An Inclusive Framework for QR

McKenzie Lamb

Ripon College

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Setting

- Very small liberal arts college: 700-800 students.
- Rural Wisconsin
- High percentage of Pell-eligible students.
- Needed to distribute students more evenly across faculty.
- Redesigned curriculum to focus on general (vs disciplinary) skills.

Catalyst Curriculum

- New *Catalyst* curriculum at Ripon College
- 124 credits + major + 5 "core" courses:
  1. Catalyst 110: Writing
  2. Catalyst 120: Quantitative Reasoning
  3. Catalyst 210: Intercultural Competence
  4. Catalyst 220: Interdisciplinary Integration
  5. Catalyst 300: Applied Innovation Seminar
- Builds toward Catalyst 300
- Focused on core liberal arts skills
- Ideal: *Any* faculty member can teach any Catalyst course

CTL 120 Instructor Disciplines (so far)

- Biology
- Chemistry
- Communication
- Economics
- Mathematics
- Physics
- Psychology
- Theater

My Role

- Quantitative Skills Coordinator.
- Spring 2016: Led working group to design guidelines for CTL 120.
- Fall 2017: Led working group to redesign CTL 120 guidelines.

Catalyst 120: Official Resolution

1. Quantitative reasoning is the focus.
2. **Is not a math or statistics course primarily, but a course using quantitative evidence effectively in authentic disciplinary contexts.**
3. Seminar will develop skills in critical thinking, specifically deductive thinking and/or scientific method.
4. Preliminary information literacy skills are introduced.
5. Oral communication skills practiced in at least one presentation.

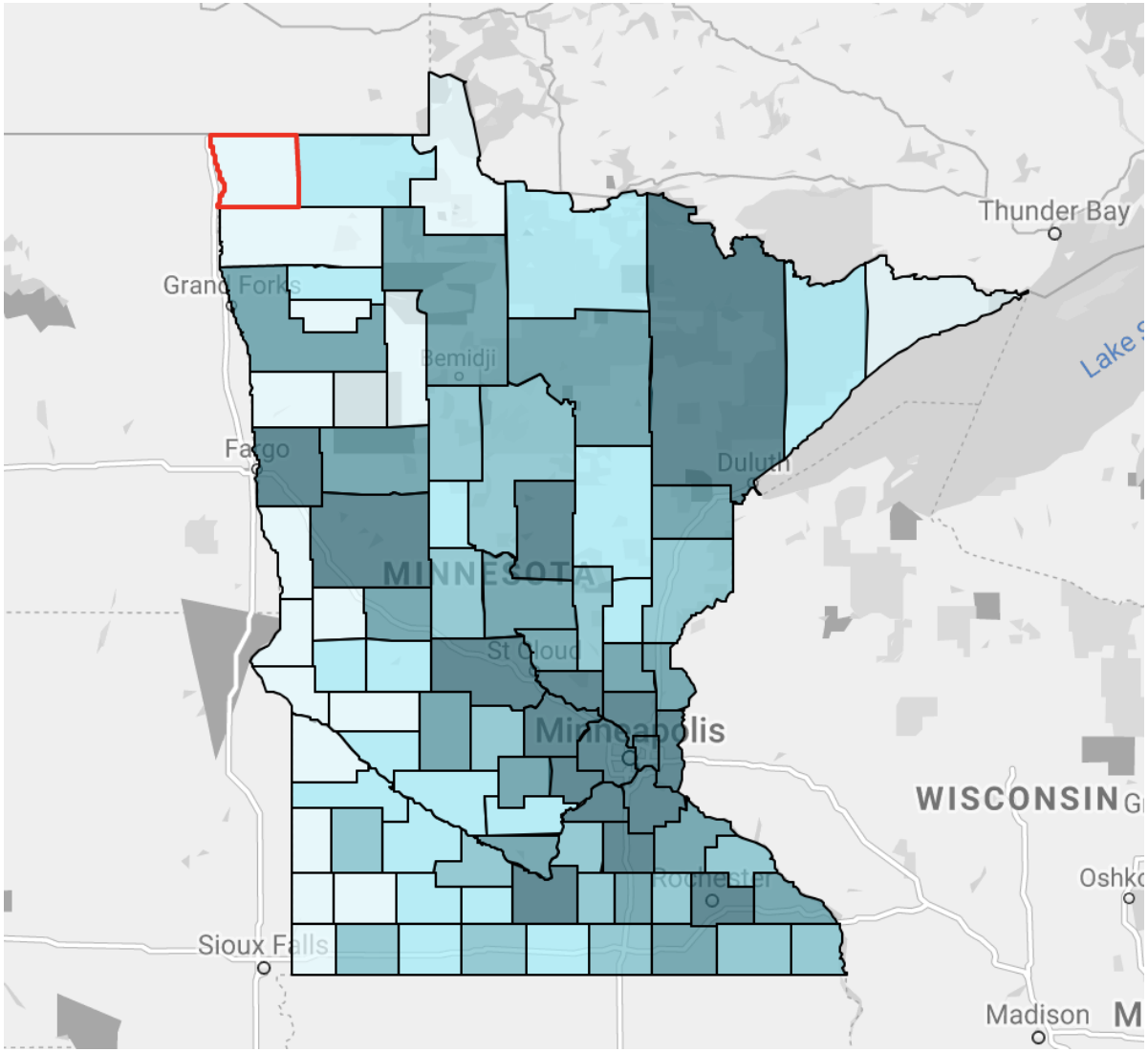
Missing Cattle

Example

From *It's Time for Another Wolf Hunt in Minnesota*, Grand Forks Herald:

" . . . there have been 118 cows and calves that simply disappeared this year in Kittson County."

Kittson County



Example: Missing Cattle

Example

From *It's Time for Another Wolf Hunt in Minnesota*, Grand Forks Herald: " . . . there have been 118 cows and calves that simply disappeared this year in Kittson County."

Possible comparisons:

- Average # of cows and calves that disappear per year
- # of cows and calves in the county
- # of cows and calves lost to other causes (lightning, mastitis, etc.)

Example: Calf Losses due to Wolves

Example

In 2015, wolves killed about 8,110 calves across the U.S.

Possible comparisons:

- # lost: 2,144,000
  - Percentage lost $\approx 0.37\%$.
- # lost to predators: 238,890
  - Percentage lost $\approx 3.4\%$.
- # lost to domestic dogs: 15,740
  - Almost double.
- # lost to poisoning: 8,820
  - More lost to poisoning than wolves.

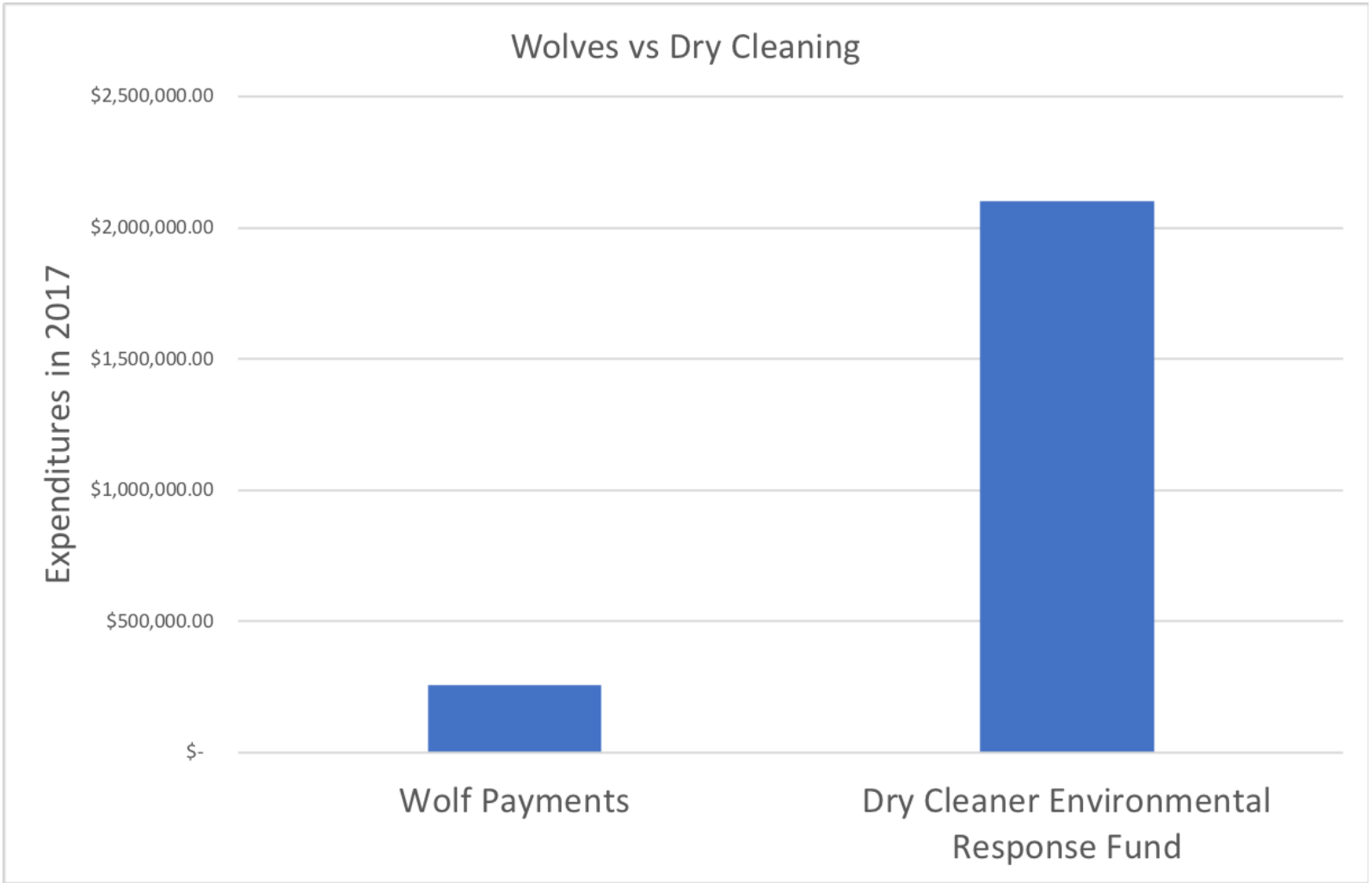
Wolf Damage Payments

Example

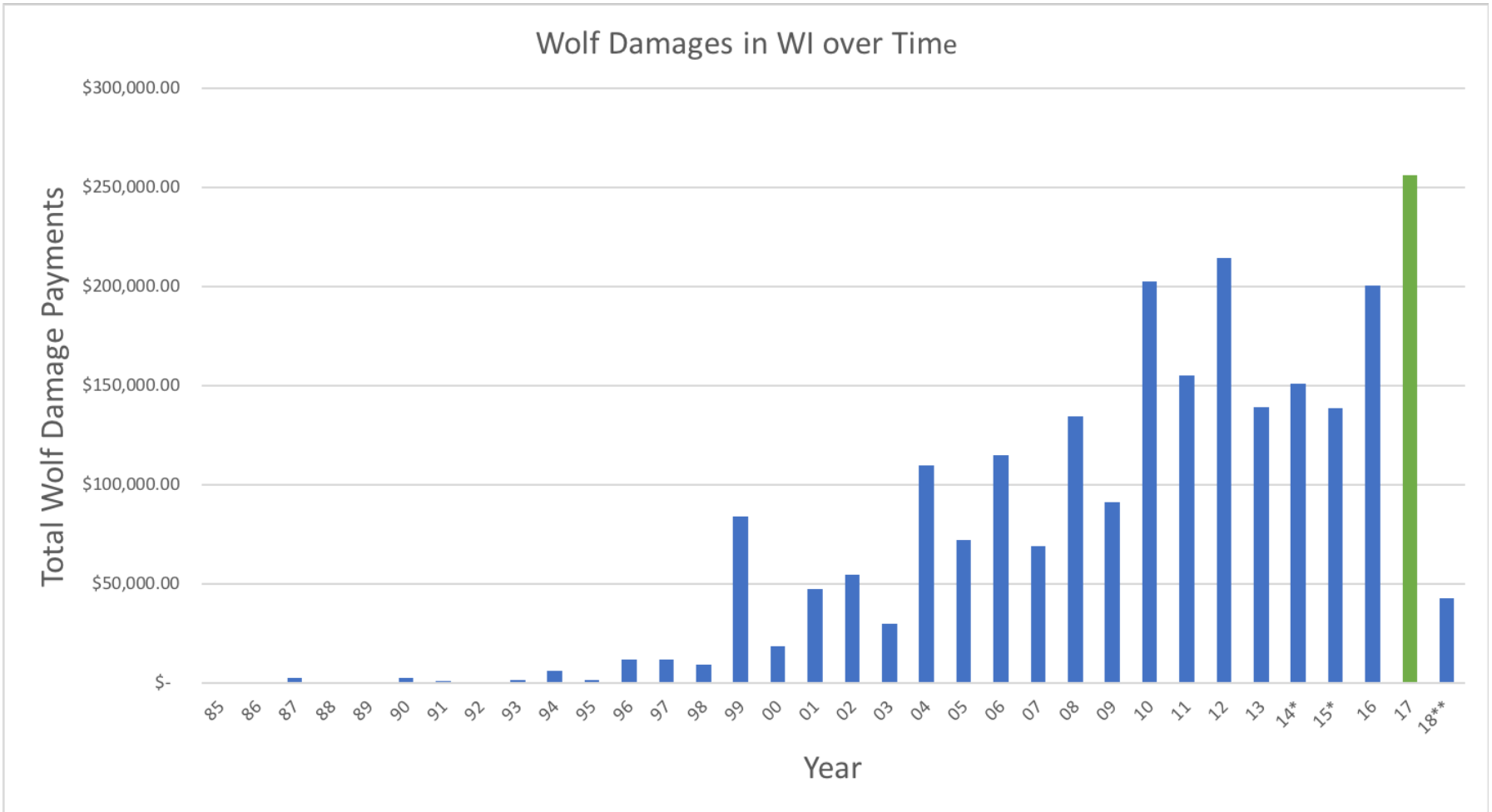
In 2017, Wisconsin paid citizens $256,148 for wolf depredations.

What does this mean?

Wolf Damage Payments



Wolf Damage Payments



Motivation for Course Guidelines

- Focus and specificity, but not too much.
- Cannot start from quantitative methods.
- Faculty ask the right questions.
- How to teach students to ask the right questions?
- What do the right questions have in common?

Basic Principles

- Raw numbers do not have practical significance.
- Relationships between numbers DO have practical significance.
- Different frames of reference $\longrightarrow$ different meanings.
- Graphical representations depict multiple comparisons simultaneously.

New Course Goals - May 2018

1. Students correctly use appropriate **numerical comparisons** to support arguments in a variety of contexts.
2. Students analyze the extent to which **numerical comparisons** are relevant to a given argument or context.
3. Students evaluate and accurately interpret **visual comparisons (e.g., charts and graphs) of quantified information** as support for arguments.
4. Students clearly express quantitative ideas in writing.
5. Students deliver an oral presentation that develops a coherent argument, supported by visual representations of quantitative information.
6. Students identify authoritative information sources based on information need.

New Course Goals - May 2018 (Continued)

Students should use all of the following types of comparisons:

1. Direct comparisons (one number is greater than another).
2. Differences
3. Ratios, such as percentages and rates
4. Using measures of central tendency, such as the mean and median, to make comparisons.

Personal Impressions

- Focus $\longrightarrow$ cohesion.
- Precise vocabulary.
- Abstract for some students.
- Still need some technical skills:
  - Rates, especially percentages
  - Spreadsheet skills: producing graphical representations

Other Faculty Impressions

- Initially: Radio silence.
- Two Psychology Profs:
  - Fits my discipline.
  - Codifies what I was already doing.
  - Helped me to focus on transfer across different contexts.
- Chemistry Prof:
  - Provides focus on interpretation vs calculation.
  - More accessible to weaker students.

Compared to Other Approaches

- Comparisons are nothing new: Joel Best, Eric Gaze, everyone else.
- Organized around comparisons rather than quantitative methods.
- Focus is on interpretation rather than calculation.
- More accessible to more faculty?

End

Thank you!

Something to ponder: *It is more or less a tautology to say that if a number is used in an argument without implicitly or explicitly using properties or operations that are unique to numbers, then the number is extraneous, and its use is incidental.*

First Attempt

- 1/3 technical skills: (Chapters 1 and 2 of Eric Gaze's book, *Thinking Quantitatively: Communicating with Numbers*.)
  1. Proportional reasoning
  2. Spreadsheets:
     - manipulate data
     - produce graphical representations
     - analyze numerical relationships
- 2/3 logical reasoning and disciplinary content

First Official Course Goals

1. Students interpret and analyze visual representations of data as appropriate to the course content.
2. Students competently interpret numerical relationships within an authentic context.
3. Students recognize when quantitative data is invalid, misleading, or inapplicable.
4. Students construct sound arguments using quantitative evidence to justify their conclusions.
5. Students recognize the kinds of conclusions that can and cannot be drawn from quantitative methods.
6. Students clearly express quantitative ideas in writing.
7. Students deliver a competently prepared oral presentation that develops a coherent argument, supported by appropriate visual aids.