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"Ding" Darling Wildlife Society - Friends of the Refuge

You Can't Always Get What You Want

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In previous articles, we discussed why some environmental projects that directly impact the J.N. "Ding" Darling Wildlife Refuge, such as the construction of the C-43 reservoir and the restoration of the Caloosahatchee River Watershed, are inherently lengthy projects. Another inherently lengthy project is the work the Army Corps of Engineers is doing to create the Lake Okeechobee System Operations Manual (LOSOM). LOSOM is important to the Refuge because it sets the strategy for water releases out of Lake Okeechobee.

On November 19, 2020, Florida's Blue Green Algae Task Force held its first meeting since July, and the principal agenda item was for the Army Corps to discuss LOSOM. The Army Corps had come up with a metric that members thought quantified the risk associated with Harmful Algal Blooms (HABs). The plan was for the Army Corps to review the metric and get feedback from the task force prior to using the metric in the modeling they are doing to create LOSOM.

This article will discuss the meeting and highlight some of the scientific and organizational challenges associated with creating LOSOM. The article will also explain why the Army Corps didn't get what it wanted from the meeting with the task force.

From LORS to LOSOM

The Army Corps currently manages releases out of Lake O based on the Lake Okeechobee Regulation Schedule (LORS), which was first implemented in 2008. The Army Corps is currently conducting a study that will result in new guidelines for the operation of Lake O. These new guidelines are referred to as the Lake Okeechobee System Operating Manual (LOSOM). One of the factors driving the creation of LOSOM is that the Herbert Hoover Dike Rehabilitation will be complete in 2022. The Water Resources Development Act (WRDA) of 2018 requires the Army Corps to expedite the completion of the Lake O regulation schedule to coincide with the completion of the Herbert Hoover Dike project.

At the Blue Green Algae Task force meeting, the Army Corps stated that the goal of LOSOM is to incorporate flexibility into Lake O operations while balancing congressionally authorized objectives. The objectives are:

1. Manage risk to public health and safety, life, and property
2. Continue to meet authorized purposes for navigation, recreation, and flood control
3. Improve water supply performance
4. Enhance ecology in Lake O, northern estuaries, and across the south Florida ecosystem.

The Army Corps also stated that it was interested in reducing HABs in Lake O in part so that it could achieve objectives 1 and 4.

The Role of Modeling

It is a common practice to model a complex system, such as LOSOM, as part of the design of that system. For example, prior to building a structure such as a bridge or an airport, the design team creates mathematical models of the proposed structure. If the structure is a bridge, the designers want to know if the bridge will be safe given an array of factors, including varying traffic loads, wind, and tidal conditions. If the structure is an airport, they want to know how well the airport will function given factors such as varying types of weather and traffic volume. Throughout the design process, the team building the structure continues to iteratively adjust its design based on the results of the modeling.

In the case of LOSOM, the Army Corps' design team wants to understand the likelihood that the approach LOSOM takes to achieve some of the congressionally approved objectives has an unacceptable impact on other objectives. For example, the corps stated its intention that the modeling that it is doing to create LOSOM will enable it to develop operational schedules that avoid conditions where it can meet all of the authorized objectives, but maximum Lake O releases are required during the peak of HAB season.

Most people who don't have a strong mathematical background assume that mathematical models, particularly ones that contain one or more Greek letters, are more powerful than they actually are. While they can be extremely helpful, mathematical models are limited due to a number of factors, including:

- Necessary data is usually lacking.
- Science needed to understand causal relationships between key factors is incomplete.
- Underlying mathematics is insufficient to describe the complex situation being modeled.

The LOSOM Process

The Army Corps has created a LOSOM Project Delivery Team (PDT). For those who want more insight into the work of this team, the public is welcome both to attend PDT meetings and provide input. See more.

The Army Corps began the process of creating LOSOM in February 2019. The phase that the process is in currently is one of PDT meetings and public workshops that are intended to:

- Develop operational alternatives
- Evaluate and compare alternatives

- Select operational alternatives.

The LOSOM project schedule calls for the final public comment period to occur in the fall of 2022. It is anticipated that this comment period will be followed by a final decision and approval, which should occur roughly four years after the start of the project.

The Army Corps' Motivation

In its modeling to create LOSOM, the Army Corps has used existing models such as the Regional Simulation Model (RSM). The model has two primary components. One component creates numerous scenarios by combining specific values of factors such as water conveyance, water storage, and water control features. For each scenario, the second component of the model solves the mathematical equations that are associated with water flow through both natural and manmade systems. One way to look at this approach is that the model creates and evaluates a large number of "what if" scenarios. See more.

As noted, the Army Corps wants to incorporate in the modeling it is doing to create LOSOM a metric that quantifies the risk of an outbreak of HABs. Part of its motivation is, as previously mentioned, that the presence of HABs makes it difficult for the Corps to achieve congressionally approved objectives 1 and 4. In addition to that motivation, in late October 2020 a Federal judge ordered the corps to consider the hazards of toxic algae when it releases water from Lake O. See more.

What the Army Corps Did and Didn't Do

The Army Corps quoted research that showed that Chlorophyll-*a* can be used as a measure of algal bloom intensity in aquatic systems. The corps used this research to justify its intention to use Chlorophyll-*a* as the indicator of a risk of HABs in the modeling it is performing.

To develop an algal bloom risk assessment metric, the corps developed statistical regression models. Those of you who took statistics might remember that linear regression is a technique used to determine which straight line comes closest to connecting a set of data points – see Figure 1. See more.
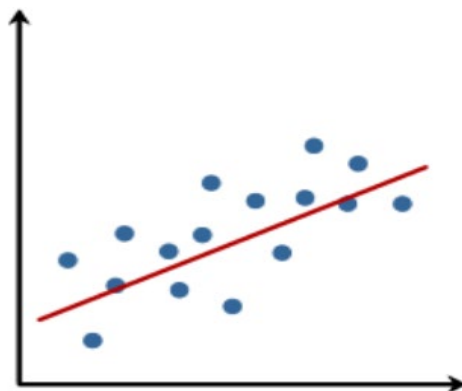
Simple Linear Regression
Figure 1

To develop the risk metric, the Army Corps used decades of data on Chlorophyll-*a* concentrations and the stages (i.e., the height) of Lake O. Referring to Figure 1, the stage of the lake is plotted on the horizontal or x axis and Chlorophyll-*a* is plotted on the vertical or y axis. The result of the linear regression is an equation for a straight line that the Army Corps intends to use to estimate the level of Chlorophyll-*a* for a given stage of the lake. Figure 1 graphically demonstrates one of the limits of modeling as the straight line that comes closest to connecting all the data points will actually connect with few, if any, of the data points.

It is important to recognize that during the task force meeting, the Army Corps acknowledged that both the underlying science and better predictive modeling tools for algal bloom risk are under development. It also acknowledged that it intends to use the proposed algal bloom risk assessment metric until better tools are available.

One thing that the corps did not do was to provide the Blue Green Algae Task Force with much information, or time to review that information, prior to the task force meeting. In addition, due to constraints on the schedules of those attending the meeting, there was relatively little time at the meeting for an in-depth discussion of what the Army Corps wanted from the task force.

To see a video of the task force meeting, see here. To see the slide presentation made by the Army Corps, see here.

What the Army Corps Wanted

The Army Corps team wanted the task force to tell them if their approach to creating a algal bloom risk assessment metric made sense. In particular, they wanted answers to the following specific questions by December 10, roughly three weeks after the task force meeting.

1. Is the metric technically sound relative to its design objective?
2. Are there any comments on the underlying theory, concept, or computational aspects of the model?
3. Does the task force see any potential issues that may affect the model's usability, reliability, or use in comparing potential alternatives?
4. Can the task force suggest additional tools that the Army Corps could use to predict the potential for algal bloom risk?

Feedback from the Blue Green Algae Task Force

The task force is made up of six distinguished scientists, each of whom has decades of experience using models to achieve goals similar to what the Army Corps was trying to accomplish. Scientists, by their very nature, are critical thinkers and because of that they don't just accept things based on a quick conversation. They are programmed to ask questions such as "Why are you doing this?" or "Have you considered that?"

The members of the task force expressed concern that the regression models the corps developed didn't do a good job of connecting the data points. In addition, the task force members had a lot of questions for the Army Corps such as:

1. Why focus just on Chlorophyll-*a* as an indicator of an HAB?
2. Is it possible to incorporate temperature into the model?
3. Is it possible to incorporate the height of the lake at the start of the rainy season into the model?
4. Why not create a model more sophisticated than a simple regression model?

As mentioned, the meeting had strict time constraints and so discussion was limited. Dr. Frazer, the chair of the committee, promised to work with the task force to get the Army Corps some additional feedback. However, given the constraints of Florida's sunshine laws and the challenge of getting the task force back together in the near term, it is doubtful that Dr. Frazer will be able to provide the type of feedback that the Army Corps wants by December 10.

Summary and Conclusions

It's possible to look at the meeting between the Army Corps and the task force as a missed opportunity to develop a better methodology to quantify the risk of a harmful algal blooms. However, given the complexity of the topic, it is highly doubtful that having the two organizations meet for a few more hours, or even meet on a couple of additional occasions, would have accomplished much of substance.

There are a lot of positive things to take out of the task force meeting, including:

1. The modeling that the Army Corps is doing to create LOSOM will include a focus on avoiding HABs.
2. The Army Corps is committed to developing better models for predicting HABs.
3. Two organizations had the kind of meeting that often sets the groundwork for a long-term working relationship.
4. The Army Corps may not have gotten what it wanted from the meeting, but it probably got what it needed.

In Case You Missed It:

The Army Corps of Engineers has started reducing the flows out of Lake O. See more.

The U.S. House of Representatives just passed the final version of the Water Resources Development Act of 2020. See more.