Terrestrial habitat and restoration using Northern Spotted Owl (*Strix occidentalis caurina)* as a resource of concern


Photo by Ross Streensland

Campbell Creek Pilot Project Working Group Webinar - April 19, 2018

Northern Spotted Owl (NSO) analysis for the Smith Creek watershed, Mendocino County

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NSO Resource Overview

NSO conservation status and (federal and state)

NSO Ecology and Biology Basics

- Species description, range, biology, population density, hunting/food habits, and habitat requirements

Territory definitions

- Activity Center, Home Range, and Core Area

Habitat Definitions

- Nesting/Roosting, Foraging, and Non-suitable Habitat

Chance for Questions

NSO Resource Overview

United States Fish and Wildlife Service (USFWS) survey protocol history and updated to USFWS take avoidance guidance to CAL FIRE

NSO data sources for the Smith Creek watershed

- THP Habitat Typing
- Lyme Redwood Spatial Data
- CDFW BIOS Spotted Owl Database

Chance for Questions

Smith Creek Watershed NSO analysis

Discussion

NSO Conservation Status – Federal

Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS) listed the Northern Spotted Owl as threatened under the Endangered Species Act (ESA) in 1990. Critical habitat designation occurred in 1992 and 2008. The 2008 designation was challenged in court and in 2009 the USFWS requested voluntary remand of the 2008 designation. A new final rule designating critical habitat was published in December 2012. The first final recovery plan for the Northern Spotted Owl was issued in 2008 and revised in 2011.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act prohibits anyone from taking, killing, or keeping any native bird, its parts, or its nest, without a permit or license. All raptors native to the U.S. are covered by this law. A Special Purpose Possession Permit and/or Endangered Species Permit (depending on species), is required under the Migratory Bird Treaty Act to keep raptors.

California Department of Fish and Wildlife. January 27, 2016. Status Review of the Northern Spotted Owl in California.

USFWS Endorsed Survey Protocols and Take Avoidance Guidance

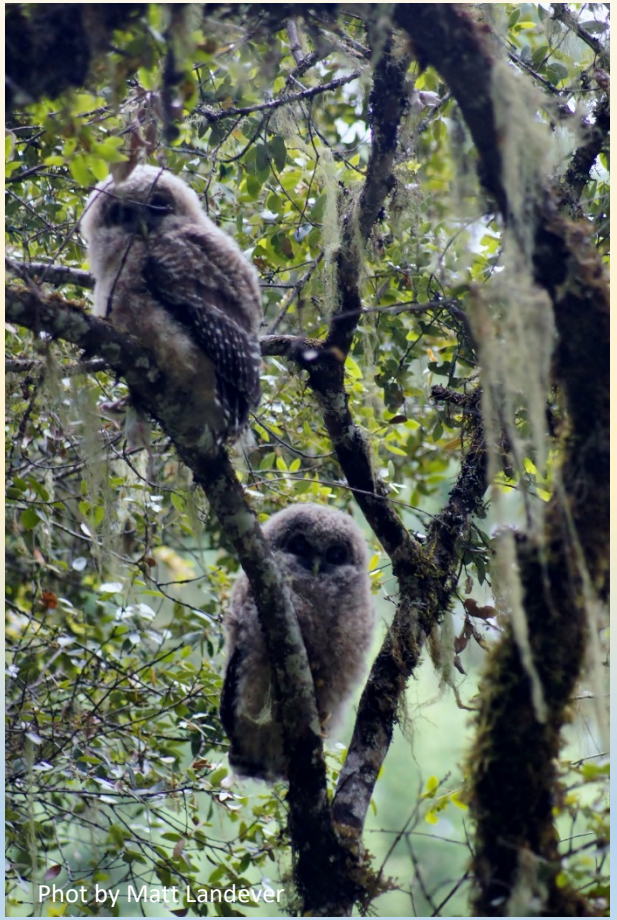
1992 NSO Survey Protocol

2008 Take avoidance analysis and guidance - “Attachment A”

2011 Revisions to “Attachment A”

2012 Revisions to NSO Survey Protocol

- In response to Barred Owl (*Strix varia*) range expansion throughout the much of the NSO range



NSO Conservation Status - California

California Endangered Species Act

After the Commission voted to accept the petition in December, 2013, the Northern Spotted Owl became a State candidate for threatened or endangered status under CESA, commencing with section 2050 of the California Fish and Game Code.

California Bird Species of Special Concern

The Department currently designates the Northern Spotted Owl as a Species of Special Concern.

Fish and Game Code

The Fish and Game Code includes certain protections for raptors, including the Northern Spotted Owl. Sections applicable to owls include the following:

Section 3503 - It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.

Section 3503.5 - It is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto.

Section 3513 - It is unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Treaty Act.

CDFW 2016 Status Review

STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION
A STATUS REVIEW OF THE
NORTHERN SPOTTED OWL
(*Strix occidentalis caurina*) IN CALIFORNIA

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
January 27, 2016

Extensive additional information about the biology and ecology of the Northern Spotted Owl can be found in California Department of Fish and Wildlife. January 27, 2016. Status Review of the Northern Spotted Owl in California (CDFW 2016 Status Review), and the literature which it references.

A status review of the Northern Spotted Owl in California

https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=116307

NSO Conservation Status - California

California Board of Forestry and Fire Protection

The California Board of Forestry and Fire Protection and the California Department of Forestry and Fire Protection (CAL FIRE) have designated Northern Spotted Owl as a "Sensitive Species" as identified in the California Forest Practice Rules (Cal. Code Regs., tit. 14, § 895 et seq.; hereafter Forest Practice Rules). These sections also define Northern Spotted Owl -related terminology, including "activity center," "Northern Spotted Owl breeding season," and "Northern Spotted Owl Evaluation Area." Specific requirements for the disclosure of information on Northern Spotted Owls in the context of timber harvesting, which in all but one case avoid take of Northern Spotted Owl, are provided by Forest Practice Rules sections 919.9 and 919.10. Section 919.9 details the type of information about Northern Spotted Owl required in project documents submitted to CAL FIRE. This information is intended to be utilized by CAL FIRE to determine whether take of Northern Spotted Owl, in conjunction with timber harvest and related activities, would be avoided according to the criteria for determining take avoidance found in Section 919.10. Other language within Section 919 also compels methods to avoid take of Northern Spotted Owl. Sections 919.2 and 919.3 set up protections of bird nests through buffers and avoidance of sensitive areas, while section 919.1 describes how snags will be retained. Section 919.16 details the protections afforded to late successional forests, which are a component of Northern Spotted Owl habitat.

CDFW 2016 Status Review

Biology and Ecology of the Northern Spotted Owl

Species Description

The Northern Spotted Owl is a medium-sized dark brown owl, with a barred tail, round, elliptical or irregular white spots on head, neck, back, and underparts, yellowish green bill, and dark brown, almost black, eyes surrounded by prominent facial disks (Gutiérrez et al. 1995). Overall, its length is approximately 46 to 48 centimeters (18 to 19 inches) (Forsman et al. 1993). Males and females are dimorphic in size, with males averaging about 13 percent smaller than females (USFWS 2011). Males weigh between 430 to 690 grams (0.95 pound to 1.52 pounds), and females weigh between 490 to 885 grams (1.1 pounds to 1.95 pounds) (Gutiérrez et al. 1995, P. Loschl and E. Forsman pers. comm. 2006 in USFWS 2011).

Photo by Matt Landever

Range of the Northern Spotted Owl

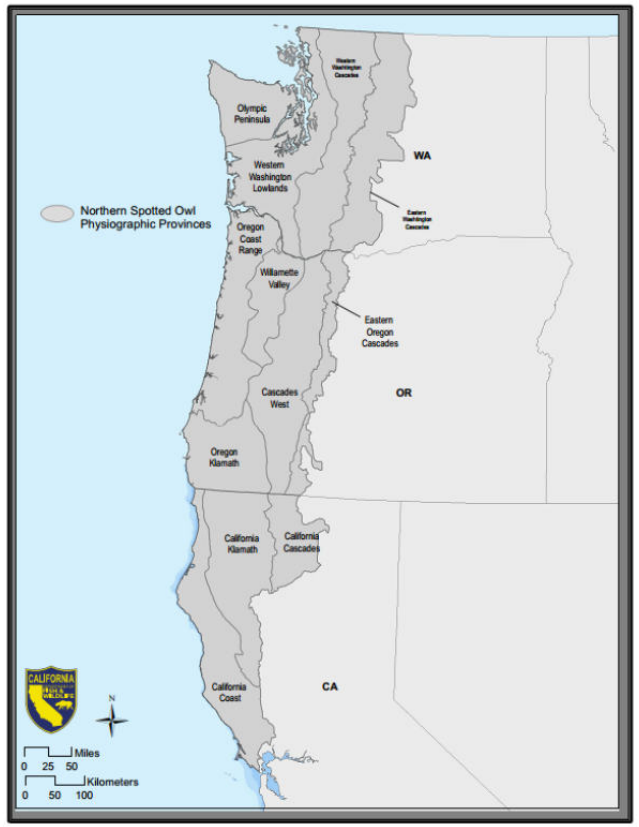


Figure 1. The 12 physiographic provinces within the Northern Spotted Owl range.

Figure 1. The 12 physiographic provinces within the Northern Spotted

Biology of the Northern Spotted Owl

Basics

- Known to live 20 years or longer in the wild
- Use nest sites in naturally occurring structures (broken tree tops, tree cavities, mistletoe, or debris accumulations in trees, as well as tree supported structures constructed by other wildlife
- Reach reproductive maturity in 1 year, but typically don't reproduce before 3 years of age
- Courtship begins in February, young may depend on parents into September
- Incubation exclusively by female, typical clutch size 1-2 eggs
- Individual owls do not always breed every year

Ecology of the Northern Spotted Owl

Population Density

- Varies across the California Coast Province
- Mendocino Redwood Company 2014 data (CDFW 2016 Status Review)
  - 0.285 owls/ km^2
  - 0.172 occupied territories per acre
  - 0.113 pairs/ km^2
- Lyme - “crude density of Activity Centers = 0.500 NSO/$mile^2$” (Campbell Global THP 1-15-107 MEN)

Foraging Habits

Hunting and Food Habits

- Nocturnal – sit and wait/perch and bounce
- Woodrats (Neotoma spp.) and Flying Squirrel (Glyaucomys spp.) primary biomass through the range
  - Dusky-footed woodrat (*Neotoma fuscipes*) is primary biomass in southern portion of the California Coast Province

"As discussed in the subsequent sections of this report, evidence demonstrates that prey abundance and availability affect selection of habitat and home range size of Northern Spotted Owls across their range. Owls tend to use a larger space and select old-growth forests with less edge habitat for foraging when flying squirrels are the dominant prey item, whereas, in **southern parts of their range where woodrats are more common in the diet, home ranges are smaller and include more edge habitat** (Courtney et al. 2004). Therefore, prey abundance and availability is likely one driving force for spatial configuration of habitat used by Northern Spotted Owls in California."

CDFW 2016 Status Review

NSO Habitat Requirements in the California Coast Province

"Most of coastal northwestern California has experienced high levels of historical logging, mainly in the form of large clearcuts, which has resulted in younger forests. However, these young redwood and mixed conifer-hardwood stands appear capable of supporting higher numbers of Northern Spotted Owls compared to younger forests in other regions, particularly in areas where hardwoods provide a multilayered structure within a conifer stand (Thomas et al. 1990, Diller and Thome 1999, Diller et al. 2012, Weisel 2015). As discussed elsewhere in this report, **high densities do not necessarily indicate high quality habitat (i.e., habitat conferring high survival and fecundity).** It is thought that stump-sprouting of redwoods and evergreen hardwoods (e.g., tanoak, madrone, California bay), rapid growth rates of redwoods, and high abundance of prey (mainly woodrats) in patchy intensively managed stands (e.g., small-patch clearcuts with residual old trees), allow owls to occupy this habitat in higher numbers in this region (Thomas et al. 1990, Folliard et al. 2000, USFWS 2011, Diller et al. 2012). Northern Spotted Owls are heat-intolerant and select cool summer roost sites to help thermoregulate (Barrows 1981). Therefore, significantly cooler summer temperatures in coastal forests as compared to high summer temperatures in interior forests also likely result in higher suitability of younger redwood forest stands as compared to younger inland stands."

CDFW 2016 Status Review

Territory, Home Range, and Core Use Areas

- Highly territorial
- Defend territories with aggressive vocal displays
- Broad home range with a centrally located nesting and roosting site (activity center)
- “Central place foragers” during the breeding season, tied to nest/roosts
- Home ranges overlap, and area used during breeding can be smaller.

Typically, Northern Spotted Owl home ranges have a greater amount of older forest near the nest and within the core area of use, and more diverse forest types and ages on the periphery of their ranges (Carey and Peeler 1995, Hunter et al. 1995, Swindle et al. 1999).

Activity Center

USFWS 2011 Attachment A

- Area of concentrated activity of either a pair of NSO or a single territorial NSO, represented by a mapped location (e.g., usually a nest tree) that occurs within, but not necessarily in the exact center of, the "Core Area," defined below.[2]
- [2]NSOs have been characterized as central-place foragers, where individuals forage over a wide area and subsequently return to a nest or roost location that is often centrally-located within the home range (Rosenberg and McKelvey 1999)

USFWS 2012 NSO Survey Protocols

- Spotted owls have been characterized as central-place foragers, where individuals forage over a wide area and subsequently return to a nest or roost location that is often centrally-located within the home range (Rosenberg and McKelvey 1999). Activity centers are a location or point representing „the best of‟ detections” such as nest stands, stands used by roosting pairs or territorial singles, or concentrated nighttime detections. Activity centers are within the core use area and are represented by this central location.

Activity Center

CDFW BIOS Spotted Owl Database

- Based on USFWS Survey Protocols, location of an Activity Center (AC) uses a hierarchy of biologically most significant detection to determine most appropriate site:
    - Nest site
        - Pair location
            - Female location
                - Male location
                    - Unknown Owl

NSO HOME RANGE

CONCEPT FOR HOME RANGE

Disproportionate use of core areas is likely influenced by territoriality in Northern Spotted Owls, and the core use area is likely a good scale at which to evaluate and manage habitat since it is contains needed resources and is defensible. Observed territorial spacing of Northern Spotted Owls provides additional support for using a 0.5 mile-radius core use area for habitat management purposes. Half the nearest neighbor distance can be used to estimate the size of the defended portions of the home ranges. Half the mean and median nearest neighbor distances for nesting Northern Spotted Owls were 0.49 mile (Hunter et al. 1995) and 0.44 mile (Franklin et al. 2000), respectively. Additional support for the validity of managing habitat within core use areas estimated as a 0.5-mile radius area around activity centers is provided by studies that modeled habitat fitness potential (Franklin et al. 2000, Dugger et al. 2005) and probability of occupancy (Zabel et al. 2003). These studies found that important Northern Spotted Owl habitat relationships were well captured at scales of 0.44 to 0.50 mile. Other studies have shown that habitat conditions in the broader home range can affect Northern Spotted Owl occupancy, survival, and fitness (Meyer et al. 1998, Olson et al. 2004, Dugger et al. 2005); therefore these areas must also be considered when managing for Northern Spotted Owl habitat.

Home Range in Managed Timberlands

USFWS 2011 Attachment A

- Defined as a 0.7 mile radius circle centered on the Activity Center for the coast redwood ecotype found in the Coast District.

USFWS 2012 NSO Survey Protocols

- The area in which a spotted owl conducts its activities during a defined period of time (USFWS 1992b) that provides important habitat elements for nesting, roosting, and foraging. Home range sizes vary generally increase from south to north and vary in relation to habitat conditions and prey availability and composition

Core Use Areas

CONCEPT FOR CORE USE AREA (CORE AREA)

- “Like many other animals, Northern Spotted Owls exhibit selective behavior by utilizing certain areas within their home range more intensively than others (Carey and Peeler 1995, Bingham and Noon 1997). These areas of disproportionate use, termed core use areas, commonly include nest and roosting sites and access to dependable food sources.”

Core Use Area in Managed Timberlands

USFWS 2011 Attachment A

- 100 acres of the 200 acres of Nesting/Roosting habitat retained within a 0.7 mile radius contiguous with the Activity Center. If 100 acres of contiguous Nesting/Roosting is not available, then the highest quality habitat available shall be included.

USFWS 2012 Survey Protocols

- An area of concentrated use within a home range that receives disproportionally high use (Bingham and Noon 1993), and commonly includes nest sites, roost sites, and foraging areas close to the activity center. Core use areas vary geographically, and in relation to habitat conditions. This is a biological definition of core use area and is not the same as a 70-acre core as defined by the Oregon Forest Practices Act nor is it equivalent to the 100acre LSRs referred to as NSO cores on federal lands.

Nesting/Roosting Habitat

NESTING AND ROOSTING HABITAT

- “In the California Coast Province, young redwood forests along the coast have structural complexity similar to that of older forests elsewhere in the Northern Spotted Owl’s range, thus providing nesting and roosting habitat within these younger forests. The rapid growth rate of redwoods, along with stump-sprouting and variable timber management practices, has shaped younger forest types within the coastal forests of Northern California (Thomas et al. 1990, Thome et al. 1999, Folliard et al. 2000, USFWS 2011, Diller et al. 2012). On managed timberland of Green Diamond Resource Company, within the coastal redwood forests of California, Northern Spotted Owls selected older more complex nest stands, i.e., areas with higher habitat heterogeneity that were in fairly close proximity to areas that had a high potential as foraging habitat (Diller et al. 2012).”

Nesting/Roosting Habitat in Managed Timberlands

- USFWS 2011 Attachment A
  Forested habitat that supports successful nesting and associated roosting behavior by NSO. Habitat with ≥60% canopy cover of trees that are ≥ 11" DBH, and have a basal area ≥ 100 square feet per acre of trees ≥ 11" DBH. Trees may be conifer or hardwood. (represents the minimum standard)
- USFWS NSO Survey Protocol
  Habitat that provides nesting and roosting opportunities for spotted owls. Important stand elements may include high canopy closure, a multi-layered, multispecies canopy with large overstory trees and a presence of broken-topped trees or other nesting platforms (*e.g.,* mistletoe clumps (USFWS 1992*b*). The appearance and structure of these forests will vary across the range of the spotted owl, particularly in the dry-forest provinces.

Foraging Habitat in Managed Timberlands

- **USFWS 2011 Attachment A**
  Habitat that contains ≥40% canopy cover of trees that are ≥ 11" DBH (diameter at breast height), and have a basal area ≥75 square feet per acre of trees ≥ 11" DBH. Trees may be conifer or hardwood.
- **USFWS 2012 Survey Protocol**
  Foraging habitat is defined as habitat that provides foraging opportunities for spotted owls, but without the structure to support nesting and roosting (USFWS 1992*b*). Owls often forage in forest conditions that meet the definition of nesting/roosting habitat, but also use a broader range of forest types for foraging. This definition identifies habitat that functions as foraging habitat, but does not meet requirements for nesting /roosting.

USFWS Endorsed Survey Protocols and Take Avoidance Guidance

1992 NSO Survey Protocol

- Three visits protocol (Year 1and 2) or Six visits (Year 1)

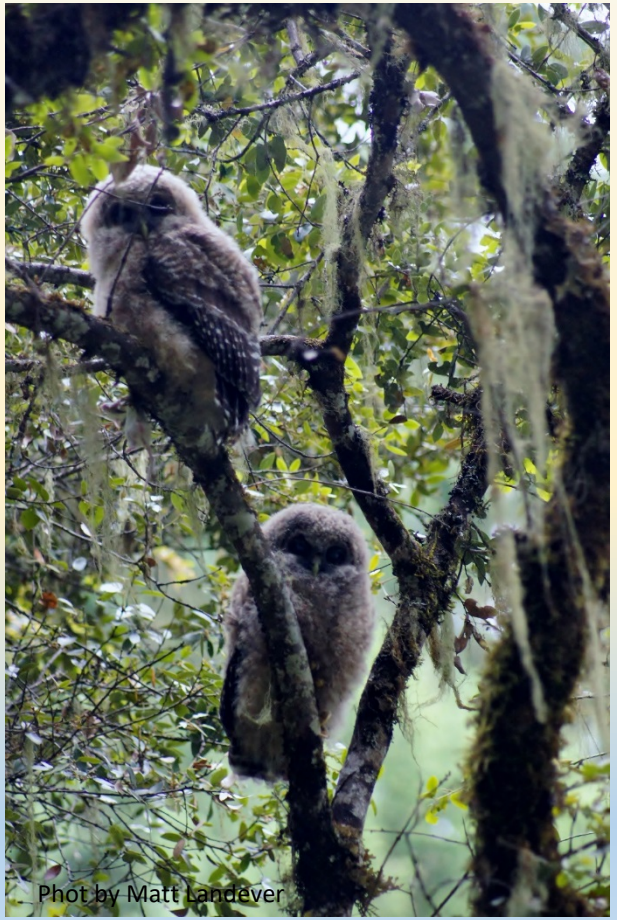
2008 Take avoidance analysis and guidance - “Attachment A” for the California Coast Province

2011 Revisions to “Attachment A”

- Territory assumed to be 0.7 mile area surrounding an identified Activity Center

2012 Revisions to NSO Survey Protocol

- Six visits protocol (Year 1 and 2)


Phot by Matt Landever

NSO Resource - Smith Creek Watershed

Lyme Redwood spatial data provided for Campbell Creek

- Current Habitat Typing
- Topographic Core Areas

Timber Harvesting Plans

- NSO habitat typing analysis (pre/post harvest)
  - Harvest units
  - Individual Activity Centers

BIOS Spotted Owl Database

- All available survey data for activity centers (ACs)
  - MEN0150
  - MEN0312
  - MEN0313
- NSO “Spider” (line file connecting survey data to associated AC)

NSO Habitat Typing per USFWS 2011 “Attachment A”

Habitat types delineated in Lyme (formally Campbell) Timber Harvest Plans

- **Nesting/Roosting** = stands with at least 60% canopy cover of trees ≥ 11 inches dbh that have a basal area of ≥ 100 feet^2/acre
- **Foraging** = stands with at least 40% canopy cover of trees ≥ 11 inches dbh that have a basal area of ≥ 75 feet^2/acre
- **Non-suitable** = stands not meeting the definitions of Nesting/Roosting or Foraging

NSO Resource - Smith Creek Watershed

Lyme Redwood spatial data provided for Campbell Creek

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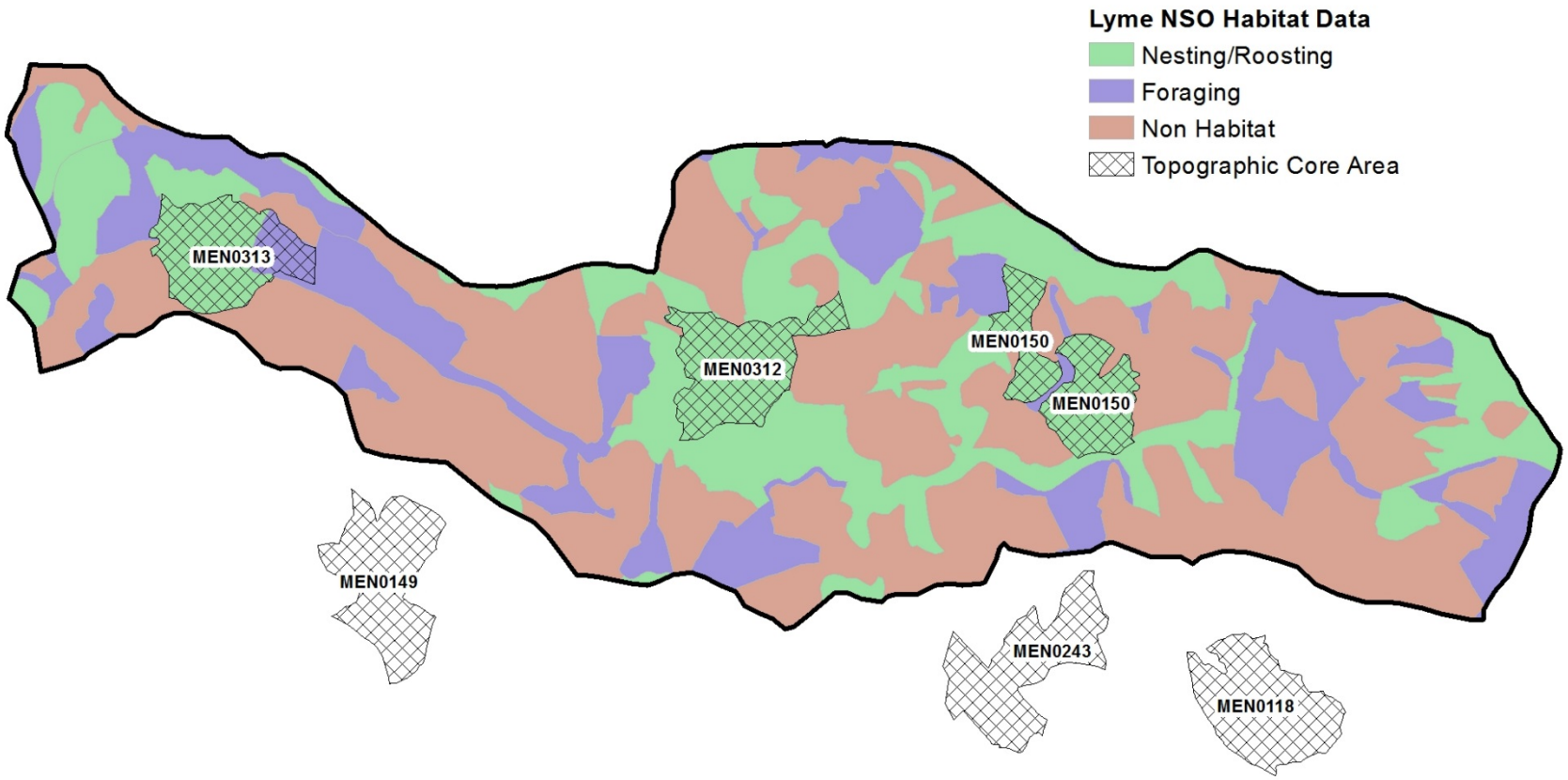
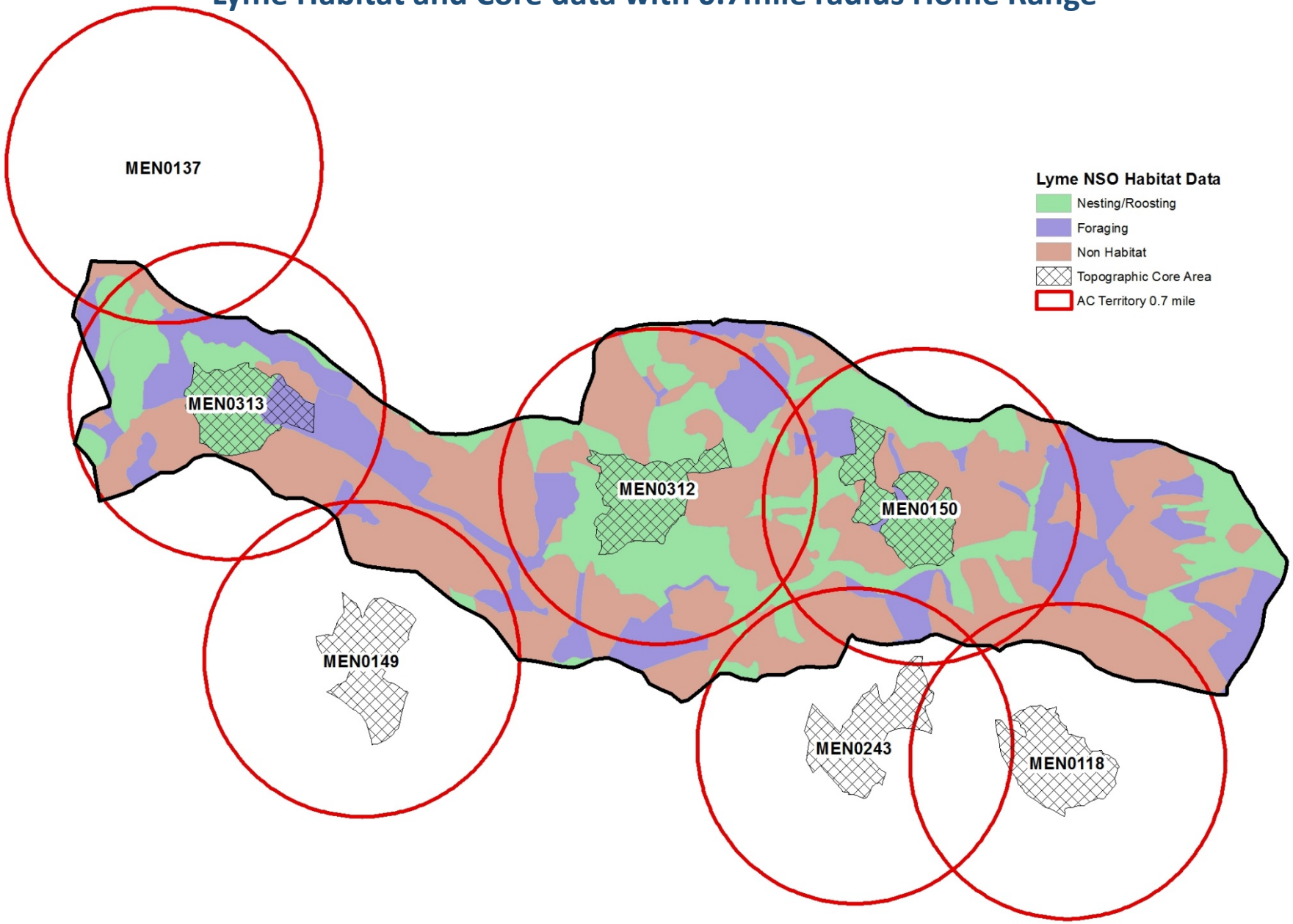

Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
MEN0313
MEN0312
MEN0150
MEN0150
MEN0149
MEN0243
MEN0118

Lyme Habitat and Core data with 0.7mile radius Home Range



NSO Resource - Smith Creek Watershed

Lyme Redwood spatial data provided for Campbell Creek

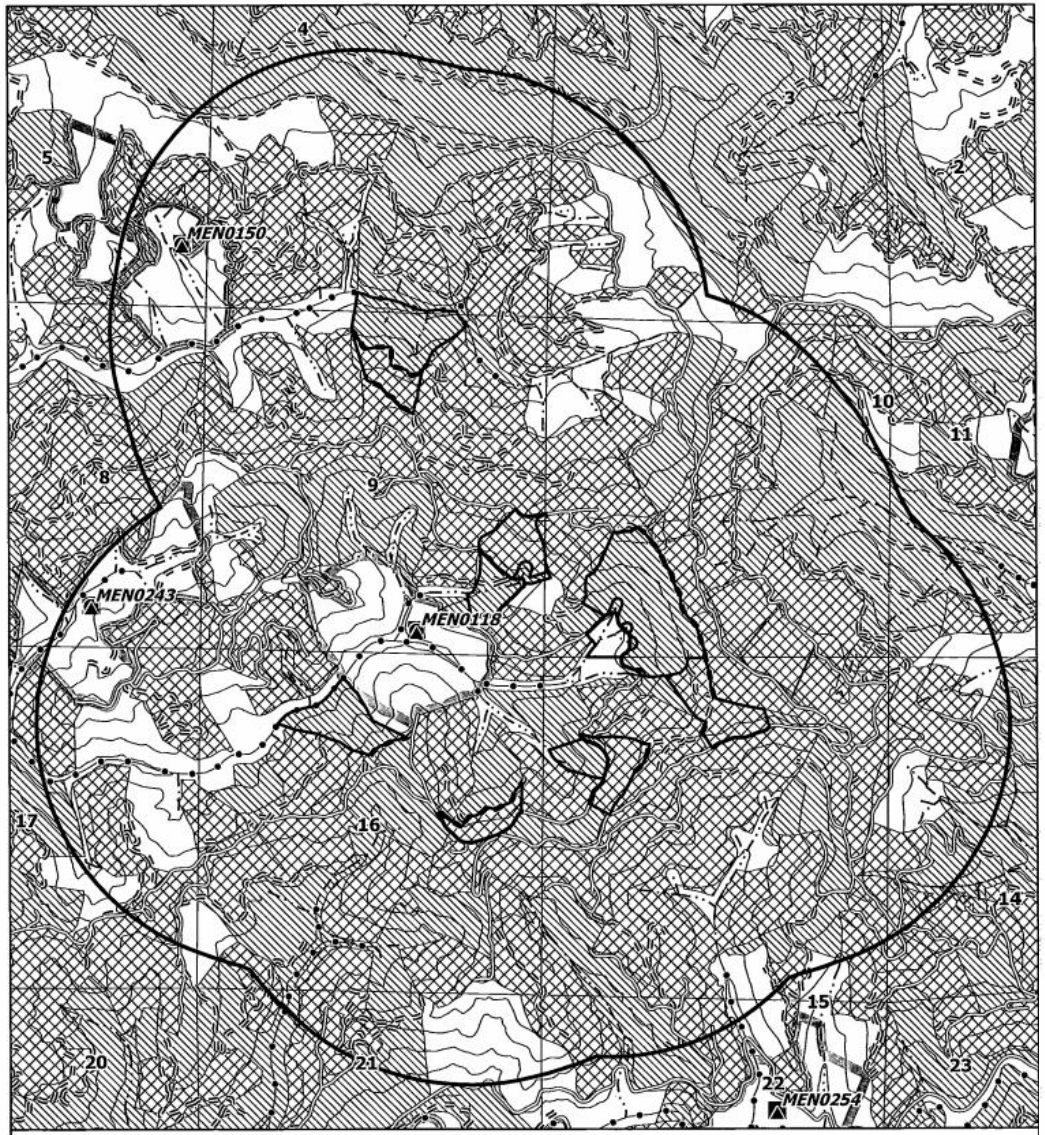
- Current Habitat Typing
- Topographic Core Areas

Timber Harvesting Plans

- NSO habitat typing analysis (pre/post harvest)
  - Harvest units
  - Individual Activity Centers

BIOS Spotted Owl Database

- All available survey data for activity centers (ACs)
  - MEN0150
  - MEN0312
  - MEN0313
- NSO “Spider” (line file connecting survey data to associated AC)



Habitat Types for Northern Spotted Owl within 0.7 miles of Plan Area

Dutchmans West

19N16W09

Post Harvest

NSO Activity Center = ■ 2013 ● 2014 ▲ 2015

Class I Watercourse
Class II Watercourse
Paved Road
Rocked Road
Dirt Road

THP and Internal Boundaries
Foraging Habitat
Nesting/Roosting Habitat
Non Habitat
Unclassified Habitat

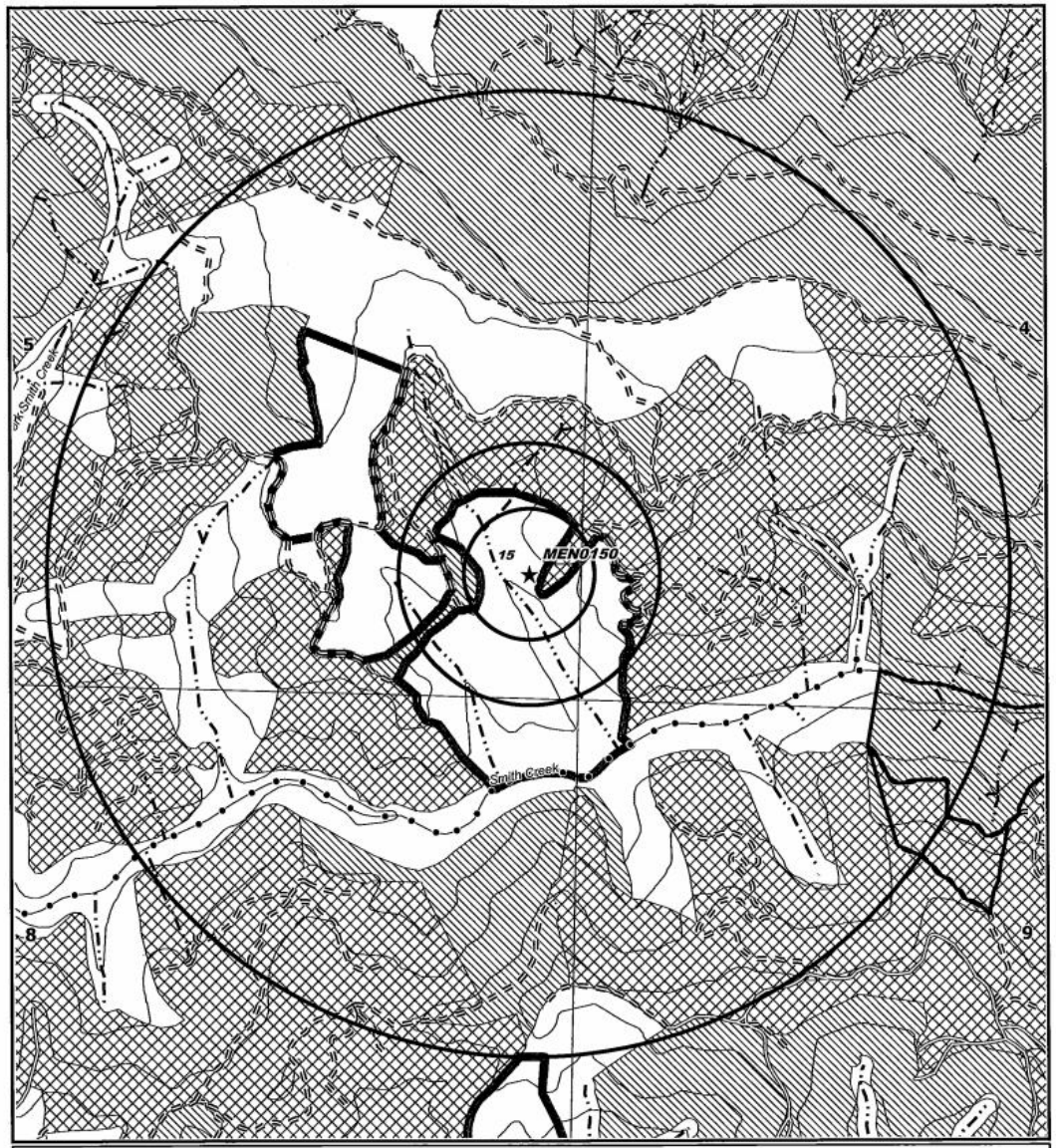
Core Habitat Polygon
Off Ownership
Contour Interval = 200'

1:24,000

Print Date: 9/29/2015

CampbellGlobal
FOREST & NATURAL RESOURCE INVESTMENTS

434



Northern Spotted Owl Habitat Types within 0.7 Miles of Activity Center

Dutchmans West

19N16W05

Post Harvest

MEN0150 (2015)

NSO Activity Center with protection buffers: 500', 1000', and 0.7 mi

Class I Watercourse
Class II Watercourse
Paved Road
Rocked Road
Dirt Road

THP and Internal Boundaries
Foraging Habitat
Nesting/Roosting Habitat
Non Habitat
Off Ownership

Core Habitat Polygon
Contour Interval = 200'

1:12,000

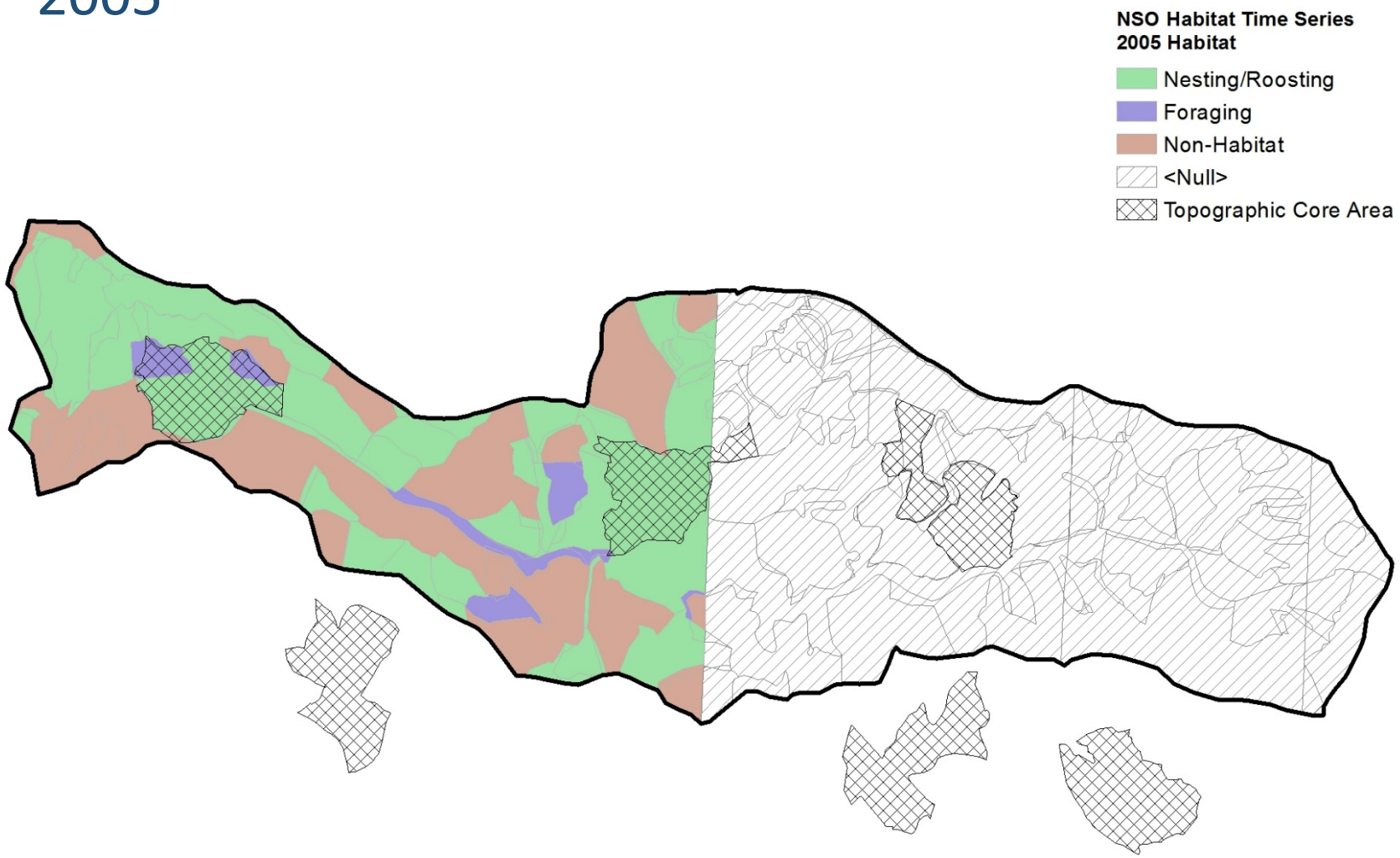
Print Date: 9/29/2015

CampbellGlobal
FOREST & NATURAL RESOURCE INVESTMENTS

441

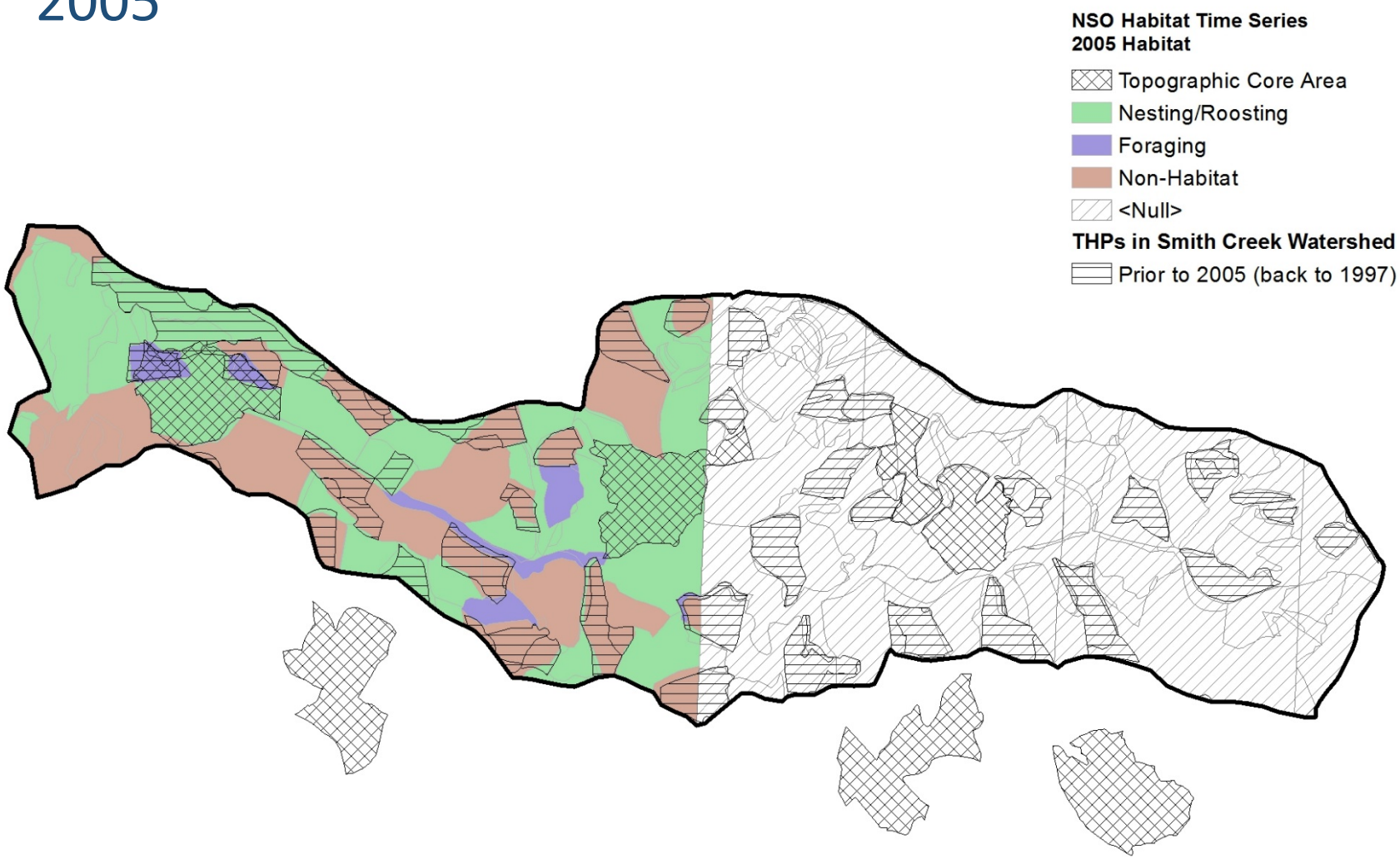
32

2005



From 2005 THP 1-05-181 MEN

2005


NSO Habitat Time Series
2005 Habitat
Topographic Core Area
Nesting/Roosting
Foraging
Non-Habitat
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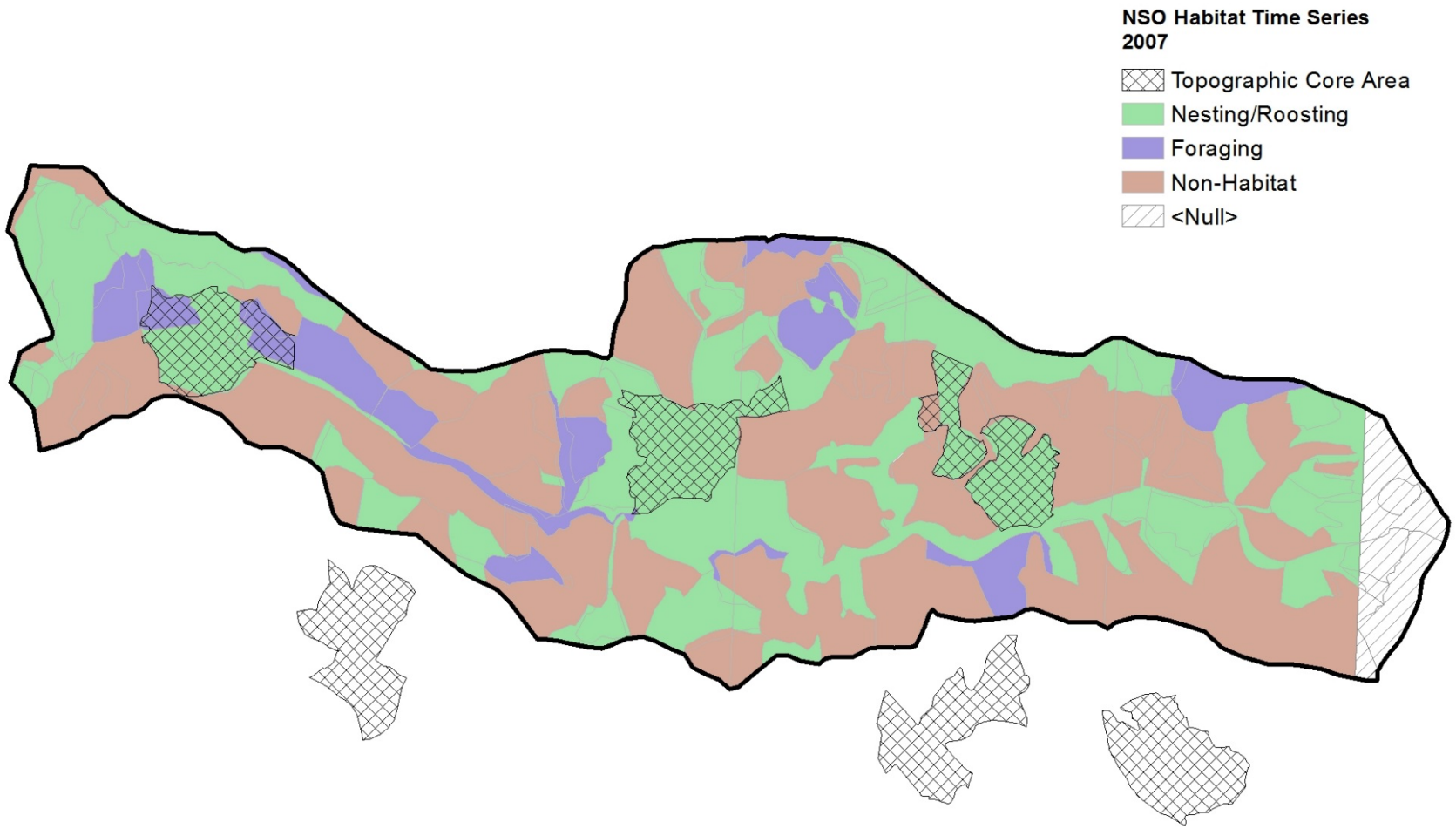
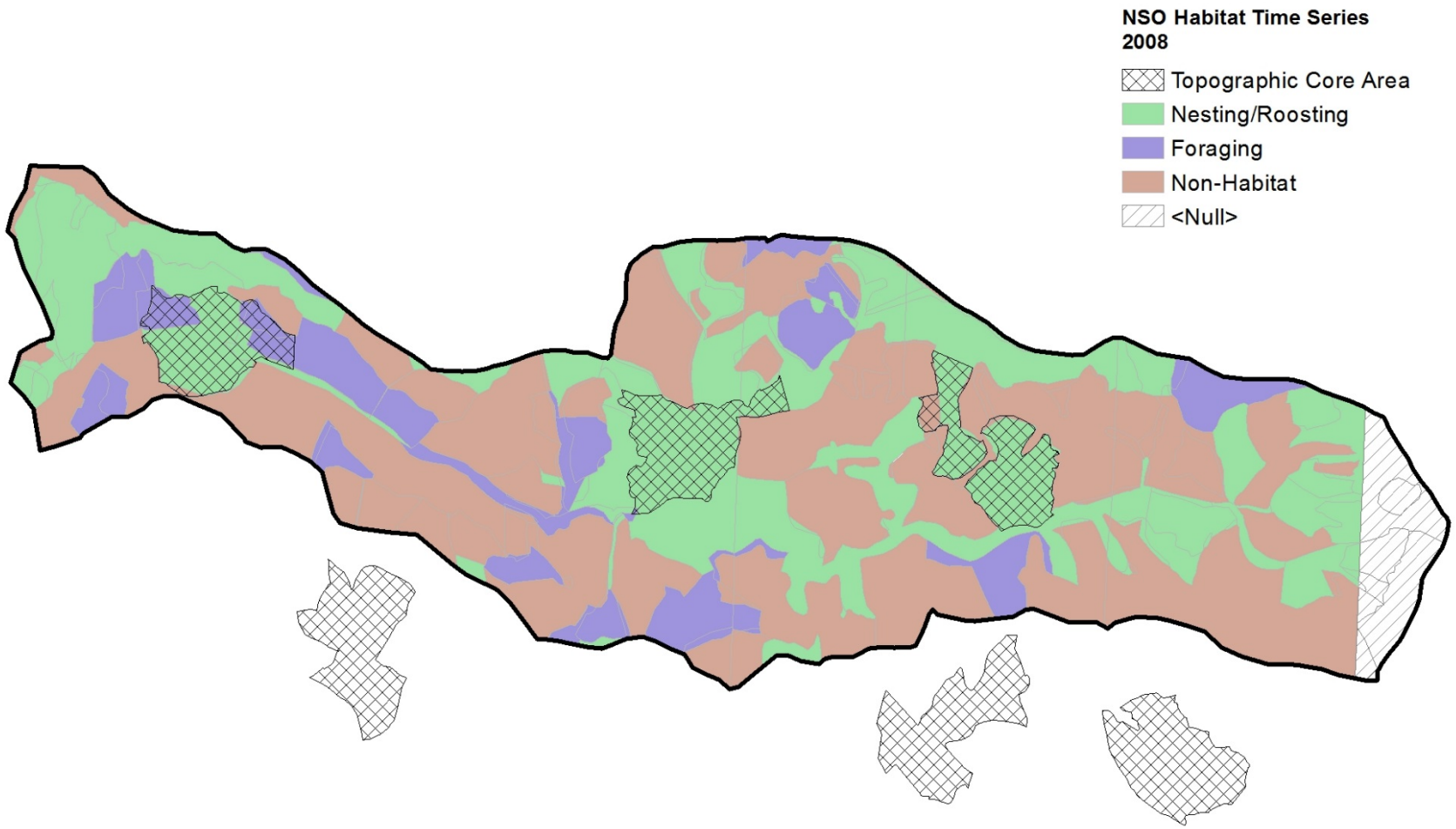
THPs in Smith Creek Watershed
Prior to 2005 (back to 1997)

2007



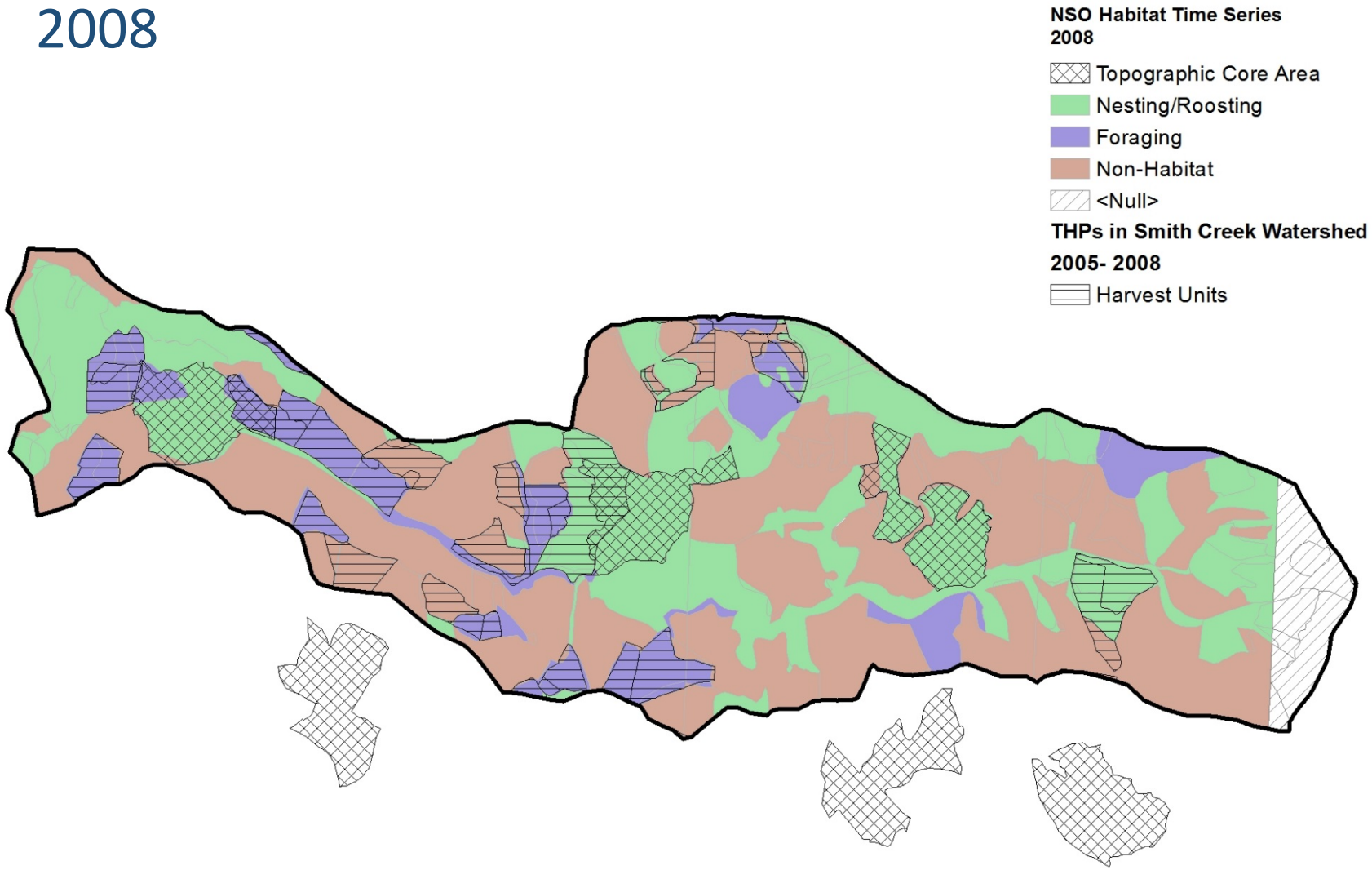
From 2007 THP 1-07-036 MEN

2008

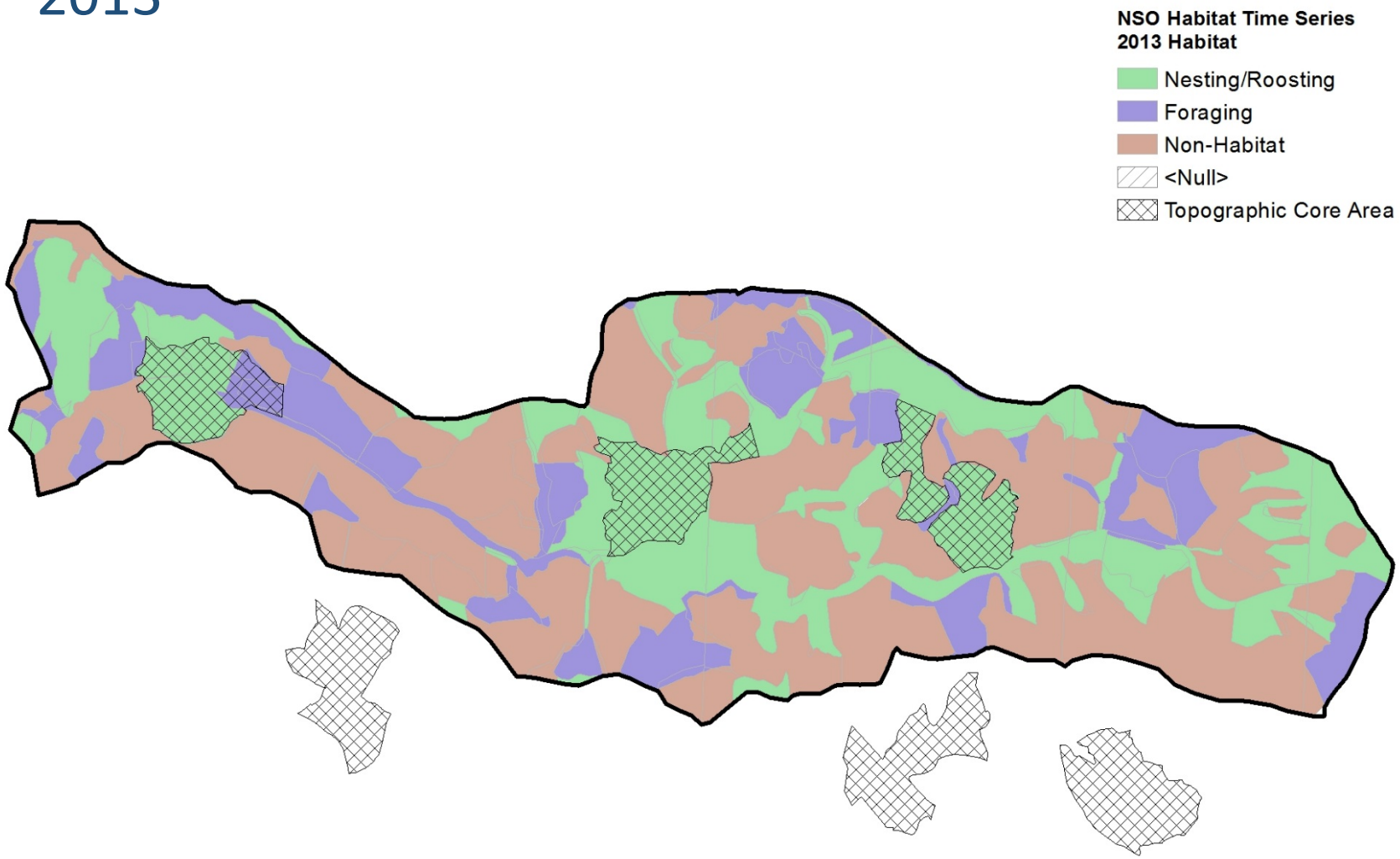


From 2008 THP 1-08-015 MEN

2008

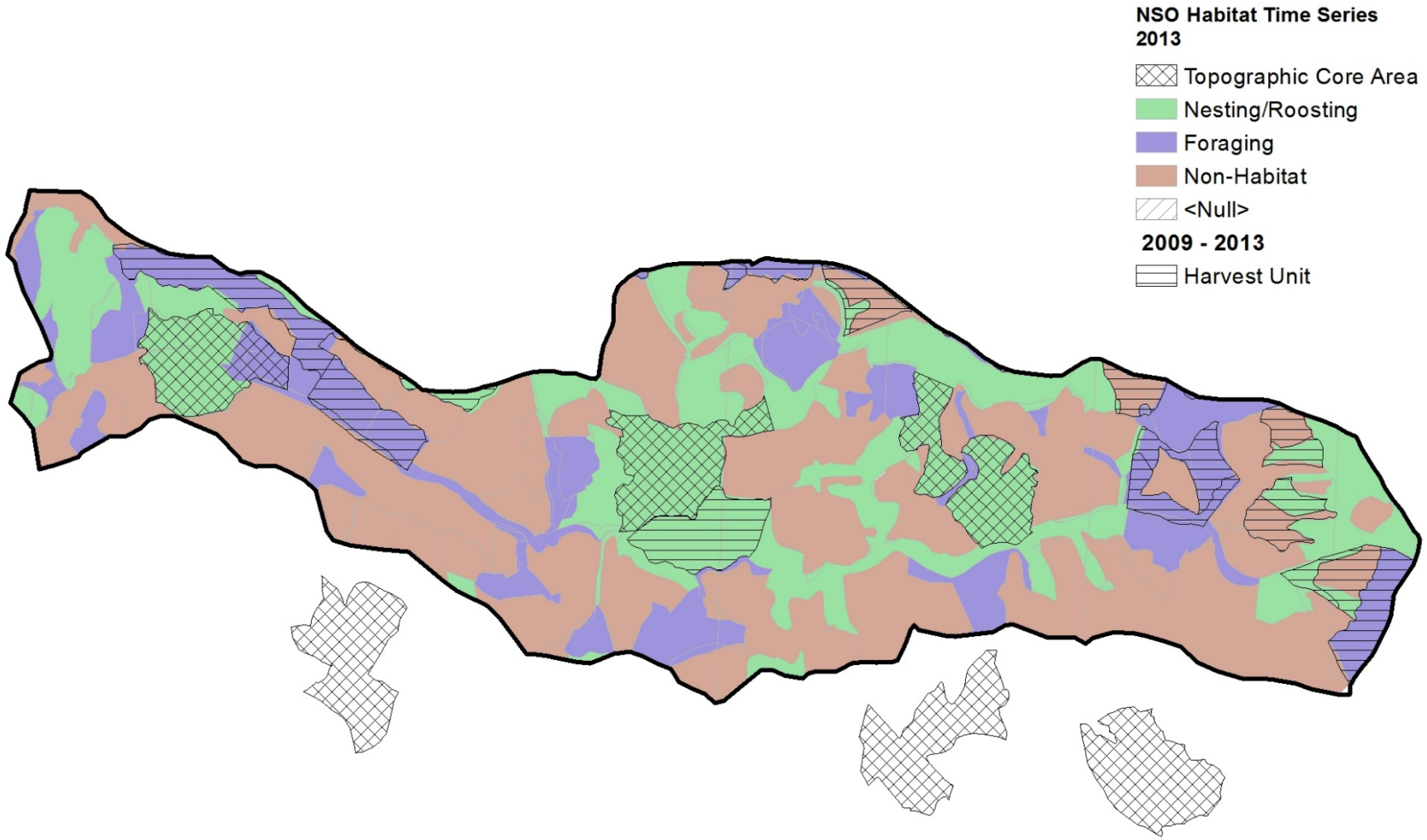

NSO Habitat Time Series
2008
Topographic Core Area
Nesting/Roosting
Foraging
Non-Habitat
<Null>
THPs in Smith Creek Watershed
2005- 2008
Harvest Units

2013

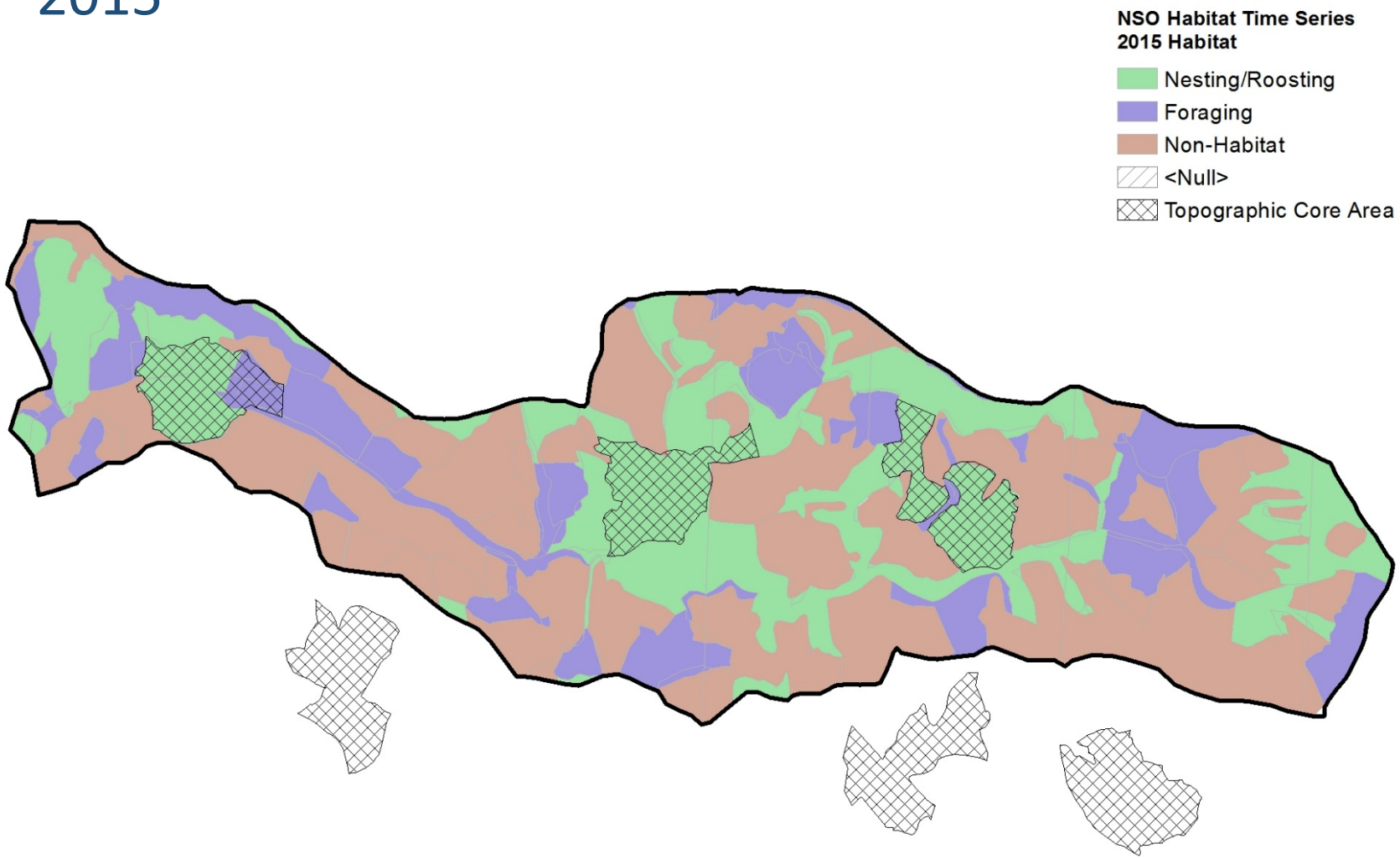


From 2013 THP 1-13-031 MEN

2013

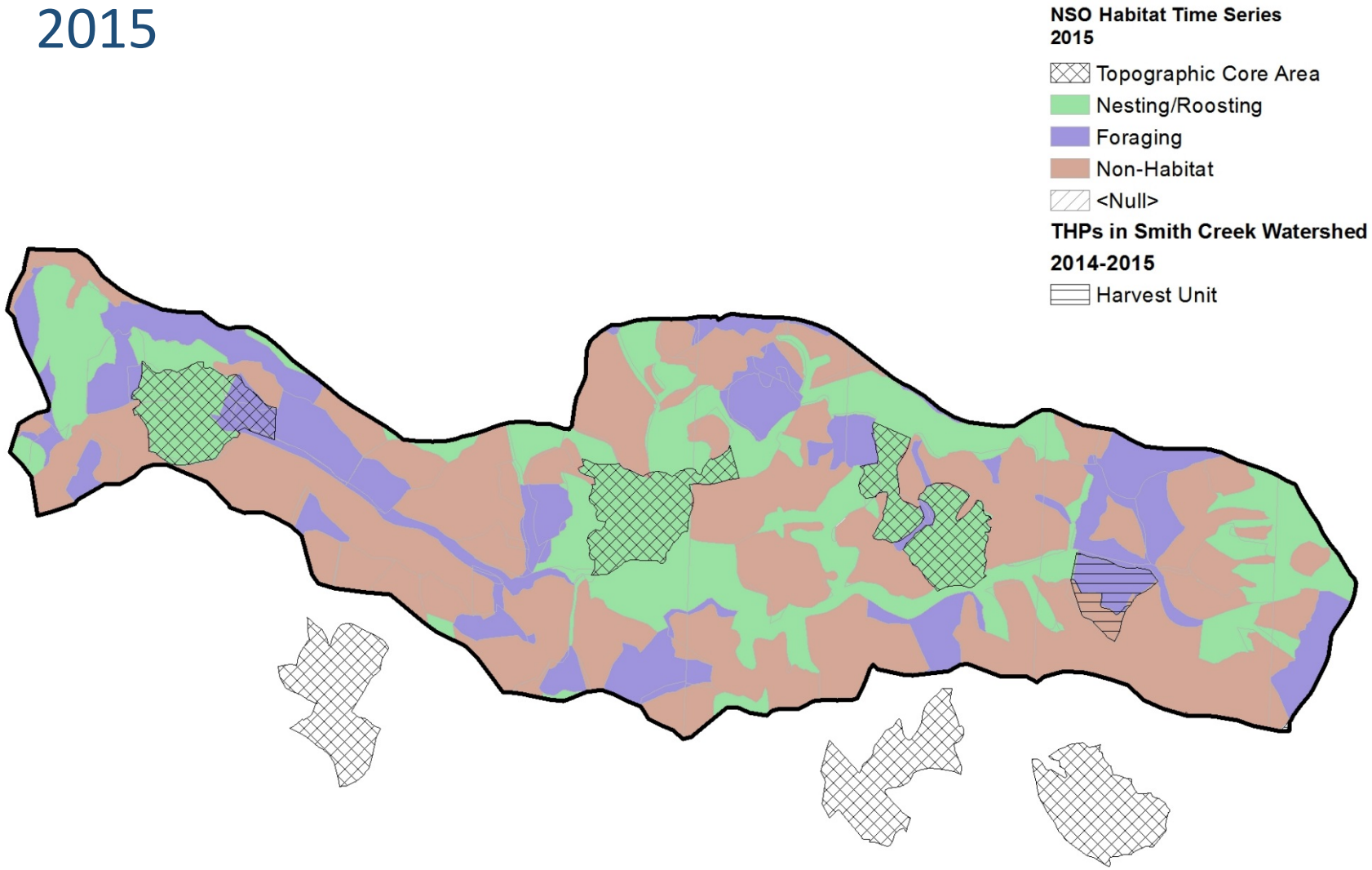

NSO Habitat Time Series
2013
Topographic Core Area
Nesting/Roosting
Foraging
Non-Habitat
<Null>
2009 - 2013
Harvest Unit

2015



From 2015 THPs 1-15-094 MEN and 1-15-107 MEN

2015


NSO Habitat Time Series
2015
Topographic Core Area
Nesting/Roosting
Foraging
Non-Habitat
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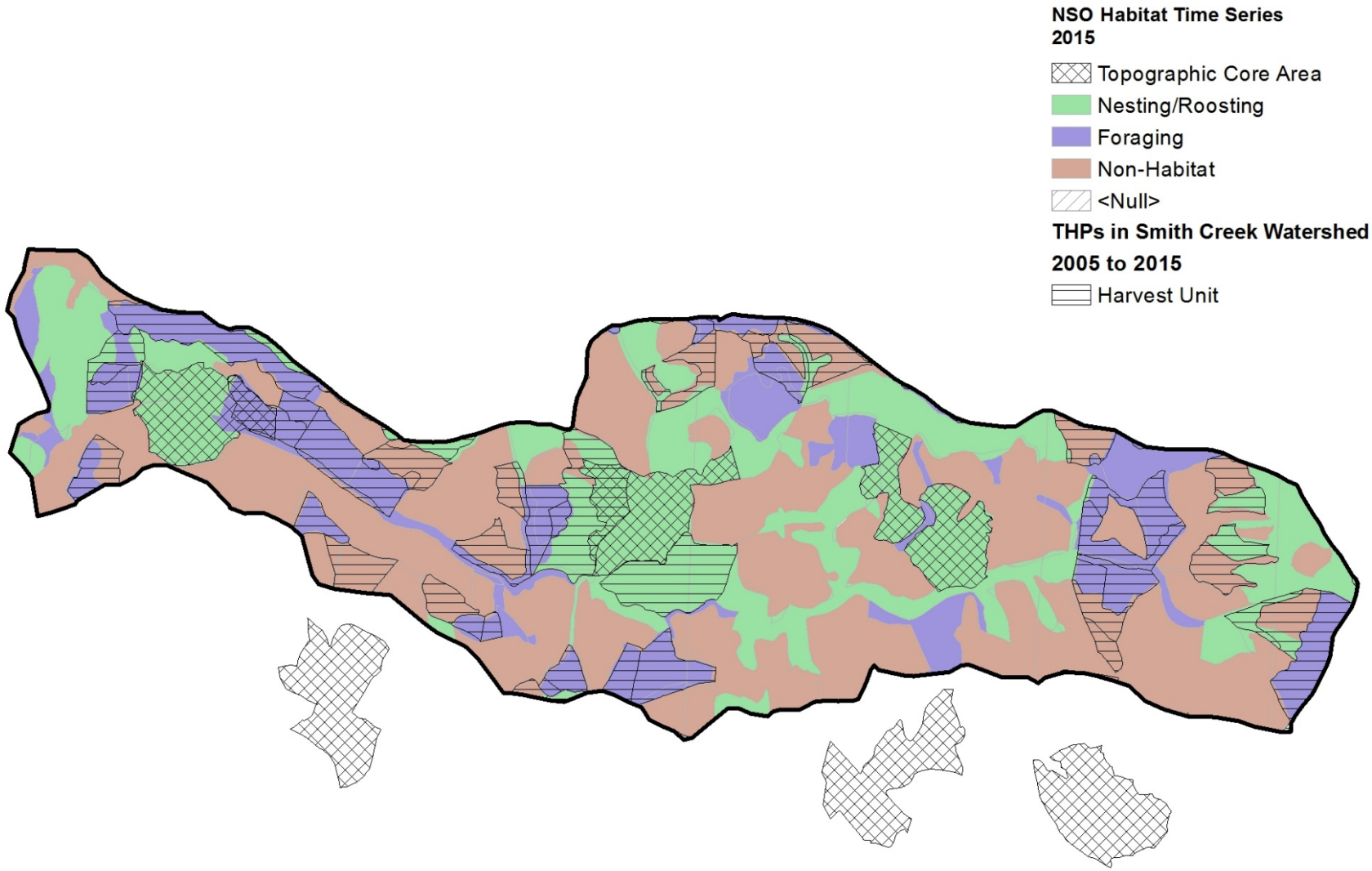
THPs in Smith Creek Watershed
2014-2015
Harvest Unit


NSO Habitat Time Series
2015
Topographic Core Area
Nesting/Roosting
Foraging
Non-Habitat
<Null>
THPs in Smith Creek Watershed
2005 to 2015
Harvest Unit

NSO Resource - Smith Creek Watershed

Lyme Redwood spatial data provided for Campbell Creek

- Current Habitat Typing
- Topographic Core Areas

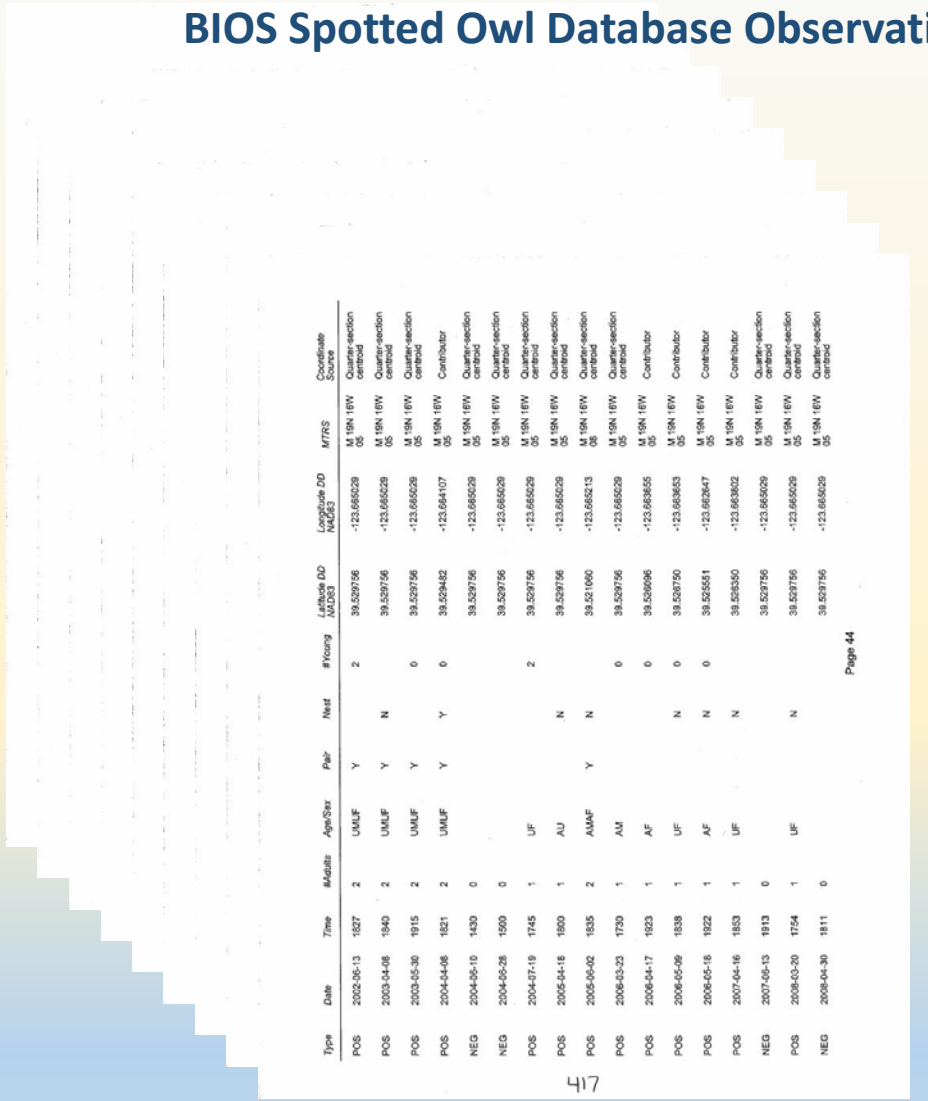
Timber Harvesting Plans

- NSO habitat typing analysis (pre/post harvest)
  - Harvest units
  - Individual Activity Centers

BIOS Spotted Owl Database

- All available survey data for activity centers (ACs)
  - MEN0150
  - MEN0312
  - MEN0313
- NSO “Spider” (line file connecting survey data to associated AC)

BIOS Spotted Owl Database Observation data for MEN0150 from THP 1-15-107 MEN



Type	Date	Time	#Adults	Age/Sex	Pair	Nest	#Young	Latitude DD NAD83	Longitude DD NAD83	MTRS	Coordinate Source
POS	2002-06-13	1827	2	UMUF	Y		2	39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
POS	2003-04-08	1940	2	UMUF	Y	N		39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
POS	2003-05-30	1915	2	UMUF	Y		0	39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
POS	2004-04-06	1821	2	UMUF	Y	Y	0	39.529482	-123.664107	M 19N 16W 05	Contributor
NEG	2004-06-10	1430	0					39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
NEG	2004-06-28	1500	0					39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
POS	2004-07-19	1745	1	UF			2	39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
POS	2005-04-18	1600	1	AU		N		39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
POS	2005-06-02	1835	2	AMAF	Y	N		39.521060	-123.665213	M 19N 16W 08	Quarter-section centroid
POS	2006-03-23	1730	1	AM			0	39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
POS	2006-04-17	1923	1	AF			0	39.526696	-123.663855	M 19N 16W 05	Contributor
POS	2006-05-09	1838	1	UF		N	0	39.529750	-123.663853	M 19N 16W 05	Contributor
POS	2006-05-16	1922	1	AF		N	0	39.525551	-123.662647	M 19N 16W 05	Contributor
POS	2007-04-16	1853	1	UF		N		39.526350	-123.663802	M 19N 16W 05	Contributor
NEG	2007-06-13	1913	0					39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
POS	2008-03-20	1754	1	UF		N		39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
NEG	2008-04-30	1811	0					39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid

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Type	Date	Time	#Adults	Age/Sex	Pair	Nest	#Young	Latitude DD NAD83	Longitude DD NAD83	MTRS	Coordinate Source
AC	2008-05-14	2021	2	UMUF	Y			39.525595	-123.666397	M 19N 16W 05	Contributor
POS	2008-06-09	1842	1	UF			0	39.529756	-123.665029	M 19N 16W 05	Quarter-section centroid
NEG	2009-04-02	2035	0					39.529753	-123.665027	M 19N 16W 05	Quarter-section centroid
POS	2009-05-13	1934	1	UU				39.529753	-123.665027	M 19N 16W 05	Quarter-section centroid
POS	2009-08-10	2020	1	UM				39.521059	-123.665213	M 19N 16W 08	Quarter-section centroid
POS	2010-04-13	1831	1	UM		N		39.529898	-123.674531	M 19N 16W 05	Quarter-section centroid
POS	2010-06-07	1825	2	UMUF	Y	N		39.529753	-123.665027	M 19N 16W 05	Quarter-section centroid
POS	2011-04-25	1858	1	UM		N		39.529753	-123.665027	M 19N 16W 05	Quarter-section centroid
POS	2011-06-02	1848	2	UMUF	Y	Y		39.529753	-123.665027	M 19N 16W 05	Quarter-section centroid
POS	2011-06-17	1855	2	UMUF	Y	N	1	39.529753	-123.665027	M 19N 16W 05	Quarter-section centroid
POS	2012-04-17	1729	2	UMUF	Y	N		39.529753	-123.665027	M 19N 16W 05	Quarter-section centroid
POS	2012-06-15	1940	1	AM				39.526821	-123.663574	M 19N 16W 05	Contributor
POS	2013-04-01	1626	1	UM		N		39.526034	-123.662540	M 19N 16W 05	Contributor
POS	2013-06-19	1705-1727	2	UMUF	Y		0	39.526786	-123.662995	M 19N 16W 05	Contributor
Masterowl: MEN0233 Subspecies: NORTHERN											
POS	1991-06-06	2237	1	UM				39.521088	-123.598539	M 19N 16W 12	Quarter-section centroid
POS	1991-06-06		2	UMUF				39.529468	-123.598495	M 19N 16W 01	Quarter-section centroid

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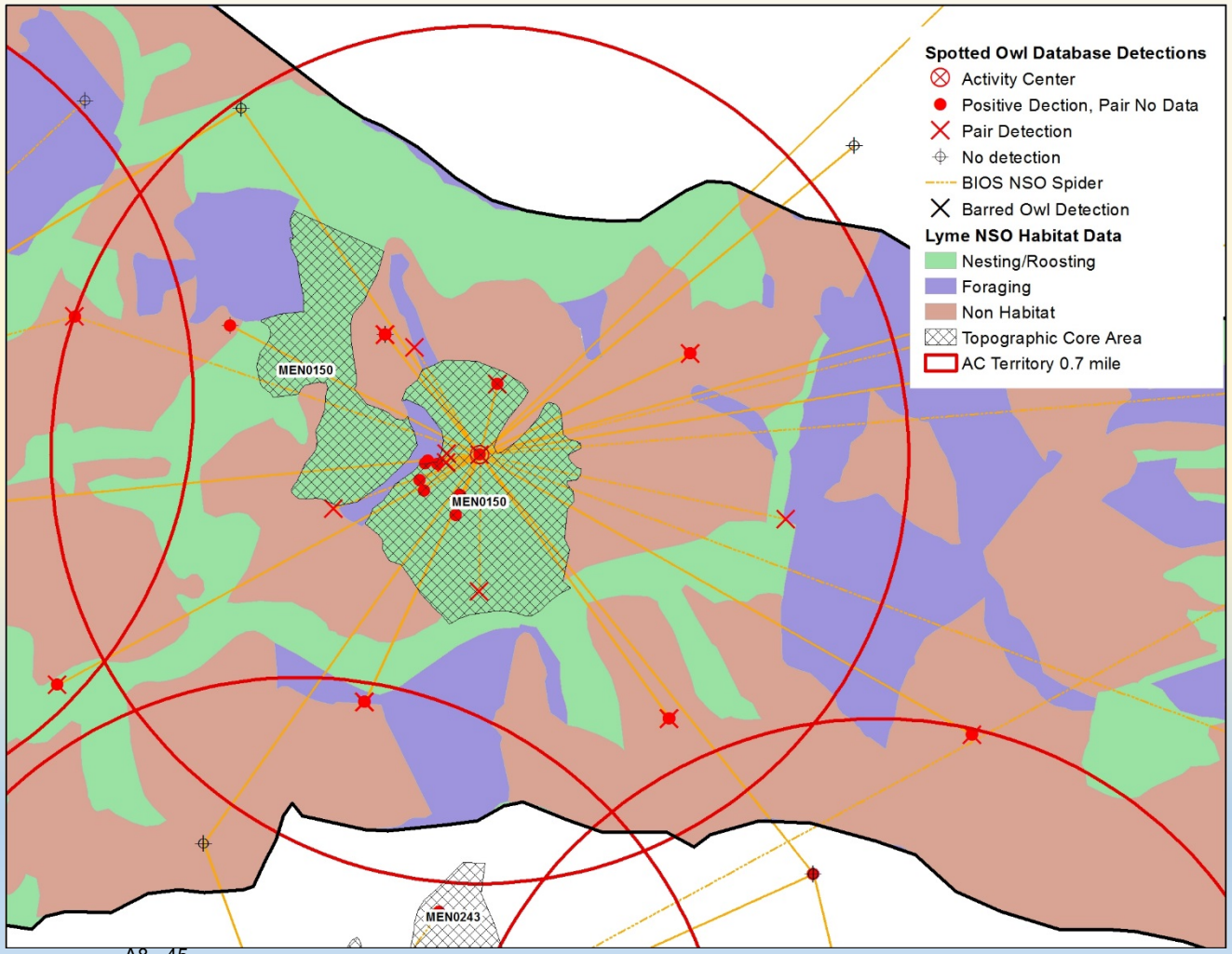
BIOS Spotted Owl Database Observation Data and Spider Diagram

Count of MASTEROWL	Column Labels								
	Pair Yes		Pair Yes Total	Pair No Data		Pair No Data Total	Grand Total		
Row Labels		Nest No	Nest Yes		Nest No	Nest Yes			
MEN0150	39	6	6	51	##	9	2	114	165
1989					1			1	1
1990	2			2	3			3	5
1991	11			11	16			16	27
1992	2			2	2			2	4
1993	2			2	6		1	7	9
1994	2			2	16			16	18
1995	6			6	12			12	18
1996	4		1	5	16			16	21
1997					2			2	2
1998	1	1		2	6			6	8
1999	1			1		1		1	2
2000			2	2					2
2001	2			2	2			2	4
2002	2			2	3			3	5
2003	1	1		2					2
2004			1	1	3			3	4
2005		1		1		1		1	2
2006					2	2		4	4
2007					1	1		2	2
2008	1			1	2	1		3	4
2009					3			3	3
2010		1		1		1		1	2
2011		1	1	2		1		1	3
2012		1		1	1			1	2
2013	1			1		1		1	2
2014					3			3	3
2015					2			2	2
2016	1		1	2	1		1	2	4
Grand Total	39	6	6	51	##	9	2	114	165



NSO Activity Center Status per USFWS 2012 Survey Protocol

Management activities often determine the level of AC status required.

- Occupancy Status

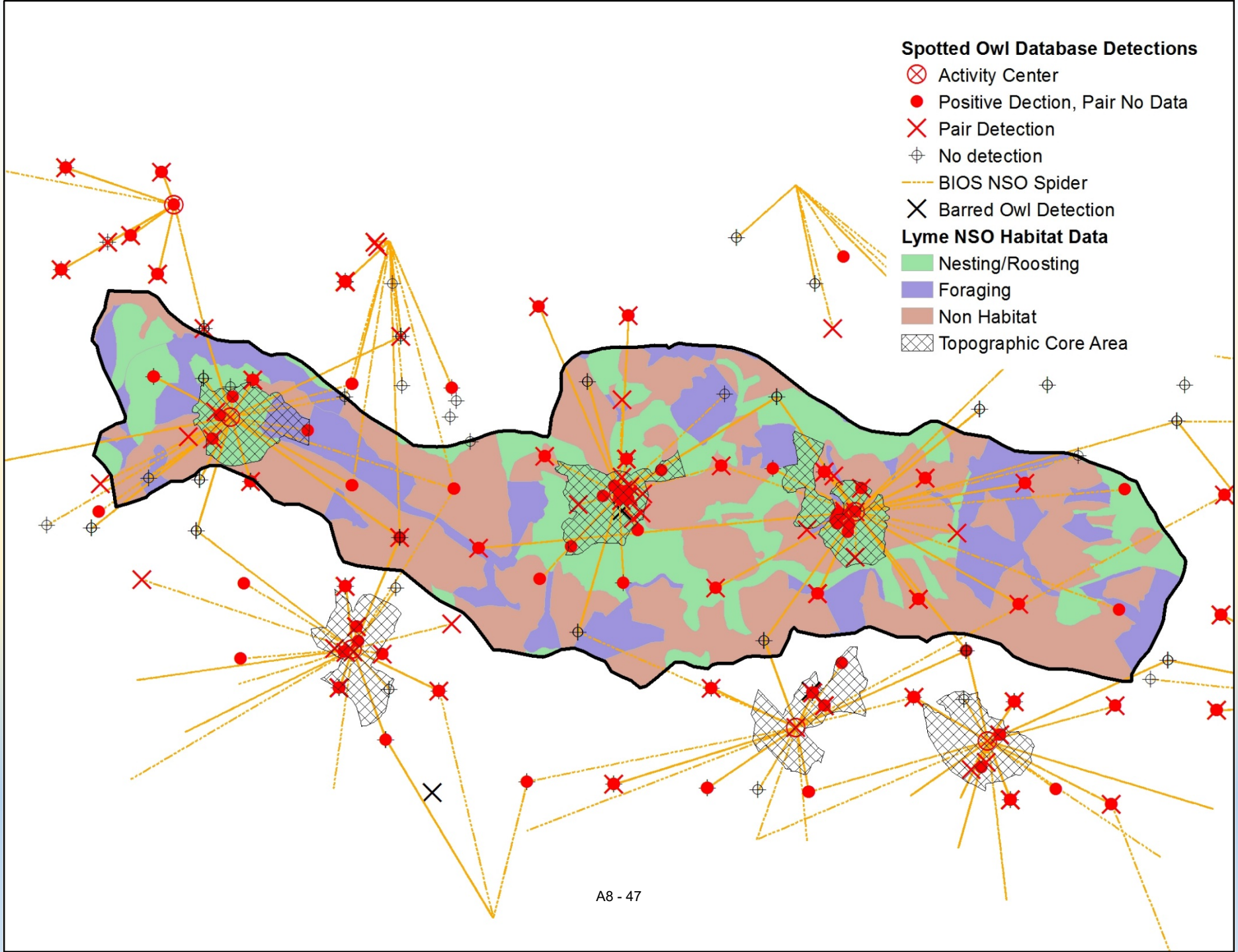
  Determines whether NSO are present within an AC territory

- Nesting Status

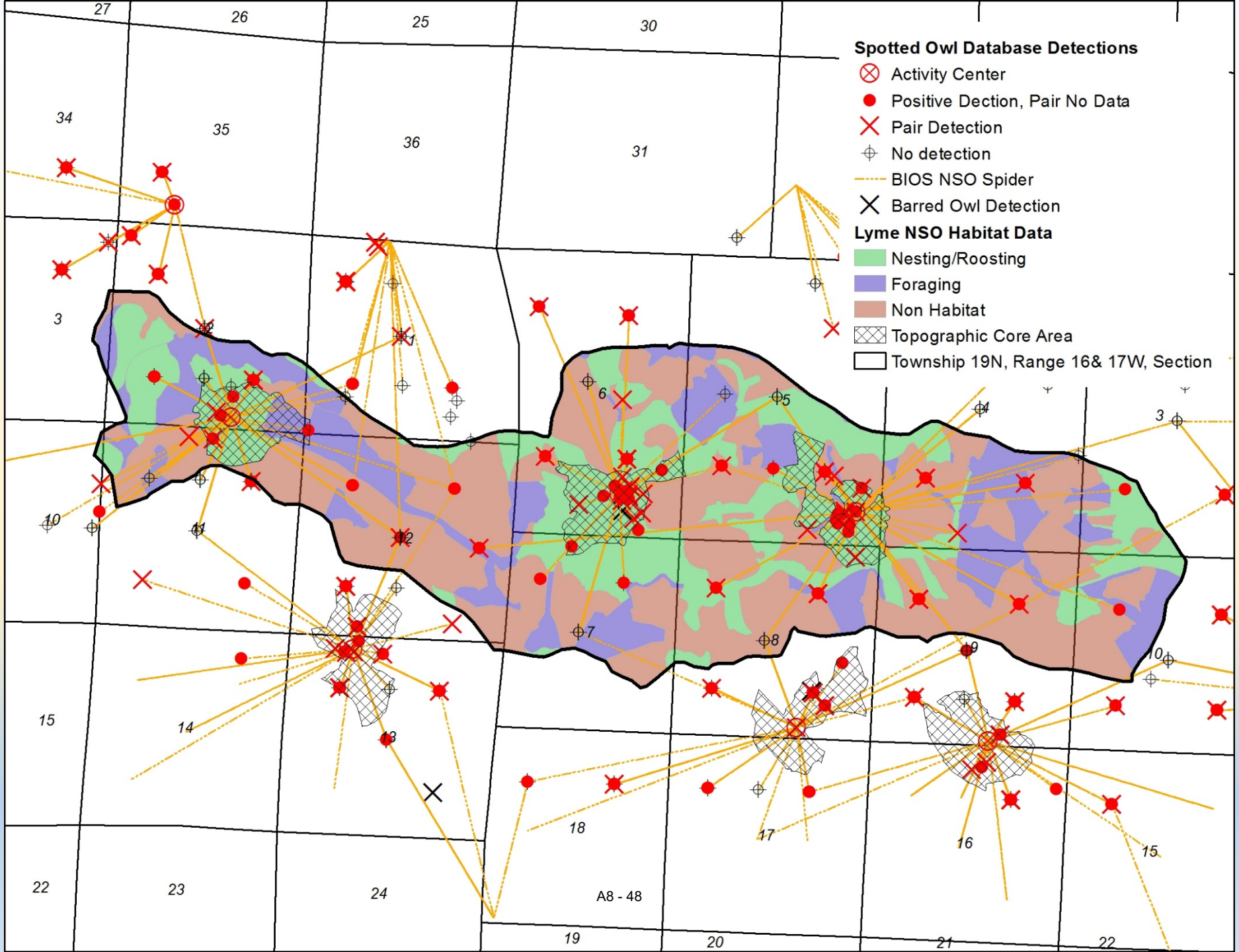
  Determines whether nesting is occurring in the breeding season surveyed for an AC with a positive occupancy determination

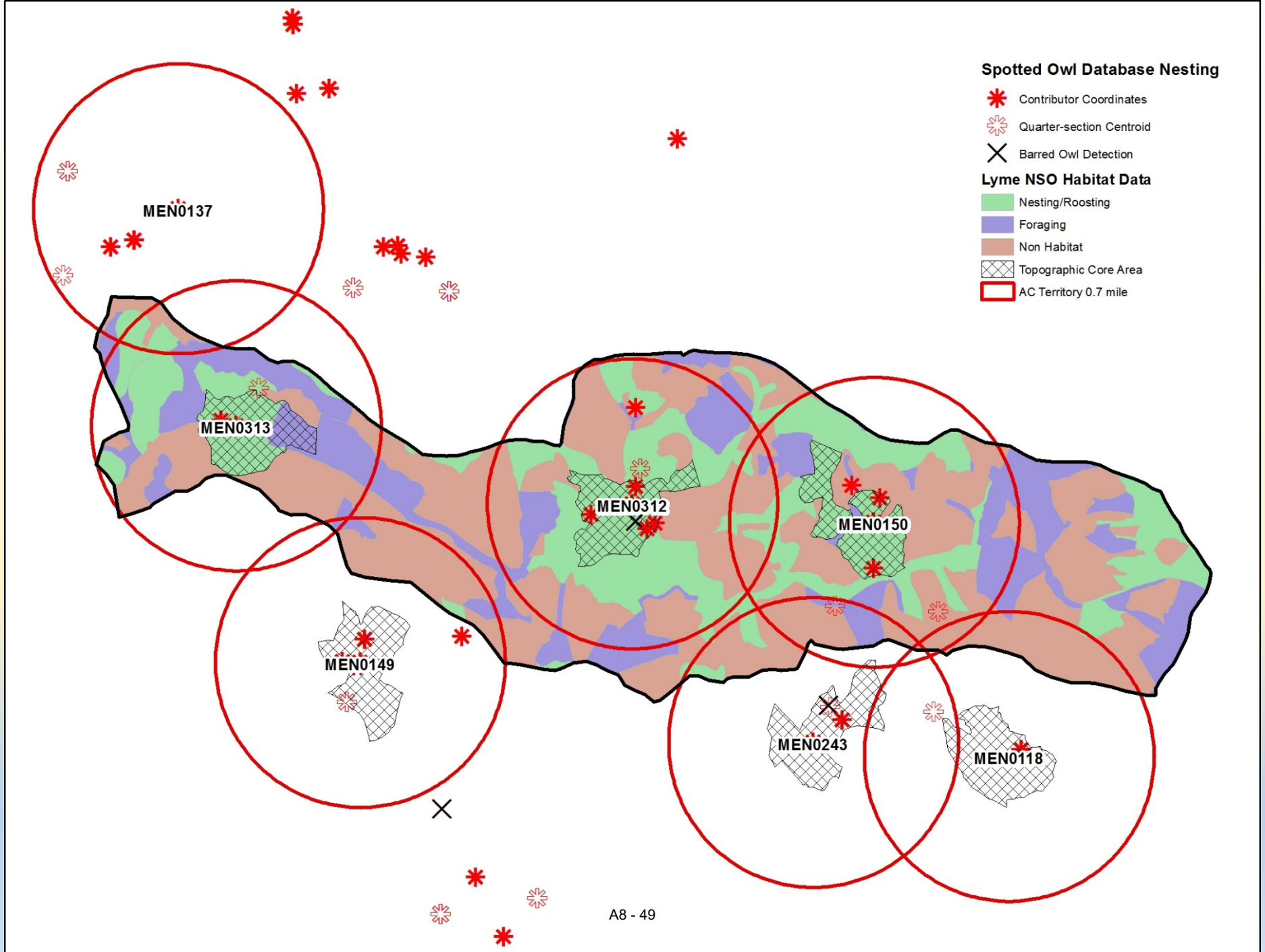
- Reproductive Status

  Determines the final outcome for a positive nesting determination

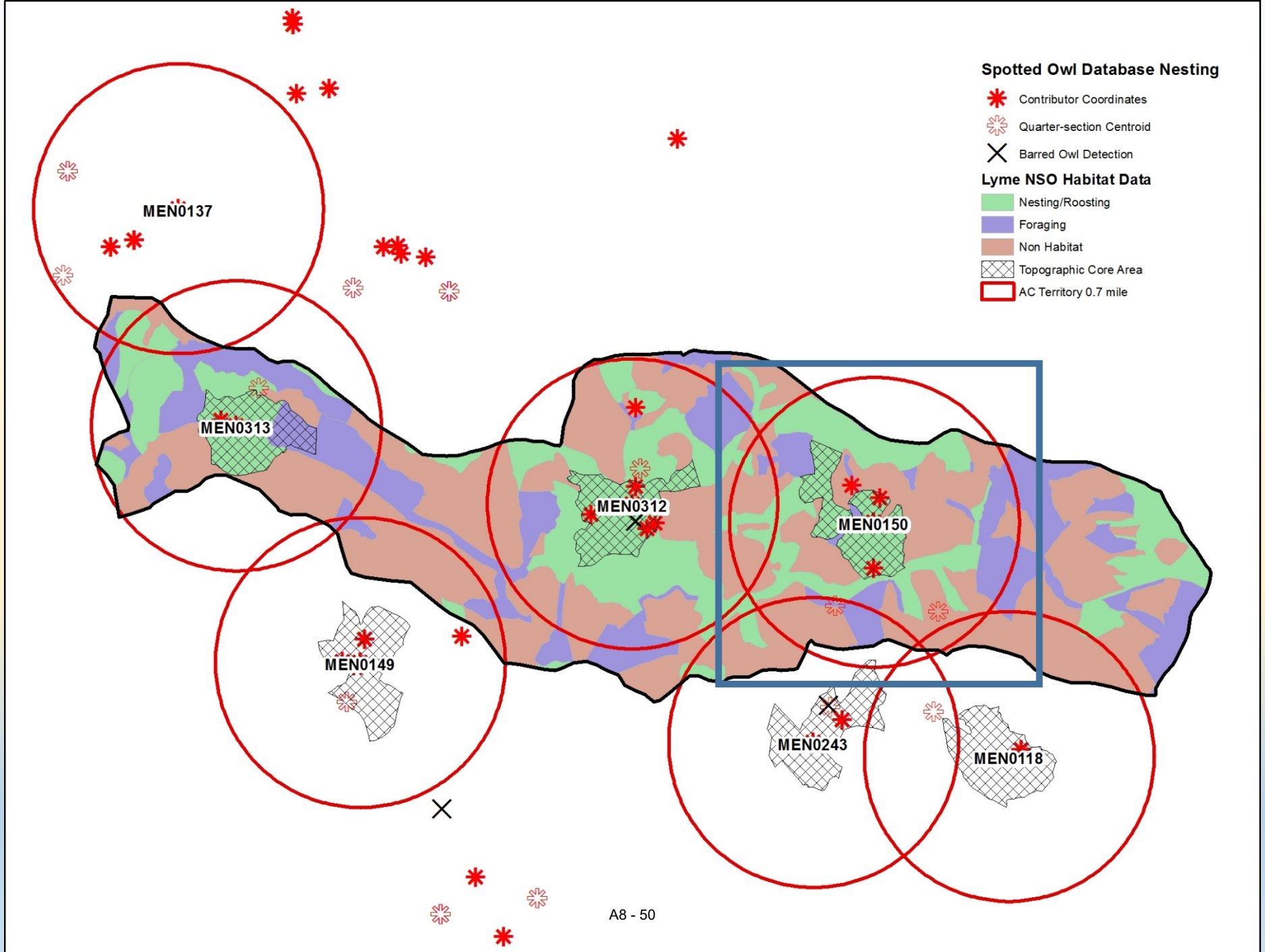

Spotted Owl Database Detections
Activity Center
Positive Dection, Pair No Data
Pair Detection
No detection
BIOS NSO Spider
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area

A8 - 47

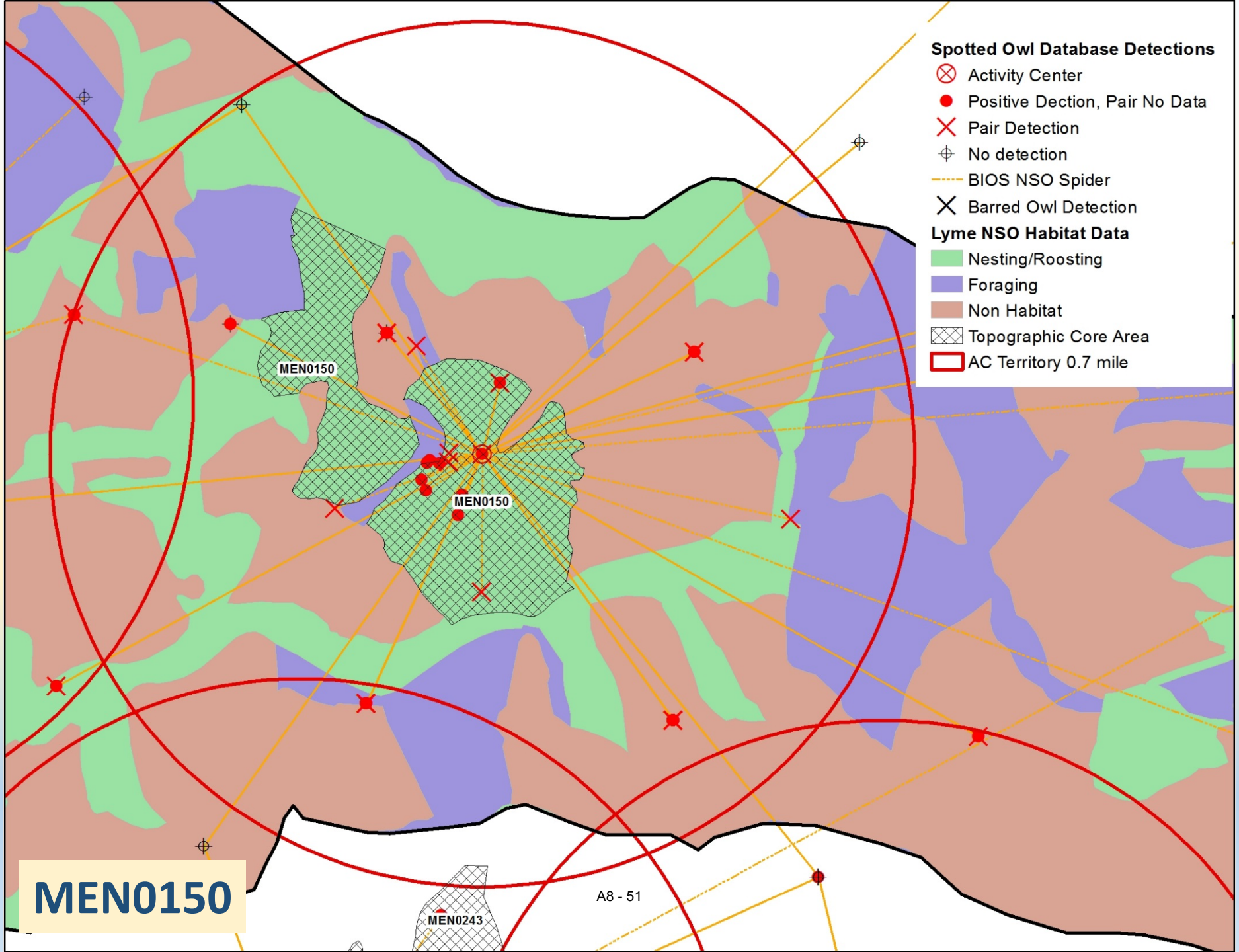

Spotted Owl Database Detections
Activity Center
Positive Dection, Pair No Data
Pair Detection
No detection
BIOS NSO Spider
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
Township 19N, Range 16& 17W, Section
A8 - 48


Spotted Owl Database Nesting
Contributor Coordinates
Quarter-section Centroid
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
MEN0137
MEN0313
MEN0312
MEN0150
MEN0149
MEN0243
MEN0118

A8 - 49

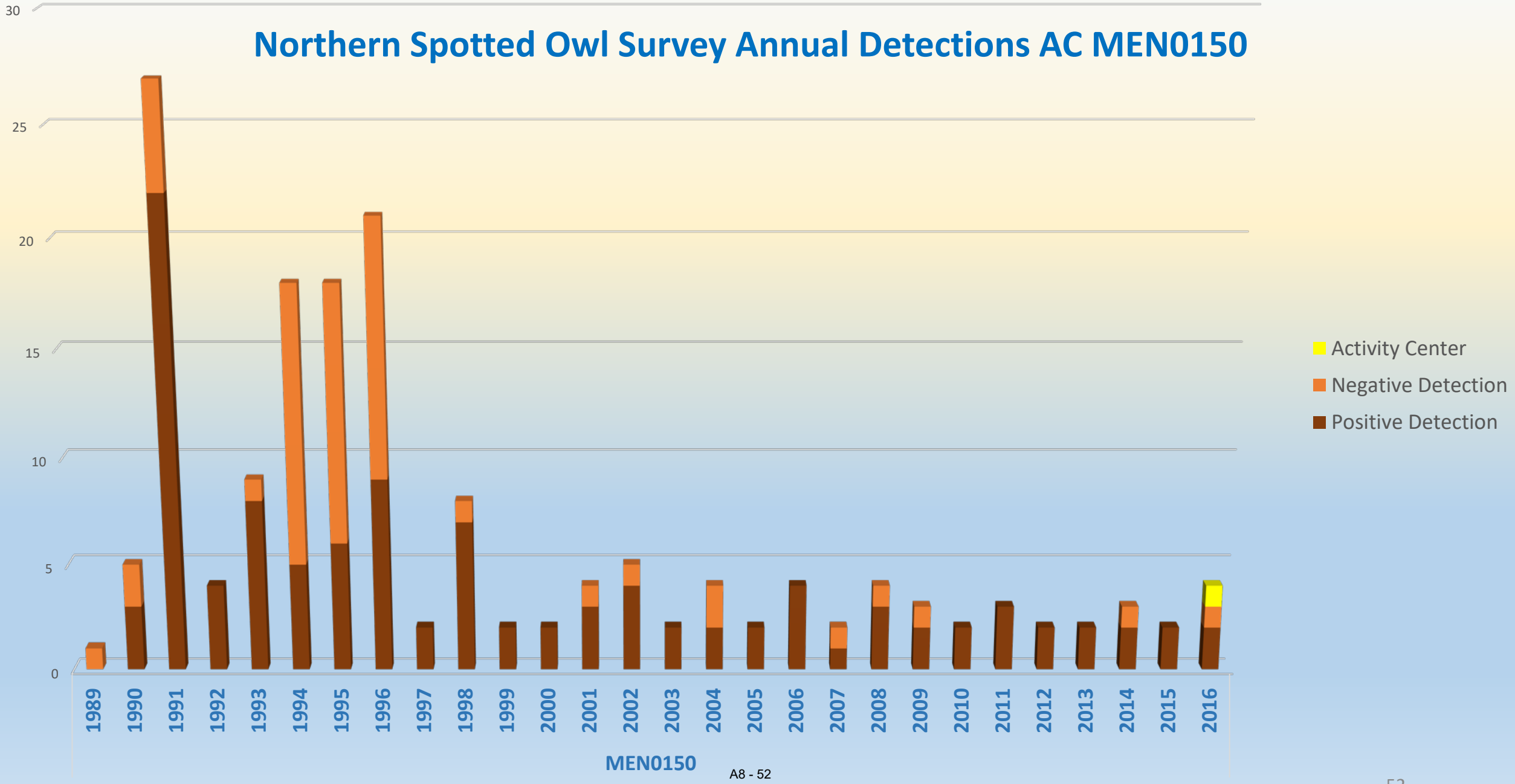

Spotted Owl Database Nesting
Contributor Coordinates
Quarter-section Centroid
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
MEN0137
MEN0313
MEN0312
MEN0150
MEN0149
MEN0243
MEN0118

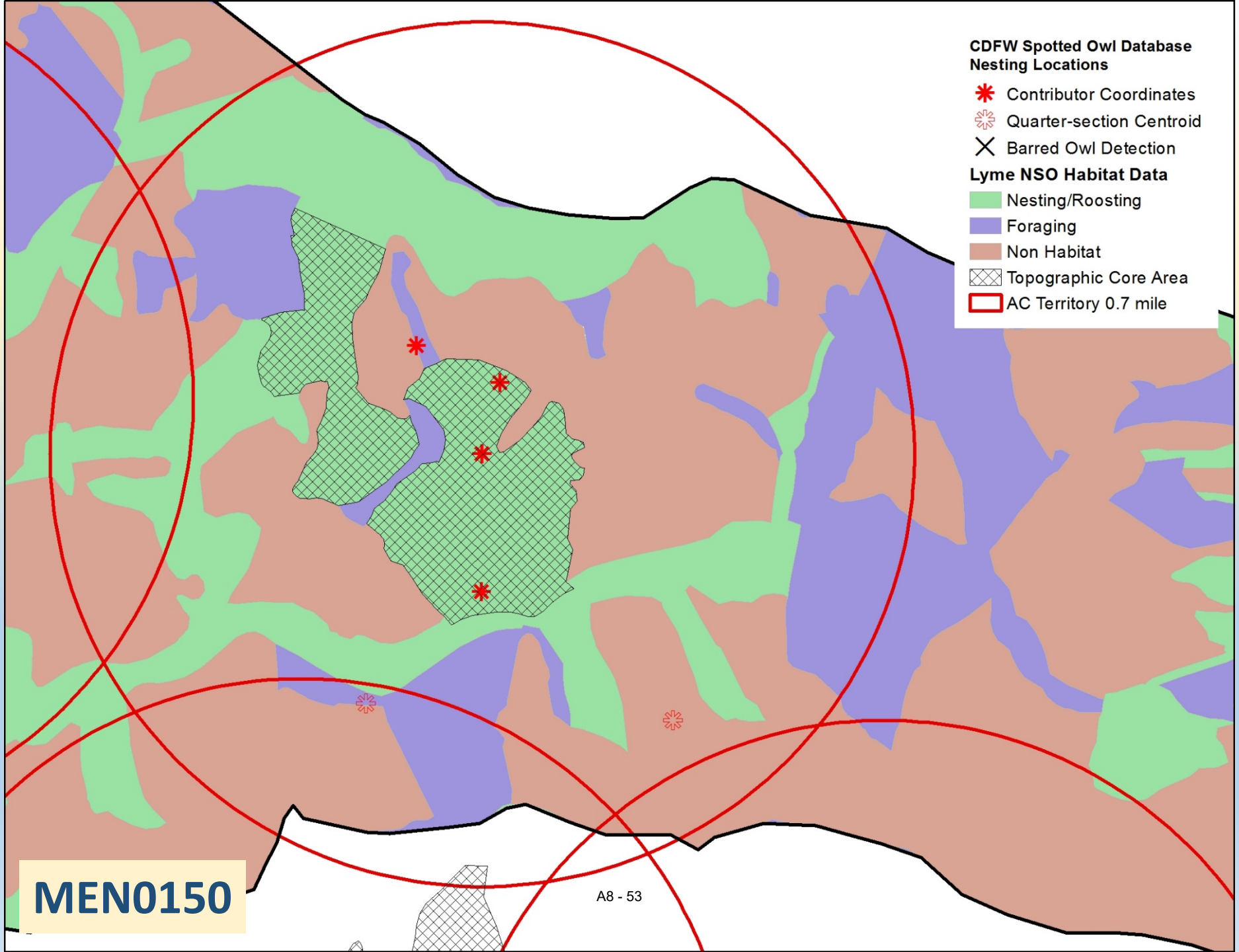
A8 - 50


Spotted Owl Database Detections
Activity Center
Positive Dection, Pair No Data
Pair Detection
No detection
BIOS NSO Spider
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
MEN0150
MEN0150
MEN0243
A8 - 51

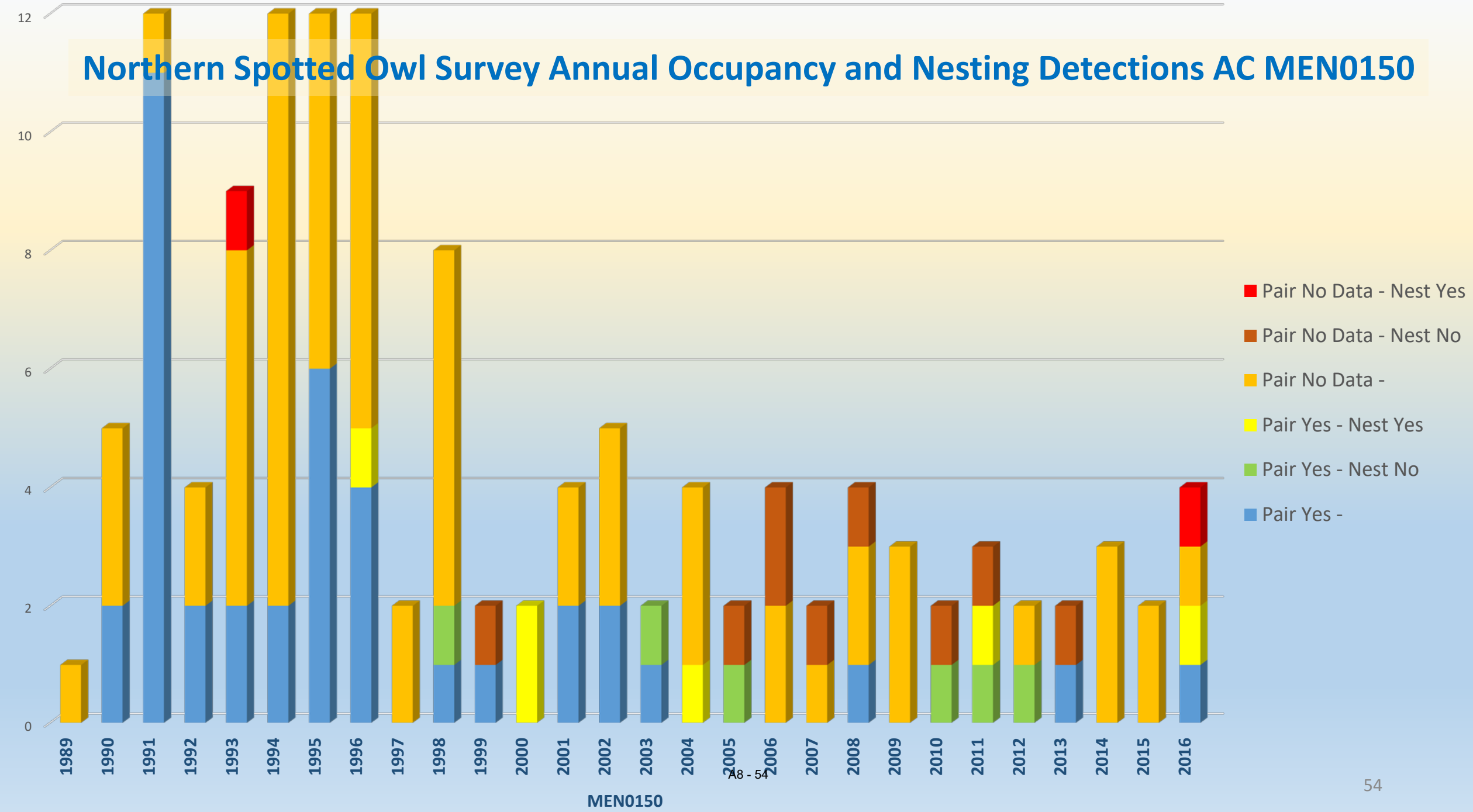
MEN0150

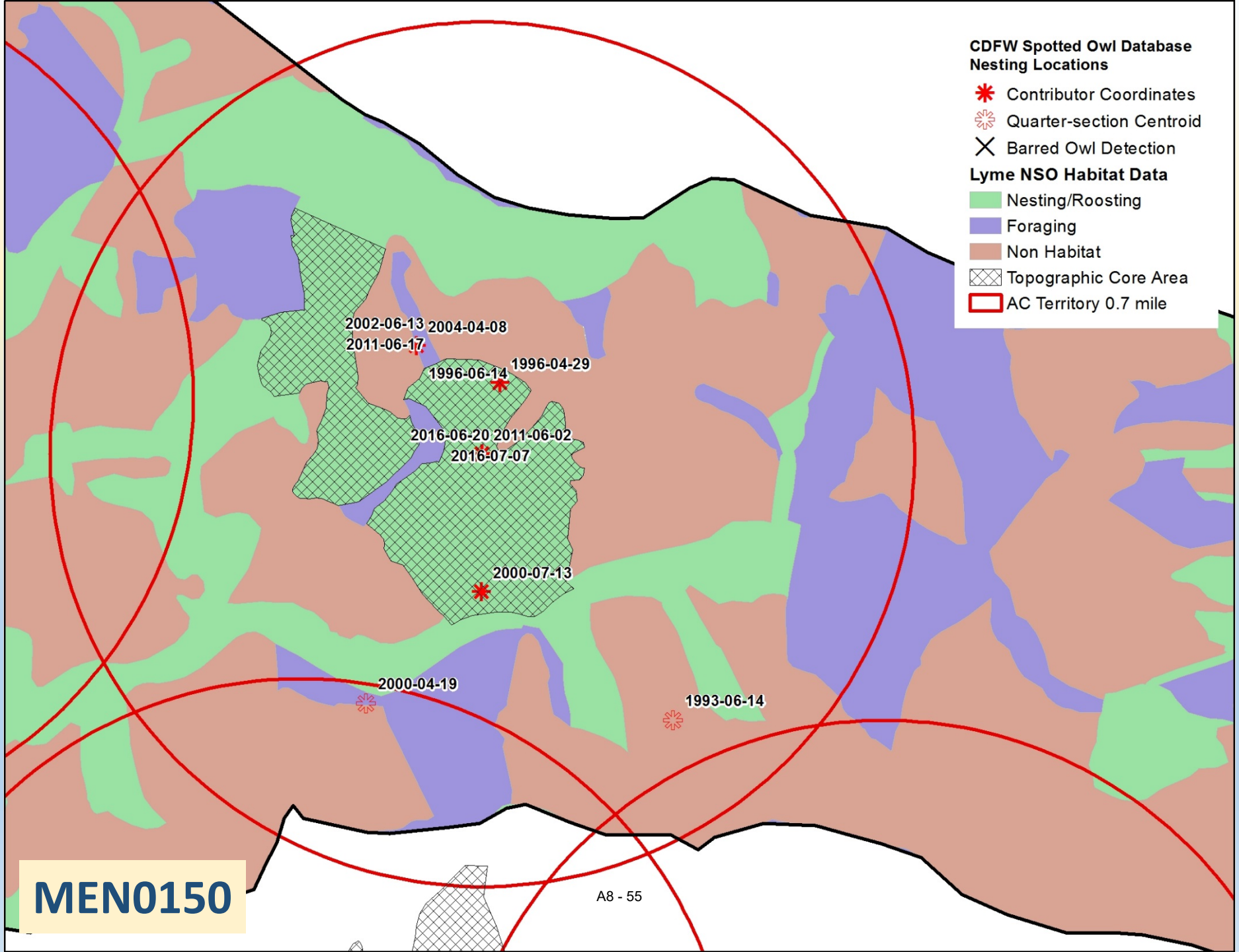
Northern Spotted Owl Survey Annual Detections AC MEN0150

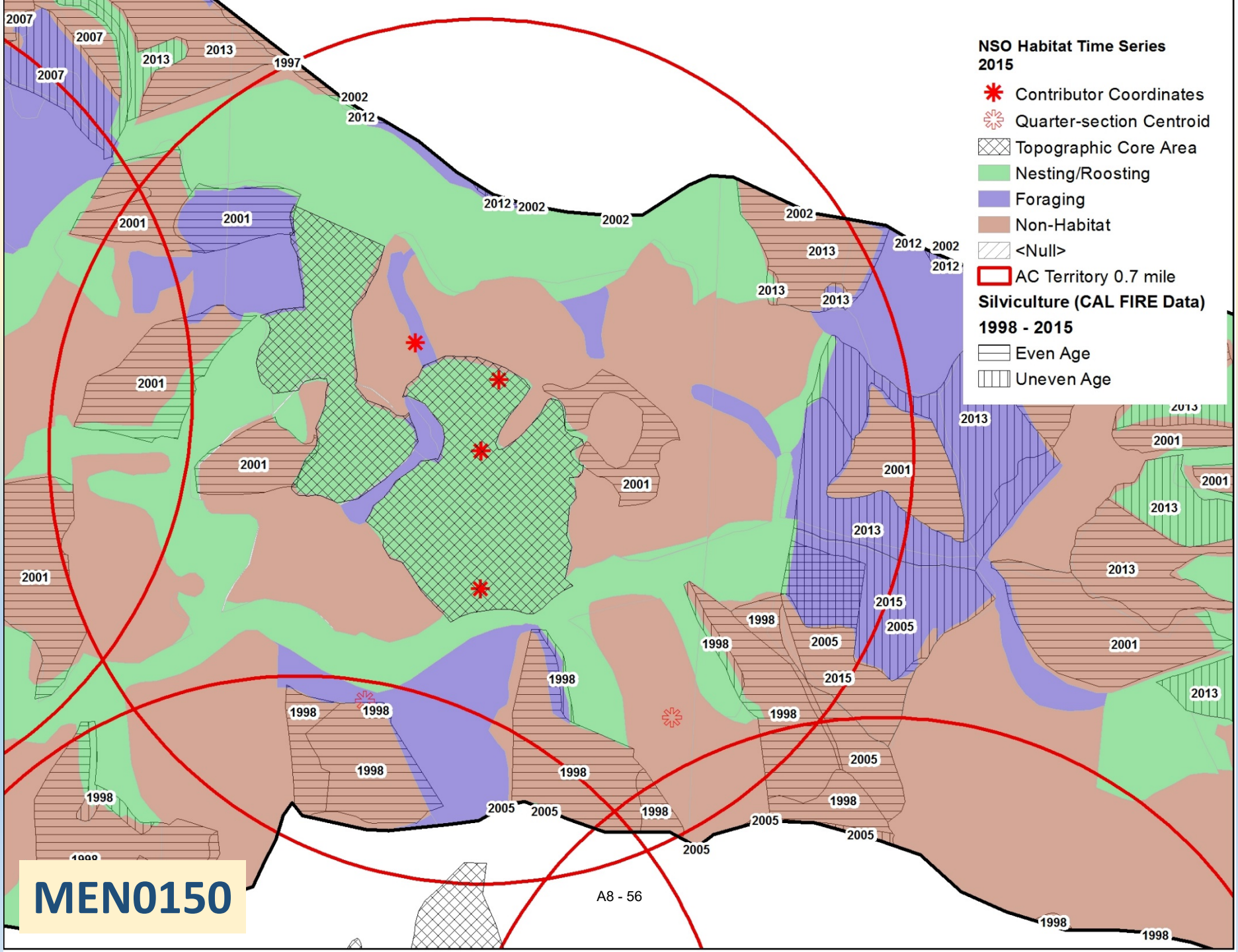


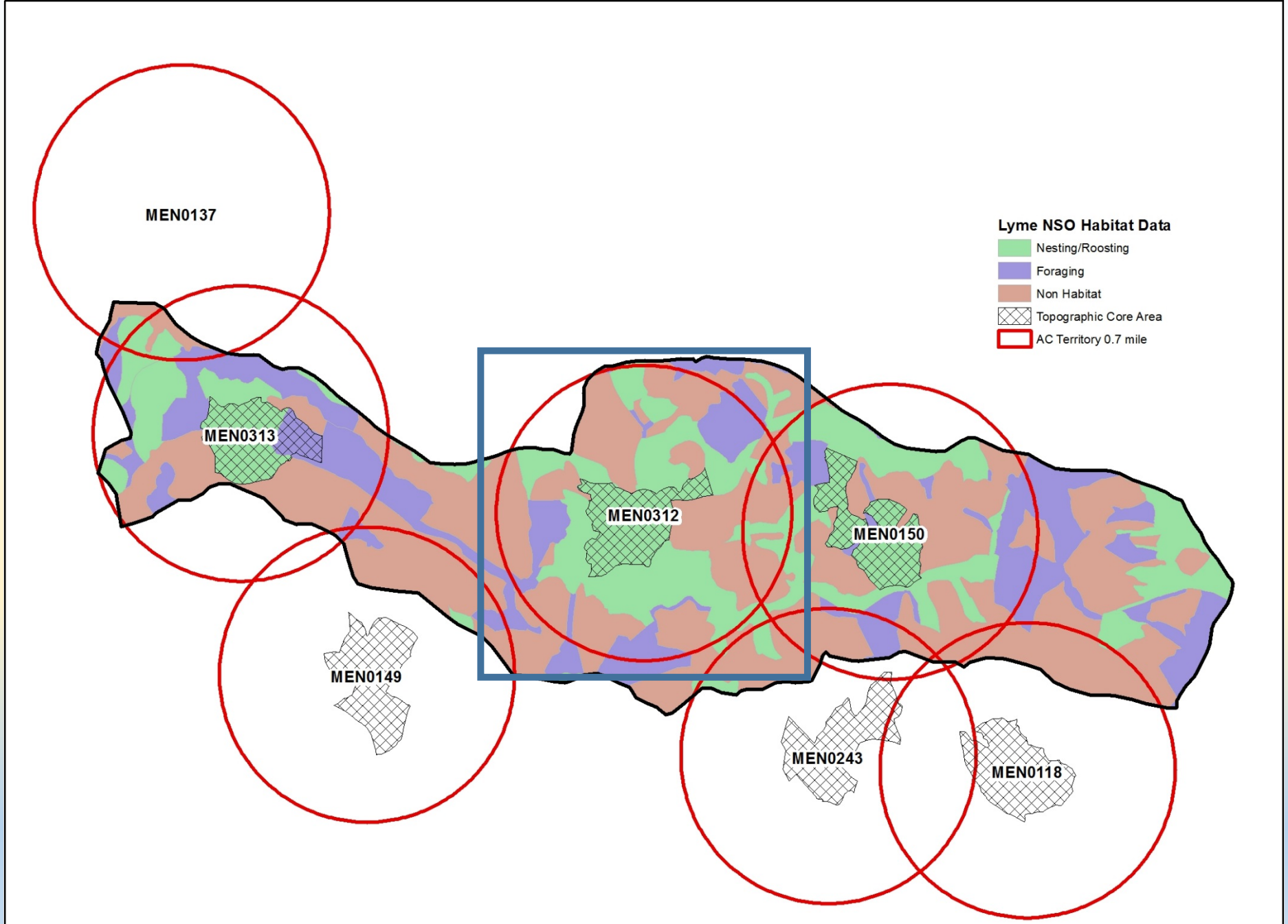

CDFW Spotted Owl Database
Nesting Locations
Contributor Coordinates
Quarter-section Centroid
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
MEN0150
A8 - 53

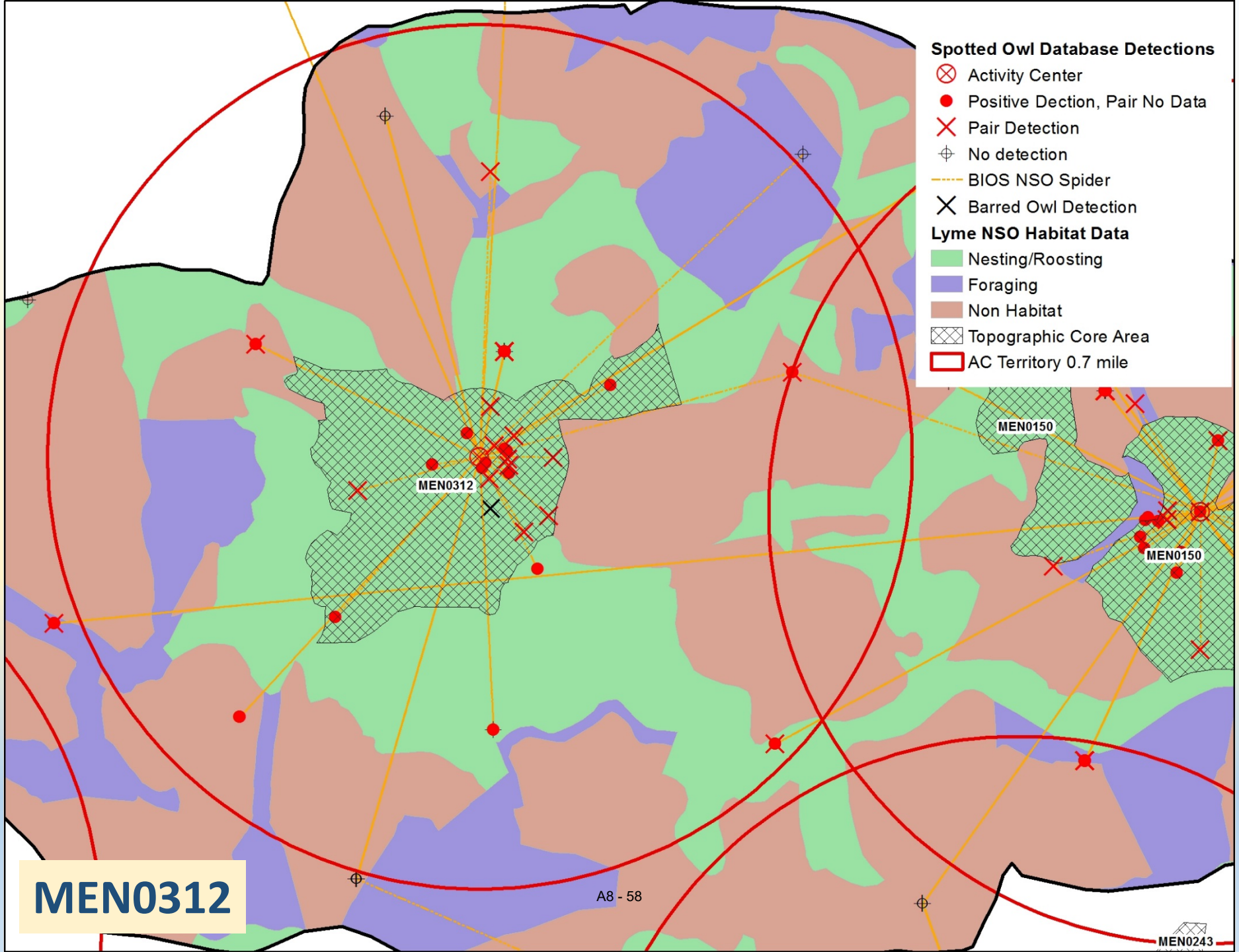
Northern Spotted Owl Survey Annual Occupancy and Nesting Detections AC MEN0150




CDFW Spotted Owl Database
Nesting Locations
Contributor Coordinates
Quarter-section Centroid
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
2002-06-13
2004-04-08
2011-06-17
1996-04-29
1996-06-14
2016-06-20
2011-06-02
2016-07-07
2000-07-13
2000-04-19
1993-06-14
MEN0150
A8 - 55

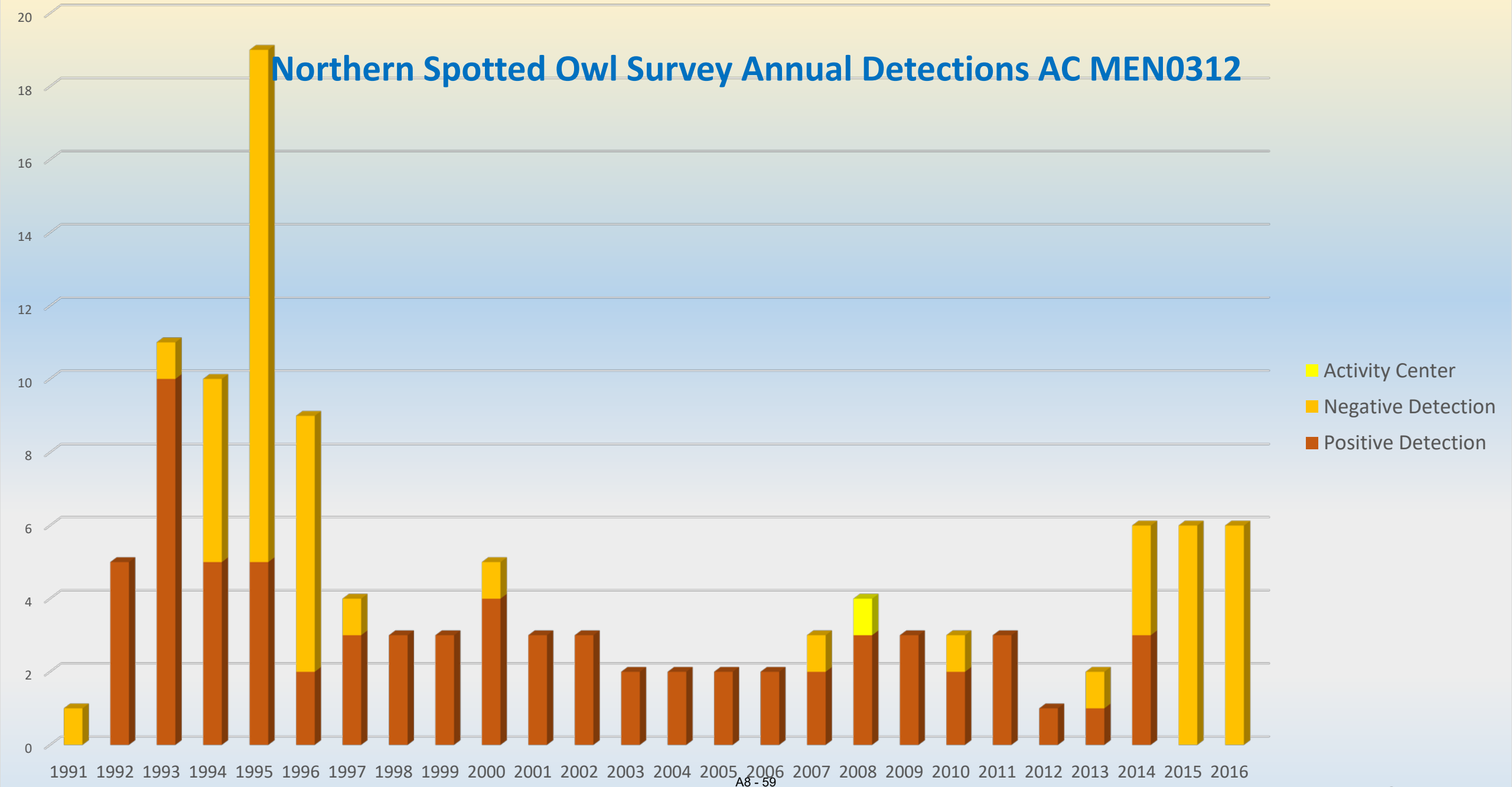

NSO Habitat Time Series
2015
Contributor Coordinates
Quarter-section Centroid
Topographic Core Area
Nesting/Roosting
Foraging
Non-Habitat
<Null>
AC Territory 0.7 mile
Silviculture (CAL FIRE Data)
1998 - 2015
Even Age
Uneven Age
MEN0150
A8 - 56


MEN0137
MEN0313
MEN0312
MEN0150
MEN0149
MEN0243
MEN0118
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile


Spotted Owl Database Detections
Activity Center
Positive Dection, Pair No Data
Pair Detection
No detection
BIOS NSO Spider
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
MEN0312
MEN0150
MEN0150
MEN0243
A8 - 58

MEN0312

Northern Spotted Owl Survey Annual Detections AC MEN0312



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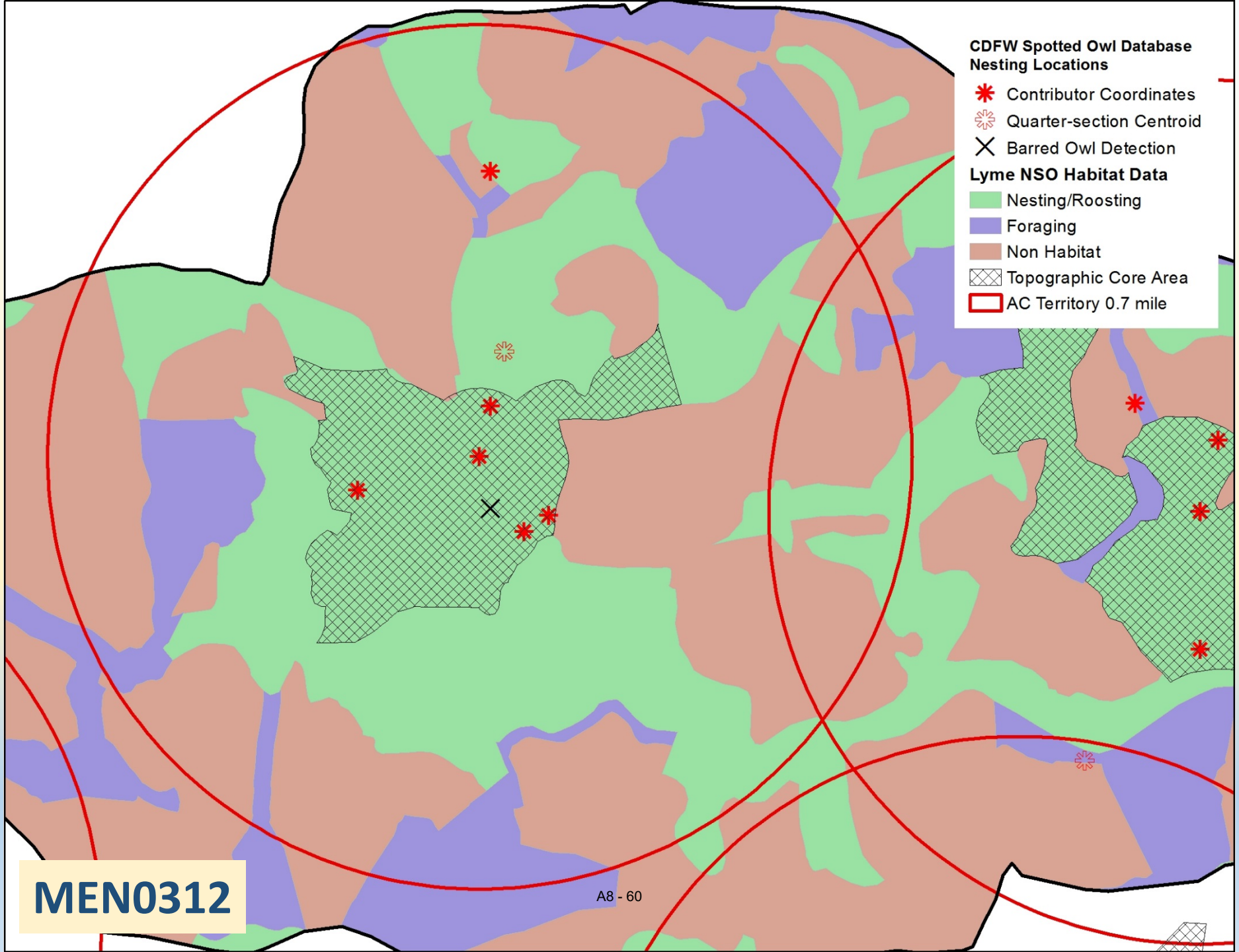
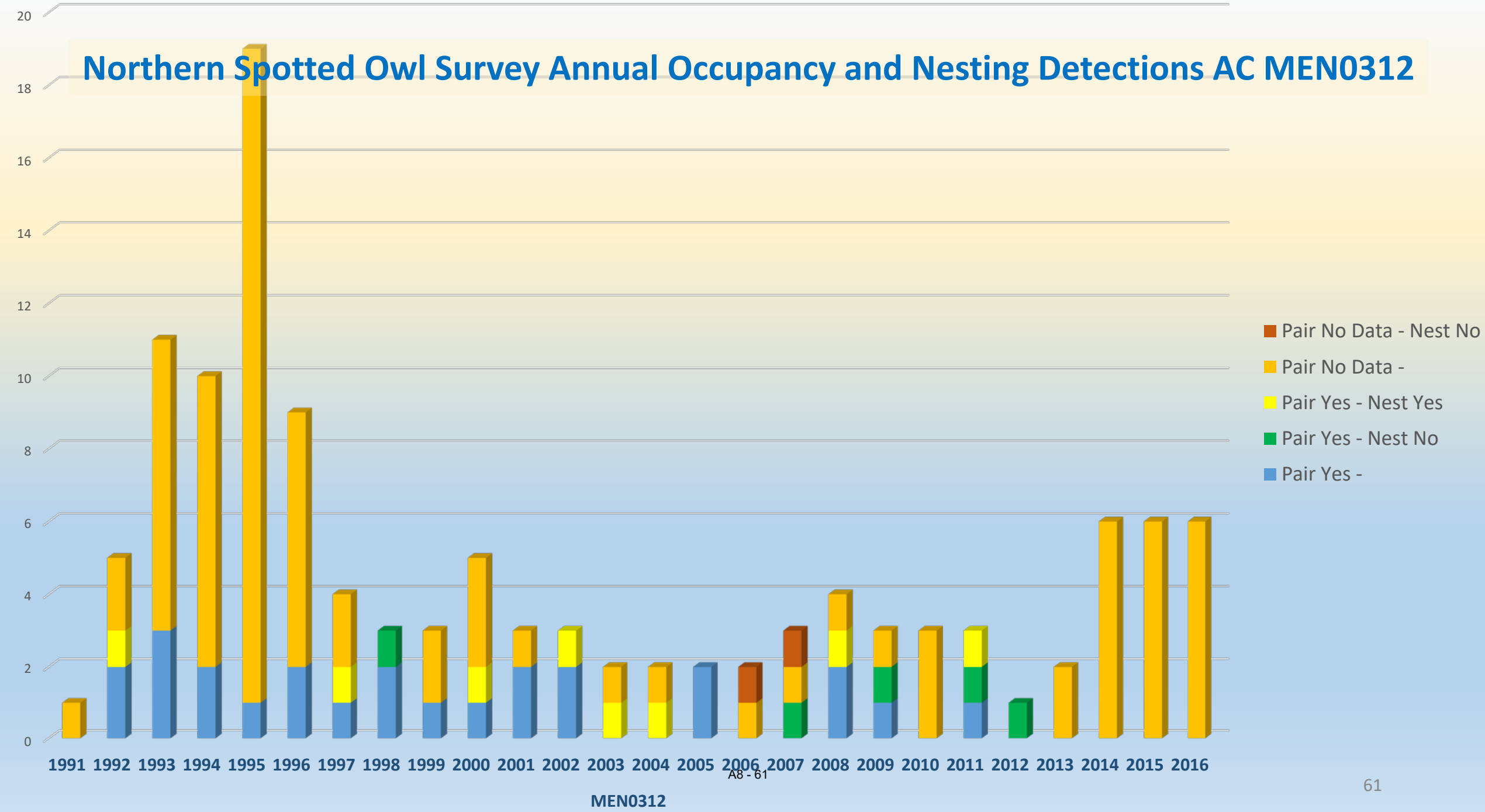
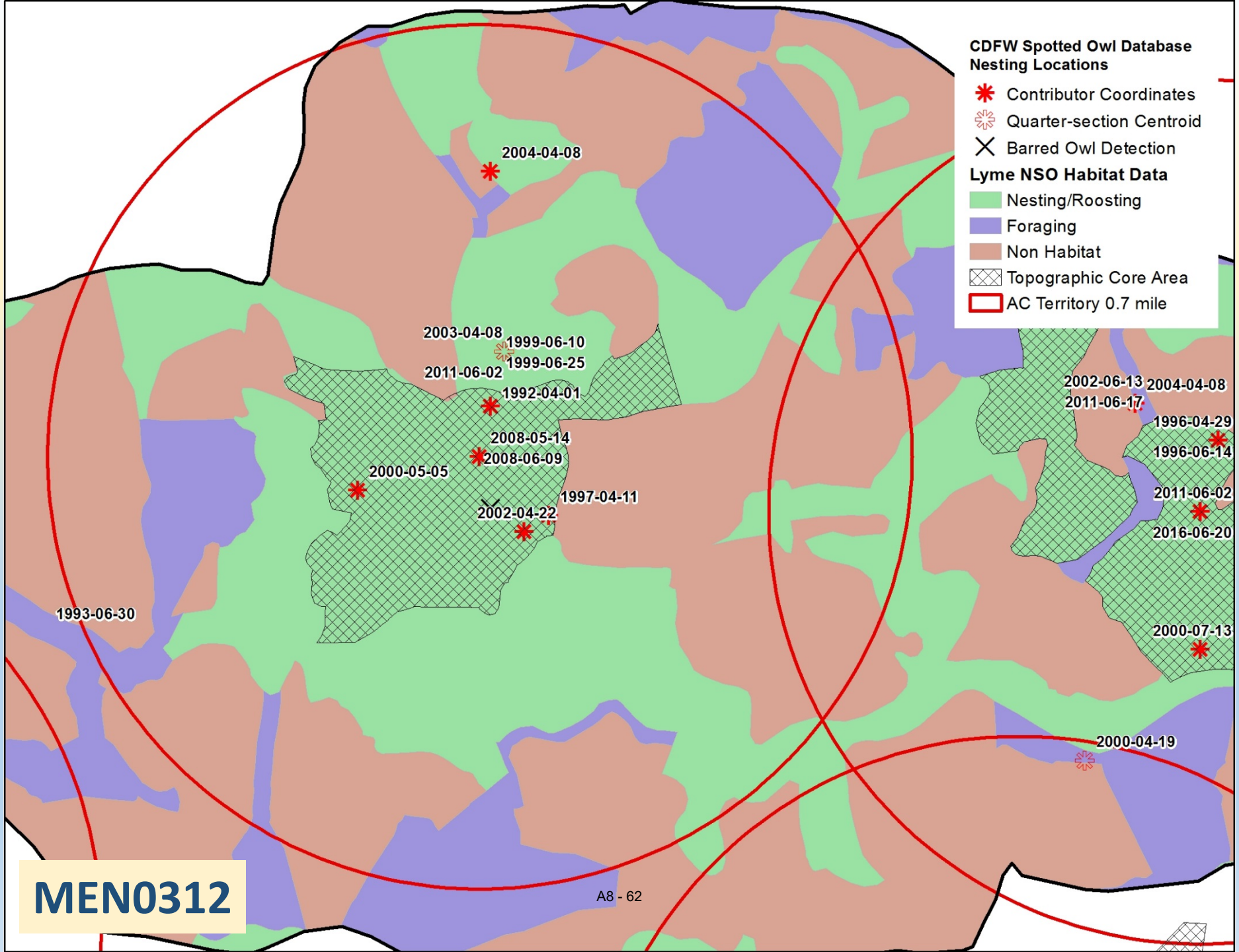

CDFW Spotted Owl Database
Nesting Locations
Contributor Coordinates
Quarter-section Centroid
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
MEN0312
A8 - 60

Northern Spotted Owl Survey Annual Occupancy and Nesting Detections AC MEN0312




CDFW Spotted Owl Database
Nesting Locations
Contributor Coordinates
Quarter-section Centroid
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
2004-04-08
2003-04-08
1999-06-10
1999-06-25
2011-06-02
1992-04-01
2008-05-14
2008-06-09
2000-05-05
1997-04-11
2002-04-22
1993-06-30
2002-06-13
2004-04-08
2011-06-17
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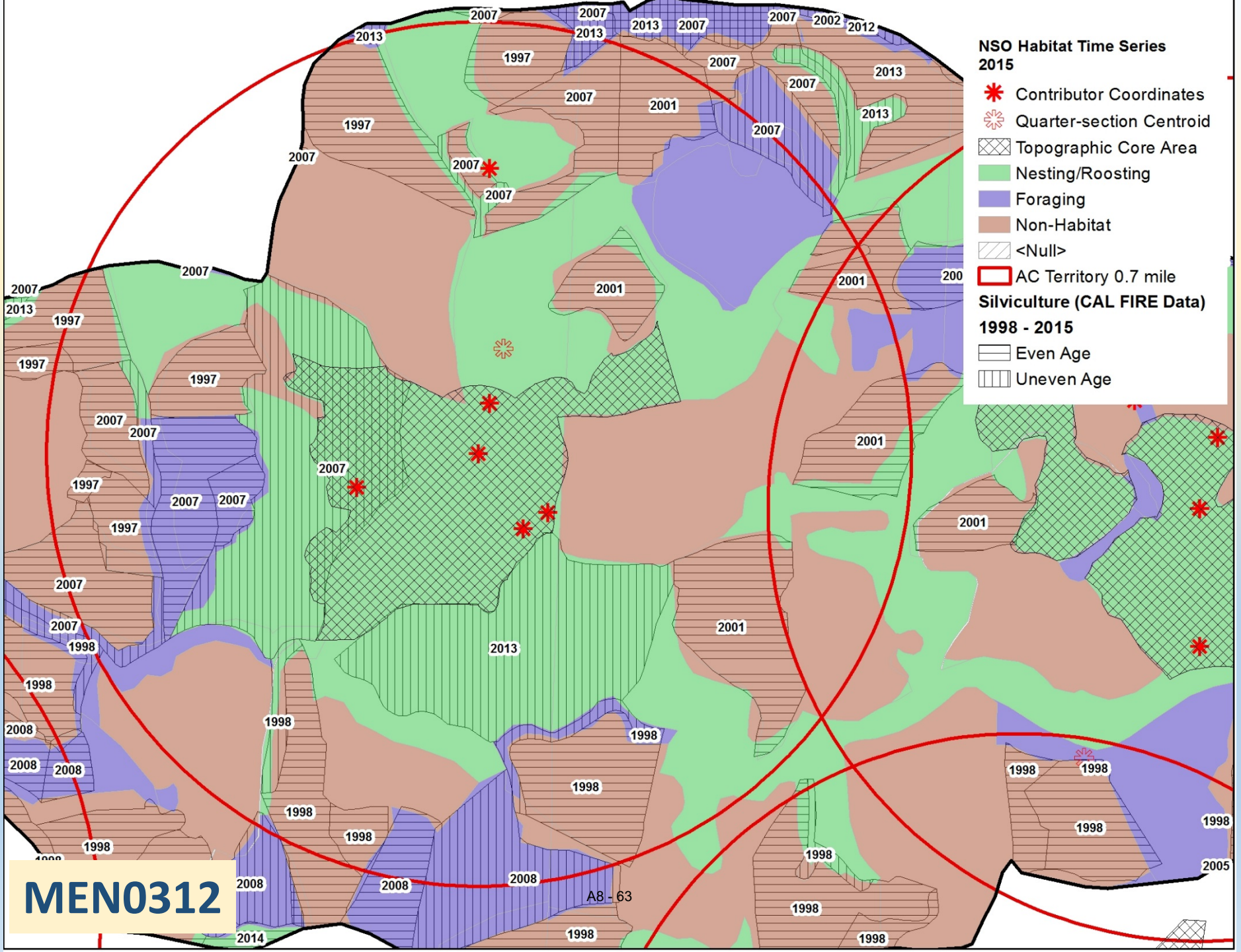
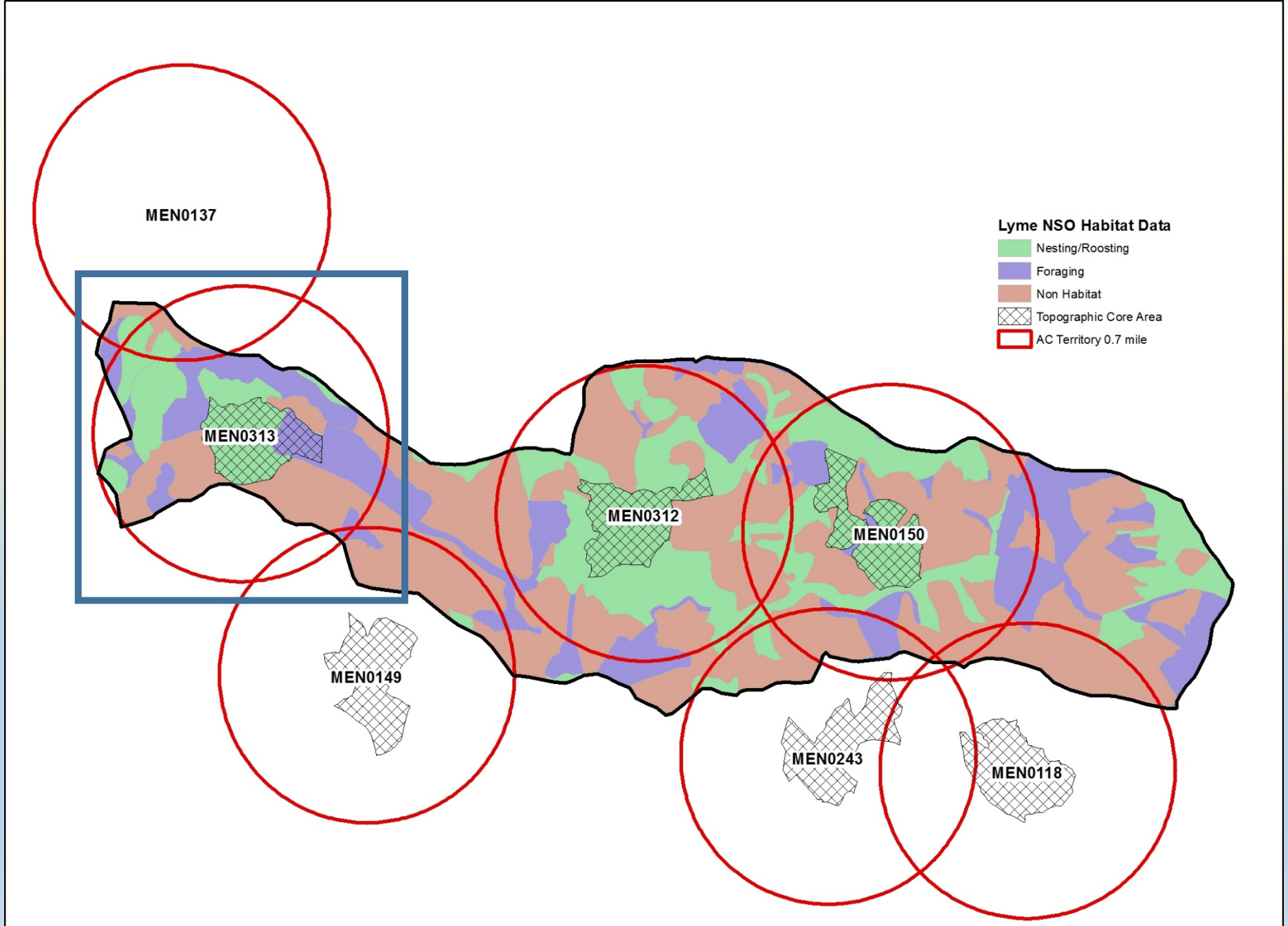
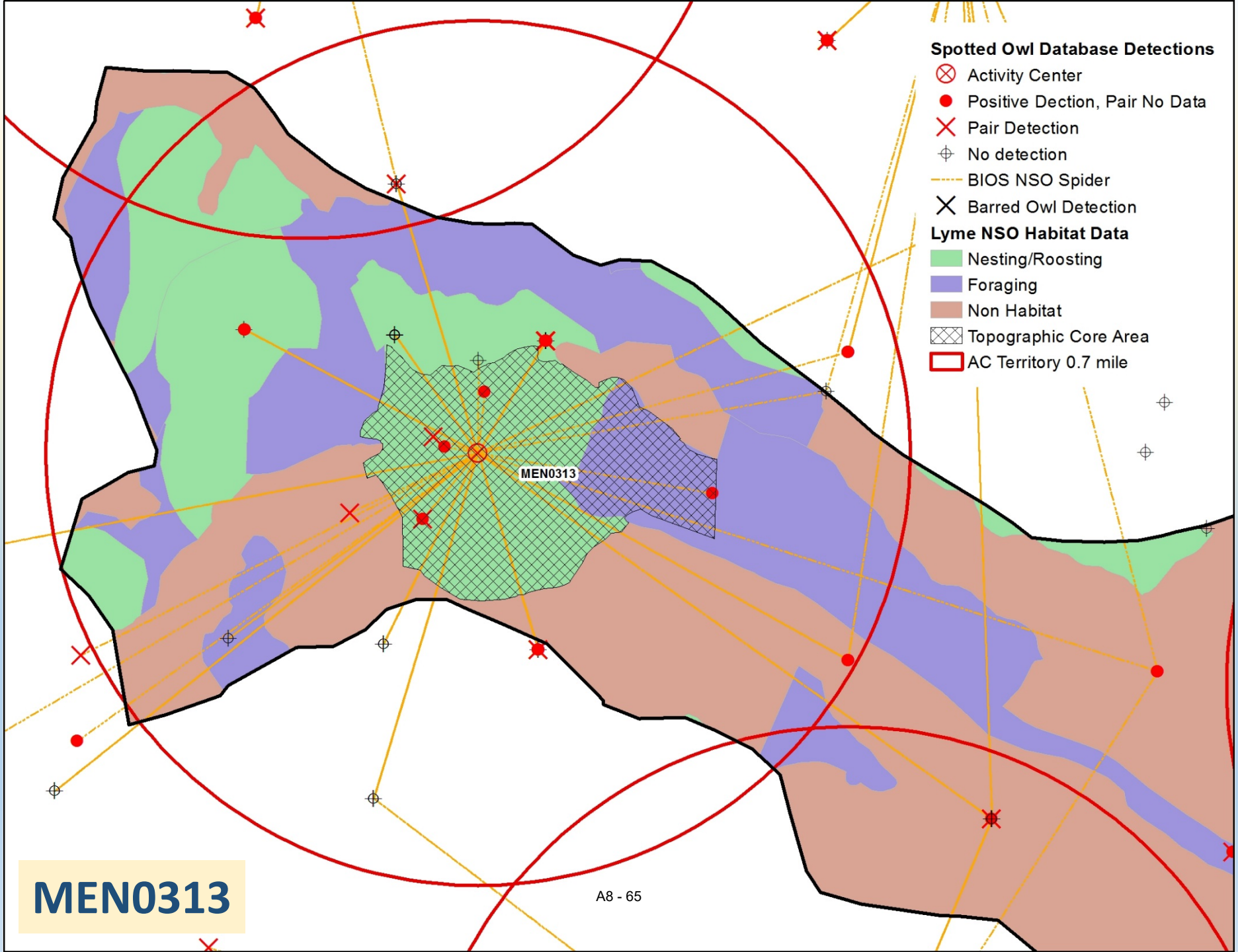
1996-06-14
2011-06-02
2016-06-20
2000-07-13
2000-04-19
MEN0312
A8 - 62


NSO Habitat Time Series
2015
Contributor Coordinates
Quarter-section Centroid
Topographic Core Area
Nesting/Roosting
Foraging
Non-Habitat
<Null>
AC Territory 0.7 mile
Silviculture (CAL FIRE Data)
1998 - 2015
Even Age
Uneven Age
MEN0312
A8 - 63

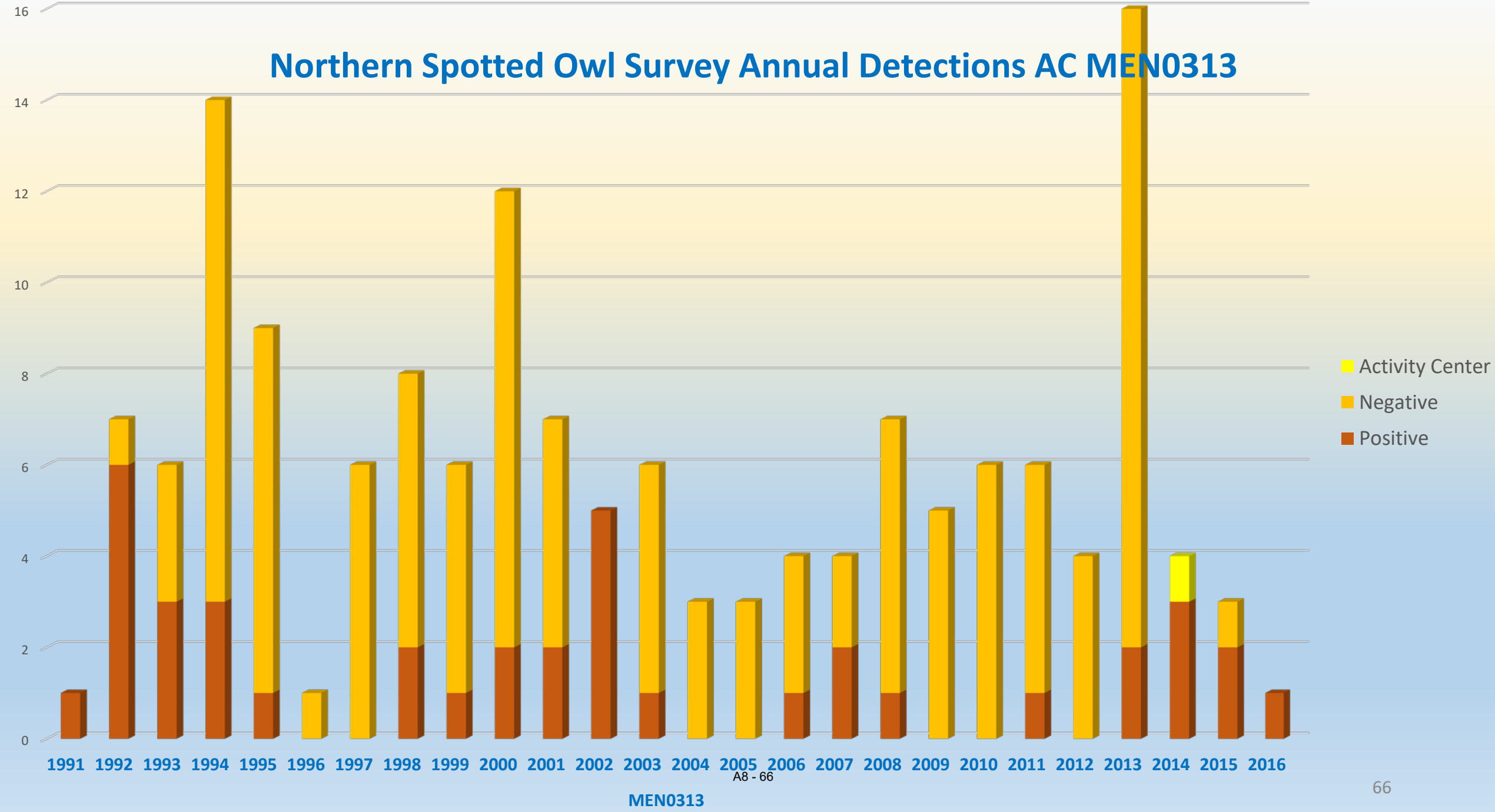

MEN0137
MEN0313
MEN0312
MEN0150
MEN0149
MEN0243
MEN0118
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile

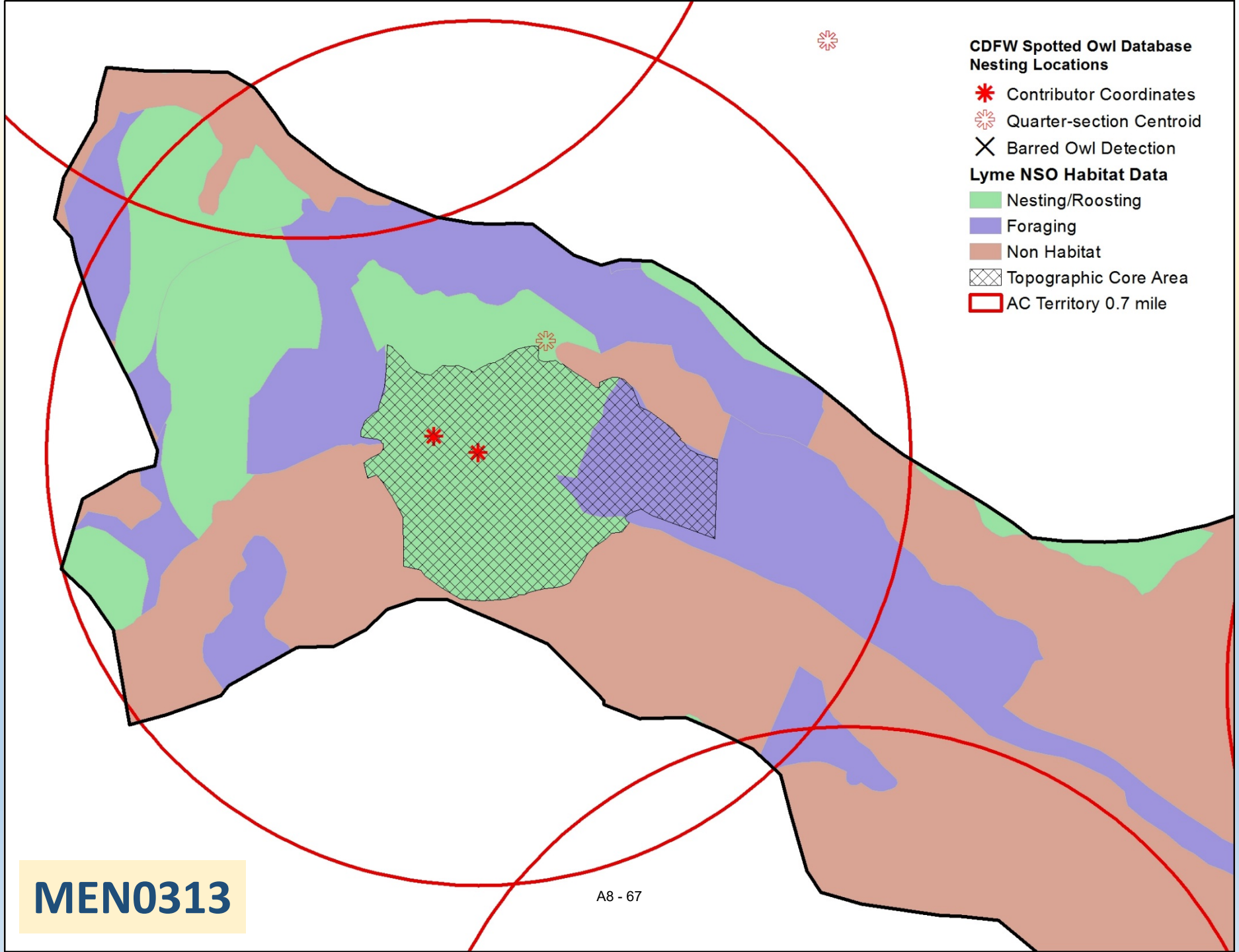


MEN0313

A8 - 65

Northern Spotted Owl Survey Annual Detections AC MEN0313

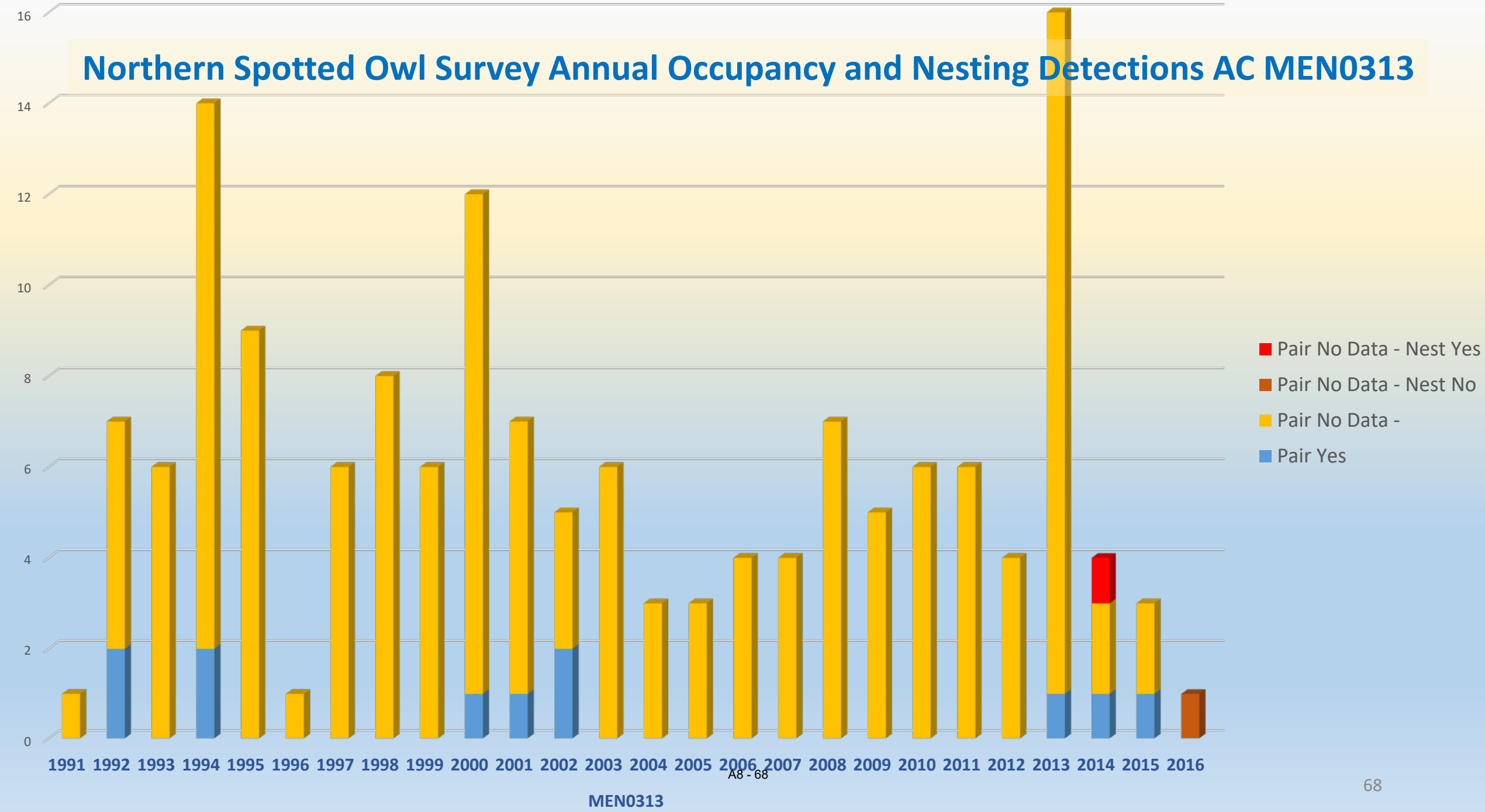


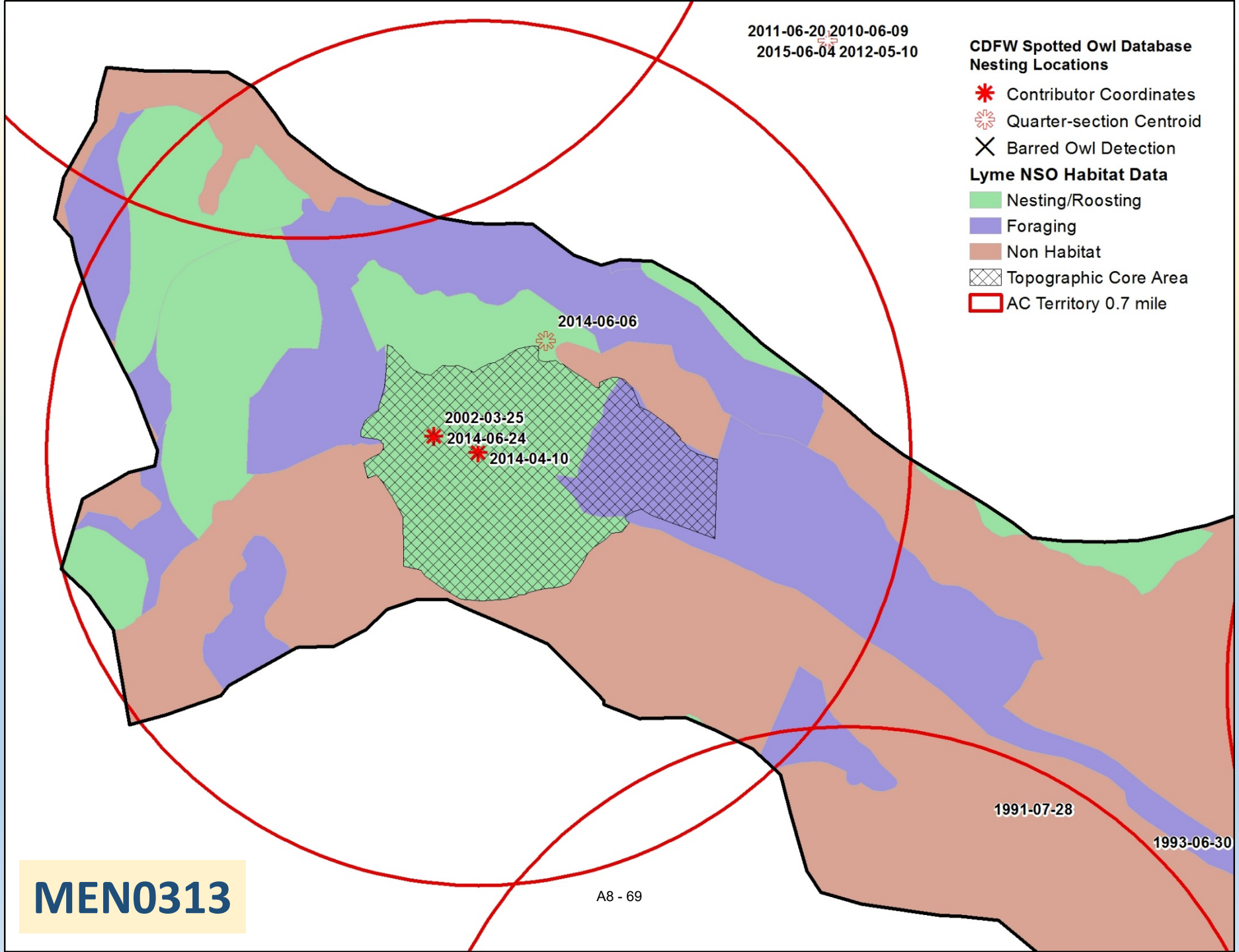


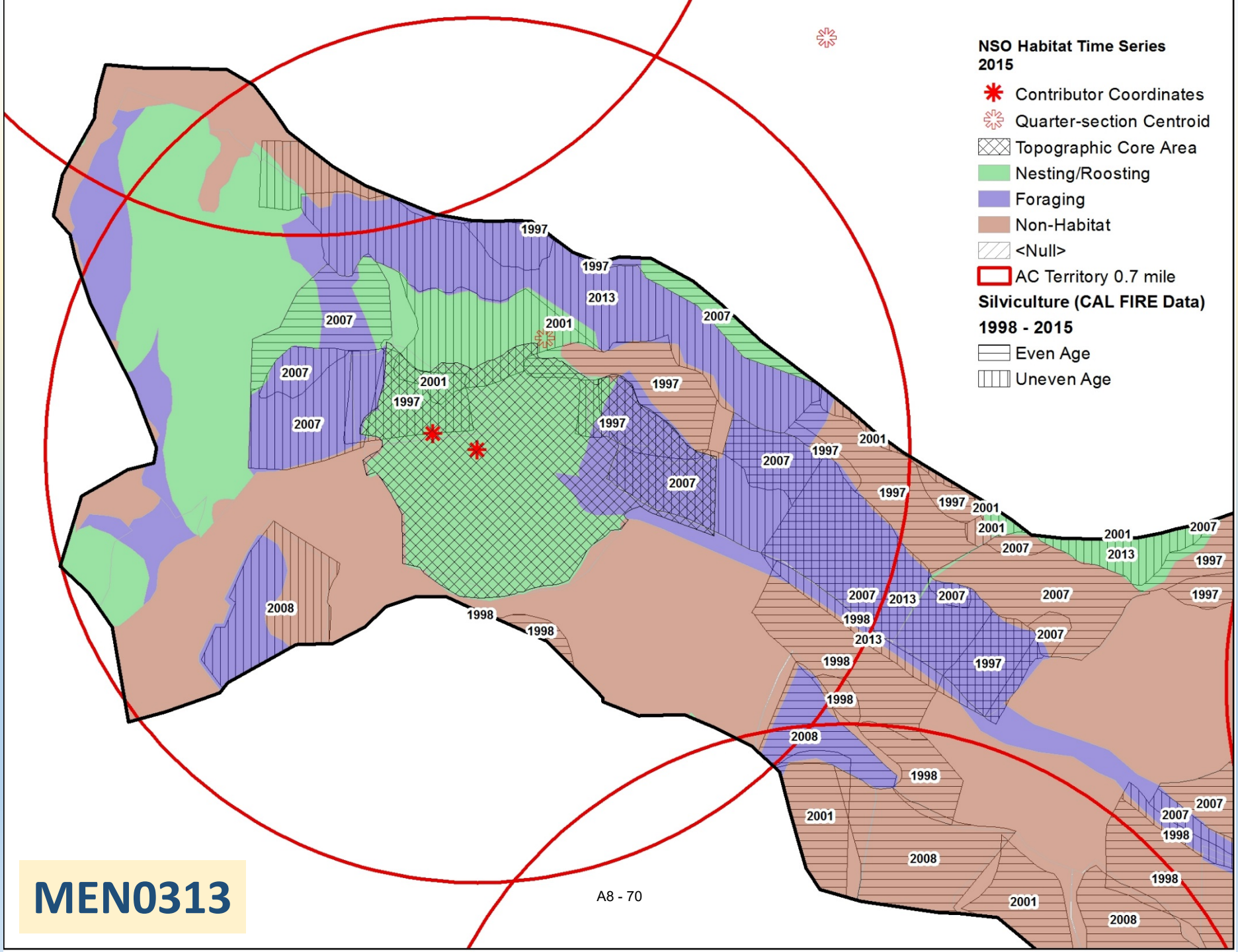
MEN0313

A8 - 67

Northern Spotted Owl Survey Annual Occupancy and Nesting Detections AC MEN0313




2011-06-20
2010-06-09
2015-06-04
2012-05-10
CDFW Spotted Owl Database
Nesting Locations
Contributor Coordinates
Quarter-section Centroid
Barred Owl Detection
Lyme NSO Habitat Data
Nesting/Roosting
Foraging
Non Habitat
Topographic Core Area
AC Territory 0.7 mile
2014-06-06
2002-03-25
2014-06-24
2014-04-10
1991-07-28
1993-06-30
MEN0313
A8 - 69



MEN0313

A8 - 70

NSO Resource Conclusions

- Lots of spatial and tabular data available
- Spatial data is at varying levels of resolution and accuracy (plotted from maps, coordinate data, and quarter-section centroid (center of a 160 acre square).
- Stand data is not always consistent in polygon shape and habitat typing from THP to THP across years
- Data generated to facilitate management objectives, does not necessarily support robust statistical study
- BIOS Spotted Owl database not designed to support analysis of nesting and/or reproductive trends and does not facilitate reliable calculation of productivity, fecundity (# of female young produced per adult female), or survival.
- Habitat typing based on minimum functional habitat definitions, vs. ranking of habitat quality (habitats modeled to have result in higher productivity, fecundity, and survival).

Higher quality NSO habitat

Overall, Northern Spotted Owls require some minimum level of **old forest within their core area and broader home range to optimize survival and reproductive output**. It is also apparent that **older forest mixed with other forest types excluding non-habitat)** benefits Northern Spotted Owl fitness in California and southern Oregon, at least partially due to the increased **foraging opportunities along transitional edges**. In spite of inconsistencies in methods used and minor differences in amount of old forest and edge that provide the highest habitat fitness for owls, the literature points to the benefits of a **mosaic of forest types that contain sufficient older forest, especially around the core area, while limiting the amount of nonhabitat in the home range**. Based on the studies in the Northern Spotted Owl range in California and southern Oregon, management that maximizes late-seral forest in the core area (at least 25% to support survival but ideally about 50% to maintain high HFP) while limiting the amount of nonforest or sapling cover types throughout the home range (no more than about 50%) would likely result in high quality Northern Spotted Owl territories.

Discussion Questions

- In a data rich watershed, what does restoration look like?
  - Improving the existing habitat?
  - Recruiting new habitat?
  - Target improving species survival and fecundity?
- What opportunities are there for terrestrial species habitat restoration on managed timberlands?
- How do (or how could) THPs facilitate terrestrial habitat restoration?
- Is the spatial and the temporal scale presented appropriate to assess cumulative impacts for terrestrial species?