# Bluesource – Boone Forestlands

# Improved Forest Management Project

**April 12, 2022**

**ACR 596**

# Boone Forestlands, LLC

**Prepared by: Blue Source, LLC**

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# A. PROJECT OVERVIEW

## A1. PROJECT TITLE

The project title is "Bluesource – Boone Forestlands Improved Forest Management Project".

## A2. PROJECT TYPE

This project is to be registered under the American Carbon Registry Standard[1] (ACR, 2019) as an Improved Forest Management (IFM) project, under an approved ACR Improved Forest Management Methodology.[2]

## A3. PROOF OF PROJECT ELIGIBILITY

Eligibility for this Improved Forest Management project has been determined with reference to the ACR Standard Version 7.0 and Improved Forest Management for Non-Federal U.S. Forestlands Version 1.3. The Bluesource – Boone Forestlands Improved Forest Management Project meets all relevant eligibility requirements as described in Table A 3.1 below.

Table A3.1. Project Eligibility Requirements

| Eligibility Requirements | Proof of Eligibility | Reference |
|---|---|---|
| Ownership Type | The project ownership is private non-federal U.S. forestland. | See section G1. PROOF OF TITLE |
| Project proponent has third-party certification or no commercial timber harvesting | The project proponent is certified under a group certificate with Forest Stewardship Council. | See also section A5.1. Background Information |
| Project area meets the definition of Forestland condition as per USFS FIA program definition | Per the ACR Forest Carbon Project Standard, the project meets the definition of forestland through a minimum of 10% forest cover (or equivalent stocking) by live trees of any size. | See also section A4. LOCATION |
| Project start date | The project start date of October 19, 2019 is established by a resolution prepared and provided by the project proponent. The resolution was deemed acceptable to establish the start date by ACR on March 3, 2021. This has been provided separately for verification purposes. The project Start Date complies with requirements of the ACR protocol, that the project must have a | See also section H1. START DATE. |

[1] ACR. 2020. American Carbon Registry Standard, Version 7.0. American Carbon Registry, Arlington, VA, USA.
[2] ACR. 2018. Improved Forest Management Methodology for Quantifying GHG Removals and Emission Reductions through Increased Forest Carbon Sequestration on Non-Federal Forestlands, Version 1.3, April 2018, American Carbon Registry, Arlington, VA, USA.

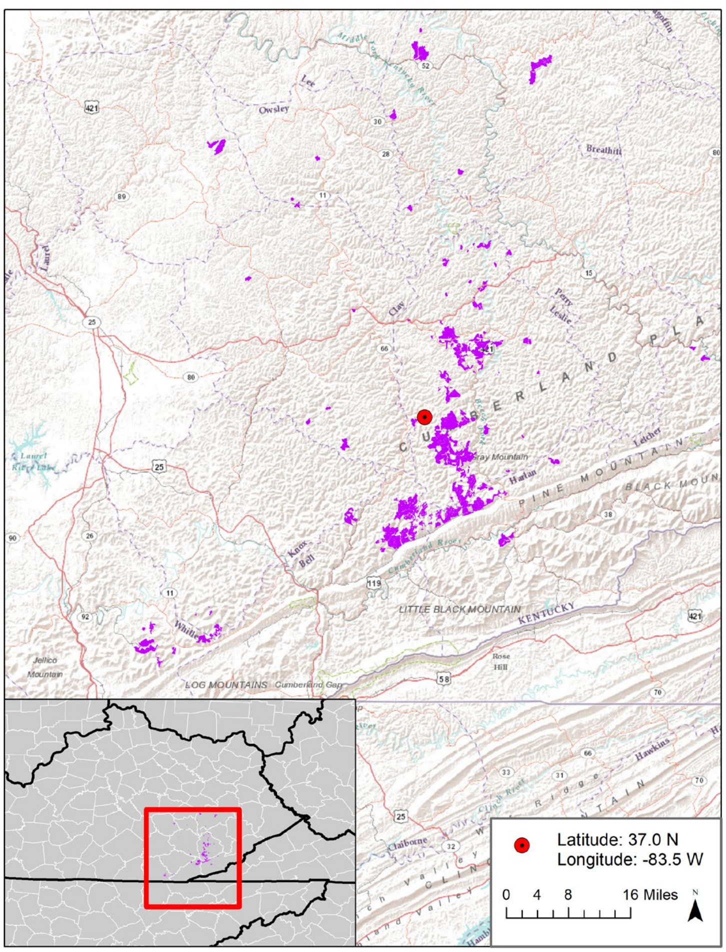
| | | |
|---|---|---|
| | validated/verified Start Date of January 1, 2000 or after. | |
| Project term | The project proponent commits to maintain the carbon project scenario stocking levels on the project area at least for the required Project Term of 40 years. | See also section H2. PROJECT TIMELINE. |
| Crediting Period | In compliance with ACR Standard Version 7.0, the crediting period for the project is 20 years. | See also section H2. PROJECT TIMELINE. |
| Real | GHG removals are quantified based on inventory of the standing stock in the project area at the time of verification. | See also sections D. MONITORING PLAN and E. QUANITIFCATION |
| Land Title | For all areas included in the project, long term land titles have been issued and ownership is thus clear, unique, and uncontested. | See also appendix A. Land Owner and Contracts. |
| Direct Emissions/ Offset Title | GHG emission reductions generated by the project activity are generated from forest carbon sources and sinks over which Boone Forestlands, LLC has all management (see Appendix A: Deeds and Contracts) and ownership rights. Boone Forestlands, LLC holds title to all lands in the project area (see Section G below) and all rights to carbon credits/offsets produced through management of forests in the project area (see Appendix A, Deeds and Contracts). | See also section G2. CHAIN OF CUSTODY |
| Additionality | Additionality for the project has been shown through a regulatory surplus test, a common practice test, and an implementation barrier test. | See also section C. ADDITIONALITY |
| Permanent | The long-term setup, risk analysis, and buffer establishment assure permanence of the project benefits. | See also section B8. PERMANENCE. |
| Net of Leakage | Possible leakage effects due to activity shifts are quantified and deducted from the GHG benefits. | See also section E3. LEAKAGE. |
| Independently Validated and Verified | In accordance with ACR methodology, the project benefits will be verified by Ruby Canyon Environmental, Inc. . | |
| Community and Environmental Impacts | Impacts on community and environment were analyzed in | See also section F. COMMUNITY & |

| | | |
|---|---|---|
| | accordance with the ACR Standard 7.0, net positive impacts were confirmed. | ENVIRONMENTAL IMPACTS |

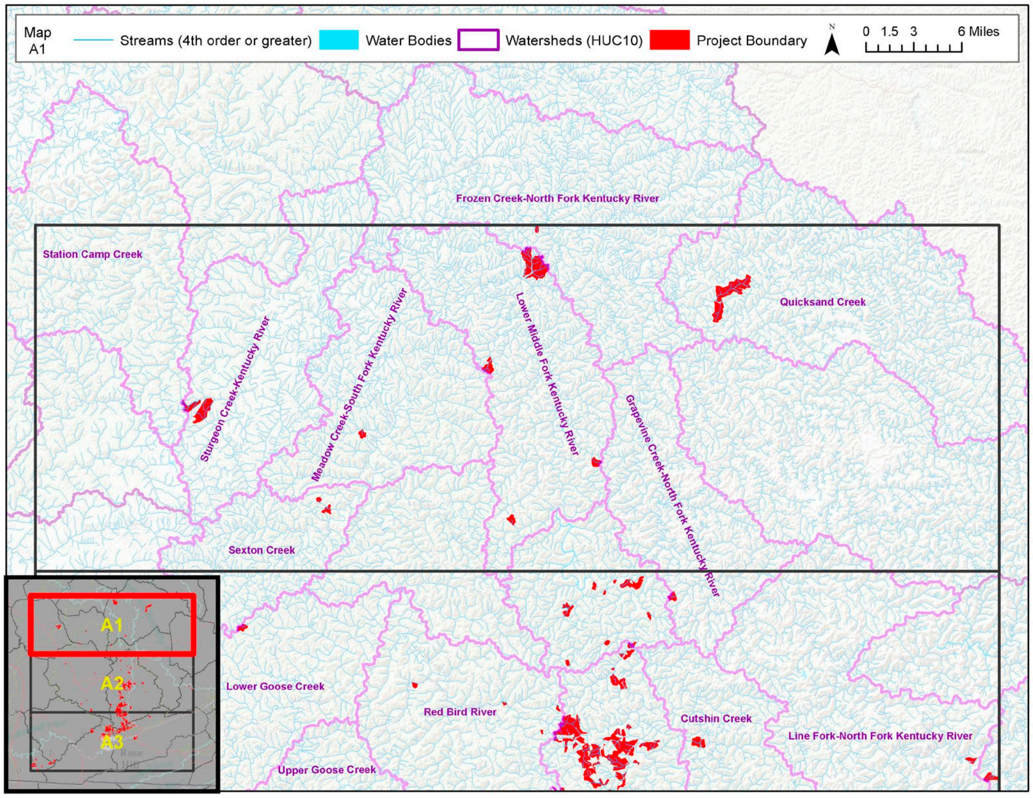
# A4. LOCATION

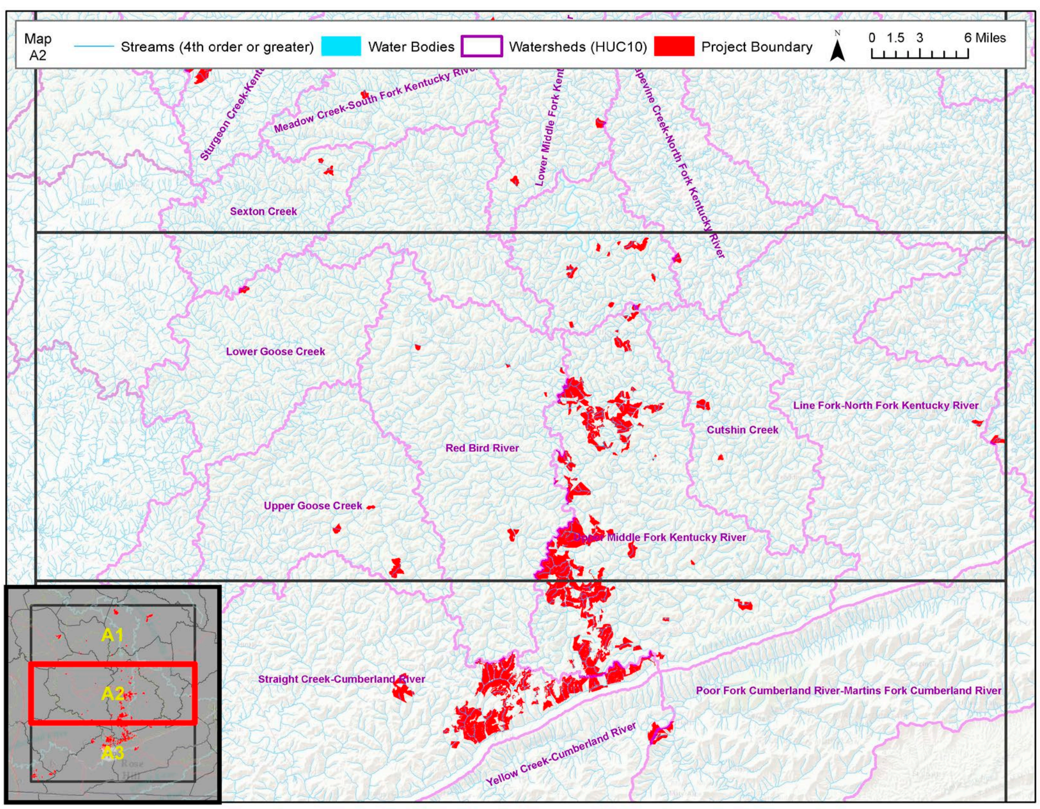
A GIS shapefile of the project area was provided separately for verification. This shapefile gives unique identification and delineation of the specific extent of the project. Vicinity map (Figure A-1.) gives project location and latitude/longitude coordinates. Figure A-2. shows the Bluesource – Boone Forestlands Improved Forest Management project in the context of local hydrology. The canopy cover map (Figure A-3.) clearly shows that the project meets the US Forest Service definition of forestland (at least 10% tree cover) as forest covers the majority of the project area. Non-forested acres were removed from the project to a minimum mapping unit of 2.5 acres. A topographic map, Figure A-4. is also provided as a reference. The roads map, Figure A-5. shows the public and private roads near and on the property, additional foot trails may exist that are not mapped. The ownership map, Figure A-6 shows the extent of land owned by Boone Forestlands, LLC.

**Figure A-1. Vicinity Map with Latitude and Longitude**



## Figure A-2. Regional Hydrology Map



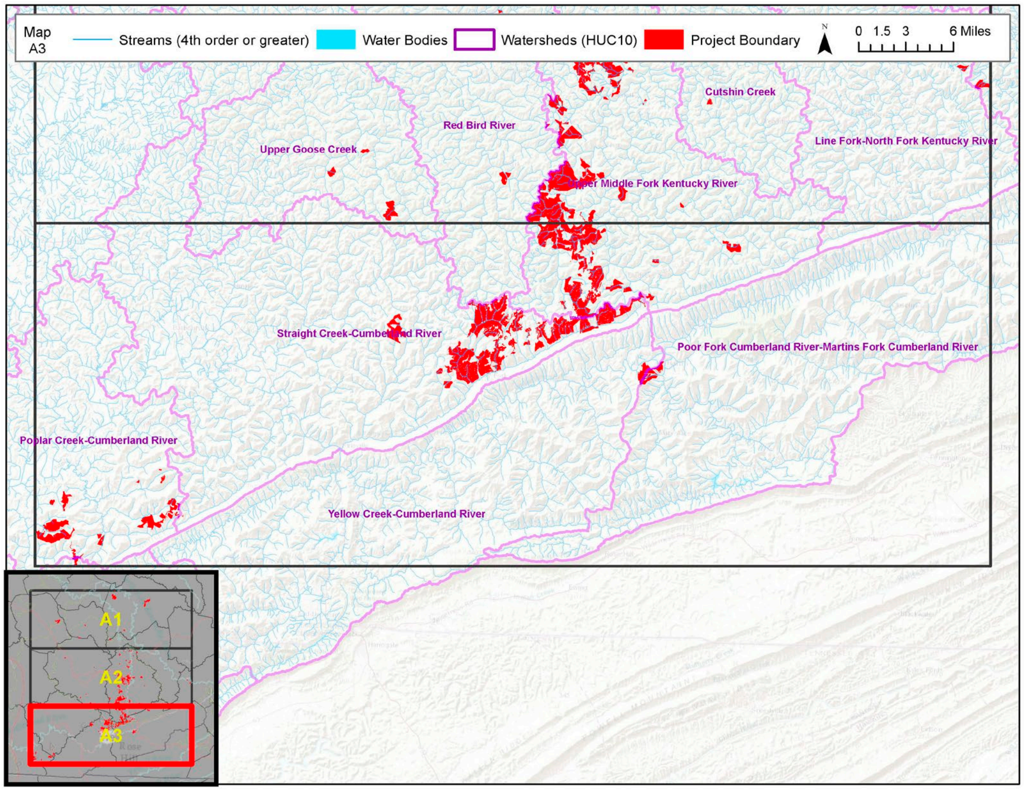
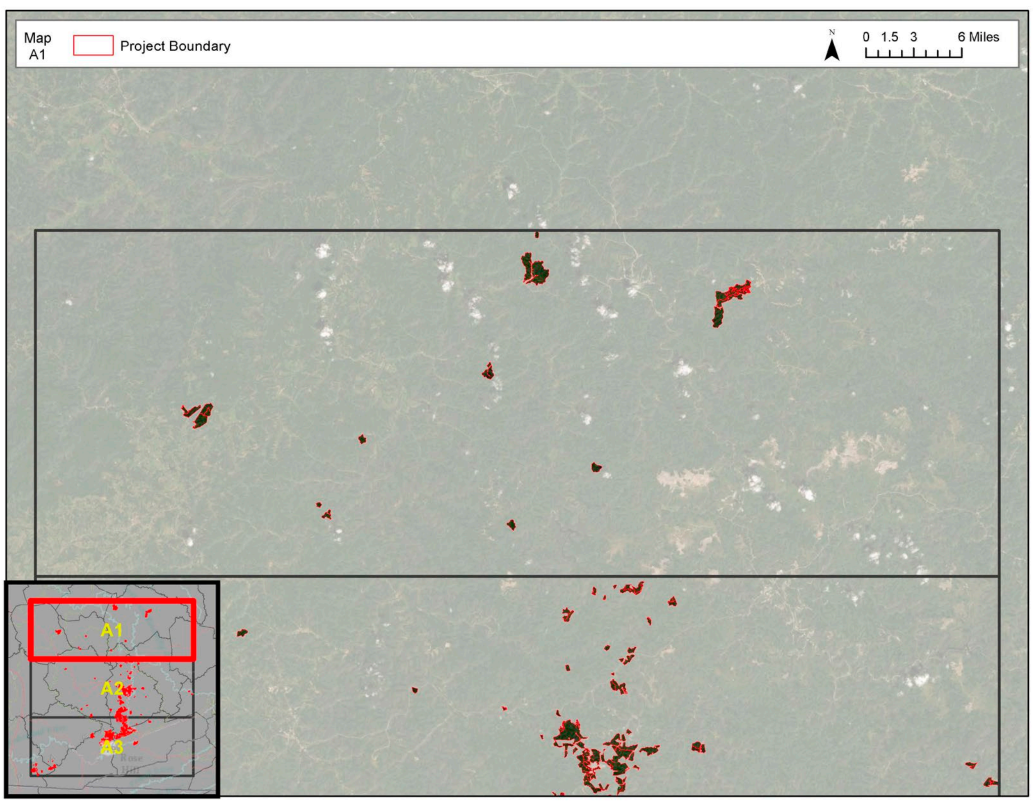
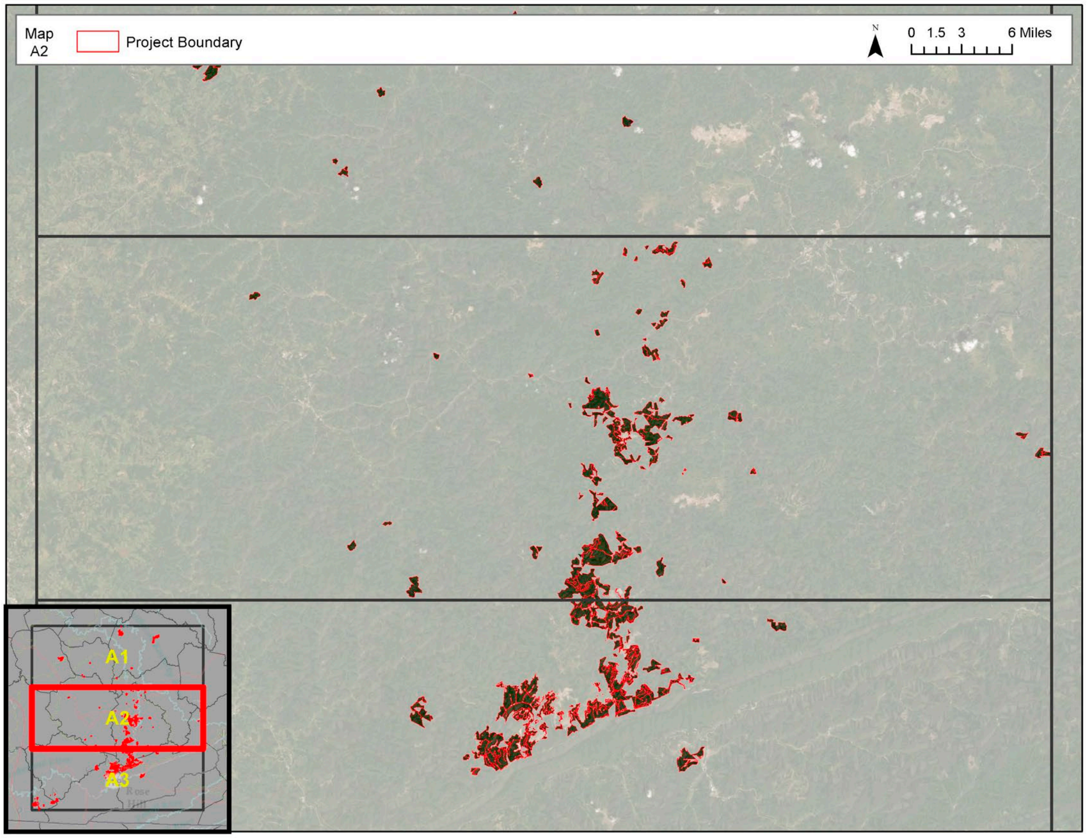



**Figure A-3. Canopy Cover Map depicting greater than 10% canopy cover.**




Map
A2
Project Boundary
N
0 1.5 3 6 Miles
A1
A2
A3

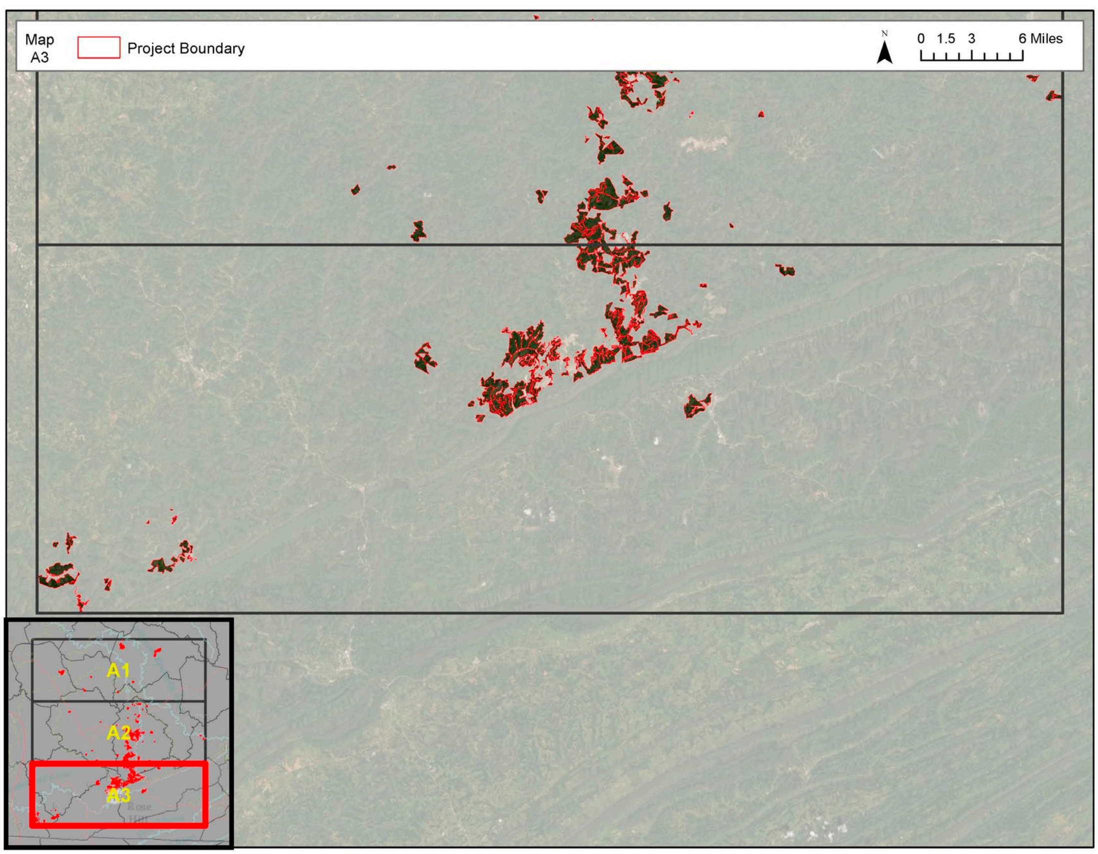
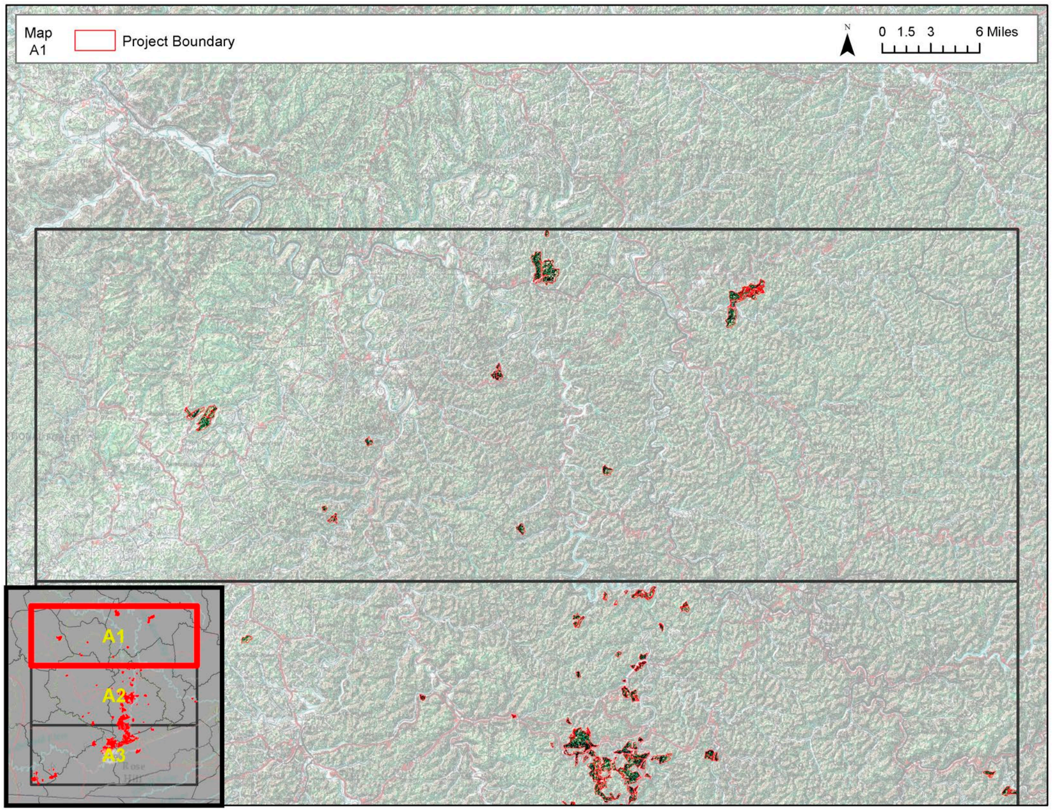
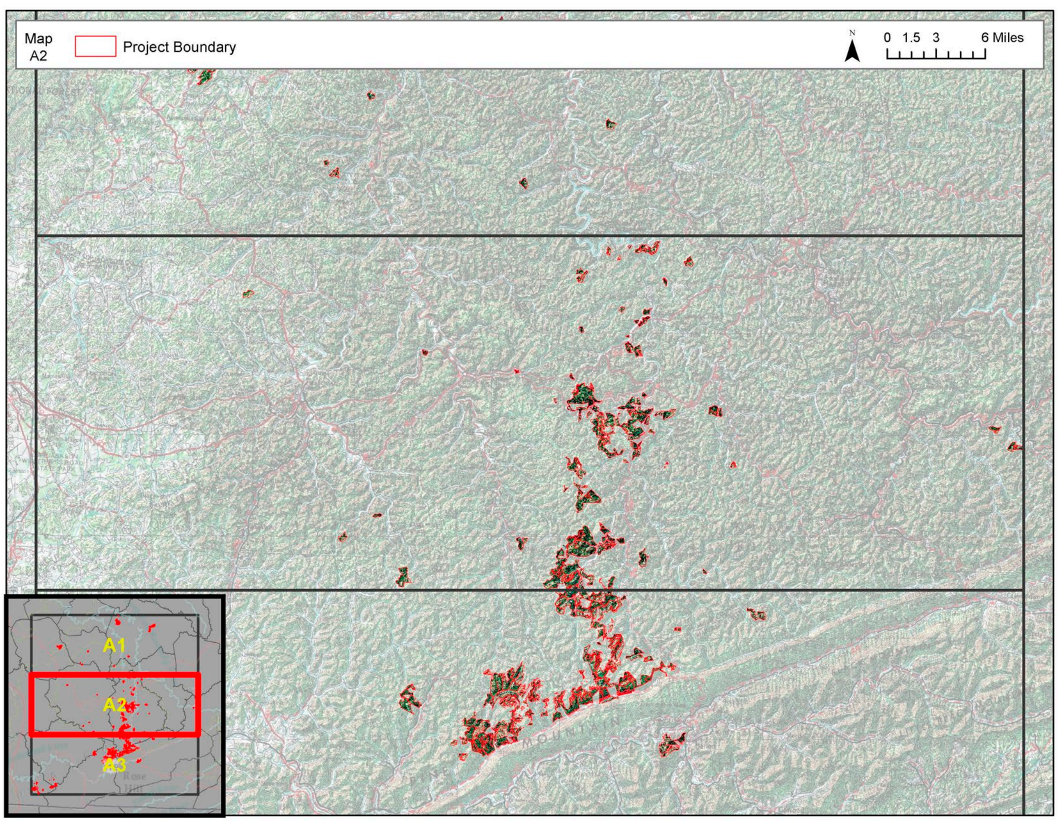

Map
A3
Project Boundary
N
0 1.5 3 6 Miles
A1
A2
A3

**Figure A-4. Topography Map**



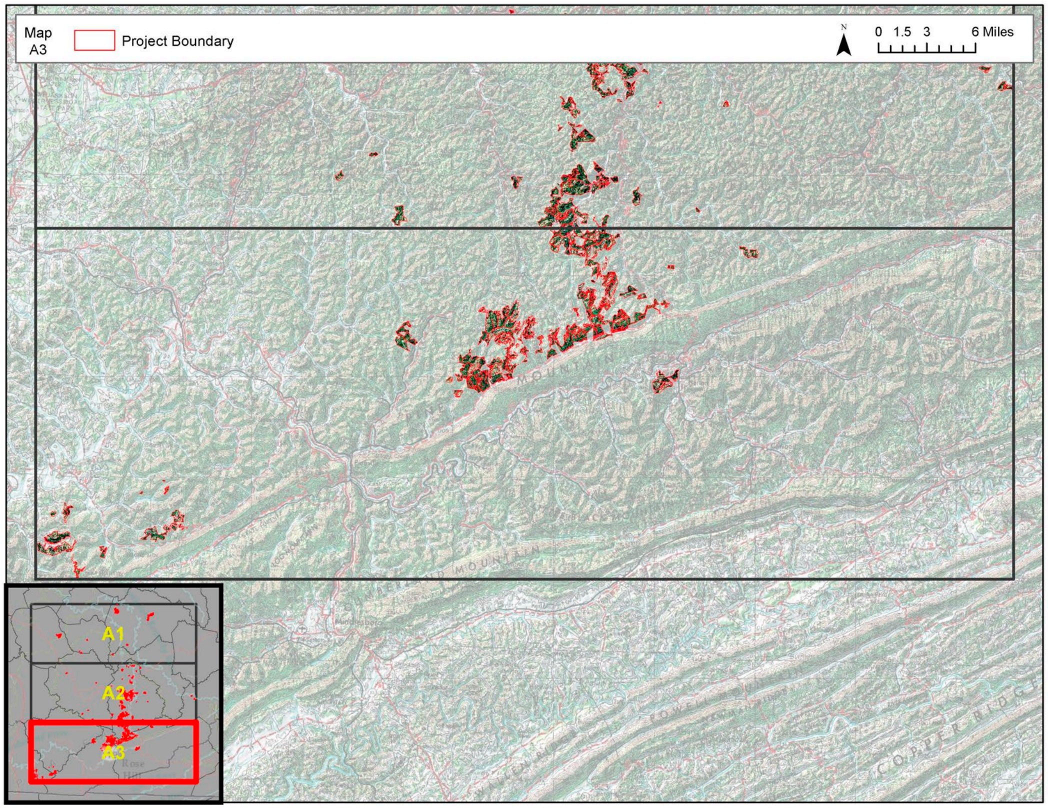
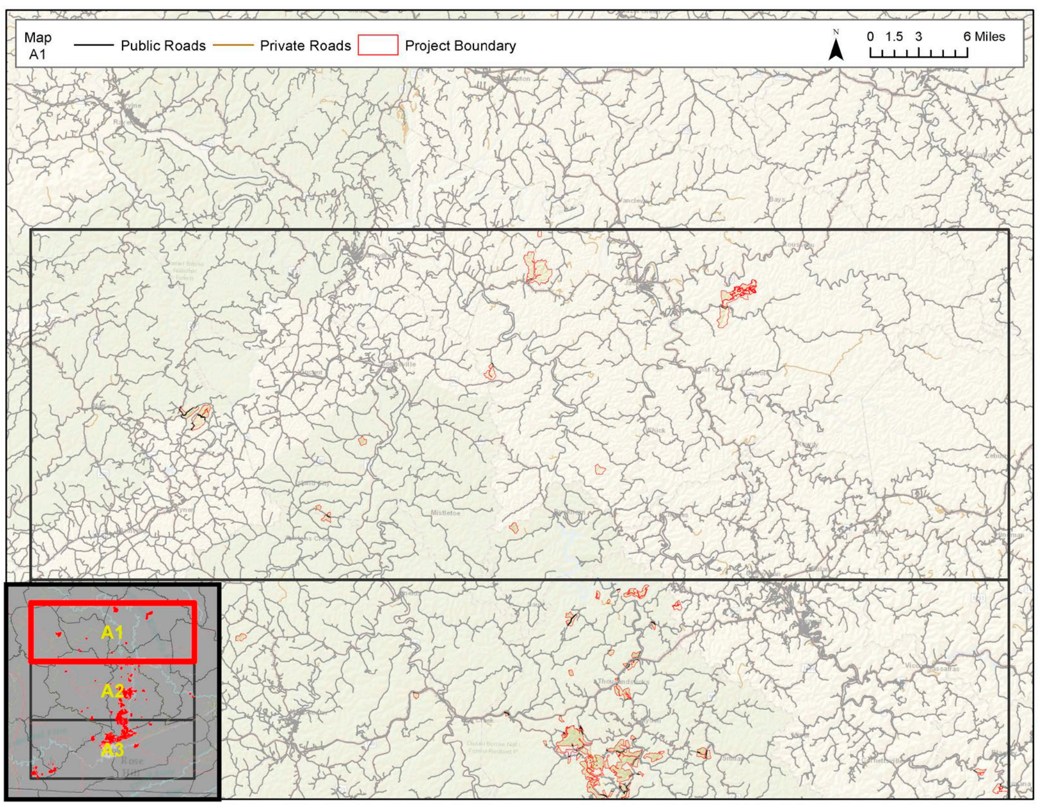
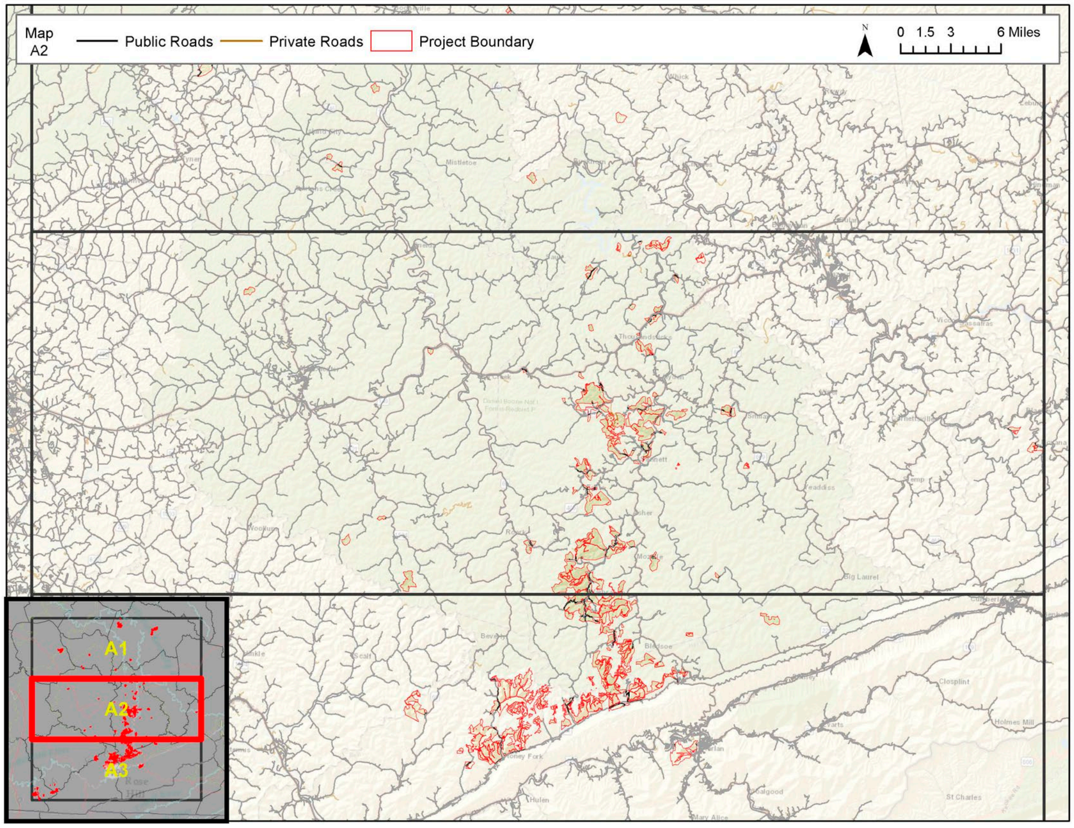
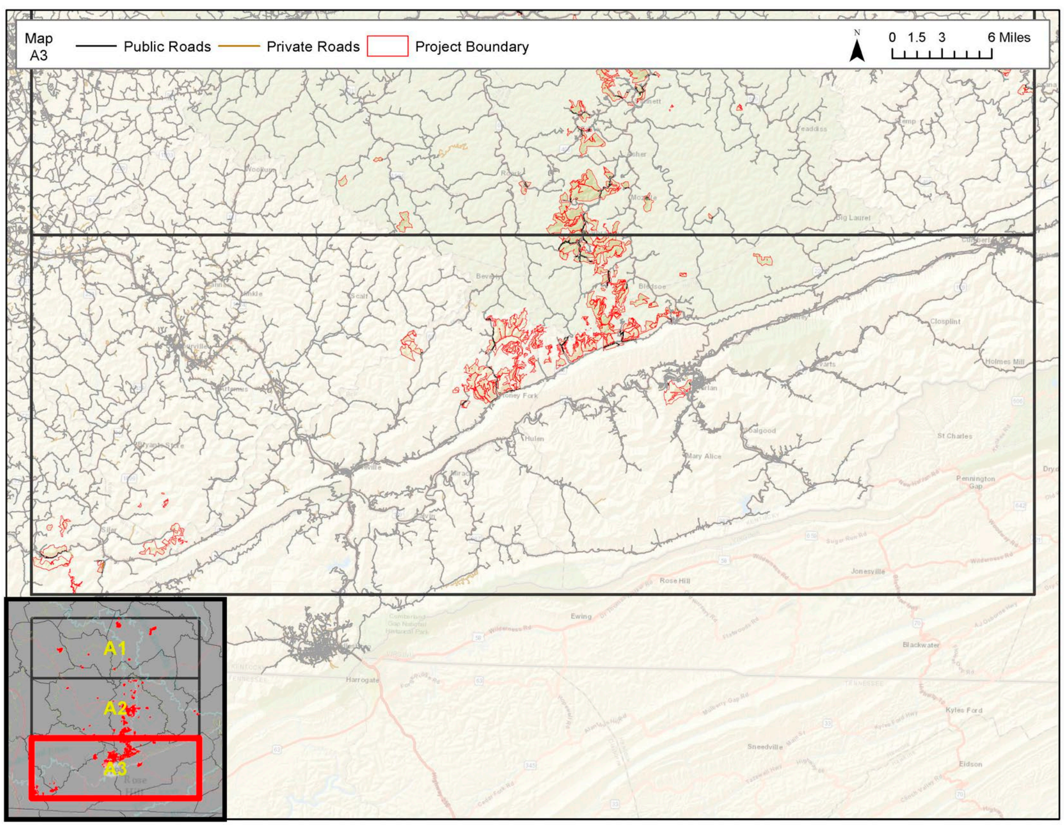


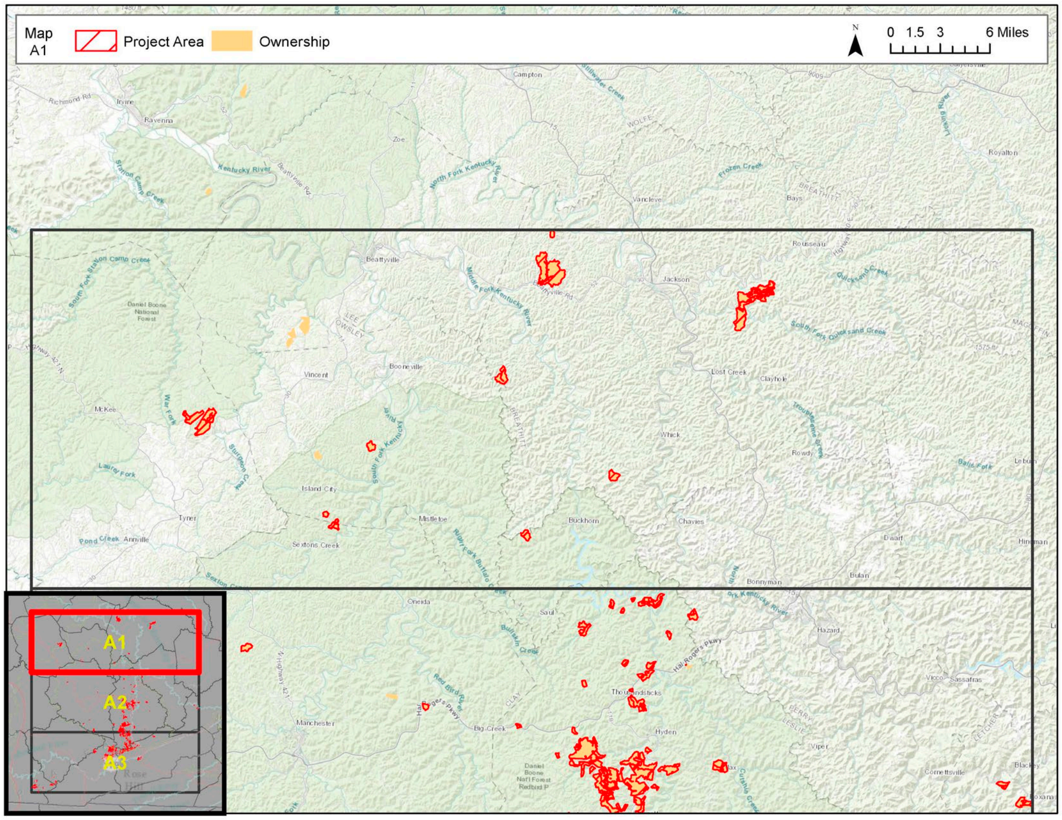

**Figure A-5. Roads Map**

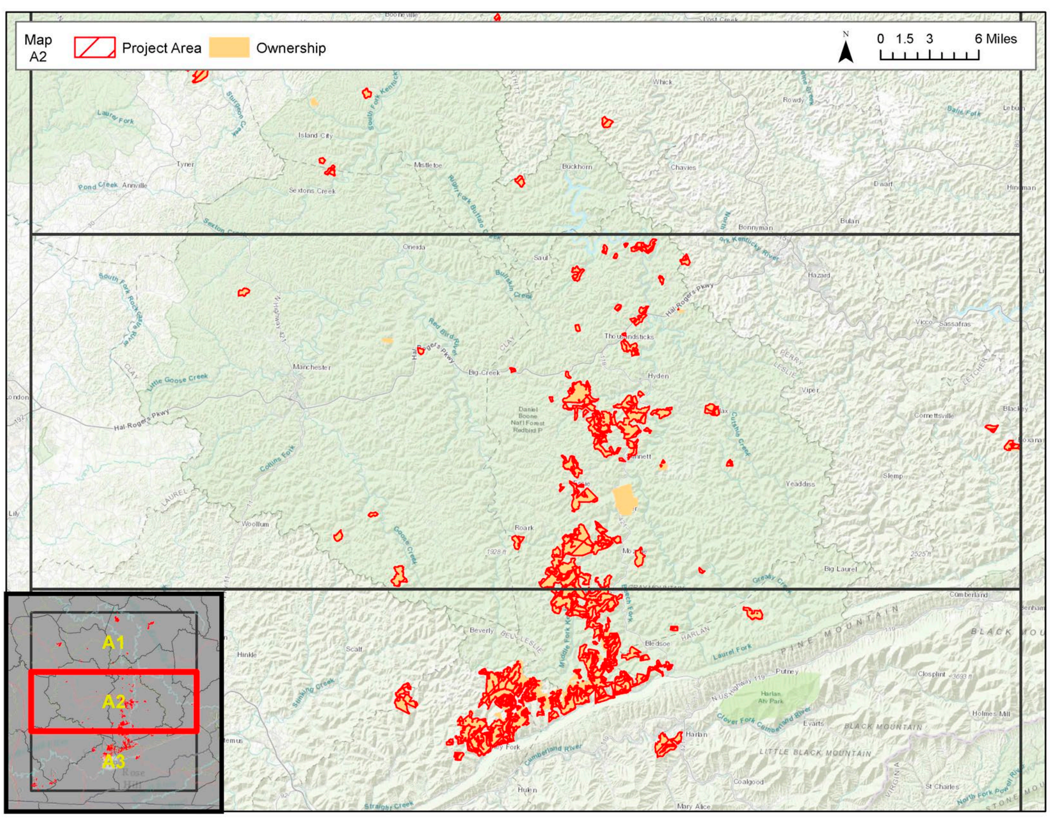


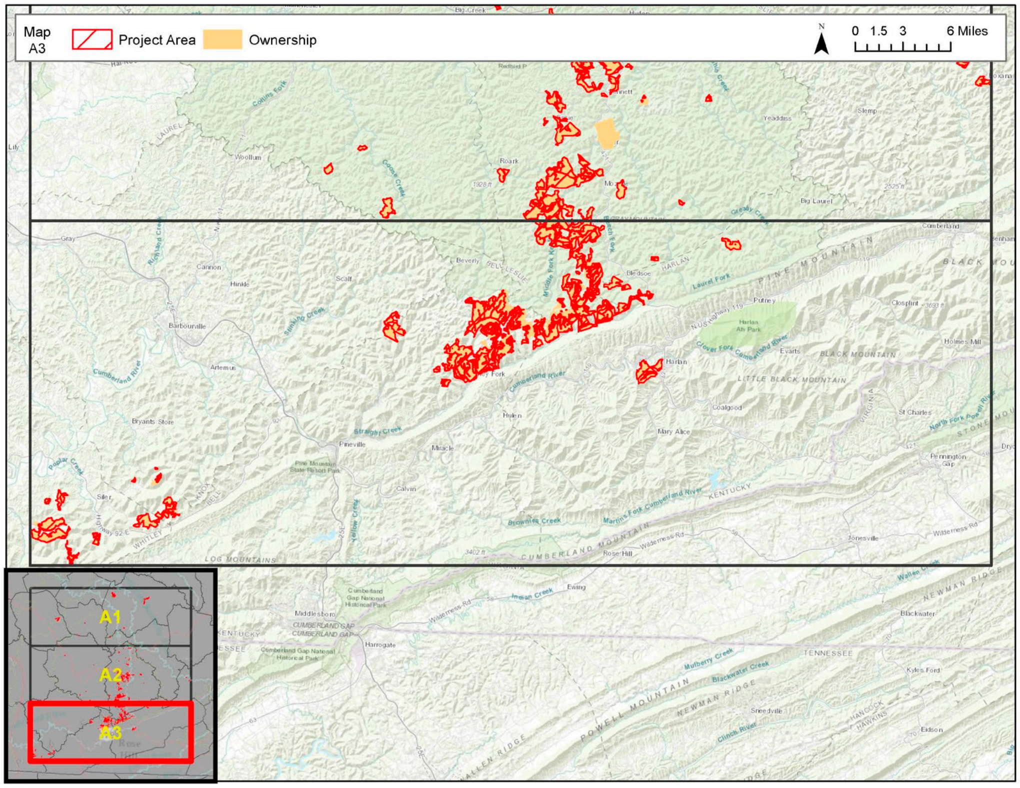

Map
A2
Public Roads
Private Roads
Project Boundary
N
0 1.5 3 6 Miles
A1
A2
A3


Map
A3
Public Roads
Private Roads
Project Boundary
N
0 1.5 3 6 Miles
A1
A2
A3

## Figure A-6. Ownership Map






# A5. BRIEF SUMMARY OF PROJECT

## A5.1 Background Information

The Bluesource – Boone Forestlands Improved Forest Management Project is located on approximately 38,272 acres of mixed hardwood forest in southeastern Kentucky. The project is spread across 11 counties in the state: Bell, Breathitt, Clay, Harlan, Jackson, Knox, Leslie, Letcher, Owsley, Perry, and Whitley. Nearby population centers include Harlan, Hyden, and Pineville, Kentucky.

Typical of southern Appalachia, the project area consists particularly of cove forest with significant yellow poplar and chestnut oak components. Timber and energy resource development and extraction (coal, oil, gas) dominate regional industry. The project area has been actively managed for both timber and energy extraction for the past 100 years.

## A5.2 Description of Project Activity

The project activity is improved forest management, with Boone Forestlands' forest management practices representing a significant improvement in the carbon storage and conservation value than higher return, more aggressive management regimes of industrial private lands in the region, which are characterized by shorter, even-aged rotations. Management decisions of the forest focus on sustainable, natural forest growth and maintenance harvests for essential activities, recreation, wildlife habitat and

forest health. The project ensures long-term sustainable management of the forests, which could otherwise undergo significant commercial timber harvesting.

**A5.3 Project Purpose and Objectives**

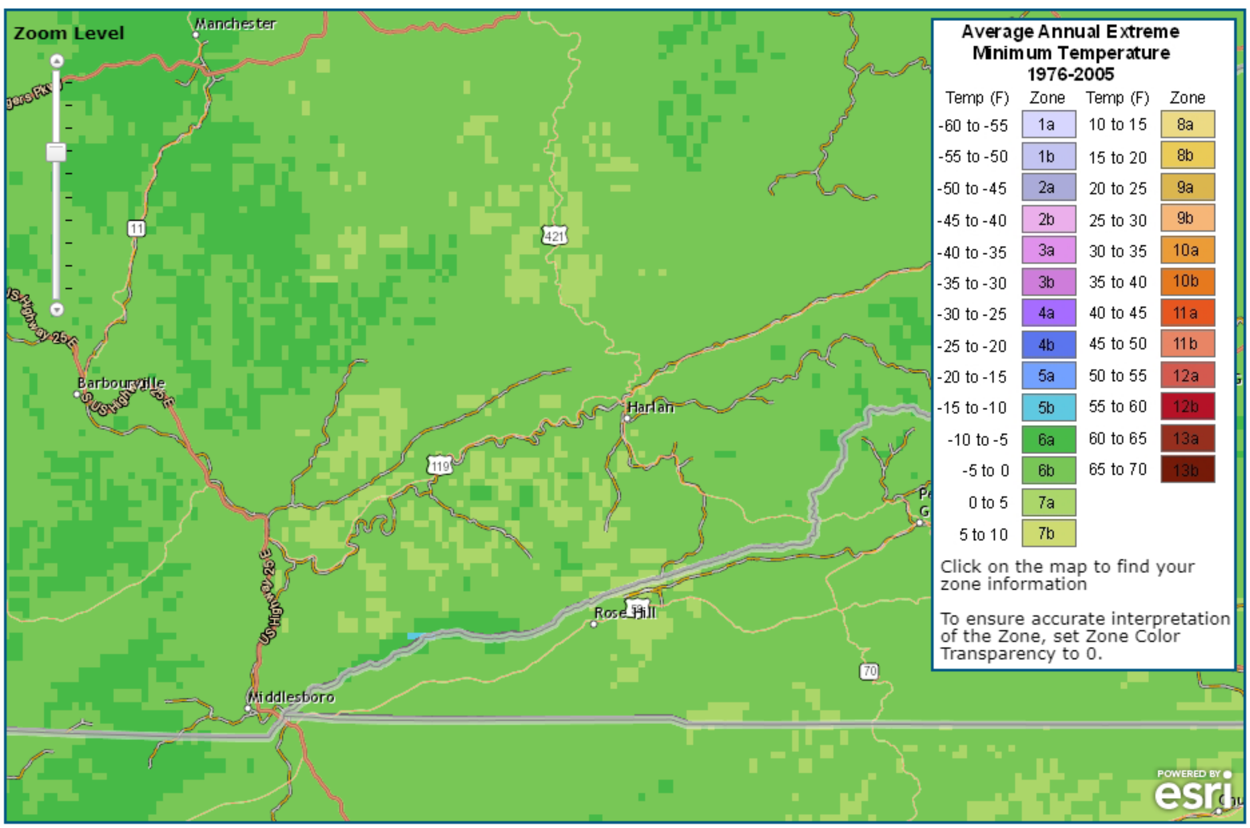
By committing to maintain forest CO2 stocks above the regional baseline level, the project will provide significant climate benefits through carbon sequestration. The aim of this project is also to ensure long-term continuance of all environmental benefits provided by the preservation of the yellow poplar, oak, hickory, and other hardwood species in the forestland.

# A6. PROJECT ACTION

**A6.1 Prior Physical Conditions**

Climactic zone

The project area is in southeastern Kentucky, which lies in zones 6a, 6b, and 7a on the USDA plant hardiness zone map. Average annual extreme minimum temperatures for these zones range from -10 to -5 degrees F, -5 to 0 degrees F, and 0 to 5 degrees F respectively.




Ecosystem/Vegetation

The project forest type is predominantly made up of mixed hardwood forest with significant yellow poplar and chestnut oak components. Prevalent tree species in the carbon project region include yellow poplar,

chestnut oak, white oak, red oak, basswood, sugar maple, and red maple. Abandoned and reclaimed strip-mining benches and plateaus throughout the property were reclaimed primarily by planting white pine. Some native hardwood species have also established themselves on these strip mines through natural regeneration, including yellow poplar, black birch, red maple, and black cherry.

Land Use

Regional land use is forestry and energy resource development and extraction, specifically coal, oil, and gas. Most of the surrounding properties are timberlands owned by industrial and non-industrial entities, many of which have been mined for energy extraction. Abandoned tram rail corridors, cemeteries, buildings and foundations, and structures related to mine operations are common throughout the ownership.

### A6.2 Description of Project Technologies, Products, Services, and Expected Level of Activity

Commercial harvesting is ongoing on the property in accordance with the long-term forest management plan. The current 10-year harvest plan indicates that the planned cut will be less than annual growth, whereas the baseline activities will be harvesting at or exceeding annual growth. This conservative harvest schedule will result in forest management practices that lead to the maintenance of forest carbon stocking above the regional common practice level.

### A6.3 Project Action

By committing to maintain forest CO2 stocks above the baseline level, the project will provide significant climate benefits through carbon sequestration. Bluesource – Boone Forestlands Improved Forest Management Project will achieve GHG removals by sequestering more atmospheric $CO_2$ than a baseline scenario in live aboveground biomass, belowground biomass and dead wood.

# A7. *EX ANTE* OFFSET PROJECTION

Total projected GHG removal is 2,605,498 mtCO2e (without risk buffer deduction) over the first crediting period of 20 years (including GHG removal from long-term wood products). Table A7.1 lists the estimates of GHG emissions reductions per year:

**Table A7.1. Estimate of net Emission Reduction Tons (ERTs) by year (includes buffer tonnes)**

| Project Year | Year | Estimates of GHG emission reductions mt CO2e |
|---|---|---|
| **0** | 2019 | 0 |
| **1** | 2021 | 469,231 |
| **2** | 2022 | 393,827 |
| **3** | 2023 | 439,006 |
| **4** | 2024 | 67,578 |
| **5** | 2025 | 82,457 |
| **6** | 2026 | 82,457 |
| **7** | 2027 | 82,457 |

| | | |
|---|---|---|
| **8** | 2028 | 82,457 |
| **9** | 2029 | 82,457 |
| **10** | 2030 | 76,475 |
| **11** | 2031 | 76,475 |
| **12** | 2032 | 76,475 |
| **13** | 2033 | 76,475 |
| **14** | 2034 | 76,475 |
| **15** | 2035 | 72,725 |
| **16** | 2036 | 72,725 |
| **17** | 2037 | 72,725 |
| **18** | 2038 | 72,725 |
| **19** | 2039 | 72,725 |

# A8. PARTIES

The project was implemented by Boone Forestlands, LLC, the landowner, and Blue Source, LLC, a carbon offsets project developer. Project verification was completed by Ruby Canyon Environmental, Inc. and the forest carbon inventory was conducted by Advantage Timberland, Inc. Technical modeling was conducted by Blue Source, LLC.

**Table A-3. Project Partners & Responsibilities**

| Project Parties | Personnel/Point of Contact | Roles and Responsibilities | Contact Information |
|---|---|---|---|
| Boone Forestlands, LLC | Dave Fehringer, Regional Director | Project Proponent – financing and implementation of long-term project management | The Forestland Group LLC<br>PO Box 9162, Chapel Hill, NC 27515<br>O: 919.929.2497<br>M. 317.491.0524 |
| Blue Source, LLC | Josh Strauss, Vice President | Offset Developer – coordination of project implementation, modeling, | Blue Source LLC<br>582 Market St., Suite 1505<br>San Francisco, CA 94104<br>Phone: 949-233-1501 |
| Ruby Canyon Environmental, Inc. | Zach Eyler<br>Vice President | Initial Verifier | Ruby Canyon Environmental, Inc.<br>743 Horizon Ct #385<br>Grand Junction, CO 81506<br>Phone: 970-241-9298 x15 |

| | | | |
|---|---|---|---|
| Advantage Timberland, Inc | Terry R. Owen<br>Forester, President | Contractor – Forest Inventory | Advantage Timberland, Inc<br>PO Box 548, Bluefield, VA 24605 |

# B. METHODOLOGY

## B1. APPROVED METHODOLOGY

The methodology used for the Bluesource – Boone Forestlands Improved Forest Management Project is the American Carbon Registry Improved Forest Management Methodology for Quantifying GHG Removals and Emission Reductions through Increased Forest Carbon Sequestration on Non-Federal U.S. Forestlands, Version 1.3. (April 2018)(hereinafter called the "methodology").

## B2. METHODOLOGY JUSTIFICATION

All applicability criteria of the selected methodology are fulfilled by the Bluesource – Boone Forestlands Improved Forest Management Project:

1. The land committed to the Boone Forestlands Improved Forest Management Project is a non-federally owned private forestland.

2. Boone Forestlands, LLC control the timber rights on the forestland and can legally harvest (appendix A. Deeds and Contracts).

3. The landowner will harvest in the future. The property is certified under the Forest Stewardship Council Certification.

4. N/A. The managing legal entities for Bluesource – Boone Forestlands Improved Forest Management project is Boone Forestlands, LLC, a private forestland owner.

5. N/A. Bluesource – Boone Forestlands Improved Forest Management Project is not on public, non-federal lands.

6. There is no use of non-native species where adequately stocked native stands were converted for forestry or other land uses after 1997.

7. There is no draining or flooding of wetlands on or after the project Start Date.

8. See attached Deeds (Appendix A. Deeds and Contracts).

9. Stocking levels increase well above the baseline conditions for the duration of the project and by the end of the Crediting Period (see section E1. Baseline).

# B3. PROJECT BOUNDARIES

The physical project boundary includes 38,272 acres of forestland, shown in the maps in section A4.

See H2. Project Timeline for the temporal boundaries of the project.

# B4. IDENTIFICATION OF GHG SOURCES AND SINKS

| Carbon pools | Included / Optional / Excluded | Justification / Explanation of Choice |
|---|---|---|
| Above-ground biomass carbon | Included | Major carbon pool subjected to the project activity. |
| Below-ground biomass carbon | Included | Major carbon pool subjected to the project activity. |
| Standing dead wood | Included/Optional | Major carbon pool in unmanaged stands subjected to the project activity. Project Proponent may also elect to include the pool in managed stands. Where included, the pool must be estimated in both the baseline and with project cases. *For Bluesource – Boone Forestlands Improved Forest Management Project, standing dead wood will be included in all stands.* |
| Lying dead wood | Optional | Project proponent may elect to include the pool. Where included, the pool must be estimate in both the baseline and with project cases. *For Bluesource – Boone Forestlands Improved Forest Management Project, lying dead wood will* ***not*** *be included.* |
| Harvested wood products | Included | Major carbon pool subjected to the project activity, |
| Litter/Forest Floor | Excluded | Changes in the litter pool are considered *de minimis* as a result of project implementation. |
| Soil organic carbon | Excluded | Changes in the litter pool are considered *de minimis* as a result of project implementation. |

| Gas | Source | Included / Excluded | Justification / Explanation of choice |
|---|---|---|---|
| $CO_2$ | Burning of biomass | Excluded | However, carbon stock decreases due to burning are accounted as a carbon stock change. |
| $CH_4$ | Burning of biomass | Included | Non-$CO_2$ gas emitted from biomass burning. |
| $N_2O$ | Burning of biomass | Excluded | Potential emissions are negligible. |

| Leakage Source | Included / Optional / Excluded | Justification/ Explanation of Choice |
|---|---|---|

| | | | |
|---|---|---|---|
| Activity-Shifting | Timber Harvesting | Excluded | Project Proponent must demonstrate no activity-shifting leakage beyond the *de minimis* threshold will occur as a result of project implementation |
| | Crops | Excluded | Forestland eligible for this methodology do not produce agricultural crops that could cause activity shifting |
| | Livestock | Excluded | Grazing activities, if occurring in the baseline scenario, are assumed to continue at the same levels under the project scenario and thus there are no leakage impacts |
| Market Effects | Timber | Included | Reductions in project outputs due to project activity may be compensated by other entities in the marketplace. Those emissions must be included in the quantification of project benefits. |

# B5. BASELINE

The baseline scenario represents an aggressive industrial harvest regime, targeted to maximize net present value at a 6% discount rate, typical of current practices in the project region on private lands. Derivation and justification of the baseline scenario is detailed in Section E.

# B6. PROJECT SCENARIO

The project scenario consists of managing the forestland using uneven-aged silvicultural techniques for generation of wood products, focusing too on preservation of water quality and wildlife habitat promotion, as described in Section A6. Project Action.

# B7. REDUCTIONS AND ENHANCED REMOVALS

The project will achieve greenhouse gas reductions through natural growth of forestland on lands that otherwise could be heavily cut in the baseline scenario. Introduction of uneven-aged harvest regimes will enhance removal rate to maintain carbon stocks above the common practice values of the region.

# B8. PERMANENCE

Project Proponent must conduct their risk assessment using the *ACR Tool for Risk Analysis and Buffer Determination*. All Project types must claim a value from risk categories A, B and C. Additional values that must be selected by project type include:

**Forestry** projects claim one value from each:

- D Conservation Easement (if applicable)
- E Fire
- F Disease/pest

G Levee failure/water table changes (required only if forested wetlands comprise more than 60% of project area)

H Other natural disaster risk scores.

1. Management and Governance Risks: All project types must select one value form each risk category that applies:

| | | |
|---|---|---|
| A | Financial | • 4% Default Value<br>• 3% US Public and Tribal Lands |
| B | Project Management | • 4% Default Value<br>• 3% US Public and Tribal Lands |
| C | Social/Policy | • 2% Default Value<br>• 5% if project is located outside of the US<br>• 3% if project is located outside of the US and demonstrates community engagements through ACR-approved mechanism |
| D | Conservation Easement Deduction | • -2% Default value<br>• -3% if there is regular onsite monitoring of activities related to carbon-specific conservation activities |

2. Natural Disaster Risks: Select one value from each risk category that applies:

| | | |
|---|---|---|
| E | Fire | • 8% if project is located in an area where fire greater than 1000 acres has occurred within 30 mile radius of project area in prior 12 months<br>• 4% if project is located in high fire risk region<br>• 2% if project is located in low fire risk region (verifiable evidence must be provided)<br>• 1% for agriculture and grassland projects only |
| F | Diseases and Pests | • 8% if epidemic disease or infestation is present within project area, or within 30 mile radius of project area<br>• 4% Default Value |
| G | Levee Failure and Water Table Changes | • 2% Default for all wetland projects (and for forest projects where more than 60% of the project area is a forested wetland) |
| H | Other Natural Disaster Events | • 2% Default Value for all sequestration projects |

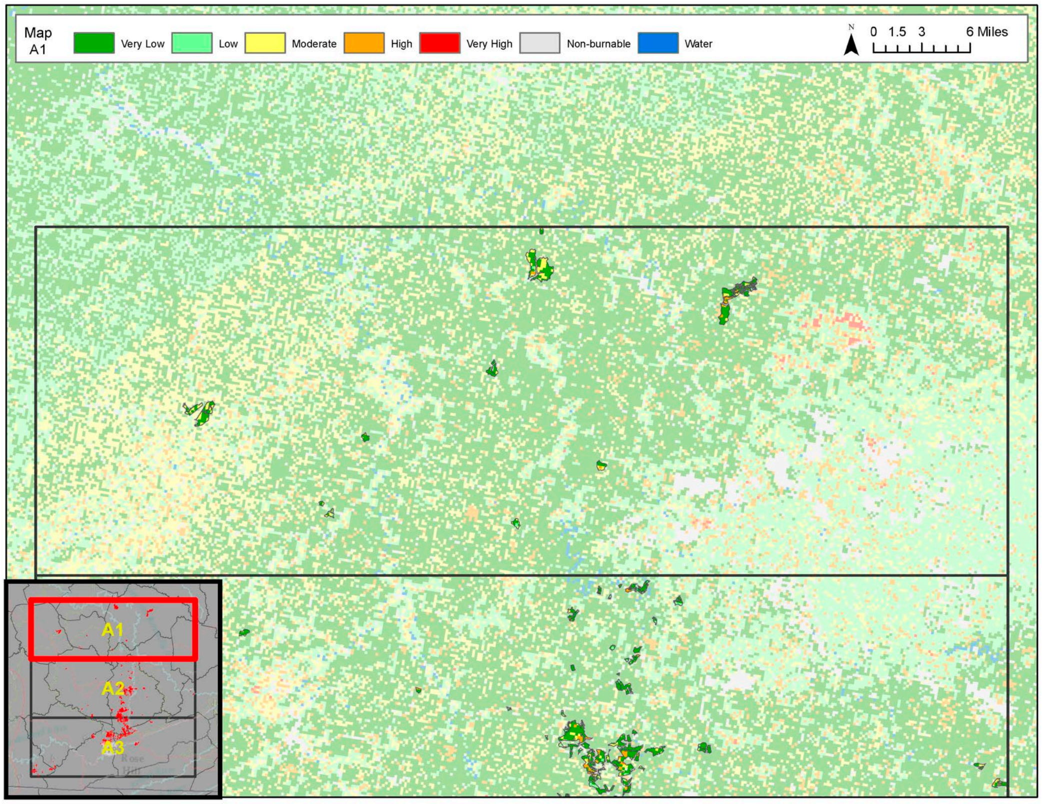
Calculated Risk Score

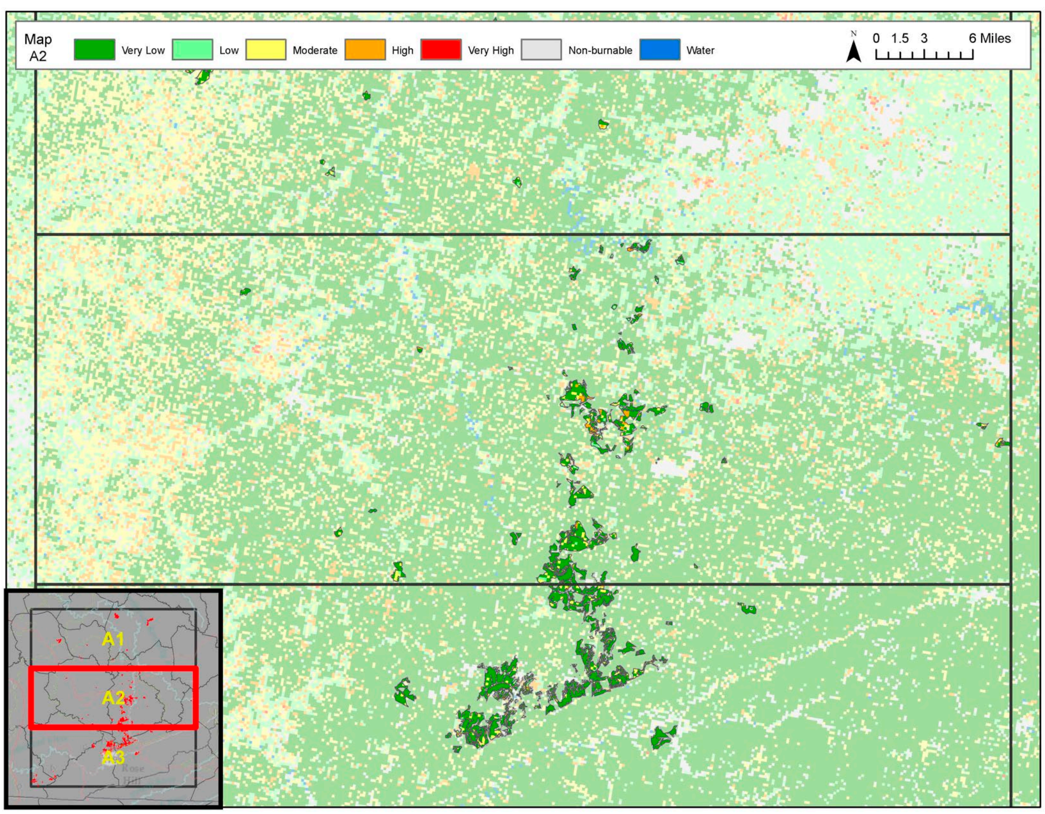
***Section 1 (A + B + C + D*) + Section 2 (E + F + G + H) = Total Risk score %***

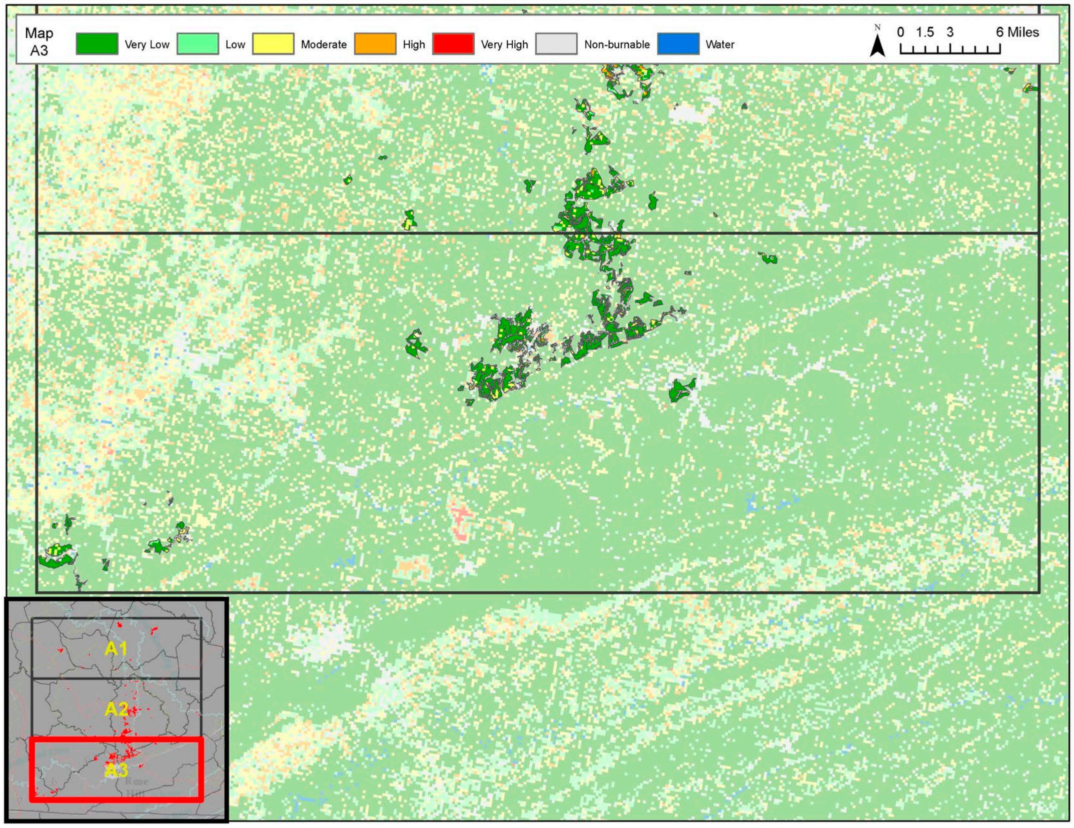
Section 1 (4 + 4 + 2 + 0*) + Section 2 (2 + 4 + 0 + 2) = 18%

*Project area is in a majority low fire risk region according to the Wildfire Hazard Potential (WHP) map provided by the USFS.

**Figure B8. Wildfire risk map using Wildfire Hazard Potential, Version 2020 from USDA Forest Service**




Map
A3
Very Low
Low
Moderate
High
Very High
Non-burnable
Water
N
0 1.5 3 6 Miles
A1
A2
A3

# C.ADDITIONALITY

## C1. REGULTORY SURPLUS TEST

Relevant laws, regulations, statues, legal rulings, and other regulatory frameworks that affect the project activity:

National laws, regulations and policies.

Clean Water Act
Endangered Species Act
Fair Labor Standards Act (1938) (amended)
Multiple-Use Sustained-Yield Act of 1960
National Environmental Policy Act (NEPA)
National Forest Management Act (NFMA)
Resources Planning Act (RPA)
Wilderness Act
The Logger's Guide to the New OSHA Logging Safety Standards, 1995

State & Local laws.

The Kentucky Forest Conservation Act
Kentucky Agriculture Water Quality Act

Binding International Agreements.

Paris Agreement, 2016
Kyoto Protocol (signed, not ratified)
United Nations Framework Convention on Climate Change, 1992
United Nations Convention on Biological Diversity, 1992 (signed, not ratified)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973
UNESCO World Heritage Convention, 1972

None of the above or any other existing law, regulation, statute, legal ruling, or other regulatory framework in effect as of the October 19, 2019 effectively requires the forest carbon project activity and its associated GHG emissions reductions/removal enhancements. Consequently, the project passes the Regulatory Surplus test.

## C2. COMMON PRACTICE TEST

The Bluesource – Boone Forestlands Improved Forest Management Project located in in southeastern Kentucky. Wood products, especially hardwood sawtimber, some softwood sawtimber and pulp are distributed to mills throughout this region, and these properties have a history of timber harvesting and contracting to logging companies. The project is an industrial, forestland ownership. Throughout the geographic region, industrial forestland is heavily cut, often through clear-cutting and high-grading, and

is managed to maximize NPV of the forestland investment. According to the 2018-2019 Kentucky Forest Sector Economic Contribution Report, wood products demand from this region has been steady for most hardwood species (oak, ash, cherry, maple)[3]. If the Bluesource – Boone Forestlands Improved Forest Management Project was not implemented, the forest management could feasibly resemble that of an industrial forestland ownership in the region. Instead, the project will exceed the common practice as described in Section A6. Project Action.

# C3. IMPLEMENTATION BARRIERS TEST

- ***Financial***
- *Technological*
- *Institutional*

| **Implementation Barriers** | *Choose one of the following three:* |
|---|---|
| ***Financial*** | Does the project face capital constraints that carbon revenues can potentially address; *or* is carbon funding reasonably expected to incentivize the project's implementation; *or* are carbon revenues a key element to maintaining the project action's ongoing economic viability after its implementation?<br>**Yes = Pass; No = Fail** |
| ***Technological*** | Does the project face significant technological barriers such as R&D deployment risk, uncorrected market failures, lack of trained personnel and supporting infrastructure for technology implementation, or lack of knowledge on practice/activity, and are carbon market incentives a key element in overcoming these barriers?<br>**Yes = Pass; No = Fail** |
| ***Institutional*** | Does this project face significant organizational, cultural, or social barriers to implementation, and are carbon market incentives a key element in overcoming these barriers?<br>**Yes = Pass; No = Fail** |
| ***If the project passes the Regulatory Surplus and Common Practice tests, and at least one Implementation Barrier test, ACR considers the project additional.*** | |

Carbon funding is reasonably expected to incentivize the project's implementation. The implementation of the carbon project represents an opportunity cost to lost revenue associated with the potential timber harvesting that could legally and feasibly occur on the property in the lifetime of the carbon project. A financial feasibility assessment is provided separately for verification demonstrating the financial barrier carbon funding overcomes in project implementation.

# C4. PERFORMANCE STANDARD TEST

The Bluesource – Boone Forestlands Improved Forest Management project uses the three-pronged approach; therefore, this step is not required.

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[3] Kentucky Forest Sector Economic Contribution Report, 2018-2019
http://forestry.ca.uky.edu/files/2020_kycontributionreport.pdf

# D.MONITORING PLAN

## D1. MONITORED DATA AND PARAMETERS

| | |
|---|---|
| Data or Parameter Monitored | $A_1$ |
| Unit of Measurement | Acres |
| Description | Area of IFM Project |
| Data Source | Provided by project proponent |
| Measurement Methodology | Strata area figures adjusted based on stocking levels and species distribution projected in modeling and verified through inventory updates |
| Monitoring Frequency | Every 5 years, following with inventory update |
| Value applied: | 38,272.02 |
| Reporting Procedure | Hand held GPS unit, GIS software |
| QA/QC Procedure | Meta data is kept current and uncorrupted |
| Purpose of Data | Calculation of project emissions |
| Calculation method: | Calculated in Arc GIS |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | T |
| Unit of Measurement | Year |
| Description | Number of years between monitoring time t and t1 (T = t2 – t1) |
| Data Source | Monitoring reports |
| Measurement Methodology | |
| Monitoring Frequency | Yearly |
| Value applied: | Calendar |
| Reporting Procedure | |
| QA/QC Procedure | All calculations double checked for accuracy prior to submission for verification |
| Purpose of Data | Calculation of project emissions |
| Calculation method: | Subtraction |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | Diameter at breast height of tree |
| Unit of Measurement | Inches (to $1/10^{th}$ an inch) |
| Description | Tree diameter measure 4.5 feet above ground |
| Data Source | Field measurement |
| Measurement Methodology | Measured with Loggers Tape or calipers |
| Monitoring Frequency | Every 5 years after the first inventory |
| Value applied: | |

| | |
|---|---|
| Reporting Procedure | Hand held GPS unit or cruise tally sheet |
| QA/QC Procedure | Equipment will be maintained in excellent condition. Breast height marked with permanent paint on all record trees > 5 inches in diameter |
| Purpose of Data | Calculations of project emissions |
| Calculation method: | N/A |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | H |
| Unit of Measurement | Feet |
| Description | Height of tree |
| Data Source | Field measurement |
| Measurement Methodology | Measured with clinometer or hypsometer |
| Monitoring Frequency | Every 5 years after the first inventory |
| Value applied: | |
| Reporting Procedure | Hand held GPS unit or cruise tally sheet |
| QA/QC Procedure | Equipment will be maintained in excellent condition. All heights will be double checked for reasonableness prior to submission for verification |
| Purpose of Data | Calculations of project emissions |
| Calculation method: | N/A |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | Decay Class |
| Unit of Measurement | |
| Description | Qualitative degree of decomposition |
| Data Source | Forest Inventory |
| Measurement Methodology | Qualitative assessment of dead tree into 1 of 5 decay classes based on class descriptions |
| Data Uncertainty | None |
| Monitoring Frequency | Every 5 years after the first inventory |
| Value applied: | |
| Reporting Procedure | Handheld GPS unit or cruise tally sheet |
| QA/QC Procedure | Equipment will be maintained in excellent condition. All decay classes will be double checked for reasonableness prior to submission for verification |
| Purpose of Data | |
| Calculation method: | |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | Tree Live/Dead Status |
| Unit of Measurement | |
| Description | Live or Dead |

| | |
|---|---|
| Data Source | Forest Inventory |
| Measurement Methodology | Consistent with the Boone Carbon Inventory Methodology. |
| Data Uncertainty | None |
| Monitoring Frequency | Every 5 years after the first inventory |
| Value applied: | |
| Reporting Procedure | Handheld GPS unit or cruise tally sheet |
| QA/QC Procedure | Equipment will be maintained in excellent condition. All tree statuses will be double checked for reasonableness prior to submission for verification |
| Purpose of Data | |
| Calculation method: | |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | Defect |
| Unit of Measurement | % |
| Description | Qualitative percent of missing biomass |
| Data Source | Forest Inventory |
| Measurement Methodology | Tree defect is assessed by dividing the tree into thirds, estimating percentage of missing carbon volume in each third, and assign a deduction value. Top height and phantom height are measured and missing biomass in the broken portion is calculated post-inventory. |
| Data Uncertainty | None |
| Monitoring Frequency | Every 5 years after the first inventory |
| Value applied: | Tree-specific |
| Reporting Procedure | Handheld GPS unit or cruise tally sheet |
| QA/QC Procedure | Equipment will be maintained in excellent condition. All tree defects will be double checked for reasonableness prior to submission for verification. |
| Purpose of Data | |
| Calculation method: | |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | Species Composition |
| Unit of Measurement | % |
| Description | Spp. composition as a percentage of basal area |
| Data Source | Forest Inventory |
| Measurement Methodology | Derived from basal area calculations from inventory data. |
| Data Uncertainty | None |
| Monitoring Frequency | Every 5 years after the first inventory |

| | |
|---|---|
| Value applied: | |
| Reporting Procedure | |
| QA/QC Procedure | Species identification is confirmed at verification. |
| Purpose of Data | Calculation of project emissions |
| Calculation method: | Basal Area = 0.005454 * $DBH^2$ |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | Harvested Wood Products |
| Unit of Measurement | Metric tons $CO_2$ |
| Description | Carbon remaining in stores wood products 40 years after harvest for the project in year t. |
| Data Source | NA |
| Measurement Methodology | NA |
| Data Uncertainty | None |
| Monitoring Frequency | Annual data summed for the monitoring period, applied as average annual for the monitoring period |
| Value applied: | |
| Reporting Procedure | |
| QA/QC Procedure | NA |
| Purpose of Data | |
| Calculation method: | |
| Notes | |

| | |
|---|---|
| Data or Parameter Monitored | Forest Carbon |
| Unit of Measurement | Metric tons of $CO_2$ |
| Description | Carbon stores in above and below ground live trees at the beginning of the year t |
| Data Source | Forest Inventory |
| Measurement Methodology | Consistent with the Boone Carbon Inventory Methodology. |
| Data Uncertainty | To be calculated as the mean +/- 90% confidence interval |
| Monitoring Frequency | Every 5 years or less, or at request for ERT issuance |
| Value applied: | |
| Reporting Procedure | |
| QA/QC Procedure | The inventory will use a random sample design and re-measure the same permanent plots established in 2021, which targeted a precision level of +/- 10% of the mean live tree biomass with 90% confidence. |
| Purpose of Data | |
| Calculation method: | |
| Notes | |

# D2. MONITORING PLAN

Each year, the Project Proponent shall submit a signed Attestation that:

- Confirms the continuance of project activities;
- Confirms that ownership remains clear and uncontested;
- Discloses any negative environmental or community impacts or claims of negative environmental and community impacts, and documents plans to mitigate any reported negative environmental or community impacts;
- Addresses any significant change in external conditions that would affect the quality or environmental integrity of the project.

The following material outlines the monitoring plan to be followed during the decade following the initial project validation and verification.

The following material outlines the monitoring plan to be followed during the decade following the initial project validation and verification.

**General Monitoring Method**

In the year prior to validation/initial verification, a representative sample of 265 fixed radius permanent inventory plots were established across the project area. The plot network provided enough data to keep total project uncertainty below 10% of the net anthropogenic greenhouse gas removals by sinks across the project, thereby avoiding any uncertainty deductions in the quantification process. All permanent plots will be re-inventoried at least once over the following decade to calibrate forest growth models and improve carbon sequestration projections.

The heavily monumented and well-maintained plot design gives forest managers the opportunity to consistently track the growth and development of specific trees over an extended timeline and allows for improved ease of plot location during field work and site verifications. All plots will be re-measured in a manner consistent with the Inventory Methodology, provided separately for verification. [4]

In addition to the full inventory update of the entire property that will be conducted on all plots every 5 years, inventories of select portions of the Project Area will be updated periodically in response to natural disturbance or significant forest management activities. Following natural disturbance events, affected project stands will be assessed for damage. If damage is significant, the affected areas will be re-inventoried and project scenario models will be adjusted to reflect onsite carbon stocks.

In years in which forest plots are not re-inventoried carbon stocks will be monitored through forest growth and yield modeling.

In addition to inventory sampling, management staff will consistently monitor the general health and condition of the forest throughout the course of normal forest management activities (e.g. harvest

4 The details of the carbon inventory methodology are considered commercially sensitive material as the methodology is the result of considerable investment of Blue Source LLC's resources.

planning and preparation, road maintenance, ecological studies, boundary marking, etc.), reducing the risk of reversal by disease, pest invasion, and unauthorized timber removal.

Blue Source LLC (Bluesource) will oversee the execution and reporting of all project reporting, modeling, and monitoring activities on behalf of the landowner. The landowner will be responsible for "on the ground" forest management activities on the project area, and an inventory crew will conduct inventory measurements and data collection. After forest inventory data collection, an inventory crew will report results to Bluesource for processing and updating of modeling projections. After processing is complete, Bluesource will house all data and submit the necessary documentation for compliance with ACR standards. Bluesource will ultimately store project data for at least ten years after the conclusion of the project.

**Data Processing and Storage**

Manually and electronically filed data are stored and archived. Backup copies of all electronically stored data are maintained in a separate data center with scheduled archiving to assure data protection. Future revisions to project documents after initial verification and registration will be clearly identified by saving them as separate files and including the date of revision in any modified documents. All data will be stored on Dropbox or similar online cloud storage service as well as on an external hard drive and kept by Bluesource for a minimum of 15 years.

**QA/QC Field Procedures**

**Field Procedures**

At the end of each field day, individual foresters email their plots from the data recorders to the senior forester. The senior forester then looks for irregularities in the data and asks the field crew to confirm the data or remeasure any plots that cannot be reconciled. The senior forester then adds all the data to a master spread sheet.

At least 10% of the plots are checked by a different forester than cruised the plot, specifically by someone senior to the field crew. This involves full plot measurement to identify any problems with determining in/out trees, species calls, defect measurements, DBH measurements, and height measurements. A summary report of the cruise checks is to be provided to Bluesource at the end of the inventory.

The purpose of the check cruise is to identify any consistent errors by either a specific cruiser, or the whole crew, and to verify that all plots are being measured with a high level of diligence. There are two ways to fail a plot during a check cruise.

- If any in/out trees are missed, or erroneously added, the plot fails.
- If there is a trend in any specific data collection-type being erroneously measured, the plot fails.

A trend is defined as ≥25% of all tally trees in the large plot, or ≥25% of all tally trees in the subplot, having consistent errors on the same measurement type. For example, if 10 trees are recorded in the large plot and 3 of those trees have DBH measured in the incorrect location, that plot fails. If Tree Class Code is

erroneously recorded on 3 of those trees, that plot fails, or if percent defect is erroneously recorded on 3 trees in that plot, the plot fails. If one tree has an error on DBH, one tree has an error on Tree Class Code, and one tree has an error on percent defect, the plot still passes. The total number of trees in the plot for the percent error calculation is separated for the total number of trees in the large plot and the total number of trees in the subplot.

If the same cruiser fails more than one plot during the check cruise, all plots completed by that cruiser since the last acceptable check must be revisited and measured again. Any errors noted during the check cruise are used to update the master spread sheet file. Any consistent height, species, DBH, or defect errors are resolved by talking with the foresters, remeasuring plots, and removing crew members as needed.

**Desk Procedures**

The following QA/QC approach is designed to ensure that field data, once inputted, is appropriately managed and maintained, and that subsequent calculations using that data to determine onsite carbon stocks and associated credit issuance are correctly implemented.

A four-stage QA/QC process with a defined review group for the project is established, engaging both personnel intimately familiar with all project files and documentation, as well as independent reviewers who are able to bring “fresh eyes” to key outputs.

> **Implementation Forester Review**: The project implementation team (Bluesource) has a team of foresters with intimate knowledge of the inventory methodology, inventory design, and property documentation. The inventory data is examined by a forester from this team to identify and fix any errors, as well as to seek clarification from the inventory contractor on any measurements and plot or tree notes that are unclear.
>
> **Technical Forester Review**: The technical team runs the inventory data through automated data checks. The development of quantitative components, such as Access databases, R Studio coding and outputs, FVS model runs and Excel workbooks, are led by one of these foresters. Prior to finalization of files, models and documents, a second forester who did not lead development of that component is tasked with a QA/QC review including random examinations and data checks to identify and fix any errors.
>
> **Technical Review**: Once quantitative outputs are finalized, exported from Access/FVS/R to Excel, and are ready to be transferred into the GHG plan, monitoring report, and other project documents, an independent manager reviews these outputs. This individual performs data checks by tracing key outputs back from final credit calculations though the chain of Excel documents to the underlying Access/FVS database.
>
> **Senior Management Review**: Once outputs have been transferred from Excel to the GHG plan, monitoring report, and other project documents, a senior manager reviews these documents and checks that all quantitative elements have been correctly exported from the underlying

workbook. At this stage, the senior manager (or other individual not involved in document preparation) also reviews text, grammar and formatting for presentation and accuracy.

# E. QUANTIFICATION

## E1. BASELINE SCENARIO

**Inventory Development Overview**

The carbon inventory of the project area was conducted from 3/3/2021 - 4/19/2021. The inventory employed a sample of 265 nested, fixed-radius circular plots installed in a random distribution across the project area. The nested plots consist of a 1/15$^{th}$ acre plot recording trees >= 5" and a 1/100$^{th}$ acre plot recording trees >=1" and <5" DBH. The entire project area (38,272 acres) was assigned to 3 strata, as shown in Table E1-a. See the Baseline Stratification section below for details.

**Table E1-1 - Area by Strata**

| Strata | Project Area (acres) | Constrained Area (acres) | Number of Plots |
|---|---|---|---|
| M | 12,982.58 | 1,052.26 | 102.00 |
| O | 23,152.39 | 804.17 | 151.00 |
| Y | 2,137.04 | 293.14 | 12.00 |
| **Total** | **38,272.02** | **2,149.57** | **265.00** |

*Sums may not total due to rounding

**Growth Model Overview**

Field measurement protocols are documented in the Boone Carbon Inventory Methodology.

The ACR protocol requires Improved Forest Management (IFM) projects to establish a baseline harvest scenario against which to measure carbon accumulation attributable to the project. The ACR protocol defines this baseline as the mix of silvicultural practices that maximizes the net present value (NPV) of timber revenues over 100 years. We used the Forest Vegetation Simulator (FVS), an empirical forest growth and yield model developed by the US Forest Service (USFS), to project carbon stocks and timber revenues under the range of harvest scenarios considered in the baseline. We selected the FVS-SN variant of the FVS growth and yield model, which encompasses Kentucky, with model equations for each plot regionally calibrated to the US National Forest located nearest to the Boone project, as shown in Table E1-2.

**Table E1-2. Plot Location for FVS Calibration**

| FVS Location Code | Nearest Natl Forest Region | Number of Plots |
|---|---|---|
| 80217 | Daniel Boone National Forest-Red Bird District | 260 |
| 80213 | Daniel Boone National Forest-Berea District | 5 |

We used the regionally calibrated FVS to 'degrow' the inventory from the plot-specific inventory date to the project start date (October 19, 2019), because the plots were inventoried after the project start date. We first initialized FVS with the original inventory measured on the plot's inventory date and projected the model forward with no harvest in order to estimate tree-level annual growth rates. We ran a single 5-year FVS projection cycle, the default cycle length for the SN FVS variant. We then computed height and diameter growth for each tree over this 5-year interval and divided by 5 to estimate annual growth. Using a monthly growth schedule derived in consultation with a local forester, we determined the fraction of annual growth that had occurred between the project start date and the inventory date and multiplied annual growth for each tree by this fraction. Finally, we subtracted this estimated height and diameter growth for each tree from the observations recorded in the original inventory. We used this growth-adjusted inventory to determine $CO_2$e stocks on the project start date (October 19, 2019). We similarly estimated $CO_2$e stocks on the project reporting period end date (February 28, 2021) by 'growing' the inventory from the plot-specific inventory date to the Reporting Period Date.

Total aboveground biomass carbon was estimated from inventory data applying species group-specific allometric equations sourced from Jenkins et al 2003[5]. Root biomass was then estimated from total aboveground biomass using component ratios from Jenkins et al 2003, to produce total live tree biomass. Total live tree biomass was converted from pounds to metric tons, multiplied by 0.5 to estimate carbon fraction, then multiplied by 3.664 to calculate t $CO_2$e.

Carbon in standing dead wood was estimated in the same way as live trees, with deductions for decay class recorded in the field. Decay classes were recorded according to the ACR standard using the methodology-defined Decay Class (Table E1-3).

**Table E1-3. ACR decay classes (applied to dead trees)[6]**

| Decay Class | Decay Factor | Description |
|---|---|---|
| 1 | 0.97 | Tree with branches and twigs that resembles a live tree (except for leaves). |
| 2 | 0.95 | Tree with no twigs but with persistent small and large branches. |
| 3 | 0.90 | Tree with large branches only. |
| 4 | 0.80 | Bole only, no branches, heartwood with advanced decay at base. |
| 5 | 0.80 | Bole only, no branches, sloughing heartwood. |

### Growth and Yield Simulation

The FVS model requires an individual species code and site index for each forest plot simulated. The site index is a location-specific measure of forest productivity. These estimates were calculated using tree cores. One dominant or co-dominant tree with a DBH of less than 30 inches within the overstory plot was

[5] Jenkins, J.C., Chojnacky, D.C., Heath, L.S. and R.A. Birdsey. 2003. National-scale biomass estimators for United States tree species. Forest Science 49:12-35

[6] Rebain et al. (2012). *FVS Fire and Fuels Extension*.

selected as a site index tree for each plot. Site Index was calculated from tree cores taken in the field and processed by Rocky Mountain Tree Ring Research. The available outputs following processing tree cores included tree species, DBH, Height, Pith Date (calendar year), DBH Age (years). From these outputs, Site Index was calculated using species-specific site index curves[7]. If a plot had no species that were cored, we assigned the plot the site index of the tree species in the species list with the highest basal area in the entire project area (red maple). For the plots with species without site index curves or less than 5" DBH, site index was estimated using publicly available Web Soil Survey (WSS) data maintained by the USDA's Natural Resources Conservation Service (NRCS). Soil classes in the WSS database can encompass multiple sub-classes, each with an associated site index. The site index for each soil sub-class is reported for at least one tree species. We used the R package soilDB developed by the NRCS to spatially co-locate inventory plots within the WSS soil classes and extract the associated soil sub-classes along with their species-specific site indices. The result is a soil class assigned to each plot. Within each plot-specific soil class, we averaged site indices by tree species across soil sub-classes. We then merged the list of tree species associated with each plot-specific soil class with the list of species found in each plot. We assigned each plot the site index of the tree species with the highest basal area in the plot found in both lists. If a plot had no species in the soil class species list, we assigned the plot the site index of the tree species in the species list with the highest basal area in the entire project area. If no site index data were available for a soil class, we averaged site indices by tree species across all soil classes and assigned the average site index for the highest basal area tree species in the plot.

The FVS "NoTriple" command was entered to avoid excessive tree records and speed processing.

Initial carbon stock estimates for the project start date were back-modeled via FVS-SN with the approach outlined below.

1. Inventory Start Date - End Date data were entered into FVS-SN and grown for 10 years with no management (with "NoTriple" keyworded to track individual trees and permit cross-referencing to raw inventory dataset).

2. For each live tree (ascribed a unique identifier), annual diameter growth was derived assuming linear growth during the 10-year projection interval (i.e. for DBH, annual growth calculated as DBH at end of 10-year interval *minus* DBH at beginning of 10-year interval, reported in the FVS Treelist output, *divided by* 10).

3. For each live tree, diameter data from the Inventory Start Date - End Date inventory were degrown referencing the annual rates derived in step 2 above, subtracting one year annual growth (i.e. one growing season) from the Inventory Start Date - End Date measurement value.

4. Initial carbon stocks were recalculated using the degrown data. No harvests or significant disturbances took place during the intervening period. Diameter of standing dead trees were assumed to be constant through the period.

[7] Carmean, W. H., Hahn, J. T., & Jacobs, R. D. (1989). Site index curves for forest tree species in the eastern United States. *General Technical Report NC-128. St. Paul, MN: US Dept. of Agriculture, Forest Service, North Central Forest Experiment Station*, *128*.

5. The baseline scenarios were subsequently modeled entering the degrown inventory data into FVS-SN.

**Table E1-4. De-grown results for live aboveground and belowground tree biomass**

| Strata | Average of Live CO2e | Standard Deviation of Live CO2e | Standard Error | Total Live CO2e | Uncertainty % |
|---|---|---|---|---|---|
| M | 121.91 | 66.14 | 6.55 | 1,582,648 | 8.84% |
| O | 144.80 | 93.64 | 7.62 | 3,352,456 | 8.66% |
| Y | 64.78 | 69.78 | 20.14 | 138,433 | 51.15% |
| **Total** | **132.57** | - | - | **5,073,537** | **6.50%** |

**Table E1-5. De-grown results for dead aboveground and belowground tree biomass**

| Strata | Average of Dead CO2e | Standard Deviation of Dead CO2e | Standard Error | Total Dead CO2e | Uncertainty % |
|---|---|---|---|---|---|
| M | 2.11 | 5.33 | 0.53 | 27,391 | 41.13% |
| O | 2.97 | 8.33 | 0.68 | 68,751 | 37.45% |
| Y | 1.18 | 2.45 | 0.71 | 2,530 | 98.10% |
| **Total** | **2.58** | - | - | **98,671** | **28.60%** |

**Table E1-6. De-grown results for total tree biomass**

| Strata | Average of Total CO2e | Standard Deviation of Total CO2e | Standard Error | Total CO2e | Uncertainty % |
|---|---|---|---|---|---|
| M | 124.02 | 66.06 | 6.54 | 1,610,040 | 8.68% |
| O | 147.78 | 93.31 | 7.59 | 3,421,206 | 8.45% |
| Y | 65.71 | 71.80 | 20.73 | 140,962 | 51.69% |
| **Total** | **135.14** | - | - | **5,172,208** | **6.37%** |

*Sums may not total due to rounding

**Baseline Stratification**

The project area was stratified based on age class of the forest area. The age class was identified as young (0-15 years), medium (16-60) and old (61+) forests.

**Baseline Harvest Schedule Scenario Overview**

The Baseline Scenario represents an industrial harvest regime designed to maximize the annual cashflows from a 100-year Net Present Value (NPV) at a 6% discount rate, subject to operational considerations in the region. Only volume from merchantable species count toward costs and revenue for regeneration harvest. The area selection for each prescription by plot was determined using a linear programming model (lpSolve package), which found the combination of prescriptions that maximizes the NPV over 100 years.

There are 7 silvicultural prescriptions in the linear programming model, shown in Table E1-7. Note that there are harvest restrictions for constrained areas.

**Table E1-7. Silvicultural prescriptions used for the baseline harvest schedule**

| Prescription | Prescription Description |
|---|---|
| GROW | Grow stand through end of baseline projection, with no silvicultural treatment. Allow existing stocks to grow 100 years. This prescription applies to all constrained acres (i.e., RMZ areas). |
| SHW70 | Residual basal area for shelterwood = 70 square feet; Overstory removal occurs 5 years after shelterwood cut; No residual overstory trees; Natural sprouting and regeneration. Stand basal area > 120 square feet per acre; Merchantable timber > 25 tons per acre; Constrained to occur at most every 40 years |
| SHW60 | Residual basal area for shelterwood = 60 square feet; Overstory removal occurs 5 years after shelterwood cut; No residual overstory trees; Natural sprouting and regeneration. Stand basal area > 120 square feet per acre; Merchantable timber > 25 tons per acre; Constrained to occur at most every 40 years |
| STS75BA10 | Harvest to basal area of 75 square feet; Q-factor = 1.4; Subsequent removal of all trees > 40 inches DBH; Natural sprouting and regeneration. Constrained to occur at most every 15 years; Merchantable timber > 25 tons per acre. This prescription applies to all constrained acres (i.e., RMZ areas). |
| VT_10BA | Residual basal area for variable retention thin = 10 square feet; No residual overstory trees; Natural sprouting and regeneration. Stand basal area > 100 square feet per acre; Merchantable timber > 25 tons per acre; Constrained to occur at most every 10 years. |
| VT_20BA | Residual basal area for variable retention thin = 20 square feet; No residual overstory trees; Natural sprouting and regeneration. Stand basal area > 100 square feet per acre; Merchantable timber > 25 tons per acre; Constrained to occur at most every 10 years. |
| DL | Cut through all species and diameter classes >10 inches DBH; Natural sprouting and regeneration. Stand basal area >80 square feet per acre; Merchantable timber > 2800 BF per acre; Constrained to occur at most every 10 years. |
| CC | Cut through all species and diameter classes >6 inches DBH; Natural sprouting and regeneration. Stand basal area >80 square feet per acre; Merchantable timber >25 tons per acre; Constrained to occur at most every 60 years. |

Volume yields were output for 100-year projections from FVS-SN, with annual yields interpolated between 10-year cycle outputs.

We then projected the revenues from sawlogs and pulp using the average stumpage price for each species, as provided separately. Stumpage prices were sourced from Timber Mart South Datamart 2019 annual report. Diameter thresholds for sawlogs and pulpwood use the default merchantable diameters in FVS-SN variant.

**Cost Assumptions**

To estimate net revenue from timber harvest, stumpage by species was used by taking an average from Timber Mart South Datamart 2019 annual report. It is assumed that all variable management costs are included in the stumpage estimate. Fixed cost estimates for the property were provided by the landowner. Ultimately, the financial analysis shows that the baseline harvest activities would be financially viable over a 100-year term using the cost and pricing estimates cited above.

**Baseline Constraints**

Management regimes in the baseline scenario were developed under legal constraints, including the Kentucky Forest Conservation Act and Kentucky Agriculture and Water Quality Act, and Kentucky BMPs dictating the size and management constraints around SMZ Buffers. For conservatism, harvest was limited to single tree selection the SMZs.

**ERT Calculation Overview**

The ERTs were computed based on the equations and coefficients provided in ACR's Improved Forest Management Methodology for Quantifying GHG Removals and Emission Reductions through Increased Forest Carbon Sequestration on Non‐Federal U.S. Forestlands, Version 1.3.

The baseline and project scenarios were projected in FVS-SN for 100 years. Projections were annualized using linear interpolation. Direct biomass carbon estimates for live trees were output via FVS FFE carbon reports, using Jenkins et al 2003 biomass predictions in metric tons of carbon per acre, matching the calculations applied to the forest inventory measurements.

Standing dead wood was modeled using the Fire and Fuels Extension of FVS (FVS FFE) to produce detailed snag lists for each model cycle. Biomass carbon of each snag was estimated using model output cubic foot volumes of hard and soft components of dead wood, multiplied by dead wood density. Dead wood densities were referenced from the US Forest Service Wood Handbook or from Miles and Smith 2009, and incorporated deductions for decay classes corresponding to the hard and soft dead wood components output from the FVS FFE model and summarized in Table E1-3. Belowground biomass was estimated for hard classes of standing dead wood applying component ratios from Jenkins et al 2003. Standing dead biomass was converted to carbon applying a carbon fraction of 0.5, and carbon converted to carbon dioxide equivalent ($CO_2e$) applying a conversion factor of 3.664.

Harvested wood products were incorporated into ERT calculations following the below steps:

Step 1:

Long-term storage in wood products was calculated from FVS projections of removals. Projected harvested volumes were broken out into the following categories: softwood sawlog, softwood pulp,

hardwood pulp and hardwood sawlog. Pulp/saw breakdowns referenced merchantability standards in the FVS-SN variant[8].

Volumes were converted to biomass by applying species-level specific gravities referenced from the USFS Wood Handbook 2010 Table 5-3a or from Miles and Smith 2009. Biomass was converted to carbon applying a carbon fraction of 0.5, and then converting to t $CO_2e$ by multiplying by 3.664. Harvest t $CO_2e$/acre (before delivery to mill) for each modeled group (i.e. baseline stratum) were summed for two categories: hardwood sawtimber and softwood sawtimber.

Step 2:

Carbon transformed to wood products was estimated applying mill efficiency values referenced from the ARB 2015 forest protocol "Regional Mill Efficiency Data.xls" database[9], for the region specified in Table E1-8. The mill efficiencies are broken down by species group (hardwood vs. softwood) and wood product (pulp vs. sawlog). However, since FVS provides no estimates of carbon by species or wood product, we determined species and product estimates from the ACR wood product classes distribution for the project's Supersection, as defined by the California ARB 2015 Forest Protocol, shown below in Table E1-9.

**Table E1-8. Regional Mill Efficiency for Wood Products**

| Mill Region | Hardwood Sawlog Efficiency | Hardwood Pulp Efficiency | Softwood Sawlog Efficiency | Softwood Pulp Efficiency |
|---|---|---|---|---|
| South Central (SC) | 0.587 | 0.581 | 0.629 | 0.57 |

**Table E1-9. Baseline Wood Product Percentages**

| Supersection | Project Area (Acres) | Softwood Lumber | Hardwood Lumber | Plywood | Oriented Strand Board OSB | Non-structural Panels | Miscellaneous | Paper |
|---|---|---|---|---|---|---|---|---|
| Allegheny & North Cumberland Mountains | 2,708 | 3.61% | 68.77% | 0.02% | 12.20% | 4.59% | 3.38% | 7.44% |
| Eastern Broadleaf Forest Cumberland Plateau | 35,564 | 9.86% | 65.01% | 0.16% | 0.04% | 3.70% | 14.58% | 6.64% |

[8] Dixon, Gary E.; Keyser, Chad E., comps. 2008 (revised November 2, 2020). Southern (SN) Variant Overview – Forest Vegetation Simulator. Internal Rep. Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Forest Management Service Center. 82p.

[9] Sourced at: *https://www.arb.ca.gov/cc/capandtrade/protocols/usforest/usforestprojects_2015.htm*

Steps 3 and 4:

Transformed carbon was summed across the hardwood/softwood/pulp/sawtimber categories and then distributed among a range of end wood product classes. Distributions of end wood product classes reference ARB 2015 forest protocol values derived from the Supersection (Table E1-9).

Wood product amounts retained in storage for 100 years in in-use wood products and landfills were then calculated referencing end wood product class-specific 100-year average storage factors provided in the methodology[10],shown in Table E1-10

**Table E1-10. 100-Year Storage Factors**

| Category | In-Use | Landfills |
|---|---|---|
| Softwood Lumber | 0.234 | 0.405 |
| Hardwood Lumber | 0.064 | 0.49 |
| Plywood | 0.245 | 0.4 |
| Oriented Strand Board | 0.349 | 0.347 |
| Non-structural panels | 0.138 | 0.454 |
| Misc | 0.003 | 0.518 |
| Paper | 0 | 0.151 |

Step 5:

Carbon in long-term storage was then summed across in-use wood products and landfills and across modeled groups/baseline strata to produce annual total t $CO_2e$ stored in in-use wood products and landfills after 100 years from wood harvested in a given year.

Emissions due to burning logging slash are conservatively assumed in the baseline to be zero. Thus, parameter $BS_{BSL}$ equals zero and the outcome of equation 4 of the methodology, parameter $GHG_{BSL}$, equals zero.

**Baseline Harvest Mix**

Table E1-14 includes the baseline mix of harvest practices that maximizes the net present value (NPV) of annual cash flows over a 100-year projection.

**Table E1-14. Baseline and Project Prescription Acreages**

| Strata | RX | Baseline Optimized Area | Project Optimized Area |
|---|---|---|---|
| M | CC | 351 | 0 |

[10] Sourced from Smith JE, Heath LS, Skog KE, Birdsey RA (2006) Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. In: General Technical Report NE-343 (eds USDAFSUSDAFS), PP. 218. USDA Forest Service, Washington, DC, USA.

| | | | |
|---|---|---|---|
| M | DL | 8304 | 0 |
| M | GROW | 41 | 10126 |
| M | SHW60 | 468 | 779 |
| M | SHW70 | 117 | 779 |
| M | STS | 1011 | 1298 |
| M | VT | 702 | 0 |
| O | CC | 1988 | 0 |
| O | DL | 1332 | 0 |
| O | GROW | 14060 | 0 |
| O | SHW60 | 175 | 18059 |
| O | SHW70 | 1480 | 1389 |
| O | STS | 148 | 1389 |
| O | VT | 778 | 2315 |
| Y | CC | 740 | 0 |
| Y | DL | 4440 | 0 |
| Y | GROW | 0 | 0 |
| Y | SHW60 | 1076 | 0 |
| Y | SHW70 | 49 | 1667 |
| Y | SHW60 | 307 | 128 |
| Y | SHW70 | 0 | 128 |
| Y | STS | 398 | 214 |
| Y | VT_10 | 154 | 0 |
| Y | VT_20 | 154 | 0 |

Projections of live tree, standing dead wood and harvested wood products carbon stocks in the project area in the baseline scenario for the first crediting period from 2019 – 2039 are shown below.

### Table E1-12. Baseline $CO_2$e stocks

| Year | Total Live CO2e (t/ac) | Standing Dead CO2e (t/ac) | Harvested Wood Products CO2e (t/ac) |
|---|---|---|---|
| 2019 | 132.57 | 2.58 | 1.09 |
| 2021 | 116.06 | 2.19 | 0.80 |
| 2022 | 101.41 | 1.84 | 0.80 |
| 2023 | 86.75 | 1.49 | 0.80 |
| 2024 | 72.09 | 1.14 | 0.80 |
| 2025 | 73.87 | 1.02 | 0.80 |
| 2026 | 75.65 | 0.90 | 0.80 |
| 2027 | 77.42 | 0.78 | 0.80 |
| 2028 | 79.20 | 0.66 | 0.80 |
| 2029 | 80.97 | 0.54 | 0.80 |

| Year | Total Live CO2e (t/ac) | Standing Dead CO2e (t/ac) | Harvested Wood Products CO2e (t/ac) |
|---|---|---|---|
| 2030 | 82.30 | 0.51 | 0.80 |
| 2031 | 83.63 | 0.48 | 0.80 |
| 2032 | 84.95 | 0.45 | 0.80 |
| 2033 | 86.28 | 0.42 | 0.80 |
| 2034 | 87.60 | 0.39 | 0.80 |
| 2035 | 89.22 | 0.39 | 0.80 |
| 2036 | 90.84 | 0.40 | 0.80 |
| 2037 | 92.46 | 0.40 | 0.80 |
| 2038 | 94.08 | 0.41 | 0.80 |
| 2039 | 95.70 | 0.41 | 0.80 |

The figure below depicts the projected baseline stocks, average baseline stock for the first crediting period, and projected with-project stocks (see below for derivation of with-project stock projections).

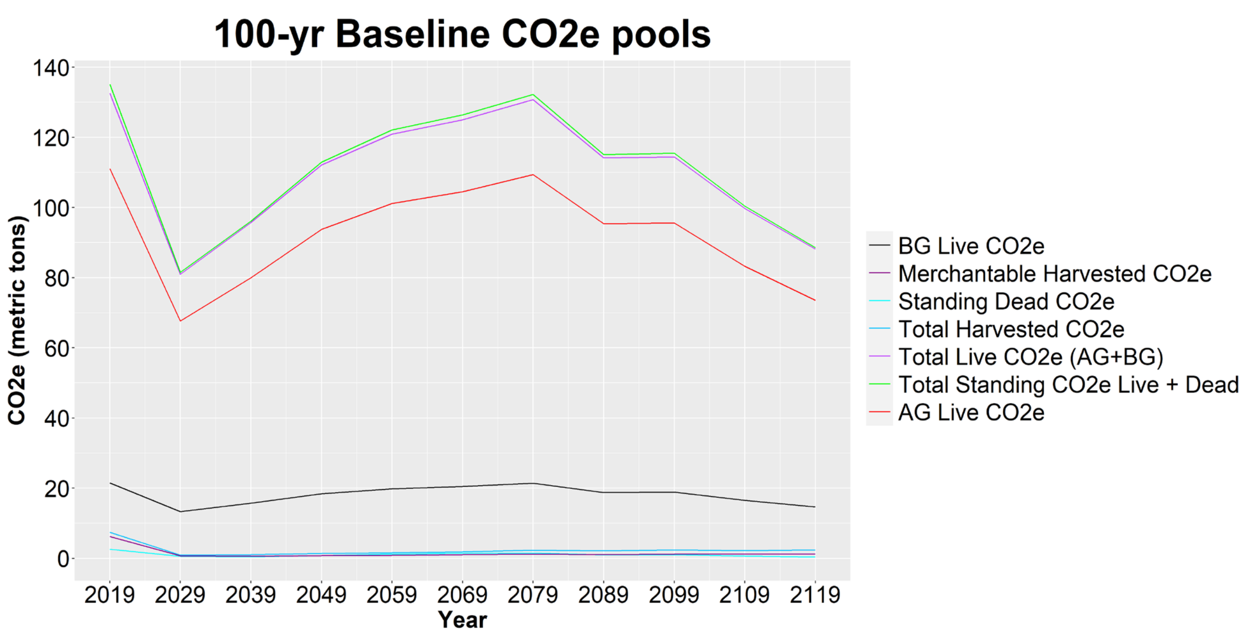


**Figure E1-1 Total standing (Live + Dead) $CO_2$e under baseline and project scenarios**

# E2. PROJECT SCENARIO

The actual project scenario is measured through future inventories over the course of the project lifetime. However, we produce an ex-ante projection of the project scenario assuming the landowner will conduct the harvest types described in Section A6.2.

# E3. LEAKAGE

Quantification of leakage is limited to market leakage, as no activity-shifting leakage is allowed by the methodology beyond *de minimis* levels.

Market leakage was determined by quantifying the merchantable carbon removed in both the baseline and with-project cases. Carbon in long-term storage in in-use wood products and landfills, calculated above, was used to assess relative amounts of "total wood products produced" in the two scenarios. No timber harvest is projected to take place in the project scenario. The decrease in wood production relative to the baseline was then calculated and the applicable market leakage discount factor was determined.

**Table E3-1. Baseline leakage factors**

| Period | Total HWP stored for 20 yr crediting period Baseline Scenario (tCO2e) | Total HWP stored for 20 yr crediting period Project Scenario (tCO2e) | Decrease in Wood Products as Percentage of Baseline Stocks | Applicable Leakage Factor (%) |
|---|---|---|---|---|
| 2019 - 2039 | 590,721 | 71,605 | 87.88% | 40.00% |

# E4. UNCERTAINTY

We computed uncertainty in project and baseline $CO_2e$ according to equations 10 and 18 of the ACR protocol. Error terms for live and dead $CO_2e$ are calculated using the inventory data. As required by ACR equations 10 and 18, these error terms ($e_{TREE}$ and $e_{DEAD}$), estimated from the most recent inventory data, are used for computing total $CO_2e$ uncertainty in both the project and baseline scenarios. The ACR protocol also specifies that the error term for live $CO_2e$ ($e_{TREE}$) be used as the uncertainty estimate for $CO_2e$ stored in wood products. No slash burning is anticipated, so expected greenhouse gas emissions (GHG) under both the project and baseline scenarios are zero. Total uncertainty in combined baseline $CO_2e$ stocks (ACR equation 10) is described in Tables E1-4 – E1-6.

# E5. REDUCTIONS AND REMOVAL ENHANCEMENTS

Table E5.a shows estimated net reductions and removal enhancements attributable to the Boone project over the first 20-year crediting period (2019 - 2039). As the annual project-level uncertainty was below the 10% threshold required by the ACR protocol, no uncertainty deduction was applied to the annual Emission Reduction Tons (ERTs) generated by the project. ERTs presented in Table A7-1 incorporate the assumed 40% market leakage. ERTs are dated beginning on October 19, 2019, the project Start Date. Therefore, annual values in Table A7-1 correspond to the 1-year interval ending on February 28 of each year.

# E6. EX-ANTE ESTIMATION METHODS

Table E6-1 shows projected $CO_2e$ stocks under the project scenario described in Sections A6.2 and E2.

**Table E6-1. Project $CO_2e$ stocks**

| Year | Total live CO2e (tons/acre) | Standing dead CO2e (tons/acre) | Total HWP CO2e (tons/acre) |
|---|---|---|---|
| 2019 | 132.57 | 2.58 | 0.20 |
| 2021 | 136.99 | 2.58 | 0.20 |
| 2022 | 139.84 | 2.58 | 0.20 |
| 2023 | 142.69 | 2.58 | 0.20 |
| 2024 | 145.54 | 2.58 | 0.20 |
| 2025 | 149.04 | 2.58 | 0.20 |
| 2026 | 152.54 | 2.58 | 0.20 |
| 2027 | 156.04 | 2.58 | 0.20 |
| 2028 | 159.54 | 2.58 | 0.20 |
| 2029 | 163.03 | 2.58 | 0.20 |
| 2030 | 166.27 | 2.58 | 0.20 |
| 2031 | 169.51 | 2.58 | 0.20 |
| 2032 | 172.75 | 2.58 | 0.20 |
| 2033 | 175.98 | 2.58 | 0.20 |
| 2034 | 179.22 | 2.58 | 0.20 |
| 2035 | 182.30 | 2.58 | 0.20 |
| 2036 | 185.37 | 2.58 | 0.20 |
| 2037 | 188.44 | 2.58 | 0.20 |
| 2038 | 191.52 | 2.58 | 0.20 |
| 2039 | 194.59 | 2.58 | 0.20 |

# F. COMMUNITY & ENVIRONMENTAL IMPACTS

## F1. NET POSITIVE IMPACTS

*An assessment of the project's environmental risks and impacts, including factors such as climate change mitigation and adaptation, biodiversity, air quality, water quality, soil quality, and ozone quality, as well as the protection, conservation, or restoration of natural habitats such as forests, grasslands, and wetlands. The assessment shall: 1) identify each risk/impact; 2) categorize the risk/impact as positive, negative, or neutral and substantiate the risk category; 3) describe how any negative impacts will be avoided, reduced, mitigated, or compensated; 4) detail how risks and impacts will be monitored, and how often and by whom; and 5) describe how positive impacts contribute to sustainable development goals (optional).*

| | |
|---|---|
| Impact | Carbon sequestration |
| Risk Category | Positive |
| Monitoring Plan (how, how often, by whom) | Forest management activities described in the Forest Management Plans and monitoring for the carbon project is described in Section D2. Monitoring Plan |
| If negative, describe aversion, reduction, mitigation, or compensation strategy: | n/a |

| | |
|---|---|
| Impact | Habitat protection for wildlife, plant species, and trees in the forested communities. |
| Risk Category | Positive |
| Monitoring Plan (how, how often, by whom) | Forest management activities described in the Forest Management Plans and monitoring for the carbon project is described in Section D2. Monitoring Plan. |
| If negative, describe aversion, reduction, mitigation, or compensation strategy: | n/a |

| | |
|---|---|
| Impact | Water quality protection |
| Risk Category | Positive |
| Monitoring Plan (how, how often, by whom) | Forest management activities described in the Forest Management Plans and monitoring for the carbon project is described in Section D2. Monitoring Plan. |
| If negative, describe aversion, reduction, mitigation, or compensation strategy: | n/a |

| | |
|---|---|
| Impact | Protection from soil erosion and degradation |
| Risk Category | Positive |
| Monitoring Plan (how, how often, by whom) | Forest management activities described in the Forest Management Plans and monitoring for the carbon project is described in Section D2. Monitoring Plan. |
| If negative, describe aversion, reduction, mitigation, or compensation strategy: | n/a |

| | |
|---|---|
| Impact | Access to recreation opportunities |
| Risk Category | Positive |

| | |
|---|---|
| Monitoring Plan (how, how often, by whom) | Forest management activities described in the Forest Management Plans and monitoring for the carbon project is described in Section D2. Monitoring Plan. |
| If negative, describe aversion, reduction, mitigation, or compensation strategy: | n/a |

The Bluesource – Boone Forestlands Improved Forest Management project has no anticipated negative community or environmental impacts. Annual attestations confirming this assessment will be provided.

## F2. STAKEHOLDER COMMENTS

N/A. The Project Proponent, Boone Forestlands, LLC is a private forestland owner, and adhered to their internally agreed upon practices of project consultation and notification on associated decision making. The Bluesource – Boone Forestlands Improved Forest Management project comprises forestland owned by Boone Forestlands, LLC, a private forestland owner. No formal stakeholder consultation was conducted in advance of the project, nor was any required because the property is privately held. If the Project Proponent is contacted by any persons regarding the project, the Project Proponent will provide references to the publicly available documentation for the project. Boone Forestlands, LLC will provide references to the publicly available documentation for the project.

# G. OWNERSHIP AND TITLE

## G1. PROOF OF TITLE

### G1.1 Ownership of forestlands

Forestlands included in the project are owned directly by the Project Proponent, Boone Forestlands, LLC, who hold full legal titles and thus have long term control of the land. The relevant deeds and contracts are available for review by verifier.

### G1.2 Emission reduction rights

Emissions reductions rights are owned by the Project Proponent.

## G2. CHAIN OF CUSTODY

No sales or purchasing of offsets was conducted prior to project registration.

## G3. PRIOR APPLICATION

The Bluesource – Boone Forestlands Improved Forest Management project has not previously applied or been registered under any GHG emission trading system or program.

# H. PROJECT TIMELINE

## H1. START DATE

The project "Bluesource – Boone Forestlands Improved Forest Management Project" has a project start date of October 19, 2019, the date as stated in the proponent's resolution. This start date is appropriate and consistent with the ACR Standard v. 7.0.

## H2. PROJECT TIMELINE

Below is a schedule of the project activities in chronological order for important aspects of the Bluesource – Boone Forestlands Improved Forest Management Project.

| Project Activity | Date | Source/Notes |
|---|---|---|
| Project Start Date (Initiation of project activities) | October 19, 2019 | Resolution (as approved by ACR) |
| Frequency of monitoring, reporting and verification | | Every 5 years after the first verification |
| Length of First Crediting period | Through October 18, 2039 | 20 years |
| Expected project longevity | Minimum Project Term of at least 40 years | 40 years |