

Ecology, evolution and undergraduates: Integrating education and research in a long-term field study



Carol Goodwillie
Biology Department
Harriot College of Arts and Sciences

A long-term experiment addresses current areas of interest in both ecology and education

- Ecology
 - Importance of long-term and large-scale data sets



A long-term experiment addresses current areas of interest in both ecology and education

- Education
 - Active learning
 - Emphasis on training students in the use of large-scale data

A long-term experiment addresses current areas of interest in both ecology and education

- Education
 - Active learning
 - Emphasis on training students in the use of large-scale data

"Overview of the Pedagogy of Large-Scale Data & Data Sources"

"Using Web-Accessible Large Ecological Data Sets for Student-Active Learning"



Long-term ecological experiment located at ECU West Research Campus





Experimental questions

- What are the interacting effects of nutrient addition and disturbance on plant community composition and diversity?

Historical foundations of the study



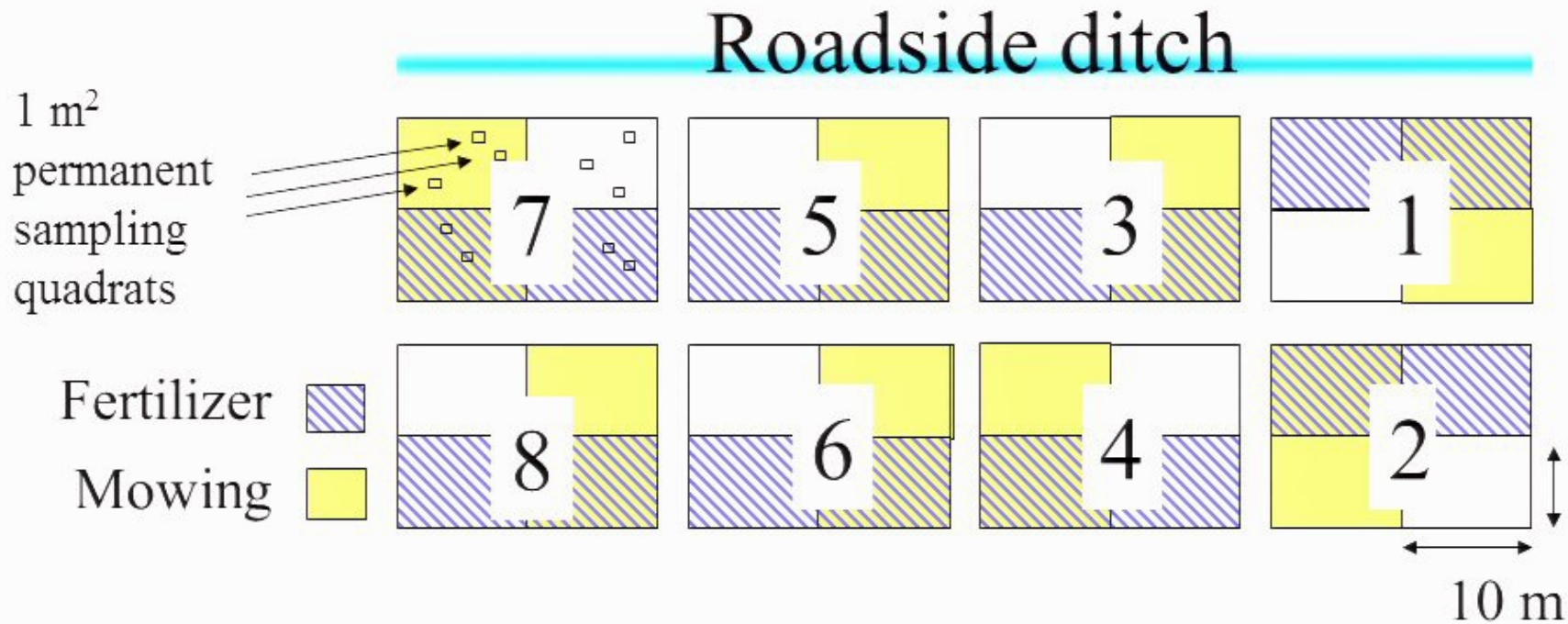
Park Grass Experiment in Britain

150 years of data on effects of nutrient addition on plant community

Implications for human impacts on communities

- Humans add nutrients through fertilizer run-off, waste and airborne industrial particulates
- Humans prevent some natural forms of disturbance – wildfires, flooding

Experimental design



Litter removed by raking crews after annual mowing



Experimental plots in 2003



Experimental plots in 2011



Undergraduate curriculum

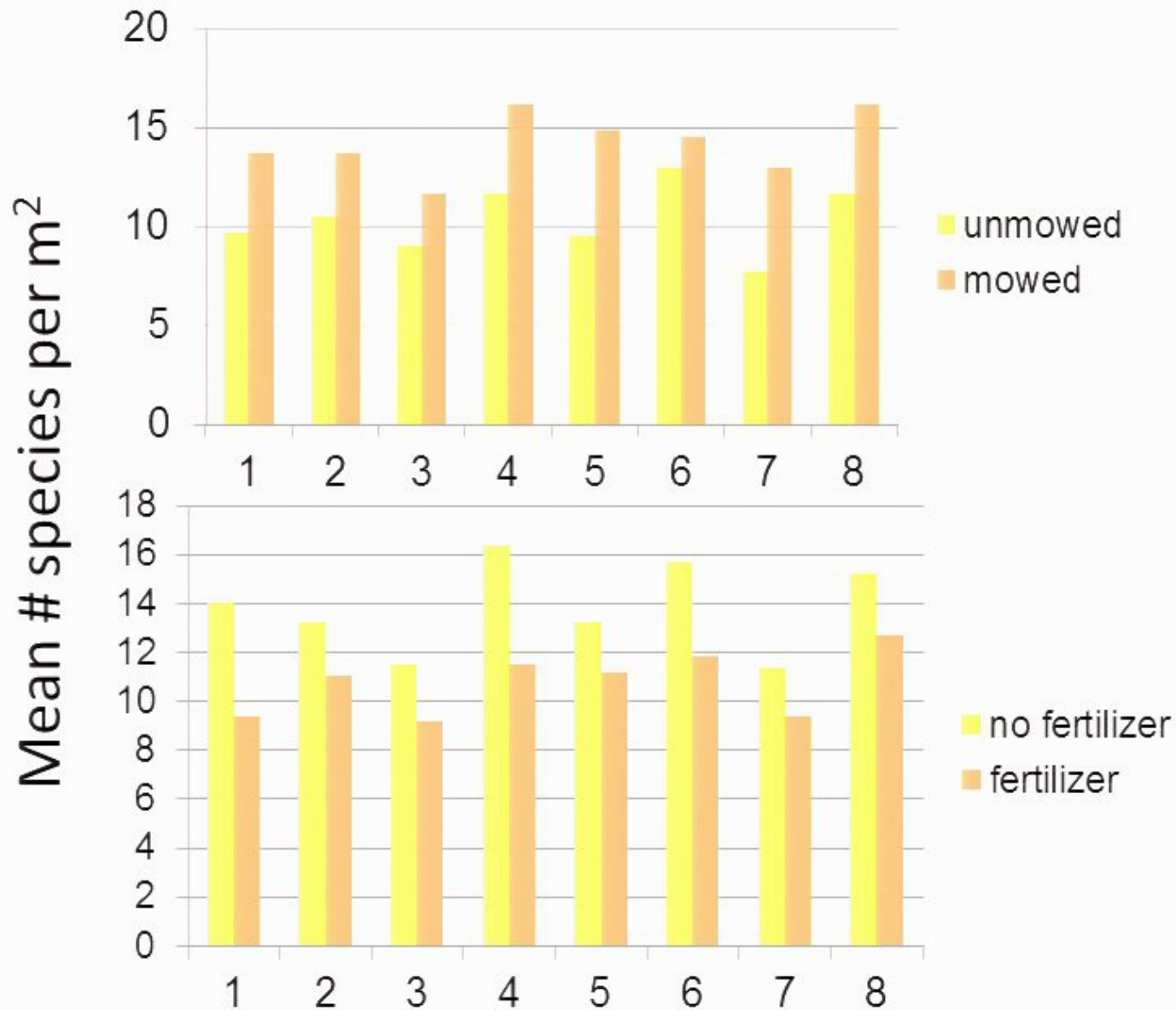




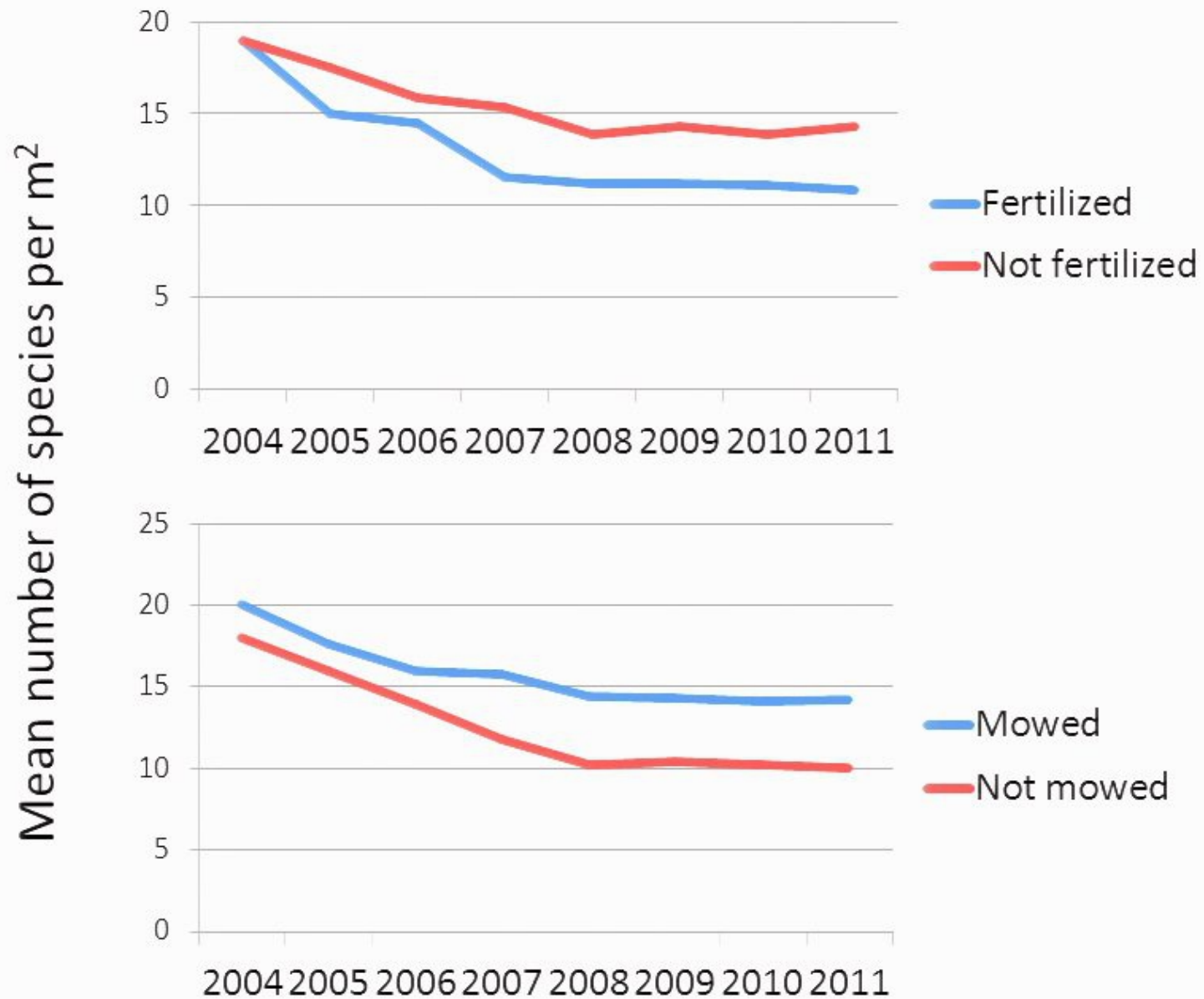




Species diversity is higher with mowing, lower with fertilizer



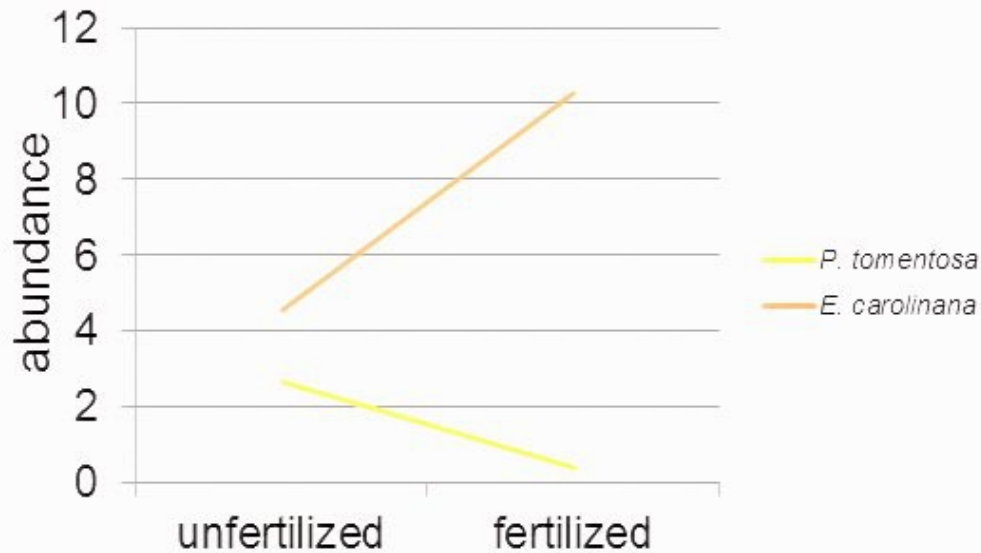
Effects of treatments are cumulative



Dominant species respond differently to fertilization



P. tomentosa



E. caroliniana

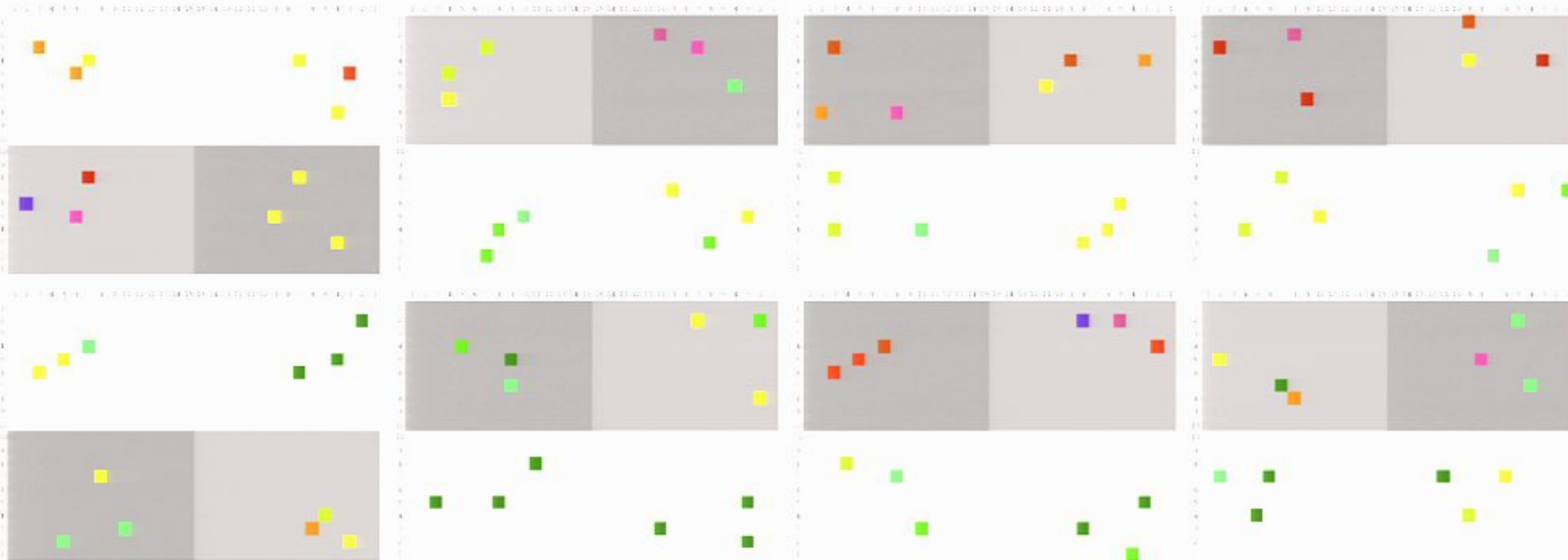


C. laxum

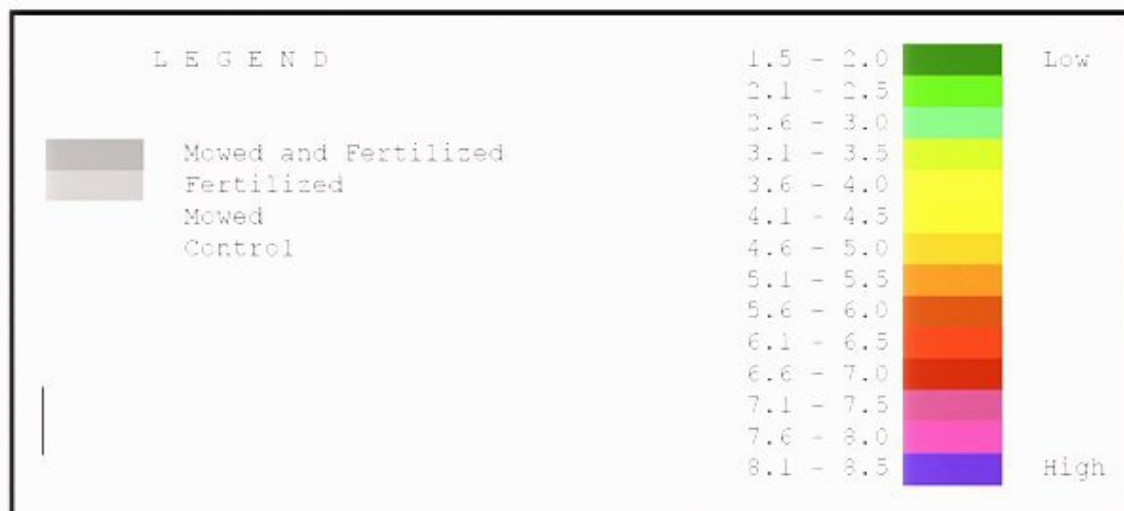


A. tecta

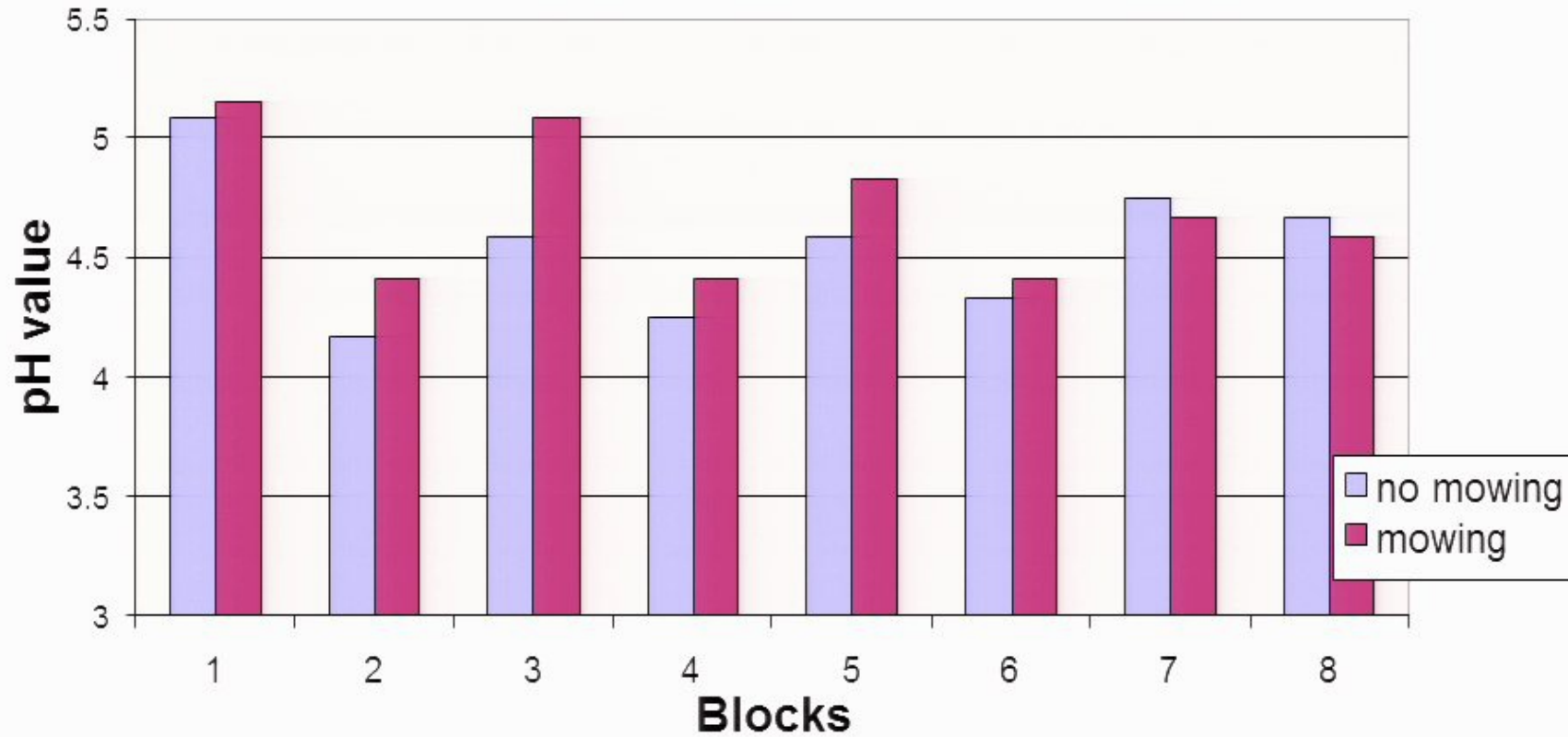
Treatments affect soil moisture



John Blanton, Justin
Castellow, Jonathan
Edwards



Soil pH is lower in unmowed plots



Mac Williams and Charles Buehner

Mowing favors species with pubescent leaves

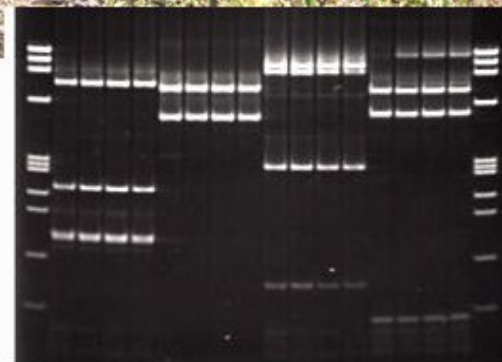


Brandon Nott
and Andrew
Poeppelman

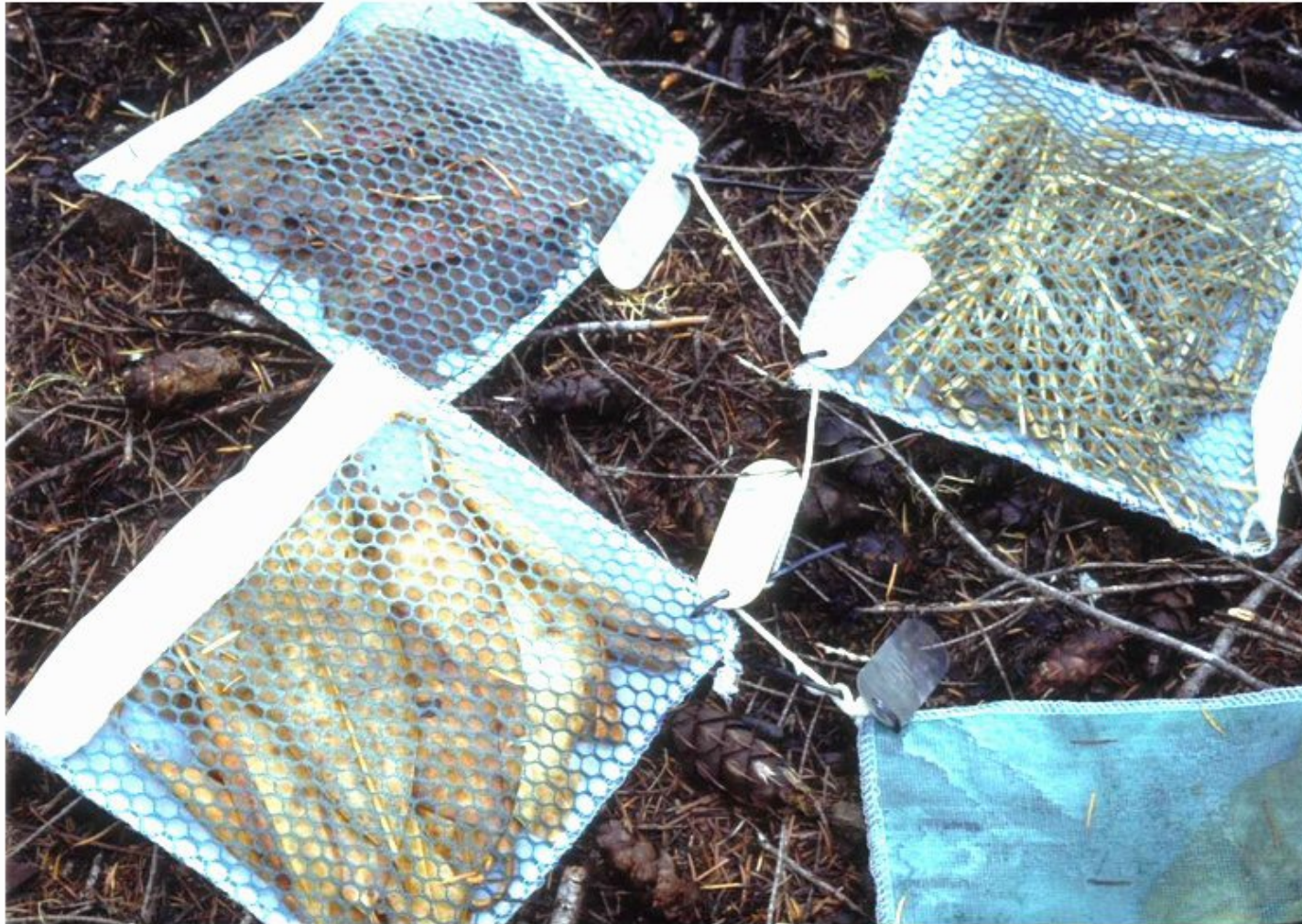
Student presentations

- 2006 Billy Franch, Co-authored paper in the Journal of the NC Academy of Sciences
- 2008 Josh Bartel and Anna Bowling, Poster at NC Undergraduate Research and Creative Activity Symposium
- 2009 Josh Bartel, Oral presentation at ECU RCAW, **Best UG presentation in Natural Sciences**
- 2010 Brittany Carr and Emilee Quinn, Oral presentation at ECU RCAW, **Best UG presentation in Natural Sciences**
- 2010 Amandeep Gujral (Matt Schrenk, advisor), Poster presentation at ECU RCAW, **Best UG poster in Natural Sciences**

Spin off projects: How do treatments affect soil microbial communities?



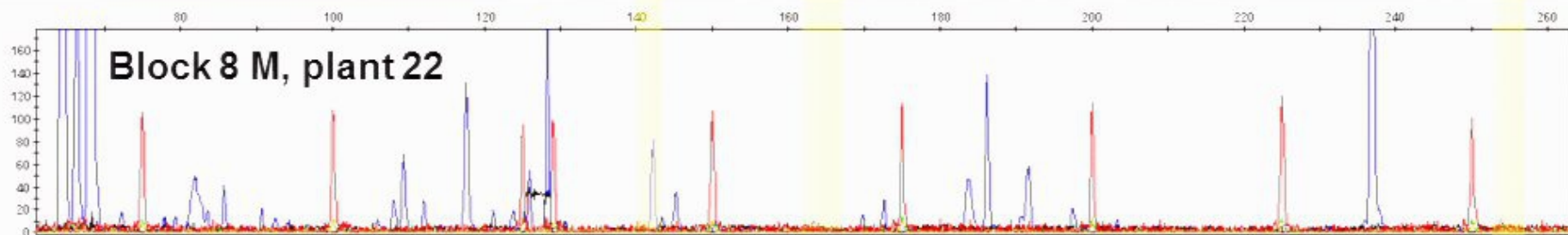
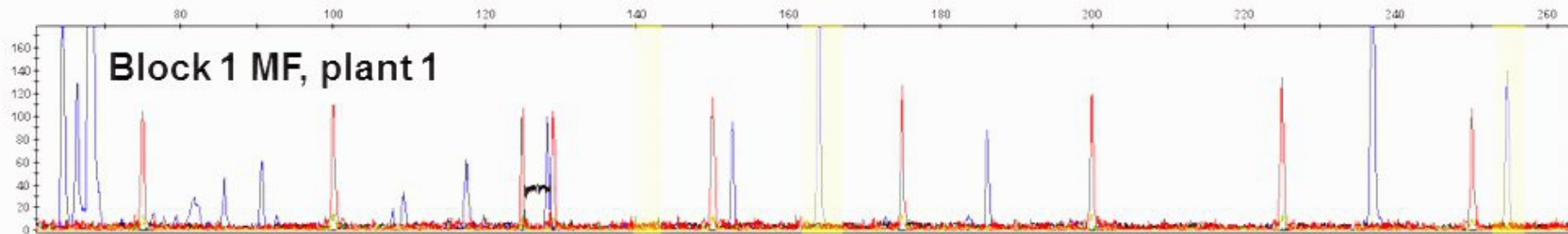
Spin off projects: How does nutrient addition affect rates of decomposition?



Spin off projects: How do the treatments affect rates of herbivory?



Spin off projects: Are treatments having effects on population genetic processes?



Conclusions

Ten years of fertilization and mowing have had dramatic and predicted effects on the plant community and its diversity

The experiment provides a framework for other investigations of ecological processes and trophic levels

The long-term ecological experiment has been a valuable resource for undergraduate education and training in research... and a lot of fun!

Thanks!

Lisa Clough

David Knowles

John Stiller

Josh Bartel

Claudia Jolls

Heather Vance-Chalcraft

Dave Chalcraft

Beth Chester

Mark Brinson

Matt Schrenk

Bob Christian

Tom Feldbush

ECU Grounds Crew

ECU Biology Department

NSF

ECU Research and Graduate Studies

Thanks to the many wonderful student researchers

Kayla Harper	Tracie McLeod,	Nicole Merli,	Lindsay Fulcher
Kendall Powers	Amanda Glisson,	Dara Gray,	James Caviness
Nora Norwood	Lynda Bridges,	Nancy Poplin,	Joe Allikas
Justin Vaughan	Cheryl White,	Jenn Brantley,	Eli Heath
Zach Harrison	Annalisa Gnoleba	Bucky Turpin,	Jonathan Carroll
Brandi Cahoon	Laura Beaudry,	Steven Warren,	Sarah Simpson
Alison Pegram	Holly Montjoy,	Kelly LeCompte,	Stephanie Odum
Gwendolyn Riddick	Chelle Whitley,	Charles Buehner	Jennifer Warner
Nicole Walter	Steve Rego,	Ann-Gelle Carter,	Spencer Conte
Marc Silverman	Michelle Wilson,	Krizella Ordanes,	Drew McCarthy
Joseph Kincaid	Brian Burne,	Christa Fleming,	Andrew Poeppelman
Joel Dieterle	Jonathan Edwards,	Anna Bowling,	Brandon Nott
Billy Franch	Danesh Ghiassi,	Jazmin Marlin,	George Vuong
Isla Tabrizi	John Blanton,	Amy Walence,	Nick Creech
Holly Golebiowski	Justin Castellow	Luke Bohanan,	Justin Bordeaux
Jessica Hair,	Lauren Roughton,	Josh Bartel,	Betty Foh
Joy Loudermelt,	Lindsay MacWilliams,	Amandeep Gujral,	Heather Potersnak
John Beddard	Matt Hojatzadeh,	Sapan Kapadia,	Mitzi Ponce
Amy Maples,	Keeden Hopkins,	Nicole Stroud,	Matt Ward
Brooke Hughes,	Tracy Toberman	Chris Oakley	Danny Crowder
Lindsay Huxley,	Kate Wilson	Meaghan Cutchin	Glenn Griffin
Ken Yimbu,			