LAKE WISE

… a voice for quiet waters

NEWSLETTER FROM OREGON LAKES ASSOCIATION

MAY 2018
Connie Bozarth, Newsletter Manager

IN THIS ISSUE

Pacific NW Lakes in a Changing World

A joint conference of the Oregon Lakes Association (OLA) and the Washington Lake Protection Association (WALPA)

September 26-28, 2018

Double Tree Hotel by Hilton, Portland, OR

We are expecting well over 200 participants for this multi-state conference. Proceedings will begin Wednesday afternoon with workshops on Aquatic plants, Cyanobacteria Identification, and Water Resources Modeling. Attendees will include students, lake associations and residents, outdoor recreationalists, scientists, researchers, educators, tribal representatives, legislators, and local, state and federal agencies. Oral and poster presentation will cover harmful algal blooms, water quality monitoring, watershed restoration, aquatic invasive species, nutrient cycling, and community involvement…just to name a handful of topics!

Abstract submission: Aug1
Earlybird registration: Sept 1
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, 2018.**
- ✓ Award will be announced by **June 15, 2018**.
- ✓ 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.
- ✓ encourages the scholarship recipient to present results of their lakes project at an OLA future annual meeting.
- ✓ at: **http://www.oregonlakes.org/Scholarship**

Christina (Chrissy) Murphy, OLA's 2017 academic scholarship winner on Lookout Point Reservoir.

Oregon Lakes in the News

Contributed by Paul Robertson, Past OLA President

USACE taking the community's temperature

The US Army Corps of Engineers is proposing a large infrastructure project on the Detroit Dam, which could improve conditions for endangered fish populations, but leave the lake, which serves for municipal water storage and recreation, dry for two years. The temperature control tower would serve to provide options for withdrawing water, seeking to meet targets for thermal conditions downstream. It would also seek to better facilitate the passage (actually collection) of fish, many of which may currently die in turbines, never even given a chance to make it back over (or more correctly to get trucked around) the dam years later. Scheduled for construction in 2021, the Corps has been reaching out to interested parties and affected communities. Get more concrete details at: Statesman Journal.

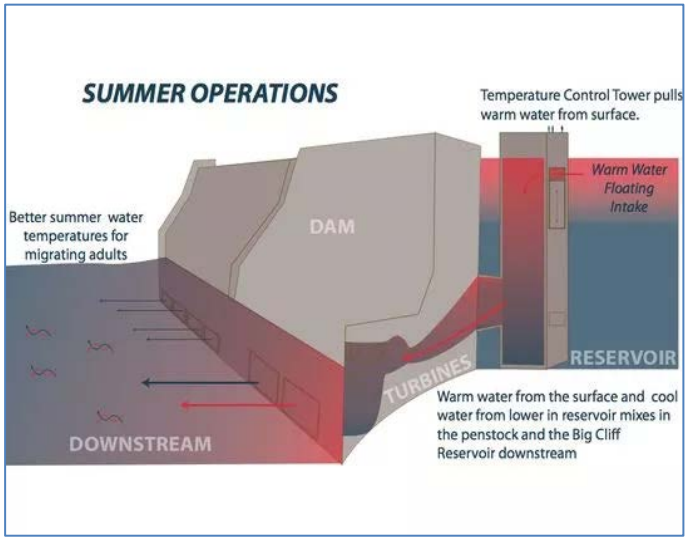

Diagram courtesy of USACE

Beavers burrow 1500 years into the past

A team of researchers at Oregon State University has recovered a sediment core from Loon Lake, east of Reedsport. The core may tell the "tail" of incremental improvements to forestry practices as well as logging the record of the most recent Cascadia subduction zone earthquake. Through 23 feet of sediment, researchers including Kris Richardson, OLA's first scholarship winner, and lead author on the recent paper, traced signatures of the dramatic to the subtle. Watershed changes have reportedly led to varying levels of sedimentation in a markedly discernable manner, particularly in recent years. Quoted in the Columbia Press, Kris described unearthing the core as "unusual to find this kind of annual resolution in lakes at this latitude, elevation and climate in North America."

Core Sampling at Loon Lake (OSU)

Bug's Life x 3,332

Diamond Lake has had its share of newsworthy events, from record setting record levels of tui chubs and the matching harmful algal blooms, to now record levels of chironomids. Hatching from the Mail Tribune, going live on the AP Wire, and molting online at US News, this story has gotten legs as they say. Best thing it features one of our own, Joe Eilers of MaxDepth Aquatics in Bend. Read more...

Harmful Algae Blooms (HABs) Corner

Contributed by Wayne Carmichael, OLA Board Secretary

Cyano HABs Stakeholder Report by Dr. Theo Dreher, OLA President

Progress Report sent to Congress on Harmful Algae

On March 6, 2018, NOAA transmitted to Congress a progress report from the Interagency Working Group on the Harmful Algal Bloom and Hypoxia Research and Control Act (HABHRCA). This report provides details on actions and activities that the agencies involved with this group have undertaken in the years since the release of National and Great Lakes-focused research plans and action strategies. The report can be found here: HABHRCA progress report.

The Progress and Implementation Report also highlights a number of federal accomplishments, including the following:

- Conducted health-effects assessments to recognize human-health risks from exposure to HABs and launched a one-health surveillance system (OHHABS) to collect human and animal data from HAB-associated exposures.
- Led the Great Lakes Water Quality Agreement (GLWQA), Annex 4 on Nutrients, a binational research and modeling effort with states and Canada to develop and adopt phosphorus reduction targets that will minimize HABs and hypoxia in Lake Erie. In 2017, the USEPA and four states released a draft Domestic Action Plan for Lake Erie that identifies how the U.S. will achieve its phosphorus reduction goals.
- Reduced nutrient and sediment field losses through continued implementation of conservation practices, and avoiding, controlling, and trapping conservation systems on agricultural lands.
- Included cyanotoxins in drinking water monitoring programs.
- Improved monitoring efforts for HABs in the Great Lakes, Pacific Northwest, Gulf of Maine and hypoxia in the Gulf of Mexico and Chesapeake Bay.
- Developed effective guidance and recommendations for HABs for the protection of public health in drinking and recreational waters
- Collaborated with stakeholders, including farmers, the tourism industry, water resource and utility managers, academics, Federal agencies, nongovernmental organizations, the public, and others.

For questions or additional information send an e-mail to IWG-HABHRCA@noaa.gov

More information: EPA CyanoHABS Website

EPA Nutrient Policy and Data Newsletters are available at: Freshwater HABs Newsletters

2018 Oregon Cyanobacterial Harmful Algae Bloom Stakeholder Meeting

As in recent years, Oregon Lakes Association, Oregon State University and Oregon Health Authority co-sponsored this meeting, held on the afternoon of Friday 26th January on the Corvallis OSU campus. The gathering of about 50 people included lake and reservoir managers, members of oversight agencies or groups with jurisdiction over or interest in use of lake waters for recreational and drinking water, scientists and academics studying lakes, and representatives of companies producing products relevant to lake blooms. The objective of the meeting was to review the HABs experienced during the 2017 bloom season, the management and public health responses, and to anticipate the 2018 bloom season. Equally important was the opportunity for participants to mingle and network informally.

Rebecca Hillwig (Oregon Health Authority, OHA) reported that 13 toxic/potentially toxic HAB advisories were issued during 2017. Most were in response to toxin measurements, most frequently of microcystin. Lengthy advisories were in force for Upper Klamath and Agency Lakes and the Klamath River downstream. Documentation on lake HAB advisories can be found here.

OHA is poised to adopt new EPA recommendations for toxin recreational criteria when they come into effect (expected prior to summer 2018). Using more conservative exposure assumptions, EPA draft recommendations have adjusted microcystin recreational water exposure criteria for microcystin and cylindrospermopsin to 4 and 8 µg/L, down from Oregon's currently used guidance values of 10 and 20 µg/L, respectively. Adopting the same assumptions, OHA expects to adjust recreational saxitoxin and anatoxin-a guidance values from 10 and 20 µg/L to 4 and 8 µg/L, respectively.

Odell Lake, July 2016. Toxic microcystin-producing Anabaena/Dolichospermum (Theo Dreher)

Rochelle Labiosa (US-EPA, Seattle) explained the origin of the proposed EPA recreational waters advisory values, with the final recommendation awaiting the process of public comments. She also outlined EPA's recent activities in formalizing cyanotoxin assay procedures and the development of resources for drinking water utilities dealing with cyanotoxins. Adult health advisories for drinking water have since 2015 been triggered by 1.6 and 3.0 µg/L of microcystins and cylindrospermopsin, respectively. EPA's efforts in addressing freshwater cyanobacterial HABs have been greatly appreciated by the HABs community. EPA has been the origin of many of the responses outlined above in the report submitted to Congress.

Al Johnson (USFS, Eugene) described the Forest Service policy of using generic warning signs around lakes that are subject to HABs, adding specific caution signs when toxin monitoring of high use areas has resulted in exceedances of toxin advisory values. Because lake users often seem to ignore notices, large and very prominent signs have been placed on access roads in some instances. Toxin occurrences on National Forests during 2017 were at Lake Billy Chinook and Odell Lake (both microcystin).

Aaron Borisenko (Oregon Department of Environmental Quality, DEQ) reviewed briefly the development of an MOU between various state agencies (including OHA) aimed at coordinating sample collection, analysis and response to HABs. He also described DEQ's response to the sudden deaths through microcystin toxicosis of 32 steers on a cattle ranch near Lakeview, OR. A persistent north

Junipers Reservoir (Pete Schreder)

wind had concentrated a bloom in Juniper's Reservoir at the south end, where cattle had direct access to the water. Very high levels of microcystin LR were detected (UC-Davis Animal Health and Food Safety Laboratory) in lake (3000 µg/L) and rumen (7100 µg/L) samples. My own research laboratory in the OSU Department of Microbiology has conducted a genetic analysis on these samples, finding that the microcystin genes originate from

Anabaena/Dolichospermum, not from *Microcystis*, which is prevalent and toxic in the Klamath basin. OHA requires testing for microcystin when *Anabaena/Dolichospermum* blooms are present, but these blooms have not to date been generally considered an acute risk for microcystin. My lab has also associated the microcystin present in Lake Billy Chinook and Odell Lake with *Anabaena/Dolichospermum*.

Finally, Richard Litts (OLA Director and Tenmile Lake Basin Partnership Monitoring Coordinator) outlined limitations and inconsistencies in Oregon's current response to freshwater HABs. He discussed the merits of more or less intensive levels of toxin monitoring, given that the available resources are entirely insufficient. Ensuing discussion, and follow-up planning for this September's joint OLA/WALPA conference, focused on the desirability of making a concerted push for legislative action in Oregon with the intention of establishing a monitoring and response capability, perhaps modelled on the program in Washington that has established widespread toxin testing [Washington State Toxic Algae]

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Our Vanishing Glaciers: One Hundred Years of Glacier Retreat in the Three Sisters Area, Oregon Cascade Range

Contributed by Jim E. O'Connor, Research Geologist, USGS

Warmest year on record; shrinking Antarctic Ice Sheets; *our vanishing glaciers...* We hear this almost daily now, particularly in the milieu of global warming and the wild weather of the last few years. But "Our Vanishing Glaciers" is in fact an old title—from 65 years ago—lifted from a 1938 Mazama Mountaineering Club publication describing glaciers in the Cascade Range of Oregon and Washington[1]. Glaciers have indeed been vanishing for decades. The first specific observations in the Three Sisters region, back in 1903 by Israel Cook Russell, noted recent glacier recession even by that time. And the abatement continues, as confirmed by modern studies in the Three Sisters area and elsewhere.

Clear evidence for vanishing glaciers comes from comparing current conditions with historical maps, drawings and photographs. In this article, adapted from a 2013 contribution to the Oregon Historical Quarterly, I document shrinking glaciers in the Three Sisters area with photographs, comparing scenes photographed in the early 1900s with views from the same spots captured in the last few years. Some of these matched photographs span exactly 100 years to the day. While the scenery remains stunning, the changes are also dramatic. Vistas filled by glacial ice in 1903 and 1910 have transformed to barren rocky fields and slopes—through-the-lens documentation of glaciers becoming smaller in the Three Sisters area of the central Oregon Cascade Range.

Many a Frosted Peak

Glaciers (including rock glaciers, their dirtier cousins), are found in all of the western mountain states except for Arizona and New Mexico. They are a hot topic. Alpine glaciers like those in the Alps and Cascade Range respond sensitively to climate. The size of a particular glacier reflects the balance between the winter's snow accumulation and summer melting. Increased snowfall or decreased summer temperatures will nourish glacier growth, generally by causing the ice to thicken and flow farther down valley. Likewise, either diminished winter snowfall accumulation or higher summer temperatures and more melting will starve a glacier, resulting in ice thinning and melt-back of the terminus. If the balance consistently tips in one direction for several years or more, the glaciers will grow or shrink accordingly, commonly in a visibly detectable manner. It is this decadal response of alpine glaciers to small but persistent temperature and precipitation changes, the very types and magnitudes expected with current ideas of climate change, which has motivated monitoring. Glacier monitoring thus helps us understand current climate change. In addition, it helps assessments of past climate change because past glacier behavior from times pre-dating temperature and precipitation
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records can commonly be reconstructed from the deposits they leave behind.

U.S. Geological Survey (USGS) maps now show nearly 300 named glaciers in the conterminous United States[2]. Of these, 36 are in Oregon. Most are on the prominent stratovolcanoes of Mount Hood, Mount Jefferson, and the Three Sisters, but tiny glaciers cling to some minor Cascade Range peaks like Mount Thielsen and Three Fingered Jack; and Benson Glacier is the solitary vestige of glacier ice in the Wallowa Mountains. Many of these glaciers, particularly on Mount Hood and in the Three Sisters region, have been monitored to varying degrees since the 1930s when it became evident that many were much diminished from their extent when first documented just after the peak of the Little Ice Age in the late 1800s and early 1900s[3].

The most interesting field—The Three Sisters

The Three Sisters area of the central Oregon Cascade Range includes three prominent stratovolcanoes, North, Middle, and South, plus several subsidiary cones and volcano remnants, including Broken Top and Mount Bachelor (Fig 1). Among these peaks are seventeen named glaciers[4], although some names and locations have become confused and misplaced as the glaciers have shrunk during the last 85 years[5]. This large number of glaciers in close proximity led Joseph Silas Diller, an early USGS geologist, to declare the "Three Sisters…as probably affording the most interesting field for glacial studies in the United States, with the exception of Alaska."[6] Diller, just beginning a 40-year career with the newly formed Geological Survey first explored the Three Sisters in the summer of 1883. He soon informed I.C. Russell of his observations for inclusion in the 1885 report on the glaciers of the United States (Fig 1).

But more than just recording Diller's impressions of the Three Sisters and naming two glaciers, I.C. Russell investigated for himself twenty years later in 1903. Russell, like Diller, was of the initial cadre of USGS geologists when the agency was consolidated in 1879 from the four western surveys. During the course of the 1903 field work, Russell ascended the eastern flank of Middle Sister on August 16, following the tall moraine crest along the south edge of what he had named Hayden Glacier[7]. His photographs, along with Rodney Glisan's from four weeks earlier during July 19-20[8], are some of the

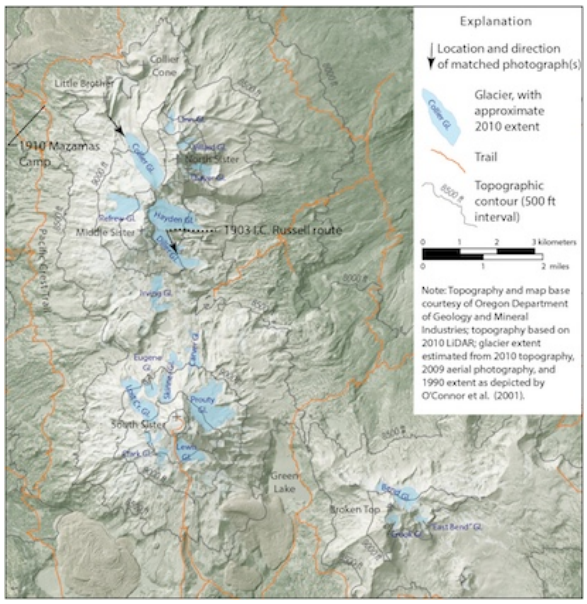

Fig 1. *Map of the Three Sisters area, central Oregon Cascade Range, showing key locations, photograph locations and directions, and the 17 named glaciers of the area, plus the unofficial "East Bend Glacier" (on the east flank of Broken top). Place and glacier names are as shown on U.S. Geological Survey maps.*

earliest alpine photographs of the Three Sisters region. Russell's photographs, in part made to document the glaciers of the area, nicely show conditions on the east side of Middle and South Sisters. A panorama, captured from near a bedrock spur cleaving Diller and Hayden glaciers, shows particularly well the extent of Diller Glacier and several of the glaciers on the northeast flank of South Sister. Russell noted in 1903 "that [Hayden] glacier has recently been lowered by melting about 40 feet" below the sharp-edged moraine crests[9].

But Russell only saw minimal glacier retreat compared to what has come to pass. Photographs made 90 years later[10], then another set on 16 August 2003 (100 years to the day after Russell's photographs) show substantial loss of glacier ice and snow on Middle Sister, South Sister, and in the distance, Broken Top (Fig. 2).

While I.C. Russell nicely documented some of the prominent glaciers on the east side of the Three Sisters, he made no mention of the much larger glacier on the more moisture-laden west side. Collier Glacier probably covered two square kilometers in 1903 as it flowed northwestward from the saddle between Middle and North Sisters. Collier Glacier was likely about twice as large as any other glacier

in the Three Sisters area, probably making it the largest glacier in Oregon[11].

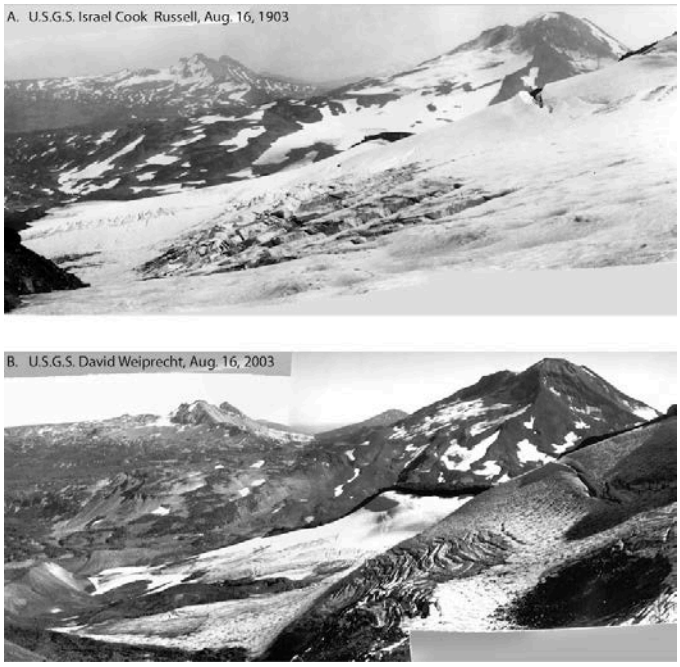

Fig 2. *Approximately matched multiple-photograph panorama views from east flank of Middle Sister, showing Diller Glacier in foreground and South Sister and Broken Top in distance.*
A. *U.S. Geological Survey photographs by Israel Cook Russell, 16 August, 1903, which appeared in U.S. Geological Survey Bulletin 242 (1905).*
B. *U.S. Geological Survey photographs from near the same position exactly 100 years later. 16 August 2003, by David Wieprecht. Russell's 1903 photograph was apparently made from on the ice, consequently the 2003 location is a little lower and to the left of Russell's view.*

The earliest photographs I am aware of showing Collier Glacier up close were made in 1910. These Collier Glacier photographs are part of an exquisite set of alpine views taken by professional photographers, climbers, and a geologist that set up camp for ten days in a meadow west of Collier Glacier in August of 1910. The weather was good, although it became smoky late in the trip, and climbing parties ascended all three of the major peaks, including the first known ascent of North Sister by H.H. Prouty[12].

Taken together, the photographs from this trip provide a broad inventory of the glaciers in the Three Sisters area. In particular the views of Collier Glacier (Fig. 3) and the summits of Middle and South Sister show the extent of several of the largest glaciers, including Diller, Hayden, Prouty, Irving, and Carver.

As for the 1903 Russell photographs, colleagues and I repeated photographs from closely matched locations almost exactly 100 years later, during 9-22 August 2010. Similarly, these matched shots document the profound recession of the area's glaciers over the last 100 years, as well as other landscape changes.

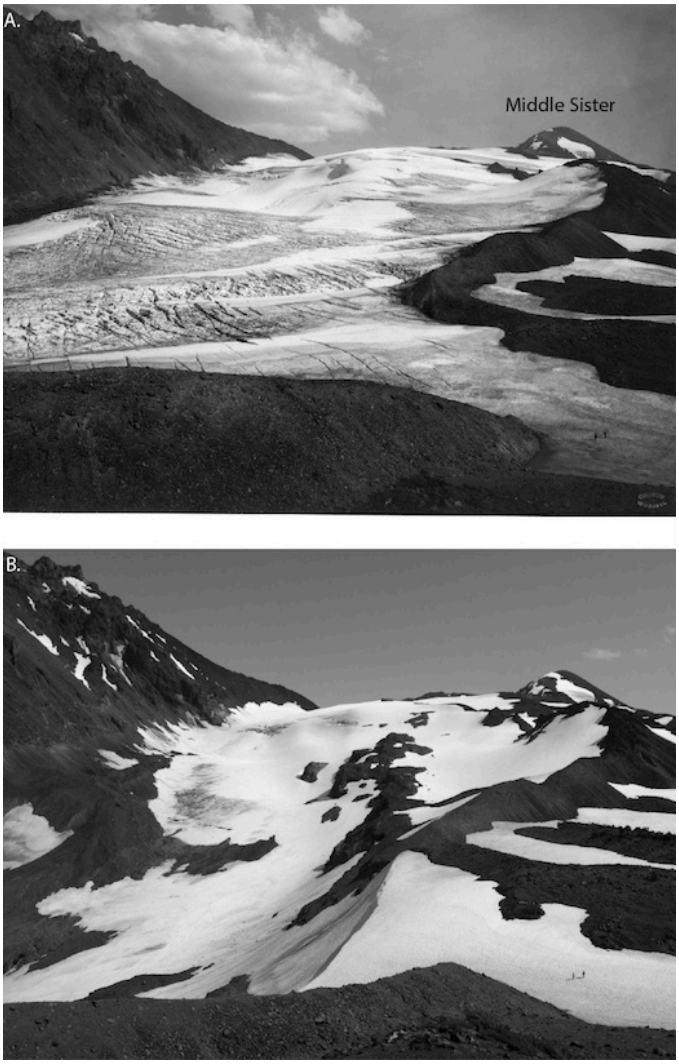

Fig 3. *Matched views of Collier Glacier from south shoulder of Little Brother. View towards Middle Sister with North Sister on left side of images. Both images show two people in snowfield in lower right.*
A. *August 1910 photograph by Clarence Winter of Kiser Photography; scan of original print courtesy of Mazamas.*
B. *August 9,2010 photograph by Jim E. O"Connor. A large part of themoraine in the foreground has slid away in the interim between photographs.*

Glaciers Then, Now, and into the Future

The time of first glacier documentation in the western U.S. in the 1870s corresponded with the end

of The Little Ice Age. This several-decade period of cold and wet resulted in glacier growth throughout the world. In Oregon, tree-ring dating indicates that Little Ice Age glaciers achieved their greatest length and thickness in the 1850s and 1860s. These vigorous glacier streams scraped away at the friable volcanic edifices, rimming themselves with tall sharp-crested moraines as ice-transported debris was conveyed downward to the ice margins. At their greatest Little Ice Age extent, glaciers covered about 15 km^2 in the Three Sisters area[13].

As far back as 1903, I.C. Russell noted "recent shrinkage of glaciers"[14] from their maximum Little Ice Age extent in the Three Sisters. For the first several decades, the thick glaciers mainly thinned behind the tall morainal rims. But by the time of Edwin Hodge's 1924 measurements, glaciers covered only 9.1 km^2. And during the warm and dry 1930s and 1940s, glacier margins melted back rapidly, as shown by Collier Glacier's quick retreat from Glacier View. In 1990, we estimated 5.8 km^2 of glacier ice[15]—about one third of the area covered during the Little Ice Age—and it is surely even less now. Predicted temperature increases for the 21st century will cause more glaciers to vanish. How many and how fast depends on the details of temperature and precipitation changes, as well as the topography of source areas. Some glaciers will undoubtedly hang on in gouged-out shady recesses of the peaks. But now knowing how sensitive glaciers are to climate change, monitoring is certain to continue, in increasingly sophisticated ways. Although new technologies will help quantify glacier changes in ways not possible before, photographs often speak the story's essence in fewer words. I suspect as long as humans have eyes, images will continue to forcefully convey the reality of our changing world.

(Ed: Oregon's lakes and reservoirs, being fed in part by glacier melt, have and will continue to see changes from the glacier declines described here.)

References

[1]Kenneth N. Phillips, "Our vanishing glaciers; observations by Mazama research committee on glaciers of the Cascade Range in Oregon," *Mazama* 20:12 (1938): 24-41.

[2]Approximate number glaciers determined from glacier listings on Portland State University Glaciers of the American West website: http://glaciers.research.pdx.edu/ (accessed 3 March 2013)

[3] For example, K.N. Phillips, "Our vanishing glaciers." In addition, the Mazamas have supported several glacier monitoring efforts since the 1930s, including graduate student thesis projects at Oregon State University and Portland State University.

[4] Many of these glaciers were first mapped and named by Edwin T. Hodge; 1925, *Mount Multnomah: Ancient ancestor of the Three Sisters* (Eugene, University of Oregon, 1925). The seventeen named glaciers are those depicted on current USGS 7.5-minute quadrangle maps covering the Three Sisters and Broken Top. The glacier names on Broken Top have been slightly confused over the years. Crook Glacier as shown on USGS Broken Top-7.5-minute quadrangle map corresponds to "Crater Glacier" as described by Phillips (1938), and the unnamed glacier east of Broken Top's summit was the "Crook Glacier" of Hodge and shown as such on earlier USGS topographic quadrangles, but has been more recently referred to as "East Bend Glacier" by J.E. O'Connor, J.H. Hardison, and J.E. Costa, *Debris flows from failures of Neoglacial-age moraine dams in the Three sisters and Mount Jefferson Wilderness Areas, Oregon*, USGS Professional Paper 1606 (Reston, Virginia, Government Printing Office, 2001).

[5] For example, Carver and Skinner Glaciers, both shown on current USGS 7.5 minute topographic quadrangles, no longer correspond to coherent glaciers.

[6] As stated in I.C. Russell, *Existing glaciers of the United States*, 341.

[7] Russell's exact route is unknown in the absence of field records from his central Oregon field work, but photograph dates and image numbers indicate his ascent route on 16 August 1903.

[8] Mazamas Research Library, Rodney Glisan Collection. Rodney Glisan was an avid climber and Mazamas Club member. The street two blocks from my house in northeast Portland is named for him.

[9] Russell, I. C., *Preliminary report on the geology and water resources of central Oregon*: 126.

[10] Published in O'Connor et al. *Debris flows from failures Neoglacial-age moraine dams in the Three Sisters and Mount Jefferson wilderness areas, Oregon*: 10.

[11] According to area measurements from 1924 mapping reported by Edwin T. Hodge in *Mount Multnomah—Ancient ancestor of the Three Sisters*: 71.

[12] Riddell, "Three Sisters Outing," 12.

[13] O'Connor et al., *Debris flows from failures Neoglacial-age moraine dams in the Three Sisters and Mount Jefferson wilderness areas, Oregon:* 13.

[14] I.C. Russell, *Preliminary report on the geology and water resources of central Oregon*: 126

[15] O'Connor et al., *Debris flows from failures Neoglacial-age moraine dams in the Three Sisters and Mount Jefferson wilderness areas, Oregon:* 13.

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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 Bloom trainings, and works as an advocate for lakes in the legislative arena. For additional information on OLA, write to the address above, or visit our website at **http://www.oregonlakes.org**.

OLA and *Lake Wise* welcome submissions of materials that further our goals of education and thoughtful lake management in Oregon. OLA is grateful for corporate support that helps sustain the organization. Corporate members are offered the opportunity to describe their products and services to *Lake Wise* readers. These descriptions are not OLA endorsements and opinions appearing in *Lake Wise* are not OLA policy statements