SURVEY OF THE CURRENT DISTRIBUTION OF THE SOUTHEASTERN POCKET GOPHER (*GEOMYS PINETIS*) IN GEORGIA

Final Report
to
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EXECUTIVE SUMMARY

The southeastern pocket gopher (*Geomys pinetis*) is listed as a high priority species for conservation in Georgia. Reports from the early 1980s suggested that the species' distribution had been significantly reduced from its historic distribution in the state. Because the species was locally abundant in suitable habitats, but absent from large parts of historical range, habitat loss was considered a primary factor driving the distribution reduction. However, little information is available on current distribution and availability of suitable habitat. The overall goal of this project was to assess the current distribution and habitat associations of the southeastern pocket gopher in Georgia. Specific goals were to determine the current occupancy status of historic southeastern pocket gopher localities known from museum and publication records, to develop habitat models of pocket gopher presence or absence based habitat characteristics at occupied and random locations, and to apply the predictive model across the potential distribution in Georgia to identify additional areas where suitable habitat conditions exist. We obtained a compiled a list of 297 historic southeastern pocket gopher locations in Georgia from Paul Skelley at the Florida State Collection of Arthropods. We surveyed 272 (97% of useable locations) of the historical pocket gopher localities in 41 counties during a roadside survey from June-August 2006. We documented current pocket gopher activity at 65 (24%) of the historic locations in 18 counties. Using a kernel density estimator in the GIS, we identified 5 high pocket gopher density areas. Lower density areas were scattered throughout across the Coastal Plain. We used the 65 confirmed locations from the historical records along with opportunistic sightings and additional confirmed locations to produce a compiled list of 106 known currently occupied locations. We used GIS layers of land cover classifications and soil drainage to quantify habitat variables within 100 m, 500 m, and 1000 m radius buffers around occupied locations and randomly chosen locations across the Coastal Plain. We used the habitat variables from the occupied and random locations to construct logistic regression models describing southeastern pocket gopher habitat relationships. Percent water/swamp habitat, percent longleaf pine habitat, and percent sandhill habitat were included in the top habitat models at all spatial scales. Percent longleaf pine and percent sandhill habitats showed a positive relationship while percent water/swamp habitat was negatively related to pocket gopher presence. At the largest spatial scale (1000 m buffer), our results indicate that the chance of pocket gopher occurrence increases 4.1% and 8.8%, respectively, for every for 1% increase in longleaf pine and sandhill habitat. The chance of pocket gopher occurrence decreases by 3.2% with each 1% increase in water/swamp habitat. Trends among habitat types were similar at the smaller spatial scales, but percentage increases generally were smaller. We used the regression equations for the 1000 m buffer to produce a predictive map of the Georgia Coastal Plain showing areas of potential for pocket gopher presence. Our results support the supposition that southeastern pocket gophers are locally abundant in suitable habitats, but appear to be absent throughout much of their original range. We only documented pocket gophers at one-quarter of the historic locations searched and in fewer than half of the counties represented in the historic locations. Our results clearly indicate a close relationship between presence of pocket gophers and longleaf and sandhill habitats. Given the recent interest in restoration of these habitats, the potential exist to restore suitable habitat for southeastern pocket gophers at a relatively large scale. However, our data show a fragmented distribution which may impede natural recolonization into restored habitats. Because several areas of high population density exist to serve as source populations, artificial reintroductions into restored habitats may be a feasible approach for southeastern pocket gopher restoration.

INTRODUCTION

The southeastern pocket gopher (*Geomys pinetis*) is listed as a high priority species for conservation in Georgia's Wildlife Action Plan (Georgia Department of Natural Resources 2005). The species is distributed throughout Southeastern Plains and Southern Coastal Plain ecoregions in Georgia (Harper 1927, 1929, 1952; Golley 1962; Laerm 1981; Laerm et al. 1982). The southeastern pocket gopher is largely associated with longleaf pine (*Pinus palustris*)-turkey oak-(*Quercus laevis*)-wiregrass (*Aristida* spp.) dominated ecosystems on well-drained, sandy soils, but also has been observed on agricultural lands, pastures, and residential areas (Avise and Laerm 1982). For over 40 years the population within Georgia has been considered locally abundant, but disjunct and restricted to patches of appropriate habitat (McNab 1966).

The southeastern pocket gopher appears to have declined from its historic distribution in Georgia (Laerm 1981). Because the species is locally abundant in suitable habitats, but absent in much of its original range, habitat loss is considered a primary factor driving the distribution reduction. Longleaf pine dominated ecosystems have been reduced to <4% of historic levels (Brockway and Outcalt 2000). Much of the original longleaf pine forest was converted to croplands or intensively managed pine plantations (Landers et al. 1995, Barnett 1999), which may be less conducive to pocket gopher habitation. The severity of fragmentation for the southeastern pocket gopher population in Georgia is currently unknown. Thus, more information describing the current distribution is warranted.

Broad assessments of species distribution across a large landscape can be difficult and time consuming using traditional field survey methods alone (Conner 2002). Building predictive presence/absence models from widely available spatial data offers an efficient alternative for assessing broad-scale distributional patterns (Scott et al. 1993). A common technique used in this approach is to identify site- and landscape-level factors that potentially influence species presence and compare locations known to be occupied with randomly selected locations (Scott et al. 1993). Factors identified as important in influencing occupancy can then be used to identify additional areas within a larger study area with potential for species presence.

OBJECTIVES

The overall goal of this project was to assess the current distribution of the southeastern pocket gopher in Georgia. The specific objectives were to:

1) Determine the current occupancy status of historic southeastern pocket gopher localities known from museum and publication records
2) Develop a predictive model of pocket gopher presence/absence based on habitat characteristics at occupied and random locations
3) Apply the predictive model across the potential distribution in Georgia to identify additional areas where suitable habitat conditions exist

STUDY AREA

Our study area covered the 9.1 million ha landscape south of the Fall Line in Georgia. This region is composed of the Southeastern Plains and Southern Coastal Plain ecoregions (Griffith et al. 2001). The Southeastern Plains, with row crop/pasture (32.7%) and evergreen forest (27.2%) as the predominant land cover types (Kramer and Elliott 2004), accounts for over two-thirds of the study area (6.5 million ha). The remaining portion of the landscape is Southern Coastal Plain (2.6 million ha), in which evergreen forest (36.0%) and forested wetland (26.1%) dominate the landscape.

METHODS

Field Survey

We obtained a compiled list of historic southeastern pocket gopher locations in Georgia from Paul Skelley at the Florida State Collection of Arthropods (Appendix A). The list was compiled as part of study examining non-parasitic arthropods associated with southeastern pocket gopher burrows (Peck and Skelley 2001, Skelley and Gordon 2001, Skelley and Kovarik 2001) and represents a complete compilation of all museum records and publication records of southeastern pocket gophers in Georgia. Reliable sightings of pocket gophers or mounds confirmed to be pocket gopher mounds by qualified individuals were also included in the list. The localities of historical locations included in our final database were accompanied either by latitude-longitude coordinates or a reliable landmark that was static over time.

Each historic southeastern pocket gopher location was visited during a roadside survey between June and August 2006. A handheld Global Positioning System (GPS) unit (Garmin International, Inc.) was used for navigating to historic locations. Roadsides were searched for mounding activity in the vicinity of the historic location coordinates. We considered the location to have pocket gophers present if mounding activity was observed within a 1 km radius of the historic location. Pocket gopher mounds were distinguished from fire ant (*Solenopsis invicta*) mounds by the lack of ants and presence of a distinct tunnel determined by digging into the mound. Locations in which we did not observe mounding activity in our surveys were considered not-confirmed. We determined the percentage of historic locations that we found occupied by pocket gophers at the time of the survey.

Opportunistic sightings of active mounds observed while traveling between sites were also recorded and added to the database of current southeastern pocket gopher locations. Additional locations of active mound systems were obtained from Georgia Department of Natural Resources personnel (Jim Ozier, Georgia Department of Natural Resources, personal communication). Those locations were visited and added to the list of current southeastern pocket gopher locations if pocket gopher presence was confirmed.

We compiled the locations from the roadside survey, opportunistic sightings, and additional confirmed locations (Appendix B) to create a spatial data layer of known currently occupied southeastern pocket gopher locations using ARC/INFO (Environmental Systems Research Institute 2006). We defined independent pocket gopher locations as those >0.5 km from other observed locations. We used the Point Density estimator tool in ArcView to calculate the number of independent pocket gopher locations within a 100 km^2 area around each cell of a 30 x 30 m raster grid. The resulting densities were reclassified into 3 categories, 0.01-0.05, 0.05--0.1, and >0.1 independent locations/km^2. Cells with densities >0.05 independent locations/km^2 were considered high density areas.

Habitat Variables

Using the data layer of currently occupied southeastern pocket gopher locations, we quantified habitat and landscape variables around each location at 3 spatial scales. To examine small-scale habitat influences on pocket gopher presence, a 100 m radius buffer was placed around each occupied and random point. A 100 m radius buffer represents an area likely to encompass the entire tunnel system associated with the mound (Romañach et al. 2005). We also buffered each point with 500 and 1000 m buffers to assess larger scale factors influencing pocket gopher presence or absence. We used ArcInfo to identify 179 random locations within the study area for comparison. We created 100, 500, and 1000 m buffers around the random locations in the same manner as the occupied locations. Because known pocket gopher locations were obtained from roadside surveys, we constrained random points to within 100 m of roads.

We measured 12 habitat variables at each location in each of the 3 buffer sizes (Table 1). We linked the buffered areas to the Georgia Gap land cover raster layer (United States Geological Survey 2003). The land cover raster data consisted of 30 x 30 m pixels categorized into 44 cover types of which 34 were located within the study area (Appendix C). We reclassified the 34 cover types into 8 cover types based on knowledge of pocket gopher habitat associations (Appendix D). We calculated the proportion of each land cover type (not including roads) out of the total area within each buffer. We calculated an index of habitat fragmentation by summing the number of land cover polygons within each buffer. We examined a categorical index of soil drainage derived from the State Soil Geographic Data Base (STATSGO; United States Department of Agriculture 1995). The STATSGO data contains 8 categories based on soil drainage characteristics and distance to water table. We reclassified the categories into 3 categories representing well-drained, moderately-drained, and poorly-drained soils. Well-drained soils (swd) are those with high hydraulic conductivity, low water holding capacity, and depth to water table >1.8 m (6 feet). Moderately-drained soils (smd) are those with intermediate water-holding capacity and depth to water table 0.9-1.8 m (3-6 feet). Poorly-drained soils (spd) are those ranging from wet at the surface or ponded to water table down to 0.9 m (3 feet). We calculated the percentage of occupied and random locations within each soil drainage category.

Habitat Modeling

We developed habitat models using logistic regression with occupied and random locations as the binary response variable within each of the buffer sizes. Before constructing models, we conducted correlation analysis to ensure no pairs of variables within a model were highly correlated. Where correlations were present we retained the most biologically meaningful variable. We fit a global logistic regression model using all 12 habitat variables. In addition to our global model, we constructed and fit 27 biologically meaningful explanatory models based on known southeastern pocket gopher ecology. We calculated odds ratios for each variable to quantify the relationship with the likelihood of pocket gopher occupancy.

We used Akaike's Information Criterion adjusted for small sample bias (AIC_c; Akaike 1973) to evaluate and select the most parsimonious model and to predict variable importance (Burnham and Anderson 2002). A confidence set of models was identified based on weight of evidence (w_i) and a 10% cutoff (Royall 1997, Burnham and Anderson 2002). We calculated Nagelkerke's R^2 to assess variation explained the top models for each buffer size (Nagelkerke 1991). We applied 10-fold cross validation procedure to our best approximating model to estimate the models sensitivity (probability of correctly predicting occupied pocket gopher locations) and specificity (probability of correctly predicting non-occupied locations). The logistic regression and 10-fold cross-validation analysis was performed using SAS software Version 9.1. We used model averaging procedures to calculate parameter estimates for each cover type included in the confidence set of models.

Table 1. Variables measured at occupied southeastern pocket gopher locations and random locations in the Georgia Coastal Plain and used to model habitat associations.

Variable	Code	Definition
% Water/swamp	pws	Percent of buffers in open water or swamp habitat
% Early successional	pes	Percent of buffers in early successional
% Urban	pu	Percent of buffers in urban areas
% Row crop	prc	Percent of buffers in row crop
% Sandhills	ps	Percent of buffers in Sandhills habitat
% Hardwood	phw	Percent of buffers in hardwood habitat
% Longleaf pine	plp	Percent of buffers in longleaf pine
% Other pine	pop	Percent of buffers in other pine species
Soil well-drained	swd	Percent of locations located on well-drained soils
Soil mod-drained	smd	Percent of locations located on moderately-drained soils
Soil poorly-drained	spd	Percent of locations located on poorly-drained soils
Fragmentation index	fi	Number of unique habitat classification polygons in buffers

Application of the Models

Using the predictive equation from the habitat analysis at the 1000 m buffer scale, we constructed a map depicting areas with potential southeastern pocket gopher habitat across the Georgia Coastal Plain. We only used the equation from the 1000 m buffer scale because it was most appropriate for prediction at the study area scale. We incorporated the Model Builder toolbox in ArcInfo (Environmental Systems Research Institute 2006) where we used a roving window (9 x 9 rectangle) that tallied the number of cells of each habitat type within each window and applied that number to the center cell of the same window. For each cell, the total for each cover type in the respective window was converted to a percentage of the total number of cells in that window (excluding roads). The resulting percentages associated with each cell were then entered into the logistic regression equations. Cells with $p \geq 0.5$ were classified as having a high probability of pocket gopher presence and represent areas of potential habitat. Cells with $p < 0.5$ were classified as having a low probability of presence. We also calculated distance between and size of potential habitat patches.

RESULTS

Field Survey

The historic location database contained 297 locations covering 49 Georgia counties. Sixteen records in the historic database were not used because they did not contain locality information or reliability of the locality information was questionable. An additional 7 locations, most of which occurred on private land away from public roads, were not searched. We did not search the single location on Cumberland Island because pocket gophers have been extirpated from the island (Laerm 1981). We surveyed 272 of the 281 useable historic records (97%) in 41 counties from June-August 2006 (Figure 1).

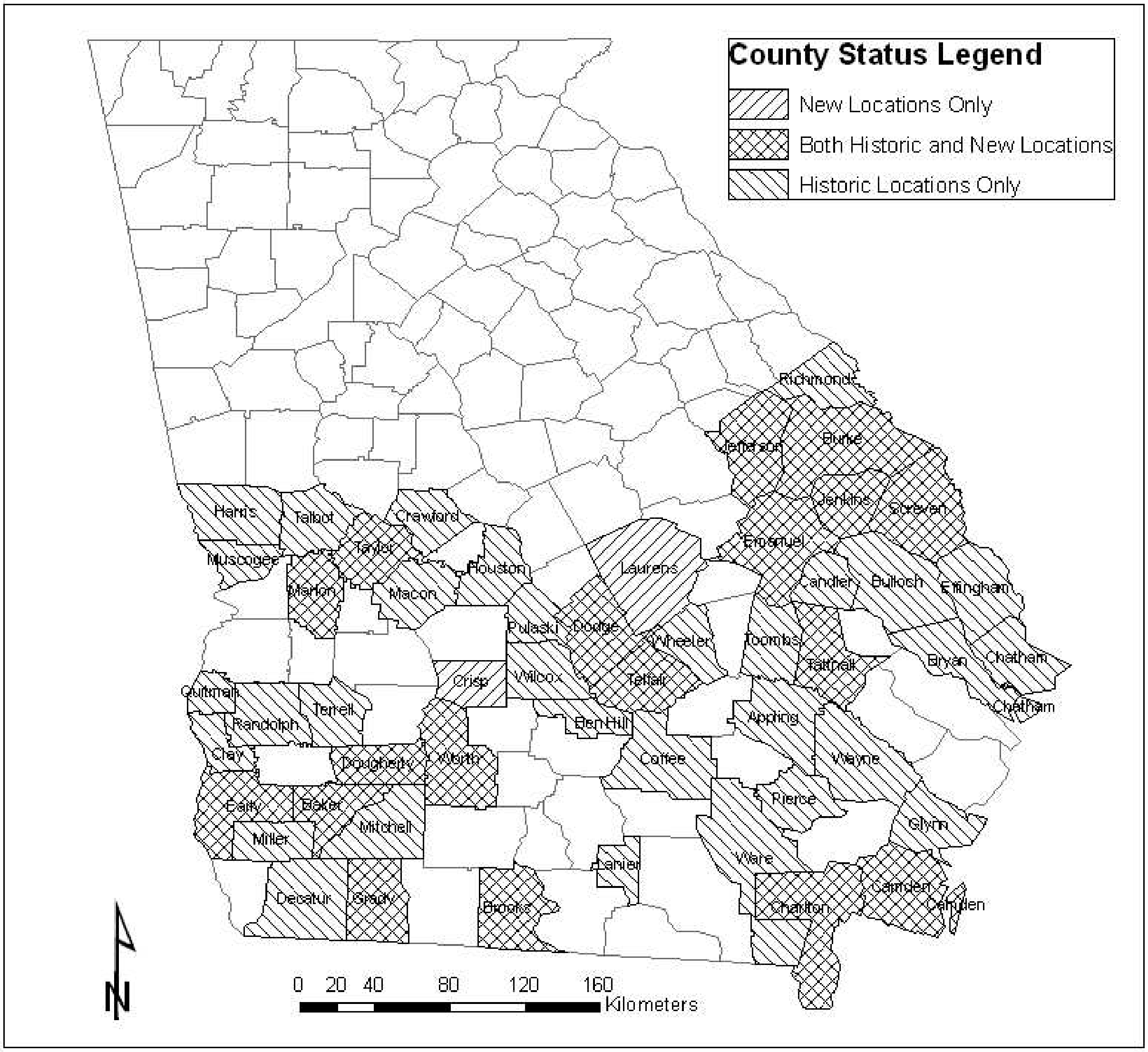

Figure 1. Map of Georgia counties showing counties with southeastern pocket gopher locations from a compiled list of historic records and counties with confirmed pocket gopher presence during roadside surveys conducted in 2006.

We documented current pocket gopher activity at 65 (24%) of the historic locations covering 18 counties. Therefore, 41% (17/41) of the counties with historic records that we searched were confirmed in our surveys.

We documented 41 additional localities currently occupied by pocket gophers through opportunistic observations during our surveys. Localities were found in 2 counties (Laurens and Crisp) not included in the historic location database (Figure 1). Including historic locations with confirmed activity and additional opportunistic observations, a total of 106 unique locations with current pocket gopher activity were documented in 20 counties (Figure 1).

High population density areas (>0.05 independent locations/km^2) were observed in 5 areas across the study area (Figure 2). The largest contiguous area of pocket gopher presence identified from our surveys was at the Joseph Jones Ecological Research Center at Ichauway located in Baker County. The other high density area in southwest Georgia was located approximately 50 km to the southwest of the Jones Center in Early County, primarily within the Williams Buff Preserve managed by The Nature Conservancy. Also in the western half of the state a high density area was identified in a farming community centered on the intersection of Talbot, Taylor, and Marion Counties. In the eastern part of the state we identified high density areas in the vicinity of Scrubby Bluff Road in Camden county and the area surrounding Plant Vogtle in Burke County near Waynesboro. Numerous moderate density areas were scattered throughout the study area.

Habitat Variables

Although no statistical comparisons were made, there were distinct differences in some variables between occupied locations and random locations at all spatial scales (Table 2). At all scales, there was lower percent water/swamp habitat surrounding occupied locations than random locations. There was a tendency for lower percentage of row crop in buffers around occupied locations than random locations at the 500 and 1000 m buffers, but not at the 100 m buffer. Percent longleaf pine and sandhills habitat was considerable higher in occupied than random locations at all scales. Differences in percent early successional, hardwood, other pine habitat, and percent urban between occupied and random locations varied among buffer sizes, but generally were similar.

Soil drainage indices also differed between occupied and random locations. The percentage of locations on well-drained soils was considerably higher for occupied sites (70.8%) compared to random sites (50.6%). The percentages of locations on moderately- and poorly-drained soils were lower for occupied sites (13.2 and 16.0%, respectively) compared to random sites (20.7 and 25.7%, respectively). Because indices were determined at each occupied and random location, values were the same for all buffer sizes.

Habitat Models

At the 100 m buffer size, the best approximating model for pocket gopher presence included percent water/swamp, percent longleaf pine, and percent sandhill habitats with a 47.8% probability ($R^2 = 0.1667$; Table 3). This model was almost 2 times more likely than the next best approximating model, which contained all of the parameters present in the top model except percent sandhill habitat. Percent hardwood habitat was also included in the confidence set, but did not have a strong effect. The confidence set of models included the top 3 models with a sum of Akaike weights of 0.828 indicating a 82.8% chance that 1 of these models was the best approximating model based on the data and set of candidate models (Table 3). There was insufficient evidence to consider the remaining models as plausible explanations for pocket gopher presence. Percent longleaf pine and percent sandhill habitats were positively related to pocket gopher presence while percent water/swamp habitat showed a negative relationship. The odds ratios for percent longleaf pine (1.036) and percent sandhill (1.027) indicate that for every 1% increase in longleaf pine or sandhill habitat within a 100 m buffer, the chance of pocket gopher occurrence increases 3.6% and 2.7%, respectively (Table 4). The chance of pocket gopher occurrence decreases by 4.4% with each 1% increase in water/swamp habitat (odds ratio = 0.956) within a 100 m buffer. The cross-validation procedure resulted in sensitivity and specificity values of 26.4% and 60.7%, respectively.

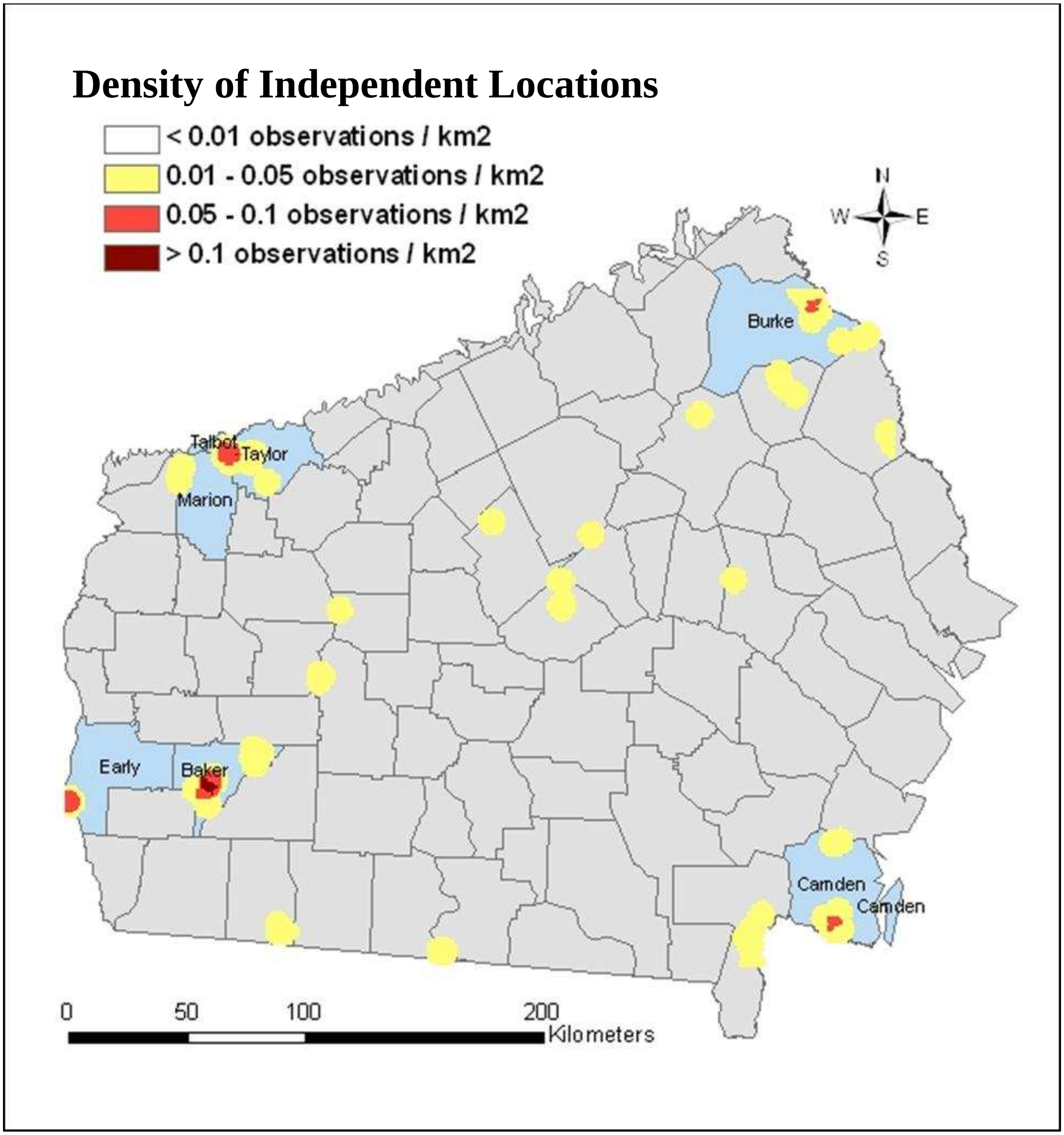

Figure 2. Density (independent locations/km^2) of confirmed southeastern pocket gopher locations documented during a roadside survey June-August 2006. Five areas within the study area contained high (>0.05 independent locations/km^2) pocket gopher activity: Williams Bluff Preserve in Early county; Joseph Jones Ecological Research Center at Ichauway in Baker county; a farming community centered on the intersection of Talbot, Taylor, and Marion Counties; the area surrounding Plant Vogtle near Waynesboro in Burke county; and the vicinity of Scrubby Bluff Road in Camden County.

Table 2. Mean percentages and standard errors (SE) of land cover classifications and fragmentation index within 100, 500, and 1000 m buffers around currently occupied southeastern pocket gopher locations surveyed June-August 2006 and randomly selected sites in the Coastal Plain of Georgia.

	100 m Buffer		500 m Buffer		1000 m Buffer	
Variable	Occupied	Random	Occupied	Random	Occupied	Random
% Water/swamp (pws)	3.03 (0.64)	8.26 (0.90)	6.64 (0.78)	14.02 (1.02)	9.20 (0.83)	15.92 (0.99)
% Early successional (pes)	19.48 (2.42)	17.12 (1.78)	18.57 (1.51)	15.51 (0.99)	16.54 (1.21)	15.39 (0.82)
% Urban (pu)	4.01 (1.19)	3.41 (0.92)	1.45 (0.42)	1.80 (0.41)	1.37 (0.41)	1.51 (0.27)
% Row crop (prc)	25.04 (2.94)	25.43 (2.61)	19.43 (1.83)	24.08 (1.95)	17.59 (1.46)	22.18 (1.67)
% Sandhills (ps)	3.41 (1.30)	0.74 (0.61)	4.11 (1.10)	0.82 (0.31)	4.47 (1.06)	0.77 (0.24)
% Hardwood (phw)	12.91 (1.75)	14.23 (1.46)	14.79 (1.31)	14.32 (1.11)	14.98 (1.10)	14.21 (0.93)
% Longleaf pine (plp)	12.07 (2.55)	1.80 (0.86)	12.55 (2.42)	1.95 (0.87)	11.56 (2.22)	1.91 (0.81)
% Other pine (pop)	20.05 (2.67)	29.20 (2.36)	22.47 (2.07)	27.54 (1.52)	24.32 (1.90)	28.30 (1.29)
Fragmentation Index (fi)	6.94 (0.22)	7.56 (0.25)	101.20 (3.29)	100.82 (3.05)	368.65 (11.18)	366.34 (8.84)

Table 3. Model selection results for the top 10 models used to predict southeastern pocket gopher occupancy in the Coastal Plain of Georgia at 100, 500, and 1000 m buffers around occupied and random locations. Variables are defined in Table 1.

Buffer/models	K	AIC_c	Δ_i	w_i
100 m buffer				
pws plp ps	5	349.045	0.000	0.4781
pws plp	4	350.337	1.292	0.2506
pws plp phw	5	352.183	3.138	0.0996
swd plp	4	353.861	4.816	0.0430
Global	12	354.396	5.351	0.0329
swd plp pu	5	354.733	5.688	0.0278
swd shw plp	5	354.926	5.881	0.0253
swd plp pu phw	6	355.895	6.850	0.0156
fi plp ps	5	356.408	7.363	0.0120
plp ps	4	357.883	8.838	0.0058
500 m buffer				
pws plp ps	5	333.910	0.000	0.9632
pws plp	4	341.366	7.456	0.0232
pws plp phw	5	343.089	9.179	0.0098
plp ps	4	346.003	12.093	0.0023
fi plp ps	5	348.001	14.091	0.0008
fi pu pes plp	6	350.285	16.375	0.0003
swd plp	4	350.943	17.033	0.0002
swd phw plp	5	352.684	18.774	0.0001
swd plp pu	5	352.802	18.892	0.0001
pws ps	4	353.081	19.171	0.0001
1000 m buffer				
pws plp ps	5	333.665	0.000	0.9186
plp ps	4	339.254	5.589	0.0562
fi plp ps	5	341.103	7.438	0.0223
pws plp	4	346.010	12.345	0.0019
pws plp phw	5	347.953	14.288	0.0007
swd plp	4	351.756	18.091	0.0001
swd plp pu	5	353.058	19.393	0.0001
swd phw plp	5	353.626	19.961	0.0000
pws ps	4	353.891	20.226	0.0000
swd plp pu phw	6	354.948	21.283	0.0000

Table 4. Parameter estimates (SE) and odds ratios (± Wald 95% confidence interval) for parameters considered in the confidence model set for 100, 500, and 1000 m buffers around occupied and random locations.

Parameter	Estimate (SE)	Odds ratio
100 m buffer		
Intercept	-0.5265 (0.1522)	n/a
Percent Water/Swamp (pws)	-0.0455 (0.0168)	0.956 (± 0.03)
Percent Longleaf Pine (plp)	0.0351 (0.0097)	1.036 (± 0.02)
Percent Sandhills (ps)	0.0264 (0.0171)	1.027 (± 0.03)
500 m buffer		
Intercept	-0.4141 (0.1919)	n/a
Percent Water/Swamp (pws)	-0.0460 (0.1919)	0.955 (± 0.03)
Percent Longleaf Pine (plp)	0.0380 (0.0100)	1.039 (± 0.02)
Percent Sandhills (ps)	0.0630 (0.0248)	1.065 (± 0.05)
1000 m buffer		
Intercept	-0.5202 (0.2159)	n/a
Percent Water/Swamp (pws)	-0.0321 (0.0131)	0.968 (0.02)
Percent Longleaf Pine (plp)	0.0400 (0.0098)	1.041 (0.02)
Percent Sandhills (ps)	0.0844 (0.0275)	1.088 (0.06)

The predictive equation resulting from the top logistic regression model for the 100 m buffer was as follows:

Probability of presence = 1/(1+exp(-(-0.5265 - 0.0455 * % Water/Swamp + 0.0351*%Longleaf + 0.0264 * %Sandhills))).

At the 500 m buffer size, the best approximating model for pocket gopher presence included percent water/swamp, percent longleaf pine, and percent sandhill habitats (R^2 = 0.2287; Table 3). This model was 48 times more likely than the next best approximating model, which contained all of the parameters present in the top model except percent sandhill habitat. The top model was the only model in the confidence set and had an Akaike weight of 0.963, indicating a 96.3% chance that it was the best approximating model based on the data and set of candidate models (Table 3). There was insufficient evidence to consider the remaining models as plausible explanations for pocket gopher presence. Percent longleaf pine and percent sandhills habitats were positively related to pocket gopher presence while percent water/swamp habitat showed a negative relationship. The odds ratios for percent longleaf pine (1.039) and percent sandhill (1.065) indicate that for every 1% increase in longleaf pine or sandhill habitat within a 500 m buffer, the chance of pocket gopher occurrence increases 3.9% and 6.5%, respectively (Table 4). The chance of pocket gopher occurrence decreases by 4.5% with each 1% increase in water/swamp habitat (odds ratio = 0.955) within a 500 m buffer. The cross-validation procedure resulted in sensitivity and specificity values of 36.8% and 59.2%, respectively. The predictive equation resulting from the composite logistic regression model for the 500 m buffer was as follows:

$$\text{Probability of presence} = 1/(1+\exp(-(-0.4141 - 0.0460 * \%\ \text{Water/Swamp} + 0.0380 * \%\text{Longleaf} + 0.0630 * \%\text{Sandhills}))).$$

At the 1000 m buffer size, the best approximating model for pocket gopher presence included percent water/swamp, percent longleaf pine, and percent sandhill habitats (Nagelkerke's $R^2 = 0.2297$; Table 3). This model was over 16 times more likely than the next best approximating model, which contained all of the parameters present in the top model except percent water/swamp habitat. The top model was the only model in the confidence set and had an Akaike weight of 0.919, indicating a 91.9% chance that it was the best approximating model based on the data and set of candidate models (Table 3). There was insufficient evidence to consider the remaining models as plausible explanations for roost-site selection. Percent longleaf pine and percent sandhill habitats were positively related to pocket gopher presence while percent water/swamp habitat showed a negative relationship. The odds ratios for percent longleaf pine (1.041) and percent sandhill (1.088) indicate that for every 1% increase in longleaf pine or sandhill habitat within a 1000 m buffer, the chance of pocket gopher occurrence increases 4.1% and 8.8%, respectively (Table 4). The chance of pocket gopher occurrence decreases by 3.2% with each 1% increase in water/swamp habitat (odds ratio = 0.968) within a 1000 m buffer. The cross-validation procedure resulted in sensitivity and specificity values of 37.7% and 60.4%, respectively. The predictive equation resulting from the composite logistic regression model for the 1000 m buffer was as follows:

$$\text{Probability of presence} = 1/(1+\exp(-(-0.5202 - 0.0321 * \%\text{Water/Swamp} + 0.0400 * \%\text{Longleaf} + 0.0844 * \%\text{Sandhills})))$$

Application of the Models

The predictive map based on our 1000 m buffer habitat model depicts a fragmented availability of potential habitat (Figure 3). The mean straight-line distance between each patch and the nearest neighboring patch of potential habitat was 4.6 km with a range from 0.07 km to 24.1 km. Mean patch size was 10.9 km^2, ranging from 0.0006 to 1043.4 km^2. The largest contiguous tract of potential southeastern pocket gopher habitat (1043.4 km^2) was located in and around Fort Benning military installation. Pebble Hill Plantation just south of Thomasville comprised much of the second largest tract (536.0) of potential habitat. The third (439.6 km^2) and fifth (100.3 km^2) largest contiguous tracts were both within the boundaries Fort Stewart military base. The Jones Center at Ichauway held the forth largest (128.1 km^2) tract of potential habitat.

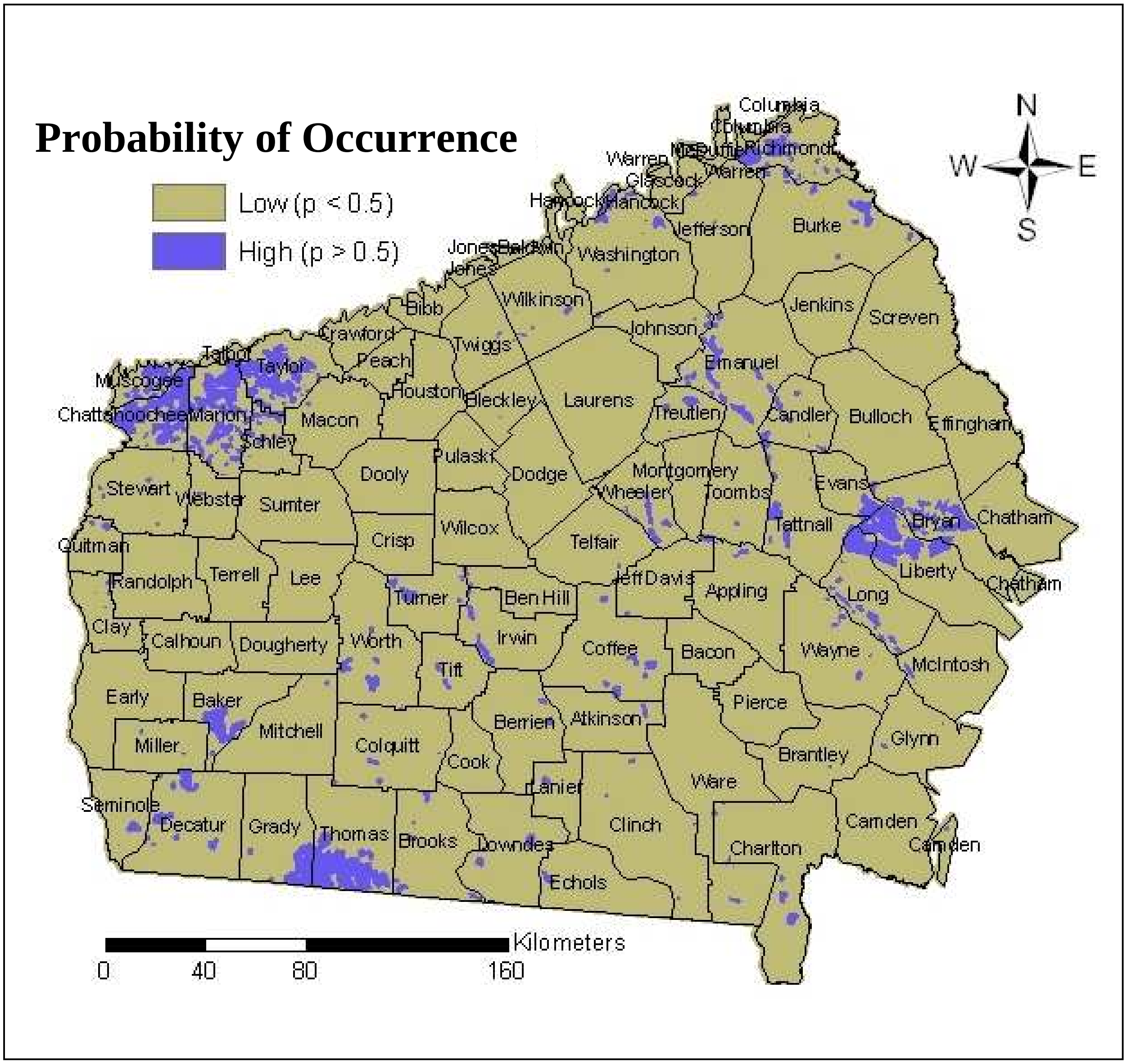

Figure 3. Map of potential southeastern pocket gopher (*Geomys pinetis*) habitat in Georgia indicating areas of high and low probability of occurrence based on the predictive equation resulting from the 1000 m radius buffer habitat model.

DISCUSSION

Our surveys of historic southeastern pocket gopher localities provide quantitative data to support the largely anecdotal supposition that the species' distribution is reduced from its historic distribution in Georgia (Laerm 1981). We confirmed presence at only 24% of historic pocket gopher locations searched in our surveys. Additionally, of the 49 counties represented in the historic database, we confirmed locations in only 18 (<40%). The spatial distribution of the counties with confirmed presence from our surveys (Figure 1) indicates that pocket gophers are present throughout the Coastal Plain. Although counties without historic pocket gopher records were not systematically searched during our surveys, we recorded opportunistic sightings from those counties while driving between search locations. Those opportunistic searches only resulted in new county records from an additional 2 counties. While pocket gophers are certain to be present in many of counties without records, anecdotal evidence from considerable time driving through those counties suggest that they are not widespread.

For logistic reasons, our sampling scheme was restricted to a roadside survey. It was not feasible to obtain access to private land around all 271 locations searched at the broad spatial scale (the entire Coastal Plain) included in our surveys. However, the method was consistent with the historic location records which were largely obtained during previous roadside surveys. Anecdotal data from our searches revealed that pocket gophers tend to be clustered in suitable habitat. Therefore, by searching roadsides within a 1 km radius of the historic location, we likely observed mounding activity in the surrounding area if pocket gophers were present. However, it is possible that pocket gophers were present at some locations, but were not detected in our survey because we restricting our search efforts to habitats found within a visual distance of roads. This situation would have resulted in a 'false negative' in our data (classifying a location as not-confirmed when pocket gophers were actually present). We do not know the false negative rate from our searches, but for reasons stated above we believe it to be relatively low.

Although we found that the southeastern pocket gopher is absent much of its original range, our results support the description of the population being locally abundant in suitable habitats (McNab 1966). We found 5 areas in the study area with high densities of pocket gopher locations (confirmed locations >0.5 km apart) based on observed mounding activity (Figure 2). However, the high-density areas are widely dispersed throughout the Coastal Plain. Numerous low- to moderate-density areas were found throughout the study area. Other high-density areas that were not included in our searches may exist.

Our results support the common assertion that the distribution of the southeastern pocket gopher is closely tied to longleaf pine and sandhill habitat (Golley 1962, Wilkins 1987). The percentage of sandhill habitat around occupied locations was more than 4 times higher compared to random locations at all 3 spatial scales we examined (Table 2). The percentage of longleaf pine habitat around occupied locations was more than 6 times higher compared to random locations at all 3 spatial scales. Furthermore, percent longleaf pine and sandhill habitat were positively related to pocket gopher presence in our habitat models at all spatial scales. Historically, longleaf pine-turkey oak and longleaf pine-wiregrass types dominated well-drained, sandy soils of the Coastal Plain. However, the area in longleaf pine habitat has been reduced to <4% of historic levels (Brockway and Outcalt 2000), much of which has been converted to croplands or intensively managed pine plantations (Landers et al. 1995, Barnett 1999) which are less conducive to pocket gopher habitation. Although we observed pocket gopher activity in fields and other early successional habitats (utility right-of-ways and fallow fields) during our surveys, these observations were uncommon. Furthermore, percent early successional habitat received virtually no support in our habitat models. Although pocket gophers are not restricted to longleaf and sandhill habitats, the close association likely has resulted in a fragmented distribution that mirrors the remaining distribution of these habitats.

Retention and restoration of longleaf and sandhill habitats will provide suitable habitat necessary for restoration of southeastern pocket gophers across its historic range. Longleaf pine habitats generally are characterized by low tree density and a relatively open canopy which promote an abundant and diverse understory layer. The understory vegetation provides food in the form of roots, tubers, and leaves (Golley 1962). Frequent fires associated with longleaf pine habitats increase its suitability as pocket gopher habitat. Golley (1962) and Gates and Tanner (1988) suggested that fire might be important in promoting forbs common in the southeastern pocket gopher diet. Suppression of fire in many habitat types within the distribution of the southeastern pocket gopher likely has contributed to the reduction in suitable habitat and fragmentation of the distribution.

Our results suggest that other pine habitats (loblolly and slash) are not important pocket gopher habitats. In the southeastern Coastal Plain, most loblolly and slash pine stands are densely-stocked plantation stands. These stands typically contain little understory vegetation making them unsuitable as pocket gopher habitat. In our searches, pocket gopher activity was virtually absent in areas dominated by plantations stands. However, older, thinned loblolly and slash pine stands, likely to be found on non-industrial private lands, may provide suitable habitat, but were not differentiated from plantation stands in our analysis.

The maps resulting from our habitat model depict numerous areas of potential habitat across the Coastal Plain, but a high degree of fragmentation between potential habitats (Figure 3). Dispersal distance for southeastern pocket gophers is unknown, but documentation of other geomyids suggests a limited range (<300 m) for dispersal movements (Hickman and Brown 1973, Daly and Patton 1990). The mean distance between patches of preferred habitat is nearly 3 times the distance of the potential dispersal limit. Although dispersal distances between preferred habitats is relatively large, pocket gopher presence was documented in additional habitat types. The status of different habitat types (early successional habitats or urban areas) as sources or sinks for the southeastern pocket gopher population in Georgia is unknown. Similarly, how suboptimal habitats influence dispersal between suitable habitat patches is unknown. Further investigation into dispersal distances, barriers to dispersal, and genetic structure of isolated populations is warranted.

MANAGEMENT RECOMMENDATIONS

Recent land management objectives to promote longleaf pine habitat restoration on both public (Georgia Department of Natural Resources 2005) and private land (Kirkman and Mitchell 2006) have potential to restore suitable habitat for southeastern pocket gophers. Holistic restoration of longleaf pine ecosystems requires restoration of the faunal community, as well as the plant community. We found that fragmentation of preferred habitats will likely be a limiting factor in the ability of southeastern pocket gophers to recolonize currently unoccupied areas as they transition towards restored longleaf habitat. We recommend incorporating pocket gopher translocations as part of restoration strategies for longleaf pine to more closely mimic historic conditions of this habitat type.

Reintroducing pocket gophers onto restored habitats is recommended to re-establish a normal soil disturbance regime associated with the longleaf pine ecosystem (Thorne and Andersen 1990). The impacts of consistent soil deposition aboveground and the intense belowground foraging by pocket gophers promote diversity within the understory plant community (Ellison and Aldous 1952, Reichman and Smith 1985, Williams et al. 1986, Huntly and Inouye 1988, Cantor and Whitham 1989, Huntly and Reichman 1994, Rezsutek and Cameron 2000). Additionally, there are numerous insect species that are pocket gopher tunnel system obligates (Skelley and Kovarik 2001), and the Florida pine snake (*Pituophis melanoleucus mugitus*), another species of special concern in Georgia (Georgia Department of Natural Resources 2005), may depend heavily on pocket gophers as a prey species or their tunnels as refuge sites (Himes 2001).

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Appendix A. Historic southeastern pocket gopher locations in Georgia compiled by Paul Skelly from the Florida State Collection of Arthropods.

County	Locality description	Latitude	Longitude	Source
Appling	Altamaha R., 4mi.S. [US-1?]	31.88111	82.35972	Florida Nat.Hist.Museum-1997
Baker	Dougherty Co.line, 1.5mi.S.on St.91	31.41472	84.27806	Skelley 1997
Baker	Mimsville	31.25583	84.52889	Williams-Genoway 1980
Baker	Newton, 8mi.SW; Ichauway, Jones Ecol.Res.Ctr.	31.22083	84.47278	Laerm-1997
Baker	Newton, 8mi.SW; Ichauway, mesic area	31.27083	84.47611	Laerm-1997
Baker	Newton, 8mi.SW; Ichauway, xeric area	31.28194	84.48083	Laerm-1997
Baker	Newton, N; 4.3mi.N.jct. Coolewahee Creek on Rt.91[Pineland Pl.]	31.37833	84.28333	Kovarik 1999
Baker	US 91 & Ichawaynochaway R., 0.5mi.below	31.20583	84.46944	Laerm-1997
Ben Hill	Fitzgerald, 10.5mi.E. [Rt-206?]	31.68778	83.07583	Williams-Genoway 1980
Ben Hill	Fitzgerald, 6.5mi.N. [Rt-11?]	31.81028	83.23861	Williams-Genoway 1980
Ben Hill	Fitzgerald, 6mi.N. [Rt-11?]	31.80194	83.24167	Williams-Genoway 1980
Ben Hill	Fitzgerald, 8mi.N. [Rt-11?]	31.82889	83.21889	Williams-Genoway 1980
Ben Hill	Fitzgerald, 9.5mi.N. [Rt-11?]	31.84056	83.20917	Williams-Genoway 1980
Ben Hill	US 319, 6.3mi.W.Ga 31	31.77833	84.41111	Florida Nat.Hist.Museum-1997
Ben Hill	US 319, 7.4mi.W.GA 31	31.77167	83.10000	Florida Nat.Hist.Museum-1997
Ben Hill	US 319, 8.2mi.W.GA 31	31.76500	83.11333	Florida Nat.Hist.Museum-1997
Ben Hill	US 319, 8.9mi.W.GA 31	31.75917	83.12028	Williams-Genoway 1980
Brooks		na	na	Golley 1962
Bryan	Blitchton, 1mi.SW. [Rt-280?]	32.18694	81.45139	Williams-Genoway 1980
Bulloch		na	na	Golley 1962

County	Locality description	Latitude	Longitude	Source
Burke	2.7mi.S.Girard on Millhaven Rd.	33.00750	81.68694	Harpoot 1999
Burke	8mi.N.Girard on Hwy.23	33.09778	81.82750	Harpoot 1999
Burke	McBean, 2.5mi.E.on river rd.	33.23778	81.90806	Laerm-1997
Burke	McBean, 4.5mi.E, 3.4mi.S.	33.18639	81.86444	Laerm-1997
Burke	McBean, 5.7mi.E.[?], 1.3mi.S.on Rt.56	33.22389	81.95222	Laerm-1997
Burke	McBean, 6mi.E., 2mi.S. [?]	33.19583	81.83083	Laerm-1997
Burke	Screven Co. line, 2.7mi.N.on Girard- Millhaven Rd.	33.00722	81.68556	Harpoot 1999
Burke	Waynesboro	33.09056	82.01556	Williams-Genoway 1980
Camden	Cumberland Island, Stafford Place	30.81583	81.46722	Hall & Kelson 1959
Camden	Kingsland	30.80000	81.69028	Williams-Genoway 1980
Camden	Kingsland, 0.7mi.E., 2.6mi.N.[nr.I-95?]	30.84500	81.68556	Laerm-1997
Camden	Kingsland, 0.7mi.E., 2.8mi.N.[nr.I-95?]	30.84944	81.68556	Laerm-1997
Camden	Kingsland, 0.7mi.S. [Rt-25?]	30.78861	81.68833	Williams-Genoway 1980
Camden	Kingsland, 0.8mi.E.of Post Office	30.79861	85.67111	Florida Nat.Hist.Museum-1997
Camden	Kingsland, 1.1mi.SSE.	30.77667	81.67722	Williams-Genoway 1980
Camden	Kingsland, 1.4mi.E., 2.1mi.S.	30.76806	81.66361	Laerm-1997
Camden	Kingsland, 1.5mi.E., 2.1mi.S.	30.76778	81.66111	Laerm-1997
Camden	Kingsland, 1.5mi.S. [Rt-25?]	30.77472	81.68750	Florida Nat.Hist.Museum-1997
Camden	Kingsland, 1.6mi.E., 2.1mi.S.	30.76889	81.65972	Laerm-1997
Camden	Kingsland, 1.8mi.S. [Rt-25?]	30.77056	81.68778	Williams-Genoway 1980
Camden	Kingsland, 1.9mi.S. [Rt-25?]	30.76889	81.68750	Williams-Genoway 1980
Camden	Kingsland, 1mi.S.	30.78444	81.68722	Williams-Genoway 1980
Camden	Kingsland, 2.1mi.S. [Rt-25?]	30.76917	81.68750	Williams-Genoway 1980

County	Locality description	Latitude	Longitude	Source
Camden	Kingsland, 2.2mi.E., 2.4mi.S.	30.75528	81.64972	Laerm-1997
Camden	Kingsland, 2.3mi.E., 3mi.S.	30.75639	81.64972	Laerm-1997
Camden	Kingsland, 2.4mi.E., 2.0mi.S.	30.77056	81.65028	Laerm-1997
Camden	Kingsland, 2.4mi.E., 2.3mi.S.	30.76806	81.65056	Laerm-1997
Camden	Kingsland, 2.4mi.E., 2.4mi.S.	30.76639	81.65028	Laerm-1997
Camden	Kingsland, 2.4mi.E., 2.5mi.S.	30.76472	81.65000	Laerm-1997
Camden	Kingsland, 2.4mi.E., 2.8mi.S.	30.75944	81.65028	Laerm-1997
Camden	Kingsland, 2.5mi.E., 2.5mi.S.	30.76111	81.64556	Laerm-1997
Camden	Kingsland, 2mi.S. [Rt-25?]	30.76694	81.68750	Williams-Genoway 1980
Camden	Kingsland, 2mi.S.,0.1mi.S.Catfish Ck.& [Rt-25]	30.77083	81.68694	Laerm-1997
Camden	Kingsland, 3.4mi.W., 1.7mi.S.	30.77722	81.75028	Laerm-1997
Camden	Kingsland, 3.5mi.E. [Rt-40?]	30.78222	81.63222	Williams-Genoway 1980
Camden	Kingsland, 3.5mi.W., 1.7mi.S.	30.77833	81.75278	Laerm-1997
Camden	Kingsland, 3mi.E., 3mi.S.	30.75778	81.63750	Laerm-1997
Camden	Kingsland, 3mi.SE.[Rt-40?]	30.78528	81.64167	Hall & Kelson 1959
Camden	Kingsland, 3mi.W.	30.80917	81.74056	Williams-Genoway 1980
Camden	Kingsland, 4.2mi.E.on Rt.40, W.Millers Br.[E?]	30.77972	81.62389	Laerm-1997
Camden	Scolarinth, 1mi.S.	na	na	Laerm-1997
Camden	Scotchville, 1mi.S.	30.75500	81.61667	Williams-Genoway 1980
Camden	Scotchville, 4.7mi.E.Kingsland on Rt.40	30.76944	81.61750	Laerm-1997
Camden	Scotchville, S.of McKinnons	30.76917	81.61778	Williams-Genoway 1980
Camden	Scrubby Bluff, 3mi.SE.[nr.Crandall, FL?]	30.72472	81.52028	Williams-Genoway 1980
Camden	Shingle Swamp, W.of; Arnot Plantation	30.86472	81.69444	Hall & Kelson 1959
Camden	Spur 40, 0.35mi.N.Rt.40 [St.Mary's]	30.75722	81.58222	Laerm-1997

County	Locality description	Latitude	Longitude	Source
Camden	Spur 40, 0.5mi.N.Rt.40 [St.Mary's]	30.75917	81.52694	Laerm-1997
Camden	St.Mary's, 4mi.W.(=Shingle Swamp)	30.75639	81.61444	Hall & Kelson 1959
Camden	St.Marys, 3mi.W. [Rt-40?]	30.76000	81.60194	Williams-Genoway 1980
Camden	St.Marys, 5.9mi.W. [Rt-40?]	30.78139	81.62833	Williams-Genoway 1980
Camden	St.Marys, 5mi.W. [Rt-40?]	30.77083	81.61833	Williams-Genoway 1980
Camden	St.Marys, 7.5mi.W. [Rt-40?]	30.78972	81.48722	Williams-Genoway 1980
Camden	West Shruglen Swamp	na	na	Laerm-1997
Camden	Dunaway's Farm [Kingsland-Scotchville]	na	na	Williams-Genoway 1980
Candler		na	na	Golley 1962
Charlton	Folkston, 1mi.S., 0.2mi.E.of Rt.23	30.81250	82.01583	Laerm-1997
Charlton	Folkston, 1mi.S.on Rt.23	30.81333	82.01806	Laerm-1997
Charlton	Folkston, SW edge on Rt.23	30.81278	82.01722	Laerm-1997
Charlton	St.MaryR, nr.Camp Pinckney[1.8mi.E.US-1&Rt.40]	30.83778	81.97611	Hall & Kelson 1959
Chatham	Savannah	32.08389	81.10194	Hall & Kelson 1959
Chatham	Savannah, 7mi.N.	32.15861	81.18278	USNM-1997
Chatham	Savannah, 7mi.NW.of viaduct [Rt-21?]	32.15833	81.18278	Florida Nat.Hist.Museum-1997
Chatham	Savannah, 8mi.NW.of viaduct [Rt-21?]	32.17611	81.18833	Florida Nat.Hist.Museum-1997
Clay	Fort Gaines	31.60917	85.04750	Williams-Genoway 1980
Clay	Fort Gaines, 3.1mi.S. [Rt-39?]	31.56778	85.01667	Florida Nat.Hist.Museum-1997
Coffee	GA 31 and Ocmulgee R.	31.78889	82.97833	Williams-Genoway 1980
Coffee	GA 31, S.of Ocmulgee R	31.78083	82.97444	Florida Nat.Hist.Museum-1997
Coffee	US 319, 0.7mi.W.of GA 31	31.76750	82.97806	Florida Nat.Hist.Museum-1997

County	Locality description	Latitude	Longitude	Source
Coffee	GA 107 and 31[=441]	31.75889	82.96667	Williams-Genoway 1980
Cook	AntiochChurch,3mi.W[7.4miSW.Adel on AntiochRd]	31.09000	83.05444	Williams-Genoway 1980
Crawford	Reynolds, 6mi.E.on Rt.96	32.54722	83.99861	Williams-Genoway 1980
Crawford	Roberta	32.72000	84.01306	Williams-Genoway 1980
Crawford	Roberta, 7mi.S. [Rt-341?]	32.62528	83.96917	Williams-Genoway 1980
Decatur	Bainbridge, 2mi.E. [Rt-38/84?]	30.89306	84.49611	Florida Nat.Hist.Museum-1997
Decatur	Bainbridge, 2mi.SE. [US-1?]	30.85639	84.54972	Williams-Genoway 1980
Decatur	Bainbridge, 3.6mi.N.jct.Rt.84 on Rt.253	30.96389	84.56806	Laerm-1997
Decatur	Bainbridge, 3mi.SE. [US-1?]	30.84472	84.53972	Williams-Genoway 1980
Decatur	Bainbridge, 5.5mi.W.Flint R.[US-84?]	30.93917	84.66833	Williams-Genoway 1980
Decatur	Bainbridge, 5mi.W. [US-84?]	30.93667	84.66028	Williams-Genoway 1980
Decatur	Bainbridge, NW; 3.5mi.N.jct.Rt.27/84 on Rt.352	30.96278	84.56833	Laerm-1997
Decatur	Climax	30.87444	84.43250	Williams-Genoway 1980
Dodge	Gresston, 1.1mi.NE.	32.29722	83.23833	Laerm-1997
Dodge	Gresston, 1mi.NE.on Wilson Woodard Rd.	32.29528	83.23667	Laerm-1997
Dodge	Gresston, 2.1mi.NW	32.30944	83.27750	Laerm-1997
Dodge	Gresston,N.;2.2mi.N.Woodyard Rd.on St.23	32.31028	83.27833	Skelley 1997
Dodge	Gresston;0.1mi.S.Woodard Rd.& St.23/341	32.28444	83.25167	Skelley 1997
Dodge	Eastman, 10mi.W. [Rt-341?]	32.22667	83.35806	Williams-Genoway 1980
Dougherty	Albany	31.57889	84.15667	Williams-Genoway 1980
Dougherty	Albany, “dunes" E of Flint R.	na	na	Williams-Genoway 1980
Dougherty	Albany, 3mi.W. [Rt-234?]	31.58778	84.23139	Williams-Genoway 1980
Dougherty	Albany, 4mi.SE. [Rt-133?]	31.52000	84.07417	Laerm-1997
Dougherty	Albany, 4mi.SW. [Rt-91?]	31.50250	84.21361	Williams-Genoway 1980

County	Locality description	Latitude	Longitude	Source
Dougherty	Albany, 4mi.W.[Rt-234?]	31.58583	84.24667	Williams-Genoway 1980
Dougherty	Albany, 5mi.W.[Rt-234?]	31.58528	84.26306	Williams-Genoway 1980
Dougherty	Albany, 6.5mi.SW. [Rt-91?]	31.47417	84.24056	Williams-Genoway 1980
Dougherty	Albany, NW Flint	na	na	Williams-Genoway 1980
Dougherty	Albany, Turner Rd.	31.58917	84.10528	Williams-Genoway 1980
Dougherty	Albany, 3mi.S. [Rt-91?]	31.51333	84.20250	Florida Nat.Hist.Museum-1997
Early	Cedar Springs, 3.2mi.NW	31.20833	85.08333	Hodges 2000
Early	Shackleford Williams Bluff Preserve	31.19778	85.07833	Turnbow 2001
Effingham		na	na	Golley 1962
Emanuel	Modoc, 4mi.N. [Rt-56?]	32.71278	82.29111	Williams-Genoway 1980
Glynn	Sterling	31.27250	81.56139	Williams-Genoway 1980
Glynn	Little Satilla R., 1.5mi.N.on US 17	31.13250	81.60000	Williams-Genoway 1980
Grady	Beachton	30.72750	84.13944	Laerm-1997
Grady	Beachton, 1.5mi.W.on Rt.93	30.72611	84.14417	Laerm-1997
Grady	Beachton, N.; 0.2mi.W.jct.Rt.319 on Blackshear Rd.[PebbleHill Pl.]	30.73889	84.11389	Kovarik 1999
Grady	Beachton, N.; 0.3mi.W.jct.Rt.319 on Blackshear Rd.[PebbleHill Pl.]	30.74083	84.11500	Kovarik 1999
Grady	Beachton, N.; 0.6mi.W.jct.Rt.319 on Blackshear Rd.[PebbleHill Pl.]	30.74556	84.11500	Kovarik 1999
Grady	Metcalf, 7mi.W.on Metcalf Rd.[1mi.E.Beachton]	30.73000	84.10222	Laerm-1997
Grady	Metcalf,7mi.W.on Metcalf Rd.	30.72944	84.11667	Laerm-1997
Grady	Rt.93, 3mi.W.of Hwy.319	30.72028	84.16861	Laerm-1997
Grady	Thomasville, S.; 0.3mi.E.SR 319 on Metcalf Rd.	30.73000	84.11333	Laerm-1997
Grady	Beachton, 3.5mi.N. [Rt-319?]	30.75611	84.09722	Williams-Genoway 1980

County	Locality description	Latitude	Longitude	Source
Harris		na	na	Golley 1962
Houston	Perry, 4mi.W. [Rt-127?]	32.43944	83.83028	Williams-Genoway 1980
Jefferson	Pinetucky [5.5mi.SW.Wadley]	32.79667	82.44528	Williams-Genoway 1980
Jenkins	3.4mi.E.Rt.25 [E.of Millen?]	32.80222	81.89139	Laerm-1997
Jenkins	3.9mi.E.Rt.25 [E.of Millen?]	32.80139	81.88361	Laerm-1997
Jenkins	Herndon (S.river)	32.81250	82.12639	Williams-Genoway 1980
Jenkins	Millen, 1mi.E.; 0.1mi.N.Rt.17 on Rt.70 [70?]	32.80556	81.93278	Laerm-1997
Jenkins	Millen, 2.6mi.W.on Rt.17	32.80889	81.99528	Laerm-1997
Jenkins	nr.Millen; 1.6mi.N.jct.Rt.21 on Rt.25	32.83000	81.95056	Harpoot 1999
Jenkins	Perkins, 2,3mi.S	32.87889	81.94556	Skelley 1997
Jenkins	Perkins, S., 3.25mi.S.Burke Co.line on US-25	32.87583	81.96333	Skelley 1997
Jenkins	Perkins, S., 3.7mi.S.Burke Co.line on US-25	32.86972	81.96139	Skelley 1997
Jenkins	Perkins, S., 3.9mi.S.Burke Co.line on US-25	32.86556	81.96111	Skelley 1997
Jenkins	Millen	32.80417	81.94889	Williams-Genoway 1980
Lanier	Alapaha R., near, on US 84	30.92806	83.02889	Williams-Genoway 1980
Macon	Ideal	32.36972	84.18833	Williams-Genoway 1980
Marion	Ft. Benning, E.; 1.1mi.S.Pine Knot Creek on Rt.355	32.42583	84.64306	Laerm-1997
Marion	Ft.Benning, E; 0.3mi.N.Pine Knot Creek on Rt.355	32.44083	84.65194	Turnbow 1997
Marion	Ft.Benning, E; 0.7mi.N.Pine Knot Creek on Rt.355	32.44556	84.64722	Turnbow 1997
Marion	Ft.Benning, E; 1mi.N.jct.Rt.355 & Rt.352 (2.5mi.S.Jupiter)	32.48222	84.62833	Turnbow 1997
Marion	Jupiter, 5.3mi.S.; 1.8mi.S.jct.Rt.352 on Rt.355	32.44611	84.64722	Laerm-1997
Mitchell	Newton, 0.5mi.below on E.bank Flint R.	31.29778	84.32889	Laerm-1997
Mitchell	Camilla, nr.	31.23194	84.21083	Williams-Genoway 1980
Muscogee	Columbus	32.45833	84.98833	USNM-1997

County	Locality description	Latitude	Longitude	Source
Pierce	Blackshear, 1.7mi.S.on US 15	31.27472	82.21583	Laerm-1997
Pierce	Blackshear, 2mi.S.on US 15	31.25722	82.20750	Laerm-1997
Pierce	Blackshear, 3mi.S.on US 15	31.27028	82.21500	Laerm-1997
Pulaski	Hawkinsville	32.28389	83.47222	Williams-Genoway 1980
Pulaski	Hawkinsville, 1.3mi.S. [Rt-12/129A?]	32.25250	83.47444	Florida Nat.Hist.Museum-1997
Quitman	Georgetown	31.88444	85.09833	Williams-Genoway 1980
Randolph		na	na	Golley 1962
Richmond	Augusta	33.46778	82.01694	Hall & Kelson 1959
Richmond	Augusta, 10mi.S. [Rt-25?]	33.29222	82.05639	Williams-Genoway 1980
Richmond	Augusta, 10mi.SW. [US-1?]	33.35778	82.14250	Williams-Genoway 1980
Richmond	Augusta, 11mi.SW. [US-1?]	33.34528	82.15389	Florida Nat.Hist.Museum-1997
Richmond	Augusta, 14mi.SW. [US-1?]	33.31389	82.20639	Williams-Genoway 1980
Richmond	Augusta, 16mi.SE. [SSE?]	na	na	Laerm-1997
Richmond	Blythe (1.5mi.N.jct.road to Wrens+Hepzibah)	33.31583	82.20139	Williams-Genoway 1980
Richmond	Blythe (2mi.N.jct.road to Wrens+Hepzibah)	33.32222	82.20194	Williams-Genoway 1980
Richmond	Blythe (3mi.N.jct.road to Wrens+Hepzibah)	33.33611	82.21306	Williams-Genoway 1980
Richmond	Hephzibah, 6mi.SE. [Rd.to McBean?]	33.25861	82.02056	Laerm-1997
Richmond	Hollywood (12mi.S.Augusta) [Mechanic Hill?]	33.29944	81.95778	Hall & Kelson 1959
Richmond	McBean	33.24500	81.95167	Williams-Genoway 1980
Richmond	McBean, 1mi.W., 1mi.N.	33.25944	81.96833	Laerm-1997
Richmond	McBean, 2.5mi.W., 1mi.N.	33.25944	81.98889	Laerm-1997
Richmond	McBean, 2mi.N.[Rt-56?]	33.27250	81.95611	Laerm-1997
Richmond	McBean, 3.05mi.N.on Rt.56	33.28778	81.95889	Laerm-1997

County	Locality description	Latitude	Longitude	Source
Richmond	McBean, 3.5mi.N.on SR.56	33.29472	81.95944	Laerm-1997
Richmond	McBean, 4mi.N.	33.30278	81.95611	Laerm-1997
Richmond	McBean, 4mi.N., 0.3mi.E.SR.56	33.28694	81.95306	Laerm-1997
Richmond	McBean, 4mi.N., 2.2mi.E.SR.56	33.28833	81.91944	Laerm-1997
Richmond	McBean, 4mi.N., 3.5mi.E.SR.56	33.27944	81.91167	Laerm-1997
Richmond	McBean, N, 0.15mi.E.Rt.56 on Horseshoe Rd.	33.28750	81.95556	Skelley 1997
Richmond	McBean, N, jct. Rt.56 & Horseshoe Rd.	33.26556	81.97611	Skelley 1997
Richmond	McBean, NNE, 0.1mi.W.BennochMill & HorseshoeRd.	33.29083	81.92389	Skelley 1997
Richmond	McBean, NNW, Clark Rd. 0.3mi.N.Hepz-McBean Rd.	33.26806	81.98528	Skelley 1997
Richmond	McBean, NNW, Clark Rd. 1.4mi.N.Hepz-McBean Rd.	33.28194	81.97611	Skelley 1997
Richmond	McBean, NNW, Old WaynesboroRd.& Hepz-McBean Rd.	33.25667	82.00806	Skelley 1997
Richmond	McBean, Old WaynesboroRd.0.15mi.N.Hepz-McBean	33.25944	82.00861	Skelley 1997
Richmond	McBean, Old WaynesboroRd.0.25mi.N.Hepz-McBean	33.26056	82.00833	Skelley 1997
Richmond	McBean, Old WaynesboroRd.0.4mi.N.Hepz-McBean Rd	33.26306	82.00889	Skelley 1997
Richmond	McBean; 0.1mi.W.Bennoch Mill & Horseshoe Rd.	33.29139	81.92361	Harpoot 1999
Richmond	SR.56& BurkeCo.line, 4.5mi.NNE,BennochMillRd.	33.29139	81.92056	Laerm-1997
Richmond	Adams [0.5mi.N.I-520&Louisville Rd, S.Augusta]	33.40972	82.01111	Williams-Genoway 1980
Screven	2.8mi.N.Oliver on Hwy.17	32.54028	81.57667	Harpoot 1999
Screven	Hursman's Lake [Hershman Lake?]	32.91694	81.51111	Williams-Genoway 1980
Screven	Hwy.21, 5.5mi.W.Hwy.301 [W. of Sylvania]	32.78194	81.74417	Harpoot 1999
Screven	Hwy.24, 15.4mi.S. Hwy.301 [W. of Blue Springs]	32.64028	81.45833	Harpoot 1999
Screven	Newington, 4.7mi.N. [Rt-24?]	32.62944	81.45194	Laerm-1997
Screven	Newington, 4.8mi.N., 0.1mi.E.Rt.24	32.63056	81.44833	Laerm-1997
Screven	Rocky Ford	32.66389	81.82972	Williams-Genoway 1980

County	Locality description	Latitude	Longitude	Source
Screven	Rt.24, 0.1mi.S.of Blue Spring Rd.	32.62639	81.45028	Laerm-1997
Screven	Rt.24, 1mi.E.	na	na	Laerm-1997
Screven	Rt.28, 2.5mi.E.	na	na	Laerm-1997
Screven	Sylvania	32.75056	81.63667	Williams-Genoway 1980
Screven	Sylvania, 10.5mi.SE. [Rt-21?]	32.62528	81.53417	Williams-Genoway 1980
Screven	Sylvania, 10mi.SE. [Rt-21?]	32.63083	81.53889	Williams-Genoway 1980
Screven	Sylvania, 14mi.N.Wade Plantation [Rt-301?]	32.92889	81.54111	Williams-Genoway 1980
Talbot	Jct.Rt. 90 & 96	32.60028	84.45306	Laerm-1997
Talbot	Junction City	32.60444	84.46472	Williams-Genoway 1980
Talbot	Mauk, 4.8mi.N.on Rt.90	32.57083	84.44167	Laerm-1997
Talbot	Taylor-Talbot Co.line, 0.4mi.N.	32.56861	84.44028	Laerm-1997
Talbot	Geneva	32.58056	84.55250	Williams-Genoway 1980
Talbot	Mauk,St.90 N.; 0.6mi.N.Taylor Co.line	32.57139	84.44222	Laerm-1997
Tattnall	Ohoopee R., 1mi.E.on US 280	32.10861	82.17528	Williams-Genoway 1980
Tattnall	Ohoopee R., 2mi.E.on US.280	32.10028	82.16139	Florida Nat.Hist.Museum-1997
Tattnall	Reidsville	32.08722	82.11833	Williams-Genoway 1980
Taylor	Butler	32.55778	84.23833	Williams-Genoway 1980
Taylor	Butler, 1mi.E. [Rt-96?]	32.55583	84.21806	Williams-Genoway 1980
Taylor	Butler, 1mi.NE.on GA 137	32.57222	84.22028	Laerm-1997
Taylor	Butler, 2mi.W. [Rt-96?]	32.56750	84.27333	Williams-Genoway 1980
Taylor	Butler, 5mi.W.on GA 96	32.58250	84.32472	Laerm-1997
Taylor	Butler, 7.5mi.S.on Rt. 19	32.45333	84.28000	Laerm-1997
Taylor	Howard	32.59500	84.38500	Williams-Genoway 1980
Taylor	Jct. SR.90 & Cr.40	32.53917	84.43528	Laerm-1997

County	Locality description	Latitude	Longitude	Source
Taylor	Junction City, 4mi.S. [Rt-90?]	32.54778	84.43611	Laerm-1997
Taylor	Mauk, 2.4mi.NW	32.53333	84.44250	Turnbow 1997
Taylor	Mauk, 0.5mi.N.on Rt.90	32.50917	84.42361	Laerm-1997
Taylor	Mauk, 1.1mi.N.	32.51750	84.42611	Laerm-1997
Taylor	Mauk, 1.1mi.N.on St.90	32.51944	84.42639	Laerm-1997
Taylor	Mauk, 2.1mi.N.on St.90	32.53167	84.43389	Laerm-1997
Taylor	Mauk, 2.5mi.N.	32.53694	84.43556	Laerm-1997
Taylor	Mauk, 3.5mi.N.	32.56028	84.43750	Laerm-1997
Taylor	Mauk, 3mi.N.	32.54417	84.43500	Laerm-1997
Taylor	Mauk, N., CR.40 0.8mi.S.Co.line	32.54944	84.44389	Laerm-1997
Taylor	Mauk, N.on St.90	32.53361	84.42528	Skelley 1997
Taylor	Mauk, N.on St.90	32.54778	84.43861	Skelley 1997
Taylor	Mauk, N.on St.90	32.56028	84.43889	Skelley 1997
Taylor	Rt.90, 1mi.SE.jct. Rt.127	32.43667	84.35222	Laerm-1997
Taylor	Rupert, 2mi.E, 2mi.N.	32.46694	84.24750	Laerm-1997
Taylor	Rupert, W.; 2 mi. W.Rt-19 on Rt-90	32.43528	84.32611	Kovarik 1999
Taylor	St.90, 1.95 mi.W of St.19	32.43500	84.32333	Skelley 1997
Taylor	Butler, 5.4mi.N. [Rt-19?]	32.64222	84.25417	Williams-Genoway 1980
Taylor	Mauk, N.; St.90 at Talbot Co.line	32.56194	84.43806	Laerm-1997
Taylor	Mauk,St.90 N.; 2.1mi.S.Talbot Co.line	32.53306	84.43389	Laerm-1997
Telfair	Douglas, 33mi.N. [4mi.S.280on441, S.Mcrae]	31.99167	82.93000	Williams-Genoway 1980
Telfair	Helena	32.07500	82.91611	Williams-Genoway 1980
Telfair	Jacksonville	31.81361	82.98111	Williams-Genoway 1980
Telfair	McRae	32.06917	82.90000	Williams-Genoway 1980

County	Locality description	Latitude	Longitude	Source
Telfair	McRae, 2mi.NW.	32.08444	82.92944	Florida Nat.Hist.Museum-1997
Telfair	McRae, 2mi.S.on US 280	32.04694	82.94500	Williams-Genoway 1980
Telfair	Helena, 2.9mi.W.	32.08528	82.96528	Florida Nat.Hist.Museum-1997
Thomas	Metcalf	30.70056	83.98861	Williams-Genoway 1980
Thomas	Metcalf, 2.4mi.N.on Rt.122	30.73528	83.99278	Laerm-1997
Thomas	Metcalf, 2.5mi.W.on Beachton Rd.	30.70250	84.03139	Laerm-1997
Thomas	Metcalf, 2mi.N.on SR.59	30.73000	83.99222	Laerm-1997
Thomas	Metcalf, 2mi.SW.on SR.59	30.68000	84.01222	Laerm-1997
Thomas	Metcalf, 3mi.N.on Rt.122	30.75917	83.99472	Laerm-1997
Thomas	Metcalf, 4.4mi.N.on SR.59	30.76583	83.99389	Laerm-1997
Thomas	Metcalf, 4mi.N.on Rt.122	30.76444	83.99528	Laerm-1997
Thomas	Metcalf, 5.5mi.N.on Rt.122	30.78111	83.99444	Laerm-1997
Thomas	Metcalf, 5.5mi.W.	30.72556	84.07444	Laerm-1997
Thomas	Metcalf, 5.6mi.N.on Rt.122	30.68250	83.99444	Laerm-1997
Thomas	Metcalf, 5.8mi.N.on SR.59, on Magnolia Rd.	30.78528	83.98500	Laerm-1997
Thomas	Metcalf, NE.; 2.7mi.S.jct.Rt.19 on New Hope Rd. [Sedgefield Pl.]	30.71889	83.94111	Kovarik 1999
Thomas	Metcalf,W.;1.8mi.S.Metcalf+Springhill Rd.	30.68861	84.07028	Laerm-1997
Thomas	Thomasville	30.83694	83.97944	Williams-Genoway 1980
Thomas	Thomasville, 10mi.SSW.; Springhill Plantation	30.70528	84.06389	Hall & Kelson 1959
Thomas	Thomasville, 10mi.SW.[Springhill Rd.?]	30.70944	84.06056	Williams-Genoway 1980
Thomas	Thomasville, 3.5mi.S.Rt-319 on Rt.59	30.76361	83.99583	Laerm-1997
Thomas	Thomasville, 7mi.SW. [Rt-319?]	30.77083	84.07222	Williams-Genoway 1980
Toombs		na	na	Golley 1962

County	Locality description	Latitude	Longitude	Source
Ware	Waycross	31.21444	82.35528	Williams-Genoway 1980
Ware	Waycross, 2mi.N. [Rt-23?, Hebardville]	31.23806	82.37194	Williams-Genoway 1980
Ware	Waycross, 5mi.N. [Rt-23?, Jamestown?]	31.28056	82.38778	Williams-Genoway 1980
Ware	Hebardsville	31.24111	82.36806	Williams-Genoway 1980
Ware	Waycross, nr.jct.Rt.1 & Rt.38	31.21250	82.35611	Florida Nat.Hist.Museum-1997
Wayne	Doctortown	31.65333	81.82972	Williams-Genoway 1980
Wayne	Jesup	31.60722	81.88556	Williams-Genoway 1980
Wheeler	McRae, 2mi.NE. [Rt-319 or Rt-280?]	32.09139	82.87778	Williams-Genoway 1980
Wheeler	McRae, NE; 3.7mi.ENE jct.Rt-319 on Rt-280	32.10750	82.82750	Kovarik 1999
Wheeler	US 280 & GA 31, 1mi.NE.of jct	32.09000	82.86778	Florida Nat.Hist.Museum-1997
Wheeler	US 280 & GA 31, jct.of	32.08361	82.88333	Florida Nat.Hist.Museum-1997
Wilcox	Abbeville, 11mi.N. [Rt-341?]	32.12611	83.40944	Laerm-1997
Worth	0.1 mi.S.Abrams Ck.on Rt-300/257 [0.6mi.S.Rt.32; 6.3mi.W.Doles]	31.71639	83.98944	Kovarik 1999
Worth	0.5 mi.S.Abrams Ck.on Rt-300/257 [1mi.S.Rt.32; 6.3mi.W.Doles]	31.71111	83.99000	Kovarik 1999
Worth	0.6 mi.S.Abrams Ck.on Rt-300/257 [1.1mi.S.Rt.32; 6.3mi.W.Doles]	31.71056	83.99000	Kovarik 1999
Worth	2.1 mi.S.Abrams Ck.on Rt-300/257 [2.6 mi.S.Rt.32; 6.3mi.W.Doles]	31.68861	83.99139	Kovarik 1999
Worth	2.6 mi.S.Rt-32 on Rt.-300 &0.1mi.E.[MercerMills, 6.4mi.W.Doles,#5]	31.69000	83.99167	Kovarik 1999
Worth	2.6mi.S.Rt-32 onRt.-300 &0.2mi.E.[MercerMills,6.4mi.W.Doles,#3,4]	31.68806	83.99056	Kovarik 1999
Worth	2.6mi.S.Rt-32 onRt.-300 &0.3mi.E.[MercerMills,6.4mi.W.Doles,#1,2]	31.68944	83.98833	Kovarik 1999

Appendix B. Currently occupied southeastern pocket gopher localities compiled from roadside surveys and confirmed opportunistic sightings June-August 2006 in the Coastal Plain of Georgia.

County	Latitude	Longitude	Date observed
Baker	31.27421	-84.48155	8/22/2006
Baker	31.27099	-84.47365	8/22/2006
Baker	31.30771	-84.46854	8/22/2006
Baker	31.30260	-84.45429	8/22/2006
Baker	31.29641	-84.45671	8/22/2006
Baker	31.28391	-84.45304	8/22/2006
Baker	31.29559	-84.44788	8/22/2006
Baker	31.30770	-84.44596	8/22/2006
Baker	31.29441	-84.44206	8/22/2006
Baker	31.29026	-84.44479	8/22/2006
Baker	31.27544	-84.50447	8/22/2006
Baker	31.26028	-84.52493	8/22/2006
Baker	31.25541	-84.51035	8/22/2006
Baker	31.24181	-84.48390	8/22/2006
Baker	31.23815	-84.47939	8/22/2006
Baker	31.22200	-84.47506	8/22/2006
Baker	31.20513	-84.46619	8/22/2006
Baker	31.20064	-84.46762	8/22/2006
Baker	31.36212	-84.26649	8/22/2006
Baker	31.38628	-84.28079	8/22/2006
Baker	31.40407	-84.24410	8/22/2006
Baker	31.41949	-84.27698	8/22/2006
Brooks	30.66914	-83.40479	8/21/2006
Brooks	30.66333	-83.41810	8/21/2006
Brooks	30.67038	-83.42046	8/21/2006
Brooks	30.66969	-83.43241	8/21/2006
Burke	33.03185	-81.56643	8/15/2006
Burke	33.02283	-81.58711	8/15/2006
Burke	33.00654	-81.68416	8/15/2006
Burke	33.08992	-81.81781	8/15/2006
Burke	33.12257	-81.79149	8/15/2006
Burke	33.11556	-81.78608	8/15/2006

County	Latitude	Longitude	Date observed
Burke	33.15272	-81.81289	8/15/2006
Burke	33.14756	-81.82068	8/15/2006
Burke	33.12657	-81.80433	8/15/2006
Burke	33.16408	-81.81263	8/15/2006
Burke	33.17008	-81.82351	8/15/2006
Burke	33.18720	-81.82491	8/15/2006
Burke	33.19610	-81.86717	8/15/2006
Camden	31.10669	-81.67475	8/3/2006
Camden	31.10016	-81.70903	8/3/2006
Camden	30.83980	-81.68496	8/3/2006
Camden	30.83927	-81.67758	8/3/2006
Camden	30.81462	-81.74279	8/3/2006
Camden	30.80589	-81.72641	8/3/2006
Camden	30.79577	-81.71906	8/3/2006
Camden	30.78125	-81.68996	8/3/2006
Camden	30.77366	-81.70217	8/3/2006
Camden	30.77760	-81.70869	8/3/2006
Camden	30.77737	-81.67789	8/4/2006
Camden	30.77265	-81.66860	8/4/2006
Charlton	30.82590	-82.01629	8/3/2006
Charlton	30.76967	-82.06166	8/3/2006
Charlton	30.75510	-82.07016	8/3/2006
Charlton	30.74037	-82.07208	8/3/2006
Charlton	30.73995	-82.08691	8/3/2006
Charlton	30.70234	-82.06727	8/3/2006
Charlton	30.63141	-82.05510	8/3/2006
Crisp	31.95456	-83.90847	8/21/2006
Dodge	32.30356	-83.23871	8/14/2006
Dougherty	31.50064	-84.21344	6/30/2006
Early	31.19136	-85.07413	6/30/2006
Early	31.20094	-85.06969	6/30/2006
Early	31.18648	-85.07531	8/21/2006
Early	31.18941	-85.07971	8/21/2006
Early	31.19360	-85.08241	8/21/2006

County	Latitude	Longitude	Date observed
Early	31.20394	-85.08625	8/21/2006
Early	31.19911	-85.08224	8/21/2006
Early	31.19250	-85.09234	8/21/2006
Emanuel	32.72182	-82.31627	8/14/2006
Grady	30.72680	-84.13980	6/29/2006
Grady	30.72987	-84.11227	6/29/2006
Grady	30.75454	-84.14253	6/29/2006
Jefferson	32.79256	-82.43113	8/14/2006
Jenkins	32.88415	-81.96529	8/14/2006
Jenkins	32.84360	-81.95122	8/14/2006
Jenkins	32.80197	-81.88915	8/14/2006
Laurens	32.26190	-82.79715	8/13/2006
Marion	32.42656	-84.64281	7/27/2006
Marion	32.44767	-84.64441	7/27/2006
Marion	32.48148	-84.63020	7/27/2006
Marion	32.52984	-84.45349	7/28/2006
Screven	32.61931	-81.44559	8/15/2006
Screven	32.64157	-81.45974	8/15/2006
Screven	32.66029	-81.46918	8/15/2006
Tattnall	32.09589	-82.15640	8/8/2006
Taylor	32.43283	-84.24940	7/1/2006
Taylor	32.55175	-84.43678	7/28/2006
Taylor	32.54974	-84.44387	7/28/2006
Taylor	32.53757	-84.44045	7/28/2006
Taylor	32.54775	-84.42472	7/28/2006
Taylor	32.54912	-84.43145	7/28/2006
Taylor	32.53623	-84.43494	7/28/2006
Taylor	32.50666	-84.42215	7/28/2006
Taylor	32.51692	-84.42577	7/28/2006
Taylor	32.54125	-84.42044	7/28/2006
Taylor	32.50855	-84.33040	8/20/2006
Taylor	32.54055	-84.31584	8/20/2006
Taylor	32.53279	-84.33664	8/20/2006
Taylor	32.53164	-84.36282	8/20/2006

County	Latitude	Longitude	Date observed
Telfair	32.08434	-82.92929	8/13/2006
Telfair	31.99935	-82.91960	8/13/2006
Telfair	31.98320	-82.92415	8/13/2006
Worth	31.68664	-83.98977	7/1/2006
Worth	31.70688	-83.98133	7/1/2006
Worth	31.71132	-83.98928	7/1/2006

Appendix C. Classifications and definitions of land cover types associated with the Georgia GAP project (USGS 2003) landcover data set used in southeastern pocket gopher habitat models.

Land Cover Type	Code	Description
Beach	7	Open sand, sandbars, mud, and some sand dunes - natural environments as well as exposed sand from dredging and other activities. Mainly in coastal areas, but also inland, especially along the banks of reservoirs.
Coastal Dune	9	Sand dunes and associated vegetation.
Open Water	11	Lakes, rivers, ponds, ocean, industrial water, aquaculture.
Transportation	18	Roads, railroads, airports, and runways.
Utility swaths	20	Open swaths maintained for transmission lines.
Low Intensity Urban - Nonforested	22	Low intensity urban areas with little or no tree canopy.
High Intensity Urban	24	Commercial/industrial and multi-family residential areas.
Clearcut - Sparse Vegetation	31	Recent clearcuts, sparse vegetation, and other early successional areas.
Quarries, Strip Mines	33	Exposed rock and soil from industrial uses, gravel pits, landfills.
Rock Outcrop	34	Rock outcrops and mountain tops.
Parks, Recreation	72	Cemeteries, playing fields, campus-like institutions, parks, schools.
Golf Course	73	Golf courses.
Pasture, Hay	80	Pasture, non-tilled grasses.
Row Crop	83	Row crops, orchards, vineyards, groves, horticultural businesses.
Forested Urban - Deciduous	201	Low intensity urban areas containing mainly deciduous trees.
Forested Urban - Evergreen	202	Low intensity urban areas containing mainly evergreen trees.
Forested Urban - Mixed	203	Low intensity urban areas containing mixed deciduous and evergreen trees.
Mesic Hardwood	410	Mesic forests of lower elevations in the mountain regions (Blue Ridge, Cumerland Plateau, and Ridge and Valley) and upper Piedmont. Includes species such as yellow-poplar, sweetgum, white oak, northern red oak, and American beech.
Sub-mesic Hardwood	411	Moderately mesic forests of the mountain regions and upper Piedmont. Includes typical oak-hickory forests. The dominant natural cover class in most mountain areas.

Land Cover Type	Code	Description
Hardwood Forest	412	Mesic to moderately mesic forests of the lower Piedmont and Coastal Plain. Includes non-wetland floodplain forests of yellow-poplar and sweetgum, ravines of oaks and American beech, and many upland oak-hickory stands.
Xeric Hardwood	413	Dry hardwood forests found throughout the state, although most common in the mountain regions, and progressively more rare southward. Includes areas dominated by southern red oak, scarlet oak, post oak, and blackjack oak.
Deciduous Cove Hardwood	414	Mesic forests of sheltered valleys in the Blue Ridge and Cumberland Plateau at moderate to high elevations. Typically includes northern red oak, basswood, buckeye, and yellow-poplar.
Northern Hardwood	415	Restricted to the highest elevations of the Blue Ridge. Dominant tree species may include yellow birch, black cherry, and American beech.
Live Oak	420	Forests dominated by live oak. Most common in maritime strands along the Atlantic Coast. Also may occur in strip along southern border into southwest Georgia.
Open Loblolly-Shortleaf Pine	422	Only mapped in the Piedmont. Includes older, fairly open stands that may be almost savanna-like in appearance.
Xeric Pine	423	Very dry evergreen forests restricted to the mountain regions and upper Piedmont. Includes Virginia, shortleaf, pitch, and table mountain pines.
Hemlock-White Pine	424	Mesic evergreen forests frequently associated with riparian areas. Restricted to Blue Ridge and Cumberland Plateau.
White Pine	425	Moderately mesic evergreen forests of the Blue Ridge, usually dominated by white pine.
Montane Mixed Pine-Hardwood	431	Moderately mesic mixed forests of the Blue Ridge. Typical species include white pine, white oak, hickories, and yellow-poplar.
Xeric Mixed Pine-Hardwood	432	Dry mixed forests found throughout the state, although most common in the mountain regions, and progressively more rare southward. Includes areas dominated by a mix of pines (most frequently shortleaf or Virginia in the mountains, and shortleaf or longleaf elsewhere) and hardwood species such as southern red oak, scarlet oak, post oak, and blackjack oak.

Land Cover Type	Code	Description
Mixed Cove Forest	433	Mesic mixed forests of sheltered valleys and riparian areas in the Blue Ridge and Cumberland Plateau at moderate to high elevations. Typically includes eastern hemlock, yellow-poplar, and black birch.
Mixed Pine-Hardwood	434	Mesic to moderately dry forests of mixed deciduous and evergreen species found throughout the state at lower elevations. May include areas dominated by sweetgum, yellow-poplar, various oak species, and loblolly or shortleaf pine.
Loblolly-Shortleaf Pine	440	Found from the upper Coastal Plain northward (rare in the Blue Ridge except at the lowest elevations). Includes many stands heavily managed for silviculture as well as areas regenerating from old field conditions.
Loblolly-Slash Pine	441	Found on the lower Coastal Plain. Includes many heavily managed stands as well as a few natural areas.
Shrub Bald	511	Restricted to mountain tops at high elevations of the Blue Ridge. May be dominated by mountain laurel, rhododendron, or blueberry.
Sandhill	512	Areas of scrub vegetation on deep, sandy soils on the Coastal Plain, especially near the Fall Line and along larger streams. May be dominated by turkey oak, blackjack oak, live oak, holly, and longleaf pine.
Coastal Scrub	513	Thickets between coastal dunes, typically dominated by wax myrtle. Sometimes found adjacent to saltmarsh areas.
Longleaf Pine	620	Open, savanna-type stands. Heavily managed plantations would likely be classed with 440 or 441. Most common on the lower Coastal Plain, although found up to the lower Piedmont and historically in the Ridge and Valley.
Cypress-Gum Swamp	890	Regularly flooded swamp forests mainly found on the Coastal Plain. May include either riparian or depressional wetlands. Usually dominated by pond or baldcypress and/or tupelo gum.
Bottomland Hardwood	900	Less frequently flooded wetland forests found throughout the state, but most common on the Coastal Plain. To the north, may be dominated by sweetgum, elms, and red maple. To the south, wetland oaks (water oak, willow oak, overcup oak, swamp chestnut oak), black gum, and even spruce pine become more common.
Saltmarsh	920	Emergent brackish or saltwater wetlands dominated by Spartina or Juncus.
Freshwater Marsh	930	Emergent freshwater wetlands found throughout the state. May be dominated by grasses or sedges.

Land Cover Type	Code	Description
Shrub Wetland	980	Closed canopy, low stature woody wetland. Found throughout the state, although most common on the Coastal Plain. May be result of clearcutting of wetland forests. Frequently includes willows, alders, and red maple.
Evergreen Forested Wetland	990	Restricted to the Coastal Plain. Includes forests dominated by bay species, wet pine forests (typically slash or pond pine), or Atlantic white cedar.

Appendix D. Land cover classifications used in southeastern pocket gopher habitat models reclassified from the original classifications found in the Georgia GAP (USGS 2003) dataset showing the GAP classifications combined and justifications for reclassification.

Reclassified Name	**Georgia GAP Codes**	**Action Taken**	**Reason**
Open Water/Swamp	11, 890, 920, 930, 980, 990	Grouped as one class	Similar habitat conditions
Early Succession	20, 31, 80	Grouped as one class	Similar habitat conditions
Urban	22, 24, 201, 202, 203	Grouped as one class	All urban derivatives
Row crop	83	Left as single cover type	Nothing similar
Sandhill	512	Left as single cover type	Nothing similar
Hardwood	412, 413, 420, 432, 434, 900	Grouped as one class	All hardwood derivatives
Longleaf Pine	612	Left as single cover type	Nothing similar
Other Pine	422, 440, 441	Grouped as one class	All pine derivatives