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Association of Massachusetts Wetland Scientists

NEWSLETTER

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IN THIS EDITION

KOONTZ V. ST. JOHNS RIVER WATER MANAGEMENT DISTRICT: EXPANSION OF REGULATORY TAKINGS IN THE CONTEXT OF LAND USE PERMITTING CONDITIONS

MICHELE A. HUNTON AND GLENN A. WOOD

Is the government's denial of a land use permit where the developer fails to agree to certain conditions, as opposed to its approval of a permit subject to certain conditions, an unconstitutional taking? Is the government's requirement of the payment of money, as opposed to its demand for real property, an unconstitutional taking? The United States Supreme Court addressed these issues for the first time in Koontz v. St. Johns River Water Management District. See 133 S. Ct. 2586 (2013).

Many are familiar with the Takings Clause of the Fifth Amendment of the United States Constitution, which limits the power of eminent domain by requiring that "just compensation" be paid if private property is taken for public use. It is straightforward when applied to situations where the government physically takes property. Another type of taking, arguably less clear is that of a "regulatory taking". It occurs when a regulation goes so far that it will be judicially recognized as the equivalent of a taking, which may not take place without just compensation. See Pa. Coal Co. v. Mahon, 260 U.S. 393 (1922). The Supreme Court case Penn Central Transp. Co. v. New York City, 438 U.S. 104 (1978), is the seminal case governing such regulatory takings. It identifies several factors to be examined in takings cases, such as the character of the government action and the economic impact of the regulation on the claimant.

Going one step further than Penn Central, the Koontz case and its predecessors Nollan v. California Coastal Comm'n and Dolan v. City of Tigard provide an additional layer of protection against unconstitutional takings with the important link between regulatory programs and conditions imposed in permits. As indicated in Koontz' dissenting opinion, these cases provide "a special application of the doctrine of unconstitutional conditions, which provides that the government may not require a person to give up a constitutional right – here the right to receive just compensation when property is taken – in exchange for a land use permit." These cases apply when a demand or condition would have constituted a taking when executed outside of the permitting process.

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AMWS IS GETTING READY FOR THE FLOOD of registrations for the November 15, 2013 Annual Meeting at the Warren Conference Center in Ashland!

Our subject, **DAM REMOVAL & WETLAND RESTORATION,** is this year's "IT" topic nationwide.

Please see page 12 for more information.

AMWS OFFICERS

PRESIDENT
Brian Butler
Oxbow Associates, Inc.
butler@oxbowassociates.com
978-929-9058

VICE PRESIDENT
Jacob Dunnell II
ARCADIS
jacob.dunnell@arcadis-us.com
978-322-7016

TREASURER
Michael Howard
Epsilon Associates, Inc.
mhoward@epsilonassociates.com
978-897-7100

SECRETARY
Jennifer Carlino
Norton Conservation Agent
conservation@nortonmaus.com
508-285-0275

PAST PRESIDENT
Heidi Davis
Mass. Dept. of Environmental Protection
heidi.davis@state.ma.us
978-694-3255

STANDING COMMITTEE CHAIRS

PROGRAM/EDUCATION
John Dick
Hancock Associates, Inc.
jdick@hancockassociates.com
978-777-3050

MEMBERSHIP
Jacob Dunnell II
ARCADIS
jacob.dunnell@arcadis-us.com
978-322-7016

GOVERNMENTAL AFFAIRS
Glenn Wood
Rubin & Rudman, LLP
gwood@rubinrudman.com
617-330-7016

WILDLIFE
Diana Walden
BSC Group
dwalden@bscgroup.com
617-896-4529

NEWSLETTER
Cori Rose, Editor
Army Corps of Engineers
cori.m.rose@usace.army.mil
978-318-8306
Ruth Ladd, Assistant Editor
Army Corps of Engineers
ruth.m.ladd@usace.army.mil
978-318-8818
Alyssa Jacobs, Assistant Editor
Epsilon Associates, Inc.
ajacobs@epsilonassociates.com
978-461-6271
Katie Barnicle, Newsletter Design
AECOM
kathryn.barnicle@aecom.com
508-888-3900 ext. 240

NON-STANDING COMMITTEE CHAIRS

ETHICS
Michael Seekamp
Seekamp Environmental Consulting, Inc.
seekampm.sec@comcast.net
603-642-8300

PROFESSIONAL NETWORKING
David Gorden
david72709@gmail.com
781-273-2500

NOTES FROM THE EDITOR

This deadline for the fall AMWS newsletter also brings with it that time of year when there is little to no period of darkness between sunset and moonrise. Warm afternoons with deep blue skies blend almost instantaneously into chilled starlit nights followed by shrouded mist-filled morning meadows. It is a special time of year, at least for me.

Reading this month's article by Irina Kadis and Alexey Zinovjev gave me the motivation to reassess the status of willows in my yard. The large shrub on the border of our pond that flowers during or shortly thereafter our pussy willows may not be the Bebb's willow that I believe it is. How disappointing. But, I did find this write-up especially helpful in sorting out the often confusing task of willow identification. This resource is clearly one to add to my field binder right next to my cheat-sheets for goldenrod, asters and sedges. I hope you find it useful too.

And, as always, we value your newsletter contributions! If you have ideas for recurring columns or a single topical article or have ever thought about submitting an article, calendar item, book review etc. to the Newsletter, please do. We are a diverse group of authors that represents regulatory agencies, law firms, consulting firms, academia, and advocacy groups. Feel free to contact me by email at cori.m.rose@usace.army.mil or corirose99@gmail.com. All ideas, submissions, and general comments regarding the Newsletter will be warmly received.

The deadlines for article submittal to the AMWS Newsletter are:

- December 10, 2013 for the January 2014 edition;
- March 10, 2014 for the April 2014 edition;
- June 10, 2014 for the July 2014 edition;
- September 10, 2014 for the October 2014 edition.

If possible, advance notice of the intent to submit an article would be appreciated so that I can plan accordingly. Thank you, in advance, for your continued support of the AMWS Newsletter.

Cori M. Rose, PWS

WEB PAGE MASTER
Brooks Garner
brooksgarner@me.com

CONTACT INFORMATION
Deborah Garner, Administrator
AMWS
109 Whitney Street
Northborough, MA 01532
administrator@amws.org
508-523-2053

The articles included in the AMWS Newsletters are for our reader's information. Inclusion of these articles does not imply endorsement by the AMWS.

MEMBERSHIP INFORMATION

AMWS is the only organization geared especially for wetlands professionals working in Massachusetts. Our members include wetland and soil scientists, hydrologists, engineers, attorneys, academics, students, and others. Members who meet the Voting Member requirements are strongly encouraged apply as such. Please see www.amws.org for membership requirements, membership information, and an application form. Annual dues are:

- $60 for Private Sector Voting and Non-voting Members;
- $40 for Public Sector Voting and Non-voting Members;
- $20 for Student (Non-voting) Members;
- $20 for Retired Voting and Non-voting Members; and
- $325 for Corporate Membership. (Corporate Membership allows multiple individuals from one company or recognized organization to join AMWS at a reduced set rate based upon ten individuals, with a pro rata fee applied to more than ten. A separate application form should be provided for each individual.)

PRESIDENT'S MESSAGE: WHEN THE WATER LEAVES THE WETLAND

BRIAN BUTLER

More and more frequently I find myself saying there isn't any such thing as a "routine" wetland delineation anymore. With the exception of suburban, lawn-edged ponds and armored brook channels, there almost never is. Be it the criteria of a local bylaw, a history of disturbance, anomalous or unfavorable conditions or other twist of fate, there seems to always be something requiring at least a modicum of thinking outside the box. Maybe it is just along the lines of the adage oft quoted by site developers - that all the "good" lots have been developed. Maybe all the good (simple and straightforward) delineations have been done.

In that regard, someone as easily bored as I should be grateful. Going out and doing mundane, unchallenging delineations and the routine permitting to support them could get painful. I've already had jobs where the repetitiveness leads to daily dread. So, I won't bemoan the numerous times I've concluded, "That'll be easy," whether based upon the client's description, the MassGIS data layers, or other preliminary sources, only to find the contrary condition in the field. More appropriately, maybe I should adopt the stance of – "expect the unexpected".

One of the phenomena that require you to use your noggin in the field is when the hydrology has been altered; and I'm not talking in the way beavers do. Drained wetlands, large or small, are a challenge. This challenge is amplified if the source of the alteration is not otherwise obvious; being too far afield, too historic, or too subtle to show itself on that first head-scratching perambulation of the site.

There is a solution, of course: piezometry. But installing standpipes and waiting for the calendar pages to blow away one by one like an old black and white movie has its down side. Time, after all, is money. A five, six, eight or ten month tolling period is emotionally and financially agonizing for most project proponents. Few will take this route voluntarily. Often the costs associated with this kind of empirical demonstration are disproportionate to a modest project's budget. For this reason, only the sites really steeped in contention typically sprout a plastic pipe farm. The interesting ones come when you need to assess the site, its history, and how that history has transformed today's conditions – and convince the regulatory bodies that you have it all figured out. These are fun.

A number of recent, and not so recent, field sites come to mind. One that bucks the trend and belies an explanation of changing conditions is that of Cape frost bottoms. A portion of these dry kettles, not necessarily hydric even in their depths, seem to mimic the drained wetland landscape. Coming upon a handful of small hardwoods in the nadir of a kettle makes it clear that there was more top soil here in the geologically recent past. A three inch diameter tree exhibiting what look like mangrove roots clearly has been robbed of soil; its growth rate stunted by the extreme conditions at ground zero. Where did the soil go and why was it here? I don't know what change might have occurred to convert an area of organic accumulation to one of organic material loss in the lifespan of some relatively small trees. With groundwater sixty feet or more below, hydrology is not the culprit. I remain perplexed. Outside of climate change (doesn't get my vote either), I have to assume a fire or regrowth after a long forgotten fire in the surrounding higher ground pitch pine forest, has changed the air circulation and microclimate in the kettle(s) from one favoring accretion to one fostering depletion.

These trees have lost about a foot of organic soil in less than fifty years
Photo Credit Brian Butler

But this is not a wetland phenomenon, just a thought provoking simile that has jogged

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my mind when I encounter similarly malformed plants in a former wetland.

At one time, finding a drained wetland was commonplace here in the Commonwealth. After all, stalwart farmers had been draining swamps to make them tillable since Myles Standish. Finding a hydric soil belying an upland condition, even beneath fields of row crops was not uncommon for at least a few centuries, I'm certain. But no one was out there with Munsell and auger looking, at least not from a regulatory perspective, until after agriculture succumbed to industry in the Northeast.

The period of agricultural abandonment that began in the 19th century meant that no one was clearing and maintaining the ditches. Limbs dropped across the ditch, the leaves accumulated, rootlets permeated the leaf windrows and, before you know it, the hydrology was, more or less, restored. Depleted soils below the plow layer resume their reduced chemical state experienced for millennia prior to modification. This is the state of affairs prevalent when the practice and regulation of wetland science crept out of the mid-century primordial ooze to evolve into the "Act".

So, it has been pretty commonplace to go to a mature second growth hardwood swamp, armed with an auger or spade, and witness the signs of the agricultural history in its recent past; a dark O or A horizon is subtended by a depleted mineral layer shuffled by ploughshares and tree tipups. Further, the hydrology seems to match both the plant community above, and the soil profile below the surface. No great brain strain there. The prevalent practice of ditching and draining for post-war subdivisions often swung the cycle back to the dry, but depleted, soil profile.

My first experience with a drained wetland goes back to the early days of my pre-career in grade school. There was a field we called the "Shrunken Heads." What it was in reality, looking back all these years later, was a tussock sedge wetland that had been drained, probably about a century earlier when the nearby reservoir was dug by brute labor and the brook became a city water supply basin. Here tussocks, growing in black soil with silvery grains, stood two or more feet out of the ground in a configuration reminiscent of soldiers marshaled for battle. We imagined these were bodies buried to the shoulders of their owners. How that became shrunken heads, I don't know. Among the "heads" were tunnels of voles and even a nest of speckled eggs of a bird I can only guess as to its identity. Why the trees didn't close in and retake this vestige of an earlier day, I have no idea. I wonder if it is still there?

At one time these roots began at the soil surface
Photo Credit Brian Butler

Decades later, and with a somewhat advanced understanding of wetlands processes, compared to my 5th grade credential, I consider my most recent experience with this sub-theme and reinitiated my thinking about this widespread, if variable, phenomenon we encounter in the field – wetlands without the water.

We got a call about some work on an existing home, in a town with a highly restrictive bylaw. I went to the site in hopes of a simple solution for the client. But when I pulled in the driveway with a view of the rear yard and the forest beyond I declared the project dead before opening the door to get out. It was obvious that red maple swamp (PF01 of Cowardin, et al.) came right up to the back of the abbreviated back yard that, no doubt, had itself been carved from this same swamp ca. 1964. What do you do? Tell the client this is a lost cause and go grab lunch?

It was winter, so plants were attenuated and soils were wet. Further review revealed more of the history of the subdivi-

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sion. Forty yards back was an eight-foot grid-like stream system flowing to a 48-inch culvert out of the subdivision. The trees in the elevated (relative to the ditch) woodlands behind the home showed extreme buttressing and prop-roots; some were leaning as their grip on Mother Earth was gradually eroded, beginning right about 1964.

This site was classic. Anoxic, organic soils, having accumulated there for centuries were given their first taste of atmospheric oxygen since the glaciers and they were lapping it up. Soils that had taken millennia to accumulate were now composting away at what appeared to be a rate of more than one vertical foot in less than half a century. The older trees were mostly maple. But the seedling tree and shrubs were considerably more biased to upland species. Eventually the mature trees will concede their footholds in progressively less soil and the upland community will prevail. Darwin, it seems, was right.

Not adventitious roots - here hydrophytes respond to a change in drainage conditions
Photo Credit Brian Butler

Another case comes to mind. One where the predominant features were large black willow and peat—the real hemic, red-brown kind, not unlike the bagged variety from Canada. This was the site of considerable controversy set on the boundary between two towns. It was one of those shoot-out scenes illustrative of "The Good, the Bad, and the Ugly." Three separate consultants represented the various concerns of neighbors, municipalities and the project proponents, with Mass DEP staff as well. There were multiple issues in play, but the area from the street that was clearly a wetland was the aspect that remains most clear in my mind.

Beneath the black willows we all stood. Brown peat was viewable in patches at the surface. You could feel the spongy texture beneath your feet and, though it wouldn't quake, it would bounce. An auger went in right to the handle with very little resistance, retrieved with very little moisture in the material. Although we were standing on at least four feet of purely organic peat with an overstory of black willow (OBL in most recent NWI revisions), we all resolved by the end of the day that the days of that site being a jurisdictional wetland probably ended with the construction of the adjacent commercial property back in the 1960s. Any remaining vestiges of wetland habitat were just that; peat destined to de-gas away to atmospheric nitrogen and carbon over time and black willows destined to topple over even sooner.

Another site I reviewed five or six years ago reminded me of the shrunken heads. Evidently, "mosquito control" had ditched the perimeter of this Worcester County property. And ditch it they did. The trough created was four to five feet lower than the flat grade that predominated the site. There again were the tussock sedges, an obligate species, joined by mature red maples and an elm here and there. The soils were compelling - almost off the (Munsell) chart with regard to their states of depletion. But early on it was clear that, though we had tussock sedges over here and maples or elms over there, all the new woody growth was considerably more upland in character. Oaks and white pine comprised the majority of seedling and sapling stage tree species. Herbaceous species were somewhat less committal, but the process had been set in motion. With the exception of the great trough, the hydrologic rug had been pulled out from under this site. It would be nice to have a volume of groundwater data to support a contention that this site, rife with hydrophytes, does not meet the criteria for jurisdictional wetlands. And of course once you assess a site you may be confronted further with the forensics. Is the "alteration" subject to Corps jurisdiction? When was it done? By what method, dredging or ditching?

I guess these challenging, off-the-norm situations are good for us. It discourages complacency and reduces the risk of boredom burn-out. Is this really why we find ourselves in this business? It is hard to explain to a civilian the mental gear-grinding that results from such non-textbook scenarios. But for those of us that understand the textbook, it keeps it fresh and real.

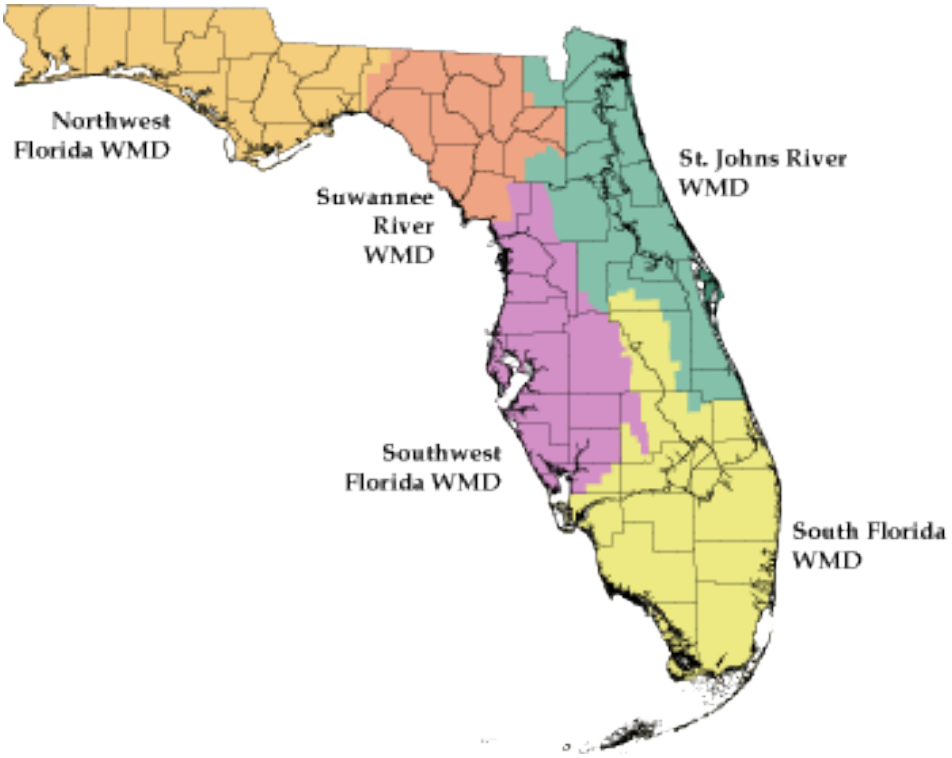
Takings (Continued from Page 1)

BACKGROUND OF CONSTITUTIONAL PROTECTIONS FOR LAND USE PERMITTING CONDITIONS

The United States Supreme Court addressed the issue of whether certain permit conditions, also known as exactions, are constitutional in Nollan v. California Coastal Comm'n, 483 U.S. 825 (1987) and Dolan v. City of Tigard, 512 U.S. 374 (1994). These were the leading cases on the constitutionality of land use permit conditions until Koontz expanded their holdings. Nollan and Dolan go beyond simply addressing excessive regulatory burdens on land use by preventing the government from imposing an "unconstitutional condition". Such is a requirement that persons give up their constitutional rights to receive just compensation "in exchange for a discretionary benefit" having "little or no relationship" to the property taken.

In Nollan, the Supreme Court invalidated a permit condition imposed by the California Coastal Commission that required the Nollans, as landowners, to grant the public a lateral easement running parallel to the Nollans' beach so the public could pass from certain public areas on one side of the beach to such areas on the other side of the beach. The Nollans had proposed to build a large house on their beachfront property and the Commission conditioned the project with this easement on the basis that the house blocked the view of the beach from the road and would prevent the public from realizing public access to a nearby beach. The Supreme Court found this to be improper not because it deprived the Nollans of all practical land use, but because the restriction failed to further the purpose of public beach access that the Coastal Commission had advanced. The Supreme Court found that this condition did not "substantially advance" a valid state interest on the record, and the "essential nexus" was missing because the easement condition did not actually protect the public's ability to see the beach or realize public access to the beach because the easement was lateral running parallel to the beach as opposed to a vertical easement running perpendicular from the road to the beach.

In Dolan, the Supreme Court held that a state is required to show a "rough proportionality" between the project's impact and the degree of exactions required by the permit conditions. Therefore, when a permit condition is a means to substantially advance a legitimate state interest, the condition needs to have not only a connection with that interest, but a certain degree of correlation. The Dolans had proposed a business expansion on their property, and the planning commission conditioned the permit on the dedication of their land within a floodplain for a greenway and an additional strip for pedestrian or bicycle paths. Upon challenge of the permit condition, the Supreme Court found that it was "obvious" that a nexus existed between the impact of the business expansion and government interests in limiting development in a floodplain and providing alternative modes of transportation. However, it found that the city's findings and conditions failed to advance their goal because while public ways are reasonable exactions, the city could not prove their relationship to the impact of the petitioner's proposed business expansion. The Supreme Court held that the Fifth Amendment requires a "rough proportionality" relationship between the conditions and the impact of development that includes an individual determination that the required dedication is related both in nature and extent to the impact of the proposed development.



Florida Water Management Districts
Photo Source Florida Department of Environmental Protection

KOONTZ EXPANDS TAKINGS PROTECTIONS TO INCLUDE PERMIT DENIALS AND REQUIREMENTS OF MONETARY PAYMENTS

The Supreme Court's holdings since the Nollan and Dolan cases have consistently been that a government may not condition the approval of a land use permit on the owners' relinquishment of a portion of their property unless there is a "nexus" and "rough proportionality" between the government's demand and the effects of the proposed use. However, Koontz for the first time raises the question as to whether the Nollan and Dolan protections apply in the following situations: 1) where a government agency denies a land use permit unless a developer agrees to a permit subject to certain conditions and 2) where a government agency requires the payment of money as opposed to demanding an easement or physical taking of land.

After purchasing a 14.9-acre piece of undeveloped property in Florida, Koontz hoped to develop the northern part of his parcel (3.7 acres), which was classified as wetlands. Koontz applied to the St. Johns River Water Management District for permits to develop the 3.7 acre northern

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portion of his land, and proposed to provide the District with a conservation easement over the remaining approximate 11 acres. The District rejected the 11-acre conservation easement as inadequate and told Koontz that it would approve his permit if he either: 1) limited his development to 1 acre, install stormwater improvements and grant a 13.9 acre conservation easement; or 2) proceed with his 3.7-acre development if he paid for improvements to a 50-acre wetland area owned by the District and outside of Koontz' property. The District also indicated that it would favorably consider alternatives proposed by Koontz to its suggested offsite mitigation projects. Koontz refused the District's options, and the District denied his application.

Koontz sued the District under Florida Law arguing that he was entitled to "monetary damages" because the District's action was "an unreasonable exercise of the state's police power constituting a taking without just compensation." The Florida Supreme Court, rejecting Koontz' claims, distinguished the facts of Koontz from Nollan and Dolan on the basis that the District denied an application as opposed to approving an application with conditions, and that the District demanded money as opposed to an interest in real property.

The United States Supreme Court reversed the Florida Supreme Court's decision, with a five Justice majority opinion written by Justice Alito, finding that a government agency must satisfy Nollan and Dolan even if it denies a permit and even if it demands payment of money in lieu of taking real property. However, the Supreme Court did not decide the merits of the claim or provide any remedies, remanding the case to the Florida Supreme Court for further proceedings.

First, the Supreme Court found that the principals of Nollan and Dolan do not change "depending on whether the government approves a permit on the condition that the applicant turn over property or denies a permit because the applicant refuses to do so." The Court reasoned that while the government may choose whether and how a permit applicant is required to mitigate the impacts of a proposed development, it may not leverage its legitimate interest in mitigation to pursue governmental ends that lack an essential nexus and rough proportionality to those impacts. The Supreme Court reasoned that a rule to the contrary would enable the government to evade the limitations of Nollan and Dolan simply by phrasing demands for property as conditions precedent to permit approvals, as opposed to conditions subsequent to issuance.

Second, the Supreme Court ruled that the District's demand for money to improve 50-acres of District-wetlands outside of Koontz' property, the "monetary exaction," must satisfy the nexus and rough proportionality requirements of Nollan and Dolan. The Court explained that a predicate for any unconstitutional conditions claim is that "the government could not have constitutionally ordered the person asserting the claim to do what it attempted to pressure that person into doing." The Supreme Court found that a taking occurred because there was not a direct link between the government's demand and a specific piece of real property.

THE POSSIBLE AFTERMATH ON GOVERNMENT AGENCIES AND DEVELOPERS

First, the Koontz decision will require land use permitting boards and agencies to exercise care in fashioning permit conditions subsequent or conditions precedent to a permit issuance to ensure compliance with Koontz. This may have the effect of inhibiting agencies and developers from negotiating permit conditions freely. As expressed in the dissenting opinion, written by Justice Kagan, the District was not coercing Koontz; rather, it merely was providing him with two mitigation options. It warned that this decision therefore puts a government entity at risk of a lawsuit every time it makes a suggestion to an applicant about how to meet permitting criteria which could discourage it from communicating with applicants. The dissenting opinion further argued that the District could have simply denied the applications (which would have invoked the Penn Central test – not Nollan and Dolan), but rather than denying them, the District attempted to work with the applicant to meet legal requirements. It explained that the District never made a demand and rather had welcomed additional mitigation proposals from Koontz, asking Koontz if he would "be willing to go back with the staff over the next month and renegotiate this thing and try to come up with" a solution; however, Koontz refused. Therefore, Koontz's failure to obtain permits did not result from his refusal to agree to a condition; instead, "it arose from the legal deficiencies of his applications, combined with his unwillingness to correct them by any means."

The Koontz' holding poses an increased risk where government agencies, worried about lawsuits, may now deny permits outright when they do not satisfy legal requirements, without providing any advice or initiating discussions or negotiations, and therefore would provide property owners with no opportunity to amend their applications or discuss mitigation options.

Second, as argued in the dissenting opinion, the Koontz decision may hinder municipalities' abilities to issue permitting fees in general because in this case, there was simply a requirement for Koontz to pay money to repair public wetlands, and such requirement was not tied to his specific property; therefore, it should not be considered a taking. It warned that such a requirement could affect the ability for agencies to issue land use fees in general, such as those regarding the costs of providing services such as sewage or water to a development.

Third, many developers will likely view the Koontz decision as a "win," believing that the Supreme Court has expanded their rights in permitting approvals because monetary exactions and denials of permits will be held to a greater judicial scrutiny. However, to the contrary, this decision may also have the effect of hindering permit approvals as permitting agencies, in fear of litigation, may be less likely to negotiate with developers and offer mitigation options. Either way, there surely will be an increase in litigation in the next years as a result of Koontz' expansion of takings protections.

Michele A. Hunton, Esq.
617-330-7024
mhunton@rubinrudman.com

Glenn A. Wood, Esq.
617-330-7016
gwood@rubinrudman.com
Rubin and Rudman, LLP
50 Rowes Wharf
Boston, MA 02110

AMWS LATE SUMMER WORKSHOP: BEST MANAGEMENT PRACTICES FOR WETLAND DESIGN & CONSTRUCTION

MARYANN DIPINTO

Wetland replication is a major component of the wetland profession, and successful implementation can be broken down into key elements, starting with a team of experts. On August 28, 2013, six wetland professionals presented best management practices to 23 participants at this sold out workshop. The morning was spent in the classroom at the Bridgewater State University Aviation Training Center located adjacent to the New Bedford Regional Airport. In the afternoon, vans took the group to visit two large wetland construction sites, one inland and one coastal.

The morning began with instructor Scott Horsley (Horsley Witten Group) reviewing hydrological principles. He noted that determining optimum groundwater is very important to a successful design. He discussed the groundwater collection and monitoring techniques necessary to ensure accuracy of seasonal high groundwater, as well as the importance of field and hydric soil indicators. Scott also spent some time on nomenclature, noting that porosity is not synonymous with permeability. For example, clay is more porous than gravel, yet it is much less permeable. He went on to say that, to ensure that hydrology will support a replication area, soil profiles should be analyzed to ascertain groundwater elevations. Also, groundwater flow should be checked to determine residence time. He noted that velocity is related to permeability, groundwater slope and porosity.

Instructor Tim Gould (Agresource) spoke about using manufactured "wetland soils" in constructed wetlands. He noted that the ideal manufactured soil provides adequate plant nutrients, healthy microbial activity, unrestricted infiltration and physical stability. This is produced by mixing on-site or off-site mineral material with compost from various sources.

Tim noted that, since wetland soils need to be low in nitrogen, the compost portion of the manufactured soil is typically derived from leaves. The soil produced from this process is typically 1/3 compost and 2/3 soil, with the soil component being approximately 60% sand, 25% silt and 15% clay for general applications. Soils created from compost derived from biosolids or manure are generally too high in nitrogen for wetland replication purposes. The composting process generates enough heat to kill seeds that might be in the material which is particularly important to control the spread of invasive plants. Tim concluded that wetland formation can be accelerated by the application of a high quality wetland soil substrate.

I was next up and presented an overview of the Wetlands Protection Act regulatory requirements for wetland replication. I noted that re-creating a wetland does not always mean like-kind replication. For example, it is not possible to re-create an old growth system by using saplings, shrubs and grasses. The key is to use wildlife habitat as the basis for design, so the replacement wetland functions similarly to the one lost. Massachusetts Department of Environmental Protection's (DEP) March 2002 Inland Wetland Replication Guidance references this. Ideally, we should be avoiding or otherwise minimizing the loss of mature forested wetlands altogether. Of note, DEP has been working under an Environmental Protection Agency (EPA) grant to evaluate and assess wetland replacement areas constructed throughout the Commonwealth and expects to have updated recommendations in 2014.

Further, the performance standards for Bordering Vegetated Wetland (BVW) at 310 CMR 10.55 (4) seems to allow replacement of a forested wetland system with a wet meadow. By focusing on replacing wetland functions that will be lost when a BVW is altered, replication may result in an in-kind replacement area. 310 CMR 10.60 3(d) states: "Interspersion and diversity of vegetation, water and other wildlife habitat characteristics of the replacement area, as well as its location relative to neighboring wildlife habitats, shall be similar [my emphasis] to that of the lost areas, insofar as necessary to maintain the wildlife habitat functions of the lost area." The guidance document contains a chart that lists the interests of the Wetlands Protection Act, how each wetland resource area provides those functions, and then how the creation of certain design features can replicate those functions.

Instructor Chad Sumner (SumCo Eco-Contracting) followed with a presentation on implementing a wetland design. He noted that good design is only a picture, and actual implementation requires a team approach to ensure that the new ecosystem provides the same functions and values as a natural system. From appropriate site excavation and custom soils to the choice of vegetation and control of invasive species, a thorough work-up of the site, communication within the team and follow-up monitoring are essential to all successful projects.

The classroom presentations ended with a preview of the field trips to follow. Instructor Mike Howard (Epsilon Associates) introduced the New Bedford Regional Airport Runway Safety Improvements Project, noting that it is one of the largest recent freshwater wetland mitigation projects in Massachusetts. He was followed by Instructor Craig Wood (The Louis Berger Group), who introduced the nearby Marsh Island Habitat Restoration Project. Craig noted that the majority of this 22-acre peninsula was a salt marsh before it was filled with dredged material in the 1930s and 1950s.

The group then moved to the field. Field site #1 was the New Bedford Regional Airport and its ongoing runway safety improvement project, led by the consulting team of Epsilon Associates, Oxbow Associates and Airport Solutions Group. The Airport is in the process of reconstructing Runway 5-23, including constructing runway safety areas on both ends, shifting Runway 5 south by approximately 200 feet, and extending Taxiway A to match the new Runway 5 end. The project also includes improving the Airport drainage system, addressing vegetative obstructions to navigable airspace and installing wildlife-exclusion fencing.

The work is situated in and near areas of BVW, state-listed rare species habitat, vernal pools, floodplain, and other wetland

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BMP's (Continued from Page 8)

resource areas. The Airport is also located in the vicinity of two major wetland systems: Apponagansett Swamp and the Acushnet Cedar Swamp State Reservation. Nearly 19 acres of new freshwater wetlands, vernal pool habitat, compensatory flood storage areas and eight acres of Eastern Box Turtle nesting habitat are in the process of being created to mitigate project-related impacts. An additional 800 linear feet of stream channel was relocated and enhanced to facilitate construction of proposed runway safety areas. In addition, nearly 1,500 native shrub species were planted in dense clusters along the banks of the Paskamansett River to increase shading and the roughness of the stream banks. Biologist Scott Smyers (Oxbow Associates) met the group on site to discuss the related Eastern Box Turtle monitoring and nesting habitat enhancement program.

Less than seven miles away in Fairhaven was site #2, the Marsh Island Habitat Restoration Project. The New Bedford Harbor Trustee Council, Coalition for Buzzard's Bay and the NOAA Restoration Center are working with The Louis Berger Group to restore salt marsh and coastal upland habitat on the parcel through a combination of excavation and disposal of dredged material. The restoration design incorporates tidal creeks, high and low salt marsh, future maintenance access and an interpretive trail system. It also includes the replacement of an extensive underground wire grid array associated with existing radio towers, as well as measures to minimize contamination risk by re-suspended PCBs entering the site and diminish construction impacts to the adjacent neighborhood.

In closing, it is well established that wetland replication remains an uncertain science. However, adherence to a well-conceived design based in part on adequate soils and hydrologic data, an understanding of the functions and values being replicated, inclusion of clear technical specifications that can be easily followed by the site contractor, and proper management/oversight measures during construction by qualified personnel should significantly improve the chance of successful and functioning mitigation areas.

MaryAnn DiPinto
MassDEP-Central Region
maryann.dipinto@state.ma.us
508-767-2711

ROCK SNOT (*DIDYMO*) IN MASSACHUSTTS

On May 30, 2013 the Massachusetts Departments of Fish and Game (MassDFG) and Conservation and Recreation (MassDCR) issued a press release to inform Massachusetts residents that the alien algae *Didymosphenia geminata* (didymo) was detected in the Green River in the towns of Alford and Egremont. There is no known method of complete elimination of didymo from a waterway.

According to the press release, Didymo is a freshwater algae favoring cold, nutrient-poor waters with neutral or slightly basic pH. Its blooms can result in a dense covering on rocky substrate, appearing grey, brown or white with a texture similar to wet wool or cotton balls. Extensive blooms can cover river substrate, impacting aquatic habitat and make recreational activities such as swimming difficult or less desirable.

It is believed that the algae are imported by attachment to boats or equipment. State staff have developed best management practices and disinfection procedures for field activities and fish stocking to minimize the spread of the aquatic species. MassDFG and MassDCR recommends that all recreational boat users thoroughly wash their equipment, clothing, waders and boats in hot, soapy water for a minimum of 30 minutes.

Rock snot (*Didymosphenia geminata*) Photo Credit Tim Daley, Pennsylvania Dept. of Environmental Protection

STANDARDIZED METHOD TO CONVERT WATER QUALITY VOLUME TO A PEAK FLOW RATE JUST RELEASED BY MASSDEP

MassDEP has standardized the computational method to size proprietary manufactured stormwater treatment devices as part of the MassDEP Wetlands Protection Program's ongoing efforts to reduce stormwater pollution to wetlands. The standardized method converts the ½- and 1-inch Water Quality Volume (WQV) specified at 310 CMR 10.05(6)(k)(4) and 314 CMR 9.06(6)(a)(4) to a peak water quality flow (WQF) rate. The method becomes effective for Notices of Intent filed on October 15, 2013 and thereafter, when a proprietary manufactured stormwater treatment device sized using a flow rate is proposed in connection with proposed work in a wetland resource area or associated buffer zone.

The standardized method was developed in consultation with MassDEP's Proprietary Best Management Practices (PBMP) Subcommittee and was reviewed by the MassDEP Stormwater Management Advisory Committee. The PBMP, which includes stormwater treatment product manufacturers, relied upon analysis of different conversion methods conducted at UMass-Amherst. Use of the standardized method is intended to provide a consistent, fair, independent, and equitable approach for municipal conservation commissions and the regulated community to ensure that proprietary manufactured stormwater treatment devices are sized to treat the peak flow rate associated with the WQV.

Notice of the method availability is at MassDEP's web site at: http://www.mass.gov/eea/agencies/massdep/water/ and "The Method" is available on DEP's web site at: http://www.mass.gov/eea/agencies/massdep/water/regulations/water-resources-policies-and-guidance-documents.html#11.

DOES MERCURY BIOACCUMULATE IN WOOD FROGS DEVELOPING IN SEASONAL POOLS?

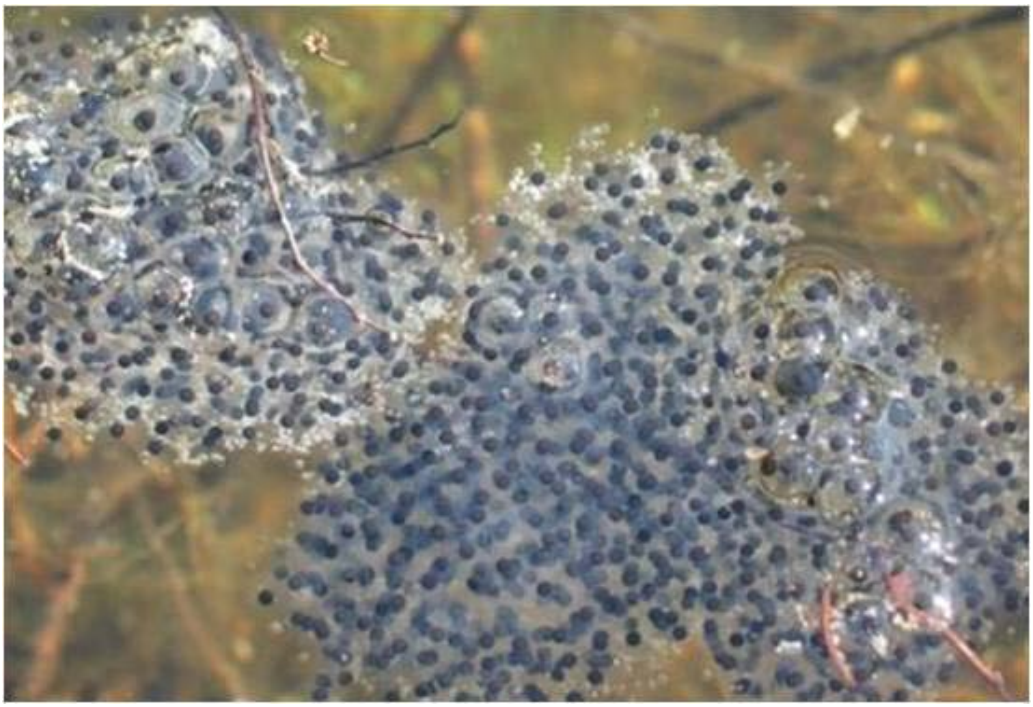
CYNTHIA LOFTIN

Amphibians are among the most threatened vertebrates globally, and species breeding in ephemeral habitats are of particular conservation concern as their populations suffer losses from habitat degradation or destruction. These compromised habitat conditions may affect amphibian egg and larval development, hatchability, timing of metamorphosis, and metamorph and adult fitness. Chemical pollution also can threaten the viability of amphibians, even when habitat otherwise appears intact. Mercury (Hg) bioaccumulation has been documented in stream-dwelling salamanders (*Eurycea bislineata*) and more terrestrial species such as American Toads (*Anaxyrus americanus*) and red-backed Salamanders *(Plethodon cinereus*), and development was compromised in pond-dwelling Southern Leopard Frogs (*Lithobates sphenocephalu*s as documented by Unrine et al. in 2004 and 2005. Although we know that the amount of Hg deposition in the northeastern USA is large, the threshold of Hg leading to impaired development and reduced survival and reproductive success in ephemeral pool-breeding amphibians such as wood frogs (*Lithobates sylvaticus*) is poorly studied.

HG IN NORTHEASTERN SEASONAL WETLANDS

Wetlands in general are hotspots for conversion of Hg to the more biologically toxic methyl mercury (MeHg). The optimal chemical environment in wetlands for microbiota responsible for Hg methylation includes abundant dissolved organic carbon (DOC), low pH, low acid neutralizing capacity (ANC), and drying-wetting cycles - conditions not unlike those in seasonal woodland pools in the northeastern USA. Research conducted in Acadia National Park (ANP), Maine, reveals that it is an apparent hotspot for Hg deposition and accumulation in the environment, including bioaccumulation across trophic levels. This is in part owing to the interception of contaminated air masses within a landscape of approximately 25% wetland area with a prevalence of DOC-rich waters. We know that conifers capture Hg more efficiently than deciduous species and also generally deliver more Hg in throughfall; however, little is known about the presence and disposition of atmospherically deposited Hg in seasonal woodland pools in the Northeast or the relationship of Hg transformation with pool conditions and characteristics of the surrounding landscape.

The pool environment changes during the spring and early summer as seasonal snowmelt flushes Hg from soils and litter. The rapid morphogenesis of developing wood frogs from egg to larva to metamorph occurs concurrently with dramatic changes in the pool environment, including rising water temperature, fluctuating pH, declining oxygen, and increasing solute concentration as the pool dries. These same pools refill with autumn rainfall that could be enriched with Hg, or could result in Hg-enriched runoff from soils and litter. These physical and chemical conditions may make amphibians in seasonal pools particularly susceptible to non-point source pollutants such as Hg. There may be negative implications of Hg in vernal pools for both metamorph survival and transport of Hg to the terrestrial environment: seasonal woodland pools contribute significant biomass to terrestrial ecosystems through production of pool-breeding amphibians that metamorphose and move into the adjacent uplands, carrying with them the Hg bioaccumulated during development in the pools.



Wood frog egg mass in Acadia National Park, Maine
Photo Credit Cynthia Loftin

DO DEVELOPING WOOD FROGS ACCUMULATE HG?

Our research examined chemical and physical characteristics in four, short-hydroperiod (e.g., inundated 39 weeks) pools and concentrations of total Hg (THg) in developing wood frogs in these pools. We hypothesized that we would detect concentrations of THg in developing wood frogs that bioaccumulated in the natal pool and that THg concentrations in wood frog embryos and larvae would reflect environmental conditions in the pool and surrounding landscape. Two of our study pools occurred in a region of ANP that burned in 1947, and two study pools were located in an unburned region, providing a contrast in forest cover type (deciduous vs. coniferous) and burn history. We sampled pool water,

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litter, and sediment soon after ice-out to establish initial chemical conditions and repeated this sampling when collecting wood frog embryos and tadpoles until the pools dried by late June; our final collection of environmental samples was after the first pool-filling rain in early October. Our data analyses focused on identifying spatio-temporal patterns in water chemistry and THg concentrations in the litter, sediment, water, and developing wood frogs.

We found that developing wood frogs in the seasonal pools we sampled in ANP bioaccumulated detectable concentrations of THg in the natal pool, and elevated concentrations of THg in the water persisted throughout wood frog larval development, increasing the probability that THg could be delivered into the adjacent terrestrial habitat with emigrating juvenile wood frogs. Although there is some support for our hypothesis that THg concentrations in wood frog larvae would track patterns of THg concentrations in the pool water that reflect the forest composition in the surrounding landscape, this result should be considered cautiously, owing to the small number of repeatedly sampled pools in our study. Nevertheless, our study suggests some compelling patterns.

Concentrations of THg in wood frog embryos were at or below detection limits, indicating that maternal transfer was absent or minimal in the study area. This finding contrasts with that of Bergeron et al. (2010a) who reported maternal transfer of Hg in American toads breeding in Virginia ponds contaminated with Hg. Concentrations of THg bioaccumulating in 6-8 weeks in our tadpoles overlapped ranges of concentrations reported in 2-3 year old green frog (L. clamitans) and American bullfrog (L. catesbeiana) tadpoles collected from permanently flooded ponds in nearby watersheds in ANP . We do not know when the THg bioaccumulated in the green frog and American bullfrog tadpoles. Methyl Hg, analyzed in only a subset of our collected wood frog larvae, comprised 6.6-42.0 % of THg in wood frog tadpoles collected when pools were nearly dry in our study, and 7.6-40.0 % of THg in green frog and bullfrog tadpoles collected in permanent water bodies in nearby watersheds. We did not detect any malformations or indications that the developing wood frog tadpoles were physically compromised by the Hg they had accumulated in their tissues, and we do not know if these Hg body burdens compromise wood frog fitness upon metamorphosis. We also do not know the specific route of uptake of the Hg by the tadpoles, which are opportunistic predators and will consume aquatic invertebrates as well as embryos and larvae of sympatric amphibian species during this period of rapid growth. Although pool water remained clear through June, and algal accumulation appeared minimal, bacterial and fungal biofilms growing on sediments and leaves may have contained Hg and been grazed by the wood frog tadpoles, which may, in addition to THg in pool water, explain the concentrations of THg detected in their tissues.

TOTAL MERCURY CONCENTRATIONS AND DYNAMICS IN THE POOL ENVIRONMENT

Hg concentrations at any location are affected by landscape characteristics and atmospheric conditions spanning local to regional scales. Because of their small size and forested character, seasonal woodland pools may receive elevated inputs of dry deposition initially captured by the forest canopy compared with, for example, lakes with large surface areas without forest canopy. In addition to throughfall from forest canopy, Hg is delivered directly into terrestrial systems through overland flow, precipitation, and litterfall. The relationships we report between THg concentrations and environmental conditions at our study sites may reflect the variety of conditions within the study pools and surrounding landscapes in which they are embedded; however, owing to our small sample size, we cannot be certain that observed differences in THg concentrations among pools are determined primarily by landscape-scale patterns or local conditions.

We found that pools embedded in softwood dominated (coniferous) landscapes contained greater concentrations of THg in pool water than pools embedded in hardwood landscapes, which agrees with other studies that estimated mercury deposition of throughfall at softwood and hardwood forested sites in ANP. We expected THg in coniferous litter to be greater than in deciduous litter as previously reported in ANP by Sheehan et al. (2006), and we found this expected forest or landscape composition-related difference in mercury concentrations of upland litter but not of wetland litter. Total Hg concentrations in deciduous and coniferous litter collected within our study pools generally were similar among pools. We expected that THg concentrations in sediments collected from unburned sites would exceed those collected in burned sites owing to release of Hg with burning in the contributing watersheds, similar to observed effects of the 1947 fire on ANP soils. Instead, the lowest THg concentrations were found in the sand-gravel sediments collected from a pool in an unburned watershed, whereas, sediments collected from the other three pools contained less sand and gravel and more organic matter, and consistently contained greater THg concentrations. Sediment THg was dynamic, increasing in all pools during the June drawdown and decreasing upon refill in October. This decrease in THg at pool re-fill may reflect dilution of Hg in pool sediments by autumn storm run-off. When inundated, topographic depressions with seasonally wet soils such as seasonal woodland pools could provide conditions leading to significant Hg reduction and methylation owing to increased sulfate concentrations and activity of sulfate-reducing bacteria. Future research should include speciation of sediment Hg and focus on dynamics of sulfate-reducing bacteria, largely responsible for Hg methylation, in pool sediments as pools fill and dry.

Although we expected peak THg concentrations in pool water with spring snowmelt, we found maximum THg concentrations occurred during several months. We attribute this pattern to Hg mobilized from the pool sediments with drying and rewetting and with throughfall and litterfall inputs occurring over several weeks or months of summer dry deposition. Terrestrial systems distribute atmospherically deposited Hg into embedded aquatic systems such as woodland pools via throughfall and runoff that carries Hg associated with dissolved and particulate organic matter. During spring snowmelt, Hg carried with dissolved and particulate organic matter from accumulated litter and the soil organic layer is re-suspended in meltwater infiltrating the upper soil horizons with thawing. As the snowpack melts from

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Mercury (Continued from Page 11)

below, the meltwater combines with Hg released from the melting soil frost layer, resulting in a peak release of Hg to streams and other water bodies immediately preceding peak snowmelt discharge (Schuster et al. 2008) that often occurs with early spring rain. Both THg and DOC concentrations measured in our study's pool water generally increased during April through June, suggesting concentration of solutes with dry-down. Concentrations of DOC and THg also were high for all but one pool in the early October pool-refilling storm.

Our data reflect the expected trends in chemical covariates with Hg: high concentrations of DOC, low pH, and low ANC correlated with elevated THg concentrations in biota, including lake fish. We found that pools with high DOC and low pH had greater THg in water, greater dissolved Al in water, and greater THg concentrations in wood frogs. Greatest total dissolved Al concentrations measured in one pool in April exceeded the LC50 (750 µg/L at pH = 4.8) for wood frogs, however, LC50 values may not be predictive of Al toxicity, which is affected by water chemistry.

Although pool water demonstrated predicted patterns of THg (greater in softwood-embedded sites with high DOC and low pH), THg measured in other components (sediment, litter, wood frogs) did not exhibit this pattern. Pools selected for future study should include replicates of the variety of local pool conditions, such as sediment type, forest species dominance, and hydroperiod range including pools that dry before metamorphosis, those that hold water through metamorphosis in years with average precipitation, and pools that dry only occasionally, to reveal the role of these conditions in determining THg and MeHg dynamics throughout the pool drawdown and refilling cycle. Additionally, future research should quantify the ratio of THg to MeHg in developing embryos, tadpoles, and juveniles emigrating from natal ponds to better understand transport of this contaminant from seasonal pools into the surrounding environment and potential for uptake into the terrestrial food web.

Editors Note: This is the summary of an article published as: Loftin, C.S., J.K. Calhoun, S.J. Nelson, A.A. Elskus, and K. Simon. 2012. Mercury bioaccumulation in Wood Frogs developing in seasonal pools. Northeastern Naturalist 19:579-600. A full copy of the paper including literature citations can be obtained from: http://www.eaglehill.us/NENAonline/articles/NENA-19-4/13-Loftin.shtml.

Cynthia Loftin,
Unit Leader & Assoc. Professor of Wildlife Ecology
USGS Maine Cooperative Fish and Wildlife Research Unit and Department of Wildlife Ecology,
University of Maine
5755 Nutting Hall
Orono, ME 04469-5755
207-581-2843

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NOVEMBER 15, 2013
AMWS ANNUAL MEETING

DAM REMOVAL & RESTORATION

WARREN CONFERENCE CENTER
ASHLAND, MASSACHUSETTS

The upcoming AMWS Annual Meeting, DAM REMOVAL & WETLAND RESTORATION, is this year's "IT" topic nationwide.

Dam removals are happening all over the country. In 2012, the Massachusetts Division of Ecological Restoration spearheaded the removal of nine dams across the state—a record for the program and second in the nation. This year's plan is to remove 6 – 8 additional dams, opening 50 miles of river.

'Don't think this topic applies to your work? The process of dam removal involves the fundamentals of wetland science-- analysis of impacts to wetlands and habitat, clean water issues and flood storage—all of which concern wetland scientists. Our rapid-fire line of experts (6 in 3 hours!) will discuss wetland creation and compensatory flood storage, as well as other technical issues that are part of your daily work.

Speakers include: Keynote Speaker Beth Lambert (Mass. Div. of Ecological Restoration); Franz Ingelfinger (Mass. Div. of Ecological Restoration); Nick Nelson (Inter-fluve); Chad Sumner (SumCo Eco-Contracting); Eric Hutchins (NOAA.); and Tom Lautzenheiser (Mass. Audubon). You'll learn what works with dam removals and wetland restoration, and as importantly, what doesn't.

This year we again offer the popular half-day format, which will include a Continental breakfast, brief business meeting, the election of officers*, and a chance to win the latest Apple iPad Mini! For more info, see www.amws.org/upcoming_workshops.html

*Nominees are: President: John Rockwood; Vice President: Mike Howard; Treasurer: Jacob Dunnell, II; Secretary: Matt Varrell. Nominations may also be made from the floor.

Eligible individuals are voting members in good standing whose nomination is made by a voting member in good standing, seconded by a voting member in good standing, and accepted by said nominee during the election process.

If you are not sure if you're a voting member, see our Membership Directory at www.amws.org/membership_directory.html Please note: If you are not a voting member and qualify to be one, you need only to submit your resume to administrator@amws.org For more info, see Membership Categories and Requirements: www.amws.org/join.html; also see AMWS Bylaws: http://amws.org/documents/AMWSBYLAWS11.04.2011.pdf.

ADDRESSING AQUATIC HABITAT IMPACTS THROUGH THE MASSACHUSETTS IN-LIEU FEE (ILF) PROGRAM

MARK ROUSSEAU

THE PROGRAM

The pre-2008 Mitigation Rule Massachusetts In-lieu Fee Program (ILFP) is a partnership between the Massachusetts Division of Marine Fisheries (DMF) and the Army Corps of Engineers (ACOE). The program is designed to provide an alternative option to permittee-responsible mitigation for offsetting authorized impacts to aquatic resources and habitats as a result of projects permitted under the ACOE General Permit. Program participants provide fee payments into the Commonwealth's Marine Mammals and Fisheries Research and Conservation Trust. This, in turn, transfers the mitigation responsibility for the authorized impacts from the permittee to the ILFP sponsor, which is DMF.

The goal of the ILFP is to increase the scope and quality of restoration and protection of aquatic resources and their related buffers by aggregating ILFP payments, then directing funds toward sustainable restoration options. Payments into the fund are tracked by the region where the impacts occur and by the types of habitats impacted. Habitat types that are tracked include open water, salt marsh, submerged aquatic vegetation (SAV), intertidal and streams. Since the program's inception in June 2008, 26 different projects affecting almost 19,000 square feet of aquatic habitats have taken advantage of this option to satisfy their mitigation requirements, contributing over $200,000 into the trust.

Identifying specific restoration options to direct ILFP funding can be challenging. As the third most densely populated state in the nation, Massachusetts is the subject of widespread development that threatens our already limited aquatic resources. Some aquatic habitats are more vulnerable to anthropogenic impacts. Others have a limited amount of suitable area available within the state for restoration, while other habitat types require substantially more effort to achieve a "restored" status. Identifying suitable projects that provide the greatest potential to replace or protect aquatic resources, functions, and values, requires a thorough understanding of both regional threats and restoration priorities.

To address this need, DMF acquired funding through the Mass. Bays Research and Planning Grant Program to develop a methodology for assessing restoration sites on a regional scale. DMF solicited input from stakeholders on applicable restoration project ranking methodologies and developed project selection criteria for ranking project proposals during the ILFP's first project funding round in December of 2012.

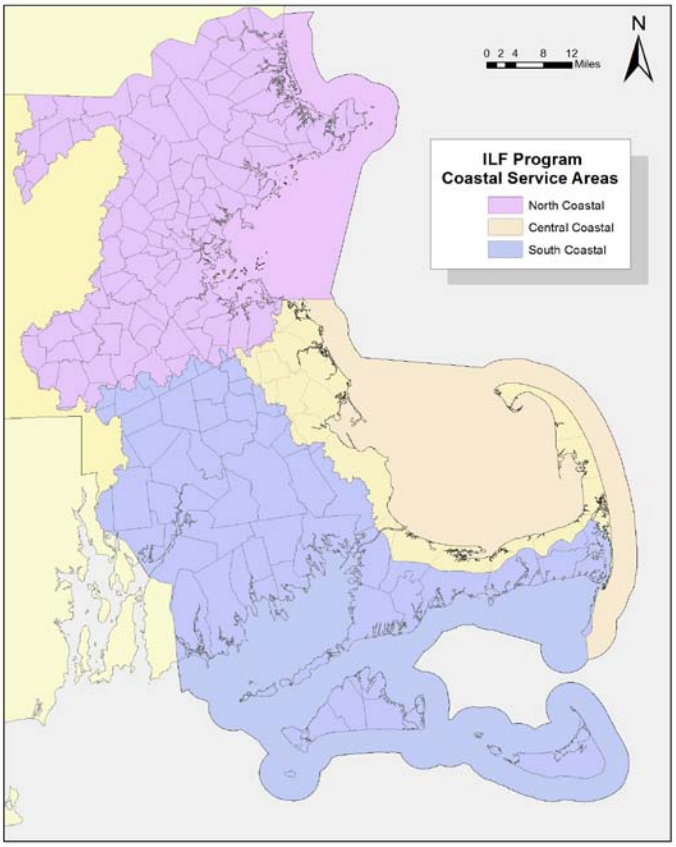

Figure 1
Massachusetts ILFP Coastal Service Areas Coastal Region Map

Restoration project proposals to be funded using ILF funds were solicited through a request for proposals. Eight restoration project proposals were received, encompassing an array of different habitat types (invasive plant control, dam removal, eelgrass planting and shellfish bed enhancement) across all ILFP regions. The applicant pool included state and town resource agencies, universities and non-profit organizations. With ACOE approval, DMF awarded over $200,000 in grants to restoration projects in four Massachusetts coastal communities; fully funding three proposals and partially funding a fourth.

THE PROJECTS

PROJECT 1. OFF BILLINGTON STREET DAM REMOVAL PROJECT - PLYMOUTH

The Town of Plymouth was awarded over $128,202.00 to facilitate, in combination with funding from other sources, the removal of the Off Billington Street Dam. The structure will be replaced with an arch bridge in order to improve water quality, and contaminated sediment from behind the dam will be removed. The project is expected to provide unimpeded fish passage for alewife (Alosa pseudoharengus), blueback herring (Alosa aestivalis) and American eel, and is part of a larger comprehensive approach to restoring the historic anadromous fish run at Town Brook. The objective is to eventually re-establish river herring access to 269 acres of spawning habitat once all phases of the project are completed. The project will open an additional 400 linear feet of stream habitat at a total estimated cost of almost $1.5 million dollars. Funds from the ILFP will be used for creating vegetative zones along

Continued on Page 14

Off Billington Dam-outlet-fishladder
Photo Credit Mark Rousseau

the exposed stream banks once the dam is removed. Work on this project is expected to begin in the fall of 2013.

PROJECT 2. ROUGH MEADOWS - ROWLEY

The Massachusetts Audubon Society was awarded $14,704.00 to fund a project that will contribute to the restoration of salt marsh and immediately adjacent brackish marsh at Rough Meadows Wildlife Sanctuary in Rowley, Mass. ILFP funds will be used over a three-year period for treatments necessary to accomplish the eradication or near-eradication of targeted stands of common reed (Phragmites australis). Successful implementation will result in the restoration of approximately 5.5 acres of marsh habitat and reduce the likelihood of the spread of common reed to additional areas. Elimination of the invasive reed colonies will improve marsh ecosystem health. In addition, the control of common reed should facilitate the migration of salt marsh as sea level rises as predicted by climate change models.

PROJECT 3. UPPER GREAT MARSH - NEWBURY

The Merrimack Valley Planning Commission (MVPC) was awarded $23,800.00 for a Phragmites control project located in the Upper Great Marsh in Newbury. The goal of the proposed project is to return a large section (approximately 1,000 acres) of the northern end of the Great Marsh in Plum Island Sound to a healthy, natural state. As Phragmites is removed from patches in the open, high marsh and native vegetation naturally re-colonize. It is expected that the natural functions of the marsh, previously impaired by the invasive monocultural growth of the reed, will return-followed by an increase in vegetative, benthic, finfish, shellfish, and avian diversity.

PROJECT 4. DRAKA DAM FISHWAY - TAUNTON

DMF's Diadromous Fisheries Program was awarded partial funding of $34,916.96 for a fishway restoration project on the Three Mile River in Taunton. DMF has been collaborating with local, regional and federal project partners on restoring diadromous fish passage between the Three Mile River and Narragansett Bay for over a decade. Restoring fish passage to the Three Mile River will allow blueback herring and alewife to reach approximately 45 acres of spawning and nursery habitat upstream of the Draka Dam in Mount Hope Pond. The new fishway will enhance the biodiversity of the Three Mile River and support marine fisheries in Mount Hope and Narragansett Bay.

Although we are still early in the implementation phase of restoration, we are confident that the process followed during the project selection phase has identified good projects that will restore several acres of aquatic habitats and enhance aquatic habitat connectivity. DMF will continue tracking the implementation and completion of all projects funded through the ILFP until all projects have been successfully implemented. All funded projects are required to submit annual monitoring reports to DMF for a period of five years.

LOOKING AHEAD

The Department of Fish and Game (DFG) is currently in the process of seeking the ACOE's approval to become the program sponsor of a statewide ILFP, expanding upon DMF's ILFP to include inland aquatic resource impacts and to address mitigation requirements for both GP and Individual Permit (IP) categories. This new program will combine the expertise of the three divisions within DFG -the Division of Fisheries and Wildlife, the Division of Ecological Restoration and DMF-- under one ILFP. DFG submitted the Prospectus for the proposed statewide ILFP in accordance with the federal 2008 mitigation rule to the ACOE on September 26, 2012, and formally submitted the draft DFG ILFP Instrument for the ACOE formal review on September 13, 2013. Through the formal review process, the Program Instrument will be provided to an Interagency Review Team (IRT) consisting of representatives from Federal and State resource agencies for additional review and comment. DFG has a goal of implementing an ACOE-approved ILF program by the end of 2013.

Mark Rousseau
Environmental Analyst
Massachusetts Division of Marine Fisheries
Fisheries Habitat Project
mark.rousseau@state.ma.us
978-282-0308 x162

EUROPEANS IN NEW ENGLAND: RUSTY WILLOW *SALIX ATROCINEREA* AND ASH WILLOW *S. CINEREA*

IRINA KADIS AND ALEXEY ZINOVJEV

MYSTERIOUS WILLOWS OF EASTERN MASSACHUSETTS

This story starts at least fifteen years ago. As newcomers to New England, we were keen to familiarize ourselves with the eastern North American willows. In eastern Massachusetts we expected to easily find nine common species: black willow (*Salix nigra*, the only native large tree among willows), shining willow (*S. lucida*), heartleaf (*S. eriocephala*), silky (*S. sericea*), slender (*S. petiolaris*), Bebb's willow (*S. bebbiana*, an old acquaintance of ours, as it is also widespread across Eurasia), American pussy (*S. discolor)*, upland (*S. humilis*), and dwarf upland willow (*S. occidentalis*).

To our amazement, locating all of the "common" species turned out to be a daunting task. Only four of them appeared to be relatively common and comparatively easy to find: black, heartleaf, slender, and pussy willow. Silky willow was uncommon, and upland willow appeared to be extremely rare. As to shining and Bebb's willow, we failed to find any, whatsoever. At the same time, the only common willow in the area appeared nowhere on the list. We spotted it again and again on pond and reservoir shores, in ditches and small streams. It was quite variable-at times resembling *S. bebbiana*, yet quite different from the *S. bebbiana* we had known. Attending botanical field trips did not help: the unknown willow was introduced as either Bebb's or pussy willow.

During the next few years, starting from 2005, we witnessed a revelation and recognition of the fact that an alien willow indeed was present in eastern Massachusetts and well beyond—from eastern Canada to North Carolina. The willow that managed to conquer the Eastern Coast unnoticed was rusty willow (*S. atrocinerea*), a West European species. It grows naturally in Britain, France, Belgium, Spain, Portugal, on some Mediterranean islands, and in North Africa. Its common name, rusty, is attributed to frequent presence of reddish hairs on leaf undersides.

A naturalized *S. atrocinerea*, it turns out, was first identified by the willow expert George Argus back in 1985, in old herbarium collections from North Carolina, the oldest of which dated back to 1929. A decade later, in 1996, a live specimen was discovered in New York, and the scale of invasion was completely unknown. Now we understand rusty willow had been introduced to North America more than a century ago. It has been long known in the nursery trade under the name "florist's gray willow" and perhaps is still sold under various erroneous names.

As a species of Atlantic distribution, *S. atrocinerea* certainly has found its second home all along the Atlantic Coast. In eastern Massachusetts it has indeed become the most common willow. One can find abundant alien willows around nearly every kettle pond on Cape Cod, in Plymouth, Wareham and Carver. They flourish in the environment of kettle pond perimeter with fluctuating water levels just as well as in floodplains of rivers, such as the Charles or Neponset in and around Boston.

According to the literature and old herbarium collections, Bebb's and pussy willow are supposed to be among the most common ones in the area. Their unexpected scarcity or even absence apparently explains how so many specialists could take similar-looking abundant alien willows for these natives. Belated recognition of rusty willow expansion may also be partially attributed to lack of consensus in its taxonomic

Rusty willow in the foreground and gray willow in the background
Photo Credit Irina Kadis

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treatment. Around the world, particularly in Australia and New Zealand, the invasive willow notoriously compromising the integrity of wetlands has been known as ash or gray willow (*S. cinerea*). However, we have to keep in mind that some botanists prefer to include *S. atrocinerea* within *S. cinerea*, considering them to be two subspecies—western (*S. cinerea ssp. oleifolia*) and eastern (*S. cinerea ssp. cinerea*)—of a single European species. One recent example of this approach is Flora Novae Angliae of 2011 by Arthur Haines.

Meanwhile, rusty appears to be quite different from ash willow in many respects. In addition to geographic dissimilarities (one is a plant of oceanic climate, the other is continental), the most drastic one is the habit: rusty is a single-trunk tree, while ash willow is a large shrub. Yet *S. atrocinerea* is sometimes referred as *S. cinerea ssp. oleifolia* or even just *S. cinerea*. Further confusion arises from the fact that both *S. atrocinerea* and *S. cinerea* (in the narrow sense) appear to be present here, in North America, within the alien complex.

Yet do we really need to distinguish between rusty and ash willow? In fact, for the majority of practical needs, we don't: both are alien invasive willows; both displace native plants. Most of the time we only need to tell them from native willows. The latter is an easier task because, be it rusty or ash, the alien willows have some features in common that help us distinguish them from any native species.

SOME DIAGNOSTIC CHARACTERS OF RUSTY AND ASH WILLOW

The most reliable feature that is readily available for observation in the field all year round is a very special bark found in these alien willows. It is colored light gray, smooth, and also fluted—often as conspicuously as the bark of hornbeam (*Carpinus caroliniana*). Of course you can find some cracked bark on lower stems of extremely old, senescent alien willows, too. So when dealing with an old plant, it is wise to look at large limbs rather than the bottom of the stem. None of the local willows have such smooth fluted bark. In the native species, the bark is smooth at young age (though without any "waves"), becoming uniformly cracked later on.

If you peel the bark of an alien willow and look at the wood underneath, you will find dense and long ridges covering the wood surface. This is a common feature of a number of European willows, including both rusty and ash. At the same time, even their closest relatives among New England willows, the ones that belong to the same section (*S. humilis* and *S. discolor*), don't have such abundant, conspicuous ridges, and that's why they don't produce fluted bark.

As we know, rusty willow will form a single-trunk smallish tree when growing undamaged. This is another helpful characteristic. Among the willows of New England, there is only one that grows into a really large tree: black willow. One more, Bebb's willow, can form a small tree. The rest of the native willows are shrubby. It is hardly possible to confuse a rusty with a young black willow, as the latter has a lacy crown formed by narrow, sickle-shaped leaves and develops dark rough bark exfoliating in large plates. Hence, when identifying a tree willow, one basically has to make a choice between rusty and Bebb's willow. There are reliable ways to make this choice.

Trunk of Rusty Willow showing smooth, gray waves or ridges in bark
Photo Credit Irina Kadis

DIFFERENTIATING BETWEEN BEBB'S, PUSSY, AND THE ALIEN WILLOWS

S. bebbiana and *S. discolor* are the two native species most often confused with *S. atrocinerea* and *S. cinerea.* However, there are some helpful characters available for observation at every season. In the fall and winter one can, first of all, observe the bark and wood. Both in *S. bebbiana* and *S. discolor*, wood ridges underneath the bark are short and sparse or even completely absent; therefore, fluted bark is never formed. Bebb's willow often forms a beautiful "plated" bark pattern. Pussy willow has cracked bark with a different pattern.

In winter one can also rely on the buds. Both *S. atrocinerea* and S. *cinerea* produce buds of two contrasting sizes, floriferous buds being much larger than leaf buds and having characteristic "clog" shape (bud tips pointing away from the branchlet). This is typical of other species of the same section (sect. Vetrix or Cinerella): the European *S. caprea, S. cinerea, S. aurita.* Meanwhile, in the more distantly related Bebb's willow, the buds look different—all smallish, uniform, without any conspicuous tips. As to pussy willow, its buds are of two contrasting sizes, just like in the alien willows, though the tips in floriferous buds are straight (parallel to branchlets). Besides, buds of *S. discolor* change color to black with the onset of cold weather due to die-off of bud scales (while in most other willows bud scales remain alive during the winter).

In spring the two alien willows are among the earliest to flower. In April you can spot these large staminate plants from afar,

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all lemon yellow with pollen. They are the only bright eye-stoppers amidst the still-gray dormant woods. April is indeed the best time to find invasive willows in a forest! One large native willow that flowers at the same time is *S. discolor*. *S. humilis* also flowers that early, though due to its delicate habit and small size, it cannot be seen in a forest from afar, so it is unlikely to be confused with an alien willow.

Not only catkins of the two alien willows and pussy willow (*S. discolor*) appear simultaneously, but they also look very similar. These catkins are of precocious type (appearing before the leaves), short-stalked, densely flowered, so that the rachis (catkin axis) is not visible, and their bracts are black.

As to *S. bebbiana*, it goes into flower nearly a whole month later, simultaneously with developing leaves, and forms quite different catkins borne on leafy stalks. They grow long and sparse with age, becoming very loose when ripe, each fruit sitting on a rather long stipe, the rachis clearly exposed; with bracts pale or light brown, sometimes black at the tip.

Even though it is hard to differentiate between *S. discolor* and a shrubby willow from the alien complex by just looking at the catkins, once the leaves are out and later on during summer we are provided with yet another helpful hint. In the alien willows, the leaf veins (up to the third order) are prominent on the leaf underside forming a dense network (reticulum) and corresponding wrinkles (rugose pattern) on the upper (adaxial) side. This character is shared by the majority of closely related species and *S. bebbiana*; however, this makes *S. discolor* different! No such reticulum is formed on rather smooth, glaucous lower leaf surface of *S. discolor*. In alien willows the leaf undersurface is never glaucous. It can be more or less hairy with gray hairs, often times mixed with rusty (ferrugineous) hairs in *S. atrocinerea*. While the presence of these hairs is diagnostic, their absence does not necessarily exclude *S. atrocinerea*. Ferrugineous hairs may be sometimes also found in *S. discolor*, but never in *S. bebbiana* or *S. cinerea*. In the latter, leaves are characteristically dull on the upper (adaxial) surface—hence the name ash willow or gray willow.

Bud shape and position of rusty willow is an important character for identification
Photo Credit Irina Kadis

The ridges (striae) of bark stripped branch on rusty willow
Photo Credit Irina Kadis

A POSSIBILITY OF HYBRIDIZATION

Upon reading all this, you may think that willow identification is very straightforward. However, in reality it is not always the case because real plants often produce a mixed habit; for example, you observe smooth and fluted bark, yet find the buds smallish and uniform, like they should in *S. bebbiana*, or else the leaves don't have a pronounced vein reticulum, etc. In these situations one can naturally assume hybridization between the alien and native willows.

Willows are famous for their ability to hybridize, yet this trait of theirs has been often over-emphasized. In the tundra biome or alpine habitats where willows are dominant and many willow species co-exist with one another, hybrids are very rare. When species are sympatric (having evolved together in the same place), they develop biological mechanisms preventing crossings. This is true for all plant populations with cross-pollination (otherwise, species would be all mixed and cease to exist). When closely related species occur on different continents, they are isolated geographically, so there

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Willows (Continued from Page 17)

is no need for them to develop isolation mechanisms. Apparently, when such normally isolated relatives as, for example, *S. atrocinerea* and *S. humilis*, meet all of a sudden due to introduction, they find themselves completely unprepared for an encounter and start forming hybrids. Hence hybrids are much more frequent in areas disturbed by human habitation than in pristine habitats.

Upon looking at the situation with willows in eastern Massachusetts described from this perspective, one cannot help but start making the connection between the overwhelming presence of strangely variable aliens and conspicuous absence of a few natives. The easternmost location of *S. bebbiana* population known to us in Massachusetts is in Sudbury. When moving away from eastern Massachusetts to the central and western part of the state, one can witness a significant decline of *S. atrocinerea*/*S. cinerea* (though some already have been found as far from the coast as the Connecticut River) and, on the contrary, reinstatement of such absentees as *S. bebbiana* and *S. humilis*. In Worcester County *S. humilis* becomes quite common. *S. bebbiana* becomes very common in the Berkshires.

S. humilis is still present to some extent in eastern Massachusetts, though it does not form good populations anymore, occurring as solitary bushes surrounded by alien willows. We once collected seed from such a solitary plant in Stony Brook Reservation (an urban reservation in Boston), and the progeny were planted at the Arnold Arboretum. What grew from seed were stout, coarse shrubs with smooth fluted bark, which had nothing to do with *S. humilis*. This made us believe that the alien willows have expanded at least partially by way of producing hybrids and backcrosses with some American willows and thus displacing and eliminating them.

Editors Note: The authors have an impressive selection of photographs of eastern Massachusetts plants, including the rusty willow on their website at www.salicicola.com.

Irina Kadis, Harvard University
Arnold Arboretum, Dana Greenhouses
125 Arborway
Boston, MA 02130
617-384-5648

Alexey Zinovjev, PhD

"CHANGING CLIMATE, CHANGING WETLANDS: CLIMATE IMPACTS TO WETLANDS AND THE ROLE OF WETLANDS IN CLIMATE CHANGE ADAPTATION AND CARBON MITIGATION"

SOCIETY OF WETLAND SCIENTISTS ANNUAL MEETING COMES TO PROVIDENCE, RHODE ISLAND IN 2015

GILLIAN DAVIES

This summer the New England Chapter of the Society of Wetland Scientists (SWS NE) made a successful bid to win the 2015 Society of Wetland Scientists Annual Meeting, which will be held in Providence, Rhode Island in 2015 (May 31 through June 4, 2015). The Annual Meeting will be a weeklong event where research papers focused on the relationship between climate change and wetlands will be presented by wetland scientists from across the country and around the world. A number of field trips, both coastal and inland, will be offered.

The SWS NE proposal provided the following introduction for the topic of the annual meeting: "Wetlands, like other ecosystems, are poised to undergo significant changes as rising temperatures (increased drought, high heat days, loss of snowpack/ice, changing seasons), rising sea levels, increases in severe storm events/ecological disturbance, and changing precipitation patterns continue." At the Annual Meeting, "current wetlands research in traditional areas of study such as biogeochemistry, ecology, hydrology, restoration/creation, biodiversity/wildlife, ephemeral wetlands/vernal pools, coastal wetland processes, riverine/floodplain wetlands, (will) be examined through the lens of our changing climate. Representing only 7% of the planets' land surface, wetlands store approximately 30% of the world's soil carbon, and thus play a disproportionate role in the global carbon cycle, and may be disproportionately impacted by a changing hydrologic cycle and warming temperatures. Wetland ecosystem services such as carbon sequestration, storm damage prevention, flood damage prevention, wildlife habitat, water quality, pollution and nutrient attenuation, and localized cooling contribute to ecological resiliency and capacity to adapt to climate change. Carbon sequestration and localized cooling mitigate climate change. The vulnerability of wetlands to increased temperatures, drought and dry-down represent a global vulnerability to increased releases of greenhouse gases as wetland organic soils oxidize and as soil respiration rates increase."

Consequently, it is of critical importance to all of us as wetland scientists, policy

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makers, regulators, and citizens, to understand how wetlands are impacted by climate change; how they will help to mitigate climate impacts; and how they can play a role in climate adaptation. By providing a national forum where the latest research findings can be shared and discussed, SWS will help move forward smart policy-making, natural resource management, climate adaptation and climate mitigation planning, and wetlands research.

The SWS NE, just as a beginning, has proposed dedicated symposia on the following topics:

BIOGEOCHEMISTRY

This symposium could focus on the impact of climate change to wetland biogeochemistry cycling and the role that wetlands play in sequestering and storing carbon. This study area could be broken down further into peatlands, inland wetlands, and coastal wetlands. The question of how to protect wetland water tables during drought and high heat could be examined. Research from the Marcell Experimental Forest, such as their S.P.R.U.C.E project and other research forests such as Hubbard Brook, New Hampshire (watershed impacts from climate change) and Harvard Forest, Massachusetts (role of headwater streams in the carbon cycle) could be highlighted.

COASTAL WETLANDS

This symposium could focus on the impacts to coastal wetlands from climate change, especially sea level rise, coastal storm surges, salt marsh die back, and salt water intrusion. It could also investigate the role that coastal wetlands play in climate adaptation and carbon mitigation. We could partner with the Estuarine Research Federation and/or the Manomet Center for Conservation Sciences (Plymouth, Massachusetts), to explore field trips to some of their research sites, as well as identifying potential speakers.

GREEN & BLUE INFRASTRUCTURE IN CLIMATE ADAPTATION

The role of wetlands in green and blue infrastructure projects (such as on the Louisiana coast following Katrina and the New York/New Jersey area following Sandy) could be examined, including how wetlands can provide both adaptation and carbon mitigation ecosystem services.

HYDROLOGY

We will identify speakers who can address the issue of the changing hydrologic cycle and how increased precipitation and flooding, increased drought and high heat, and decreased snow pack and ice will impact the hydrologic functioning of different types of wetlands in different environments.

BIODIVERSITY/WILDLIFE

This symposium could address how climate change is impacting wetland wildlife and investigate impacts such as seasonal shifts, de-synchronization of predator-prey relationships, range shifts and the need for connectivity and large undisturbed areas, changing hydrologic cycle, loss of winter conditions and resulting changes in habitat structure. Research on rare species, and species relying on especially vulnerable wetlands such as vernal pools could be included. Development of adaptation strategies could be examined.

ECOSYSTEM SERVICES/FUNCTIONS & VALUES

Wetlands play a disproportionate role in the carbon cycle, due to their enhanced capacity to sequester and store carbon. They play significant roles in additional climate-related services such as localized cooling, flood control, storm damage prevention, nutrient and pollutant attenuation, water quality and biodiversity/wildlife habitat. This symposium could focus on how these functions will be impacted by climate change, and how to incorporate wetland preservation, restoration and creation into climate adaptation and carbon mitigation planning. The question of trade-offs amongst the various ecosystem services should be addressed along with how to include assessment of ecosystem service trade-offs in policy and decision-making when engaging in climate adaptation and carbon mitigation planning.

WETLAND PRESERVATION/RESTORATION/CREATION

This symposium could focus on wetland preservation, restoration and creation in the context of climate change adaptation and carbon mitigation. Case studies from recent projects in post-Katrina Louisiana and post-Sandy New York/New Jersey could be examined, as well as research on wetlands in different environments, such as coastal, inland, riverine, peatland, temperate, and tropical settings.

HYDRIC SOILS

Given that approximately 30% of the world's soil carbon is stored in wetland soils and that the sequestering of atmospheric carbon into soil and biomass is the only known efficient way to remove carbon from the atmosphere, understanding the role that hydric soils play is essential. Soil scientists and restoration ecologists, as well as wetland scientists, would be invited to discuss the impact to hydric soils and the carbon stored in them (such as lowered water tables during drought and high heat, increased soil respiration rates, increased flooding and erosive velocities during severe storm events). Wetland/soil conservation, restoration and creation could be addressed. Case studies involving restoration of degraded/disturbed land could be examined.

These symposia topics are just some of the possibilities. Do you have any ideas for other possible workshops?

SWS NE welcomes the opportunity for regional groups, such as AMWS, MACC, SSSSNE & SSSNNE, New England Wildflower Society, Audubon, and the Wildlife Society, to sponsor and/or partner with SWS in presenting the 2015 SWS Annual Meeting.

Please plan on attending this exciting world-class event and keep your eye out for future announcements regarding this conference.

Gillian Davies, PWS, NHCWS
Senior Wetland Scientist
BSC Group, Inc.
gdavies@bscgroup.com
617-896-4524

CALENDAR AND AMWS WORKSHOPS

For the most current information on upcoming 2013 AMWS Workshops, go to www.amws.org.

OCTOBER 2013
IMPROVING STREAM CROSSINGS:
FLOOD RESILIENT, FISH FRIENDLY
TAUNTON (OCT. 10, 2013), WAKEFIELD (OCT. 17, 2013) &
MARLBOROUGH (OCT. 29, 2013) MASSACHUSETTS

These day-long workshop sessions have been developed in collaboration with the Massachusetts Rivers Alliance, Baystate Roads, and River Continuity Partners and will bring together state-wide experts from all sectors to cover the Value of Road-Smart Stream Crossings, Massachusetts Stream Crossings Standards and Permitting, Engineering Standards and Guidance, Case Studies and Technical and Funding Resources. The workshops are intended for municipal public works staff, municipal staff and volunteers, and engineering consultants and will focus on making stream crossings safer and more resilient in the face of future storms. Download the flier for more information or click here to sign up.

OCTOBER 30-NOVEMBER 1, 2013
MID-ATLANTIC STREAM RESTORATION CONFERENCE
RENAISSANCE BALTIMORE HARBOR PLACE,
BALTIMORE, MARYLAND

The 6th Mid-Atlantic Stream Restoration Conference will focus on science, engineering and technology. The conference will provide an opportunity for stream restoration practitioners, researchers and policy makers to share ideas and lessons learned in stream restoration planning, assessment, design, construction and evaluation, and other topical stream issues. Scientists and practitioners are encouraged to share experiences, network with colleagues, and become involved in shaping the future of stream restoration in not just the Mid-Atlantic but the Northeast region too. Call for abstracts deadline is June 15, 2013. For more information, click here.

NOVEMBER 14, 2013
EPA WEBINAR ON
PROPOSED CHANGES TO THE
CLEAN WATER ACT'S WATER QUALITY STANDARDS

On September 4, 2013, the US EPA released a draft rule on the proposed changes including regulatory clarification to its water quality standards. The changes are anticipated to improve the regulation's effectiveness in restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The EPA is seeking comments from interested parties on these proposed revisions. The EPA is accepting public comments on these proposed changes; submit your written comments to Docket ID No. EPA-HQ-OW-2010-0606 using one of the methods identified in the in the Federal Register Notice. The public comment period closes on December 3, 2013. In the meantime, the EPA is hosting a free webinar explaining the proposed changes on Thursday, November 14 from 1:00 PM - 3:00 PM; click here to sign up or for more info.

NOVEMBER 15, 2013 - HALF-DAY
AMWS ANNUAL MEETING:
DAM REMOVAL & WETLAND RESTORATION
WARREN CONFERENCE CENTER,
ASHLAND, MASSACHUSETTS
8:00 A.M. - 12:00 P.M.

This year's Annual meeting will cover the removal of nine dams across the state and the replacement of one culvert-- a record for the program and second in the nation. Topics include the functions, values and habitat associated with riverine and floodplain wetlands, sediment management, dealing with pollutants and lessons learned. There will also be short business meeting, election of officers, and member raffle. For more info, see www.amws.org/upcoming_workshops.html

For the most current information on upcoming AMWS Workshops in 2013, go to www.amws.org.

NOTICE: The intent of the Calendar is to provide timely information on conferences and courses to our membership. Mention of a particular conference, course, or company in the Calendar does not imply endorsement by AMWS.

NOVEMBER 16, 2013
MACC FALL CONFERENCE
INVASIVE PLANT SPECIES: PICK YOUR BATTLES TO WIN!
CLARK UNIVERSITY,
WORCESTER, MASSACHUSETTS

The Massachusetts Association of Conservation Commissions (MACC) will be hosting its Fall Conference, Invasive Plant Species: Pick Your Battles to Win!, on Saturday, November 16, 2013 at Clark University in Worcester. Through various presentations and case studies, learn how land managers tackle this problem and how Conservation Commissions can permit certain invasive species work. Participants will come away from this conference with exciting and new electronic tools for plant identification as well as examples of how invasive species projects can be funded. In addition, participants will leave with a renewed appreciation of the essential role native plants play in sustaining native wildlife populations. Click here for more information, or contact MACC staff at staff@maccweb.org or 617- 489-3930 for more info.

NOVEMBER 17, 2013
WORKSHOP:
ECOLOGICAL IMPACTS OF CLIMATE CHANGE IN
NEW ENGLAND GARDEN IN THE WOODS,
FRAMINGHAM, MASSACHUSETTS

This workshop will begin to summarize what scientists know about climate change, including past warmings, and what we can expect for the future. The workshop will take place at the New England Wild Flower Society's Garden in the Woods in Framingham on Sunday, November 17 from 1:30 PM - 3:30 PM. Ailene Kane Ettinger, Ph.D., Botanist and Ecologist, will discuss what remains uncertain and what can be expected for New England's flora, fauna, and unique habitats. Find out about resources for continued learning and ways to take action yourself on climate change. Click here to sign up or for more info.

MAY 6-9, 2014
17TH NATIONAL MITIGATION &
ECOSYSTEM BANKING CONFERENCE
HYATT REGENCY DENVER DOWNTOWN,
DENVER, COLORADO

The 2014 National Mitigation & Ecosystem Banking Conference is the only national conference that brings together key players in the industry, and offers quality hands-on sessions and important regulatory updates. Proven to be "the" place to gain insights, explore new markets and learn from sessions, they are continuing with more focus on educational content - both advanced and basic sessions as well as moderated exchanges that help to connect bankers, regulators, users and others involved in this industry. You'll hear perspectives from bankers, regulators and users, get updated on regulations, legislation and legal challenges, and participate in field trips and more. With a high attendance this past year, we anticipate a record attendance in Denver! For more information go to http://www.mitigationbankingconference.com.

MAY 18-23, 2014
THE FIRST EVER JOINT AQUATIC SCIENCES MEETING (JASM)
PORTLAND CONVENTION CENTER,
PORTLAND, OREGON

"Bridging Genes to Ecosystems: Aquatic Science at a Time of Rapid Change" is the theme for a historic joint meeting of four of the leading aquatic scientific societies: Association for the Sciences of Limnology and Oceanography (ASLO), Phycological Society of America (PSA), Society for Freshwater Science (SFS), and Society of Wetland Scientists (SWS). For more information, please contact The Schneider Group at 254-776-3550 or by email at LacyKC@sgmeet.com.

JULY 28-AUGUST 1, 2014
CONFERENCE ON ECOLOGICAL AND
ECOSYSTEM RESTORATION (CEER),
NEW ORLEANS, LOUISIANA

This conference is a Collaborative Effort of the leaders of the National Conference on Ecosystem Restoration (NCER) and the Society for Ecological Restoration (SER). It will bring together ecological and ecosystem restoration scientists and practitioners to address challenges and share information about restoration projects programs and research from across North America. To obtain more information go to the Conference website.