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FROM THE EDITOR'S DESK

As the new editor of *Wetland Science and Practice* (*WSP*) I am charged with moving the publication forward as an e-publication. This change brings an opportunity to make full use of the benefits of the internet, not the least of which is the use of color images in articles, and will result in increased exposure for the Society. It also means that we will be able to accommodate more articles. Over the next few issues of *WSP* you will see examples of the types of articles we are seeking for publication. You will also see new sections that introduce wetland research at universities and other facilities (Wetland Science), current issues in wetland regulation, policy, restoration, monitoring, mapping, and education (Wetland Practice), the availability of new publications (Wetland Bookshelf), and plant and animal activity in wetlands (Notes from the Field).

Ralph Tiner,
WSP Editor

On the cover of the last issue of *WSP,* you saw a huge fishing boat made out of reeds. When the picture was sent to me I thought it would make for a good lead-in to a short story about the native people – the Uros of Lake Titicaca – and their dependence on the wetlands. As a Jersey boy with a passion for wetlands, I've always been fascinated by cultures that actually live in marshes and swamps. Seeing that magnificent reed boat made me want to know more about these people and their life in the marshes. I thought others might share this interest, so I decided to do a little research and provide readers with a glimpse of Uros life in Lake Titicaca. I encourage readers to submit similar accounts of indigenous people's dependence on wetlands elsewhere around the globe for future issues of *WSP*.

In addition to providing updates of Society news, *WSP* provides you with an opportunity to publish short articles on your work in wetlands, contribute original essays on natural history, and to help document the phenology of wetlands. If you have recently completed a wetland restoration, creation, monitoring or education project or conducted a survey of plants or wildlife in a local wetland, for example, please consider writing a short summary for *WSP* as such will spread the word on your findings as you prepare a more technical article for *Wetlands* or another journal. Also, let us know what publications you've written or have run across in your time on the internet – we'll add that to the Wetland Bookshelf. This issue is the first of a new approach to *WSP* and is a work in progress. Your comments and contributions are welcomed!

In closing I hope you celebrated "Wetlands Month" by enjoying the sight and sounds of wetlands. After dealing with winter weather for months, I always look forward to hearing the Wood Frogs and Spring Peepers and seeing Skunk Cabbage flourish in the maple swamps and False Hellebore along the streams. Spring is welcomed by all and a fine time to take family and friends out to a local wetland and let them experience first-hand why we support wetland conservation and do what we do as wetland scientists.

Happy Swamping! ■

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Cover photo: Biedler Swamp, South Carolina in the spring (Ralph Tiner)

PRESIDENT'S MESSAGE

As my tenure as president of SWS ends, it has been my honor and privilege to serve the Society in this capacity. It has been a challenging and rewarding year that passed by quickly. In collaboration with both the Executive Board and Board of Directors, I have focused on activities that I hope will provide enhanced value to our members and help SWS continue to prosper into the future. We concluded a long-term initiative of evaluating and overhauling our information technology needs with a new and improved SWS website that will improve communication and interaction among the members, business office staff, the public, and SWS leadership. We have taken advantage of our management company's (AMPED) expertise and have made great progress on a number of other long-term efforts to improve our business practices and governance operations. These include a comprehensive review and streamlining of our bylaws, standing rules, and policy and procedures manual to more accurately reflect our operational and decision-making structure, restructuring of some of our standing committees, adoption of a formal investment policy, and hiring a financial management firm to sustainably fund existing activities and high-priority initiatives.

Steve Faulkner, SWS Immediate Past President

The other major area of focus has been on our publications. We welcomed Ralph Tiner, a widely respected wetland scientist, as the new editor of *Wetland Science and Practice*. We are working with him on enhancing *WSP* to complement our journal *Wetlands* and welcome your thoughts and ideas on what you would like to see as it grows and develops under Ralph's leadership. Moving *WSP* to an all-digital format recognized the rapidly changing world of scientific publishing and information distribution and dissemination. We are facing the same challenges and decisions with *Wetlands* as our contract with the publisher, Springer, is up at the end of 2014. This is a major revenue source for the Society and I have been actively engaged in on-going negotiations with Springer, in conjunction with the Publications Committee, in order to secure the best terms for SWS.

Our continued growth and development as a productive and influential scientific society is dependent on growth and engagement of members through our chapters and student associations. I appointed an ad-hoc committee of chapter presidents (or their representatives) to evaluate whether the current chapter support is adequate to achieve SWS goals and objective and recommend actions SWS might take in funding chapter initiatives and goals.

We all find inspiration from many places – family, friends, the beauty and mystery of the natural world around us, or historical figures. My current favorite quote is from Dr. F. Sherwood Rowland, who shared the 1995 Nobel Prize in Chemistry for his influential work showing how chlorofluorocarbons caused ozone depletion in the atmosphere and then promoted that science to actually fix the problem: "What's the use of having developed a science well enough to make predictions if, in the end, all we're willing to do is stand around and wait for them to come true?" I hope that SWS provides you with many opportunities not to stand around and wait, but to use your inspiration to be engaged, connected, exhilarated, and motivated to make a difference for wetlands wherever you are in the world. ■

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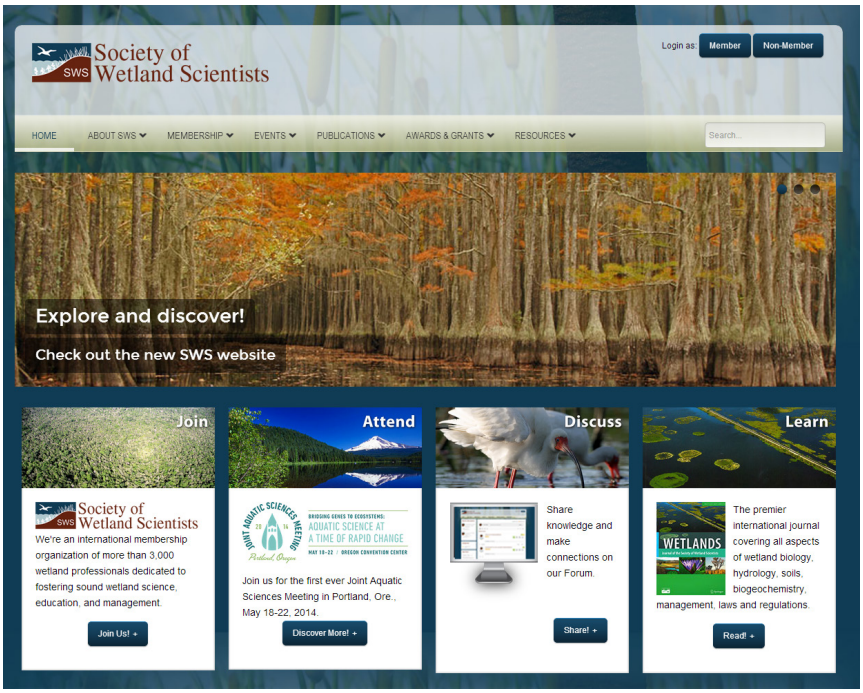


A Whole New Look for sws.org

Explore our newly redesigned website at www.sws.org. The site features a fresh new look and includes news for members and prospective members, information about upcoming events, a job posting board, links to the Society's publications, plus a discussion forum and much more. Also featured are exceptional photographs of wetlands and the flora and fauna that frequent them. We hope you'll visit often! ■

2015 SOCIETY OF WETLAND SCIENTISTS

Changing climate. Changing wetlands. Providence, Rhode Island

May 31 - June 4, 2015

The New England Chapter of the Society of Wetland Scientists is pleased to announce that our region will host the 2015 Annual Meeting of the Society of Wetland Scientists. This ground-breaking conference will examine the role that wetlands play in the global carbon cycle, how wetlands provide climate adaptation services, and how wetlands are being impacted by our changing climate. Although wetlands occupy only approximately 7% of the planets' land surface, they store approximately 30% of the world's soil carbon, and are some of the most efficient natural systems with regard to carbon sequestration. They provide a variety of ecosystem services that protect communities from the impacts of climate change, and yet are particularly vulnerable to some of the climate changes that are occurring. Over the course of five days, leading researchers from around the world will present research findings that represent our most current understanding of how wetlands function in the context of climate change. A number of field trips, both coastal and inland will be offered. ■

Bosire Receives International Fellow Award

Dr. Jared Bosire, World Wildlife Fund – Kenya, was recognized as the 2014 SWS International Fellow Award winner at the Joint Aquatic Sciences Meeting in Portland, Ore. He was awarded this honor for his distinguished contributions to the field of wetland science and for fostering the aims of the SWS within his own country and abroad.

Dr. Bosire is an internationally leading wetland scientist with a focus on wetland biodiversity conservation to support livelihoods, specifically mangrove forest ecology and conservation. He is a renowned mangrove scientist and conservationist in Kenya, an extremely understudied region of the world. Currently the conservation manager for the WWF Kenya Country Office, he previously served as a scientist and staff manager in charge of a large research division at the Kenya Marine and Fisheries Research Institute. Dr. Bosire is a dedicated mangrove scientist with impressive scientific contributions on mangrove ecology as well as mangrove conservation, restoration, and policy. His research and publications have been on a diverse range of topics from restoration ecology and mangrove forest regeneration to sustainable forest management and poverty alleviation. He has worked for many international organizations as lead technical expert and has played a very important role in wetland science capacity building in East Africa and the western Indian Ocean. Dr. Bosire is now engaged in policy development and conservation in a multi-stakeholder environment at national, regional and/or international levels. Commitment to the conservation, management and understanding of mangrove forests both in Kenya and in the rest of Africa has been shown throughout his career.

Visit sws.org for a complete list of 2014 award winners. ■

JASM 2014

JOINT AQUATIC SCIENCES MEETING • PORTLAND, OREGON

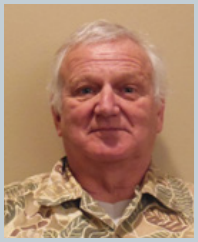
(l to r) SWS member Jos Verhoeven visits staff in the SWS booth at JASM; SWS Immediate Past President Steve Faulkner carries on the traditional passing of the spoon to President Jim Perry; Dr. Wahid Moufaddal of the National Institute of Oceanography and Fisheries in Egypt, one of our International Travel Award winners, stops by for a photo in the SWS booth; Undergraduate students taking part in the SWS Undergraduate Mentoring Program are recognized at the Annual Business Meeting and Awards Presentation on Monday evening. ■

2014 Election Results

Congratulations to our newly elected Secretary-General Loretta Battaglia and President-Elect Kim Ponzio. We also welcome our new President Jim Perry. Special thanks to Stephen Faulkner for his service as President in 2013-2014, now stepping into the role of immediate past president. We also recognize and thank George Lukacs who has rolled of the board after serving in the role of immediate past president during 2013-2104. To those who ran for an elected office this year or served in any volunteer capacity – thank you! ■

Secretary-General
2014-2017
Loretta Battaglia
Southern Illinois University

President-Elect
2014-2015
Kim Ponzio
St. John's River Water Management District



President
2014-2015
Jim Perry
Virginia Institute of Marine Science
The College of William & Mary

RESEARCH

Climate Adaptation at Kennedy Space Center: How Can Wetlands Help NASA Adapt to Warming Temperature and Rising Seas?

Samantha Chapman[1], Heather Tran and Cheryl Doughty, Department of Biology, Villanova University, Villanova, PA

Looming above the coastal wetlands at the Kennedy Space Center (KSC) is the Vehicle Assembly Building (VAB), a reminder of the close proximity between these protective ecosystems and NASA's important facilities and infrastructure. The impacts of climate change and associated sea level rise on places like KSC are yet unknown, but NASA is taking steps to ensure that they are ready to adapt to climate change. The NASA Climate Adaptation Science Investigators Workgroup is comprised of NASA scientists, university scientists, facilities managers, and institutional stewards. As part of this group, we are investigating the impacts of climate change on the wetlands and their protective capacities at KSC. We are working closely with NASA facilities managers to better understand how the land-building marshes and mangroves that surround the buildings at KSC can assist the center in adapting to climate change (Figure 1).

Figure 1. Kennedy Space Center and surrounding marshes and mangrove swamps along Florida's east coast. (Photo: Carlton Hall)

Mangroves marching northward: The future of subtropical wetlands in the United States

From butterflies to trees, increasing temperatures due to climate change are likely to shuffle species existing ranges on Earth (Parmesan and Yohe 2003). The coastal wetlands of subtropical southeastern U.S. are currently undergoing dramatic plant community shifts due to the expansion of mangroves (Figure 2). Coastal wetlands in this region were historically identified as salt marshes but have been increasing in mangrove abundance over the past century (Giri et al. 2011; Raabe et al. 2012; Cavanaugh et al. 2014). Recent findings suggest that poleward mangrove expansion is primarily driven by declining frequency in severe freezing events where temperatures remain at -4°C for several days (Cavanaugh et al. 2014). Both salt marshes and mangroves provide key ecosystem services, such as creating habitat for fauna, improving water quality and acting as buffers to oceanic forces (Zedler and Kercher 2005), but do so in very different ways given the distinct architectures of mangroves versus marshes. Any potential change in the vegetation of these systems may have far-reaching social and ecological impacts.

At KSC, we, along with Ilka Feller (Smithsonian Environmental Research Center) have been measuring salt marsh-mangrove interactions for over five years (Figure 3). KSC and the overlying Merritt Island National Wildlife Reserve (MINWR), lie in the center of the salt marsh-

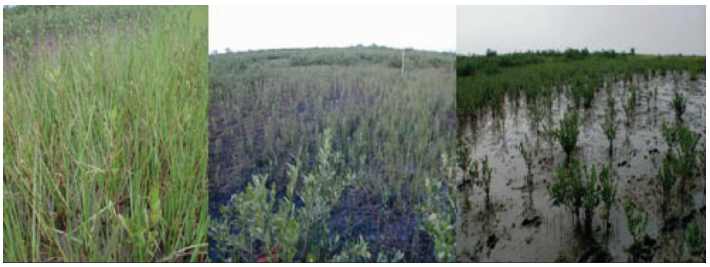


Figure 2. Changes from salt marsh to black mangroves in coastal Louisiana following sudden dieback of smooth cordgrass (*Spartina alterniflora*). (Source: U.S. Geological Survey; McKee 2014)

1. For additional information, contact samantha.chapman@villanova.edu

mangrove ecotone - the transitional area between the two systems on the Atlantic Coast. In order to understand how these vegetation shifts might influence the capacity for these wetlands to absorb storm surges and keep up with rising sea levels, we are examining how these plants "build land." Key parameters for measurement include plant growth, soil chemistry, and the elevation of the land relative to sea level. To predict the effect of climate change we will simulate future conditions.

Simulating the future at Kennedy Space Center: How will these wetlands function 100 years from now?

To simulate local climate conditions in 100 years, Villanova postdoctoral associate Glenn Coldren has built chambers that warm the air surrounding marsh plants and mangroves. These structures were constructed of PVC and film and instrumented with micrometeorological equipment that measures climatic factors like temperature and humidity. For the past year, warming chambers have been placed in patches of marsh where mangrove seedlings have established (Figure 4). This experiment is allowing us to assess how the invasion of mangroves into marshes is progressing under a warmer climate. To date, survivorship of mangroves has been higher in the warmer chambers than in the control plots. If this pattern continues, these results suggest that the structurally larger mangroves may come to dominate these communities and may alter the ecosystem services they provide.

Figure 3. Aerial images showing vegetation change at Merritt Island National Wildlife Refuge between 2003 and 2013. Note the darker green mangroves encroaching into the salt marsh in the orange box over this ten year period. (Source: Google Earth)

Mangroves and salt marshes must maintain a presence above sea level to avoid collapse (Nicholls 2004; Cahoon et al. 2006), and thus wetland ecosystem maintenance is dependent upon belowground processes such as sedimentation, the growth of roots, and the decomposition of organic matter (Middleton and McKee 2001). The effect of mangrove encroachment and warming on the resilience of coastal wetlands to sea level rise will depend partly on the balancing act between root productivity and decomposition. For instance, if warming accelerates decomposition, then elevation gain could fall below the rate of sea level rise, all else being equal. A series of larger warming chambers outfitted with soil elevation tables were erected this April and will allow us to examine how land-building (measured by soil elevation) is changed by warming. Graduate student Heather Tran will use these chambers to assess both root growth and root decomposition under control and warming conditions, providing a better understanding of how marshes and mangroves will maintain elevation when exposed to future climate. Figure 5 highlights our ideas on how belowground processes, warming and vegetation shifts interact to alter soil elevation change, and thus future wetland sustainability.

If mangroves keep invading marshes will a wetland's ability to scrub carbon from the atmosphere change?

In a related project at KSC, we are working with Feller, Dr. Adam Langley (Villanova), and Dr. Wayne Walker (Woods Hole Research Center) to assess how much carbon mangroves and salt marshes scrub out of the atmosphere and store in solid form. Coastal ecosystems are highly efficient carbon sinks. Wetland vegetation sequesters carbon in living biomass and through high rates of organic and mineral carbon accretion in sediments, which persist for long periods of time (Chambers et al. 2001; Nellemann et al. 2009; McLeod et al. 2011). Further, carbon storage may serve as a proxy for other ecosystem services that are essential in sustaining wetlands against global climate change. For example, if mangroves are able to sequester carbon more efficiently than salt marsh, then the encroachment of mangroves into salt marsh systems may increase carbon sequestration and insure coastal stability in the face of sea level rise. Assessment of carbon stores in various vegetation types and changes in storage as vegetation shifts may aid management in predicting wetland resilience to future climate change.

Graduate student Cheryl Doughty has been coupling field measurements of carbon with land cover vegeta-

tion maps made by NASA scientist Ron Schaub to determine how much carbon is being stored at the landscape scale at KSC. Thus far, she has found that mangroves store more carbon in aboveground biomass than salt marsh plants. She is attempting to predict future mangrove distributions in a warming climate and under rising seas by using climate envelope modeling. Climate envelope models determine which environmental factors contribute most to the current distribution of mangroves and use those factors to determine where mangroves will migrate in response to future climate scenarios. These models will allow her to illustrate the potential impacts of shifting mangroves to landscape carbon storage (Elith et al. 2011).

Figure 4: Aerial view of small warming chambers at KSC.

How will this research be incorporated into management?

We expect that our collective findings will aid facilities managers at KSC in decisions on building sites, restoration, and planning for future storms by incorporating the buffering capacities of wetland vegetation. At the larger scale, wetland managers can use the data on rapidly changing wetlands, particularly on belowground processes, for planning restoration and mitigation to combat rising seas, severe storm events, and increasing levels of atmospheric CO2.

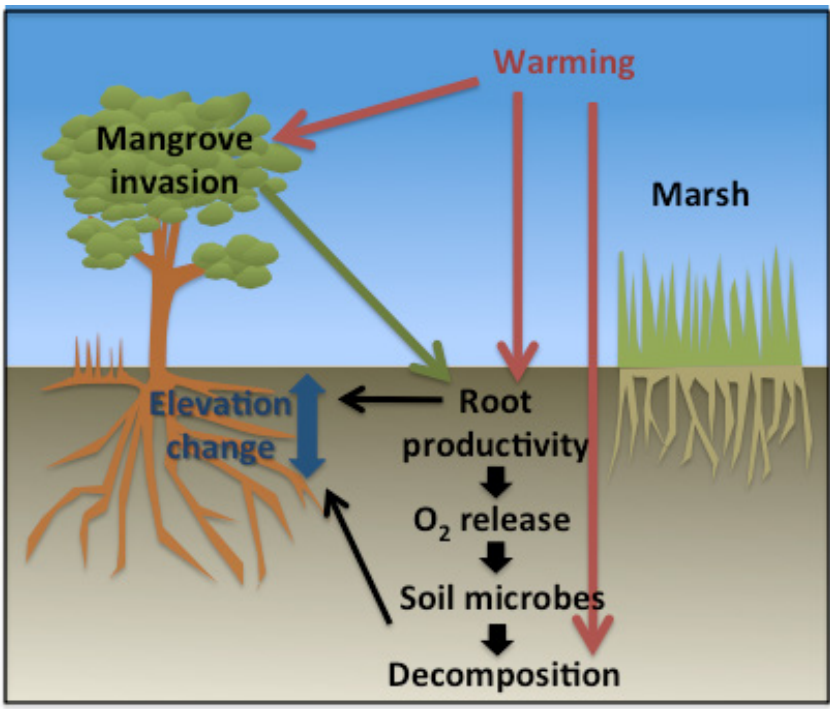


Figure 5. Conceptual schematic of influences of invasion and warming on belowground

References

Cahoon, D. R., P. F. Hensel, T. Spencer, D. J. Reed, K. L. McKee, and N. Saintilan. 2006. Coastal wetland vulnerability to relative sea level rise: wetland elevation trends and process controls. Pages 271-292 *in* J. T. A. Verhoeven, B. Beltman, R. Bobbink, and D. F. Whigham, editors. *Wetlands and Natural Resource Management*. Springer Berlin Heidelberg, Berlin.

Cavanaugh, K. C., J. R. Kellner, A. J. Forde, D. S. Gruner, J. D. Parker, W. Rodriguez, and I. C. Feller. 2014. Poleward expansion of mangroves is a threshold response to decreased frequency of extreme cold events. *Proceedings of the National Academy of Sciences* 111:723-727.

Chambers, J. Q., N. Higuchi, E. S. Tribuzy, and S. E. Trumbore. 2001. Carbon sink for a century. *Nature* 410:429-429.

Elith, J., S. J. Phillips, T. Hastie, M. Dudik, Y. E. Chee, and C. J. Yates. 2011. A statistical explanation of MaxEnt for ecologists. *Diversity and Distributions* 17:43-57.

Giri, C., J. Long, and L. Tieszen. 2011. Mapping and Monitoring Louisiana's Mangroves in the Aftermath of the 2010 Gulf of Mexico Oil Spill. *Journal of Coastal Research* 27:1059-1064.

McLeod, E., G. L. Chmura, S. Bouillon, R. Salm, M. Bjork, C. M. Duarte, C. E. Lovelock, W. H. Schlesinger, and B. R. Silliman. 2011. A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO2. *Frontiers in Ecology and the Environment* 9:552-560.

McKee, K.L. 2014. Global change impacts on mangrove ecosystems. U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA. http://www.nwrc.usgs.gov/factshts/2004-3125.pdf

Middleton, B. A., and K. L. McKee. 2001. Degradation of mangrove tissues and implications for peat formation in Belizean island forests. *Journal of Ecology* 89:818-828.

Nellemann, C., E. Corcoran, C. Duarte, L. Valdés, C. De Young, L. Fonseca, and G. Grimsditch. 2009. Blue Carbon. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal.

Nicholls, R. J. 2004. Coastal flooding and wetland loss in the 21st century: changes under the SRES climate and socio-economic scenarios. *Global Environmental Change-Human and Policy Dimensions 14:69-86.*

Parmesan, C., and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. *Nature* 421:37-42.

Raabe, E. A., L. C. Roy, and C. C. McIvor. 2012. Tampa Bay coastal wetlands: Nineteenth to Twentieth Century tidal marsh-to-mangrove conversion. *Estuaries and Coasts* 35:1145-1162.

Zedler, J. B., and S. Kercher. 2005. Wetland resources: Status, trends, ecosystem services, and restorability. Pages 39-74 *Annual Review of Environment and Resources*. ■

Evaluating Methods for Analyzing Vegetation and Determining Hydrophytic Vegetation for Wetland Delineation

Robert Lichvar and Jennifer Gillrich[1], U.S. Army Corps of Engineers, ERDC-CRREL, Hanover, NH

The U.S. Army Corps of Engineers (Corps), Engineering and Research and Development Center (ERDC) recently release two publications evaluating proposed revisions to the 1987 Corps Wetland Delineation Manual (Environmental Laboratory 1987) (hereafter the 1987 Wetland Manual). These two studies address problematic technical issues in the 1987 Wetland Manual as identified by the National Technical Committee for Wetland Vegetation (NTCWV). The NTCWV is a composed of 16 members from six federal agencies and four academic institutions, all of whom are botanists or vegetation ecologists. A primary goal of the NTCWV is to suggest scientifically tested and sound methods to improve the sampling and determination of hydrophytic vegetation for wetland delineation purposes. This includes methods of areal plant cover estimation, plot size, and the calculation of hydrophytic vegetation, which require scientific testing before possible inclusion into the revised Corps Wetland Manual under development. The first of the two recent publications discussed here compares three methods for making hydrophytic vegetation determinations during wetland delineations (Lichvar and Gillrich 2014a) while the second tests the effects of different plot designs and sampling methods used during this process (Lichvar and Gillrich 2014b).

Evaluating Hydrophytic Vegetation Determination Methods

In support of the update to the 1987 Wetland Manual, three common methods for making hydrophytic vegetation determinations - the Hydrophytic Cover Index (HCI), the Dominance Ratio (DR) and the Prevalence Index (PI) - were tested and compared using a large national dataset of delineation data (Lichvar and Gillrich 2014a). The HCI was recommended by the National Technical Committee for Wetland Vegetation (NTCWV) in light of recent work showing that up to 20% of determinations made using the DR are biased (Lichvar et al. 2011) and that up to 14% of determinations made using the PI are incorrect (Lichvar and Gillrich unpublished data). The national dataset is from nine Corps regions collected during the development and field testing of the Regional Supplements to the Army Corps of Engineers Wetland Delineation Manual (Berkowitz 2011). It consists of data from 637 plots at 232 sites. For each site, nested circular sample plots with 9 m and 2m radii were located on each side of the wetland boundary or along a wetland-to-upland transect. The HCI, the PI, and the DR were calculated for each plot in the national data set (n = 637), and the number of plots containing hydrophytic vegetation were tallied for each method. The HCI was calculated using wetland ratings and the percent cover data from each plot, as follows:

$$HCI = (\Sigma C_{OBL} + \Sigma C_{FACW} + \Sigma C_{FAC})/(\Sigma C_{OBL} + \Sigma C_{FACW} + \Sigma C_{FAC} + \Sigma C_{FACU} + \Sigma C_{UPL}) \times 100$$

where Σ is the sum and C is the cover – the percent areal cover for species represented by each of five wetland indicator status ratings: Obligate Wetland (OBL), Facultative Wetland (FACW), Facultative (FAC), Facultative Upland (FACU), and Upland (UPL). The PI and the DR were

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calculated according to descriptions in the 1987 Wetland Manual and the Regional Supplements (Environmental Laboratory 1987; e.g., USACE 2010). For the HCI method, plots with summed areal cover values >50% of the total were considered hydrophytic vegetation.

The dataset was divided into two subsets: 1) plots with >50% hydrophyte cover and 2) plots with ≤ 50% hydrophyte cover (where hydrophyte species are considered those rated FAC, FACW, or OBL). The percentage of hydrophytic vegetation determinations was compared among the three methods. Overall, the HCI demonstrated 100% accuracy in classifying plots as hydrophytic or nonhydrophytic in 637 wetland delineation plots, outperforming the PI and DR which demonstrated 88% and 91% accuracy, respectively. Overall, the PI (69%) and the DR (76%) produced significantly fewer hydrophytic vegetation determinations than the HCI (80%). One explanation for these discrepancies is that the PI assigns larger weighted values to nonhydrophytes (which subsequently have a disproportionate impact on the results), while DR results are potentially distorted by a built-in odd-even bias and the use of strata to select dominant species (e.g., one species may be a dominant in more than one stratum). By contrast, the HCI is a simplified method that relies only on wetland ratings and percent cover values, and thus produces consistently accurate results. Note that the greater frequency of hydrophytic vegetation determinations produced by the HCI does not necessarily result in an expansion of the wetland boundary since the vegetation calculation is only one aspect of a 3-factor approach to wetland delineation where soils and signs of hydrology are also considered. The HCI formula for making hydrophytic vegetation determinations is therefore recommended for use in the revised Corps wetland delineation manual and its supplements.

The Effect of Sampling Procedures on Hydrophytic Vegetation Determinations

The second study assessed the impact of vegetation sampling procedures on the outcome of hydrophytic vegetation determinations using the HCI formula discussed above (Lichvar and Gillrich 2014b). HCI results using nested circular plots with 9 m and 2 m radii were compared with those using rectangular 10 x 2 m plots. Data were collected from forested, scrub-shrub, and herbaceous meadow wetland types (n = 66) in three regions: 1) Northcentral–Northeast, 2) Western Mountains, Valleys, and Coast, and 3) Alaska. Vegetation near wetland boundaries was sampled in circular plots with 9 m and 2 m radii according to the routine delineation method described in the 1987 Wetland Manual and in rectangular 10 × 2 m plots using a strata-less approach suggested by the NTCWV to estimate areal cover by species. Results showed that plot dimensions had no notable effect on the percentage of hydrophytic vegetation determinations produced by the HCI. Therefore, using rectangular 10 × 2 m plots and absolute percent areal cover data collected without stratifying vegetation by growth form appears to be an accurate method for wetland boundary delineations.

In addition to plot dimensions, the NTCWV suggested that the HCI results be compared using different percentages of the total cover identified within a plot. Using data from the same national delineation dataset used in the first study, the HCI was calculated using 100%, 90%, and 80% of the cover data and the associated wetland ratings from each plot. Results showed no notable distinctions in the number of hydrophytic determinations made, regardless of whether 80%, 90%, or 100% of the total vegetation was included in the analysis. This suggests that accurate results can be obtained by identifying only 80% of the total cover to the species level, thus potentially increasing the efficiency of wetland determinations.

As part of the continued testing of these proposed changes to the 1987 Wetland Manual, the Corps will lead an interagency effort to test the methods contained in the revised manual during the summer of 2014. The modification of on-site sampling procedures, plots sizes, areal cover estimates, hydrophytic vegetation determinations, and all other indicators for the three-factor wetland delineation method will be tested. The effort will evaluate whether there is any change in wetland boundaries and if the newly proposed methods are clear and easier to apply than current methods.

Acknowledgements

This research was funded by the Wetlands Regulatory Assistance Program (WRAP) of the US Army Corps of Engineers. The authors express appreciation to the wetland ecologists and biologists from Alaska to the Caribbean who collected the national delineation data.

References

Berkowitz, J. F. 2011. Recent advances in wetland delineation—Implications and impact of regionalization. *Wetlands* 31:593–601.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1. Vicksburg, MS: Environmental Laboratory, US Army Corps of EngineersWaterways Experiment Station. http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf.

Lichvar, R.W., and J. J. Gillrich. 2014a. *Examining Discrepancies Among Three Methods Used to Make Hydrophytic Vegetation Determinations for Wetland Delineation Purposes.* ERDC/CRREL TR-14-2. Hanover, NH: US Army Engineer Research and Development Center. http://acwc.sdp.sirsi.net/client/search/asset/1034001

Lichvar, R.W., and J. J. Gillrich. 2014b. Field Testing New Plot Designs and Methods for determining if Vegetation is Hydrophytic during Wetland Delineations in the United States. ERDC/CRREL TR-14-1. Hanover, NH: US Army Engineer Research and Development Center. http://acwc.sdp.sirsi.net/client/search/asset/1034041

Lichvar, R.W., J. J. Gillrich, and W.R. Ochs. 2011. Discrepancies in hydrophytic determinations produced by three vegetation formulas used for wetland delineations. *Wetlands* 31:603–611.

U.S. Army Corps of Engineers. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)*, ed. J. S. Wakeley, R.W. Lichvar, and C. V. Noble. ERDC/EL TR-10-3. Vicksburg, MS: US Army Engineer Research and Development Center. http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/reg_supp/west_mt_finalsupp.pdf ■

Figure 1. Northern Pintail are one migratory bird species frequenting these Wetlands of International Importance. (Photo: Eddy Edwards, U.S. Fish and Wildlife

Missisquoi Delta and Bay Wetlands Ramsar Site Designated in Vermont

Ken Sturm[1], Missisquoi National Wildlife Refuge, U.S. Fish and Wildlife Service, Swanton, VT

The Missisquoi National Wildlife Refuge and the U.S. Fish and Wildlife Service's Lake Champlain Fish and Wildlife Resources Office worked with Vermont Fish and Wildlife Department to designate the refuge along with three State Wildlife Management Areas as *Wetlands of International Importance under the Ramsar Convention on Wetlands*. The application was approved and Missisquoi Delta and Bay Wetlands were officially designated as a *Wetland of International Importance* on November 20, 2013.

Figure 2. View of Missisquoi marshes. (Photo: Ken Sturm, U.S. Fish and Wildlife Service)

The Ramsar Convention is a 42 year-old intergovernmental treaty, signed by over 160 countries, to promote voluntary international cooperation for wetland and waterfowl conservation. The Convention's mission centers on the wise use and conservation of wetlands around the globe focusing on local and national action and international cooperation. The treaty recognizes the importance of wetlands and offers to recognize sites considered a *Wetland of International Importance* based on a number of specific attributes, such as rare or unique wetlands, biological diverse plant or animal communities, large or diverse waterbird and fish populations.

The first such site in Vermont, Missisquoi Delta and Bay Wetlands encompasse 7,665 acres, and includes the Missisquoi National Wildlife Refuge and the Vermont Fish and Wildlife Department's Maquam, Carmen's Marsh and Rock River Wildlife Management Areas. There are currently 35 other designated sites in the U.S. and over 2,000 around the world. The Missisquoi Delta and Bay Wetlands join the ranks of other important wetland areas such as the Everglades and San Francisco Bay with this designation. Missisquoi National Wildlife Refuge is the 20th national wildlife refuge to be designated under the Ramsar Convention.

Established in 1943 for the protection and management of migratory birds, the Missisquoi National Wildlife Refuge is at the heart of the newly designated Ramsar site comprising almost 90% of the total acreage. Refuge wetlands provide habitat for more than 200 species of birds, including thousands of migratory waterfowl during fall migration (Figure 1). The refuge is also an important regional breeding area for waterfowl and other migratory birds. Fall populations of waterfowl on the refuge often peak at

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20,000. The largest great blue heron rookery on the Vermont side of Lake Champlain is located on the refuge's Shad and Metcalfe Islands. These wetlands also support breeding populations of numerous other species, such as rails, bitterns, common moorhens, pied-billed grebes, and numerous grassland, wetland and forest passerine species. The refuge also supports a diversity of native wildlife, including 35 species of mammals.

The Missisquoi River delta is the largest wetland complex in the Lake Champlain Basin. As it flows toward the lake, the Missisquoi River passes through the largest and perhaps highest quality silver maple (*Acer saccharinum*) floodplain forest in the State of Vermont as well as natural and managed marshes of wild rice (*Zizania aquatica*), buttonbush (*Cephalanthus occidentalis*), and tussock sedge (*Carex stricta*) (Figure 2). The river harbors rare freshwater mussels, turtles, and fish. Its delta is a critical link for migratory birds along the Atlantic Flyway. These wetlands host the largest concentration of waterfowl in Vermont and approximately half of the waterfowl in the Champlain Valley during early October. Also inside the Missisquoi Delta and Bay Wetland site is the Maquam Bog, a mixed shrub-sedge bog which is one of the largest ombrotrophic bogs in New England. The Pitch Pine Woodland Bog (*Pinus rigida*) is also found here and is the only example of this natural community type in Vermont (Figure 3).

Figure 3. Maquam Bog, Vermont's only Pitch Pine Woodland Bog. (Photo: Ken Sturm, U.S. Fish and Wildlife

Figure 4. Lake Sturgeon (*Acipenser fulvescens*). (Photo: Vermont Fish and Wildlife Department) For information on sturgeon spawning in the Missisquoi River see U.S. Fish and Wildlife Service report http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife/Spawning_Habitat_Suitability_for_Walleye_and_Lake_Sturgeon_in_the_Missisquoi_River.pdf

The Missisquoi Delta and Bay Wetlands also provide food and spawning habitat for numerous fish species. As a site that includes an extensive river delta and associated wetlands, there are numerous ecological interactions between the fish and birds (such as ospreys, bald eagles and herons) of the wetland as well as between prey fish found in the wetland and the predator fish of the lake and river. The lower Missisquoi River is one of the few remaining spawning grounds for the state-listed endangered lake sturgeon (*Acipenser fulvescens*; Figure 4) and provides habitat for the state threatened sand darter (*Ammocrypta pellucida*).

This new designation creates added significance to the state's most important wetland complex. Given the troubled waters which feed these wetlands, this designation may add fuel to the grassroots efforts aimed at improving water quality throughout the 393,000-acre Missisquoi River watershed and ultimately Lake Champlain itself. Through combined and cooperative management between the U.S. Fish and Wildlife Service and the Vermont Department of Fish and Wildlife, the Missisquoi Delta and Bay Wetlands will continue to provide the irreplaceable ecosystem benefits for generations to come. ■

Figure 1. Area map showing Lake Titicaca and boundary line between Peru (left) and Bolivia (right). (Map data: ©2014 Google, Mapcity)

Figure 2. Totora (*Schoenoplectus californicus* ssp. *totora*). This subspecies differs morphologically from the typical species by its compact inflorescence versus a more open-inflorescence in the latter (Heiser 1978). (Photo: Hernán

The Uros of Lake Titicaca and their Dependence on Totora (*Schoenoplectus californicus* ssp. *totora*; Cyperaceae)

Ralph Tiner[1]*, Editor, Wetland Science and Practice*

Many of us have heard the name "Lake Titicaca" but where is it? Lake Titicaca is the largest freshwater lake in South America and is reportedly the highest navigable lake in the world. It is located at an elevation of 3810 m above sea level along the border of Peru and Bolivia in the northern Andes (Figure 1; whc.unesco.org). It is one of the less than twenty of the world's ancient lakes and is recognized as a World Heritage Site. The lake is slightly brackish (around 5 ppt) and averages 140-180 m in depth (280 m maximum). Being located in a semi-arid region, lake levels are dynamic both seasonally and cyclically. Seasonal changes may average 70 cm with a peak in late April and minimum in December (Orlove 2002). Over the past 100 years, lake levels have fluctuated by as much as 6.5m (Erickson 2000). The lake contains many endemic species, harboring over half of the known species of the Andean killifish of the genus *Orestias* (23 of 43 species; Parenti 1984). All of the lake's sponges are endemic as are 90.9% of its amphipods, 88% of its fishes, 61.9% of the mollusks, 32% of the aquatic insects, and 28.6% of its amphibians (UN Development Programme 1995).

Marshes are common along the shores of the lake. These wetlands are dominated by two emergent species: totora (*Schoenoplectus californicus* ssp. *totora*; Figure 2) and totorilla (*Juncus arcticus* var. *andicola*) and two aquatics:

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Figure 3. Location of floating islands in Lake Titicaca: (top) 2012 and (bottom) 2002. (Map data: ©2014Google, DigitalGlobe)

Figure 4. Floating platform: a) demonstration of construction of the floating platform showing a 1 m block of rootmass with stems laid on top, and b) platform view from water showing houses and small fish pond. (Photos: a - tillthemoneyrunsout.com and b - familyonbikes.org)

Whitestem pondweed (*Elodea potamogeton*) and Andian watermilfoil (*Myriophyllum quitense*), while muskgrasses or stoneworts (*Chara* spp.) and pondweeds (*Potomogeton* spp.) occupy deeper waters (UN Development Programme 1995). The two emergents are economically important to local people as they are used for mats, mattresses, handicrafts, fodder for livestock, and other purposes (Macia 2001; Macia and Balslev 2000; Heiser 1978). For this article, I will focus on the unique relationship between totora and the Uru people who live in the marshes of Lake Titicaca, recognizing that other peoples in the lake region also make use of this valuable plant.

Islands of Reed

Perhaps the most interesting aspect of the Uros is that they live on artificial floating islands built from totora. According to historical accounts they fled to the marshes to seek shelter from the invading cultures (e.g., Incas in the 14th and 15th centuries and later from the Spanish in the 16th century). Yet the construction of the floating islands seems to be a more recent event as Orlove (2002) suggests that the first floating islands were built in the 1800s when landdwellers from Coata and Huata moved to Lake Titicaca's marshlands. Today about 1200 people live on somewhere around 60 floating islands in the lake – the Uros Islands (Figure 3a). The number of these islands appears to have increased in the past decade (Figure 3b) as booming ecotourism has probably made it easier for more Uros to make a living in the marshes. The islands were reportedly once located further from the mainland, but with the increase in tourism and desire for better access the city for goods and services and for educating their children, the floating islands are now located closer to the city of Puno.

The island platforms are made of the bulrush called "totora" (or "junco") in South America. Each artificial island is comprised of two layers: one a layer of the natural rootmass about 1 meter thick and the second layer – one of harvested reeds laid in a crisscrossed pattern (Figure 4). According to Poon (2007), the rootmass is excavated from the marshes in large rectangular sections (5 m x 12 m x 1 m thick), then multiple sections are strung together by ropes through holes made in the "slabs" that are joined together to form a floating platform. Layers of freshly cut reeds are

Figure 5. House built of totora reeds. (Photo: tillthemoneyrunsout.com)

then laid on top of the platform in a criss-crossed pattern. The islands are anchored to prevent drifting. Since the vegetation decomposes over time, the Uros need to keep adding more reeds to the surface – every 3 months during the dry season and monthly during the wet season. Eventually the platform becomes thick enough to rest on the lake bottom. At that point, the island is abandoned and a new one built. The islands last for about 15-18 years.

Other Uses of Totora

Totora not only provides the substrate for living in the marshes but is vital to other aspects of life for the Uru people. They use the bulrush as raw material for homes, boats, mattresses, furniture, and handicrafts (e.g., fans, mats, and toys). The light-weight, water-repellent dried stems provide excellent shelter for living on a floating island (Figure 5). When the island platform is refreshed with new reeds, the reed houses are simply lifted off the ground and moved to the replenished section. Houses are also elevated somewhat above the platform surface to reduce moisture.

In the absence of wood, totora reeds have served as the material for boat construction since pre-Columbian times (Figure 6). Lake Titicaca reed boats (balsas) have intrigued archeologists and others for many years (Allen 2014). In fact, the renown explorer Thor Heyerdahl (famous for his 1947 trans-Pacific voyage on a balsa boat – Kon-Tiki) had reed boat builders from Lake Titicaca construct RA-II that he used to cross the Atlantic (Morocco to Barbados) in 47 days. A totora boat may last 3-6 months with normal use but if plastic tarps are laid to protect the inside of the boat, its life expectancy is increased to 8-12 months (Banack et al. 2004). For additional information on reed boats consult Vranich et al. (2005) for a description of the boat building process and Allen (2014) for a brief history of reed boat construction.

The white inner portion of the basal shoots of totora (high in iodine) is eaten raw by the Uros. Tea is made from the flowers. The Uros fish and hunt fowl in the marshes, which provide essential breeding and feeding habitat for these species. The Uros also practice aquaculture on a small scale on their islands. Totora has medicinal uses: wrapping the reed around a sore tends to ease pain. Similarly it is

reportedly used to help deal with hang-overs (roll the white part of the lower shoot in one's hand then press the reed to the forehead). Dried totora is used as fuel for fires (Heiser 1978).

Harvest of wild stands of totora appears sufficient to meet the needs of the Uros but the plant is cultivated by other peoples in the lake region. Totora is planted in areas subject to periodic flooding by the lake or in "sunken gardens" – natural wet depressions or hand-dug pits (Banack et al. 2004; Erickson 2000; Heiser 1978). The use of totora as fodder for livestock may be the driving force behind increased cultivation of the species around the lake (Orlove 2002).

Totora is truly a remarkable plant – the foundation of life for the Uru people and widely used by other peoples where it occurs in abundance in South America. To learn more about the Uros and other peoples of the Lake Titicaca region and their uses of totora read "Lines in the Water: Nature and Culture at Lake Titicaca" (Orlove 2002).

Figure 6. Reed boats from Lake Titicaca: a) traditional boat – this one built by Aymara people for harvesting totora, and b) fancier boats made by the Uros to carry tourists. (Photos: a – Daniel Heuclin; b – tillthemoneyrunsout.com)

Acknowledgments

Special thanks to Hernán Tolosa, Daniel Heuclin, and the creators of two websites (tillthemoneyrunsout.com and familyonbikes.org) for use of their photos. Additional images can be viewed at these sites.

References

Allen, J.M. 2014. History of reed ships. http://www.atlantisbolivia.org/areedboathistory.htm. Accessed April 18, 2014.

Banack, S.A., X.J. Rondon, and W. Diaz-Huamanchumo. 2004. Indigenous cultivation and conservation of Totora (*Schoenoplectus californicus*, Cyperaceae) in Peru. *Economic Botany* 58:11-20.

Erickson, C.L. 2000. The Lake Titicaca Basin: A Precolumbian built landscape. In: D. Lentz (ed.) Imperfect Balance: Landscape Transformations in the Precolumbian Americas. Columbia University Press, New York, NY. pp. 316-356.

Heiser, C.B. 1978. The totora (*Scirpus californicus*) in Ecuador and Peru. *Economic Botany* 32:222–236.

Macia, M.J. 2001. Economic uses of totorilla (*Juncus arcticus*, Juncaeae) in Ecuador. *Economic Botany* 55:236-242.

Macía, M.J., and H. Balslev. 2000. Use and management of totora (*Schoenoplectus californicus*, Cyperaceae) in Ecuador. *Economic Botany* 54:82–89.

Orlove, B. 2002. *Lines in the Water: Nature and Culture at Lake Titicaca*. University of California Press, Berkeley.

Parenti, L.R. 1984. A taxonomic revision of the Andean killish genus *Orestias* (Cyprinodontiformes, Cyprinodontidae). *Bulletin of the American Museum of Natural History* 178:107-214.

Poon, C.M. 2007. The floating islands of the Uros. *Jurutera* (March 2007):56.

UN Development Programme. 1995. Biodiversity Conservation of Titicaca-Desaguadero-Poopo-Salar de Coipasa (TDPS) Water Basin. World Resource Report, Project: RLA/95/G31/E/1G/99. United Nations, New York.

Vranich, A., P. Harmon, and C. Knutson. 2005. Reed boats and experimental archeology on Lake Titicaca. *Expedition Magazine* 47:20-27. ■

This section is intended to inform readers about ongoing wetland research by various universities, government agencies, NGOs and others. When studies are completed, WSP invites short articles that address key findings, while more technical papers are submitted to Wetlands or other peer-reviewed journals. Researchers interested in posting short or more detailed summaries of their investigations are encouraged to contact the WSP editor (please include "WSP Research News" in the email subject box). This first version highlights wetland research at the University of Illinois and WSP thanks Drs. Heath Hagy and Jeffrey Matthews for this excellent compilation.

Wetland Research at the University of Illinois

Wetland management strategies that maximize marsh bird use in the Midwest. Marsh birds are an understudied guild of wetland-associated species that can be valuable indicators of wetland health and condition. As wetlands have declined across the Midwest and especially in Illinois, likely so have marsh birds, but until recently standardized monitoring protocols made assessing population size and wetland occupancy difficult. We are conducting a project to determine secretive marsh bird use across a wide range of representative wetland types (e.g., emergent, non-vegetated, riparian), hydrologic regimes (e.g., temporary, seasonal, semi-permanent), and past disturbance regimes (e.g., natural and restored through Wetlands Reserve Program, impounded and unimpounded) that include management practices (e.g., active, passive, unmanaged) for waterfowl and other focal species. Contact: Heath Hagy, hhagy@illinois.edu

Validation and development of standard moist-soil wetland inventory and monitoring procedures. We are working with the University of Tennessee – Knoxville and the U.S. Fish and Wildlife Service to evaluate the robustness of current moist-soil wetland inventory and monitoring procedures used on many National Wildlife Refuges in the southeastern U.S., refine rapid assessment models for predicting energetic carrying capacity of waterfowl (i.e., duck-energy days) in moist-soil wetlands, and develop a standard operating procedure for monitoring moist-soil wetland energetic quality for waterfowl. Contact: Joshua Osborn, osbornjm@illinois.edu

Identifying wetland availability and quality for focal species of the Illinois Wetlands Campaign. Hydrologic variation often limits the availability of resources provided by wetlands to wetland-dependent organisms in that they may be dry when organisms are most dependent on them. This variation in inundation of wetlands makes accurately developing restoration goals based on the resource needs of wildlife populations difficult because, although we have an adequate estimate of the total acreage of wetlands, we are unable to estimate the acreage of wetlands that are inundated by water and of sufficient quality to benefit focal wildlife species. In cooperation with the Illinois Department of Natural Resources and Southern Illinois University, we are beginning a project to determine functional wetland habitat availability for focal species of the Illinois Wetlands Campaign. We will develop models to predict wetland quantity and quantity relative to natural processes (e.g., flooding, precipitation) and anthropogenic stressors in Illinois. Contact: Heath Hagy and Mike Eichholz, hhagy@illinois.edu

While many government agencies and universities are engaged in various aspects of wetland research, a few have established "centers" dedicated to wetlands. The following list is simply a list of federal research facilities that employ scientists dedicated to working in wetlands and universities with "wetland research centers." Their websites often have links to ongoing research and publications. If others should be added to the list, please send the name and link to the WSP editor.

U.S. Federal Centers

U.S. Forest Service, Center for Forested Wetland Research: http://www.srs.fs.usda.gov/charleston/
U.S. Geological Survey, National Wetlands Research Center: http://www.nwrc.usgs.gov/
U.S. Geological Survey, Northern Prairie Wildlife Research Center: http://www.npwrc.usgs.gov/
U.S. Geological Survey, Patuxent Wildlife Research Center: http://www.pwrc.usgs.gov/
U.S. Environmental Protection Agency, Western Ecology Division: http://www.epa.gov/wed/
U.S. Army Corps of Engineers, Wetlands and Coastal Ecology Branch: http://el.erdc.usace.army.mil/org.cfm?Code=EE-W

University Wetland Research Centers

Christopher Newport University, Center for Wetland Conservation: http://cnu.edu/cwc/
Duke University Wetland Center: http://nicholas.duke.edu/wetland/
Florida Gulf Coast University, Everglades Wetland Research Park: http://www.fgcu.edu/swamp/research.html
Florida International University, Wetland Ecosystems Research Lab: http://wetland.fiu.edu/
Halmstead University, Wetland Research Centre (Sweden): http://www.hh.se/english/sbe/research/bless/wetlandresearchcentre.286_en.html
Penn State University, Riparia: http://www.wetlands.psu.edu/home.asp
Radboud University Nijmegen, Institute for Water and Wetland Research (Netherlands): http://www.ru.nl/iwwr/about_iwwr/mission/
The University Network for Wetland Research and Trainings in the Mekong Region: http://www.en.mahidol.ac.th/wetland/
University of Florida, Wetland Biogeochemistry Laboratory: http://soils.ifas.ufl.edu/wetlands/
University of Florida, Howard T. Odum Center for Wetlands: http://cfw.essie.ufl.edu/
University of Ghana, Center for African Wetlands: http://www.afriwet.org/_home/Center%20for%20African%20Wetlands%20-%20University%20of%20Ghana_about%20CAW.html
University of Hull, Wetland Archeology and Environments Research Centre: http://www2.hull.ac.uk/science/waerc.aspx

Breeding waterbird ecology at Emiquon Preserve. Historically, the wetlands of the Illinois River valley (IRV) provided extensive and valuable habitat to migratory waterbirds and other wetland-dependent wildlife in the Upper Midwest, but anthropogenic modification have greatly changed the available habitats. The Nature Conservancy's Emiquon Preserve (hereafter, Emiquon) is the most substantial wetland restoration effort to date in the region, directly restoring, enhancing, or protecting >2,700 ha of former wetlands and associated uplands in the central IRV. In particular, Emiquon contains abundant aquatic plant communities largely absent from other wetlands in the IRV and important to waterbirds and secretive marsh birds. We cooperating with the National Great Rivers Research and Education Center, Illinois Ornithological Society, and Franklin College to provide opportunities for undergraduate students to gain valuable research experience while evaluating 1) nest density, 2) nest success, and 3) nest-site characteristics of waterbirds at Emiquon preserve. Contact: Heath Hagy, Ben O'Neal, and students,hhagy@illinois.edu

Body composition, gut parasite loads and blood parameters of spring-migrating scaup in the Upper Midwest. We are collaborating with the U.S. Fish and Wildlife Service and the Illinois Department of Natural Resources to examine the condition of spring-migrating diving ducks in the Upper Midwest. We will examine health-related aspects of migrating lesser scaup such as parasite loads, hematology parameters, and body nutrient composition and related to food availability and use, foraging habitat quality indicated by blood metabolites, stress, environmental contaminant exposure, and migration chronology in conjunction with other concurrent studies. Contact: Conner England, jconnerengland@gmail.com

An assessment of aquatic invasive plants in the Illinois River: water hyacinth surveillance, mapping, persistence, and potential seed dispersal. Water hyacinth (Eichhornia crassipes) is a re-occurring problem in the Illinois River – Chicago Areas Waterway System (CAWS) but the sources of the recurring infestation are unknown. Water hyacinth forms dense mats of vegetation on the surface of slow-moving waterways and backwaters restricting commercial and recreation traffic, outcompeting native emergent and submerged plants, and affecting natural biogeochemical and evapotranspiration cycles. Regular reoccurrence of water hyacinth represents a significant threat to the recreation, fisheries, and wildlife resources of both the Great Lakes and the Illinois & Mississippi River basins. We are documenting the temporal and spatial distribution of water hyacinth in the CAWS, developing an aerial survey technique for monitoring hyacinth coverage, and assessing seed prevalence in the soil and movement vectors. Contact: Jay VonBank, jayvonbank@gmail.com

Monitoring floodplain wetland restoration at Emiquon Preserve. Emiquon Preserve is a >2,700 ha drainage and levee district adjacent to the Illinois River near Havana, IL. This property was historically home to Thompson and Flag Lakes, widely renowned as two of the most productive lakes in the Illinois River valley. The lakes were drained in the early 1920s and used for agricultural production for more than 80 years. The Nature Conservancy (TNC) acquired the property in 2000 and restored these historic lake basins. As water and wildlife returned to the property, we have monitored the response of wetland vegetation and waterbirds to restoration efforts at Emiquon since fall 2007 to evaluate restoration success relative to desired conditions. To accomplish this, we've worked with TNC to document 1) abundance, diversity, and behavior of waterfowl and other waterbirds through counts and observations; 2) productivity by waterfowl and other waterbirds through brood counts; 3) plant seed and invertebrate biomass to understand energetic carrying capacity for waterfowl during migration and breeding; and 4) composition and arrangement of wetland vegetation communities through geospatial covermapping. Contact: Chris Hine, chine@illinois.edu

Aerial inventory of waterfowl along the Illinois and Central Mississippi Rivers. The Illinois and Mississippi river valleys are major migration and wintering areas for nearly 30 species of waterfowl in the Mississippi Flyway. The Illinois Natural History Survey, with support from the Illinois Department of Natural Resources and the U.S. Fish and Wildlife Service (USFWS), has conducted aerial inventories of waterfowl along the Illinois and Mississippi rivers since 1948. This undertaking represents the longest known inventory of waterfowl, preceding even the USFWS breeding waterfowl counts and mid-winter inventories established in 1955. Therefore, 65 years of data exist on fall-migrating waterfowl for these critical ecoregions. These data are used to evaluate site management and wetland restoration projects, describe the effects of natural events (e.g., floods and droughts), illustrate the effects of climate variation, develop wetland habitat carrying capacity models, and many other uses. Contact: Aaron Yetter and Michelle Horath, ayetter@illinois.edu

Evaluation of an aerial quadrat waterfowl survey along the Illinois River. An evaluation of long-term aerial inventories conducted by the Illinois Natural History Survey and the Illinois Department of Natural Resources are needed to determine the bias in relation to actual population sizes. A concurrent evaluation of a quadrat survey design using double observer, double sampling, and photographs of sampled locations to estimate detection probabilities with existing traditional aerial inventory methods will allow comparisons between counts and estimates. Understanding this relationship will provide a linkage between estimates produced by new

aerial surveys and counts produced using traditional methodology. Contact: Michelle Horath, mgeorgi@illinois.edu

Breeding bird use of wetlands managed for waterfowl in Illinois. Grassland, shrubland, and other guilds of breeding birds have declined precipitously in Illinois and across North America due to habitat alteration and loss, but waterfowl management activities may produce habitat suitable for breeding songbirds. A key assumption of several conservation planning documents is that some non-wetland bird habitat and population objectives can be accomplished by fulfilling waterfowl habitat objectives. Quantifying the benefits of moist-soil vegetation managed for waterfowl to other wildlife will help guide development of Illinois Department of Natural Resource land management strategies and the Illinois Wetlands Campaign documents. Contact: Heath Hagy, hhagy@illinois.edu

Foraging thresholds of spring migrating dabbling ducks in central Illinois. Giving-up densities (GUDs), which express the amount of food that remains after organisms cease foraging, can be used to estimate foraging thresholds in wetland habitat carrying capacity models. We used experimental foraging patches, placed in wetlands used by spring-migrating dabbling ducks (Anas spp.) along the central Illinois River valley (IRV), to estimate the GUD in relation to experimentally manipulated seed density, seed size, seed depth in the substrate, substrate type, and predation risk. Despite inter-annual differences, our results demonstrated that ducks were capable of removing substantially more seed from wetland habitats than previously known. Contact: Aaron Yetter, ayetter@illinois.edu

Status of great blue heron and great egret colonies and nesting bald eagles in Illinois. We aerially searched known wading bird colonies (i.e., great blue heron [Ardea herodias] and great egret [Ardea alba]) and bald eagle (Haliaeetus leucocephalus) nests in Illinois during spring 2012. We identified 148 active eagle nests and 95 active wading bird colonies in Illinois and along the shoreline of the Mississippi, Wabash, and Ohio rivers bordering Illinois. Comparisons with previous surveys indicated that the number of wading bird colonies in Illinois were stable. The number of active eagle nests (n = 148) identified during spring 2012 increased substantially from known nests in 2001 (minimum of 70 nests). Bald eagles have expanded their nesting distribution in Illinois. The eagle nest and wading bird database will be updated during spring 2014. Contact: Aaron Yetter, ayetter@illinois.edu

Ecology of spring-migrating canvasbacks and lesser scaup in the central Illinois and Mississippi River Valleys and the Upper Midwest. Lesser scaup and canvasbacks are commonly-harvested species of waterfowl in Illinois and are also listed as in greatest need of conservation under the Illinois Wildlife Plan. Populations of these species have declined in recent decades. Illinois wetlands provide resources during spring that likely influence breeding success, and sparse information exists to guide conservation planning in Illinois. We are evaluating spring habitat composition and quality (e.g., forage abundance), quantifying behavior to estimate the functional response to variation in habitat, assessing diets and blood metabolites, and leg-banding lesser scaup and canvasbacks in Illinois and Wisconsin. Contact: Joshua Osborn, osbornjm@illinois.edu

Department of Natural Resources and Environmental Sciences

The following projects are being conducted at the Department of Natural Resources and Environmental Sciences, University of Illinois, Champaign, IL under the Direction of Dr. Jeffrey Matthews (jmatthew@illinois.edu)

Soil organic matter and aggregate development in restored freshwater wetlands. George Geatz, a Ph. D. student, plans to explore vegetation and soil management activities that may promote soil development. The project is expected to be completed in Spring 2018. Contact: ggeatz@illinois.edu.

Tradeoffs among ecosystem services in restored wetlands. Jordan Jessop, a M.S. student, and collaborators measured decomposition rates, denitrification potential, herbaceous plant biomass, soil organic content, flood water storage potential and the diversity of plants, birds and anurans at 30 compensatory mitigation wetlands. They have found a clear tradeoff between biodiversity support and nutrient-cycling processes in these wetlands. This study is expected to be completed this spring. Contact: jessop2@illinois.edu.

Survival and growth of planted trees and recruitment of naturally colonizing trees in a restored flooplain forest. Adrianna Krzywicka, M.S. student, will relate tree species establishment to soil saturation, light availability and distance from seed sources and explore the potential for using soil magnetic susceptibility as a proxy for soil moisture when planting restored wetlands. Expected completion in Fall 2015. Contact: krzywic1@illinois.edu..

Is inter-wetland distance or local environmental factors better for predicting the occurrence and composition of non-native plant species in wetlands adjacent to roadways? Dennis Skultety, M.S. student, is evaluating this question for roadways in the Chicago region. He will use wetland data collected by the Illinois Natural History Survey at more than 2000 wetland delineation sites in his assessment. The study is expected to be completed in Fall 2015. Contact: skultety@illinois.edu. ■

The US EPA and Corps of Engineers proposed rules to clarify protection of wetlands and streams under the Federal Clean Water Act – link to news release: http://yosemite.epa.gov/opa/admpress.nsf/3881d73f4d4aaa0b85257359003f5348/ae90dedd9595a02485257ca600557e30

On April 3, 2014, the Corps of Engineers released Version 3.2 of the National Wetland Plants List Website (USACE NWPL Website) and the 2014 NWPL plant list updates. The 2014 lists are published on the website and include the following Changes to the 2013 NWPL. Version 3.1 National, Regional and State Plant Lists are still available under Download Plant Lists (2013) at the website (http://rsgisias.crrel.usace.army.mil/NWPL/).

The Association of State Wetland Manager's Website offers many news clips from across the U.S. about wetland issues and activitites: http://aswm.org/

U.S. Fish and Wildlife Service Completes Digital Wetland Coverage for the Lower 48 States, Hawaii, Trust Territories and 35 % of Alaska

Mitchell T. Bergeson[1], U.S. Fish and Wildlife Service, Madison, WI

The U.S. Fish and Wildlife Service's National Wetlands Inventory Program (NWI) is announcing the completion of the digital wetland coverage for the conterminous 48 States, Hawaii, Puerto Rico, the Virgin Islands, Guam, the major Northern Mariana Islands and 35% of Alaska (Figure 1). This was accomplished by adding updated data, accepting contributed data from states, digitizing existing hardcopy maps and producing scalable wetland data for those areas without maps. With this effort, the Service will have achieved the legislative mandate to map and digitize the wetlands of the conterminous United States, which is a National Geospatial Data Asset (NGDA) dataset designated by OMB Circular A-16 and the Federal Geographic Data Committee (FGDC).

The Service recognizes that landscape level analysis for long-range planning and resource management hinges on the availability and utility of large geospatial datasets at the regional or national level. We also believe landscape-level approaches to management hold the promise of a broader-based and more consistent consideration of both development and conservation, as opposed to the current piecemeal approaches. National digital datasets such as the wetlands layer will allow us to move toward system-focused actions for resource assessment.

The NWI dataset provides the public, tribes, universities and federal, state and local agencies with access to a wetlands data layer that contains nearly 20 million wetland and deepwater polygons with an average source date of 1988. The lower 48 states alone have over 18.7 million

1. mitch_bergeson@fws.gov *The findings and conclusions in this article are those of the author and do not necessarily represent the views of the U.S. Fish and Wildlife Service.*

Federal Agency Sites

U.S. Army Corps of Engineers, Regulatory: http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx
U.S. Army Corps of Engineers, Mitigation: http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/mitig_info.aspx
U.S. Environmental Protection Agency, Wetlands: http://water.epa.gov/type/wetlands/
U.S. Fish and Wildlife Service: http://www.fws.gov/
U.S. Forest Service, Wetlands Reserve Program: http://www.fs.fed.us/spf/coop/programs/loa/wrp.shtml
USDA Natural Resources Conservation Service, Wetlands Reserve Program: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/wetlands/
NOAA, National Marine Fisheries Service: http://www.nmfs.noaa.gov/
NOAA, National Estuarine Research Reserve System: http://www.nerrs.noaa.gov/
National Park Service, Wetlands Program: http://www.nature.nps.gov/water/wetlands/

Wetland Restoration and Monitoring Sites

U.S. Environmental Protection Agency: http://water.epa.gov/type/wetlands/restore/
U.S. Fish and Wildlife Service, Partners for Fish and Wildlife Program: http://www.fws.gov/partners/
USDA, Natural Resources Conservation Service, Restoration: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/wetlands/restore/
NOAA, Restoration Center: http://www.habitat.noaa.gov/restoration/index.html

Wetland Mapping Sites

Association of State Wetland Managers, Wetlands One-Stop Mapping ("NWI+ Web Mapper"): http://aswm.org/wetland-science/wetlands-one-stop-mapping
NOAA, C-CAP Land Cover Atlas: http://www.csc.noaa.gov/digitalcoast/tools/lca
NOAA, Digital Coast (Coastal Change Analysis Program Regional Land Cover): http://www.csc.noaa.gov/digitalcoast/data/ccapregional
U.S. Fish and Wildlife Service, National Wetlands Inventory ("Wetlands Mapper"): http://www.fws.gov/wetlands/Data/Mapper.html

mapped polygons which comprise over 100 million acres of wetlands and over 66 million acres of lacustrine and riverine habitats including the Great Lakes.

The present goal of the Service is to provide the citizens of the United States and its Trust Territories with geospatially referenced information on the status, extent, characteristics and functions of wetland, deepwater and related aquatic habitats to promote the understanding and conservation of these resources. This is realized in part by the implementation of the Wetlands Mapper which was accessed by over 335,000 users last year. The Wetlands Mapper provides easy access to anyone with a computer to view wetlands in their area of interest, print their own custom map and gain information on the size and types of these wetland and deepwater habitats. The Wetlands Mapper is accessed at: http://www.fws.gov/wetlands/Data/Mapper.html. The more casual users can view the wetlands on their free version of Google Earth. All it takes is one click to download the wetlands data at: http://www.fws.gov/wetlands/Data/Google-Earth.html.

Advanced GIS users can stream wetlands data live to their desktop GIS software or mapping applications through Web Map Services. This allows the user to integrate digital wetland data with other resource information they have to produce their own customized maps or answer management questions. For more information on the U.S. Fish and Wildlife Service's wetlands data layer, downloading instructions, standards, contacts and information on how to contribute wetlands data to this layer visit: http://www.fws.gov/wetlands/index.html. ■

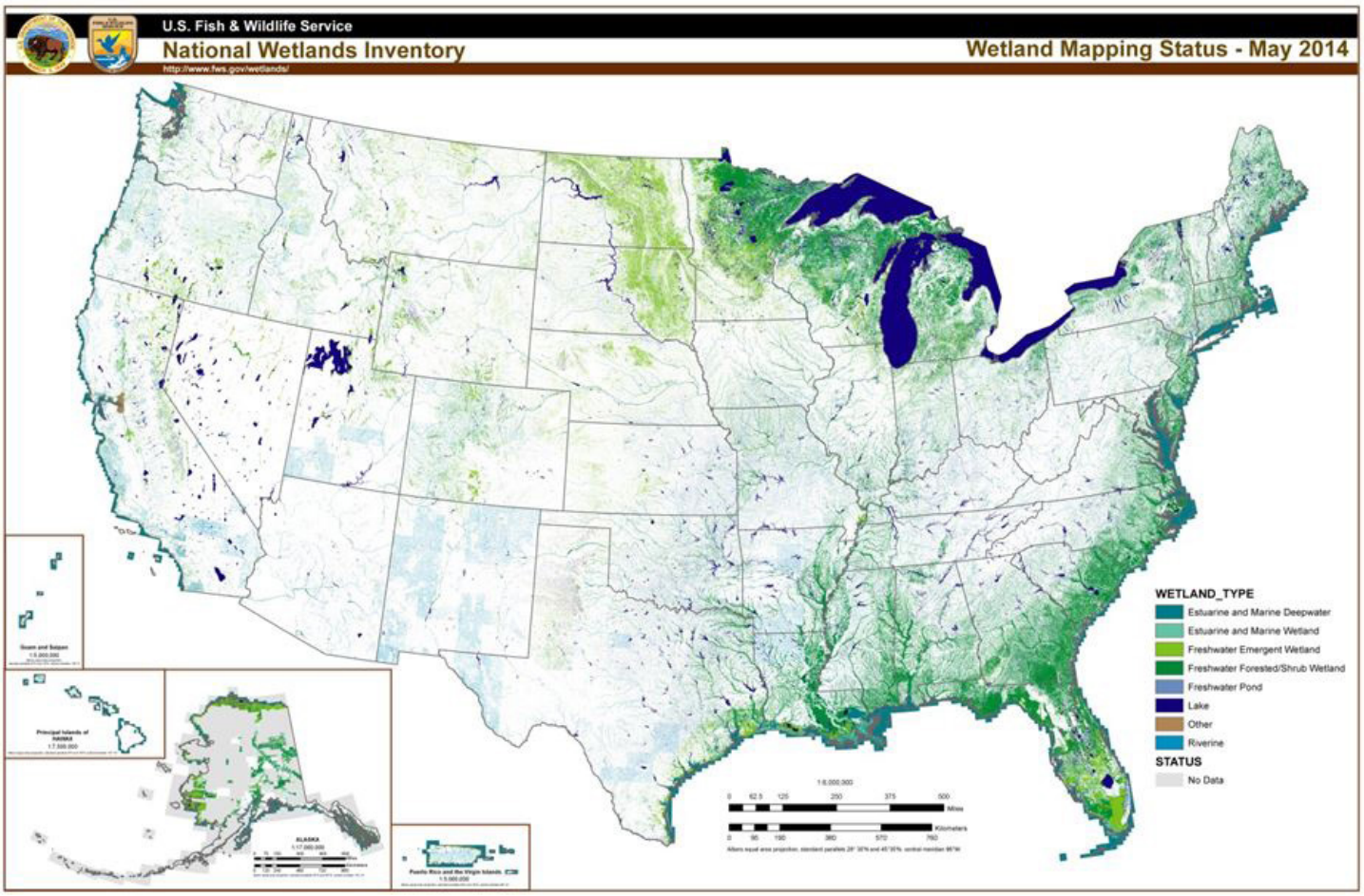


Figure 1. General distribution of wetlands and deepwater habitats in the conterminous U.S. and coverage of digital NWI for Alaska, Hawaii, and U.S. territories as of May 2014.

This new section is devoted to recording observations of plant and animal activity in wetlands. For this issue the focus was mostly on signs of such things as bud break, leaf emergence, first bloom, the return of migrants, and the commencement of breeding by amphibians. We started this effort a bit late this year for some parts of the country but should have observations from winter to spring in coming years. For other WSP issues, these and other signs such as fall migration of birds and leaf color changes and leaf drop, and plant die-back are worth documenting. Since this is the first issue with this section the observations are limited in geographic scope. Over time we hope to get participation from other areas across North America and elsewhere. If you would like to participate in recording your observations of life in the wetlands, please let me know by email (rtiner@eco.umass.edu). In your email, please put "WSP Nature Observations" in the subject box and in your response please indicate your geographic area. Special thanks to all who contributed to this issue!

NORTHEAST

Observations from New York

Rachel Schultz reports:

On April 11 in a riparian wetland dominated by Eastern Cottonwood (*Populus deltoides*) along the Saranac River in Plattsburgh (Clinton County): Skunk Cabbage (*Symplocarpus foetidus*) in flower, by April 18 most specimens averaged 8 cm in height, and by May 2 the leaves were unfolding (average height 30 cm).

May 2 in same wetland: bud break in Honeysuckle (*Lonicera* sp.), Red Osier Dogwood (*Cornus sericea*), and Common Buckthorn (*Rhamnus cathartica*); *Ribes* sp. had almost completely leafed out. Fiddleheads started to emerge, approximately 5 cm high; Eastern Phoebe singing its raspy song in the riparian area and a garter snake (*Thamnophis sirtalis)* slithering along the riparian bank. Also visited a cedar swamp along the river where Marsh Marigold (*Caltha palustris*) had leaves approximately 8 cm in height and a few plants with flower buds; Blue Flag (*Iris versicolor*) leaves emerged (approximately 12 cm in height); bud break in Speckled Alder (*Alnus incana* ssp. *rugosa*) and *Ribes*. In a less flooded area of the swamp, Skunk Cabbage flowers all had pollen, while leaves were still mostly tightly rolled up (approximately 15 cm tall). Leaves of Two-leaved Toothwort (*Cardamine diphylla*) were approximately 10 cm in height and Barberry (*Berberis* sp.) had started to leaf out.

Fiddleheads, Rachel Schultz

Marsh Marigold and Iris, Rachel Schultz

Jake Straub and Veronica Schmitt report:

April 4 from a wooded swamp in Flatrock State Forest (Clinton County): Marsh Marigold starting to emerge (<2 cm in height) even when 75% of ground still covered in snow. Later on April 25 Marsh Marigold noticeably larger about 6 cm, still no flowers, but large swelling flower buds visible; Blue Flag leaves emerged to a mean height of 4 cm. On May 1 approximately 20% of Marsh Marigold were flowering and Blue Flag leaves were now approximately 14 cm high. From a beaver-influenced emergent wetland in Flatrock State Forest (Clinton County): Arrowhead (*Sagittaria* sp.) plants about 20 cm tall still submerged in 1 m of water.

Ralph Tiner reports:

May 13 from Nelson Swamp, a calcareous forested fen in Nelson (Madison County): Marsh Marigold in full bloom in open areas along roadside. Other plants flowering include Shadbush (*Amelanchier canadensis*), Pussy Willow (Salix discolor), Marsh Blue Violet (Viola cucullata), and an unidentified sedge (*Carex* sp.; along roadside). Basal leaves of Wild Calla (*Calla palustris*) and flower buds present. Horsetails (*Equisetum* spp.) from 10-15 cm tall. In forest interior, Swamp Saxifrage (*Saxifraga pensylvanica*) had fertile stalk growing up to about 20 cm tall from cluster of large basal leaves, flower buds on inflorescence still immature.

Observations from Massachusetts

Ralph Tiner reports:

March 25 from a cattail marsh in Hadley (Hampshire County): Red-winged Blackbird returned from wintering grounds; other reports of this birds return can be found via Cornell University's "All About Birds" website (www.allaboutbirds.org) that contains range maps of species with past and present sightings recorded on dynamic maps of eBird sightings (http://ebird.org/content/ebird/).

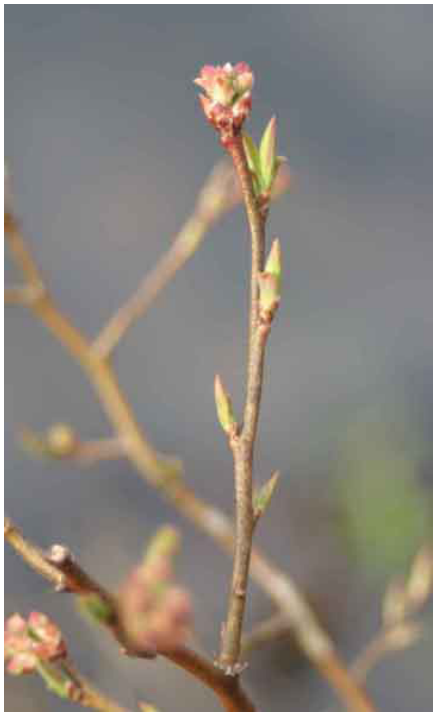
April 8 from cattail marshes, Leverett (Franklin County): For the first time this spring, Spring Peepers (*Pseudacris crucifer crucifer*) and Wood Frogs (*Rana sylvatica*) chorusing in a cattail marsh (*Typha latifolia*) and in a second cattail marsh about ½ mile down the road, only Spring Peepers calling; no chorusing yet up on Cave Hill as the woodland ponds are still iced over due to the surrounding evergreens and higher elevation. To hear their calls, visit: http://www.wildlifeofct.com/websitesounds/wood_frog_call.mp3 and http://www.wildlifeofct.com/websitesounds/20peepers.mp3.

April 10 from woodland ponds (vernal pools in Leverett): Wood Frogs have begun chorusing in large numbers; later on April 13 heard a few Spring Peepers in the pools used by Wood Frogs. (Note: Later in the month when cold weather returned, frog choruses ceased until warmer weather arrived.)

April 17 from streamside wetland in Leverett: False Hellebore (*Veratrum viride*) leaves emerged recently, plants are now 15-20 cm tall; Spicebush (*Lindera benzoin*) in flower. From nearby pond: flower buds present on Leatherleaf (*Chamaedaphne calyculata*).

May 2 from same streamside wetland, after a rainy week: False Hellebore now up to 50 cm or more. In neighboring seep: Canada Mayflower (*Maianthemum canadense*) leaves have emerged (up to 4 cm tall), Cinnamon Fern (*Osmunda cinnamomea*) fiddleheads to 25 cm in sunny spots, starting to unfurl (others much smaller), with Wood Anemone (*Anemone quinquefolia*) and Dwarf Ginseng (*Panax trifolium*) in flower. The Black Flies also called Buffalo Gnats (Simuliidae) were out in fair numbers around the creek. They are fondly referred to by many folks as the state bird of Maine. Along margins of a small pond: Leatherleaf flowers are now open. Leaf buds opening on Shining Rose (*Rosa nitida*) and flower buds expanding on Highbush Blueberry (*Vaccinium corymbosum*) - should open very soon. Chorusing of Spring Peepers almost deafening, only a few clucks from Wood Frogs.

Pussy Willow, Ralph Tiner



Blueberry bud, Ralph Tiner

Leatherleaf, Ralph Tiner

May 3 from vernal pool, Leverett: first call of Eastern American Toad (*Anaxyrus americanus americanus*; http://www.wildlifeofct.com/american%20toad.html) but Spring Peepers still dominant. Along the edges of a red maple swamp: Sensitive Fern (*Onoclea sensibilis*) fiddleheads and a few expanded to about 15 cm tall.

May 8 in early evening heard what I believed was a faint call of a single Gray Treefrog (*Hyla versicolor*; http://wildlifeofct.com/websitesounds/gray_treefrog_call.mp3) and a stronger call on rainy May 10 evening, but still a lone call (not repeating); chorus of Spring Peepers remains at high intensity.

May 11 from vernal pool, Leverett: Hundreds of wood frog tadpoles in the shallow end of the pool and many Spotted Salamander (*Ambystoma maculatum*) egg masses most with symbiotic algae.

May 14 from Leverett, heard a few more Gray Treefrogs while Peepers still loud; on May 16 rainy evening mixed chorus of Peepers and many Gray Treefrogs.

Observations from New Jersey

David M. Kunz reports:

All observations from a suburban riparian wetland (a former irrigation pond) in Flemington (Hunterdon County) is associated with a deeply incised, low-order stream that drains into the South Branch of the Raritan River.

April 11, several species had already leafed out: Skunk Cabbage (*Symplocarpus foetidus*; 15-30 cm high), Reed Canary Grass (P*halaris arundinacea*; 15-20 cm), and Yellow Rocket (*Barbarea vulgaris*; rosette leaves only). Bud-break in Spicebush (*Lindera benzoin*; flower buds) and Japanese Honeysuckle (*Lonicera japonica*; leaf

buds). New growth in Tussock Sedge (*Carex stricta*; 8-15 cm of green shoots/leaves from tussock) and Sweet Flag (*Acorus calamus*; 5-8 cm tall).

April 14, leaf buds breaking in Box Elder (*Acer negundo*).

April 20, leaf bud break in Morrow's Honeysuckle (*Lonicera morrowii*) and new growth (5-8 cm) in Agrimony (*Agrimonia* sp. (Agrimony).

April 23, flower bud break in Box Elder and flower buds formed on Yellow Rocket.

April 29, Yellow Rocket's flower buds began to open, while leaf buds started to break in Spicebush and Grape (*Vitis* sp.). Fiddleheads of Sensitive Fern (*Onoclea sensibilis*) emerged (5-10 cm tall) along with the new leaves of Southern Arrowwood (*Viburnum* cf *dentatum*). Fertile stems of Horsetail (*Equisetum arvense*) were fully developed, while sterile stems had just emerged.

Golden Club, Bill Sipple

Skunk Cabbage, Ralph Tiner

Wood Frog eggs, Bill Sipple

Observations from Delaware

Will Hohman reports:

April 2 from a coastal plain flatwood dominated by Loblolly Pine (*Pinus taeda*), Common Greenbrier (*Smilax rotundifolia*), and Red Maple (*Acer rubrum*) in Delmar (Sussex County): Red maple was in flower in areas exposed to partial/full sunlight. Spring Peeper in wet depression. Sweetbay Magnolia (*Magnolia virginiana*) losing its winter leaves, while buds emerging while buds emerging. Other plants still dormant including Lowland Broomsedge (*Andropogon glomeratus*), Sweet Pepperbush (*Clethra alnifolia*), and Soft Rush (*Juncus effusus*).

Observations from Pennsylvania

Will Hohman reports:

April 28 from floodplain along Crossings Run Creek, Collegeville (Montgomery County): About 50% of the Choke Cherry (*Prunus pensylvanica*) in understory in partial bloom, May Apple (*Podophyllum peltatum*) fully leafed out but no flowers detected, most of the Jack-in-the-Pulpit (*Arisaema triphyllum*) were in full bloom while approximately 20% were initiating flowers. Garlic Mustard (*Alliaria petiolata*) in sunny areas were in bloom but not elsewhere. Forest floor covered with the invasive Lesser Celandine (*Ranunculus ficaria*) in bloom. Sensitive Fern in poorly drained areas adjacent to incised creek had many fronds at the early stages of unfurling (rachis straight or nearly so), while others were in fiddlehead stage amongst last year's remnant stalks.

Observations from Maryland

Bill Sipple reports:

March 31 from a floodplain wetland along a non-tidal tributary of Piscataway Creek (Prince Georges County): Red Maple flowering on floodplain; Spring Beauty (*Claytonia virginica*) and Ivy-leaf Speedwell (*Veronica hederaefolia*) flowering on steep, 3-4 foot high, warmer southwest exposed creek bank, but not flowering on the cooler opposite side or on floodplain itself. Bud burst in Spicebush, both the leaf and flower buds are already green. Repeatedly flushed an early migrant warbler, the Louisiana Waterthrush, as it worked the creek channel for food, apparently either small earth worms or other tiny invertebrates. The first butterfly to emerge from overwintering pupae in the spring, the Spring Azure (*Celastrina argiolus*), settled in full sunlight on a muddy bar (Note: Spicebush is an important nectar source for adults.) Raccoon tracks on sand/mud bars; flushed a few Water Striders (*Gerris* sp.) from a small eddy; saw a couple of Northern Two-lined Salamanders (*Eurycea bislineata*) and an overwintered dragonfly nymph. In a small creek overflow area that functions like a vernal pool, spotted two juxtaposed Wood Frog egg masses (each cluster had an estimated 60 eggs). In a linear, very wet, forested seepage paralleling the stream: plants of the invasive Lesser Celandine were thriving and flowering as if it were an obligate hydrophyte. Leaf and flower buds of Box Elder were opening.

March 31 in a forested non-tidal wetland along Mattawoman Creek (Charles County): a large monotypic stand of Yellow Flag (*Iris pseudacorus*) plants emerged up to 10 cm above the water surface (maximum depth less than 30 cm), plants not yet flowering. Surrounding swamp was dominated by Red Maple, Green Ash (*Fraxinus pennsylvanica*), and Sweet Gum (*Liquidambar styraciflua*) with an understory of mostly Spicebush: Northern Spring Peepers were chorusing. At a fresh tidal Green Ash swamp along the Mattawomman: some Golden-club (*Orontium aquaticum*) flowering with no leaves present (something I have never encountered before), spadices were narrow and somewhat

immature, but already had stalks up to 2 cm tall. Along the shoreline: Smooth Alder (*Alnus serrulata*) buds were bursting as were those of Black-haw (*Viburnum prunifolium*), whose young inflorescences were even slightly exposed. Noted otter tracks on the tidally exposed shoreline sand/mud bars.

May 14 from Mattawoman Creek marshes: Yellow Flag now in bloom; all Golden-club in flower, many in fruit. Leaves of some Golden-club heavily browsed, possibly by deer.


Marsh Marigold, Ralph Tiner


Swamp Saxifrage, Ralph Tiner


Spotted Salamander egg mass, Ralph Tiner

MIDWEST

Observations from North Dakota

Lindsey Meyers reports:

April 16-17 from Burleigh and Morton Counties: no evidence of wetland plants emerging in many wetlands that were still frozen, but Smooth Bromegrass (*Bromus inermis*) was emerging in uplands. In Morton County, Reed Canary Grass (*Phalaris arundinacea*) was emerging in an oxbow wetland.

April 30 from McKenzie County: despite snow earlier in the week, Prairie Crocus (*Anemone patens*) was blooming in the uplands - this is the earliest prairie flower.

May 15 from a semipermanently flooded marsh (Burleigh County), reed canary grass (*Phalaris arundinacea*) emerged up to about 15 cm tall; from wet meadow/shallow marsh, Baltic Rush (*Juncus arcticus* ssp. *littoralis*) growth about 5 cm.

SOUTHEAST

Observations from Virginia

Alicia Koroi reports:

April 2 from floodplain of Goose Creek, Banshee Reeks Nature Preserve (Loudon County): mottled leaves present in Trout Lily (*Erythronium umbilicatum*) and buds of Virginia Bluebells (*Mertensia virginiana*) had blue petals peeking out. From an 8-year old created mitigation bank – a palustrine scrub-shrub/emergent wetland: sedges (*Carex* sp.) with leaves about 10 cm long.

April 10 from rain-fed wetland mesocosms on George Mason University Campus, Fairfax (Fairfax County): Green Bulrush (*Scirpus atrovirens*) with leaves about 10 cm long and Cattail (*Typha* sp.) stems about 10 cm tall.

April 13 from bottomland forested wetland/hardwood forest (with about 0.4 cm of water in places) and freshwater marsh (with 15-20 cm of water) at Huntley Meadows Park, Alexandria (Fairfax County): flower buds large and plump on Redbud (*Cercis canadensis*), Spring Beauty in bloom and covering forest floor like a mat, Red Maple bearing winged fruits, Box Elder leafing out, May Apple erect and leafed out but no flowers, first leaves of Alder (*Alnus* sp.) emerging (1.25 cm unfurled), a few Violets (*Viola* sp.) in bloom, Virginia Creeper (*Parthenocissus quinquefolia*) fully leafed out but still immature (in marsh, leaf buds only 1.25-2.5 cm). No leaves yet on Poison Ivy (*Toxicodendron radicans*). In marsh, cattail shoots up to 40 cm; stems of rushes (Juncus sp.) green. Snapping Turtles (*Chelydra serpentina*) and Eastern Painted Turtles (*Chrysemys picta picta*) active, two Eastern Garter Snakes sunning themselves or hunting, heard trills of Eastern American Toad as well as the calls of Red-winged Blackbirds.

April 16 from detention pond and wetland on George Mason University's Fairfax Campus: small leaves observed in Black Willow (*Salix nigra*); those of some Red Maples were unfolding like an umbrella, while others had only winged fruits (samaras). Leaves of Alder (possibly *Alnus serrulata*) were <2 cm, while small alder shoots were farther along at leafing out than larger bushes.

April 19 from a 15-year old created wetland - North Fork Mitigation Bank - in Haymarket (Prince William County): Black-legged Tick (*Ixodes scapularis*) and Lone-star Tick (*Amblyomma americanum*) active; reddish-brown leaves (5-8 cm in diameter) of White Water Lily (*Nymphaea odorata*) cover a significant portion of open water; Black Willow (*Salix nigra)* leafed-out (1-2 cm; about 5 nodes of leaves per stem) and bearing catkins (about 20 catkins per multi-stem tree at water's edge); shoots of Pickerelweed (*Pontederia cordata*) have emerged bearing small leaves; majority of buds on Sycamore (*Platanus occidentalis*) have not broken; Dogwoods (*Cornus* spp.) bearing tiny leaves; compound leaves of Green Ash have recently emerged (still small); buds of Sweet Gum (*Liquidambar styraciflua*) have just broken (tiny bundled green leaves growing), while buds of Pin Oak (*Quercus palustris*) are green but not open.

April 27 from a floodplain forest along the Potomac

River at Scotts Run Nature Preserve, Great Falls (Fairfax County): several species flowering: Pawpaw (*Asimina tribola*), Star Chickweed (*Stellaria pubera*), Rue Anemone (*Thalictrum thalictroides*), Purple Woodland Phlox (*Phlox divaricata*) and Virginia Bluebells. New leaves (glossy, dark brown to bronze) emerged in Poison Ivy.

May 5 from brackish tidal marsh at York River State Park, Williamsburg (James City County): new shoots of Common Reed (*Phragmites australis*) about 60 cm tall. And from floodplain forest at the Park: Red Columbine (*Aquilegia canadensis*) in bloom on riverbank and Ninebark (*Physocarpus opulifolius*) just beginning to flower (only parts of compound inflorescences were flowering). From the bank of a neighboring pond: Tulip Poplar (*Liriodendron tulipifera*) had most flowers just starting to form; Water Oak (*Quercus nigra*) flowering, and Red-berried Greenbrier (*Smilax walteri*) with flower buds.

Observations from North Carolina

Scott King reports:

March 15 in forest beside Morgan Creek (Orange County): a few Northern Trout Lily (*Erythronium americanum*) in flower.

April 2 along an unnamed tributary of Cane Creek (Alamance County): an extensive stand of Bloodroot (*Sanguinaria canadensis*) in bloom.

April 11 from a floodplain of Turkey Hill Creek (Alamance County): very dense groundcover of Spring Beauty in bloom.

April 12 from the floodplain of Sevenmile Creek (Orange County): the following species are flowering: Quaker-lady Bluets (*Houstonia caerulea*), Swamp Buttercup (*Ranunculus carolinianus*), Coville's Phacelia (*Phacelia covillei*), Chickweed (*Stellaria pubera*), Blue Cohosh (*Caulophyllum thalictroides*), and Spring Beauty.

April 16 from floodplain along Crabtree Creek (Wake County): Jack-in-the-Pulpit was newly flowering (only half were still bare), Little Brown Jug (*Hexastylis arifolia*) in bloom, and Yellow Jasmine (*Gelsemium sempervirens*) was at the end of flowering (most petals had fallen).

April 24 from forested floodplain of an unnamed tributary to the Haw River in Guilford County: Swamp Buttercup was in full bloom, Field Pansy (*Viola bicolor*) appeared to be near the end of its flowering. Three American Goldfinches (at least one male, other two unknown) and two Bluebirds (one male, one female) in area.

Cross Vine, Ralph Tiner

Shadbush, Ralph Tiner

Copperhead, Ralph Tiner

Observations from Florida

Jay Kamke reports:

February 4 in a hydric hammock in the Peace River watershed (Brushy Creek; Hardee County): some Toothpetal Bog Orchid (*Habenaria odontopetala*) with the seed pods forming from the fading flowers (petals were browning in senescence).February 6 in wet pine flatwoods located within the same watershed (Brushy Creek; Hardee County): Yellow Hatpins (*Syngonanthus flavidulus*) had flowerbuds (not yet opened up) and Bog White Violet (*Viola lanceolata*) was blooming.

March 26 in a freshwater prairie adjacent to West Bay (Bay County): Yellow Pitcher Plant (*Sarracenia flava*) and Buckwheat Tree (*Cliftonia monophylla*) in full bloom.

March 29 in a floodplain forest along an unnamed freshwater brook in the Munson Slough watershed (Leon County): Coastal Doghobble (*Leucothoe axillaris*) starting to bloom.

April 1 within the edge of a wetland ecotone of wet pine flatwoods located within the Peace River watershed (Oak Creek; Hardee County): Southeastern Sneezeweed (*Helenium pinnatifidum*) was flowering

April 3 in a freshwater marsh in the same watershed (Oak Creek; Hardee County): the following plants were in bloom - Dixie Iris (*Iris hexagona*), Soft Rush (*Juncus effusus*), Dotted Smartweed (*Polygonum punctatum*), Nuttall's Thistle (*Cirsium nuttallii*), and Buttonbush (*Cephalanthus occidentalis*).

April 4 in a floodplain forest in the Peace River Watershed (West Fork; Hardee County): the following plants were in bloom - Lizard's Tail (*Saururus cernuus*), Dixie Iris, Blue Mistflower (*Conoclinium coelestinum*), Bay Lobelia (*Lobelia feayana*), Water Pimpernel (*Samolus parviflorus*), and Fourleaf Vetch (*Vicia acutifolia*).

April 11 in a floodplain forest of an unnamed freshwater brook in the Munson Slough watershed (Leon County)" two plants just starting to bloom - Bursting Heart (*Euonymus americana*) and Canadian Black Snakeroot (*Sanicula canadensis*).

PACIFIC NORTHWEST

Observations from Washington

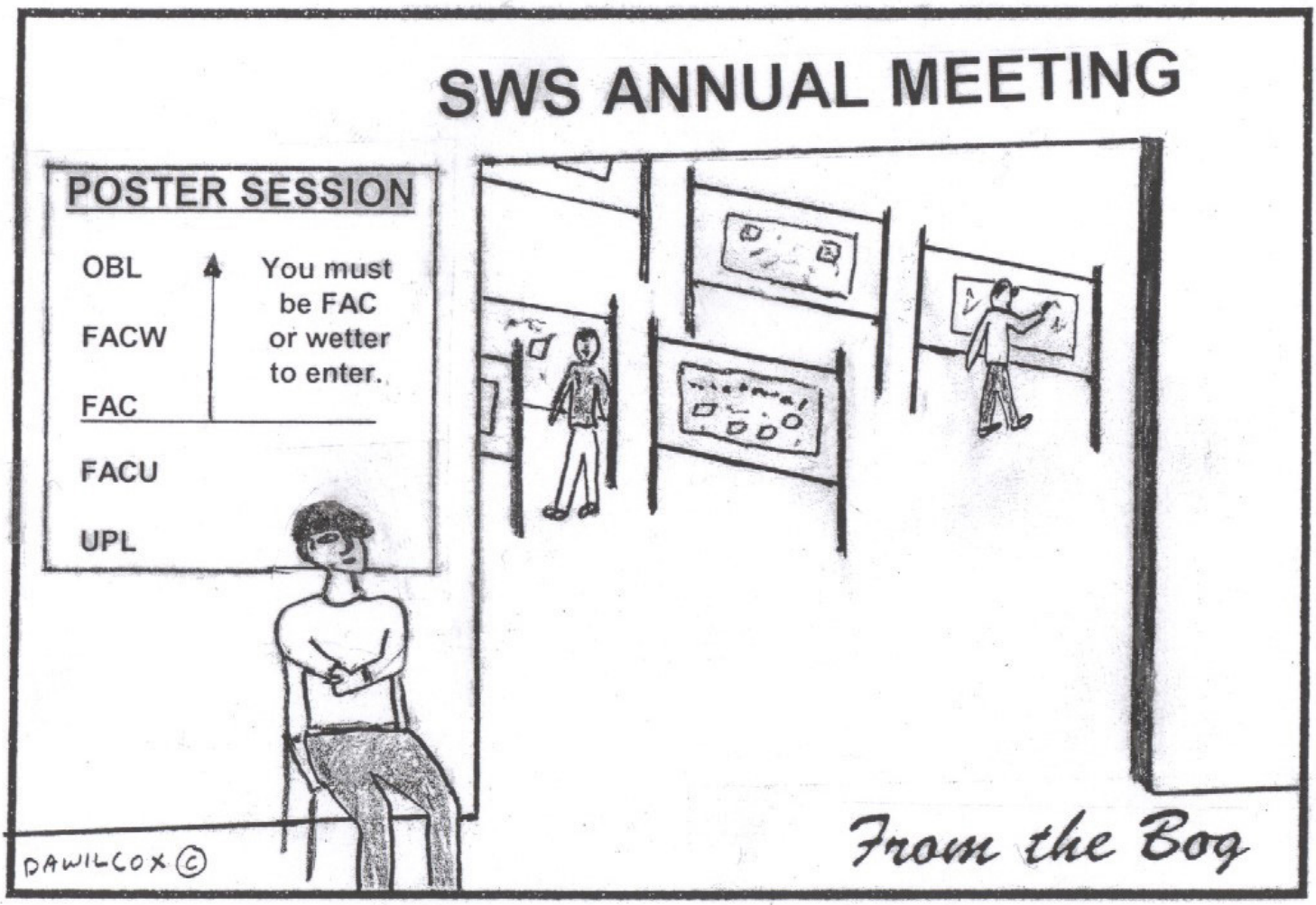
Maki Dalzell reports:

April 16 from forested wetlands along a stream in urban watershed in Federal Way (King County): Salmonberry (*Rubus spectabilis*) starting to flower, but majority of other species have no flowers/buds yet. Skunk Cabbage (*Lysichiton americanus*) has fresh green leaves but no flowers. Fiddleheads of Lady Fern (*Athyrium filix-femina*) are completely opened up. Red Alder (*Alnus rubra*) has green catkins but no cones yet.

April 28-29 from an estuarine wetland near Steamboat Slough in Marysville (Snohomish County): Narrowleaf Cattail (*Typha angustifolia*) is pretty much flowered out and Red-winged Blackbird is actively calling. Lyngbye's Sedge (*Carex lyngbyei*) has started blooming. Seaside Arrow-grass (*Triglochin maritima*) has green buds but not blooming. Softstem Bulrush (*Schoenoplectus tabernaemontanii*) is starting to bud out. Small leaves observed on Fat-hen Saltbush (*Atriplex patula*) and Pacific Silverweed (*Argentina egedii*) but no flowers yet. Stems of Spikerush (*Eleocharis obtusa*) are starting to emerge. Small fish in the shallow channel in the wetland. Great Blue Heron was flying nearby. From a forested freshwater wetland near Steamboat Slough: some Twinberry (*Lonicera involucrata*) have flowers and/or fruits. Soft Rush (*Juncus effusus*) and Slough Sedge (*Carex obnupta*) observed in the middle of the forested wetland where it is mostly inundated with approximately 15 cm of surface water. Soft Rush has been grazed by deer but do not appear to have flowers yet. Slough Sedge spikes are brown and appear to be blooming. Two species of willows – Pacific Willow (*Salix lasiandra*) and Scouler's Willow (*S. scouleriana*) were in the wetland; Pacific Willow bore female catkins. ■

Streamside False Hellebore, Ralph Tiner

Wood Frog tadpoles, Ralph Tiner



wetland science & practice

The WSP is the formal voice of the Society of Wetland Scientists. It is a quarterly publication focusing on the news of the SWS, at international, national and chapter levels, as well as important and relevant announcements for members. In addition, manuscripts are published on topics that are descriptive in nature, that focus on particular case studies, or analyze policies. All manuscripts should follow guidelines for authors as listed for Wetlands as closely as possible. All papers published in WSP will be reviewed by the editor for suitability. 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.