Conserving temporary wetlands: moving from isolation to connectivity.

Aram JK Calhoun, ML Hunter and colleagues
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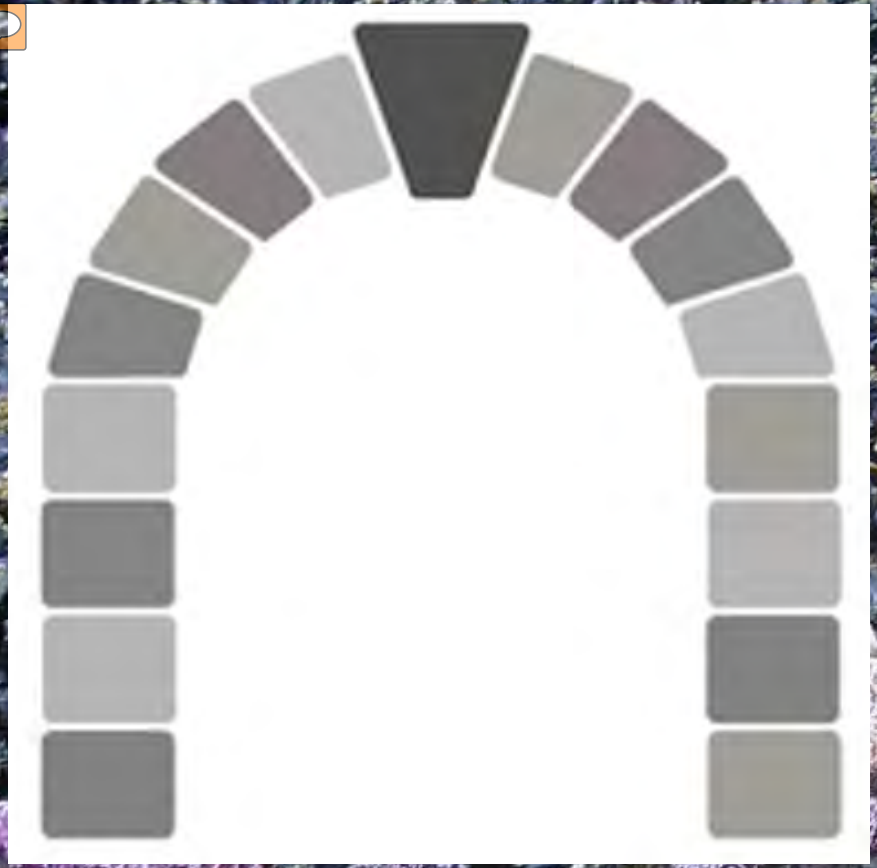
Outline

- **Small natural features: e.g., vernal pools or temporary wetlands**
- **Keystone ecosystems**
- **Meso-filter approach**

- Functions of temporary wetlands
- Challenges to managing temporary wetlands
- Innovative solutions:meso-filter approach to vernal pool conservation

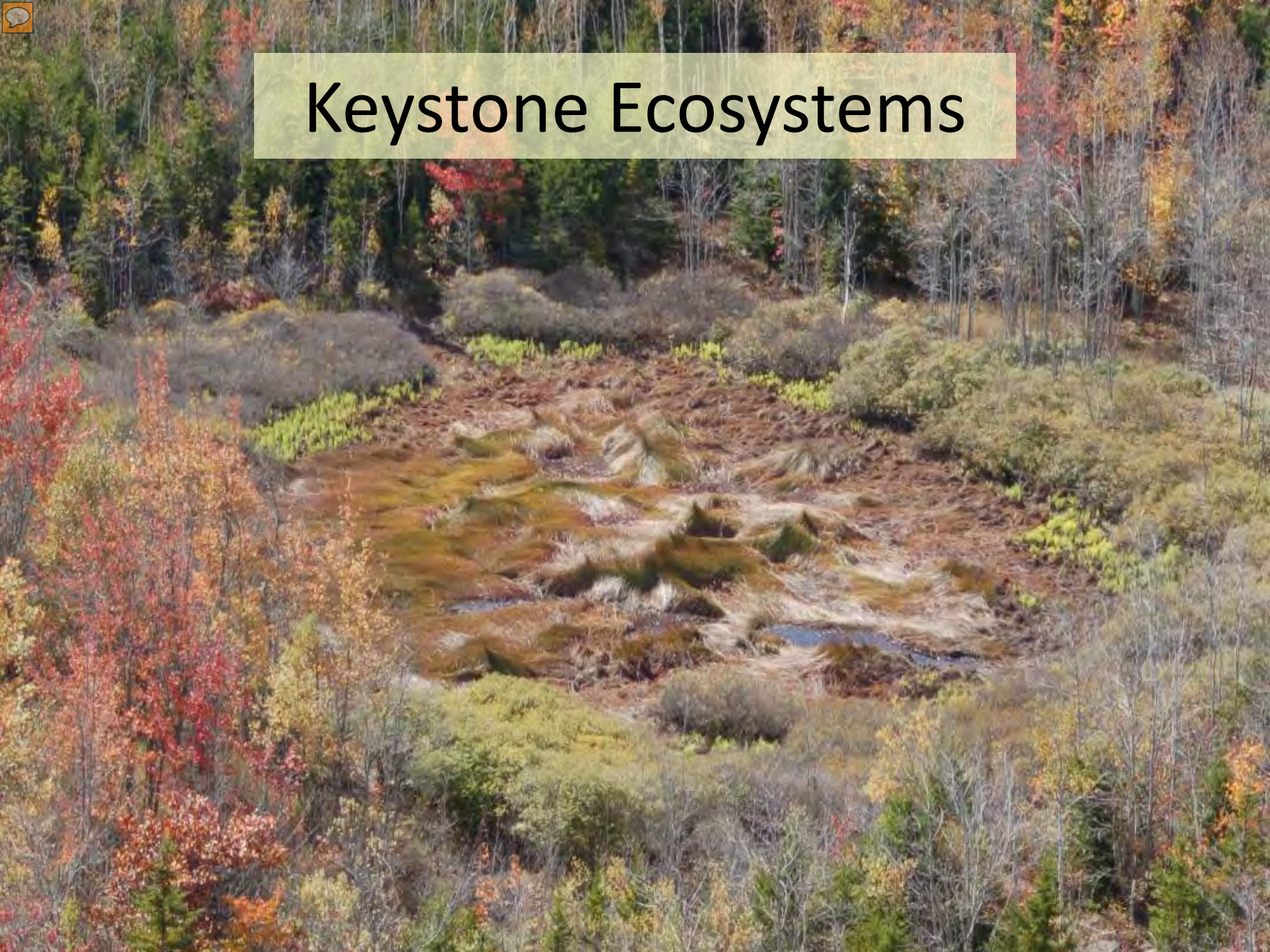
Small Natural Features

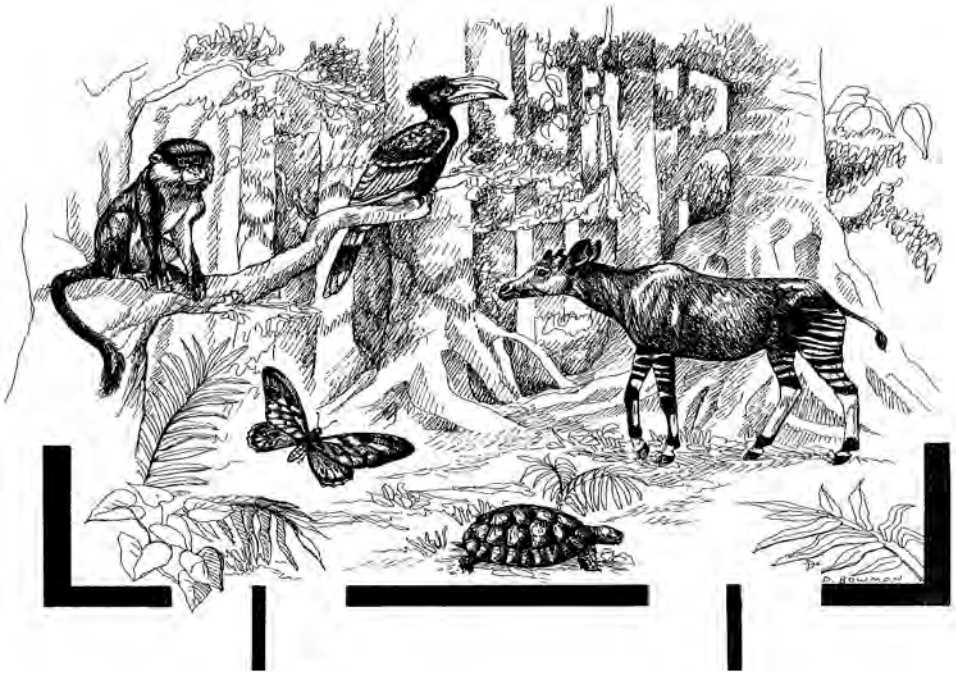
Coral Bommies



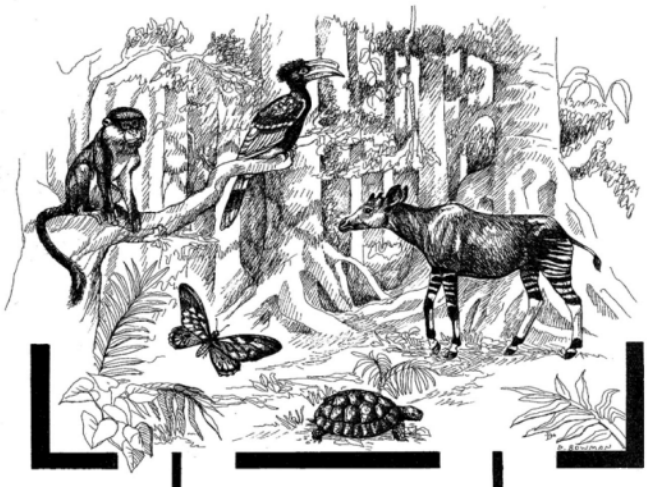
Keystone Species

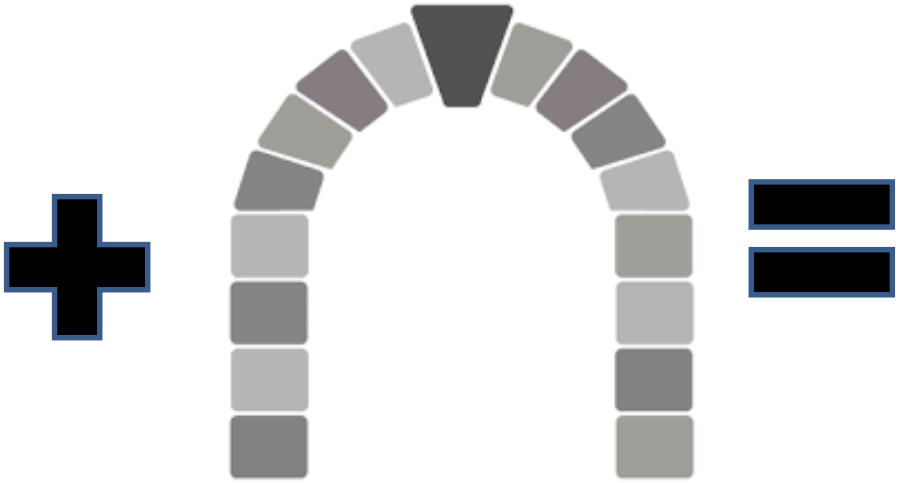
Keystone Ecosystems





Coarse-filter conservation

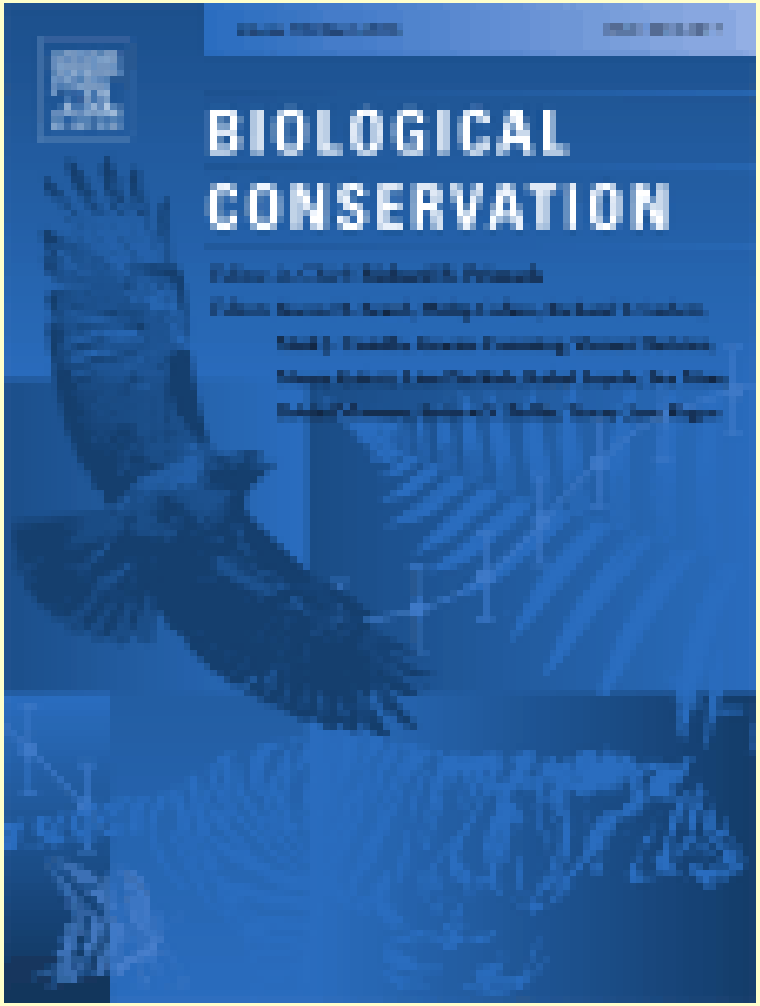




Meso-filter conservation

Hunter 2005

Biological Conservation



Conserving Small Natural Features

- **Bat caves, Large trees, rock outcrops, desert springs, temporary streams**
- **Temporary Wetlands**: *Aram Calhoun (USA), Kathleen Bell (USA), Dani Boix (Spain), James Fitzsimons (Australia), Francis Isselin-Nondedeu (France), and David Mushet (USA)*

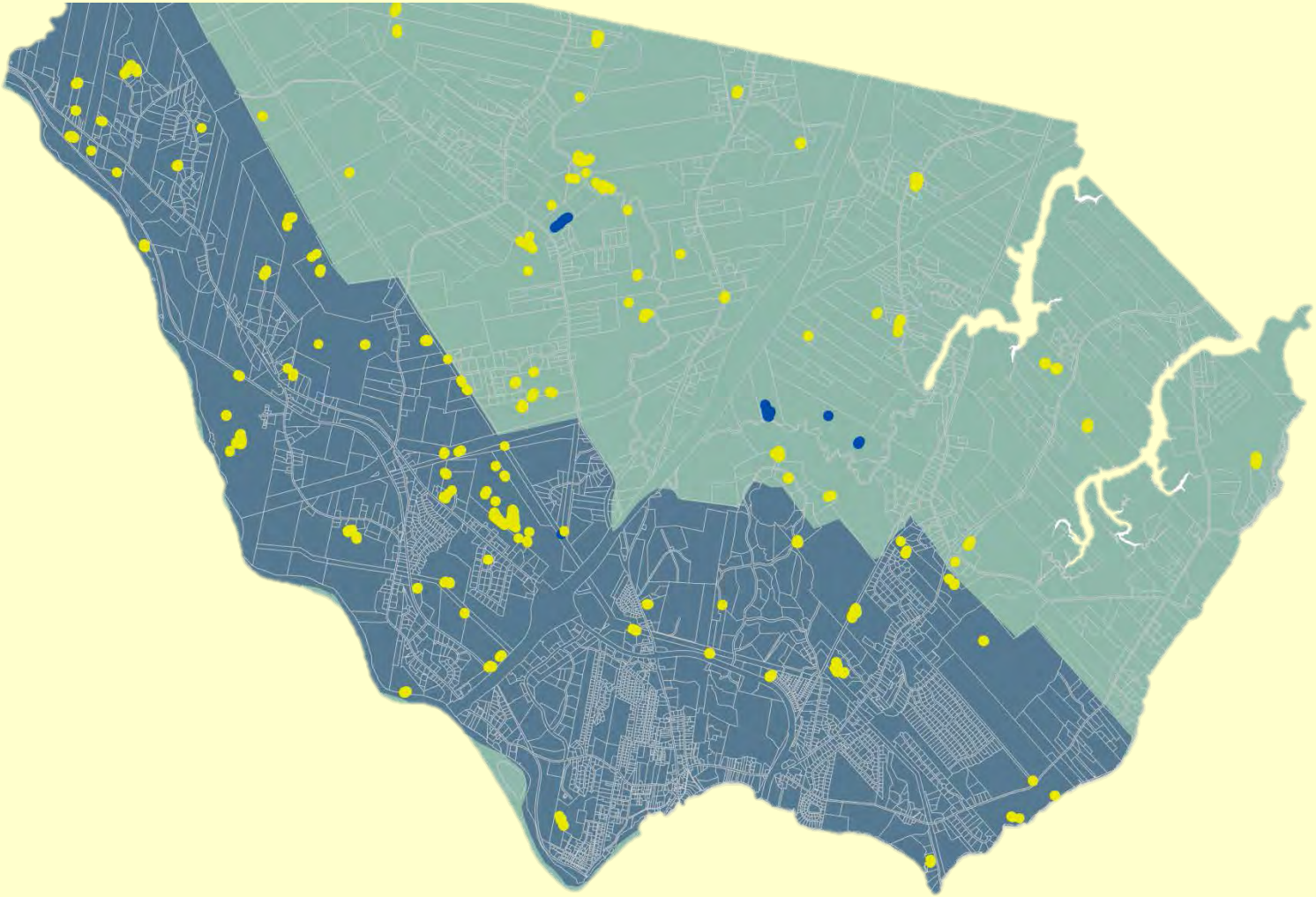
Why are they important?
What are the management challenges?
How can they be conserved?

What are temporary wetlands?

- temporary ponds (Europe, Australia)
- gilgais (Australia)
- prairie potholes (North America)
- vernal pools (North America)

Why are these features important?

Landscape Functions of keystone ecosystem



Landscape functions…

Do Geographically Isolated Wetlands Influence Landscape Functions?

Matthew J. Cohen[1,*], Irena F. Creed[2], Laurie C. Alexander[3], Nandita B. Basu[4], Aram J. K. Calhoun[5], Chris B. Craft[6], Ellen D'Amico[7], Edward S. DeKeyser[8], Laurie A. Fowler[9], Heather E. Golden[10], James W. Jawitz[11], Peter Kalla[12], L. Katherine Kirkman[13], Charles R. Lane[10], Megan W. Lang[14], Scott G. Leibowitz[15], David B. Lewis[16], John M. Marton[17], Daniel L. McLaughlin[18], David M. Mushet[19], Hadas Raanan-Kiperwas[20], Mark C. Rains[21], Lora L. Smith[13], Susan C. Walls[22]

1 – School of Forest Resources and Conservation, University of Florida, Gainesville FL 32611 2 – Department of Biology, Western University, London, ON N6A 5B7 3 – US EPA National Center for Environmental Assessment, Washington, DC 20460 4 – Department of Earth and Environmental Sciences, University of Waterloo, Waterloo, ON N2L 3G1 5 – Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono, ME 04469 6 – School of Public Health and Environmental Affairs, Indiana University, Bloomington, IN 47405 7 – CSS-Dynamac Corporation, Cincinnati, OH 45268 8 – School of Natural Resource Sciences, North Dakota State University, Fargo, ND 58108-6050 9 – Odum School of Ecology, The University of Georgia, Athens, GA 30602 10 – US EPA National Exposure Research Laboratory, Cincinnati, OH 45268 11 – Soil and Water Science Department, University of Florida, Gainesville FL 32611 12 – US EPA Region 4, Athens, GA 30605 13 – Joseph W. Jones Ecological Research Center, Newton, GA 39870 14 – Department of Geographical Sciences, University of Maryland, College Park, MD 20742 15 – US EPA National Health and Environmental Effects Research Laboratory, Western Ecology Division, Corvallis, OR 97333 16 – Department of Integrative Biology, University of South Florida, Tampa, FL 33620 17 – CDM Smith, Inc., Indianapolis IN 46204 18 – Department of Forest Resources and Conservation, Virginia Tech, Blacksburg, VA 24061 19 – US Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND 58401 20 – ORISE Fellow, US EPA Office of Wetlands, Oceans, and Watersheds, Washington, DC 20460 21 – School of Geosciences, University of South Florida, Tampa, FL 3362 22 – US Geological Survey, Wetland and Aquatic Research Center, Gainesville, FL 32653

Landscape functions such as flow generation, nutrient and sediment retention, and biodiversity support depend on material, energy, and organism exchanges among elements in hydrological and habitat networks. Wetlands are integral network elements, providing hydrological, biogeochemical and biological functions that vary in time and space along a continuum of

require demonstration of a "significant nexus" with certain downstream waters. Based on analysis of wetland geography and synthesis of wetland functions, we argue that sustaining landscape functions requires conserving the entire continuum of wetland connectivity.

connectivity | navigable waters | significant nexus

transformation, carbon sequestration; 26-28), and biological (e.g., habitat, refugia; 29-32) functions. Variation in wetland connectivity to other landscape elements impacts wetland functions, and thus which services are provided. Wetlands connected to other landscape elements via persistent surface flowpaths provide a different blend of storage and water quality services than wetlands

YES!!!

Hydrology…

INVITED COMMENTARY

HP TODAY

HYDROLOGICAL PROCESSES
Hydrol. Process. **30**, 153–160 (2016)
Published online 13 September 2015 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/hyp.10610

Geographically isolated wetlands are part of the hydrological landscape

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M. J. Cohen,[3] I. F. Creed,[4]
H. E. Golden,[5] J. W. Jawitz,[6]
P. Kalla,[7] C. R. Lane,[5]
M. W. Lang[8] and
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Introduction

Since the US Supreme Court's 2001 *SWANCC* case (531 US 159), there has been significant focus on whether Clean Water Act (CWA) protections should be extended to so-called geographically isolated wetlands (GIWs); wetlands that are surrounded by uplands and lack readily apparent surface water connections to downgradient waters (Downing *et al.*, 2003; Leibowitz and Nadeau, 2003; Tiner, 2003a, b; see Mushet *et al.* (2015) for a history and critique of this term). Following the US Supreme Court's 2006 *Rapanos* case (547 US 715), interest in GIWs increased, with a more recent emphasis

Andrew Reeve
Kelli Straka

Biogeochemical functions…

Geographically Isolated Wetlands are Important Biogeochemical Reactors on the Landscape

JOHN M. MARTON, IRENA F. CREED, DAVID B. LEWIS, CHARLES R. LANE, NANDITA B. BASU, MATTHEW J. COHEN, AND CHRISTOPHER B. CRAFT

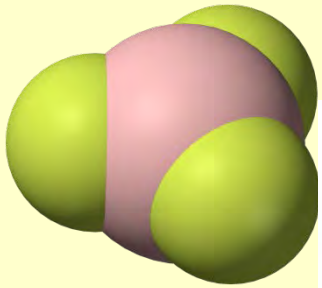
Wetlands provide many ecosystem services, including sediment and carbon retention, nutrient transformation, and water quality improvement. Although all wetlands are biogeochemical hotspots, geographically isolated wetlands (GIWs) receive fewer legal protections compared with other types of wetlands because of their apparent isolation from jurisdictional waters. Here, we consider controls on biogeochemical functions that influence water quality, and estimate changes in ecosystem service delivery that would occur if these landscape features were lost following recent US Supreme Court decisions (i.e., Rapanos, SWANCC). We conclude that, despite their lack of persistent surfacewater connectivity or adjacency to jurisdictional waters, GIWs are integral to biogeochemical processing on the landscape and therefore maintaining the integrity of US waters. Given the likelihood that any GIW contributes to downstream water quality, we suggest that the burden of proof could be shifted to assuming that all GIWs are critical for protecting aquatic systems until proven otherwise.

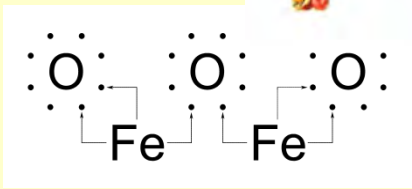
Keywords: geographically isolated wetlands, connectivity, adjacency, biogeochemistry, wetland protection

Wetlands exist along a continuum of hydrologic connectivity to surrounding upland and aquatic eco-

communities or undrained hydric soils surrounded by non-hydric soils." GIWs are formed by natural forces that create

Lydia Kifner
Aria Amirbahman
Aram Calhoun
Steve Norton
Krista Capps
Laura Podzikowski





Ecosystems (2014) 17: 1455–1468
DOI: 10.1007/s10021-014-9807-z

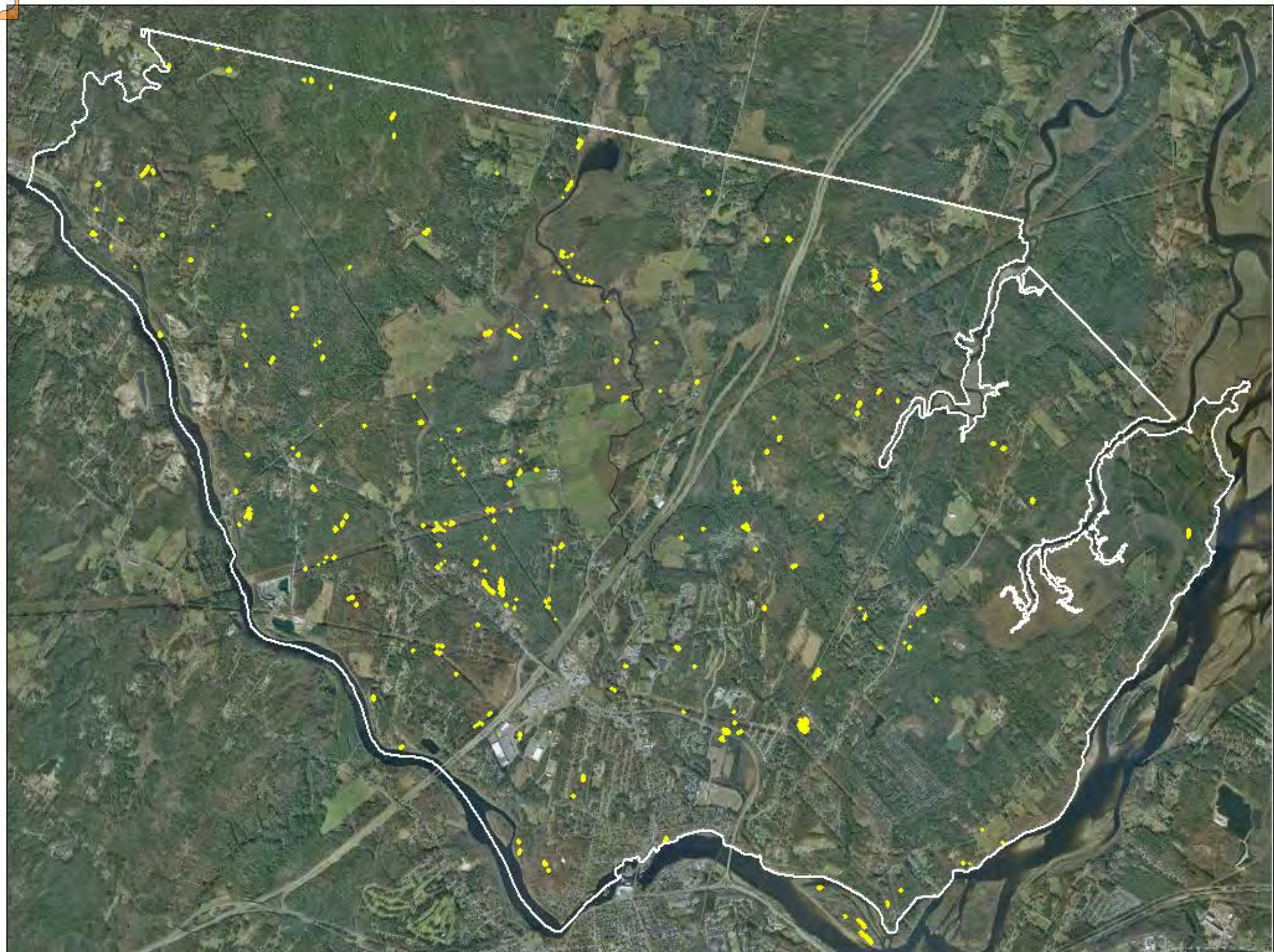
ECOSYSTEMS

Biogeochemical Hotspots in Forested Landscapes: The Role of Vernal Pools in Denitrification and Organic Matter Processing

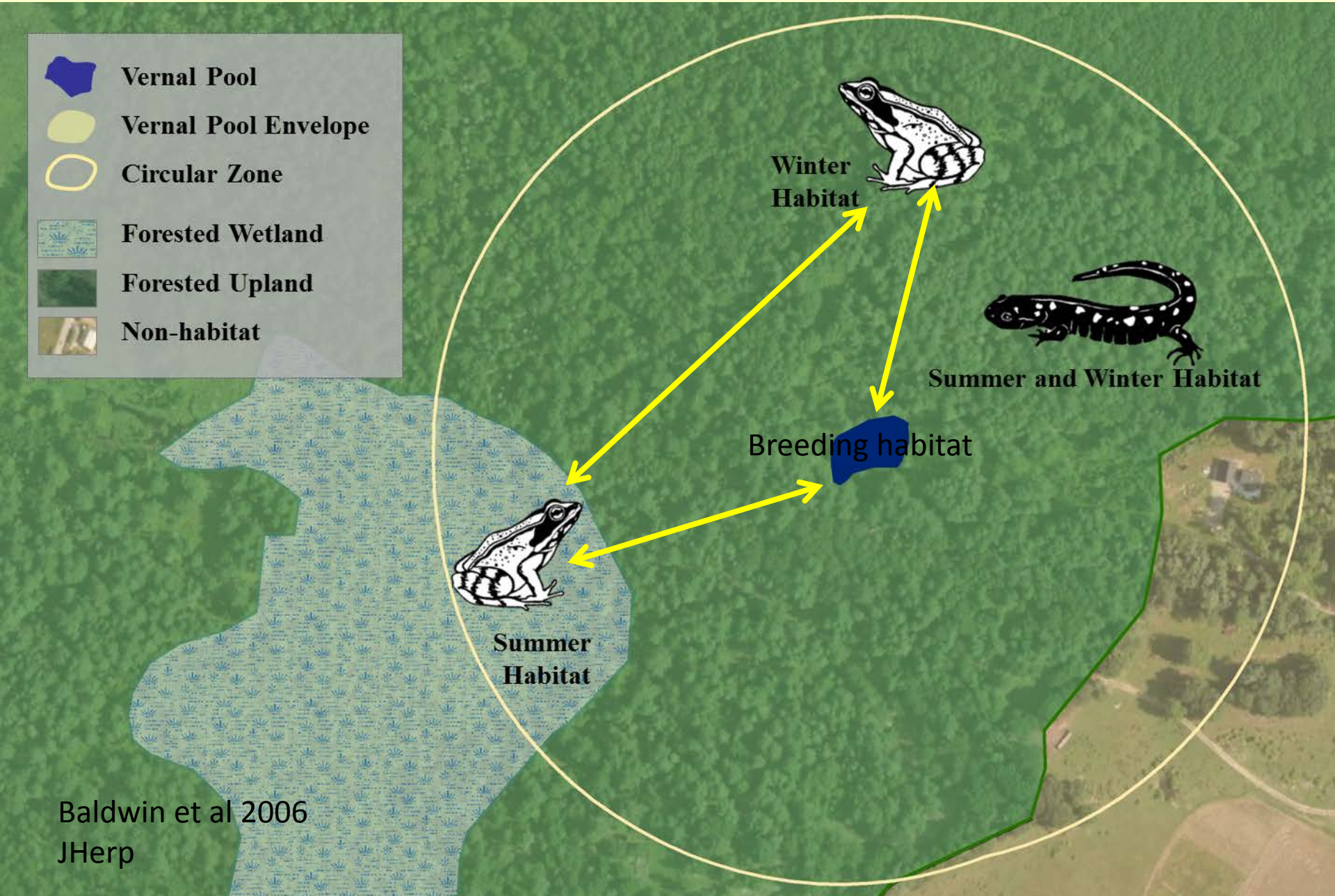
Krista A. Capps,[1,2]* Regina Rancatti,[3] Nathan Tomczyk,[3] Thomas B. Parr,[1,3] Aram J. K. Calhoun,[1,2,3] and Malcolm Hunter Jr.[1,2]

[1]*Sustainability Solutions Initiative, University of Maine, Orono, Maine 04469, USA;* [2]*Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono, Maine 04469, USA;* [3]*Ecology and Environmental Science Program, University of Maine, Orono, Maine 04469, USA*

What are current management challenges?



Variable life history needs



Baldwin et al 2006
JHerp

Geographically Isolated Wetlands

What's in a name?

Wetlands (2015) 35:423–431
DOI 10.1007/s13157-015-0631-9

REVIEW ARTICLE

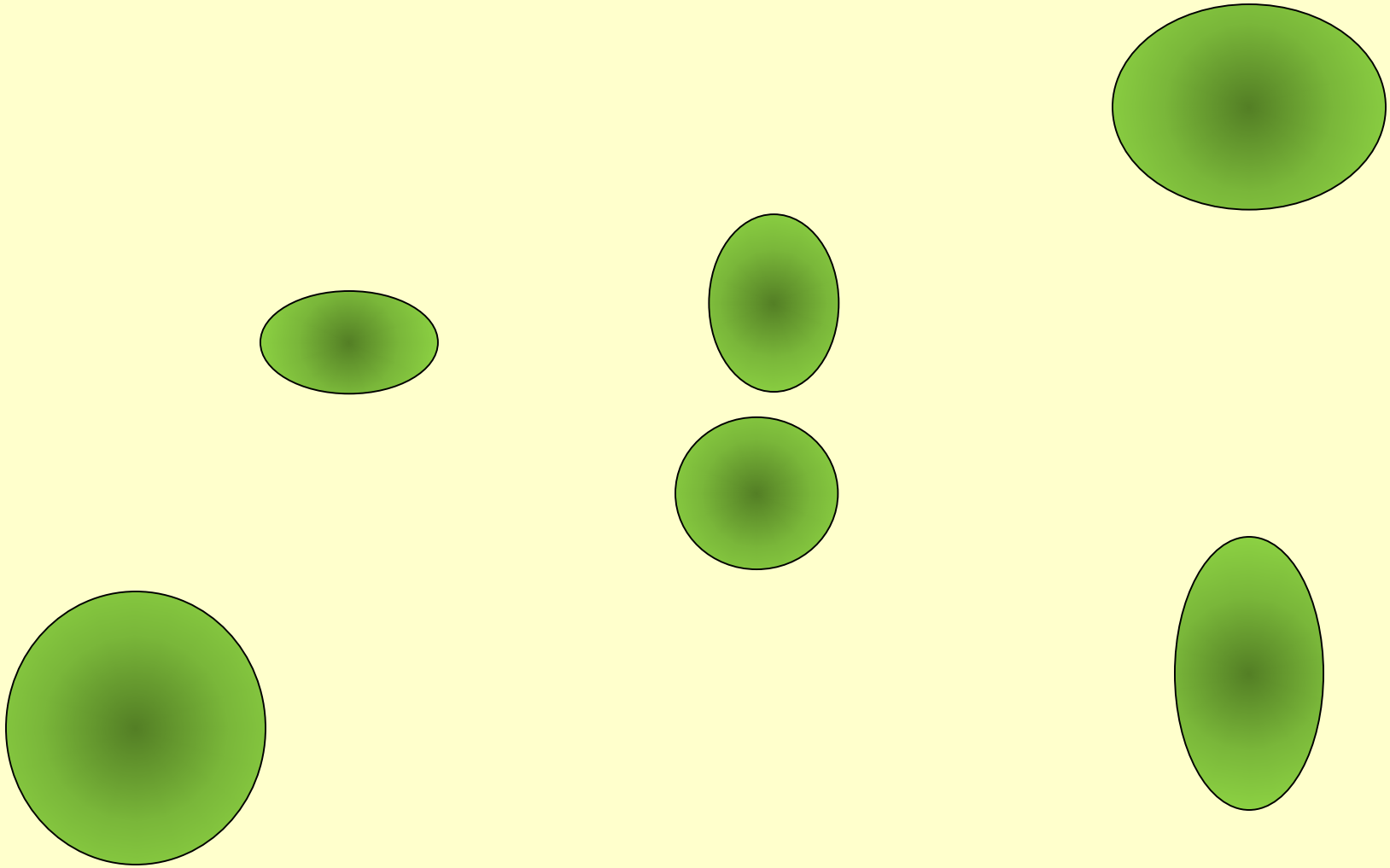
Geographically Isolated Wetlands: Rethinking a Misnomer

David M. Mushet · Aram J. K. Calhoun · Laurie C. Alexander · Matthew J. Cohen · Edward S. DeKeyser · Laurie Fowler · Charles R. Lane · Megan W. Lang · Mark C. Rains · Susan C. Walls

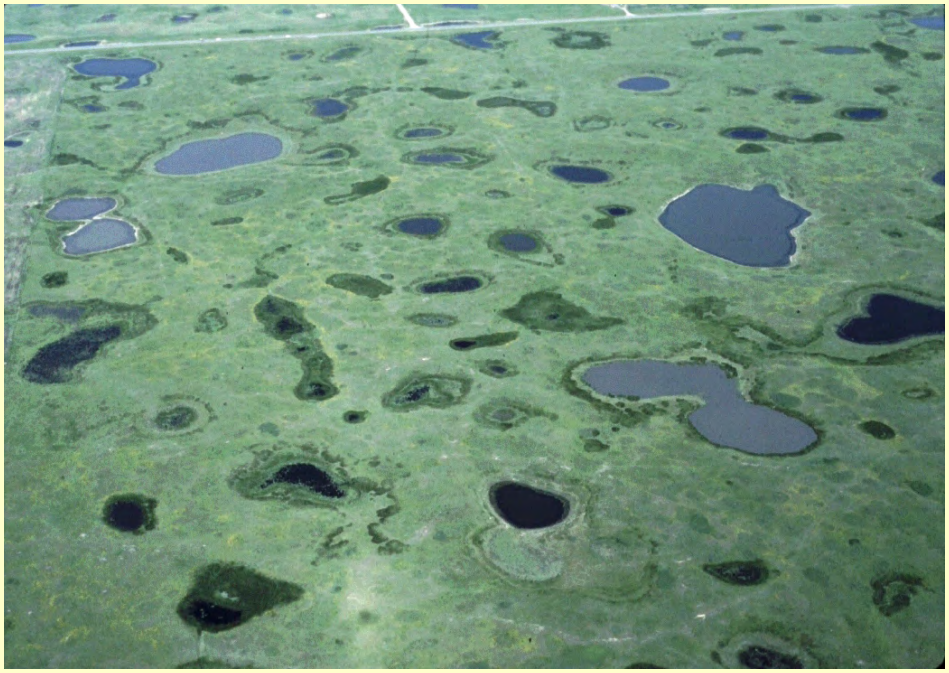
Received: 13 June 2014 / Accepted: 15 January 2015 / Published online: 27 January 2015

Abstract We explore the category "geographically isolated wetlands" (GIWs; i.e., wetlands completely surrounded by uplands at the local scale) as used in the wetland sciences. As currently used, the GIW category (1) hampers scientific efforts by obscuring important hydrological and ecological differences among multiple wetland functional types, (2) aggregates wetlands in a manner not reflective of regulatory and management information needs, (3) implies wetlands so described are in some way "isolated," an often incorrect "isolation." Additionally, an HGM-type approach could be used in combination with terms reflective of current regulatory or policymaking needs. For those rare cases in which the condition of being surrounded by uplands is the relevant distinguishing characteristic, use of terminology that does not unnecessarily imply isolation (e.g., "upland embedded wetlands") would help alleviate much confusion caused by the "geographically isolated wetlands" misnomer.

Current policies lead to pools on paper…..



Future of wetland management: the value of **bird's eye** *and* frog's eye views



How do we conserve these small natural features?

Improving management of small natural features on private lands by negotiating the science–policy boundary for Maine vernal pools

Aram J. K. Calhoun[a,b,1], Jessica S. Jansujwicz[b], Kathleen P. Bell[b,c], and Malcolm L. Hunter, Jr.[a,b]

[a]Department of Wildlife, Fisheries, and Conservation Biology, [b]Sustainability Solutions Initiative, and [c]School of Economics, University of Maine, Orono, ME 04469

Edited by Anthony J. Bebbington, Clark University, Worcester, MA, and approved June 10, 2014 (received for review January 21, 2014)

Vernal pools are far more important for providing ecosystem services than one would predict based on their small size. However, prevailing resource-management strategies are not effectively conserving pools and other small natural features on private lands. Solutions are complicated by tensions between private property and societal rights, uncertainties over resource location and function, diverse stakeholders, and fragmented regulatory authority. The development and testing of new conservation approaches that link scientific knowledge, stakeholder decision-making, and conservation outcomes are important responses to this conservation dilemma. Drawing from a 15-y history of vernal pool conservation

fish, they provide an ideal breeding habitat for invertebrate and amphibian species susceptible to depredation by predators associated with permanent waters. Vernal pool systems include the pool and adjacent forests that provide shade and organic material for the pool and postbreeding habitat for pool-breeding amphibians that live the majority of their lives on the forest floor (5). Besides habitat for many aquatic and terrestrial species, vernal pools provide other ecosystem services, such as export of carbon and nutrients to adjacent forests (4, 6).

Although vernal pools are unique ecosystems that perform important functions at the landscape scale (7), they face signif-

Tried, but not true

- Traditional top-down regulation
- Incidental
- Voluntary

Innovative approaches

- Locally driven
- Local intelligence
- “Ownership”
- Flexibility
- Attention to human dimensions of conservation

Science: POLICY FORUM

Vulnerable Waters: The case for enhanced protection of headwater streams and wetlands outside of floodplains

By Irena F. Creed[1,*], Charles R. Lane[2], Laurie Alexander[3], Nandita Basu[4], Aram Calhoun[5], Matthew J. Cohen[6], Chris Craft[7], Ellen D'Amico[8], Edward DeKeyser[9], Laurie Fowler[10], Heather E. Golden[11], James W. Jawitz[12], Peter Kalla[13], L. Katherine Kirkman[14], Megan Lang[15], Scott G. Leibowitz[16], David B. Lewis[17], John Marton[18], Daniel L. McLaughlin[19], Hadas Raanan-Kiperwas[20], Mark C. Rains[21], Lora Smith[22], Jacqueline N. Serran[23]

Four strategies for managing aquatic vulnerable waters

Protect for:

1. Inherent value.
2. Influence on Navigable Waters.
3. Portfolio of Functions
4. Use Practical Surrogates

Wood Frog
Max: 3018 feet
Median: 435 feet

Jefferson Salamander
Max: 1550 feet

Blue-spotted Hybrid
Max: 922 feet
Median: 133 feet

Blue-spotted Salamander
Max: 715 feet
Median: 219 feet

Spotted Salamander
Max: 817 feet

Beyond mapping...

Orono

Brunswick
Scarborough
Wayne
Readfield

Topsham

Yarmouth
Windham
Freeport
Cumberland
Bar Harbor

Turning Contention into Collaboration

Stakeholder solutions

Vernal Pool Special Area Management Plan

February 2016 DRAFT

Prepared by: University of Maine – Orono

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Ruth M. Ladd
Chief, Policy and Technical Support Branch
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New England District Corps of Engineers
696 Virginia Road

The Maine Vernal Pool SAMP is…

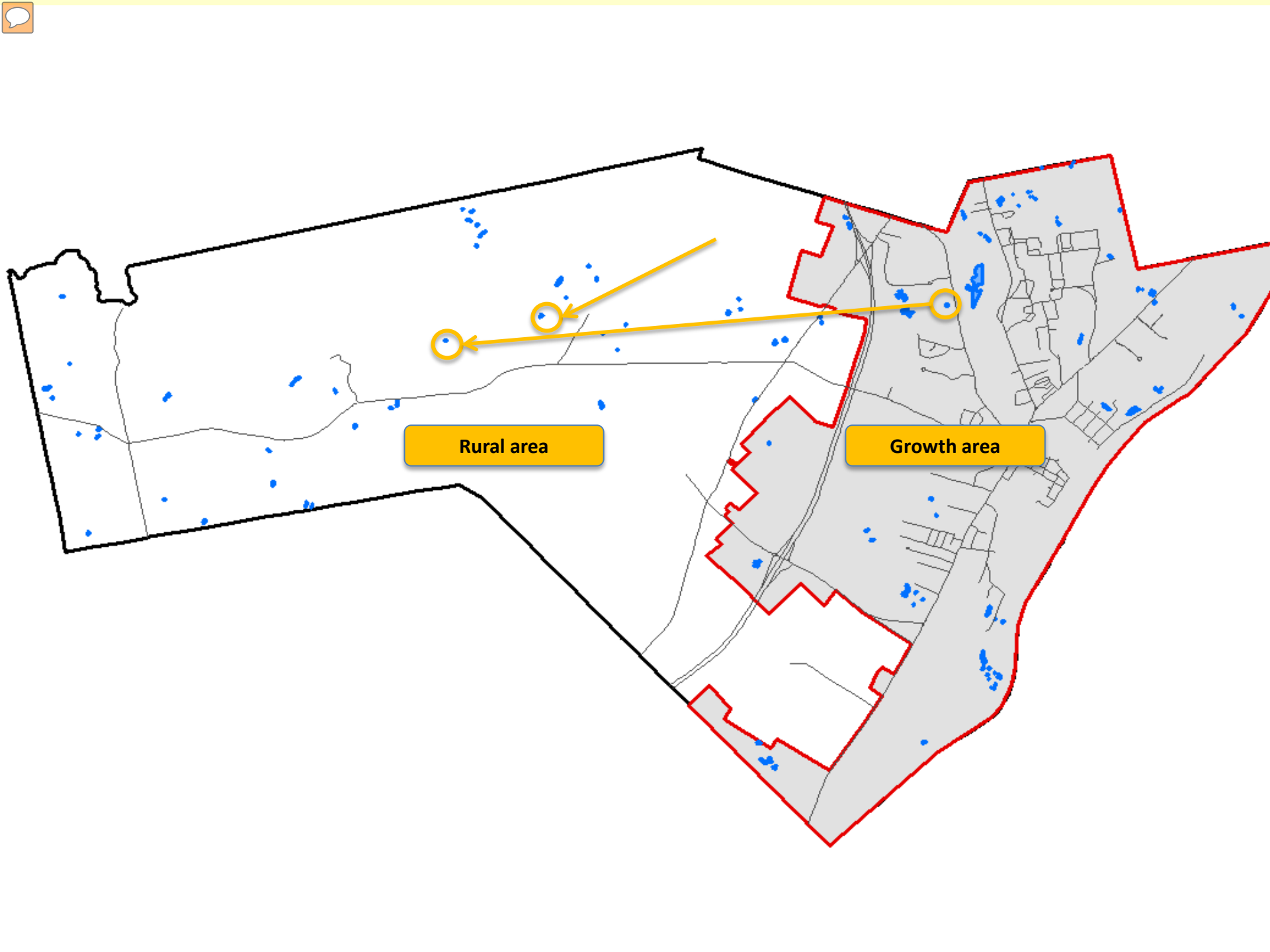
1. An alternate regulatory mechanism that balances vernal pool protection with economic development.

   - Voluntary
   - Promotes long term conservation of high value resources
   - Makes development in growth zones predictable
   - Removes economic burdens from rural land owners
   - Supports local priorities

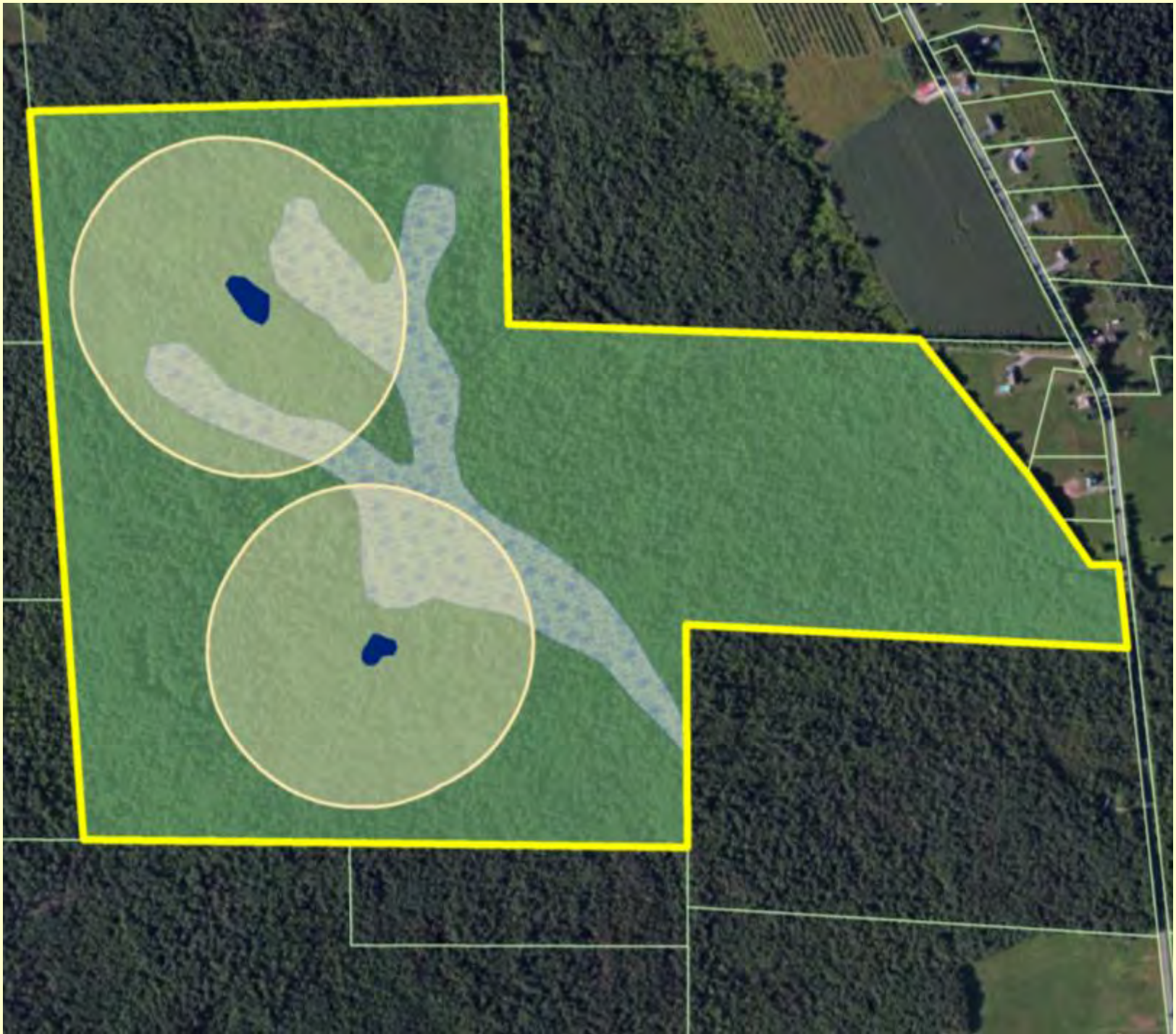
2. A partnership among

   - Federal and state regulators
   - Municipalities
   - Developers
   - Non-profit land conservation organizations

- ✓ 5.5 years
- ✓ 60+ meetings
- ✓ Development community
- ✓ Economists/Appraisers
- ✓ Biologists
- ✓ Citizens
- ✓ 2 towns
- ✓ 7 state and federal agencies
- ✓ 2 Land trusts


Rural area
Growth area


250 feet



How will the SAMP affect resource managers?

- Town driven, alternative voluntary tool; default is current regulatory framework
- Small scope: only portion of growth area
- Still need wetland permits for projects
- Pilot project
- Annual review and feedback: adaptive management built-in

www.nae.usace.army.mil/Missions/Regulatory/PublicNotices.aspx

US Army Corps
of Engineers ®
New England District
696 Virginia Road
Concord, MA 01742-2751

PUBLIC NOTICE

Comment Period Begins: March 1, 2016
Comment Period Ends: March 30, 2016
File Number: NAE-2016-xxxxx
In Reply Refer To: Ruth M. Ladd
Phone: (978) 318-8818
E-mail: ruth.m.ladd@usace.army.mil

Proposed Special Area Management Plan For Vernal Pools in Maine

The New England District, U.S. Army Corps of Engineers, is evaluating a Special Area Management Plan (SAMP) for vernal pools in Maine that will modify the way projects impacting some vernal pools are authorized under the Maine General Permit. The Department of the Army Maine General Permit can be found at [link]. General Condition 23 requires certain management practices for Self-Verification projects that affect vernal pools to ensure that activities authorized under the GP have no more than minimal adverse environmental effect. If the SAMP is approved, these practices will not be required for projects that take place within the SAMP area, meet its conditions, and are in a community which has adopted the requirements of the SAMP.

The Corps defines the SAMP process as a "comprehensive plan providing for natural resource protection and reasonable economic growth containing a detailed and comprehensive statement of policies, standards and criteria to guide public and private uses of lands and waters and mechanisms for timely implementation in specific geographic areas." The decision whether to approve a SAMP will be based on an evaluation of the probable impact of the proposed SAMP on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which may reasonably accrue from the SAMP must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the

Acknowledgments

Small Natural Features Team: Mac Hunter, Kathleen P. Bell, Dana Bauer, Cyndy Loftin, Mike Kinnison, Eric Nelson, Krista Capps

Graduate Students: Luke Groff, Kristine Hoffmann, Lydia Kifner, Carly Eakin, Mitchell Jones, Jared Homola, Jessica Balukas, Laura Podzikowski, Vanessa Levesque

Photo credits: Kristine Hoffmann, Luke Groff, Dawn Morgan, Lydia Kifner

Funding: National Science Foundation, University of Maine

Maine VP SAMP Team

- University of Maine (Bell, Calhoun, Hunter, Kinnison, Levesque, Loftin, Morgan,Owen)
- US Army Corps of Engineers (Ladd, Clement, McCarthy)
- US Environmental Protection Agency (Kern)
- US Fish and Wildlife Service (Mahaney)
- Maine DEP (Mullen)
- Maine DACF (Hertz, Puryear)
- Maine DIFW (deMaynadier, Walker)
- Topsham Economic and Community Development (Shattuck)
- Town of Orono, ME (Richert, Gordon, Shepherd, Thompson)
- Town of Topsham, ME (Roedner, Melanson, Eyreman)

And representatives from the following groups:

- Real estate and development community (Howard, Spann, Wasileski)
- Real estate appraisal (Siegel)
- Land trusts both local and regional (OLT, BTLT)
- Private consultant (Eyreman)


Discussion?