

#### **Green stuff from space!**

Blake Schaeffer John Johnston Erin Urquhart Megan Coffer Wilson Salls Bridget Seegers





















#### Impact











### Impact

HAB Action Plan



- -"WDEQ is exploring the use of satellite imagery that can remotely detect HABs"
- -8 health advisories 2018
- Oregon Rule 333-061-0510 (2018)



- -"The Authority determines the source is susceptible based on the characteristics of the source, including, but not limited to...<u>satellite imagery</u>...or other relevant information."
- UT DEQ Health Advisories
- -\$600k total societal costs avoided.



Stroming et al., In Prep. Valuables Impact Assessment









### Impact

- Office of Water N-STEPS Program
  - -Technical capability
    - Idaho DEQ
    - Coeur d'Alene Tribe
    - Oklahoma

(12) United States Patent	(10) Patent No.: US 10,290,089 B2
Schaeffer et al.	(45) Date of Patent: May 14, 2019
(54) CYANOBACTERIA ASSESSMENT	H04W 4/02 (2018.01)
NETWORK	or contract G06F 16/9537 (2019.01) H04L 29/08 (2006.01)

 Potential avoided costs using remotely sensed chlorophyll-a values ~\$3.4 (S3) to \$146 (L8) million annually









#### Landsat Secchi





Keith et al., In Prep. International Journal of Remote Sensing









### **Sentinel-2 Chlorophyll**





Salls et al., In Prep. International Journal of Remote Sensing











Salls et al., In Prep. International Journal of Remote Sensing









#### **Rivers?**

#### Sentinel-3 pixel



300 m



Salls et al., In Prep. International Journal of Remote Sensing









### **Sentinel-3 Chlorophyll**





Seegers et al., In Prep. Remote Sensing of Environment





#### **USGS** science for a changing world





Seegers et al., In Prep. Remote Sensing of Environment

#### Sentinel-3 <u>CI</u> Chlorophyll











#### Frequency



Schaeffer et al., In prep. Ecological Indicators



















### Magnitude











Extent										ME			
									VT	NH	MA		
		WA	МТ	ND	SD	MN	WI	МІ		NY	СТ	RI	
		OR	ID	WY	NE	IA	IL	IN	ОН	PA	NJ		
	СА	NV	UT	со	KS	мо	KY	wv	DC	MD	DE		
			ΑZ	NM	ок	AR	ΤN	VA	NC	Ī	Percent (%)		
			тх	LA	MS	AL	GA	SC		7	76-100		
	FL N							N	26-50				
										Â.	-	1-25	

Urquhart et al., In Prep. Ecological Indicators









#### Percentage





#### Coffer et al., 2019. In EPA clearance. Ecological Indicators















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#### Software and training

Public app training July 24<sup>th</sup> 2-3:30PM Includes training certificate https://tinyurl.com/y26txek2



























#### CyAN User Research Study

<u>Purpose</u>: Improve the water quality decision making process.

#### <u>Goal</u>:

Explore ways to create HAB decision support tools that are *truly relevant* to water resource managers.

• Gain an understanding of the experiences & workdays of water quality managers.

#### Goal:

Explore ways to create and improve upon lake water quality information pathways for recreation.

• Gain an understanding of the experiences of lake goers.

-In-depth interviews; 09/19 -Online Survey; IWG-HABHRCA; 07/19 -Unobtrusive Lake Observation; 07/19



## **Commercial Data Buy**







# Commercial satellite









### **Seagrass & Commercial Data Buy**





Rapid Eye 5m





Deep Convolution Neural Network (CNN)





#### **Seagrass & Commercial Data Buy**



Channel-by-channel comparison of reflectance within each ROI

Coffer et al., In prep. Remote Sensing of Environment