Biodiversity Values of Geographically Isolated Wetlands in the United States

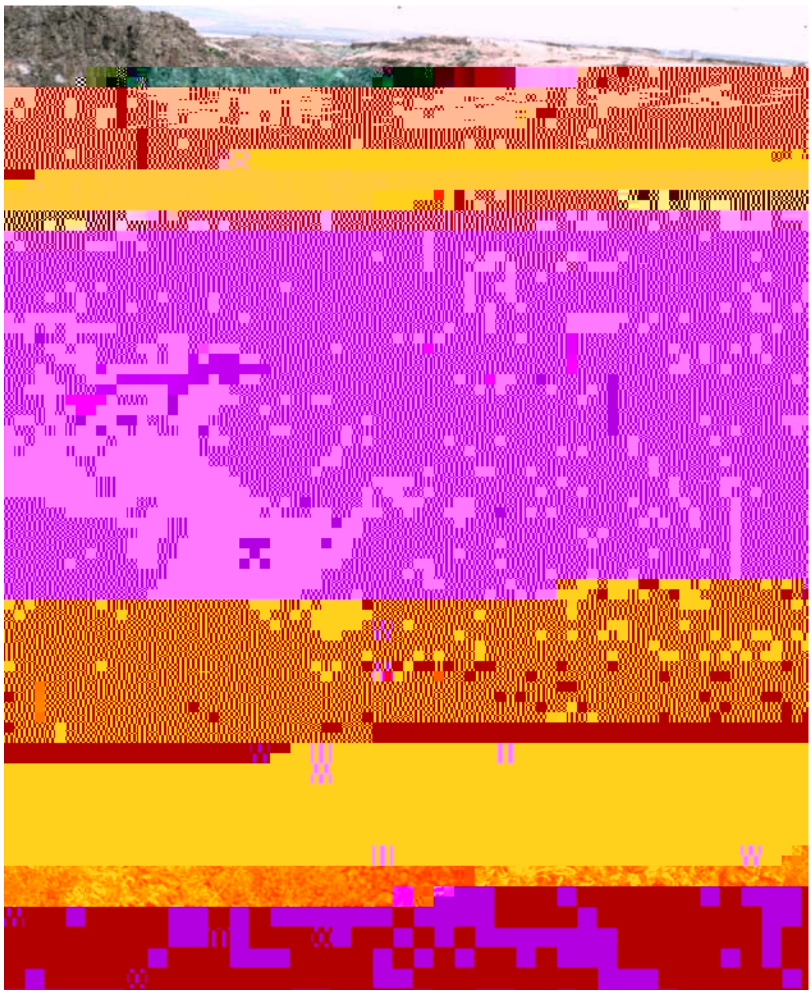

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Table of Contents

Executive Summary

As a result of a 2001 Supreme Court decision (Solid Waste Agency of Northern Cook County vs. U.S. Army Corps of Engineers, 2001), some wetlands and other waters that are considered "geographically isolated" from navigable waters no longer fall under the jurisdiction of the Clean Water Act. Scientific assessments of the potential impacts of the court's decision are needed to provide guidance to the federal agencies, states, tribes and local governments that will have responsibility for protecting these valuable resources.

In this study we sought to assess potential impacts of the court's decision on the nation's biological diversity. To do so, we first used a nationally standardized classification of wetland ecological systems. We then established a working definition to categorize types as "geographically isolated," and using expert knowledge of these wetland types, we narrowed the national list of wetland ecological systems to those that tend to occur "geographically isolated" from navigable waters. Through review of scientific literature, input from regional experts, and compilation of existing location data for at-risk species (those species considered rare, imperiled or critically imperiled using NatureServe's standard criteria) we identified those at-risk species and plant communities that are supported by these isolated wetland types throughout the United States.

This assessment used the best currently available information. Because comprehensive wetland maps are unavailable nationally, this study focuses on documenting the number, or diversity, of isolated wetland types, rather than on the acreage these wetland types occupy. These analyses could be significantly augmented in the future with the collection of additional data on the occurrence of isolated wetland types, their spatial extent, and their associated species and communities.

Key Findings

Significant wetland diversity exists in every state of the nation. Of 276 types of wetland described for the United States, 81 (29%) met our project-specific definition of "geographically isolated." These types of wetlands may no longer be regulated under the Clean Water Act. Their regulation will therefore largely be determined by how lawmakers, regulators, and the courts interpret the term "isolated." Of the 636 U.S. terrestrial ecological system types (both upland and wetland) currently classified and described by NatureServe (NatureServe 2005), these 81 isolated wetland types amount to 13% of all "natural/near-natural" terrestrial ecological system types.

This study documents that isolated wetland ecological systems support high levels of biodiversity, including significant numbers of at-risk species and plant communities. For example:

- A total of 274 at-risk plant and animal species are supported by isolated wetlands, with more than one-third (35%) apparently restricted to these wetland types. At-risk animal species are even more closely tied to isolated wetlands; more than one-half of at-risk animals considered in this study appear to be obligate to isolated wetland habitats.
- A total of 86 plant and animal species listed as threatened, endangered, or candidates under the Endangered Species Act are supported by isolated wetland habitats. This represents about 5% of all plant and animal species currently listed under the Act. A majority (52%) of these listed species are completely dependent on isolated wetland habitat for their survival.
- Nearly half of isolated wetland types (35 of 81, or 43%) are known to support at least one listed species under the Endangered Species Act.

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Introduction

As a result of a 2001 Supreme Court decision, *Solid Waste Agency of Northern Cook County vs. U.S. Army Corps of Engineers* (SWANCC, 2001), an unknown but potentially significant number of wetlands and other waters throughout the United States are longer protected under the Clean Water Act. The SWANCC decision eliminated reliance on the so-called Migratory Bird Rule that included many geographically isolated wetlands within the jurisdiction of the Clean Water Act through their linkages to interstate commerce (Downing et al. 2003). The court ruled that, while the Clean Water Act was clearly intended to protect the "biological integrity" of "waters of the United States," the Act does not have jurisdiction over geographically isolated, intrastate, non-navigable waters based solely on habitat use by migratory birds. Since the SWANCC decision, scientists and policy-makers have struggled to understand exactly what water resources no longer receive federal protection under the Clean Water Act and what functions and ecological benefits these wetlands provide. Analysis of potential impacts of the SWANCC decision is needed to provide appropriate guidance to policy-makers as they tackle the difficult task of implementing the decision, and to states, tribes, and local governments, and private individuals that ma[illegible]

The SWANCC decision has stimulated new research and discussion about wetland resources (e.g., Petrie et al. 2001, Tiner et al. 2002) and has highlighted the need for additional dialogue between scientists, conservationists, resource managers, and policy-makers (Leibowitz and Nadeau, 2003). However, clarifying the impact of the SWANCC decision is continually hampered by technical and scientific uncertainty. Additional uncertainty results from the lack of an agreed-upon definition for an "isolated wetland" in the legal arena. Furthermore inadequate mapped information to document baseline status and trends among these wetlands and associated resource values, and insufficient knowledge of hydrologic and ecological processes that connect wetlands to navigable water bodies in diverse landscape settings makes it difficult to fully understand which wetland habitats might be at risk as a result of the ruling.

Close analysis of wetland ecosystems suggests that the concept of isolation is best viewed along a continuum, and that all wetlands are, in some form, hydrologically and ecologically connected to navigable water bodies (Leibowitz 2003, Winter and Labaugh 2003). Indeed, geographic, ecologic, and hydrologic isolation can be described at multiple spatial and temporal scales. Wetlands within a large, closed basin in central Nevada would be deemed isolated at a regional scale, but locally, could be connected to navigable water bodies. Other wetlands remain hydrologically isolated much of the time, but periodic events reconnect them with navigable waters. In most instances, isolation is best analyzed from the perspective of individual species or processes of concern. Individual wetlands in a complex of prairie potholes could be viewed as isolated from the perspective of amphibians with limited dispersal capabilities; but from the perspective of migratory waterfowl, these same wetlands might form a highly inter-connected network of stopover points. This ambiguity in defining "isolation" leads to a number of alternative methods for identifying and mapping these wetland types, and analyses that yield varying results (Tiner 2003c).

Questions of Clean Water Act jurisdiction are likely to be settled in the policy and legal arenas. Regardless of what is to be ultimately deemed jurisdictional through the Clean Water Act, practical methods and tools, where a series of indicators are used to categorize a given seemingly isolated wetland will be critical for helping determine jurisdiction on the ground. For example, new research documenting semi-aquatic species that require isolated wetlands for portions of their lif

NatureServe and its Network of Natural Heritage Programs

NatureServe is a non-profit, non-advocacy conservation organization that provides the scientific information and tools needed to help guide effective conservation action. Together with its network of natural heritage member programs, NatureServe is a leading source for detailed information about rare and endangered species, ecological communities, and characteristic ecosystems (collectively referred to as “elements of biodiversity” using NatureServe methodology). Natu documented plant associations in the United States, those considered at-risk (G1, G2, and G3) that are linked to each wetland ecological system type may be readily identified.

Currently NatureServe's data on rare species and ecological classifications are publicly available on the NatureServe Explorer website (www.natureserve.org/explorer). This site houses searchable data on more than 60,000 plants, animals, vegetation associations, and ecological systems and provides comprehensive text reports containing available data on taxonomy, description, distribution, and conservation status of these elements of biodiversity. Some 500,000 localities, or occurrences, of at-risk species tracked by NatureServe member programs are maintained in central databases. As applicable, all of these data were used in this analysis.

Key Objectives and Project Tasks

Four primary areas of activity characterize this project.

1) Through review of published literature and consultation with ecologists throughout the United States, we established a project-specific (*non-jurisdictional*) definition for the term "geographically isolated wetland" with sub-categories of "strict" and "partial" isolation. This definition was intended to be applied to classified wetland *types* (i.e., an entire class of wetlands rather than individual wetland localities).

2) We evaluated NatureServe's Ecological System Classification (Comer et al. 2003, NatureServe 2005) to identify which of the ecological system types known to occur within the United States fit this project-specific "geographically isolated" definition.

3) We documented current published and expert knowledge to identify the "at-risk" species[2] (i.e., those animals[3] and vascular plants ranked by NatureServe as critically imperiled, imperiled, or vulnerable (see Table 1) and/or those with status under the federal Endangered Species Act) that are closely and predictably associated with each of the selected ecological system types for some or all of their habitat requirements. We also documented current knowledge on component plant communities for each of the selected wetland ecological system types, along with their known distribution and global conservation status.

4) To be most useful to states, tribes, and local communities, we have upgraded the NatureServe Explorer website (www.natureserve.org/explorer) to provide ecological systems data in a user-friendly format. Users can search and report on wetland ecological system types that meet our project-specific definition for "geographically isolated" and can view the at-risk species and plant communities that are closely and

Methods

Standard Ecological Classification

Standard ecological classification provides an important tool for comparative analysis of wetland types and a framework for establishing practical indicators of wetland status and trends, especially where landscape setting and hydro-dynamics are integrated factors. Development of a standard classification is a critical first step to consistent identification and mapping of ecological units. Having a standard classification allows the identification of patterns in biodiversity among wetland types and across regional landscapes. It also allows better documentation of factors that determine the ecological function of each wetland type in diverse landscape settings and clarification of indicators for use in protection, management, and monitoring.

Tiner (2003a) and others have provided excellent overview discussions of some geographically isolated wetland types in the United States. These overview descriptions have been based on numerous and varied regional and local classification efforts. While these disparate classification efforts form the basis for our understanding of these wetland systems, a consistent standard for their classification is desirable to allow for more repeatable and rigorous comparative analysis.

Our current effort builds on NatureServe's existing national classification of terrestrial ecological systems, which includes both wetland and upland types (Comer et al. 2003, NatureServe 2005). In this study we updated the national ecological system classification and identified all of the system types that fit our project-specific definition of "geographically isolated." See Appendix I for a description of the methodology used to define and describe ecological systems, and Appendices II and III, as well as www.natureserve.org/explorer, to view current descriptive information on these types.

Geographically Isolated Wetland Ecological Systems

For this study, we have established a practical definition to identify "geographically isolated" wetland ecological systems.

Throughout this report we will interchangeably use the terms

NOTE: *The following project-specific definitions were developed solely to facilitate this analysis using an existing classification of wetland ecological system types from NatureServe's databases, to create linkages to at-risk species, and* water bodies. This condition may be inferred where occurrences are geographically isolated and near-impermeable substrates are characteristic.

For example, a classified wetland type that overwhelmingly occurs on solid rock surfaces or clay pans at least 75 meters distant from a mapped 100-year floodplain would likely meet these criteria. Similar geographically isolated wetland types with shallow (< 1 meter), porous surface layers over near-impermeable surfaces (clays or thick concretions) may also fit this description. Overflow of these wetlands could cause seepage to ground water from around the rim of existing hard pans, but a distance of at least 75 meters from 100-year floodplains is likely adequate to infer hydrologic isolation from nearby water bodies.

ç ***Partial Isolation.*** An ecological system type is *partially* isolated if more than 80% of all known occurrences have very infrequent interchange of *surface water* between the wetland and other water bodies. Practically, this is limited to geographically isolated wetlands where various types of substrates are characteristic (any unconsolidated material). No assumptions are made about the type and frequency of groundwater exchange between these wetlands and other water bodies.

To summarize, the difference between “strict isolation” and “partial isolation” sub-category definitions is that “partial isolation” does not require that we infer no interchange of ground water between these wetland and the broader aquatic ecosystem.

Examples of geographically isolated wetland ecological systems include:

Atlantic Coastal Plain Northern Pondshore. This system includes groundwater-flooded depressions with a flora generally restricted to the Atlantic Coastal Plain from the southern portion of the Delmarva Peninsula to Cape Cod, Massachusetts. Ponds may contain permanent surface water, such as the deep glacial kettle holes of Cape Cod and Long Island, New York, or may be shallow basins where groundwater drops below the surface late in the growing season. This system occurs on sandy deposits such as outwash plains of the glaciated region (Long Island and Cape Cod), on the deep sands of the New Jersey Pine Barrens, or on finer sediments of the Coastal Plain of Cape May, New Jersey, the Delmarva Peninsula, and the Chesapeake Bay region. The vegetation of steeper-sided basins (generally those containing permanent water) are characterized by stro

Jersey, but also includes *Juncus repens, Boltonia asteroides, Fimbristylis perpusilla, Coelorachis rugosa, Dichanthelium spretum, Saccharum giganteum, Eleocharis quadrangulata,* wetlands within this system may undergo successional cycles. This system includes elements of emergent marsh and wet, sedge meadows that develop into a pattern of concentric rings.

Inter-Mountain Basins Greasewood Flat. This system occurs throughout much of the western U.S. in inter-montane basins and extends onto the western Great Plains. It typically occurs near intermittent drainages on stream terraces and flats or may support inclusions of more sparsely vegetated desert playas. Sites typically have saline soils, a shallow water table, and flood intermittently, but remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations. This system usually occurs as open to moderately

The first step in this process was to define the terms "closely associated" with a given isolated wetland type. We adapted the existing, commonly applied concepts for describing wetland affinities to plants (USACE 1987, Reed 1998) to describe the relative association of at-risk species with isolated wetland systems.

Obligate to Isolated Wetlands. *Almost always occurs in isolated wetland systems (estimated probability >99%) under natural conditions.*

Facultative to Isolated Wetlands. *Usually occurs in isolated wetland systems (estimated probability 67% - 99%) but occasionally occurs in systems that are not isolated wetland systems.*

While NatureServe maintains a centralized data set for some 500,000 localities (occurrences) of rare and endangered plant and animal species, we do not currently have centralized occurrence data for all wetland types across the United States. Therefore, we could not implement a relatively straightforward process of overlaying nationally standardized spatial information to analyze co-occurrence of at-risk species and communities with isolated ecological system types. While our at-risk species occurrence information provides a wealth of insights, these particular questions of co-occurrence with specific wetland types must, for now, be addressed using expert knowledge.

Given this situation, we developed distinct processes to compile knowledge of at-risk species and plant community co-occurrence with wetland ecological systems types. For at-risk species, we first drafted a subset of wetland-dependent species to be evaluated in greater depth. Using knowledge from across the network of NatureServe member programs (and beyond), we then finalized the list of wetland species. Regional experts then indicated the specific isolated wetland system types that characterize habitat for each species, along with the degree of their association (i.e., obligate vs. facultative) to isolated wetland types. More specific aspects of methodology for animal, plant, and community groups are described below.

Animal Species Linked to Isolated Wetlands

We developed a draft list of animals with conservation status ranks of G1-G3 (T1-T3) that may be strongly associated with isolated wetland habitats by using ha

We surveyed ecologists and biologists from natural

Results

Isolated Wetland Ecological Systems

Of the 276 wetland and riparian ecological systems described for the United States (NatureServe 2005), 81 (29%) met our working definition for "geographically isolated," based on documented knowledge of their distribution and typical site characteristics. Of the 81 isolated wetland types, only 16 (20%) fall into the strict isolation subcategory, while the remaining 65 systems (80%) fall into the partial isolation subcategory (Tables 2-4). Using our definition, isolated wetlands make up 13% of the 636 "natural/near natural" terrestrial ecological system types (*both upland and wetland*) currently classified and described by NatureServe for the United States (NatureServe 2005)

REGIONAL PATTERNS OF ISOLATED WETLAND SYSTEMS

Many factors of regional climate and characteristic landforms describe the distribution of these wetland types. Summary information in Table 2 is organized by clusters of states in broad biogeographic regions of the United States.

Along the *North Atlantic Coast*, there are relatively few geographically isolated wetland types (n=3), typically found in glaciated landscapes that support depressional bogs, more extensive spruce-dominated flats, or small seepages wetlands, such as the Acadian-Appalachian Conifer Seepage Forest.

Further south, along the *Central Atlantic Coast*, isolated wetland types are also limited in number (n=4) and tend to occur in association with maritime dunes, or shallow pondshores and swamps further inland.

The *South Atlantic and Gulf Coast* region includes the greatest documented diversity in isolated wetland types (n=24) of any region in the country, owing to

Extending out onto the *Great Plains* region, five major isolated wetland types are characteristic, including the often-described prairie potholes. But also, several types of closed and open depressional wetlands are characteristic, located among sand hills or scattered across extensive, fine-textured alluvial plains.

Throughout the *Intermountain and Rocky Mountain* region, six different types of isolated wetlands are found, mostly limited to arid environmental settings; vernal pools, playas, alkaline closed depressions, and greasewood-dominated flats are characteristic in cold-desert, intermontane basins. Rare isolated wetland types include swales among active and stabilized dunes and “hanging gardens” found with cracked, seeping bedrock of canyon walls on the Colorado Plateau.

The *Southwest* region, extending from central Texas west through southeastern California, includes seven isolated wetland types, from bedrock flatrock systems of the Edwards Plateau to warm desert playas, interdunal swales, to Sonoran fan palm oases.

Open, herbaceous-dominated vernal pools find their highest diversity on types in the *Pacific Coast* region, from southern California north through western Washington. There are also other alkali closed-basin wetlands, interdunal wetlands, and wet prairies among the 10 isolated wetland types in this region.

Alaska includes just two described isolated wetland types, in interdunal areas and in isolated depressional bogs found throughout Alaska’s interior.

Hawai’i also includes two described isolated wetland types, one being a montane bog, and another being a type of vernal pool.

Table 2. Isolated Wetland Ecological Systems in the United States.
All types identified by region; also indicating the hydrogeomorphic class and type of isolation.

PROJECT REGION Ecological System	Hydrogeomorphic Class	Isolation Type
East Gulf Coastal Plain Sandhill Lakeshore Depression	Depressional	Partial
East Gulf Coastal Plain Southern Depression Pondshore	Depressional	Partial
East Gulf Coastal Plain Southern Loblolly-H		

PROJECT REGION

HYDROGEOMORPHIC PATTERNS OF ISOLATED WETLAND SYSTEMS

Most wetlands meeting our project-specific definition of geographically isolated fall into the “depressional” hydrogeomorphic (HGM) class (Brinson 1993). Sixty-two of 81 types, or 77%, were categorized as such (Table 3). Roughly equal numbers of types fall in the other two HGM classes of “extensive wet flat” (n=9) and “seepage-fed sloping (n=10).” Isolated wetlands occurring as extensive wet flats tend to be limited to relatively flat regional landscapes, either in the Atlantic and Gulf coastal plain or in northern sub-boreal regions. Those falling into the seepage-fed sloping HGM class are found in more varied circumstances

Kentucky, Tennessee, and West Virginia. In Indiana, Iowa, Kansas, Michigan, Minnesota, North Dakota, and Wisconsin, more than half of the wetland system types meet our project-specific definition for geographically isolated (Table 4). Appendix VIII provides a list of the isolated systems occurring in each state.

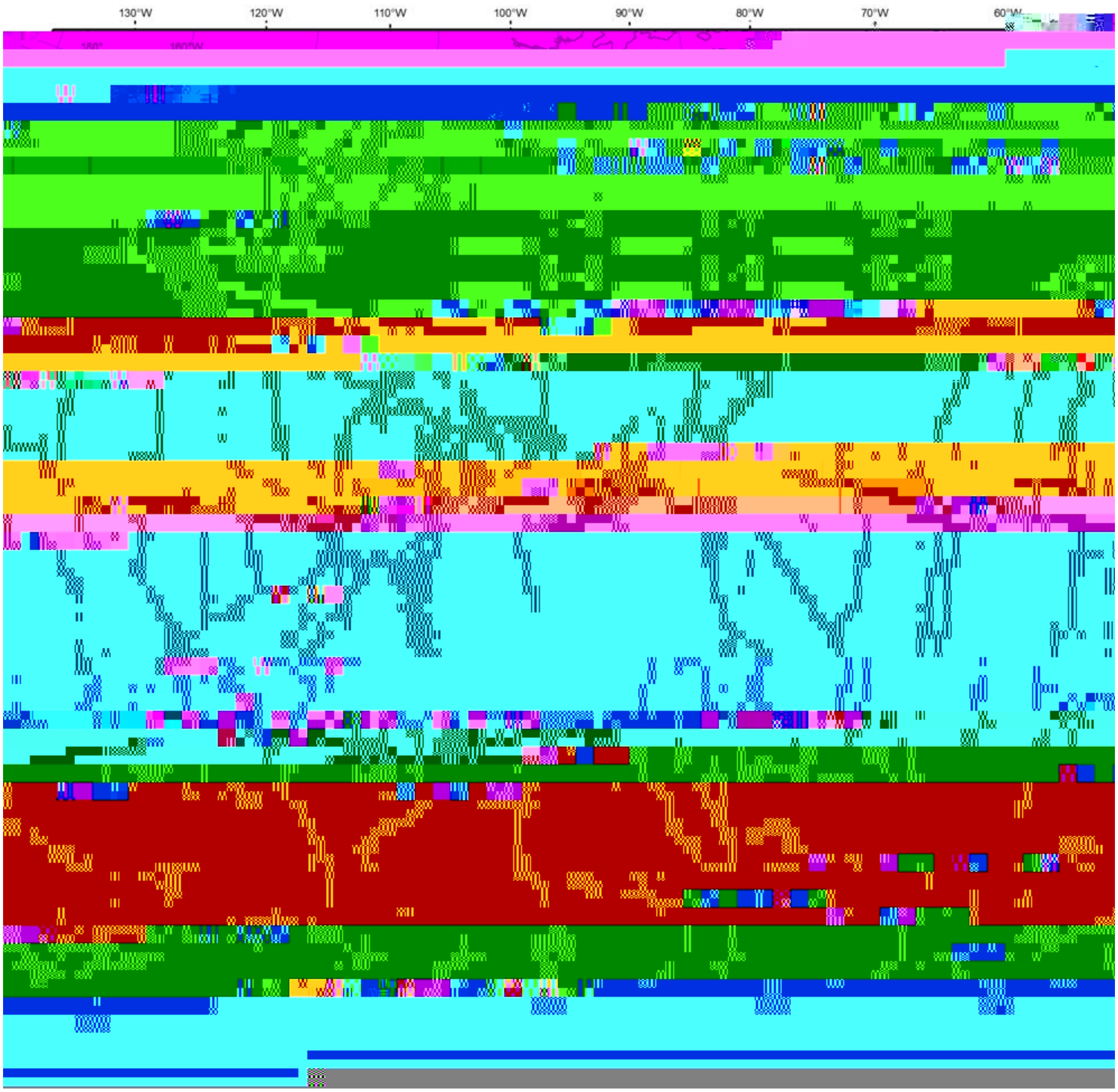

Figure 1. Number of Isolated Wetland Ecological System Types per State

Table 4. Numbers of Isolated Wetland vs. non-Isolated Wetland Systems by State

State	# Isolated Wetland Systems		

Table 5. Isolated Wetland Ecological Systems Containing Animal Species with ESA Status*
** ESA threatened, endangered or candidate species*

Isolated Wetland System	Type of Isolation	Total # of Animal Species with ESA Status
Northern California Claypan Vernal Pool	Strict	4
South Coastal California Vernal Pool	Strict	4
East Gulf Coastal Plain Southern Depression Pondshore	Partial	2
Inter-Mountain Basins Alkaline Closed Depression	Partial	2
Mediterranean California Coastal Interdunal Wetland	Partial	2
Atlantic Coastal Plain Southern Depression Pondshore	Partial	1

STATE COMPARISONS OF AT-RISK ANIMAL SPECIES

The percentage of at-risk animals in a given state that occur in isolated wetlands ranges from 0-4% (4% in Massachusetts) (Figure 2, Table 7). Some 28 states include no at-risk species linked to isolated wetland types. However, these percentages may change into the future as habitat information is developed for additional invertebrate groups. California has the greatest number of at-risk animals (n=15) occurring within isolated wetlands. California also has the highest number of ESA listed animal species (n=10) while all of the rest of the states have 2 or fewer. Appendix VIII provides a list of the G1-G3 animal species occurring in isolated wetland types in each state.

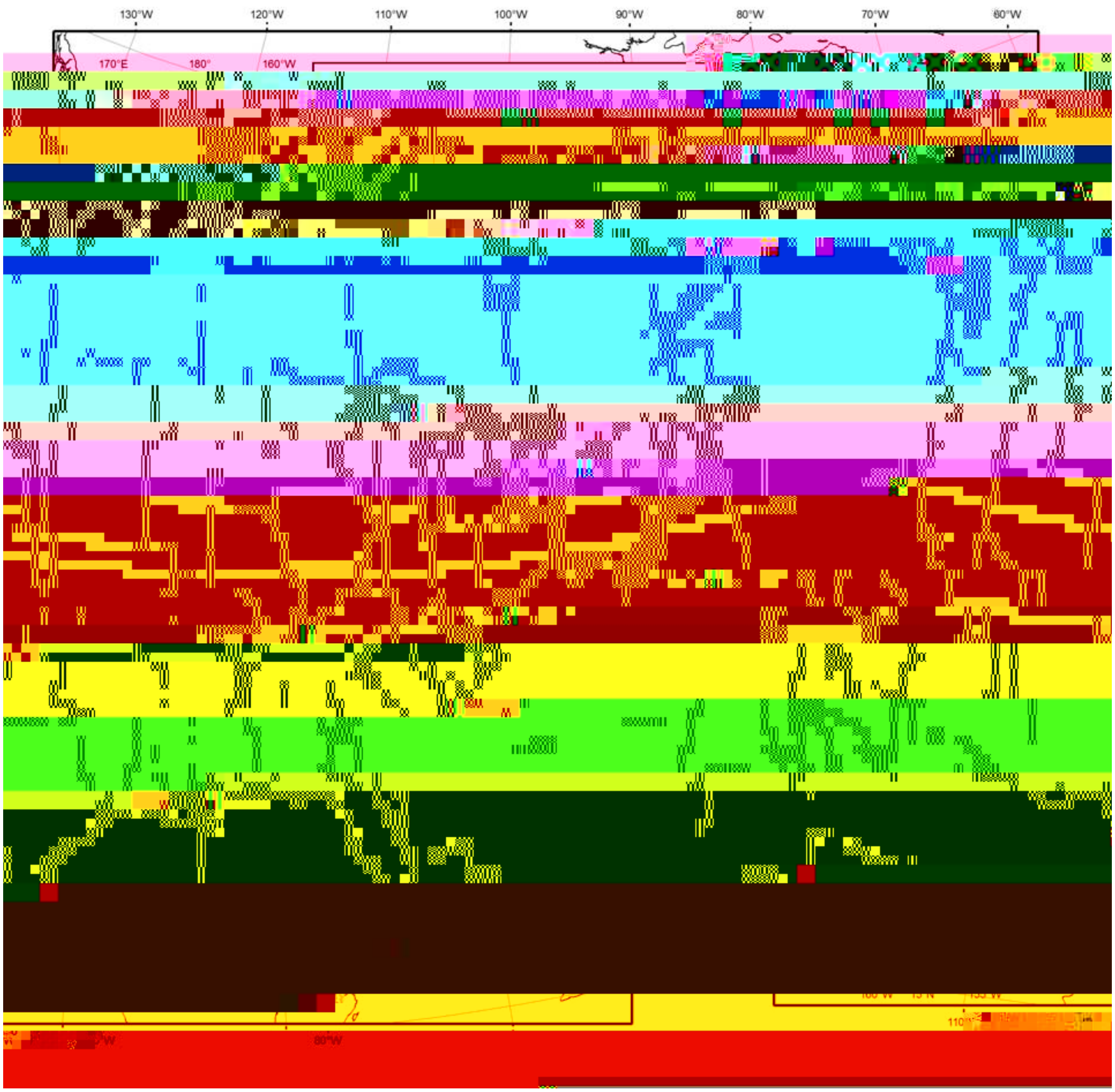

Figure 2. Number of At-Risk Animal Species in Isolated Wetlands per State

Table 7. Animal Species Associated with Isolated Wetlands in Each State

State	# At-Risk Animals in Isolated Wetlands (number with ESA Status)	Total # At-Risk Animals	Percent of At-Risk Animals That Occur in Isolated Wetlands
Alabama	4 (2)	515	1%
Alaska	0 (0)	73	0
Arizona	1 (0)	339	<1%
Arkansas	0 %		

Table 7. Animal Species Associated with Isolated Wetlands in Each State

State	# At-Risk Animals in Isolated Wetlands (number with ESA Status)	Total # At-Risk Animals	Percent of At-Risk Animals That Occur in Isolated Wetlands
Rhode Island	0 (0)	31	0
South Carolina	2 (1)	250	1%
South Dakota	0 (0)	28	0

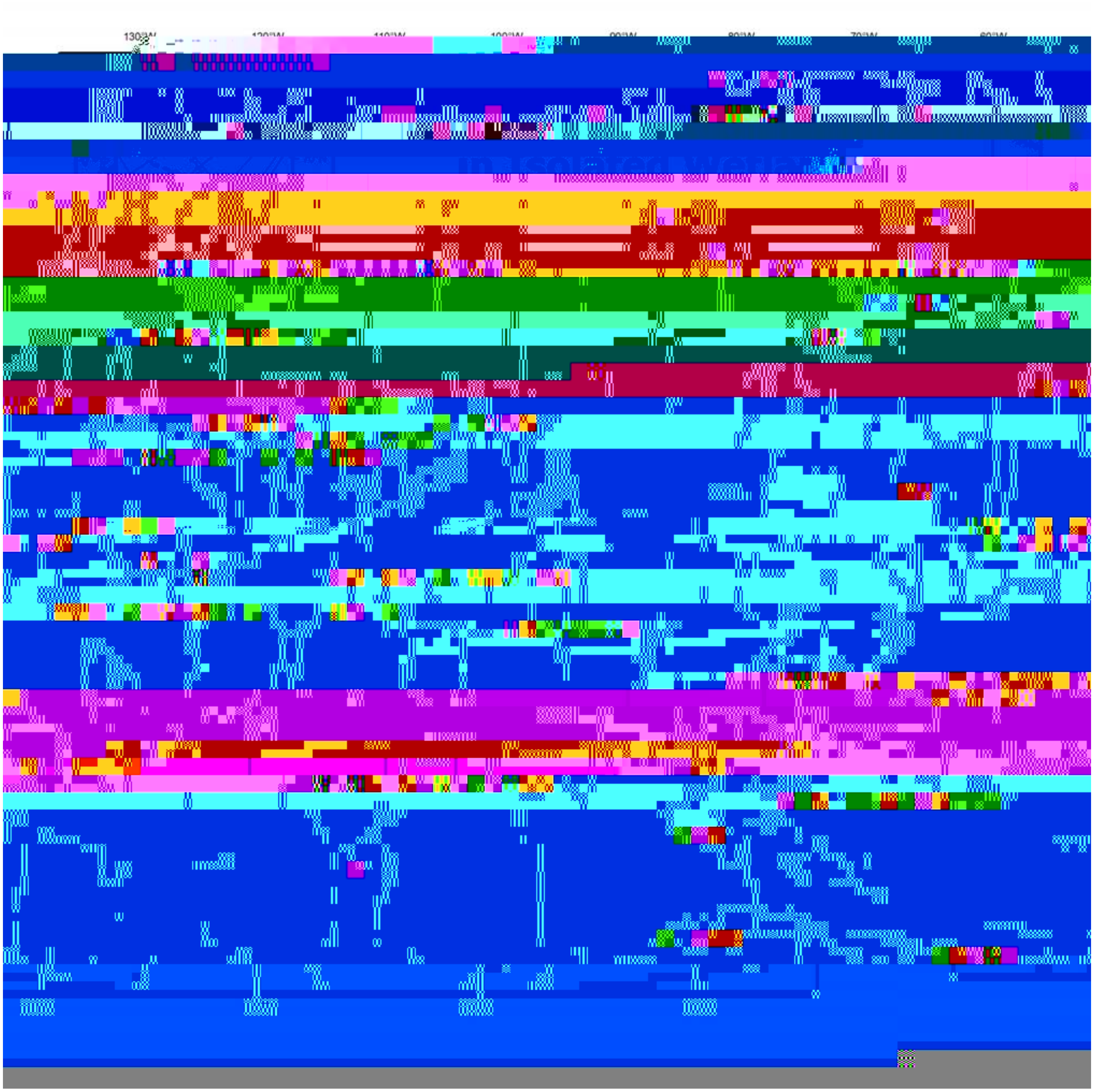

Figure 3. Number of At-Risk Plant Species in Isolated Wetlands per State

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Table 10. Plant Species Associated with Isolated Wetlands in Each State

State	# At-Risk Plants in Isolated Wetlands in State (number with ESA Status)	Total # At-Risk Plants	Percent of At-Risk Plants That Occur in Isolated Wetlands
Rhode Island	5 (0)	32	16%
South Carolina	28 (4)	259	11%
South Dakota	0 (0)	17	0%
Tennessee	10 (1)	239	4%
Texas	8 (0)	474	2%
Utah	7 (1)	501	1%

Figure 4. Area-weighted Number of At-Risk Species Associated with Isolated Wetlands per U.S. County

REGIONAL PATTERNS IN AT-RISK ASSOCIATIONS

Table 11 includes the number of at-risk associations found with isolated wetlands by region. Those listed also as characteristic for other wetland systems are listed as "facultative" to isolated wetlands, while those listed solely for isolated wetland types are listed as "obligate" communities. The South Atlantic and Gulf Coast region includes substantially greater numbers of G1-G3 associations found with isolated wetlands than the other regions. A second tier of regions has 30-51 at-risk plant associations listed. These include the Central Hardwoods and Interior Highlands (n=51), Great Plains and Tallgrass Prairie Region (n=44), Pacific Coast (n=34), Central Atlantic Coast (n=34), Intermountain and Rocky Mountain (n=30), and the Southwest (n=30).

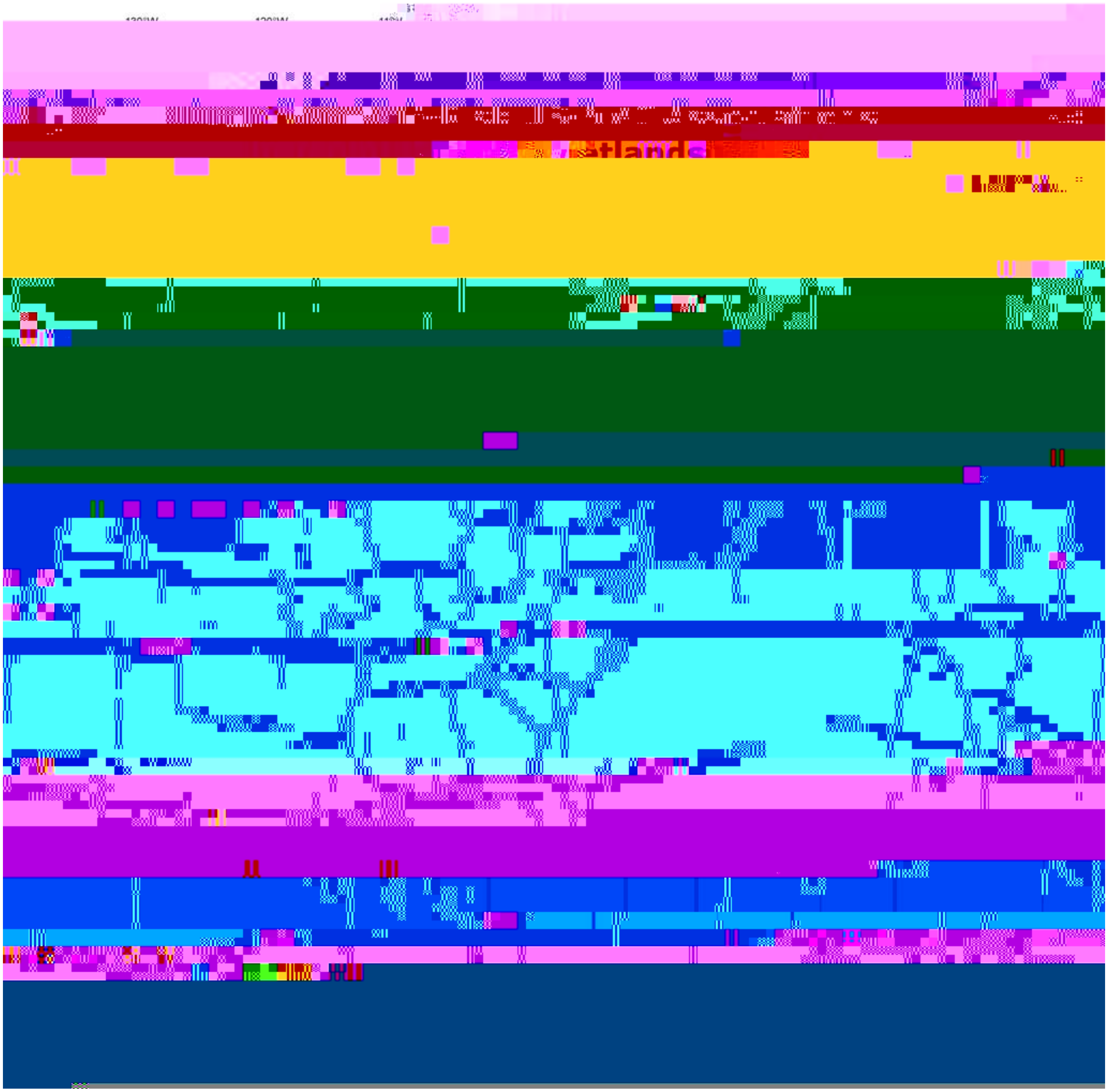

Figure 5. Number of At-Risk Plant Communities in Isolated Wetlands per State

State	# At-Risk Wetland Plant Associations in Isolated Wetlands	Total # At-Risk Plant Associations	Percent of At-Risk Associations That Occur in Isolated Wetlands
Texas	25	238	11%
Utah	9	136	7%
Vermont	7	25	28%
Virginia	23	172	13%
Washington	20	324	6%
West Virginia	1	30	3%
Wisconsin	12	75	16%
Wyoming	4	202	2%
United States**	**279**	**3136**	**9%**

**Classification is in development in Alaska and Hawaii.*

*** Because associations can occur in more than one region, total counts for the U.S. do not equal the sum of values across regions.*

Knowledge and Data Gaps

Much of the uncertainty about the impact of the SWANCC decision on biodiversity results from the ongoing process of ecological classification, which depends on the accumu48 62.94 1h.Wu7 Tc0.0007 Tw77 T1n occur in

Consequently, our knowledge of the precise ecological systems used by species remains incomplete. Future increased collaboration between zoologists, botanists, and those familiar with ecological classification, will be useful in refining our knowledge of species associations with isolated wetland systems. As more information about species linkages is gathered, it is possible that the list of species closely tied to isolated wetlands or their obligate/facultative status will shift. Without further information, it is difficult to predict the direction of the shift (i.e., whether more or fewer species will be identified as closely tied to isolated wetlands or whether there will be more or fewer species with "obligate" or "facultative" relationships to the isolated wetland systems).

Discussion

The U.S. Supreme Court's SWANCC decision has highlighted the need for new research and for additional discussion about wetland resources among scientists, conservationists, resource managers, and policy-makers. Understanding the impacts of SWANCC on the function and value of isolated wetlands will be critical as the SWANCC decision is implemented. NatureServe, through its network of member programs, completed this initial assessment to contribute to this ongoing science-policy dialogue. This study provides an analysis of the possible impact of the decision on the biodiversity of isolated wetlands. It is based upon the best available data, and should help policy-makers and resource managers from federal, state, tribal and local governments understand the potential biodiversity impacts of the SWANCC decision in their jurisdiction and to inform conservation and planning decisions.

What is At Risk?

This study shows that some 29% of riparian and wetland ecological system types documented for the United States met our definition of "geographically isolated" and therefore may no longer be under the jurisdiction of the Clean Water Act after the SWANCC decision. Of course, as mentioned previously, we are making no statements here regarding wetland *acreage*. Comprehensive wetland maps are unavailable nationally, and we cannot say anything substantive about wetland acreage at risk without this critical information. More than 80% of these isolated wetland ecological system types fit the sub-category of "partial isolation" and therefore, most likely fall into a significant regulatory gray area. The protection status of these isolated wetland types will be most directly affected by the interpretation of the SWANCC decision. The fate of these wetlands will depend on how policy-makers and/or permitting authorities

- A total of 279 at-risk U.S. National Vegetation Classification associations were documented as being characteristics of isolated wetlands, and 67% of these associations are not known to be supported by any other types of natural habitat.

Significant loss of isolated wetland habitats could therefore have a serious impact on the survival of the at-risk species that depend on them. The Clean Water Act provided one of the few federal mechanisms for the protection of these biodiversity values. Plant associations that are tied to isolated wetlands may lose the little federal protection they had prior to the SWANCC decision.

Beyond the Clean Water Act: Other Mechanisms for Protecting Isolated Wetlands

While loss of protection due to SWANCC will put many isolated wetlands at-risk, some may still be

The impact of state and local regulation on isolated wetlands will vary by many factors, including the degree to which the wetlands occur on public lands. Those isolated wetlands on public lands will likely pose less of a protection challenge than those on private lands. The typical mix of land ownership of isolated wetlands across the United States suggests that their conservation should involve a mix of stakeholders, including federal, state, county, and township land managers and regulators as well as private landowners.

Systematic Inventory of Wetland Resources

Underlying any approach to conserve wetland resources are the data to adequately locate and identify sensitive resource values. These data are needed to clarify where sensitive resource values occur, allow stakeholders to minimize conflict, and support mitigating actions. Substantial new investments are needed to systematically inventory wetland resources to fully document biodiversity values. Examples of systematic inventory include those for California vernal pools (Keeler-Wolf et al. 1998), canyon seeps (Jankovski –Jones et al. 2001), Atlantic coastal plain pondshores (Sperduto 1994), and Great Lakes lakeplain prairie (Comer et al. 1995). This is perhaps the most efficient means to acquire sufficiently high quality and detailed information on wetland biodiversity values and forms the basis for sound resource management.

Making Use of This Information

Having an understanding of the isolated wetlands and the species they support in a given jurisdiction is critical to the development of any policy or land management decision. Data from this study are available as appendices of this report and on the NatureServe Explorer website (www.natureserve.org/explorer). Appendix VIII and NatureServe Explorer will be of most use to state wetland regulators and managers that need to understand which isolated wetlands occur in their state and which at-risk species (G1-G3 and listed endangered, threatened and candidate species) and communities are supported by them. Those who want a quick summary list of isolated wetland systems and their related species and communities should consult Appendix VIII. Those who are interested in detailed type-by-type descriptive information should consult NatureServe Explorer. Detailed descriptions of the isolated wetland ecological systems are found in Appendix III and are also on NatureServe Explorer. Having an understanding of the limitations of the data is also critical to policymaking. Appendix IX provides a summary of known data gaps and some recommendations for additional inventory.

Users needing specific locational information for isolated wetlands or their associated species should directly contact the natural heritage program in the state(s) of interest for more information.

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