Ontario History and Social Science Teachers' Association
Association des enseignant·es des sciences humaines de l'Ontario

Unit 3 Lesson 5: Investigating Civic Issues - Climate Change

Lesson Overview: (1 75-minute lesson. Could be extended to a 2-day activity with extended time for individual research)
In this issue-based lesson, students will learn about climate change as a civic issue. They will investigate sources to become informed about the issue of climate change and re-evaluate their position on the issue throughout the lesson.

This lesson can also be adapted to focus on 2SLGBTQ+ issues and activism. See the Limestone District School Board lesson package, 2SLGBTQ+ Civics Resource.

Connections to Inquiry Process (at least one)	**Connections to Political Thinking Concept(s)**
★ Formulate Questions ★ Interpret and Analyze ★ Evaluate and Draw Conclusions	• Political Significance • Stability and Change • Political Perspective • Objectives and Results
Curriculum Expectations **A1. Political Inquiry: use the political inquiry process and the concepts of political thinking when investigating issues, events, and developments of civic importance** A1.3 apply critical-thinking skills to assess the credibility and biases of relevant sources from a wide variety of media forms, including social media **B1. Civic Issues, Democratic Values: describe beliefs and values associated with democratic citizenship in Canada, and explain how they are related to civic action and to one's position on civic issues (FOCUS ON: *Political Significance; Political Perspective*)** B1.5 communicate their own position on some issues of civic importance at the local, national, and/or global level, explaining how their position is influenced by their beliefs/values **B2. Canadian and Indigenous Governance Systems: explain, with reference to a range of issues of civic importance, the roles and responsibilities of various institutions, structures, and positions in Canadian and Indigenous governance systems, treaty relationships, and other Crown-Indigenous relations (FOCUS ON: *Stability and Change; Political Perspective*)** B2.7 explain, with reference to issues of civic importance, including economic issues, how various domestic, foreign, and international groups and institutions can influence government policy, and describe ways in which government policy affects individuals' lives and the economy **C1. Civic Contributions, Inclusion, and Service: analyse the importance of various contributions to the common good, and assess the recognition of beliefs, values, and perspectives, in communities in Canada and internationally (FOCUS ON: *Political Significance; Stability and Change; Political Perspective*)**	**Learning Goals** We are learning how to investigate sources to inform ourselves about key civic issues like climate change. We are doing this to ensure we are accessing accurate information so we can make educated civic choices (voting, volunteering and/or protesting, boycotting).

C1.5 explain various ways in which people can access information about civic matters, highlighting the importance of applying related digital literacy and critical-thinking skills, and assess the effectiveness of ways in which individuals can voice their opinions and influence others' opinions on these matters, including through social media.	
Readiness Students will already be familiar with the concept of climate change from grade 9 geography and intermediate social studies. **Terminology** • Climate Change • Greenhouse Gases • Lateral Reading • Adaptation • Mitigation • Biodiversity • Economy	**Materials** • Computer • Projector • Screen • Speakers • Access to a computer lab for student research **Resources** Canadian Geographic Infographics on Climate Change Adaptation-and-Mitigation_EN.pdf Biodiversity_EN-1.pdf Climate-Change_EN-1.pdf Economy_EN.pdf Environment_EN-1.pdf Health-and-Urban-Living_EN-1.pdf Climate Change Quotes Slide Deck
Minds On • Establishing a positive learning environment • Connecting to prior learning and/or experiences • Setting the context for learning	**Connections**
Individual Anticipation Guide with Quotes, video and infographic - 10 minutes 1. Distribute a copy of the Anticipation Guide to each student. Have them respond to each quote by circling A (agree) or D (disagree) in the LEFT-HAND column. 2. For the last statement in the Anticipation Guide, go to the video, The Impacts of Climate Change This video was produced by The Climate Commission, an independent body established in 2011 by the Government of Australia to communicate "reliable and authoritative information" about climate change in Australia. 3. Project the infographic on Climate Change from Canadian Geographic. 4. A good strategy to use to read the infographic with students is called "Close Reading". This strategy is explained in an ELearning Ontario infographic, "How to Close Read an Infographic" Key questions to discuss with students:	**Assessment for learning** Descriptive feedback from the teacher to ensure students can read an infographic ***Differentiated Instruction:*** • Students can read each statement aloud to ensure understanding of key concepts and vocabulary. • Teacher can prompt vocabulary comprehension by having students highlight key terms or new vocabulary (ie. emissions, absorptive capacity, prosperous, genesis)

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- What is the main idea and how is this conveyed?
- What supporting evidence is used to get the main idea across?

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Action

- Introducing new learning or extending/reinforcing prior learning
- Providing opportunities for practice and application of learning (guided > independent)

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Connections

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Gallery Walk (15 minutes)

1. Create six stations in the classroom. Place a Canadian Geographic infographic (including the one used in the Minds On) at each station.

Station #1 - What is Climate Change?
Station #2 - Climate Change and Biodiversity
Station #3 - Climate Change and the Economy
Station #4 - Climate Change and the Environment
Station #5 - Climate change: Health and Urban Living
Station #6 - Adaptation and Mitigation

2. Distribute the Climate Change Gallery walk organisers to each student. Then divide students up into groups and have them do a gallery walk to explore each infographic. At each station, the students should be able to identify:

- The main idea
- Supporting evidence

On their Climate Change Gallery Walk organisers, eEncourage group discussions at each station to identify these two points. The teacher will circulate around the room to check in on students and group discussions.

Individual student reflection (10 minutes)

3. Provide each student with a copy of the Investigating Climate Change handout.
4. Have them complete the chart on page 2 (Making connections to Society and You) individually. At this point, they can walk between stations to use the infographics to complete their charts.

Individual student investigation (25 minutes)

5. Students will now need access to a computer lab, netbooks/tablets or use their own devices to access the internet.
6. Have students complete steps 3-5 of their Investigating Climate Change handout.
7. Remind students that they should be using lateral thinking to investigate sources. If they need a refresher, use these videos from Ctrl+F - Online Verification Skills:
   - Investigate the source

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Assessment for Learning

- Students will monitor their own learning through group discussions and individual reflection in lesson package

Assessment of Learning

- Evaluation of the individual Climate Change lesson packages is included on the document. Checking for knowledge/understanding, application of skills, and communication. (30 marks)

Differentiated Instruction:

- Students can work together in Infographic Analysis (#3) to collaborate their information.

Quick Tips:

- Put up infographic posters BEFORE the lesson begins to reduce transition time.
- Print out infographic posters in colour.

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- Advanced Claim Check

8. Once students have completed the handout, they can hand them in for assessment.

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Consolidation

- Providing opportunities for consolidation and reflection
- Helping students demonstrate what they have learned

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Connections

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Anticipation Guide and Exit Card - individually (15 minutes)

1. Students will return to their Anticipation Guides from the beginning of the class.
2. Load the slide deck and click through each slide, revealing the source of each quote.
3. They will revisit their answers and write evidence from the lesson in their guides. Ask them if the source of the quote gives it more authority and if so, to write that in their evidence section.
4. Have students complete #3 on the back of the Anticipation guide or use their exit card tracking sheet.
5. They will submit the anticipation guide for assessment to ensure they can use evidence to support their positions .

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Assessment as learning:

- Students will monitor their own learning using the anticipation guide and exit card.
- Teacher will provide formative assessment or this can be evaluated for understanding of concepts (right-hand of anticipation guide and evidence)

Differentiated Instruction:

Quick Tips:

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Additional Sources

1. Climate Justice in BC - Lessons for Transformation
2. Canadian Geographic - Climate Change Education Resources (including 6 infographics and lesson plans)
3. Civic Online Reasoning - Stanford History Education Group - Lateral and Vertical Reading Poster
4. Ctrl+F - Online Verification Skills Playlist
5. Spot Fake News - see Unit 1 - Media Literacy
6. California Academy of Sciences - Infographics Toolkit - Activity 1
7. Miller, J et al. (July/August 2021) Media Literacy in the Age of Covid and Climate Change. The Science Teacher.
8. Elections Canada - Elections by the Numbers - student interpret and make their own infographics about voting trends

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Anticipation Guide - Climate Change

1. Read through each of the quotations before the lesson starts. Do you AGREE or DISAGREE?
2. After we have finished the lesson, revisit these statements and change your answers. Provide ONE piece of evidence from the lesson to support the correct answer.

BEFORE		STATEMENTS	AFTER	
A	D	For the first time in human history, science has told us that human activity is dramatically altering the destiny of our planet	A	D
Evidence:				
A	D	Emissions are growing much faster than we'd thought, the absorptive capacity of the planet is less than we'd thought, the risks of greenhouse gases are potentially bigger than more cautious estimates, and the speed of climate change seems to be faster	A	D
Evidence:				
A	D	It is the poorest of the poor in the world, and this includes poor people even in prosperous societies, who are going to be the worst hit [by climate change]	A	D
Evidence:				
A	D	Long-term thinking is not radical. What's radical is to completely alter the planet's climate, to betray the future of my generation... What's radical is to write off the fact that change is within our reach	A	D
Evidence:				
A	D	The injustice of the whole issue of global warming and climate change lies in the fact that those who have contributed nothing to its genesis will suffer the most from its consequences...	A	D
Evidence:				
A	D	It is the political and moral responsibility of the world, particularly those who caused the problem, to save small islands and countries like Tuvalu from climate change…	A	D
Evidence:				
A	D	Climate change… is poised to become the most massive human rights violation the world has ever seen	A	D
Evidence:				
A	D	Inuit are facing the beginning of a possible end of a way of life that has allowed us to thrive for millennia because of the climate	A	D

		changes caused by global warming…. What will be left of our culture if this comes to pass?		
Evidence:				
A	D	Those developed economies most responsible for past and present emissions must take the lead.	A	D
Evidence:				
A	D	If we did not take action to solve this crisis, it could indeed threaten the future of human civilization. That sounds shrill. It sounds hard to accept. I believe it's deadly accurate. But again, we can solve it.	A	D
Evidence:				
A	D	We are the first generation to feel the effect of climate change and the last generation who can do something about it.	A	D
Evidence:				
A	D	Adults keep saying we owe it to the young people, to give them hope, but I don't want your hope. I don't want you to be hopeful. I want you to panic. I want you to feel the fear I feel every day. I want you to act. I want you to act as you would in a crisis. I want you to act as if the house is on fire, because it is.	A	D
Evidence:				
A	D	Watch the video: The Impacts of Climate Change. Do you think what they are stating is true or false?	A	D
Evidence:				

3. Exit Card on **Climate Change**

Once the lesson is done, identify ONE quote above that is closest to your attitude about **climate chang**e. Use the quote to support your response to the following prompts and include evidence from the lesson (statistic, idea, additional quote) to complete your thought. Use your tracking page or complete this on a separate page.

I used to think ….

Now I think ….

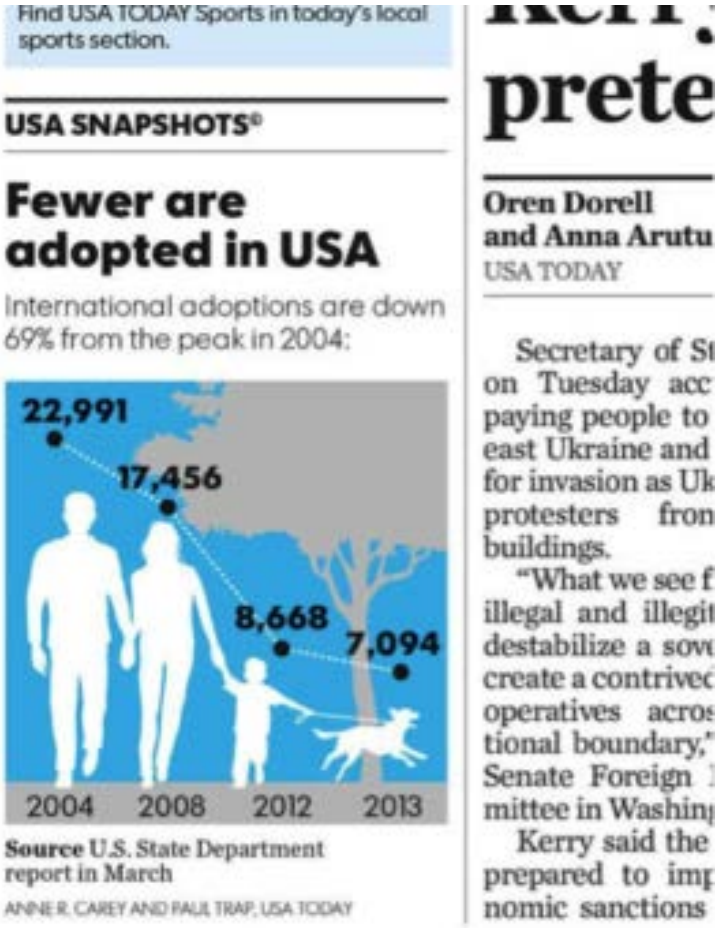
Media Literacy: How To Close Read Infographics

BY FRANK BAKER · PUBLISHED 05/30/2017

Do you know what an “infographic” is? Do your students? Increasingly more and more information is being conveyed in visual terms.

Infographics are visual representations of information, often using numbers and proportional data. Increasingly they also include arresting graphics that grab the attention of our image-attuned 21st century brains. They may convey a single “factoid” or an entire story narrative.

A good example of the ‘factoid” is the familiar news graphic found on the bottom left hand corner of the daily USA Today newspaper.


Find USA TODAY Sports in today's local sports section.

USA SNAPSHOTS®

Fewer are adopted in USA

International adoptions are down 69% from the peak in 2004:

Source U.S. State Department report in March

ANNE R. CAREY AND PAUL TRAP, USA TODAY

prete

Oren Dorell and Anna Arutu
USA TODAY

Secretary of St on Tuesday acc paying people to east Ukraine and for invasion as Uk protesters fron buildings.

“What we see f illegal and illegit destabilize a sov create a contrivec operatives acros tional boundary,” Senate Foreign mittee in Washin

Kerry said the prepared to imp nomic sanctions

Because marketers know that visuals translate to sharing on social media, a number of industries have embraced infographics including entertainment, sports, health, psychology, lifestyle, and food.

They can be used to lure customers (like this “get on the bandwagon” appeal):

TACO BELL HAS SOLD OVER 1 BILLION DORITOS LOCOS TACOS

AMOUNT OF INGREDIENTS USED FOR 1 BILLION DORITOS LOCOS TACOS

31 MILLION LBS OF DLT SHELLS

\+

93.8 MILLION LBS OF SEASONED BEEF

\+

31.3 MILLION LBS OF LETTUCE

\+

15.6 MILLION LBS OF CHEESE

MARKET WITH THE HIGHEST DLT PURCHASE

LAREDO, TEXAS

MOST SHARED/TWEETED DLT FLAVOR

COOL RANCH

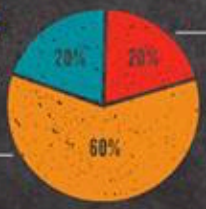
370,000 MENTIONS

SOLD ENOUGH DLTS FOR EVERYONE IN THE U.S. TO HAVE 3 TACOS

LARGEST DLT ORDER

OVER 1,300

NACHO CHEESE IS THE MOST POPULAR FLAVOR



FOLLOWED BY COOL RANCH AND FIERY

HOW MANY TIMES #DLT HAS BEEN HASHTAGGED **544,179**

LOCATION OF THE FIRST DLT SOLD **ORANGE COUNTY, CA**

ESTIMATED TIME SPENT MAKING 1 BILLION DLTS = 196,700 DAYS = 28,000 WEEKS = 540 YEARS

1 BILLION DORITOS LOCOS TACOS WOULD...

EQUAL THE HEIGHT OF

79,649 BURJ KHALIFAS (WORLD'S TALLEST BUILDING)

149,031 EMPIRE STATE BUILDINGS

452,284 GREAT PYRAMIDS OF GIZA

1,331,558 NFL FOOTBALL FIELDS (AND THAT IS WITH END ZONES!)

GO AROUND THE WORLD

3.5X

TRAVEL FROM NEW YORK CITY TO LOS ANGELES **37X**

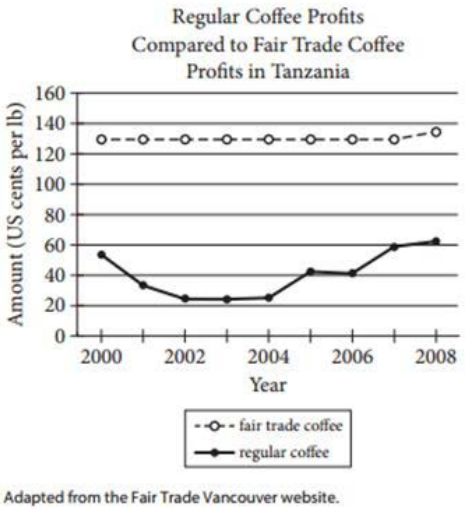
NOT QUITE REACH TO THE MOON, YET.
(WE ARE 1.5B DLTS AWAY!)

Or perhaps scare customers in another direction (like this natural health site's attention-getter):

Why teach about infographics?

The SAT college admissions test has increased the use of graphic-type questions in both the reading and math sections. The head of the College Board justified the addition of "graphic literacy" saying "being a literate consumer of that information is valuable regardless of your career." Source

Here is a sample graph from a practice SAT:



Adapted from the Fair Trade Vancouver website.

20

Data in the graph indicate that the greatest difference between per-pound profits from fair trade coffee and those from regular coffee occurred during which period?

A) 2000 to 2002
B) 2002 to 2004
C) 2004 to 2005
D) 2006 to 2008

Source

It’s easy to see how students could be disoriented if they’ve not had any prior experience analyzing and deconstructing these types of graphics or how to answer the multiple-choice questions that accompanies them. The Common Core Standards for Math make reference to these visuals when they say students “represent and solve equations and inequalities graphically.” Source

The sciences are another discipline which regularly employs infographics to explain sometimes complicated concepts, like climate change. The back page of every issue of Scholastic Science World magazine features a full page infographic. In this example, the graphic is used to coach students as they visually interpret the facts from a story inside the issue about coral reef degradation due to global climate change.

Close reading infographics

If you've followed my previous columns on "close reading" the media, then you'll know that it is important for students to question how media is constructed. It is also vital to know who created the media; who is the audience; what techniques are used to make the message credible; and who or what might be omitted. These same "media literacy" critical thinking questions are also keys to understanding infographics.

Every infographic should have a central theme or idea – in other words, what is the designer or marketer trying to communicate? What are they trying to get the reader to know and to understand? Go back and look at that USA Today graphic: did you notice the headline above the image? What other words are found inside and outside the graphic – how important are they? Is there anything omitted that you'd like to know? Do you know where to go to find that information?

Many infographics are designed by experts who employ visual literacy and art techniques. This includes everything from the rule-of-thirds, to color, to font style and size, and layout. Infographics may convey information by using pie charts or bar charts. Or they may "invent" their own display systems. The American Automobile Association (AAA) created this infographic to capture public attention about driving distractions, including cellphones. The infographic communicates to many audiences more effectively than the original news release reporting on research by cognitive distraction expert Dr. David Strayer.

Just as in advertising, color is important in infographics. Black, for example, can signify luxury. Green often communicates nature or health. Red is thought of as the most attention-getting of all of the colors. Read more about the meanings of color here.

Infographics can also be misleading as evidenced by this graphic produced and distributed by Microsoft. (Source) Did you notice: the image used for 2014 contributions is double that of 2011, but the actual dollar contributions are not.

Have your students create infographics

Your students can be tasked with reading a news story, culling the important data or information from it, and creating their own infographic. What images and colors will they decide to use? How will the chosen words compliment the images? What's the best way to explain and display the information? And how will it be informative or persuasive?

This web site lists 10 apps or software for creating free infographics.

It is clear that more information is being communicated to us visually, through the news, magazines, television and online. Already the SAT and Common Core acknowledge the importance of having today's students be proficient in understanding graphic representations. If any of this is new to you, perhaps now is the time to determine if there are professional development opportunities that would help you better understand not only how to read visuals, but also how to implement them in your classroom.

Climate Change Gallery Walk

Main idea about **Climate Change**:

Evidence:

Main idea about **Climate Change and the Economy**:

Evidence:

Main idea about **Climate Change and Biodiversity**:

Evidence:

Main idea about **Climate Change and the Environment**:

Evidence:

Main idea about **Climate Change and Health & Urban Living**:

Evidence:

Main idea about **Climate Change and Adaptability & Mitigation**:

Evidence:

Investigating Climate Change
Research Activity

1. Learning about Climate Change in Canada

Task: **Gallery Walk**. Work through the six infographic stations with your group.

As you walk to each station, discuss with your group members the following questions:

- What is the main idea and how is this conveyed?
- What supporting evidence is used to get the main idea across?

Station #1 - What is Climate Change?

Station #2 - Climate Change and Biodiversity

Station #3 - Climate Change and the Economy

Station #4 - Climate Change and the Environment

Station #5 - Climate change: Health and Urban Living

Station #6 - Adaptation and Mitigation

As you walk to each station, discuss with your group members the following questions:

- What is the main idea and how is this conveyed?
- What supporting evidence is used to get the main idea across?

2. Making Connections to Society and You

Think about how climate change has affected you personally and how it has impacted Canadian society.

Task: Complete the chart below. For 'society' you should be able to identify at least 3 points from the infographics you examined and at least 1 point for your personal experience. **This is completely confidential.

Changes	**You personally**	**Society**
Health Risks		
Food/Agriculture		
Water resources		
Severe weather		
Energy resources		

3. Interpreting Infographics (13 marks - k/u, t/i)

Task: Select ONE of the infographics you examined in step 1. Investigate the infographic more deeply by answering the following questions about it.

a) What ideas or pieces of information does the author present? List FOUR key takeaways. (4 marks)

_____
_____
_____
_____

b) Identify the main conclusion of the infographic. This should NOT just be the title, but also conclusions you can make (ie. next steps) based on the information provided. (1 mark)

_____

c) Pick one point on the infographic that represents a number. What is the number and what are the units? What is the source of the data? (2 marks)

_____
_____

d) Describe how the author represents the data in the graphic. (colour, sizes, shapes) (2 marks)

_____
_____

e) What other ways does the author tell the audience about the key message? (1 mark)

_____

f) What aspects of the infographic are confusing for you? (1 mark)

_____

g) What do you like the MOST about this infographic (appealing, ease of use)? (1 mark)

_____

h) What do you DISLIKE the most about this infographic (confusing, simplistic)? (1 mark)

_____

i) Overall, how effective do you think the infographic is in conveying the message and the information? Rank it from 1-10 with 1 being NOT effective and 10 being VERY effective.

4. Checking the facts (12 marks - t/i)

a) Using the same infographic, investigate the key facts used by investigating other sources.
b) Find 3 separate sources that corroborate (confirm or support) the claims of the infographic.
c) For each source, investigate whether or not the source is credible. Remember to use lateral reading strategies introduced in Unit 1: Lesson 5 (Media Literacy). For a refresher, watch Online Verification Skills: Investigate the Source on YouTube (https://youtu.be/hB6qjIxKltA).

Question	Source #1	Source #2	Source #3
Name of source (1)			
Is it credible? Answer YES or NO (1)			
Evidence (1)			
Evidence (1)			

5. Formulating Conclusions (5 marks, c)

Based on your investigation of the infographic and the information provided in it by additional sources, what is your overall impression of the information provided in the infographic? Is it accurate? Is it not accurate? Is it only partially accurate? Write your conclusions in a paragraph below using information from the infographic and the sources you used to investigate it.

_____

_____

_____

_____

_____

Climate Change, Climate Justice and Climate Activism

Greta Thunberg
Sophia Mathur
Autumn Pelletier
Saj Starcevich

Rebellion

Why did Greta Thunberg go on strike from school?

Famous quote:
“You say you love your children above all else, and yet you are stealing their future in front of their very eyes.”

Where in Canada was the first student to go on strike for climate change?

What is a ‘rebellion’?
Why does David Suzuki (host) refer to this movement as a ‘rebellion’? Refer to the moment in the film where a ‘declaration’ is made.
TEach climate justice:
https://teachclimatejustice.ca/the-lessons/module-1-introduction-to-climate-justice/

Youth climate activists:

https://www.cbc.ca/kidsnews/post/understanding-climate-change-from-a-kids-perspective

https://www.cbc.ca/kidsnews/post/kids-tried-to-sue-canada-over-climate-inaction.-they-lost

Climate change articles and news stories
https://climate.nasa.gov/scientific-consensus/
https://www.sciencealert.com/alexander-graham-bell-s-prediction-about-the-state-of-the-world-today-is-eerily-accurate
https://www.cbc.ca/news/world/climate-bill-canada-minerals-1.6551920

EXIT CARD: ONGOING JOURNAL

This is your exit card ongoing journal for the duration of the course. Throughout the course, you will be asked to write an exit card - this journal is where you will keep track of all your entries.

Fill in the chart below each time your teacher asks you to write an exit card:

EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

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EXIT CARD #:	DATE and NAME/TOPIC OF LESSON	QUESTION TO BE ANSWERED	YOUR ANSWER (make course and life connections, too)

Using the <u>RUBRIC BELOW THIS CHART</u>, give yourself a mark out of 10 for <u>EACH</u> of the categories: Knowledge, Thinking, Communication, and Application and a one-sentence explanation (for each category) as to why you gave yourself that mark. Write your answer below:

CATEGORY	**MARK OUT OF 10**	**ONE SENTENCE EXPLANATION**
Knowledge		
Thinking		

Communication		
Application		

EXIT CARD RUBRIC: Ongoing Journal

Name:_____

Categories	Below Level 1: 0-49%	Level 1: 50-59%	Level 2: 60-69%	Level 3: 70-79%	Level 4: 80-100%
Knowledge: (e.g., facts, terms, definitions) ***Did you fill in ALL the exit cards from the course?***	Did not meet requirement OR No evidence	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
Thinking: Use of planning skills (e.g., organizing an inquiry; formulating questions; gathering and organizing data, evidence, and information; setting goals; focusing research) ***Did I answer the questions in a robust way? Did you give yourself a mark?***	Did not meet requirement OR No evidence	uses planning skills with limited effectiveness	uses planning skills with some effectiveness	uses planning skills with considerable effectiveness	uses planning skills with a high degree of effectiveness
Communication: Clear expression and logical organization in oral, visual, and written forms ***Are my responses clear and easy to understand?***	Did not meet requirement OR No evidence	expresses and organizes ideas and information with limited effectiveness	expresses and organizes ideas and information with some effectiveness	expresses and organizes ideas and information with considerable effectiveness	expresses and organizes ideas and information with a high degree of effectiveness
Application: Making connections within and between	Did not meet requirement OR	makes connections within and between	makes connections within and between	makes connections within and between various contexts with	makes connections within and

various contexts (e.g., between topics/issues being studied and everyday life; between disciplines; between past, present, and future contexts; in different spatial, cultural, or environmental contexts) ***Am I making connections to my life and/or the course?***	No evidence	various contexts with limited effectiveness	various contexts with some effectiveness	considerable effectiveness	between various contexts with a high degree of effectiveness

Infographics in the Classroom: Using Data Visualization to Engage in Scientific Practices

Activity 1: Data Graphic Interpretation

1. Use David MacCandless's Peak Breakup Times blank infographic (Figure 1) to have a fun introduction to infographics. Share this using the "Activity 1 Presentation" power point slides (download the slides at www.calacademy.org/infographics-in-the-classroom-teacher-toolkit. PDF versions of the slides are also included in this packet). After students try to guess what the blank graphic is showing, reveal what it is and some of the "explanations" MacCandless offers. We modeled this after his TED talk: http://www.ted.com/talks/david_mccandless_the_beauty_of_data_visualization?language=en.
2. Briefly discuss with students why they think scientists would visualize their data.
3. Hand out a few graphics to analyze (Figures 2-8) and *Worksheet 1*. Give them 10 minutes to answer the questions on their own.
4. Have students find people who did the same graphic (if you have a large class, you may want to break them into smaller groups) and share out within their group what they think the graphic is about. You can also have them complete the worksheet together.
5. Working as a group, make a poster to share what you noticed in the graphic: 1-2 sentences describing the central ideas; what numbers/data are represented and how are they represented; what do you like/dislike about the way the author presents his/her story?
6. Give the students a chance to share out their ideas as a group.
7. Make new groups of 3-5 people who did different graphics. Share what the main story was and how the author visualized the numbers. The goal of this discussion is to come up with a list of all the different ways you can visualize/represent numbers. Have them write each one on a post-it. When they are done have each group bring up the post-its and start sorting them by similar ideas
8. Wrap up this section by summarizing the different post-it ideas. Pass out the Academy's list of ways to visualize data. Have a quick read over them – what is similar/different between them.

Infographics used for this lesson:

- David MacCandless, 20th Century Deaths, from his book, Visual Miscellaneum. There is a more complicated version here: http://www.informationisbeautiful.net/visualizations/20th-century-death/
- New York Times, One race, every medalist ever, http://www.nytimes.com/interactive/2012/08/05/sports/olympics/the-100-meter-dash-one-race-every-medalist-ever.html?_r=0

- Big Oak Studios, Inc, Diving the Depths Infographic http://visual.ly/diving-depths-infographic
- David MacCandless, 20th Century Deaths, from his book, Visual Miscellaneum\
- Craig Robinson, The Rise and Fall of Scoring in Baseball, Smithsonian Magazine, http://www.smithsonianmag.com/history/infographic-the-rise-and-fall-of-scoring-in-baseball-170927844
- Ocean Conservancy, International Costal Cleanup 25 years of Debris Collected, http://media-cache-ec4.pinimg.com/550x/7d/35/82/7d358209a4be18d0db69af13ef75ce78.jpg

Activity 1
Data Graphic Interpretation

CALIFORNIA ACADEMY OF SCIENCES

Name _____

Date _____

Title of Graphic _____

1. What ideas or pieces of information does the author present? List as many as you can.

2. Identify main conclusion told in the graphic. This should not just be the title, but what conclusion you can make from the information provided.

3. Pick one point on the image that represents a number. What is that number (you can approximate, if necessary) and what are the units? If known, what is the source of the data?

4. Describe how the author represents data in the graphic? (Ex. Using color to differentiate two things.)

- »
- »
- »
- »

5. What other ways does the author tell the audience about the key message(s)?

6. What questions do you have about the graphic? What confuses you?

7. What do you like/dislike about the graphic?

20th Century Death

What's killed the most?

famine
111m

food
76m

obesity 11m
diabetes 30m
heart disease 35m

ideology
16m

8.5m 7.1m 0.1m

war
124m

revolution
9.5m

5m 2m 1.6m 1m

nature
9.7m

tobacco
71m

disease
1390m

suicide
70m

murder
20m

technology
0.2m

smallpox
500m

measles
200m

meningitis
190m

tuberculosis
150m

whooping cough
30m

influenza
30m

HIV
25m

animals
4m

0.5m 90,000 29,000 5000 4000 100 100

source: Internet and wikipedia. Data very coarse. Some guesswork and extrapolation

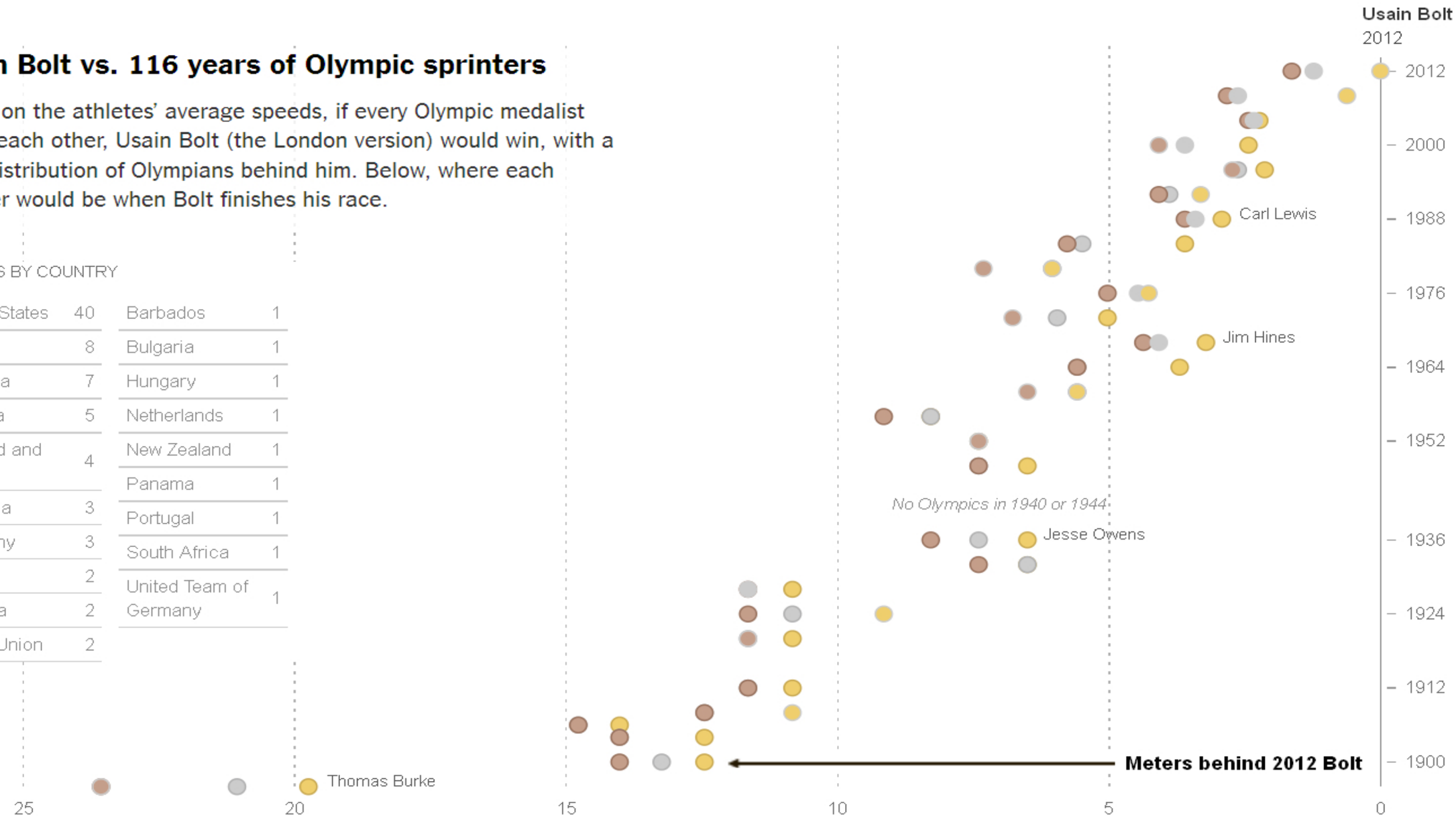
http://www.nytimes.com/interactive/2012/08/05/sports/olympics/the-100-meter-dash-one-race-every-medalist-ever.html

Usain Bolt vs. 116 years of Olympic sprinters

Based on the athletes' average speeds, if every Olympic medalist raced each other, Usain Bolt (the London version) would win, with a wide distribution of Olympians behind him. Below, where each sprinter would be when Bolt finishes his race.

MEDALS BY COUNTRY

United States	40	Barbados	1
Britain	8	Bulgaria	1
Jamaica	7	Hungary	1
Canada	5	Netherlands	1
Trinidad and Tobago	4	New Zealand	1
Australia	3	Panama	1
Germany	3	Portugal	1
Cuba	2	South Africa	1
Namibia	2	United Team of Germany	1
Soviet Union	2		



This chart includes medals for the United States and Australia in the "Intermediary" Games of 1906, which the I.O.C. does not formally recognize.

Diving the Depths

Pearl Divers to Squid Eaters

Pearl Diver (Free Dive)

Pearl divers of the central Tuamotu Archipelago in French Polynesia dive without external air supply. They can dive to depths of more than 39 meters where they collect oysters for up to two minutes.

39 meters

Emperor Penguin

Emperor penguins dive deeper than any other bird. They hold their breath when they dive and how long they hold their breath depends on how deep they dive and how fast they move.

200 meters

SCUBA Diver (Aided Dive)

In June 2005 Nuno Gomes set the World's Deepest Open Circuit SCUBA record; independently verified by Guinness World Records. It took Gomes about 20 minutes to reach 318.25m, and 12 hours to surface.

318.25 meters

Bottlenose Dolphin

Bottlenose dolphins usually do not need to dive deep to catch their food however they are capable of diving. Under experimental conditions, one bottlenose dolphin dove to 535 meters.

535 meters

647 meters

Beluga Whale

Beluga whales are able to swim both forward and backwards (something few other whales can do). Under experimental conditions a trained beluga whale dove to a depth of 647 meters.

Southern Elephant Seal

Southern elephant seals live in sub-Antarctic and Antarctic waters and are the largest of all seals. The deepest dive recorded by an Elephant Seal is 2388 meters.

2388 meters

Sperm Whale

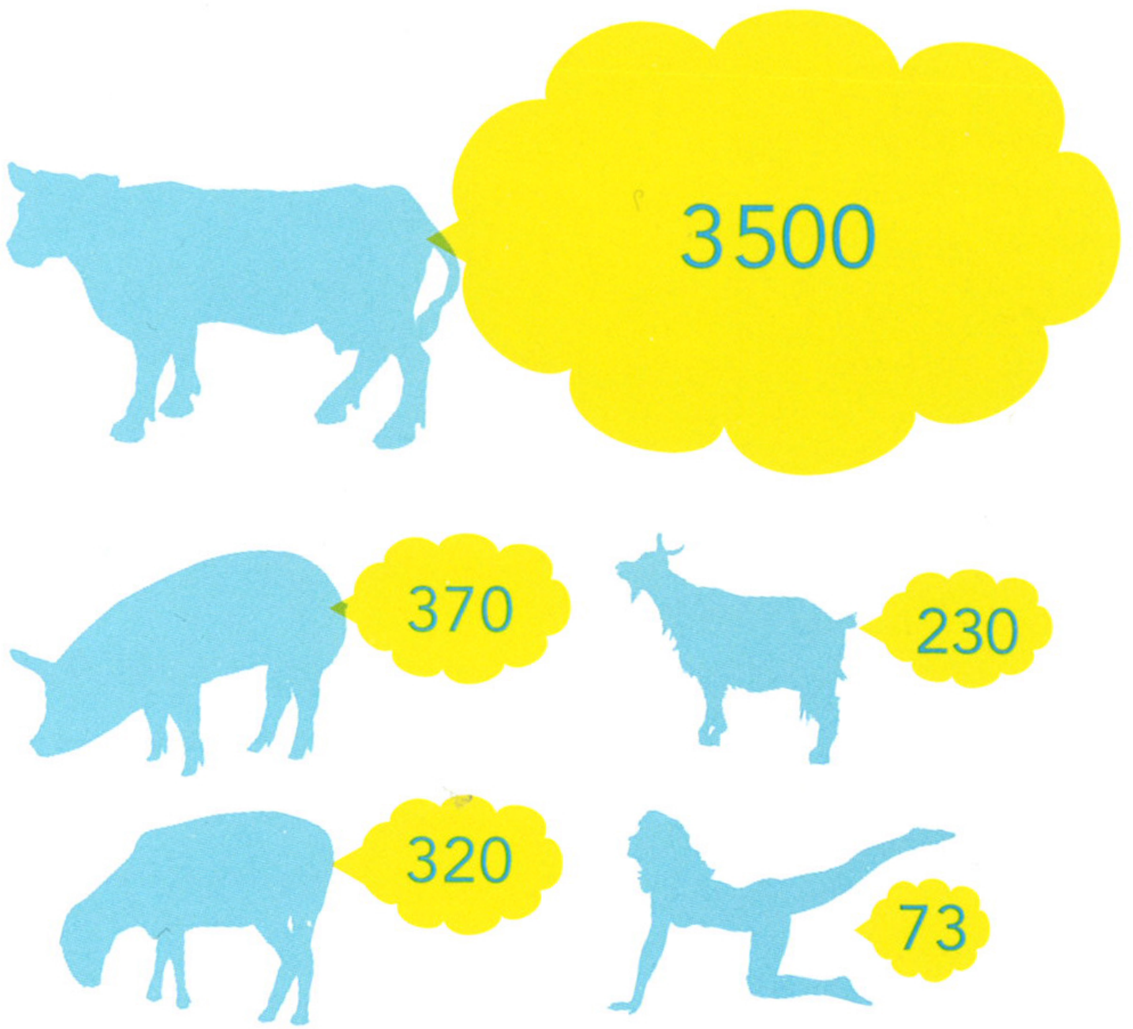
Sperm Whales are one of the deepest-diving mammals in the world. They dive in search of squid to eat and are believed to be able to dive up to 3000 meters in depth to the ocean floor.

3000 meters

http://visual.ly/diving-depths-infographic

Farty Animals

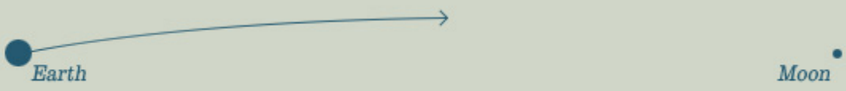
Annual methane emissions in equivalent CO2



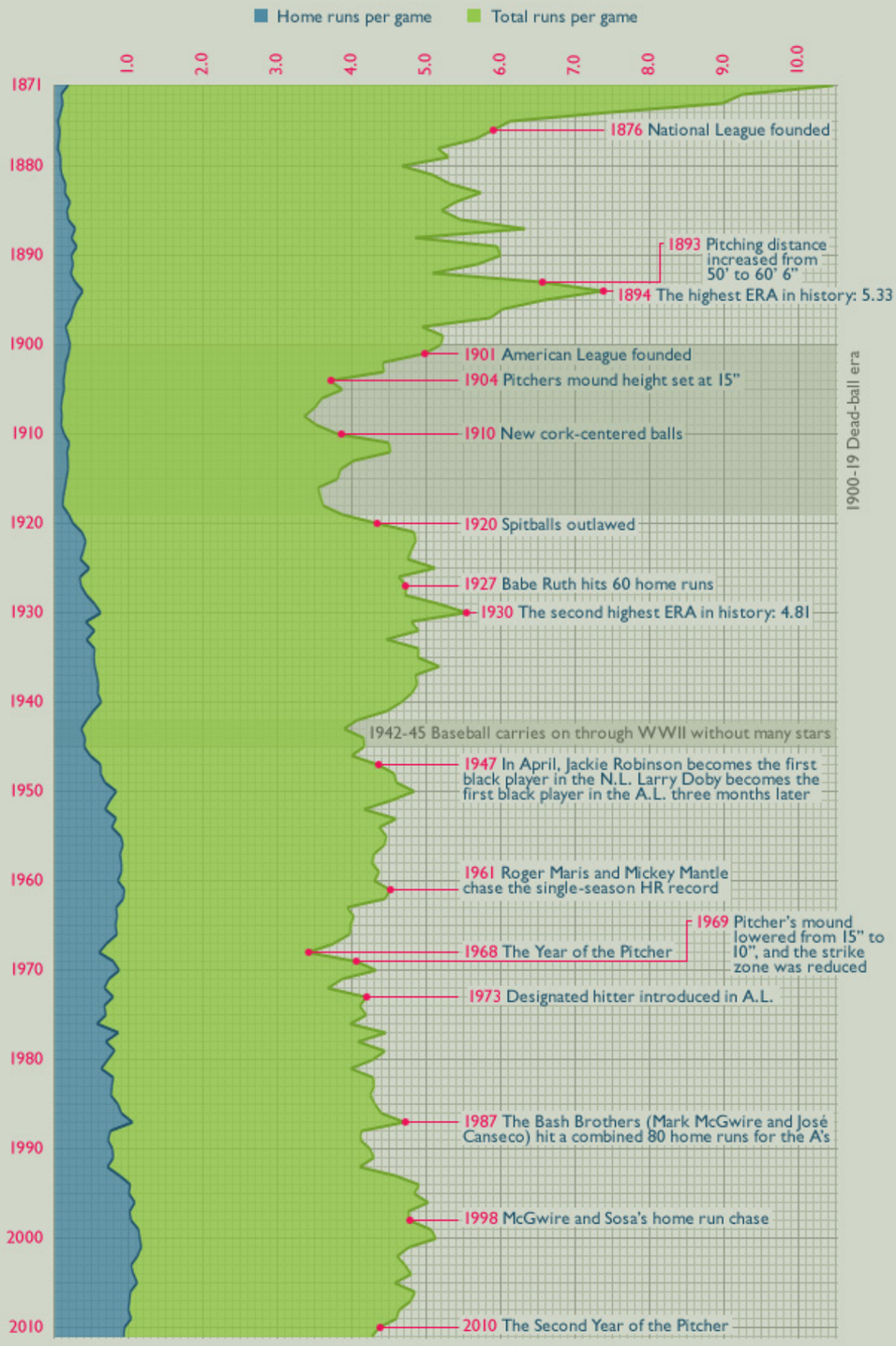
source: UN Environmental Programme, theregister.co.uk

TOTAL RUNS SCORED IN MAJOR LEAGUE BASEBALL
1871-2011

The total number of runs scored since 1871 is 1,814,039.
If you multiply those runs by the 360 ft covered when scoring a run, the total distance is 123,684.48 miles: 51.8% of the way to the moon.
It's also 4.97 times the circumference of the Earth's equator.



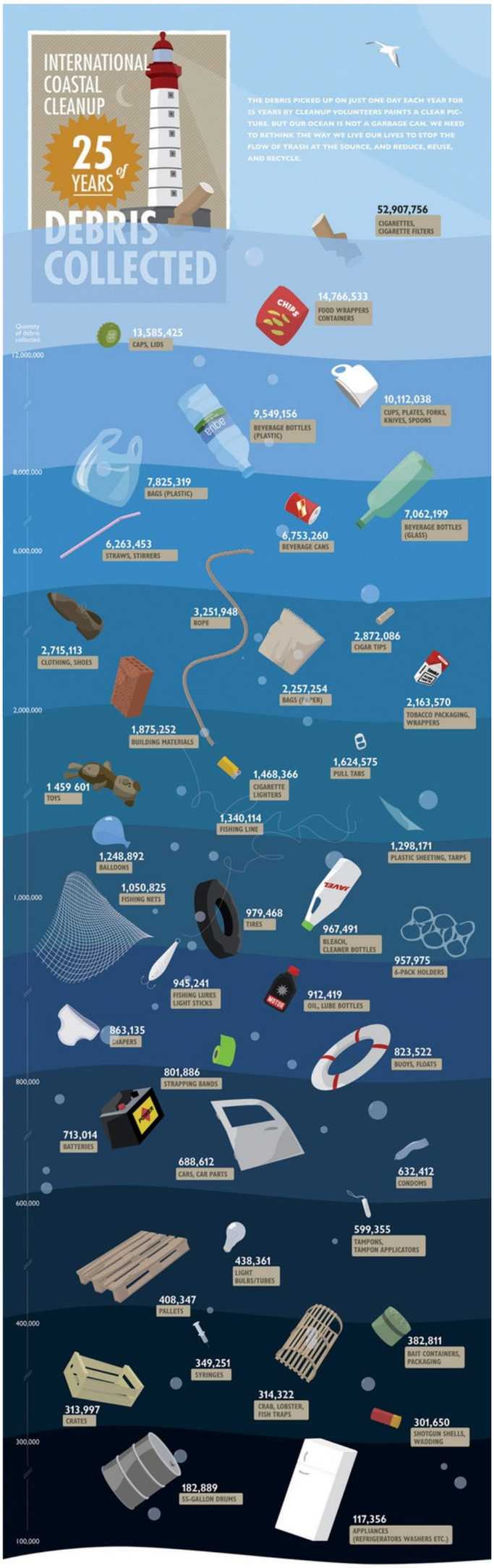
AVERAGE NUMBER OF RUNS SCORED PER TEAM



SOURCES
http://www.baseball-reference.com/leagues/MLB/bat.shtml
http://www.baseball-reference.com/leagues/MLB/pitch.shtml
http://solarsystem.nasa.gov/planets/profile.cfm?Display=Facts&Object=Moon
http://earth-info.nga.mil/GandG/publications/geolay/TR80003A.html
http://www.baseball-almanac.com/rulechng.shtml

DESIGN & RESEARCH
Craig Robinson www.craigrobinson.com

Smithsonian.com



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www.eclairagepublic.net

http://media-cache-ec4.pinimg.com/550x/7d/35/82/7d358209a4be18d0db69af13ef75ce78.jpg
http://www.oceanconservancy.org/our-work/marine-debris/check-out-our-latest-trash.html

How do Scientists Communicate?

Take 3 minutes to come up with a list of as many different ways that a scientist might use to share their findings with other scientists and with the the public

Scientists often use visual representations of their data to tell stories about their research

Let’s look at one example taken from social scientists, who study how groups of people behave…

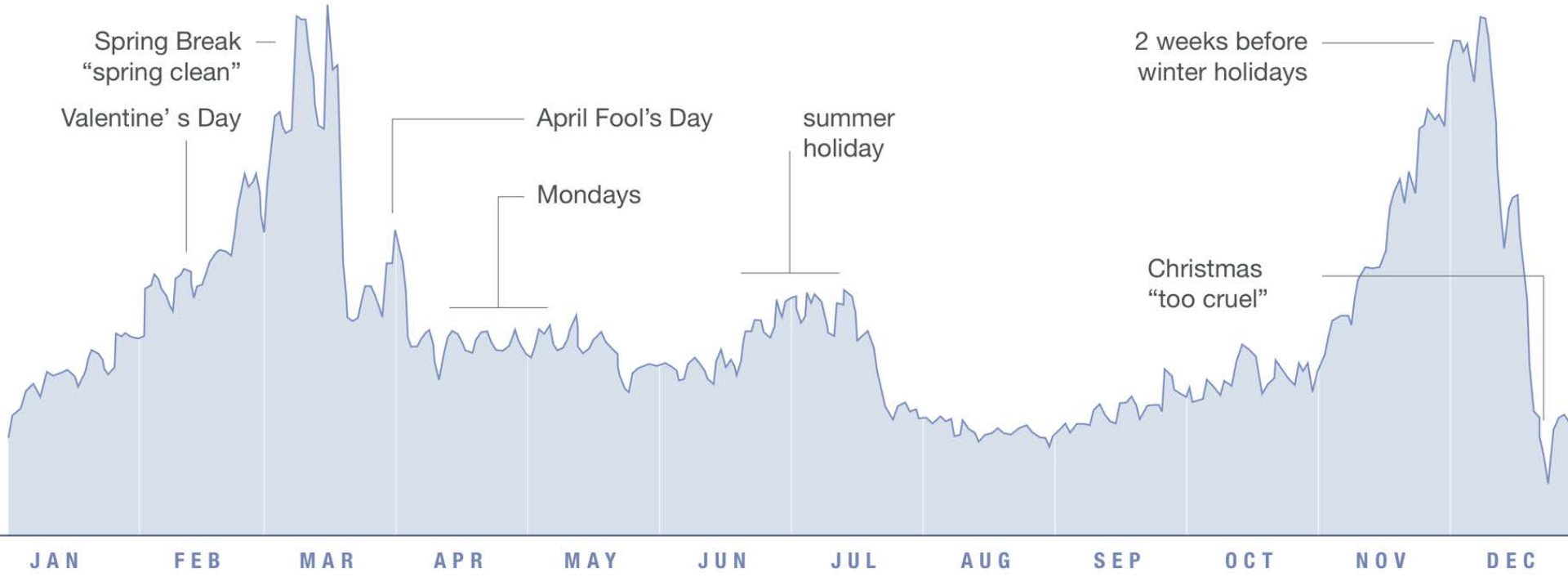

JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Peak Break-Up Times

According to Facebook status updates

Peak Break-Up Times

According to Facebook status updates



Source: searches for "we broke up because" from Facebook Lexicon

Main idea about **Climate Change**:

Evidence:

Main idea about **Climate Change and the Economy**:

Evidence:

Main idea about **Climate Change and Biodiversity**:

Evidence:

Main idea about **Climate Change and the Environment**:

Evidence:

Main idea about **Climate Change and Health & Urban Living**:

Evidence:

Main idea about **Climate Change and Adaptability & Mitigation**:

Evidence:

Adaptation involves modifying our decisions, activities and ways of thinking to adjust to a changing climate

Goals

Increasing our capacity to adapt

Improving our ability to thrive under different climate conditions

Building resilience to extreme weather and climate changes

Examples

Forest protection

Infrastructure and building design

Flood protection

Changing agricultural practices
Planting different crops to respond to changing growing seasons and temperatures, or planting a variety of crops to reduce damage from pests that could migrate northward

Overlapping examples

Green infrastructure

Water and energy conservation

Mitigation aims to reduce the causes of climate change

Goal

Cut down greenhouse gas emissions

Examples

Energy efficient technology

Sustainable transportation

Industrial process improvements

Renewable energy

Creating community and home gardens
Increasing local agricultural capacity helps reduce the need to import food over long distances, and by extension the consumption of fossil fuels

Climate Change: Adaptation and Mitigation

For the whole Canada in a Changing Climate report, visit **Adaptation.NRCan.gc.ca**

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Canada

Climate Change and Biodiversity

Biodiversity is about **living things** and their relationships with each other

This includes **species**, **ecosystems** and the **ecological processes** of which they are a part

The **earlier arrival** of spring changes the **life cycles** of many plants that provide food and habitat for other species

Many species won't be able to **adapt** quickly enough to changes in their **environment**

Habitat fragmentation

happens when natural landscapes are broken up by development such as river dams and highways, which can interrupt migration routes

Phenological mismatches

happen when the life cycles of dependent species change and no longer match up

E.g., migratory species arrive at a site after their prey has passed

Northern ecosystems are vulnerable to habitat loss and could see an influx of new species and diseases from the south

More CO_2 in the atmosphere and higher temperatures could lead to **longer growing seasons** for forests

Climate change can cause

Range contraction

when already limited habitats change and shrink further

Habitat destruction

In **prairie ecosystems**, more droughts will likely harm the growth of natural grasslands

Climate change can lead to competition for resources among species, as well as bigger and more frequent **infestation outbreaks**

Wolf + Coyote

Hybridization

is the mixing of different but similar species, and can drive rare species to extinction or increase adaptability

Extreme storms and **rising sea levels** can cause coastal squeeze

Climate change causes harmful algae growth in **marine ecosystems**, which are also at risk of pollution, commercial fishing and wetland drainage

Preservation through adaptation

Protect - nature reserves and marine sanctuaries
Connect - wildlife crossings, bridges and corridors
Restore - selective fishing, animal breeding programs

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WHAT IS CLIMATE CHANGE?

ANY CHANGE IN CLIMATE OVER TIME
DUE TO NATURAL FACTORS,
HUMAN ACTIVITY, OR BOTH

THE CLIMATE IN CANADA VARIES BY REGION, AND FROM YEAR TO YEAR

CLIMATE CHANGE AFFECTS CANADA'S BIODIVERSITY,

ECONOMY AND THE
HEALTH OF CANADIANS

ACROSS CANADA

COMMUNITIES, ORGANIZATIONS
AND ALL LEVELS OF GOVERNMENT
ARE WORKING TOGETHER TO RESEARCH
CLIMATE CHANGE

KEY IMPACTS OF CLIMATE CHANGE

- INCREASED MELTING OF SNOW AND ICE COVER
- MORE EXTREME PRECIPITATION, E.G., FREEZING RAIN
- AIR TEMPERATURES ARE RISING
- MORE FREQUENT FOREST FIRES
- DROUGHTS BECOMING MORE SEVERE
- OCEAN ECOSYSTEMS SUFFERING FROM WARMING

GREENHOUSE GAS

EMISSIONS ARE THE MAIN
CAUSE OF CLIMATE CHANGE

ADAPTATION

AND MITIGATION ARE
STRATEGIES FOR RESPONDING
TO CLIMATE CHANGE

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CLIMATE CHANGE AND THE ECONOMY

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ENERGY

Warmer winters decrease the use of natural gas and heating oil

More air conditioning in the summer increases electricity consumption

Extreme weather is a common cause of interruptions in power supply

FORESTRY

Changes in forest composition, pest and disease outbreaks, and more frequent fires could lead to more mill closures and lost jobs

Winter tourism such as skiing will suffer shorter seasons

TOURISM

Warm weather tourism such as camping is expected to grow

More frequent droughts and heat waves

Livestock operations may require less heating but more air conditioning; trees may have to be added to pastures to provide shade

FOOD

Longer and warmer growing seasons would allow crops to be grown farther north, lengthen outdoor feeding seasons for livestock and allow Canada's maple syrup industry to expand northward

HOUSING

Land-use planners can encourage the construction of homes in areas protected from hazards associated with extreme weather events

Subsidies and other policies promote retrofits that improve energy efficiency and insulation, as well as the resiliency of older homes to extreme weather

Heavier spring melts can increase flood risk

MINING

In the mountains, more frequent heavy rain events increase the chance of mudslides and wash out roads, as well as damage mines

Ice roads, which are used for transportation in the North during the winter, are becoming less reliable

Permafrost thawing damages buildings, roads and airport runways

Loss and damage due to heavy rainfall, hurricanes, tornadoes, wildfires and winter storms is now more costly than fire and theft

INSURANCE

Homeowners and businesses are already paying more for insurance due to the greater likelihood of extreme weather

Extreme weather disruptions can delay the distribution of supplies, cause power failures in factories and raise production costs

MANUFACTURING

Climate change can affect the availability of supplies and resources for manufacturing, such as water and timber

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CLIMATE CHANGE AND THE ENVIRONMENT

CANADA
has received
16% more precipitation
in the past six decades

Annual average
air temperature
has warmed
1.5°C
in the past six decades

The
ARCTIC
is warming twice
as fast as the south

Warmer temperatures increase water **evaporation**, leading to bigger and more **dangerous storms**

2001-2010:
warmest decade on record

Temperature over land is
WARMING
faster than over oceans

PERMAFROST
temperatures across the country have increased

There is a great loss of **snow cover** in the **spring** and **summer**

Melting permafrost releases
GREENHOUSE GASES

MELTING GLACIERS
contribute to rising sea levels

RIVER FLOW
has decreased over the past few decades in southern Canada but increased in northern Canada

Each decade,
SEA ICE
is shrinking more and more

STRATIFICATION
is the formation of different layers of water in the ocean

OCEAN ACIDIFICATION
Too much CO_2 is absorbed into the water, making it difficult for some species to build shells and skeletal structures. Some waters are already considered "corrosive" to these organisms.

GLOBAL WARMING
stops these layers from mixing properly, impacting the exchange of nutrients, heat and CO_2

In some areas, there is a lack of oxygen in the water, which is harmful to
MARINE LIFE

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CLIMATE CHANGE: HEALTH AND URBAN *LIVING*

Canadians can expect storms, wildfires, heat waves, freezing rain and droughts to become more **common** and **more intense**

Health and emergency services could struggle to help communities in need of evacuation or treatment for climate change-related disasters

Inhaling smoke from more frequent regional wildfires can cause lung damage and result in the **evacuation of entire communities**

Higher average temperatures could lead to the spread of **rare and exotic diseases** in Canada

Floods can cause **injuries,** as well as **respiratory illnesses** from mold

Floods, one of the most **common, destructive** and **costly natural disasters** in Canada, are happening **more frequently**

Warming waters can negatively affect **freshwater** and **seafood supplies**

In cities, water flows **more rapidly** over land that has been built on and paved over, leading to **flooded or damaged roads, overflow of sewer systems** and **flooded buildings**

Cities often have **higher temperatures** and **levels of air pollution** than rural areas, conditions which can be exacerbated by **climate change**

In 2008, air pollution was estimated to be responsible for the death of **21,000 Canadians**

Seniors, children, Indigenous peoples, and the **socially and economically disadvantaged** are most vulnerable to **climate change**

Natural disasters can **negatively affect mental health**, causing or contributing to **anxiety, depression, lack of concentration, post-traumatic stress disorder, sleep difficulties** and **more**

More frequent droughts could lead to **higher food prices**, putting low-income people at risk and increasing **food insecurity**

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