

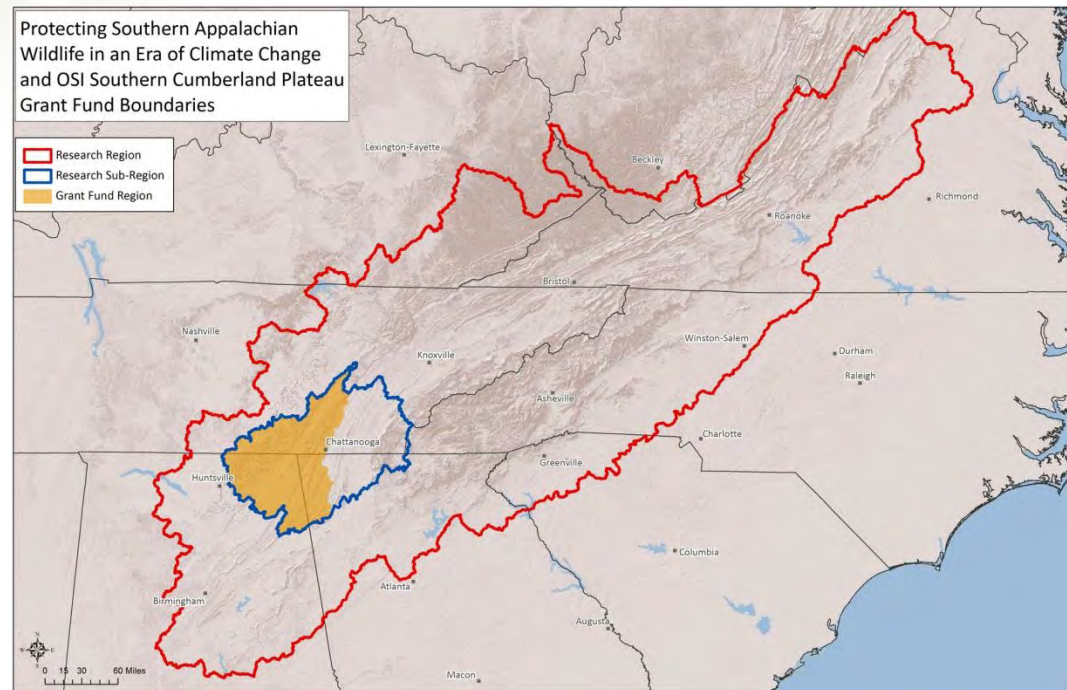
Protecting Southern Appalachian Wildlife in an Era of Climate Change

***Project Review
October 23, 2011***



Research Project Goals

- Regionalize SWAPs
- Prioritize corridors for protection
- Refine priorities based on climate research
- Develop products and tools
- Launch focused grant fund



Step 1

1) Regionalize SWAP
Priorities

2) Collect Other
Species and Habitat
Data

3) Assess Corridors
using *Corridor
Designer* and *Circuit
Scape*

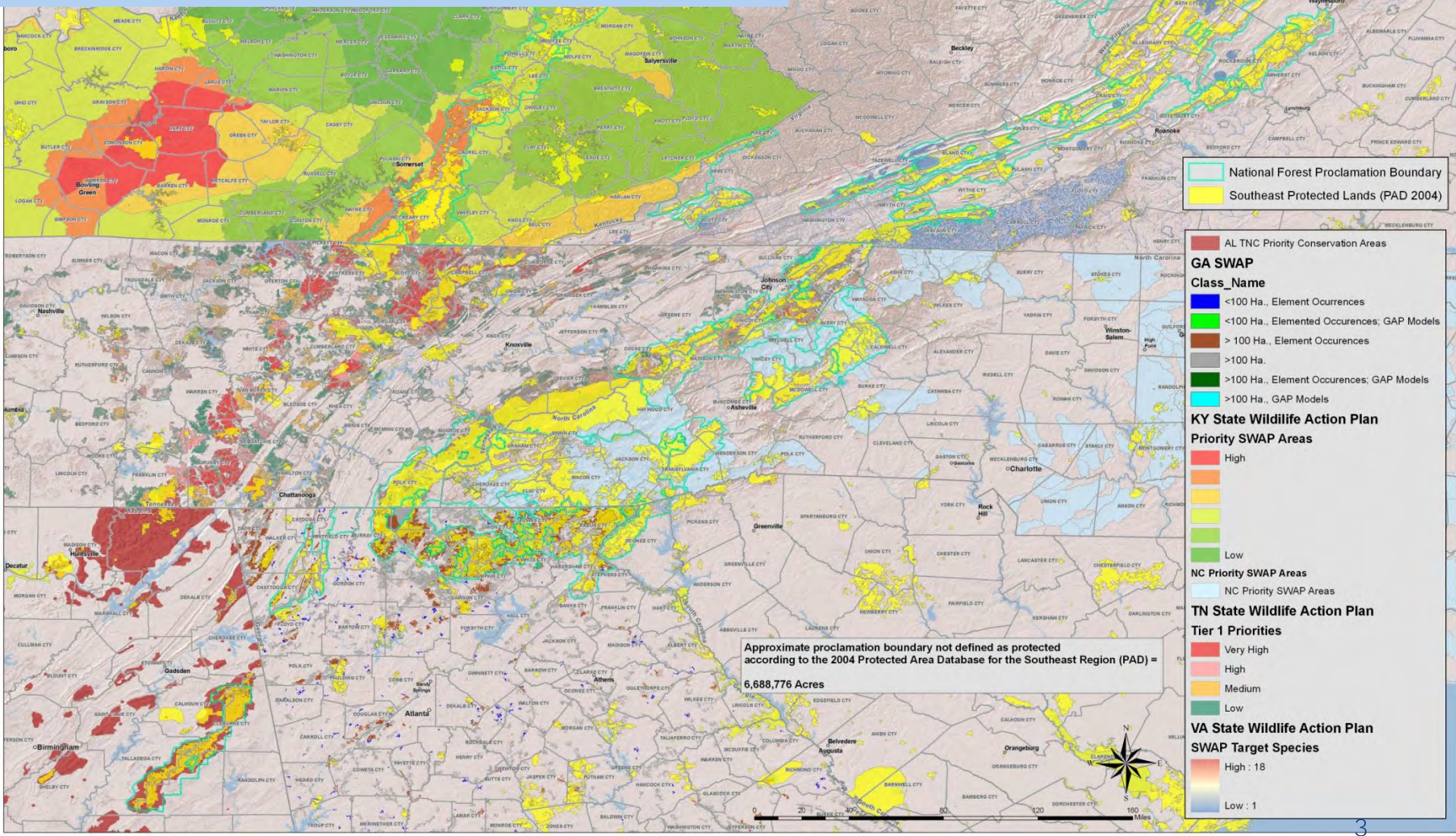
4) Habitat Priorities
with Corridors

5) Model Wildlife
Climate Vulnerability
using *Climate
Wizard* and
NatureServe CCVI

6) Climate-Adjusted
Regional Protection
Priorities



Individual Southeast SWAP Products



▬ National Forest Proclamation Boundary
 Southeast Protected Lands (PAD 2004)

AL TNC Priority Conservation Areas

GA SWAP

Class_Name

- <100 Ha., Element Occurrences
- <100 Ha., Element Occurrences; GAP Models
- > 100 Ha., Element Occurrences
- >100 Ha.
- >100 Ha., Element Occurrences; GAP Models
- >100 Ha., GAP Models

KY State Wildlife Action Plan

Priority SWAP Areas

- High
-
-
-
- Low

NC Priority SWAP Areas

- NC Priority SWAP Areas

TN State Wildlife Action Plan

Tier 1 Priorities

- Very High
- High
- Medium
- Low

VA State Wildlife Action Plan

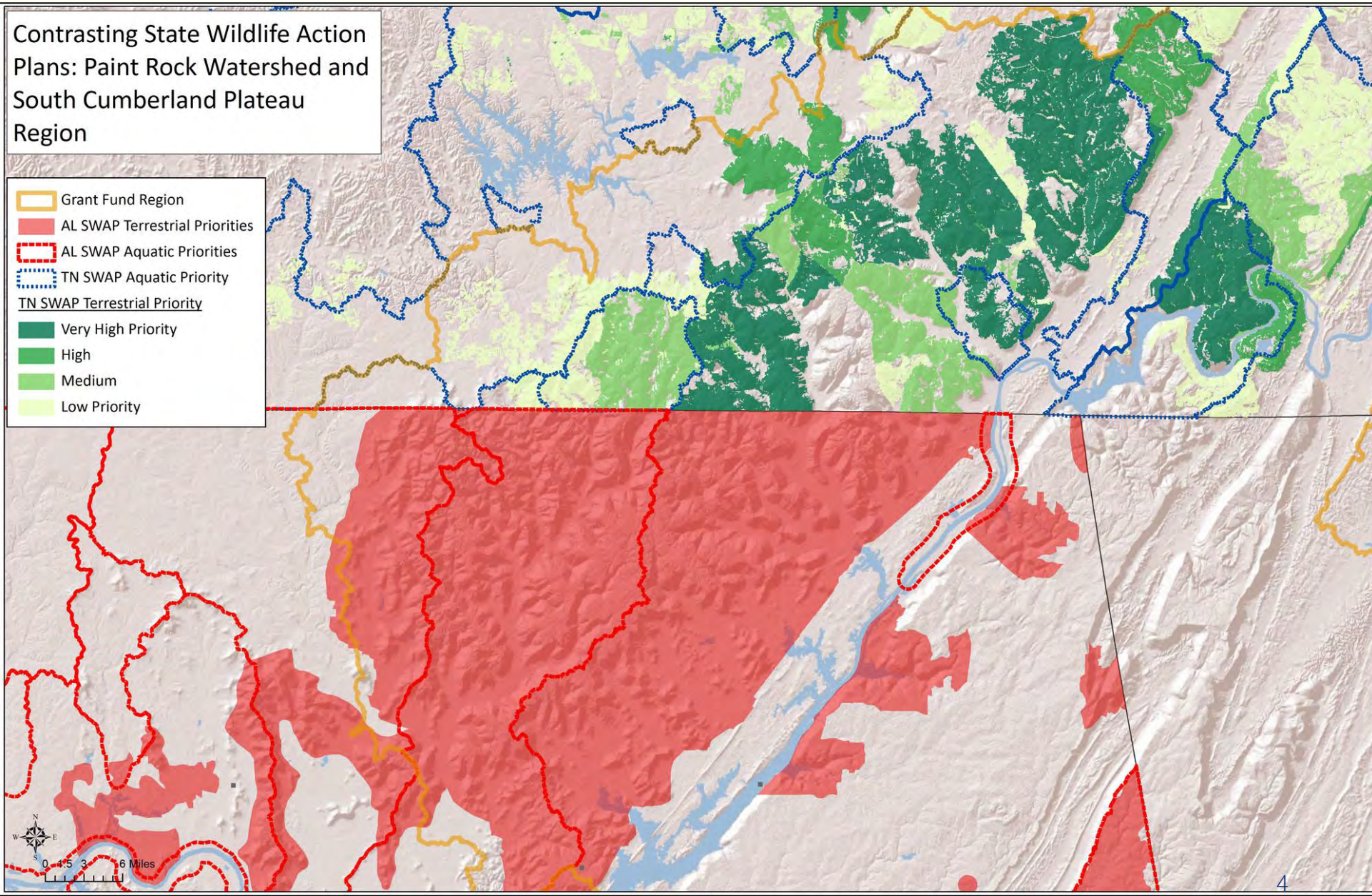
SWAP Target Species

- High : 18
- Low : 1

Approximate proclamation boundary not defined as protected according to the 2004 Protected Area Database for the Southeast Region (PAD) = 6,688,776 Acres

Contrasting State Wildlife Action Plans: Paint Rock Watershed and South Cumberland Plateau Region

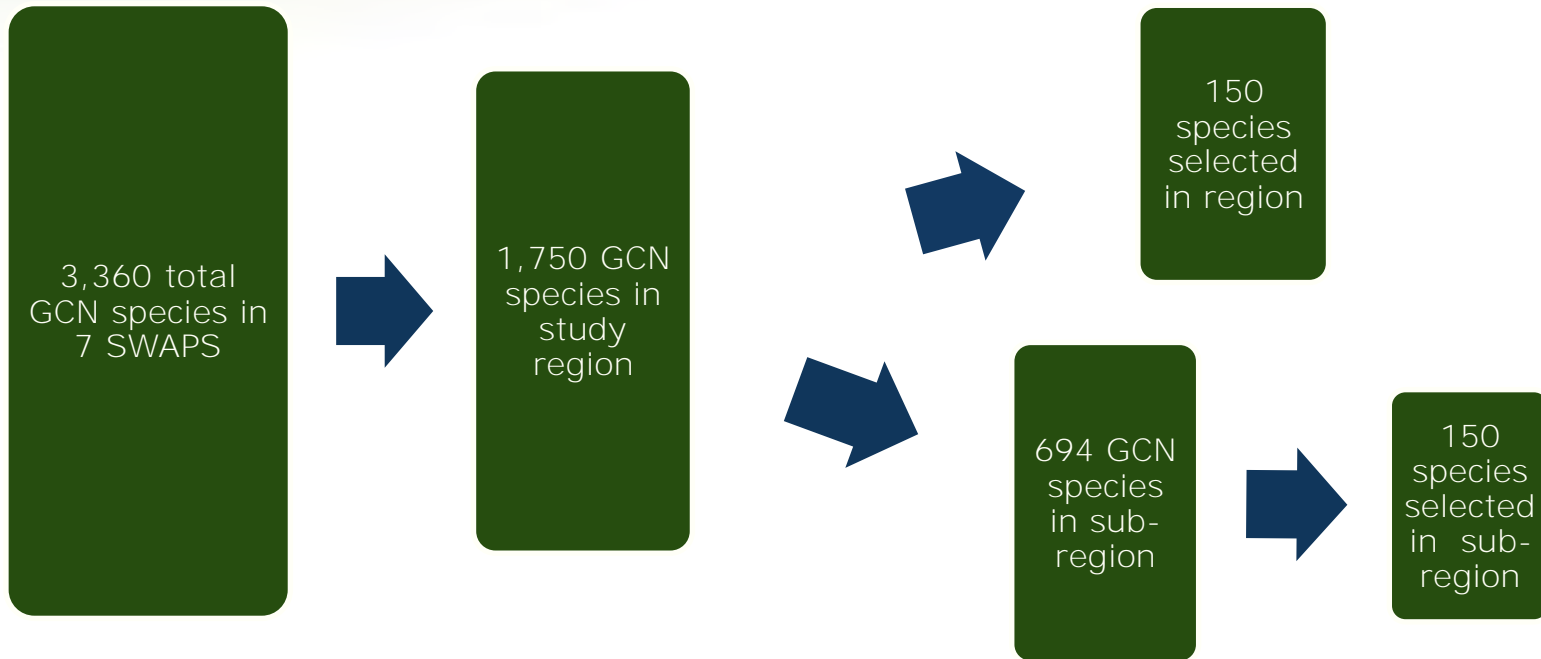
- Grant Fund Region
- AL SWAP Terrestrial Priorities
- AL SWAP Aquatic Priorities
- TN SWAP Aquatic Priority
- TN SWAP Terrestrial Priority
- Very High Priority
- High
- Medium
- Low Priority



Species of Greatest Conservation Need (GCN)



Species Selection for Study



Step 2

1) Regionalize SWAP
Priorities

2) Collect Other
Species and Habitat
Data

3) Assess Corridors
using *Corridor
Designer* and *Circuit
Scape*

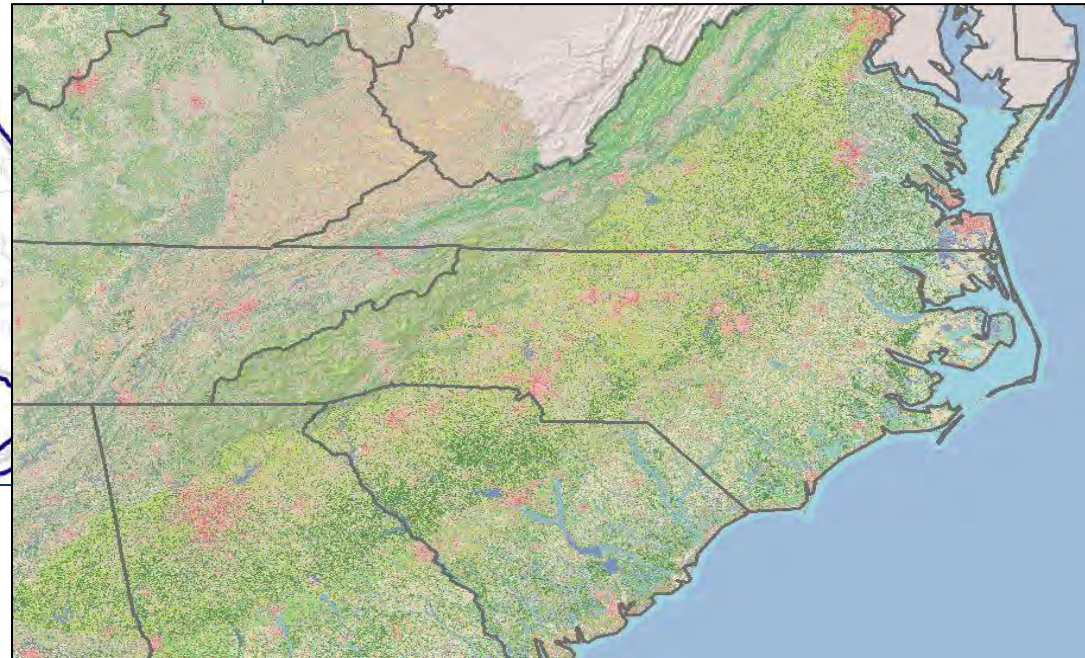
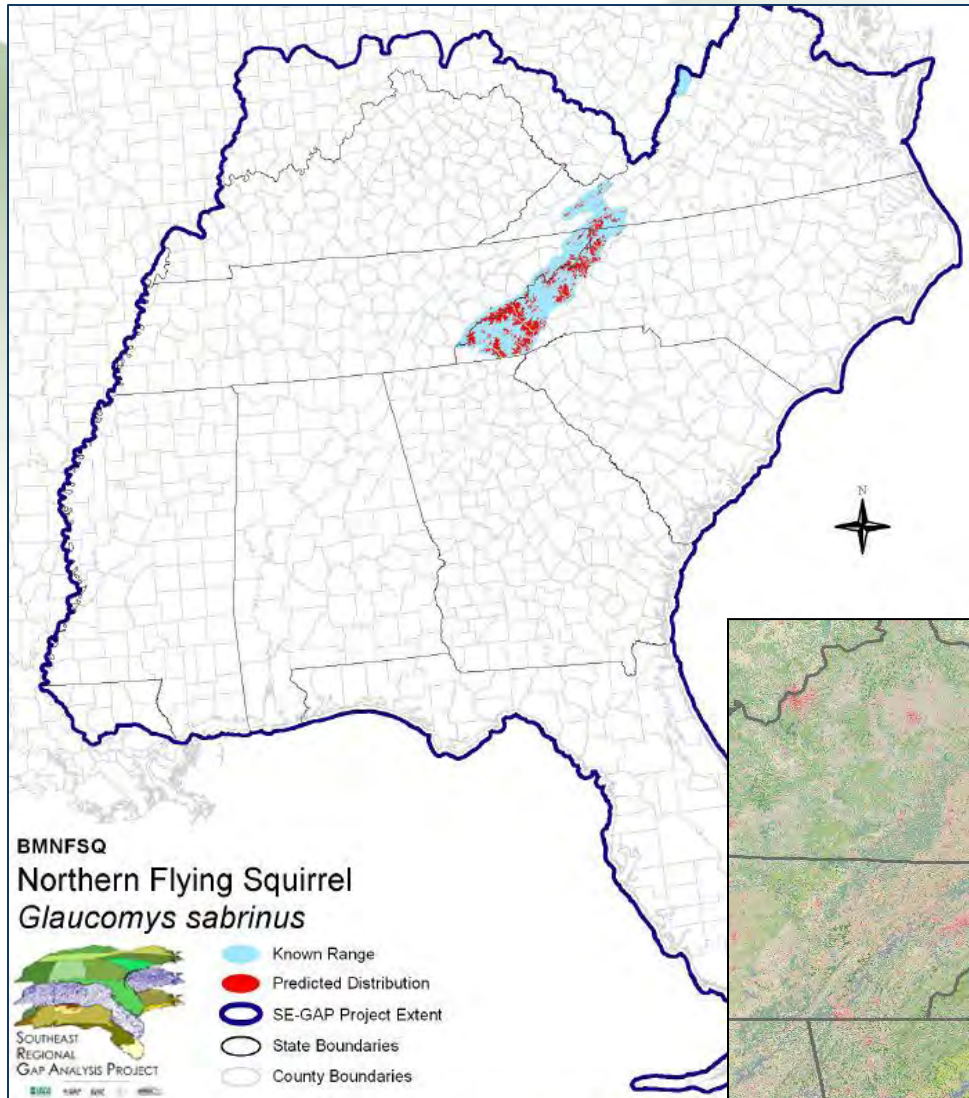
4) Habitat Priorities
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Regional Protection
Priorities

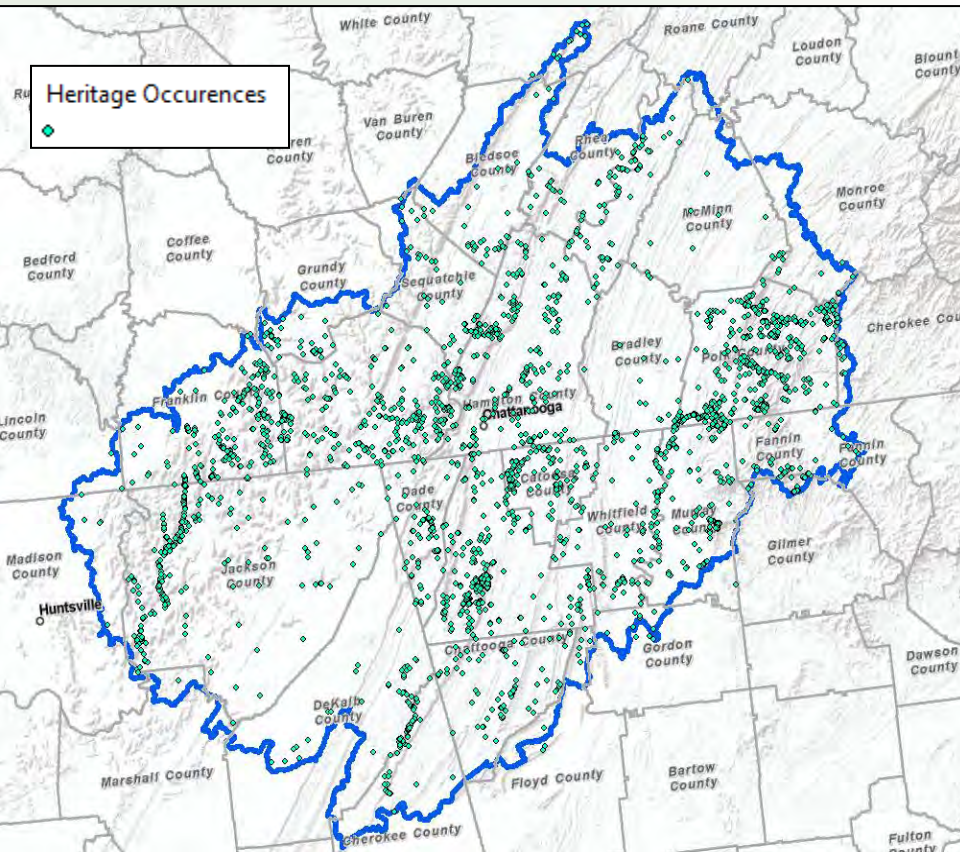


Locating Habitat

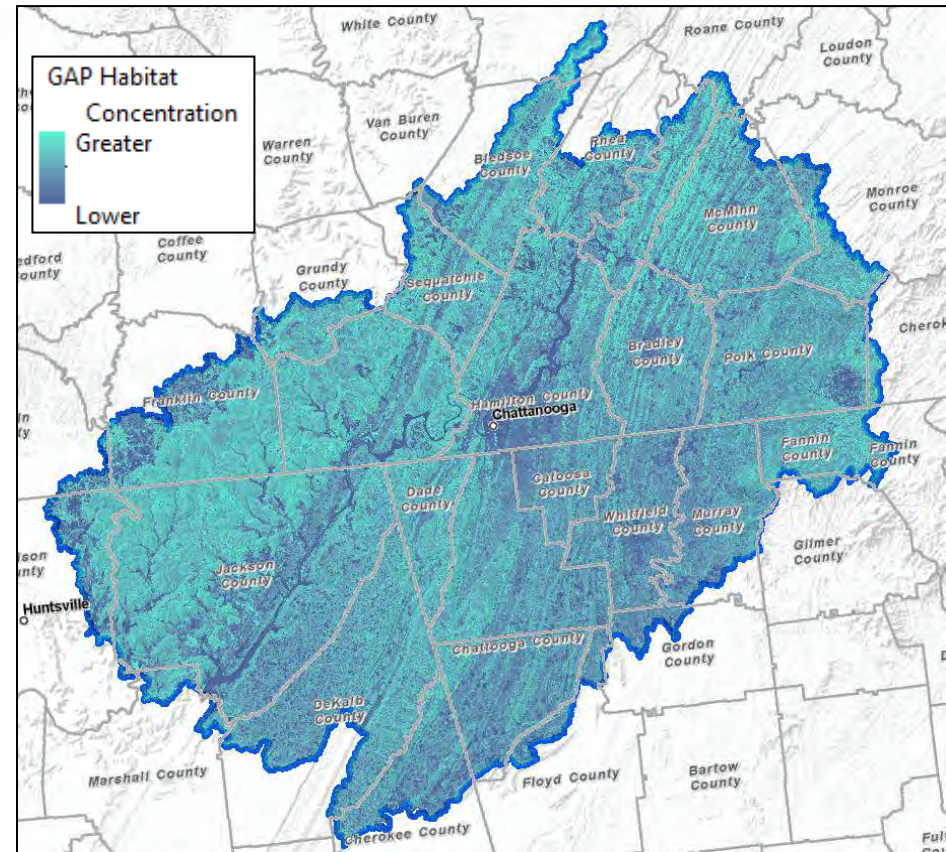


Species Data Collected

Heritage Data



GAP Distribution



Step 3

1) Regionalize SWAP
Priorities



2) Collect Other
Species and Habitat
Data



3) Assess Corridors
using *Corridor
Designer* and *Circuit
Scape*



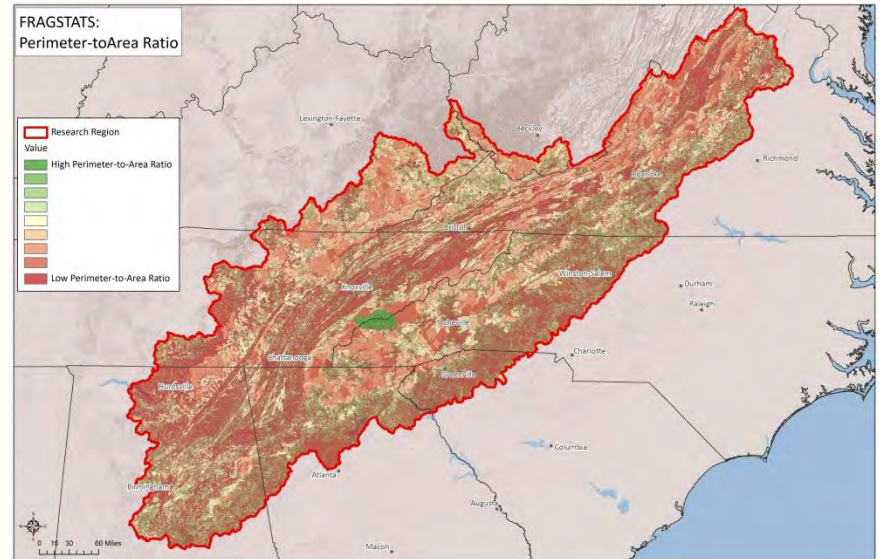
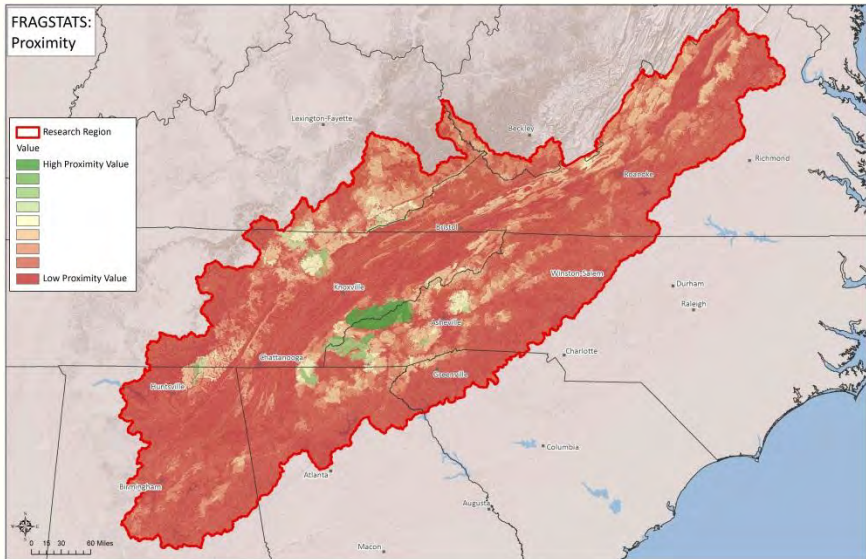
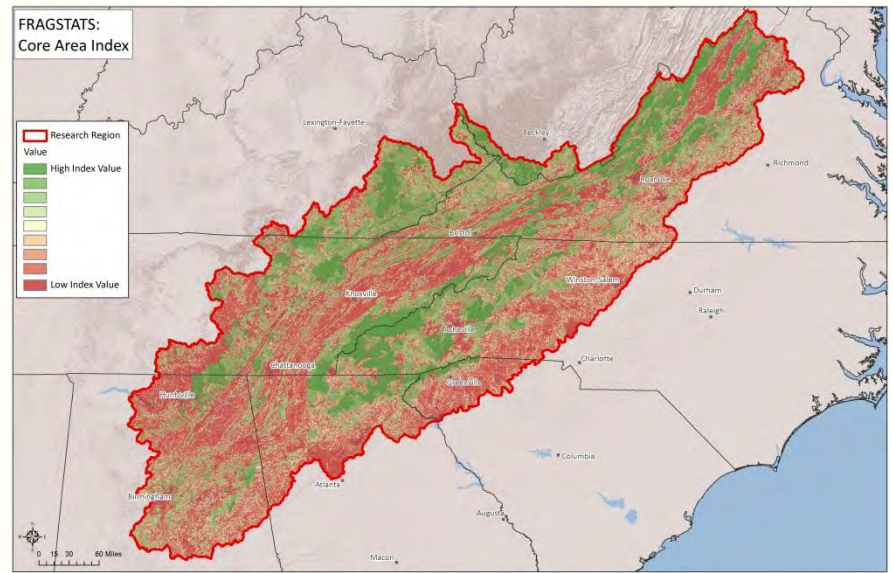
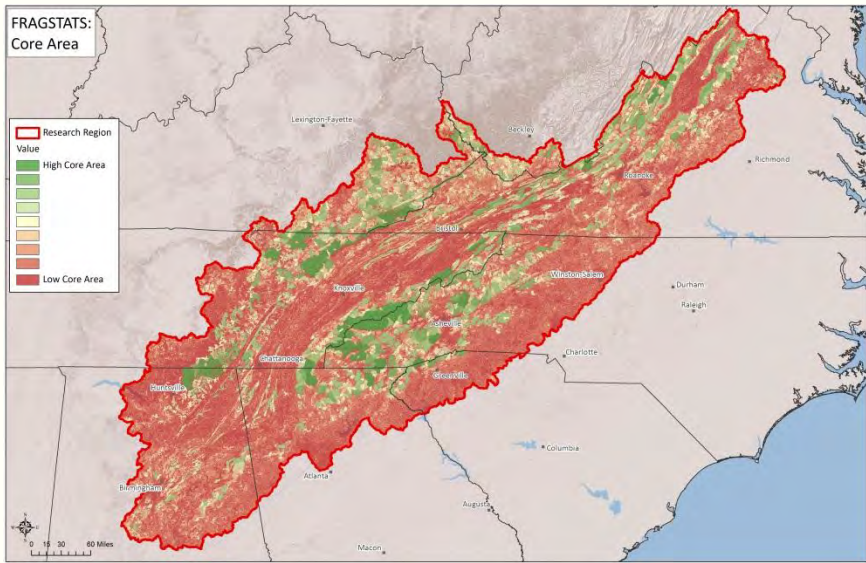
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Regional Protection
Priorities

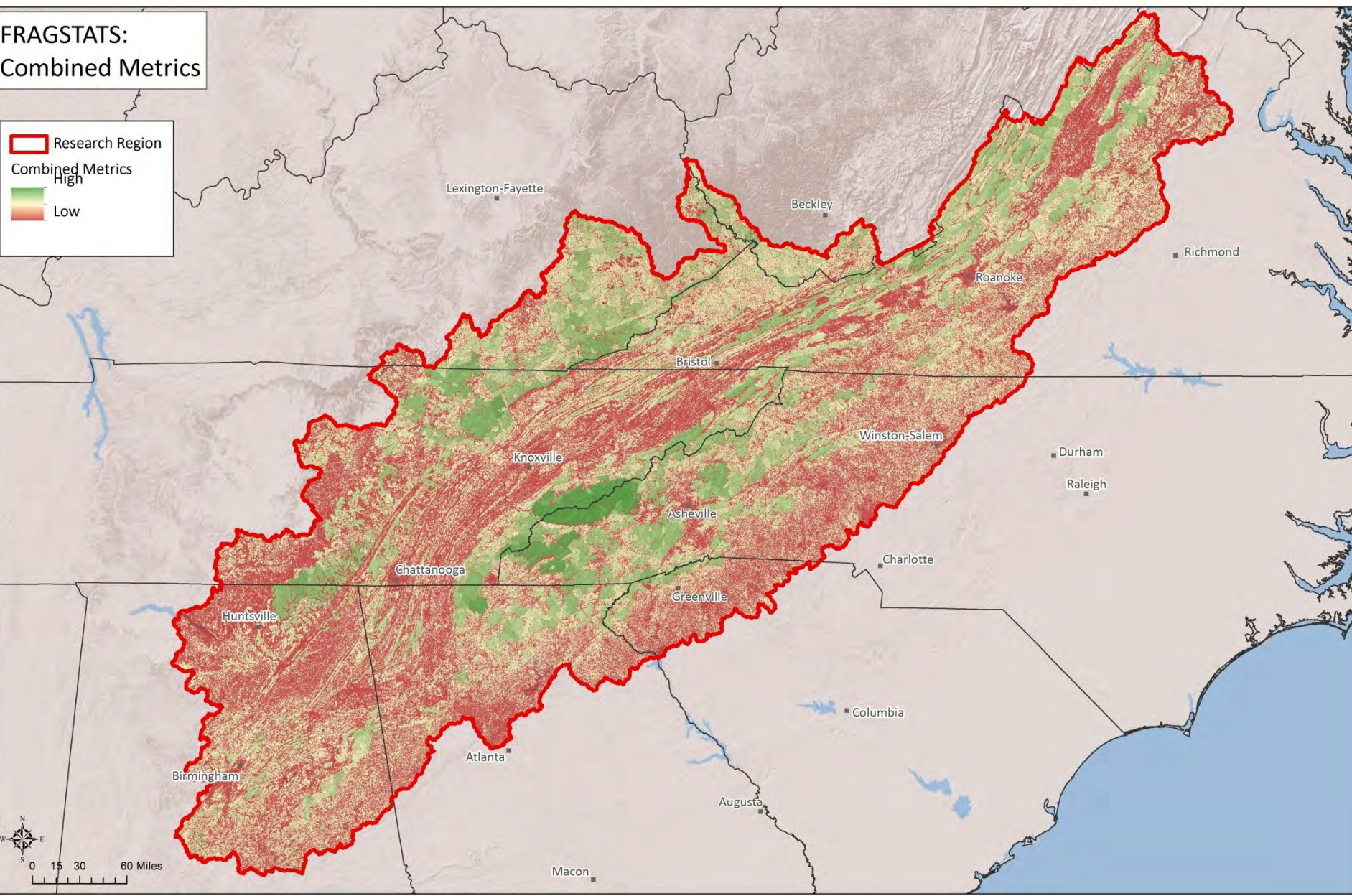


FRAGSTATS: Combined Metrics

 Research Region

Combined Metrics

 High
Low





Assigned Value

Natural Landscape Index

- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1

Forest Blocks

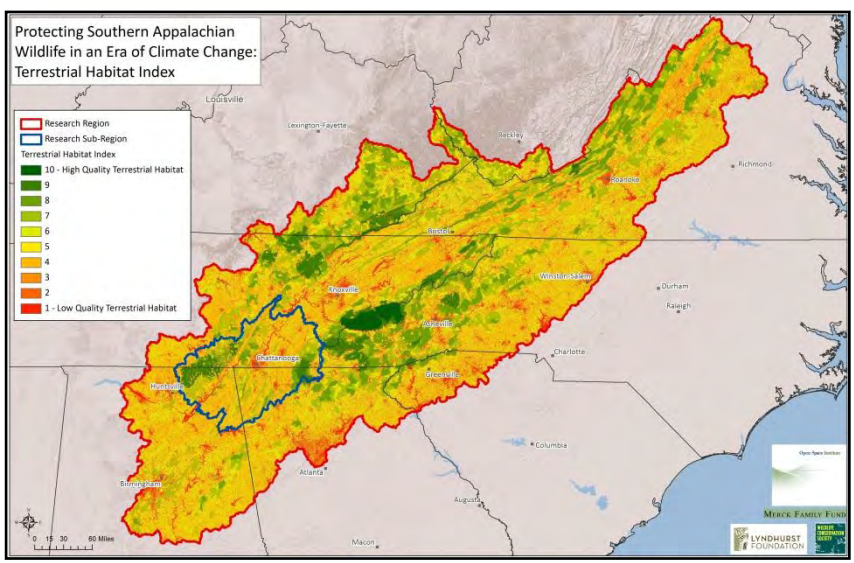


Agricultural Land Use,
Forestry Lands,

Developed – Open
Space; Recently
Disturbed; Clear-cuts

Low Intensity Developed

Medium - High Intensity
Developed; Open Water;
Bare Soil; Quarries-
Mines-Pits



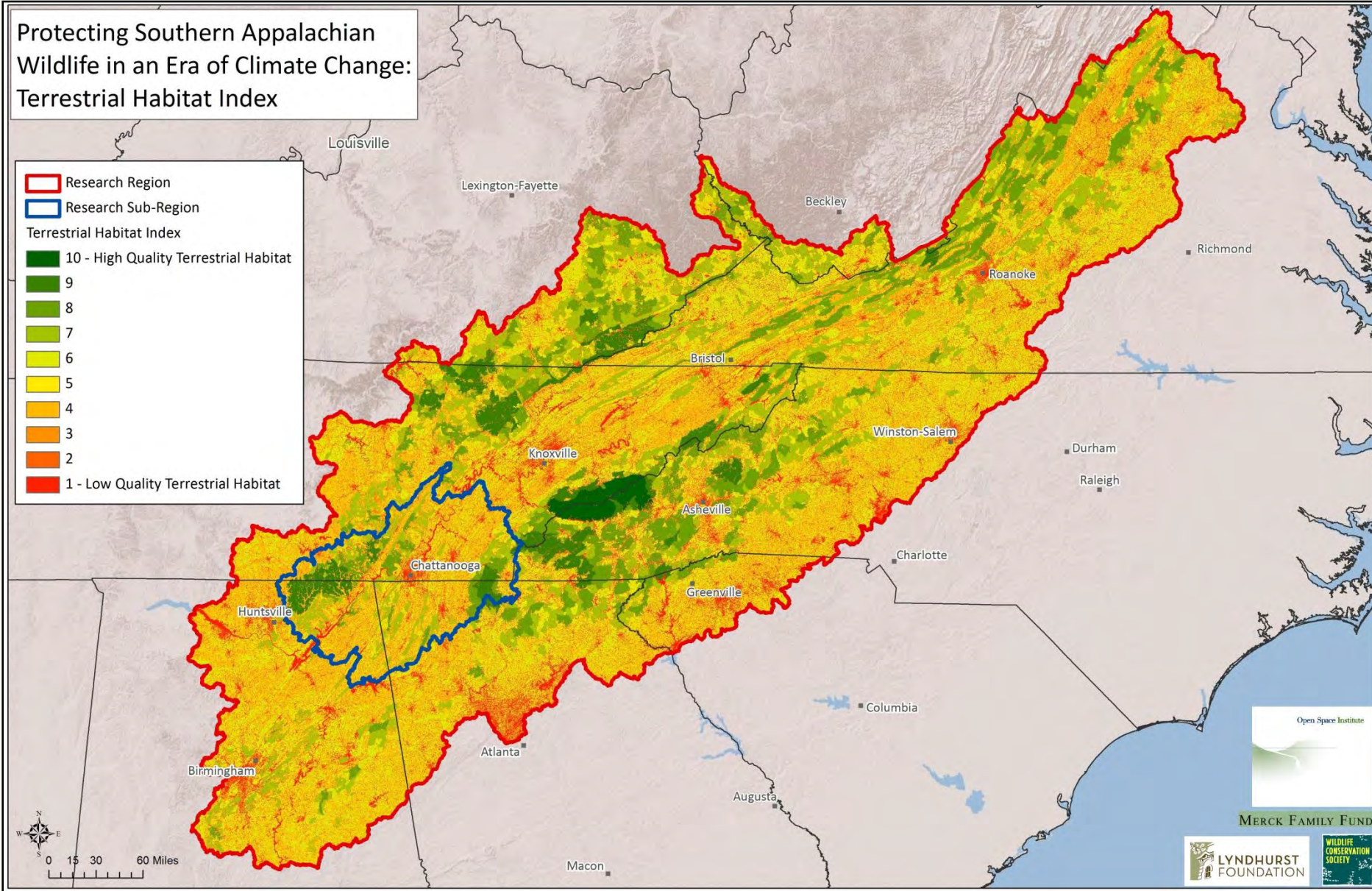
Protecting Southern Appalachian Wildlife in an Era of Climate Change: Terrestrial Habitat Index

Research Region (Red outline)

Research Sub-Region (Blue outline)

Terrestrial Habitat Index

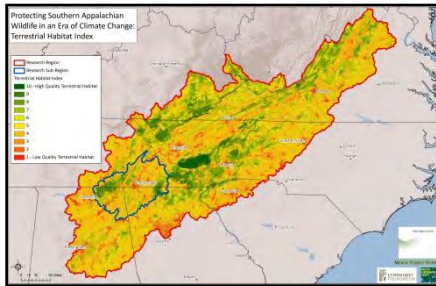
- 10 - High Quality Terrestrial Habitat
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1 - Low Quality Terrestrial Habitat



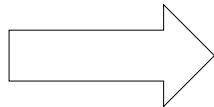
MERCK FAMILY FUND



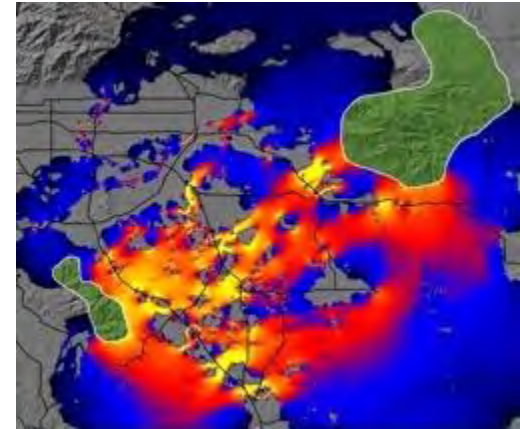
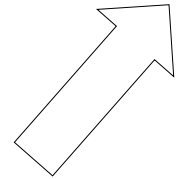
Two Corridor Modeling Approaches



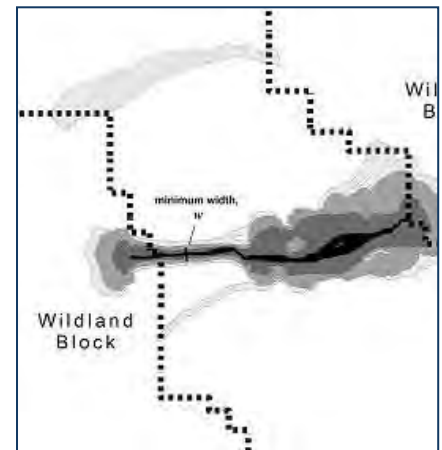
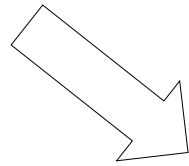
Natural Landscape Index



Reclassify to Cost Surface






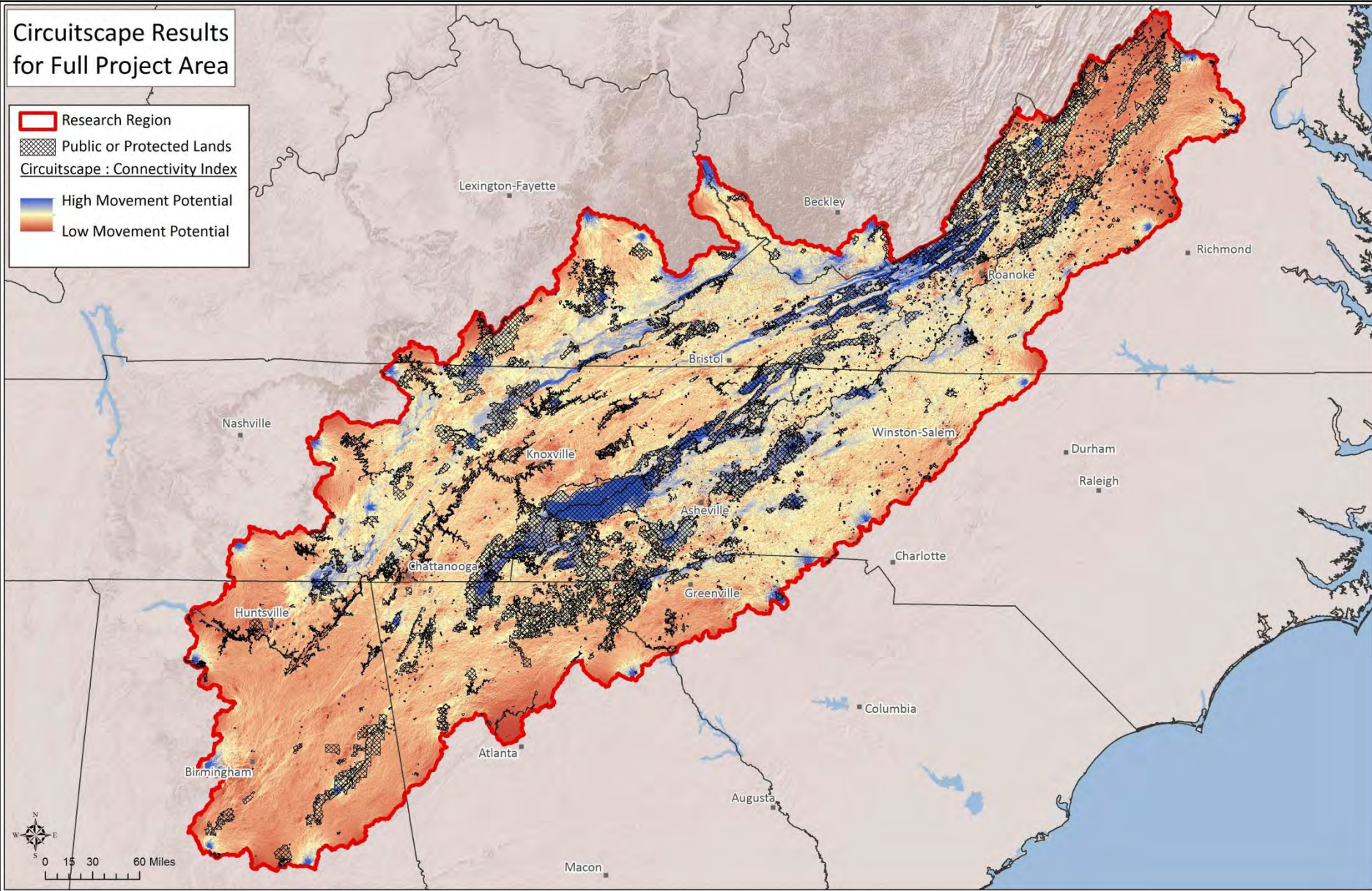
Circuit Flow Modeling




Least Cost Corridors


Circuitscape Results for Full Project Area

-  Research Region
-  Public or Protected Lands
- Circuitscape : Connectivity Index**
-  High Movement Potential
-  Low Movement Potential





Circuitscape Results for Full Project Area

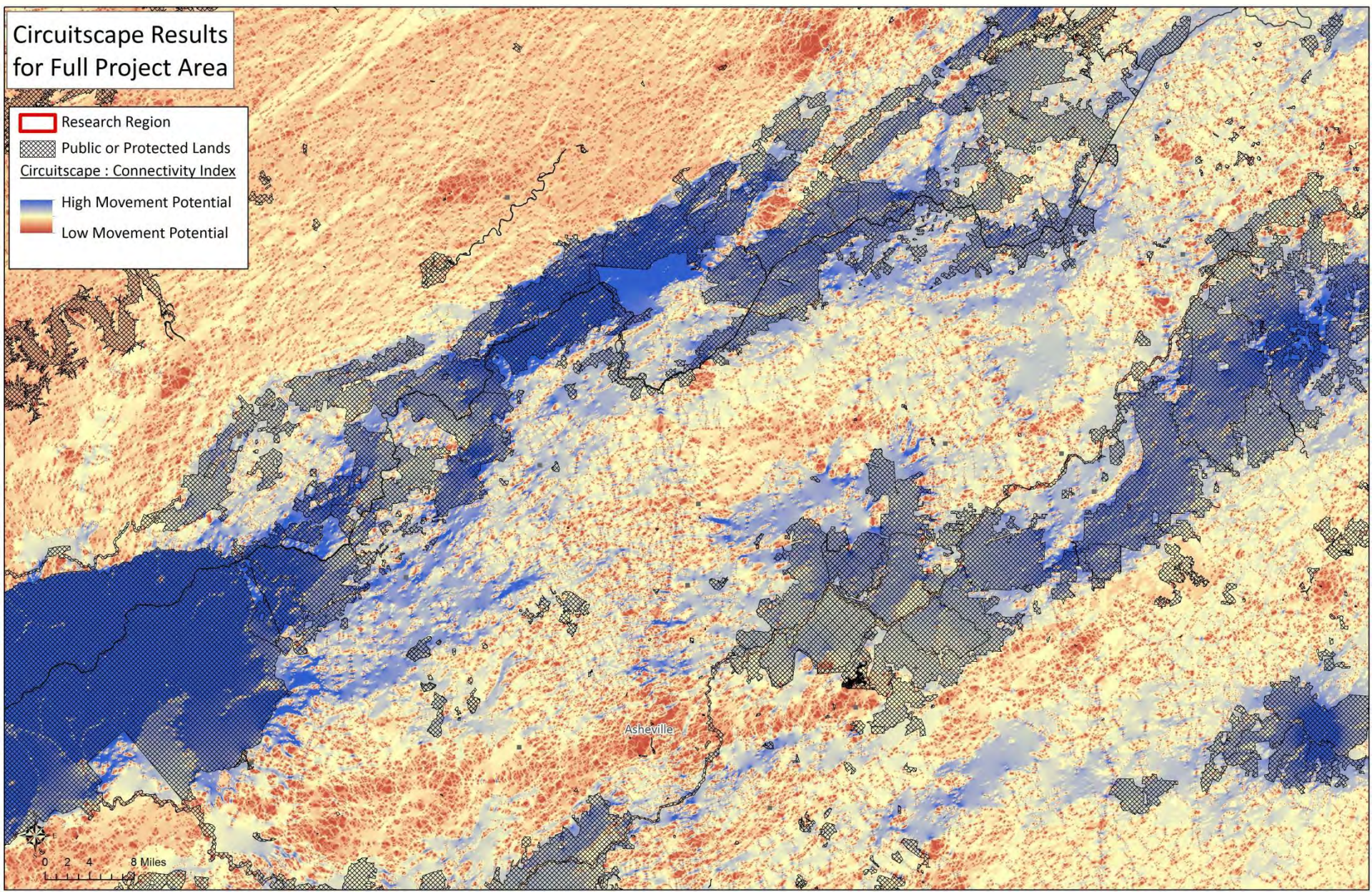
 Research Region

 Public or Protected Lands




Circuitscape : Connectivity Index

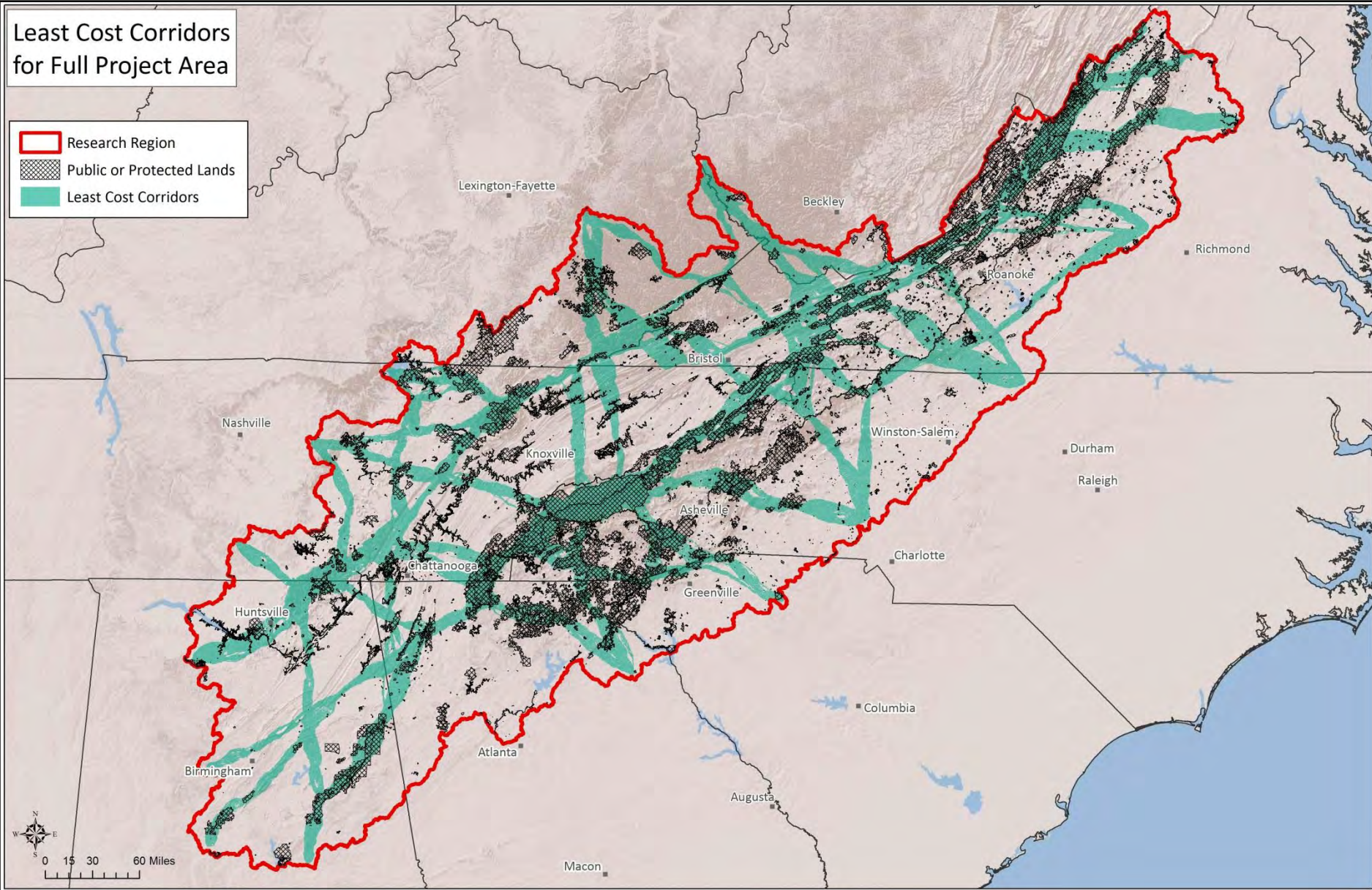
 High Movement Potential

 Low Movement Potential



Least Cost Corridors for Full Project Area

-  Research Region
-  Public or Protected Lands
-  Least Cost Corridors





1) Regionalize SWAP
Priorities



2) Collect Other
Species and Habitat
Data



3) Assess Corridors
using *Corridor
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4) Habitat Priorities
with Corridors



5) Model Wildlife
Climate Vulnerability
using *Climate
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NatureServe CCVI



6) Climate-Adjusted
Regional Protection
Priorities

Forest Blocks Containing Terrestrial GCN Species Habitat

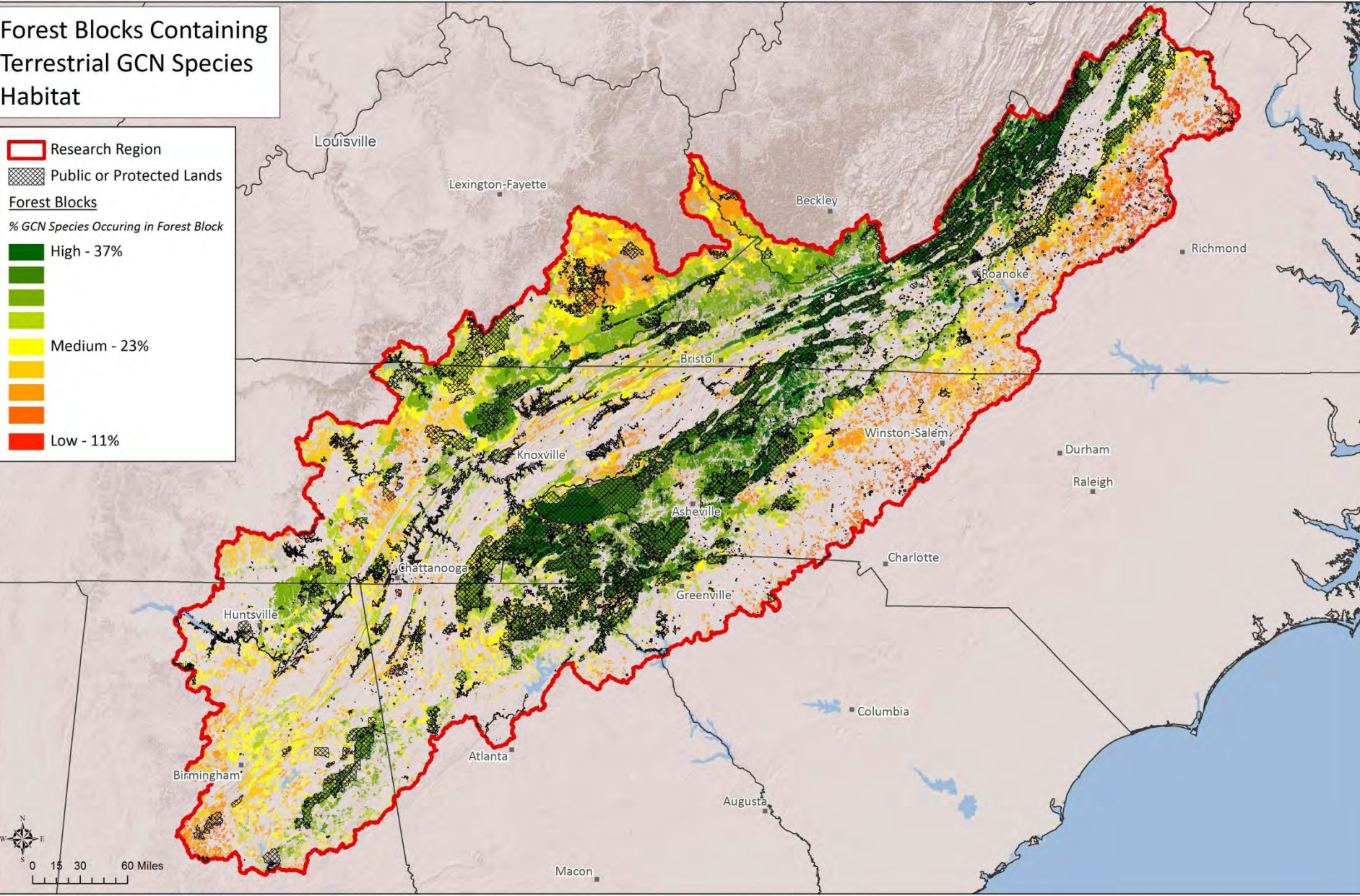
Research Region

Public or Protected Lands

Forest Blocks

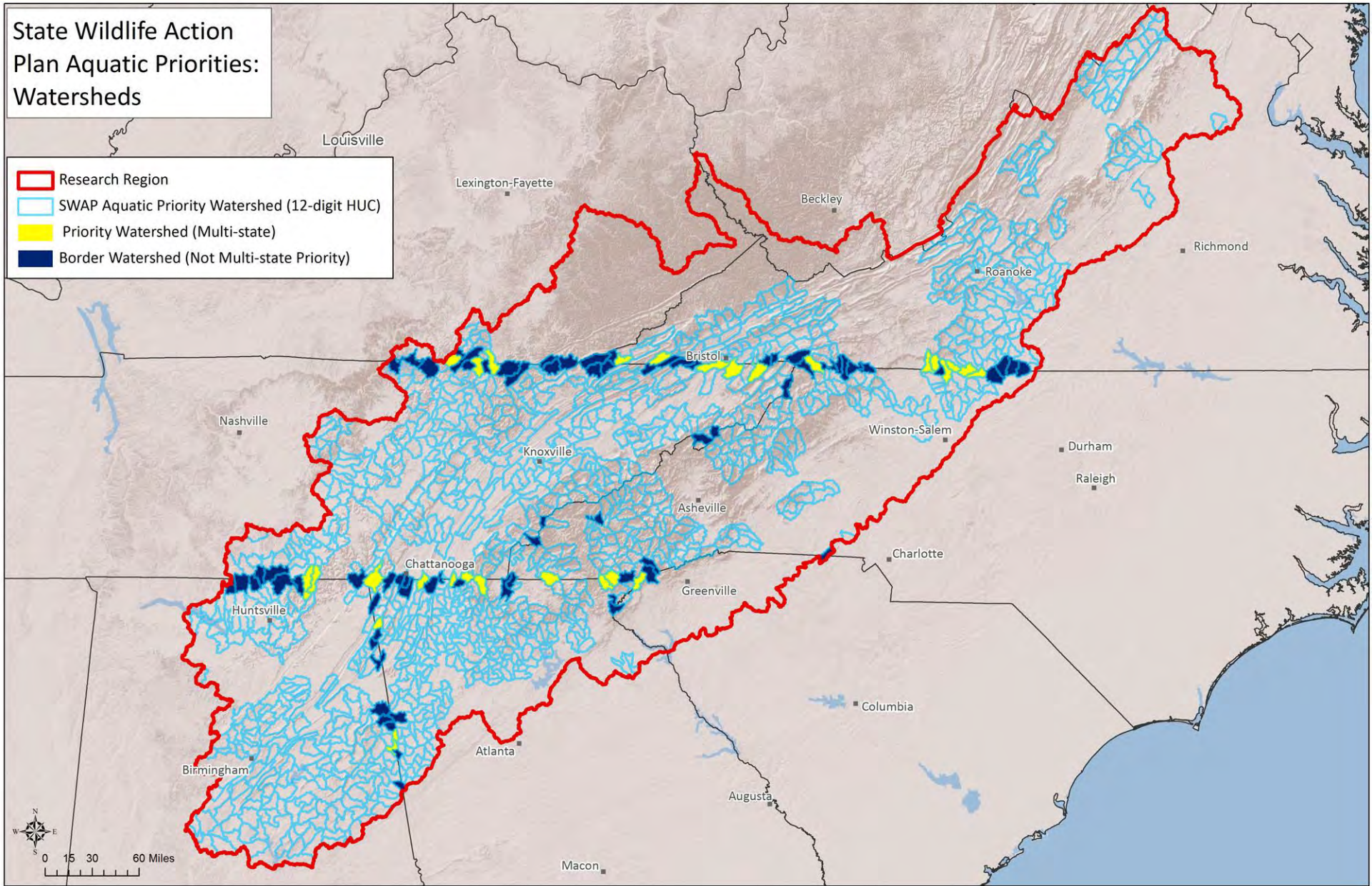
% GCN Species Occuring in Forest Block

- High - 37%
- Medium - 23%
- Low - 11%



State Wildlife Action Plan Aquatic Priorities: Watersheds

- Research Region
- SWAP Aquatic Priority Watershed (12-digit HUC)
- Priority Watershed (Multi-state)
- Border Watershed (Not Multi-state Priority)



State Wildlife Action Plan Aquatic Priorities: GCN Species Distribution

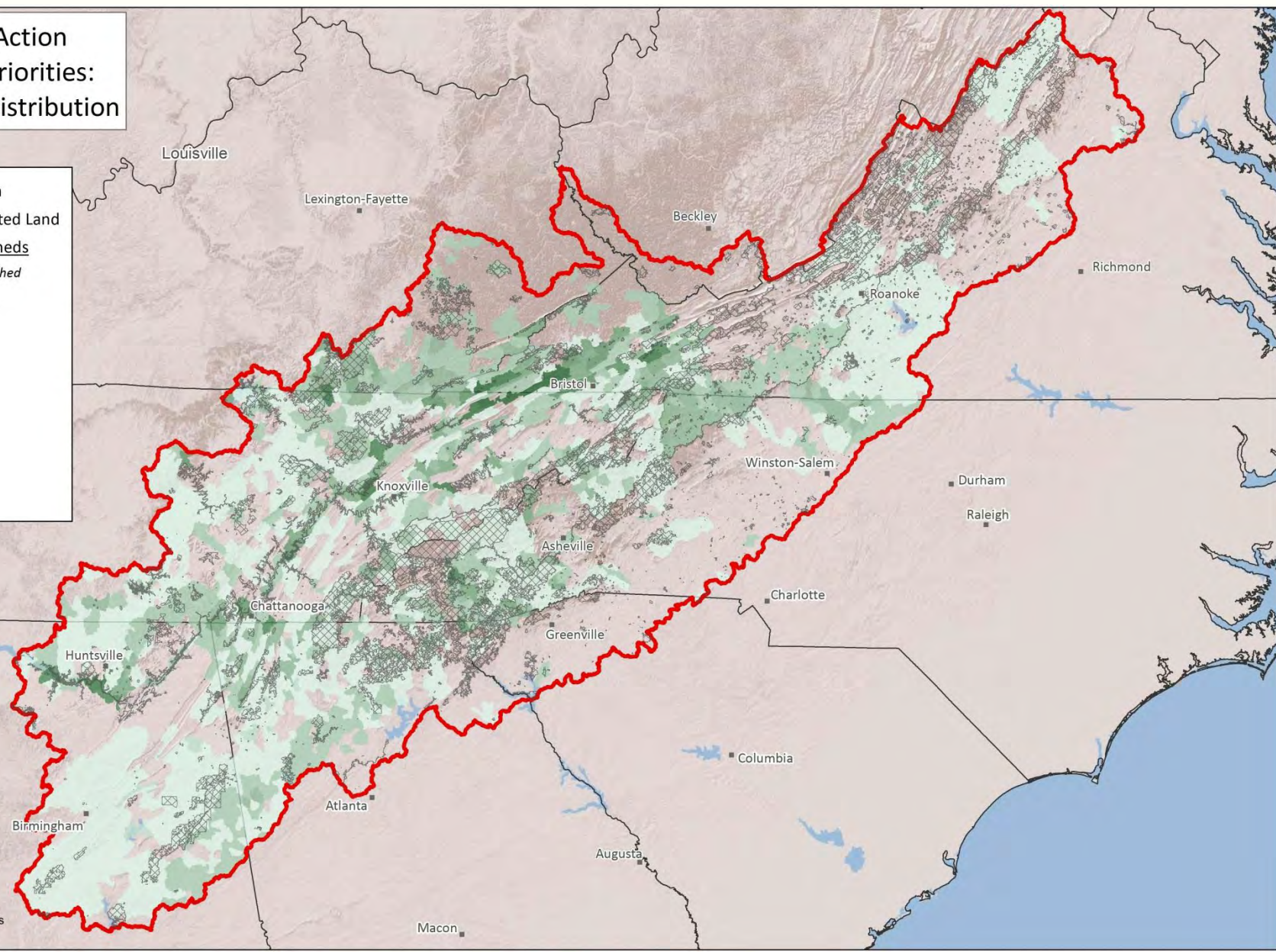
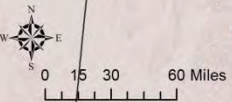
Research Region

Public or Protected Land

SWAP Priority Watersheds

% of GCN Species in Watershed

Dark Green	High - 12 - 23%
Medium Green	Medium - 6%
Light Green	Low - 0%



Research Steps

1) Regionalize SWAP Priorities

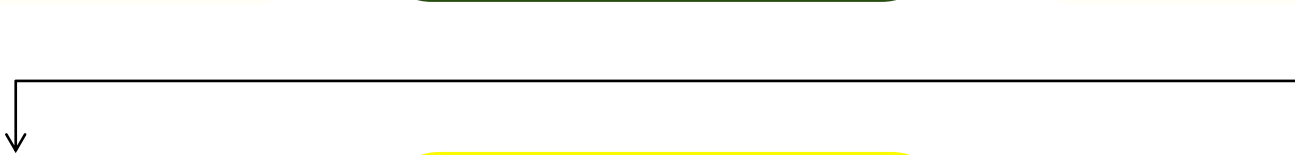
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4) Habitat Priorities with Corridors

5) Model Wildlife Climate Vulnerability using *Climate Wizard* and *NatureServe CCVI*

6) Climate-Adjusted Regional Protection Priorities



Integrating Climate Science

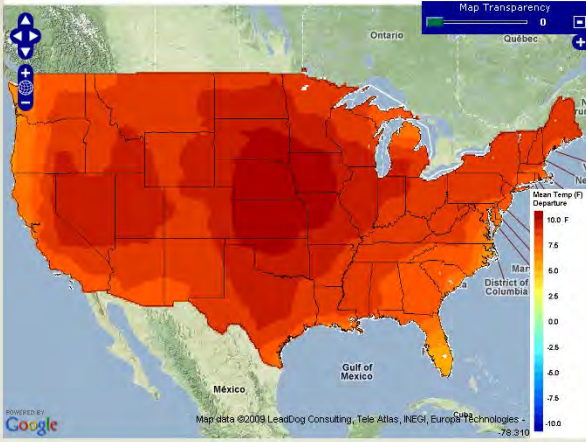
The Nature Conservancy  **ClimateWizard**  UNIVERSITY OF WASHINGTON
Protecting nature. Preserving life.  THE UNIVERSITY OF SOUTHERN MISSISSIPPI

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Analysis Area	Time Period	Map Options	Measurement	Resources
<input checked="" type="radio"/> United States <input type="radio"/> Global United States <input type="text"/>	<input type="radio"/> Past 50 Years <input type="radio"/> Mid Century (2050) <input checked="" type="radio"/> End Century (2100)	<input type="radio"/> Map of Average <input checked="" type="radio"/> Map of Change Annual <input type="text"/>	<input checked="" type="radio"/> Average Temperature <input type="radio"/> Precipitation	Case Studies Documentation Data (GIS format) Map Images Printer-Friendly Version



Future Climate Model
 IPCC Fourth Assessment Emission Scenario: High A2
 General Circulation Model: Ensemble Average

Change in Annual Temperature by 2100
 Model: Ensemble Average, SRES emission scenario: A2



Data Source: Base climate projections downloaded by [Majumdar, et al. \(2007\)](#) Santa Clara University. For more information see [About Us](#).

Map data ©2008 LeadDog Consulting, Tele Atlas, INEGI, Europa Technologies - 78.310

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Contact

Bruce Young 
 Director of Species Science

Index

- NatureServe's Strategy
- Climate Change Vulnerability Index
- Guidance in NatureServe Vista

Download

- Version 2.0 of the **NatureServe Climate Change Vulnerability Index**
- Guidance for v2.0 (PDF, 513KB)
- Introductory Training Session
- Webinar: Overview of the Climate Change Vulnerability Index

The NatureServe Climate Change Vulnerability Index

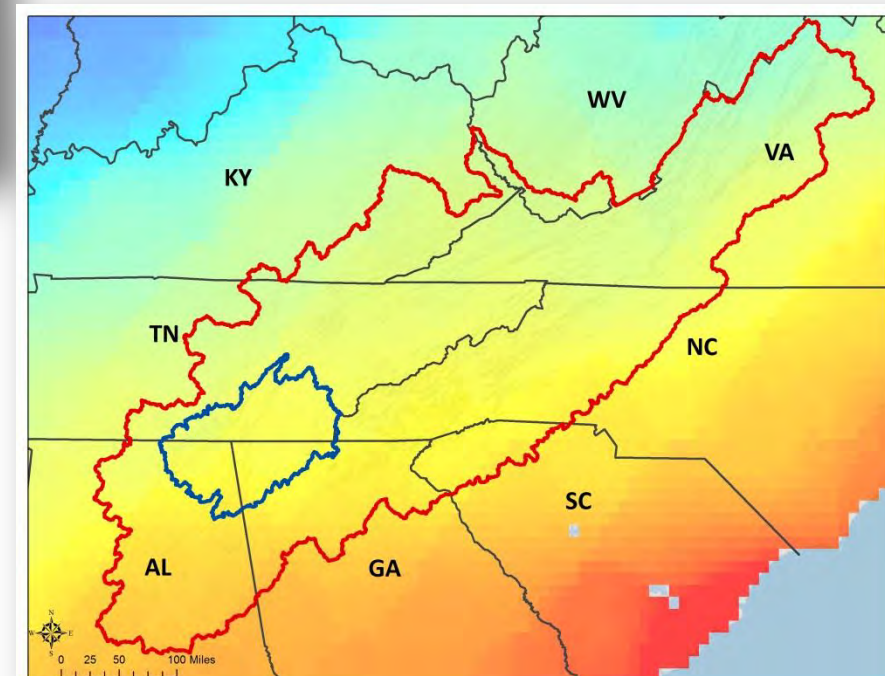
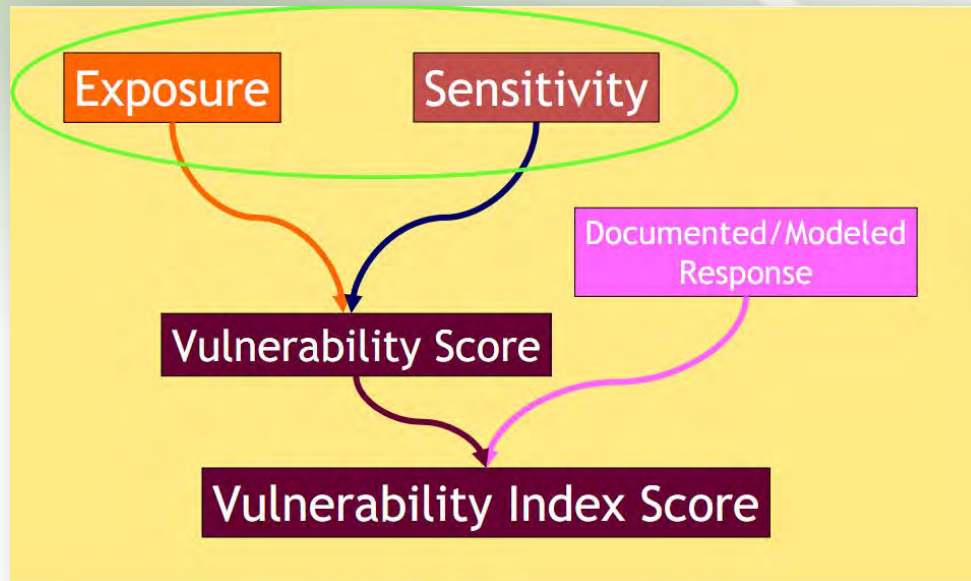
Climate change is affecting numerous plant and animal species right now. But how do you determine which species are most vulnerable, which ones need more focused attention sooner rather than later?

The *NatureServe Climate Change Vulnerability Index* can help identify plant and animal species that are particularly vulnerable to the effects of climate change. Using the Index, you apply readily available information about a species' natural history, distribution and landscape circumstances to predict whether it will likely suffer a range contraction, population reductions, or both during the coming years. You can use the Index as part of a variety of analyses, including assessing the relative risk of species listed in State Wildlife Action Plans or part of any assessment of the vulnerability of species to climate change.

Update: Version 2.0 now available!

Every day, we learn more about our climate, the changes it is undergoing, and the impacts of those changes on biodiversity. NatureServe actively incorporates that new knowledge into our databases, tools, and services. Just released, version 2.0 of the NatureServe Climate Change Vulnerability Index incorporates changes necessary for working with updated downscaled climate predictions provided by the **Climate Wizard**.

NatureServe Climate Change Vulnerability Index (CCVI)



90
91 **Climate Change Vulnerability Index**
92 **for *Plethodon petraeus* in Georgia**

Copy Data to
Results Table

93
94 **Extremely Vulnerable**
95

96
97 **Confidence in Species**
98 **Information**
99 **Very High**

* Histogram below

Notes:

100 **Definitions of Index Values**

101 Extremely Vulnerable (EV): Abundance and/or range extent within geographical area assessed extremely likely to substantially decrease or disappear by 2050.

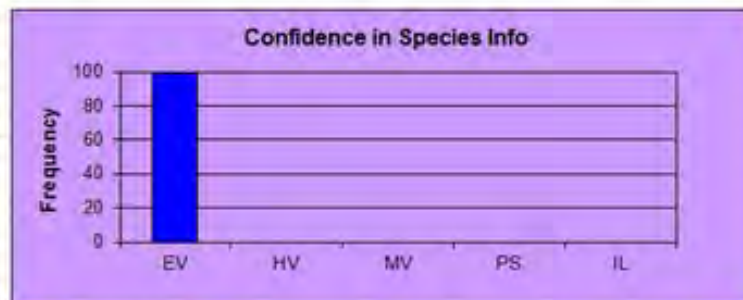
102 Highly Vulnerable (HV): Abundance and/or range extent within geographical area assessed likely to decrease significantly by 2050.

103 Moderately Vulnerable (MV): Abundance and/or range extent within geographical area assessed likely to decrease by 2050.

104 Not Vulnerable/Presumed Stable (PS): Available evidence does not suggest that abundance and/or range extent within the geographical area assessed will change
105 (increase/decrease) substantially by 2050. Actual range boundaries may change.

106 Not Vulnerable/Increase Likely (IL): Available evidence suggests that abundance and/or range extent within geographical area assessed is likely to increase by 2050.

107 Insufficient Evidence (IE): Available information about a species' vulnerability is inadequate to calculate an Index score.
108
109
110
111



Results of a Monte Carlo simulation (1000 runs) of the data entered in the Index.

	A	B	C	D	E	F
39	<i>Phenacobius catostomus</i>	Rifle Minnow	PS	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Phenacobius_catostomus	Georgia, Alabama, Tennessee
40	<i>Phoxinus saylori</i>	Laurel Dace	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Phoxinus_saylori	Tennessee
41	<i>Phoxinus tennesseensis</i>	Tennessee Dace	MV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Phoxinus_tennesseensis	Tennessee
42	<i>Alasmidonta marginata</i>	Elktoe	MV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Alasmidonta_marginata	Tennessee
43	<i>Alasmidonta viridis</i>	Slippershell	MV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Alasmidonta_viridis	Alabama, Tennessee
44	<i>Elliptio arca</i>	Alabama Spike	MV	Mod	http://www.acarroll-gis.org/OSI/Sub_aquatics/Elliptio_arca	Alabama, Georgia, Tennessee
45	<i>Elliptio dilatata</i>	Spike	MV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Elliptio_dilatata	Alabama, Tennessee
46	<i>Epioblasma florentina walkeri</i>	Tan Riffleshell	MV	Mod	http://www.acarroll-gis.org/OSI/Sub_aquatics/Epioblasma_florentina_walkeri	Tennessee
47	<i>Epioblasma triquetra</i>	Snuffbox	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Epioblasma_triquetra	Alabama, Tennessee
48	<i>Fusconaia cor</i>	Shiny Pigtoe	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Fusconaia_cor	Alabama
49	<i>Fusconaia cuneolus</i>	Finerayed Pigtoe	HV	Low	http://www.acarroll-gis.org/OSI/Sub_aquatics/Fusconaia_cuneolus	Alabama
50	<i>Hamiota altilis</i>	Finelined Pocketbook	HV	Low	http://www.acarroll-gis.org/OSI/Sub_aquatics/Hamiota_altilis	Georgia, Alabama, Tennessee
51	<i>Lampsilis fasciola</i>	Wavyrayed Lampmussel	MV	Mod	http://www.acarroll-gis.org/OSI/Sub_aquatics/Lampsilis_fasciola	Alabama, Tennessee
52	<i>Lampsilis virescens</i>	Alabama Lampmussel	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Lampsilis_virescens	Alabama
53	<i>Lasmigona costata</i>	Flutedshell	HV	Low	http://www.acarroll-gis.org/OSI/Sub_aquatics/Lasmigona_costata	Alabama, Tennessee
54	<i>Lasmigona etowaensis</i>	Etowah Heelsplitter	HV	Low	http://www.acarroll-gis.org/OSI/Sub_aquatics/Lasmigona_etowaensis	Georgia, Alabama, Tennessee
55	<i>Medionidus conradicus</i>	Cumberland Moccasinshell	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Medionidus_conradicus	Alabama
56	<i>Pleurobema decisum</i>	Southern Clubshell	HV	Low	http://www.acarroll-gis.org/OSI/Sub_aquatics/Pleurobema_decisum	Georgia, Alabama
57	<i>Pleurobema georgianum</i>	Southern Pigtoe	HV	Low	http://www.acarroll-gis.org/OSI/Sub_aquatics/Pleurobema_georgianum	Alabama, Georgia, Tennessee
58	<i>Pleurobema oviforme</i>	Tennessee Clubshell	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Pleurobema_oviforme	Alabama
59	<i>Pleuroaia dolabelloides</i>	Tennessee Clubshell	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Pleuroaia_dolabelloides	Alabama
60	<i>Ptychobranthus foremanianus</i>	Rayed Kidneyshell	HV	Low	http://www.acarroll-gis.org/OSI/Sub_aquatics/Ptychobranthus_foremanianus	Alabama
61	<i>Pyganodon grandis</i>	Giant Floater	MV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Pyganodon_grandis	Alabama, Georgia, Tennessee
62	<i>Quadrula asperata</i>	Alabama Orb	MV	Mod	http://www.acarroll-gis.org/OSI/Sub_aquatics/Quadrula_asperata	Alabama, Georgia
63	<i>Quadrula cylindrica</i>	Rabbitsfoot	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Quadrula_cylindrica	Alabama, Tennessee
64	<i>Strophitus connasaugaensis</i>	Alabama Creekmussel	HV	Low	http://www.acarroll-gis.org/OSI/Sub_aquatics/Strophitus_connasaugaensis	Alabama, Tennessee, Georgia
65	<i>Toxolasma cylindrellus</i>	Pale Lilliput	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Toxolasma_cylindrellus	Alabama, Tennessee
66	<i>Toxolasma lividum</i>	Purple Lilliput	HV	Mod	http://www.acarroll-gis.org/OSI/Sub_aquatics/Toxolasma_lividum	Alabama
67	<i>Villosa taeniata</i>	Painted Creekshell	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Villosa_taeiniata	Alabama
68	<i>Villosa umbrans</i>	Coosa Creekshell	MV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Villosa_umbrans	Alabama, Tennessee, Georgia
69	<i>Cambarus acanthura</i>	Thornytail Crayfish	MV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Cambarus_acanthura	Alabama, Georgia, North Caro
70	<i>Cambarus connasaugaensis</i>	Mountain Crayfish	MV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Cambarus_connasaugaensis	Georgia, Tennessee
71	<i>Cambarus cymatilis</i>	Conasauga Blue Burrower	HV	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Cambarus_cymatilis	Georgia, Tennessee
72	<i>Cambarus extraneus</i>	Chickamauga Crayfish	MV	Mod	http://www.acarroll-gis.org/OSI/Sub_aquatics/Cambarus_extraneus	Georgia, Tennessee
73	<i>Cambarus longirostris</i>	Longnose Crayfish	PS	VH	http://www.acarroll-gis.org/OSI/Sub_aquatics/Cambarus_longirostris	Georgia, Alabama, Tennessee

Research Steps

1) Regionalize SWAP Priorities

2) Collect Other Species and Habitat Data

3) Assess Corridors using *Corridor Designer* and *Circuit Scape*









4) Habitat Priorities with Corridors

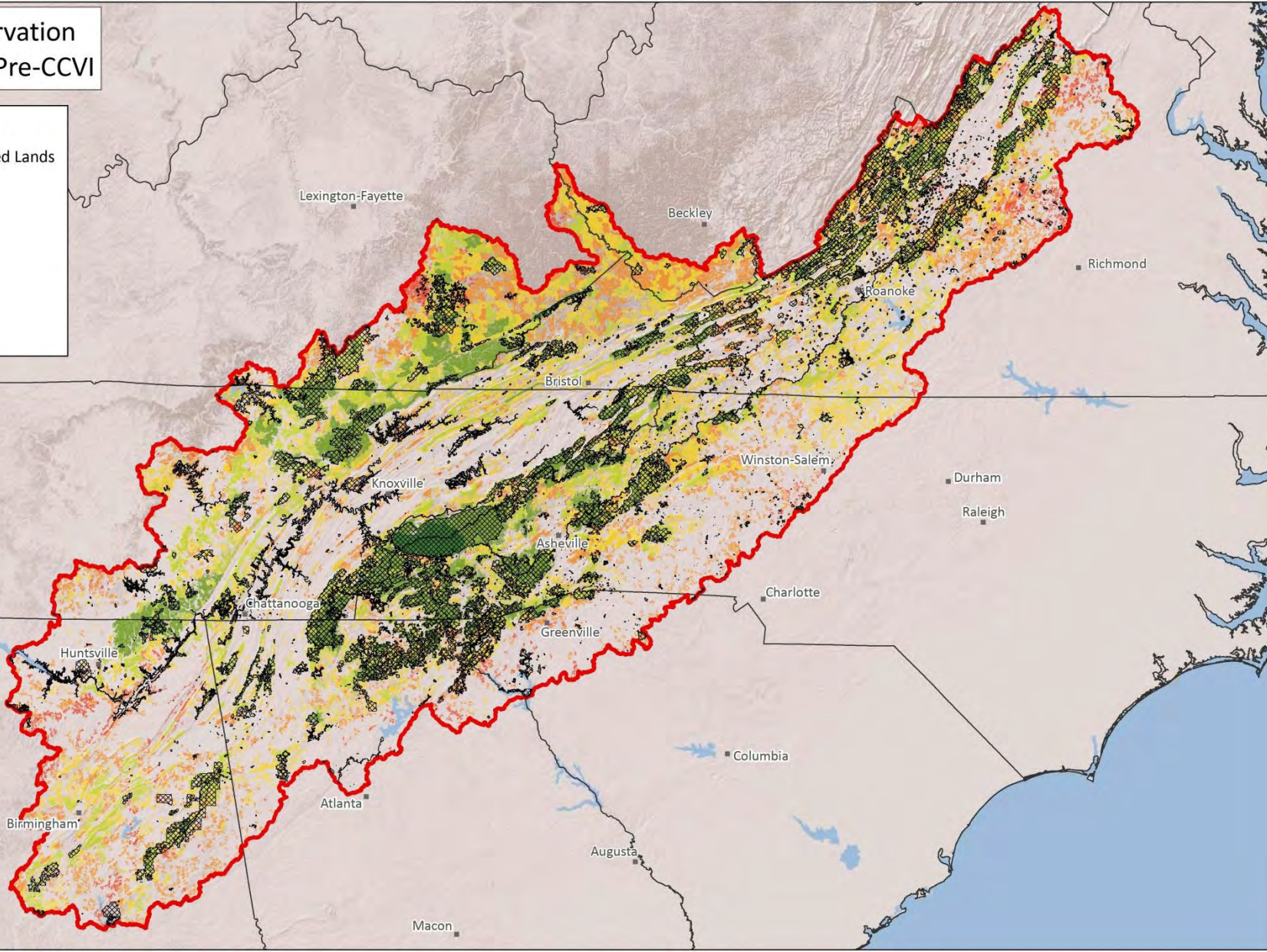
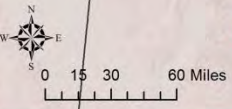
5) Model Wildlife Climate Vulnerability using *Climate Wizard* and *NatureServe CCVI*

6) Climate-Adjusted Regional Protection Priorities





Relative Conservation Priority Index: Pre-CCVI

-  Research Region
-  Public or Protected Lands
- Forest Blocks
 -  High - 70
 - 
 - 
 - 
 - 
 -  Low - 20








Forest Blocks Containing CCVI Vulnerable Terrestrial GCN Species Habitat

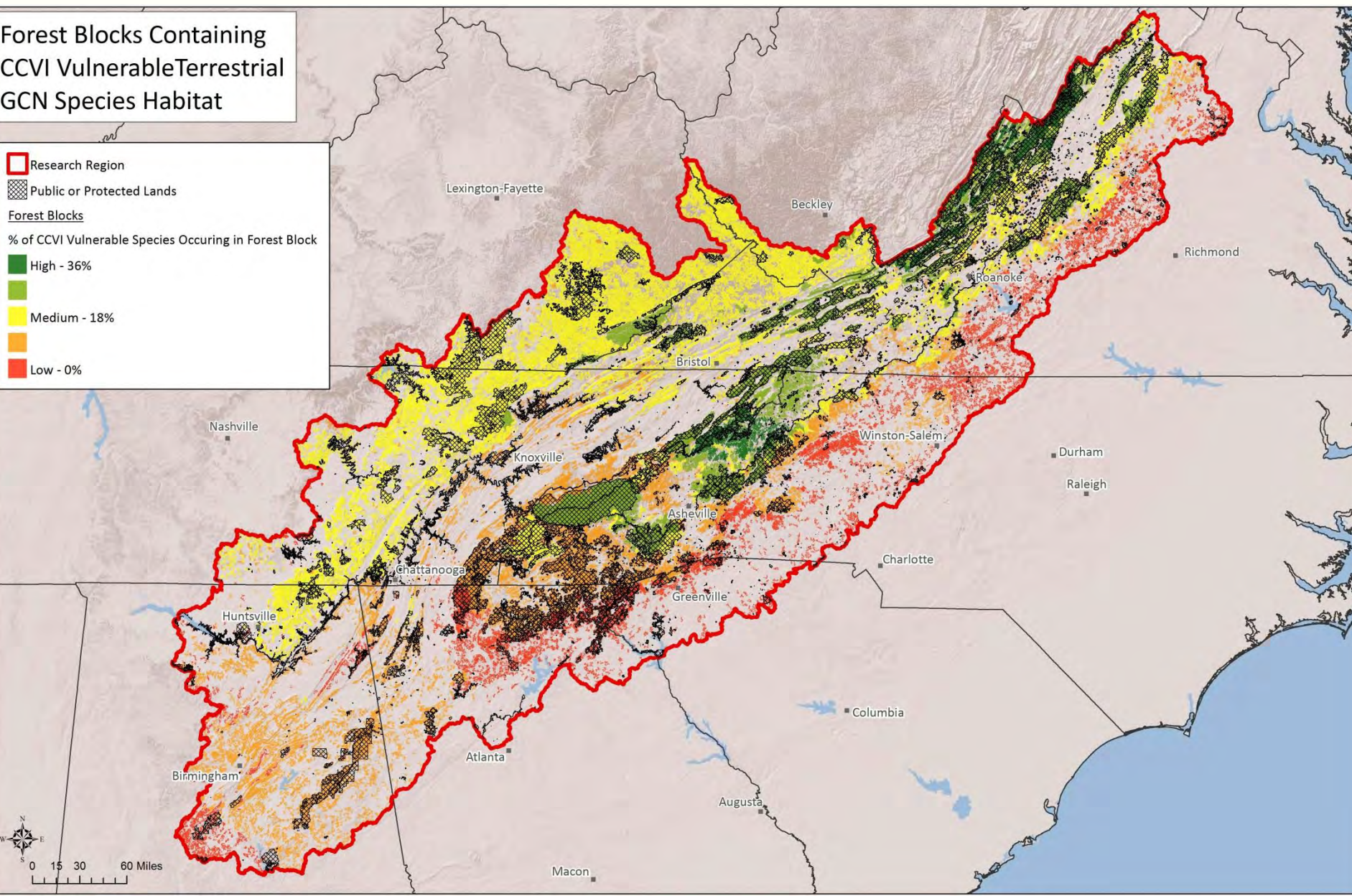
 Research Region

 Public or Protected Lands




Forest Blocks

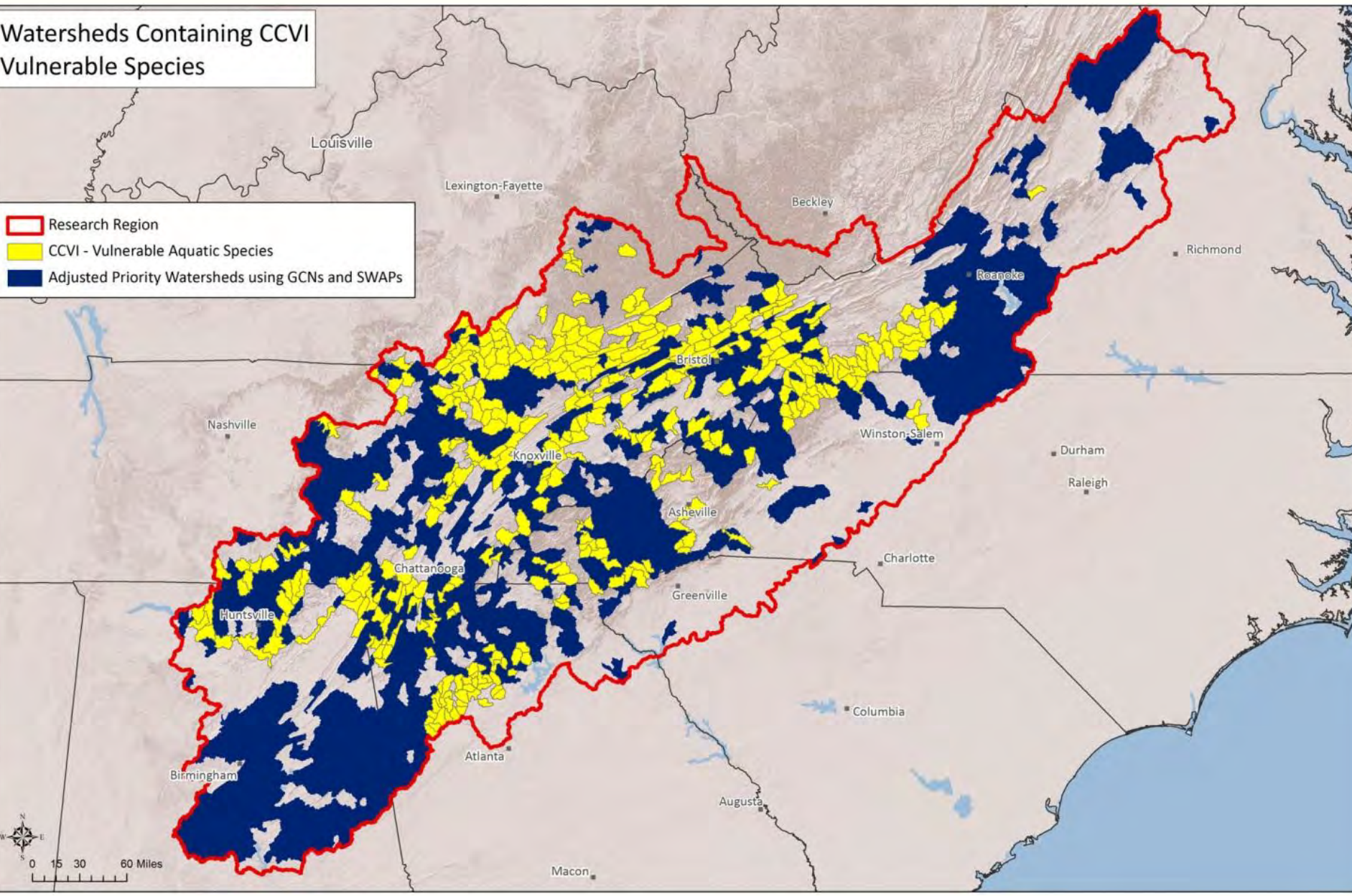
% of CCVI Vulnerable Species Occuring in Forest Block

-  High - 36%
-  Medium - 18%
-  Low - 0%
-  Low - 0%
-  Low - 0%



Watersheds Containing CCVI Vulnerable Species

-  Research Region
-  CCVI - Vulnerable Aquatic Species
-  Adjusted Priority Watersheds using GCNs and SWAPs



State Wildlife Action Plan Aquatic Priorities: CCVI Vulnerable GCN Species Distribution

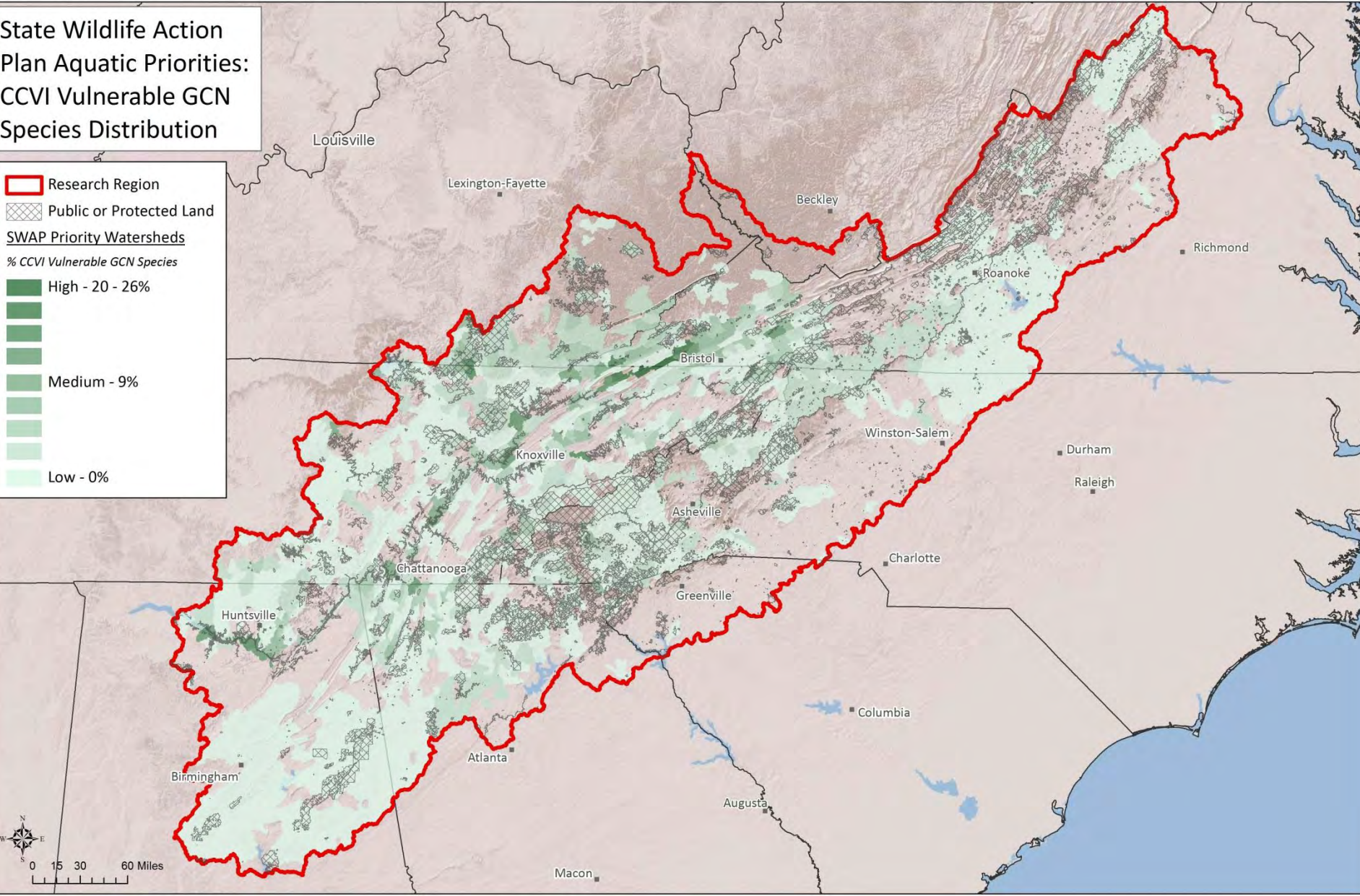
Research Region

Public or Protected Land

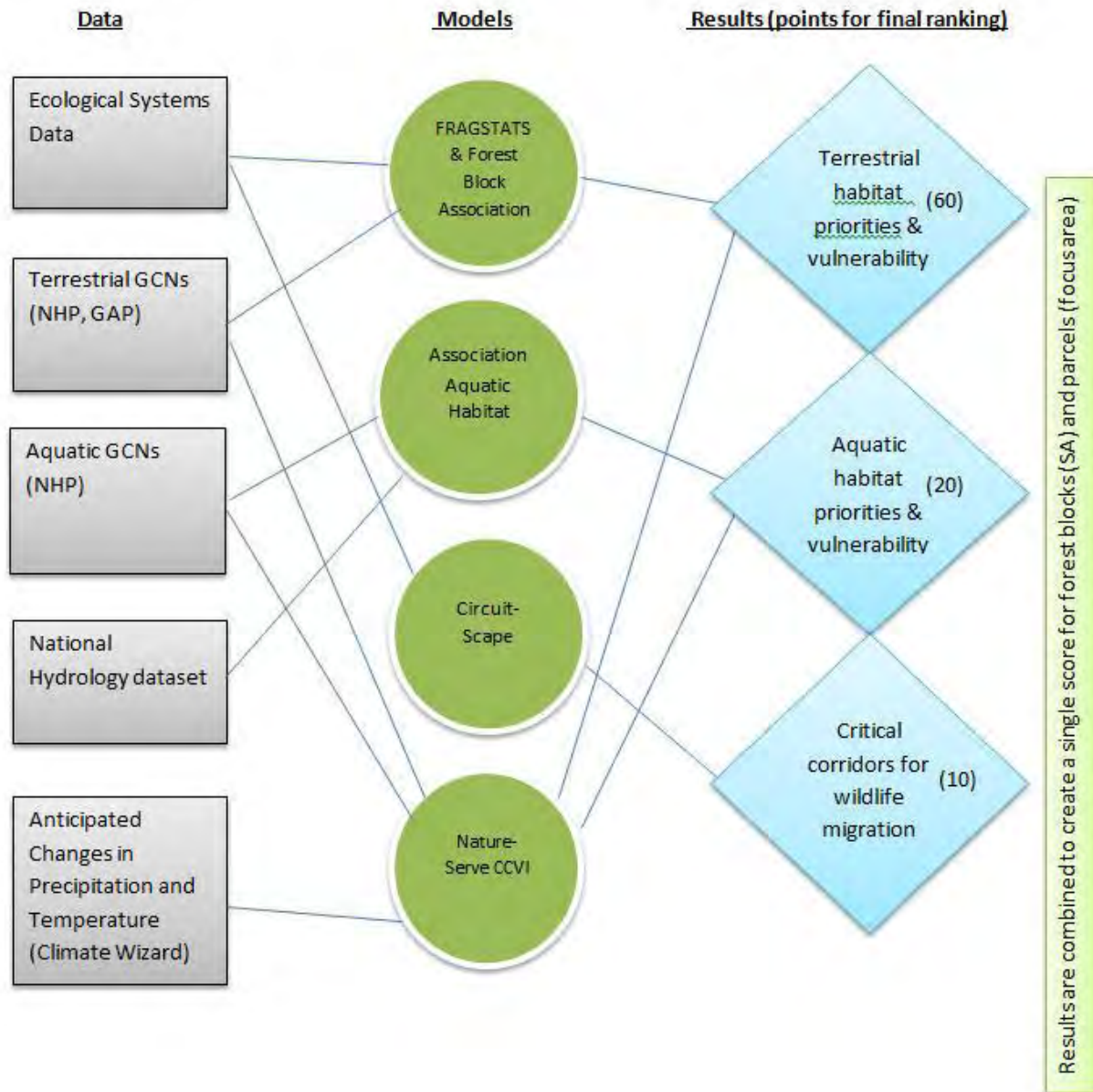
SWAP Priority Watersheds

% CCVI Vulnerable GCN Species


- High - 20 - 26%
- Medium - 9%
- Low - 0%




Open Space Institute
Protecting Southern Appalachian Wildlife in an Era of Climate Change
Diagram of Methodology




Forest Block: Relative Conservation Priority Index


 Research Region


 Public or Protected Lands


Forest Blocks


Index Score


 High - 90

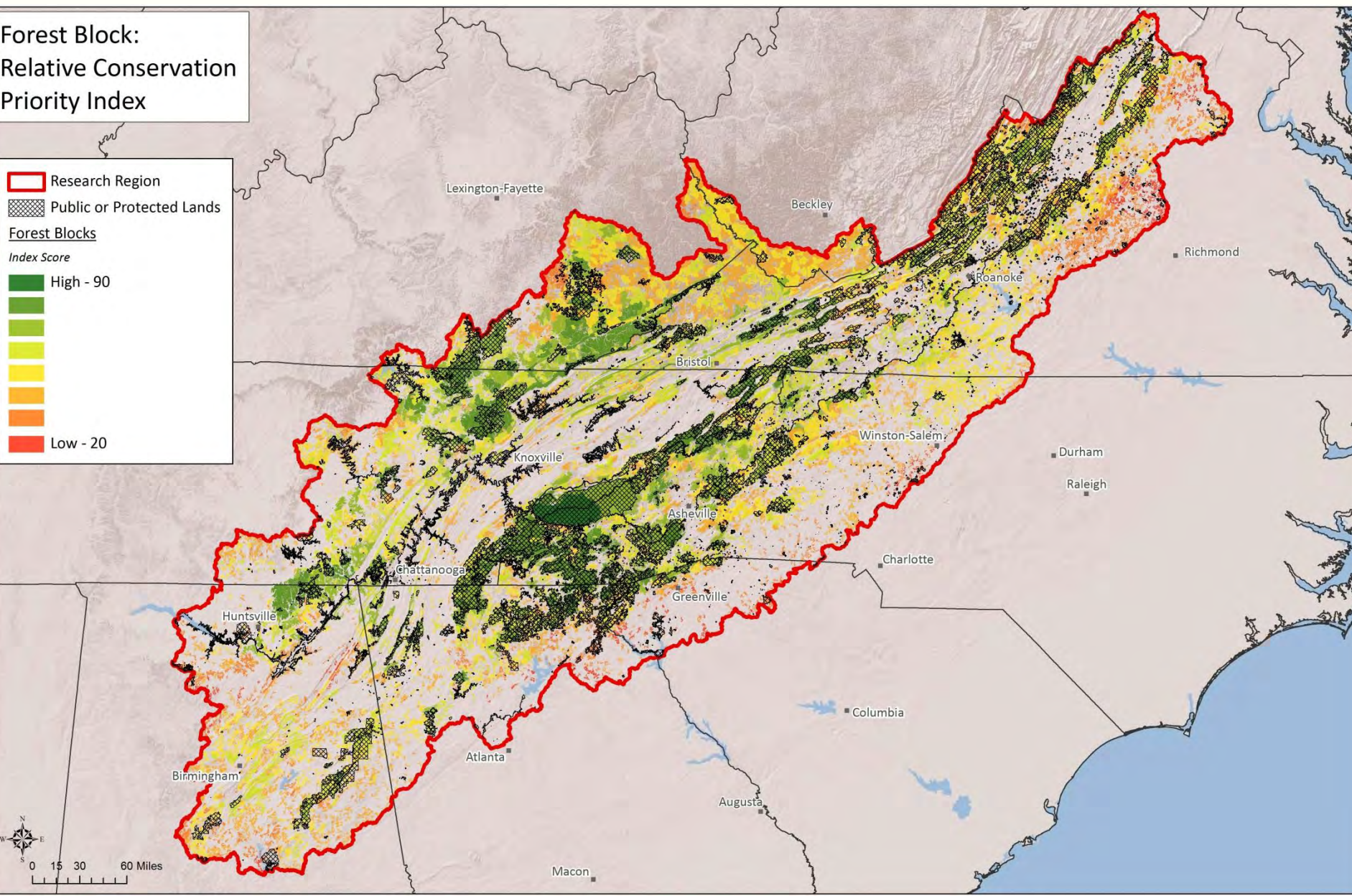




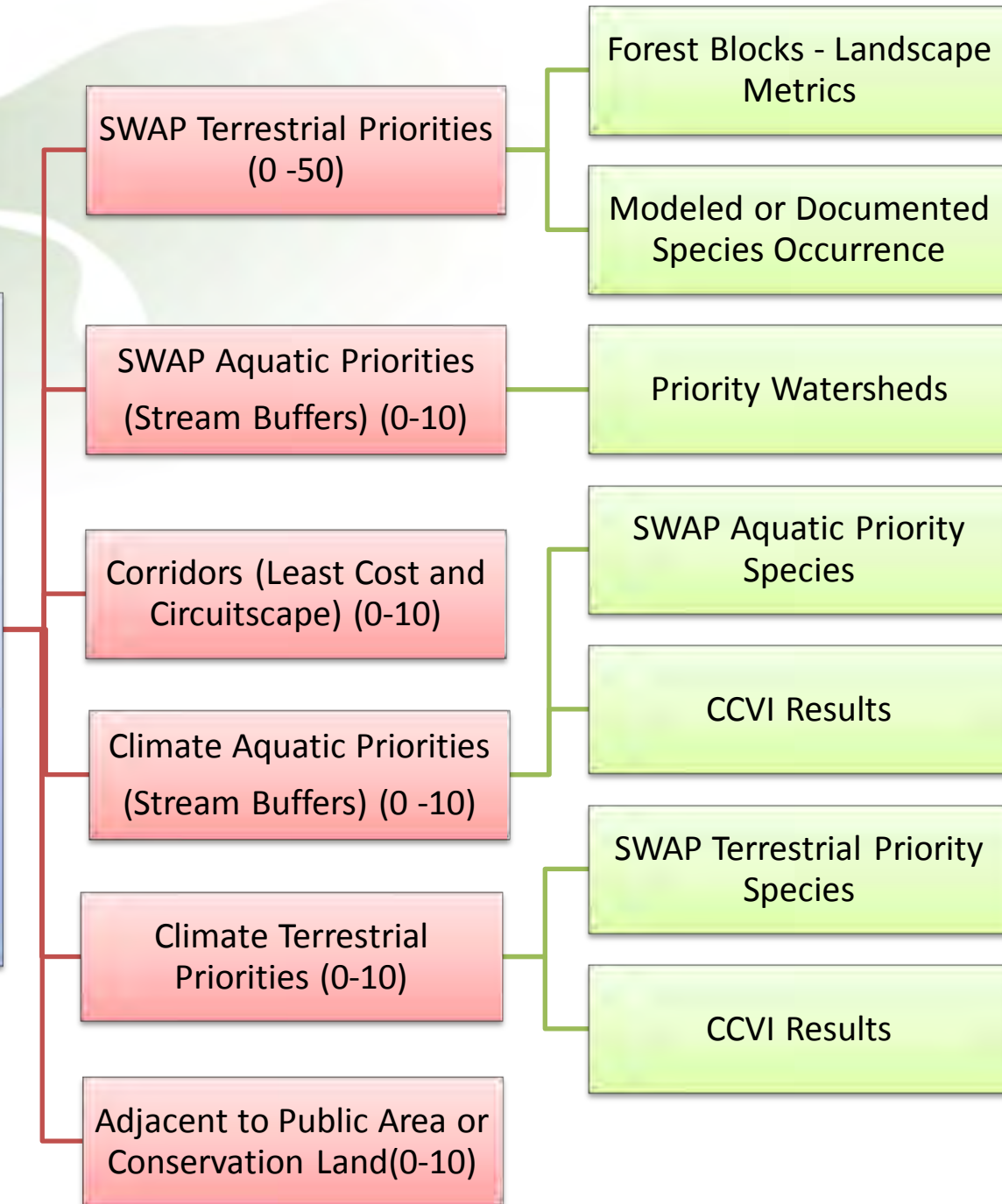




 Low - 20



Parcel Index



Parcel Index Methodology

Public or Protected Land

Conservation Priority Index

10 - High Conservation Priority

9

8

7

6

5 - Medium Conservation Priority

Identify

Identify from: Subregion Parcels

- Subregion Parcels
 - 026.108 00200

Location: 588,646.644 3,886,383.421 Meters

Field	Value
OBJECTID	324812
PIN	026.108 00200
Owner	CARTER DAVID A
County	Franklin
Acres	3162.1904
Terrestrial SWAP/Habitat Rank	44
SWAP Terrestrial Priorities Present	10
SWAP Aquatic Priorities	10
Corridor Rank	10
Climate Aquatic Priorities	10
Climate Terrestrial Index Rank	10
Proximity to Public or Protected	10
Parcel Index	94

Identified 1 feature

Identify

Identify from: Subregion Parcels

- Subregion Parcels
 - 026.138 00100

Location: 589,116.501 3,882,127.935 Meters

Field	Value
OBJECTID	326138
PIN	026.138 00100
Owner	CARTER JOETTE
County	Franklin
Acres	7171.2388
Terrestrial SWAP/Habitat Rank	45
SWAP Terrestrial Priorities Present	10
SWAP Aquatic Priorities	10
Corridor Rank	10
Climate Aquatic Priorities	10
Climate Terrestrial Index Rank	10
Proximity to Public or Protected	10
Parcel Index	95

Identified 1 feature

Identify

Identify from: Subregion Parcels

- Subregion Parcels
 - 22-01-11-0-000-001.000

Location: 575,556.578 3,850,708.601 Meters

Field	Value
OBJECTID	57493
PIN	22-01-11-0-000-001.000
Owner	REYNOLDS MACK
County	Jackson
Acres	655.1087
Terrestrial SWAP/Habitat Rank	22
SWAP Terrestrial Priorities Present	10
SWAP Aquatic Priorities	10
Corridor Rank	10
Climate Aquatic Priorities	0
Climate Terrestrial Index Rank	10
Proximity to Public or Protected	0
Parcel Index	52

Identified 1 feature

Identify

Identify from: Subregion Parcels

- Subregion Parcels
 - 026.108 00200

Location: 588,646.644 3,886,383.421 Meters

Field	Value
OBJECTID	324812
PIN	026.108 00200
Owner	CARTER DAVID A
County	Franklin
Acres	3162.1904
Terrestrial SWAP/Habitat Rank	44
SWAP Terrestrial Priorities Present	10
SWAP Aquatic Priorities	10
Corridor Rank	10
Climate Aquatic Priorities	10
Climate Terrestrial Index Rank	10
Proximity to Public or Protected	10
Parcel Index	94

Identified 1 feature

Huntsville

