Prioritizing land conservation in East Tennessee:
A parcel-scale geospatial analysis to assist a land trust's multi-criteria decision making

by

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Executive Summary

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With limited resources, land trusts face complex decisions about where to prioritize their efforts. These decisions impact which areas on the landscape receive protection for conservation value, and thus the character of conservation benefits delivered to both natural and human systems. This report provides the Southern Appalachian Highlands Conservancy (SAHC) with a geospatial decision support tool to frame prioritization within their conservation strategy for their service area in East Tennessee.

The value of the model lies in 1) its generation of priority-ranked lists of individual tax parcels based on predicted conservation value, and 2) its objective and dynamic nature which stems from construction under a Multi-Criteria Decision Analysis (MCDA) framework. Such an MCDA model allows relative valuation of separate conservation objectives. As such, it is useful for examining a range of priority alternatives—thereby enhancing the process of identifying conservation partners. In consultation with SAHC, an objectives hierarchy was developed to align institutional goals with indicator datasets. These indicators quantitatively measure the projected impact of land protection in respect to the overarching goals of the organization.

I then implemented the prioritization structure over a suite of weighting scenarios designed to incorporate the preferences of typical SAHC collaborators. These scenarios generated alternative priority parcel lists, which, in concert with the baseline priorities, point to projects with potentially enhanced feasibility given their attractiveness to partners. I also screened priority parcels with feasibility criteria directly related to potential funding resources. Finally, I assessed parcels to determine whether they could support forestry management. Such parcels may hold financial opportunities that make land protection deals more attractive to landowners.

The prioritization scenarios tested in this report found that the Highlands of Roan and the Appalachian Trail Countryside focus areas hold the largest amount of priority parcels. The Highlands of Roan holds the highest concentration of priority parcels, and also shows the highest level of priority convergence across scenarios. This means that SAHC would need to make fewer mission-driven sacrifices to enhance project feasibility in this focus area.

However, the Highlands of Roan loses part of its share of priority parcels when considering climate resilience data. Despite still having the highest concentration of priority parcels under this scenario, the focus area's shift may reveal operational implications for SAHC's commitment to preserving biodiversity into the future.

In regard to accessibility of funding, most of SAHC's priority parcels corresponded with priorities identified by the Tennessee Wildlife Resources Agency (TWRA). In contrast, very few priority parcels meet criteria for grants disbursed by the Open Space Institute (OSI). Without regard to the magnitude of funding, the Tennessee Wildlife Resources Agency likely provides a more viable outlet to improve project feasibility through enhanced funding.

Forest management appears feasible for most of SAHC's priority parcels. Of these, a substantial number have characteristics making them highly favorable to forestry.
With such broad overlap, forest management presents a viable tool to assist SAHC in making land protection deals.

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Introduction

Land protection serves as a primary means for maintaining ecosystem integrity, ecosystem services, and aesthetic and recreational values across a landscape. In the United States, land trusts have been an integral player in this effort, accounting for 56.4 million acres of protected land (LTA 2015). With limited resources, land trusts face complex decisions about where to prioritize their work. This analysis assists the Southern Appalachian Highlands Conservancy (SAHC) in that decision-making process.

SAHC operates in western North Carolina and East Tennessee where it aims to protect "unique plant and animal habitat, clean water, farmland, scenic beauty, and places for people to enjoy outdoor recreation" (SAHC [date unknown b]). As part of the Appalachian/Blue Ridge Forests ecoregion, the World Wildlife Fund ranks this region as "Globally Outstanding" for its biological distinctiveness—set apart by exceptional richness in temperate flora, relict taxa, and high degrees of endemism (Rickets et al. 1999). In this prized landscape, SAHC protects properties bordering iconic protected areas like Great Smoky Mountains National Park, Pisgah and Cherokee National Forests, Roan Mountain State Park, and Mount Mitchell State Park. Since its roots in 1966 and founding in 1974, SAHC has helped conserve more than 70,000 acres of land (SAHC [date unknown a]). One of the main techniques SAHC uses to protect land is through fee-simple purchase. By acquiring property outright, SAHC can hold and manage land themselves or transfer it to other protective entities like the United States Forest Service. Another tool that SAHC employs for land protection is the conservation easement. This strategy keeps property in the hands of individual landowners. In exchange for a reduced tax burden, these landowners transfer certain property rights (like development) to SAHC to be permanently extinguished. SAHC then monitors these properties for compliance and to ensure that conservation value persists.

SAHC is currently advancing land protection with a record-sized project pipeline (SAHC personal communication 2017). However, a land trust's property portfolio is limited by the monitoring capacity of its staff. Therefore, each of SAHC's projects must be carefully selected to optimally fulfill their mission.

Like many conservation organizations, SAHC has chosen to assist their decision-making with the help of geospatial analysis tools. Over the past decade, SAHC has overseen the development of a series of geospatial models designed to predict conservation value on the landscape. In 2012, SAHC enlisted Stephanie Graham of Duke University's Nicholas School of the Environment to develop a farmland prioritization model (Graham 2012) which reflected the Farm and Ranchlands Protection Program ranking criteria. Most recently, SAHC began collaboration with other partner land trusts to develop a model that could be tailored to each organization's goals. This collaboration was made possible by a grant from the Open Space Institute (OSI) for the purpose of incorporating climate resilience planning into land protection. As such, the model used newly minted data from The Nature Conservancy (TNC) identifying *Resilient Sites for Terrestrial Conservation in Eastern North America* (Anderson et al. 2016a) and *Resilient and Connected Landscapes for Terrestrial Conservation* (Anderson et al. 2016b). In essence, these datasets identify locations with varieties of microclimates and habitat connectivity that will support the successful relocation of biota under a changing climate (Anderson et al. 2016a, 2016b).

SAHC used the grant as an opportunity to overhaul the design and scope of their prioritization model, contracting its construction in 2017. However, this applied only to territory within North Carolina. As an outgrowth of those efforts, the analyses conducted herein address prioritization needs in SAHC's Tennessee service area.

Objective

SAHC's new proactive conservation strategy centers on maintaining a list of parcels ranked by predicted conservation value. This project's main objective was to identify those parcels for SAHC's "mountain-land" conservation strategy. Although SAHC commits resources to farmland conservation as part of its mission, its "farmland" strategy operates on a different set of criteria and thus merits a separate modeling framework. The primary product of this report was a table of top-ranking tax parcels for the "mountain-land" portions of East

Tennessee falling within SAHC's "Highlands of Roan," "Appalachian Trail Countryside," "French Broad River Valley," and "Smoky Mountains" Focus Areas. Every parcel has a set of attributes corresponding to each of a suite of landscape metrics evaluated by the model. During project evaluation, these metrics assist SAHC in making grant applications, landowner communication, and detailed comparison between properties. For example, SAHC staff can quickly reference the acreage of hydric soils or percent area falling within the Appalachian Trail's viewshed for any prospective property. Priority maps accompany the priority lists, illustrating the location and relative conservation value of priority parcels.

For SAHC, priority is explicitly driven by two collective factors. The first factor is the consideration of landscape characteristics supportive of their mission statement. These can be thought of as the first properties SAHC would strive to protect barring the impacts of cost or availability. The second factor considers the feasibility of acquisition, which can be further divided into two contributing concepts. Availability of funding is often the most tangible influence on feasibility. SAHC favors properties with attributes that will attract funding, thus facilitating acquisition. Secondly, the availability of collaborating partners has an important influence on project feasibility. SAHC exercises a range of collaborative processes in their conservation portfolio, including co-owning properties with other land trusts, executing collaborative grants for land management and restoration, assisting acquisition of land by public agencies, and co-hosting campaigns and events with other conservation organizations and local businesses. While collaboration often results in boosted funding, it also enhances feasibility by engaging a broader base of stakeholders to build project momentum. Therefore, identification of parcels ripe for collaboration serves an important role in SAHC's conservation strategy.

To close deals in land protection, SAHC must have landowners who are willing to sell their property or place it into a conservation easement. Easements may be more attractive to landowners if the loss in property value can be mitigated by other financial opportunities. In the forested ecosystems of East Tennessee, timber production may serve that purpose. SAHC stands to benefit from a knowledge of forestry potential on priority parcels. While SAHC does not prioritize forestry lands, this information could prove valuable when trying to partner with certain landowners.

To consider the variety of factors that influence SAHC's land protection strategy, this analysis produced multiple sets of priority parcels, including those that:

1) Reflect priority based solely upon SAHC mission-driven criteria
2) Reflect priority based upon feasibility:
    a. Projected by the emphasis of suites of potential collaborators
    b. Screened by criteria of potential funding sources
    c. Screened by criteria of forest management potential
3) Reflect priority as the convergence of mission-driven and feasibility criteria.

Importantly, the model's design structure allows SAHC to reassess priority across the landscape should conservation preferences shift. For example, SAHC has recently moved to emphasize the concept of climate resilience to ensure their conservation efforts stand up to climate stressors. To help SAHC evaluate and communicate the impact of this strategy toward on-the-ground efforts, this report contains priority parcel lists both with and without consideration of climate resilience.

This report uses a Multi-Criteria Decision Analysis (MCDA) framework to provide SAHC with a suite of objectively prioritized parcel lists that act as a decision support tool. It also serves as a guide for appropriately using the geospatial model and interpreting results for future prioritization schema.

Study Area

The analysis was conducted for tax parcels overlapped by SAHC's focus areas in seven Tennessee counties (Figure 1) including Sevier, Cocke, Greene, Washington, Unicoi, Carter, and Johnson counties. Six of these share their eastern border with North Carolina, whereas Washington County lies within 5 miles of the North Carolina border. Four of SAHC's Focus Areas overlap these counties, including the "Smoky Mountains," "French Broad River Valley," "Appalachian Trail Countryside," and "Highlands of Roan". In total, SAHC's Tennessee service area covers approximately 480,000 acres of territory[1] and 34,058 tax parcels (TNMT 2018 Mar 7). Data used to determine parcel contents were masked or clipped by the seven county boundaries. To account for features outside of the county boundaries that could attribute conservation value to parcels within the counties, a 2,500 meter buffer was added to this mask. Due to their frequency, the prioritization analysis excluded parcels smaller than 5 acres. This allowed priority results to capture only parcels that SAHC would consider viable conservation targets. Table 1 summarizes the breakdown of area and number of tax parcels by county for each focus area.

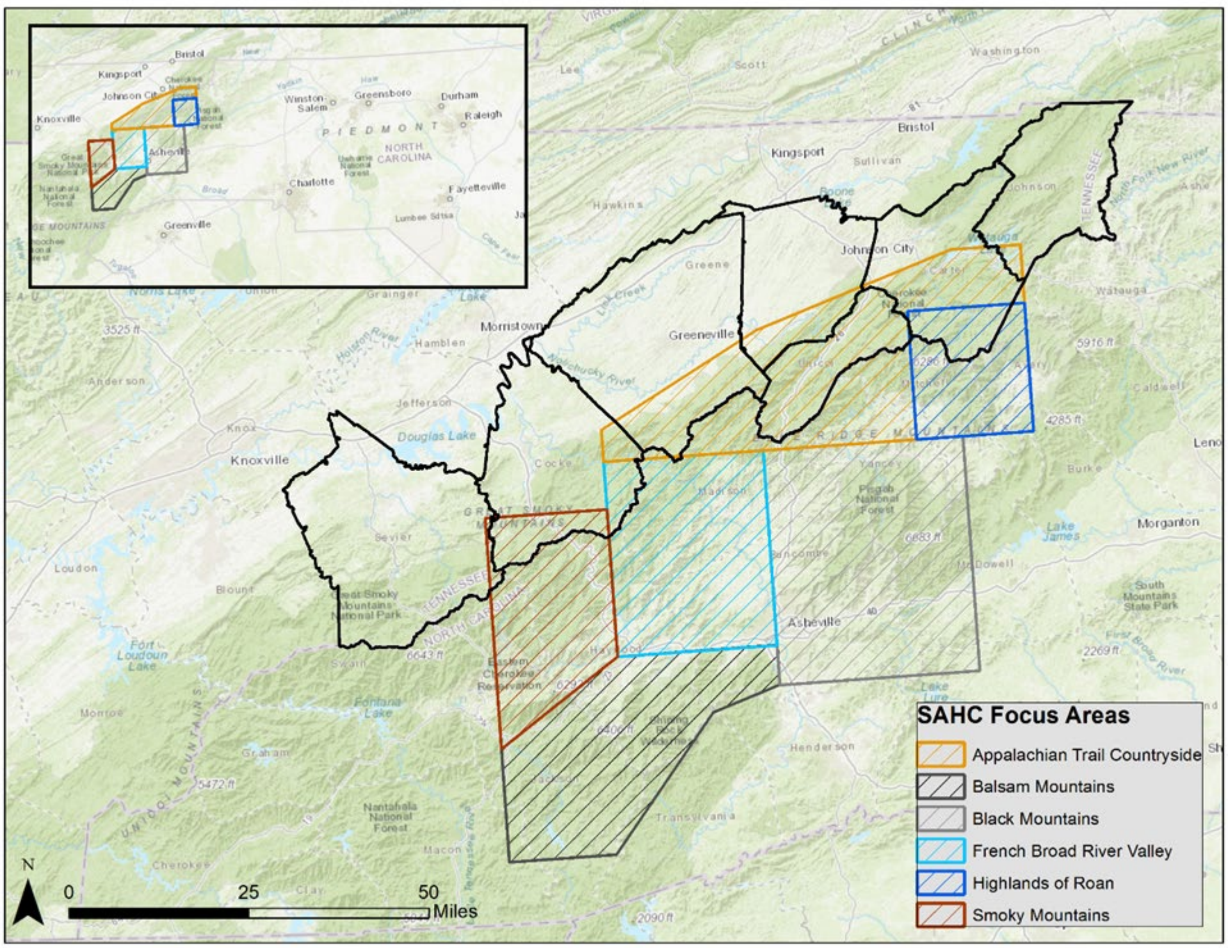

Figure 1. The Study Area, consisting of Tennessee counties overlapping SAHC's service area.

[1] Areas calculated using projected coordinate system: North American Datum 1983 Tennessee State Plane FIPS 4100 Feet, projection: Lambert Conformal Conic projection

Table 1. Content summary of study area (territory within intersection of SAHC focus areas and Tennessee).

Focus Area	By County	Acreage	Number of Tax Parcels & [No. greater than 5 acres]	Elevation Range (feet)
Smoky Mountains	Cocke	48,364		1198 - 6349
	Sevier	5,910		1287 - 6622
	Total	54,273	3,094 [779]	1198 - 6622
French Broad River Valley	Cocke	23,953		1129 - 4631
	Greene	384		2601 - 3662
	Total	24,337	760 [278]	1129 - 4631
Appalachian Trail Countryside	Unicoi	119,047		1569 - 5514
	Greene	87,717		1229 - 4834
	Carter	82,477		1616 - 4325
	Washington	44,284		1377 - 3524
	Cocke	13,893		1169 - 2869
	Johnson	6819		1953 - 4294
	Total	354,236	26597 [6301]	1169 - 5514
Highlands of Roan	Carter	46,491		2347 - 6282
	Unicoi	295		3111 - 4164
	Total	46,786	3718 [1031]	2347 - 6282
Combined	Grand Total		34,058 [8293]	1129 - 6622

Note: Tax parcel counts are for the number of separate features, not the number of Parcel IDs. Totals for parcel numbers do not sum to Grand Total across Focus Areas because Focus Area boundaries are not aligned with parcel boundaries. Therefore, some individual parcels count toward the Total for multiple Focus Areas. County areas were calculated with the county shapefile (TDEC [created 2014 May 16]).

Methods

Structured Decision Making

The structure of the model allows geospatial prioritization to occur within a Multi-Criteria Decision Analysis (MCDA) framework. MCDA is a process that assists decision-making by defining, evaluating, and ordering an array of actions both 1) in respect to the various benefits (particularly non-monetary) they produce and 2) with consideration of the value of those benefits to a diversity of stakeholders (DCLG 2009, Maguire 2014, Maguire et al. c2018).

Implementation alongside a Geographic Information System (GIS) allows MCDA to incorporate spatial data and consider spatial choices. This pairing has been implemented since the 1980s, and by the mid-2000s, GIS-MCDA had solidified into a canon of literature (Malczewski 2007). In his 2007 literature review, Malczewski explains the union succinctly as “a process that transforms and combines geographical data and value judgments (the decision-maker’s preferences) to obtain information for decision making.”

The model structure supports MCDA because it leverages the relative importance of reasonably distinct landscape values and services (e.g. terrestrial biodiversity, aquatic resources, recreational/cultural/scenic resources, etc.) that may require tradeoffs to protect (Maguire 2014, Maguire et al. c2018). Thus, it allows the user to systematically examine the effects of alternate conservation goals on their acquisition targets (Maguire 2014, Maguire et al. c2018). Moreover, it considers these values hierarchically—allowing maximum breadth and specificity for examination of goals (Maguire 2014, Maguire et al. c2018). This can be done if the model structure is developed with an objectives hierarchy.

An objectives hierarchy includes a comprehensive set of explicitly defined stakeholder goals (Maguire 2014, Maguire et al. c2018) and can be fortified by conceptual breakdown of those goals into specific objectives (DCLG 2009, Maguire 2014, Maguire et al. c2018). The objectives hierarchy also points to appropriate indicators by which the objectives can be fulfilled (Maguire 2014, Maguire et al. c2018). Importantly, indicators must be measurable and non-redundant (Maguire 2014, Maguire et al. c2018).

SAHC expended significant effort in designing the weighting scheme and modeling structure for their current North Carolina model. This structure served as an initial platform for developing the Objectives Hierarchy (Table 2) and identifying appropriate indicators. SAHC land protection and stewardship staff were consulted in the creation of this Objectives Hierarchy so that it adequately reflected the suite of conservation values by which they desire to evaluate properties.

Table 2. Objectives Hierarchy

Goals	Objectives	Indicators (Geospatial Datasets)
Preserve terrestrial biodiversity where it exists now	Protect high quality and unique habitats	Tennessee State Wildlife Action Plan (SWAP) Habitat Priorities (Terrestrial, Karst)
		National Wetlands Inventory
		NRCS Hydric Soils
	Protect areas with presence of unique species/communities	Natural Heritage Program Element Occurrences (terrestrial & wetland)
Preserve viability of terrestrial biodiversity into the future	Secure microclimate diversity and connectedness at landscape scale	TNC Resilient Sites for Terrestrial Conservation: Final Resilience Scores
	Secure landscape permeability/species mobility at regional scale	TNC Resilient and Connected Landscapes for Terrestrial Conservation: Corridors and Flow Zones
	Secure full suite of geophysical setting diversity	Underrepresented Geophysical Settings
Preserve health of aquatic resources and aquatic biodiversity where it exists now	Protect high quality and unique habitat	Tennessee State Wildlife Action Plan Habitat Priorities (Aquatic, Upstream of Aquatic)
	Protect areas with presence of unique species/communities	Natural Heritage Program Element Occurrences (aquatic)
	Protect quality and quantity of drinking water at a landscape to regional scale	Forests to Faucets: Importance of Watershed to Surface Drinking Water
	Protect all stream features and riparian zones at greatest possible extent	Custom Hydrography dataset
	Protect water quantity and quality for cultural, recreational, and supply uses at local scales	Outstanding National Resource Waters
		Tennessee Wild Trout Streams
		Trout Unlimited Eastern Brook Trout Conservation Portfolio population designations
Preserve human connection to the landscape	Protect the landscape along major recreation routes that supports their use and aesthetic quality	Appalachian Trail Viewsheds
		Appalachian Trail Centerline Buffer
		Overmountain Victory Trail
		Scenic Roads
	Protect centers of regional, community, and national heritage	National Register of Historic Places
	Protect general scenic features and community focal points	Prominent Ridgelines dataset
Secure landscape connectivity	Connect protected properties and expand protected areas	Proximity to Protected Lands
Conservation at scale	Magnify impact of all other objectives	Parcel size

The first four goals listed in the Objectives Hierarchy reflect the major elements of SAHC's mission statement. Logically, recreational, scenic, and cultural factors target direct and tangible human engagement with the landscape and the resources that are part of the history of that engagement. Aquatic factors correspond to the protection of clean water for aquatic biota and human use. Although the aquatic system supports human connection to the landscape, its focal presence as a dynamic and interconnected network merits separate categorization.

While not explicit in the mission statement, future viability of biodiversity has become engrained in SAHC's operational psyche. Much of this thinking comes from a land trust's permanent obligation to safeguard a property's conservation value via stewardship. Given that the disturbances and stressors accompanying climate change may provide the greatest challenges for maintaining ecological integrity, it behooves SAHC to integrate climate resilience thinking into its operations. Because The Nature Conservancy's climate resilience datasets focus on the temporal trajectory of biodiversity at landscape and regional scales, they aptly address SAHC's goal of preserving biodiversity into the future.

SAHC understands that the spatial arrangement of conservation areas can affect all four of these base aims, with consolidation generally enhancing value across the board. As an overarching driver of conservation strategy, proximity merits its own category.

Finally, larger parcels constitute greater conservation gains, and usually enhance the viability of all constituent parts that convey conservation value in the first place. Large parcels also facilitate effective stewardship and efficient monitoring. Parcel size offers a simple and effective means of measuring conservation at scale.

Data Overview

The prioritization model utilizes a parcel database containing parcel attributes for each landscape metric deemed useful for predicting conservation value. This database was created by finding the intersection of each parcel with each input dataset (indicator) containing these landscape metrics. Amongst these datasets (Table 3), some were publicly available, others were proprietary, and others were developed from precursor datasets (e.g. Digital Elevation Model) specifically for this analysis. The descriptions of each dataset and rationale for their inclusion are included in Appendix A, as are descriptions of dataset modifications and detailed methods for development of custom datasets. These include the custom hydrography network, ridgeline areas, scenic roads, and the protected areas dataset. Precursor datasets and other supporting data (e.g. map-making) are also included in Appendix A.

Table 3. Input datasets used for creating parcel attribute database.

Dataset Name	Creator/Source	Type	Availability
Tennessee Tax Parcels	State of Tennessee, TNMap Team	vector	Available upon request with usage agreement
Protected Areas Dataset (TN and NC)	Collated from: USGS PADUS, SAHC Protected Lands, TN Natural Areas, TN State Parks, NC Managed Areas (MAREA), TN Managed Areas	vector	Proprietary: SAHC Protected Lands Request: TN Managed Areas Public: USGS PADUS, NC MAREA, TN State Parks, TN Natural Areas
Appalachian Trail Viewsheds	Appalachian Trail Conservancy	raster	Proprietary
Appalachian Trail Centerline Buffer	Modified from: Appalachian Trail Conference and National Park Service Appalachian Trail Office	vector	New version is publicly available, see dataset descriptions for vintage used in this analysis
Resilient Sites for Terrestrial Conservation in Eastern North America: Final Resilience Scores	The Nature Conservancy (Anderson et al.)	raster	Public
Resilient and Connected Landscapes for Terrestrial Conservation	The Nature Conservancy: (Anderson et al.)	raster	Public
Tennessee State Wildlife Action Plan (SWAP) Habitat Priorities	Tennessee State Wildlife Resources Agency (TWRA) & The Nature Conservancy	raster	Public
Tennessee Natural Heritage Program Element Occurrences	Tennessee Natural Heritage Program	vector	Available upon request with usage agreement
National Hydrography Dataset High Resolution (1:24,000 or better)	U.S. Geological Survey	vector	Public

Custom Hydrography Dataset	Derived from: National Elevation Dataset DEM	vector	Public
Forests to Faucets: Surface Drinking Water Importance	U.S. Forest Service	tabular	Public
12 Digit Hydrologic Unit Code Watershed Boundaries	National Geospatial Center for Excellence, National Resources Conservation Service	vector	Public
Underrepresented Geophysical Settings	Derived from: The Nature Conservancy (Anderson et al.) & Open Space Institute	vector	Request: TNC Public: OSI
Overmountain Victory Historic Trail	National Park Service	vector	Public
National Register of Historic Places	National Park Service	vector	Public
Scenic Roads	Derived from: United States Census Bureau TIGER/Line	vector	Public
Prominent Ridgelines	Derived from: National Elevation Dataset DEM	vector	Public
National Wetlands Inventory	U.S. Fish and Wildlife Service	vector	Public
USA Soils Hydric Class	ESRI, National Resource Conservation Service	raster	Available with ArcGIS Online account access
Tennessee Wild Trout Streams	Tennessee Wildlife Resources Agency	vector	Available upon request
Trout Unlimited Eastern Brook Trout Portfolio	Trout Unlimited	vector	Available upon request
Outstanding National Resource Waters	Tennessee Department of Environment and Conservation Division of Water Resources	vector	Available upon request

Model Structure and Implementation of Objectives Hierarchy

Although more explicitly structured in its consideration of mission-based and feasibility-based landscape metrics, this model intends to parallel the functionality of SAHC's previously contracted North Carolina prioritization model by:

1) Implementing adjustable scores for each landscape metric
2) Using the same or similar datasets where possible
3) Using a category-based scoring structure
4) Operating from a parcel attribute database table

The model predicts priority using a weighted overlay approach with a two level hierarchy. Each landscape metric (indicator) is binned into one of the following 6 categories according to the goals outlined in the Objectives Hierarchy (Table 2):

1) Terrestrial Biodiversity
2) Future Viability of Terrestrial Biodiversity (Climate Resilience)
3) Aquatic Resources
4) Recreational, Scenic, and Cultural (Human Connection)
5) Proximity to Protected Land
6) Parcel Size

Within each category, indicators were weighted for their value relative to one another according to SAHC's preferences. For example, in the Recreational, Scenic, and Cultural category, a weight of 10 for parcels within the Appalachian Trail view-shed means that this landscape characteristic conveys five times as much conservation value as parcels neighboring a scenic road (assigned a weight of 2). Parcels receive points corresponding to the assigned indicator weights. Within each category, awarded points are summed and divided by total points available to create a category score scaled from 0 to 1. A second level of weights is applied to each of the 6 category scores, attributing a percentage of final parcel score to each category. The final score for any given parcel can be calculated by the equation:

$$(W_1)\frac{\sum points\ awarded_1}{\sum points\ available_1}+(W_2)\frac{\sum points\ awarded_2}{\sum points\ available_2}+(W_3)\frac{\sum points\ awarded_3}{\sum points\ available_3}+ (W_4)\frac{\sum points\ awarded_4}{\sum points\ available_4}+(W_5)\frac{\sum points\ awarded_5}{\sum points\ available_5}+(W_6)\frac{\sum points\ awarded_6}{\sum points\ available_6} \quad (1)$$

where W equals category weight as a percentage and subscripts 1-6 point to the corresponding categories. Final parcel scores range from 0 to 1. This scoring system is beneficial for several reasons. First, the binning of indicators by category ensures that an indicator weight change in one category does not spill over to affect the overall importance of indicators within other categories. This simplifies the exercise of determining new weights because fewer relative comparisons need to be considered. Second, the magnitude of indicator weights is arbitrary—

only their relative value to one another matters. This allows new weighting schemes to employ an infinite range of contrasting value between indicators. Finally, it allows the 6 goals identified in the objectives hierarchy to compete on a level playing field, regardless of the complexity or number of objectives necessary to achieve them. Importantly, this provides the means to contrast the priority of broad sectors of potential collaborators or to reflect goal-level shifts in institutional preference.

For this analysis, indicator weights remained fixed for the array of goal-level weighting scenarios considered. To streamline assignment of indicator weights, a pilot weighting scheme was created and submitted to SAHC for revision. They were instructed to consider the relative value of each indicator within each category as described above. The pilot weights were based on extensive experience working with SAHC in the capacity of Land Conservation Strategy Intern in the summer of 2017, which helped communicate their organizational priorities. During this time period, the tuning of the weighting scheme for the North Carolina prioritization model (which shared a categorical weighting design) occurred. Although that model was not designed alongside an explicitly defined objectives hierarchy, it included efforts to relativize weights amongst indicators within categories. On a coarse level, that model's weights advised the Tennessee pilot weights. Specific attention was given to preserve the North Carolina model's relative weights for indicators with multiple criteria levels (e.g. "Average", "Above Average", "Far Above Average resilience" (Anderson et al. 2016a). SAHC was pleased with the informative output of the North Carolina model, and in an effort to maximize comparability of Tennessee and North Carolina prioritizations, they made several edits to the Tennessee pilot weights to maximize the parallels. "Criteria Score" values (Table 4) communicate the full suite of indicator weights reflecting SAHC preferences.

It should be noted that after developing an initial conceptual model of the Objectives Hierarchy, some changes were made iteratively to the model's scoring structure. As a scoring representation of the goals and objectives, these model changes were translated into the Objectives Hierarchy presented in Table 2. The changes included separating the "Preserve biodiversity where it is now" goal into aquatic and terrestrial components. This entailed splitting element occurrences into aquatic and terrestrial indicator datasets, and incorporating an aquatic habitat indicator dataset (SWAP aquatic priorities). Several indicator metrics designated in the previous Objectives Hierarchy also had to be removed because data was not available. These included an additional stream classification for water quality and a designation for hatchery supported trout waters. Two indicator datasets were added including the Underrepresented Geophysical Settings and the ¼ mile buffer of the Appalachian Trail.

Table 4. Prioritization model design

Category Weight)	Dataset/ Landscape Metric	Criteria				Threshold	Criteria Scores			
Terrestrial Biodiversity	SWAP Terrestrial Habitat Priorities	Very High	High			Acreage required to score = 5.0	6	4		
		Medium	Low				2	0		
	SWAP Adjacent to Karst Habitat Priorities	Very High	High			Acreage required to score = 5.0	3	2		
		Medium	Low				1	0		
	Natural Heritage Program Element Occurrences (Terrestrial)	G = Global, S = State								
		G1S1	G2S2	G3S3	G4S4		10	8	5	3
		G2S1	G3S2	G4S3	G5S4		9	7	4	2
		G3S1	G4S2	G5S3			8	6	3	
		G4S1	G5S2				7	5		
		G5S1					6			
	National Wetlands Inventory and Hydric Soils	Freshwater Emergent or Forest/Shrub Wetland					5			
		Hydric Soils					3			
Aquatic Resources	Custom Hydrography Dataset	>6000 linear feet					12			
		>3000 linear feet					10			
		>1500 linear feet					6			
		>500 linear feet					4			
		>200 linear feet					2			
	USFS Forest to Faucets: Surface Drinking Water Importance	≥96%ile nationally				Acreage required to score = 1.0	12			
		≥93%ile nationally					10			
		≥90%ile nationally					8			
		≥87%ile nationally					7			
		≥84%ile nationally					6			
	SWAP Aquatic Habitat Priorities	Very High	High			Within 300 ft (intersects)	12	8		
		Medium	Low				4	0		
	SWAP Upstream Aquatic Priorities	Very High	High			Acreage required to score = 5	12	8		
		Medium	Low				4	0		
	Natural Heritage Program Element Occurrences (Aquatic)	G = Global, S = State								
		G1S1	G2S2	G3S3	G4S4		20	16	10	6
		G2S1	G3S2	G4S3	G5S4		18	14	8	4
		G3S1	G4S2	G5S3			16	12	6	
		G4S1	G5S2				14	10		
		G5S1					12			
	Waterway classifications	Within 100 ft (intersects) Outstanding National Resource Waters					15			

	Wild Trout Streams	Within 100 ft (intersects)		6
	Trout Unlimited Eastern Brook Trout Conservation Portfolio	Resilient Populations	Acreage required to score = 5 & hydrography linear ft. > 0	6
		Redundant Populations		4
		Other Populations		2
Recreational, Cultural, and Scenic Resources	Appalachian Trail	Within viewshed of trail vista point		10
		Within ¼ mile of trail centerline		10
		Within viewshed of trail locations (quarter mile increments)		0
	Overmountain Victory Historic Trail	Within 100 ft (intersects)		8
		Within ½ mile		3
	Scenic Roads (within ½ mile)	National Scenic Byways		6
		Tennessee Scenic Highways		6
		Tennessee Parkways		6
	National Register of Historic Places	Within 300 ft of NRH parcels		10
	Prominent Ridges & Peaks	Within 100ft elevation of ridges ≥3000 ft		4
Proximity to Protected Areas	Protected Areas database	Within 100ft (borders property)		2
		Within 1/4 mile		1
Climate Resilience	Resilient Sites	Well Above Average	acreage required to score = 10	20
		Above Average		12
		Slightly Above Average		6
	Connected Landscapes (Permeability)	Intersects Climate Corridor	Acreage required to score =1	10
		Intersects Climate Flow Zone		5
	Under-represented Geophysical Settings	Overlies underrepresented setting		0
Parcel Size	100-200 acres 50-100 acres 20-50 acres	>200 acres | 100-200 acres | 50-100 acres		30 | 20 | 10
		20-50 acres | 10-20 acres | 5-10 acres		5 | 2 | 0

For each landscape metric, only the highest scoring criterion was counted. For example, a parcel with both hydric soils and wetlands only received the higher score for its wetland contents. The single exception was the Appalachian Trail. Parcels were eligible to accumulate scores for proximity (¼ mile) to the trail and for being within the viewshed. For the habitat priority and resilient sites metrics, lower ranking levels of criteria were allowed to overcome the acreage threshold by inheriting acreage from a higher ranking. Therefore, if a parcel contained 9 acres of "above average" resilience and 2 acres of "well above average" resilience, it qualified to score at the "above average" level. When parcels were scored for this report, a scoring weight for the underrepresented geophysical settings dataset had not been decided. Therefore, it received a score of zero. Similarly, a scoring weight had not been confirmed for the ¼ mile trail location version of the Appalachian Trail Viewshed, so it received a score of zero.

The model structure provides an additional level of flexibility with "Threshold" values (Table 4) that instill a minimum area requirement for scoring. This tuning mechanism can have a variety of applications for model implementation. For example, SAHC might decide that a habitat management practice cannot be implemented for blocks of high priority terrestrial habitat smaller than 50 acres. In response, they could set the threshold at 50 acres to prevent unmanageable habitat patches from projecting high conservation value in the prioritization results. Experiential ground-truthing of each indicator dataset will also occur as SAHC investigates priority properties. When datasets tend to over or underestimate the extent of the landscape metrics they measure, the adjustable area threshold can help correct for inaccuracy or hedge against uncertainty. The acreage thresholds used for this analysis were supplied to SAHC for review so that they could make any desired changes. There were two exceptions of acreage thresholds which were not reviewed. A threshold of one acre was put into place for the Forests to Faucets dataset in order to prevent parcels from receiving a score from a HUC-12 catchment to which they did not belong. Since some property edges are defined by HUC-12 boundaries, it is probable that misalignment of the digitized parcels and the HUC-12 dataset can produce erroneous overlaps. The one acre limit was designed to exclude these overlaps. The other exception was for SWAP aquatic priorities, which had the initial acreage minimum set to 0.5 acres. This was lifted so that any parcels within 300 feet of SWAP streamlines were eligible for scoring.

Analysis for this report considered 4 alternative goal-weighting scenarios to contrast priority results. Scenario 1 (Table 5) used weights to exclusively express SAHC preferences. Scenario 2 projected priority absent the use of climate resilience data. As such, all other category weights scaled up relative to their initial contribution in Scenario 1. SAHC frequently collaborates with a number of conservation organizations and funds with aquatic-oriented missions, including MainSpring Conservation Trust, RiverLink, and Trout Unlimited. Therefore, Scenario 3 projected priority with preference for aquatic resources to help identify attractive projects for aquatic-oriented collaborators. SAHC also works with partners having scenic, recreational, and cultural focus, including the Appalachian Trail Conservancy and the US Forest Service. SAHC's origin traces to land protection in the Highlands of Roan in support of the Appalachian Trail corridor (SAHC [date unknown a]). This action was inspired by its spectacular scenery and the community's historic use of those vista points (SAHC personal communication 2017). This community remains a vocal stakeholder in SAHC's conservation efforts, thus Scenario 4 projected priority with emphasis on protection of recreational, scenic, and cultural resources. Scenario 3 and 4 both set their goal of emphasis to 50% of the scoring total, scaling back all other scores in equal proportion.

Table 5. Weights for alternate priority scenarios

	Scenario 1 SAHC baseline preferences	Scenario 2 SAHC baseline preferences (no climate resilience)	Scenario 3 Aquatic Emphasis	Scenario 4 Scenic, Recreational, and Cultural Emphasis
Goal/Category				
Terrestrial Biodiversity (Present)	20%	22.2%	12.5%	12.5%
Aquatic Resources	20%	22.2%	50%	12.5%
Recreational, Cultural, and Scenic Resources	20%	22.2%	12.5%	50%
Proximity to Protected Lands	20%	22.2%	12.5%	12.5%
Climate Resilience	10%	0%	6.25%	6.25%
Parcel Size	10%	11.1%	6.25%	6.25%

Evaluating Project Feasibility through Funding Sources

Scenarios 3 and 4 help assess project feasibility through the lens of potential collaborative partners whose priorities are more generally defined. Feasibility through available funding can be more directly assessed by comparing the already existing criteria of specific funding or partner agencies which themselves have well-defined priority plans.
This analysis considered two potential funding outlets that SAHC has accessed or pursued in the past.

Until recent completion of the fund, The Open Space Institute (OSI) disbursed grants from its Southeast Resilient Landscapes Fund to help “assemble networks of protected lands to preserve plant and animal diversity in a changing climate” (OSI c2018). This report’s feasibility analysis for receiving an OSI grant can be thought of as a separate prioritization model. Its criteria were developed with guidance from Joel Houser, Southeast Field Coordinator at OSI who assisted in scoping projects for grant awards. Although the initial fund was completed, OSI is actively designing a successor program (Joel Houser e-mail April 16 2018). While an update will be required, this analysis assumes any new criteria will closely resemble those of the old fund. The Southeast Resilient Landscape’s Fund required a project’s extent to “rank above average for Landscape Resilience” (OSI c2018) with TNC’s *Resilient and Connected Landscapes for Terrestrial Conservation* data. It gave preference to projects near significant holdings of protected land, projects overlying certain underrepresented geophysical settings, and areas whose resilience scores also had a high scoring component for landscape diversity (OSI c2018). OSI chose 20 (of 65 possible (Anderson et al. 2016a)) geophysical settings with high incidences of land use conversion and low levels of current protection to qualify as underrepresented (OSI 2017). All parcels considered in the full SAHC prioritization analysis were screened to qualify as either 1) eligible grant candidates or 2) competitive grant candidates (Table 6). Since 100 acre projects set the bottom end of the size range for successful grants in OSI’s Southern Blue Ridge Focus Area (Joel Houser e-mail April 16 2018), that acreage sets the threshold for competitive candidates. It should be noted however that the average grant awardee was 1000 acres, with a median of 635 acres and most projects surpassing 400 acres (Joel Houser e-mail April 16 2018). Meanwhile, the rarity of OSI’s selected underrepresented geophysical settings means that in the Southern Blue Ridge, greater than 10% coverage for a particular parcel serves as a very selective criterion (Joel Houser e-mail April 16 2018, Joel Houser phone call April 16 2018).

Table 6. Feasibility Criteria: Open Space Institute Resilience Grant

OSI Grant Candidate Strength	Criteria
Eligible	• At least 50% of parcel extent has TNC Resilience scores of "Slightly Above Average", "Above Average", or "Far Above Average"
Competitive	All of the following: • Meets Eligible requirements • Exceeds 100 acres total area • Adjacent to protected land • At least 10% of extent overlies underrepresented geophysical settings

This report considered the Tennessee Wildlife Resources Agency (TWRA) as a second potential funding outlet to assess project feasibility. With help from The Nature Conservancy, the TWRA completed a Wildlife Legacy Plan in 2017 which mapped priority areas for their efforts in habitat conservation and land acquisition (Elliott and Lynch [date unknown]). The TWRA based this priority modeling from the Tennessee State Wildlife Action Plan (SWAP) and TNC climate resilience data, amongst other datasets (Elliott and Lynch [date unknown]). This report compared SAHC priority parcels against a draft dataset (TWRATNC 2017 August 16) of TWRA's priority lands which was constrained to considerations of SWAP habitat and TNC climate resilience. It should then be expected that SAHC's prioritization results have significant overlap with TWRA priorities. As a standard model input, TWRA priorities would be redundant. However, when compared in this context with alternative model results, they serve the purpose of identifying locations where TWRA would be likely to commit funding for the purpose of fulfilling the mission of their Wildlife Legacy Plan. This analysis considered parcels as highly desirable by TWRA standards if at least 50% of their acreage overlapped TWRA priority lands. To highlight opportunities for enhanced project funding, this report's priority parcel lists are attributed to show commonality with TWRA priorities as well as OSI grant candidates.

Evaluating Project Feasibility by Forestry Management Potential

Some landowners may practice forestry as a way to further reduce their tax burden. In Tennessee, forestry properties can qualify for present-use value to achieve preferential tax treatment (TCT 2017). Forest areas that are 15 acres or larger can receive present-use assessment if they are managed for sustained yield (TCT 2017, State of Tennessee c2018). Therefore, this analysis required fifteen acres of land for parcels to be considered feasible for forestry. Although landowners can begin forest management by converting non-forested areas (e.g. pasture), this would represent a shift in behavior. The current mix of land cover on a property reasons to be a more reflective of landowner preferences. Therefore, only currently forested areas could contribute to a parcel meeting the 15 acre threshold. Forest cover was determined using the National Land Cover Dataset (USGS 2014), with deciduous forest, evergreen forest, and mixed forest classes all counting toward total forested area.

While feasible parcels might qualify for lower taxes, other variables dictate whether these properties can truly undergo successful forest management. For this analysis, parcels qualified as *favorable* for forest management if they met criteria for sensitivity to erosion and equipment operability. Parcels qualified as *highly favorable* if they met additional criteria for productivity and distance to sawmill (Table 7).

Table 7. Criteria for forest management potential

Forest Management Level of Potential	Criteria
Feasible	• At least 15 acres of a parcel is covered by forest
Favorable	• At least 15 acres of forested area must not coincide with a soil type rated “Poorly suited” for Harvest Equipment Operability • The same forested area must not coincide with a soil type rated “Severe” or “Very Severe” for Erosion Hazard (Off-Road, Off-Trail)
Highly Favorable	• Meets all Favorable requirements • The forested area coincides with soil type/s whose site index exceeds the average for at least one of ten common tree species • The parcel is within 30 miles driving distance of a sawmill

When practiced in unfavorable conditions, forestry operations can create ecological damage. Poor practice can also degrade a site’s ability to generate future forest products (Soil Survey Staff [modified 2017 Aug 21]). The Web Soil Survey (Soil Survey Staff [modified 2017 Aug 21]) maintains a database of mapped soil types, including soil attributes for vulnerability to erosion from forestry operations, as well as soil suitability for forestry equipment. This analysis considered forested areas to be unfavorable to management if they received a rating of “Poorly suited” for equipment or a rating of “severe” or “very severe” for erosion hazard (Table 7). Soils with these ratings are listed in Appendix B along with detailed descriptions of the ratings. To be considered favorable, parcels had to have at least 15 acres of forest not overlying negatively rated soils. The analysis used the Soil Survey Geographic Database (Soil Survey Staff 2018 May 2) to determine the location of soil types. Analysis was constrained to soils mapped in Tennessee.

The criteria for *highly favorable* parcels related to their capacity to deliver economic value to landowners. In this respect, forestry makes more sense on sites with high productivity. A metric called site index conveys productivity, with higher values indicating that trees will grow taller at a benchmark age. (Yancey 2014). Doolittle (1958) calculated average site indexes (Table 8) for ten deciduous and coniferous species in the Southern Appalachian region, including yellow-poplar (tuliptree), northern red oak, scarlet oak, black oak, chestnut oak, white oak, eastern white pine, Virginia pine, shortleaf pine, and pitch pine.

Table 8. Average site index used as threshold for highly favorable forest management parcels.

Common Name	Current Scientific Name [Taxonomy used by Doolittle 1958]	Average Site Index from Doolittle 1958
yellow poplar	*Liriodendron tulipifera*	88
northern red oak	*Quercus rubra*	72
scarlet oak	*Quercus coccinea*	64
black oak	*Quercus velutina*	67
pin oak	*Quercus palustris*	68*
chestnut oak	*Quercus montana [Quercus prinus]*	59
white oak	*Quercus alba*	59
white pine	*Pinus strobus*	83
Virginia pine	*Pinus virginiana*	72
shortleaf pine	*Pinus echinata*	59
pitch pine	*Pinus rigida*	56

*Mean of northern red oak, scarlet oak, black oak.

Most of these species can yield merchantable timber, and they are some of the most common species associated with soil survey site indexes (Soil Survey Staff [modified 2017 Aug 21]). Only soils rated with above average site index for one of these species could quality as highly favorable. A small fraction of soil types did not have site indexes listed for any of these species. Forest overlying these soils could not qualify as highly favorable. An exception was made for pin oak, whose average site index was calculated as the mean of the four red oak species examined by Doolittle (1958).

To benefit from their land's timber production, landowners need access to markets where they can receive a fair price. Their market opportunity depends on proximity to a sawmill. Mills need the source to be close enough so that transportation costs remain economical. The Primary Forest Products Network (USFS [date unknown]) furnishes a list of sawmills across the southeast. Using TIGER/Line (USCBGD 2018) data for the road system, ArcGIS Desktop's (ESRI 2018) network analysis extension was used to calculate service areas for 40 sawmills (Appendix B) near SAHC's Tennessee focus areas. These sawmills were located in 17 Tennessee and North Carolina counties. By calculating road distances, network analysis provided a more accurate representation of timber transportation. Abbas and Clatterbuck (2015) surveyed harvest logistics trends across Tennessee and found that most sawlog (50%) and chip (67%) operations have transport distances less than 30 miles. They also found that average operation size was approximately 50 acres, and that operator costs increased 31% for steep terrain and 16% for selective cuts (Abbas and Clatterbuck 2015). Harvests on conservation easement properties would likely be less than 50 acres. Landowners with conservation easements also reason to favor less intensive harvests. Given the rugged landscape of East Tennessee, forest management of an eased property would likely impose higher costs on operators. Therefore, 30 miles was taken as a reasonable threshold for access to the market. While 30 miles was set as the criterion, parcels were also assessed in the context of 10 and 20 mile service areas. Since the TIGER/Line roads data does not intersect each property, parcel locations were converted to points and snapped to the nearest road to determine overlap with a sawmill service area.

Software

The model was implemented in ArcGIS Desktop (ESRI 2017, 2018). It was run with Python (Python Software Foundation c2017) script with ESRI's arcpy module to make it easier to iterate processes and execute the complex if/then statements necessary for parcel scoring. Scripting also allowed use of other Python integrated software like SciPy (Oliphant et al. 2001-).

The stats module of SciPy assisted in attributing parcel ranks after parcel scores were transferred into a NumPy (Oliphant et al. 2015 Sep 21) array. The Pandas module in Python was also used to facilitate scenic roads data editing by selecting features from a ".csv" file. Scripts were run either directly through ArcGIS Desktop's Python portal, from the PythonWin (Hammond c2008) integrated development environment, or through script tools in ArcGIS Desktop. ArcGIS Desktop's Model Builder was also used as a supplementary tool, particularly to build custom datasets and conduct the forestry analysis.

Results

A general overview of priority results are presented first for the entire service area. Detailed priority results are then presented separately for each of the four Focus Areas. Listed priorities had to score within the top 5% (top 402 of 8040) of all unprotected parcels. Appendix A contains a description of how parcels were attributed for protected status. The 5% screen ensured that all priority listings have exceedingly high projected conservation value regardless of uneven spatial distribution of the results. Due to differences in size of the Focus Areas (Table 1) and distributions of high priority parcels (Table 9) the priority lists include only the top 50 parcels for the Appalachian Trail Countryside and Highlands of Roan under SAHC's Scenario 1 baseline preferences. A descriptive breakdown is provided (Table 9) of the spatial distribution of top 5% scoring parcels for each weighting scenario and commonalities with funding outlet priorities and forest management potential. The spatial distribution of priority parcels across the entire service area is also illustrated (Figure 2). A separate breakdown is provided (Table 10) of forest management potential across all unprotected parcels. The illustration of this distribution (Figure 3) displays all three levels of management potential.

Overview

While the total number of priority parcels remained fixed across scenarios, their distribution across Focus Areas tended to vary substantially (Table 9). As a result, parcels that achieved priority for Scenarios 1, 3, and 4 constituted less than 2.5% of the candidate parcels on the landscape. Parcels that qualified as competitive under OSI grant criteria were exceedingly rare, with just 15 (0.2%) in SAHC's service area. In contrast, parcels commonly qualified for TWRA standards, with 5279 (~65%) having majority overlap with TWRA priority lands. Of SAHC's Scenario 1 priority parcels, 95% were deemed highly favorable to the TWRA. For reference, the TWRA priority lands dataset covered approximately 79% of SAHC's Tennessee service area.

When considering potential for forest management, over 30% (2578) of unprotected parcels qualified as feasible (Table 10). This number dropped substantially to 876 when advancing to more restrictive criteria, leaving about 11% of parcels as favorable for management. Criteria for high favorability caused a smaller reduction, leaving 771 (10%) qualifying parcels. The network analysis of sawmill service areas showed that no parcels were farther than 30 miles from a sawmill. Two parcels were calculated outside of the service area only because their nearby road segments were disconnected from the network. Likewise, the 20-mile service area was minimally restrictive, excluding an additional two parcels from mill access. Both of these were attached to the road network and therefore outside of the nearest service area. Analysis run for ten mile service areas did exclude a sizeable number of parcels. At this threshold, 76% (6106) of parcels had access to a sawmill. Since no parcel was outside the 30-mile threshold, site index was the sole criterion that prevented 105 parcels (Table 10) from advancing to a highly favorable rating. While nearly all (92%) of Scenario 1 priority parcels were feasible for forest management, just under half were favorable or highly favorable for management (Table 9).

Table 9. Priority parcel results summary across Focus Areas and weighting scenarios

	Number [& Proportion] of top 5% scoring parcels				
	Smoky Mountains	French Broad River Valley	Appalachian Trail Countryside	Roan Highlands	Total
Scenario 1 SAHC Baseline Preferences	11 [2.7%]	19 [4.7%]	271 [66.7%]	120 [29.6%]	406
Scenario 2 SAHC Preferences No Climate Resilience	9 [2.2%]	19 [4.7%]	229 [56.8%]	163 [40.4%]	403
Scenario 3 Aquatic Partner Preferences	13 [3.2%]	23 [5.7%]	260 [64.7%]	120 [29.9%]	402
Scenario 4 Human Connection Preferences	9 [2.2%]	11 [2.7%]	187 [46.4%]	213 [52.9%]	403
Shared among Scenarios 1,3,4	4 [2.1%]	7 [3.7%]	103 [54.8%]	85 [45.2%]	188
Scenario 1 Top 5% & OSI Competitive Candidate	0 [0%]	2 [13.3%]	14 [100%]	0 [0%]	14
Scenario 1 & TWRA Priority	11 [2.8%]	19 [4.9%]	257 [66.2%]	114 [29.4%]	388
Scenario 1 & Forestry: Feasible	11 [2.9%]	18 [4.8%]	256 [68.3%]	105 [28.0%]	375
Scenario 1 & Forestry: Favorable	6 [3.3%]	11 [6.0%]	140 [76.5%]	35 [19.1%]	183
Scenario 1 & Forestry: Highly Favorable	5 [3.0%]	11 [6.6%]	126 [75.0%]	35 [20.8%]	168

Table 10. Parcel results summary for forest management potential

	Number of Qualifying Parcels [& Proportion]				
Forest Management Potential	Smoky Mountains	French Broad River Valley	Appalachian Trail Countryside	Roan Highlands	Total
Feasible	319 [12.4%]	109 [4.2%]	1823 [70.7%]	381 [14.8%]	2578
Favorable	75 [8.6%]	29 [3.3%]	700 [80.0%]	96 [11.0%]	875
Highly Favorable	59 [7.7%]	26 [3.4%]	614 [79.7%]	96 [12.5%]	770

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Figure 2. Priority parcels across SAHC Tennessee service area

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Figure 3. Forest management potential across SAHC Tennessee service area

Smoky Mountains

The Smoky Mountains Focus Area contained 11 (2.7%) of the top 5% scoring parcels (Table 9) for all of SAHC's Tennessee service area when considering SAHC's baseline preferences from Scenario 1. This was the fewest amongst all Focus Areas. Four of these parcels also scored within the top 5 % for feasibility evaluations under scenarios 3 and 4, which considered aquatic and human connection emphases, respectively. None of these 11 priority parcels met the standards to be considered competitive OSI grant candidates, while all 11 qualified as TWRA priority lands.

When withholding weight for climate resilience (Scenario 2), this Focus Area saw a decrease in its share of the top 5% scoring parcels from 11 to 9 parcels. The highest share of priority parcels was achieved under Scenario 3 (Aquatic Emphasis), capturing 13 parcels.

Forest management was predicted to be feasible on all 11 of the Scenario 1 priority parcels. Five of these were highly favorable to forestry. This was the fewest amongst all Focus Areas. Thus, the frequency of feasibility was 100% while frequency of favorability was near 50%. This was comparable to the French Broad River Valley and Appalachian Trail Countryside Focus Areas.

Table 11. Priority parcels for Smoky Mountains Focus Area.

Parcels scoring top 5% for Scenarios 1, 3, & 4 are highlighted in green.				Feasibility & Forestry Evaluation OSI A = Eligible OSI B = Competitive TWRA A = Overlap TWRA B = Priority Forest Potential A = Feasible Forest Potential B = Favorable Forest Potential C = Highly Favorable							Raw Parcel Scores by Scenario (Top 5% scorers for specific scenarios are indicated by corresponding highlight)			
Focus Area Rank (Total Rank)		PARCEL ID (REDACTED)	Acreage Class	OSI		TWRA		Forest Potential			1	2	3	4
				A	B	A	B	A	B	C				
1	(80)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.48	0.40	0.35
2	(116)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.47	0.46	0.41	0.32
3	(141)		200+	Yes	No	Yes	Yes	Yes	No	No	0.46	0.45	0.34	0.40
4	(209)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.44	0.43	0.35	0.38
5	(260)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.43	0.43	0.39	0.31
6	(319)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.42	0.42	0.35	0.42
7	(326)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.42	0.40	0.32	0.34
8	(367)		50-100	Yes	No	Yes	Yes	Yes	Yes	No	0.41	0.39	0.38	0.34
9	(372)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.41	0.41	0.34	0.30
10	(376)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.41	0.39	0.33	0.34
11	(396)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.41	0.37	0.35	0.25

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Figure 4. Priority parcels in Smoky Mountains: SAHC baseline preferences

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Figure 5. Priority parcels in Smoky Mountains: SAHC preferences excluding climate resilience

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Figure 6. Priority parcels in Smoky Mountains: aquatic emphasis

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Figure 7. Priority parcels in Smoky Mountains: emphasis on human connection

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Figure 8. Priority parcels in Smoky Mountains: combined priority of scenarios 1, 3, and 4

French Broad River Valley

The French Broad River Valley Focus Area contains 19 (4.7%) of the top 5% scoring parcels (Table 10) for all of SAHC's Tennessee service area when considering SAHC's baseline preferences in Scenario 1. This is the second fewest amongst the four Focus Areas. Seven of these parcels also scored within the top 5% for feasibility evaluations under scenarios 3 and 4, which considered aquatic and human connection emphases, respectively. Two of the Scenario 1 priority parcels (both shared with the Appalachian Trail Countryside) met the standards to be considered competitive OSI grant candidates, while all 19 qualified as TWRA priority lands.

The French Broad River Valley Focus Area contained (shared with Appalachian Trail Countryside) the top scoring parcel in SAHC's Tennessee service area. This parcel was unique—a railroad corridor that winds over 30 miles in length (over 8 miles within the Focus Area boundaries). Approximately 100 feet in width, this parcel's total area summed to 230 acres. The limitations portion of the discussion section addresses the context of this parcel for conservation and prioritization.

When withholding weight for climate resilience (Scenario 2), this Focus Area did not see a change in its share of the top 5% scoring parcels. The highest share of priority parcels was achieved under Scenario 3 (Aquatic Emphasis), capturing 23 parcels. Its share of priority parcels was reduced by over a third under Scenario 4 (Human Connection), which captured 11 parcels.

Forest management was predicted to be feasible on 18 of the Scenario 1 priority parcels. Of these, 11 were highly favorable to forestry. Thus, the frequency of feasibility was near 100% while favorability was near 50%. This was comparable to the Smoky Mountains and Appalachian Trail Countryside Focus Areas.

Table 12. Priority parcels for French Broad River Valley Focus Area

Parcels scoring top 5% for Scenarios 1, 3, & 4 are highlighted in green.				Feasibility & Forestry Evaluation OSI A = Eligible OSI B = Competitive TWRA A = Overlap TWRA B = Priority Forest Potential A = Feasible Forest Potential B = Favorable Forest Potential C = Highly Favorable							Raw Parcel Score by Scenario (Top 5% scorers for specific scenarios are indicated by corresponding highlight)			
Focus Area Rank (Total Rank)		PARCELID (REDACTED)	Acreage Class	OSI		TWRA		Forest Potential			1	2	3	4
				A	B	A	B	A	B	C				
1	(1)		200+	No	No	Yes	Yes	Yes	Yes	Yes	0.63	0.62	0.52	0.44
2	(7)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.59	0.59	0.50	0.41
3	(22)		200+	Yes	Yes	Yes	Yes	Yes	No	No	0.55	0.53	0.50	0.39
4	(40)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.53	0.46	0.36
5	(62)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.50	0.50	0.46	0.36
6	(69)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.51	0.44	0.42
7	(75)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.50	0.42	0.34
8	(84)		100-200	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0.49	0.48	0.42	0.35
9	(118)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.47	0.46	0.40	0.34
10	(147)		50-100	Yes	No	Yes	Yes	Yes	Yes	Yes	0.46	0.45	0.41	0.33
11	(186)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.45	0.42	0.40	0.33
12	(199)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.44	0.45	0.35	0.36
13	(243)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.43	0.42	0.35	0.32
14	(283)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.42	0.41	0.36	0.31
15	(300)		20-50	Yes	No	Yes	Yes	Yes	Yes	Yes	0.42	0.43	0.30	0.37
16	(300)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.42	0.43	0.30	0.37
17	(338)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.42	0.42	0.39	0.26
18	(360)		10-20	Yes	No	Yes	Yes	No	No	No	0.41	0.42	0.29	0.37
19	(401)		50-100	Yes	No	Yes	Yes	Yes	Yes	Yes	0.41	0.39	0.33	0.25

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Figure 9. Priority parcels in French Broad River Valley: SAHC Baseline Preferences

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Figure 10. Priority parcels in French Broad River Valley: SAHC preferences excluding climate resilience

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Figure 11. Priority parcels in French Broad River Valley: aquatic emphasis

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Figure 12. Priority parcels in French Broad River Valley: emphasis on human connection

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Figure 13. Priority parcels in French Broad River Valley: combined priority of scenarios 1, 3, and 4

Appalachian Trail Countryside

The Appalachian Trail Countryside Focus Area contains 271 (66.7%) of the top 5% scoring parcels for all of SAHC's Tennessee service area when considering SAHC's baseline preferences in Scenario 1. This is the most amongst the four Focus Areas. 103 of these parcels also scored within the top 5% for feasibility evaluations under scenarios 3 and 4, which considered aquatic and human connection emphases, respectively. All 14 of the Scenario 1 priority parcels that also met the standards to be considered competitive OSI grant candidates occur in this Focus Area. 257 priority parcels in this Focus Area also qualified as TWRA priority lands. One of this focus area's listed priorities was a multi-record parcel (marked *). See the tax parcel dataset description (Appendix A) for interpretation.

When withholding weight for climate resilience (Scenario 2), this Focus Area saw a decrease in its share of the top 5% scoring parcels from 271to 229 parcels (15.5% relative drop by number). Scenario 1 also captured the highest share of priority parcels, while Scenario 4 (Human Connection emphasis) conveyed the lowest share of priority parcels with 187 (31.0% drop from Scenario 1 baseline).

Forest management was predicted to be feasible on 256 of the Scenario 1 priority parcels. Of these, 140 were favorable and 126 were highly favorable. For all three ratings, this was the most amongst Focus Areas. Thus, the frequency of feasibility was near 100% while favorability ranged near 50%. This was comparable to the Smoky Mountains and French Broad River Valley Focus Areas.

Table 13. Priority parcels for Appalachian Trail Countryside Focus Area

Parcels scoring top 5% for Scenarios 1, 3, & 4 are highlighted in green.				Feasibility & Forestry Evaluation OSI A = Eligible OSI B = Competitive TWRA A = Overlap TWRA B = Priority Forest Potential A = Feasible Forest Potential B = Favorable Forest Potential C = Highly Favorable							Raw Parcel Score by Scenario (Top 5% scorers for specific scenarios are indicated by corresponding highlight)			
Focus Area Rank (Total Rank)		PARCELID (REDACTED)	Acreage Class	OSI		TWRA		Forest Potential			1	2	3	4
				A	B	A	B	A	B	C				
1	(1)		200+	No	No	Yes	Yes	Yes	Yes	Yes	0.63	0.62	0.52	0.44
2	(2)		200+	Yes	No	Yes	Yes	Yes	No	No	0.62	0.61	0.51	0.42
3	(4)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.60	0.58	0.53	0.48
4	(5)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.59	0.57	0.48	0.48
5	(7)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.59	0.59	0.50	0.41
6	(8)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.58	0.58	0.46	0.55
7	(9)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.58	0.60	0.51	0.55
8	(10)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.58	0.56	0.46	0.44
9	(10)		200+	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0.58	0.56	0.46	0.36
10	(12)		100-200	No	No	Yes	No	Yes	No	No	0.58	0.62	0.51	0.61
11	(13)		100-200	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0.57	0.56	0.55	0.41
12*	(14)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.57	0.57	0.51	0.47
13	(15)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.56	0.51	0.43	0.38
14	(16)		200+	Yes	No	Yes	Yes	Yes	No	No	0.56	0.54	0.47	0.50
15	(17)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.56	0.57	0.47	0.54
16	(22)		200+	Yes	Yes	Yes	Yes	Yes	No	No	0.55	0.53	0.50	0.39
17	(23)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.55	0.57	0.46	0.53
18	(24)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.55	0.50	0.44	0.42
19	(25)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.55	0.55	0.47	0.50
20	(27)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.55	0.53	0.42	0.45
21	(28)		200+	Yes	No	Yes	Yes	Yes	No	No	0.55	0.54	0.45	0.45
22	(29)		200+	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0.55	0.56	0.52	0.39
23	(31)		200+	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0.54	0.49	0.47	0.34
24	(32)		100-200	Yes	No	Yes	Yes	Yes	Yes	No	0.54	0.52	0.48	0.34
25	(33)		20-50	No	No	Yes	Yes	Yes	Yes	Yes	0.54	0.58	0.53	0.54

26	(34)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.54	0.53	0.42	0.37
27	(35)		10-20	Yes	No	Yes	Yes	Yes	No	No	0.53	0.51	0.39	0.52
28	(39)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.52	0.50	0.47	0.37
29	(41)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.53	0.44	0.51
30	(41)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.53	0.44	0.43
31	(41)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.51	0.44	0.37
32	(45)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.52	0.53	0.43	0.43
33	(46)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.50	0.43	0.43
34	(47)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.52	0.53	0.46	0.40
35	(47)		50-100	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.49	0.46	0.32
36	(49)		200+	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0.52	0.49	0.45	0.32
37	(51)		50-100	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.53	0.42	0.51
38	(51)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.53	0.42	0.43
39	(53)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.49	0.39	0.43
40	(56)		50-100	Yes	No	Yes	Yes	Yes	Yes	Yes	0.51	0.49	0.46	0.37
41	(59)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.50	0.45	0.43	0.35
42	(60)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.50	0.50	0.43	0.39
43	(63)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.50	0.51	0.43	0.44
44	(63)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.50	0.50	0.43	0.36
45	(65)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.50	0.44	0.39	0.34
46	(68)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.50	0.51	0.42	0.47
47	(71)		20-50	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.51	0.40	0.50
48	(72)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.45	0.40	0.34
49	(74)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.50	0.45	0.35
50	(75)		20-50	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.50	0.42	0.49

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Figure 14. Priority parcels in Appalachian Trail Countryside: SAHC baseline preferences

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Figure 15. Priority parcels in Appalachian Trail Countryside: SAHC preferences excluding climate resilience

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Figure 16. Priority parcels in Appalachian Trail Countryside: aquatic emphasis

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Figure 17. Priority parcels in Appalachian Trail Countryside: emphasis on human connection

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Figure 18. Priority parcels in Appalachian Trail Countryside: combined priority of scenarios 1, 3, and 4

Highlands of Roan

The Highlands of Roan Focus Area contains 120 (29.6%) of the top 5% scoring parcels for all of SAHC's Tennessee service area when considering SAHC's baseline preferences in Scenario 1. This is the second most amongst the four Focus Areas. 85 of these parcels also scored within the top 5% for feasibility evaluations under scenarios 3 and 4, which considered aquatic and human connection emphases, respectively. None of the Scenario 1 priority parcels met the standards to be considered competitive OSI grant candidates, while 114 qualified as TWRA priority lands. One of this Focus Area's top 5% scoring parcels was multi-record, however it did not rank highly enough to make the top 50 list (Table 14). See the tax parcel dataset description (Appendix A) for interpretation of multi-record parcels.

When withholding weight for climate resilience (Scenario 2), this Focus Area saw an increase in its share of the top 5% scoring parcels from 120 to 163 parcels (35.8% relative increase). The highest share of priority parcels was achieved under Scenario 4 (Human Connection), capturing 213 parcels (52.9% of the total). Scenario 1 and Scenario 3 (Aquatic Emphasis) conveyed the lowest share of priority parcels at around 30% of the total for the service area.

Forest management was predicted to be feasible on 105 of the Scenario 1 priority parcels. Of these, 35 were favorable/highly favorable to forestry. While the Highlands of Roan had the second greatest amount of parcels with forestry potential, it had the smallest proportion with respect to total amount of priority parcels. In contrast to the 50% favorability rate of the other Focus Areas, only 29% of priority parcels in the Highlands of Roan were favorable to forest management.

Table 14. Priority Parcels for Highlands of Roan Focus Area

Parcels scoring top 5% for Scenarios 1, 3, & 4 are highlighted in green.				Feasibility & Forestry Evaluation OSI A = Eligible OSI B = Competitive TWRA A = Overlap TWRA B = Priority Forest Potential A = Feasible Forest Potential B = Favorable Forest Potential C = Highly Favorable							Raw Parcel Score by Scenario (Top 5% scorers for specific scenarios are indicated by corresponding highlight)			
Focus Area Rank (Total Rank)		PARCELID (REDACTED)	Acreage Class	OSI		TWRA		Forest Potential			1	2	3	4
				A	B	A	B	A	B	C				
1	(3)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.61	0.62	0.52	0.57
2	(5)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.59	0.61	0.48	0.60
3	(9)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.58	0.60	0.51	0.55
4	(12)		100-200	No	No	Yes	No	Yes	No	No	0.58	0.62	0.51	0.61
5	(17)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.56	0.57	0.47	0.54
6	(17)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.56	0.57	0.47	0.46
7	(19)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.56	0.57	0.46	0.52
8	(19)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.56	0.57	0.46	0.46
9	(21)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.55	0.57	0.51	0.42
10	(26)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.55	0.57	0.45	0.45
11	(30)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.54	0.56	0.47	0.48
12	(36)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.53	0.55	0.47	0.44
13	(37)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.53	0.55	0.44	0.50
14	(38)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.53	0.54	0.45	0.50
15	(41)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.53	0.44	0.51
16	(41)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.53	0.44	0.43
17	(44)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.52	0.53	0.44	0.46
18	(50)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.52	0.53	0.43	0.43
19	(54)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.51	0.52	0.41	0.43
20	(54)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.51	0.52	0.41	0.43
21	(57)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.51	0.52	0.46	0.35
22	(58)		100-200	Yes	No	Yes	Yes	Yes	Yes	Yes	0.51	0.52	0.44	0.43
23	(61)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.50	0.54	0.39	0.56
24	(66)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.50	0.51	0.42	0.47
25	(67)		20-50	Yes	No	Yes	No	No	No	No	0.50	0.51	0.41	0.48

26	(70)		50-100	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.51	0.43	0.50
27	(73)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.49	0.50	0.46	0.45
28	(75)		50-100	Yes	No	Yes	No	Yes	Yes	Yes	0.49	0.50	0.42	0.49
29	(81)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.49	0.50	0.39	0.44
30	(84)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.49	0.48	0.42	0.49
31	(87)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.49	0.50	0.38	0.48
32	(88)		50-100	No	No	Yes	Yes	Yes	Yes	Yes	0.48	0.49	0.41	0.41
33	(92)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.48	0.49	0.36	0.49
34	(93)		50-100	Yes	No	Yes	Yes	Yes	Yes	Yes	0.48	0.46	0.43	0.41
35	(99)		10-20	Yes	No	Yes	Yes	No	No	No	0.48	0.51	0.41	0.47
36	(107)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.47	0.48	0.38	0.48
37	(107)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.47	0.48	0.38	0.43
38	(110)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.47	0.48	0.36	0.45
39	(113)		50-100	Yes	No	Yes	Yes	Yes	Yes	Yes	0.47	0.45	0.41	0.40
40	(120)		50-100	Yes	No	Yes	No	Yes	No	No	0.47	0.48	0.39	0.47
41	(124)		200+	Yes	No	Yes	No	Yes	Yes	Yes	0.47	0.47	0.43	0.40
42	(134)		100-200	Yes	No	Yes	Yes	Yes	No	No	0.46	0.47	0.41	0.44
43	(135)		200+	Yes	No	Yes	Yes	Yes	Yes	Yes	0.46	0.47	0.39	0.32
44	(137)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.46	0.47	0.38	0.48
45	(141)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.46	0.47	0.34	0.40
46	(146)		50-100	Yes	No	Yes	Yes	Yes	No	No	0.46	0.49	0.40	0.36
47	(147)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.46	0.46	0.41	0.36
48	(150)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.46	0.46	0.38	0.47
49	(150)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.46	0.46	0.38	0.38
50	(158)		20-50	Yes	No	Yes	Yes	Yes	No	No	0.46	0.46	0.34	0.42

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Figure 19. Priority parcels for Highlands of Roan: SAHC baseline preferences

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Figure 20. Priority parcels for Highlands of Roan: SAHC preferences excluding climate resilience

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Figure 21. Priority parcels for Highlands of Roan: aquatic emphasis

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Figure 22. Priority parcels for Highlands of Roan: emphasis on human connection

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Figure 23. Priority parcels for Highlands of Roan: combined priority of scenarios 1, 3, and 4

Discussion

Prioritization

This analysis provided a simple yet valuable understanding of where on the landscape priority parcels aggregate. On a coarse level, areas of concentrated priority (e.g. specific focus areas) can help direct the energy of SAHC's efforts for several reasons. Most simply, these areas speak to high levels of opportunity given the array of potential projects. These areas may also communicate more viable long term opportunity for the assembly of a network of conserved lands. Importantly, landowner engagement in conservation projects has spillover effects to its community. Much of SAHC's conservation strategy has been reactive to landowner inquiries. Oftentimes, these inquiries resulted from the spread of knowledge of conservation opportunity by word-of-mouth. Thus, it would be prudent for SAHC to "seed" knowledge about the potential for conservation action in locations where inquiries from neighboring landowners would be more likely to yield attractive projects.

This analysis found that the Appalachian Trail Countryside and Highlands of Roan Focus Areas had the largest quantity of priority parcels. This aggregation occurs for both Scenario 1 priorities and the convergence of priority for Scenarios 1, 3, and 4. It is especially evident in the Highlands of Roan when the number of priority parcels gets relativized to its total number of unprotected parcels or acreage. Despite having only 13-16% of the total parcels and acreage as the Appalachian Trail Countryside, the Highlands of Roan possesses 44-83% (Scenario 1 or Combined) the amount of priority parcels as the Appalachian Trail Countryside. The Highlands of Roan also performs favorably to the Smoky Mountains and French Broad River Valley after relativizing for available parcels and total area. This information might be taken as reinforcement for SAHC's historic work, the majority of which has occurred in the Highlands of Roan. However, it should be emphasized that this history also influenced this report's projection of high conservation value. Because the weighting scheme incorporates proximity to protected areas, the addition of protected lands would have boosted the conservation value of neighboring parcels. This effect gets amplified where conservation efforts create new (i.e.

relatively isolated) patches of protection around which future expansion can proceed. Additions to adjacent protected lands (e.g. National Forest) have proportionally less impact on changing the spatial arrangement of priority.

A useful exercise moving forward would incorporate hypothetical placement of protected lands into novel areas while observing shifts in priority for neighboring parcels. In some areas, neighboring parcels might become priorities upon the addition of a new conservation area. These locations could be areas of strategic direction moving forward. Should SAHC's pipeline of project inquiries become dominated by relatively isolated parcels, this exercise could help indicate which would have the potential to become catalysts or foundations for future work. The potential for this type of exercise highlights the importance of the prioritization model for decision support. More than just a means to produce priority results, it can function as an aid to explore alternative actions and their repercussions.

While the Highlands of Roan possesses the greatest aggregation of priority across scenarios, this effect is actually more pronounced upon the removal of climate resilience data from the model, under which the Focus Area increases its number of priority parcels by about 35%. While this should not take away from the fact that the Focus Area still has the greatest aggregation of conservation value when considering the impacts of climate change, it may be indicative how this consideration has or should shift SAHC's concentration of efforts. For example, the Appalachian Trail Countryside and Smoky Mountains Focus Areas observed increases in their amount of priority parcels when incorporating climate resilience data with Scenario 1. Thus, these regions may merit more attention for project-scoping than they have in past years.

SAHC welcomed the development of priority results because they provide an objective framework to substantiate an organizational response. This includes responding to inquiries from landowners with less desirable properties. The capacity to do this is extremely important for maintaining goodwill and preventing landowners from becoming disenchanted with the conservation community should their land be less valuable than hoped (SAHC personal communication 2017). This task could become more challenging for scenarios where prospective properties have high current conservation value but low contribution to climate resilience. The contrast provided by the removal of climate resilience data can help solve this quandary. Should SAHC need to decline collaboration for such a project, possession of the Objectives Hierarchy and both sets of priority results can demonstrate their revised commitments and decision guidance.

SAHC's need to substantiate decision making highlights another application of the model outside of its priority results. In her primer on multi-criteria evaluation, Lynn Maguire (2014) points to the value of a weighting scheme and comparison of alternative weights to communicate the rationale for priority, understand alternative preferences, and help resolve conflict. Should an SAHC decision come into question (either externally or within the organization), organizational preferences can be traced back to the Objectives Hierarchy and contextualized with the weighting scheme to ensure appropriate implementation. With the model structure, SAHC can now quantify the shift in preference required to also produce a shift in the priority results. For example, a party might claim basis for priority (on a non-qualifying property) for characteristics they believe are underappreciated. With the model's relative weighting structure, it is fairly straightforward to express the value of these characteristics relative to other landscape metrics. The conflict could be resolved by posing a hypothetical question of preference:

> "For Parcel X to qualify as a priority, the value of Indicator (or Goal) A would need to be 3 times that of the value of Indicator (or Goal) B. Currently they are rated evenly. Is Indicator A actually 3 times more valuable than Indicator B?"

If the answer is no, then the decision is substantiated, assisting in resolution. If the answer is yes, then additional information about the discrepancy of the two parties' relative valuation is revealed (Maguire 2014). While this does not resolve the disagreement, it does objectively communicate why the decision was made. Such framing can inform parties how to better align their objectives in the future based on clear expectations (Maguire 2014).

In addition to general priority, results from Scenario 1, 3 and 4 demonstrate some distinct trends in how competing values aggregate on separate parts of the landscape. The Highlands of Roan, while possessing a higher concentration of priority parcels than any other focus area, still possesses fewer overall (45-70%) priority parcels than the Appalachian Trail

Countryside under most scenarios. However, Scenario 4 (emphasizing human connection) produces more than a 75% increase in the amount of priority parcels occurring in the Highlands of Roan, exceeding even the Appalachian Trail Countryside in magnitude despite a six to seven-fold difference in size/number of parcels. Meanwhile, the Appalachian Trail Countryside experiences a sharp drop (~30% reduction) in its priority parcels under Scenario 4. Clearly, the two focus areas have distinct differences in their capacity to deliver different services. These trends are important for helping SAHC understand which collaborators they will work best with and where. These trends may also help in building strategy to enhance the delivery of multiple values on a regionally collective scale. The priority results suggest that when pursuing collaborations for recreational, scenic, and cultural values, the Highlands of Roan should receive attention at a regional level in preference to the Appalachian Trail Countryside. Meanwhile, when contrasting SAHC's baseline priorities with the aquatic emphasis of Scenario 3, the focus areas show less pronounced differences in the number of priority properties they contain. This signifies that on the whole, SAHC's priorities may align well with those of collaborators interested in aquatic conservation, and that fewer mission-driven sacrifices need be made in order to seize the benefits that such partnerships could provide. Given that 1) the Highlands of Roan has an aggregation of priority properties under the Human Connection scenario and 2) the aquatic priorities observe less pronounced departure from SAHC baseline priorities, it follows that the Highlands of Roan would have the highest proportion of its priority parcels to share priority for Scenarios 1, 3, and 4. Indeed, 85 of the focus area's 120 priority parcels scored in the top 5% for all three scenarios. With the highest proportion of conserved priority, the Highlands of Roan also stands out as the focus area where SAHC need sacrifice the least mission-driven preference in order to garner the benefits of collaboration.

Although the Highlands of Roan possesses the highest concentration of priority parcels, the Appalachian Trail Countryside holds a greater share of parcels at the top end of the priority range. All of the Appalachian Trail Countryside's top 50 parcels rank within the top 75 parcels for the entire service area. In contrast, 15 of the top 50 parcels in the Highlands of Roan are outside of the top 100 for the full service area. Ground-truthing will help reveal whether parcels in the top 99th percentile have appreciably more conservation value than parcels in the 98th

percentile. If parcels at the highest end of scoring are substantially more desirable, than the Appalachian Trail Countryside may merit the most attention for conservation efforts.

Funding Outlets and Forest Management

When scoping a project for access to funding, SAHC's attention should prioritize attention toward TWRA resources over OSI grant resources. The total number of parcels amenable to TWRA's priorities vastly outweigh those that appeal to OSI's grant-making interests. However, this contrast should not exclude OSI grants from consideration. Instead, these results indicate the need for separate lines of strategic thinking. The prevalence of TWRA priority overlap means that SAHC can rely on its own conservation strategy and remain confident in TWRA interest. To implicate OSI as a partner, SAHC will have to direct its conservation efforts toward specific priorities. Balancing these strategies will likely depend on the financial resources at hand for SAHC as well as the magnitude of each respective partner's potential contribution. It should be emphasized that feasibility results from OSI and TWRA funding potential should not be treated statically. Model criteria should be reviewed as SAHC refines its understanding of OSI and TWRA preferences over time. This will help contextualize these results and assist in model tuning to generate updated results. For example, the TWRA priority lands dataset reasoned to have substantial overlap with SAHC priority parcels because it covered nearly 79% of SAHC's service area. However, some of TWRA's funding preferences may be more constrained, as they have extended their priority mapping to additionally capture recreational and water-supply criterion (Elliott and Lynch [date unknown]). SAHC could enhance future modeling of TWRA funding opportunities by incorporating this dataset and learning how TWRA wishes to apply it to project implementation.

Given its broad feasibility amongst priority parcels, SAHC can consider forest management as a potential resource in its deal-making toolkit. With over 40% of priority parcels rated as highly favorable, there are likely to be landowners who can relieve the financial sacrifice of a conservation easement by producing forest products. Compared to the other

Focus Areas, the Highlands of Roan is the least viable area for this strategy. It has the lowest rate of priority parcels meeting criteria for forest management potential.

The individual characteristics of any parcel will also dictate whether forest management is a good fit for a conservation deal. Parcels prioritized for their viewshed might preclude SAHC from agreeing to forest management as a condition of a conservation easement. SAHC may also want to contextualize forest management criteria in consideration of individual landowners. In terms of soil erosion potential, the forestry criteria only screened out parcels with a "severe" rating. However, SAHC may predict certain landowners to be less rigorous stewards of their resources. In these cases, a soil erosion potential rating of "moderate" might exceed an acceptable level of risk. SAHC should refer to the rating definitions (Appendix B) when interpreting a landowner's forest management goals.

Project scoping might also benefit from a more detailed consideration of sawmills within a property's vicinity. The network analysis considered 40 sawmills near SAHC's service area. Combined with a 30-mile service threshold, this number of locations produced a low barrier for accessibility. Analysis may have overestimated accessibility if certain mills have product class limitations. Moreover, Tennessee has shown a capacity for a rapid loss of mill operators, losing nearly 20% of its sawmills between 2007 and 2009 (Bentley et al. 2011). By 2015, the number of sawmills decreased to 235 (Gray et al. 2017), almost 27% less than the 2007 number. When making conservation deals with forest management in mind, landowners will benefit from site-specific research to gauge whether a current or projected market exists for their forest products. It should be noted that the network analysis for mill service areas was conducted using a road network projected to a meters version of Tennessee State Plane FIPS 4100. While this differed from the rest of the analyses and datasets, it was not expected to produce any appreciable difference in result.

Limitations

Given the extensive variety and volume of data used for this analysis and the number of geoprocessing, data manipulation, and bookkeeping steps their use entails, the priority scoring results and parcel contents for any individual parcel should be independently verified when used in assessment of potential projects. This verification should begin with a review of the dataset descriptions in Appendix A for a clear understanding of the landscape metrics they intend to capture. In addition to the need to ground truth to account for discrepancies between data prediction and reality, there are also known biases and dataset limitations that require consideration. The verification process relies on being aware of the limitations and weaknesses outlined below.

Custom Hydrography

A custom hydrography dataset was developed to create uniform resolution for fair comparison of parcels (see Appendix A for details). However, the custom stream network should not be expected to predict accurate stream lengths within parcels that neighbor large waterbodies like lakes or within parcels along waterways that create gaps in the tax parcel database (or where waterways are drawn as a separate parcel). Because the hydrography dataset was derived from a remotely sensed Digital Elevation Model, these flat waterbodies create irregularities in calculated flow direction and flow accumulation (Figure 8). For large lakes, the modeled stream lines tend to run around the lake perimeter, causing overestimates of stream length within affected parcels.

Fortunately, large waterbodies that cause this error are rare within SAHC's Tennessee service area. Waterways (e.g. rivers) creating gaps between parcels can be problematic because modeled streamlines fall inside their boundaries and fail to intersect adjacent parcels. Therefore, parcels along wide rivers can tend to be under-rewarded for their hydrological contents. Standard streamlines from NHD coverage experience the same underestimation. The priority ranks of parcels within these limiting areas need not be disregarded. A visual examination of the behavior of the custom hydrological network (best done in conjunction with NHD data) within these parcels will reveal if the score for their hydrography content may have been misrepresented. In many cases, use of ArcGIS Desktop's measurement tools allows a user to identify the magnitude of the error. With this information, the priority score can be manually recalculated (or uncertainty defined to a range) with the user's weighting schema.

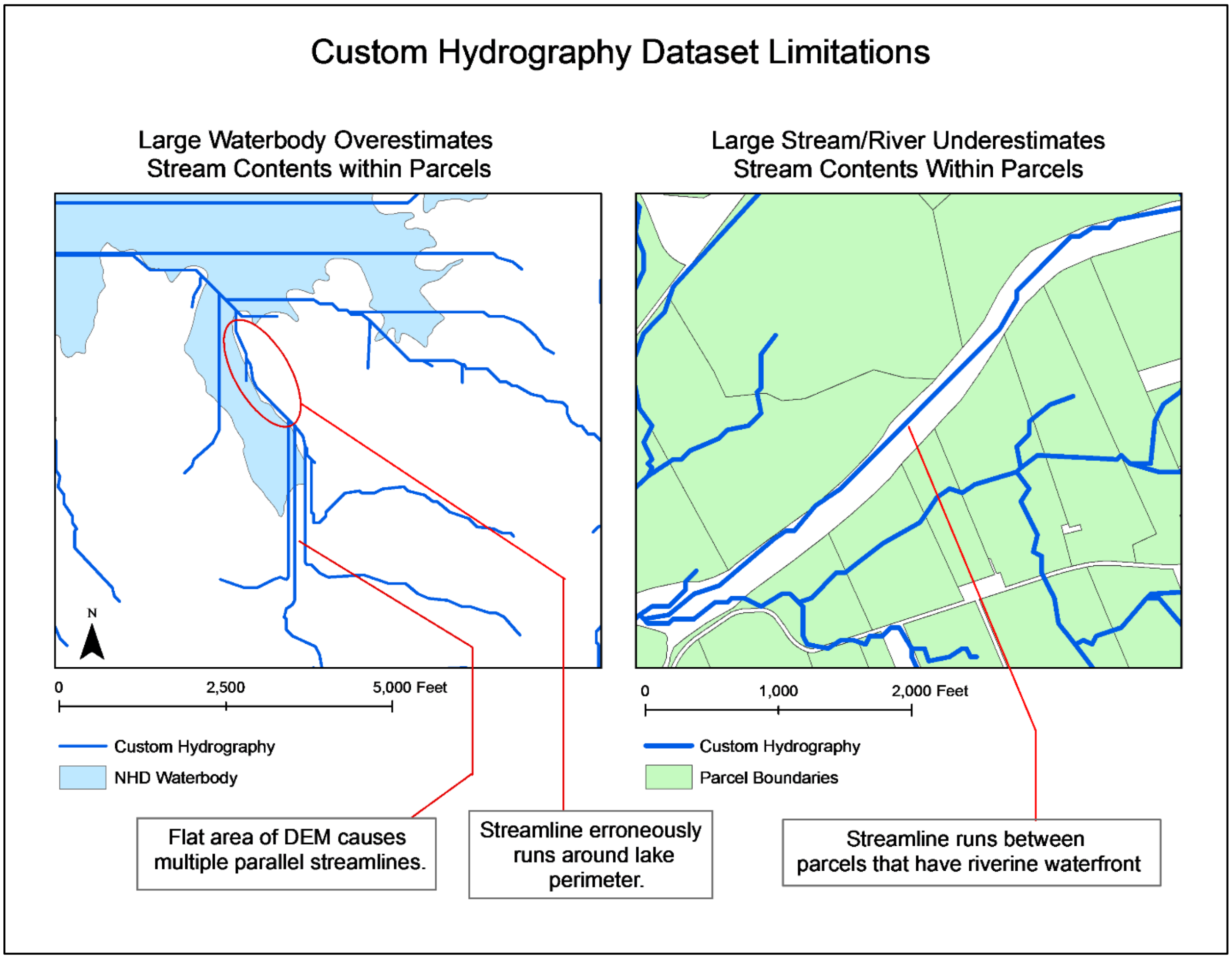

Figure 24. Custom hydrography limitations

Displays errors associated with large waterbodies and rivers that separate parcels. Waterbody shown is Watauga Lake on the northern boundary of the Appalachian Trail Countryside Focus Area in Carter County. River shown is Nolichucky River along northern boundary of the Appalachian Trail Countryside Focus Area in Washington County.

Use of the custom hydrography dataset should also acknowledge potential bias associated with tuning of the flow accumulation threshold. A threshold was chosen so that the custom stream network would mirror NHD stream lines. However, the dataset was initially developed to be applicable for prioritization of all parcels within the seven Tennessee counties. Therefore, much of the area used to determine the threshold was slightly outside of the SAHC service area. With differences in topography between some parts of the focus area and some of the locations used for threshold tuning, the custom stream network might not be ideally adapted for SAHC's service area. For some parts of the study area, the custom hydrography appears to consistently underestimate the NHD hydrography. Nonetheless, the custom stream lines provide a reasonable fit for the NHD network, striking a balance to accomplish accurate lengths of main branches without creating excessive side branches. Even if tuning had been constrained to SAHC's service area, it is likely that the variable topography would have produced certain locations with systematic over or underestimates of the NHD network.

Protected Lands

The data that were collated to create the protected lands dataset do not align perfectly with tax parcel boundaries. These misalignments can cause parcels near the margin of the scoring buffer for the protected land dataset to register false positive or false negative scores for this indicator. Visual inspection of the parcels in ArcGIS Desktop alongside the protected lands dataset should quickly reveal whether such an error may have occurred and allow reconsideration of the resultant priority score. While this issue should be considered during project scoping, it is worth noting that the "adjacent to protected land" metric was designed with a 100ft buffer to mitigate effects of these misalignments.

Species Element Occurrence

Because it consists of on-the-ground species encounters, the Natural Heritage Element Occurrence data is more informative for public properties (e.g. Forest Service land, State Parks, etc.) where surveying is more likely to have occurred. Private properties, particularly those with landowners unaware of their property's species inventory, are less likely to have their contents accurately captured by Element Occurrence (EO) data. Knowledge of species occurrences on public properties may increase the likelihood that neighboring private properties will receive a search for similar species. Thus, private properties neighboring protected lands may have a bias toward higher priority scores than parcels that don't neighbor protected lands. For the aquatic EO data, the issue of incomplete surveying may be particularly impactful. This dataset contains only 122 records of extant occurrences within the seven counties, 29 of which occur within SAHC's service area. In contrast, SAHC's service area holds 1001 extant terrestrial and wetland occurrences. Given the limited scoring opportunities, each aquatic EO has a significant influence on the spatial composition of aquatic priority on the landscape. To help mitigate for this effect, the aquatic EO scoring weights were reduced to 75% of the relative value that SAHC attributed according to their preferences. However, conducting a sensitivity analysis for this weight reduction to ascertain its effect on priorities was outside the scope of this report. While SAHC's progressive use of the model and ground-truthing of priority results will provide an experiential means of evaluating this reduction, formal analysis could be merited if SAHC desires to incorporate this kind of adjustment with objective rigor. Future model improvements might also incorporate levels of weighting for EOs of different viability and locational accuracy ratings. This highlights the importance of assessing the presence and condition of mapped Element Occurrences on parcels considered for acquisition.

Non-intersecting indicator

Outside of the Tennessee Wild Trout Streams data, the Outstanding National Resource Waters (ONRW) serve as the only waterway designation indicator with readily available geospatial data. However, it was revealed upon conclusion of this analysis that the nearest ONRW feature lies just outside of SAHC's Tennessee service area in Sevier County. Without eligible parcels to receive a score for ONRW contents, the aquatic category experiences an effective down-weighting relative to other categories. For the baseline scenario, the aquatic category's percent contribution toward a maximum attainable score is reduced from 20% to 17.4%, with the other categories experiencing a slight increase. This context should be considered when SAHC interprets results under this model structure. Nonetheless, this indicator's absence from the service area does not render it useless, as it may communicate a missing value for all parcels. Amended ONRW designations or an expanded scope of prioritization could also reinforce the use of this indicator in the model.

Prominent Ridgeline Processing Error

Development of the prominent ridgeline dataset (see Appendix B for details) masked geo-processing to the extent of the seven Tennessee counties plus a 2500 meter buffer. An undiagnosed geo-processing behavior caused this mask to be applied twice for the initial processing steps (e.g. topographic convergence index), with one instance of the mask slightly offset to the northwest. Along the southern edge of the mask, the offset caused up to ~1800 feet to be removed from the processing area for ridgeline extent. Given the 2500 meter buffer, ridges within the service area were insulated from the offset. Inspection of the dataset against a Digital Elevation Model (DEM) hill-shade revealed that buffered ridgelines along the service area's southern border accomplished the desired outcomes. Nonetheless, SAHC should examine these areas against a hill-shade if the results for parcel contents conflict with expectations.

Additional limitations

The manner by which indicator weights were chosen also merits discussion in regard to model limitations. Given that North Carolina model tuning and weight assignments were used to inform the weights for Tennessee, methodological weaknesses in North Carolina model design and weight selection may have propagated into this report's weighting scheme. The North Carolina model, having been constructed in a less formal framework, used some indicators that likely presented issues with double counting. Because weights were developed with those datasets in mind, the weights (even on a subconscious level) could reflect manipulations outside of SAHC's objective preferences in order to deal with that specific model structure and function. Thus, using any NC weight to hone the Tennessee model risks translating these manipulations. This effect might also occur simply by virtue that the two models did not use all of the same datasets. Additionally, the method of collecting SAHC preferences to determine weights may have introduced bias. The legacy of the project development meant that the most time-efficient method was to solicit a full suite of weights advised by prior experience, followed with opportunity for editing under the guidelines identified in the Methods. However, this technique may have psychologically primed SAHC to accept the initial weights (Betsy Albright, Assistant Professor of the Practice, Duke University, personal communication 2018), perhaps supplying a false confidence or creating an unwillingness to appear burdensome by asking for significant changes.

Finally, the need for individual parcel inspection is highlighted by examining the highest ranking parcel from the analysis: a railroad corridor that passes through both the French Broad River Valley and Appalachian Trail Countryside focus areas. Inspection against orthoimagery (ESRI 2009 Dec 12 [updated 2018 Dec 6]) revealed a physical railway structure in this corridor. Therefore, it is not likely of conservation interest for SAHC. It attained maximum scores for parcel size and proximity to protected lands, with much of the railway parcel extending into Cherokee National Forest. Its climate score is likely inflated due to its thin geometry. Anderson et al.'s (2016a) final resilience scores designate the corridor as developed. However, the resilience mapping of the raster dataset does not align perfectly with the polygon feature. As a result, intersection analysis allowed the parcel to capture the above average resilient sites just outside of the corridor.

Still, the parcel passes through a substantial amount of high priority terrestrial habitat and is adjacent to other priority parcels. With real conservation value around this corridor, it could provide a unique opportunity if retired from use—perhaps as a trail to promote recreational and aesthetic appreciation of the landscape.

Another parcel of similar geometry ranked 12th in the entire service area despite being a small network of roads under private ownership in the Highlands of Roan. Ideally, this parcel would have been screened out before prioritization. However, an advantage of prioritization is that it focuses attention. There were likely other anomalous parcels that never attained priority results for this analysis. Much time would have been wasted by attempting to investigate all parcels before conducting prioritization.

Given the weighting scheme and model structure, it was appropriate for this parcel to score highly. It has numerous priority parcels in its vicinity, and overlies a number of valuable resources like the Appalachian Trail Viewshed, prominent ridgelines, and a resilient brook trout population, to name a few. However, the high scores of this parcel and the railway corridor highlight that the model does not incorporate consideration of parcel geometry. Future models could screen out undesirable geometries by incorporating a metric for the ratio of core area to edge. The current model structure may be able to accomplish similar screening by using higher acreage thresholds for certain metrics.

Appendix A

Appendix A contains detailed methodology for construction of custom datasets, descriptions and rationale for inclusion of input datasets in the model, and the workflow for creating the parcel attribute database upon which the prioritization scripts operate.

Dataset Descriptions and Rationale for Inclusion

Appalachian Trail Centerline Buffer

Spanning northern Georgia to Maine, the Appalachian Trail (AT) is an iconic hiking trail of exceptional recreational and scenic value. If protected, parcels in the immediate vicinity of the trail have the potential to enhance and preserve recreational access. This analysis attributed priority conservation value to parcels within ¼ mile of the trail. This buffer was calculated from a trail centerline shapefile created by the Appalachian Trail Conference (now Appalachian Trail Conservancy) and National Park Service Appalachian Trail Office (2001 Oct 15). This version was used because it accompanied a prioritization analysis conducted by the Appalachian Trail Conservancy which was distributed to SAHC. A newer version is publicly available from the National Park Service Appalachian Trail Office and Appalachian Trail Conservancy (2014 Apr 7).

Appalachian Trail Viewsheds

The Appalachian Trail Conservancy (ATC) incorporated an Appalachian Trail viewshed analysis (ATC, unpublished data) into their 2005 land conservation modeling effort in order to identify areas that impact the user experience (ATC, unpublished powerpoint slides). To the same end, SAHC prioritization quantified aesthetic/recreational value by assessing parcels for their visibility from the trail. Parcels were analyzed for their intersection with two elements of the Appalachian Trail Conservancy's viewshed data. One dataset indicates visibility from vista points along the trail, with the value of each grid cell relating the number of vista points from which it is visible (Matthew Robinson [former ATC] e-mail 2018 Dec 6). ATC calculated the viewshed from each of 89 vista points, 39 of which fell within a 2500 meter buffer of SAHC's Tennessee service area. However, SAHC wanted to account for diminished visibility with distance, so this report clipped the viewshed to exclude areas greater than two miles from the Appalachian Trail. This distance was calculated from the same Appalachian Trail centerline used to generate the ¼ mile buffer input layer. The second dataset indicates visibility from quarter-mile increments along the length of the trail, with the value of each grid cell relating the number of ¼ mile trail locations from which it is visible (Matthew Robinson [former ATC] e-mail 2018 Dec 6). Parcel contents were calculated for these viewsheds, grouping visibility by 10-19, 20-29, and 30+ trail locations. While available for review in the parcel contents database, this trail location viewshed was not included as a scoring metric.

Hydric Soils

Given the challenges of wetland determination, this analysis considered that the National Wetland Inventory dataset might miss certain features on the landscape. Since hydric soils are a defining factor of wetlands (NRCS 2017 Jan 4), this analysis used locations of hydric soils to predict where wetland systems might be supported. Parcels attaining scores for hydric soil contents will need to be ground-truthed to determine whether they contain unique wetland habitat. The analysis used an ESRI image service layer (NRCS 2017 Jan 4) that used the 2017 Gridded Soil Survey Geographic Database's (gSSURGO) hydric classifications. Soils with hydric values of 97-100% were extracted for parcel contents analysis and scoring. This 2017 version of the dataset has been updated on ArcGIS Online with a 2018 version.

National Register of Historic Places

The National Register of Historic Places (NRH) dataset (Stutts 2014) comes in geodatabase form with separate layers for historic structures, buildings, districts, objects, and sites. Additionally, each category has point and polygon representations. Protection of any of these features (or the surrounding landscape) has the potential to sustain community, regional, or national heritage. Originally, all types of historic elements on the register were combined into two shapefiles: one each for points and polygons. Both were necessary because many historic elements are only represented by either a point or polygon. When both exist, a buffered polygon improves the chances that adjacent parcels will receive a score for historic elements in their immediate vicinity. However, closer assessment of the data revealed that positional inaccuracies translated into a high level of mismatch between parcels that should and should not score, particularly given the scarcity of historic elements in the service area. To accommodate this, the correct parcel/s overlying historic registry elements were determined by consulting documentation for each element's reference number from the NPGallery database (NPGallery Staff [date unknown]). Only historic elements overlapping a 2500 meter buffer of SAHC's service area were considered. This validation was assisted with use of aerial imagery (ESRI 2009 Dec 12 [updated 2018 Dec 13]), the TIGER/Line roads shapefiles (USCBGD 2018), and the spatial data's attributes. These parcels were then buffered for parcel intersection. The database was consulted on December 28, 2018 for reference numbers: 007001010, 86000400, 96001315, 93000530, 07001167, 73001852, 760000204, and 94000613, and on January 3, 2018 for reference numbers: 02000812, 11000088, and 05001410. One element (07001010) was excluded from buffering because its true location was outside of the service area, while another (05001410) was excluded for being located in North Carolina and several thousand feet from any Tennessee parcel. Two elements (73001852, 76000204) occurred in large protected area parcels (e.g. Great Smoky Mountains National Park). These received a negative buffer to shield their numerous adjacent parcels from unmerited historic scores. The NRH dataset's metadata indicates an update was scheduled for January 31, 2015 (Stutts 2014). However, this marker's presence at the time of download indicates that this 2014 geodatabase was still the most current geospatial data furnished by the National Park Service.

National Wetlands Inventory

For SAHC, parcels containing wetlands are particularly desirable as unique habitat supportive of biodiversity. Intended to serve various uses including wetland conservation, the National Wetlands Inventory dataset charts the locations of different types of wetlands across the country (USFWS [updated 2018 Nov 26]). To cover the study area, this analysis used data from six HUC-8 watersheds, including:

- 06010102(USFWS 2017 Oct 1a)
- 06010103(USFWS 2017 Oct 1b)
- 06010105(USFWS 2017 Oct 1c)
- 06010106(USFWS 2017 Oct 1d)
- 06010107(USFWS 2017 Oct 1e)
- 06010108(USFWS 2017 Oct 1f)
- 06010201(USFWS 2017 Oct 1g)

For use in prioritization, all non-wetland features like lakes, ponds, and rivers were removed. Only freshwater emergent wetland and freshwater forested/shrub wetland features were included for parcel intersection.

National Hydrography Dataset

While only the custom hydrography dataset was used for scoring parcels, the stream network from the National Hydrography Dataset was also intersected with parcels for SAHC's reference. It also assisted in tuning the flow accumulation threshold for the custom hydrography dataset. The stream network was merged from eight HUC-8 subbasins, including:

- 05050001 (USGS 2018 Mar 4 [cited 2018 Mar 22])
- 06010102 (USGS 2018 Mar 5)
- 06010103 (USGS 2017 Nov 19)
- 06010104 (USGS 2018 Mar 6)

- 06010105 (USGS 2018 Mar 6)
- 06010106 (USGS 2018 Mar 4 [cited 2018 Mar 28])
- 06010107 (USGS 2018 Mar 5)
- 06010108 (USGS 2017 Nov 19)

Specifically, the analyzed stream network was derived from the "NHDFlowline" shapefiles. Downloaded for HUC-8 0601 (USGS 2018 Mar 2), the "NHDWaterbody" shapefile was also used in map-making (Figure 24).

Natural Heritage Program Element Occurrences

This dataset (TNHP 2017) contains documented location occurrences of rare species in Tennessee. Tennessee's Natural Heritage Inventory Program uses NatureServe methodology (NatureServe [date unknown]) to compile this data and, due to its sensitivity, distributes it under a data use agreement. If protected, parcels containing element occurrences can preserve known locations of rare biodiversity. This analysis excluded historical and extirpated occurrences from the dataset. Terrestrial and aquatic occurrences were also separated to be evaluated under this model's respective categories of Terrestrial Biodiversity and Aquatic Resources. The "WET_HABITAT_FLAG" attribute was used to isolate aquatic occurrences, with all others sorted to terrestrial occurrences. Occurrences of bald eagle were listed as aquatic, however they were transferred for consideration in the terrestrial category. Element occurrences are ranked for their conservation status both globally (G) and at the state level (S) (NatureServe 2002). Lower numbers indicate less secure conservation status, with G1 indicating that a species is "critically imperiled globally." (NatureServe 2002). These global and state ranks were the basis for prioritization scoring. Some species with uncertain conservation status receive a dual ranking like G2G3 (NatureServe 2002). For these instances, the score was determined using the higher number (less vulnerable ranking). Occurrences can also have qualifiers attached to their rankings (e.g. T for subspecies) (NatureServe 2002). These qualifiers did not impact consideration of model scoring. Some occurrences have the "NR" qualifier or a "U" qualifier, indicating they are unranked or unrankable, respectively (NatureServe c2018). When this qualifier occurred at one level and not at the other (e.g. G4SNR), the element occurrence was scored at the lowest ranking of conservation concern for the level which did not have a ranking. Therefore, a GNRS3 became G5S3. Since vulnerability must be ranked lowest at the global level (NatureServe c2018), SNR and SU ranks inherited the global rank number. Therefore, a G4SNR rank was scored as a G4S4. This was done to preserve the value of known rarity.

Outstanding National Resource Waters

This dataset (State of Tennessee 2007) maps streams and rivers designated by the state through rulemaking which have "exceptional recreational or ecological significance" or that "constitute an outstanding national resource" (e.g. run through National/State Park) (TDEC 2015). Protection of parcels along these waters helps support the wide array of values that the State of Tennessee recognized in making the ONRW designations. Because these waters are subject to rules that prohibit degradation (TDEC 2015), protected parcels stand to benefit from sustained environmental quality. Because hydrography datasets do not align perfectly with parcel boundaries, the shapefile features were buffered to 100 feet, with intersecting parcels considered to be adjacent to (or containing) the stream features.

Overmountain Victory Historic Trail

The Overmountain Victory Historic Trail allows motorists and hikers to experience the historic journey of Patriot militia who traveled from East Tennessee to South Carolina in a campaign for American Independence (NPS [updated 2017 Mar 23], NPF [date unknown]). Trail infrastructure is expanding and relies on landowner agreements (NPF [date unknown]). Therefore, land conservation along the route promises to support its recreational use and experiential value. Even properties within its vicinity (1/2 mile buffer for this analysis) can help maintain its historic character. This analysis used a dataset furnished by the National Park Service (NPSSRGST 2015 Jun) which outlines the trail's route. This geodatabase contains several layers for alternate routes and historic locations. Specifically, parcels were evaluated for intersection/proximity to both the existing trails layer, and the "OVVI_BND_Trail_ln" layer, which combines the historic and motor route layers.

Resilient Sites

Anderson et al. (2016a) developed a dataset which combines metrics of landscape diversity (proxy for microclimate diversity) and landscape connectedness (e.g. continuity of natural land cover) to evaluate areas where organisms have the capacity to relocate into a microclimate suitable to their survival. Parcels were analyzed using the Final Resilience Scores (after ecoregional override) from this dataset, with parcel contents organized by the seven classes (e.g. above average resilience, well above average resilience, etc.) established by Anderson et al. (2016a).

Resilient and Connected Landscapes

To map areas which assist or benefit from climate migration, Anderson et al. (2016b) modeled the potential of species to move over larger areas (e.g. regions). The product was a prioritized resilience network. The landscape permeability modeling that they incorporated was different than the local landscape connectedness examined in the Resilient Sites (Anderson 2016a) dataset. The raster of this prioritized network categorizes it into classes that include climate corridors and flow zones. All classes of climate corridor were aggregated into one class for parcel analysis. These included “Climate Corridor (Vulnerable Portion of Connector)”, “Climate Corridor with Confirmed Diversity” and “Climate Corridor”. The study area did not contain any locations of the class “Climate Corridor (Resilient Portion of Connector)”, so this was not included in the parcel analysis. All classes of flow zones were also aggregated into one class for parcel analysis. These included “Climate Flow Zone” and “Climate Flow Zone with Confirmed Diversity.” Because climate corridors are areas of concentrated flow (in contrast to the diffuse flow of flow zones), they receive higher priority for protection.

Tennessee State Wildlife Action Plan (SWAP) Habitat Priorities

As part of the 2015 Tennessee State Wildlife Action Plan (TNSWAPT 2015), the Tennessee Wildlife Resource Agency enlisted help from the Nature Conservancy to produce geospatial data to rank areas of important habitat for rare species conservation (Wisby and Palmer 2015). This data maps four types of priority areas, including habitat for terrestrial species, in-stream reaches for aquatic species, upstream catchments which contribute flow to aquatic species, and areas in the vicinity of caves which host subterranean species. All four elements of habitat priority were used for this analysis.

Tennessee Tax Parcels

Distributed by the State of Tennessee’s TNMap Team, the original dataset (TNMT 2018) held all parcels for the entire state in a geodatabase format. To comply with their usage agreement for obtaining the data, SAHC’s distribution to me (their collaborator) was made for my exclusive use on this SAHC-specific project (SAHC e-mail March 26 2018). Parcels came fully attributed with Parcel IDs, owner names, and mailing addresses. The dataset was trimmed to parcels within SAHC’s service area for this analysis and converted to a shapefile format in the process. It required further cleaning before use in prioritization. Many parcels have duplicate records—usually separated for fiscal and calendar year tax purposes. Only 2018 records were kept. These included fiscal year records for Greene County (2017 calendar year removed) and calendar year records for the other 6 counties (2019 fiscal year removed). Although the parcels come attributed for calculated acreage and deeded acreage, these records are often incorrect or missing. All parcel areas were recalculated for prioritization purposes. To speed production of the parcel attribute database, all parcels smaller than 5.0 acres were removed. Occasionally, certain Parcel IDs had multiple features as separate records. These features were not merged as they correspond to separate spatial areas with their own boundaries. One parcel within SAHC's Tennessee service area had 9 separate records all corresponding to some portion of the Watauga Lake shoreline. Given this was not a likely conservation target for SAHC, it was removed to allow accurate percentile priority rankings. Eight other multi-record parcels occurred. Multi-record parcels for protected lands were not removed as they did not affect unprotected priority rankings. Five unprotected Parcel IDs had two records, and one had three records. Only the largest feature for each of these Parcel IDs was kept for inclusion in the priority lists. However, since each record's intersection with the indicator datasets was based on the Parcel ID, each individual record ended up inheriting the combined contents of all features associated with its Parcel ID. For example, if feature A from parcel X had 10 acres of forest cover, and feature B from parcel X had 5 acres of forest cover, then both feature A and feature B were calculated to have 15 acres of forest cover. With one exception, all of these duplicates were contiguous with their counterpart. Therefore, the combined contents result was not necessarily undesirable because conservation would still involve one landowner over a connected landscape. However, since acreages were recalculated for each feature, their size category score was based on individual extent and not the collective extent of their counterparts. Two multi-record parcels qualified for top 5% priority. Since the larger polygons would not have entered a higher scoring size class with the addition of the smaller polygons, their priority ranks remained accurate. Since each parcel's score was derived from the combined contents of its two records, both polygons are represented on the priority maps (Figures 2, 14 through 18 & 19-21).

Tennessee State Wildlife Resources Agency Priority Areas

This dataset (TWRATNC 2017 August 16) contains areas which the TWRA designated as acquisition priorities. In their full 2017 Wildlife Legacy Plan, the TWRA conducted prioritization mapping which, in addition to incorporating the Tennessee SWAP habitat priorities and TNC climate resilience data, included recreational and water supply values (Elliott and Lynch [date unknown]). Assisted by The Nature Conservancy, that effort featured multiple levels of priority (Elliott & Lynch [date unknown]). However, this dataset is a draft version and only utilizes SWAP and TNC (2014 vintage) resilience data to delineate a single level of priority. In this dataset, priority distinction can be attained by a high value from either dataset (excluding the upstream aquatic SWAP priorities).

Trout Unlimited Eastern Brook Trout Conservation Portfolio

To scope opportunities for eastern brook trout (*Salvelinus fontinalis*) conservation, Trout Unlimited conducted a range-wide characterization of individual trout populations in the east (Fesenmyer et al. 2017). SAHC can use this data both to protect an iconic species and to identify parcels for a conservation partnership with Trout Unlimited. Kurt Fesenmyer, Trout Unlimited's GIS and Conservation Planning Director, advised that the 3-R framework portion of this data is more likely to impact evaluation of potential projects and partners, with resilient and redundant populations representing the first and second priorities, and all other populations in a third category of priority (Kurt Fesenmyer phone call March 29, 2018). He graciously provided the ESRI geodatabase associated with Trout Unlimited's analysis, including a feature class of catchment-based assessment unit polygons. These polygons included "habitat patches" developed for the Eastern Brook Trout Joint Venture (Coombs and Nislow 2015 Sep 23). These were the populations assessed by Trout Unlimited. These depict the spatial extent of trout populations over catchment areas and not the actual stream network. In order to grade parcels based on whether they contained trout-supporting waters, parcels also had to intersect the custom hydrography dataset. While only the habitat patches were associated with scoring populations for this parcel analysis, the assessment unit feature class also included HUC12 boundaries cited in Fesenmyer et al. (2017).

Underrepresented Geophysical Settings

Anderson et al. (2016a) mapped geophysical settings as an element of their resilient sites dataset. Defined by an elevation class and geological composition, geophysical settings have associated ecological attributes and community assemblages (Anderson et al. 2016a). Two modifications of this dataset were used in this analysis. The first extracted only geophysical settings listed by the Open Space Institute as priorities for protection (OSI 2017). These settings were used to evaluate parcels for OSI grant competitiveness.

The second version included geophysical settings which, according to The Nature Conservancy (Anderson et al. 2016b, pg. 82-83), were no more than 20% protected across the East, and which had a conversion to securement ratio larger than 1.0. The 20% benchmark matches what SAHC used in their North Carolina prioritization. The conversion to securement ratio of 1.0 is what OSI used when developing their set of underrepresented settings (OSI 2017). Together, these criteria produced a list of settings inclusive of those identified by OSI, but with the addition of the mid elevation and high elevation calcareous settings. While these settings were not scored for parcel prioritization in this analysis, they are available in the parcel contents database for review.

While developed in Anderson et al. (2016a), the geophysical settings geodatabase is not publicly available and was provided upon request by The Nature Conservancy.

United States Forest Service Forests to Faucets

This dataset ranks all HUC-12 catchments in the United States on their contribution to the surface drinking water supply (Weidner and Todd 2011 Oct). SAHC's Tennessee service area overlaps 35 HUC-12 catchments ranging in ranking from 84^{th} to 98^{th} percentile nationally. While this speaks to the importance of SAHC's service area for water supply, it should be noted that the ranking calculations include comparison against many HUC-12s that lie in regions (e.g. arid western states) where drinking water is sourced mostly from groundwater (Weidner and Todd 2011 Oct). Thus, when considered in regional context (e.g. within Appalachia or the southeast) the spread in rankings may provide more contrast in importance than the numbers alone suggest. Each HUC-12 gets scored as the product of the surface volume it produces and the population served by that production (assessed by surface water intake locations) (Weidner and Todd 2011 Oct). This dataset is especially useful because it takes into account both local populations served by HUC-12's surface water as well as downstream populations (incorporating a decline by distance function) (Weidner and Todd 2011 Oct). Thus, this dataset allows SAHC to evaluate their conservation effort's impact at both a landscape and regional scale. The Forests to Faucets dataset is tabular. For parcel analysis, it was joined to HUC12 polygons (NGCE 2013-Present) which were downloaded separately.

Wild Trout Waters

This dataset (TWRA 2006b) maps streams identified by the Tennessee Wildlife Resources Agency which provide "good to excellent fishing" for naturally reproducing trout (TWRA 2006a). Adjacent parcels can help protect the recreational quality of these streams and enhance angling opportunity. Because this hydrography dataset does not align with parcel boundaries, and to account for inaccuracy, the shapefile was buffered to 100 feet. Intersecting parcels were considered to be adjacent to (or contain) the stream features. While hatchery-supported streams would also support recreational opportunity, the Tennessee Wildlife Resources Agency relayed that they did not possess a stream feature dataset on these waters (Tracy Porter e-mail April 2 2018).

Custom Dataset Construction

Prominent Ridgeline Dataset

For SAHC, mission-driven conservation includes protecting prominent ridgelines and peaks that impact the aesthetic quality of the landscape. To capture this information, the model used a 3000+ foot ridgeline dataset derived from 10 meter resolution (1/3 arc second) Digital Elevation Model (DEM) tiles (USGS 2017 Nov 9a, 2017 Nov 9b, 2017 Nov 14a, 2017 Nov 14b, 2017 Nov 14c). First, a mosaic DEM was created from five 1 degree x 1 degree tiles to cover the entire focus area. Ridge cells were identified by calculating Topographic Position Index (TPI) values from the DEM according to the raster calculator expression (Weiss 2001):

$$TPI = int((DEM - focalmean(DEM, annulus, irad, orad)) + .5) \qquad (2)$$

where *int* specifies integer values, *DEM* represents the DEM dataset (also a parameter for the focal mean function), *focalmean* calls ArcGIs Desktop's focal mean function, annulus is the neighborhood shape parameter, and irad and orad are parameters for the inside and outside radii of the annulus in terms of number of DEM cells. This expression was integrated into a pre-built tool (John Fay, Nicholas School of the Environment, unpublished ArcGIS Desktop Model Builder tool) for use in this analysis' larger workflow. In this TPI method, large extent neighborhoods capture coarse scale features, while small extent neighborhood parameters are better suited to fine scale topography (Weiss 2001). For the study area, an inner radius of 10 cells (100 meters) and outer radius of 40 cells (400 meters) produced a TPI indexed grid that, relative to other annulus parameters, struck an effective balance of excluding very small branches stemming from main ridges while also preventing the width of identified ridges from being too large. Weiss (2001) recommends TPI values of >1 standard deviation from the mean as a starting point for defining ridges. For this analysis, the appropriate TPI threshold was assessed by visual comparison against a DEM hill-shade (which allowed visual identification of ridges). For this study area, the >1 standard deviation threshold provided an adequate representation of ridge areas so that 1) calculated ridgelines (delineated by thinning of ridge areas to linear features) provided a close match to true ridgelines, and 2) continuous ridgelines observed minimal fragmentation. Once delineated to linear features, ridgelines were cleaned to exclude reaches below 3000 feet in elevation.

To capture areas (i.e. hillslopes) adjacent to ridges that impact the viewshed, ridge centerlines were buffered to delineate terrain within a 100 foot[2] elevation drop. These areas were delineated with a technique (Meltz c2011) which allocates grid elevation values to that of the nearest ridge cell, then finds the difference between allocated elevation and true elevation (DEM) to determine elevation drop. It should be noted that because calculated ridgelines were determined from the center of high TPI zones, any deviation they possess from true ridgeline locations will create vertical drop buffers larger than 100 feet. For example, if a calculated ridgeline was delineated with 100 feet of horizontal error down a continuous 50% slope, then the its elevation would occur 50 feet below the true ridge, and the vertical buffer would extend 150 feet in elevation below the true ridge (on both sides). This technique also creates patches of vertical ridgeline buffer in areas not directly adjacent to ridges (e.g. across narrow valleys where elevation rises again but does not reach 3000 feet) (Meltz c2011). To remove these zones, the ridgeline buffer raster grid was extracted to a 500 foot horizontal buffer from ridge centerlines. Thus, slope would need to average below 20% over this extent to not capture the entirety of a 100 foot elevation drop. Assuming that most slopes near ridgelines of aesthetic value exceed 20% in the study area, 500 feet provides an appropriate buffer.

Notes for future adaptation:

When delineating ridgelines and their surrounding elevation drops, multiple levers exist in this geo-processing workflow to customize the scale and extent of ridges that the user desires to capture. Among these are the aforementioned neighborhood size (or shape) used to calculate TPI, TPI value threshold used to define ridges, and horizontal buffer size used to exclude zones not adjacent to ridges. The user should also consider the parameters of the thinning function used to linearize zones of high TPI to ridge centerlines. In particular, the "maximum thickness" parameter can have a dramatic effect on the degree to which shorter length (ranging approximately 200-700 feet) spur ridges are delineated or excluded. Small maximum thickness values increase the extent of ridgeline delineation (more short ridges captured), while larger maximum thickness values exclude these spur ridges and focus on capturing ridges of more significant extent. ESRI recommends the maximum thickness input parameter match that of the "thickest linear features to be thinned" (ESRI c2018). For this study area, the maximum width of high-TPI (i.e. > 1 SD) zones ranges around 1200-1300 feet. For this analysis, a maximum width of 40 times cell size (383.7 meters = 1258.8 ft) matched this metric. Compared with thinning using lower maximum width inputs, this parameter eliminated many

[2] While 100 feet is the metric requested by SAHC, the elevation drop is technically in meters (30) as this is the unit of the DEM and the allocation function required integer values. For consistent calculation of 20% slope, the horizontal buffer is technically 150 meters (492.126 feet) rather than 500 feet.

short spur ridges which would increase the extent of the vertical buffer (from main ridge) over 100 feet in many areas. Thinning conducted with maximum width parameter = 100x cell size did not show much additional exclusion of short spur ridges, yet removed some desirable ridges up to ~2000 feet in length.

The user might also consider setting the threshold for "prominent ridgelines" to a value other than 3000 feet, or alternatively, create multiple classes of ridgeline at different elevation thresholds for alternative scoring in the model.

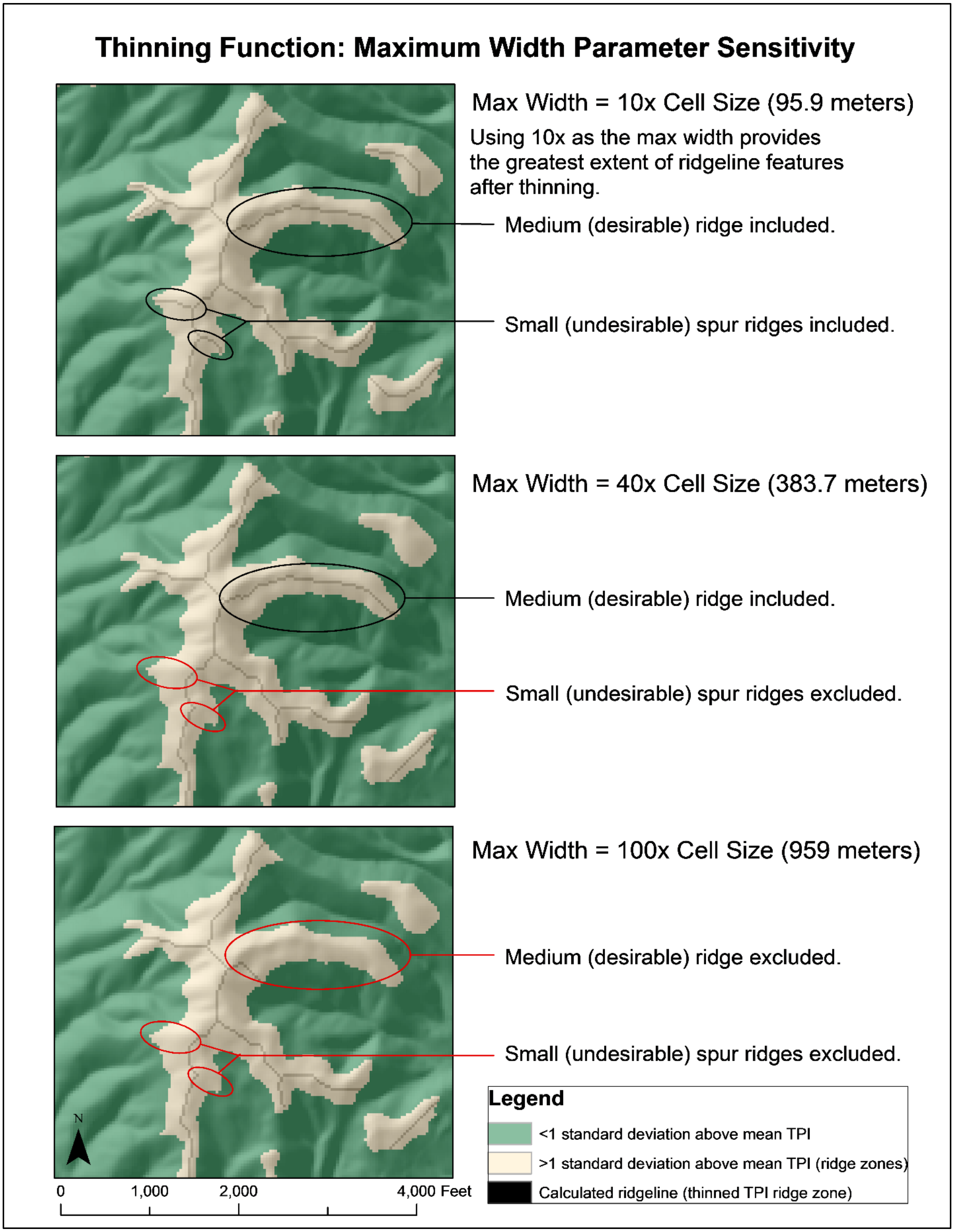

Figure 25. Ridgeline dataset construction: effect of Maximum Width parameter on thinning function

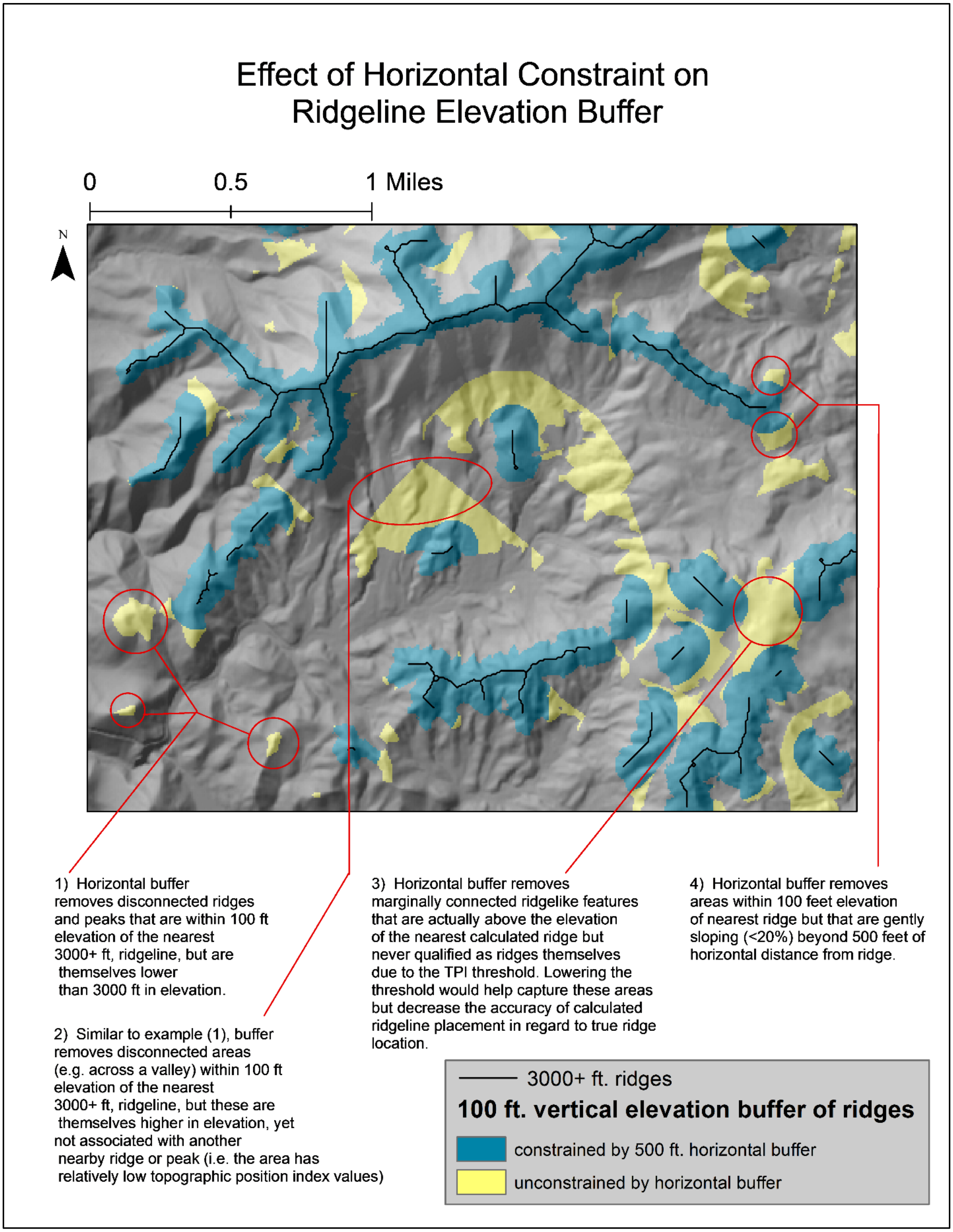

Figure 26. Ridgeline dataset construction: effect of horizontal buffer constraint on vertical elevation buffer

Protected Areas Dataset

Unfortunately, there is no comprehensive protected areas dataset for the study area. In addition to different designations and reporting for publicly and privately protected locations, there are a range of designations with varying degrees of permanence. The protected areas dataset used to assess proximity to protected areas for this analysis was developed by collating the following layers:

1. United States Geological Survey Protected Areas Database (PADUS)

   This dataset (USGS 2005-2016) contains a collection of protected areas collated from private and public lands on the state and federal level (including some local data), and includes easements (Gergely and McKerrow 2016). The Appalachian Land Conservation Cooperative Unit portion of this dataset was downloaded for this analysis. It was the principal dataset that contained most protected features for Tennessee and North Carolina. However, the boundaries of its features can differ from those provided from other datasets. Since it was generated in 2016, the other datasets were necessary for updated coverage.

2. SAHC Protected Lands

   This dataset (SAHC, unpublished data [version 2018 Mar 12]) contains all properties that SAHC owns, holds an easement for, or had a hand in protecting. Use of this dataset addressed gaps and differences in PADUS coverage for SAHC owned or eased properties.

3. Tennessee Natural Areas

   While their ownership and management responsibility vary, Tennessee Natural Areas receive statutory designation and permanent protection, and are overseen by the Tennessee Natural Areas Program (TDEC [date unknown]). This dataset (TDEC [updated 2018 Jan 22]) maps those areas which are open to the public. While use of this dataset addressed gaps and differences in PADUS coverage for the Tennessee Natural Areas, it does not contain any features within SAHC's Tennessee service area. It was included for potential application of this prioritization model for the entire extent of the seven Tennessee counties.

4. Tennessee State Parks

This dataset (TDEC [updated 2018 Mar 2]) maps Tennessee State Parks and other TDEC managed areas. Its use addressed gaps and differences in PADUS coverage. Within the SAHC service area, it contains Roan Mountain State Park and Rocky Fork State Park.

5. North Carolina Natural Heritage Program database of Managed Areas (MAREA)

Created on January 10, 2018, this shapefile was produced by the North Carolina Natural Heritage Program (2018), and maps conservation related properties of various ownership and designation. Use of this dataset addressed gaps and differences in PADUS coverage of North Carolina protected areas. The analysis required protected areas for both states because many Tennessee parcels along the border lie in close proximity to protected areas in North Carolina. Leaving out North Carolina protected areas would have prevented Tennessee border properties from obtaining their merited proximity scores. Despite its comprehensive nature, the MAREA dataset contains the designation "Registered Heritage Area" which is a non-permanent and non-binding status (NCNHP [date unknown]). Instances of privately owned RHA's were removed from the MAREA dataset prior to collation. Though the MAREA dataset is also publicly accessible, this shapefile was provided by SAHC.

6. Tennessee Natural Heritage Program Managed Areas dataset

Tennessee also holds state conservation lands only delineated in the Tennessee Natural Heritage Program's Managed Areas dataset (TNHP 2017). However, the Managed Areas shapefile does not cut out most private parcel inholdings within National Forest features. It subsumes them into protected polygons and hence could not be simply merged into the collated protected land dataset. The only areas needing incorporation from this dataset were the Martha Sundquist State Forest and the Bumpus Cove Wildlife Management Area. Features for these areas were isolated and then merged into the collated dataset.

Prior to merging, all datasets were projected to North American Datum 1983 Tennessee State Plane FIPS 4100 Feet. The components of this consolidated dataset also served as the basis for determining which tax parcels were protected so they could be excluded from the ranking of priority parcels. However, due to different digitization methods and reporting across sources, the features of this dataset scarcely align perfectly with features in the tax parcel database. Identifying protected parcels by intersection could have caused mislabeling. Instead, each protected parcel intersecting SAHC's service area was manually inspected by combination of overlay with the protected areas dataset and ownership attributes within the tax parcel database. Because some parcels had a partial or unknown protected status, three protected designations were determined. All were excluded from the priority ranking lists.

Protected parcels included:

- All parcels with tax parcel "CLASS" attribute = "04 FEDERAL", unless:
    - tax parcel "OWNER" attribute = "USA/IRS". IRS parcels were excluded given the possibility they were seized and thus may not be intended for federal ownership.
    - tax parcel "OWNER" attribute = "Tennessee Valley Authority" or "TVA". The actual jurisdiction of TVA properties is unclear as some are listed under federal lands while others receive state land designations. TVA properties might conceivably become conservation targets, thus their protected status was listed "UNK" for unknown.
- Parcels clearly overlapping the collated protected areas dataset and having tax parcel ownership attributes that demonstrated clear connection to its management for conservation (e.g. SAHC, US Forest Service, State Park, etc.).
- Parcels not overlapping the collated protected areas dataset but having tax parcel ownership attributes that demonstrated clear connection to its management for conservation (e.g. "OWNER" = "THE CONSERVATION FUND AND THE")
- All parcels with tax parcel "CLASS" attribute = "03 STATE" and clear overlap with collated protected areas dataset(ownership could often be cross-referenced with TDEC Managed Area dataset), unless:
    - Tax parcel "OWNER" attribute = "TVA" or "TENNESSEE VALLEY AUTHORITY" or "TENN VALLEY AUTHORITY". TVA properties were listed "UNK", unless:
        - TVA property attributes "OWNER2" = "SUBSTATION", thus no conservation target potential.
- All parcels with tax parcel "CLASS" attribute = "03 STATE" and "OWNER" attribute = "UNITED STATES OF AMERICA" or "UNITED STATES OF", indicating federal ownership.
- All parcels with tax parcel "CLASS" attribute = "03 STATE" and Tennessee Managed Area attribute "MANAGED_AREA_NAME" = "BUMPUS COVE WILDLIFE MANAGEMENT AREA" or "MARTHA SUNDQUIST STATE FOREST"
- All parcels with tax parcel "PARCELID" as above (i.e. duplicates)

Partially protected parcels included:

- All parcels overlapping PADUS dataset indicating Natural Resources Conservation Service easements, indicated by attribute "Mang_Name" = "NRCS".

Parcels with unknown protected status included:

- Parcels clearly overlapping a Tennessee Managed Area feature and having city ownership (e.g. tax parcel attribute "OWNER" = "TOWN OF JONESBOROUGH".

- Parcels with partial overlap of collated protected areas dataset and having city ownership (e.g. tax parcel attribute “OWNER” = “TOWN OF ERWIN”. This on a parcel which partly overlaps the PADUS attribute “Loc_Mang” = “ERWIN NATIONAL FISH HATCHERY”.
- All parcels with tax parcel attribute “OWNER” = “TENNESSEE VALLEY AUTHORITY” or “TENN VALLEY AUTHORITY”
- Parcels clearly overlapping the collated protected areas dataset but not having clear indication of conservation ownership in the tax parcel attributes (e.g. non-distinct private owner name)

Importantly, some counties report duplicate versions of tax parcels, with multiple records appearing with the same PARCELID. However, sometimes only one of these records will have the owner information necessary to discern protected status. Therefore, all duplicates needed to be marked for protected status. Therefore, when duplicates were removed for the prioritization analysis, parcel protection was not lost by removing the wrong duplicate.

Custom Hydrography Dataset

When collecting data for this analysis, the original intent was to use datasets which could allow prioritization across the entirety of the seven Tennessee counties. The National Hydrography Dataset High Resolution (USGS 2017 Nov 19, USGS 2018 Mar 4, USGS 2018 Mar 5, USGS 2018 Mar 6) coverage for these Tennessee counties features resolution of at least 1:24,000. Because the data was assembled by best resolution available (sometimes exceeding 1:24,000) (USGS [date unknown]), the streamline density was not always consistent. A custom hydrography dataset allowed for uniform resolution and therefore comparable analysis of all parcels. While different NHD resolutions were not an obvious issue within SAHC’s focus area, the custom hydrography dataset was still employed. It was derived from 10 meter National Elevation Dataset DEM tiles (USGS 2017 Nov 9a, 2017 Nov 9b, 2017 Nov 14a, 2017 Nov 14b, 2017 Nov 14c) with the following hydro-geoprocessing workflow, adapted from ESRI (2014 Apr 10, 2016 May 5):

1. Fill DEM
2. Calculate Flow Direction Raster from DEM
3. Calculate Flow Accumulation Raster
4. Calculate stream raster by thresholding flow accumulation to match spatial extent of 1:24,000 scale NHD blue lines
5. Convert stream raster to vector stream network
6. Simplify stream vector network

The threshold for flow accumulation was set to 800 contributing cells. The simplify step was done to compensate for the zig-zagging that occurs after converting rasterized stream lines to vectors. This allowed custom stream features to more closely resemble the smooth contours of the National Hydrography Dataset's stream features. Foregoing this step would cause parcels to register greater lengths of stream contents.

Scenic Roads Datasets

Mission-driven conservation includes protecting areas along designated scenic roads in order to maintain the landscape-oriented aesthetic qualities that support recreational use. The Tennessee Department of Transportation (TDOT) has two state designations for such roadways including Tennessee Scenic Highways and Tennessee Parkways (TDOT [date unknown a], TDOT [date unknown b]). Tennessee also has designated roadways supported by Federal Highway Administration Funding under the National Scenic Byways Program (TDOT [date unknown a], FHA [date unknown b]). As TDOT does not host georeferenced datasets of these roadways, custom layers were created for this analysis. Road lines delineated in the 2015 TIGER/Line dataset (UCSBGD 2015) served as the foundation for these datasets. TIGER/Line road segments matching the designated stretches from published maps of Tennessee Parkways and Scenic Highways (TDOT [date unknown b]) and National Scenic Byways (FHA [date unknown a]) were extracted to create a separate dataset for each of the three scenic road types. However, not all line features in the TIGER/Line® dataset terminate at locations where scenic designations end, necessitating editing of the extracted scenic features. The true termini of scenic road stretches were determined by noting the point of intersection with other features (e.g. roads, state boundaries) on the published maps. The TIGER/Line® features were manually altered with ArcGIS Desktop Editor tools to remove segments outside the extent of the true scenic roads. The only National Scenic Byway (East Tennessee Crossing) within the study area (FHA [date unknown c]) did not require manual editing. The following tables contain the road features extracted for scenic road dataset development, as well as portions of roads removed during manual editing. No features required editing for the National Scenic Byways layer.

Table 15. TIGER/Line features used to develop the Tennessee Parkways (Scenic Roads) dataset.

TIGER/Line				
FID	LINEARID	FULLNAME	Edited	Description of Segment Deleted
	110223850577	State Rte 173		
	110224203778	Wilton Springs Rd		
	110479841913	State Hwy 81		
2962	110479841919	State Rte 107	Yes	From intersection of State Rte 107 & State Hwy 173(Simerly Creek Rd), southeast to NC/TN border
	110482049161	State Rte 66		
	1102166818197	State Rte 143		
	1103026482984	US Hwy 23		
	1103075420810	State Rte 73		
	1103691326961	I- 26		
809	1103700722173	State Rte 93	Yes	Everything north from intersection of State Rte 93 & I-81
	1104258249087	US Hwy 321		
	1104258249092	US Hwy 321		
	1104258249094	US Hwy 321		
	1104258249103	US Hwy 441		
	1104258638449	State Rte 73		
	1104258641843	State Rte 73		
	1104260328513	State Rte 71		
	1104264006157	State Rte 73		
	1104264006171	State Rte 73		
	1104264023235	US Hwy 321		
	1104471683629	US Hwy 321		
	1104471683637	US Hwy 321		
	1104471684670	State Rte 37		
	1104471685214	US Hwy 19E		
	1104472002238	US Hwy 321		
	1104472009189	State Rte 67		
1798	1104474007092	State Rte 37	Yes (2x)	1. From intersection of State Rte 37(US Hwy 19E) and State Rte 143, east to TN/NC border 2. From intersection of State Rte 37(US Hwy 19E) and State Rte 143(Simerly Creek Rd), north to transition to State Rte 37(US Hwy 19E LINEARID=1104483771373)
	1104483336612	State Rte 67		
	1104483771414	State Rte 67		
	1104486618618	State Rte 67		
	1104486658399	State Rte 143		
	1104486658400	State Rte 143		
	1104486658401	State Rte 143		
	1104486658766	State Rte 91		
	1104690778559	State Rte 37		
	1104690798970	I- 26		
	1104690798976	State Rte 34		

	1104691779208	US Hwy 421		
	1104691779209	US Hwy 421		
	1104691822637	State Rte 34		
	1104699604893	US Hwy 321		
	1104700158126	State Rte 35		
	1104700406761	State Rte 35		
	1104746231067	I- 26		
	1104746255310	State Rte 81		
8669	1104746255349	State Rte 93	Yes	Everything north of intersection of State Rte 93 and I-81
10218	1104746255350	US Hwy 321	Yes	From intersection of US Hwy 321(State Rte 67) & I-26(US Hwy 23), east to transition to New Elizabethton Hwy(US Hwy 321 LINEARID=1104471568391)
7042	1104746255351	State Rte 93	Yes	From intersection of State Rte 93 & State Rte 81 (Hwy 81N), southwest to transition to Kingsport Hwy(State Rte 93 LINEARID = 1102381871609)
	1104746432984	State Rte 381		
	1104746441507	State Rte 34		
9683	1104747891555	State Rte 75	Yes	Everything north of intersection of State Rte 75 & I-26(US Hwy 23).
	1104747946526	Hartford Rd		
	1104747951035	State Rte 32		
	1104747954903	State Rte 73		
	1104747960983	US Hwy 321		
	1104747961047	US Hwy 25E		
	1104747961048	US Hwy 25E		
	1104747966427	US Hwy 321		
	1104747978452	US Hwy 321		
	1104747978454	US Hwy 321		
	1104747978552	State Rte 34		
	1104747978580	State Rte 67		
	1104747978581	State Rte 91		
	1104747978592	State Hwy 173		
	1104747978814	State Rte 73		
	1104781777385	US Hwy 19W		
	1105326755494	State Rte 91		
	1105326755511	State Rte 91		
	1105326755524	State Rte 91		

Table 16. TIGER/Line features used to develop the Tennessee Scenic Highways (Scenic Roads) dataset.

TIGER/Line				
FID	LINEARID	FULLNAME	Edited	Description of Segment Deleted
	110482052048	Maryville Hwy		
	1104258249105	Newport Hwy		
	1104258249104	Newport Hwy		
	1102416905719	Pittman Center Rd		
	1104279578765	Sevierville Rd		
	1102978895183	State Rte 416		
	110482049234	State Rte 416		
	1102416897789	State Rte 416		
	1102416897790	State Rte 416		
	1102978895180	State Rte 416		
	1104742633469	State Rte 71	Yes	Everything northwest of intersection of State Rte 168 (W Governor John Sevier Hwy) & US Hwy 441(State Rte 71)
	1104258249099	US Hwy 411		

Table 17. TIGER/Line features used to develop the National Scenic Byways (Scenic Roads) dataset.

TIGER/Line		
FID	LINEARID	FULLNAME
	1104747960739	Hwy 25 E
	1104693077954	State Rte 32
	1104747961070	State Rte 32
	1104747978737	US Hwy 25
	1104696807499	US Hwy 25 E
	1104692856799	US Hwy 25E
	1104693053674	US Hwy 25E
	1104747961049	US Hwy 25E
	1104695302693	US Hwy 25E
	1104695689193	US Hwy 25E
	1104763745828	US Hwy 25E

Datasets (Non-Model Inputs)

North Carolina County Boundaries

This shapefile (NDOTGISU 2018 Feb 2) delineates North Carolina county boundaries. It was used to assist in map-making.

National Elevation Dataset Digital Elevation Model (DEM)

Both the custom hydrography dataset and the prominent ridgeline dataset were built from these 10 meter resolution (1/3 arc second) Digital Elevation Model tiles. Five 1 degree x 1 degree tiles were mosaicked so that the custom ridge and stream datasets had complete focus area coverage. The tiles include:

- n36w083 (USGS 2017 Nov 14a)
- n36w084 (USGS 2017 Nov 9a)
- n37w082 (USGS 2017 Nov14b)
- n37w083 (USGS 2017 Nov14c)
- n37w084 (USGS 2017 Nov 9b)

Southern Appalachian Highlands Conservancy Focus Areas

This shapefile (SAHC, unpublished data [created 2010 Mar 24]) delineates each of SAHC's focus area boundaries across their entire service area. Each focus area polygon extends into North Carolina. The data was used for mapping, for calculating the extent of each focus area within Tennessee (Table 1), and for assigning priority parcels to their respective focus area. A buffer of this dataset was also used to mask several input datasets.

Tennessee County Boundaries

This shapefile (TDEC [created 2014 May 16]) delineated Tennessee county boundaries. It was used to produce maps and to produce study area masks for geoprocessing and map-making. It was also used to calculate the extent of each county within SAHC's service area (Table 1).

World Imagery

This ESRI basemap (ESRI 2009 Dec 12 [updated 2018 Dec 13]) was accessed on December 28, 2018 and January 3 and January 4, 2019 to validate parcel locations of National Historic Register elements. The December 6, 2018 update of this imagery was accessed on December 7, 2018 to assist contextualization of parcels. Prior versions were accessed in 2018 to assist evaluation of appropriate buffer distances for imprecise data features like hydrography lines.

World Topographic Map

This ESRI basemap (ESRI 2013 Jun 23 [updated 2018 Nov 9]) was used in map-making (Figure 1).

Workflow for Creating the Parcel Attribute Database (Parcel Contents)

The parcel attribute database indexes the contents of each parcel for future processing by any number of prioritization model designs and weighting schemes. Conducting analysis to summarize parcel contents was done separately to minimize the computing time necessary for use of the prioritization script. Rather than incorporating intensive geoprocessing, scoring scripts can rapidly assess the values held in the pre-constructed attribute table. Many datasets required specific manipulations to integrate the desired metrics into the parcel attribute database. These specifics are discussed in the respective dataset descriptions. The generic workflow for creating the parcel attribute database was as follows:

1. Set all data to same projection: North American Datum 1983 Tennessee State Plane FIPS 4100 Feet, Lambert Conformal Conic projection
2. Vector geo-processing: buffer to specified distances
3. Convert raster datasets to vector
4. Tabulate area/length of intersection between parcels and vector datasets (produces separate table for each dataset intersection)
5. Pivot parcel intersection tables to preserve classes within datasets (e.g. EO Rankings, Resilience score classes, etc.) as separate attributes
6. Convert intersection fields to human readable form
    a. add new renamed field(s)
    b. transfer (via calculate field) value from old pivot field
    c. delete old field(s)
7. Join all pivoted intersection tables
8. Join master intersection table back to parcel database

The field for protected status (see protected areas dataset description) was also incorporated into the parcel attribute database. This was necessary to constrain priority results to unprotected parcels only.

Appendix B

Appendix B contains details about the data used to conduct analysis for forest management potential.

National Land Cover Dataset

The feasibility criterion for forest management required at least 15 acres of forest cover in a given parcel. Forest cover was established using the National Land Cover Dataset (USGS 2014). The dataset contains 20 land cover classes. Deciduous Forest, Evergreen Forest, and Mixed Forest classes qualified as forest cover in this analysis. The dataset was downloaded for North Carolina and Tennessee to ensure tax parcels not exactly aligned with county boundaries could qualify for all potential forest cover.

Gridded Soil Survey Geographic Survey Database (gSSURGO)

The mapped soil units used to determine locations of favorable and highly favorable soils for forest management came from the gSSURGO database (Soil Survey Staff 2018 May 2). Only the Tennessee soils geodatabase was used since soil ratings for equipment operability, site index, and erosion potential were only investigated for Tennessee. Future versions of the forestry analysis could incorporate North Carolina soils to ensure that boundary parcels which overlap North Carolina soils are more accurately characterized. However, these minimal boundary overlaps are not expected to substantially alter predictions for forest management potential. Since parcels required co-occurrence of forests and favorable soils, the incorporation of North Carolina soils could only improve forest management potential ratings. In other words, excluding that data did not produce false positives.

Web Soil Survey

Soil ratings used for analysis of forest management potential were taken from reports produced by the National Resource Conservation Service's Web Soil Survey App (Soil Survey Staff [modified 2017 Aug 21]). Reports were generated for each Tennessee County in SAHC's service area. By taking into account a soil's slope and its erosion factor K, the rating for Erosion Hazard (Off-Road, Off-Trail) characterizes whether erosion will accompany 50-75% soil exposure (e.g. from logging) (Soil Survey Staff [modified 2017 Aug 21]). The "severe" rating describes soils where “erosion is very likely and that erosion-control measures…are advised”, while the “very severe” rating describes soils where “significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion control measures are costly and generally impractical.” (Soil Survey Staff [modified 2017 Aug 21]). Table 18 lists all soil type codes that classified as severe or very severe.

Ratings for Harvest Equipment Operability are based on whether bulldozers and skidders can function, with operation on “poorly suited” soils calling for “special design, extra maintenance, and costly alteration” (Soil Survey Staff [modified 2017 Aug 21]). Table 19 lists all soil type codes with poorly suited ratings.

The Web Soil Survey app also listed site index by species for each soil type in each county. Table 20 lists all soil type codes where no listed species had an above-average site index. There are a few exceptions that need to be noted for creation of this list. A number of soil type codes were associated with either a soil complex or multiple soil types. For example, soil code *24F* was associated with two soil types. For one type, all listed species were below average site index. For the other soil type, white pine and Virginia pine were below average site index, while shortleaf pine had a site index that exceeded the average by one foot. Since the margin for being above average was very slim and all other species were more than 10 feet below average site index, this soil type code was taken to be unfavorable to forest management, and thus included in the list. This exception applied to a number of soil type codes, which are marked by an asterisk in Table 20. While rare, there were some soil types that did not list site index for any of the criteria species, but did have potentially high site indexes for other species. For example, soil code *Hk* had site indexes of 100, 90, and 90 for eastern cottonwood, loblolly, and sweetgum, respectively. Because this soil did not list any criteria species, it was considered an unproductive soil for the analysis. However, further research into site index for these species could allow a refined analysis.

Table 18. Soils with Severe or Very Severe ratings for Erosion Hazard

110F	11F	11G	15F	16F	16G	185F	187G	21E	21F	22E	22F	23F	23G	24F
24G	25E	25F	25G	3F	43E	43F	53F	53G	85F	9F	9G	AcF	Ae	Ak
Al	Ao	AsF	BaE2	BaF	BaF2	Bd	BeE	BoE2	BrE2	BrF	BrF2	BsE	BsF	BtE2
BtF	BtG	BuF	BzE	BzF	CaE	CaF	CaG	CbrG	CcE	CcF	CcG	ChF	ChG	CjE
CjF	CkE	CkG	CrF	Dc	DeE	DeE2	DeF	Df	Dg	DhF	DhG	DjF	Dnc	Dnf
Dnk	Dnn	Dnr	Dr	DrE	Dsc	Dsf	Dsk	DtF	DtG	Duc	DuE2	Duf	EvE	EvF
GcE2	Gd	GrE2	GrF	GrG	JbE	JbF	JeE	JeF	KeE	KeF	KsE	Lf	Lk	Ll
Lo	LoE	Ls	Lt	MaF	MdF	MoF	MoG	MwE	NcF	NcG	NnE3	NoF	NoG	PgE
PgF	PnE	PnF	PsF	ScE	ScF	SeE	ShF	Sm	Sn	SoE	SoF	SoG	SpF	SpG
SyF	SyG	TaE2	Tb	Tc	ToE2	TtF	TuF	UaF	UcF	UcG	UdE	UkF	UnE	UnF
UnG	WaF													

Table 19. Soils with Poorly Suited ratings for Harvest Equipment Operability

110F	11F	11G	15F	16F	16G	183E	185F	187G	21F	22F	23F	23G	24F	24G
25F	25G	3F	43F	53F	53G	85F	99E	9F	9G	AcF	Ae	Ak	Al	Ao
AsF	BaF	BaF2	Bd	BoE2	BrF	BrF2	BsF	BtD	BtE	BtF	BtG	BuF	BxD	BxE
BzE	BzF	CaE	CaF	CaG	CbrG	CcE	CcF	CcG	ChF	ChG	CjE	CjF	CkE	CkG
CrF	Dc	DeE2	DeF	Df	Dg	DhF	DhG	DjF	Dnc	Dnf	Dnk	Dnn	Dnr	Dr
Dsc	Dsf	Dsk	DtF	DtG	Duc	DuE2	Duf	EvE	EvF	FuE2	GcE2	Gd	GrE2	GrF
GrG	JbF	JeE	JeF	KeF	KsF	Lf	Lk	Ll	Lo	Ls	LsC	LsD	Lt	MaF
MdF	MoF	MoG	MwE	NcF	NcG	NnE3	NoF	NoG	PgF	PnE	PnF	PsF	PsG	PuE
ScF	ShF	SM	Sn	So	SoE	SoF	SoG	SpF	SpG	SyF	SyG	TaE2	ToE2	TtF
TuF	UaF	UcF	UcG	UdE	UkF	UnE	UnF	UnG	WaF					

Table 20. Soils with below average site-index

11E	11F	11G	16D	16E	16F	16G	175E	183E	185F	187G	23F	23G	24F*	24G*
86G	89E	99E	9E	9F	9G	Ah	Ak	Al	Am	An	Ao	BaD2	BaE2	BaF
BaF2	Bd	Bm	BrB	BrC	BrD2	BrE2	BrF2	BtD	BtE	BtF	BuD	BuF	BwD	BxD
BxE	BzD	BzE	BzF	CaD	CaE	CaF	CaG	CcE*	CcF	CcG	CkG	CrF	Da	Db
Dc	Dd	De	Df	Dg	DhE	DhF	DhG	DjF*	Dnd	Dne	Dnf	DnyC	Dsd	Dse
Dsf	DtE	DtF	DtG	Dub	Due	Gm	GuE	GxE	Hk	Ht	Hu	JeD	JeE	JeF
Md	Me	MnB	NcF	NcG	Ne	NnC3	NnD3	NnE3	NoD	NoE	NoF	NoG	RuG	Sh
Sk	Sl	Sm	Sn	So	SyF*	SyG*	Ta	Tb	UcF	UcG	UdE*	UnE	UnF	UnG
WaE	WaF													

Forest Products Network

The network analysis used to calculate sawmill service areas used locations from a directory compiled by the Primary Forest Products Network (USFS [date unknown]). Although the directory was queried to extract only facilities with a type designation of “sawmill,” the exported list included other listings which had to be removed. Only listings with a physical address were included in analysis. The list of mills used in the analysis was constrained to 17 counties overlapping or near SAHC's Tennessee service area. In Tennessee, these included Carter, Cocke, Greene, Jefferson, Johnson, Sevier, Sullivan, Unicoi, and Washington County. In North Carolina, these included Avery, Buncombe, Haywood, Madison, Mitchell, Swain, Watauga, and Yancey County. All 40 mills used in this analysis are listed in table 21. The table also includes the year, size classification, and wood type listings from the Forest Products Network. Sawmill addresses were translated into geospatial locations for network analysis by using the ArcGIS World Geocoding Service functionality within ArcGIS Desktop (ESRI 2018).

Table 21. Sawmills used for network analysis

County	Name	Address	Year	Telephone	Species	Size
Buncombe	C & M Sawmill	27 Sawmill Rd, Weaverville, North Carolina, 28787	2011	(828)645-4086		Small
Buncombe	Sunrise Sawmill	68 W Chapel Rd, Asheville, North Carolina, 28803	2011	(828)277-0120		Small
Carter	Black Snake Lumber	347 Fork Mountain Rd, Roan Mountain, Tennessee, 37687	2014	423-725-4900	Hardwood	Medium
Carter	McCloud Lumber Co	5255 Highway 19 E, Hampton, Tennessee, 37658	2014	423-725-4884	Hardwood	Large
Carter	Miller Brothers Sawmill	240 Sally Cove Creek Rd, Hampton, Tennessee, 37658	2014	423-725-3492	Hardwood	Small
Cocke	Daniels Sawmill	334 Lower Bogard Rd, Newport, Tennessee, 37821	2014	423-625-0653	Hardwood	Small
Cocke	Frank Pack Sawmill	451 Punkton Rd, Del Rio, Tennessee, 37727	2014	423-487-5821	Hardwood	Small
Cocke	Hearthstone Sawmill	2553 Highway 25 70 E, Del Rio, Tennessee, 37727	2014	423-623-7410	Hardwood	Small
Cocke	Middle Fork Sawmill	471 Middle Fork Way, Del Rio, Tennessee, 37727	2014	423-487-5047	Hardwood	Small
Cocke	Phillips Lumber Co	185 Shelton Chapel Rd, Parrottsville, Tennessee, 37843	2014	423-623-0293	Hardwood	Small
Cocke	Shults Sawmill	1271 Sunset Gap Rd, Cosby, Tennessee, 37722	2014	423-623-2604	Hardwood	Small
Cocke	Slabbark Sawmill	1750 TN-73, Newport, Tennessee, 37821	2014	423-623-8437	Hardwood	Small
Greene	Kuykendall Sawmill	705 Welcome Grove Rd, Mosheim, Tennessee, 37818	2014	423-422-4785	Hardwood	Small
Greene	Shelton and Sons Sawmill	9328 Asheville Hwy, Greeneville, Tennessee, 37743	2014	423-639-4730	Hardwood	Small
Greene	TMV Lumber Co and Log Houses	126 Bohannon Ave, Greeneville, Tennessee, 37745	2014	423-639-2195	Hardwood	Small
Greene	Lynda Hughes Dawson Lumber Inc	15695 Horton Hwy, Chuckey, Tennessee, 37641	2014	423-234-0123	Hardwood	Small
Haywood	East Fork Lumber Co.	9072 Cruso Rd, Canton, North Carolina, 28716	2011	(828)235-8594		Small
Johnson	Poplar Ridge Lumber	11136 Highway 421 S, Trade, Tennessee, 37691	2014	423-727-8358	Hardwood	Small

Johnson	Shoun Lumber LLC	147 George Shoun Ln, Butler, Tennessee, 37640	2014	423-768-3211	Hardwood	Large
Madison	D. T. Ramsey Lumber Co.	14245 US-25, Marshall, North Carolina, 28753	2011	(828)656-2754		Small
Madison	H & M Wood Products	160 California Creek Rd, Mars Hill, North Carolina, 28754	2011	(828)689-4079		Small
Mitchell	Mitchell Lumber	55 Altapass Hwy, Spruce Pine, North Carolina, 28777	2011	(828)765-2732		Medium
Mitchell	Street Lumber, Inc.	10170 N 226 Hwy, Bakersville, North Carolina, 28705	2011	(828)688-4218		Small
Sevier	Denton Road Sawmill	1248 Denton Rd, Sevierville, Tennessee, 37862	2014	865-591-0722	Hardwood	Small
Sullivan	Donnie Carrier Sawmill	608 Flatwoods Rd, Bluff City, Tennessee, 37618	2014	423-538-5860	Hardwood	Small
Sullivan	Rice's Sawmill	331 Morrell Creek Rd, Bluff City, Tennessee, 37618	2014	423-538-4803	Hardwood	Medium
Sullivan	Jarrett Lumber Co	1212 Silver Grove Rd, Bluff City, Tennessee, 37618	2014	423-538-4163	Hardwood	Small
Sullivan	Smith Bros Sawmill	785 Sugar Hollow Rd, Piney Flats, Tennessee, 37686	2014	423-323-8873	Hardwood	Small
Sullivan	Wassom Brothers Sawmill	3863 Rockhold Rd, Bluff City, Tennessee, 37618	2014	423-538-6676	Hardwood	Small
Sullivan	Lynn Shankle Logging and Sawing	241 Hunters Trl, Blountville, Tennessee, 37617	2014	423-341-4754	Hardwood	Small
Sullivan	Randy Whitaker	208 Anderson Ln, Blountville, Tennessee, 37617	2014	423-323-3022	Hardwood	Small
Unicoi	English Sawmill	514 Ledford Rd, Erwin, Tennessee, 37650	2014	423-743-9879	Hardwood	Small
Unicoi	C G Shelton Lumber Company	1621 Devil Fork Rd, Flag Pond, Tennessee, 37657	2014	423-743-0110	Hardwood	Medium
Unicoi	Silvers Pallets and Skids	642 Stockton Rd, Erwin, Tennessee, 37650	2014	423-743-7491	Hardwood	Small
Washington	Garland Hardwoods Inc	126 Bacon Branch Rd, Jonesborough, Tennessee, 37659	2014	423-753-4921	Hardwood	Large
Washington	Lynda Hughes Dawson Lumber LLC	3016 Highway 81, Fall Branch, Tennessee, 37656	2014	423-348-7828	Hardwood	Large
Washington	Malones Custom Sawing	245 Frog Level Rd, Johnson City, Tennessee, 37615	2014	423-477-4071	Hardwood	Small
Washington	Unaka Forest Products Inc	217 Dry Creek Rd, Jonesborough, Tennessee, 37659	2014	423-753-9576	Hardwood	Large
Watauga	J. C. Greene Rail Fencing	12472 US Highway 421 S, Deep Gap, North Carolina, 28618	2011	(828)264-7370		Small
Watauga	John & Donald Norris Sawmill	1290 Ball Branch Rd, Boone, North Carolina, 28607	2011	(828)264-5746		Small

TIGER/Line Roads

The network analysis used to calculate sawmill service areas used TIGER/Line (USCBGD 2018) data for the road network. Specifically, the “All Roads” shapefiles were downloaded for each of the 17 counties eligible for mill locations. The network analysis used a merged road network dataset with connectivity policy set to “Any Vertex”.

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