

Connecting Dubuque: Developing Software and Analyzing Local Climate Data.

Samuel K. Zebarth & Dale H. Easley, Department of Natural and Applied Sciences, University of Dubuque, 2000 University Avenue, Dubuque IA 52001, szebarth@dbq.edu



Introduction

Climate disruption is occurring all around the world. Fires are ever-present, droughts are becoming commonplace, and extreme weather events are increasing in scale and strength. Extreme weather events are becoming much more common in America.



Texas Power Outage Crisis
A Foreboding Sign Of Climate Change
Tess Gellert March 21, 2021

Iowa is no exception to this fact. We're experiencing extreme weather phenomena that are unprecedented in scale, damage, and cost.

The Washington Post

Iowa derecho in August was most costly thunderstorm disaster in U.S. history

NOAA estimates damage at \$7.5 billion, higher than many hurricanes.

Climate disruption is also happening locally. Dubuque's climate is shifting towards a wetter, less predictable future.



Calby Davis walks along U.S. 52 after fleeing her flooded home, north of Dubuque, on Thursday morning. The 11-state area was rocked by a storm that dumped as much as 15 inches of rain in 12 hours. Dubuque's official total of 10.14 inches shattered the previous 24-hour record of 6.85 inches in 2002.

UNPRECEDENTED

'I have never witnessed anything like what we have seen in the last 12 hours'

Despair from climate disruption is present today, even though many of us may never see it. Understanding how Dubuque's climate is changing is imperative to quelling that suffering. Farmers commit suicide at twice the rate of veterans and four times the rate of the general public. While there are many factors that contribute to this, more information about their local fields is imperative to help farmers mitigate weather-related loss of crops.



The suicide rate for farmers is more than double that of veterans. A former farmer gives an insider's perspective on farm life - and how to help.
I wrote about farmers' suicides - and the reaction has been overwhelming.
Debbie Weingarten

Project Objective

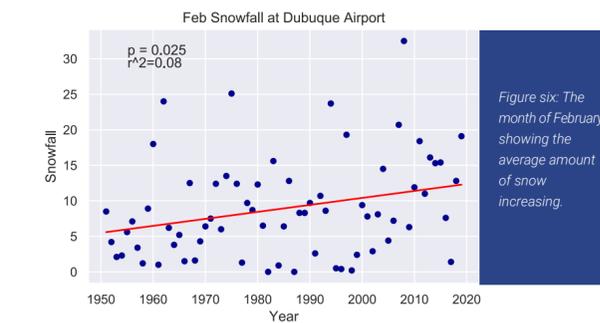
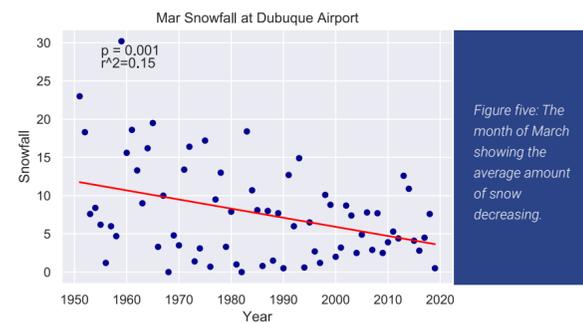
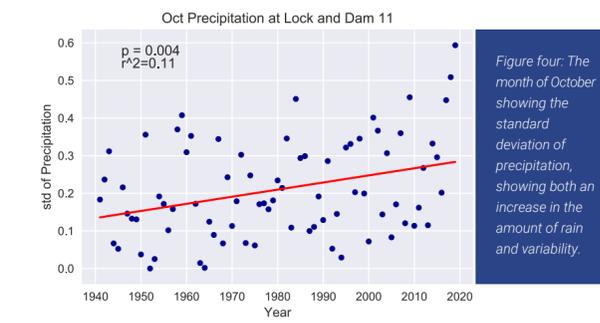
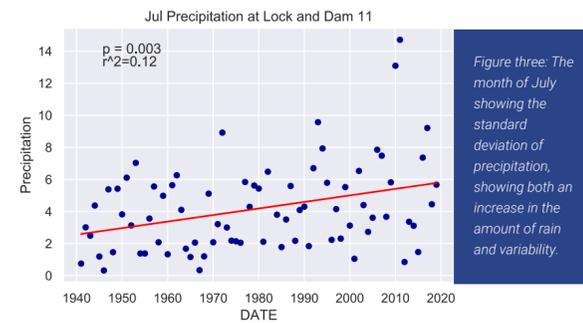
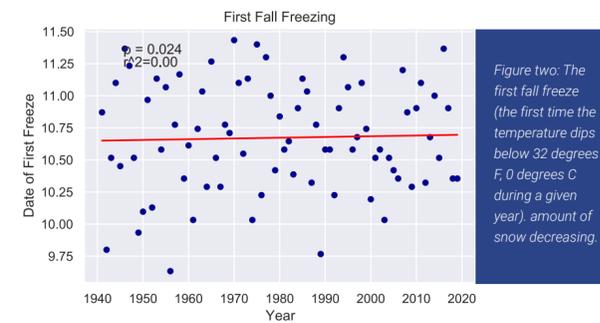
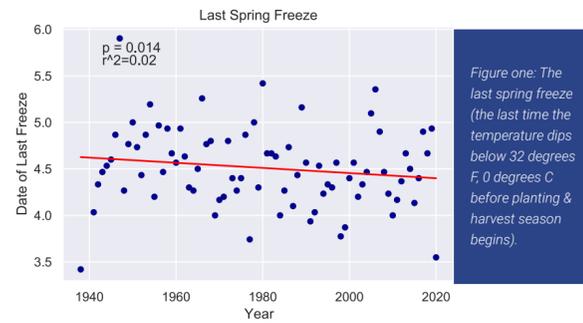
Communicating our results effectively is key to developing a trusting community. We are hopeful that through different methods of reaching the audience we will help farmers and local communities adapt less stressfully to changing climate. Therefore, we have used analysis of local climate data to bridge a gap between locals, farmers, and scientists.

Methods

- Obtain Data:** The information was collected from many different weather stations. The National Oceanic and Atmospheric Administration maintains a repository of all weather data collected by local stations. For Dubuque, we used Lock and Dam 11 and the Dubuque Regional Airport to gather information.
- Develop Python Code:** Python is a coding language that is excellent for analyzing data. We developed numerous programs to morph, separate, and determine statistically significant weather-related patterns.
- Generate Visual Data:** One of the major points of this research was to show our results visually. Using the numerous libraries built into Python, such as Pandas, SciPy, NumPy, and Seaborn - we created our own plots of the data.
- Disseminate the Results:** The processed data about the Dubuque area cannot simply be published, it must be available and presented. Using a separate coding language, HTML, we created an online repository that is available to the public. Furthermore, we are communicating this information to the public via presentations, discussions, and storytelling.

Results

- The last spring freeze is occurring earlier.
- The first fall freeze is occurring later.
- July is wetter and more variable.
- October is wetter and more variable.
- March is receiving much less snow.
- February is receiving much more snow.



Discussion

Increased rainfall and rainfall-variability in October make the harvest season more stressful.

Increased July rainfall-variability makes flooding and soil erosion an additional problem for farmers.

However, changes in the growing season could lead to earlier planting and earlier harvesting, avoiding some of October's stress-inducing uncertainty.

Better communication practices can lead to farmers seeing climate scientists as allies, rather than their foes.

Continuing Work

Beginning to look at the relationship between air temperature and soil temperature to develop more information about planting times.

Comparing soil temperature with certain crops to develop local planting timelines that can be compared with state-wide planting timelines.

Reaching out to local farmers in order to develop a community between farmers and scientists.

Developing media to help reach individuals through storytelling, a method that has proven successful in the development of a community.

Other Information

Similar work has been completed for many other cities, you can check out which ones at <http://www.daleeasley.com/local-climate-data.php> Or you can scan the first QR code:



More work will be released as time continues, but in the meantime, you can also check out my personal site <https://zebartsam.wixsite.com/samueltaylor> (second QR code) to see updates and other projects I'm working on!

Sources

NOAA National Centers for Environmental Information. Climate Data Online. Available at: <https://www.ncdc.noaa.gov/cdo-web/>. Accessed: 3/21/20.

High Plains Regional Climate Center. Municipal Climate Adaptation: A Report for Dubuque Iowa. Available at: https://hprcc.unl.edu/pdf/C4C_City_Plans/reports/Climate4Cities-Dubuque-IA.pdf

Berendzen, P. B., Cruse, R. M., Jackson, L. L., Mulqueen, R., Mutel, C. F., Osterberg, D., ... Thorne, P. S. (2010). Climate Change Impacts on Iowa, Report to the Governor and the Iowa General Assembly (pp. 1-9). Iowa DNR.

Gellert, T., & Tess Gellert is an undergraduate student at the University of British Columbia studying media studies and political science. She is a senior correspondent with OWP and is also the deputy advisor for the Climate Change/Environmental Conflict Crisis Ind. (2021, March 21). Texas power Outage crisis a foreboding sign of climate change. Retrieved March 22, 2021, from <https://theowp.org/reports/texas-power-outage-crisis-a-foreboding-sign-of-climate-change/>

Weingarten, D. (2018, December 11). Why are America's Farmers Killing Themselves? Retrieved March 22, 2021, from <https://www.theguardian.com/us-news/2017/dec/06/why-are-americas-farmers-killing-themselves-in-record-numbers>

Pryor, S. C., Scavia, D., Downer, C., Gaden, M., Iverson, L., Nordstrom, R., ... Robertson, G. P. (2014). Ch. 18: Midwest Climate Change Impacts in the United States: The Third National Climate Assessment. doi: 10.7930/J01012n

Payne, K. (2019, September 5). Report: Climate Change Impacts Clearer in Iowa Than Much Of US. Retrieved from <https://www.iowapublicradio.org/post/report-climate-change-impacts-clearer-iowa-much-us#stream/0>

Hogstrom, E (2011) UNPRECEDENTED. Telegraph Herald, p. 1.

Henson, B. (2020, November 06). Iowa derecho in August was most costly Thunderstorm disaster in U.S. history. Retrieved March 23, 2021, from <https://www.washingtonpost.com/weather/2020/10/17/iowa-derecho-damage-cost/>

Hofstrand, D. (2018, July) The impact of climate change on midwest agriculture. Ag Decision Maker. Retrieved from <https://www.extension.iastate.edu/agdm/articles/hof/HofJuly18.html>