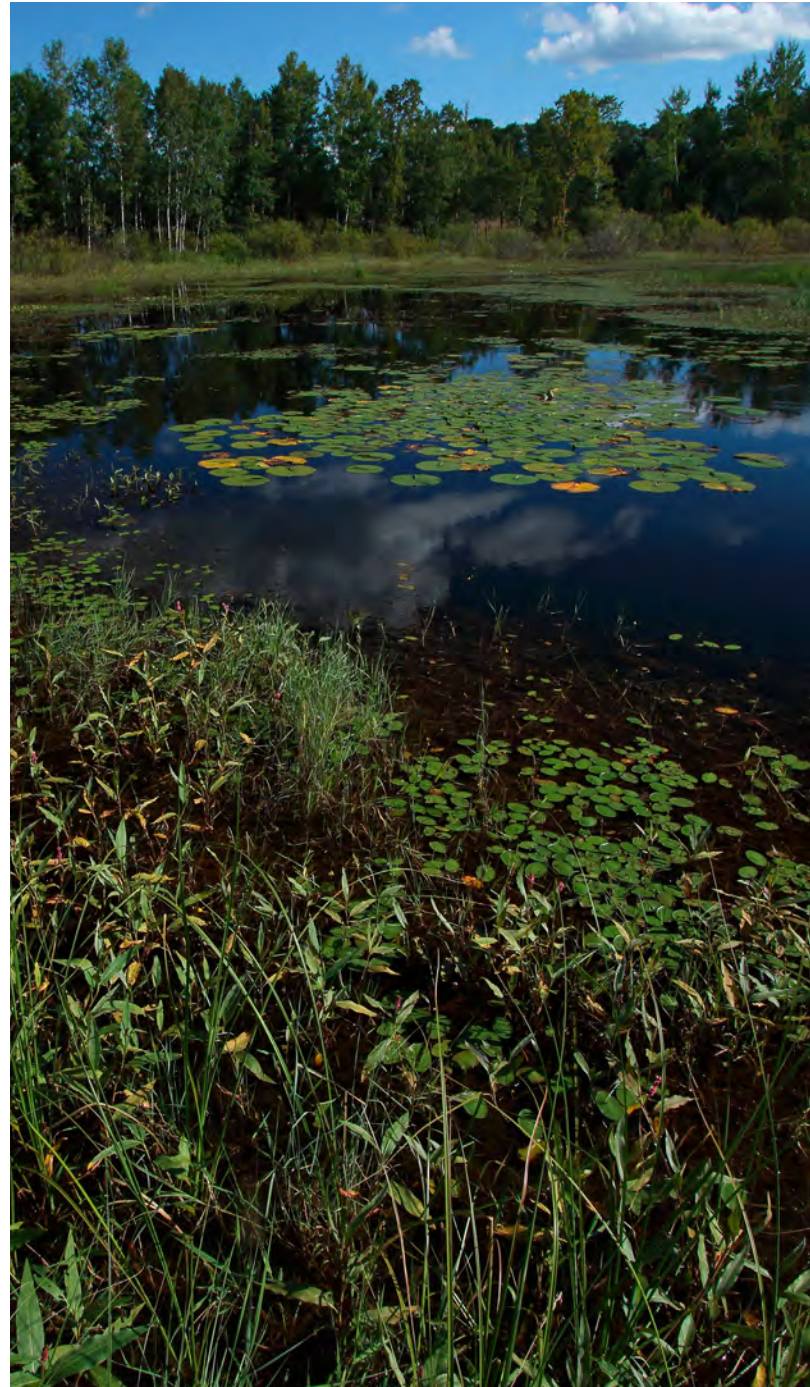


# wetland science & practice

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## **TWO EXAMPLES OF HYDRARCH SUCCESSION IN THE UPPER MIDWEST:**

(L) Floating shrub bog mat in Mille Lacs Kathio State Park, Mille Lacs County, Minnesota

(R) Lakeshore marsh and aquatic beds in Burnett County, Wisconsin

**Another Fall is approaching its end and another year of *Wetland Science and Practice* issues has passed with this issue.** I hope you've noticed that we are now posting all the issues except the current issue online with access open to all. Since articles will be available worldwide in three months after first published in WSP, I'm hoping that we'll get more contributions from members as well as non-members.



Ralph Tiner  
WSP Editor

This year there was enough rain to produce a bumper crop of apples at our local orchard as well as fill my vernal pools and small backyard pond with water. With the onset of cold weather, I moved water lilies from my water garden and half whiskey barrel to the pond for overwintering. I also relocated a few goldfish there as well.

The weather has been a bit strange lately. October produced record high temperatures for New England states....the warmest on record since 1895 according to the U.S. National Centers for Environmental Information (<https://visibleearth.nasa.gov/view.php?id=91278>). Monthly average temperatures for New England states were 4.2 to 4.4 degrees Celsius (7.5 to 7.9 degrees Fahrenheit) above the 20th Century average. Much warmer than average temperatures also were reported for the Mid-Atlantic and Great Lakes states, as well as for the Southwest. Yet, October temperatures in the Rocky Mountain region were among the top-10 coldest for several cities (<https://visibleearth.nasa.gov/view.php?id=91278>). The tables have turned for us in November. After experiencing a few unseasonably warm days (in the 70s F), we've experienced colder than normal days including a few very cold days with lows in the 20s and teens. The hurricane season has come to a close much to the relief of our coastal states and Caribbean neighbors.

By the time you read this issue, the EPA and the Corps will have closed the period for comments on their proposed changes to the definition of waters of the United States. SWS joined other conservation organizations in opposing those changes (see letter in *SWS News*). We're all anxious to see how this turns out. Other *SWS News* involves the initiation of the Wetland Ambassadors Program and changes to our journal *WETLANDS*. In this issue of *WSP*, you'll find the second article in a series on the history of wetland science. This one written by SWS President Arnold van der Valk is about three 19<sup>th</sup> century German and Austrian scientists who made important contributions to our field. We also have an article by SWS' Max Finlayson, William Moomaw and Gillian Davies about scientists concern for the future of wetlands given continued impacts from humans. In *Notes from the Field*, Steve Eggers provides an overview of a state wildlife area in Wisconsin along with some action images of sandhill cranes. Finally, Doug Wilcox submitted another cartoon for *From the Bog*.

Thanks to all our contributors for this issue as well as for other issues of 2017. Our next issue comes after first quarter of the New Year (March 2018) and I'm hoping that some of you make a resolution to contribute an article to *Wetland Science and Practice* in 2018.

Til then, Happy Holidays, and keep enjoying the swamps! ■

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*Examples of hydrarch succession*  
(Photos courtesy of Steve Eggers)

SOCIETY OF WETLAND SCIENTISTS

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**Note to Readers:** All State-of-the-Science reports are peer reviewed, with anonymity to reviewers.

## PRESIDENT'S MESSAGE

**In this report, I will discuss two topics that will impact the future of SWS, the new status of Sections and our projected budget deficit for 2018.** I will begin with the good news, the new status of Sections, and then move on to the bad news, our projected budget deficit for 2018 and our plans to deal with it.



Arnold van der Valk  
SWS President

### SECTIONS

SWS is currently making a serious effort to become a more international organization. Strengthening and raising the visibility of our Sections is an important first step in the internationalization plan. Active and visible Sections will help us to attract new members, especially from outside North America.

The Board of Directors and the membership have voted overwhelmingly to equalize the status of all our interest groups, Chapters and Sections. This means our Sections will now have a vote on the Board of Directors, just like Chapters. With this change in status, Sections are expected to expand their activities and to use their dues to provide services similar to those of Chapters (for example, student scholarships, student research grants, organize specialty meetings, etc.). Under our current funding mechanism, however, Sections receive much less funding than Chapters, and a new funding mechanism is needed that will provide Sections the resources needed to expand their activities. What this new funding mechanism should be is currently under discussion and will be a major agenda item at the upcoming Board of Directors meeting.

As part of the ongoing effort to increase the visibility of our Sections, SWS also needs to develop new sections that will be of interest to wetland scientists around the world. We established two new sections (Education, Public Policy and Regulation) this year. But we need additional sections in areas like wetland management, tropical wetlands, mangroves, remote sensing, wetland classification, invasive species, etc. New Sections can only be initiated by a petition signed by 25 member. If you have an interest in getting a new Section established, please let me know ([valk@iastate.edu](mailto:valk@iastate.edu)) and I can help you with the logistics of getting a petition organized.

### BUDGET

The proposed SWS budget for 2018 is projected have a deficit of over \$100,000. In other words, predicted revenues in 2018 from dues, meeting income, royalties, etc. will not come close to covering our projected expenses. Why? Besides the inevitable increase in fixed expenses due to inflation, our expenses have grown over the last few years due to new initiatives and programs (doubling per capita payments to chapters, Wetlands Ambassadors, Wetlands

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# wetland science & practice

PRESIDENT / [Arnold van der Valk, Ph.D., PWS](#)  
PRESIDENT-ELECT / [Beth Middleton, Ph.D.](#)  
IMMEDIATE PAST PRESIDENT / [Gillian Davies, PWS](#)  
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CANADA / [Gordon Goldborough, Ph.D.](#)  
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EUROPE / [Matthew Simpson, PWS](#)  
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## Wetland Ambassadors Graduate Research Fellowship

The Society of Wetland Scientists (SWS) is pleased to announce the availability of two to three Wetland Ambassadors Graduate Research Fellowships for the Summer of 2018. The fellowships will provide the opportunity for a graduate student to travel to another country and conduct groundbreaking wetland research with some of the world's top wetland research scientists.

### ELIGIBILITY

In order to be considered for a fellowship, the applicant must:

- Currently be enrolled in a M.S. or Ph.D. program related to wetland science (e.g. biology, environmental science, environmental engineering, etc.).
- Be proficient in the English language.
- Be in good academic standing and demonstrate interest in wetland science.
- Not have previously been awarded a Wetland Ambassador Graduate Research Fellowship.

### APPLICATION INSTRUCTIONS

To apply for the fellowship, applicants must complete all materials at the application website by **Friday, January 12th at 11:59pm EST**: <https://fs24.formsite.com/SWS2015/form41/index.html>

The application requires:

- General personal and demographic information
- Academic transcripts (unofficial transcripts are acceptable)
- 1 letter of recommendation (not from family member, or current graduate research advisor)
- 2 brief essays
- Deliverables agreement (delineates responsibilities of fellow, if awarded)

Before applying, all applicants must review the official 2018 list of Research Mentors at [http://www.sws.org/images/Wetland\\_Ambassadors/WA-Research-Mentors-2018.pdf](http://www.sws.org/images/Wetland_Ambassadors/WA-Research-Mentors-2018.pdf) to determine their top three choices of mentor if chosen as a Wetland Ambassador. Applicants can also contact potential mentors with any questions prior to applying. The 2018 list of research mentors, their project proposals, and contact information is below, and can also be accessed on the SWS website here: <http://www.sws.org/Awards-and-Grants/wetland-ambassadors-graduate-research-fellowship.html>. ■

## Take Full Advantage of Your Membership Through SWS' Monthly Webinar Series

Participate in outstanding educational opportunities without leaving your desk! SWS is pleased to provide its webinar series on wetland science topics of interest. The convenience and flexibility of SWS webinars enables you to educate one or a large number of employees at once, reduce travel expenses, and maintain consistent levels of productivity by eliminating time out of the office. Webinar registration is a complimentary member benefit. Certificates of completion are available upon request and can be used towards PWS certification. A limited number of spots are available for each webinar. If you're unable to participate in the live webinar, all webinars are recorded and archived for complimentary viewing by SWS members.

### MORE INFORMATION ABOUT UPCOMING WEBINARS:

[www.sws.org](http://www.sws.org)  
>Events >Upcoming Webinars

### MISSED A WEBINAR?

View webinar archives at:  
[www.sws.org](http://www.sws.org)  
>Events >Past Webinars

Webinars are now viewable with subtitles on YouTube! The Webinar Committee is excited to announce that our free webinar recordings are now available on the SWS YouTube channel. SWS supporters around the world can watch the webinars with subtitles in their native language. To view the webinars with subtitles, click the "CC" button in the bottom, right-hand corner of the video. You can change the language of the subtitles by clicking on the settings button in the bottom, right-hand corner and going to subtitles/CC > auto-translate > and choosing the language of your choice. Attend a webinar with subtitles: <http://sws.ontrapages.com/youtuberegistration>. ■

### P.S. DON'T MISS THE DECEMBER WEBINAR!

The December webinar will be open to the public, so invite your friends! *Five Causal Factors: A General Framework for Wetland Science and Restoration* will be held on **Thursday, December 14, 2017, at 1:00 p.m. EST**, and presented by Paul Keddy, Ph.D., Independent Scholar and the 2017 SWS Lifetime Achievement Award Winner. [Learn more](#).

## Shop AmazonSmile this Holiday Season

In preparation for this holiday season, consider using AmazonSmile to shop; the AmazonSmile Foundation will donate .5% of the price of your purchase to the Society of Wetland Scientists! If interested in donating to SWS via AmazonSmile, visit <https://smile.amazon.com/ch/48-1146960>. You will be prompted to log into your Amazon account and select a charitable organization before you begin shopping. For more information, visit [www.smile.amazon.com/about](http://www.smile.amazon.com/about). ■

## Enter the 2017 Photo Contest

Enter your wetland photos for a chance to win a one-year SWS membership and conference registration to the 2018 SWS Annual Meeting. Four winners will be chosen; the top photos from the following three categories and one overall, grand prize winner. Anyone over the age of 18 can enter. How to enter? Check the SWS website for more information: <http://sws.org/Resources/education-and-outreach.html>. All submissions must be received by December 31, 2017, at 11:59 p.m. GMT. Questions? Contact Kara Miller at [kmiller@sws.org](mailto:kmiller@sws.org). ■

## 'Tis the Season to Renew

Membership renewal season is in full swing! Your membership will expire at the end of the year, so take the time to be jolly, and renew today! You can do so online, over the phone or through the mail. If you have any questions, please contact us at [membership@sws.org](mailto:membership@sws.org) or call us at (608) 310-7855. ■

## Check Out the New SWS Natural Disaster Relief Board

In the wake of numerous natural disasters around the world, SWS supports all those who were affected. As SWS President Arnold van der Valk said, "SWS stands by all those affected by recent natural disasters. Our hearts go out particularly to our members affected both personally and professionally. If it happened to you, it happened to all of us."

Now, SWS is proud to be an international resource for members and communities in need to connect with those offering support. We are collecting both requests for help and offers of support. Please join us in this initiative to help unify and strengthen our SWS community. Learn more: <http://sws.org/Resources/sws-natural-disaster-relief.html>. ■

## Apply for Society Awards and Student Research Grants

The SWS Awards Committee invites individuals to apply or nominate a fellow SWS colleague for SWS awards. Recipients will be recognized at the 2018 SWS Annual Meeting. Visit the Society Awards page (<http://sws.org/Awards-and-Grants/society-awards.html>) for applications, complete award descriptions, and a listing of past winners. For any questions, please contact Jen Brydges at [jbrydges@sws.org](mailto:jbrydges@sws.org). All nominations are due by January 31, 2018.

### FELLOW AWARD

The highest recognition of membership bestowed by the Society. Nominees must be active SWS members who have been nominated by other active members to receive the honor, recommended by the Fellows Committee and elected by the SWS Board of Directors.

### INTERNATIONAL FELLOW AWARD

Honors an internationally outstanding wetland scientist for distinguished contributions to the field of wetland science and for fostering the aims of SWS within his or her own country and abroad. Except for extraordinary circumstances, candidates should live and work outside of the United States.

### MERIT AWARD

Recognizes individuals demonstrating outstanding original research, achievement or contribution to wetland science while inspiring future efforts.

### INTERNATIONAL TRAVEL AWARD

Provides financial assistance to wetland scientists from developing countries that are disadvantaged through regional economic conditions. The awards are given to encourage participation in Society activities through a travel grant to the Annual Meeting and a complimentary membership for three years.

### ATTENTION STUDENTS: APPLY FOR RESEARCH GRANTS

Don't miss the opportunity to apply for an SWS student research grant. Grants are awarded on a competitive basis to graduate or undergraduate students who conduct research on wetlands. Please note that these grants are intended to aid students' costs of travel, room and board during the course of field investigation and to help cover costs of expendable materials and supplies required in the execution of the proposed research. The application and further instructions and guidelines are available on the [Student Research Grants page](#). The deadline to apply is January 31, 2018. For any questions, please contact Jen Brydges at [jbrydges@sws.org](mailto:jbrydges@sws.org). ■

## Call for Executive Board Nominations

Nominations to serve on the SWS Executive Board are now being accepted from any active SWS member in good standing. We are currently accepting nominations for both the 2018 President-Elect and Treasurer positions. If you've ever wanted to participate in the governance of your organization, we encourage you to consider completing a nomination form for one of the two open positions. If you know someone that would be a good candidate, please feel free to let us know and we'll reach out to them personally to see if they're interested. **The deadline for nominations is Friday, December 22, 2017.** Submit a nomination form: <https://fs24.formsite.com/SWS2015/form50/index.html>. Please contact Jen Brydges at [jbrydges@sws.org](mailto:jbrydges@sws.org) with any questions. ■

## Wetland Foundation Travel Grants Available

The Wetland Foundation is soliciting applications for 2018 travel grants. Applications are being accepted from any student who is currently enrolled at an academic institution in the United States and who meets the specific criteria for one of the types of grants offered. For more information, visit grants page on the Wetland Foundation website ([http://thewetlandfoundation.org/The\\_Wetland\\_Foundation/Wetland\\_Grants.html](http://thewetlandfoundation.org/The_Wetland_Foundation/Wetland_Grants.html)). Application deadline is December 18, 2017. ■

## SWS representing CASS at SACNAS 2017



SWS attended SACNAS 2017 - The National Diversity in STEM Conference - along with its Consortium of Aquatic Science Societies (CASS) partners in October.

## Call for Reviewers

The Intergovernmental Panel on Climate Change (IPCC) is seeking reviewers for its first order draft of the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, as indicated in this outline: [http://www.ipcc-nggip.iges.or.jp/home/2019refinement/fod/Decision\\_IPCC\\_XLIV-5.pdf](http://www.ipcc-nggip.iges.or.jp/home/2019refinement/fod/Decision_IPCC_XLIV-5.pdf). Wetlands and wetland management are relevant in several places: Volume 1, chapter 1; Volume 4, chapter 7; and Volume 5, chapter 6.

Based on our members' extensive knowledge in wetlands and climate change, Royal Gardner, Chair of the Ramsar Scientific and Technical Review Panel, has asked for SWS experts to participate as reviewers. Should you wish to review, you must register by February 4, 2018. You will have until February 11, 2018 to provide comments. Register: <http://www.ipcc-nggip.iges.or.jp/home/2019refinement/fod.html>. ■

## A 'Citizen Science' Assessment of the State of the World's Wetlands

In 2017, the Ramsar Section of the Society of Wetland Scientists, the World Wetland Network, and the Wildfowl & Wetlands Trust came together to gather and evaluate information from across the world and to lead a global assessment based on 'citizen-science' knowledge about the state of wetlands.

### RESPONSES

The survey received 541 useable responses from people in 92 countries in seven different languages. If you contributed to this survey, thank you for your invaluable input.

### THE STATE OF THE WORLD'S WETLANDS

Based on the responses, the global picture suggests that 30% of the wetlands reported on are in a good state, 46% are in a fair state and 24% are in a poor state. Regional differences were reported. Responses from Africa indicated that 38% of wetlands are in a poor state but only 10.2% of North American wetlands were reported to be in a poor state. Globally, the responses indicated that the 21% of wetlands have an improving state, but 36% are deteriorating with 43% not changing.

### WHAT'S NEXT?

The responses to the survey have provided a very rich source of data. This communication is only intended to provide the headline results. Further analyses are underway, the results of which will be published over the coming months, and will be presented at Ramsar's 13th Conference of Contracting Parties (COP13) in Dubai in October 2018.

If you want to be kept informed of progress please contact: [chris.rostron@worldwetnet.org](mailto:chris.rostron@worldwetnet.org). ■

## China and Asia Chapters Schedule Joint Meeting in 2018

The 2018 SWS - China Chapter and Asia Chapter Joint Meeting: Wetlands and Ecological Civilization will be held at the Comprehensive Building, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun, P. R. China from August 17 to 21, 2018. The scientific program of the forum reflects the many recent advances and breakthroughs in wetland science as well as the challenges that we face in a changing world. The forum will provide a good opportunity for participants to exchange ideas, establish collaborations, and make new friends in Asia. All SWS members are invited to attend. Please visit the webpage: <http://shidi2018.csp.escience.cn/dct/page/1> for details.

If you have any questions, please contact:

Wei-Ta Fang, Ph.D.

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E-mail: [wawaf@hotmail.com](mailto:wawaf@hotmail.com); [wtfang@ntnu.edu.tw](mailto:wtfang@ntnu.edu.tw) ■

## Get Involved with Your Local Chapter

With more than 3,000 members around the world, SWS encourages you to participate in your local chapter to get the most out of your membership. These chapters provide a local resource for networking, education and other wetland-related events.

One chapter subscription is included with your membership. You are welcome to subscribe to as many chapters as you like for a small additional fee. More information about Chapters: <http://www.sws.org/Membership/chapter-membership.html> ■

### UPCOMING CHAPTER MEETINGS

- **13th Europe Chapter Meeting**  
April 30 – May 4, 2018  
Ohrid, Macedonia
- **2018 Asia Chapter and China Chapter Joint Meeting: Wetlands and Ecological Civilization**  
August 17 - 21, 2018  
Changchun, P. R. China

## President's Message continued

of Distinction, video intern, Webinars, etc.). During this same period, however, we did not raise dues, nor were we able to find new sources of revenues.

The Executive Board, the Ways and Means Committee, and the Membership Committee are currently working on developing a comprehensive plan to deal with this budget situation. This plan will have three parts: (1) developing an annual disbursement policy from our endowment; (2) increasing annual dues; and (3) selectively cutting funding for, or possibly eliminating, some initiatives or programs.

The Ways and Means Committee is developing a sustainable disbursement policy for our endowment, i.e., determining how much money we can expect annually from our endowment to cover our operating expenses. SWS currently does not have an endowment disbursement policy. Such a policy is designed (1) to provide funds each year to support some of our activities and (2) to preserve the real value of the endowment over time. We are very lucky that we have an endowment, without it SWS would be facing major cutbacks in its programs and activities. Nevertheless, our endowment is not large enough for a sustainable disbursement in 2018 to come close to covering the projected budget deficit. In addition, much of our endowment can only be used to cover costs associated with various SWS awards.

The Membership Committee is examining how much we need to increase member dues, by far our largest source of revenues. As already mentioned, SWS has not raised its dues for a number of years. In order to cover the projected deficit, we will have to raise our dues.

If the additional revenues from our endowment and increased dues are not enough to eliminate the projected deficit, the Executive Board will make recommendations to the Board of Directors to reduce funding for, or to eliminate, existing initiatives or programs, but it will do so only as a last resort. The Executive Board has already voted not to increase funding in 2018 for any existing program or initiative above 2017 levels. Because our budget should reflect our strategic plan, any required cuts to existing programs or initiatives will be based on their relevance to our strategic plan. ■

## SWS Joins Other Scientific Organizations in Opposing Narrower Definition of Waters of the U.S.

In June, the EPA and the U.S. Army Corps of Engineers announced the proposed repeal of the 2015 Clean Water Rule in anticipation of replacing it with a narrower definition of “Waters of the U.S.” or “WOTUS.” The EPA and the Army Corps of Engineers are currently soliciting recommendations for this new definition, the second step in the rulemaking process.

SWS joined with several science societies in opposition to a new, narrower definition of WOTUS based on Justice Antonin Scalia’s plurality opinion in *Rapanos v. United States*, 547 U.S. 715 (2006). This definition would include only those relatively permanent, standing or continuously flowing bodies of water and only those wetlands with a continuous surface connection to bodies that are ‘waters of the United States’ in their own right. Additionally, it must be hard to distinguish the boundary between the primary water and the wetland that has the continuous surface connection between the primary water and the wetland, in order for the wetland to be jurisdictional. The societies believe such a definition is unsupported by the peer-reviewed

science and that the proposed redefinition of WOTUS based on Justice Scalia’s opinion would make it impossible to achieve the objective of the Clean Water Act (CWA), which is, “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”

SWS fully supports the 2015 rule, and along with 11 other scientific societies, representing nearly 200,000 members, urged EPA and the Corps to include headwaters, tributaries and wetlands with a significant nexus to primary waters in any new definition of WOTUS even if they do not exhibit a continuous surface connection to primary waters. Excluding these waters poses a significant threat to the integrity and security of our drinking water, public health, fisheries, and wildlife habitat, while significantly increasing the risks and costs associated with flood and storm damage. A copy of the response letter follows.

Please note that other SWS letters of comment can be reviewed here: <http://www.sws.org/Resources/letters-of-comment.html>. ■

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The American Fisheries Society • American Institute of Biological Sciences • Association for the Sciences of Limnology and Oceanography • Coastal and Estuarine Research Federation • Ecological Society of America • Freshwater Mollusk Conservation Society • International Association for Great Lakes Research • North American Lake Management Society • Phycological Society of America • Society for Ecological Restoration • Society for Freshwater Science • Society of Wetland Scientists

November 20, 2017

The Honorable Scott Pruitt  
Administrator  
U.S. Environmental Protection Agency  
Office of Policy Regulatory Reform  
Mail Code 1803A  
1200 Pennsylvania Ave NW  
Washington, DC 20460

The Honorable Ryan A. Fisher Acting Assistant Secretary  
of the Army for Civil Works Office of the Assistant Secretary  
of the Army for Civil Works  
Department of the Army 104 Army Pentagon Washington,  
DC 20310-0104

**RE: DOCKET ID NO. EPA-HQ-OW-2017-0480; PROPOSED RULE: DEFINITION OF “WATERS OF THE UNITED STATES: PRE-PROPOSAL OUTREACH COMMENTS”**

Dear Administrator Pruitt and Mr. Fisher:

On behalf of our nearly 200,000 members, the undersigned science societies respectfully submit the following comments in response to your solicitation regarding the proposed rule, Definition of “Waters of the United States” - Pre-proposal Outreach Comments, EPA-HQ-OW-2017-0480, published in the Federal Register on August 28, 2017. The



undersigned societies are science-based organizations with diverse areas of expertise in the ecological, hydrologic and biological sciences. Our members work in the private sector, academia, and various tribal, state and federal agencies. We support wetland and aquatic resource research, education, restoration and sustainable management, and foster sound science. Thus, we promote science-based policy-making for the benefit of aquatic resources and the goods and services these resources supply in support of the health and economy of local communities.

We fully support the definition of “Waters of the United States” (WOTUS) in the 2015 Clean Water Rule: Definition of Waters of the United States as promulgated by the agencies in 80 FR 37054, June 29, 2015 (2015 CWR). We strongly oppose the repeal of the 2015 CWR rule and vehemently object to a definition of WOTUS based on Justice Antonin Scalia’s plurality opinion in *Rapanos v. United States*, 547 U.S. 715 (2006). In *Rapanos*, Justice Scalia asserted that the “only plausible interpretation [of WOTUS] includes only those relatively permanent, standing or continuously flowing bodies of water ‘forming geographic features’ that are described in ordinary parlance as ‘streams[,] ... oceans, rivers, [and] lakes’ [and] only those wetlands with a continuous surface connection to bodies that are ‘waters of the United States’ in their own right, so that there is no clear demarcation between ‘waters’ and wetlands, are ‘adjacent to’ such waters and covered by the Act.”(Justice Scalia Opinion).

The proposed redefinition of WOTUS based on the Justice Scalia Opinion would make it impossible to achieve the objective of the Clean Water Act (CWA), which is, “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.” (33 U.S.C. 1251, Sec 101(a)). Such a definition would exclude numerous waters that affect the chemical, physical and biological integrity of primary waters (traditional navigable waters, interstate waters, and the territorial sea). The proposed redefinition based on the Justice Scalia Opinion reflects a fundamental misunderstanding of the integral role that headwaters, tributaries, and wetlands play in the chemical, physical and biological integrity of the downstream primary waters. Such a definition appears to ignore the functional relationship between headwaters, tributaries, wetlands, and the downstream primary waters that they feed and support, as well as the functional objective of the CWA itself. Excluding the hydrological and ecological function of wetlands and waters that support primary waters poses a significant threat to the integrity and security of our drinking water, public health, fisheries, and wildlife habitat, while significantly increasing the risks and costs associated with flood and storm damage. Limiting jurisdiction of the CWA to tributaries and wetlands that are “relatively permanent” and/or have a “continuous surface connection” to primary waters is unreasonable in light of the scientific literature and current knowledge. This definition is simply unsupported by the peer-reviewed science.

Further, the CWA states, “it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985.” Should headwaters, wetlands and tributaries with a significant nexus, but not necessarily a continuous surface connection, to primary waters lose protection, pollutant levels will increase and will, more often than not, flow or seep into the downstream/downgradient primary waters. In this provision, the CWA requires that the “discharge” of pollutants be eliminated, and does not distinguish among the various points at which the pollutants may potentially enter the source waters, as: a) flow from a primary water, b) flow from an intermittent, headwater, or tributary water, or c) unchanneled seepage from a wetland. In any of these situations, the result is potentially wide-spread pollution of navigable waters, which violates the Clean Water Act.

Headwaters, tributaries, and wetlands with a significant nexus to primary waters transfer the nutrients, pollutants, oxygen, minerals, sediments, fish and other biota that they are carrying to the downstream/downgradient primary waters in much the same way that capillaries, lesser blood vessels, and peripheral organs contribute to the functioning of the heart and brain. Maintaining the chemical, physical and biological integrity of organs receiving blood flow from peripheral regions of the body is not possible if these peripheral features are significantly compromised or polluted. In both cases, the overall health of the human body or the primary water body is damaged or lost if the peripheral features are unprotected from significant damage or pollution.

We are extremely concerned about the implications of a definition of WOTUS based on a Justice Scalia Opinion, because this would likely exclude most wetlands that are currently regulated, as well as those with a significant nexus to primary waters that would be regulated under the 2015 CWR. Such a definition relies on an artificial visual characteristic that is unrelated to the functional connection between waters and wetlands with a “significant nexus” (i.e., functional connection) to primary waters, and is equally unrelated to achievement of the objectives of the CWA. Countless headwater streams, tributaries and millions of prairie pothole and vernal pool wetlands across the country would be unprotected. Many, if not most, forested, shrub/scrub, peatland and marsh wetlands are not continuously connected to relatively perma-

nent or continuously flowing bodies of water and would not be protected. Even some iconic waters and wetlands would be excluded from jurisdiction under such a definition including:

- the iconic Big Cypress Swamp in the Western Everglades,  
Parts of:

- the Okefenokee Swamp in Georgia and Florida,
- wetland permafrost areas in Alaska,
- the patterned peatlands in Minnesota such as those in the Lake Agassiz Lowlands,
- the Atchafalaya Swamp in Louisiana, and
- the Hockomock Swamp in Massachusetts.

The economic and public health and safety value of the ecosystem services provided by these waters and wetlands cannot be overestimated. Protection of the integrity and function of wetlands and headwaters greatly reduces both risks and costs.

In states that have no state wetland protection laws, these “waters and wetlands that safeguard the chemical, physical and biological integrity of the Nation’s waters” would be unprotected at both the federal and state levels. Before implementing any new WOTUS definition, we urge the agencies to fully evaluate the impact of such a change at the state level, and the capacity and willingness of states to take on responsibility for ensuring that the chemical, physical and biological integrity of the Nation’s waters is not compromised<sup>1</sup>.

The 2015 CWR was supported by peer-reviewed science and evidentiary analysis, and was subject to rigorous independent peer review and a robust public comment process. We urge you to conduct a similar process for any new definition of WOTUS. Additionally, any new definition of WOTUS should be consistent with, and supported by, the scientific evidence, documented in the EPA’s *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence* report<sup>2</sup>, which underwent external peer review by the EPA Science Advisory Board, and incorporates results from over 1,200 peer-reviewed scientific publications. Any new WOTUS definition should also be consistent with scientific evidence presented in the *Brief of the Amici Curiae in Support of Respondents and in Support of Upholding the Clean Water Rule*<sup>3</sup>, filed with the U.S. Court of Appeals for the Sixth Circuit, as well as numerous peer-reviewed studies (e.g., Golden et al. 2017)<sup>4</sup>, agency experience and U.S. Supreme Court precedent. Any new definition of WOTUS should be supported by a complete and scientifically valid economic analysis, like the one conducted for the 2015 CWR, and as supported by the numerous economic studies referenced at the end of this letter<sup>5</sup>.

Wetlands sustain essential habitat for fish, wildlife and waterfowl to feed, breed, nest, spawn, and rear their young. The areas comprising our nation’s wetlands have been reduced by over 50% over the past 200 years and now cover a small portion of our landscapes (<6% of the land area in the lower 48 states), but they play a disproportionately significant role in protecting our nation’s waters.

Wetlands, headwater streams and tributaries provide vital services that promote human health and safety, and support American businesses. These essential components of our hydrologic networks improve water quality in our streams, lakes, and groundwater by naturally cleansing surface waters, including urban, mining, timber harvesting and agricultural runoff; they also provide stored water during drought, and absorb stormwater runoff and floodwaters, reducing disaster recovery costs. A 2016 study (Narayan et al. 2016)<sup>6</sup> found that coastal wetlands prevented \$625 million in property damages during Hurricane Sandy, and that coastal wetlands reduced annual property damages in Ocean County, New Jersey by nearly 20%. Many of the stream and wetland resources that provide these economic benefits would not be protected under the definition of WOTUS in the Judge Scalia Opinion.

Should the agencies decide to move forward in developing a new definition of WOTUS, we urge you to include headwaters, tributaries and wetlands with a significant nexus to primary waters (i.e., those covered by the 2015 CWR) even if they do not exhibit a continuous surface connection to primary waters. The protection of water quality, water supply, and aquatic ecosystem health, the prevention of storm, flood, property, and infrastructure damage, and the protection of the chemical, physical, and biological integrity of WOTUS will be jeopardized without the protection afforded by headwaters, tributaries, wetlands (including some isolated wetlands), and adjacent waters as outlined in the 2015 CWR. A definition of WOTUS that provides more limited protection of wetland and aquatic resources than those identified in the 2015 CWR would lead to incomplete achievement of the CWA mandate, as noted in this comment letter, with costly and significant negative consequences for American citizens, businesses, and communities, as they experience deteriorated water quality, more limited water supplies, more severe flood and storm damage to properties and infrastructure, reduced fisheries, reduced recreational activities supporting American businesses, and degraded ecosystem and wildlife habitat conditions.

Compensation for losses as well as any restoration of these ecosystem services will result in significant financial costs to our citizens and our nation, which we can ill afford. Considering the critical functions of our nation's wetlands, headwater streams and tributaries in providing a broad suite of ecosystem services to society and the costs associated with replacing those ecosystem services, as well as the far-reaching implications for fish, wildlife, and their habitat from redefining WOTUS based on the Justice Scalia Opinion or similar narrow definition, we urge the EPA and the Army Corps of Engineers to either reaffirm the existing 2015 CWR, or to develop a WOTUS definition and associated revised rule that is as scientifically, legally, economically and ecologically robust as the 2015 CWR so that the concerns and interests of American citizens, businesses, communities, and the approximately 200,000 members of our societies are addressed.

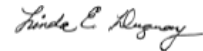
Sincerely,



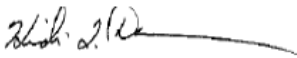
Douglas J. Austen, Executive Director  
American Fisheries Society




Robert Gropp, Ph.D., Co-Executive Director  
American Institute for Biological Sciences

Linda Duguay, President  
Association for the Sciences of Limnology  
and Oceanography

Heidi Dunn, President  
Freshwater Mollusk Conservation Society




Robert R. Twilley, President  
Coastal and Estuarine Research Federation




Erin Dunlop, President  
International Association for Great Lakes  
Research



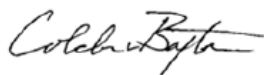

Katherine S. McCarter, Executive Director  
Ecological Society of America




Frank Wilhelm, President  
North American Lake Management Society




Timothy A. Nelson, President  
Phycological Society of America

Colden Baxter, President  
Society for Freshwater Science




Bethanie Walder, Executive Director  
Society for Ecological Restoration




Arnold van der Valk, President  
Society of Wetland Scientists



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## Join Us - 2018 SWS Annual Meeting

The Society of Wetland Scientists' 2018 Annual Meeting will be hosted at the Hilton Denver City Center in Denver, Colorado, May 29 - June 1, 2018.

*Wetland Science: Integrating Research, Practice and Policy - An Exchange of Expertise* will focus on the intercommunication of the most recent developments in wetland science, practice and policy between the different sectors of SWS. It will encourage collaboration and partnerships among wetland researchers, practitioners, managers and policymakers, with the overall goal of improving wetland science. Please visit [swsannualmeeting.org](https://www.swsannualmeeting.org) for info about the Annual Meeting.

### SUBMIT ABSTRACT

We are currently accepting abstract submissions. The deadline for abstract submissions is January 15, 2018.

### PLAN TO ATTEND!

Registration will open in mid-December. You won't want to miss the educational presentations, workshops, field trips, and symposia, as well as the camaraderie of networking with like-minded scientists. We can't wait to see you in May! ■



## Support the SWS Annual Meeting

### SPONSOR

A variety of sponsorship levels are available on a first-come, first-selected basis and are sure to provide international exposure among leaders in wetland science. For more information: <https://www.swsannualmeeting.org/sponsor>.

Not sure which sponsorship opportunity to choose? Construct your own sponsorship package to fit your unique needs and goals. To discuss sponsorship and reserve an opportunity for your company, please contact Amanda Safa ([asafa@sws.org](mailto:asafa@sws.org)). More info about sponsorship opportunities on the following two pages. ■

### EXHIBIT

SWS meetings gather the highest level of wetland professionals, researchers and managers to provide an unequalled opportunity for you to network and build countless professional connections. Simply complete and return the Exhibitor Agreement to reserve your booth today! For more information visit the Exhibitors page on the meeting website (<https://www.swsannualmeeting.org/exhibit>). Agreements must be received by April 30, 2018. To discuss exhibiting at the 2018 SWS Annual Meeting, contact Amanda Safa ([asafa@sws.org](mailto:asafa@sws.org)). ■

### SILENT AUCTION

The SWS Rocky Mountain Chapter will host a silent auction during the Poster Session reception on Thursday, May 31, 2018. All proceeds will go directly to the Chapter to support future Chapter initiatives including support for students in wetland science and funding for student research. Members and friends of the wetland science community are invited to donate an item or service.

Donations may be related to the wetland profession, such as field equipment, or personal interests, such as books, movie passes, sports memorabilia, or gift cards. Silent auction items will be on display for all registrants to see and bid on.

Please indicate your interest by returning the donation form found on the Silent Auction page (<https://www.swsannualmeeting.org/silent-auction>) by Monday, April 30, 2018. Thank you for investing in the future of wetland science! ■



## SWS 2018 Annual Meeting Denver, Colorado ■ May 29 - June 1

Wetland Science: Integrating Research, Practice, and Policy - An Exchange of Expertise

# Sponsorship Opportunities

A variety of sponsorship levels are available on a first-come, first-selected basis and are sure to provide international exposure among leaders in wetland science. Not sure which sponsorship opportunity to choose? Construct your own sponsorship package to fit your unique needs and goals.

### CONTRIBUTING LEVEL \$500

Help make the SWS 2018 Annual Meeting a success by making a general contribution.

### BRONZE LEVEL \$1,000

- **DAILY PLENARY SPEAKER.** The 2018 Annual Meeting will feature three highly renowned plenary speakers who will present the latest wetland research. Three opportunities available.
- **DAILY MORNING & AFTERNOON REFRESHMENTS.** Attendees will enjoy light snacks and beverages during daily morning and afternoon refreshments. Six opportunities available.

### SILVER LEVEL \$2,500

- **POSTER SESSION & SILENT AUCTION.** The 2018 poster session will showcase the latest wetland research and provide an opportunity to meet with experts to learn about their scientific studies. The Rocky Mountain Chapter will also be holding a silent auction to help fund Chapter activities.
- **STUDENT MIXER.** A great opportunity for student attendees to mingle, exchange ideas and learn about opportunities for involvement in SWS.
- **ATTENDEE PEN.** Attendees will receive a meeting-themed pen in their attendee bag which will feature the sponsor's logo.

### GOLD LEVEL \$5,000

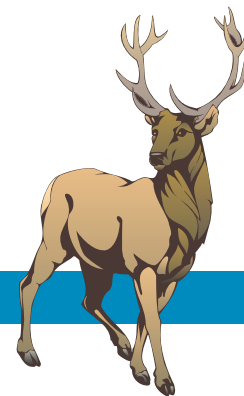
- **HOTEL ROOM KEY.** All guests will receive a custom hotel key card as they check in under the SWS hotel block which will feature the sponsor's logo.
- **ATTENDEE BAG.** Meeting-branded attendee bags will be distributed to all participants containing important meeting materials. The sponsor's logo will be featured on each bag.
- **LANYARDS.** Meeting-themed lanyards will be distributed to each attendee at registration which will feature the sponsor's logo.
- **WATER BOTTLE.** Attendees will receive a meeting-themed water bottle in their attendee bag which will feature the sponsor's logo.

### PLATINUM LEVEL \$7,500

- **WELCOME RECEPTION.** The 2018 Annual Meeting will kick off with a special Welcome Reception providing attendees the chance to network with friends, old and new, over hors d'oeuvres and cocktails.
- **MOBILE APP.** Attendees will be able to access the meeting program, general meeting information and session details via their smart phones and the web. The sponsor's logo will be featured on the homepage of the app.
- **WIFI.** Internet access will be available at the meeting venue. The sponsor's logo will be featured on the landing page with the option to customize the WIFI network and password.

BENEFITS OF SPONSORSHIP	\$500	\$1,000	\$2,500	\$5,000	\$7,500
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One marketing item dropped in attendee bag			★	★	★
One complimentary registration to the SWS Annual Meeting				★	
Two complimentary registrations to the SWS Annual Meeting					★
One complimentary exhibit booth at the SWS Annual Meeting					★

\*Prices in U.S. dollars.



## Conference Journal Advertising Opportunities

Increase your visibility at the SWS 2018 Annual Meeting by participating as an advertiser in the Conference Journal. Limited ad space available and insertion is on a first-come, first-served basis. Don't miss this special opportunity to showcase your brand to conference attendees.

### SIZE OPTIONS (\*prices in U.S. dollars)

Select	Size/Placement	Size	Rate
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<input type="checkbox"/>	Full Page (Back Cover or Inside Front Cover), with no bleeds	6"w x 10.5"h	\$2,000
<input type="checkbox"/>	½-Page Horizontal *	6"w x 5.125"h	\$750
<input type="checkbox"/>	½-Page Vertical *	2.875"w x 10.5"h	\$750

\* Only eight ½-page ads will be sold.

<b>Full Page</b> (Back Cover or Inside Front), with bleeds \$2,000	<b>Full Page</b> (Back Cover or Inside Front), with no bleeds \$2,000	<b>Half Page</b> <b>Horizontal</b> \$750	<b>Half Page</b> <b>Vertical</b> \$750
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- Advertisement attached/enclosed       Advertisement arriving separately

### IMPORTANT DATES

Advertising reservation deadline: March 29, 2018

Artwork submission deadline: April 5, 2018

Please send this reservation form, as well as print-ready art files, to [asafa@sws.org](mailto:asafa@sws.org).

### SUBMISSION GUIDELINES

The advertising art file that you submit must follow these guidelines:

- .Pdf file type
- High-resolution, of at least 300 dpi
- CMYK color space
- Any bleeds need to be at least .125"

To discuss sponsorship or advertising opportunities, contact Amanda Safa, [asafa@sws.org](mailto:asafa@sws.org), 608-310-7855.

## Antecedent Wetland Ecologists - German and Austrian in the Ninetieth Century

Arnold van der Valk<sup>1</sup>, *Ecology, Evolution and Organismal Biology, Iowa State University, Ames, IA*

Please note that this is the first of a series in WSP. Many of the people, and even institutions, who influenced the development of the wetland science as a field have recently died or closed, and many other pioneering wetland scientists have retired or will soon retire. Given this, we would like to capture the early history of our science by getting the people who created it to write about their reasons for becoming wetland scientists and their contributions to the field. This series of articles will focus on two major topics: (1) the contributions of major scientists working in wetlands to the development of wetland science, and (2) the roles of major wetland institutions and organizations in the development of wetland science. Each article will highlight major advances, organizational and/or intellectual, that have shaped wetland science in the United States and around the world.

We have invited a number of distinguished wetland scientists to contribute articles in the series. We also like to invite anyone interested in the history of wetland science to submit an article for this series. We are particularly interested in accounts of the history of wetland science outside of the United States. If you would like to contribute an article to this series, please contact either of the editors of this series, Arnold van der Valk, Ecology, Evolution and Organismal Biology, Iowa State University, Ames, IA 50011 ([valk@iastate.edu](mailto:valk@iastate.edu)) or Gordon Goldsborough, Department of Biological Sciences, University of Manitoba, Winnipeg, MB R3T 2N2, Canada ([gordon.goldsborough@umanitoba.ca](mailto:gordon.goldsborough@umanitoba.ca)).

### ABSTRACT

The ideas of three nineteenth-century German-speaking, academic scientists (Anton Kerner, Karl Möbius, and Heinrich Schenck) greatly influenced the development of wetland ecology. Anton Kerner in his landmark book, *Das Pflanzenleben der Donaulaender*, described hydrarch succession as an orderly process and also discussed the implications of large-scale drainage of wetlands in Hungary on regional climate. Studies of oyster beds by Karl Möbius resulted in the formulation of the concept of ecological

communities being in equilibrium due to the interaction of their constituent species, unless they are disturbed. Heinrich Schenck pioneered the study of aquatic plants and their adaptations for life under water. All three raised the visibility of wetlands and wetland plants in the scientific community in the nineteenth century.

### INTRODUCTION

As originally formulated in the 19<sup>th</sup> century by Ernst Haeckel (1834-1919) in his *Generelle Morphologie*, ecology was the study of organisms and their interactions in their natural environment, as opposed to their study in the laboratory (Haeckel 1866). In other words, ecology is the study of organisms in nature. Haeckel, an early supporter of Darwin, saw it as a new, much needed science that focused on the study of natural selection. For an account of the development of an ecological perspective among thinkers interested in natural history in the early nineteenth century like Alexander von Humboldt, Charles Darwin, and many of their contemporaries, see Donald Worster's *Nature's Economy* (1977).

Ecology did not develop in a systematic way, however, but as an accumulation over time of numerous, disparate studies done on a variety of organisms (algae, invertebrates, plants, birds, fish, mammals, etc.) in a variety of environmental contexts (grasslands, forests, lakes, oceans, rivers, wetlands, etc.). From its inception, ecology has always consisted of a myriad of subdisciplines often focused on a specific type of ecosystem such as grassland ecology, forest ecology, tropical ecology, limnology, etc. or on a group of organisms such as animal ecology, insect ecology, plant ecology, etc. Because they were typically trained as either botanists or zoologists, most pioneering ecologists in the late nineteenth and early twentieth centuries thought of themselves as either plant ecologists or animal ecologists, if they thought of themselves as ecologists at all.

How did the science of wetland ecology develop? Wetland ecology is clearly a subdiscipline of ecology. As I will demonstrate in a later installment in this series, wetland ecology did not become a self-conscious science, i.e., a science with a recognized name with which scientists identified themselves, until the 1970s. Nevertheless, prior to the 1970s, there were many scientists who worked exclusively,

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primarily, or occasionally on wetlands or wetland organisms. Their studies collectively form the basis for what came to be called wetland ecology.

At this point, I would like to make an important distinction between what have been called protoecologists and what I will call antecedent ecologists. Protoecologists are individuals who made observations that in retrospect would be considered to fall within the science of ecology. Such observations can be found in numerous writings from classical antiquity to those of Darwin. Frank Egerton's book *Roots of Ecology: Antiquity to Haeckel* (2012) provides a detailed account of many protoecologists and their observations. Antecedent ecologists are individuals in a variety of disciplines, mostly scientific, whose research work or writings on organisms, populations, communities, or ecosystems created an interest in ecology as an object of scientific study and/or who raised the visibility of ecology both within the scientific community and outside it. Most, but not all antecedent ecologists were academic scientists, but some were not scientists at all.

In this paper, I am going to examine the contributions of three nineteenth-century German-speaking, antecedent wetland ecologists, two academic botanists (Anton Kerner, Heinrich Schenk) and one academic zoologist (Carl Möbius), to the development of wetland ecology. In my brief discussions of their scientific contributions, I will emphasize how novel ecological insights from their studies of wetlands or wetland organisms contributed to a greater awareness of the importance of wetlands among their contemporaries and how this helped lay the foundation for wetland ecology. Two of these scientists (Kerner and Möbius) are widely recognized for their contributions to the development of "scientific ecology" in Europe (McIntosh 1985, Acot 1998, van der Valk 2011). The influence of the third, Schenck, has been more limited, and he is little known today (Les 2003). Nevertheless, he was an important contributor to the study of wetland plants and their adaptations to aquatic life. In the writings of these men are found many of the important ideas about wetlands and wetland plants that shaped the development of wetland ecology.

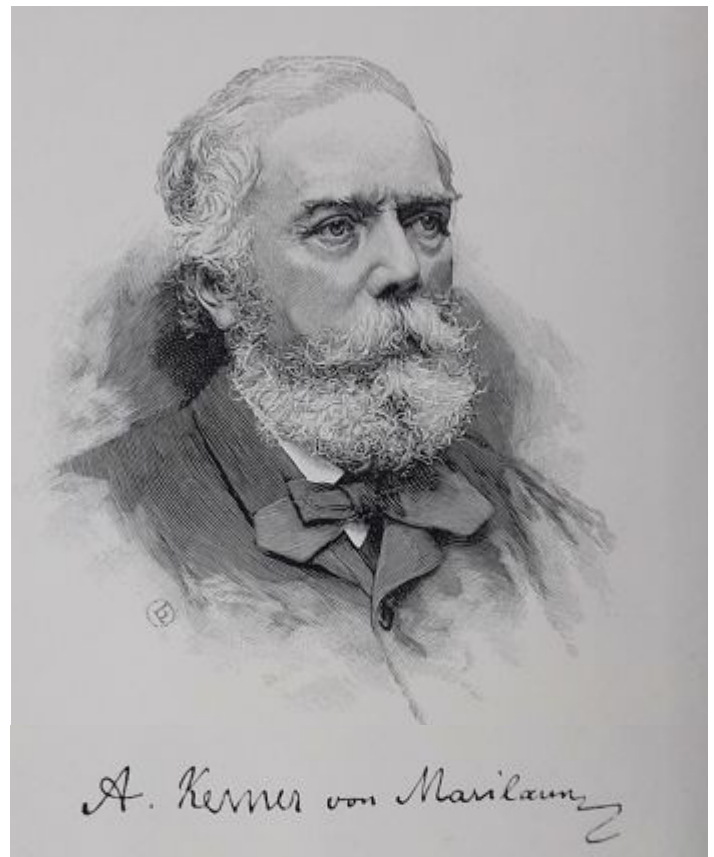
### **ANTON KERNER VON MARILAÜN (1831-1898)**

Anton Kerner (Figure 1) grew up in what is now Austria. As a boy, he developed a life-long interest in plants. Although he studied medicine at the University of Vienna (1848-1854) and became a medical doctor, he quickly gave up medicine after a cholera epidemic in 1855. For the rest of his life, he worked as a botanist and eventually became a professor of botany and director of the botanical garden at the University of Innsbruck (1860-1878) and then the University of Vienna (1878-1898).

In 1863, Kerner published his most influential book, *Das Pflanzenleben der Donauländer* or *The Plant Life of the Danube Basin*. It was translated into English by Henry S. Conard (1951) as *The Background of Plant Ecology*. In the Foreword to his translation, Conard described Kerner's book as the "immediate and direct parent of all later works on Plant Ecology." This book made Kerner famous in Europe, and it is still considered to be a landmark work on the classification of vegetation (Conard 1951, McIntosh 1985).

"The horizontal and vertical assorting of large plant communities is by no means accidental in spite of its apparent lack of order. It follows certain immutable laws. Every plant has its place, its time, its functions, and its meaning. In every zone, plant life has been developing through an inconceivably long time according to the same pattern to build up its green structure over naked earth. In every zone the plants are gathered into definite groups, which appear either developing or as finished communities, but never transgress the orderly structure and correct composition of their kind." (Translation from Conard 1951). According to Kerner, it is the role of plant geographers to define and characterize these recurring plant communities and their development. Kerner notes that it was the descriptions of exotic vegetation types in "word and picture" from around the world that poured into Europe in the early and mid-

**FIGURE 1.** Anton Kerner von Marilaün. (From F. W. Oliver 1904)

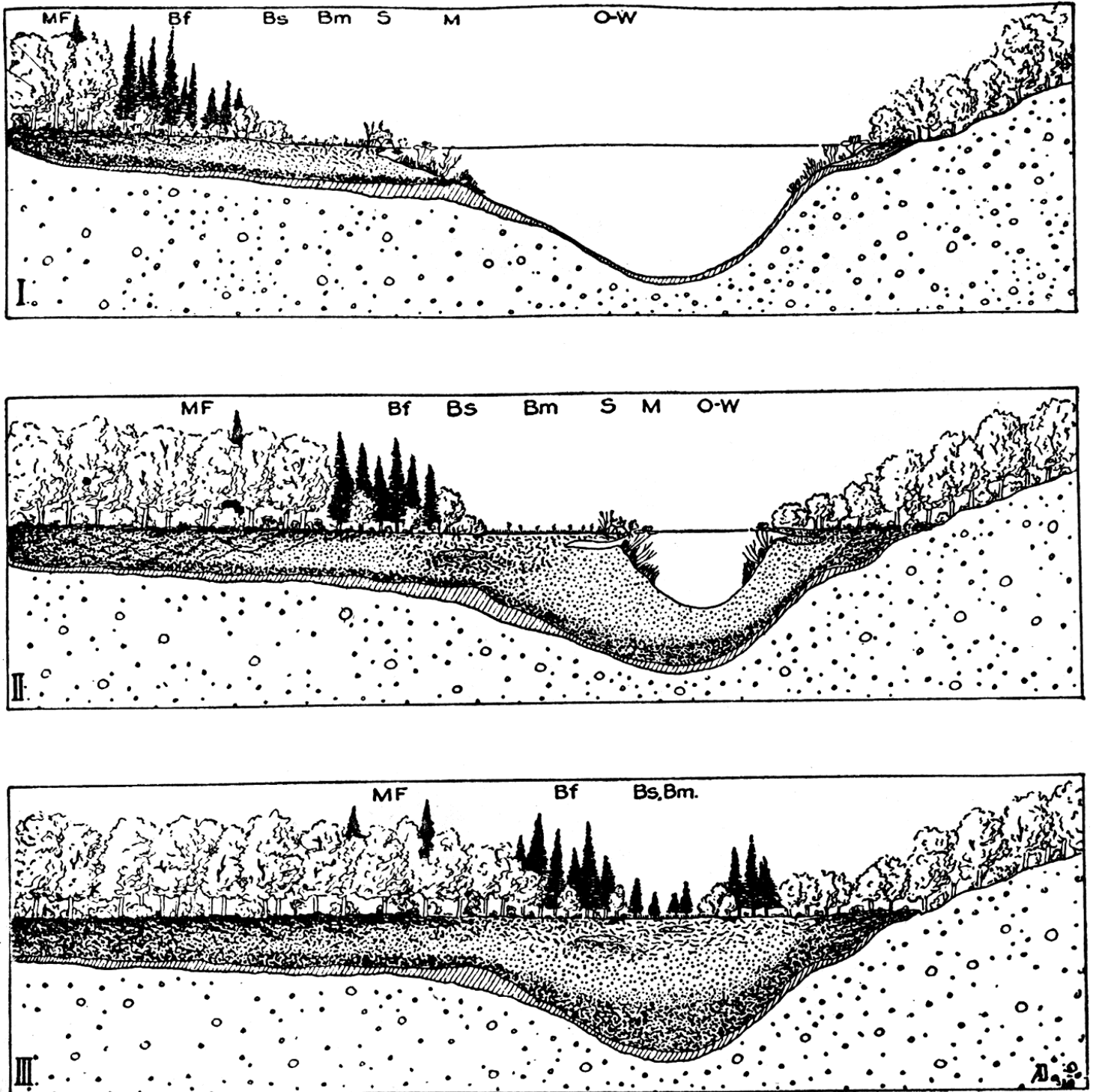


nineteenth century that stimulated an interest, including his own, in the natural vegetation of Europe.

It is Chapter 9, How a Swamp becomes a Meadow, in *The Plant Life of the Danube Basin* that particularly influenced the development of wetland ecology. In it, Kerner

describes what came to be known as hydrarch succession. "In the shore of every pond which is not disturbed by the hand of man one notices a growth of "rushes," and in the water, wherever it is not too deep, countless floating and submerged water plants, which beneath the clear water

**FIGURE 2.** "Diagram illustrating the gradual filling up of lakes by the encroachment of vegetation, and also the stages in the origin of peat and marl deposits in lakes. The several plant associations of the Bog series, displacing one another, belong to the following major groups: (1) O. W., open water succession; (2) M., marginal succession; (3) S., shore succession; (4) B., bog succession, comprising the bog-meadow (Bm), bog-shrub (Bs) and bog-forest (Bf); and (5) M. F., mesophytic forest succession." (From Gager 1916)



at the edge of the pond, give rise to moor soil, or a peaty mass. The runners of the reeds on the shore sink their roots into this mass, the roots become enmeshed together, hold the peaty residues between their strands, and build a shelf of peat which is not always firmly attached to the bottom of the pond. Portions of this may break loose and become floating islands. Thus the cane-break reaches ever further from the shore toward the middle of the pond, the open water surface is more and more narrowly confined and finally changed to a reed formation. But in nature there is no ending and no standing still, but only an ever coming and ever going.” (Translation from Conard 1951). Kerner closes Chapter 9 with the following sentence, “Having now learned how unaided nature reclaims the swamp lands in the Hungarian lowlands, it will be profitable to take a look at the results of reclamation by the hand of man.” Chapter 10 is titled “Draining the Swamps.”

In Chapter 10, Kerner examines the environmental implications of a very large (300 square miles, “as large as the Kingdom of Württemberg”) wetland drainage project in Hungary to create more farmland. The question that Kerner asks himself is, how this will affect the climate of the region and its vegetation? He predicts “increases in the extreme differences in temperatures” between summer and winter. Summer rainfall he also predicts will decrease because of reduced evapotranspiration in the region. Eventually, these climatic changes will cause changes in the upland vegetation.

Kerner’s book made wetlands an exciting and productive object of study for ecologists. He emphasized the potential importance of wetlands for understanding succession, their significance for regulating regional climates, and the potential negative impacts of their drainage for an entire region. Kerner was one of the first to appreciate the services provided by wetlands. His description of a pond going from open water to meadow due to the annual deposition of dead plant material became the textbook example of succession (Figure 2). Versions of Figure 2, which is from a 1916 introductory botany text (Gager 1916), that are based on Kerner’s description of hydrarch succession, are still readily available today on the internet as classic examples of succession. Kerner’s emphasis on the orderly and predictable development of vegetation during hydrarch succession would greatly influence the thinking of both later European and America ecologists interested in succession, e.g., Frederic E. Clements. It would not be for another hundred years that more detailed studies of actual hydrarch successions would provide a more nuanced and very different paradigm of hydrarch succession. More on this in a later installment.

### KARL AUGUST MÖBIUS (1825-1908)

Karl Möbius (Figure 3) was born in Saxony, a province of Prussia, now part of Germany. Because his parents could not afford to send him to university, he was trained to become a primary school teacher, and he taught in an elementary school for five years. He developed an interest in natural history after reading Alexander von Humboldt’s books. In 1849, he began studying natural history at the University of Berlin. In 1853, he obtained a job in Hamburg as a high school teacher and completed his doctorate. His natural science studies eventually resulted in a position at the Hamburg Museum of Natural History. Möbius also was one of the founders of the Hamburg Zoo and the first public aquarium in Germany. His main research interests were in marine invertebrates like corals, and he is credited with discovering symbioses in marine invertebrates. While in Hamburg, Möbius began working on the invertebrates of the Baltic Sea near the coastal city of Kiel. In 1868, he was appointed to a professorship at the University of Kiel and the directorship of the Kiel Zoological Museum. While at Kiel, he began to study oysters and oyster cultivation. In 1877, he published an influential monograph, *Die Auster und die Austernwirtschaft* (The Oyster and Oyster Farming). In it, he described in detail the interactions among different organisms in a community, an oyster bank. In 1887, Möbius was appointed the director of the Zoological Museum in Berlin. For more information about Möbius and his later career, see Nyhart (1998, 2009) and Glaubrecht (2008).

It is Möbius’ studies of oyster banks that establish the idea in ecology that assemblages of organisms in an area, because they interact with each other, form a stable com-

**FIGURE 3.** Karl August Möbius. (From Museum für Naturkunde, Berlin, Germany)



munity. In other words, not just abiotic factors (salinity, temperature, light, etc.), but also biotic factors (competition, predation, parasitism, etc.) control the composition and relative abundance of species in an area. He coined the term *biocönose* to describe such living communities. His monograph on oysters was translated into English by H. J. Rice for the U.S. Commission of Fish and Fisheries (Rice 1883) which brought Möbius' ideas about communities to the attention of English-speaking ecologists.

According to Möbius, an oyster bank "is thus, to a certain degree, a community of living beings, a collection of species and a massing of individuals, which find here everything necessary for their growth and continuance, such as suitable soil, sufficient food, the requisite percentage of salt, and a temperature favorable to their development. Each species that lives here is represented by the greatest number of individuals which can grow to maturity subject to the conditions which surround them, for among all species the number of individuals which arrive at maturity at each breeding period is much smaller than the number of

germs produced at that time. ... Science possesses, as yet, no word for a community where the sum of species and individuals, being mutually limited and selected under the average external conditions of life, have, by means of transmission, continued in possession of a certain definite territory. I propose the word *Biocoenosis* for such a community. Any change in any of the relative factors of a biocönose produces changes in other factors of the same. If, at any time, one of the external conditions of life should deviate for a long time from its ordinary mean, the entire biocönose, or community, would be transformed. It would also be transformed, if the number of individuals of a particular species increased or diminished through the instrumentality of man, or if one species entirely disappeared from, or a new species entered into, the community." (Rice's translation as quoted in Nyhart 1998).

Möbius' definition of community stressed four things: (1) physical conditions largely determine which species can live in an area; (2) the interactions among different species regulated their abundances; (3) there is a large difference between the number of propagules (colonizers) and the number of mature individuals in a community; and (4) the community exists in a balanced state (equilibrium) that would only change if a factor controlling its composition and/or interactions among its component species changed, including human interference like harvesting. His ideas about the nature of communities still resonate with ecologists today.

#### HEINRICH SCHENCK (1860–1927)

Heinrich Schenck (Figure 4) was born in Siegen, Germany, received a doctorate from the University of Bonn (1884), became a lecturer at Bonn in 1889, and, starting in 1896, taught at the Polytechnic Institute of Darmstadt, where he was also the director of the botanical garden. Unlike Kerner and Möbius, Heinrich Schenck is not a major figure in the development of ecology. But Schenck is a major contributor to the development of wetland ecology.

Plant ecology arose primarily in Germany in the 1880s (Cittadino 1990). This happened because of three important developments: (1) Darwin's publication in 1859 of *The Origin of Species* with its emphasis on adaptations and natural selection, (2) an increased interest in plant geography (spatial distribution of plants) that resulted from European explorations in Asia, South America, and Africa, and (3) the rapidly developing field of plant physiology in Germany due to major advances in chemistry and optics. This resulted in an interest among German antecedent ecologists in trying to explain how plant anatomical and morphological adaptations enabled plant species to live in different climatic regions, e.g., deserts and the wet tropics. This fu-

**FIGURE 4.** Heinrich Schenck. (From Les 2003)



*H. Schenck*

sion of plant geography and plant physiology to form plant ecology resulted in the development of a central ecological tenet: the distribution of organisms is largely determined by their physiological tolerances.

One of the major figures in the development of plant ecology was Simon Swendener (1829-1919), especially after he arrived at the University of Berlin in 1878 (Cittadino 1990). Swendener encouraged his students to study plants in their natural environments in order to understand how the anatomy and morphology of their organs (leaves, stems, roots, etc.) make it possible for them to live in regions with different climates. Although Swendener himself was not a believer in natural selection, his students were heavily influenced by Darwin. In effect, Swendener's students took German botanical laboratory science and applied it to the study of plant distribution.

Heinrich Schenck was one of these students who was greatly influenced by Swendener. Schenck studied primarily at the University of Bonn, starting in 1880 and receiving his doctorate in 1884, but he spent 1881-1882 at the University of Berlin where he came into contact with Swendener. After completing his doctorate, Schenck began to study the adaptations of aquatic plants. How did the anatomical and morphological features of aquatic plants allow them to survive under water?

In 1886, Schenck published a major monograph, *Die Biologie von Wassergewächse (The Biology of Aquatic Plants*; Les 2003). Agnes Arber (1920) called Schenck's book "... one of the most important general contributions ever made to the study of water plants..." In it, Schenck noted that "... they [aquatic plants] inhabit such a strange medium, in which the physiological process is partially carried out differently than in air, in which the demands to the mechanical construction of the plant are also different, and in which special adaptations must arise in floral organization, in the means of fertilization, in the formation of fruits and seeds, in their dispersal, and in their germination." Schenck's work on aquatic plants highlighted their amazing anatomical and morphological adaptations, and thus focused attention on wetlands as an important habitat that could be profitably studied by scientists who were becoming interested in ecology. As Les (2003) notes, Schenck's classic work is today almost completely unknown, but this should not be the case. Like Kerner and Möbius, he greatly raised the visibility of wetlands and wetland plants in the scientific community in the nineteenth century and beyond. ■

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## The Second Warning to Humanity and Wetlands

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### INTRODUCTION

Ripple et al. (2017) have issued a “Second Warning to Humanity” on the 25<sup>th</sup> anniversary of the “World Scientists Warning to Humanity” that was issued by the Union of Concerned Scientists (1992). The 1992 warning came from 1700 independent scientists who asked us to take action to curtail the environmental degradation that was all too obvious and which would have dire outcomes for humankind. They warned that we were on a collision course with nature. Their warning included the declining availability of fresh water, destruction of biodiversity, ocean dead zones, and climate change – all issues of concern to wetland researchers, managers and decision-makers. The warning provided by Ripple et al (2017) builds on the initiative of the Union of Concerned Scientists and provides an updated call for further and urgent action.

To read the 2017 Second Warning, which was signed by 15,364 scientists from 184 countries, readers may access the website at <http://scientistswarning.forestry.oregonstate.edu/>. Scientists wishing to add their names to the Second Warning, may continue to do so at the website noted above. To read the 1992 statement, readers may access the following website <http://www.ucsusa.org/sites/default/files/attach/2017/11/World%20Scientists%27%20Warning%20to%20Humanity%201992.pdf>.

Ripple et al. (2017) report that “with the exception of stabilizing the stratospheric ozone layer, humanity has failed to make sufficient progress in generally solving these foreseen environmental challenges, and alarmingly, most of them are getting far worse”. They raised concerns about the “current trajectory of potentially catastrophic climate change due to rising GHGs from burning fossil fuels”. We are well aware that many wetlands are vulnerable to the consequences of climate change (Middleton and Souter 2016). They also pointed to the unleashing of “a mass extinction event, the sixth in roughly 540 million years, wherein many current life forms could be annihilated or at least committed to extinction by the end of this century. Wetlands are part of this – the Millennium Ecosystem (2005) reported on the appalling loss of wetland biodiver-

sity; a situation that has been confirmed by more recent analyses (Davidson et al. 2014; Gardner et al. 2015).

Further, this decline has occurred in the face of 25 years of policy development and consensus decisions through the Ramsar Convention on Wetlands, which brings into question the value of such processes (Finlayson 2012). There is also doubt that the Convention will be able to adequately respond to the impending consequences of climate change (Finlayson et al. 2017). More accurately, there is doubt that the contracting parties (countries) to the Convention who make the decisions and are responsible for their implementation will be able to respond adequately unless there is a rapid and major turnaround in policy and practice. Additionally, a number of countries have implemented wetland protection at various levels of government, with mixed results. Calls to stop and reverse the loss of wetlands, such as made in the Mediterranean (Hollis et al. 1992) have not been heeded. In the United States, the goal of “no net loss” of wetlands continues to elude us, and the wetlands that do remain often face continued degradation (Dahl 2011). Our changing climate further exacerbates existing stressors on wetlands (Middleton and Souter 2016).

### WETLANDS AND THE SECOND WARNING

The need to address the existing causes of wetland loss and degradation has been recognised by the wetland research community, as expressed through many publications, as summarised in global assessments, such as the Millennium Ecosystem Assessment (2005), as well as a diversity of wetland laws and policies (Finlayson and Gardner 2016; Bonells 2016). However, wetland loss and degradation has not been stopped, let alone reversed. Given that calls to stop and reverse this loss and degradation were instrumental in developing the Ramsar Convention, it is obvious that something more is needed. The Second Warning to Humanity provides another call and also a template to highlight the particular issues for wetlands. The steps recommended in the Second Warning (Ripple et al. 2017) have been paraphrased in the text below with a particular emphasis on wetlands:

- (a) prioritize the enactment of connected well-funded and well-managed reserves for a significant propor-

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tion of the world's wetlands, being aware that while approximately 18.6% of the global wetland area of 12.1 million km<sup>2</sup> (Davidson et al. 2018) is now contained within sites listed as Wetlands of International Importance (and known as Ramsar sites) under the Ramsar Convention a systematic appraisal of the management effectiveness at these sites is not available;

- (b) maintain the ecosystem services provided by wetlands by halting their conversion to other land uses, thereby reducing or eliminating the loss of many of these services that have been shown to incredibly important for people, and include the supply of food, fresh water, storm regulation and coastal protection, as well as cultural and spiritual benefits (Millennium Ecosystem Assessment 2005);
- (c) restore native wetland plant communities at landscape scales, being aware that the high rates of wetland loss and degradation over centuries have led to changes in the distribution of many species as well as the introduction of invasive alien species that have changed the ecological functioning of many wetlands (Finlayson 2009).
- (d) re-wild wetlands with native species, especially apex predators, to restore ecological processes and dynamics, noting that such measures, to be successful, need careful planning and engagement with local communities in order to reduce conflicts between such animals and people (Law et al. 2017).
- (e) develop and adopt adequate wetland policies at local, provincial and national levels to reduce the loss of native animals, poaching and over fishing, and the ongoing exploitation and unregulated trade of threatened species (Finlayson and Gardner 2016; Bonells 2016).

Ripple et al. (2017) make further recommendations about the social and economic drivers of biodiversity loss which apply generically across different ecosystem types and which have largely been included in wetland assessments. However, it is argued that given the results on the ground these recommendations have not yet been sufficient to make the difference that is required if these valuable ecosystems are to be maintained or restored for the betterment of humankind.

## THE SECOND WARNING AND THE SOCIETY OF WETLAND SCIENTISTS

With the knowledge that we have about wetlands and their importance for people through the multiple ecosystem services that they provide from protecting urban areas from storm surges and flooding, providing water supply during

drought, protecting water quality, providing nurseries for many valuable ocean species, to sequestering greenhouse gases from the atmosphere, there seems little rhyme or reason for the continuing loss and degradation of wetlands despite existing laws, treaties and policies. The warnings have been made and have been repeated. With more than 15,000 signatories to the Second Warning and the formation of an Alliance of World Scientists (<http://scientists.forestry.oregonstate.edu/>) concerned about global climate and environmental trends there are opportunities for more responses, including from scientists who are well placed to assist with the development of practical solutions and to communicate with the public and decision makers at all levels. This includes addressing the science and understanding the importance of climate change for wetlands.

The Society of Wetland Scientists took a step to inform its membership about the issues of climate change and wetlands at its June 5-8, 2017 Annual Meeting in San Juan, Puerto Rico by issuing the San Juan Statement on Climate Change and Wetlands (Figure 1). This raised the importance of policy decisions, including at an international level, for mitigating climate change and supporting resiliency to the climate changes that are already underway. It also requested wetland managers and scientists to share the statement and support local to global efforts to combat climate change for the betterment of humankind.

FIGURE 1: The San Juan Statement

### SOCIETY OF WETLAND SCIENTISTS SAN JUAN STATEMENT ON CLIMATE CHANGE AND WETLANDS

The following participants at the Society of Wetland Scientists 2017 Annual Meeting encourage(s) policy makers in all countries to continue their collaborative efforts to develop and implement international policies, such as the Paris Climate Agreement, to mitigate global climate change and, in so doing:

- Ensure the protection of existing carbon banks in wetlands and encourage carbon sequestration;
- Maintain or restore wetlands for their biodiversity and ecosystem services, including climate resiliency;
- Request all wetland managers and scientists to share this statement and support local to global efforts to combat climate change for the betterment of humankind.”

This may seem a small step in light of the weight attached to the ongoing inter-governmental negotiations and decisions undertaken through the UN Framework Convention for Climate Change and the Ramsar Convention for Wetlands, among others, but as raised in the Second Warning to Humanity, it is important that we share and communicate our views on critical environmental issues, as well as inform decision-makers. With this in mind, you may want to share the San Juan Statement with your colleagues as well as add your name to the Second Warning statement, if you haven't done so already. In these ways, we can offer our support to each other as we strive to collect relevant information and inform policy and decision-makers about the need to take immediate steps to address the key issues that are faced by wetlands (and other ecosystems) globally, and to support the continued provision of ecosystem services that provide many benefits to many people. ■

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## WETLANDS Introduces Permanent Series on Topics in Wetland Science

Marinus Otte, Editor-in-Chief, WETLANDS ([marinus.otte@ndsu.edu](mailto:marinus.otte@ndsu.edu))

Since its inception over 35 years ago, *WETLANDS* published three ‘article types’: research articles, review papers, and short communications. Occasionally, a Special Issue on a specific topic appeared. The journal will continue to do so, but the publications are now categorized by ‘article types’ around a theme, with the aim to highlight the many subdisciplines and topics that make up ‘wetland science’.

When submitting an article, authors will now be asked to first select an ‘article type’ according to those themes, currently under the headings of:

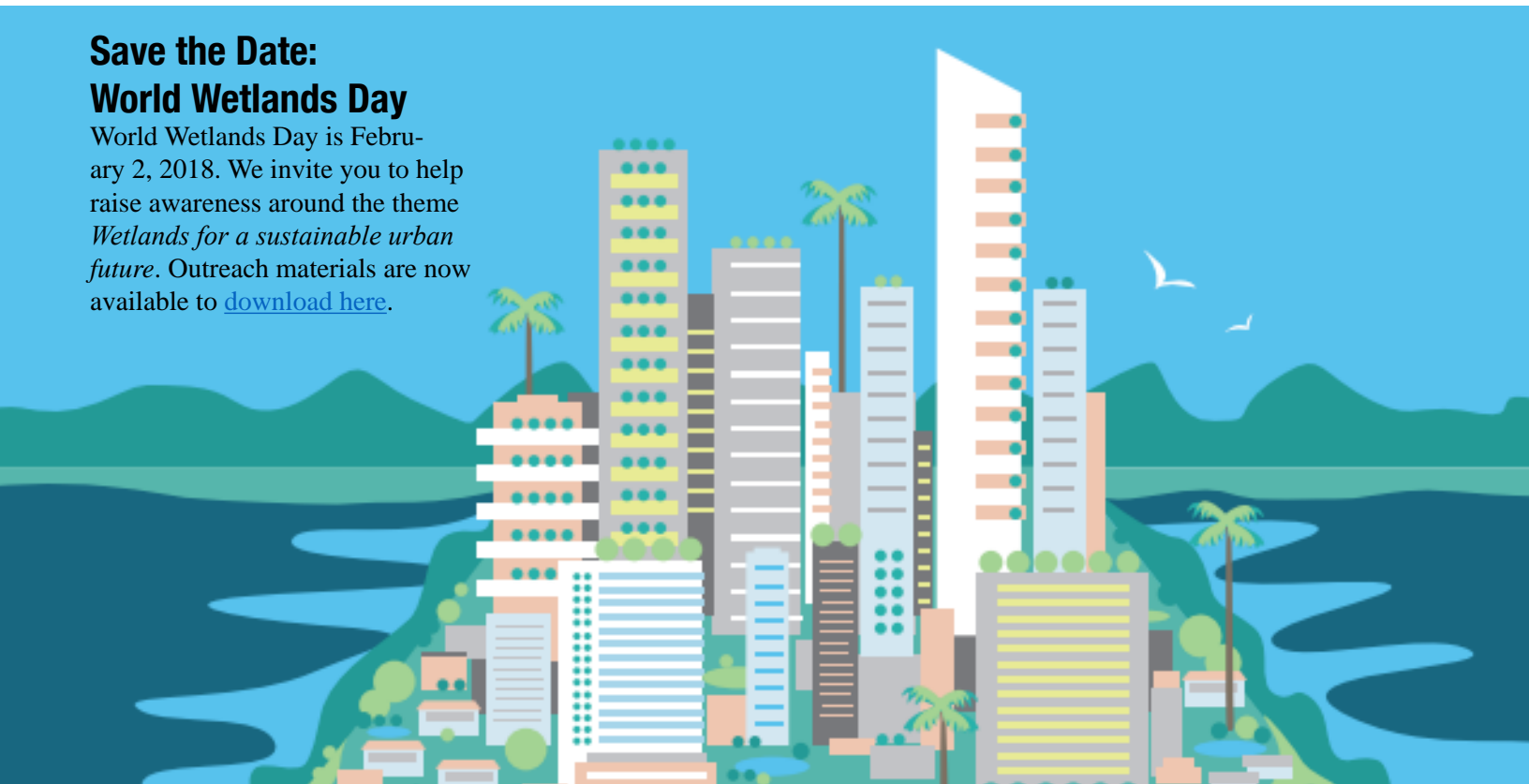
- Mark Brinson Reviews
- Wetlands in the Developing World
- Applied Wetland Science
- Socio-economic Aspects of Wetlands
- Wetlands and Climate Change
- Ramsar
- Wetlands Education
- Wetlands Restoration

- Wetlands Conservation
- Constructed Wetlands
- Ecosystem Services of Wetlands
- Wetlands and Indigenous People
- General Wetland Science

The latter applies to all papers that do not fit the other article types. Within the ‘article types’ then, authors are asked to choose a category of research article, review or short communication, except for the Mark Brinson reviews, which are all review papers. More themes will be developed over time. When published, papers will now have a banner at the top with the title of the theme. It is hoped that this new approach will serve the purpose of explaining the breadth of publication topics that fit the field of Wetland Science, as well as to provide one platform for papers that were previously spread across a range of journals (for example, Ramsar). ■

### Save the Date: World Wetlands Day

World Wetlands Day is February 2, 2018. We invite you to help raise awareness around the theme *Wetlands for a sustainable urban future*. Outreach materials are now available to [download here](#).



Steve Eggers of the St. Paul District of the U.S. Army Corps of Engineers submitted this overview of one of his favorite natural areas. He wanted to share some of his sandhill crane photos with WSP readers. Besides being an avid photographer, Steve has extensive knowledge of the region's wetlands. His field guide *Wetland Plants and Plant Communities of Minnesota and Wisconsin* (co-authored with Donald Reed) is a must-read for any wetlander working in those states. It is fully illustrated with color photos of wetland types and characteristic plants. The third edition of this book is available online free-of-charge at: [http://www.bwsr.state.mn.us/wetlands/delineation/WPPC\\_MN\\_WI/](http://www.bwsr.state.mn.us/wetlands/delineation/WPPC_MN_WI/).

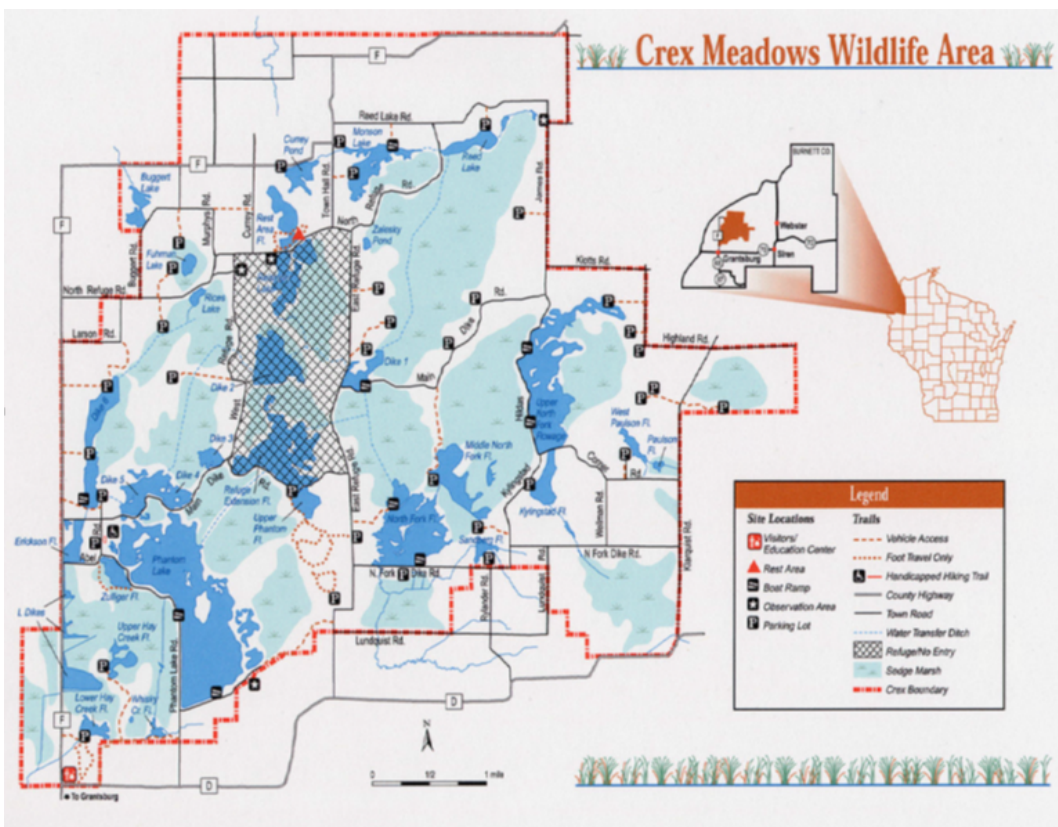
**CREX MEADOWS STATE WILDLIFE AREA, BURNETT COUNTY, WISCONSIN**

Crex Meadows is an approximately 30,000 acre wildlife area in northwestern Wisconsin (Figure 1). It consists of restored wetlands and brush prairie intensively managed by the Wisconsin Department of Natural Resources (Figure 2). Two hundred eighty species of birds, 720 species of plants, and 96 species of butterflies have been recorded within the site. Karner blue butterflies, trumpeter swans, Blandings turtles, gray wolves, and sharp-tailed grouse are some of the notable species. Spring and autumn migrations bring in thousands of sandhill cranes, up to 8,000 during the autumn migration (Figure 3 a, b, c).

Glaciers receding some 13,000 years ago left a gently rolling to nearly flat, sandy plain including large expanses of marshes. Large-scale drainage began in the 1890s. In 1912 the Crex Carpet Company purchased 23,000 acres and produced “wire-grass” rugs primarily using two sedge species: *Carex lasiocarpa* and *Carex oligosperma*. “Crex” is a colloquial expression for the genus name, *Carex*. The Crex Carpet Company operated successfully until the development of linoleum for floor covering, which resulted in the company going bankrupt in 1933. The drought of the 1930s and additional drainage in the 1940s further reduced the areal extent and quality of the marshes. Soils were poor for farming and large tracts of land went tax-forfeit. In 1946, the State of Wisconsin purchased the first parcel of what would become the present-day approximately 30,000 acre wildlife area. Prescribed burns and reversing the effect of drainage ditches through ditch plugs/berms are two of the tools used to manage the acreage.

For additional information, see <http://dnr.wi.gov/topic/lands/wildlifeareas/crex.html>. ■

**FIGURE 1.** Crex Meadows State Wildlife Area



**FIGURE 2.** Wire-grass sedge meadow. (Steve Eggers photo)



**FIGURE 3.** Sandhill cranes: a) in flight, b) preparing to land, c) feeding, and d) taking off at sunset. (Steve Eggers photos).





For the latest news on wetlands and related topics, readers are referred to the Association of State Wetland Managers website. Their “Wetland Science News” section include links to newspaper articles that should be of interest: <https://www.aswm.org/news/wetland-science-news>. Additional resources are listed below. Please help us add new books and reports to this listing. If your agency, organization, or institution has published new publications on wetlands, please send the information to Ralph Tiner, Editor of Wetland Science & Practice at [ralphtiner83@gmail.com](mailto:ralphtiner83@gmail.com). Your cooperation is appreciated. ■

### BOOKS

- Wetland Indicators – A Guide to Wetland Formation, Identification, Delineation, Classification, and Mapping <https://www.crcpress.com/Wetland-Indicators-A-Guide-to-Wetland-Identification-Delineation-Classification/Tiner/p/book/9781439853696>
- Wetland Soils: Genesis, Hydrology, Landscapes, and Classification <https://www.crcpress.com/Wetland-Soils-Genesis-Hydrology-Landscapes-and-Classification/Vepraskas-Richardson-Vepraskas-Craft/9781566704847>
- Creating and Restoring Wetlands: From Theory to Practice <http://store.elsevier.com/Creating-and-Restoring-Wetlands/Christopher-Craft/isbn-9780124072329/>
- Salt Marsh Secrets. Who uncovered them and how? <http://trnerr.org/SaltMarshSecrets/>
- Remote Sensing of Wetlands: Applications and Advances. <https://www.crcpress.com/product/isbn/9781482237351>
- Wetlands (5th Edition). <http://www.wiley.com/WileyCDA/WileyTitle/productCd-1118676823.html>
- Black Swan Lake – Life of a Wetland <http://press.uchicago.edu/ucp/books/book/distributed/B/bo15564698.html>
- Coastal Wetlands of the World: Geology, Ecology, Distribution and Applications <http://www.cambridge.org/us/academic/subjects/earth-and-environmental-science/environmental-science/coastal-wetlands-world-geology-ecology-distribution-and-applications>
- Florida’s Wetlands <http://www.pineapplepress.com/ad.asp?isbn=978-1-56164-687-6>
- Mid-Atlantic Freshwater Wetlands: Science, Management, Policy, and Practice <http://www.springer.com/environment/aquatic+sciences/book/978-1-4614-5595-0>
- The Atchafalaya River Basin: History and Ecology of an American Wetland <http://www.tamupress.com/product/Atchafalaya-River-Basin.7733.aspx>
- Tidal Wetlands Primer: An Introduction to their Ecology, Natural History, Status and Conservation <https://www.umass.edu/umpress/title/tidal-wetlands-primer>
- Wetland Landscape Characterization: Practical Tools, Methods, and Approaches for Landscape Ecology <http://www.crcpress.com/product/isbn/9781466503762>
- Wetland Techniques (3 volumes) <http://www.springer.com/life+sciences/ecology/book/978-94-007-6859-8>

- Wetland-related publications: [-http://acwc.sdp.sirsi.net/client/en\\_US/default/search/results?te=&lm=WRP](http://acwc.sdp.sirsi.net/client/en_US/default/search/results?te=&lm=WRP)  
[-http://acwc.sdp.sirsi.net/client/en\\_US/default/search/results?te=&lm=WRP](http://acwc.sdp.sirsi.net/client/en_US/default/search/results?te=&lm=WRP)
- National Wetland Plant List publications: <http://rsgisias.crrel.usace.army.mil/NWPL/>
- National Technical Committee for Wetland Vegetation: [http://rsgisias.crrel.usace.army.mil/nwpl\\_static/ntcwg.html](http://rsgisias.crrel.usace.army.mil/nwpl_static/ntcwg.html)
- U.S. Environmental Protection Agency wetland reports and searches: <http://water.epa.gov/type/wetlands/wetpubs.cfm>
- A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Forested Wetlands in Alluvial Valleys of the Coastal Plain of the Southeastern United States [ERDC/EL TR-13-1](http://erdc.gov/ERDC/EL-TR-13-1)
- Hydrogeomorphic (HGM) Approach to Assessing Wetland Functions: Guidelines for Developing Guidebooks (Version 2) [ERDC/EL TR-13-11](http://erdc.gov/ERDC/EL-TR-13-11)
- Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing the Functions of Flat and Seasonally Inundated Depression Wetlands on the Highland Rim [ERDC/EL TR-13-12](http://erdc.gov/ERDC/EL-TR-13-12)

### U.S. FISH AND WILDLIFE SERVICE, NATIONAL WETLANDS INVENTORY

- Wetland Characterization and Landscape-level Functional Assessment for Long Island, New York [http://www.fws.gov/northeast/ecologicalservices/pdf/wetlands/Characterization\\_Report\\_February\\_2015.pdf](http://www.fws.gov/northeast/ecologicalservices/pdf/wetlands/Characterization_Report_February_2015.pdf) or [http://www.aswm.org/wetland-sonestop/wetland\\_characterization\\_long\\_island\\_ny\\_021715.pdf](http://www.aswm.org/wetland-sonestop/wetland_characterization_long_island_ny_021715.pdf)
- Also wetland characterization/landscape-level functional assessment reports for over 12 small watersheds in New York at: <http://www.aswm.org/wetland-science/134-wetlands-one-stop/5044-nwi-reports>
- Preliminary Inventory of Potential Wetland Restoration Sites for Long Island, New York [http://www.aswm.org/wetlandsonestop/restoration\\_inventory\\_long\\_island\\_ny\\_021715.pdf](http://www.aswm.org/wetlandsonestop/restoration_inventory_long_island_ny_021715.pdf)
- Dichotomous Keys and Mapping Codes for Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Descriptors. Version 3.0. U.S. Fish and Wildlife Service, Northeast Region, Hadley, MA.
- Connecticut Wetlands Reports
- [Changes in Connecticut Wetlands: 1990 to 2010](http://www.aswm.org/wetland-science/134-wetlands-one-stop/5044-nwi-reports)
- [Potential Wetland Restoration Sites for Connecticut: Results of a Preliminary Statewide Survey](http://www.aswm.org/wetland-science/134-wetlands-one-stop/5044-nwi-reports)
- [Wetlands and Waters of Connecticut: Status 2010](http://www.aswm.org/wetland-science/134-wetlands-one-stop/5044-nwi-reports)
- [Connecticut Wetlands: Characterization and Landscape-level Functional Assessment](http://www.aswm.org/wetland-science/134-wetlands-one-stop/5044-nwi-reports)
- Rhode Island Wetlands: Status, Characterization, and Landscape-level Functional Assessment [http://www.aswm.org/wetlandsonestop/rhode\\_island\\_wetlands\\_llww.pdf](http://www.aswm.org/wetlandsonestop/rhode_island_wetlands_llww.pdf)

### ONLINE PUBLICATIONS

#### U.S. ARMY CORPS OF ENGINEERS

- Regional Guidebook for the Functional Assessment of Organic Flats, Slopes, and Depressional Wetlands in the Northcentral and Northeast Region [http://acwc.sdp.sirsi.net/client/en\\_US/search/asset/1047786](http://acwc.sdp.sirsi.net/client/en_US/search/asset/1047786)

- Status and Trends of Wetlands in the Coastal Watersheds of the Conterminous United States 2004 to 2009. <http://www.fws.gov/wetlands/Documents/Status-and-Trends-of-Wetlands-In-the-Coastal-Watersheds-of-the-Conterminous-US-2004-to-2009.pdf>
- The NWI+ Web Mapper – Expanded Data for Wetland Conservation [http://www.aswm.org/wetlandsonestop/nwiplus\\_web\\_mapper\\_nwn\\_2013.pdf](http://www.aswm.org/wetlandsonestop/nwiplus_web_mapper_nwn_2013.pdf)
- Wetlands One-Stop Mapping: Providing Easy Online Access to Geospatial Data on Wetlands and Soils and Related Information [http://www.aswm.org/wetlandsonestop/wetlands\\_one\\_stop\\_mapping\\_in\\_wetland\\_science\\_and\\_practice.pdf](http://www.aswm.org/wetlandsonestop/wetlands_one_stop_mapping_in_wetland_science_and_practice.pdf)
- Wetlands of Pennsylvania's Lake Erie Watershed: Status, Characterization, Landscape-level Functional Assessment, and Potential Wetland Restoration Sites [http://www.aswm.org/wetlandsonestop/lake\\_erie\\_watershed\\_report\\_0514.pdf](http://www.aswm.org/wetlandsonestop/lake_erie_watershed_report_0514.pdf)

### U.S. FOREST SERVICE

- Historical Range of Variation Assessment for Wetland and Riparian Ecosystems, U.S. Forest Service Rocky Mountain Region. [http://www.fs.fed.us/rm/pubs/rmrs\\_gtr286.pdf](http://www.fs.fed.us/rm/pubs/rmrs_gtr286.pdf)
- Inventory of Fens in a Large Landscape of West-Central Colorado [http://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb5363703.pdf](http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5363703.pdf)

### U.S. GEOLOGICAL SURVEY, NATIONAL WETLANDS RESEARCH CENTER

- Link to publications: <http://www.nwrc.usgs.gov/pblctns.htm> (recent publications are noted)
- A Regional Classification of the Effectiveness of Depressional Wetlands at Mitigating Nitrogen Transport to Surface Waters in the Northern Atlantic Coastal Plain <http://pubs.usgs.gov/sir/2012/5266/pdf/sir2012-5266.pdf>
- Tidal Wetlands of the Yaquina and Alsea River Estuaries, Oregon: Geographic Information Systems Layer Development and Recommendations for National Wetlands Inventory Revisions <http://pubs.usgs.gov/of/2012/1038/pdf/ofr2012-1038.pdf>

### U.S.D.A. NATURAL RESOURCES CONSERVATION SERVICE

- Link to information on hydric soils: <http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/>

### PUBLICATIONS BY OTHER ORGANIZATIONS

- The Nature Conservancy has posted several reports on wetland and riparian restoration for the Gunnison Basin, Colorado at: <http://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/Colorado/science/climate/gunnison/Pages/Reports.aspx> (Note: Other TNC reports are also available via this website by looking under different regions.)
- Book: Ecology and Conservation of Waterfowl in the Northern Hemisphere, Proceedings of the 6th North American Duck Symposium and Workshop (Memphis, TN; January 27-31, 2013). Wildfowl Special Issue No. 4. Wildfowl & Wetlands Trust, Slimbridge, Gloucestershire, UK.
- Report on State Definitions, Jurisdiction and Mitigation Requirements in State Programs for Ephemeral, Intermittent and Perennial Streams in the United States (Association of State Wetland Managers) [http://aswm.org/stream\\_mitigation/streams\\_in\\_the\\_us.pdf](http://aswm.org/stream_mitigation/streams_in_the_us.pdf)

- Wetlands and People (International Water Management Institute) <http://www.iwmi.cgiar.org/Publications/Books/PDF/wetlands-and-people.pdf>

### ARTICLES OF INTEREST FROM VARIED SOURCES

- Comparative phylogeography of the wild-rice genus *Zizania* (Poaceae) in eastern Asia and North America; American Journal of Botany 102:239-247. <http://www.amjbot.org/content/102/2/239.abstract>

### LINKS TO WETLAND-RELATED JOURNALS AND NEWSLETTERS

#### JOURNALS

- Aquatic Botany <http://www.journals.elsevier.com/aquatic-botany/>
- Aquatic Conservation: Marine and Freshwater Ecosystems <http://onlinelibrary.wiley.com/journal/10.1002/%28ISSN%291099-0755>
- Aquatic Sciences <http://www.springer.com/life+sciences/ecology/journal/27>
- Ecological Engineering <http://www.journals.elsevier.com/ecological-engineering/>
- Estuaries and Coasts <http://www.springer.com/environment/journal/12237>
- Estuarine, Coastal and Shelf Science <http://www.journals.elsevier.com/estuarine-coastal-and-shelf-science/>
- Hydrobiologia <http://link.springer.com/journal/10750>
- Hydrological Sciences Journal <http://www.tandfonline.com/toc/thsj20/current>
- Journal of Hydrology <http://www.journals.elsevier.com/journal-of-hydrology/>
- Wetlands <http://link.springer.com/journal/13157>
- Wetlands Ecology and Management <http://link.springer.com/journal/11273>

#### NEWSLETTERS

Two of the following newsletters have been terminated yet maintain archives of past issues. The only active newsletter is "Wetland Breaking News" from the Association of State Wetland Managers.

- Biological Conservation Newsletter contained some articles that addressed wetland issues; the final newsletter was the January 2017 issue; all issues now accessed through the "Archives") <http://botany.si.edu/pubs/bcn/issue/latest.htm#biblio>
- For news about conservation research from the Smithsonian Institution, please visit these websites:
  - Smithsonian Newsdesk <http://newsdesk.si.edu/>
  - Smithsonian Insider <http://insider.si.edu/>
  - The Plant Press [http://nrmnh.typepad.com/the\\_plant\\_press/](http://nrmnh.typepad.com/the_plant_press/)
  - SCBI Conservation News <http://nationalzoo.si.edu/conservation>
  - STRI News [http://www.stri.si.edu/english/about\\_stri/headline\\_news/news](http://www.stri.si.edu/english/about_stri/headline_news/news)
- Wetland Breaking News (Association of State Wetland Managers) <http://aswm.org/news/wetland-breaking-news>
- National Wetlands Newsletter (Environmental Law Institute) – access to archived issues as the newsletter was suspended in mid-2016 due to the changing climate for printed publications. <https://www.wetlandsnewsletter.org/>

### About *Wetland Science & Practice*

**W***etland Science and Practice* (WSP) is the SWS quarterly publication aimed at providing information on select SWS activities (technical committee summaries, chapter workshop overview/abstracts, and SWS-funded student activities), brief summary articles on ongoing or recently completed wetland research, restoration, or management projects or on the general ecology and natural history of wetlands, and highlights of current events. *WSP* also includes sections listing new publications and research at various institutions, and links to major wetland research facilities, federal agencies, wetland restoration/monitoring sites and wetland mapping sites. The publication also serves as an outlet for commentaries, perspectives and opinions on important developments in wetland science, theory, management and policy.

Both invited and unsolicited manuscripts are reviewed by the *WSP* editor for suitability for publication. Student papers are welcomed. Please see publication guidelines at the end of this issue.

[Electronic access to \*Wetland Science and Practice\*](#) is included in your SWS membership. All issues published, except the the current issue, are available via the internet to the general public. At the San Juan meeting, the SWS Board of Directors voted to approve release of past issues of *WSP* when a new issue is available to SWS members only. This means that a *WSP* issue will be available to the public four months after it has been read by SWS members (e.g., the June 2017 issue will be an open access issue in September 2017). Such availability will hopefully stimulate more interest in contributing to the journal. And, we are excited about this opportunity to promote the good work done by our members.

#### HOW YOU CAN HELP

If you read something you like in *WSP*, or that you think someone else would find interesting, be sure to share. Share links to your Facebook, Twitter, Instagram and LinkedIn accounts.

Make sure that all your SWS colleagues are checking out our recent issues, and help spread the word about SWS to non-members!

Questions? Contact editor Ralph Tiner, PWS Emeritus ([ralphtiner83@gmail.com](mailto:ralphtiner83@gmail.com)). ■

### WSP Manuscript – General Guidelines

#### LENGTH:

Approximately 5,000 words; can be longer if necessary.

#### STYLE:

See existing articles from 2014 to more recent years available online at:

<http://www.sws.org/category/wetland-science-practice.html>

#### TEXT:

Word document, 12 font, Times New Roman, single-spaced; keep tables and figures separate, although captions can be included in text. For reference citations in text use this format: (Smith 2016; Jones and Whithead 2014; Peterson et al. 2010).

#### FIGURES:

Please include color images and photos of subject wetland(s) as *WSP* is a full-color e-publication.

*Image size should be less than 1MB – 500KB may work best for this e-publication.*

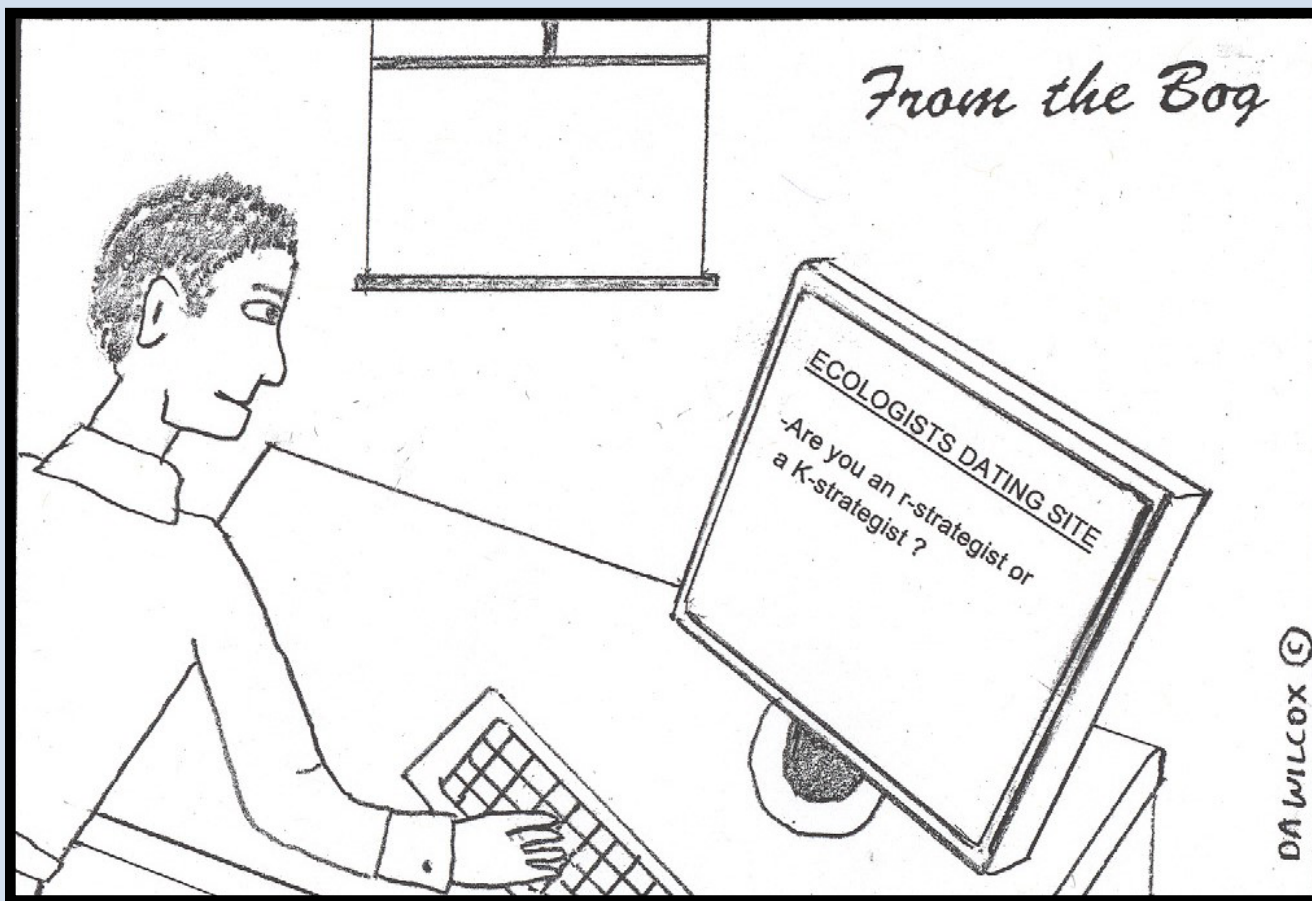
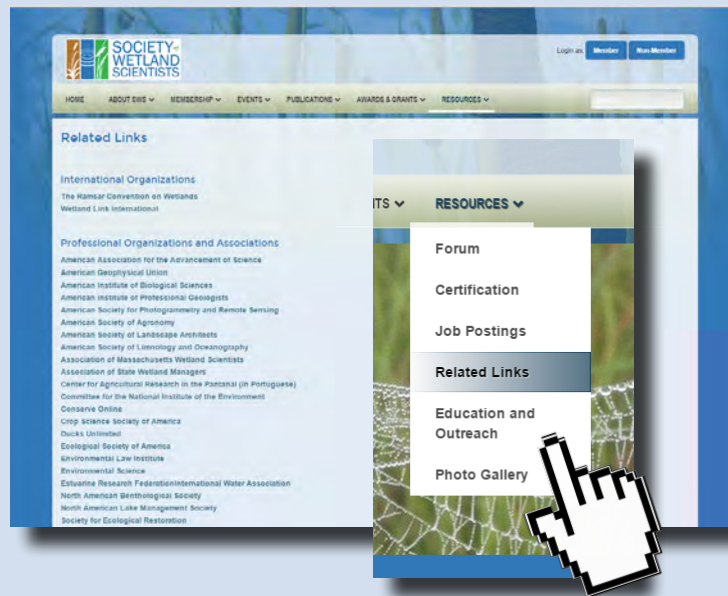
#### REFERENCE CITATION EXAMPLES:

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- Cooper, D.J. and D.M. Merritt. 2012. Assessing the water needs of riparian and wetland vegetation in the western United States. U.S.D.A., Forest Service, Rocky Mountain Research Station, Ft. Collins, CO. Gen. Tech. Rep. RMRS-GTR-282.

# Resources at your fingertips!

For your convenience, SWS has compiled a hefty list of wetland science websites, books, newsletters, government agencies, research centers and more, and saved them to sws.org.

Find them on the Related Links page [sws.org](http://sws.org).



## wetland science & practice

WSP is the formal voice of the Society of Wetland Scientists. It is a quarterly publication focusing on the news of the SWS and providing important announcements for members and opportunities for wetland scientists, managers, and graduate students to publish brief summaries of their works and conservation initiatives. Topics for articles may include descriptions of threatened wetlands around the globe or the establishment of wetland conservation areas, and summary findings from research or restoration projects. All manuscripts should follow guidelines for authors listed above. All papers published in WSP will be reviewed by the editor for suitability and may be subject to peer review as necessary. Most articles will be published within 3 months of receipt. Letters to the editor are also encouraged, but must be relevant to broad wetland-related topics. All material should be sent electronically to the current editor of WSP. Complaints about SWS policy or personnel should be sent directly to the elected officers of SWS and will not be considered for publication in WSP. ■