University of Wyoming
Department of Economics

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AARON J. ENRIQUEZ

PhD Candidate | Department of Economics
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EDUCATION

University of Wyoming	***Laramie, WY***
PhD, Economics	May 2021 (expected)
MS, Economics, Environment and Natural Resources	Aug 2017
BS, Biology, Honors Program, *summa cum laude*	May 2015
BS, Economics, *summa cum laude*	May 2015

DISSERTATION

Title: Bioeconomic analysis and nonmarket valuation of grizzly bears in the Greater Yellowstone Ecosystem
Committee: David Finnoff (Chair), Stephen Newbold (Co-Chair), Jason Shogren, David Aadland, and Carlos Martínez del Rio (External Department Member)
Fields: Environmental and natural resource economics, applied microeconomics

Themes:

- Examine **human-ecosystem interactions**, with a specific focus on the relationship between humans and grizzly bears in the Greater Yellowstone Ecosystem.
- Explore the **tradeoffs** associated with multi-use species that cause both benefits and damages to people in society. Grizzly bear benefits and damages are modeled as linear and nonlinear functions of grizzly bear population size and other controls. Benefits include existence value, sighting value, and consumptive use value while damages include property damages, human injuries, and livestock depredations.
- Model ecological population dynamics by accounting for **feedback loops** between wildlife and humans. Human-caused grizzly bear mortalities are estimated as a function of grizzly bear population size, expansion of grizzly bear occupied range, climate, and resource quality using negative binomial count regressions. The results are used to parameterize a differential equation in which human-caused mortality limits grizzly bear net growth.
- Analyze **decision making by resource managers**. A representative wildlife agency determines optimal management of grizzly bears over time by simultaneously accounting for ecological realities (e.g., population growth) and human realities (e.g., benefits and damages). Optimal management can simultaneously improve ecological outcomes (e.g., reduce grizzly bear mortality) and improve human outcomes (e.g., reduce grizzly bear-human conflicts).
- Use a combined revealed and stated preference **nonmarket valuation** survey to quantify people's **use and nonuse values**, including values for grizzly bear sightings and conservation.

JOB MARKET PAPER

Enriquez, AJ and DC Finnoff. Managing mortality of multi-use megafauna. Invited for revision and resubmission to the *Journal of Environmental Economics and Management*.

Abstract: Grizzly bears in the Greater Yellowstone Ecosystem, which are currently listed under the Endangered Species Act, are a multi-use species that cause both benefits and damages. As the grizzly bear population has increased over time, there has been an increase in the number of grizzly bear-human conflicts and human-caused grizzly bear mortalities. Federal protections prevent active management (i.e., direct population control through harvest). Instead, wildlife managers rely on reactive management (i.e., indirect population control through conflict management). To shed light on when a recovery program ought to transition to active management, a bioeconomic model is constructed and parameterized. A representative wildlife agency decides whether to enact active management by taking into account how stock-dependent benefits and damages adjust along a recovery path. Given the assumptions in the base case, the grizzly bear population has surpassed the size at which protections ought to have been removed. When an active management program is a contentious and negotiated settlement with little flexibility, the natural capital value of a live animal may be negative for an interval of time, during which it is optimal for society to conserve the species by developing a buffer.

WORKING PAPERS

Enriquez, AJ, BT Gilbert, and LH Thunström. The pain of paying with other people's money. Under review at *Review of Behavioral Economics*.

Abstract: Spending decisions are at the heart of consumer research, and factors that impact spending have been studied for many decades. So far, research has focused on spending decisions based on own money. However, people often spend money earned by someone else (e.g., partners spend each other's earned money, government officials spend tax-payer money, employees spend employer money, people in need spend social benefits). We take a first step towards understanding how spending depends on who earned the money. We focus on the shortest social distance between consumer and earner – intra household spending – and survey 166 couples on how pain of paying from a fixed purchase is affected by who earned the money. Pain of paying is a proxy for the opportunity cost of consumption and regulates consumer spending; the higher the pain, the lower the spending. We find that people feel *higher* pain of paying when spending money earned by their partner, compared to when earned by self, suggesting they might be more frugal with money earned by others. Further, their pain of paying increases if they believe their partner will be unhappy with their purchases. Their ability to accurately predict the partner's feelings about the purchase increases with partner similarity in spendthriftiness.

Bagdonas, DA, **AJ Enriquez**, KA Coddington, DC Finnoff, JF McLaughlin, MD Bazilian, EH Phillips, and TL McCling. Rare earth element resource evaluation of coal byproducts: A case study from the Powder River Basin, Wyoming. In preparation for submission to *Renewable and Sustainable Energy Reviews*.

Abstract: Domestic rare earth element sources and production are limited in the United States and currently rely on final processing overseas. Increasing demand and resource security has led to significant investigation into domestic rare earth element resources. Much of the existing research focuses on unconventional potential ore stocks, including coal and coal byproducts. This investigation focuses on coal byproducts generated as ash from coal-burning power stations. Wyoming's Powder River Basin hosts the largest U.S. coal stocks for energy production, providing approximately 40% of all thermal coal mined in the country. In Section I, we study Powder River Basin coal byproducts for rare earth element

concentrations and compare the data to current alternative resource knowledge. We find that the coal byproducts are consistently high enough in rare earth element concentration (above the current Department of Energy 300 ppm cutoff grade) to warrant consideration as a promising potential resource. Rare earth element behavior within the host coal seams is also considered in an effort to better understand resource prospecting and ore body description. In Section II, we evaluate the economic feasibility of rare earth extraction from coal byproducts using net present value analysis and the rare earth concentrations data from Section I. We calculate the break-even ash-to-oxide output and input unit costs for four coal stations in the Powder River Basin. All stations have break-even unit costs that are higher than the mine-to-oxide operating cost reported for a traditional rare earth element mine. This is a promising result, especially given that it is more costly to refine rare earths from mined material than from ash. The results are highly sensitive to rare earth prices: given low long-term prices, none of the stations can feasibly break even. In Section III, we summarize federal policy considerations in rare earth element resource development. Recent policy developments, which have focused on rare earth element-specific funding legislation, paired with the results from Sections I and II, suggest a robust opportunity for development of Wyoming-based coal byproducts as a partial solution to current domestic rare earth element shortfalls and strategic needs.

Marchal, AJ, **AJ Enriquez**, MD Ehmke, and CA Camargo, Jr. Free riding toward personal protection: Relating parental cooperation behavior to vaccine hesitancy.

Abstract: Small urban clusters and rural communities, which have historically had low vaccination rates, are especially vulnerable to healthcare system overloads. We conducted a study in which parents from these locations participated in a voluntary contribution mechanism experiment and then answered survey questions about influenza vaccinations. We observe whether parents' cooperative actions in the experiment (i.e., contributions to a shared group account) relate to their flu vaccination decisions for themselves and their children. We classify different player-types based on parents' propensities to cooperate and react to their partners' actions, including "free riders" (keep the majority of tokens), "contributors" (contribute the majority of tokens), and "responders" (adjust contributions based on partners' actions). We also control for the intensity of reciprocation among all players. We find that free riders and parents who tend to reciprocate are most likely to vaccinate, which is a departure from previous literature. The findings shed light on the behavioral motives behind people's vaccination decisions. Policies that amplify free riding and reciprocation may increase vaccination rates, which would be critical for mitigating the damaging effects of COVID-19 and other preventable diseases.

Richardson, LA and **AJ Enriquez**. The economic value of wildlife tourism and losses from marginal population changes: The case of bear viewing in Yellowstone National Park.

IN-PROGRESS SURVEYS

Project: Nonmarket valuation of grizzly bears in the Greater Yellowstone Ecosystem
Researchers: Aaron Enriquez, Stephen Newbold, and David Finnoff

Goals:

- Use stated preference components (choice experiments) to estimate people's willingness to pay for changes in the following grizzly bear-related attributes: chance of seeing a grizzly bear, risk of being injured by a grizzly bear, number of grizzly bear-human conflicts, and grizzly bear extinction probability
- Use a revealed preference component to estimate people's aggregate demand for recreational trips to the area as a function of trip cost, grizzly bear-related attributes, and other key control variables

– Integrate the stated and revealed preference components with a utility-maximization framework that can be used to derive people's average willingness to pay for future grizzly bear management policies
– Compare average willingness to pay between locals and non-locals

Completed Work:

– Obtained Institutional Review Board approval
– Pretested the survey by running five focus group sessions and a one-on-one interview
– Secured funding for an expected sample size of 2,500 respondents
– Communicated with and sought feedback from grizzly bear experts in three agencies
– Finalized the experimental design and conducted power analysis and simulations in R
– Programmed the survey in Qualtrics
– Began online administration of the survey

Project: Preferences for wind energy in Wyoming
Researchers: Aaron Enriquez and Rob Godby

Goals:

– Elicit Wyoming residents' attitudes about competing energy sources, including fossil fuels and renewable energy
– Determine what drives Wyoming residents' preferences for (or against) wind energy
– Use a set of economic experiments in which respondents assign credits to signal how important they find various impacts from potential future wind energy developments. The impacts span the following categories: economic considerations, electricity generation, effects on wildlife, effects on climate and environment, and physical characteristics, location, and viewshed

Completed Work:

– Obtained Institutional Review Board approval
– Pretested the survey by running four focus group sessions
– Secured funding for an expected sample size of 800 respondents
– Programmed the survey in Qualtrics
– Began online administration of the survey

RESEARCH EXPERIENCE

Department of Economics, University of Wyoming

Graduate Research Assistant (20 hrs/week) Aug 2020 - Present

– *Project*: Valuing grizzly bear conservation and viewing in the Greater Yellowstone Ecosystem
– *Supervisor*: Dr. David Finnoff
– *Funding*: Research Enhancement Grant, Biodiversity Institute, U. of Wyoming

Graduate Research Assistant (20 hrs/week) Jan 2018 - July 2020

– *Project*: Preferences for wind energy in Wyoming
– *Supervisor*: Dr. Rob Godby
– *Funding*: Energy Graduate Assistant (Jan - May 2018, Aug 2018 - May 2019, Aug 2019 - July 2020)

Graduate Research Assistant (20 hrs/week) Aug 2015 - Dec 2017

- *Projects*: Economic feasibility of rare earth extraction from coal ash, risks of animal and plant infectious diseases through trade (RAPID Trade), undergraduate advisor for economics capstone projects
- *Supervisor*: Dr. David Finnoff
- *Funding*: Rare Earth Fund, School of Energy Resources, U. of Wyoming (Aug 2015 - June 2016); RAPID Trade grant, National Science Foundation (Aug 2016 – Dec 2016)

Haub School of Environment & Natural Resources, University of Wyoming

Research Aide (up to 10 hrs/week) June - Aug 2017

- *Project*: Small scale aquaculture as a livelihood alternative with marine conservation benefits in coastal communities in Chile
- *Supervisor*: Dr. Jo Albers
- *Highlights*:
  - Worked as a research assistant and facilitated writing a successful grant proposal
  - Obtained fieldwork experience in Southern Chile (April 2018). Participated in stakeholder interviews (conducted in Spanish). Stakeholders included artisanal fishers, members of fisher organizations, and government employees.

Wyoming EPSCoR Program, University of Wyoming

Undergraduate Research Fellow (30 hrs/week on average) June - Aug 2013

- *Project*: Scoring algae for algaecide resistance and first steps toward engineering hydrogen peroxide resistance in the green alga *Chlamydomonas*
- *Advisor*: Dr. Stephen Herbert

TECHNICAL SKILLS

Programming: R
Statistical/Mathematical Software: Mathematica, MATLAB, Stata
GIS: QGIS, ArcGIS Pro
Survey: Qualtrics
Others: LaTeX, Microsoft Office (Word, PowerPoint, and Excel)

TRAINING

Winter School: Survey Design and Experimental Methods in Applied and Agricultural Economics

Host: Arizona State University, USA
Dates: May 18-22, 2020 (*first online portion*); January 6-10, 2021 (*second online portion*)
Highlights:

- Selected as the EXECON Winter School Scholar: full tuition scholarship ($1,950) from the Experimental Economics Section of the Agricultural and Applied Economics Association

Foundations of GIST Course

Host: University of Wyoming, USA
Dates: Fall 2020
Description: 3-credit online graduate course

- "The course will provide an introduction to geographic information systems and spatial analysis for graduate students, with a focus on the integration of common GIS software

(ArcPro) and open source tools (R)"

PRESENTATIONS *(abstracts available on website)*

UW-CSU Graduate Student Symposium (Laramie, WY) April 2019

– *Presenter:* "Bioeconomic grizzly bear management"

International Institute of Fisheries Economics & Trade Conference (Seattle, WA) July 2018

– *Presenter:* "From the shore or from the water? Enforcement of resource rights under discrete enforcement technologies"

Geological Society of America Annual Meeting (Denver, CO) Sept 2016

– *Presenter:* "Economic feasibility of rare earth element extraction from Wyoming coal ash/char"

TEACHING EXPERIENCE *(evaluations available on website)*

Department of Economics, University of Wyoming

Instructor of Record, Principles of Microeconomics (online) Summer 2019

– *Class size*: 41 students
– *Instructor quality*: 4.35/5 (response rate: 58.5%)

Instructor of Record, Principles of Microeconomics (on-campus) Fall 2018

– *Class size*: 123 students
– *Instructor quality*: 4.52/5 (response rate: 74.8%, department mean: 3.95/5)

Haub School of Environment & Natural Resources, U. of Wyoming

Instructor of Record, Mini Microeconomics (online) J-Term 2019

– *Description*: Introductory economics course for non-economics majors interested in environmental and natural resource applications
– *Class size*: 6 students
– *Instructor quality*: 4.67/5 (50% response rate)

Instructor of Record, Mini Microeconomics (online) J-Term 2018

– *Class size*: 19 students
– *Instructor quality*: 4.09/5 (57.9% response rate)

OTHER TEACHING EXPERIENCE

Department of Economics, University of Wyoming

Online Course Mentor, Principles of Microeconomics Fall 2019

Guest Lecturer, Math Economics Fall 2017

Undergraduate Advisor for Capstone Projects, History of Economic Thought Spring 2017

Guest Lecturer, Natural Resource Economics Fall 2016

Department of Molecular Biology, University of Wyoming

Teaching Assistant, Medical Microbiology Lab Spring 2014

PROFESSIONAL EXPERIENCE

Department of Physics & Astronomy, University of Wyoming

Position: **Camp Counselor** June 2015
Camp: ExxonMobil Bernard Harris Summer Science Camp

United States Forest Service

Positions: **Forestry Aid (General) & Forestry Tech (General)** July - Aug 2011,
Series/Grade: GS-0462-2/1 May - Aug 2012

Organization: Rocky Mountain Region, Region 2, Shoshone National Forest
Type of Appointment: Student Temporary Experience Program
Description: Wildland Fire Initial Attack Dispatcher (40 hrs/wk)
Address: Cody Interagency Dispatch Center
2501 Wright Bros Drive, Cody WY 82414

AWARDS

University of Wyoming

Attilio & Hedy Bedont Outstanding Graduate Student Award, *College of Business* — April 2020 & April 2018

Best Graduate Student Teaching Award, *Department of Economics* — April 2019

Top 20 Outstanding Grad, *College of Arts & Sciences* — May 2015

John S. Bugas Theory Award – Microeconomics, *Department of Economics & Finance* — April 2015

M. Clare Mundell Outstanding Senior Award, *College of Business* — April 2015

Dean's Award to Outstanding Seniors, *College of Business* — April 2015

GRANTS

University of Wyoming

2020 Research Enhancement Grant, *Biodiversity Institute* Spring 2020

Project: Valuing grizzly bear conservation and viewing in the Greater Yellowstone Ecosystem
Authors: Aaron Enriquez (PI), David Finnoff (faculty advisor)
Amount: $9,023

Student Research and Creative Activities Grant, *Haub School of ENR* Spring 2019

Project: Economic valuation of grizzly bears
Authors: Aaron Enriquez (PI), Stephen Newbold, and David Finnoff
Amount: $1,000

Dick and Lynne Cheney Study-Abroad Grant Fall 2016

Destination: Tenerife, Spain (for a graduate course on international environmental assessment)
Amount: $600

SCHOLARSHIPS

Experimental Economics Section, Agricultural & Applied Economics Association

EXECON Winter School Scholar — Spring 2020
Amount: $1,950

University of Wyoming

Carlton R. Barkhurst Dissertation Fellowship — Spring 2021
Amount: $9,351

John Tschirhart Graduate Scholarship in Bioeconomics — Spring 2020
Amount: $9,600

Rocky Mountain Power Grad. Scholarship in Regulatory Economics — Fall 2019
Amount: $1,500

Rocky Mountain Power Grad. Scholarship in Regulatory Economics — Spring 2017
Amount: $2,000

Rocky Mountain Power Grad. Scholarship in Regulatory Economics — Fall 2015 - Spring 2016
Amount: $2,000

Trustees' Scholars Award — Fall 2011 - Spring 2015
Amount: Full-ride scholarship covering tuition, fees, and room and board for 8 semesters of undergraduate study

SERVICE & LEADERSHIP

Journal Reviewer, *Forest Science* — 2020

Crisis Counselor, *Crisis Text Line* — Oct 2017 - Aug 2019
34 hours of training, 200 hours of service

Volunteer U-16 Coed Soccer Coach, *Laramie Soccer Association* — April - May 2015

Captain, *Men's Club Soccer, University of Wyoming* — Fall 2018

Treasurer, *The National Society of Collegiate Scholars, U. of WY* — 2014 - 2015

President and Player-Coach, *Men's Club Soccer, U. of WY* — 2014 - 2015

MEMBERSHIP

American Economic Association — Sep 2019 - Present

Association of Environmental and Resource Economists — July 2018 - Present

The Honor Society of Phi Beta Kappa — 2015 - Present

LANGUAGES

Swiss-German (native), English (fluent), Spanish (intermediate)

REFERENCES *(all may be contacted)*

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National Park Service
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