InterChange Newsletter

From the Regional Math & Science Center at Grand Valley State University

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CELEBRATING 25 YEARS OF MATH AND SCIENCE!

You are invited to join us in celebrating the *25th Anniversary of the GVSU Regional Math and Science Center* through a series of opportunities designed to gaze back over the past and look forward to the future. This year we will also be celebrating the *International Year of Light* through one of our Super Science Saturdays in January. We hope that you will connect with us as we live into our mission – *Math & Science: Excitement in learning for success in living*!

full story

JOIN US AT THE ANNUAL FALL SCIENCE UPDATE SEMINAR!

The 30th annual Fall Science Update Seminar hosted by the Regional Math and Science Center at Grand Valley State University (GVSU) will be held Wednesday, November 19, 2014. The theme for the upcoming event is *"Celebrating Science Education: Past, Present, Future*." *full story*

PROFESSIONAL LEARNING OPPORTUNITIES OFFERED BY THE RMSC

As you and your district make plans for professional learning for the 2014-2015 academic year, be sure that you are aware of the offerings available through the GVSU Regional Math and Science Center. *full story*

CELEBRATE THE INTERNATIONAL YEAR OF LIGHT 2015 WITH SUPER SCIENCE SATURDAY!

In celebration of the International Year of Light 2015 and the Regional Math and Science Center's (RMSC) 25th Anniversary, the RMSC and the Physics Department at GVSU will be hosting *Super Science Saturday: The Wonder of Light,* a science extravaganza for the West Michigan community. *full story*

GROUNDSWELL OFFERS TEACHING OUTDOORS FOR GRADES 3-12

This workshop is presented by Groundswell for teachers interested in feeling comfortable and safe while teaching outdoors more effectively. *full story*

KENT ISD OFFERS PROFESSIONAL DEVELOPMENT COURSES

Kent Intermediate School District has a number of professional development offerings in the coming months. *full story*

TAKE PART IN EARTH SCIENCE WEEK 2014!

Held October 12-18, Earth Science Week 2014 will promote awareness of the dynamic interactions of the planet's natural and human systems. *full story*

ATTEND THE GENETIC UPDATE CONFERENCE AT GVSU WITH DR. SAM RHINE

On Monday, November 10, 2014, the Regional Math and Science Center at GVSU will host the Genetic Update Conference featuring the internationally known lecturer, Dr. Sam Rhine. *full story*

REGISTER NOW FOR THE SECOND ANNUAL MATH-TEAM-MATICS COMPETITION!

This fun and friendly competition will feature creative and engaging problems to bring the mathematical practices to life. *full story*

CALENDAR OF EVENTS

Calendar

CONNECTIONS FOR THE STEM CLASSROOM

Changing Carbon Balance in the Great Lakes

Bopi Biddanda and Anthony Weinke, Annis Water Resources Institute, GVSU faculty *full story*

Celebrating 25 Years of Math and Science!

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Open House

Our first event of the academic year will be an open house for our colleagues and friends on

Tuesday, September 23, 2014 from 3:00 – 6:00 pm at our office location, C-1-120 Mackinac Hall, on the GVSU Allendale Campus. This is a time to reminisce and network with others who have been involved with the RMSC over the past twenty-five years or, perhaps, visit us for the first time.

Share a Memory

To commemorate this milestone in the life of the RMSC, we would like to hear about your memories involving the Center or one of our programs. To share a memory or how your involvement in science and mathematics education has been impacted by the RMSC, email us. These memories will be shared on our website throughout the year.

Support the Continued Work of the RMSC:

The Regional Math and Science Center depends on the continued support of partners like you. With your support, we can continue to develop a strong presence in the community and expand the services we offer K-12 students and teachers. Visit our website and discover ways to support the work that we do.

With your engagement in the work that we do, the Center will continue to inspire and nurture excellence in mathematics and science for schools, teachers, and the community in West Michigan.

Join us at the Annual Fall Science Update Seminar!

The 30th annual Fall Science Update Seminar hosted by the Regional Math and Science Center at Grand Valley State University (GVSU) will be held Wednesday, November 19, 2014. The theme for the upcoming event is *"Celebrating Science Education: Past, Present, Future."*

The keynote speaker will be master teacher Larry Fegel. During his presentation, he will share the successes and challenges of over 40 years of teaching science in West Michigan, as well as what he foresees for the future of science education.

The cost is $45 per person, $20 pre-service teacher, or $10 pre-service teacher without lunch.

Please plan on joining us at GVSU for this all-day conference of rich science content and pedagogy. For more information, visit the website.

Brochures will be available in mid-October.

Professional Learning Opportunities Offered by the RMSC

PROFESSIONAL LEARNING FOR YOU!

As you and your district make plans for professional learning for the 2014-2015 academic year, be sure that you are aware of the offerings available through the GVSU Regional Math and Science Center. NEW this year are best practice sessions that can be scheduled at your school / district site at minimal cost. Check out the list below.

These opportunities also include two scheduled workshops with substitute reimbursement assistance available held on the GVSU Allendale Campus, and our signature annual conferences. The following are highlights of these programs for the upcoming school year. Watch the RMSC website www.gvsu.edu/rmsc, for more detailed information.

Scheduled Workshops:

(Registration materials for these workshops are available on the RMSC Website.)

- Orchestrating Mathematics Discussions in the High School Classroom (Flier)
  - Audience: Secondary mathematics teachers of algebra
  - Dates: October 7, November 13, & December 12, 2014
  - Location: GVSU Allendale Campus
  - Description: Based on the 5 Practices for Orchestrating Productive Mathematics Discussions and materials developed through the award-winning PRIME program, this workshop will provide teachers with concrete guidance for engaging students in meaningful discussions around mathematics in a way that is accessible and manageable for teachers. The content used for examples will be algebra-based.
  - Facilitators: Chelsea Ridge & Karen Meyers
  - Cost: $60 per person for the series; grant funds are available to assist with substitute reimbursement costs.

- Effective, Engaging Strategies for Writing in Science (Flier)
  - Audience: Secondary science teachers
  - Dates: October 14 & November 5, 2014
  - Location: GVSU Allendale Campus
  - Description: This two-day workshop will help teachers learn how to incorporate writing strategies into science instruction. This series will look at ways that writing can be used in the grade 6-12 science classroom that are effective, will engage students, and provide avenues for evaluating student learning. Participants will be provided with pedagogical tools designed to facilitate student learning and deepen conceptual understanding of the NGSS 7 and 8:
    - Engaging in argument from evidence
    - Obtaining, evaluating, and communicating information.
  - In addition, the Common Core State Standards, Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12, will be addressed. Resources for additional writing strategies, improving laboratory reports, and digital writing will be provided.
  - Facilitators: Kathy Agee & Karen Meyers
  - Cost: $40 per person for the two days; grant funds are available to assist with substitute reimbursement costs.

Conferences:

- Fall Science Update Wednesday, November 19, 2014 GVSU Pew Campus (downtown Grand Rapids). Cost: $45 per teacher.
- Math In Action Saturday, February 21, 2015 - GVSU Allendale campus. Cost $30 per teacher.

Best Practices for School / District Level Professional Learning

- Math Talk
  - Audience: K-8 Teachers, Administrators, Instructional Coaches
  - Recommended Length : A variety of options are available for districts to consider: Two six-hour days with 3 hours of coaching; Four three-hour days with 3 hours of coaching; Three five-hour days; or Five three-hour days.
  - Description: This is a workshop to develop students abilities to communicate mathematical thinking. Standardized testing associated with the Common Core State Standards for Mathematics is moving toward assessing students abilities to construct viable arguments and critique the

reasoning of others [SMP 3]. This kind of Math Talk requires intentional instruction. Join us as we explore instructional strategies for developing students communicating and reasoning skills.
  - Facilitators: Drs. Esther Billings & David Coffey
  - Cost: Negotiable (but minimal); dependent on number of teachers and location.

- SaM3: Science and Mathematics Misconceptions Management
  - Audience: Grades 5 9 Math and Science Teachers
  - Recommended Length of Time Required: Three full days for complete workshop
  - Description: The goal of the SaM3 professional development program is to increase a teachers ability to elicit and address student misconceptions, utilizing the content areas of Energy (science) and Fractions (mathematics) as a context for applying misconception management strategies. Connections will be made to the mathematics practices of the CCSS and the science and engineering practices of the NGSS.
  - Teacher teams who participate in this SaM3 training will gain:
    - Increased core content knowledge in the focus areas of Fractions (mathematics) and Energy (science) across the disciplines.
    - Increased understanding of common student misconceptions in their content area.
    - A set of misconception management strategies to teach for understanding.
    - Usable lesson plans to use and examine through the year.
    - Skills in analyzing student work for understanding.
  - Cost: Negotiable (but minimal); dependent on number of teachers and location; grant funds available.

- Developing Powerful Measurers
  - Audience: Grades K-5 teachers
  - Recommended Length: 2 3 full days
  - Description: The Developing Powerful Measurers workshop series is the outgrowth of an NSF funded project: Strengthening Tomorrows Education in Measurement (STEM) with Dr. Jack Smith from Michigan State University. The purpose of the project is to enrich the classroom experience of students and teachers for spatial measurement (length, area, and volume) especially in the elementary grades. Participants in this workshop series will discuss the conceptual, procedural, and conventional knowledge needed for success in the area of measurement. Elements of conceptual knowledge needed for effective teaching and learning in measurement (and its importance) such as the meaning of length, unit iteration, unit-measure compensation, unit conversion, and zero/scale on a ruler will be addressed.
  - Facilitators: Karen Meyers & Chelsea Ridge
  - Cost: Negotiable(but minimal); dependent on number of teachers and location.

- Family Engineering for Teachers
  - Audience: K-6 Teachers
  - Recommended Length: One afterschool session (two to three hours long)
  - Description: Modeled after the popular Family Math and Family Science Nights, Family Engineering is a program developed to actively engage parents and their children in fun, hands-on engineering activities and events. (Engineering and engineering practices are new areas of emphasis in the Next Generation Science Standards, which need to be incorporated into K-12 classrooms.) Through this workshop, teachers and administrators will learn how to engage elementary children & parents in learning about what engineers do and the role engineering plays in all aspects of our lives. The program is also appropriate for classroom use. Visit Family Engineering at: http://www.familyengineering.org/ to learn more about this new national program.
  - Facilitators: Kathy Agee & Karen Meyers
  - Cost: Negotiable (but minimal); dependent on number of teachers and location.

- GLOBE Climate Change
  - Audience: Teachers of grades 5-9
  - Recommended Length: One or two full days
  - Description: The primary objective of the workshop is to foster deeper understanding regarding Earth Systems Science and climate change through:
    - providing the needed background content knowledge for teachers in Climate Literacy,
    - addressing some of the widely held misconceptions about climate change, and
    - equipping teachers with methods to assist students in collecting data related to climate change.
  - Participants will explore major issues associated with climate change with emphasis on the Great Lakes, learn how to monitor abiotic and biotic factors that impact climate using Global Learning and Observations to Benefit the Environment (GLOBE) protocols, and participate in activities that model instructional strategies for teaching about climate.
  - Facilitators: Janet Vail (AWRI) & Karen Meyers (RMSC)
  - Cost: Negotiable (but minimal); dependent on number of teachers and location.

Celebrate the International Year of Light 2015 with Super Science Saturday!

WHAT:

In celebration of the International Year of Light 2015 and the Regional Math and Science Center's (RMSC) 25th Anniversary, the RMSC and the Physics Department at GVSU will be hosting *Super Science Saturday: The Wonder of Light,* a science extravaganza for the West Michigan community. This event will provide educational activities and opportunities for students and their families to experience light as it applies to biology, Earth science, physics, engineering, technology, history, art, and more! The program will focus on understanding the importance of light in our lives and our future. These experiences will include:

- Large group demonstration by GVSU science faculty and/or guest presenters
- Hands-on activities in laboratories and/or classrooms provided by GVSU science, mathematics, engineering, history, geography, and arts faculty, professors from other colleges and universities in our region, pre-service teachers, community science-related organizations, and area business/industry
- Invited guest speakers
- Free-standing and poster displays

WHEN:

Saturday, January 24, 2015 / 10:00 a.m – 4:00 p.m.

WHO:

- K-12 students, teachers, and parents in Allegan, Kent, Montcalm, Muskegon, Newaygo, Ottawa, and VanBuren counties
- GVSU faculty, students, and alumni
- West Michigan community-at-large

WHERE:

Grand Valley State University, Allendale Campus: Seymour and Esther Padnos Hall of Science

HOW TO BE INVOLVED:

If you are interested in attending, please show up on January 24th, 2015 and be ready for a fun filled day of science! No registration is necessary and the event is completely **FREE**!

If you are interested in presenting or volunteering please contact Chelsea Ridge at ridgec@gvsu.edu.

For sponsorship and promotional opportunities, funds are being accepted here. Additional funds are being provided by the Grand Valley State University Provost's Office, Center for Scholarly and Creative Excellence, College of Liberal Arts & Sciences, Physics Department, and the Regional Math and Science Center.

Groundswell Offers Teaching Outdoors for Grades 3-12

This workshop is presented by Groundswell for teachers interested in feeling comfortable and safe while teaching outdoors more effectively. Educators will learn to utilize the outdoors as part of their inquiry-based classroom. Participants will learn tips, tricks, and strategies for making outdoor education the "norm", instead of the exception, utilizing an urban, suburban, or rural environment. Activities will most directly apply to science, but will integrate language arts, social studies, and art connections and include outdoor strategies which can be used by any educator teaching any discipline.

Groundswell, a regional hub of the Great Lakes Stewardship Initiative, currently provides place-based environmental service-learning professional development and grant-funded support for K-12 teachers from fifteen Kent ISD schools. Groundswell teacher teams engage students in hands-on watershed education and work with local partners to identify and address community stewardship needs. Through community partnerships and project implementation, students gain valuable experience that ties directly into their school curriculum. Groundswell is now extending high-quality, low-cost place-based environmental education learning opportunities to all teachers. Grand Valley State University's College of Education serves as fiscal agent and hosts the Groundswell office.

Course Details:

Teaching Outdoors (Grades 3-12) will be held Friday, September 26, 2014, 8:30 AM—3:45 PM at City High/ Middle School, 1720 Plainfield NE 49505. Please bring a water bottle (lunch will be provided), appropriate clothing to be outdoors rain or shine, and a journal, spiral notebook, or clipboard for taking notes on the trail. The cost is $45 per person.

Presenters:

Colleen Bourque, Groundswell Project Coordinator, holds BAs in English Literature and French from Saint Mary's University of Minnesota, an MA in instruction from Saint Mary's University, and an MS in Natural Science from the University of Wyoming, and studied at the Teton Science School. Colleen taught middle school science and language arts in Montana.

Mike Posthumus is Director of Groundswell and Asst. Director of the Center for Educational Partnerships at GVSU's College of Education. Mike's passion for the environment started as a student at the Blandford School, GRPS. He holds a BS in Science (Biology) from GVSU, an MA in Educational Administration and Supervision of Instruction from Northern Michigan University, and served as an Instructor at the Teton Science School.

Home

Kent ISD Offers a Variety of Professional Development Opportunities

Kent ISD has a variety of professional development courses for educators this coming year! A number of science workshops are offered, including Science Educator Institute and NGSS Awareness and Implementation.

To find out more, visit the website. Click here for a list of all upcoming Kent ISD Professional Development opportunities.

KENT ISD OFFERS MAPMAKING WITH CHILDREN (K-8)

Making maps fascinates children and we should use this intrinsic desire to shape developmentally appropriate curriculum in social studies, math, and language arts. This practical and participatory workshop will include:

- drawing maps that represent the 10-year-old view of the landscape
- a clear developmental model of children's geographic understanding
- review of research on children's neighborhood maps
- examples of integrated curriculum based on this developmental model
- indoor mapmaking activities suitable for early elementary grades
- an outdoors mapmaking/treasure hunt activity that involves local exploration and a literacy challenge adaptable for K-6 and beyond

This workshop will range from developmental theory to brass tacks practical, from serious reflecting on the purposes of education to the giddy thrill of finding hidden treasure. Come prepared to draw maps, solve problems, plan curriculum and perhaps get a bit wet and muddy.

Presenter:

David T. Sobel, M.Ed., is a Senior Faculty in the Education Department and Director of the Center for Place-based Education at Antioch University New England. David's exploration and documentation of the natural interests of children are the foundation for much of his work.

Go to the agenda and presenter link to see the agenda for the day and for more about the presenter.

The workshop will be held Thursday, November 6, 2014 8:30 a.m. to 3:30 p.m at the Kent ISD Conference Center.

KENT ISD OFFERS CAREER READINESS PROFESSIONAL DEVELOPMENT

Development

The Kent ISD Career Readiness Department has a number of professional development offerings in the coming months.

Date	Location	Content
October 8	Kent ISD	3D modeling, 3D printing
October 24	Kent ISD	Teachers in Industry

Date	Location	Content
November 18	Kent Aviation Center	Math in Electricity
December 12	Kent ISD	Teachers in Industry

Opportunities in Winter 2015 include:

Date	Location	Content
January 20	Kent ISD	Computer Coding
March 17	Kent Aviation Center	Transportation Systems
March 19	Kent Aviation Center	TECH Talk: STEM in Flight
May 5	Kent ISD	Engineering Design, 3D modeling, 3D printing
May 8	Kent ISD	Teachers in Industry

Take part in Earth Science Week 2014!

Held October 12-18, Earth Science Week (ESW) 2014 will promote awareness of the dynamic interactions of the planet's natural and human systems. "Earth's Connected Systems," the theme of ESW 2014, engages young people and others in exploring the ways that geoscience illuminates natural change processes. By deepening our understanding of interactions of Earth systems -- geosphere, hydrosphere, atmosphere, and biosphere -- Earth science helps us manage our greatest challenges and make the most of vital opportunities.

Resources for teachers may be found here. The Earth Science Week 2014 Toolkit can be ordered here.

Attend the Genetic Update Conference at GVSU with Dr. Sam Rhine November 10

On Monday, November 10, 2014, the Regional Math and Science Center at GVSU will host the Genetic Update Conference featuring the internationally known lecturer, Dr. Sam Rhine. Dr. Rhine is a physician who graduated from the Harvard Medical School and Indiana University's School of Medicine. For the past 30 plus years, he has devoted himself to genetics education, developing student programs for high school Biology, AP Biology, and other life science courses. His one-day conferences are designed to teach the latest in genetics advances and active research areas.

Date: Monday, November 10, 2014

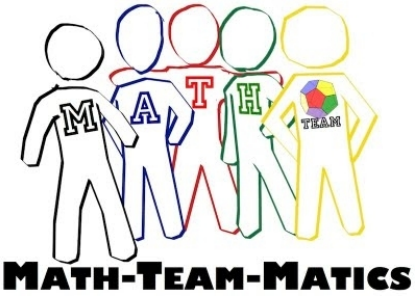
Time: Registration: 8:30 a.m., Program: 9:00 a.m. – 1:00 p.m.

Location: Grand River Room, Kirkhof Center, GVSU Allendale campus.

This conference is for area high school biology students and their teachers. The cost is $20 per person. To pre-register, view topics to be covered, and get more information go to: www.samrhine.com . Every school must pre-register on line to attend the conference. Every school that pre-registers will receive an updated set of notes the week before the conference. Plus, only those who are pre-registered can receive information about site parking, time changes, weather delays or postponements.

Grand Valley State University faculty members and GVSU students are welcome to attend this lecture free of charge as their schedule permits.

Register Now for the Second Annual Math-Team-Matics Competition!



This fun and friendly competition will feature creative and engaging problems to bring the mathematical practices to life. The event is hosted by Grand Valley State University's Department of Mathematics and the Regional Math and Science Center on the Allendale Campus.

When: Saturday, November 8th, 2014

Time: 9 a.m.-3 p.m.

Location: Mackinac Hall, GVSU Allendale Campus

Cost: $65.00 for a team of 5 and 1 coach. $8 for each additional lunch.

Registration Deadline: October 24th, 2014

Audience: The event is open to teams of 5 students in 7th-10th grade. There will be a division of 7th -8th graders and division of 9th -10th graders.

This is the only math competition in West Michigan that is open to middle schools! Content for the competition will be drawn from K-8 mathematics as well as high school algebra and high school geometry. The competition will begin with individual and team competitions followed by intense head-to-head "Quiz Bowl"-style team competitions in the afternoon immediately followed by awards. Lunch is provided for students and coaches. Friends and family are welcome to observe the afternoon activities.

Check out our website for example competition questions and additional information or contact Chelsea Ridge, ridgec@gvsu.edu. To register go to our registration page.

InterChange Newsletter

Connections for the STEM Classroom

CHANGING CARBON BALANCE IN THE GREAT LAKES

by Bopi Biddanda and Anthony Weinke, Annis Water Resources Institute, GVSU

The system of life on this planet is so astoundingly complex that it was a long time before man even realized that it was a system at all and that it wasn't something that was just there.
- Douglas Adam and Mark Carwardine (*Last Chance to See*, 1990).

Over time and space, the linkages between land and water are more variable than we ever imagined – changes compounded by anthropogenic activities concentrated in the over-crowded land margin ecosystems of the world. The carbon cycle of coastal ecosystems is a dynamic component of the global carbon cycle. As human population and standard of living continue to increase, agricultural runoff from the world's continents is fueling enhanced phytoplankton production – and likely increased respiration as well - in coastal waters everywhere. Recent observations suggesting that the coastal ocean carbon cycle may have indeed shifted from its traditional role as sources of atmospheric carbon dioxide in pre-industrial period to active sinks for carbon dioxide in more modern times, further emphasize the need for such cross-ecosystem and long-term process measurements.

Freshwater systems cover ~1% of our planet, and provide a commensurate contribution to global primary production but disproportionally contribute to global carbon cycling through their high rates of respiration. Freshwater systems are also characterized by strong linkages to the surrounding land from which they receive significant inputs of terrestrial carbon such as soil carbon and plant material. Freshwater lakes are particularly active sites for the cycling of these organic carbon inputs. Globally, while organic carbon burial in inland waters is comparable to sequestration on the entire ocean floor, carbon emissions are also considerable. Of the estimated 2 Pg (1 Pg=10^{15} g) terrestrial organic carbon freshwater systems process per year, nearly half is respired by bacteria in inland freshwater and coastal water bodies. In conjunction with soil inorganic carbon out-gassing, this leads to net carbon emissions of the same order of magnitude as the net uptake by all of the the oceans.

In the face of emerging evidence of the disproportionately large role that freshwater ecosystems play in the global carbon cycle, there is increasing concern about the serious lack of production and respiration measurements in Earth's inland waters. Furthermore, recent models suggest that the world's coastal zones may be switching or have switched from their pre-industrial role as CO_2 sources into CO_2 sinks due to the combined influence of anthropogenically enhanced nutrient runoff and ongoing climate change. Could a similar phenomenon be taking place in the coastal zones of the Laurentian Great Lakes? The Great Lakes contain ~ 20% of Earth's surface freshwater and drain more than 200,000 square miles of land, resulting in significant terrestrial loadings. The 10,000 miles of Great Lakes' shoreline are intersected by almost 3,000 tributaries. Many complex processes occur from the headwaters of these tributaries all the way to their river mouths. For example, land-use of upstream watersheds, has marked influence on downstream biogeochemical processing. The Muskegon River, which empties into Muskegon Lake followed by Lake Michigan, is the second longest river in Michigan and drains an area of ~ 6,000 km^2.

In this paper, we summarize the results of an 11-year study of plankton metabolism from Muskegon Lake, a Michigan estuary, to Lake Michigan, one of the Laurentian Great Lakes. Our results show that the pelagic waters of the drowned river-mouth of Muskegon Lake are highly productive, and that the levels of planktonic production and respiration both decrease systematically as one goes further out into low-productivity Lake Michigan (Figure 1). However, production decreases more so than respiration along this land-to-lake transect leaving the nearshore waters net autotrophic (CO_2 sinks) and the offshore waters net heterotrophic (CO_2 sources). Thus, our findings describe the systematically variable planktonic carbon metabolism in a rapidly changing Great Lakes coastal ecosystem and lay the baseline foundation for monitoring changes in the carbon balance in future years.

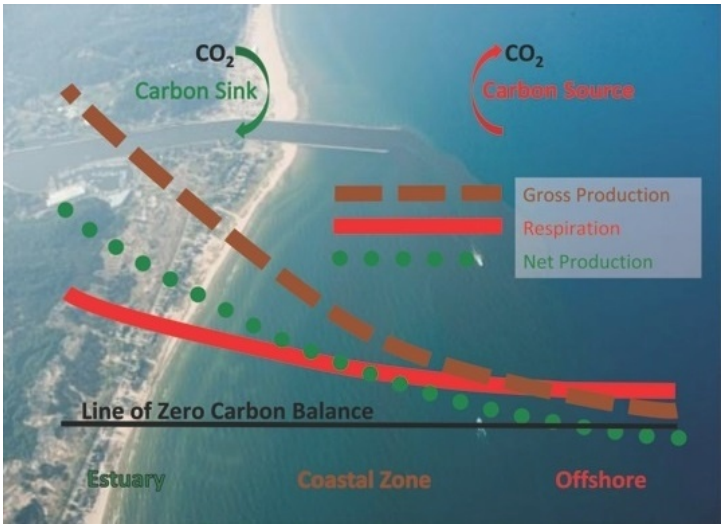


Figure 1. Land to lake linkages and gradients: Generalized conceptual diagram of systematic variability in planktonic gross production, respiration, and net production along the land-to-lake gradient in aquatic ecosystems (based on the present study) superimposed on an aerial image of the Grand River output into coastal Lake Michigan (looking South). Both the axes scales are relative, and the horizontal line serves as the "zero carbon balance" reference line. From Land-to-Lake, carbon metabolism decreases systematically, as the systems switch from a potential carbon sink inland, to a carbon source offshore Rivers and Estuaries express integrated signals from an entire watershed, contributing relatively concentrated plumes of sediment, carbon and nutrients to coastal Great Lakes and the oceans, but those signals are are diluted by time they get to offshore waters. Knowing how major ecosystem processes change across the coastal ecosystem gradient will enhance our current understanding and capability to predict future changes in such critical land-margin ecosystems. Aerial photo credit: Marge Beaver, Photography Plus.

Such findings are useful to students, researchers and policy makers. Students can use this information in classes to study the systematic changes within and across a gradient of ecosystems and make comparisons to other distant ecosystems. They can also use it to study how actions in one area of an ecosystem can show effects in another area. Researchers can use this data as a baseline in comparison to similar systems in other areas, and to visualize/track changes through time. They can even expand upon the transect, looking at productivity in the upland tributaries in the watershed, and further offshore and into deeper aphotic waters. Policy makers can use such information to influence regulations regarding land-use development and nutrient use in the watershed and to combat emerging issues such as eutrophication, harmful algal blooms and climate change mitigation.

Over the years, this decade-long research effort was supported by a NASA Michigan Space Grant Consortium Seed Grant and an EPA Great lake Restoration Initiative Grant.

Reference:

Weinke, A.D., S. T. Kendall, D. J. Kroll, E. A. Strickler, M. E. Weinert, T. M. Holcomb, D. K. Dila, A. A. Defore, M. J. Snider, L. C. Gereaux, B.A. Biddanda (2014). *Systematically variable planktonic carbon metabolism along a land-to-lake gradient in a Great Lakes coastal zone*. *Journal of Plankton Research*. Advance Access published August 11, 2014, doi: 10.1093/plankt/fbu066. Link to paper.