be avoided!

Dress for the field - layering provides warmth and allows removal to prevent over-heating.
Be mindful of your surroundings . . .

Misapplication of excessive attention to electronic devices can result in miscalculations and misfortunate mistakes that— with mischievous misadventure— compound miserable mishaps and foment misgivings as relates to missed opportunities to enjoy the miseenscene and other interesting miscellany in the natural world.

Do not text and nature.
Questions about Environmental Service Learning?

Contact: Dr. Victoria Schmalhofer
Assistant Director, Center for Earth and Environmental Science
Indiana University – Purdue University Indianapolis
723 W Michigan Street, SL 118
Indianapolis, IN 46202
email: cees@iupui.edu

Please direct all questions by email:

No phone calls!
Stay Connected!

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Twitter: @CEES_IUPUI
Why Do These Projects?

Improve water quality.
What has the natural environment done for you lately?

**ECOSYSTEM SERVICES**

- BREATHABLE ATMOSPHERE \((O_2)\)
- WATER REGULATION & SUPPLY
  - watersheds, reservoirs, aquifers
- EROSION CONTROL
- FLOOD CONTROL
- SOIL FORMATION
- WASTE TREATMENT
- NUTRIENT CYCLING
- RECREATION
- POLLINATION
  - 1/3 of food supply depends on pollinators
- BIOLOGICAL CONTROL
  - predators control prey numbers
- RAW MATERIALS
  - food/fodder
  - fuel
  - building materials
  - medicine
- GENETIC RESOURCES
- CULTURE
- ECOSYSTEM SERVICES
Healthy Water = Healthy Environment

. . . . it doesn’t ensure it, but it contributes to attaining it.

Point Source Pollution
Single source of a large amount of pollution (e.g. factory that dumps wastes into river)
 Most point-sources have been cleaned up since the 1970s. Occasional major accidents are the predominant point sources of pollution today.

Non-Point Source Pollution
Many small sources, spread over a large area; each contributes a small amount of pollution (e.g. farms, individual homes)
Many small individual contributions yield major impacts.

In the United States, most pollution today is non-point source.
Small scale local actions yield large scale regional impacts.

Just as many small individual sources of pollution yield large cumulative impacts, so, too, can many small-scale acts of remediation/restoration yield large cumulative benefits.

CAUSE OF PROBLEM

SOLUTION TO PROBLEM

NO SINGLE RAINDROP BELIEVES IT IS TO BLAME FOR THE FLOOD.
Local pollution does not remain local. Any contaminant that finds its way into local streams and rivers in the Indianapolis area will eventually make its way to the Gulf of Mexico.

Sewers lead to rivers.

“All drains lead to the ocean, Kid.”
- Gill, Finding Nemo

Rivers lead to the ocean.
Addressing Environmental Pollution of Waterways & Surrounding Areas

Water pollution falls into two main categories: **macro-pollution** (the big, easy to see stuff) and **micro-pollution** (very small, often “invisible” material).

Preventing trash – especially plastics – from making its way to the ocean is one of our goals.
THE PROBLEMATIC NATURE OF PLASTIC

In the macro-pollution category, plastics have become an increasingly common contaminant.

Plastics are of great concern because, although the material photo-degrades into small pieces, it does not readily biodegrade.

A diamond is forever – so too, for all intents and purposes, is plastic.

Plastics begins as and breaks down to small bits known as nerdles.

small photo-degraded plastic bits

Nerdles

pre-production plastic pellets
Microbeads

**Extremely Environmentally Detrimental**

- Some forms of plastic are now recognized as being extremely harmful when released into the environment.

- Polyethylene and polypropylene are both recyclable. The problem with microbeads is their size and shape.

- Microbeads cause damage to water treatment facilities & are eaten by aquatic organisms.

**Typical Formulations**

- Polyethylene
- Polypropylene

- They are used in:
  - Exfoliating Body Washes
  - Whitening Toothpastes
  - Many other products

**Microbead-Free Waters Act of 2015**

- Phased out of rinse-off products by 2017.
Plastic = Pollution Sponge

Plastics are petrochemicals – a type of oil-based organic compound. Many synthetic organic compounds, such as pesticides, herbicides, flame retardants, etc. are also oil-based. These similar compounds will tend to stick to one another. If a compound is fat-soluble, as many synthetic organics are, it can be stored in the fatty tissues of organisms that ingest it. Consequently, consumption of plastics may increase the toxin load of an organism, and effects can magnify up the food chain.

Plastic ≠ food

Unfortunately, it is often mistaken for food.

Many toxic chemicals stick to plastics.

plastic bits acquire a toxic coating

Nerdles and microbeads resemble the food of many aquatic organisms.

Plastic and its toxic load is consumed.
The Fate of Plastics . . . .

Much ends up in the ocean circulating in one of the gyres. . .

Oceanic plastic causes problems for marine life.
The Fate of Plastics . . .

Ingested plastic can cause death by choking/intestinal blockage and also by starvation.

Large pieces cause problems such as entanglement.

Plastic may be eaten.

Too much plastic and not enough food is consumed.
During Service Learning events, we clean up trash in order address the macro-pollutant problem and to help prevent plastics from reaching the ocean.

Chemical and particulate pollution also impacts aquatic environments and communities.

The main goal of most events, however, is to address micro-pollution.
Surface runoff makes their way to the ocean. Surface runoff can scar the landscape (erosion) and soil particles (and the nutrients and other chemicals they carry – REMEMBER: sediment particles are is sticky) contribute to sediment/nutrient loading of waterways. Prevention is key!
In 2011, surface runoff containing fertilizers cause algal blooms (some toxic) that covered a third of Lake Erie (photo below).

Decomposition in natural settings may contribute to small scale, localized eutrophication; it does not typically contribute in a significant way to the high levels of nutrient loading that cause major, large-scale eutrophication events.
Algae & Cyanobacteria (Blue Green Algae)

Problems in Local Waterways:

Aesthetic Issues

Odor issues

Toxins (?)

An ounce of prevention is worth a pound of cure: it is much more cost effective to prevent eutrophication events from happening in the first place than it is remediate the resulting problems after they’ve occurred.

Eagle Creek Reservoir – Indianapolis’s source of drinking water – is monitored throughout the spring/summer/autumn.

Eutrophication of drinking water reservoirs is a continuing problem.
Economic Impacts

Would you want to go spend your Spring Break on this beach?

Lake Okeechobee
All the material carried by the waters within the Mississippi watershed ends up in the Gulf of Mexico.

The Mississippi watershed drains a vast area: ~1.2 million square miles. It is the world’s fourth largest watershed.

Service Learning activities at CEES contribute to both local improvements and large scale regional improvements in water quality.

Imagine the large scale impact if thousands of people were participating in similar projects throughout the watershed!
All rivers lead to the ocean . . . . .

Sediment Plumes in the Gulf

- sediment deposition smothers organisms
- fertilizers promote algal blooms
- smothered organisms & algae die
- decomposition of dead organisms by bacteria uses up dissolved $O_2$

Marine algae respond to fertilizers like any other plant/algae: fertilizers stimulate growth.

Large fertilizer input equals algal population boom.

Yes, one of those events.

Eutrophication (marine algae, phytoplankton)

Water contains dissolved oxygen ($O_2$). Dissolved oxygen is oxygen that occupies spaces between water molecules; it is not part of a water molecule.

Nom nom nom.

Finite life span: the algal bloom boom is over.

New population explosion: bacterial bloom boom.
Result: Dead Zone

Dissolved $O_2$ becomes depleted, and animals suffocate.
A “dead zone” (an area where the water is depleted of dissolved oxygen – in other words, it is hypoxic) forms in the Gulf of Mexico every summer.

How BIG of a problem is it?

Well . . . . it depends . . . . but generally quite large.

The size of the dead zone varies from year to year.

Many factors contribute: temperature, rainfall, type of crops being grown, fertilizer usage, etc.

For reference, Indiana has an area of 36,418 mi² (94,322 km²).

n.d. = no data

No data was collected in 1988 and 1989.
How can action taken in Indiana affect what happens in the Gulf of Mexico?
We need to ensure that our sediment stays put.

It’s good topsoil. We want to keep it here!

Loss of topsoil in farm fields leads to increased use of fertilizers because more fertilizer is needed to take the place of the nutrients lost with the topsoil . . .

This is an example of what is known as a **vicious cycle**.

What happens in Indy stays in Indy.

Lack of good topsoil is why homeowners tend to use a lot of fertilizer to get a lush, green lawn.

When housing developments are built, the land is stripped of topsoil prior to house construction.

The topsoil is not replaced. The developer can make money by selling the topsoil to a local retailer that sells topsoil, mulch, etc.

Sod or grass seed is put down on bare mineral soil. The homeowner then has to fertilize to maintain a lawn.

There is a good reason for doing this. The area needs to be made suitable for a house – graded, contoured to promote water flow away from the house’s foundation.
Plant roots help hold soil in place.

Roots also help water to penetrate into the soil. Plant roots are like roads for water: they create an opening into the soil that the water can follow.

Encourage native plants with strong roots.

Plants with deep roots encourage movement of water into deeper soil layers. This helps replenish groundwater and reduces surface flow.

Water movement over bare ground:

- carries away topsoil
  - increased sediment load in the water
- carries contaminants adhering to soil particles
  - nutrients (nitrogen, phosphorus)
  - toxins (pesticides, herbicides)

One of our goals.

If soil stays in place, then the compounds adhering to the soil particles will also remain land-bound.

Strong, deeply rooted plants are key to help hold soil in place and prevent erosion.
We have met the enemy

Non-native species
Invasive species

and it is Amur Bush Honeysuckle.

Non-native, invasive plant species are harmful to the environment for many reasons. In the case of Amur Honeysuckle, one of those reasons is that the plant is very poor at holding soil in place.

Being an invasive species, Amur Honeysuckle is very good at displacing native plants that are better at holding soil.

Lonicera maackii
Invasive species are typically superior competitors.

- exclude and displace native species

Plants compete viciously with one another for all sorts of resources: light, water, soil nutrients . . . .

Amur Bush Honeysuckle

- fast growing
  - leafs out early in the season (less light competition)
  - hollow stems (less energy and materials per unit of stem)

- shallow rooted
  - does not hold soil well
  - poor water percolation to deeper soil layers

- bird dispersed
  - fruits are eaten
  - seed pass thru unharmed

Birds tend to feed and roost in different locations. Seeds are pooped out in a different location.

- allelopathic
  - synthesizes chemicals that kill other plants
  - bare zone around the plant

Due to these characteristics, honeysuckle has a significant advantage when competing against other plant species.

It gets a head start growing before the trees have leafed out and block a lot of sunlight from reaching the lower understory in the forest.

Because it has a hollow core, it invests less material per unit length/volume of stem. Consequently, a given amount of material produces a longer stem than it would in a plant that has solid stems.

Increases soil loss during periods of surface water flow.
You do make a difference!
BEFORE service learning

AFTER service learning
One more thing ........
Have you seen this spider?

Here’s your chance to rid your house of those pesky spiders and contribute to science!

Actual size of an adult spider, including legs, is ~ 2 ½ cm. In other words, they are about as big as a quarter.

Juvenile spiders are smaller.

Spiders (juveniles) are most likely to be found indoors once weather becomes colder.

This common house spider is needed for research purposes. Likes to wander around and hang out on walls and ceilings – the spider, not the researcher.

Caution: they bite.

WANTED: Cheiracanthium mildei
Alias: Yellow Sac Spider

Contact Dr. Victoria Schmalhofer for more information: vrschmal@iupui.edu
Collecting Spiders

Step 1: locate spider

Step 2: invert cup over spider

Step 3: slide postcard under cup

Step 4: place & seal spider/cup in ziplock bag

Step 5: contact Dr. Schmalhofer for spider delivery

You'll never catch me!

Drat.

I am so embarrassed.

This is about the silk, isn't it?

I will neither confirm nor deny that I am the one who’s been depositing silk on the curtains.

There is sufficient air to last the spider a couple of days.