Celebrate Science!

Scientific activities Goshen College students engaged in the past year.

Science Speakers

- Anna Costanza, Characterization of Primary Production and Commuity Composition of Marine Phytoplankton in the San Francisco Bay Area
- Pete Biddle, Photo-chemical Degradation of Organic Photovoltaic Polymers
- Jessica Davila, Jacob Penner, & Peter Meyer Reimer, Ants, Fire, and Elephants: Ecological Synergies
- Reuben Ng, Growing the Bread of Tomorrow
- Michael Yoder, Determination of the Expression Pattern of unc-53 in *Caenorhabditis elegans*

Conferences

- Butler Conference:
  - Technology and Awareness: Does Haptic Interaction with Technology Interfere with Attention to Surroundings? By Prashansa Dickson, Sam Foxvog, Moses Kaelo, & Katrina Kennel
  - Fakebook: Anonymous Perceptions of Mental Illness in the Social Media Context by Brett Conrad, Missy Mackowiak, Sam Langley, Evette Yoder, & Seth Miller
- Mathematical Association of America, Indiana Section Spring Meeting:
  - Philip Bontrager, Luke Graber, Lucas Harnish, Julian Harnish, Jon Kaasa, Minah Kim, Deeksha Pagar, Peter Schrock, Seth Yoder
- Indiana Academy of Science:

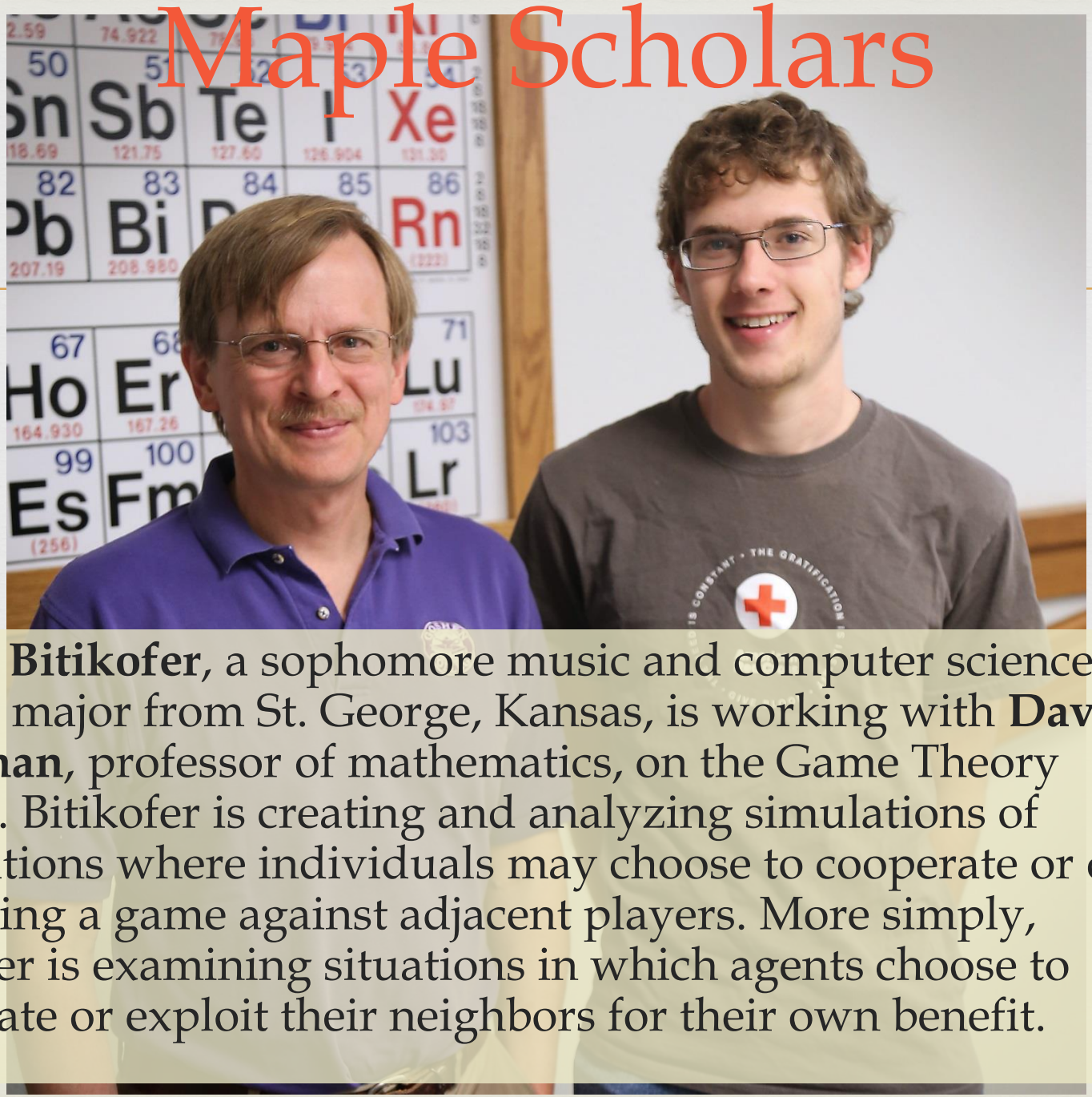
Maple Scholars

- Whether it's exploring the relationship between math and music, testing the stress levels of drunk honeybees, or developing curriculum for a criminal justice course at the county jail, each year Goshen College students spend the summer doing intense study and research during the college's eight-week Maple Scholars program.
- During the program, each scholar is paired with a faculty member who serves as both colleague and supervisor. Creating a community of scholars, the students are all housed together and in the Friday colloquium, scholars take turns presenting the work they are doing and answering questions from other students and faculty. At the end is a celebration day when the results of each project are presented to the public.

Maple Scholars

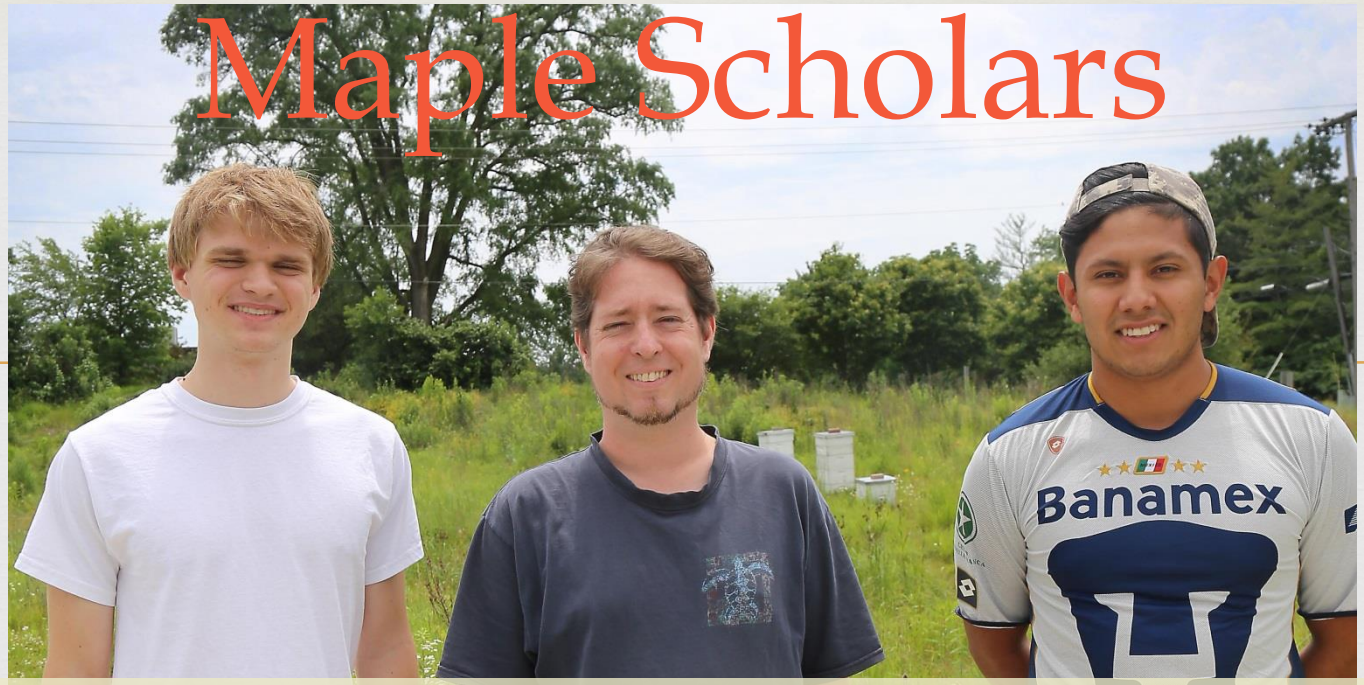
Bryan Yoder, a senior physics and mathematics double major from Manheim, Pennsylvania, and **John Ross Buschert**, professor of physics, are designing and building an electronic musical instrument. Yoder is looking to make a design for the instrument that has an engaging interface, can be played with variations in tone and style and can be easily learned while sounding good when played by beginners.

Maple Scholars



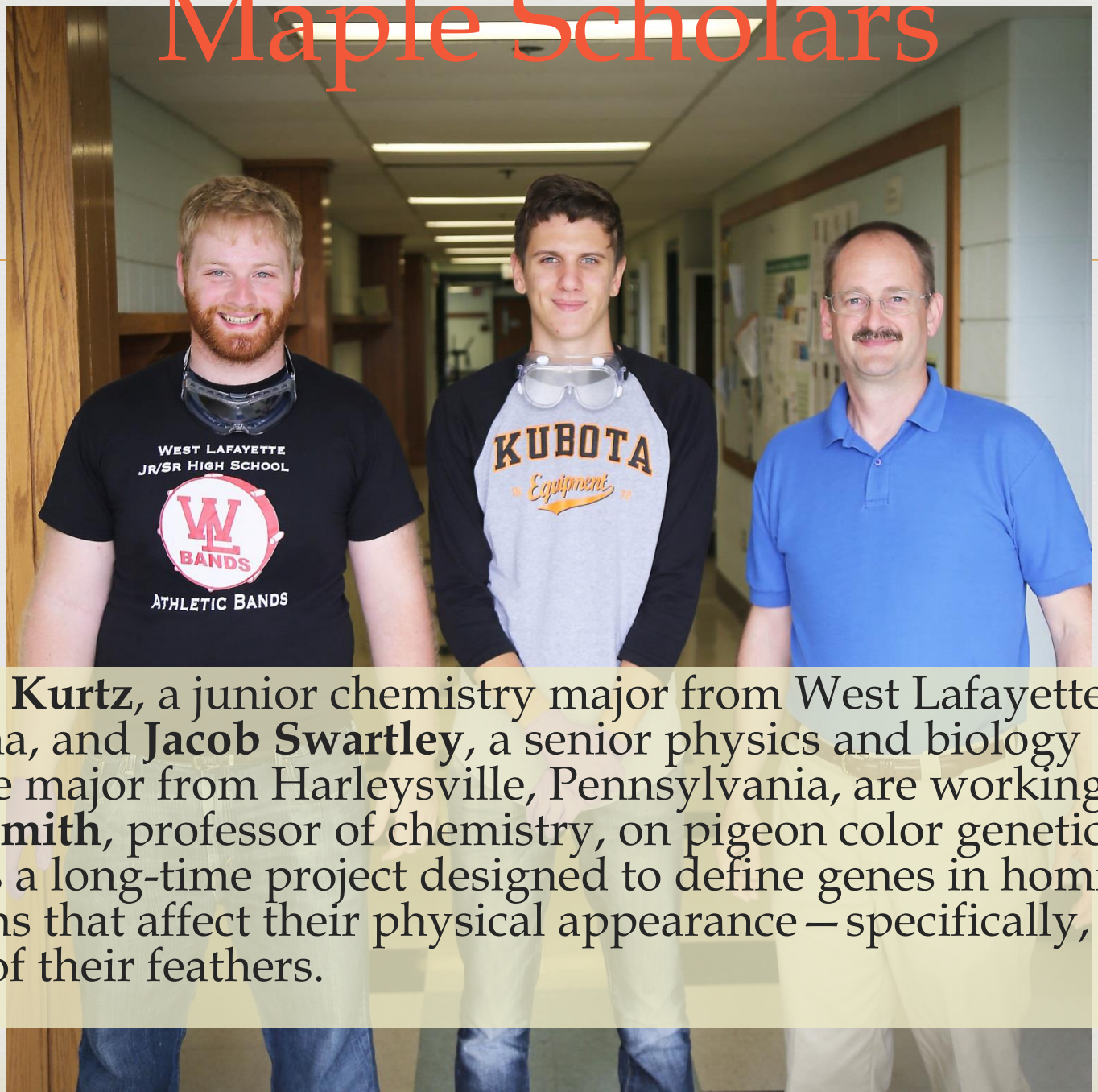
Kenan Bitikofer, a sophomore music and computer science double major from St. George, Kansas, is working with **David Housman**, professor of mathematics, on the Game Theory Project. Bitikofer is creating and analyzing simulations of populations where individuals may choose to cooperate or defect in playing a game against adjacent players. More simply, Bitikofer is examining situations in which agents choose to cooperate or exploit their neighbors for their own benefit.

Maple Scholars



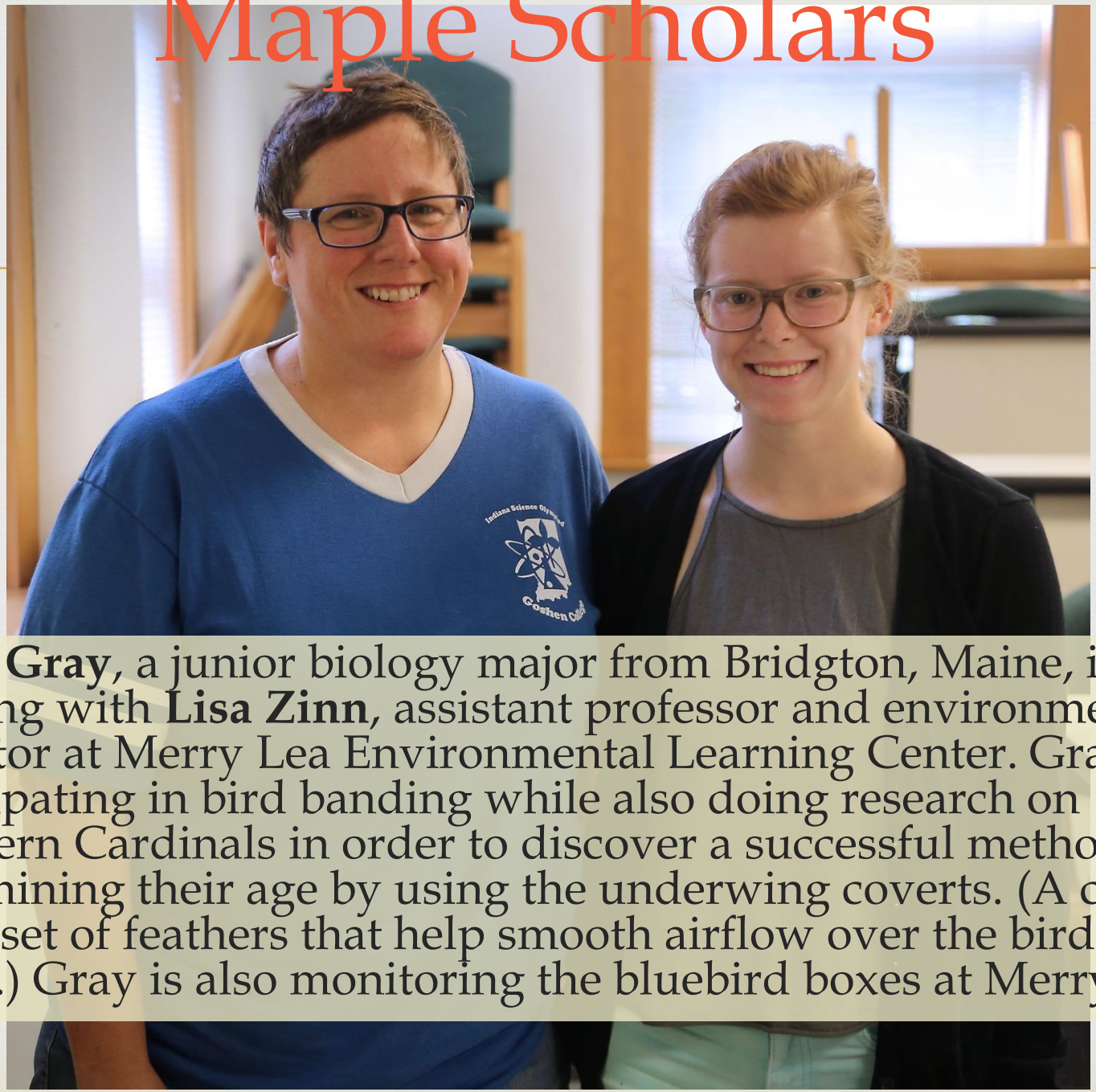
Alejandro Genis, a senior molecular biology and biochemistry major from Elkhart, Indiana and **Nate O'Leary**, a sophomore molecular biology and biochemistry major from Seattle, Washington, are working with **Andy Ammons**, associate professor of biology. Within bee communities, there is a specific behavior called "drifting," when bees enter the wrong hive or end up in the wrong location after having been collecting food for a while. This behavior can lead to colonies dying off, so the goal for Genis is to minimize this behavior. O'Leary looked at alcohol sensitivity and pheromone production in the bees,

Maple Scholars



Stuart Kurtz, a junior chemistry major from West Lafayette, Indiana, and **Jacob Swartley**, a senior physics and biology double major from Harleysville, Pennsylvania, are working with **Dan Smith**, professor of chemistry, on pigeon color genetics. This is a long-time project designed to define genes in homing pigeons that affect their physical appearance—specifically, the color of their feathers.

Maple Scholars



Kayla Gray, a junior biology major from Bridgton, Maine, is working with **Lisa Zinn**, assistant professor and environmental educator at Merry Lea Environmental Learning Center. Gray is participating in bird banding while also doing research on Northern Cardinals in order to discover a successful method of determining their age by using the underwing coverts. (A covert is one set of feathers that help smooth airflow over the birds' wings.) Gray is also monitoring the bluebird boxes at Merry Lea.

Maple Scholars

Isaiah Breckbill, a junior physics major from Kidron, Ohio, is working with Paul Meyer Reimer, associate professor of physics. Breckbill is looking at changes in groundwater by using gravity measurements from NASA's GRACE satellite. He and Meyer Reimer are developing software tools to map and analyze changes in groundwater.

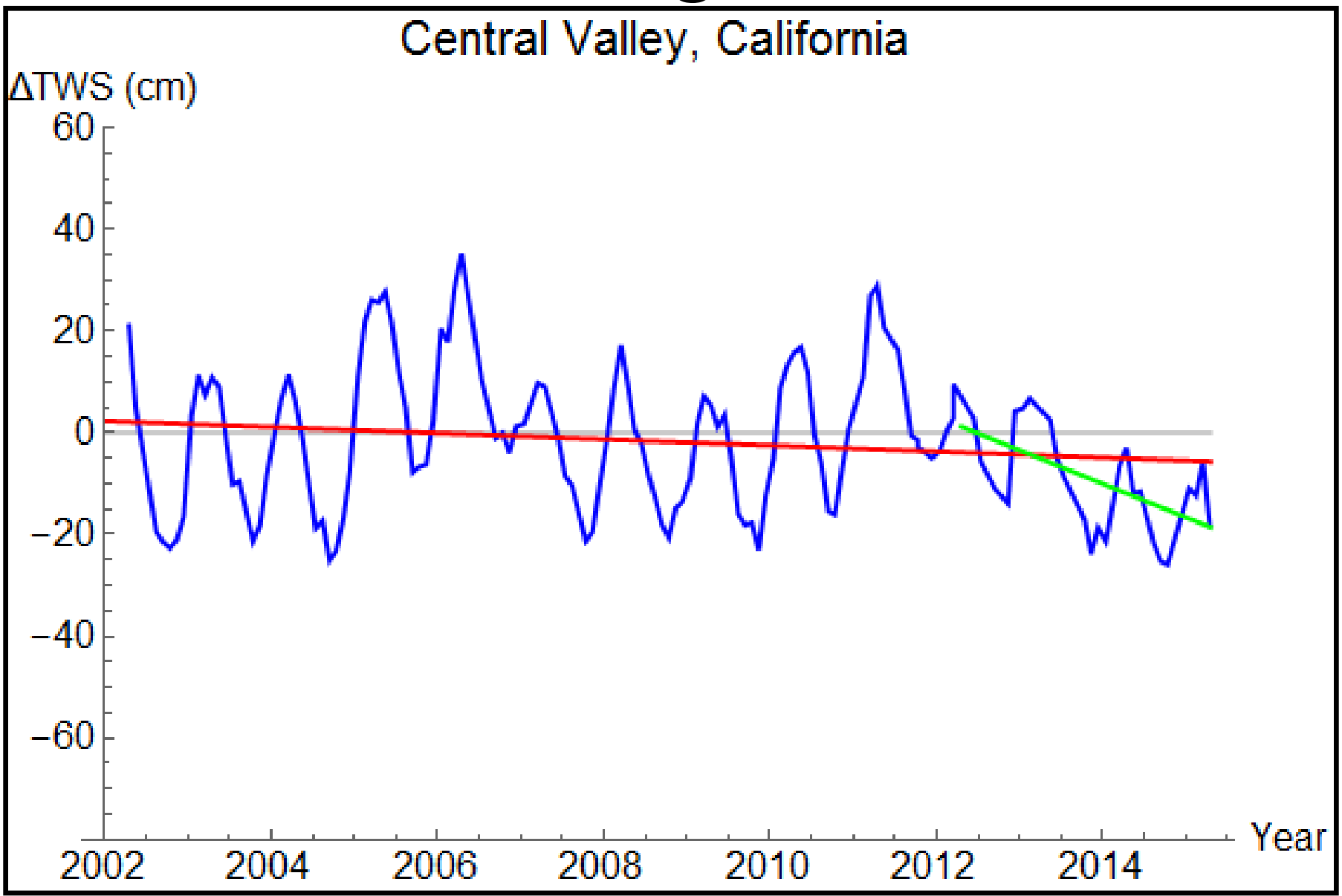
Gravity and Groundwater

Isaiah Breckbill
Paul Meyer Reimer
Maple Scholars 2015

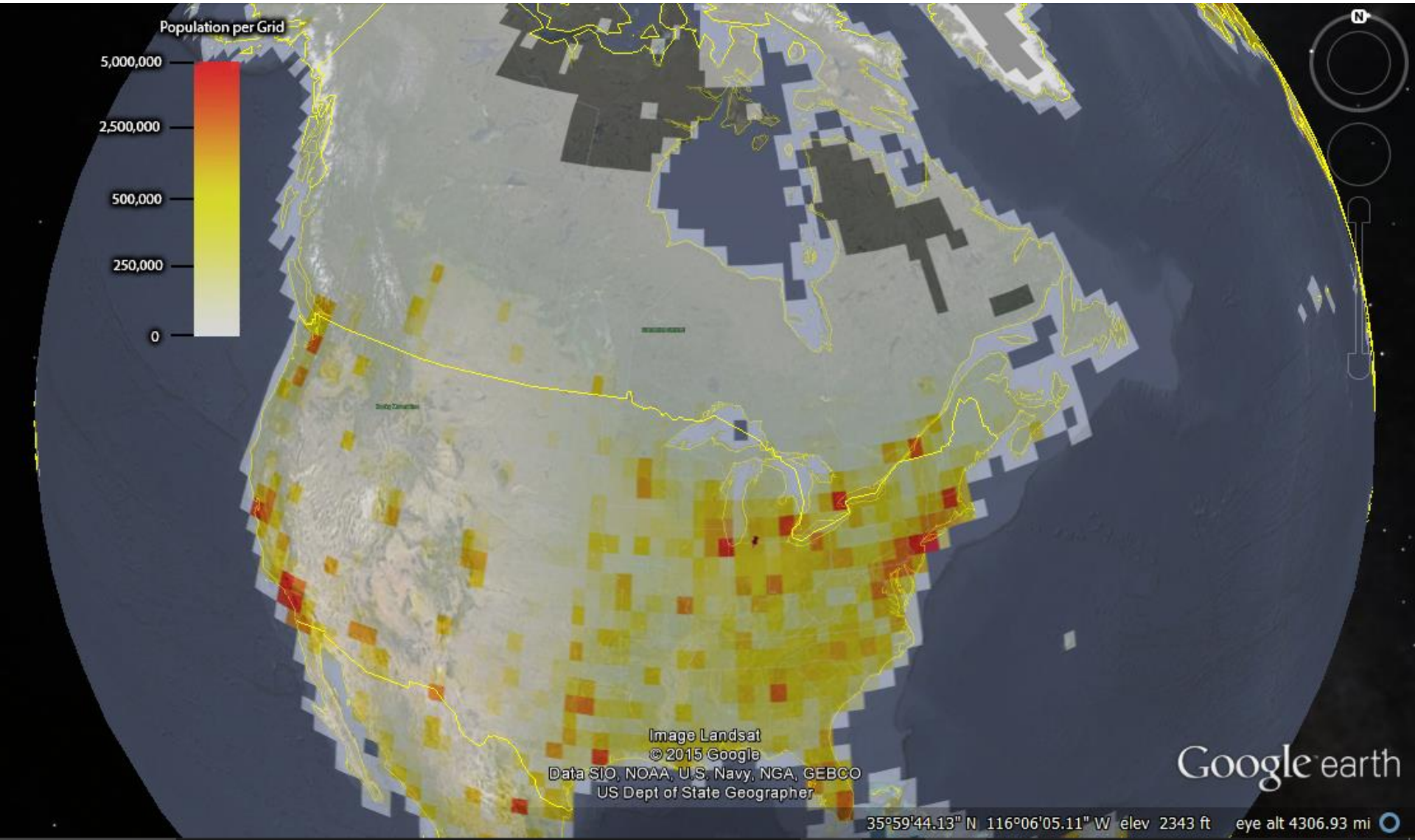
Background and Context

- NASA GRACE Mission
- Satellites Launched in 2002, still collecting data
- Monthly gravity measurement for each 1° latitude by 1 ° longitude.
- Units of equivalent cm of water

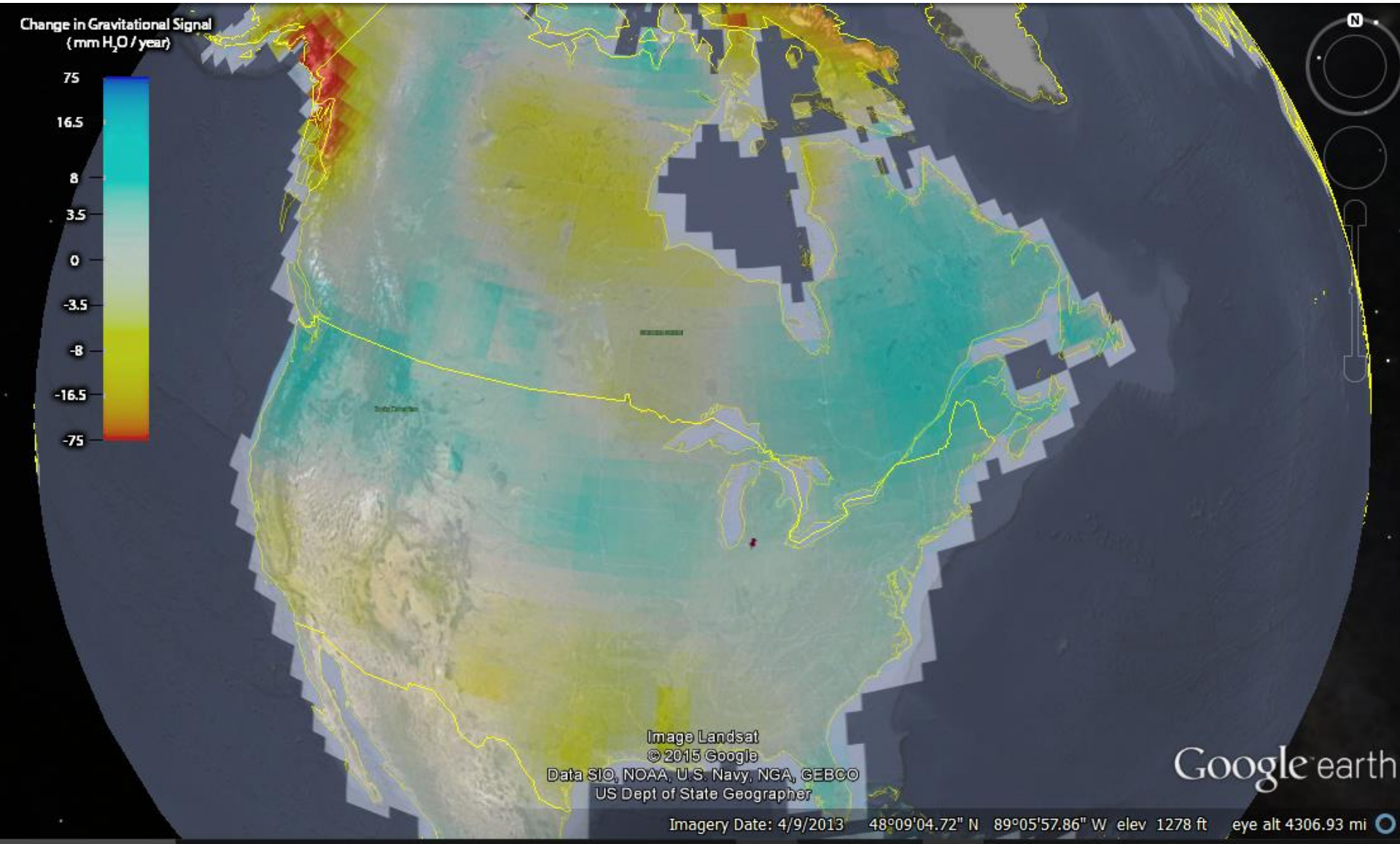
Linear Regressions



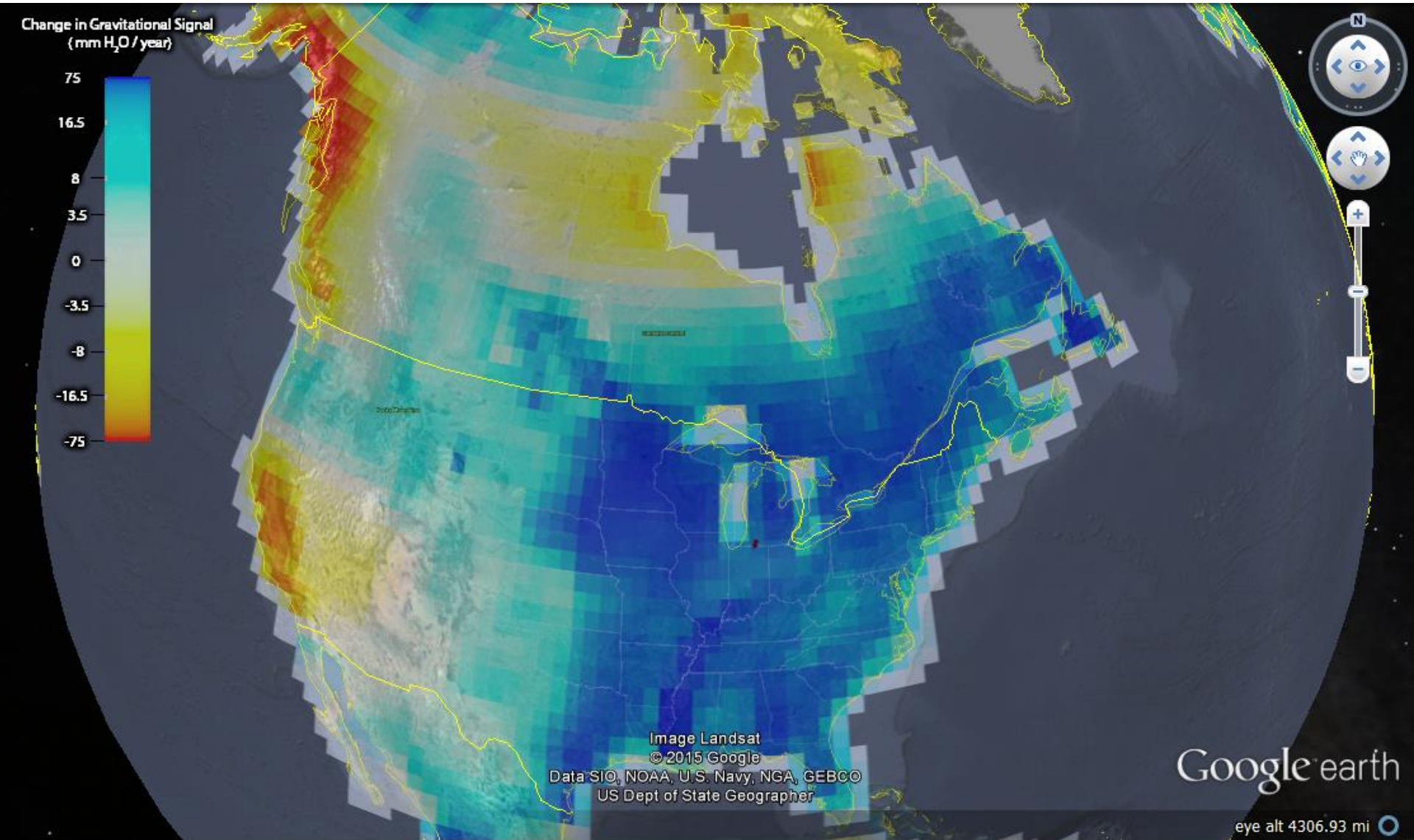
North America Population



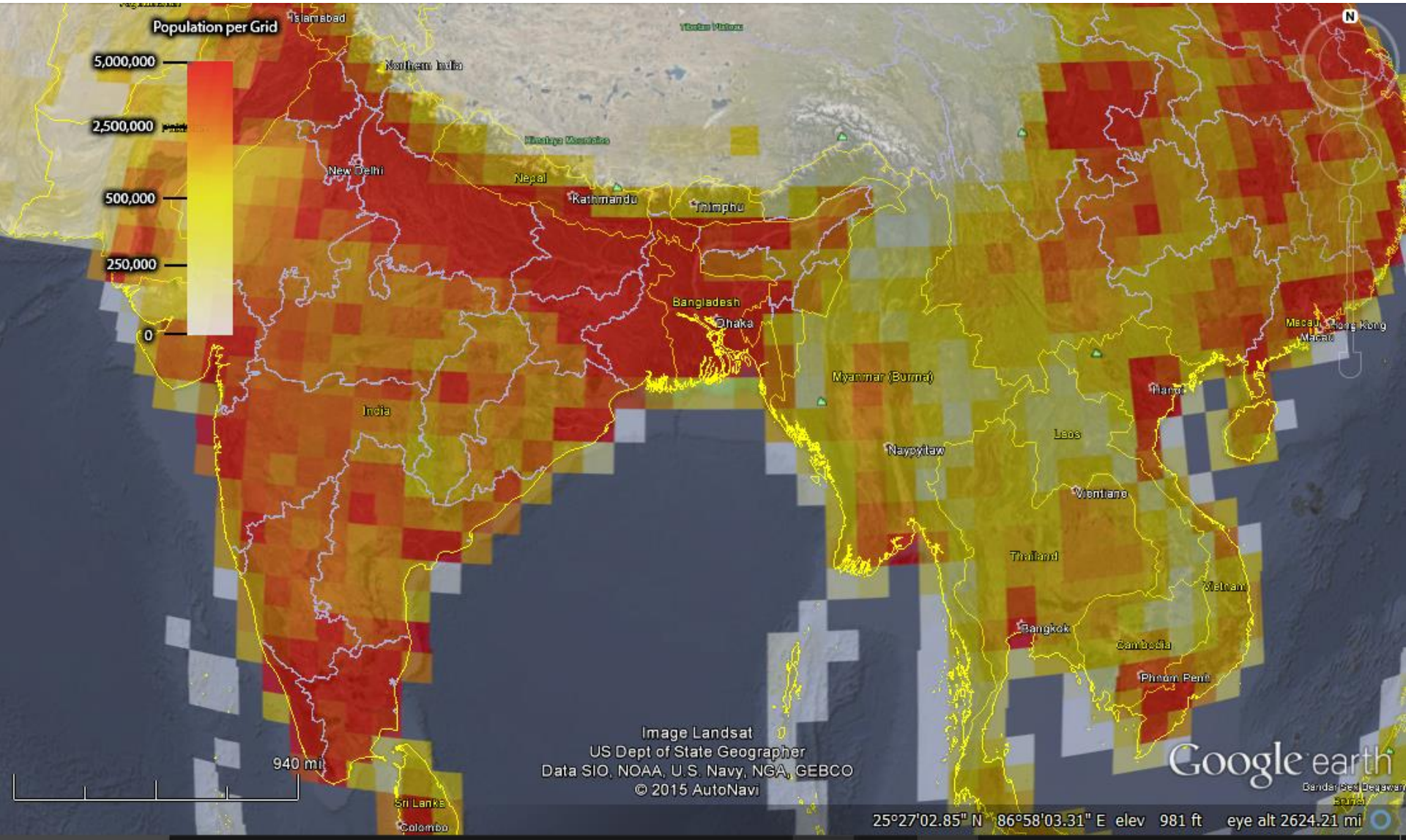
North America (2002-2015)



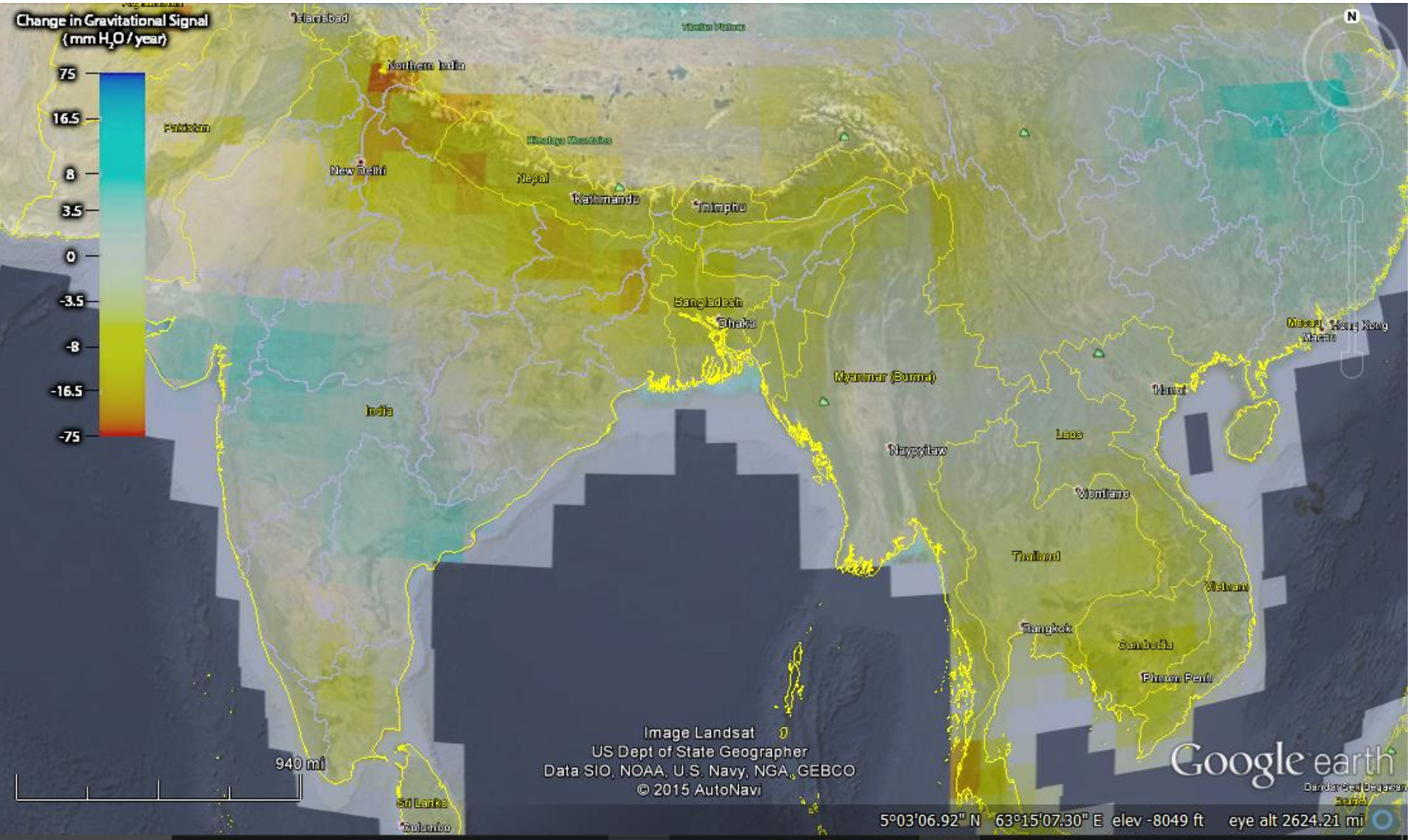
North America (2012-2015)



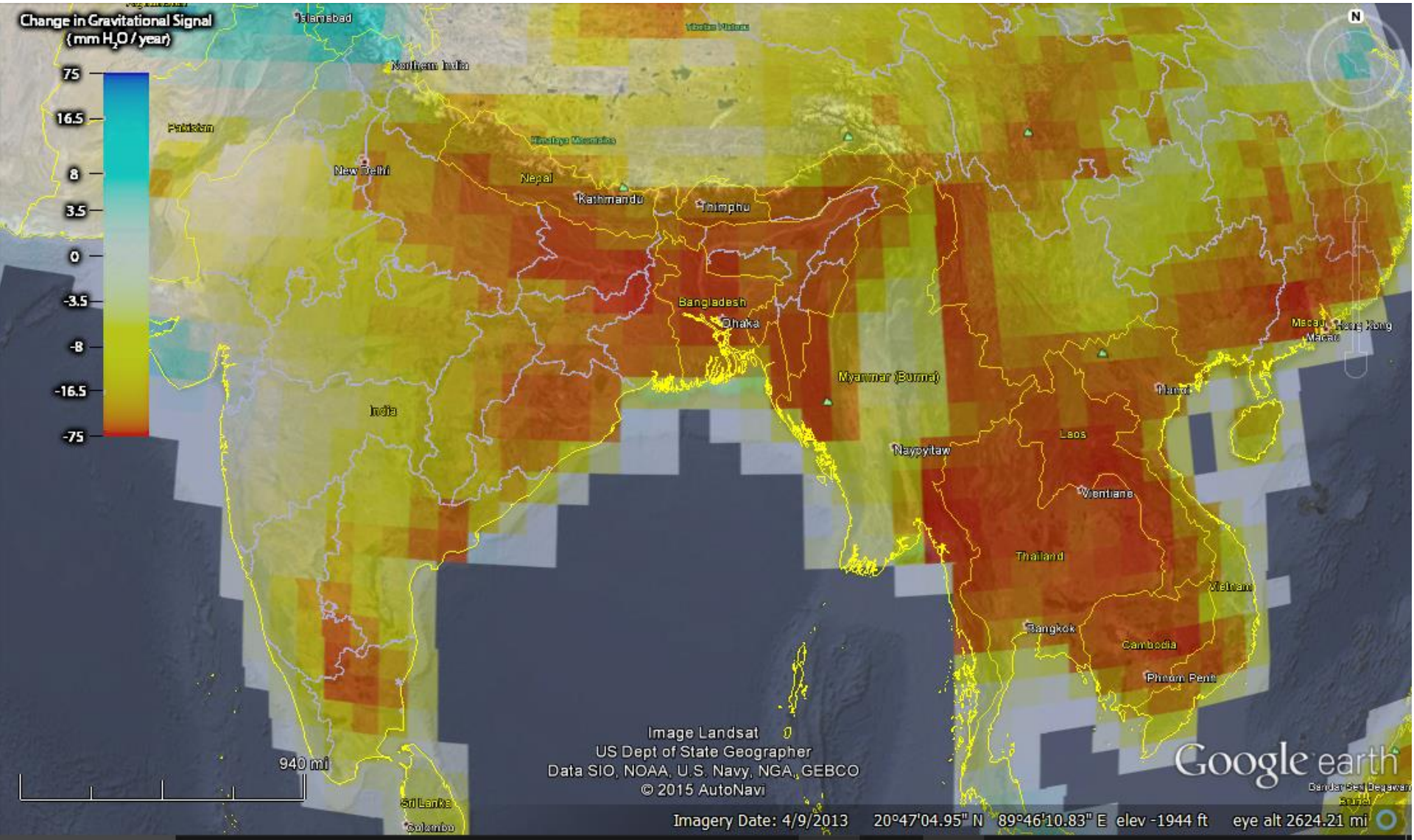
South Asia Population



South Asia (2002-2015)



South Asia (2012-2015)



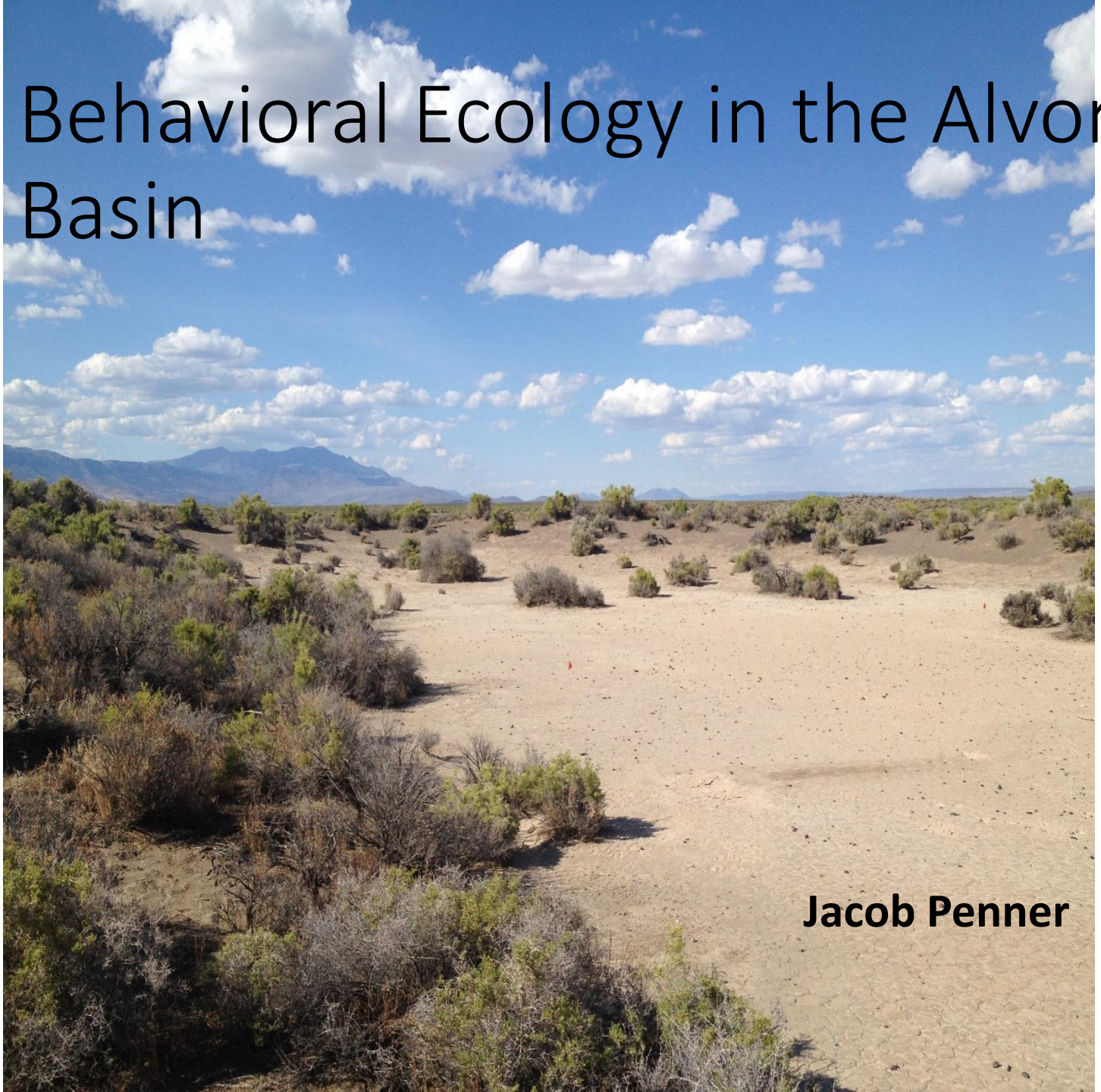
Other Areas of Focus

- Alaska (Arctic)
- Amazon River/ Other Places in South America
- Colorado River Basin
- Aral Sea (Kazakhstan)
- Nile River Delta
- Mississippi River Delta

Other Research Programs

- Jessica Davila (Molecular Biology/Biochemistry), Indiana University
- Jacob Penner (Environmental Science), Kansas University Biodiversity Institute
- National Science Foundation Research for Undergraduates Programs are offered at a variety of colleges and universities in a variety of research areas.
- The Oak Ridge Institute for Science and Education (ORISE) sponsors more than 50 research programs for undergraduate students at national laboratories and other federal research facilities in 24 states and some outside the United States.

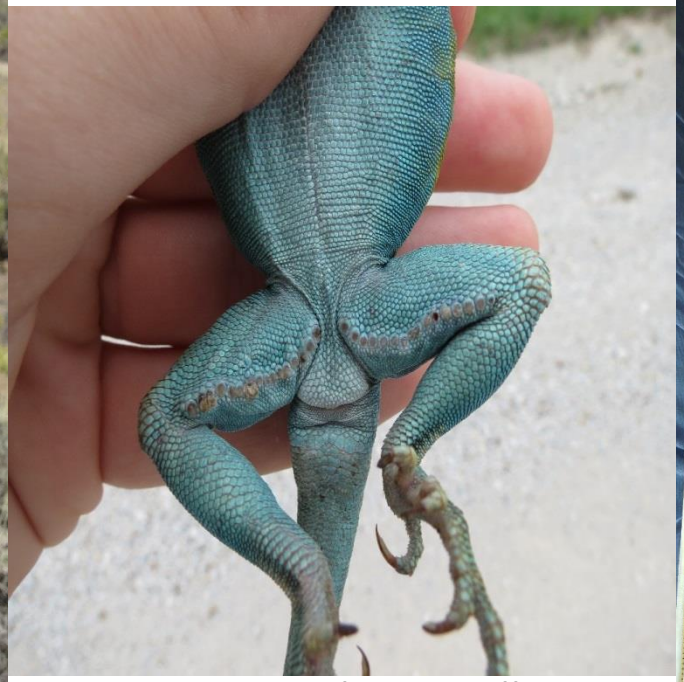
Behavioral Ecology in the Alvord Basin



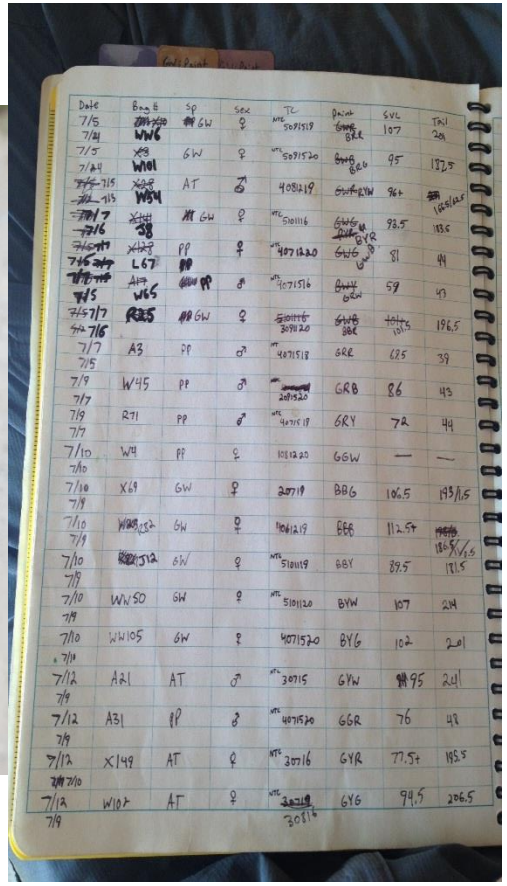
Jacob Penner

How do conspecifics, pheromones, and the environment influence lizard behavior?

Gambelia wislizenii



Crotaphytus collaris



Field data!

One Month in the Des

Life in the field

The work continues…

GOSHEN COLLEGE

The Effect of TGF beta inhibitors on Pancreatic Adenocarcinoma using mice as a model organism

Jessica Davila

IU HEALTH Goshen Hospital & Physicians

IU SCHOOL OF MEDICINE INDIANA UNIVERSITY

Introduction: Pancreatic Adenocarcinoma (PAC)

- Cancer: leading cause of death worldwide
  - PAC: 4th leading cause of death in US
    - Less than 5% survival rate over 5 years[1]
- Asymptomatic[2]
- Difficult to detect owing to small size of pancreas[2]
- Few treatment options (no cure)
  1. *Whipple* operation[3]
  2. Immunotherapy[4]
  3. **Chemotherapy**
  4. **TGF-beta inhibitors - Therapy**

Human Pancreas. Medicinet.com

[1]Maitra, A., & Hruban, R., 2009
[2]Chiu et al., 2014
[3]Tsalis et al. 2014
[4]Abate-Daga, 2014
[5] Zhou et al., 2014

Introduction: Pancreatic Adenocarcinoma (PAC)

- Cell's life cycle disrupted
  - Uncontrolled cell division
  - Epithelial to mesenchymal transition
    - Metastasis
- Not clear cause
- Risk Factors
  - Smoking
  - Obesity
  - High Fat diet
  - Diabetes
  - Alcohol abuse
  - Chronic pancreatitis
  - Family history

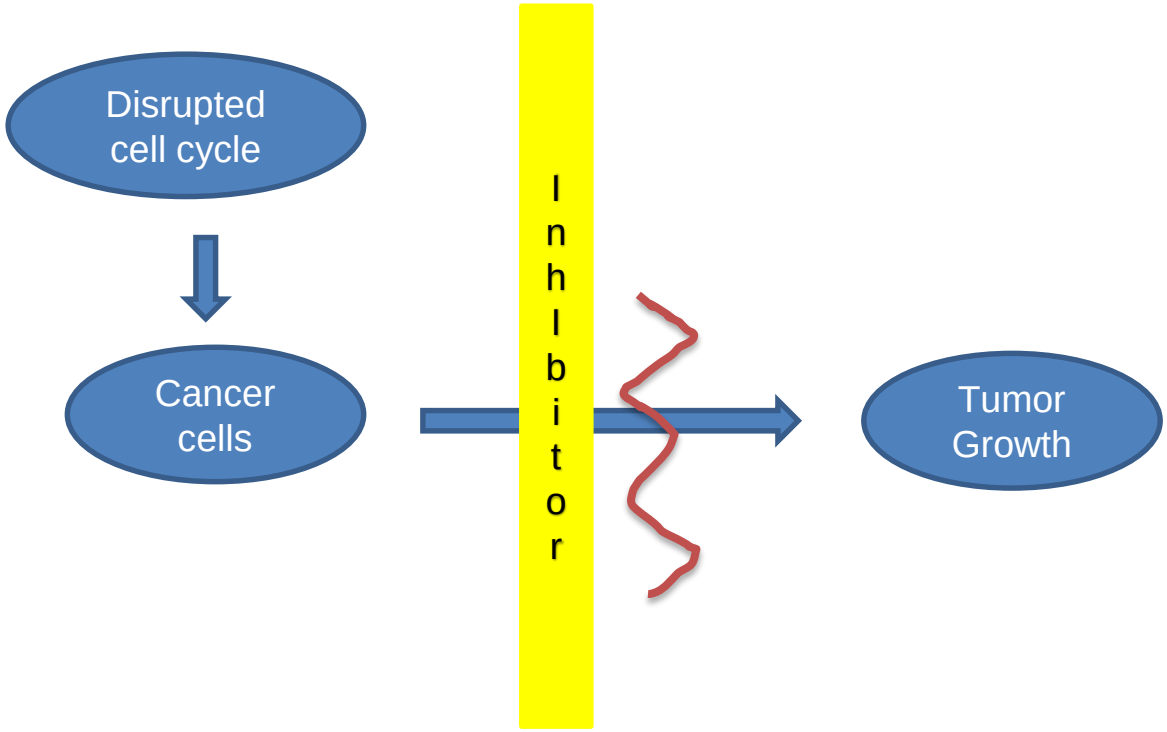
Pancreatic Cancer. Medicinet.com

Healthy Human Pancreas. Cornell University

Maitra, A., & Hruban, R., 2009

Introduction: TGF beta pathway in cancer

- Tumors → uncontrolled growth
- Body has means to deal with tumors
  - Tumor suppressor genes
  - Inflammatory processes
- TGF-B signaling pathway
  - 1) Regulation of cancer progression through
    - Immunity, growth



Recent studies:

Inhibiting pathway → prevents growth & metastasis of some cancers. Possibly Pancreatic Adenocarcinoma as well

Hypothesis

- Introduction of selected inhibitor will decrease tumor growth & metastasis in PAC mice

LY2157299

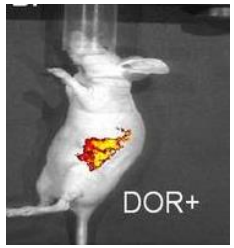
- Chemotherapy combination will enhance tumor suppressing effects

nab-paclitaxel plus gemcitabine (NPT+Gem)

Kano et al., 2007

Experiments – In vivo

- Pancreatic Cancer cells injected into mice
- Survival experiment
- Tumor Growth Experiment
- **3 Groups – 5 mice each**
  - Control
  - 2 experimental groups
    - TGF-B alone
    - TGF-B + Chemotherapy



Kano et al., 2007

Experiments – In vitro

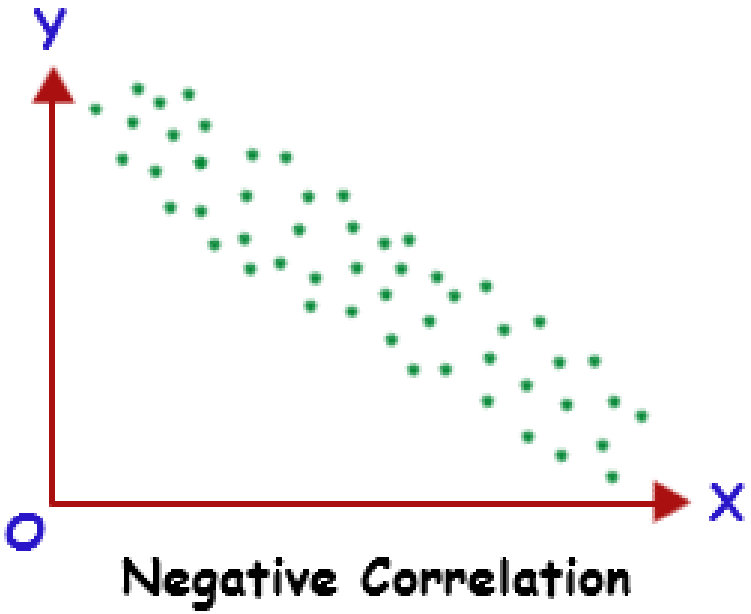
- Pancreatic Cancer cells culture
  - Measure toxicity (healthy cell damage/death etc.)
    - Inhibitor alone
    - Inhibitor + chemotherapy

Predicted Results

- Extended Survival & Tumor size reduction with use of inhibitor
- Greater effect with chemotherapy combination

Already outlived control group – FDA Approval

1 year agreement



→ Contribution to finding a cancer therapy that works in humans.

Acknowledgements

- IUSB and Goshen Cancer Care Center
  - Dr. Roderich Schwarz
- Goshen College
  - Dr. Kristopher Schmidt
  - Dr. Ryan Sensenig

GOSHEN COLLEGE

SCHOOL OF MEDICINE
INDIANA UNIVERSITY

HARPER
CANCER RESEARCH INSTITUTE

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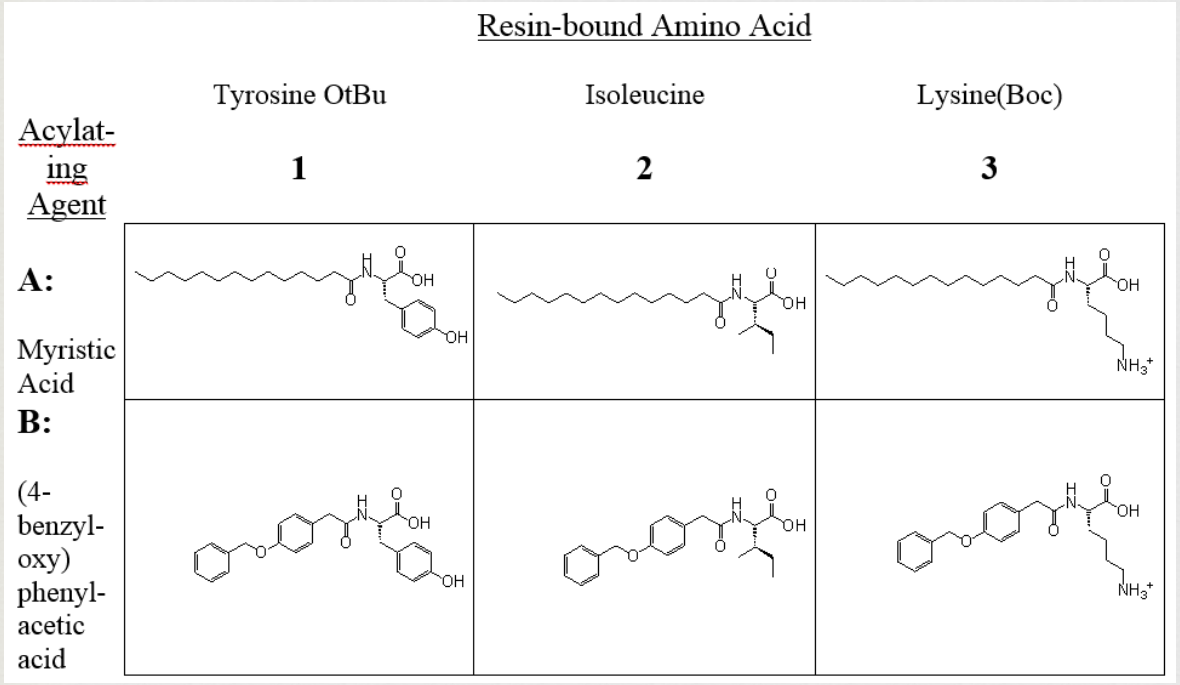
Academic Year Research

- Professor Kris Schmidt, C. Elegans
  - Michael Yoder ('15) - Tagging Full-length UNC-53 with GFP and FLAG
  - Dechen Tuladhar ('16) - Identifying UNC-53 as a Supressor of the GTPase CDC-42
- Professor Andy Ammons, Bees
  - James Garcia, Alejandro Genis, and Theo Kuchar
- Professor Dave Ostergren, Environmental Policy
  - Hannah Barg, Facilitated Collaborative Restoration with Tribes
- Professor Paul Meyer Reimer, Mapping water from satellite data
  - Isiaah Breckbill, Peter Wise, Phil Chan, Emily Schaeffer, Deeksha Pagar, Sijan Shrestha, Sujan Basnet
- Professor Stan Grove, Algaetown
  - Nat Dick, David Jantz, Tessa Yoder
  - Paid by a grant from the Indiana Academy of Sciences

Research for Novel Antibiotics using Combinatorial Organic Synthesis*



- Prof. Doug Schirch with
  - Petey Biddle
  - Sam Weaver
  - Kate Vendrely
  - Tae Hwang
  - Kara Hostetter

**In collaboration with the IUPUI D3 project*

Biology Senior Seminar

- Aaron Stiffney, Energy and Water Sustainability Solutions Model for Goshen College's J.N. Roth Marine Biology Facility: Technical Focus
- Avery Bischoff, The Importance of Understanding Declining Populations of Amphibians and Salamanders at the Merry Lea Environmental Learning Center
- Anika Baumgartner, Effects of Treadmill Training on Ambulation in Children with Neuromotor Delays
- Derek Swartzendruber, Minority Student Retention in Undergraduate Biology at Goshen College
- Ruth Ordonez, A Test of Using Natural Enemies for Biological Control of Colorado Potato Beetles *(Leptinotarsa decemlineata)*
- Jeptha Miller, The Use of Antibiotics as Growth Promoters in Feed for *Gallus gallus domesticus*

Academic Year Research

- Psychology Research & Methods and Senior Seminar
- Professor John Buschert, Musical Instruments
  - Maria Jantz and Seth Miller
- Professor Ryan Sensenig, Kenya Wildlife Ecology
  - Peter Meyer Reimer and Jacob Penner, Fire-induced changes in tree forage quality: what makes trees attractive to elephants
  - Kenya field course and research opportunity available in summer of 2016.
- Professor Dan Smith, Pigeon Genetics
  - Stuart Kurtz and Jacob Swartley

Internships

- Caleb Beachy (Molecular Biology/Biochemistry), Physician Office
- Gabby Castanon (Environmental Science), San Antonio Office of Sustainability
- Melanie Drinkwater (Biology), Costa Rica
- Joelle Friesen (Molecular Biology/Biochemistry), Illinois State University
- Laura Mason (Biology), Potawatomi Zoo
- Morgan Owens (Biology), Veterinarian Tech
- Reena Ramos (Environmental Science)
- Bekah Schrag (Environmental Science), Clay Bottom Farm
- Kate Vendrely (Molecular Biology/Biochemistry), Marine Biology

Internships

- Evette Yoder (Psychology), Elkhart County Women's Shelter
- Katrina Kennel (Psychology), Elkhart County Clubhouse
- Moses Kaelo (Psychology), MDC Goldenrod
- Sam Langley (Psychology), Crossroads

Internships

- Philip Bontrager (Informatics & Mathematics), Solutions Source
- Jackson Bush (Mathematics), Woods & Poole Economics
- Lucas Harnish (Mathematics), OSMC Physical Therapy Clinic
- John Miller (Informatics), Prospero's Pen Games
- Clayton Pelfrey (Informatics), Goshen College Admissions Department
- Matthew Pletcher (Computer Science), Simple Updates
- Nick Schwartz (Informatics), Goshen College Instructional Technology Services
- Jacob Shetler (Informatics), Hertzler Systems

Contests

- Consortium for Computing Sciences in Colleges Programming Contest: Seth Yoder and Maria Jantz (1st place of 29 teams)
- Putnam Competition: Peter Schrock (74th percentile), Kenan Bitikofer (72nd percentile), Matthew Chen, Julian Harnish, Jon Kaasa
- Indiana Colleges Mathematics Contest: Phil Bontrager, Luke Graber. Lucas Harnish, Julian Harnish, Jon Kaasa, Minah Kim, Deeksha Pagar, Peter Schrock, Seth Yoder
- Mathematical Competition in Modeling: Garrett Ahlgrim and Zoe Blosser (Honorable Mention)


Global Game Jam

- The Global Game Jam (GGJ) is the world's largest game creation event taking place around the world at physical locations. In January 2015, there were 28,837 people registered for 518 jam sites in 78 countries and 5438 games were produced.
- Goshen College was one of the sites, drawing people from as far away as Ball State University as well as Goshen College students Kenen Bitikofer, Philip Bontrager, Crystopher Echavarria, John Miller, Deeksha Pagar, Clayton Pelfrey, Balaz Pirot, Matt Pletcher, Brian Sutter, Nick Schwartz, and Seth Yoder.
- This year, the GGJ will be held January 29-31, 2016.

Science Olympiad

- Over 100 students, faculty, and community members volunteered to run 23 events for 8 middle school and 13 high school teams on Saturday, February, 14, 2015.
- This year, the Goshen College Regional Tournament will be on Saturday, February 13, 2016.

INDIANA SCIENCE OLYMPIAD

Leaf Scholars

- Academically talented first-generation students majoring in STEM.
- Morgan Catron
- McKinzi Vega
- Josue De La Rosa
- Philip Chan
- Meghan Gerke
- Bryan Nguyen
- Dmitriy Shendel

Alicia Showalter Reynolds Scholarship

- Awarded annually to women who are considering graduate studies in the sciences
- Sophie Sears & Cecilia Lapp Stoltzfus

Clemens Scholarship

- Awarded to an upper-level Chemistry major in honor of Don Clemens' 30+ years as a Chemistry Professor
- Stuart Kurtz

General Chemistry Achievement Award

- Presented by Professor Dan Smith
- Awarded to the highest achieving students in General Chemistry
- Prizes provided by CRC Press
- Natalie Mark and Simon Weaver

Math Book Awards

- Awarded to first-year students for outstanding achievement in 200+ level mathematics courses.
- Started with a donation from Bruce Sellers
- Kenen Bitikofer (Discrete Math and Graph Theory)
- Julian Harnish (Discrete Math and Graph Theory)
- Abby Flickner (Calculus I and II)