Geographical Analysis of Male Golden-Winged Warbler Territory in Central Appalachia

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BACKGROUND

The U.S. Fish and Wildlife Service currently identifies the Golden-winged Warbler (*Vermivora chrysoptera*) as a species of concern and is considering listing the species as threatened. Mirroring declines in shrubland in the Appalachian Mountains, the Golden-winged Warbler has also experienced a population decline of about 8% per year (Sauer et al., 2012; Yahner, 2003).

Studying male breeding territories can help define resource use for active land management for this species. Male breeding territories usually range 0.4-0.6 ha and are located with shrub and herbaceous cover along a forest edge (Confer, 1992). Our objectives are to 1) examine the movement and landscape utilization of male territories, and 2) determine the land cover classification of these territories.
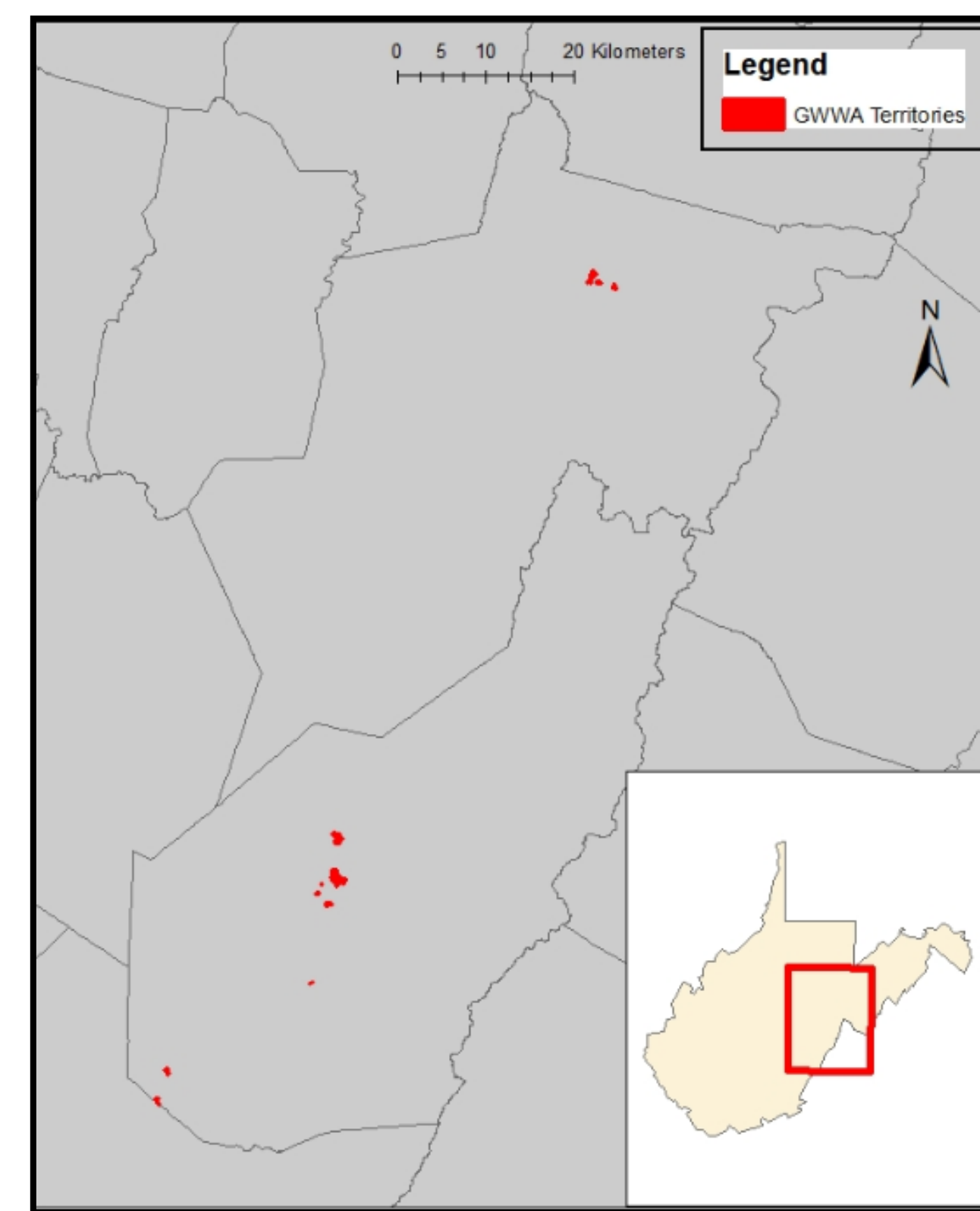

Photo (CC License): http://endangerednj.blogspot.com/.

Figure 1. Map of 2009-2014 territories.

METHODS

During nesting seasons from 2009-2014, male Golden-winged Warblers were banded. Trained staff recorded the bird's location with GPS when birds were observed. 50% minimum convex hull polygons (MCPs) were calculated from 6,622 observations to distinguish 211 individual male territories and remove the outliers using the adehabitatHR package in R (Calenge, 2006; R Development Core Team 2008). MCP's were categorized by year to illustrate how territories moved over time. Kernel density estimation was performed also to find core territories by year and by bird. A mask using MCP's was applied to the 2011 National Land Cover Database (NLCD) to determine the land cover of territories using ArcGIS (ESRI, Redlands, CA).
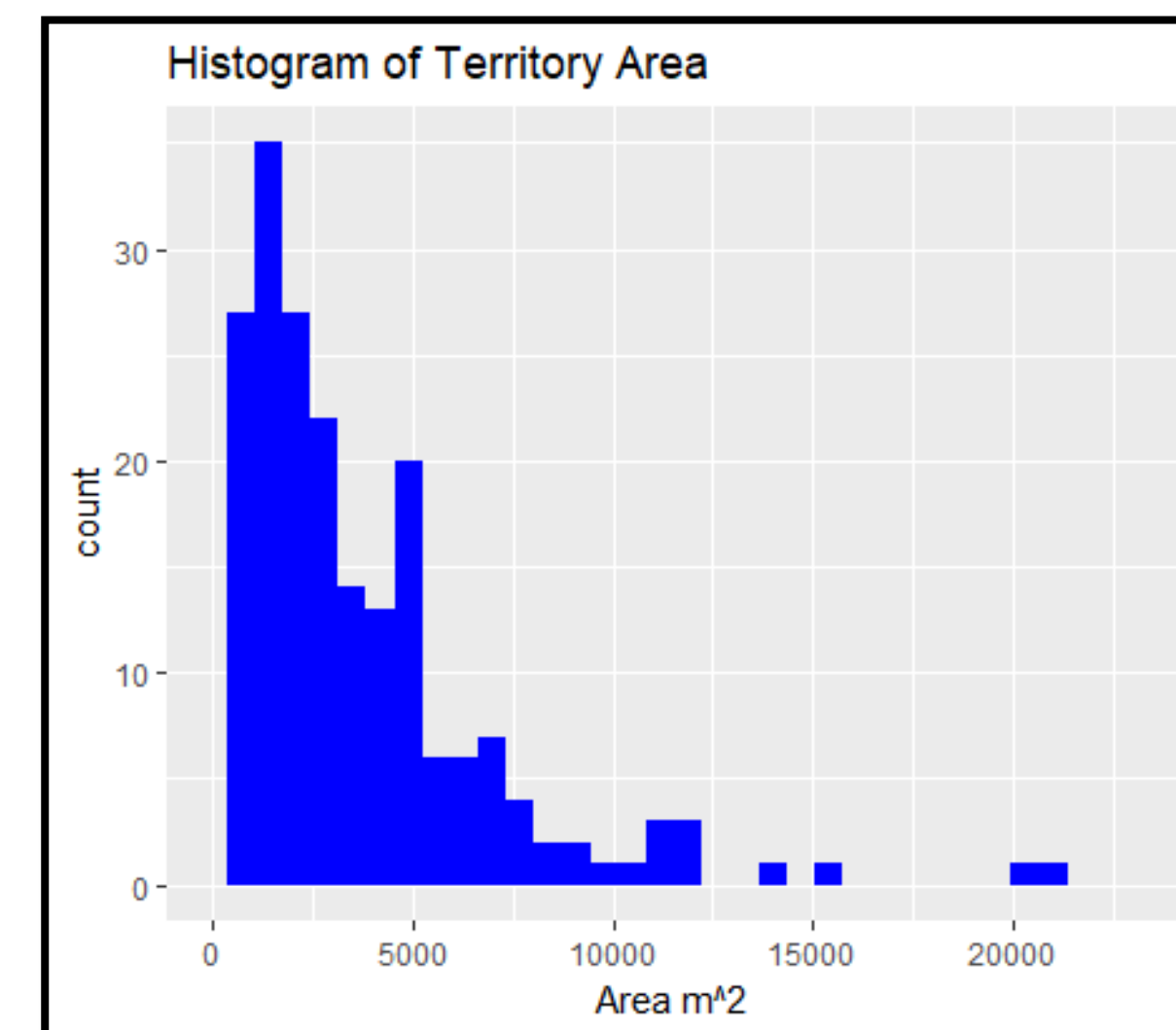
RESULTS

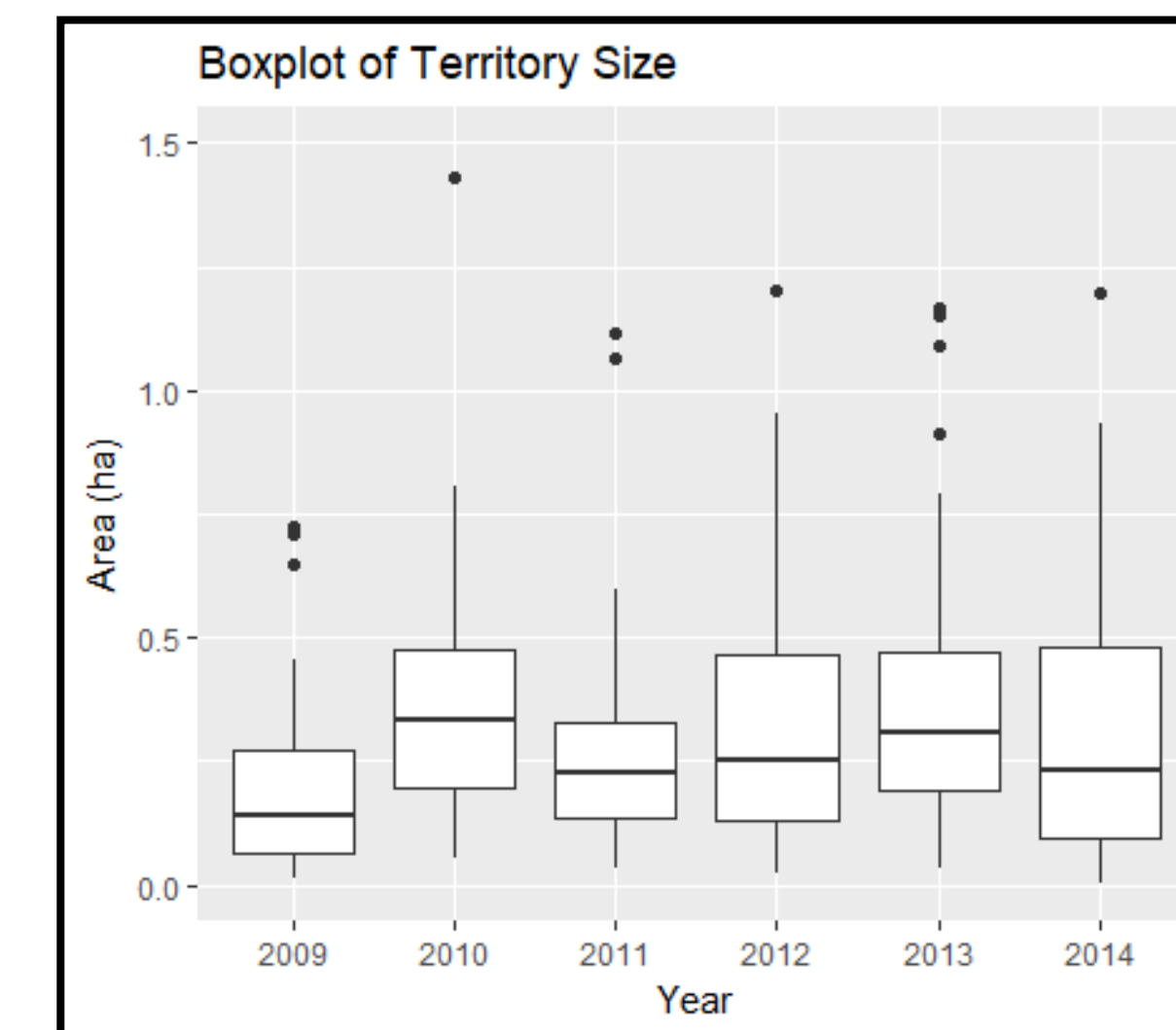Figure 2. A histogram of territory size.

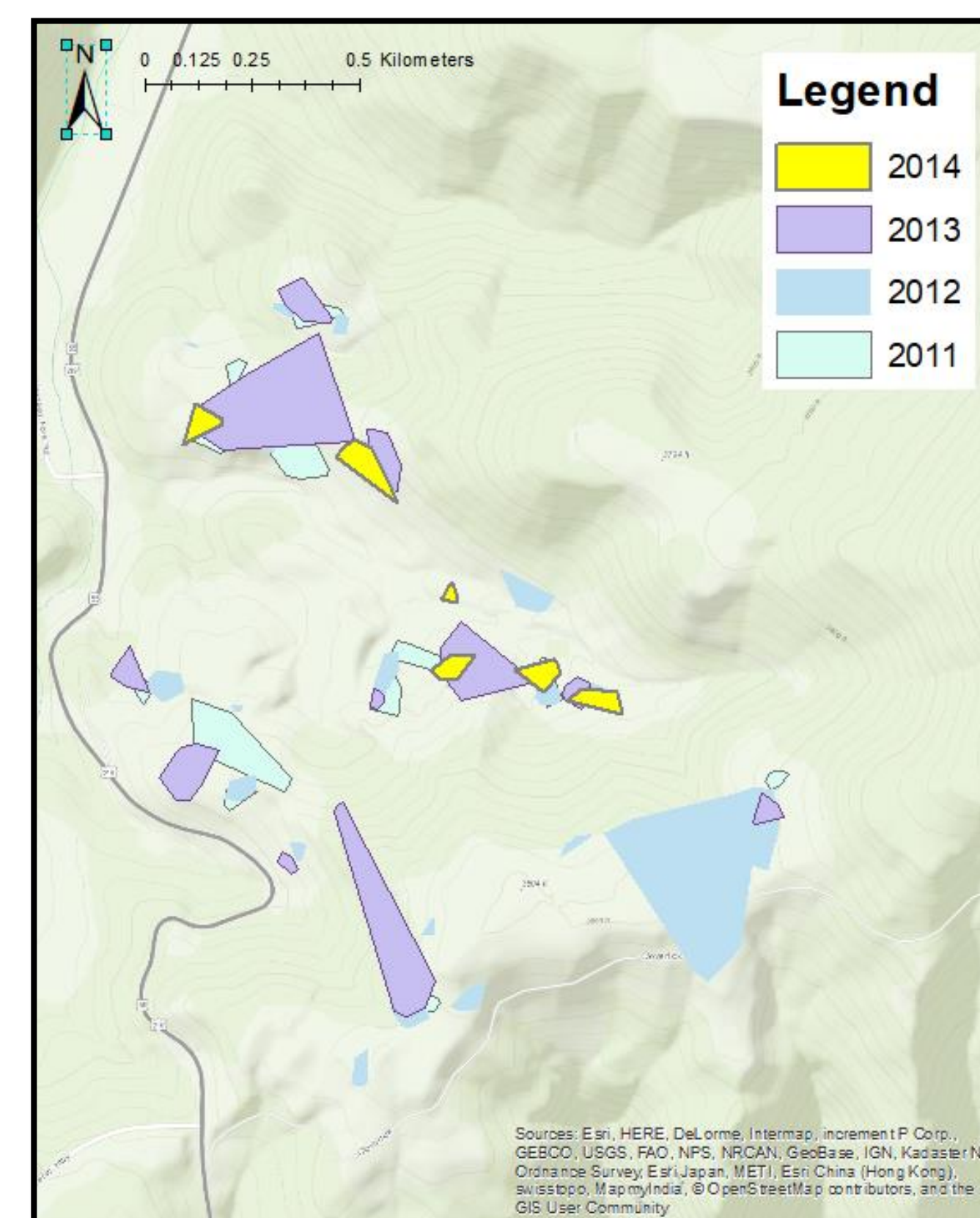
Figure 3. A boxplot of territory size.

Figure 4. Movement of male Golden-winged warbler territories, 2011-2014.
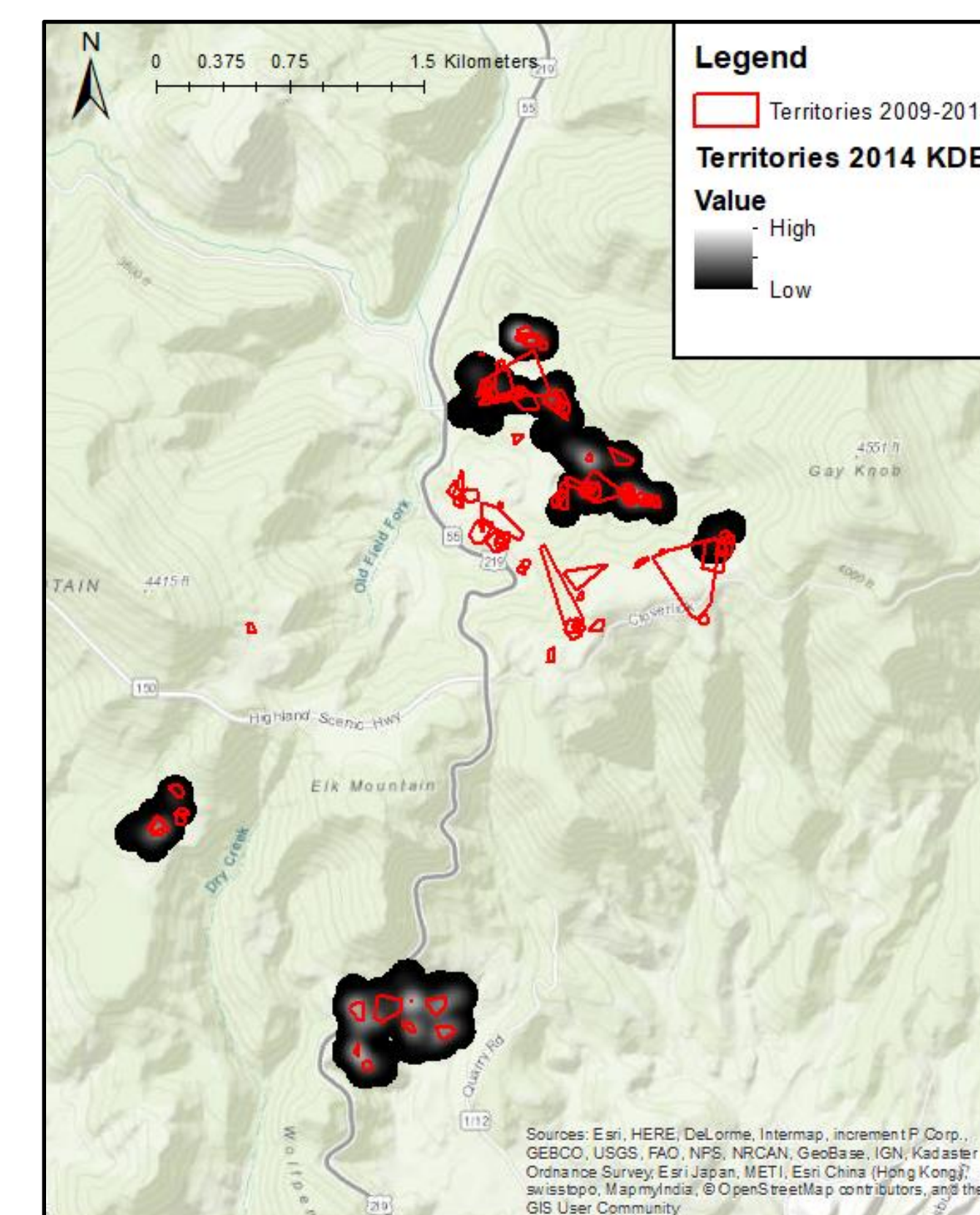

Figure 5. KDE of territory in 2014 compared with territories 2009-2014.

The average territory size was found to be 0.46 hectares. The majority of territories were under 0.5 hectares. By categorizing the territories by year, the movement of territories could be captured. Figure 4 and 5 demonstrate an abandonment of previous territory in 2014. Table 1 displays the percent cover of NLCD classes for the 2009-2014 territories which ranged from 84% deciduous forest to 0.001% shrub.

Land Cover Type	Class	Number of Pixels	Percent of Territory
Deciduous Forest	41	699	84%
Barren Land	31	46	5.50%
Pasture	81	37	4.50%
Developed, Open Space	21	34	4%
Cropland	82	14	1.70%
Shrub	52	1	0.001%

Table 1. Percent of NLCD land cover classes comprising the male Golden-winged Warbler territories 2009-2014.

DISCUSSION

A 50% minimum convex hull was applied to 6,622 observations of banded male Golden-winged Warblers to determine territories shown in Figure 1. The average size of male Golden-winged Warbler territory (Figure 2 and 3) was 0.46 ha which is consistent with the range of 0.4-0.6 ha found in the literature (Confer, 1992). Most territories were under 0.6 ha and larger territories were due to males not finding a mate or nest failure. Categorizing male territory by year was successful in identifying areas where favorable and unfavorable land cover change had occurred. In Figure 4 and 5, the southern territories were abandoned in 2014 as territories were concentrated in the northern section. Grazing had ceased on a pasture 2 years earlier creating an ideal habitat (C. Johnson, personal communication, 2018).

Looking at the classification of NLCD land cover within the male territories revealed the difficulty in identifying habitat for the Golden-winged Warbler. The land cover classification skews to deciduous forest (84%) as compared to shrub (.001%) for this shrub-dependent species (Table 1.), This discrepancy is due to their territories being shrub areas adjacent to forests (Confer, 1992).

CONCLUSION

This geographical analysis of male Golden-winged Warbler territory illustrates their movement and landscape utilization to more ideally suited habitat. Difficulties in identifying quality habitat for this shrub-dependent species has been demonstrated as the NLCD classifications for these territories reveal a dominant deciduous forest class representation versus a nearly nonexistent shrub land cover class. Future work will focus on whether spatial resolution will improve shrub classification within these territories.

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