2014

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Recommended Citation:

Mojica, E.K. and B. D. Watts. 2014. Creation of a National Registry for Bald Eagle Communal Roosts. Center for Conservation Biology Technical Report Series, CCBTR-14-20. College of William and Mary and The Virginia Commonwealth University, Williamsburg, VA. 12 pp.

Project Funded by:

American Eagle Foundation
US Fish and Wildlife Service

Front Cover: Bald eagles roosting at a federal fish experimental station in North Carolina. Photo by Reese Lukei, Jr.

Revised December 2015

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EXECUTIVE SUMMARY

Communal roosts play an important role in the life cycle of non-breeding eagles and are specifically protected in the “disturb” clause of the Bald and Golden Eagle Protection Act. Many state and federal regulatory agencies are unable to adequately protect eagle roosts because of a lack of information on roost location and roost usage. We created a National Eagle Roost Registry to address this information gap critical for protecting non-breeding eagles. The registry is an initial attempt to consolidate roost locations in one database and provide information needed by agencies to manage roosts using the National Bald Eagle Management Guidelines.

We delineated 1,538 communal bald eagle roosts in North America using telemetry (n=1,067), literature (n=136) and observational data (n=335) in 31 states and provinces. Communal roosts were delineated using satellite transmitter data from 118 bald eagles in the Atlantic Flyway and 8 bald eagles in the Mississippi Flyway. We collected historic and active roost locations from knowledgeable land managers and biologists in the Pacific, Central, and Mississippi Flyways. The National Eagle Roost Registry is available online and roosts are displayed on a Google Map base layer.

INTRODUCTION

Communal roosts play an important role in the life cycle of non-breeding eagles and are specifically protected in the "disturb" clause of the Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668d). Communal roost sites are defined in the National Bald Eagle Management Guidelines as "areas where bald eagles gather and perch overnight and sometimes during the day" (US Fish and Wildlife Service 2007). Many state and federal regulatory agencies are currently unable to adequately protect eagle roosts because of a lack of information on roost locations and roost usage. Delineation of communal roosts for inclusion in a National Eagle Roost Registry would address this information gap critical for protecting non-breeding eagles. A registry would provide information needed by agencies to enforce the Bald and Golden Eagle Protection Act.

Communal roosts are protected under the BGEPA under the working definition of the "disturb" clause. "Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (72 FR 31131). Disturbance at known roosts can be minimized or avoided with distance buffers, time of year access restrictions, and time of day restrictions.

The definition of a communal roost in the federal guidelines does not specify a minimum number of eagles roosting per night or per season. Roosts have been defined as $\geq$1 eagle for $\geq$1 night (Grubb et al. 1989, Buehler et al. 1991, Grubb 2003), and $\geq$3 eagles for $\geq$2 nights (Anderson et al. 1985). Wide variation in roosting behavior exists throughout the species range as eagles use different substrates and habitats and congregate for varying food resources. Communal roosting behavior is common in non-breeding Bald Eagles (adults and sub-adults) often occurring within seasonal eagle concentration areas. Rather than roosting individually, birds form communal roosts where 2 to 500 individuals roost together within a relatively confined space (Edwards 1969, Grubb 2003, Keister and Anthony 1983, Watts and Mojica 2012).

Roosts are composed primarily of perch trees but can also include a habitat buffer around the roost trees. This habitat buffer can provide a favorable microclimate during harsh weather or a visual buffer from nearby human activity (ex. Roads, residential areas, boating, etc). Management buffers of 330' and 660' are being used by federal and state agencies to provide a disturbance buffer for roosts inadvertently protecting habitat buffers.

Disseminating information on communal roost locations and usage will enable regulatory agencies to more effectively protect this critical resource for bald eagles and comply with BGEPA. Knowledge of roost locations can prevent loss of roosts from tree harvest in forestry management activities, human intrusion, and other preventable disturbance activities. A National Eagle Roost Registry addresses the need for information and benefits conservation of roost sites throughout the species range.

OBJECTIVES

1) Delineation of communal roosts in the Mid-Atlantic and Northeastern US using GPS tracking data.
2) Compiling an initial database of known roost locations from published literature and biologist observations
3) Launching a National Eagle Roost Registry online to facilitate reporting and management use of roost information.

METHODS

We documented eagle roosts from both observational and satellite telemetry data, primarily in the Atlantic Flyway. Observations were compiled from aerial and ground surveys conducted by Center for Conservation Biology staff (1980-2014) in the Chesapeake Bay, raptor biologists in other parts of the species range, and from literature available on the species.

Telemetry Roost Delineation

Satellite telemetry data were compiled from two telemetry projects on the Atlantic Flyway and one on the Mississippi Flyway (Table 1, Figure 1). The largest data set was from studies of mixed-age Chesapeake Bay residents and seasonal migrants with data ranging from Florida to Quebec (Watts et al. 2012, Mojica and Watts 2014, Mojica and Watts unpublished data). The second study on the Atlantic Flyway was from a tracking study of Florida nestlings including both migratory and non-migratory individuals (Millsap et al. 2004). The Kentucky Division of Fish and Wildlife Resources (KDFWR) provided GPS telemetry data from nestlings and adults transmitting which allowed for additional roost analysis on the Mississippi flyway (K. Heyden unpublished data). The Chesapeake Bay and Kentucky projects collected GPS locations with an accuracy of +18m with 70g GPS-PTTs and 70g GSM-PTTs (Microwave Telemetry, Inc). The Florida project collected Argos satellite fixes with an accuracy ranging from 150-1,000m using 95g Argos-PTTs (Microwave Telemetry, Inc).

Table 1. List of telemetry studies included in GIS roost analysis.

Study	Tagging Location	Data Region	No. Eagles	No. Roost Nights	Years
Watts et al. 2012, Mojica and Watts 2014, Mojica and Watts (unpublished data)	Chesapeake Bay	Atlantic Flyway	70	62,293	2007-2014
Millsap et al. 2004	Florida	Atlantic Flyway	48	2,291	1997-2004
Heyden, K. (unpublished data)	Kentucky	Mississippi Flyway	8	2,129	2010-2014

The GPS quality data were analyzed in a nearest neighbor clustering script in Crimestat 4.01 (Levine 2014). Argos satellite data were used to supplement the GPS data in areas of Florida and Canada with limited GPS data. Locations from breeding adults roosting near nests were excluded from the analysis. Locations from nestlings were not included until after they began roosting away from the natal site. Cluster parameters were set to search a fixed distance

of 200 m for a minimum of five night locations (Watts and Mojica 2012). Minimum convex polygons of roosts were created in Crimestat and visually examined in ArcMap 10.1. At least two transmittered eagles had to visit a roost during the study period for it to qualify as a "confirmed" communal roost. Roosts used by single eagles in multiple years were designated as "suspected" roosts.

Literature and Observational Roost Delineation

Observational data supplemented the telemetry data in areas with limited telemetry data coverage. Roost polygon boundaries were enlarged on the map in cases where direct observation proved the roost was larger than what was revealed by telemetry data. A literature search was conducted and online GIS layers from ArcGIS online were used to delineate communal roosts in the mid-west and western flyways. Requests for data assistance were posted in the Raptor Research Foundation's Wingspan newsletter and in the Ornithological Societies of North America newsletter.

Observations of a roost were included in the roost registry as confirmed communal roosts if they met they following qualifications 1) the observations included repetition of surveys between seasons or years to confirm continued use of a roost site, 2) observations were made by trained wildlife biologists qualified to identify and count flying and perched eagles.

RESULTS

We delineated 1,538 communal bald eagle roosts in North America using telemetry (n=1,067), literature (n=136) and observational data (n=335) in 31 states and provinces (Table 2, Figure 2). We designated 1,314 as confirmed communal, 210 as suspected communal, 4 as no longer in use, 1 as unknown status, and 9 as destroyed (substrate loss). Of those 9 destroyed roosts, 6 were converted to agriculture land, 1 was lost to residential development, 1 logged for timber harvest, and 1 lost to natural forest succession along a riverbank. The 4 roosts no longer in use continue to have substrate available for roosting but 1 has an active breeding pair defending the forest patch from intruders and the other 3 roosts were lost to forest succession closing the tree canopy to eagle flight.

White and gray literature referencing bald eagle roost locations were cataloged from library and online reference databases (n=107). The confirmation dates for roost documentation range from 1969-2015. Unfortunately very few published accounts had enough detail in text or figures for roosts to be included in the roost registry. Contact with the authors provided some assistance mapping roosts but many authors either did not remember the roost locations 20-40 years after publishing or did not respond to our information request. Theses, gray literature, and ArcGIS online data layers were the most useful sources of roost polygons. We were unable to determine an exact location for 136 roosts mentioned in the literature.

A poster was presented at the 2014 annual meeting of the Raptor Research Foundation in Corpus Christi, Texas. Interactions with conference participants about the poster provided additional leads on the location of unpublished roosts.

An online map was published on The Center for Conservation Biology website in August 2014 http://www.ccbbirds.org/maps/. Roosts are shown as polygons, centroids, and polygons with 330' and 660' buffers (Figure 3). Data from three sources were not included in the online data layer at the request of the data provider (n = 346 roosts). The US Forest Service in San Bernardino National Forest provided 48 roosts from a VHF telemetry study conducted from 1992-1995 but with the condition the data not be available to the public. KDFWR requested roosts delineated in Kentucky from their tracking data (n=15) not be available as polygons or centroids on the public map. Washington Department of Fish and Wildlife's Biological Data Management office provided 283 roosts with the condition the exact location not be posted online. In response to these data restrictions, we created another map layer summarizing the number of roosts at the topographic quad level to show presence of roosts in an area but protect the exact location at the request of the data provider.

DISCUSSION

The National Bald Eagle Management Guidelines (2007) extend the same recommended protections to communal roosts historically provided to active Bald Eagle nests. There have been state and regional efforts to locate and delineate communal roosts but only a small portion receive any protection on a national or international scale. In this study we provide the first mass delineation and mapping of eagle roosts for the species as an initial effort to identify roosts across the species range.

Disseminating information on communal roost locations and usage enables regulatory agencies to protect this critical resource for bald eagles and comply with BGEPA. Knowledge of roost locations can prevent loss of roosts from tree harvest in forestry management activities, human intrusion, and other preventable disturbance activities. Although many of the communal roosts compiled in the registry occur on conservation lands, the majority of roosts delineated here reside on private lands. Many state and federal agencies have successfully managed known roosts with site specific eagle management plans including Colorado, Virginia, and Washington.

In this study we found cases where eagle roosts were destroyed or lost by conversion to agriculture, timber harvest, and lack of active forest management. We can assume these few roosts represent a larger management issue for eagles where lack of information about eagle roost management has led to the loss of these roosts on the landscape. The impact of roost loss is unknown but is likely variable between regions and populations. In habitats with limited roosting habitat, the loss of a single roost could impact eagles finding alternate roost sites near available food resources. In areas with extensive forested areas, eagles may have more opportunities to relocate a roost. For example three roosts documented in the 1980s on the James River National Wildlife Refuge are no longer in use because of forest succession shifting roost usage to other forest stands. These shifts in roost usage can inform future management guidelines as examples of the resiliency of roosting eagles in regions with alternative roosting habitat.

The National Eagle Roost Registry is an initial attempt to consolidate roosts in a single database but is not comprehensive. At the time of this report, there were several state agencies still considering contributing their roost information to the registry. The roost registry is a living database and will continue to need support to expand the database and keep roost information current. Future work on the roost registry is needed including additional personal contact with state and federal eagle biologists for roost locations, continuing contact with literature authors for roost information, and analysis of additional telemetry datasets in the Pacific, Central and Mississippi flyways. We have pending roost data commitments from New Jersey Fish and Wildlife, New York Department of Environmental Conservation, Environment Canada (Fraser River Delta, BC), and Biodiversity Research Institute (Maine). These data will be added to the registry as they become available. During this study numerous researchers and agencies biologists requested methods to document eagle use at communal roosts. A guidance document would be beneficial for establishing a 1) standardized national protocol on roost documentation and monitoring and 2) providing best management practices recommendations on roost substrate management.

ACKNOWLEDGMENTS

This research was funded by the US Fish and Wildlife Service and the American Eagle Foundation. Telemetry data was provided by The Center for Conservation Biology, Florida Fish and Wildlife Conservation Commission, Kentucky Department of Fish and Wildlife Resources, and the US Army. We thank the many individuals and agencies that provided data and field support. M. Pitts provided online mapping support for the registry. E. Lawler provided contracting support.

LITERATURE CITED

Anderson, D.P., R.G. Anthony, and M.V. Ichisaka. 1985. Wintering ecology of Bald Eagles on the Lewis River, Washington 1984–85. Report to Pacific Power and Light Company, Portland, OR U.S.A.

Anthony, R. G., R. L. Knight, G. T. Allen, B. R. McClelland, and J. I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Transactions of the North American Wildlife and Natural Resources Conference 47:332-342.

Buehler, D.A., T.J. Mersmann, J.D. Fraser, and J.K.D. Seegar. 1991. Nonbreeding Bald Eagle communal and solitary roosting behavior and roost habitat on the northern Chesapeake Bay. Journal of Wildlife Management 55:273–281.

Edwards, C.C. 1969. Winter behavior and population dynamics of Americna Bald Eagles in western Utah. Ph.D. dissertation, Brigham Young University, Provo, UT. U.S.A.

Grubb, T.G., S.J. Nagiller, W.L. Eakle, and G.A. Goodwin. 1989. Winter roosting patterns of Bald Eagles (*Haliaeetus leucocephalus*) in north-central Arizona. Southwestern Naturalist 34:453–459.

Grubb, T.G. 2003. Wintering Bald Eagle trends in Northern Arizona, 1975-2000. Southwestern Naturalist 48(2): 223-230.

Keister, G.P., Jr. and R.G. Anthony. 1983. Characteristics of Bald Eagle communal roosts in the Klamath Basin, Oregon and California. Journal of Wildlife Management 47:1072–1079.

Millsap. B., T. Breen, E. McConnell, T. Steffer, L. Phillips, N. Douglass, and S. Taylor. 2004. Comparative Fecundity and survival of Bald Eagles fledged from suburban and rural natal areas. Journal of Wildlife Management 68:1018-1031.

Mojica, E.K. and B.D. Watts. 2014. Bald Eagle Telemetry at the Holtwood Redevelopment Project: Final report. Center for Conservation Biology Technical Report Series, CCBTR-14-17. College of William and Mary and The Virginia Commonwealth University, Williamsburg, VA. 8pp.

U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. U.S. Fish and Wildlife Service, Reston, VA. 23 pp.

Watts, B.D., E.K. Mojica, and B.J. Paxton. 2012. Use of satellite telemetry to delineate bald eagle activity centers for hazard mitigation and land planning within Aberdeen Proving Ground and the upper Chesapeake Bay. Final Report. Center for Conservation Biology Technical Report Series, CCBTR-12-05. College of William and Mary and Virginia Commonwealth University, Williamsburg, VA. U.S.A 402 pp.

Watts, B.D. and E.K. Mojica. 2012. Use of satellite transmitters to delineate bald eagle communal roosts within the upper Chesapeake Bay. Journal of Raptor Research 46(1): 121-128.

Table 2. Bald Eagle communal roosts included in the National Eagle Roost Registry.

State or Province		Roosts Identified
United States		
	Arizona	8
	California	52
	Colorado	25
	Delaware	40
	Florida	45
	Illinois	28
	Indiana	3
	Iowa	10
	Kentucky	15
	Louisiana	1
	Maine	5
	Maryland	622
	Michigan	6
	New Jersey	14
	New York	26
	North Carolina	8
	Oregon	78
	Pennsylvania	49
	South Carolina	2
	Tennessee	1
	Utah	2
	Vermont	1
	Virginia	150
	Washington	291
	West Virginia	2
	Wisconsin	3
Canada		
	New Brunswick	18
	Newfoundland and Labrador	1
	Nova Scotia	2
	Ontario	6
	Quebec	24
	Total	1,538

Table 3. Literature used to map roost polygon boundaries for the National Eagle Roost Registry.

Published Reference	Number of Roosts
Bureau of Land Management. 2006. United States Bureau of Land Management (BLM) Western Oregon Plan Revision - Bald Eagle Management Areas. http://salcc.databasin.org/datasets/92578ed1efbd44eea5ed63571f4d13bf	16
Cohn, J.P. 1999. A makeover for Rocky Mountain Arsenal. Bioscience 49:273-277	1
Colorado Parks and Wildlife. 2014. CPW All Species Activity Mapping Data. ArcGIS online data layer http://www.arcgis.com/home/item.html?id=30cc9afded9c44d8835141f98f0c485a	25
Dellasalla, D.A., R.G. Anthony, T.A. Spies, K.A. Engel. 1998. Use of domestic sheep carrion by bald eagles wintering in the Willamette Valley, Oregon. Northwest Science 63:104-108.	11
Hall, K. 2005. The ecological needs and economic benefits of bald eagles wintering in South Central Wisconsin. Thesis, University of Wisconsin-Madison, Madison, WI. 111p	3
Issacs, F.B., R.G. Anthony, M.V. Heyden, C.D. Miller, W. Weatherford. 1993. Habits of bald eagles wintering along the Upper John Day River, Oregon. Final report. Oregon Cooperative Wildlife Research Unit, Oregon State University, Corvallis, OR.	61
Jonen, J. R. 1973. The Winter Ecology of the bald eagle in West-central Illinois. Thesis, Western Illinois University.	3
Joshi, P.K. 2009. Night roosts of bald eagles (*Haliaeetus leucocephalus*) wintering in northern Arizona. Thesis at Northern Arizona University. 94pp.	8
Keister, G. 1981. Characteristics of Bald Eagle Communal Roosts in the Klamath Basin. Master's Thesis, Oregon State University.	5
Martell, M.S., C. Gieck, J.B. Nibe, D. Erickson, B. Mandernack, P.T. Redig. 1991. Bald eagle winter roosts on the Mississippi and Wisconsin Rivers. Report submitted to the Wisconsin Department of Natural Resources, Madison, WI. 42pp.	3
Pacific Northwest National Laboratory. 2009. Wintering Bald Eagle Surveys in Hanford National Research Park. http://nerp.pnnl.gov/projects_f&w/baldEagle.asp	8
Sabine, N. 1982. Ecology of bald eagles wintering in Southern Illinois. Master's thesis, Southern Illinois University, Carbondale, IL.	3
Sabine, N. 1987. Aspects of bald eagle winter behavior in Rush Valley, Utah: a telemetry study. Doctoral thesis, Brigham Young University, Provo, Utah.	1
Sabine, N. 1996. Bald Eagles Wintering Along the Des Moines River, Iowa. Journal of the Iowa Academy of Science 103:29-33.	1
Wilson, R.B. 1999. Characteristics of bald eagle communal roosts in Northern Utah and a survey of eagles occupying roosts. Master's Thesis, Utah State University, Logan Utah. 37p.	1

Figure 1. Night roosting telemetry data from three tracking projects used to delineate communal eagle roosts.

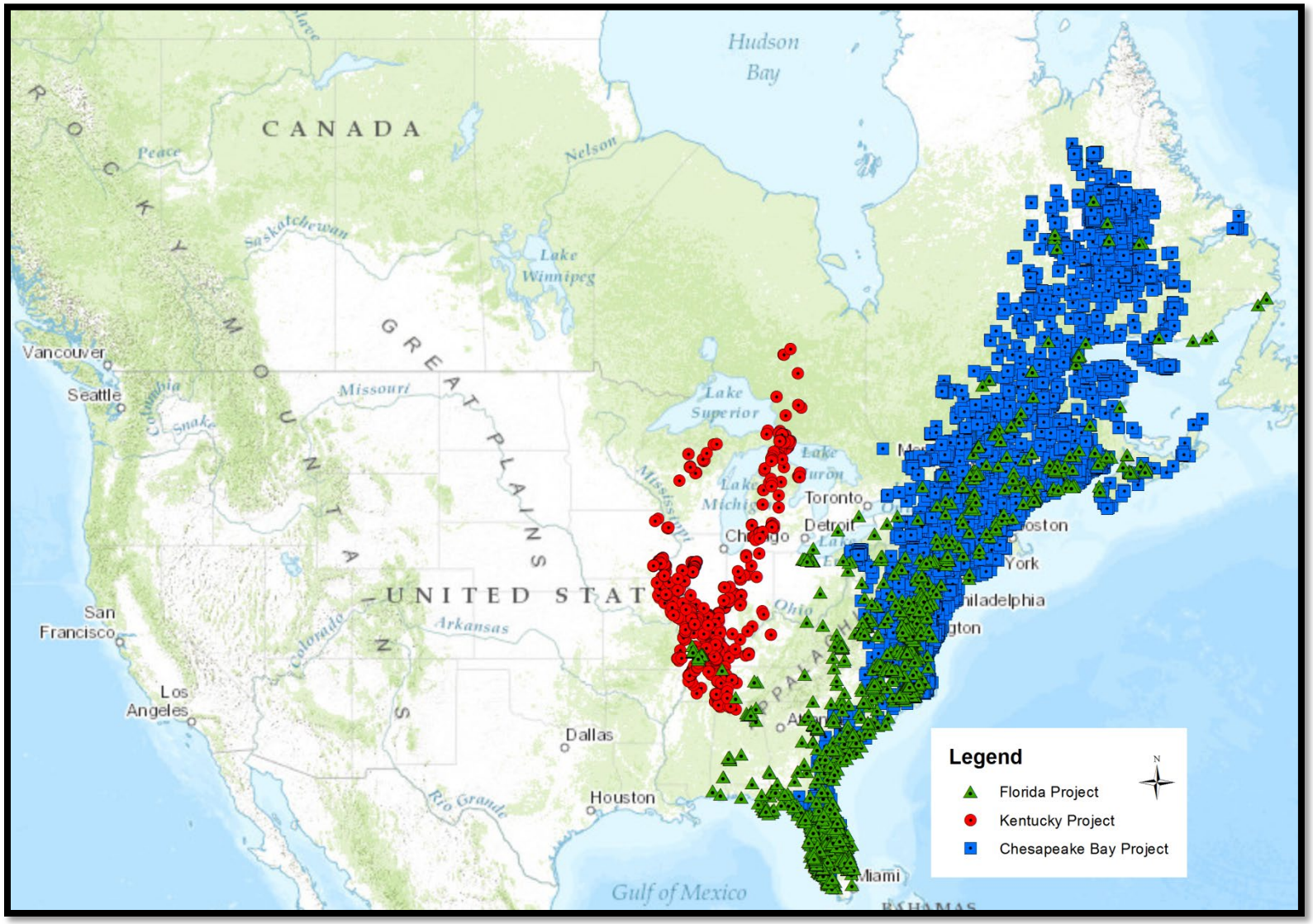

Figure 2. Bald Eagle communal roosts included in the National Eagle Roost Registry (n = 1,538).

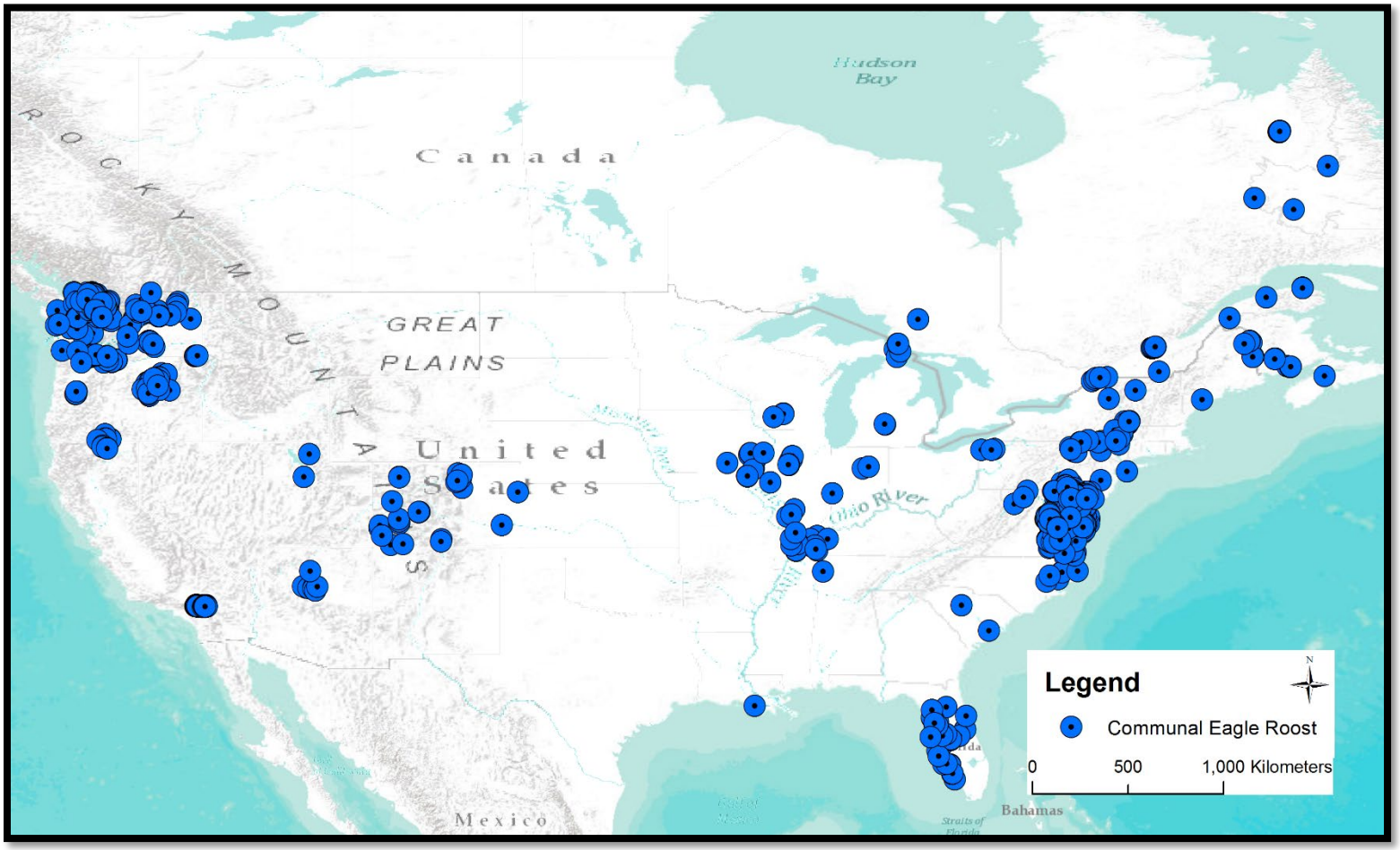

Figure 3. Online National Eagle Roost Registry on The Center for Conservation Biology mapping portal website. The roost polygons are shown here with 300' and 660' buffers. A mouse over feature pops up an information window about each roost.