

My project consists of multiple components including a Survey, a hosted feature layer, web maps, and web map apps. Using Survey123 Connect, I created a survey that's purpose is to allow volunteers without a professional background in biology or botany to collect data on non-native invasive plant species on the American River Parkway with only a small amount of training that is primarily focused on terminology, ID techniques. The hosted feature layer created from the survey and its resulting data will be used to create a series of maps and web map applications for use by anyone interested.

## Creating the Survey

I started by creating my survey using Survey123 connect. Survey 123 Connect is xlsForm based. There are 3 required fields which represent- data type (type), name of the field in the resulting feature layer (name) which must be a unique list, and the label shown on the survey (label.) There are many other optional fields that allow you to refine your survey. The Form contains multiple spreadsheets: 'survey', 'choices', 'setting', 'types.'

	A	B	C	H	I	J
1	type	name	label	required_message	appearance	default
2	start	start				
3	end	end				
4	username	username	username			
5	email	email	email			
6	geopoint	Location	Location:	Help us map the location of your observation.		
7	dateTime	Date	When:	Tell us when you observed this plant.		now()
8	begin group	Basic	Species Info:			

The first thing I put in my xlsForm collects metadata about the survey including, the time the survey was started and ended, the user name of the surveyor, and also the email of the surveyor. These are automatically collected when the survey is started.

The first row collecting data is the geopoint data type to collect the location of where the surveyor is observing a non-native invasive plant species. The survey automatically finds your location but you have the option to change it manually if you are not pleased with its accuracy.

The dateTime question automatically collects the time and date the survey was started using the 'now()' function in the 'default' field of the 'survey' spreadsheet.

The next question is a 'select\_one' data type which is a multiple-choice question. I asked what species have you found? The answer to this question automatically fills in the next two fields of the survey by using the 'pulldata()' function. I created a related table with three columns: common\_name, Binomial, IPC\_Rating. When you answer the multiple choice question it uses the answer as a key field to pull the data from the related table and fill out the next two questions on the spreadsheet automatically- 'Binomial', 'Cal-IPC Rating.'

The next question asks if the plant species being observed has flowers on it. Using the 'relevant' field of the 'survey' spreadsheet, if the answer to this question is 'yes,' a hidden question is revealed. It prompts the user to take a photo of the flower to help verify the ID.

	type	name	label	relevant	calculation	choice_filter
15	select_one yes_no	Flowering	Is the plant flowering?			
16	image	Flower_Image	Take a photo of the flower for ID verification if you're unsure of your ID.	\$(Flowering) = 'yes'		
17	image	Plant_Image	Take a photo of the whole plant for ID verification if you're unsure of your ID.		Relevant	

The next question is also an image data type and asks the surveyor to take a photo of the whole plant for ID verification.

The next question ask what plants populations is and gives two options: 'more than ten', and 'less than ten.'

The next question is a select\_one question type and asks if the population is naturalized or not.

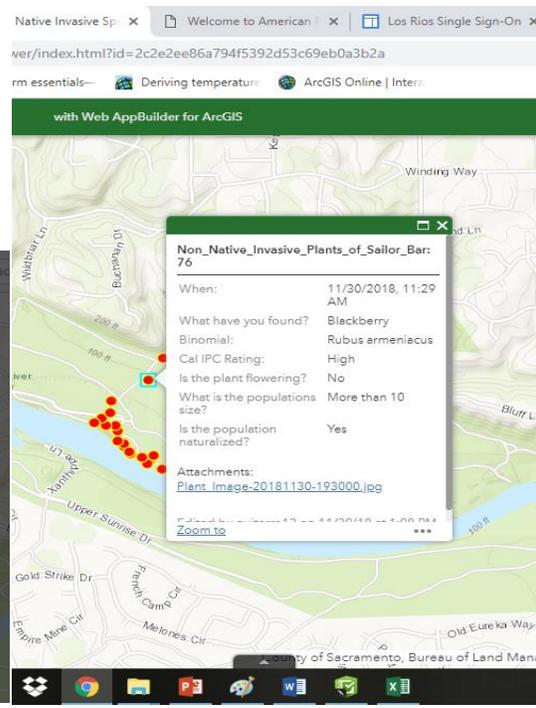
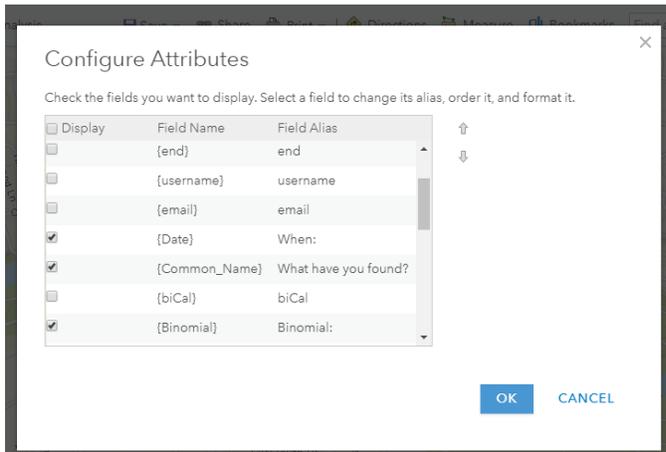
The next question is a select\_one data type and asks how the user experience is. It gives three option and if the user answer 'dissatisfied' a hidden question type is revealed which is a space for a note with the prompt to explain how the survey could be improved.

You then submit the survey and answers are put into this hosted feature layer schema on ArcGIS online:

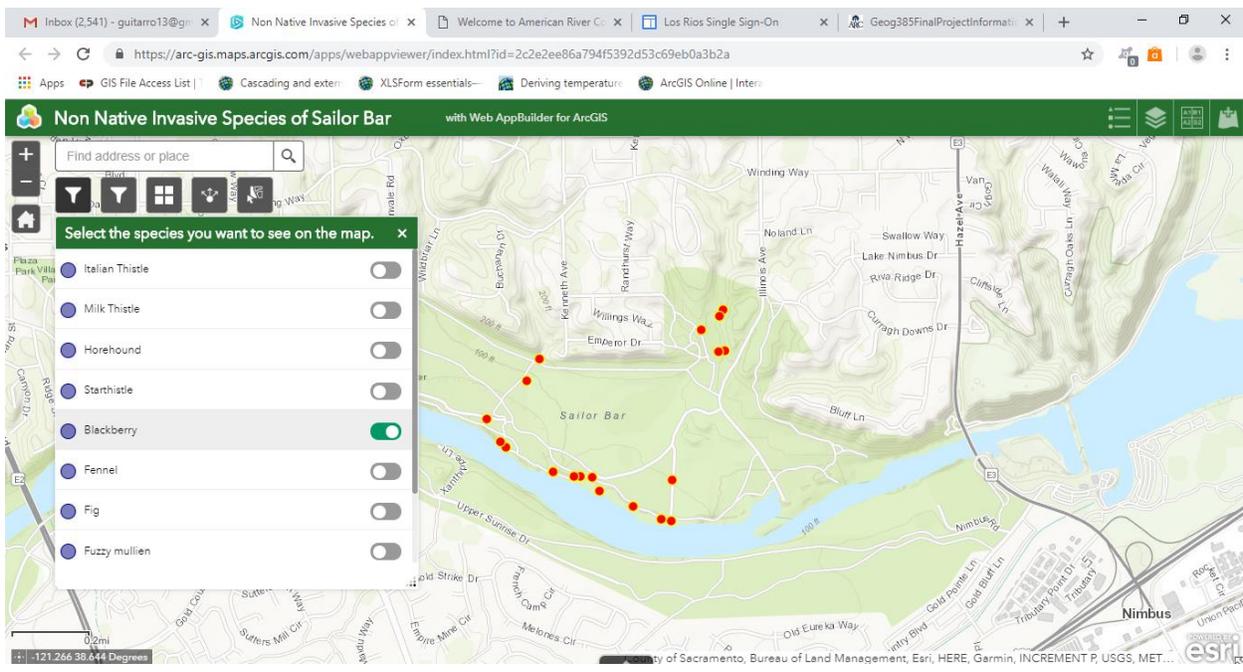
Field Name	Type	Esri Type	Length	Required	Read Only	Default
start	dateTime	esriFieldTypeDate	255	false	false	
end	dateTime	esriFieldTypeDate	255	false	false	
username	string	esriFieldTypeString	255	false	false	
email	string	esriFieldTypeString	255	false	false	
Location	geopoint	esriFieldTypeGeometry	255	true	false	position
Date	dateTime	esriFieldTypeDate	255	true	false	now()
Common_Name	select1	esriFieldTypeString	255	true	false	
biCal	string	esriFieldTypeString	255	false	false	
Binomial	string	esriFieldTypeString	255	false	true	
ipcCal	string	esriFieldTypeString	255	false	false	
IPC_Rating	string	esriFieldTypeString	255	false	true	
Flowering	select1	esriFieldTypeString	255	true	false	no
Flower_Image	binary	<attachment>	255	false	false	
Plant_Image	binary	<attachment>	255	false	false	
Pop_size	select1	esriFieldTypeString	255	true	false	>10
Nat_not	select1	esriFieldTypeString	255	false	false	yes
Experience	select1	esriFieldTypeString	255	false	false	Neutral
Comments	string	esriFieldTypeString	255	false	false	

## Web Maps and Apps

Using the feature layer created from this survey I styled a map showing each point as a red dot, then configured the pop up to show only the data I thought relevant to the end user.

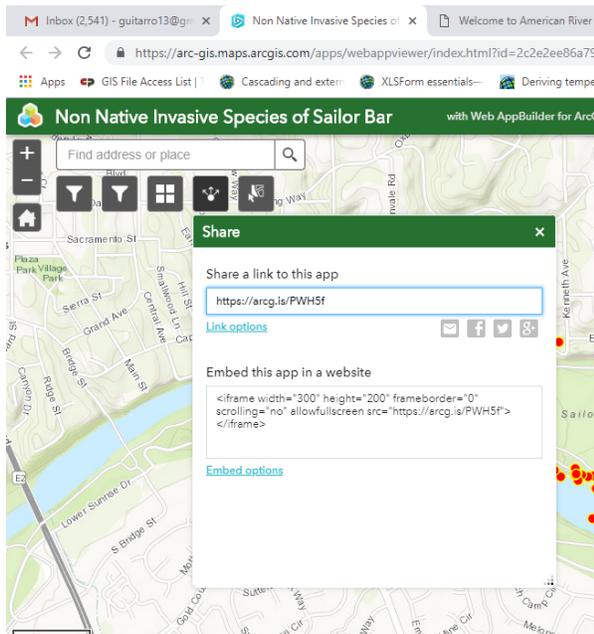


From this map I made a web map app with multiple widgets that allow the user to look at the data easily. The first widget I used was the filter widget that allows a user to filter the observations based on which plant species they want to see.

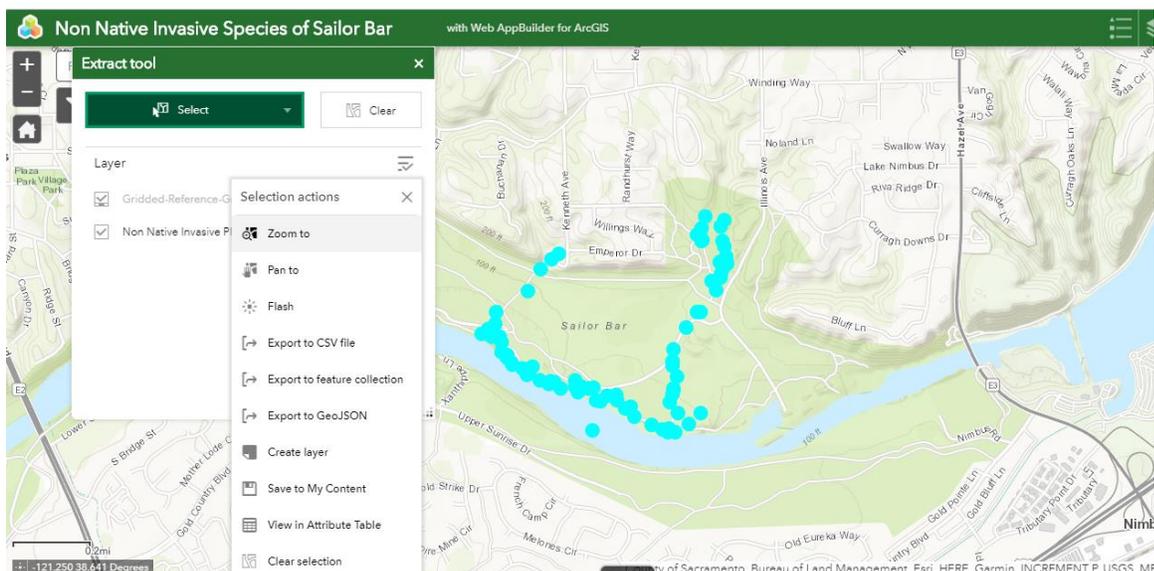




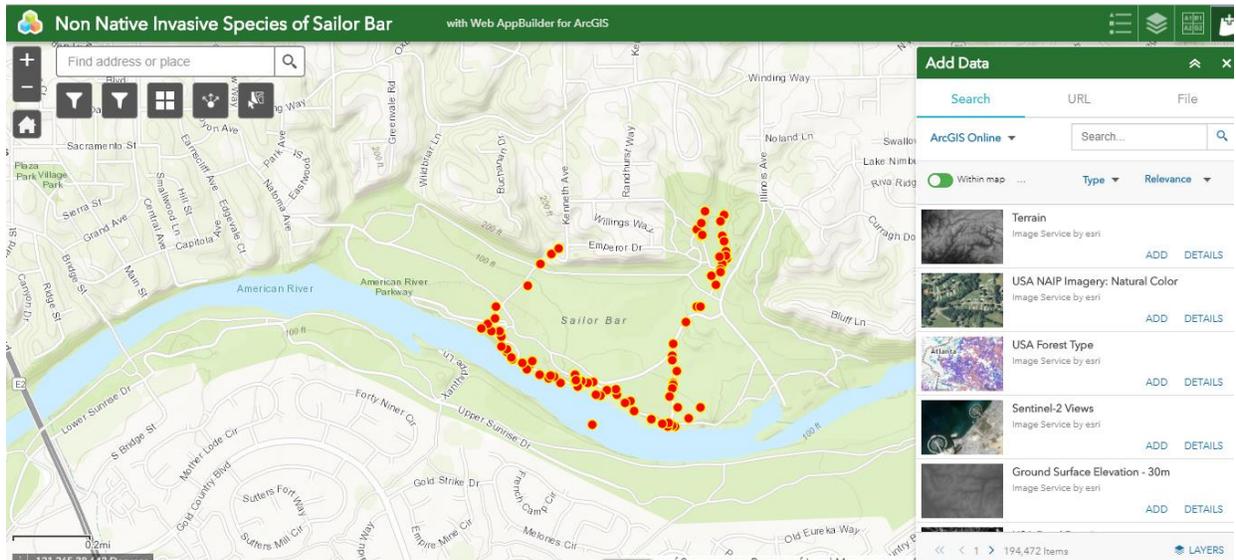
The fourth widget allows the user to share the map they have made on social media, or a link, or even embed the map on a platform.



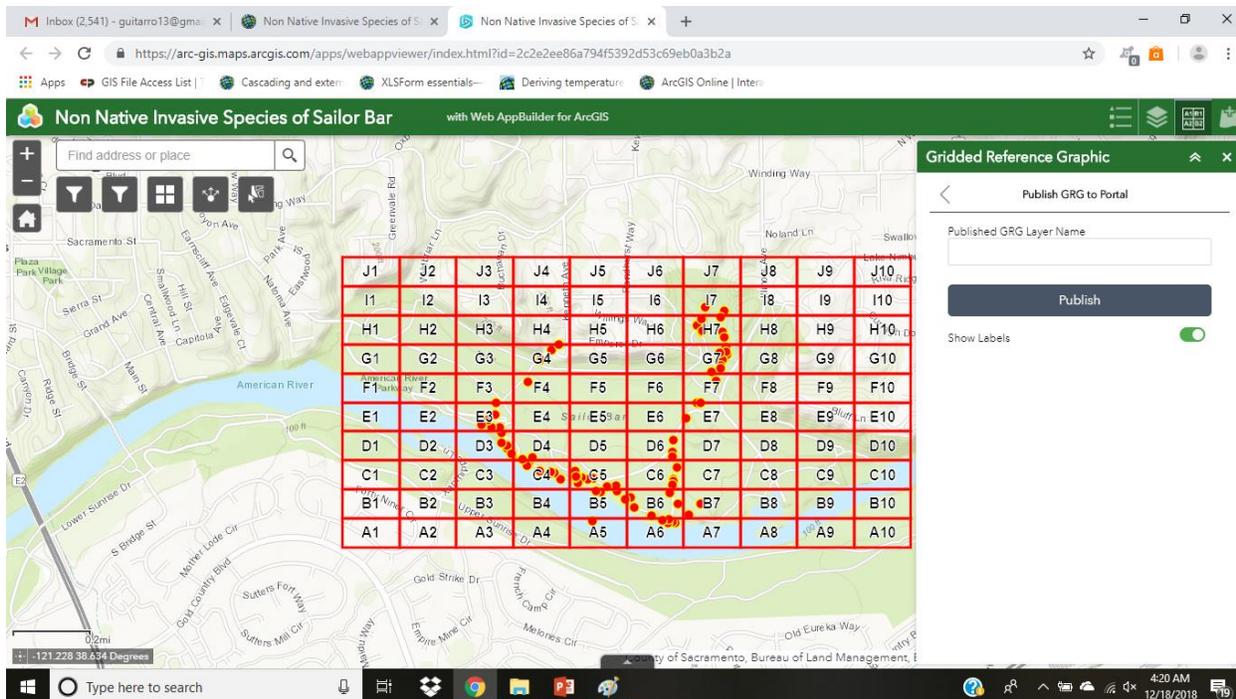
The fifth widget I used is the select widget. It allows a user to select and extract the data they want to use for their own purposes.



The sixth widget is the Add Data widget that allows a user to search for and add data they may find relevant to their analysis of the map.



The seventh widget is the Gridded Reference Graph widget. It allows a user to create graph of polygons to survey an area based on polygons instead of points.



## Difficulties

The most difficult aspect of this project was learning how to make the survey automatically fill in the binomial and IPC\_Rating fields based on the answer to a previous question. This was important to me because the survey is geared toward volunteers without a professional background in botany or biology and I didn't want them to have to use reference sheets to fill in the correct data. In general I spent a lot of time trying to make the survey completable within a few clicks.

## **Conclusion**

The survey is the most powerful part of this project. When I collected this data in the field manually using a gps unit and a notepad it took me 3.5 hours to take 66 points, over a length of just under 1 mile. I then had to manually enter the data and process it in ArcMap to create a layer. The total time needed to do both of these tasks was 5.5 hours. Using this survey, I took 80 points over a distance of 2 miles in 1.5 hours and it automatically updates the feature service and resulting web maps and web map apps. This is powerful for non profit organizations or any organization with minimum resources and a need to do the most with the least.

In the future I'd like to create a tile package so a user can have access to basemaps when they're taking the survey in areas without internet or phone signal. I'd also like to learn how to connect the survey to an existing feature service.