Complete Guide to ENR 2100
Scientific Poster Assignment

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The Ohio State University
POSTER ASSIGNMENT
LEARNING OBJECTIVES

• Students learn how to find information and critically evaluate a topic, issues, results and conclusions.

• Students learn how scientific research is conducted and how results and conclusions are reported to the public so that people can make more informed decisions in their own lives.

• Students learn that the peer-review evaluation system is an integral part of the scientific process that enables scientists to maintain high standards of quality and provides credibility to research and scholarly works.

• Peer reviews teach students how to become better writers and speakers by focusing their attention on particular details and considering the input of an actual audience.
More information about the poster assignment and examples of scientific posters can be seen on the Environmental Science Student Symposium website: http://u.osu.edu/environmentalsciencesymposium/
**POSTER TIMELINE**

**Week 1-3**: Pick a Topic, find 10 references (6 need to be primary sources) and write abstract on Carmen.

**Week 4-8**: Design, create, and produce a first draft of your poster. Teaching assistants will grade your poster and provide feedback.

**Week 9-12**: Revise your poster based on feedback and print your final poster at UNI-Print or another store.

**Week 13-14**: Present poster at Poster Symposium and provide peer reviews for 3 student posters and submit on Carmen.
PICKING A TOPIC
A scientific poster is an illustrated abstract of research that assists scientists and researchers in presenting their scientific data to larger audiences. Posters are often shown at events such as symposiums, conferences, and meetings, often to show new information to people in differing fields. For this assignment you will be designing, constructing, and presenting a large-format poster.
HOW TO PICK YOUR TOPIC

1. It has to deal with environmental science on Earth, although other planets **MAY** be acceptable (you should ask Dr. Lower if you are thinking about writing an article about somewhere besides Earth).

2. It has to be **FOCUSED** and NOT be a general overview of a topic.

3. It should be of interest to you and something that you want to learn more about.

4. Use a book, journal, website, magazine, documentary, etc. to find a topic that is interesting to you. Good sources of information can be found on Twitter @OSUEnViRo - click on our Tweets or look at who we are Following.
FOCUS POSTER = EXCELLENT GRADE

GENERAL POSTER = POOR GRADE
Scientific Posters should be FOCUSED and NOT a general overview of a topic.

They should include:

1. Environmental issue/problem/area of focus
2. Species of focus
3. A specific geographic location

For example:
Wind Turbine Use Threatens San Francisco Bay Golden Eagle Population

Environmental Issue Specific geographic location Species of focus
FOCUSED TOPIC

1. Decreased Arctic sea ice causing changes in the diets of Polar Bear living in the North Slope of Alaska.

2. Poly aromatic hydrocarbons (PAHs) released from roofing tar linked to lung cancer in children in Beijing.

3. Synthetic organic compounds used to clean coal in Appalachia bioaccumulate in river trout.

4. Solar lithium-ion microgrid systems provide shared electricity among rural areas in western USA.

GENERAL TOPIC

1. Climate change is affecting the Arctic.

2. Air pollution in Beijing is caused by cars and is bad for human health.

3. Burning coal leads to water pollution in Ohio.

SOME GOOD PLACES TO START

SECONDARY SOURCES
3. Our textbook or any other Earth or Life Science textbook
4. Any of the people that @OSUEnViRo is Following on Twitter
7. PBS NOVA http://www.pbs.org/wgbh/nova/
8. PBS FRONTLINE http://www.pbs.org/wgbh/frontline/

PRIMARY SOURCES
12. Nature http://www.nature.com
SOME U.S. GOVERNMENT WEBSITES THAT ARE EXCELLENT SECONDARY SOURCES

SECONDARY SOURCES

1. Centers for Disease Control and Prevention (CDC) http://www.cdc.gov
5. National Park Service (NPS) http://www.nps.gov
9. Environmental Protection Agency (EPA) http://www.epa.gov
10. Fish and Wildlife Service (FWS) http://www.fws.gov
11. Food and Drug Administration (FDA) http://www.fda.gov
When selecting your Poster topic, try reviewing articles and publications from SECONDARY SOURCES first. These sources and information will be easier to understand and faster to read. Once you find an article that you are interested in, then you can begin locating PRIMARY SOURCES. Primary sources will have more specific information and can help you narrow down your topic further.

If you have questions about locating a topic, narrowing your topic, or any other poster information you should visit with a teaching assistant at their office hours or email OSUEnvironment@gmail.com.
FINDING SOURCES
Your Poster should contain a MINIMUM of 10 references.

- 6 references should be from a PRIMARY source
- 4 references can be from either a PRIMARY source or SECONDARY source
- 0 references can be from a TERTIARY source

**References (Use Arial and 10 pt. font size)**


At least 6 references **MUST** be from a **PRIMARY SOURCE**, which means they have to be a **JOURNAL ARTICLE**. Primary sources, such as journal articles, are peer reviewed prior to publication and only after they have passed this process can they be published. And so their content can be trusted because it has went through a rigorous review process. Many high-impact journals are so selective in what they publish, that they will reject greater than 90% of all the manuscripts that are sent to them for publication.
Primary sources are journal articles that have been written by professors, scientists and engineers and submitted to a journal for publication. These professionals are the original source of the information being discussed in the article. The editors working at the journal take the manuscript (it’s not referred to as an article until after its published) and send it out for review to usually 3-5 experts in that particular field of research. These experts take 2-5 weeks to review the article and tell the editors if the manuscript is acceptable for publication in their journal. These experts are often very critical of the manuscript and the research that is presented in the manuscript. As a result, they will tell the editor NOT to accept the manuscript for publication and reject the manuscript. If this happens then the manuscript is sent back to the authors and they have to conduct more research and then submit their manuscript back to the same or another journal for the peer review process to start all over again.

High impact journals like Science and Nature set very high bars of success and will reject greater than 95% of all manuscripts that they receive due to poor reviews. Typically, the better the journal the higher the rejection rate.
SOME EXCELLENT EXAMPLES OF VERY WELL RESPECTED PRIMARY SOURCES

**PRIMARY SOURCES**

2. Nature [http://www.nature.com](http://www.nature.com)
4. Many of the people that @OSUEnViRo is Following on Twitter

There are literally thousands of different journals that publish hundreds of individual articles each year. Scientists have been publishing articles in journals for hundreds of years. This works out to **tens of millions of published articles** contained within all these journals. Therefore, the very BEST way to find articles that are of interest to you is to use a computer and a search engine, such as Web of Science.
For your poster assignment, we recommend using the research database search engines from the OSU library to locate FREE primary source journal articles. These search engines allow you to search through millions of published articles to find those related to your topic. Two of the most popular search engines that scientists use are Web of Science and PubMed.

Visit https://library.osu.edu

Click the “Research Databases List” on the right hand side of the page.
Search for the Web of Science Research Database here or whichever database that you would like to use. **Web of Science** is an Excellent Tool That can be used to find Journal Articles.
Search by topic, article title, author, publication name, etc. or add in multiple filters if you are trying to locate a specific article.
After searching, you can find thousands of FREE articles to download to your computer for use in your poster assignment.
The remaining 4 references can be SECONDARY SOURCES, which generally means newspapers, radio programs, news programs, documentaries, videos, magazines. These sources have generally NOT been peer reviewed, however, some have been reviewed by an editor(s) prior to publication because they want to maintain a high degree of integrity in their company and publication.
Secondary sources have NOT been peer reviewed. But this does NOT mean that they are bad sources of information. Some secondary sources are very well respected and excellent sources of information. These articles (or audio- or video-recordings) are used to provide information that has originally been presented elsewhere (for example, in a journal article, in a seminar at a professional conference). These articles are often reviewed by an editor or editors prior to publication to ensure the quality of writing and the integrity of the story. Just as is the case for journals, a strong reputation is what these publishers are striving for. Those that have developed a trust with the general public because they have a strong reputation for unbiased reporting are generally well respected as sources of trustworthy information.

SECONDARY SOURCES ARE USUALLY EASIER TO READ AND UNDERSTAND THAN PRIMARY SOURCES.

Highly respected newspapers like The New York Times, the Wall Street Journal and the Washington Post have an extensive editorial staff and professional writers to ensure high quality articles. Textbooks, such as the one we use for our class, are also excellent secondary sources.
SOME EXCELLENT EXAMPLES OF VERY WELL RESPECTED SECONDARY SOURCES

SECONDARY SOURCES

3. Our textbook or any other Earth or Life Science textbook
4. Many of the people that @OSUEnViRo is Following on Twitter
7. PBS NOVA http://www.pbs.org/wgbh/nova/
8. PBS FRONTLINE http://www.pbs.org/wgbh/frontline/
SOME U.S. GOVERNMENT WEBSITES THAT ARE EXCELLENT SECONDARY SOURCES

1. Centers for Disease Control and Prevention (CDC) http://www.cdc.gov
2. National Aeronautics and Space Administration (NASA)
   https://www.nasa.gov
4. National Oceanic and Atmospheric Administration (NOAA)
   http://www.noaa.gov
5. National Park Service (NPS) http://www.nps.gov
9. Environmental Protection Agency (EPA) http://www.epa.gov
10. Fish and Wildlife Service (FWS) http://www.fws.gov
11. Food and Drug Administration (FDA) http://www.fda.gov
TERTIARY SOURCES

Tertiary sources should be avoided for your project. These sources have not been reviewed and are unreliable. They are often sources that are biased and lack evidence. HOWEVER, tertiary sources CAN be used to help you narrow your search for authors or research groups who are conducting research in your area of interest and whose names can be used in Web of Science to search for primary source journal articles or to search newspapers and other secondary sources, which can be used in your article.
Tertiary sources should NOT be used in your Poster because they are often difficult to define and have different meanings for different disciplines. Tertiary sources are NOT necessarily unreliable, but it's often difficult to determine what information is unbiased and what type of information is biased.

A good example of a tertiary source, that should probably be avoided for this assignment, would be a company’s website (that is, anything with a “.com” at the end). Apple (https://apple.com) and Microsoft (https://www.microsoft.com) are two very successful and well respected companies. However, Apple is most likely only going to present information that is favorable to Apple and the same is likely for Microsoft. This means that these sources may be biased and should NOT be used for your Poster.
Another good example, of a tertiary source that should probably be avoided for this assignment would be some nonprofit organizations, or professional organization, which may have a biased view on a particular topic. These often have a “.org” website. Many of these companies are highly respectable and would be acceptable sources, however, it’s often difficult to determine, what is biased and what is unbiased.

Many of these organizations have noble causes and honorable missions, which is great, but that doesn’t mean that you should use it as a source for your article.

What would be acceptable is if you visit one of these websites and read about a scientist who is doing some great research on your topic. Rather than use the non-profit organization’s website directly as your source, you should copy and paste the name of the professor into Web of Science and find her or his journal articles (these are primary sources and acceptable for your Poster) and use these journal articles as your source of information.
THINKING OF A TITLE AND WRITING AN ABSTRACT
COMPOSING A GREAT TITLE
Your title should be:

- Descriptive
- Unbiased
- Approximately 8-15 words in length
- Focused, NOT general
- Include the environmental issues, geographic location, and species of focus for your article
You are writing a scientific article and so it should be **UNBIASED**. Your title and abstract should be **UNBIASED**. Meaning, for example, that you should avoid using adjectives, phrases and words that convey bias or feelings. So for example, you should **NOT** use the following title: “Evil coal-fired power plants in Yucatan, Mexico linked to dangerous mercury levels that ruthlessly kill thousands of poor children”.

Let the data and results talk for themselves. With the example above you CAN write a title like: “Mercury emissions from coal-fired power plants in Yucatan, Mexico linked genetically to developmental stress markers in children”. **GOOD TITLE**

Biased title and therefore **NOT** acceptable for a scientific article. **BAD TITLE**

Unbiased title and therefore **IS** acceptable for a scientific article.
Your title should be descriptive and about 8-15 words in length.

**TITLE:** Female Polar Bears that Sunbathe in the Northern Lights Give Birth to More Cubs

**NAME:** James E. Westinghouse

**INSTITUTION:** Tundra State University, Department of Zoology, 101 North Pole Lane, Redknife River, Alaska (USA).

*Disclaimer: This title, name, institution and abstract is completely fabricated and totally false. None of the information contained is accurate. It should only be used as an example that shows what an abstract should contain: introduction, methods, results and discussion.*
WRITING AN ABSTRACT
Abstracts are included at the very beginning of every journal article so that we can read a brief summary of the entire article.

An abstract is a ONE paragraph SUMMARY of your ENTIRE article. It should be DESCRIPTIVE enough so that it can STAND ALONE and tell the entire story that you want to convey to your reader. Abstracts contain NO figures and NO tables. The abstract consists strictly of words.
What should your abstract look like?

• 1 paragraph
• 250-350 words in length (10-20 sentences)
• Introduction (2-3 sentences)
• Material & Methods (2-3 sentences)
• Results (2-4 sentences)
• Discussion (2-4 sentences).
• (Optional) Conclusion/Future Work (1-2 sentences)

You do NOT have to cite your references in your abstract for this assignment. You MUST, however, cite your references in the actual poster when you start writing it later in the semester.
ABSTRACT: Over the past 40 years, polar bear (Ursus maritimus) populations in the Wanachee National Preserve have declined over 40%. This is particularly troubling considering that these animals are keystone predators and as such exert top-down population controls on many of the r-adapted species. Recent studies by the U.S. National Arctic and Atmospheric Association (NAAA) suggest that the denning behavior of female bears (sows) can be altered by ultrasonic light emitted by the aurora borealis (northern lights). Radiotelemetry and remote video cameras were used to examine polar bear denning behavior during March-May 2009 and March-May 2010. A total of 22 den sites and 18 sows (age 3-5 years) were observed during these periods. During this same period of time, 8 single-lens reflex (SLR) cameras were set 10 km apart to capture three-dimensional images of the aurora borealis. These measurements were used to determine the altitude at which electrons in the atmosphere emit the light that produced the aurora and the wavelength of light that was emitted at different quadrants and time. Results demonstrated that light having a wavelength of 250-385 nanometers (nm) caused 9 or the 18 young sows to abandon their dens after mating. Red-spectra light (600-715 nm) had no affect on the denning behavior. Pregnant sows exposed to ultraviolet light (100-175 nm) resulted in 67% higher fertility rates than sows that were not exposed to ultraviolet light. The results suggest that sows should spend at least 4 hours per day tanning themselves on ice flows prior to denning. Not only will this behavioral adaption likely led to higher rates of dermal cancer in female bears, the increasing number of female bears sunning themselves on icebergs will likely cause an influx of male bears (boars) to the Wanachee area. Further research needs to be conducted to determine if tanning lotions prevent ultraviolet exposure and thus lowers fertility rates and/or promote a deeper tan for the sunbathing sows. In addition, more studies are needed to determine which, if any, sunscreen boars prefer and whether the aurora affects courtship and/or foraging behavior in male bears.
Use TurnItIn to check for plagiarism in your poster and correct the mistake BEFORE you turn it in to Dr. Lower. Follow the link provided on Carmen, it’s FREE:  http://turnitin.com
POSTER FIGURES
Poster Figure Requirements

Figures (Illustrations, tables, graphs and photographs)
1. You need a minimum of 4 and can use a maximum of 10 figures.
2. The figures should be high quality and/or high-resolution images.
3. You should include a variety of figures i.e. not all the same type of figure (photograph, table, graph, etc).
4. You need to include at least 1 original figure that you yourself designed, created or photographed.

Legends for figures, illustrations, tables, graphs, and photographs
1. Figure captions should be short (that is, less than 50 words) but descriptive.
2. Remember to cite the source of your figure if you are not using an original figure that you made yourself.
Your poster should include 4-10 figures (illustrations, graphs, tables, photographs, etc) that are high quality and help to describe your topic. Figures assist the reader of your article to better understand your topic and should be able to stand alone with the captions that you compose for them. Figures are important elements of all scientific papers and assist scientists in conveying research results and the importance of their research topics.
Figure Types for your Poster

Photographs

Maps
Most posters should contain at least one graph. Graphs assist scientists in displaying statistical information.
Figure Types for your Poster

Tables or Charts

<table>
<thead>
<tr>
<th>Year</th>
<th>Crane Population</th>
<th>Year</th>
<th>Crane Population</th>
<th>Year</th>
<th>Crane Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>26</td>
<td>1993</td>
<td>143</td>
<td>2001</td>
<td>175</td>
</tr>
<tr>
<td>1950</td>
<td>31</td>
<td>1994</td>
<td>133</td>
<td>2002</td>
<td>185</td>
</tr>
<tr>
<td>1960</td>
<td>36</td>
<td>1995</td>
<td>158</td>
<td>2003</td>
<td>194</td>
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<tr>
<td>1980</td>
<td>78</td>
<td>1997</td>
<td>182</td>
<td>2005</td>
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<tr>
<td>1990</td>
<td>146</td>
<td>1998</td>
<td>183</td>
<td>2006</td>
<td>237</td>
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<tr>
<td>1991</td>
<td>132</td>
<td>1999</td>
<td>188</td>
<td>2007</td>
<td>266</td>
</tr>
<tr>
<td>1992</td>
<td>136</td>
<td>2000</td>
<td>180</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: General differences between burial grounds

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Burial site</th>
<th>Park cemeteries</th>
<th>Green cemeteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boundaries</td>
<td>Established perimeter with an entrance gate that declares the purpose of the site</td>
<td>Similar to urban parks</td>
<td>Without defined boundaries</td>
</tr>
<tr>
<td>Organisation</td>
<td>Divided by roads and paths. The graves are well ordered</td>
<td>Uniform rows</td>
<td>Graves are located by global positioning system</td>
</tr>
<tr>
<td>Grave markers</td>
<td>Ranging from elaborate statues and monuments to small plaques</td>
<td>Small plaque</td>
<td>Usually none but small wood plaques without chemical treatments are allowed</td>
</tr>
<tr>
<td>Grave covering</td>
<td>Pavement or grass</td>
<td>Grass</td>
<td>Native plants</td>
</tr>
<tr>
<td>Inhumation depth</td>
<td>About 1.80 m</td>
<td>About 1.30 m</td>
<td>Active layer of soil. Inhumation of ashes is not allowed</td>
</tr>
<tr>
<td>Materials used</td>
<td>Usually materials are not controlled</td>
<td>Usually materials are not controlled</td>
<td>Biodegradable materials from sustainable sources. Embalment is not allowed</td>
</tr>
</tbody>
</table>
Figure Types for your Poster

Timelines, Flowcharts, and more!

Be creative. You can always modify or create a figure to fit your needs.
Do not use blurry or low resolution figures.
Figures always have two parts:

1. The figure itself.

2. The figure caption. This will accompany the figure and describe the figure to the reader.

Figures may have a third part if you based your figure on a previously published source. If you did, you need to remember to include a citation:

3. Cite your source in your References section.
DESIGNING YOUR ORIGINAL FIGURE

For your poster you need to include at least 1 original figure that you yourself designed, created or photographed. This figure can be any of the previously shown figure types.

Example of a student created figure. This student used GIS software to show land cover changes as a result of deforestation in Brazil.

Example of a student created figure. This student used data found from the Fish and Wildlife Service to graph the population size of Florida Panthers over several years — and predict the future populations.
6 Steps for Creating a Figure

1. Find, download and organize your material on your computer.

2. Use Apple Keynote, Microsoft PowerPoint or Adobe Photoshop to create your figure and save it as a JPEG file (Part 1).

3. Write a thorough, organized and descriptive figure caption (Part 2).

4. Include the references (Part 3) for your material.

5. Properly cite other people’s work.

6. Be prepared to discuss your figure in detail.

*Each figure will take you 1-3 hours to complete all six steps.
The next few slides show the figure that I designed using Apple Keynote. Use whichever software program you are most comfortable using.

Other programs that you can use to modify or create figures include:

- Microsoft Powerpoint
- Microsoft Excel
- Adobe Photoshop
- Adobe Illustrator
- Pixlr
STEP 1. ORGANIZE MATERIALS

To create a figure you need to gather, download and organize your materials into a folder on your computer. Then you will use software to create the actual figure.

In this example, you can see that I have downloaded all the files that I will need to create one figure. These files are saved on my computer in a folder called “Stuff for Figure”. Inside this folder you can see that I have 2 PDF files, 1 JPEG file and 4 PNG files. The PDF files are 2 journal articles that I am using for my poster. The JPEG and PNG files are images that I will use to create my figure.
STEP 2. CREATE FIGURE

I like to use Apple Keynote to create my figures. I used Keynote and all the material that I had in my folder “Stuff for Figure” to create Figure 1, which you can see on the next slide.

I will use Figure 1 in the Introduction section of my poster (or article) to introduce the audience to my research topic, which is the ecology of magnetotactic bacteria in Pavilion Lake, British Columbia.

I will use Figure 1 to show my audience where Pavilion Lake is located, what the lake looks like, what magnetotactic bacteria look like under the microscope, where the research area is located and how the researchers collected and isolated the bacteria from Pavilion Lake.
So now I have a publication quality figure that I’d like to use for my article. What I need to do next is save the figure as either a TIFF or JPEG file. Most publishers only accept TIFF or JPEG files. Make sure you save these images with the highest quality resolution possible.

I’m using Apple Keynote to design this figure. So to save it as a TIFF file I select File > Export > Images. You’ll have a choice to save as a JPEG, PNG or TIFF file. Select TIFF and save this file to your desktop. If you choose to save it as a JPEG, make sure you select highest quality.
STEP 3. WRITE FIGURE CAPTION

All figures need a caption to describe what is contained in the figure. This caption should also tell the audience where the material was obtained (i.e., what references did you use). Here is the caption for Figure 1:

Figure 1. Collection and isolation of magnetotactic bacteria from Pavilion Lake. (A) Map showing the location of Pavilion Lake in British Columbia, Canada at 50.87° North, 121.74° West. Map obtained using Google Maps. The maximum lake depth is 70 meters, length is 5.75 km, maximum width is 0.8 km, and surface elevation is 820 meters. (B) Photograph of Pavilion Lake obtained from Google Maps and taken by S. Davies in August, 2016 near the location where bacteria samples were taken. (C) Photograph of scientist collecting magnetotactic bacteria from Pavilion Lake. Obtained from Oestreicher et al., 2012, Journal of Visualized Experiments Vol. 69, e50123. (D) Isolation of magnetotactic bacteria using magnets and a transmission electron microscope image of a single bacterium. Images obtained from Oestreicher et al., 2013, Frontiers in Microbiology, Vol. 4, article 406, pages 1-6.
STEP 4. INCLUDE FIGURE REFERENCES

You will most likely need to cite the source(s) for your figure. The only way that you do NOT need to cite a source is if YOU collect the data or photograph yourself. If you obtained the data (e.g., graph, table, map, equation) from a journal article or newspaper, then you MUST cite the source. For my figure I used two journal articles as my sources and so I MUST cited these two sources in the reference section of my article or poster:

STEP 5. PROVIDE CITATIONS FOR THE WORK OF OTHERS:

If you use someone else’s photograph or work in your figures then you MUST given them proper credit. For Figure 1, I use previously published research from 4 different sources (listed as i, ii, iii, iv below). You’ll notice that Figure 1 contains a map from Google Maps and a photograph from Google Maps that was taken by S. Davies. I obtained both of these online. I need to provide proper credit for these two sources and so in my FIGURE CAPTION the text reads that the map and photograph of Pavilion Lake were obtained from Google Maps and the photograph was taken by S. Davis. This way I am giving credit to all of my sources (i.e., (i) Google and (ii) S. Davis) and I am NOT plagiarizing their work. For figure 1, I also included the previous research of Oestreicher et al., 2013, Frontiers in Microbiology, Vol. 4, article 406, pp. 1-6 and Oestreicher et al., 2012, Journal of Visualized Experiments, Vol. 69, pp. e50123. And so I must cite these two journal articles as well. This way I am NOT plagiarizing the work of (iii) Oestreicher et al., 2012 and (iv) Oestreicher et al., 2013.
STEP 6. THE AUTHOR (YOU) UNDERSTANDS THE FIGURE

You need to understand every detail of your figure and communicate the information contained in the figure to your audience. This means that you communicate with your audience in well-written sentences and paragraphs for articles or posters, or communicated with your audience verbally AND nonverbally (e.g., using your hands to point to the bacteria on Figure 1 and describe the different parts of the figure) for talks and presentations.

In all honesty, you should be able to spend a minimum of 3 minutes talking to your audience about each figure. If you can’t do this then you (1) don’t understand the figure well enough and you need to do some reading/studying yourself to learn the material or (2) your figure doesn’t contain enough useful information and it is completely useless for your article or poster and you need to re-design the figure so that it is meaningful to the research that you present in your article or poster.
Figure 1. Collection and isolation of magnetotactic bacteria from Pavilion Lake. (A) Map showing the location of Pavilion Lake in British Columbia, Canada at 50.87° North, 121.74° West. Map obtained using Google Maps. The maximum lake depth is 70 meters, length is 5.75 km, maximum width is 0.8 km, and surface elevation is 820 meters. (B) Photograph of Pavilion Lake obtained from Google Maps and taken by S. Davies in August, 2016 near the location of where samples were taken. (C) Photograph of scientist collecting magnetotactic bacteria from Pavilion Lake. Obtained from Oestreicher et al., 2012, Journal of Visualized Experiments Vol. 69, e50123. (D) Isolation of magnetotactic bacteria using magnets, and a transmission electron microscope image of a single bacterium. Images obtained from Oestreicher et al., 2013, Frontiers in Microbiology, Vol. 4, article 406, pages 1-6.

References:
PROPER FORMATTING STYLE FOR CITING REFERENCES
You have likely been taught about MLA (Modern Language Association of America) or APA (American Psychological Association) formatting and style guide in middle or high school. Many of you are likely proficient in these styles or perhaps you hate them. In either case it doesn’t matter because you will NOT use MLA nor APA for writing your Poster.

There is a practical explanation for this and it’s because their are literally thousands of different scientific journals published worldwide. And each journal has its own formatting style that is used to cite a source of information. Therefore, there is absolutely no reason for anyone in science to memorize the different formatting styles used by each journal. In fact, many scientists use software, that with a click of a button, will transform all of our citations into the proper style and format for a any journal.
For your Poater, we will use a simple formatting style to cite all of your sources. The style was based on the journals Nature and Science. These styles are provided on the following pages. Each will provide: author(s) name, publication date, publisher’s name (e.g., the name of the newspaper or journal where the article was published), and sometimes you will be asked to include volume, issue, patent number, and page number(s).
STYLE FOR CITING A PRIMARY SOURCE

1. **Print Journal article**: Most journals are printed on paper. Authors, surname first followed by comma and initials of given names. Date in parenthesis. Journal title in italics. Volume number in bold, issue number in parenthesis: page numbers.

   A. **Journal article with two authors**:


   B. **Journal article with more than two authors**:


2. **Online journal article**: These journals are electronic and NOT printed on paper. Should give authors, date of publication in parenthesis and journal or newspaper name in italics, volume number and or page numbers, followed by URL in full – or DOI if known.


These are the two styles that you will use MOST OFTEN in your article.
3. **Patent:** Name surname first followed by comma and initials of given names. Date in parenthesis. Title of patented item/process in italics. Patent number.

1. **Book Chapter**: Authors surname first followed by comma and initials of given names. Date of publication in parenthesis. Chapter title, page numbers. Editors of book, book title in italics, city of publication, name of publisher.


3. **Magazine Article in print**: Authors name. Title of article. Publication date. Title of magazine, volume number, issue number, page numbers.

   Miller, J. M. Road map to a great deal. (2009, October). Consumer Reports, 74(10), 44-47.
4. **Magazine article in a database:** Author. Publication date. Title of publication. Name of magazine. Volume number, page numbers, web address.


5. **Newspaper Article in print:** Author. Publication date. Title of publication. Name of newspaper. page numbers.


6. **Newspaper article in a database:** Author. Publication date. Title of publication. Name of newspaper. web address.

7. **Podcast**: Producer. Publication date. Title of podcast [video or audio]. Date retrieved from Internet, web address.


8. **Video / Movie**: Producers and Director. Date of Release. Title of movie [DVD or film]. Film company who released video.


9. **Webpage**: Author. Publication date. Title of webpage. Web address.

10. **Webpage organization or Group of authors**: Organization. Publication date. Title of webpage. Web address.

FINAL POSTER
The next slide is an example of a final poster. It is just an example. You poster will likely look very different. It has been provided so that you can see all the parts to a well-organized and well-designed scientific poster. The poster contains the following:

1. Title, name, institutional information.
3. 3-5 columns of text, graphs, figures, references, tables, etc.
4. 4-10 figures (e.g., graphs, tables, maps, photographs, diagrams).
5. A minimum of 10 references AND a minimum of 6 of these MUST be journal articles.

Your poster should be printed out on 36-inch (height) x 48-inch (width) paper at UNI-PRINT or another store. If you are enrolled in our online ENR2100 course then you do not need to print your poster on paper. But you do need to have an electronic file (e.g., PowerPoint file) of your poster that is 36-inches x 48-inches. This electronic file will be uploaded to Canvas and will be graded.
Countering Human Effects on Greater Sage-Grouse Habitats from Mining near Sink Valley, Utah

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Abstract

By 2015, the sagebrush ecosystem in western North America, which is essential to the greater sage-grouse (Centrocercus urophasianus), only covered half of the 500,000 square miles that it originally spanned. Studies have concluded that mining for coal and natural gas destroys what is left of this ecosystem enough to drive the sage-grouse away from the mines, further limiting their habitat.

Over the past several years, mining projects near Sink Valley, Utah have been accompanied by projects to counter the negative effects they have on local sage-grouse populations. These projects included expanding sagebrush grassland in the area through the removal of trees and rubber rabbitbrush (Elaeagnus nauseosa), as well as controlling the local populations of predators. Sage-grouse population estimates for years before, during, and after mining activity were determined through data that the Utah Division of Wildlife Resources collected on the local gatherings of male sage-grouse for mating. Sage-grouse location information recorded on monthly searches of their common habitats was used to look for changes in their use of the habitat and the distance they kept from the mining operation.

The results showed that sage-grouse were sighted within two kilometers of the mine before mining started. These results contrast other studies which showed that sage-grouse are unlikely to be found within 4 kilometers of coal and natural gas mining and that removal of predators reduces sage-grouse numbers. The difference is that the mining projects in those studies did not have the mitigation measures that were implemented in Utah. This is also supported by a study linking the expansion of sagebrush populations through removal of predators to increased rates of sage-grouse nesting.

Habitat Selection Factors

The sagebrush habitat, which is crucial to greater sage-grouse that rely heavily on it for nesting in the spring and as a source of food in the winter, is facing many threats. A 2008 study on greater sage-grouse winter habitat selection in the Powder River Basin near the Montana-Wyoming border found that, among other factors, sage-grouse tend to not be found near coal-bed natural gas wells, presumably due to the habitat disruption that this energy development causes.

Sage-grouse habitats are also threatened by human infrastructure (such as roads, fences, and pipelines), agriculture expansion, and urbanization, in addition to the natural processes of woodland tree cover encroaching on the sagebrush ecosystem. Sage-grouse have been shown to prefer open, shrub-free areas and the presence of trees and other vegetation can negatively impact their habitat. This habitat disruption has resulted in a net reduction in the range that sage-grouse are found in and contributed to the declining trends in sage-grouse population estimates since 1985 in the western US.

In order to counteract the habitat disruption of their coal mining operation, a mining company in Sink Valley, Utah also conducted projects to re-establish and improve sage-grouse habitats in the area. They removed Pinyon-juniper woodlands and rubber rabbitbrush that had taken over large areas of sagebrush to compensate for the land that their mine was disturbing. To keep the population of ravens that prey on sage-grouse from increasing due to the mine causing greater availability of food and places to perch, they also placed hard-boiled eggs treated with avicide in areas that the ravens scavenged for food.

Population Response

To measure the way the sage-grouse responded to the combination of mining and habitat improvements, local sage-grouse populations were analyzed using data on attendance of leks in which males gather at a specific location to compete for mates. Lek counts are expected to fluctuate in 9-12 year cycles. In 2012 it was observed that the number of leks had moved by 0.8 kilometers, but the average attendance was relatively unchanged before, during, and after the mining.

Habitat Use Response

The figure above maps attendance data from Sink Valley, Utah sage-grouse leks. Low counts immediately prior to the discovery of the new lek location may be inaccurate due to this transition. Figure modified from Peterson et al., Human-Wildlife Interactions, Sept. 1, 2016.

Conclusions and Discussion

The study in Sink Valley, Utah was successful in demonstrating that habitat conservation projects can, at the very least, nearly negate the negative effects that mining alone has been observed to come with, if not actually result in a net improvement.

Greater sage-grouse populations have begun to come back up since 2013 due largely to a $200 million protection effort in 11 western states that has triggered federal action. The findings from Sink Valley are especially promising addition to this progress because they suggest that it can be continued without sacrificing energy development efforts.

References


The table above shows data from the mining company's internal reports, Utah Division of Wildlife Resources, and information from the Department of the Interior.
Posters can be printed on campus at the locations listed. I recommend **UniPrint in the Ohio Union** because you will receive a discounted rate of around $36.00 to print your poster. To receive this discount, tell UniPrint that this assignment is for Dr. Lower’s ENR 2100 class.

**Printing Locations**

- UniPrint in the Ohio Union ($36 discounted rate): [https://denman.uniprintonline.osu.edu/uStore/14/](https://denman.uniprintonline.osu.edu/uStore/14/)
- Ohio Union Resource Room: [https://activities.osu.edu/involvement/student_organizations/resource_room](https://activities.osu.edu/involvement/student_organizations/resource_room)
- Thompson Library: OIT Computer Lab, Room 160 (247-4577)
- Health Sciences Library: [http://hsl.osu.edu/service-areas/medvis/services/poster-printing](http://hsl.osu.edu/service-areas/medvis/services/poster-printing)
In person section: The last assignment for your poster will be presenting your poster at the ENR 2100 Student Poster Symposium in the Ohio Union. During the Symposium, you will set up your poster, interact with your fellow students and guests of the symposium, and complete 3 poster peer reviews.

Online section: If you are enrolled in the online section of the course, you will not be required to print your poster, so you will not be required to attend the in person symposium. Instead, there will be an online symposium set up through Carmen.
POSTER PRESENTATIONS
Excellent Poster Presentations are Simple

The following is an example of a poster that has a clean design, excellent flow of text and figures and contains all the parts necessary to produce a high quality poster. Each poster will be unique and so your poster does NOT have to look exactly like this example poster in order to earn a grade of A.
Increased Temperatures in the Bering Sea Area Cause Tufted Puffin Populations to Diminish

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**ABSTRACT**

The Bering Sea area has been under close supervision after it has seen temperature fluctuations in recent years, most likely due to change in climate. Many organisms in the area have been affected by these temperature changes, but most recently, tufted puffins have been dying in increasing numbers. To research the effects of climate change in the Bering Sea, the water and air temperatures were monitored, as well as organism populations. The diets of the tufted puffins were recorded, as well as the behavior of their primary prey. For tufted puffin populations, it was observed that many of the hatchlings weren’t healthy enough to become fledglings before dying. Because their primary food source, the sand lance fish, prefer colder waters, the puffins were forced to feed their young less nutritious alternatives, causing them not to be strong enough to survive. Decreases in the amount of large zooplankton at the bottom of the food chain also cause complications for the tufted puffins, and many starve to death. Because it is speculated that overall climate change is the cause of the increased temperature of the Bering Sea, there is not much that humans can do at this time besides continuing to research and monitor the conditions of the location.

**INTRODUCTION**

The Bering Sea, off the west coast of the United States, is an extremely important ecosystem, providing resources for "large populations of shellfish…marine birds and marine mammals." The climate in the Bering Sea has experienced "interdecadal variation", with air and water temperature fluctuations and "increasing oceanic heat content." A major food source for the tufted puffins in this area are the juvenile herring and sand lance. Because puffins, like many other sea birds, spend the majority of their time near or in the water, "their population dynamics are logically tied to oceanic conditions." Recently, water and air temperatures in the Bering Sea have risen again after a cold snap in 2010, and the new warmer water has caused a large drop in tufted puffins’ major food supply, because of the decrease in large zooplankton, and many of the young birds died. Contributing to the increased water temperatures in the area is a "high-pressure system" cast over the North Pacific. Warming temperatures in this area can have affects on sea ice, organism populations, and the large fishing industry present off the west coast of the United States.

**METHODS & RESULTS**

**Area Where Tufted Puffins are Found**

The Bering Sea area has been under close supervision for years, and large fluctuations between extremely cold and extremely warm climates keep reoccurring. For the time being, the current state of the Bering Sea is very warm and worrisome for scientists studying the marine life there. Because of the recent lack of zooplankton at the bottom of the food chain and decrease in the number of surviving puffin hatchlings, the future of the tufted puffins in the Bering Sea is unknown, but scientists hope to do more research to understand the overall effects these warm temperatures have on the ecosystem.

**RESULTS**

The past few years have seen a decrease in temperature, which has caused the puffins and other marine life in the Bering Sea to suffer. Scientists have been monitoring the area since 2000, and have recorded decreases in the number of tufted puffins in the area. This decrease is likely due to the change in climate. Many organisms in the Bering Sea area have been affected by these temperature changes, but most recently, tufted puffins have been dying in increasing numbers. To research the effects of climate change in the Bering Sea, the water and air temperatures were monitored, as well as organism populations. The diets of the tufted puffins were recorded, as well as the behavior of their primary prey. For tufted puffin populations, it was observed that many of the hatchlings weren’t healthy enough to become fledglings before dying. Because their primary food source, the sand lance fish, prefer colder waters, the puffins were forced to feed their young less nutritious alternatives, causing them not to be strong enough to survive. Decreases in the amount of large zooplankton at the bottom of the food chain also cause complications for the tufted puffins, and many starve to death. Because it is speculated that overall climate change is the cause of the increased temperature of the Bering Sea, there is not much that humans can do at this time besides continuing to research and monitor the conditions of the location.

**DISCUSSION**

Because the climate in the Bering Sea area is continuously fluctuating and is due in part to worldwide temperature and climate changes, humans will have trouble directly improving the changes in the ecosystem. However, scientists are able to monitor the changes and provide continuous updates on the status of the Bering Sea climate and the organisms that inhabit it in order to prevent mass deaths of organisms in the future.

**BIBLIOGRAPHY**

Abstract top left corner of the poster, 200-300 words long. It contains all the necessary parts: introduction, methods, results, discussion.

Poster has 5-8 figures (maps, photographs).

Introduction sets the stage for the story that is told in this poster comes right after abstract.

In-text citations using superscript numbers throughout the poster. These numbers correspond with numbered references.

Fig. 3 Tuffed puffins are commonly found in the Northern Pacific coast. Tufted puffins feed mostly on fish and their migratory habits are tied to oceanic conditions. 3,4

INTRODUCTION

The Bering Sea, off the west coast of the United States, is an extremely cold area where many of its water and air temperatures are normally below freezing. This area is a high-pressure system cast over the North Pacific. 1,2 Warming temperatures in this area are logically tied to oceanic conditions. 3,4 Recently, water temperatures suspected to be the underlying cause of the die-off may be linked to hotter seas. National Geographic. (2016 Nov. 8). Huge puffin die-off may be linked to hotter seas. National Geographic. Retrieved Feb. 2017.

METHODS & RESULTS

Because the population of tufted puffins in the Bering Sea area is only around 6,000, the organisms in twenty days is very concerning for scientists in the Bering Sea area. At this time, it is estimated that as many as half of the entire population of puffins may be affected by the warmer waters. 10 The area is an extremely important ecosystem, providing resources for many of its water and air temperatures monitored for years, and large fluctuations between extremely cold and warm are logically tied to oceanic conditions. 3,4

CONCLUSIONS

Introduction sets the stage for the story that is told in this poster comes right after abstract.

Well written, figure captions with citation at the end to show where figure was obtained.

Methods Section combined with Results section. Ideally we would like to see these as two separate sections, however, on this poster there wasn’t enough space so Bridget combined both sections.

DISCUSSION

Discussion section right before the references. This is a bit short here, ideally we would like this to be 2-3 paragraphs.

BIBLIOGRAPHY

Reference or Bibliography section at the end of the poster. 6 of these are primary sources and 4 are secondary sources. The references are numbered as they appear for the in-text citations. This section could use smaller font to allow for more space for a more robust discussion section.
Poster Presentation

• **Practice** your presentation. Dress professionally, casual attire (e.g., jeans and button up shirt). Your audience will be focused on your poster for **2-4 minutes** so you don’t have much time to capture their attention and tell your story. **Colorful figures, maps, graphs will be the first thing they look at.**

• Your audience will look at the figures, graphs, tables, maps. They **rarely read the text**. If they read any text at all, it will likely be the **abstract or figure captions** so really focus on those areas when you prepare for your poster presentation.

• Speak clearly and **know your topic**. Remember you are the expert so you need to know your stuff. **Know about ALL the figures and tables** in your poster.

• Start with the **Introduction**, describe the issue(s) and use the figures to help explain your story. Use **maps** to show the area of study, use photographs of your organism or pollutant or issue, use **graphs** and **tables** to show patterns (e.g., population increased over past 5 years) focus on **important points**. **Flow from one figure to the next until you end up with your discussion or conclusion.** Point to the poster when you are talking about a specific figure, use your words and hands to help explain what you mean.

• Allow audience to participate, allow them to ask questions throughout your presentation. **ALWAYS be respectful** of your audience. **ALWAYS try to answer questions**. If you don’t know the answer, the best thing to say is “I don’t know” or you can point to another study that you are aware of and let the audience know that these other scientists are working on this very question and tell audience where work was published.

• **Avoid saying things like “stuff” and “things” and other general phrases like “this work was great”.** **Give specifics because this shows that you know your topic.** Use the vocabulary words that you learned and explain these to the audience. For example, rather than say “this work was great” you could say “This work was great because it was the first time that we observed orangutan feeding behavior in the wild and it allowed us to determine that female orangutans need 5,500 calories per day during their breeding season. Those females that obtained 5,500 calories per day were twice as likely to give birth”.