LAKE WISE

… a voice for quiet waters

NEWSLETTER FROM OREGON LAKES ASSOCIATION

MAY 2019

Connie Bozarth, Newsletter Manager

IN THIS ISSUE

High Desert and Mountain Lakes of Oregon

Annual Conference of the Oregon Lakes Association (OLA)

October 25-26

Riverhouse on the Deschutes, Bend, OR

Enjoy the OLA conference together with Bend's outdoor and food & drink attractions! The conference will run from midday Friday to midday Saturday, with a field trip on Saturday afternoon. Attendees will include students, lake association members and residents, outdoor recreationists, researchers, educators, tribal representatives, legislators, agency personnel, and anyone else interested in lakes.

Oral and poster presentations will cover a broad range of topics related to Oregon's lakes such as harmful algae blooms, water quality, lake and watershed restoration, aquatic invasive species, nutrient cycling, effects of climate change, hydrology, fauna and flora, coastal, mountain, and dryland lakes.

Abstract submission deadline: September 15

Early-bird registration by: September 29

Please visit our conference event website

2017 Oregon Lakes Association (OLA) Scholarship Announcement

Contributed by Wayne Carmichael, OLA Board Secretary

- ✓ **The Oregon Lakes Association, as part of its scholarship and outreach commitment, is pleased to announce the availability of a $1000 academic scholarship.**
- ✓ Application deadline is **May 31, 2019.**
- ✓ Award will be announced by **June 15, 2019**.
- ✓ The successful applicant will also be awarded a one-year membership in OLA, an invitation to attend our annual meeting with up to $200 in travel expenses and a waiver of the conference fee, in order for OLA to present the award. In addition, OLA encourages the scholarship recipient to present results of their lakes project at a future OLA meeting.
- ✓ See our website with instructions at: **https://www.oregonlakes.org/Scholarship/**

Laura Costadone, OLA's 2018 academic scholarship winner.

2019 SCHOLARSHIP DONATION GOAL

Thus far OLA has provided over $8,000 in scholarships and travel expenses to the recipients. Please consider donating to the Scholarship and Outreach Fund today, so we can sustain this program well into the future. Please consider making a donation today!

Harmful Algae Blooms (HABs) Corner

Contributed by Theo Dreher, President, OLA, Professor of Microbiology, Oregon State University

With committee members Wayne Carmichael and Gwen Bury

Report of the 2019 Oregon CyanoHABs Stakeholder Meeting

As we have done in the last few years, OLA co-sponsored (with Oregon Health Authority and Oregon State University) the annual CyanoHABs Stakeholder Meeting on 22 February, 2019, on the OSU campus.

Rebecca Hillwig (OHA) briefly described the 11 CyanoHABs advisories issued during 2018, which can be found at the OHA Harmful Algae Blooms website. Advisories were in effect longer than in previous years, in part because lower cyanotoxin guidance values (esp. 4 µg/L for microcystins) have resulted in longer exceedances. She also mentioned regulatory changes that were officially announced in an email distributed 3/29/2019. OHA will continue issuing advisories for parts of large lakes when exposure risks vary, a practice that has been followed for two years. New changes are to accept only toxin analysis and to terminate the use of cell counts for decisions regarding issuing or lifting advisories, and to consider *Aphanizomenon flos-aquae* (AFA) as potentially toxigenic.

Gregg Baird, also with OHA, discussed the temporary cyanotoxin testing requirements for drinking water that were put in place after the Salem drinking water crisis, which spanned 33 days in early summer 2018 until pretreatment of raw water with activated carbon was possible. About 100 water sources were being tested every 2 weeks, many by the DEQ lab, with costs borne by the state through an emergency allocation. Microcystins (MCY) were detected in four sources (Siltcoos, Detroit, Selmac Lakes and Gooseneck Creek Pond, Yamhill basin), with cylindrospermopsin (CYN) detected in Detroit Lake and the North Santiam River. After a public discussion period, permanent testing requirements were decided upon, affecting 58 drinking water sources, with routine monitoring consisting of testing raw water for MCY and CYN every two weeks. Funding from the state for continued testing is not yet in hand, and ultimately costs will likely be shifted to customers.

Aaron Borisenko (DEQ) discussed DEQ's analytical capabilities, particularly ELISA-based analysis of cyanotoxins. Al Johnson (US Forest Service) described the monitoring challenges for an agency that manages about a quarter of Oregon's land area and 25-30% of its lakes. Emphasis is placed on high usage areas where recreational exposure to cyanotoxins is most likely. During 2018, MCY exceedances were seen at the Perry South campground on Lake Billy Chinook and at Odell Lake. MCY and CYN exceedances were observed in Detroit Reservoir.

Rochelle Labiosa (USEPA, Seattle office) described the resources EPA has been putting together over recent years, in particular those assisting drinking water providers afflicted with CyanoHABs. EPA has published example Cyanotoxin Management Plans, including a Risk Communication Toolbox. These publications contain the sort of information that should prevent the mis-steps associated with the Salem water crisis from happening in the future. On the recreational exposure side, there has been a lengthy delay in issuing the draft recommendations for guidance values of 4 µg/L MCY and 8 µg/L CYN dating from 2016.

Dave Donahue (Eugene Water and Electric Board) discussed the concerns associated with Cougar and Blue River Reservoirs as their sources of drinking water. The reservoirs are 40-45 miles upstream of the drinking water intake on the McKenzie River. Compared with cell counts dating to the 1990's, CyanoHABs are considerably more intense in Blue River Reservoir, though perhaps not in Cougar Reservoir. From 2018 analyses, the highest toxin concentration seen in the reservoirs was 0.53 µg/L in Blue River Res. EWEB is developing their own capability for ELISA-based analysis of cyanotoxins in order to provide the fastest results after sampling. Sample results will be posted at the EWEB website, as are various types of water quality data.

Unlike most water utilities, EWEB has developed in-house expertise to track CyanoHABs through microscopic observation, which affords immediate understanding of the state of blooms. For 2019, experimental monitoring using genetic testing with PCR to detect total cyanobacteria and toxin genes is planned, together with some studies on the genomes of CyanoHABs with the Dreher lab at OSU. There is also a collaboration with USGS that will monitor toxins with solid phase algal toxin trackers as well as following water quality parameters with real-time sondes deployed at several sites. One goal of these studies is to track the movement of blooms down-river from the reservoirs and potentially to regulate reservoir releases in order to minimize periods of high bloom transport. Clearly, the problems seen with the Salem water crisis are causing water utilities to look more closely at source water quality.

Theo Dreher summarized legislative advocacy in support of a comprehensive CyanoHABs Program (described elsewhere in this issue).

Other actions of note in Oregon concerning CyanoHABs: Rich Miller (Portland State University) conducts Oregon Lake Watch training sessions throughout the summer, teaching basic methods by which volunteers can monitor the health of a lake; Desiree Tullos (Oregon State University) is incorporating in to her River Engineering course a study of potential modifications that could dissipate the toxic CyanoHABs occurring in Ross Island Lagoon; Theo Dreher's lab (OSU) has developed methods for determining genome sequences of current CyanoHABs and has determined the complete genome of the CYN producing *Anabaena/Dolichospermum* from Detroit Reservoir that was responsible for the 2018 Salem water crisis.

OLA-Recommended CyanoHABs Program makes Legislative Progress

As reported in the December 2018 newsletter, OLA has recently developed an outline for a comprehensive CyanoHABs Program to address issues relating to the occurrence and health risks posed by cyanobacterial blooms in Oregon's freshwater lakes and reservoirs. OLA hopes to see such a program funded by the Oregon Legislature for the benefit of Oregon's citizens and lakes. A subcommittee consisting of Board Member Wayne Carmichael, OLA Member Gwen Bury and myself has pursued these goals over the last year or so.

We have contacted or met with several state legislators to explain our program recommendations and have seen some positive developments during the current legislative session in Salem. Three visible CyanoHABs occurrences in very different settings have made the CyanoHABs problem obvious to legislators: a toxic CyanoHAB emanating from Ross Island Lagoon flowing down the Willamette River through downtown Portland in several recent summers, cattle deaths in rural SE Oregon in June 2017, and especially the Salem drinking water crisis in May/June 2018. Most importantly, we were able to gain the interest of Rep. Ken Helm, who chairs the House Committee on Energy and the Environment. He participated in a session at our September 2018 conference dedicated to advancing legislation supporting a CyanoHABs program, and he recently sponsored HB 3326, which charges Oregon Health Authority (OHA) and Department of Environmental Quality (DEQ) to jointly develop a CyanoHABs program that generally follows the outline we have recommended. The first draft of HB 3326 included allocation of nearly $1M for the biennium to allow DEQ to fund positions focused on CyanoHABs analysis.

OLA submitted comments for consideration by the House Committee on Energy and Environment concerning HB 3326 and two other bills concerning CyanoHABs. You can read the text at the Oregon State Legislative Information (OLIS) website. On 14 March, I presented OLA recommendations verbally to the committee during

a public testimony session. At this meeting, I heard that OLA's advocacy was in fact crucial in the development of this bill. There are several good features to HB 3326.

1. It recognizes that CyanoHABs are a statewide problem that is greater than a concern focused on providing clean drinking water; we had some concern that legislative responses might focus unduly on drinking water issues.

2. It charges OHA and DEQ to run a CyanoHABs Program jointly and collaboratively. This is sensible, as each of these agencies already has developed relevant expertise, OHA in regulating, educating and communicating the public health concerns, DEQ in sampling, toxin analysis and examining factors (such as nutrient pollution) that are responsible for CyanoHABs.

3. It requires data related to CyanoHABs to be expeditiously made publicly available.

4. It addresses the fact that long-term solutions require attention to watershed health, particularly nutrient pollution.

5. It includes funding for DEQ to work on CyanoHABs.

Our testimony emphasized the importance of these components, as well as mentioning some improvements that could be considered, most importantly the inclusion of CyanoHABs funding for OHA and inclusion of funds for a research program focused on Oregon CyanoHABs. Testimony from drinking water groups also supported HB 3326 and its funding for DEQ, and voiced support for a research program.

As of the end of the first week April, HB 3326 has taken an unexpected turn, becoming an emergency funding tool with the funds mentioned above for DEQ but also funding for an OHA position addressing recreational exposures to CyanoHABs. However, the guidelines for a broader program (points 1 through 4 above) have been removed. The other CyanoHABs-related bills have died. One of these was very similar to HB 3326 but lacked funding for DEQ, while the other was focused on drinking water and called for a task force study. HB 3326 has been scheduled for consideration by the Ways and Means Committee, so there is reason to be optimistic that this emergency bill will be funded. However, it appears that we will need to work on getting implementation of a broader plan during the next biennium. At this stage, it appears that it was felt that more discussions were needed to craft a CyanoHABs program that could be passed into legislation.

It is important to let legislators know about OLA's interest in CyanoHABs. Input is most effective from constituents. Please consider contacting your local representative or senator and voice support for a CyanoHABs program or legislation in general that supports healthy lakes. Our recent experience indicates that input can be productive.

Oregon Lakes in the News

Contributed by Paul Robertson, Past OLA President

Lost Creek Lake Rises, Town of Trail Watches

Following the powerful rain events of early April, rivers along Oregon's Southern end were not the only water bodies feeling the surge. Lakes, and reservoirs in particular, saw some of their largest volume flows from their outfalls. Amanda Rose of NBC5 News reported that the US Army Corp of Engineers haven't dealt with this much water for over 20 years in the Rogue Basin.

TRAIL, Ore. — Southern Oregon and Northern California are drying out after heavy rain washed out roads, flooded some homes, and even triggered landslides.

Flashback to a Fishless, "Two Miles Deep" Crater Lake ~ 1896

IS TWO MILES DEEP.

CRATER LAKE THE SUBJECT OF INVESTIGATION.

The United States Fish Commission Has Just Dispatched an Expedition to Oregon's Wonderful Body of Water—May Be Stocked.

(Washington Letter.)

THE United States Fish Commission has just sent an expedition to investigate the famous Crater Lake in Oregon. This is the deepest body of fresh water in America. Only one

Crater Lake was as famous then as it is now, and maybe even more mysterious, but in 1896 the US Government was taking steps to alter Oregons' "wonderful body of water" indefinitely. Trout were being considered for introduction into this fishless jewel at the behest of a mountain climbing club. The Portland based Mazamas petitioned the US Fish Commission to introduce fish into America's deepest pool. While fishless no more, Crater Lake, at 1949 feet deep, still holds mysteries that mountain climbers and scientists alike continue to explore to this day.

Thanks to the Crater Lake Institute for republishing this story from the Akron Pioneer Press, from August 21, 1896.

Albany, OR Responds to 2018 Detroit Lake Bloom

The Albany Democrat Herald (4/29/2019) reports that Albany's water quality report shows no violations of the Safe Drinking Water Act last year, despite drawing drinking water from the main stem of the Santiam River. The city instituted new testing for cyanotoxins, from May 1- October 31 yearly, to meet the new OHA mandate.

Albany City Hall, Ashley Smith, Democrat Herald

Wind Causes Surges on Oregon Lakes

Contributed by Ron Larson, OLA Board Member

Hurricane-caused surges can be catastrophic for coastal areas, but surges also affect lakes and can have adverse effects, usually at a much smaller scale. Lake elevations can also oscillate back and forth owing to changes in atmospheric pressure in what are called seiches. Seiches can also be created by seismic events, such as the 11-3-2002, Denali Earthquake in Alaska that created waves in Seattle's Lake Union and damaged boats. In some situations, a surge can be followed by a seiche because they can both be created by the same events.

Upper Klamath Lake Surges

Wind-caused changes in lake elevations are well known in Upper Klamath Lake in southern Oregon. The lake is about 20 miles long and is Oregon's largest lake. Lake elevations there are constantly monitored because the lake is an important source of water for irrigation and hydropower, and provides environmental flows downstream in the Klamath River and lake habitat for two species of endangered fish. Because the lake is sensitive to south winds, owing to its north-south orientation, there are three water-level gages in the lake to monitor changes. Surges of several inches are common on the lake and ones of 1-2 feet do occasionally occur under strong south winds (Fig.1).

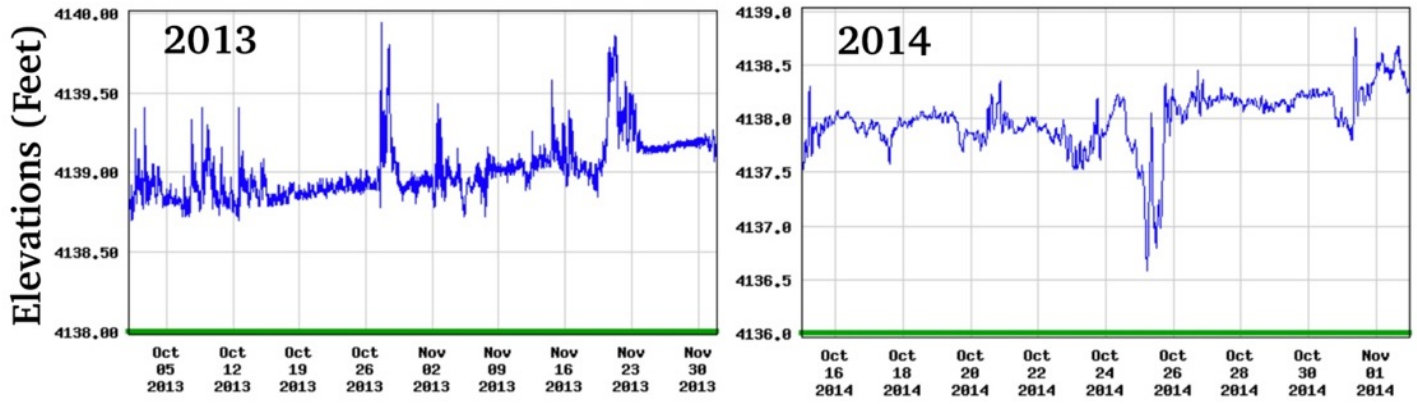

Fig. 1. Graphs showing effects of winds on water levels in Upper Klamath Lake in October 2013 (left) and November 2014 (right). Note that in 2013, winds increased water levels at the gage, but on October 25, 2014, winds caused them to decrease, suggesting winds were blowing from different directions. Graphs provided by the US Geological Survey.

Under sustained strong south winds even higher surges are possible in Upper Klamath Lake, as apparently occurred in July 1918. On that date, strong south winds likely forced water towards the north end of the lake and lowered levels at the south, causing the Link River that drains the lake to cease flowing (Fig. 2).

Fig. 2. Men and boys standing on the dry bed of the Link River when it ceased flowing as a result of a storm

Applegate-Good (1941), reported the July 1918 incident:

> *Several times in the memory of man the wind has so completely checked the flow of water down the narrow gorge and backed it up…that persons have been able to walk across the river dry shod. The last occasion on which this happened, I believe, was July 15, 1919, when the river bed was dry for six hours. Most of the trout escaped to the upper lake before it was too late; the mullet [Lost River suckers or shortnose suckers], being less agile or intelligent, died by the thousands; water snakes crept out of their hiding places…The scene was visited by hundreds of Klamath Falls people.*

The Link River was named “Yulalona” by the Klamath Tribes and meant “receding and returning water.” Their oral tradition tells that the river would “blew dry.” Kmukamtch, their principal deity, created Yulalona, a fish trap, as a gift to the people (Spindor 1996). Based on this information, it is clear that storm surges were not that uncommon on the lake and were well known to the Klamath people because it provided an easily-caught source of fish.

Lake Abert Surges

Evidence of small wind-caused surges is perhaps most visible at Lake Abert, in south-central Oregon. The lake is about 15 miles long and is the state’s 6th largest. Like Upper Klamath Lake, Lake Abert is oriented north and south. Additionally, Lake Abert is extremely shallow, with much of it being only a few inches deep; it often has a wide playa of exposed mud, especially on the north shore. Consequently, south winds easily move water onshore at the north end. I saw this happen one spring when I laid my pack and tripod about 25 feet from the north shore while I was watching shorebirds some distance away. A slight south wind came up while I was gone, and when I returned about an hour later, the water was nearly where I had left the equipment. Thus, I had unknowingly witnessed a small surge. Satellite images show that larger surges force water a mile or more onto the north shore. This can be seen in Fig. 3, where the changes in the distribution of water at the north end (top of photos) is evident in the images taken 2 weeks apart.

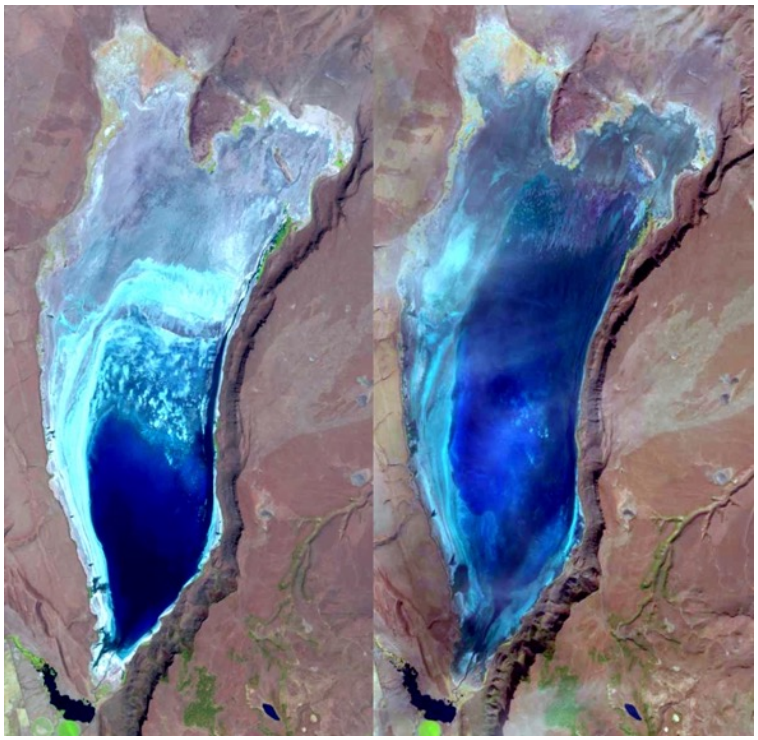

Fig. 3. These two Landsat satellite images of 15-mile-long Lake Abert were taken 2 weeks apart and show evidence of a surge. Left: 10-15-2016, and right: 11-2-2016. Strong southwest winds occurred after the first image was taken and forced a thin layer of water several miles onto the north shore.

References

Applegate-Good, R. 1941. History of Klamath County, its Resources and its People. Klamath Falls. 598 p.

Spindor, J. 1996. Yulalona. Klamath County Historical Society. Trumpeter No. 44. http://klamathcountyhistoricalsociety.org/images/1990Trumpeters/JuneTrumpeter199644.pdf

Climate Change and the National Wildlife Refuge System in the Pacific Northwest (Part 2)

Contributed by Tim Mayer, Supervisory Hydrologist, Water Resources Branch, US Fish and Wildlife Service

In my last article for this newsletter, I talked about climate change impacts to water resources on national wildlife refuges (NWRs) in the Pacific Northwest (PNW). First, I introduced some of the common threats to water resources that we face on refuges here in the PNW, including limited water supply, over-allocation of water, increased groundwater pumping, and warmer water temperatures. Then I made the point that climate change is making all of these threats worse. It is a “threat multiplier,” to borrow a term from the military vernacular. Finally, I concluded by noting that we are seldom dealing with the isolated impacts from climate change alone at refuges. It is climate change in addition to all the other stresses that threaten the water resources of refuges in the PNW. In this second article, I illustrate that point with examples from two refuges.

The first refuge is Nisqually NWR, located on Puget Sound in Washington between Olympia and Tacoma, at the delta of the Nisqually River. This area had been diked and drained for farming long before it became a refuge in 1974. In 2009, the refuge removed the dikes and reconnected 762 acres of the refuge to Puget Sound in an effort to restore tidal wetland habitat.

A big challenge with tidal restoration projects like these is that areas that have been diked and drained for long periods subside over time, leaving the lands lower in elevation. These areas require sediment accretion to increase elevations and function properly as a tidal marsh when they are restored. Normally the glacial-fed Nisqually River would contribute lots of sediment to the delta to allow sediment accretion. However, a dam up-

stream of the refuge currently traps much of the sediment, leaving very little in the river where it reaches the delta. Furthermore, the I-5 highway that bisects the delta south of the refuge cuts off and traps sediment from other tributaries to the delta as well. This situation will be made worse by rising sea levels. Here is an example where climate change (sea level rise) is exacerbating the challenges the refuge faces with restoration.

To counter these challenges, the approved boundary of the refuge (shown in white on Fig1.) was expanded in 2005 and the USFWS got the authority to buy farmlands from willing sellers that are located inland, to the south of the I-5 highway. These lands are currently farmed but they could become tidal wetlands in the next several decades as sea level rises. The USFWS is also in discussions with WDOT to possibly elevate the I-5 highway where it crosses the delta, which would allow tidal flows from Puget Sound to reach lands to the south. This would also allow sediment (and fish) from tributaries to move to the restored area more freely.

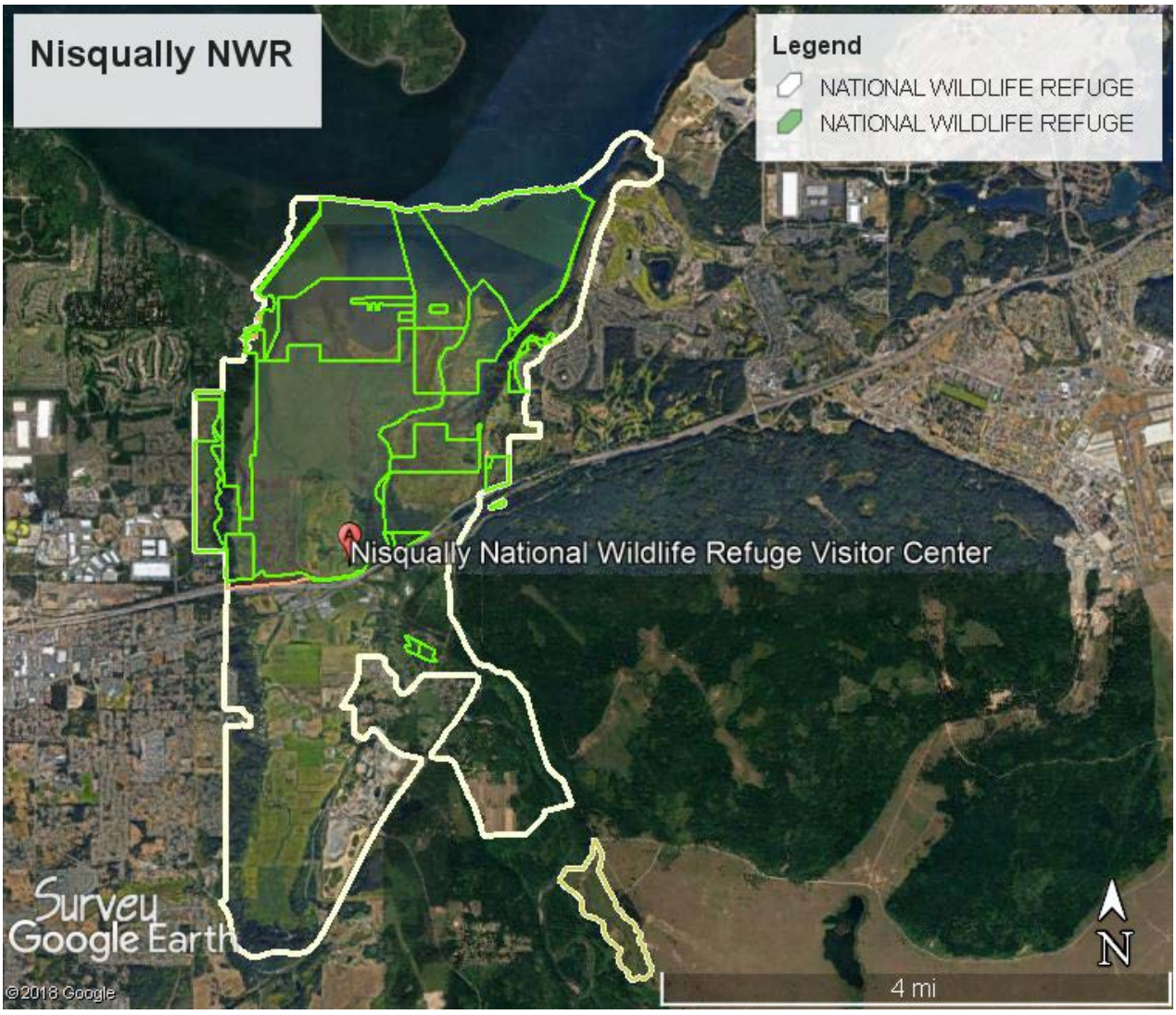

Fig 1. Nisqually National Wildlife Refuge, on Puget Sound between Olympia and Tacoma Washington

The second example is from the Upper Klamath Basin in southern Oregon. The Basin includes private, irrigated farmlands and six national wildlife refuges as well as Upper Klamath Lake and the Klamath River, which flows to the ocean. All but one of the six Klamath NWRs are wetland refuges, established for waterbirds, and all of these rely primarily on water diversions. The main water supply for both farmlands and refuges in the Ba-

sin is Upper Klamath Lake, a large shallow lake with very limited storage. For decades, the farmers and the refuges used as much water as they wanted from the lake and water needed to maintain lake levels and downstream river flows wasn't even considered. Water was over-allocated – too much was promised to everyone and in dry years, both the lake and the river system suffered. But in the 1990s, the Endangered Species Act (ESA) listing of suckers in the lake and salmon downstream in the river changed all that. Now, water must be allocated for lake levels, river flows, and diversions for irrigation and refuges. Accommodating the water needs of the suckers and salmon means a smaller slice of the "water pie" for other users. This has limited water supply for irrigators and refuges.

Climate change is exacerbating the problems with limited storage and over-allocation. According to the

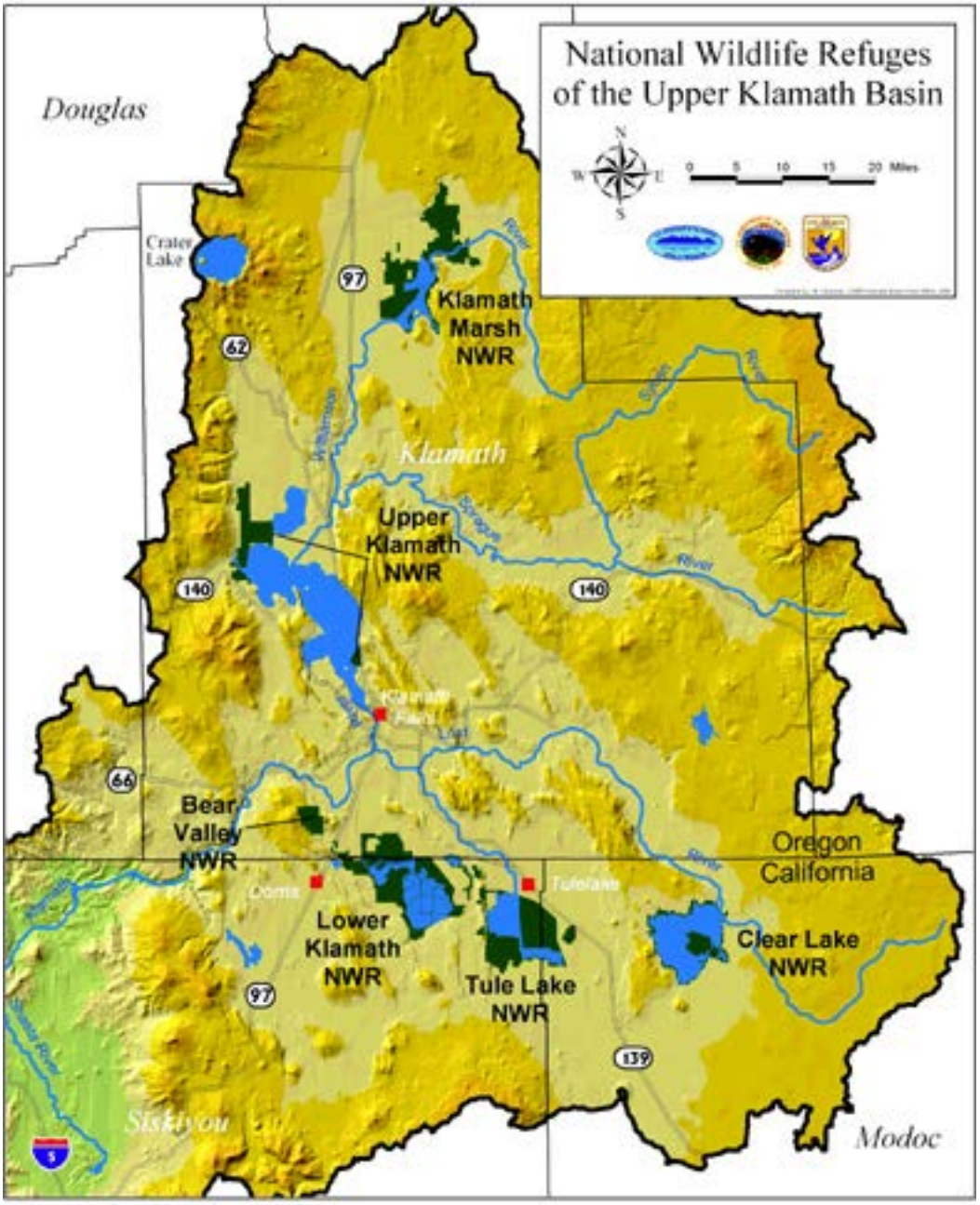

Fig 2. National Wildlife Refuges of the Upper Klamath Valley in southern Oregon and northern California

National Park Service, Crater Lake National Park, which is located in the Basin, received on average 51 feet of snow a year in the 1930s. Over the subsequent decades, that has slowly diminished and in the last decade, the

park received an average of just 35 feet a year. The amount of annual precipitation hasn't really changed, just the form, with more falling as rain instead of snow. This is due to warmer air temperatures.

One consequence of the decline in snowpack in the Basin is a reduction in inflow to Upper Klamath Lake. There are reliable records since 1981 and these records show earlier peak runoff and less available water in summer over time. The decline in water availability is due to a combination of decreased inflow during spring and summer and increased evaporation from the lake. This has limited water supply for fish, farmers, and refuges. To make matters worse, longer warmer summers mean more water is required for all needs (river flows, lake levels, crops, and wetlands). Here is another example where problems with limited water supply and storage, over-allocation of water, and ESA needs have been exacerbated by climate change impacts as well.

The take-home message from these two examples is that climate change is adding an additional stressor to water resources on refuges. It is a threat multiplier. The challenges concerning water resources on refuges are seldom just from climate change impacts alone; they are a combination of climate change and other stressors. Climate change has the potential to transform any of the other water issues and problems we face into crises.

Ample Winter Snows Replenish Cascade Lakes

Ample late winter snows fell in the Cascades this year, recovering snow packs to near normal levels. Maxwell Butte trail, elevation about 4000' is shown here on 17 February. Note the CyanoHABs warning poster left from the previosu season. The nearest lakes are the very small Duffy, Mowich and Santiam Lakes. Marion, which is known to have blooms, is further to the north.

Photos by Theo Dreher

Lake Wise
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The Oregon Lakes Association Mission

OLA, a non-profit organization founded in 1990, promotes understanding, protection and thoughtful management of lake and watershed ecosystems in Oregon. Serving entirely through volunteer efforts, the Oregon Lakes Association puts on an annual conference, publishes a tri-annual newsletter, sponsors Harmful Algal