Plan Overview

A Data Management Plan created using DMPTool

Title: The contribution of water retention, nutrient loading and microbial community to mosquito breeding and West Nile virus transmission in Spokane County

Creator: Krisztian Magori

Affiliation: Eastern Washington University (ewu.edu)

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Template: U.S. Geological Survey (USGS)

Project abstract:

Mosquitoes are the deadliest animals on the planet, due to the many diseases they transmit. In the US, the most common mosquito-borne disease is West Nile virus (WNV), transmitted by Culex mosquitoes. In urban environments, improperly draining storm-water infrastructure, such as catch basins and culverts, which contain polluted stagnant water, provide ideal habitat for these mosquitoes, creating localized foci of WNV transmission risk. Our project focuses on surveying and identifying mosquito habitats in the City of Spokane and the City of Cheney, and understanding the relationship between environmental conditions, mosquito productivity and WNV transmission risk. Faculty from the Department of Biology at Eastern Washington University (Krisztian Magori, Camille McNeely and Jenifer Walke) and from Gonzaga University (Christy Andrade) will collaborate with the Spokane Regional Health District (SRDH), the Washington Department of Health (WADOH) Zoonotic Disease program, and other stakeholders in this project. During the summer, a graduate student from EWU will lead undergraduate students to check catch basins and culverts for standing water, take measurements and water samples, and monitor for mosquito larvae. If mosquito breeding is detected, they will set traps and collect mosquitoes, and send them to WADOH for WNV testing, communicating the risk to SRDH. Water samples and mosquito larvae will be tested for both nutrient and microbial content to identify the combination of nutrients and microbes that support mosquito productivity. The project will also identify specific locations that contribute to significant mosquito production and WNV transmission, allowing SRDH and other stakeholders to monitor and mitigate them.

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Copyright information:

The contribution of water retention, nutrient loading and microbial community to mosquito breeding and West Nile virus transmission in Spokane County

1. Project and Contact Information

What is the name of the project?
Include any identifiers related to the project (e.g. Project ID, Funding ID etc).
The contribution of water retention, nutrient loading and microbial community to mosquito breeding and West Nile virus transmission in Spokane County

What is the name of the USGS Center/Program that oversees the project?
Include contact information (email, phone, address).
State of Washington Water Research Center
Jacqueline McCabe, Principal Assistant
jacquem@wsu.edu, watercenter@wsu.edu
Washington State University
PACCAR Room 242
Pullman, WA 99164-5825
Phone: 509-335-5531

Summary description of the project.
Include reason why the data is being collected.
Mosquitoes are the deadliest animals on the planet, due to the many diseases they transmit. In the US, the most common mosquito-borne disease is West Nile virus (WNV), transmitted by Culex mosquitoes. In urban environments, improperly draining storm-water infrastructure, such as catch basins and culverts, which contain polluted stagnant water, provide ideal habitat for these mosquitoes, creating localized foci of WNV transmission risk. Our project focuses on surveying and identifying mosquito habitats in the City of Spokane and the City of Cheney, and understanding the relationship between environmental conditions, mosquito productivity and WNV transmission risk. Faculty from the Department of Biology at Eastern Washington University (Krisztian Magori, Camille McNeely and Jenifer Walke) and from Gonzaga University (Christy Andrade) will collaborate with the Spokane Regional Health District (SRDH), the Washington Department of Health (WADOH) Zoonotic Disease program, and other stakeholders in this project. During the summer, a graduate student from EWU will lead undergraduate students to check catch basins and culverts for standing water, take measurements and water samples, and monitor for mosquito larvae. If mosquito breeding is detected, they will set traps and collect mosquitoes, and send them to WADOH for WNV testing, communicating the risk to SRDH. Water samples and mosquito larvae will be tested for both nutrient and microbial content to identify the combination of nutrients and microbes that support mosquito productivity. The project will also identify specific locations that contribute to significant mosquito production and WNV transmission, allowing SRDH and other stakeholders to monitor and mitigate them.

What is the project start date?
Start date.
3/1/2019

What is the project's expected end date?
Estimated end date. This field can be updated as needed.
2/28/2020

Are there additional information available?
Include any web links with more information related to the project, if applicable.
https://sites.ewu.edu/diseaseecology/identifying-mosquito-breeding-sites-and-west-nile-virus-foci-in-cheney-and-spokane/

Who is the main point of contact for the project and its data?
Also list any alternate points of contact, if any.
Krisztian Magori
kmagori@ewu.edu
(509)-359-2868

Are there collaborating/funding agencies and organizations?
Who are they and who are the main points of contact?
Spokane Regional Health District
Environmental Health Division
Juliana Awbrey, Living Environment/Special Projects Program Manager
jawbrey@srdh.org
509-324-1570

Washington Department of Health
Zoonotic Disease Program
Wayne Clifford
360-236-3181
Wayne.Clifford@doh.wa.gov

2. Plan and Acquire

How will the data be acquired?
Are they newly collected or using existing datasets?

There will be several datasets collected. The unit of collection will be the storm water catch basins and culverts. Researchers will note other potential mosquito breeding sites in the vicinity, but not investigate, especially on private property. Data collected will be the presence/absence of standing water in each storm-water catch basin on the day of survey. If standing water is found, researchers will return once a week to the location and collect the following data each time:

- water level height from the bottom
- water level height from the top
- water temperature (using iButton every 10 seconds)
- the average number of mosquito larvae collected per dip in 10 dippings
- ID number of the sample vial for nutrient analysis
- ID number of the sample vial for microbiome analysis

If any mosquito larvae are present, the following additional data will be collected:

- ID number for the vial with mosquito larvae from this location

In addition, a gravid trap will be placed within 10 m of the catch basin or culvert, and operated once a week, collecting the following additional data:

- ID number of the catch bag containing mosquitoes collected at the site on the specific collection date
- the number of mosquitoes of different species (data from WADOH)
- the WNV status of vector mosquitoes (data from WADOH)
- Minimum Infection Rate (calculated from the above 2 information)
- Vector Index (calculated from the above 3 pieces of information)

Once water samples are processed for nutrient analysis, the following data will be obtained for each water sample:

- nitrate concentration
- phospate concentration

Once water samples are processed for microbial analysis, the following data will be obtained for each water sample:

- overall bacterial load
- species of culturable bacteria
- microbiome species diversity
- microbiome composition

Once mosquito larvae are processed, the following data will be obtained for each mosquito larva sample:

- species identity of mosquito larvae collected
- species diversity of mosquito larvae
- species composition of mosquito larvae
- microbial community of mosquito larvae
- species and composition of other macroscopic organisms

If acquiring existing datasets, include more information.
Include the name, format, a persistent identifier, and source citation, if any. Are there any restrictions or agreements such as Memorandum of Understandings (MOUs) for use and storage?

We will use existing data on the location of storm water inlets (storm drains) and storm water gravity mains. These are stored as GIS shapefiles at:

http://data-spokane.opendata.arcgis.com/datasets?t=public%20works

We will work with the City of Spokane Public Works and Utilities to identify the best dataset to use to identify catch basins and culverts throughout the City. These shapefiles seem to be open to the public.

We will also work with the City of Cheney and potentially Spokane County to find and acquire similar dataset for Cheney.

If collecting new data, include more information.
Are there special processes or procedures for collecting the data (e.g. licenses, permissions, equipment, software)?

We will work with the Spokane Regional Health District, the City of Spokane and the City of Cheney, and Spokane County to obtain any necessary permits. We will also apply for a scientific collection permit from the Washington Department of Fish and Wildlife to collect mosquito larvae and adults.

The undergraduate and the graduate student will collect the information initially on paper forms on the presence of standing water and other potential breeding sites. For catch basins containing standing water, a separate form will be completed with information on the water height from the bottom and from the top, the ID of the water temperature logger, and the ID of the water samples for nutrient and microbiome analysis, as well as the presence of mosquito larvae, and their density per dip if present, as well as the ID of the vial containing mosquito larvae. These paper forms will be transferred into Microsoft Excel at the end of the day, both by the undergraduate and the graduate student, duplicated for accuracy. The PI will check at least once a week and consult with the students to resolve discrepancies.

Separate form will be completed for each adult mosquito trapping event, including the ID number of the collection bag, the location and the date of trapping. Upon receipt of information from WADOH, this will be expanded to include the number of adult mosquitoes of each species, the species diversity, and the presence or absence of WNV in the mosquitoes, as well as the MIR at the location and the Vector Index. These forms will be completed in Microsoft Excel.

Another form will contain information on the nutrient levels measured in the water sample. This form will contain the ID number of the vial tested, the location and date of collection, and the amount of nitrate and phosphate in the water sample. This form will be in Microsoft Excel.

Another form will contain information on the microbiome of the water sample. This form will include the ID number of the vial tested, the location and date of collection, and the bacterial load, culturable microbe, and the microbiome diversity and composition in the water sample. This form will be in Microsoft Excel.

Finally, another form will contain information on the mosquitoes in the collection of mosquito larvae. This form will include the ID number of the vial of mosquito larvae, the location and date of collection, the number of mosquito larvae of different species, the microbial community of mosquito larvae, as well as a list of other macroscopic organisms found in the water sample. This will also be in Microsoft Excel.

What is the estimated volume of the data collected, transformed, and/or generated?
For example in megabyte (MB), GB, TB, or PB.

I believe the amount of data generated will not be more than 1 GB, and it shouldn't pose a challenge in terms of storing or sharing. The only exception might be raw sequence data from the microbiome portion of the project, but that will just be used for generating the microbiome composition.

Will the data be static or frequently updated?
If frequent updates, describe how frequent (e.g. Continuously, weekly, annually, irregular etc)
Data will be updated as collected, but static afterwards.

Are the appropriate equipment and staff resources accounted for in the budget?
Include estimated time and cost for such data management activities.
The PI and the graduate student will be responsible for data management as part of their regular duties.

3. Describe/Metadata and Manage Quality

How many new datasets will be created?
List the anticipated title of each dataset.
Catch basin/culvert dataset

Dataset on the presence/absence of standing water at each catch basin and culvert in the City of Spokane and the City of Cheney.

Breeding site dataset

Dataset on the characteristics of each catch basin and culvert in the City of Spokane and the City of Cheney that contained standing water, with the amount and characteristics of standing water (volume, residence time, temperature, nutrient levels, microbial load, microbiome composition, presence/absence of mosquito larvae and other macroscopic organisms).

Mosquito larvae dataset

Dataset on the characteristics of each catch basin and culvert in the City of Spokane and the City of Cheney that were inhabited by mosquito larvae at any point in the season, including mosquito larval density, species of mosquitoes, length of the season when containing mosquito larvae, microbial characteristics in mosquitoes, in addition to the characteristics above.

Adult mosquito dataset

Dataset on adult mosquitoes collected, associated with the catch basins and culverts in the City of Spokane and the City of Cheney inhabited by mosquito larvae at any point in the season, including the number of adult mosquitoes of various species collected, the West Nile virus status of the vector mosquitoes, and the Minimum Infection Rate and Vector Index throughout the season.

What are the data types and formats, in which the data will be maintained?
Open data formats such as csv, tiff, mp3, are required.
All data will be collected as CSV (comma-separated value) files, in order to easily read in in R. These will be then merged with shapefiles of the catch basins/culverts to create maps. Potentially MS Access will used to cross-reference datasets.

Briefly describe the data processing steps or provide the scientific workflow.
Also identify any software or technology needs where applicable.
R will be used for data analysis. Quality assurance will be conducted by cross-referencing ID numbers between different datasets using R, potentially MS Access. R will be used to test hypotheses for the presence/absence of mosquito larvae, adult mosquitoes, and West Nile virus infection, in relation to nutrient levels and microbiome characteristics.

How will the metadata for each dataset be created?
Who will be responsible for the metadata creation and update? Include their contact information.
Metadata will be created and updated by the graduate student and the PI, in consultation with the co-PIs and other collaborators. Metadata will be created at the time of data collection. As the CSV files are created, each column will be identified and described in the metadata, following metadata standards.

Which metadata standard will be used to describe each dataset?
For USGS, FGDC-CSDGM or ISO 19115 series are required.
FGDC-CSDGM will be used.

What procedures will be used for ensuring data quality (QA/QC)?
If using a known standard or protocol, include the citation source.
QA/QC will be provided by duplicate recording from the undergraduate and the graduate student, and checking for discrepancies by the PI, and resolving discrepancies. QA/QC will also be conducted using R to check linkages between datasets by cross-referencing using ID numbers.

4. Backup/Secure and Preserve

Where will the data be stored in the short-term?
Is it properly secured, backed up, and environmentally controlled?
Data will be stored on paper forms in the field, which will be transcribed into digital CSV spreadsheets at the end of the day. Paper forms will be stored in a filing cabinet at EWU. CSV files will be saved in a Dropbox folder archived and privately shared between the project participants.

What will be the approach for routine backup of the data?
Include the frequency, duration, software, and media information. Will the data be stored in multiple places and on different media types (recommended minimum of 3 copies with 1 stored in an offsite location)?
Data will be backed up using Dropbox cloud storage. The PI has a Professional Dropbox account which allows 1 TB of storage.

Describe any potential access restrictions.
For example if the data contain Personally Identifiable Information (PII). Please include any practices to ensure access will be restricted.
While there are no human participants in the project, there are potential access restrictions regarding exact location information. Collaborators, such as SRDH, the City of Spokane and the City of Cheney will be consulted before sharing location-specific information with third parties. Restrictions will be imposed by removing spatial identifying information from CSV files.

What will be the final format of the data product?
Will there be any software needs? Will the data format be appropriate for long-term preservation? Open data formats such as csv, tiff, mp3, are required.
The final format of the data will be both CSV and ArcGIS shapefiles.

Where will the data and metadata be preserved in the long-term?
And which funding Program if in collaboration, will be responsible for the preservation of the data? Who will be the point of contact?
Data and metadata will be deposited in DataOne.org. Identifying information to specific locations will be subject to approval of collaborators and stakeholders such as SRDH, City of Spokane and City of Cheney. The point of contact will be the PI, Krisztian Magori.

If costs are associated with long-term storage, how will they be provided for?
Are there agreements made for the preservation of the data and metadata?
There are no associated costs.

5. Publish and Share

How will the data be shared and made available to the public?
For example a web page, system or application, data portal, repository, USGS Data Series, etc. Are there data release policies that need to be followed?
All data will be shared with the collaborators (SRDH, WADOH, City of Spokane and City of Cheney). A decision will be made after consultation with them about the granularity of the data that can be made available to the public, particularly in terms of spatial resolution. Data deemed to be releasable to the public will be then shared as either CSV files (and possibly ArcGIS shapefiles) on DataOne.org.

Will there be access or use restrictions on the data?
For example for sensitive data, restricted data, privacy, software with license restrictions, etc. Provide justification for the restriction citing any policies or legal reasons.
Restrictions might apply in terms of specific geographic locations.

How can someone overcome any access restrictions?
For example are the following required? Fees, non-disclosure statements, special authorization, data embargo or hold, MOUs/MOAs.
Access restrictions can be overcome after discussion and special authorization by SRDH and the City of Spokane and the City of Cheney.

Identify any anticipated publications or electronic outlets resulting from the data.
For example, peer-reviewed articles, information/fact sheets, web pages. If a USGS publication, indicate type (e.g. Open File Report, Provisional Release etc).
Peer-reviewed article will be written based on the data collected. The graduate student will use the data collected for his thesis project, which will be published as a peer-reviewed article. In addition, the results of the study will be informally described as blog posts and web pages.

Where will metadata be stored to enable data discovery by the public?
USGS requires that your metadata must be available for harvest by the USGS Science Data Catalog. Contact sciencedatacatalog@usgs.gov for more information.
Metadata will be stored along with the data on DataOne.org, made available for harvest by the USGS Science Data Catalog.

How and where will you obtain a digital object identifier (DOI) for the data?
USGS provides a Digital Object Identifier Creation Tool available at https://www1.usgs.gov/csas/doi/
We will create a DOI for the data using the Digital Object Identifier Creation Tool or the Open Science Framework.