

PART I - CLIMATE IMPACT AND INITIAL FINDINGS

CREST CLIMATE

HUBS

CLIMATE ACTION REPORT

BACK CREEK
MONROE COUNTY
WEST VIRGINIA
United States of America

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CLIMATE ACTION REPORT

FOR BACK CREEK, MONROE COUNTY, WV BY CREST FOUNDATION

Climate change has enormous impact on survival of all living creatures. Failure to adapt is one of the major factors for extinction. studying endangered species, geological changes and damage causing factors can lead way to define a methodical roadmap in conceptualizing Climate Hubs (which has direct influence on human wellbeing as well).

A consolidative study based on online research from authentic sources focusing on several man-made developments across state of West Virginia further boiling down to Monroe county. This includes mapping of climate and geological changes occurred over period of time and its impact on natural resources. Fact remains that State of West Virginia ranks 49 of 50 in the state rankings of the US sustainability Development Report 2021. That makes it even more critical for Climate Hub to design targets based on corrective actions to achieve important Sustainability GOALS specific to Back Creek, Monroe County, WV.

These considerations are increasingly critical to integrate with the principles of the new age community developments across the modern world for future proof human science. Climate Action Report designed by CREST Foundation is a scientific framework to build Climate Hubs to combat both climate and lifecycle disasters. Part - 1 navigates first step towards Climate and Project Feasibility. Primary focus of this report is to constitute a solution framework to restore ecological balance with broad roadmap towards environmental impact goals of CREST Foundation overlapped and measured in comparison with UN Sustainable Development Goals defined for the state of West Virginia. Evidence and results occurred in this report will be further evolved in Report II - Climate Hub Design and Implementation Roadmap with micro level details based on intense on ground and inperson inspection of the site location involving several subject matter experts.

A photograph of a hiker standing on a rocky mountain peak, looking out over a vast, rugged mountain range under a dramatic, cloudy sky.

PILOT STUDY OF
BACK CREEK AT
**MONROE
COUNTY**

PILOT STUDY OF MONROE COUNTY

BACK CREEK WILDERNESS

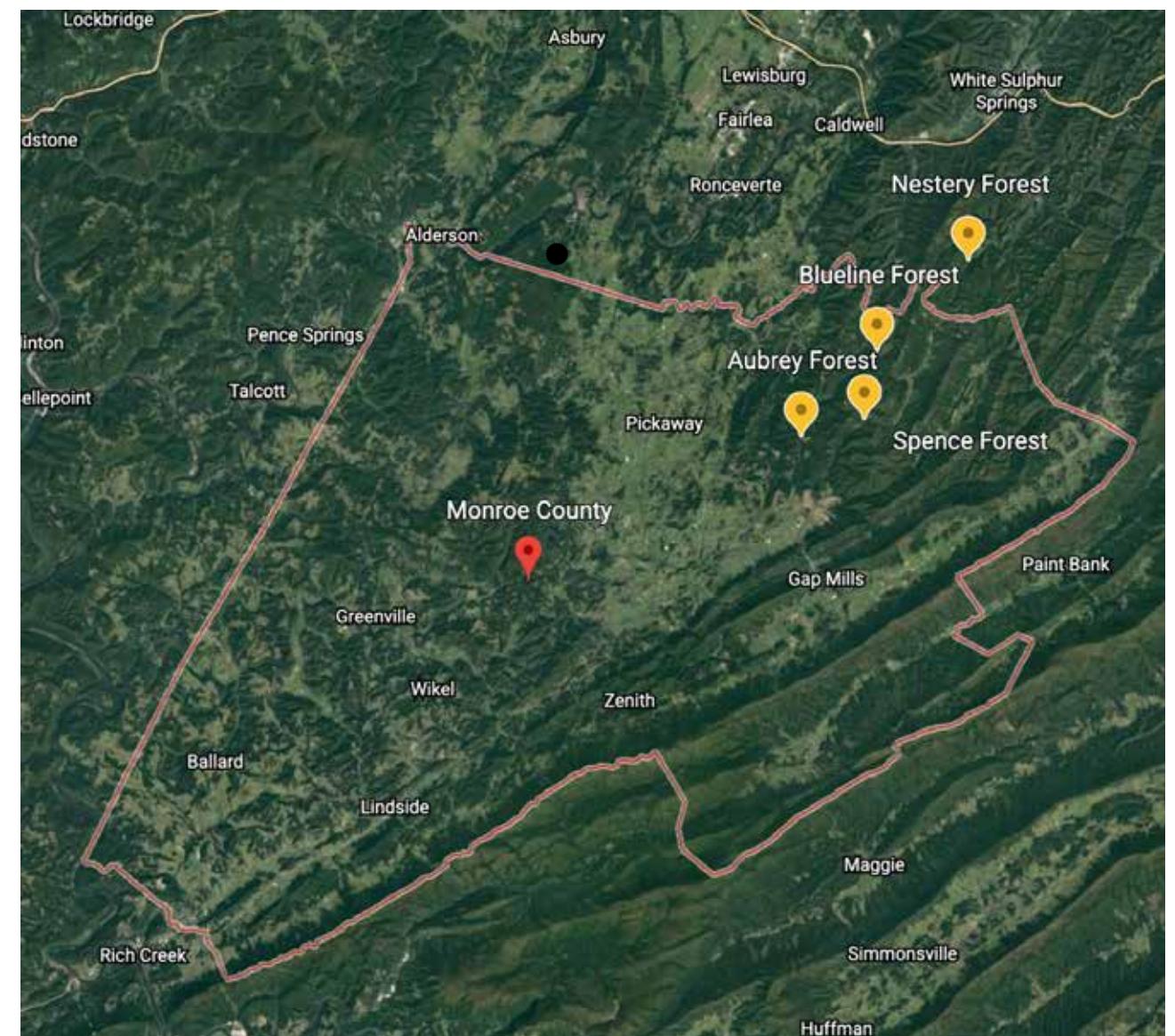
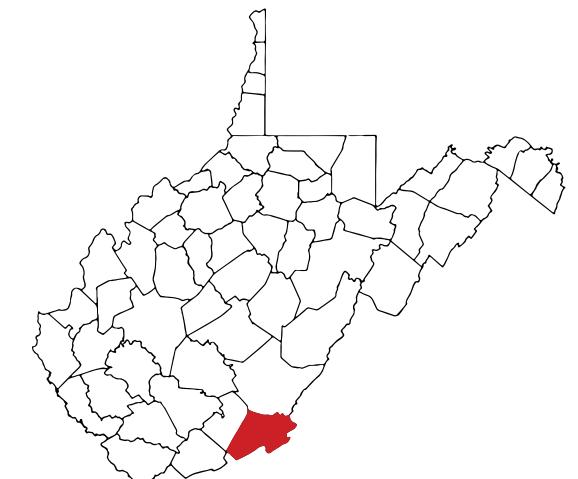
The 5771-acre Back Creek Wilderness property shares a common boundary with the George Washington - Jefferson National Forest and the Moncove Lake Wildlife Management Area. The forest has a long history of quality timberland management influenced by investment parameters designed to maximize timber production, while maintaining the highest and best use of the land.

The property has been managed under West Virginia Best Management Practices and is currently FSC third-party certified. At present, there are no county zoning restrictions, allowing for the expansion of property use. Back Creek Wilderness is a tremendous producer of Oxygen and Carbon Sequester. With 5771 acres, the vigorously growing forest is sequestering approximately 1 million tons of Carbon Dioxide each per year.



LOCATION

Monroe County lies on the southeast side of West Virginia while the property falls on the Northeast Quadrant of Monroe County. The county's terrain is mountainous and covered with trees with all sufficiently flat surfaces dedicated to Agriculture.



CONNECTIVITY

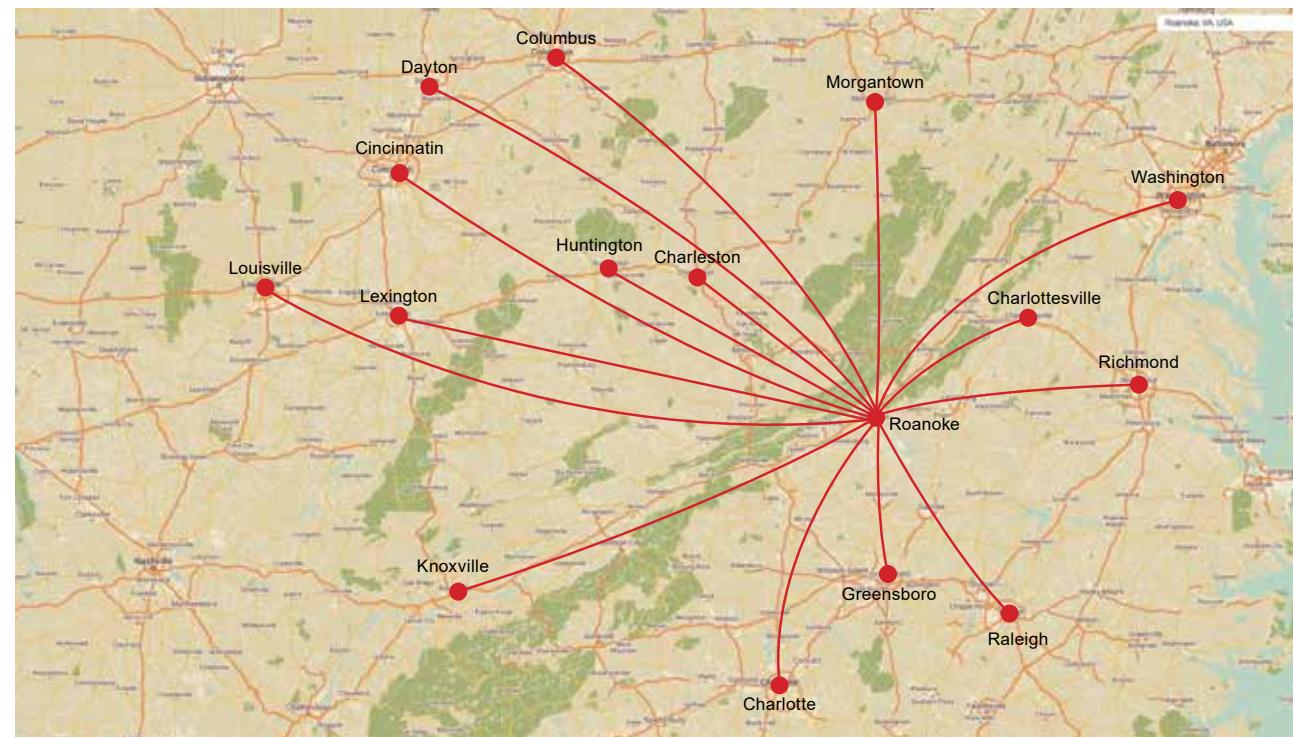
ROANOKE, VA TO BACK CREEK, MONROE COUNTY, WV

Back Creek is about 1hour's driving distance from Roanoke-Blacksburg Regional Airport and about 4 hours from Washington, DC.

Major highways that run through the county are:

• US Highway	219
• West Virginia Route	3
• West Virginia Route	12
• West Virginia Route	122
• West Virginia Route	311

“Roanoke-Blacksburg Airport connects over 16 major airports which can be reached in about 1.5 hours by air or less than 4 hours by road”



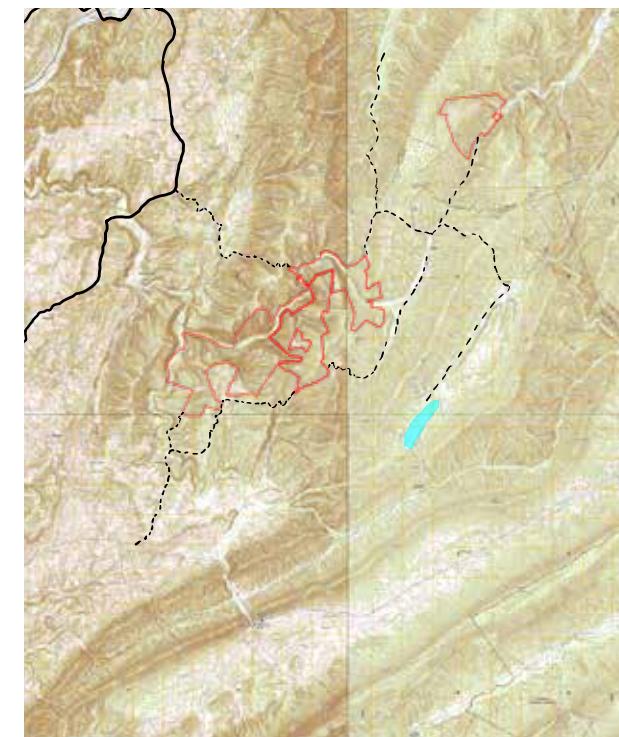
INTERNAL ROAD NETWORK AT BACK CREEK AND MONROE COUNTY, WV

Back Creek Land holds over 4 forests that are part of the project location, Aubrey, Blueline, Spence and Nester. While Aubrey, Blueline and Spence share common boundaries and are part of Monroe County, Nester is 5.1 miles i.e., 11 minutes away and is part of Greenbrier county.

The project location is accessible by four roads and one of them is directly connected to US highway 219 by 5 miles. These roads are not fully paved in several locations and are predominantly dirt roads.

The entire project is on a mountainous terrain due to which there are very few relatively flat lands that are ideal for development.

To access these lands, two new roads with a span of 1 mile each have been proposed.



“Undeveloped road network at BackCreek shows virgin forestry with very limited access to habitable flat lands”

- | | |
|-----------------|----------------|
| — Site Boundary | ---- Roads |
| — Highway | — Moncove Lake |

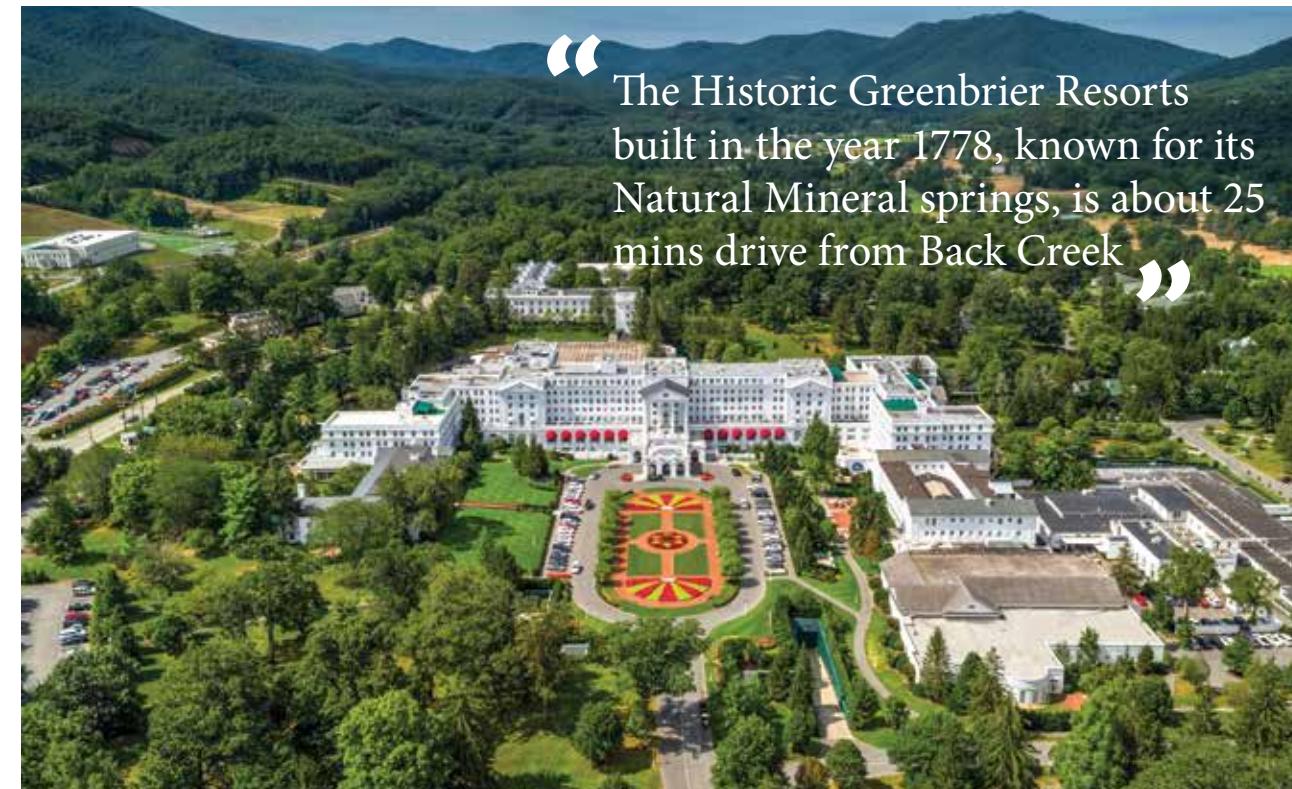
SURROUNDING DEVELOPMENTS

BACK CREEK, MONROE COUNTY, WV

The village of Union is a 30-minute drive from the property. It has facilities such as Banking, healthcare, drugstore, grocery shopping, farm center, and a family restaurant.

The coolest small-town Lewisburg is 45 minutes away. It interestingly has a year-round live theatre, Carnegie Hall, several fabulous restaurants, antique shops, and boutiques, along with hospitals and medical facilities.

The World-Famous Greenbrier resort is few hours drive from the property. Major airports connecting Monroe County are Greenbrier Valley airport & Raleigh County Memorial Airport are not more than an hour away from Back Creek.



“ The Historic Greenbrier Resorts built in the year 1778, known for its Natural Mineral springs, is about 25 mins drive from Back Creek ”

ATTRACTIOnS

BACK CREEK'S RECREATIONAL OPPORTUNITIES

Back creek wilderness offers unparalleled recreational opportunities. Numerous soft recreational activities are anchored by 6 miles of back creek.

Natureviewing

Nature viewing is one of the most sought after activities at Back Creek. Attentive wildlife management has been geared not to just game animals but equal consideration has been extended to increase the numbers and diversity of species including neo-tropical songbirds, butterflies, turtles, frogs, rabbits, chipmunks, dragonflies, owls, hawks.



Stargazing-Planet Observation

Experiencing complete darkness in modern world the most sort after exploration by millennials. Back Creek and Monroe County in specific is known for its pristine star gazing and camping sites of America, thereby affording the opportunity to develop millennial housing with zero light pollution making it most aspirational great night sky living a brilliant wonder.



All Terrain Motorsports

Back Creek Wilderness has about 30 miles of internal roads and some 100 miles of forest trails that are perfect for experiencing the property from an ATV or UTV. The riders can go from down along the streams, wind through the pine and hardwood forest and climb nearly 1400' to the highest ridges.



ATTRACTI0NS

BACK CREEK'S RECREATIONAL OPPORTUNITIES

Hunting

The 22 miles of creeks and intermittent streams provide habitat for wood duck, geese, and mallards. White tail deer, black bear, red/gray fox, bobcat, wild turkey, grouse, squirrel, raccoon, fox, and rabbit make up the resident wildlife population. It is hard to find a property that has a better mix of wildlife as there has been professional wildlife management for many years.

- Shooting-sports devotees find all the land and privacy needed to enjoy:
- Paintball-Airsoft-Laser tag-Archery tag
- Shotgun sport shooting including Skeet, Trap, Double Trap and Sporting Clays
- Rifle & Handgun shooting: bullseye, silhouette, western, bench rest, long-range, fast draw
- Archery and Crossbow competition shooting
- An old 22 single shot rifle and a few tin cans make a fun day



“
Bikers across the
world visit Back Creek
Wilderness to experience
its famous 100 miles of
beautiful and historic
forest trails ”

ATTRACTI0NS

BACK CREEK'S RECREATIONAL OPPORTUNITIES

Water-Sports

Enthusiasts will find the streams ideal for: Swimming, canoeing, fishing, kayaking, tubing, snorkeling, paddle boarding and windsurfing.



Dirt Bikes

Can also be a lot of fun and they come in all sizes and horsepower to fit anyone who enjoys being on two wheels.



Mountain Biking, Horseback Riding and Hiking

The same trails used for Motorsports can also be used for mountain biking or horseback riding. The trails are designed to be on gentle grades but some trails coming off the river offer a more challenging climb.





STUDY OF
BIONETWORK
AT MONROE COUNTY

A study of the existing biological network around Monroe County helps us in understanding the several factors of sustainability that effect the living conditions of Humans along with study of its Flora, Fauna, and the most endangered / vulnerable species spread across the wilderness property.

AIR

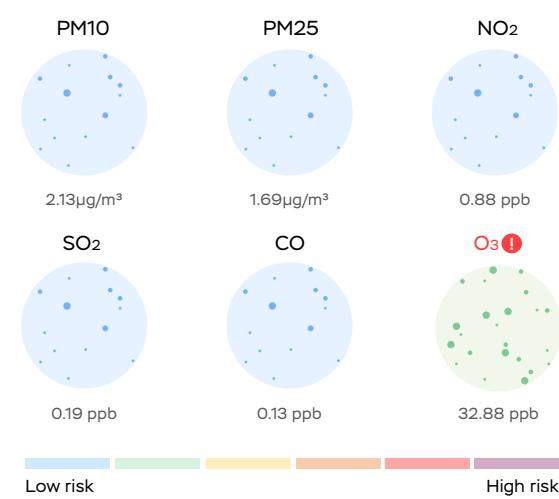
AIR QUALITY INDEX (AQI), AT MONROE COUNTY

The Environmental Protection Agency (EPA) calculates the AQI for five major air pollutants, for which national air quality standards have been established to safeguard public health.

1. Ground-level ozone
2. Particle pollution/particulate matter (PM_{2.5}/pm 10)
3. Carbon Monoxide
4. Sulphur dioxide
5. Nitrogen dioxide

The air quality in Monroe County is good with the only moderate contaminant being ground level O₃ (Ozone) which is not harmful. The average AQI is 29.

POLUTANTS IN MONROE COUNTY, WV UNITED STATES



“ Monroe County’s Air Quality Index (AQI) is currently good with negligible pollution in terms of particulate matter, carbon monoxide, Sulphur dioxide & nitrogen dioxide. ”

This information is based on data available online and the stats may vary when a detailed, on ground survey is performed at the location.

AQI	REMARKS	COLOR CODE	POSSIBLE HEALTH IMPACTS
0-50	Good	Green	Minimal Impact
51-100	Satisfactory	Light Green	Minor breathing discomfort to sensitive people
101-200	Moderate	Yellow	Breathing discomfort to the people with lungs, astama and heart deases
202-300	Poor	Orange	Breathing discomfort to most people on prolonged exposure
301-400	Very Poor	Red	Respiratory illness on prolonged exposure
401-500	Severe	Dark Red	Affects healthy people and seriously impacts those with existing diseases

SOIL

KARSTLAND, MONROE COUNTY

The Greenbrier limestone formation (pink) dominates the landscape of northern Monroe County covering over 70 square miles. Swopes Knobs is a remnant of the Bluefield formation (blue) comprised of red and green shale with a few thin limestone lenses. It rests on top of the Greenbrier formation, draining onto the Greenbrier karstland to the north, east and west. Presence of excess limestone leads to karsts and sinkholes.

“A sinkhole is a depression or a hole in the ground majority of which are caused by karst processes – the chemical dissolution of carbonate rocks, collapse or suffusion processes. Sinkholes are usually circular and vary in size from tens to hundreds of meters both in diameter and depth and vary in form from soil-lined bowls to bedrock-edged chasms. Sinkholes may form gradually or suddenly.

Prediction of sinkhole location or occurrence is difficult and there is always a significant degree of uncertainty associated with the occurrence of future sinkholes. Structures built within the area of influence of a sinkhole can also be affected by sinkhole collapse or subsidence. By virtue of the underlying geologic formation, the Owner must acknowledge there is an inherent risk of potential ground subsidence or collapse associated with construction of structures in karst terrain. All sites in karst terrain have the potential for sinkhole formation.” This limestone also hosts the largest, deepest, and most complex caves, the largest karst basins, the largest number of caves, and one of the largest karst springs in West Virginia.

- » Monroe has 30 identified mines listed in The Digging.
- » The most listed primary commodities in Monroe mines are Manganese, Iron, and Nickel.
- » At the time these mines were surveyed, 15 mines in Monroe were observed to have ore mineralization in an outcrop, shallow pit, or isolated drill hole—known as an occurrence mine.

Monroe has 4 prospect mines. 11 mines were in production at the time the data was entered into USGS records.

Top Commodities in Monroe County, West Virginia

- » Manganese (17)
- » Iron (13)
- » Nickel (2)



“ Monroe County karstland is one of the world’s densest sinkhole plains, with an average of 18 sinkholes per square kilometer ”

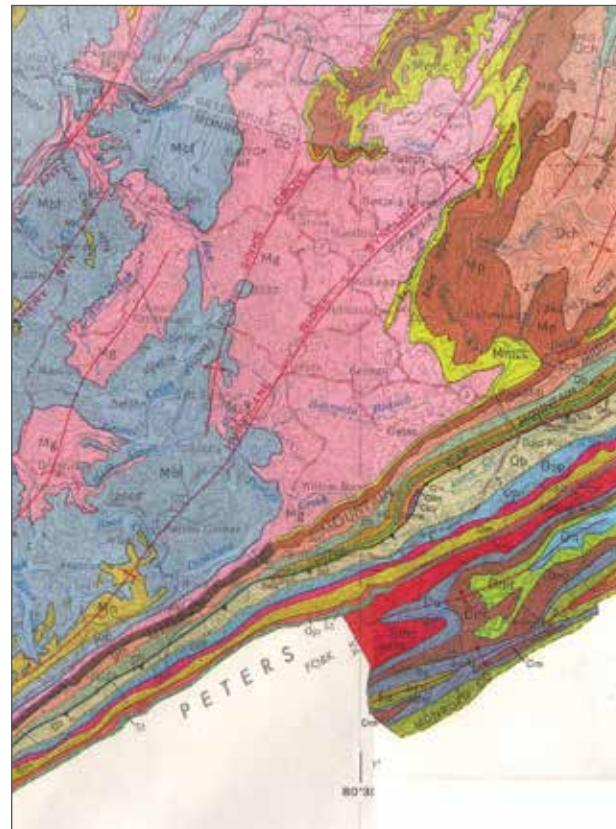
SOIL

SINKHOLE PLAINS AT MONROE COUNTY

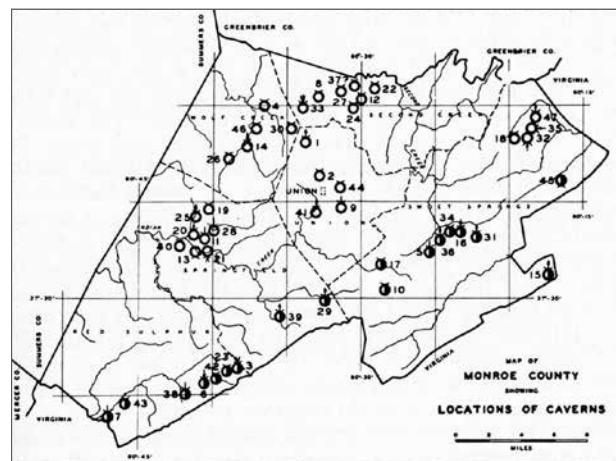
The Greenbrier limestone formation (pink) dominates the landscape of northern Monroe County covering over 70 square miles. Swopes Knobs is a remnant of the Bluefield formation (blue) comprised of red and green shale with a few thin limestone lenses. It rests on top of the Greenbrier formation, draining onto the Greenbrier karstland to the north, east and west.



The 1925 West Virginia Geological Survey listed 49 caves in Monroe County. Hundreds are known today, including the extensive Scott Hollow cave system found in 1985. Scott Hollow drains an area of at least a fourteen square miles and possibly much more. Mystic River, the underground river flowing through the Scott Hollow cave system, stretches five miles from deep under the Knobs to within two miles of the Greenbrier River. Twenty-eight miles of cave passages have mapped so far in Scott Hollow.



Geological Formations at Monroe County



Location of Caverns at Monroe County

WATER

WATERSHED ASSESSMENT

Detailed study is essential to examine how these caves are affecting the property and to also understand the actual soil biology.

Major sources of Water

- Laurel Creek
- Second Creek
- Mountain Springs
- Water wells

Though public water is available from springs and wells in Union, Greenville, and Peterstown, most of the county depends on private springs and wells for water.

Additionally, the karst formation has many cracks, tunnels, and fissures. The monitor lineament is an easily spotted straight line across the Monroe County landscape. On close observation it is a six-mile-long string of sinkholes, likely caused by water flowing along an ancient fracture and slowly dissolving the limestone, causing it to collapse.

Flowing through relatively hollow karst, contaminants from the surface can dump directly into the groundwater. In addition, wells of any sort, shallow or deep, drilled into karst can potentially divert water to a deeper conduit in the limestone

“Second creek falls along with limestone, caverns, and karst terrain due to which contaminants on the surface could get diverted to the property through the creek and karst basins”



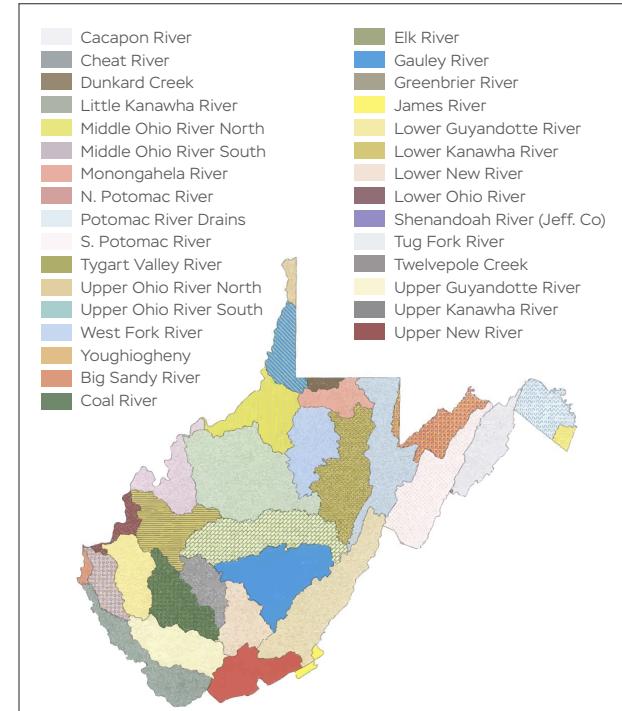
WATER

WATERSHED ASSESSMENT

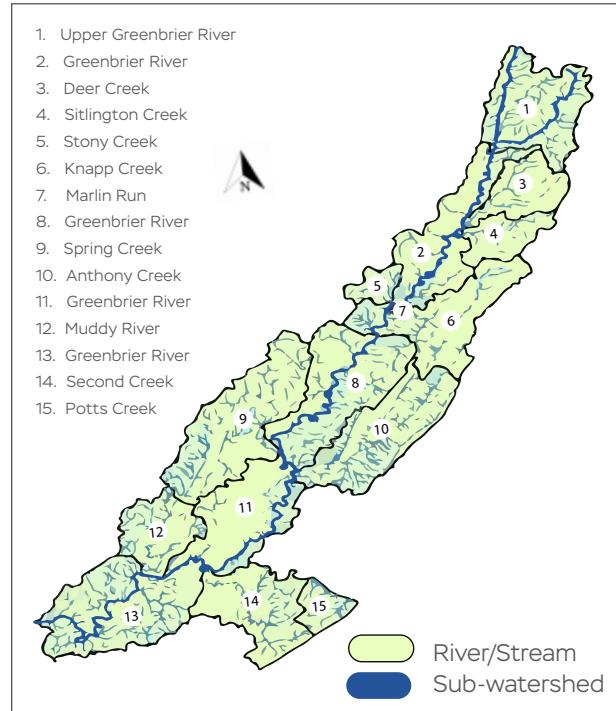
The project site is in the Greenbrier River watershed. The Greenbrier watershed is in south-eastern West Virginia and encompasses approximately 1,646 square miles. The majority of the watershed lies within Pocahontas, Greenbrier, Monroe and Summers counties. Major tributaries include, East Fork and West Fork of the Greenbrier River, Deer Creek, Sitlington Creek, Knapp Creek, Anthony Creek, Spring Creek, Howard Creek, Second Creek, and Muddy Creek.

The average elevation in the watershed is 3,034 feet above mean sea level. The highest point is at 4,703 feet on Red Spruce Knob, which is in the western portion of the watershed in Pocahontas County. The minimum elevation is 1,365 feet at the confluence of the Greenbrier River with the New River.

Map of West Virginia Watersheds



Greenbrier Watershed



WATER

SECOND CREEK SUB-WATERSHED

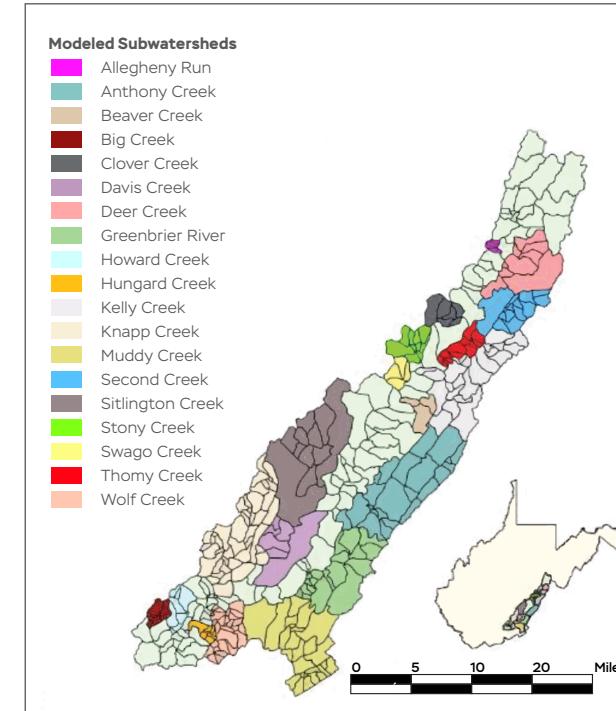
The Department of Environmental Protection has received a number of reports of excessive algal growth along certain sections of the Greenbrier River which has made fishing and swimming in the areas nearly impossible during portions of the summer season.

The initial investigation documented conditions in the mainstem of 2010 Integrated Water Quality Monitoring and Assessment Report 16 the Greenbrier River.

Thick algal mats and/or large areas of attached filamentous algae growth occurred over approximately 50 miles of the river, at times stretching from bank to bank. Similar conditions occurred in 2008. During both 2007 and 2008, public water suppliers drawing river water from affected areas received complaints of odour in their drinking water requiring initiation of additional treatment measures.

In 2009, DEP personnel performed intensive water quality sampling along the Greenbrier River as the algae began to bloom. Instream grab samples were analyzed for total and dissolved phosphorus, total nitrogen, alkalinity, hardness, and other parameters. Both the chemical and physical conditions in the Greenbrier River – including hardness, alkalinity, temperature, clarity, and substrate – proved to be ideal for growth of filamentous algae.

Greenbrier Sub-watersheds



“ Increase in algal growth also makes it impossible for fishing and swimming in certain portions during the summer ”

Fecal coliform bacteria TMDLs for the Greenbrier River Watershed

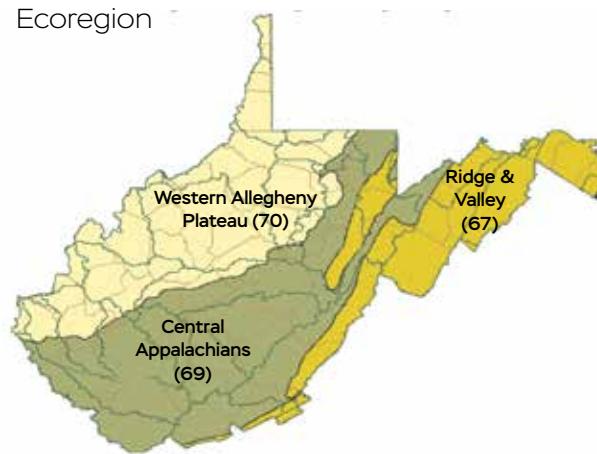
TMDL Watershed	Stream Code	Stream Name	Load Allocation (counts/day)	WWW	Margin of Safety (counts/day)	TMDL (counts/day)
Second Creek	WVKNG-23	Second Creek	1.93E+14	2.07E+10	1.01E+13	2.03E+14
Second Creek	WVKNG-23-G	Kitchen Creek/Second Creek	2.22E+13	NA	1.17E+12	2.34E+13
Second Creek	WVKNG-23-H	Back Creek	1.88E+13	NA	9.88E+11	1.98E+13

WATER

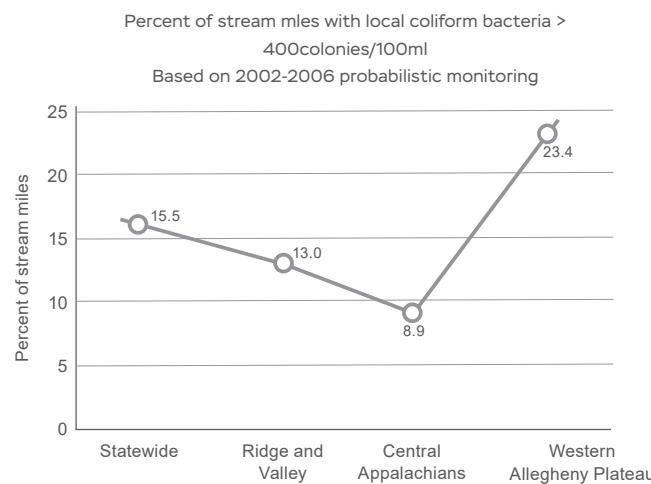
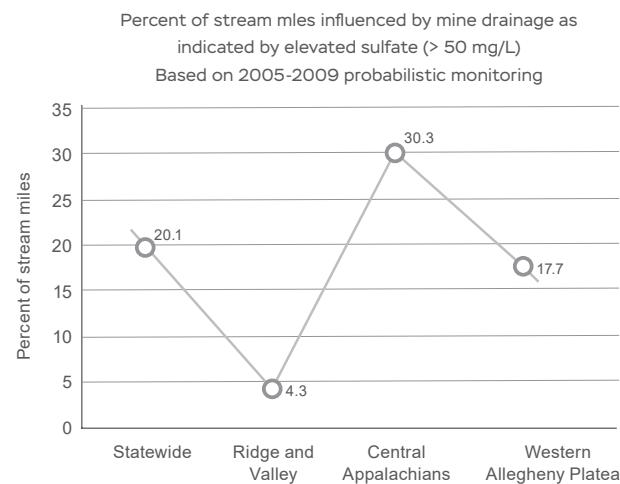
WATER QUALITY

Many West Virginia waters contain elevated levels of fecal coliform bacteria. Contributors to the problem include leaking or overflowing sewage collection systems, illegal homeowner sewage discharges by straight pipes or failing septic systems, and runoff from urban or residential areas and agricultural lands. Based on probabilistic data, about 15.5% of stream miles in the state have fecal coliform bacteria levels that exceed the criterion of 400 colonies/100mL.

In general, watersheds in the more developed regions of the state had a greater proportion of stream miles exceeding the criterion. The proportion of stream miles violating the criterion was highest in the Western Allegheny Plateau Ecoregion (23.4% of stream miles) and somewhat lower in the Central Appalachians (8.9% of stream miles) and the Ridge and Valley Ecoregions (13.0% of stream miles).



Mine drainage streams may be impaired by low pH and/or elevated concentrations of metals, including iron, aluminum, and manganese. Other dissolved ions such as sulfate may also be present in concentrations above ambient levels. A sulfate concentration greater than 50 mg/L was used to identify probabilistic sites influenced by mine drainage. On an ecoregional basis, mine drainage influences a greater proportion of stream miles in the coal rich Central Appalachians (Ecoregion 69) than in the Ridge and Valley (Ecoregion 67)



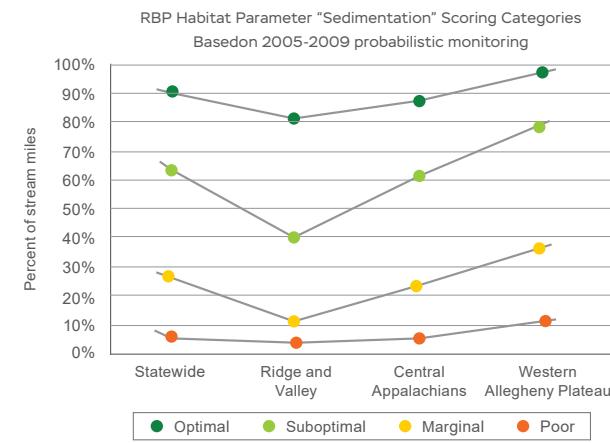
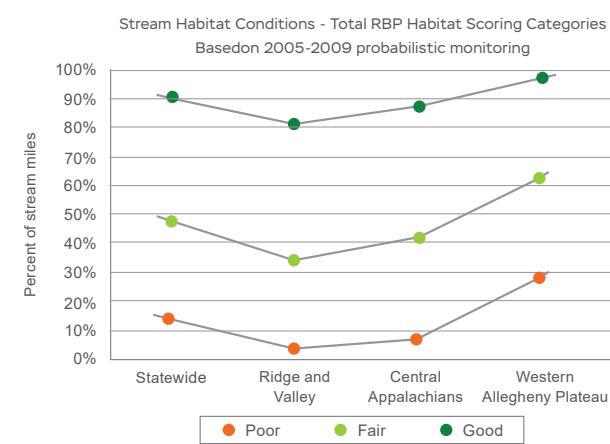
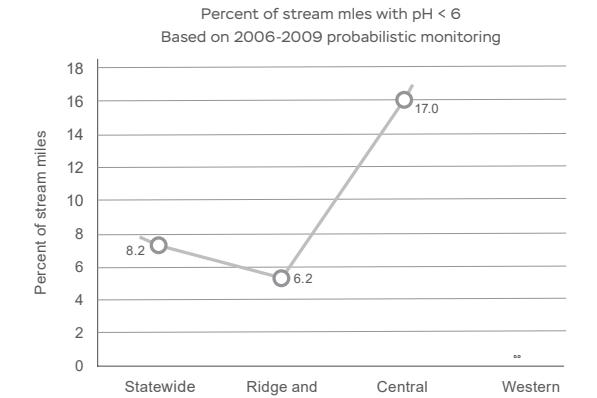
WATER

WATER QUALITY

The aquatic life communities in the headwater sections of many West Virginia waters continue to be impacted by low pH acidic water quality. The impairment is most prevalent in watersheds with soils of low buffering capacity and most often caused by acid precipitation and less often (but more severely) by acid mine drainage. An evaluation of probabilistic data indicates that approximately 8.2% of the stream miles in the state have pH values below 6.0 (Table 12). Most of the stream miles identified as impacted by acidic waters are in the Central Appalachians Ecoregion, representing 17.0% of the stream miles within this area. Specifically, the Forested Hills and Mountains section of this ecoregion are largely susceptible to acid deposition impacts due to infertile soils and resistant sandstones of the Pottsville group. The Ridge and Valley Ecoregion is less susceptible to the impacts of acid deposition with geologic materials such as limestone and shale providing more buffering capacity to neutralize acid precipitation. Nonetheless, probabilistic data indicates that approximately 6.2% of the stream miles in this ecoregion are impacted by acidic conditions.

The Ridge and Valley and Central Appalachians Ecoregions are similar with respect to overall habitat quality. Over 24% of stream miles in each of these ecoregions are of good quality and less than 7% are poor with respect to overall habitat quality. The presence of more widespread development and factors such as higher rates of soil erosion in this ecoregion are potential causes for only 2% of its stream miles being rated as good in overall habitat quality.

Sedimentation is one of the most significant problems facing West Virginia streams. Significant sources of increased sedimentation include agricultural activities, mining, logging, oil and gas, roads, urban and suburban development, and removal of stream bank and riparian vegetation. The effects of sediment deposition on stream biota are well known and include interference with respiration and the smothering of physical habitat and organism eggs. The widespread impacts of sedimentation in West Virginia are apparent in that over 83% of the wadeable streams miles in the state score less than optimal.



FLORA

AGRICULTURE & FOREST ECOSYSTEMS AT MONROE COUNTY

Forest Species:

The forest's predominately well-drained upland terrain has led to a resource dominated by hardwood species. Overall, the species composition is highly desirable and favors Appalachian hardwood types, consisting primarily of: Black Cherry, Sugar Maple, Poplar/Cucumber/Basswood, Red Oak Group, White Oak/Chestnut Oak, Soft Maple, Hickory, Ash, Black walnut and several other species like, birch, beech, sassafras, wahoo, buckeye



Agriculture:

Corn, soybeans, wheat, and truck crops such as tomatoes, lettuce, melons, beets, broccoli, celery, radishes, onions, cabbage, and strawberries are most cultivated wherever flat terrain is available in Monroe County. Other common crops are medicinal herbs and mushrooms, shade-loving native ornamentals, moss, fruit, nuts, other food crops, and decorative materials for crafts. These crops are often referred to as special forest products.



Here are some specific examples of crops in each category that are currently being cultivated:

Medicinal Herbs: Ginseng, goldenseal, black cohosh, bloodroot, passionflower, and mayapple
Mushrooms: Shiitake and oyster mushrooms
Native ornamentals: Rhododendrons and dogwood
Moss: Log or sheet moss
Fruit: Pawpaws, currants, elderberries, and lowbush blueberries
Nuts: Black walnuts, hazelnuts, hickory nuts, and beechnuts
Other food crops: Ramps (wild leeks), maple syrup, and honey
Plants used for decorative purposes, dyes, and crafts: Galax, princess pine, white oak, pussy willow branches in the spring, holly, bittersweet, and bloodroot and ground pine (<i>Lycopodium</i>)

FLORA

AGRICULTURE & FOREST ECOSYSTEMS AT MONROE COUNTY



Black Cherry



Sugar Maple



Ash Tree



Black Walnut



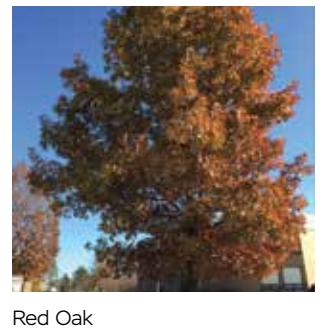
White Oak



Sassafras



Poplar Tree



Red Oak



Birch Tree



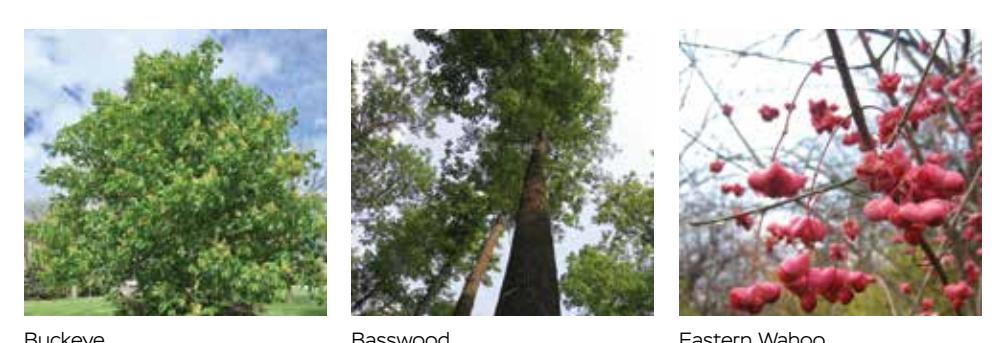
Beech Tree



Soft Maple



Hickory



Buckeye



Basswood



Eastern Wahoo

FAUNA

WILDLIFE AT MONROE COUNTY

Back Creek Wilderness is a major contributor to the local ecosystem's richness and diversity for both plants and animals. The 22 miles of streams/intermittent creeks and the surrounding aquatic plant life create a water supported community with a wide variety of wildlife. Some of the margin of the creeks are fringed by lowlands. These lowlands support the aquatic food web, provide shelter for wildlife, and stabilize the shore of the streams. The plant life associated with the wetland includes rushes, sedges, cattails, duckweed and algae.

There are many animals, that at times, live in and around the edges of the creeks including, trout, beaver, otters, mink, raccoons, opossums, blue herons, Canada geese, wood ducks, mallards, minnows, stocked fish, turtles, salamanders, newts, crayfish, muskrat, bull frogs, eagles, hawks and redwing blackbirds.

There is the insect and microscopic world including butterflies, dragonflies, pond skaters, water beetles, damselflies, tadpoles and various insect larvae.

The property has a mixture of mature hardwood species, white pine forest, and hemlock. The diverse tree species, coupled with the abundant water supply from the creeks and springs, creates the perfect wildlife habitat. The miles of "edge effect" created between the creeks, hollows, ridges, rock outcrops and forest is the textbook habitat benefiting all the resident wildlife. Bald eagles, white tail deer, black bear, wild turkey, squirrel, rabbit, bobcat, raccoon, fox and many species of songbirds, owls and raptors make up the resident wildlife population.

The hardwood forest provides the essential nutrient source and produces tons of hard mast including acorns, hickory nuts, beech nuts and black walnuts. Soft mast includes stag horn sumac, black cherry, tulip poplar seeds, maple seeds, autumn olive berries and blackberries.

“Diversity in forests at Back Creek provide favorable habitats for few wildlife species”



FLORA & FAUNA

ENDANGERED & VULNERABLE SPECIES

Endangered and vulnerable species are classified into,
CR - Critically Imperiled

NT - Near Threatened

EN - Imperiled

VU - Vulnerable

EX - Extinct

All species play an essential role in balancing the planet's ecosystem. Every living organism however small has a role to play in this vast biology of existence.

Some species such as Common Grackle, American Coot etc., though considered pests in agriculture, still help in curtailing and controlling other insect/bird/prey population thereby eradicating the implied threat to humans.

For e.g., as per a recent report by climate central (<https://medialibrary.climatecentral.org/resources/more-mosquito-days>) Mosquito days have increased from 182 days/year in 1980s to 217 days/year in 2010s and so is increase in the mosquito population which would soon go on to become a leading cause of diseases such as Malaria, dengue etc.,

“Mosquito days have increased from 182 days in 1980s to 217 days in 2010s making it a leading cause for Malarial infections”



These alarming rise in numbers are due to the increase in temperatures and, eradication of predatory species that control the population of these mosquitoes.

FLORA & FAUNA

FEDERALLY THREATENED AND ENDANGERED SPECIES IN WEST VIRGINIA

Federally Endangered Species		Critical Habitat	Year Listed	
Indiana bat	<i>Myotis sodalis</i>	Y	1967	
Gray bat (accidental)	<i>Myotis grisescens</i>		1976	
Pink mucket pearlymussel	<i>Lampsilis abrupta</i>		1976	
Virginia big-eared bat	<i>Corynorhinus townsendii virginianus</i>	Y	1979	
Running buffalo clover *	<i>Trifolium stoloniferum</i>		1987	
Harperella	<i>Ptilimnium nodosum</i>		1988	
Shale barren rockcress	<i>Arabis serotina</i>		1989	
Fanshell	<i>Cyprogenia stegaria</i>		1990	
Purple cat's paw pearlymussel	<i>Epioblasma obliquata obliquata</i>		1990	
Northeastern bulrush *	<i>Scirpus ancistrochaetus</i>		1991	
Northern riffleshell	<i>Epioblasma torulosa rangiana</i>		1993	
Clubshell	<i>Pleurobema clava</i>		1993	
James spiny mussel	<i>Pleurobema coffina</i>		1998	
Snuffbox	<i>Epioblasma triquetra</i>		2012	
Rayed bean	<i>Villosa fabalis</i>		2012	
Spectaclecase	<i>Cumber/andia monodonta</i>		2012	
Sheepnose	<i>Plethobasus cyphyus</i>		2012	
Diamond darter	<i>Crystallaria cincotta</i>	Y	2013	
Guyandotte river crayfish	<i>Cambarus veteranus</i>	Proposed	2016	
Rusty patched bumble bee	<i>Bombus affinis</i>		2017	
Candy darter	<i>Etheostoma osburni</i>	Proposed	2018	
Tuberclad-blossom pearly mussel	<i>Epioblasma torulosa torulosa</i>		Extirpated	
Federally Threatened Species		Critical Habitat	4(d) rule	Year Listed
Flat-spined three-toothed land snail	<i>Triodopsis platysayoides</i>			1978
Madison cave isopod	<i>Antrolana lira</i>	Y		1982
Small whorled pogonia	<i>Isotria medeoloides</i>			1982
Cheat mountain salamander	<i>Plethodon nettingi</i>			1989
Virginia spiraea	<i>Spiraea virginiana</i>			1990
Northern long-eared bat	<i>Myotis septentrionalis</i>		Y	2015
Big sandy crayfish	<i>Cambarus callainus</i>	Proposed		2016
Eastern black rail (accidental)	<i>Lateralis jamaicensis jamaicensis</i>		Y	2020
Species Proposed for Listing		Critical Habitat	Status	Year Listed
Round hickorynut	<i>Obovaria subrotunda</i>	Y	Thr.	2020
Longsolid	<i>Fusconaia subrotunda</i>	Y	Thr.	2020

Proposed for delisting

Revised: 30 September 2020

FLORA & FAUNA

ENDANGERED SPECIES AND REASONS FOR VULNERABILITY

“ About 64 species of Flora & Fauna are on the verge of extinction as per the IUCN Red List ”



Smooth Phlox



Violet Coral Fungus



Carolina Sweetshrub



Eastern Hemlock



American Elm



James River Spiny mussel



Bentley's Coralroot



Orange-fringed Orchid



Carolina Parakeet

FLORA & FAUNA

ENDANGERED SPECIES AND REASONS FOR VULNERABILITY



Sharp-shinned Hawk:
Due to DDT and other pesticides



Blue-winged Teal:
Marked as least concern by IUCN



Eastern Small-footed Myotis:
Endangered. Habitat loss



Common Grackle:
Considered as a pest by farmers.



Cope's Gray Treefrog:
Marked as least concern by IUCN



Peregrine Falcon:
Used in Falconry, decline due to DDT



Double-crested Cormorant:
DDT and colonization of the lakes



Decula 17-Year Cicada:
Marked as least concern by IUCN



American Bittern:
Habitat Loss



Black Tern:
Habitat Loss



Northern Myotis:
White-nose syndrome



Townsend's Big-eared Bat:
Marked as least concern by IUCN



Timber Rattlesnake:
Not declining fast so listed as least concern
and is endemic to the United States.



Black-bellied Salamander:
Threatened by habitat loss and is endemic to the United States.



Jefferson Salamander:
Species of least concern globally but its habitat is threatened.



Marsh Wren:
Loss of wetland habitat and wholesale draining of marshes

FLORA & FAUNA

ENDANGERED SPECIES AND REASONS FOR VULNERABILITY



Hermit Thrush:
Marked as least concern by IUCN



Evening Grosbeak:
Marked as least concern by IUCN



Long-eared Owl:
Marked as least concern by IUCN



Sora:
Predation and Roadkill



Blackpoll Warbler:
Marked as least concern by IUCN



Snowshoe Hare:
Vulnerability to climate change



Rudiloria kleinpeteri:
Marked as least concern by IUCN



Star-nosed Mole:
Marked as least concern by IUCN



Coal Skink:
Marked as least concern by IUCN



Upland Chorus Frog:
Habitat loss



Pied-billed Grebe:
Habitat loss due to destruction of wetlands



Gray Bat: Apparently secure and Human disturbance



Semipalmated Sandpiper:
Heavily dependent on few key stop over habitats during migration.



Bald Eagle:
Thinning of eggshells due to exposure to pesticide DDT and hunting.



Eastern Meadowlark:
Suitable for agricultural areas. Decline due to loss of suitable habitat.

FLORA & FAUNA

ENDANGERED SPECIES AND REASONS FOR VULNERABILITY



Brown Creeper:
Potentially vulnerable to logging, climate change, or replacement of those tree species by Ponderosa pine



Blackburnian Warbler:
Due to destruction of forest, this species lost 30% of its wintering and breeding habitat.



White-throated Sparrow:
considered least concern due Other predators and rivalry within white throated sparrows.



Loggerhead Shrike:
Habitat loss/pesticide contamination and human disturbance

FLORA & FAUNA

ENDANGERED SPECIES AND REASONS FOR VULNERABILITY



Pine Snake:
Least concern however; threatened due to continuous habitat destruction and degradation.



Little Brown Bat:
Listed as endangered in 2018 due to fungus-caused disease known as white-nose syndrome



Northern Cricket Frog:
Important indicators of wetland health and general environmental quality in the areas they inhabit.



Appalachian Cottontail:
Destruction and maturation of habitat, as well as habitat fragmentation which is due to urban development.



Yellow-bellied Sapsucker
considered least concern due to high population numbers and it is illegal to hunt, take, keep and kill this species in the united states without a permit



Black Vulture
It is considered as a threat by farmers due to its predation on newborn cattle and its excreta is harmful for trees and other vegetation.



Prothonotary Warbler:
Loss of habitat, also parasitized by the brown-headed cowbird (*Molothrus ater*), or outcompeted for nest sites by the house wren



Yellow-crowned Night-Heron:
Other predators harass their young and the eggs/Loss of habitat due to human activity. In some parts there is considered a delicacy.



Osprey
It is of least concern due to its very slowly declining numbers however; threat to them include egg collectors and hunting of adults.



Cerulean Warbler:
Rapid declining neotropical migrant songbird due to decline in wintering habitat. Vulnerable to nest parasitism by brown-headed cowbird.



Cooper's Hawk:
Poisoning, Pole trapping and shooting, Collisions with man made objects, pollutants, cyanide poisoning and lead poisoning.



American Black Duck: Habitat loss due to development for oil, gas, and mining industries, hydroelectric projects, and the clearing of forests for forestry, Mercury contamination



Eastern Hognose Snake:
Due to direct anthropogenic pressures including habitat loss and fragmentation, road mortality, environmental degradation, and intentional killing.



Common Box Turtle:
Agricultural & urban development is destroying their habitat while human fire management is degrading it. They are frequently killed on roads and highways.



Chimney Swift: Population declines are largely unclear but may be related to the alteration of the insect community due to pesticide use in the early half of the 20th century. Roadkill is also a common cause for their decline.



Eastern Spotted Skunk:
Pesticide use, modernization of farming techniques, over-trapping and consolidation of barns and other man made structures are all believed to have had a negative effect on eastern spotted skunk populations.



Horned Grebe:
Primarily to human disturbance, forestry operations around breeding sites, fluctuating water levels, and stocking of lakes with rainbow trout that compete for aquatic insects, frequently caught in nets, vulnerable to oil spills and diseases. Habitat loss



American Coot: It is a game bird. Habitat loss due to drainage, filling of wetlands due to urbanization, global warming and rising sea levels. Some conservationists consider hybridization and competition with the mallard as an additional source of concern should this decline continue.



Hellbender:there has been a dramatic decline in populations. Many anthropogenic sources have helped to create this decline, including the siltation and sedimentation, blocking of dispersal/migration routes, and destruction of riverine habitats created by dams and other development, as well as pollution, disease and overharvesting for commercial and scientific purposes.

GEOLOGY

GEOLOGIC MYSTERY IN MONROE COUNTY

Unknown to many residents of Greenbrier Valley in southern West Virginia, a six-mile crack in the surface of the earth has been hiding beneath their feet.

Visible only from the air, the "Monitor Lineament" is one of the strangest landforms in this scenic landscape of bluegrass pastures, vanishing brooks, and healing springs.

Coursing in a straight line across northern Monroe County from near Sinks Grove to Second Creek, the lineament is seemingly impossible to perceive at eye-level.

A thoughtful observer might recognize it as an exceptionally regular row of sink-holes, each marking the location of a cavern beneath – all part of a maze

of caverns that underlies the "levels" of the southern Greenbrier Valley.

Though the average valley resident may not know of the lineament, most cavers and geologists do. Only a handful of obscure sources speak of it online, though a cursory inquiry on social media inspired many contributing voices.

What is the lineament and how did it form? Simply put, the lineament is a minor fold, or wrinkle, in the topmost layers of the Earth's crust. It was named by geologists for the community of Monitor, along which a line of sinkholes runs.

Cavers and geologists agree that the slow movement and warping of the crust over millions of years created



GEOLOGY

GEOLOGIC MYSTERY IN MONROE COUNTY



The Monitor Lineament



Lidar image of northern Monroe County

“
A Six-mile crack known as the “Monitor Lineament” is one of the strangest landforms spread across Monroe County as a straight line that is only visible from the air
”



Aerial image by William K. Jones.

GEOLOGY

GEOLOGIC MYSTERY IN MONROE COUNTY

this fold and others nearby, though the Monitor line does not match the general trend of most other folds in the Appalachian Mountains.

Geologist Nick Schaer speculates that the lineament may be a recent development, geologically speaking. He notes that the fold extends beyond the valley's "karst" – the porous layer of limestone in which the region's caverns have developed.

"You can see that the formation expresses itself some distance beyond the karst region," Schaer said. "Of course, the lineament is most obvious in the karst, where sinkholes are well-developed, but, particularly to the west, you can see that it extends beyond the karst."

As the line extends beyond the limestone layer, it might infer that the fold occurred after the formation of the



“The lineament is a minor fold, or a wrinkle, in the topmost layers of the Earth’s crust”

GEOLOGY

GEOLOGIC MYSTERY IN MONROE COUNTY

bed of limestone, though Schaer said he was unaware of any studies that looked at the larger geologic structure of the region.

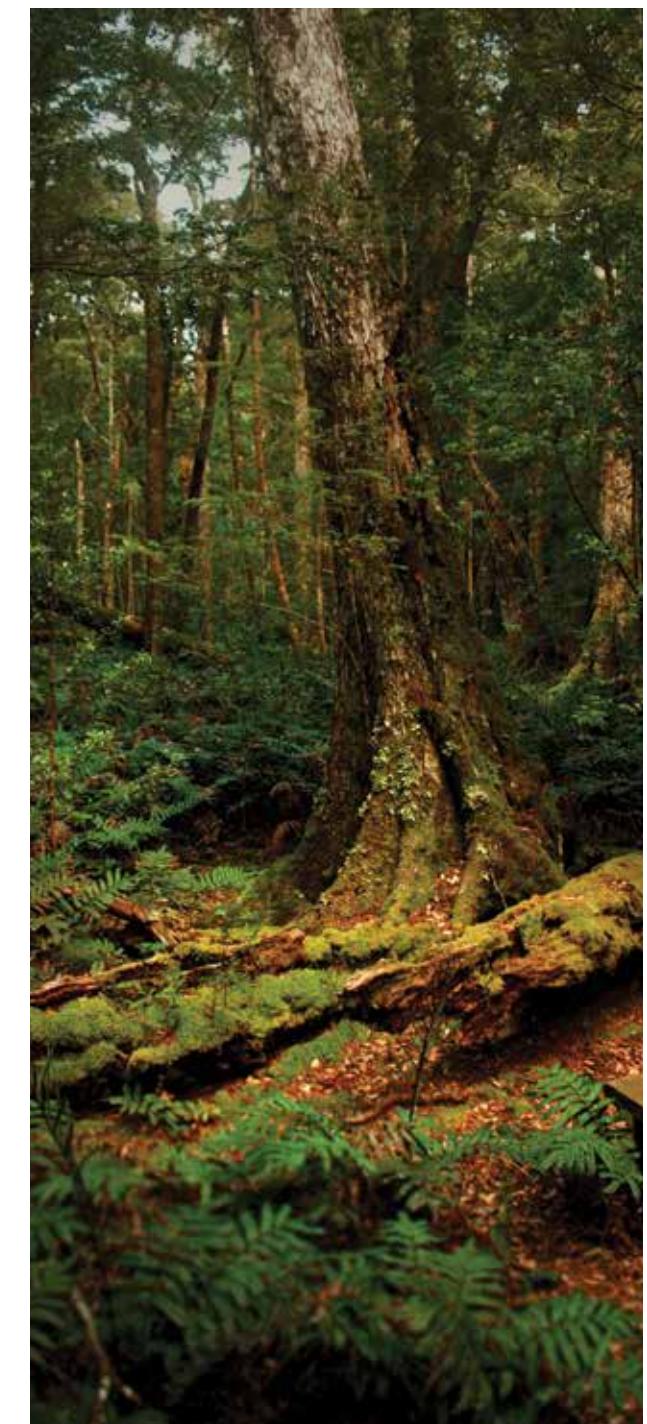
Caver Justin Beverage, a recent graduate of the environmental geoscience program at Concord University, speculates that the line is an extension fault associated with larger folds nearby.

"It's likely that the strain of the fold event caused the rocks to fracture – like bending Play-Doh into a fold and looking near the apex of the fold," Beverage said.

"Looking at a topographic map, it appears there is another lineament two-miles north-trending the same way. This would reinforce my guess since extension faults in fold-systems usually happen in groups."

According to Bill Balfour, who lectures on the region's karst, hydrologists and geologists employed by the U.S. Geological Survey are re-mapping Monroe County for the first time in decades, and many local cavers hope the new survey will tell them far more about the karst.

“Monroe county is now being re-mapped by Hydrologists and Geologists to find out more information about the karst”



ALARMING

CLIMATE INDICATORS

WEST VIRGINIA

West Virginia's climate is changing. Majority of the state has warmed one-half to one degree (F) in the last century, with heavy rainstorms becoming more frequent. In the coming decades, a changing climate is likely to increase flooding, harm existing ecosystems, increase health problems, and possibly threaten recreational activities.

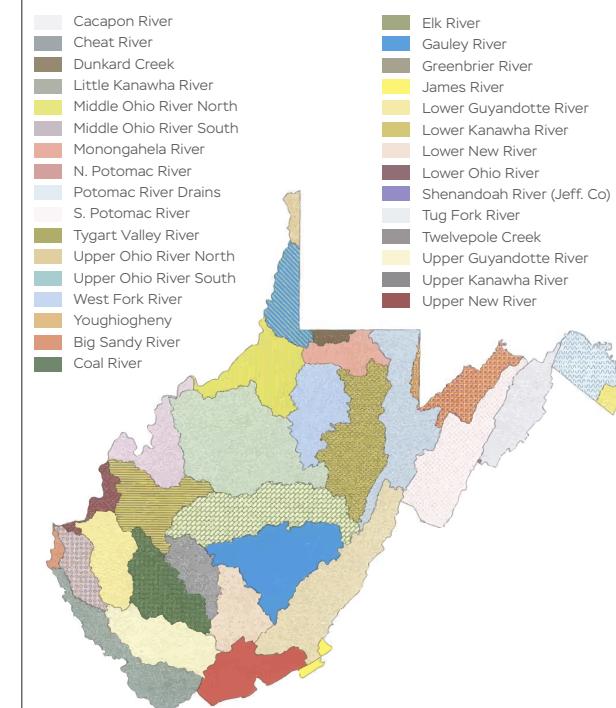
Carbon dioxide reacts with water to form carbonic acid, so the oceans are becoming more acidic. The surface of the ocean has warmed about one degree during the last 80 years, and sea level is rising at an alarming rate. Warming is also causing snow to melt earlier in spring.

In recent decades, the state has had flood-related disaster declarations nearly every year. These disasters

have often been associated with heavy rainstorms that also caused landslides and mudslides.

Increasingly heavy rains could increase pollution runoff and harm water that is used for fishing and swimming. Forests and Farms Rising temperatures and changes in rainfall are unlikely to substantially reduce forest cover in West Virginia, although the composition of those forests may change. More droughts would reduce forest productivity, and climate change is also likely to increase the damage from insects and disease. But longer growing seasons and increased carbon dioxide concentrations could more than offset the losses from those factors.

Forests cover more than three-quarters of the state.



“Rising temperatures and shifting rainfall patterns are likely to increase intensity of both floods and droughts. Annual precipitation in most of West Virginia has increased since the first half of 20th century disrupting the existing relationships between species”

ALARMING

CLIMATE INDICATORS

WEST VIRGINIA

Maple, beech, and birch are the most common tree species in the central part of the state, while oak and hickory dominate the forests elsewhere. As the climate changes, oak and hickory trees are likely to become more common in the central part of the state as well. Climate change may also pose challenges for farmers.

Longer frost-free growing seasons and increased concentrations of atmospheric carbon dioxide tend to increase yields for many crops during an average year.

But more severe droughts and more hot days are likely to reduce yields. Higher temperatures are also likely to reduce livestock productivity: hot weather causes cows to eat less, grow more slowly, and produce less milk—and it can threaten their health.

“Increase in temperature and rainfall is the reason for reduction in forest cover of West Virginia that makes up more than three-quarters of the state”



Flood waters from the little Kanswha river in parkersburg credit: ED Hupp, wood county emergency management

ALARMING

CLIMATE INDICATORS

ECOSYSTEMS

A changing climate threatens ecosystems by disrupting the existing relationships between species. Wildflowers and woody perennials are blooming—and migratory birds are arriving—sooner in spring. Not all species adjust in the same way, however, so the food that one species need may no longer be available when that species arrives on its migration. This can lead to animals not getting enough food. Warmer temperatures allow deer populations to increase, leading to a loss of forest underbrush, which, in turn, makes some animals more vulnerable to predators. Rising temperatures also enable invasive species to move into areas that were

“Compared to people in the United States, people in West Virginia will face increased risks from storm and heat due to climate change over the next 30 years.”

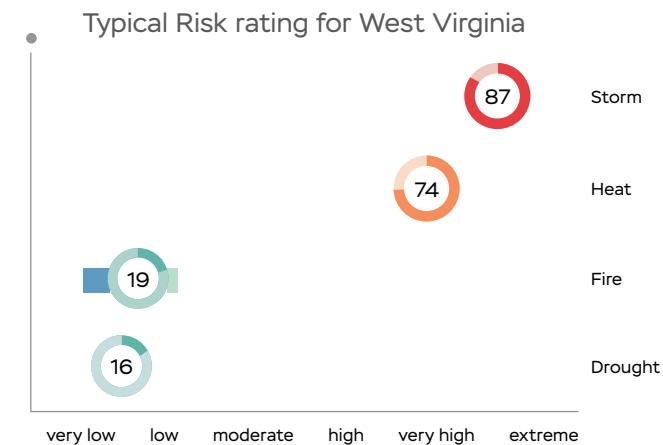


ALARMING

CLIMATE INDICATORS

ECOSYSTEMS

previously too cold. Rising temperatures and changing precipitation could also harm aquatic ecosystems. Warmer water lowers the level of dissolved oxygen in surface water, which can severely limit fish populations. Because fish cannot regulate their body temperatures, warmer water can make a stream uninhabitable for fish that require cooler water. Warmer water can also increase the frequency of algal blooms, which can be toxic and further reduce dissolved oxygen. Summer droughts may amplify these effects, while periods of extreme rainfall can cause runoff that increases pollution in streams.

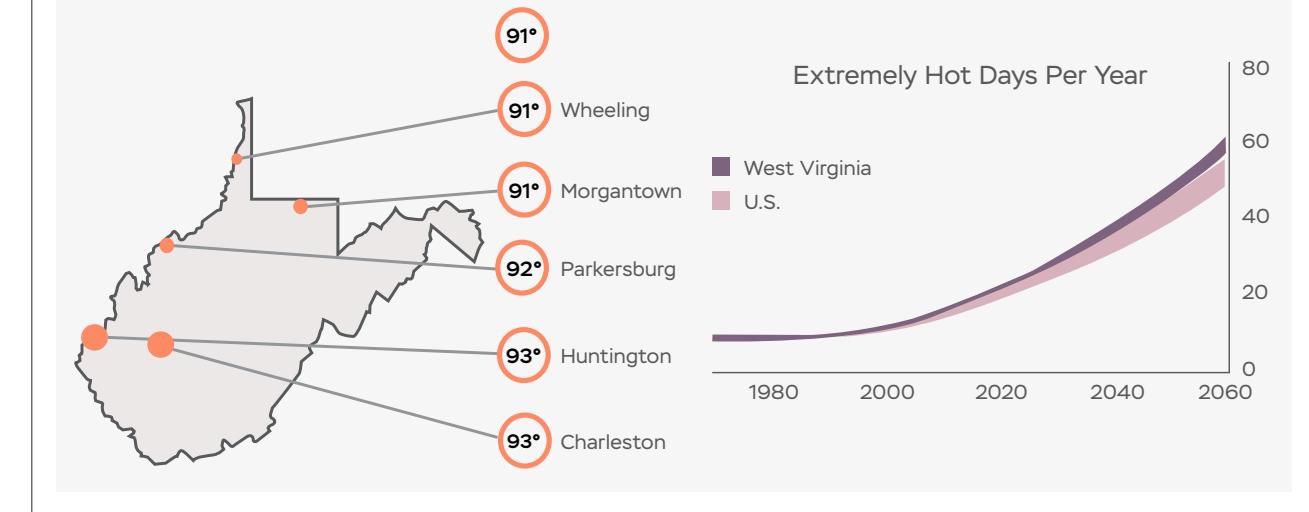


Heat Risk in West Virginia with Climate Change

An extremely hot day in West Virginia is about 91°F. This is based on historical maximum temperatures on the top 2% of days in an average year.

The frequency of very hot days is increasing. On average, someone in West Virginia will experience about 47 extremely hot days in 2050.

A typical person in the U.S. will experience about 43 extremely hot days in 2050.





INCOME AND EMPLOYMENT

THE ECONOMY OF WEST VIRGINIA IS ONE OF
THE WEAKEST OF ALL STATES OF AMERICA

According to US Census Bureau data, West Virginia is Third from the bottom in per capita income, ahead of only Arkansas and Mississippi. It is also the Last state in median household income. One major contributor to the state's low economic rankings is the low educational level of its population. The proportion of West Virginia's adult population with a bachelor's degree is the lowest in the country, at 15.3%.

One of the major resources in West Virginia's economy is coal. West Virginia also engaged in drilling oil, but currently only has small/medium sized scatter natural gas fields. Farming is also practiced in West Virginia the state ranks second in the US in total coal production, with about 15% of the US total. It is also a leader in steel, glass, aluminum, and chemical manufactures. Major agricultural commodities are poultry and eggs, dairy products, and apples.

Tourism is increasingly popular in mountainous West Virginia. More than a million acres have been set aside in 37 state parks and recreation areas and in 9 state forests and 2 national forests. 65.5% of total civilian noninstitutional population aged 16-64 is employed.

15% of youth aged 16-24 are not enrolled in school and not employed. 5.1% of population aged 25-64 years old is unemployed. Average income of a Monroe County resident is \$20,041 per year and the median household income is \$38,239 per year while the US average is \$28,555 and \$53,482 per year, respectively.



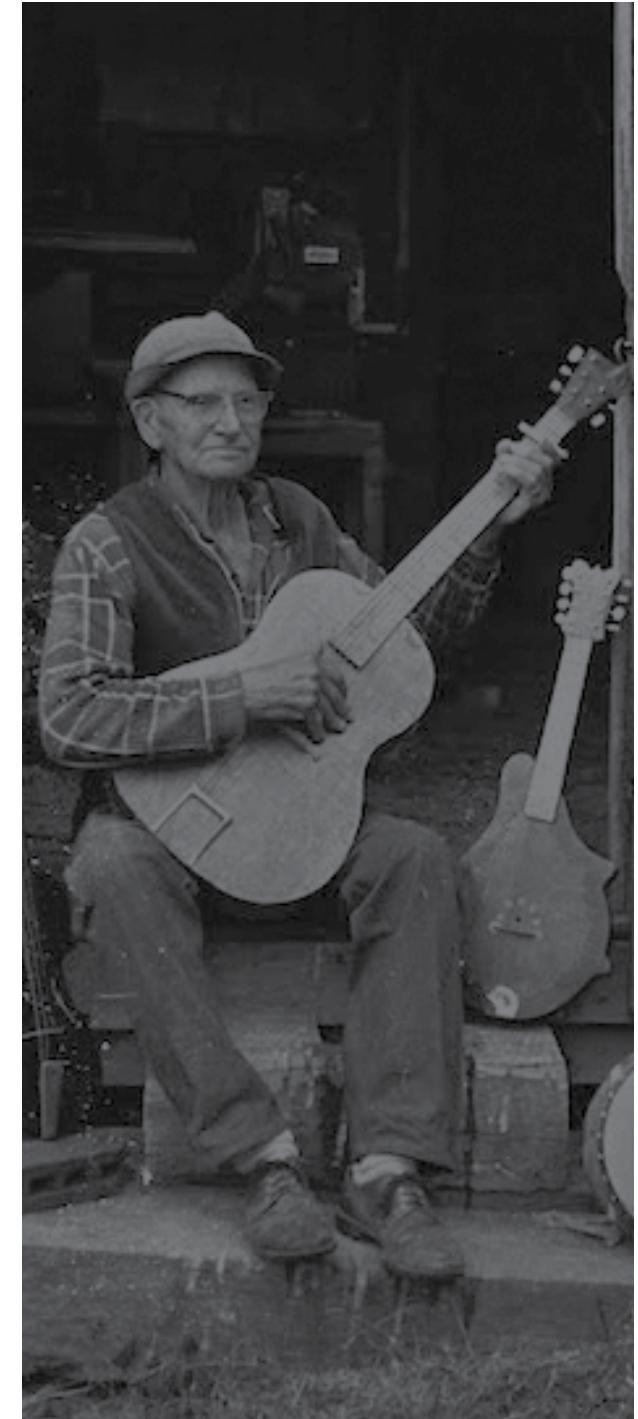
LIFESTYLE STUDY

WEST VIRGINIA'S CULTURE

West Virginia has kept the Appalachian culture, which originated during the American Civil War, alive throughout the years. This is seen mostly through its folk music, brought by the Irish and Scottish settlers in the 18th century, which consists of the fiddle, banjo, and the Appalachian dulcimer. African-American blues is also an important part of West Virginia's culture, as is bluegrass and old-time country music. For more than 20 years Elkins, has hosted the annual Augusta Heritage Festival, which celebrates the Appalachian culture in West Virginia.

English and German ancestry is the most dominant in West Virginia, making up for more than 50 percent of the population. The town of Helvetia, however, is made up of predominantly of Swiss immigrants, a phenomenon celebrated at the annual Swiss-themed Helvetia Community Fair. Still, it is the Scots-Irish that influence the state's culture the most, and not only through music. They also brought quilt making to West Virginia, although now the state has a style unique to itself. Quilting techniques here include the lack of contrasting borders, a unified pattern, and blocks pieced in a pattern, obscured by same color patterns and adjacent fabrics.

“ Appalachian culture with its rich folk music is the most predominant in West Virginia ”





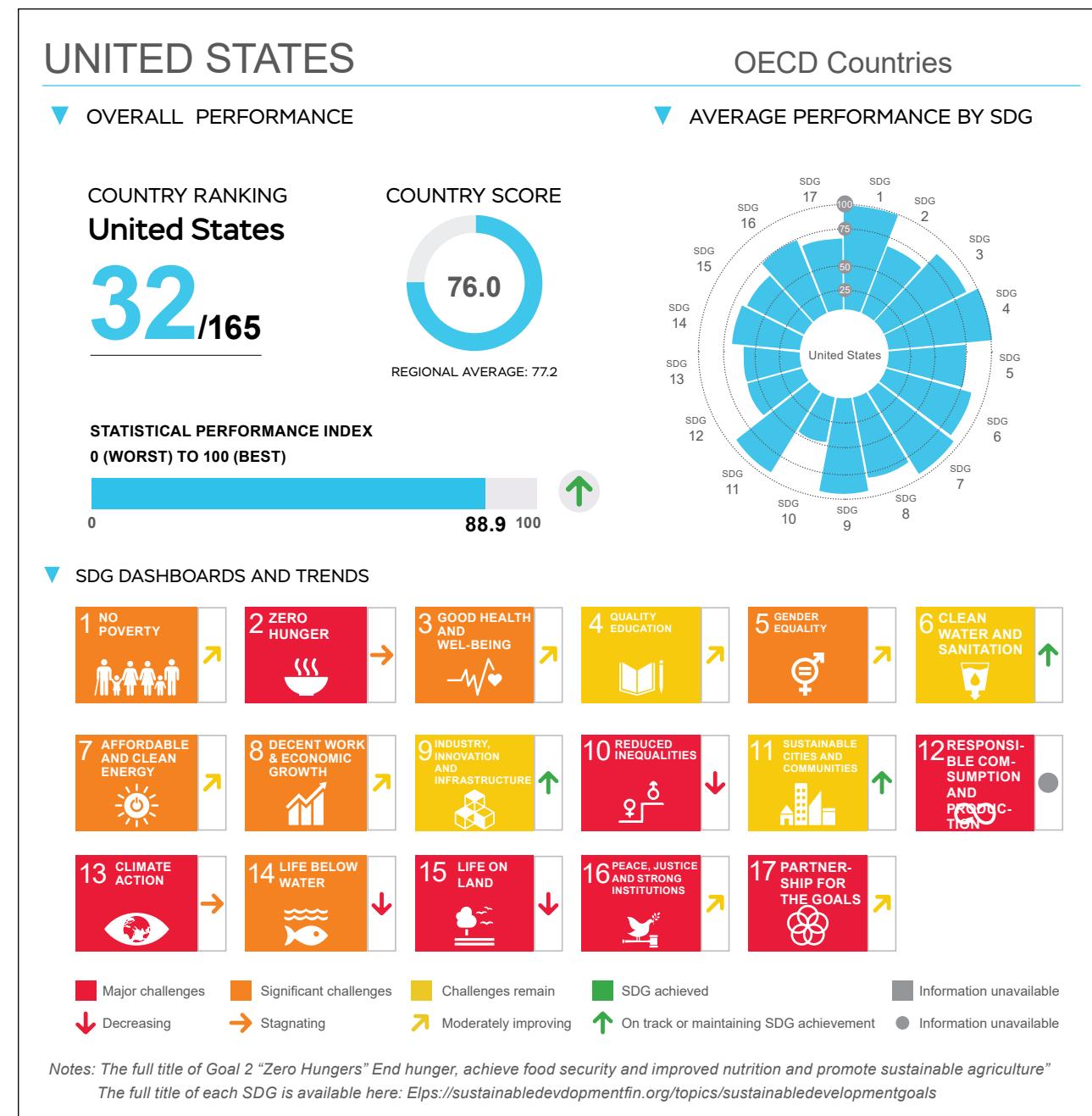
UNITED STATES

SUSTAINABILITY DEVELOPMENT REPORT

STATE WISE RANKINGS

PERFORMANCE OF 193 UN MEMBER STATES

Countries are ranked by their overall score. The overall score measures a country's total progress towards achieving all 17 SDGs. The score can be interpreted as a percentage of SDG achievement. A score of 100 indicates that all SDGs have been achieved.



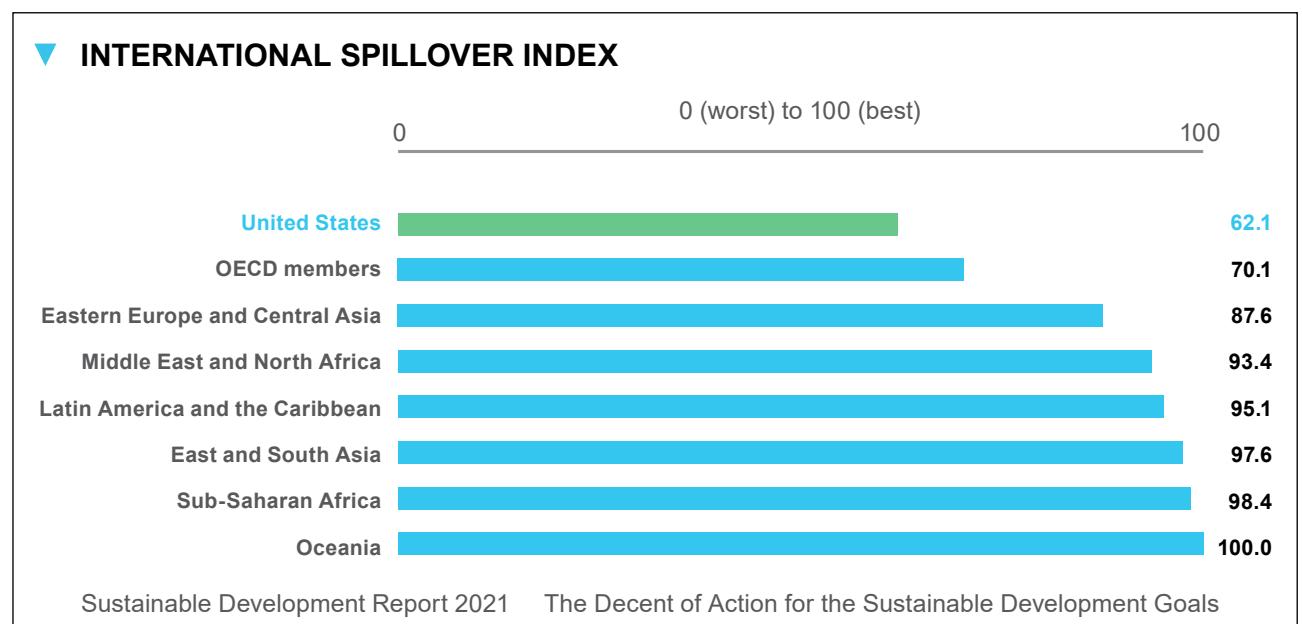
INTERNATIONAL SPILLOVER INDEX

Each country's actions can have positive or negative effects on other countries' abilities to achieve the SDGs. The Spillover Index assesses such spillovers along three dimensions: environmental & social impacts embodied into trade, economy & finance, and security. A higher score means that a country causes more positive and fewer negative spillover effects.

USA ranks 32nd in the listing with a score of 88.9 in the statistical performance index. However, the spillover score of USA is 62.1 with a rank of 146 out of 165 which means that there is huge scope for improvement on curtailing its negative spillover effects

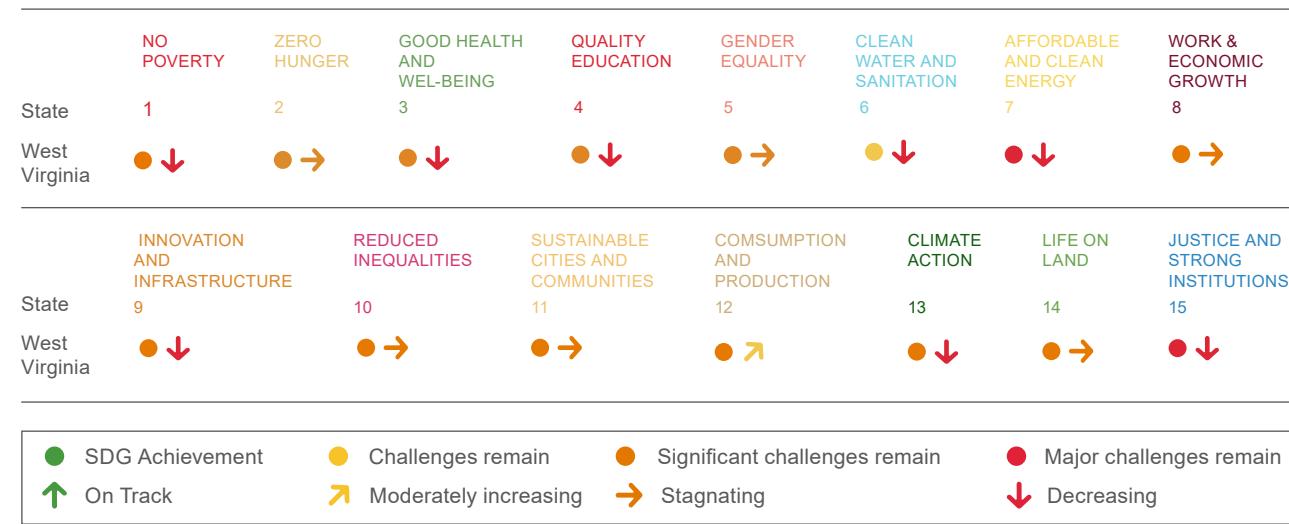
	United States
SDR 2021	
Spillover score	
Spillover score : 62.14/100	Spillover rank : 146/165

“ USA ranks 32nd in the overall performance index and 146th in its spillover ranking showing huge potential for improvement in their negative spillover effects ”



STATE WISE RANKINGS - USA

West Virginia ranks 49 out of 50 in the state wise sustainability rankings which means it has a huge scope for improvement and need to interfere.



Rank	State	Score	Trend
1	Vermont	60.4	→
2	Massachusetts	58.8	→
3	Washington	58.2	→
4	Minnesota	57.1	→
5	Maine	56.2	→
6	Oregon	55.5	→
7	New Hampshire	54.8	→
8	Hawaii	54.5	→
9	Maryland	54.3	→
10	California	54.1	→
11	New York	53.9	→
12	Connecticut	53.8	→
13	Colorado	53.6	→
14	New Jersey	52.4	→
15	Rhode Island	52.3	→
16	Wisconsin	51.2	→
17	Idaho	49.6	→
18	Delaware	48.4	→
19	Michigan	48.3	→
20	Virginia	48.2	→
21	Nebraska	47.4	→
22	Utah	46.6	→
23	Iowa	46.3	→
24	South Dakota	46.2	→
25	Illinois	44.6	→

Rank	State	Score	Trend
26	Montana	44.7	→
27	Nevada	44.5	→
28	Kansas	43.7	→
29	Pennsylvania	43.2	→
30	North Carolina	43.2	→
31	Arizona	42.9	→
32	Wyoming	42.3	→
33	Florida	41.9	→
34	Georgia	41.4	→
35	North Dakota	40.4	→
36	Missouri	40.4	→
37	South Carolina	39.5	→
38	Tennessee	39.5	→
39	Ohio	39.1	→
40	Kentucky	38.2	→
41	Texas	38.1	→
42	New Mexico	37.7	→
43	Alaska	36.9	→
44	Indiana	36.8	→
45	Alabama	34.3	→
46	Oklahoma	33.7	→
47	Arkansas	32.8	→
48	Louisiana	31.2	→
49	West Virginia	30.9	→
50	Mississippi	30.5	→

“ West Virginia ranks 49th out of 50 states in the state wise rankings ”

“ Trends for West Virginia show decrease in values for 8 Sustainability Goals while all the others either show stagnation or no improvement ”

West Virginia





An aerial photograph capturing a winding river or creek flowing through a dense, green forest. The river's path is clearly visible as a light blue-grey line against the surrounding vegetation. The forest consists of a mix of evergreen and deciduous trees, with some showing autumnal yellow and orange hues. A narrow, light-colored path or road follows the river's edge on the right side of the frame. The overall scene is one of natural beauty and tranquility.

CREST CLIMATE ACTION TARGETS

BACK CREEK,
MONROE COUNTY, WV



CLIMATE HUB

Buildings consume 40% of the energy worldwide as 21% of the greenhouse gases originate from them. This is the time to rethink about the way we are building homes.

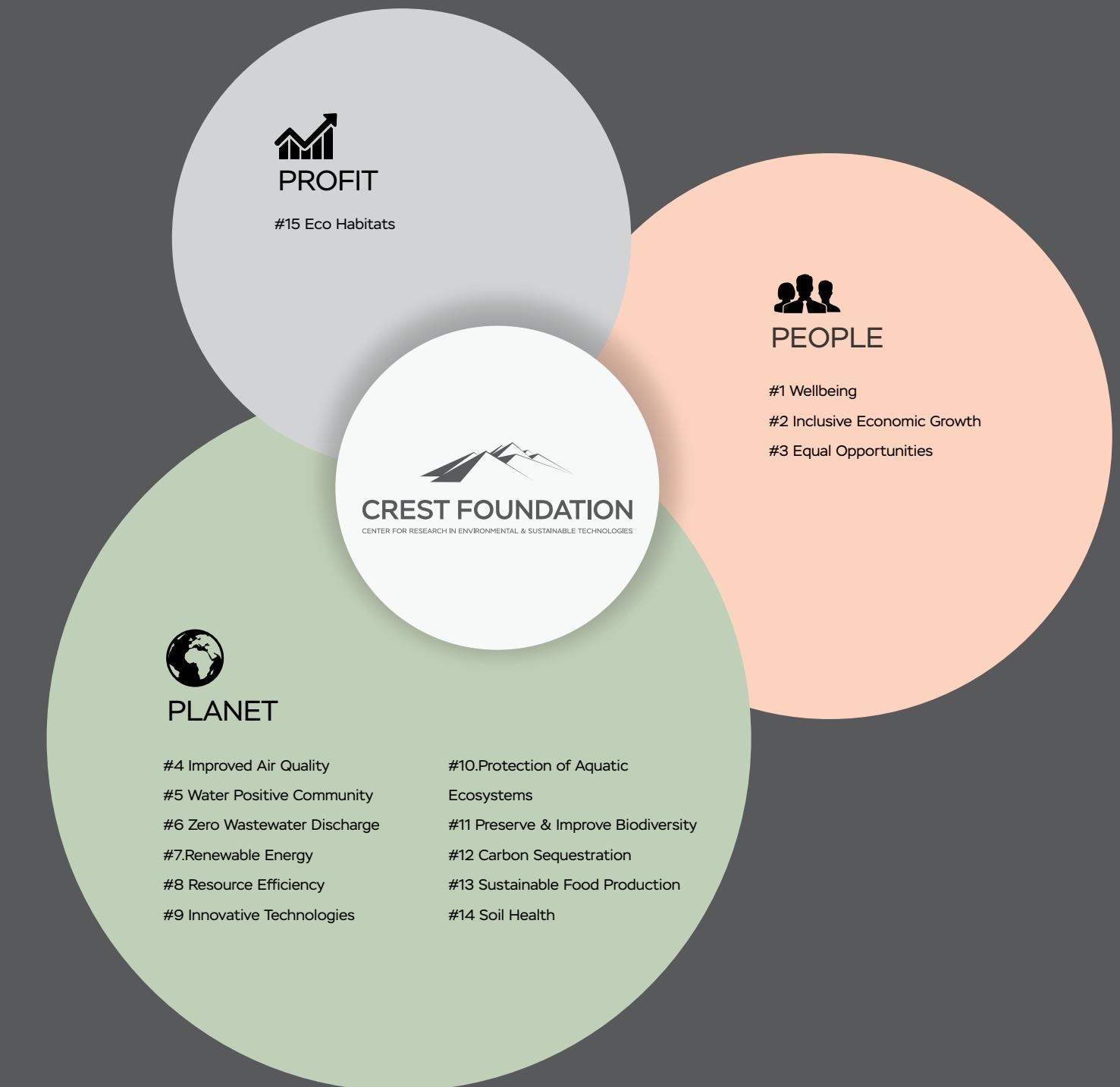
Climate hub is “The Solution” in the current scenario. Climate hubs are closed ecological systems which do not rely on matter exchange with anything from outside of the system. The waste generated by one species is used by another species forming closely knit biological communities within themselves.

New ecosystems are created by making the place conducive for various organisms thereby increasing the biodiversity of the place. Climate hubs enhance the quality of bionetworks such as soil, air and water including the surrounding neighborhoods & environment.

Climate hubs are group of homes built & integrated with nature. They are highly energy efficient, low on resources, self-sustainable communities relying completely on renewable sources for energy, food production through natural ways of farming, near zero waste processes etc.,

Back creek climate hub is a self-sustainable off grid community with no dependence of power and water from the local municipalities. The community of 280 homes with 1082 occupants will generate their own power, harvest rainwater for domestic use and produce their own food.

CREST FOUNDATION'S #15 CLIMATE ACTION TARGETS FOR BACK CREEK, MONROE COUNTY





KEY CLIMATE ACTION TARGET #1 WELLBEING

People and the way they live are important aspects of the community along with their interactions within and outside. Their involvement in social welfare is an essential criterion for the wellbeing of a Climate Hub. To ensure healthy interaction within the community, Climate Hub incorporates the below elements into its design,

Amenities for physical wellbeing of the occupants:

Specially designed spaces to conduct Social, Financial, Physical & Community Level events will be an essential part of design. The project will assign common activity spaces for community events, parties and get togethers etc., to bring people from different walks of life together for a healthy social interaction. Thereby also addressing several psychosomatic medical disorders in humans such as depression, sleep disorders, social isolation etc., and enhances overall well-being.

Back Creek also has several hidden scenic paths that are a joy to fitness enthusiasts and nature lovers alike. There will be cycling and jogging pathways and other relevant infrastructure through such routes to ensure and increase the use of cycles within the community.

The farm buffer area that is continuous and uninterrupted throughout the farm is designed to promote passive health with pebble walkways, semi covered spaces to practice yoga or just plain meeting and conversation spaces.

Climate Hub will also have its very own Medical Spa where one can relish leisure with ayurvedic massages, well equipped body care salon, at the luxury of their community spaces itself.

Congregated spaces for discussions and awareness programs: Tie ups with NGOs and rehabilitation centers etc., is part of the wellness plan of a Climate Hub. Help from these organizations by conducting workshops to promote healthy lifestyles contribute in supporting overall wellbeing of the community.

Health benefits of taking organic food: Climate Hub is a community driven by "The Greenculture" who respect nature's way to lead a life of self-sustenance through completely sustainable methods of farming. Community members get to witness firsthand the design, execution and maintenance of Witnessed, unadulterated organic food cultivated without the use of harmful chemicals, antibiotics or growth hormones.



KEY CLIMATE ACTION TARGET #2 INCLUSIVE ECONOMIC GROWTH

Employment to people from surrounding rural areas thereby increasing their income levels: A Climate Hub will need several personnel for service roles such as Construction, Administration, Security, Housekeeping, and many more. CREST would identify staff required from people in surrounding counties and provide them with skill development training to eventually hire them as part of the maintenance team for the whole property. So, the employment needs are locally fulfilled.

Apart from opportunities within the community, there would be an increase in auxiliary job opportunities because of the development such as, road maintenance, kitchen support, waste management, marketplaces etc., creating a spillover effect by also improving the property prices. Climate Hub will have the capacity to provide employment to approximately 200 support staff without any discrimination based on religion, sex, race, nationality, age. This in turn positively contributes to the per capita income levels and decreases the unemployment rate of the county.

Places like WV and Monroe County, have relatively less population, hence, there is potential for support to be provided at a larger scale with the help of climate Hub

Helping people de-urbanize: Simple living standards such as waste management starting at home, letting go of redundant spending habits, becoming one with nature, exploring possibilities of a minimalistic lifestyle would all become part of everyday life at Back Creek Climate Hub.

“ CREST Climate Hub would create full-time jobs for about 300 people at Back Creek and over 500 jobs through circular economy of the community ”



KEY CLIMATE ACTION TARGET #3 EQUAL OPPORTUNITIES

Zero discrimination as the motto, Climate Hub will provide equal Opportunities irrespective of Gender, Religion, Caste & Color.

It is important to create a community that is fair, inclusive, and builds a workforce which reflects diversity. A diverse community allows all contributors to contribute their knowledge, skills, and abilities to the community regardless of background, religion, race, gender, sexual orientation, or any grounds for discrimination and eliminating barriers to participation.

Climate Hub follows a Diversity Policy that provides a framework for the organization to achieve the following.

- Diversity in context of employment primarily refers to the equal employment opportunity provided to everyone.

- Challenge unacceptable behaviors and create a climate where complaints can be raised without the fear of reprisal.
- Take firm action where unfairness or inconsistency exists.
- Encourage and support diversity within the community
- Demonstrate and promote considerate and fair behavior.
- Treat staff with dignity and respect and recognize and value individual skills and contributions
- Demonstrate through words and actions that diversity is an integral part of the Climate Hub's culture.
- Create an environment in which every contributor can identify and share good practice, celebrate success, and encourage positive attitudes towards diversity



KEY CLIMATE ACTION TARGET **#4 IMPROVED AIR QUALITY**

Air Quality in Monroe County is good with negligible ground Ozone levels (O₃)

Smog (Smoke + Fog) is the main reason for increase in ground level ozone. It is formed when smoke from vehicles is mixed with fog. It is extremely toxic to plants and can cause breathing difficulties in humans.

Vehicular pollution is reduced within the community by introducing safer means of commuting e.g., e-bikes, cycling, other sustainable commuting options etc.,

Use of low VOC compounds:

VOCs are only one of several toxic compounds that can be found in paints. VOCs are crucial pollutants because of

their contribution to the formation of ground-level ozone. When VOCs are released into the atmosphere, they react with nitrogen oxides (NO_x) to create ozone molecules. Ground-level ozone can have many impacts on human health and is the key pollutant that causes smog.

Low VOC refers to volatile organic compounds that are not harmful to the environment and humans as they contain a lower amount of VOC content than conventional paints and create no impact on the ozone layer.

All farming and afforestation activities in the property will be chemical free ensuring the end users have zero exposure to pesticides.



“ Plant species for Afforestation at Back Creek are carefully chosen to reduce toxicity and maintain good Air Quality ”

KEY CLIMATE ACTION TARGET **#5 WATER POSITIVE COMMUNITY**

The water demand for the project is primarily domestic and farming. The project intends to use rainwater for all its domestic requirements. The Annual domestic water requirement is 31,831,358 Gallons. 100% of the domestic water requirement will be met by harvested rainwater.

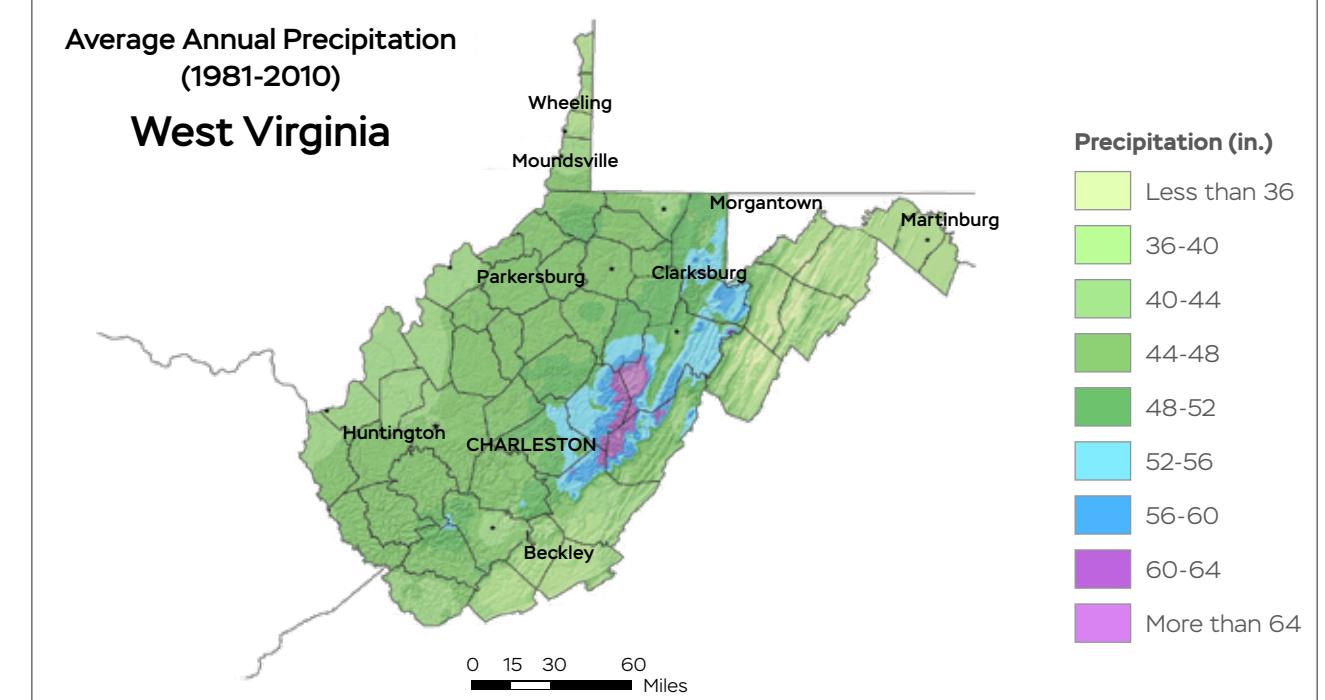
The average mean precipitation of the state is 45 inches with an average of 145 days of precipitation. The site has a rainwater harvesting potential of 1,416,502,420 Gallons of water. The rainwater from rooftops and rainwater runoff from the landscape areas will be collected along the trenches and will be routed into the rainwater collection ponds.

The collected rainwater will be filtered in the water treatment plant and distributed for domestic use.

Water consumption would be further controlled/reduced with the help of water efficient plumbing fixtures.

Elaborate and include article on effects of limestone on water.

“ CREST Foundation’s Watershed initiatives for Back Creek hold potential to harvest 1.416 billion gallons of rainwater every year ”



KEY CLIMATE ACTION TARGET

#6 ZERO WASTEWATER DISCHARGE

The Back Creek Climate Hub will be a zero-wastewater discharge site. It is observed that the water in the streams of Greenbrier watershed have fecal contaminants due to failure of septic systems.

The project will have an onsite wastewater treatment facility to treat the black and grey water using natural biological systems and chemical free methods. The treated wastewater will be used for farming and landscaping purposes.

There is no discharge of liquid effluent into surface waters, in effect completely eliminating the environmental pollution associated with the treatment.

Effective use of wastewater treatment, recycling, and reuse contributes to water conservation through reduced intake of fresh water.

It is a wastewater management strategy that eliminates liquid waste and maximizes water usage efficiency.

“
Wastewater treatment facility at Back Creek is critical to keep water contamination under control
”



KEY CLIMATE ACTION TARGET

#7 RENEWABLE ENERGY

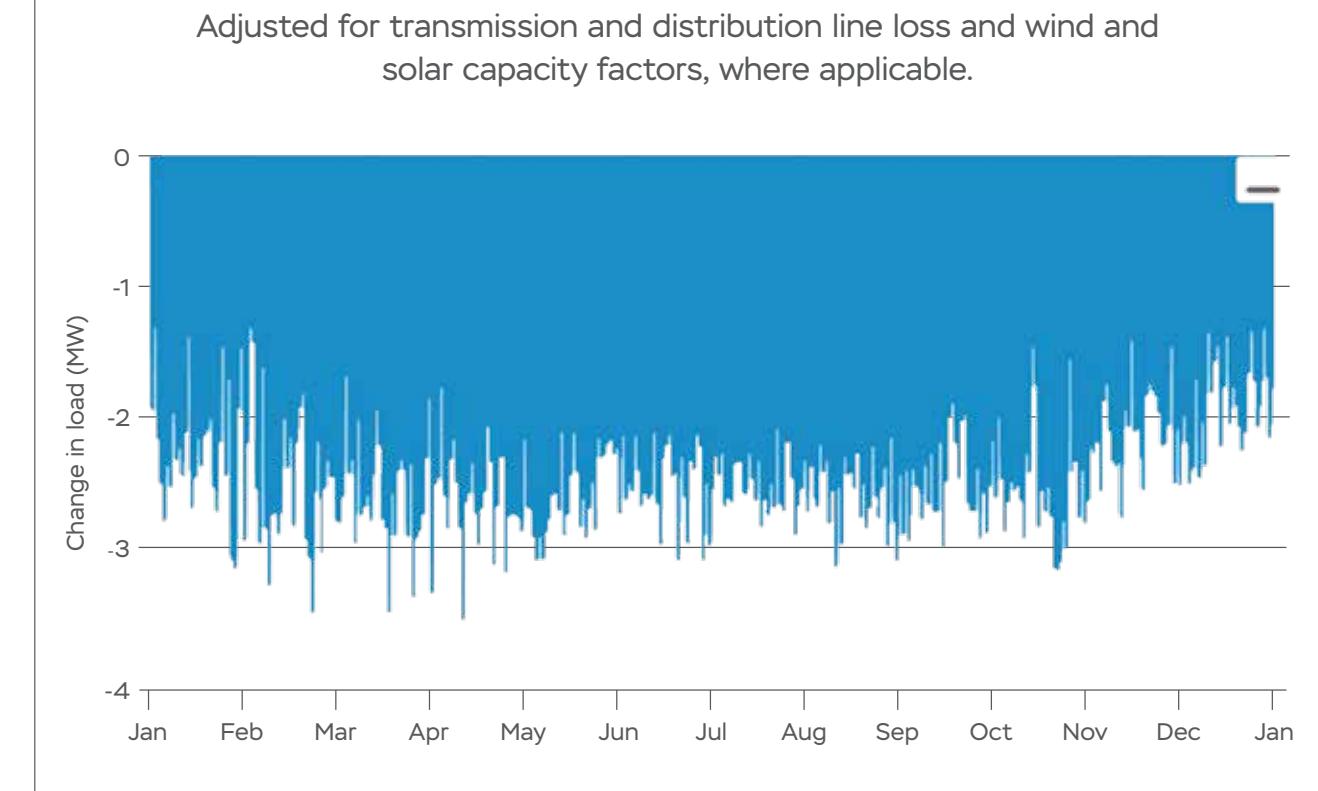
Climate Hubs are net zero-energy positive communities which produce renewable energy through solar and wind energy systems to meet 100% of the energy demand loads.

The combined annual energy consumption per household is approx. 13408kwh.

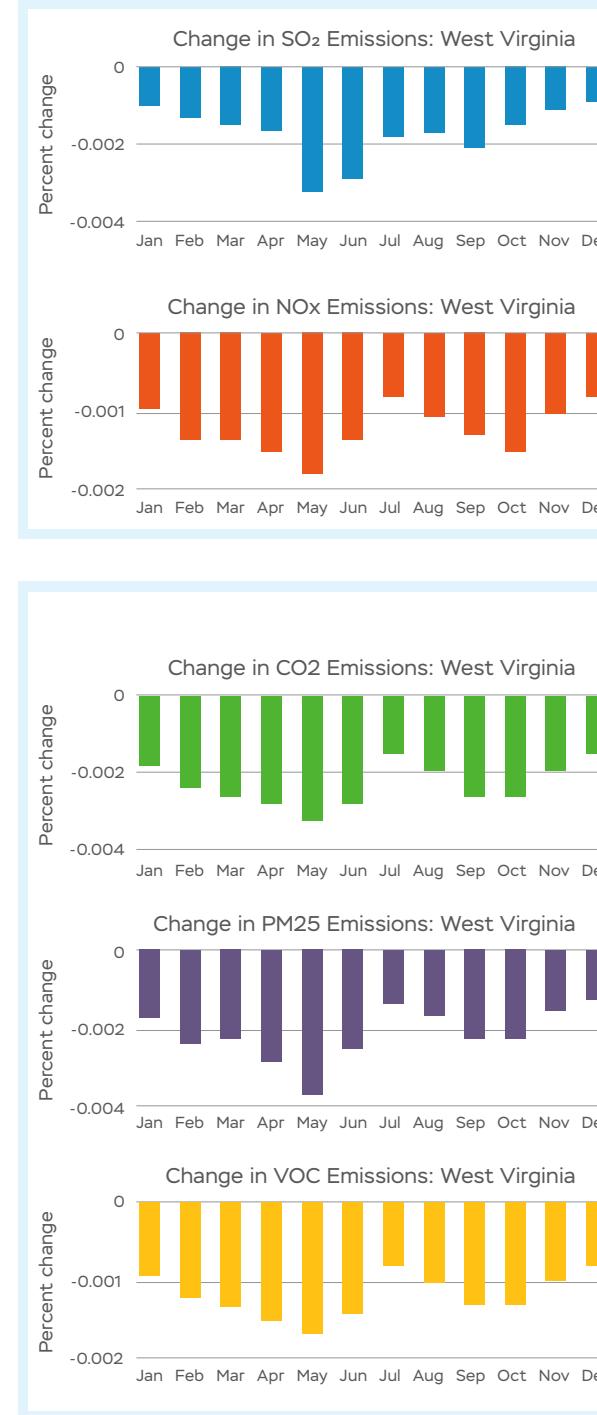
The total energy demand for the project including common areas and amenities would be approx. 4,554,147 kwh.

A solar wind hybrid energy system of 3.5MW capacity shall be installed which would produce energy of approx. 5,425,000 kwh

“
4,554,147 kwh energy demand loads of Back Creek shall be met through Clean Energy using Solar Wind Hybrid system
”

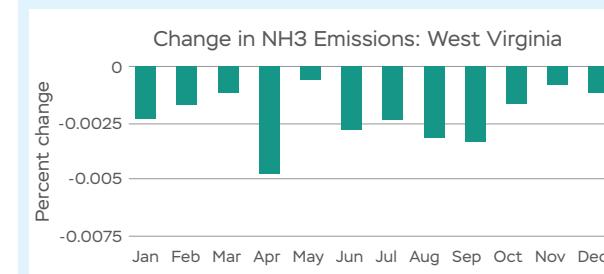


AVOIDED EMISSIONS POST INSTALLATION OF RENEWABLE ENERGY SYSTEMS



The graphs show the impact the installation of 3.5MW Renewable Energy system at Back Creek has in emissions of particulate matter (PM2.5), nitrogen oxides (NO_x), sulfur dioxide (SO₂), carbon dioxide (CO₂), volatile organic compounds (VOCs), and ammonia (NH₃) from electric power plants at state level.

The table shows original emissions, avoided emissions post-installation of Renewable Energy systems and the impact due to Renewable energy systems on the Mid-Atlantic Region.



ANNUAL REGIONAL DISPLACEMENTS & MICRO GRID

Annual Regional Displacements: Mid-Atlantic Region

	Original	Post-EE/RE	EE/RE Impacts
Generation(mwh)	462, 205, 000	462, 199, 110	-5, 890
Total Emissions from Fossil Generation Fleet			
SO ₂ (lb)	384, 131, 570	384, 125, 080	-6, 490
NO _x (lb)	285, 094, 440	285, 090, 160	-4, 280
Ozone season NO _x (lb)	121, 757, 180	121, 755, 150	-2,030
CO ₂ (tons)	319, 283, 750	319, 279, 440	-4,310
PM _{2.5} (lb)	40, 034, 350	40, 033, 800	-550
VOCs (lb)	6, 885, 850	6, 885, 730	-110
NH ₃ (lb)	8, 069, 740	8, 069, 610	-130
AVERT-de-derived Emission Rates:	Average Fossil		Marginal Fossil
SO ₂ (lb/MWh)	0. 831		1. 101
NO _x (lb/MWh)	0. 617		0. 727
Ozone season NO _x (lb/MWh)	0. 580		0. 732
CO ₂ (tons/MWh)	0. 691		0. 731
PM _{2.5} (lb/MWh)	0. 087		0. 094
VOCs (lb/MWh)	0. 015		0. 019
NH ₃ (lb/MWh)	0. 017		0. 022

Negative numbers indicate displaced generation and emissions. All results are rounded to the nearest ten. A dash ('-') indicates a result greater than zero, but lower than the level of reportable significance.

When solar power is not in tune with energy demand loads, the demand is met by the external electrical grid.

Net Metering is the policy that allows individuals with solar to get a credit on their electric bill for the energy they produce from their system.

Net Metering is used to compensate for energy deficiency when production is low. When energy production is greater than required, the excess energy is exported to the grid.

The West Virginia senate passed a bill that exempts solar power purchase agreements from state regulatory jurisdiction in an effort to encourage retail customer investment in solar energy.

“ The amount of renewable energy produced within Back Creek Climate Hub will displace 6 GWh of regional fossil fuel generation over a year. This equals to the annual electricity consumption by 487 homes in the United States. **”**

KEY CLIMATE ACTION TARGET

#8 RESOURCE EFFICIENCY

Population explosion, coupled with improved lifestyle needs of people, results in increased solid waste generation in urban as well as rural areas of the country.

All wastes become hazardous if not carefully disposed of resulting in irreversible damage to earth overtime. But what is equally important is that all waste is recyclable.

Recycling reduces the demand of virgin materials, consumes less water and energy. There is a need to look at the waste not merely as an environmental polluter but a recyclable material of great potential and energy saver.

Strategies for Waste Management & Reduction:

Types and quantity of waste generated by community will be monitored. Residents, staff and vendors would be educated on how to reduce the waste

Waste hierarchy shows the best way to avoid shrinkage of valuable resources by preventing waste from getting generated in the first place. The goal is to maximise efficiency and avoid unnecessary consumption through behaviours such as :

- Selecting items with the least packaging or that require the fewest resources to produce
- Avoiding disposable goods or single-use materials
- Buying products that are recycled, recyclable, repairable, refillable, re-usable or biodegradable
- Using leftover food rather than throwing it away

KEY OBJECTIVES:

- To take all reasonable steps to ensure that wastemanagement controls are observed.
- To minimize the amount of waste generated and maximize the amount of waste reused and recycled.
- To reuse and recycle as much waste as possible on-site. Where on-site reuse is not possible, identify the most appropriate waste management option in line with the waste hierarchy.
- To manage waste as close as possible to the site location.
- To provide training to improve awareness of waste management issues with all residents, staff and vendors and to improve waste management practices on-site.

RESOURCE EFFICIENCY



“ Back Creek Climate Hub is a Zero waste to landfill project ”

Types of Waste :

- Domestic waste can be broadly classified in to 5 types
1. Dry Waste (paper, plastics, tetra packs, cardboard, glass, thermocol, etc)
 2. Wet Waste (food leftovers, rotten fruits, eggshells, tea leaves, flowers, etc.)
 3. Sanitary Waste (sanitary napkins, diapers, bandages, condoms, etc)
 4. E- Waste (all electronic waste like batteries, phones, chargers, computer parts, appliances, etc.,)
 5. Hazardous Waste (chemicals, cosmetics, paints, oils, medicines, syringes, razors, broken glass, etc.)

Segregation of Waste at Home Level :

For simplification and ease of segregation for residents, there would be three bins only at home level

- Dry Waste
- Wet Waste
- Reject Waste – Sanitary & Hazardous Waste.
- Wet waste would be transferred to the Biogas plants for power generation & compost
- Dry waste would be transferred to central waste storage facility where it will be further segregated into papers, cardboard, plastic, metals, rubber, thermocol, etc.,
- Closed loop systems
- All recyclable materials will be sent to recycling facility and non-recyclable plastics will be used as raw material in plastic to fuel/energy systems to recover energy.
- Sanitary waste like diapers and sanitary napkins must be covered fully in newspaper and marked with a red cross. They will be incinerated within the site.
- E-waste is collected quarterly by the housekeeping team and stored centrally and will be picked up by recycling vendors
- Hazardous waste like chemicals, paints, oils, pesticides will be separately stored in the HHW bin at the central waste storage facility and will be handed over to permitted Hazardous waste treatment facility.

KEY CLIMATE ACTION TARGET

#9 INNOVATIVE TECHNOLOGIES

In the U.S., discarded plastic is far more likely to end up in a landfill or a facility like Covanta's than it is to be recycled.

According to the Environmental Protection Agency, Americans recycled only 9.1% of their plastics in 2015. Waste-to-energy facilities combusted 15.5%. But the most likely destination for the plastics discarded in the U.S. is the landfill.

According to EPA, recycling metals, paper, and plastics recovers roughly 16 billion J of energy per metric ton of material. Burning that same ton for energy saves about 7 billion J.

Proponents of waste to energy say the technology is cleaner than other power sources. According to SWANA's O'Brien, waste-to-energy plants emit less CO₂, sulfur dioxide, and nitrogen oxides than coal-fired power plants do per unit of power.

Waste-to-energy plants emit less than coal-and oil based energy plants but more than natural gas plants.

FUEL	EMISSIONS, kg/(MW·h)		
	CARBON DIOXIDE	SULFUR DIOXIDE	NITROGEN OXIDES
Municipal solid waste	560.45	0.23	1.50
Coal	1,022.27	5.91	2.73
Oil	760.00	5.45	1.82
Natural gas	515.91	0.05	0.77

Source: Jeremy O'Brien, director of applied research, Solid Waste Association of North America

ENERGY POTENTIAL FROM WASTE

If all municipal solid waste headed to landfills each year could be converted to energy, we could produce enough electricity to power nearly 14 million households annually. That could be more than 12 percent of American households powered solely from garbage. In other words, we have a domestic source of energy that could power 14 million homes every year.

“ Two-thirds of carbon in the trash is derived from Biomass such as Food and Wood while Plastics comprise of the other third ”



INNOVATIVE TECHNOLOGIES - POWERMAX WASTE GASIFICATION

POWERMAX Waste Gasification Power Generation System is to use RDF (fuel made by crushing, selecting, drying and compressing of the combustible rubbish) as raw materials and adopts the advanced technology of waste gasification to produce combustible gas. The steam produced from the burning of the gas can be used by the steam turbine to generate power (POWERMAX Waste Gasification Steam Power Generation Technology), or the combustible gas can be cooled down to drive the power generation of the gas gensets(POWERMAX Waste Gasification Gas Engine Power Generation Technology). In addition, the produced gas can also be delivered directly to all kinds of boilers or kilns for heating and thermal application; or to be supplied to residential users as their household energy.



INNOVATIVE TECHNOLOGIES - PLASTIC 2 OIL

Plastic2Oil Inc. has pioneered the development of a process that derives ultra-clean, ultra-low sulphur fuel which does not require further refining, directly from unwashed, unsorted waste plastics.

The modular design of the P2O process is built on a structure of racked reactors, feeders and towers which allows for cost-effective process efficiencies.

Plastic2Oil has been issued all necessary permits



to operate by the New York State Department of Environmental Conservation (NYSDEC). Engineering report performed by SAIC validates and verifies the technology and economics.

The processor requires only 4,500 sq. ft. of operating space. Height requirement is approximately 20 ft. Highly automated; very low operator to processor ratio. Modular design allows for easy deployment.

“ CREST Climate Hub at Back Creek employs innovative technologies that help in conversion of waste from landfills to energy. Powermax Waste Gasification Power Generation System & Plastic 2 Oil are two such technologies which derive energy/fuel from unrecyclable plastic ”

PLASTIC 2 OIL - PROCESS & RESOURCE USAGE

The conversion ratio for waste plastic into fuel averages 86%. Approximately 1 gallon of fuel is extracted from 8.3 lbs. of plastic.

The processor uses its own off-gases as fuel (approximately 10-12% of process output); minimal energy is required to run the machine. Approximately 2-4% of the resulting product is Petcoke (Carbon Black), a high BTU fuel. Emissions are lower than a natural gas furnace of similar size, and the quality of the emissions improve with increased feed rates. Results from the final stack test performed by Conestoga-Rivers & Associates confirm that the processor emissions are well within the limits allowable under a NYSDEC air permit.

The P2O processor is designed to use minimal amounts of external energy. As well as being beneficial for the environment, this is also a significant factor in the commercial viability of the process. Water is used for cooling only and usage is minimized through recycling the water in a non-contact closed loop. The water is not in contact with the process itself, keeping it clean and uncontaminated. Only 53 kWh electricity is required to run the fans, pumps and small motors. No electricity is used in the transformation of the plastic to fuel. Natural gas is only used on start-up to heat the reactor – once the processor is running, the reactor is heated with its own off-gases. A facility-wide gas compression system governs natural gas usage throughout the entire production process.



PLASTIC 2 OIL - PARTNERSHIPS

Plastic waste is expensive to deal with and leads to the need for increased landfill capacity. With Plastic2Oil's P2O technology, companies can manage expensive waste plastic streams, reduce costs and align themselves with viable environmentally responsible initiatives.

A second option for business partnership with Plastic2Oil® is one which involves processors being installed at corporate sites that manage large volume plastic streams. Installing a P2O processor at these sites helps organizations to:

- Decrease tonnage of waste plastic that is currently being directed to landfill and reduce cost associated with disposal (ie. tipping fees).



As both solar radiation and wind vary throughout the year, neither solar nor wind based system can provide reliable power individually. Thus, hybridizing Solar Wind system provides reliable source of energy all round the year.

PowerMill™ designed and built by WindStream Technologies and solves the problem of deploying utility scale wind power devices where conventional Horizontal Axis Wind Turbines (HAWT) do not meet the geographical or resource needs of the area. Built to harness lower wind speeds than are required by large HAWT, the PowerMill™ utilizes WindStream' proprietary Vertical Axis Wind Turbine (VAWT) technology with a system of solar panels making up a true hybrid renewable energy solution. Packaged into a convenient turn-key solution, the PowerMill™ is uniquely designed

“ Solar Wind Hybrid System enhances power generation to 24 hours 365 days a year making it most efficient ”



to be installed where traditional utility scale devices cannot provide a compelling return on investment for the owner/operator.

Features

- All in one micro-grid ready system.
- Deploys straight out of container.
- Flexibility with wind, PV and battery inversion.
- Containerized battery storage and control system.
- Off-grid capability.
- Container acts as stabilizer for mounting and installation.

Advantages – On Grid/Off Grid

- More Power
- Highly Scalable
- More reliable
- Fast Installation
- Improved Generation Stability
- Less Space

KEY CLIMATE ACTION TARGET

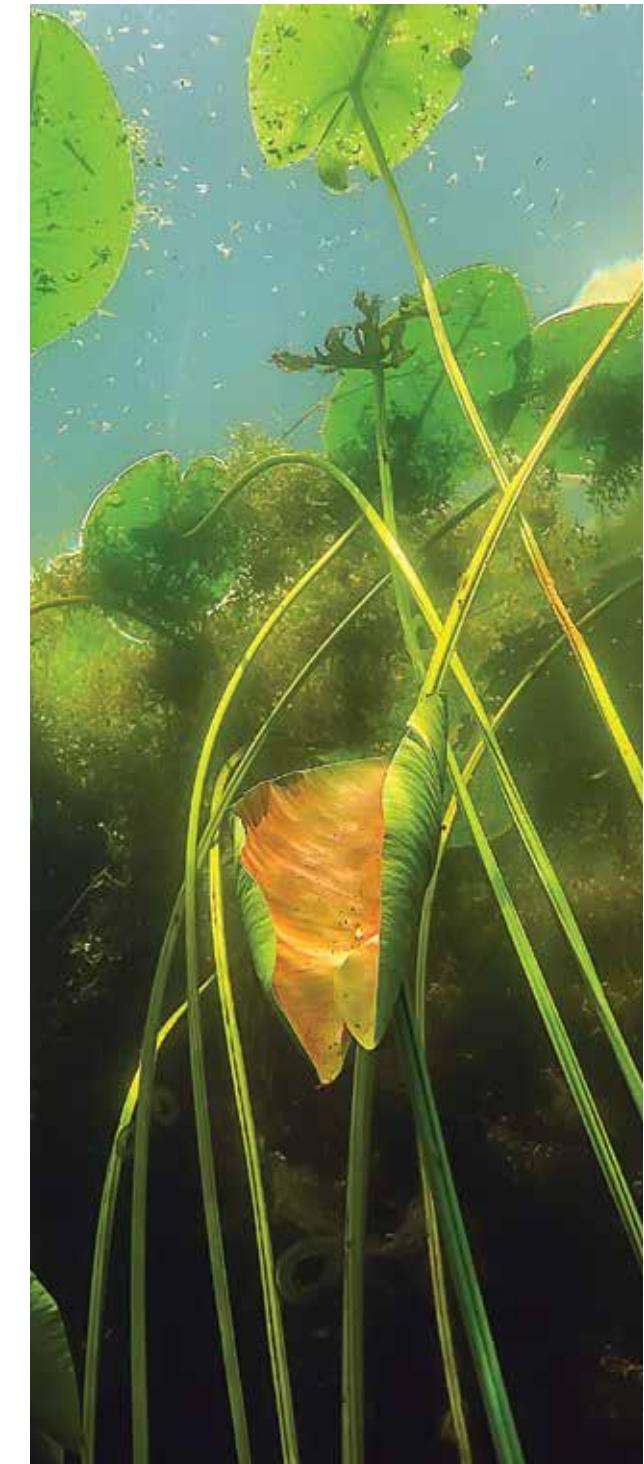
#10 PROTECTION OF AQUATIC ECOSYSTEMS

United States Environmental Protection Agency (USEPA) bases aquatic life criteria on how much of a chemical can be present in surface water before it is likely to harm plant and animal life. The strategy to protect both freshwater and saltwater organisms from short-term and long-term exposure is crucial to conserving aquatic ecosystems.

Contaminants of concern (CECs) such as pharmaceuticals and Personal Care Products (PPCPs) are being detected in low levels in surface water which might have an impact on aquatic life. These CECs and PPCPs act as Endocrine Disruptors that alter the normal functions of hormones resulting various health defects predominantly reproductive effects in aquatic organisms

Use of natural materials for cleaning and housekeeping: Replacing harmful cleaning chemicals with natural materials reduces the flow of toxic waste into wastewater. Seepage of toxic substances into water streams kills organisms which are essential for maintaining the natural ecosystem while also making it unsafe for consumption. The conventional chemical substances have a terrible impact on our waterways, air quality, soil health, and wildlife habitats.

“ Use of natural cleansing agents has shown to reduce toxicity in the Aquatic Ecosystems ”

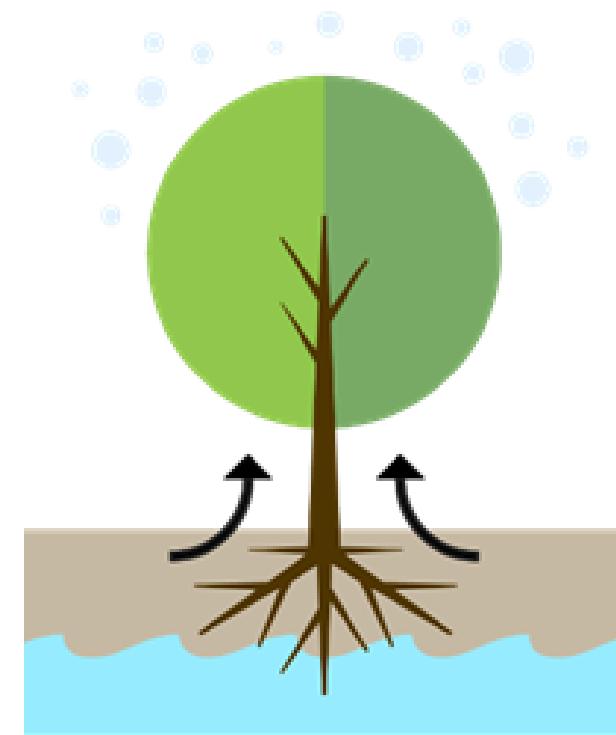


PHYTOREMEDIATION

"The process of planting trees and other plants to clean up contaminated soil and water. Due to recent advances in plant microbiology, phytoremediation has increasingly become more cost-effective and feasible than traditional remediation approaches for a wide range of polluted sites, while providing communities with the host of co-benefits inherently offered by trees—shade, carbon sequestration, watershed health, and habitat for wildlife"



“
Phytoremediation
helps clean up
contaminated soil and
water free of cost
”



KEY CLIMATE ACTION TARGET

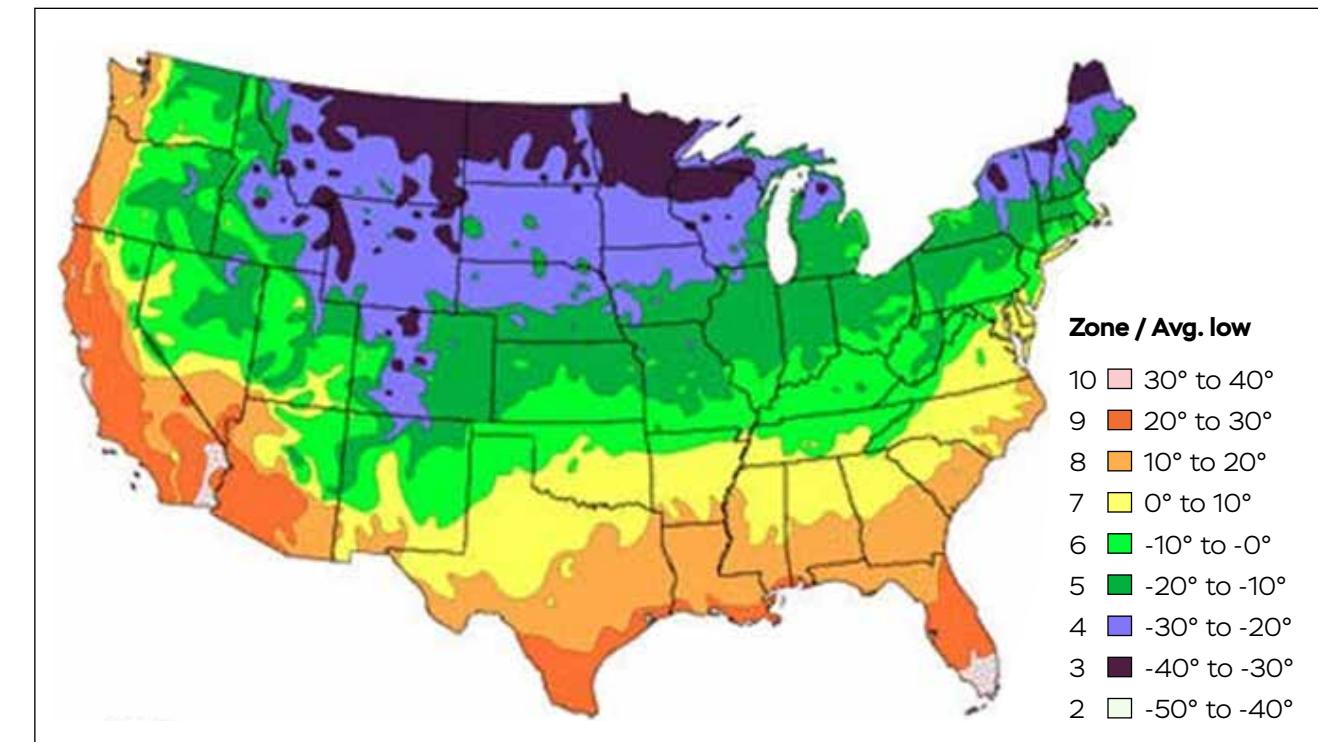
#11 PRESERVE & IMPROVE BIODIVERSITY

Trees play an important role in creating safer, healthier, and more connected communities. Cleaning the air, filtering water, and protecting soil from run off while also providing shade and cooling our homes.

Healthy forests are critical to conserving some of the complex ecosystems of the planet by supporting the habitats of wildlife and aquatic life and keeping the waterways healthy.

An average homeowner can save up to 20% on energy bills but just having the right trees in the right place. Trees improve air quality, protect soil from runoff, sequester carbon and many more In one year, an acre of mature trees absorbs the amount of CO₂ produced by a car driven 26,000 miles i.e., 48 pounds before releasing Oxygen in exchange.

“
Medicinal Herbs,
Conifers, Shrubs, and
Wildflowers reduce soil
erosion and stormwater
runoff creating conducive
habitats for birds and
other pollinators
”



PRESERVE & IMPROVE BIODIVERSITY

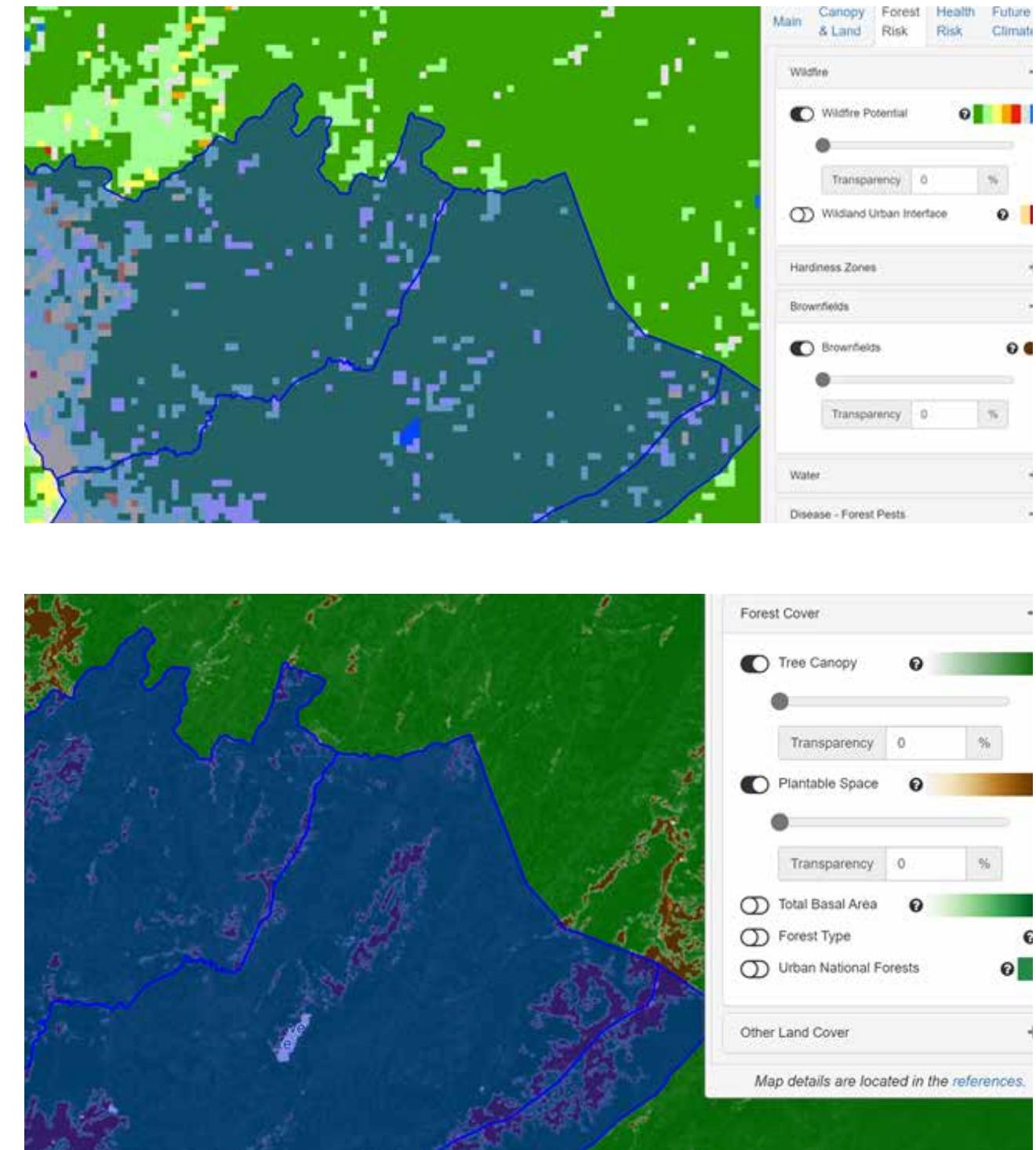
A concerted effort to create forests through Afforestation is one of the primary goals of Climate Hub. It helps in Carbon Capture by reduction of atmospheric CO₂ resulting in conducive habitats for wildlife, improving water quality, enhancing soil health, and creating natural wind breaks.

Reforestation will be done in places where the trees have been damaged or dead due to natural calamities or man-made disasters.

Plantation of native trees, medicinal herbs including hardwoods, bare-root conifers, shrubs, wildflowers, such as, White Cedar (*Arborvitae*), Paper Birch, American Cranberry, and Red Osier Dogwood would help reduce erosion, reduce stormwater runoff, and create habitat for pollinators.



WILDFIRE POTENTIAL OF THE PROPERTY



Disease – Forest Pests predominant in Back Creek:

Armillaria Root Disease

Annosus Root Disease

Butternut Canker

Chestnut Blight

Dogwood Anthracnose

Dutch Elm Disease

Laurel Wilt

Oak Wilt

White Pine Blister Rust

Insect Pests (Pest range maps are derived from the Forest Health Technology Enterprise Team (FHTET))
predominant at Back Creek

Gypsy Moth

Hemlock Woolly Adelgid

Pine Shoot Beetle

Spruce Beetle

Southern Pine Beetle



“The forests that extend throughout the property experience heavy floods resulting in soil erosion while also showing an increase in pest population and diseases”

KEY CLIMATE ACTION TARGET #12 CARBON SEQUESTRATION

Heat from the earth is trapped in the atmosphere due to high levels of carbon dioxide (CO₂) and other heat-trapping gases that prohibit it from releasing the heat into space. This creates a phenomenon known today as the “greenhouse effect.”

Trees help by removing (sequestering) CO₂ from the atmosphere during photosynthesis to form carbohydrates that are used in plant structure/function and return oxygen back into the atmosphere as a byproduct. Roughly half of the greenhouse effect is caused by CO₂. Therefore, trees act as carbon sinks, alleviating the greenhouse effect.

On average, one acre of new forest can sequester about 2.5 tons of carbon annually. Young trees absorb CO₂ at a rate of 13 pounds per tree each year. Trees reach their most productive stage of carbon storage at about 10 years at which point they are estimated to absorb 48 pounds of CO₂ per year. At that rate, they release enough oxygen back into the atmosphere to support two human beings. Planting 100 million trees could reduce an estimated 18 million tons of carbon per year and consequently save American consumers \$4 billion each year on utility bills.

There are certain methods employed to improve carbon sequestration, they are:

Plantation of shrubs/cover crops & Improved plantations:

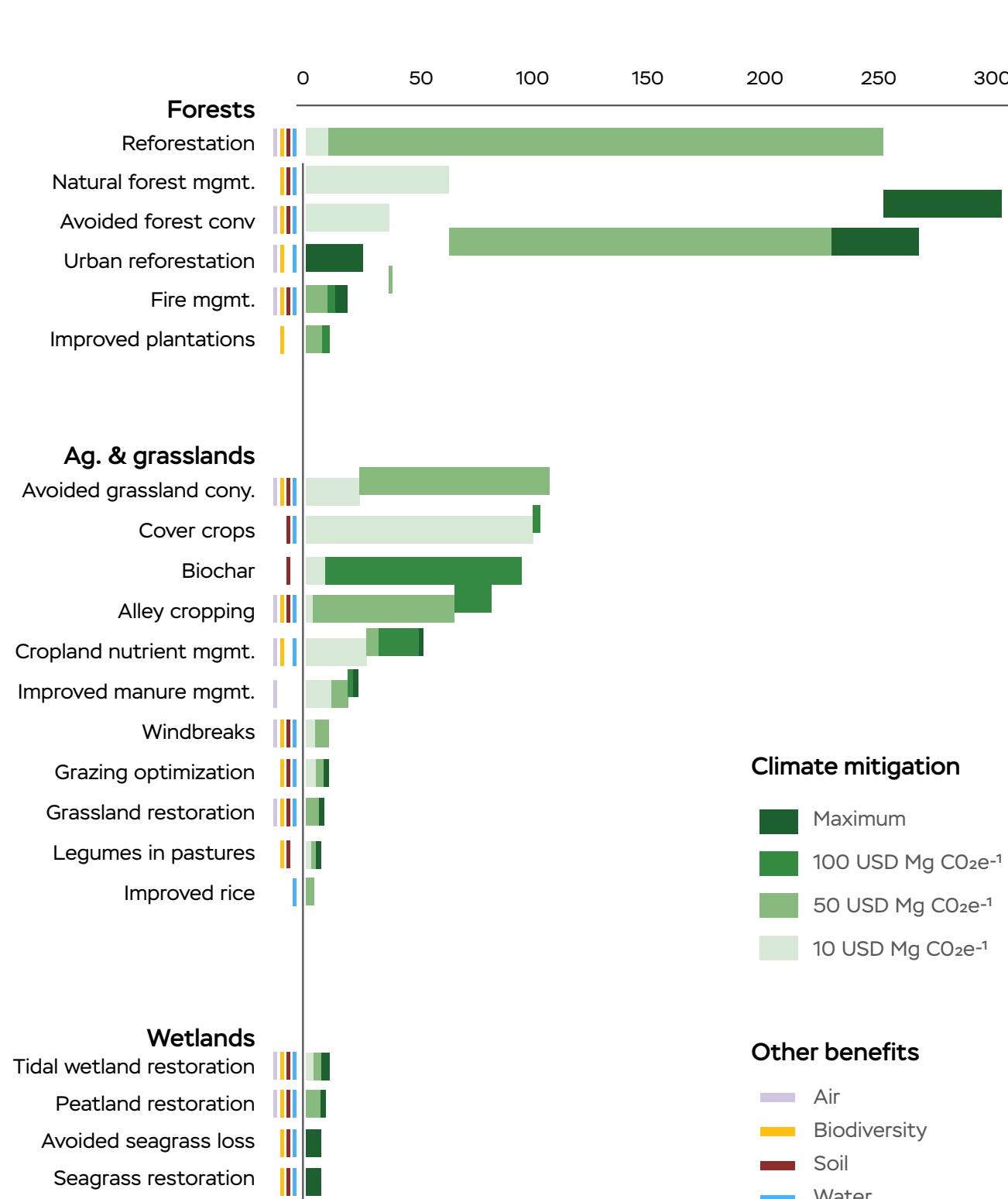
Shrubs are a necessary part of landscape for carbon sequestration. Carbon sequestration opportunities in croplands include the use of cover crops and improved cropland nutrient management. Cover crops, grown when fields are normally bare, provide additional carbon inputs to soils. Use of cover crops such as corn, soy, wheat, rice, and cotton

Reforestation & Urban Reforestation & Natural Forest Management:

Additional carbon sequestration in above and below ground biomass and soils gained by converting non-forest (<25% tree cover) to forest >25% tree cover in areas where forests are the native cover type.

- Fire Management
- Avoid conversion of grasslands
- Biochar
- Alley Cropping
- Cropland nutrient management
- Improved manure management
- Windbreaks
- Grazing optimization
- Grassland restoration
- Legumes in pastures
- Improved rice management
- Tidal wetland restoration
- Peatland restoration
- Avoided seagrass loss
- Seagrass restoration

CLIMATE MITIGATION POTENTIAL IN 2025 (Tg CO₂ e year-1)



CLIMATE MITIGATION POTENTIAL IN 2025 (Tg CO₂ e year-1)

Maximum carbon sequestration occurs when multiple species of plants with similar cultural needs form a community with, each other, with other organisms, and with the living soil micro climate in which they grow. The complex ecological relationships and interactions among these community members literally create and maintain the conditions they themselves need to flourish. These interactions also enable short and long-term carbon sequestration.

Community health is the reason that boreal and Amazonian forests, as well as wetlands, prairies, woodlands, and savannas can store so much carbon, naturally.

Crucial to carbon gardening is choosing plants with similar cultural requirements that suit the site and the existing soil and will not require high-carbon inputs such as synthetic fertilizer, weekly mowing, frequent edging and hedge trimming or the use of leaf blowers. Nor would a carbon-storing design call for conservation-inappropriate practices such as weekly watering, leaving soil bare through the winter, or growing water-dependent exotic ornamentals in arid regions.

Further, any plant mix should aim for at least 80% native plants. Every region has guilds of native plants—natural companions—that might be suitable for the soil and light conditions of the region's gardens. And if starting with an established garden, there is no need to rip everything out and start over.

Careful assessment and thoughtful changes such as adding native trees and bushes and surrounding them with a mixed understory/groundcover of low-growing perennials—a living mulch—so they can form a community, rather than isolating them in mulch islands, will improve carbon sequestration remarkably soon, though sequestering significant amounts of carbon is not a quick, do-and-done project.

While soil will start improving rapidly near the surface, the downward percolation of soluble organic matter and its conversion to stable soil carbon takes longer; but this is what we should strive for.

(Carbon Gardening: A Natural Climate Solution that Can Help Reduce CO₂ Emissions While Restoring Biodiversity - Resilience)

“ Carbon sequestration is achieved by planting different kinds of species with similar cultural needs forming a community of organization with complex ecological relationships ”



TYPES OF TREES FOR BACK CREEK AND THEIR CARBON SEQUESTRATION DATA

Name	Tree Type (H/C)	Growth Rate (S/M/F)	Tree Age (B)	Number of Age 0 trees planted (C)	Survival Factor (D)	Number of Surviving Trees (E = C x D)	Annual Sequestration Rate lbs/tree (F)	Carbon Sequestered (G = E x F)
Ash, white, Fraxinus americana	H	F	2	2000	0.736	1472	5.4	7948.8
Ash, mountain, American, Sorbus americana	H	M	4	2000	0.678	1356	5.2	7051.2
Aspen, bigtooth, Populus grandidentata	H	M	4	2000	0.678	1356	5.2	7051.2
Basswood, American, Tilia americana,	H	F	4	2000	0.678	1356	8.5	11526
Beech, American, Fagus grandifolia	H	S	4	2000	0.678	1356	2.8	3796.8
Birch, yellow, Betula alleghaniensis	H	S	4	2000	0.678	1356	2.8	3796.8
Birch, river, Betula nigra	H	M	4	2000	0.678	1356	5.2	7051.2
Boxelder, Acer negundo	H	F	4	2000	0.678	1356	8.5	11526
Buckeye, Ohio, Aesculus glabra	H	S	4	2000	0.678	1356	2.8	3796.8
Catalpa, northern, Catalpa speciosa	H	F	4	2000	0.678	1356	8.5	11526
Cherry, black, Prunus serotina	H	F	4	2000	0.678	1356	8.5	11526
Crabapple, Malus spp.	H	M	4	2000	0.678	1356	5.2	7051.2
Cedar-white, northern, Thuja occidentalis	C	M	4	2000	0.678	1356	3.1	4203.6
Cucumbertree, Magnolia acuminata	H	F	4	2000	0.678	1356	8.5	11526
Cottonwood, eastern, Populus deltoides	H	M	4	2000	0.678	1356	5.2	7051.2
Dogwood, flowering, Cornus florida	H	S	4	2000	0.678	1356	2.8	3796.8
Elm, American, Ulmus americana	H	F	4	2000	0.678	1356	8.5	11526
Elm, slippery, Ulmus rubra	H	M	4	2000	0.678	1356	5.2	7051.2
Elm, slippery, Ulmus rubra	H	M	4	2000	0.678	1356	5.2	7051.2
Fir, Douglas, Pseudotsuga menziesii	C	F	4	2000	0.678	1356	5.2	7051.2
Hackberry, Celtis occidentalis	H	F	4	2000	0.678	1356	8.5	11526
Hawthorne, Crataegus spp.	H	M	4	2000	0.678	1356	5.2	7051.2
Hickory, bitternut, Carya cordiformis	H	S	4	2000	0.678	1356	2.8	3796.8
Hickory, mockernut, Carya tomentosa	H	M	4	2000	0.678	1356	5.2	7051.2
Hickory, shagbark, Carya ovata	H	S	4	2000	0.678	1356	2.8	3796.8
Hickory, pignut, Carya glabra	H	M	4	2000	0.678	1356	5.2	7051.2
Holly, American, Ilex opaca	H	S	4	2000	0.678	1356	2.8	3796.8
Honeylocust, Gleditsia triacanthos	H	F	4	2000	0.678	1356	8.5	11526
Hophornbeam, eastern, Ostrya virginiana	H	S	4	2000	0.678	1356	2.8	3796.8
Horsechestnut, common, Aesculus	H	F	4	2000	0.678	1356	8.5	11526

TYPES OF TREES FOR BACK CREEK AND THEIR CARBON SEQUESTRATION DATA

Name	Tree Type (H/C)	Growth Rate (S/M/F)	Tree Age (B)	Number of Age 0 trees planted (C)	Survival Factor (D)	Number of Surviving Trees (E = C x D)	Annual Sequestration Rate lbs/tree (F)	Carbon Sequestered (G = E x F)
Locust, black, Robinia pseudoacacia	H	F	4	2000	0.678	1356	8.5	11526
Magnolia, southern, Magnolia grandifolia	H	M	4	2000	0.678	1356	5.2	7051.2
Maple, bigleaf, Acer macrophyllum	H	S	4	2000	0.678	1356	2.8	3796.8
Maple, red, Acer rubrum	H	M	4	2000	0.678	1356	5.2	7051.2
Maple, silver, Acer saccharinum	H	M	4	2000	0.678	1356	5.2	7051.2
Maple, sugar, Acer saccharum	H	S	4	2000	0.678	1356	2.8	3796.8
Maple, Norway, Acer platanoides	H	M	4	2000	0.678	1356	5.2	7051.2
Mulberry, red, Morus rubra	H	F	4	2000	0.678	1356	8.5	11526
Oak, black, Quercus velutina	H	M	4	2000	0.678	1356	5.2	7051.2
Oak, chestnut, Quercus prinus	H	S	4	2000	0.678	1356	2.8	3796.8
Oak, pin, Quercus palustris	H	F	4	2000	0.678	1356	8.5	11526
Oak, northern red, Quercus rubra	H	F	4	2000	0.678	1356	8.5	11526
Oak, scarlet, Quercus coccinea	H	F	4	2000	0.678	1356	8.5	11526
Oak, white, Quercus alba	H	S	4	2000	0.678	1356	2.8	3796.8
Pine, Virginia, Pinus virginiana	C	M	4	2000	0.678	1356	3.1	4203.6
Redbud, eastern, Cercis canadensis	H	M	4	2000	0.678	1356	5.2	7051.2
Sassafras, Sassafras albidum	H	M	4	2000	0.678	1356	5.2	7051.2
Sugarberry, Celtis laevigata	H	F	4	2000	0.678	1356	8.5	11526
Sycamore, Platanus occidentalis	H	F	4	2000	0.678	1356	8.5	11526
Walnut, black, Juglans nigra	H	F	4	2000	0.678	1356	8.5	11526
Willow, black, Salix nigra	H	F	4	2000	0.678	1356	8.5	11526
Pine, Scotch, Pinus sylvestris	C	S	4	2000	0.678	1356	1.6	2169.6
Pine, white eastern, Pinus strobus	C	F	4	2000	0.678	1356	5.2	7051.2
Fir, balsam, Abies balsamea	C	S	4	2000	0.678	1356	1.6	2169.6
Hemlock, eastern, Tsuga canadensis	C	M	4	2000	0.678	1356	3.1	4203.6
Tamarack, Larix laricina	C	F	4	2000	0.678	1356	5.2	7051.2
Spruce, Norway, Picea abies	C	M	4	2000	0.678	1356	3.1	4203.6
Spruce, red, Picea rubens	C	S	4	2000	0.678	1356	1.6	2169.6
Total Pounds of Carbon Sequestered								425326
Total Pounds of Equivalent CO2 Sequestered								1560945
Equivalent Co2 Sequestered in Short Tons /2000								780

TYPES OF TREES FOR BACK CREEK AND THEIR CARBON SEQUESTRATION DATA

Total Pounds of Carbon

Sequestered:

425,326

Total Pounds of Equivalent CO₂

Sequestered

1,560,945

Equivalent CO₂ Sequestered in
Short Tons / 2000

780



“ Mix of native plants with their natural companions/ low growing perennials form a community are suggested to improve Carbon Sequestration ”

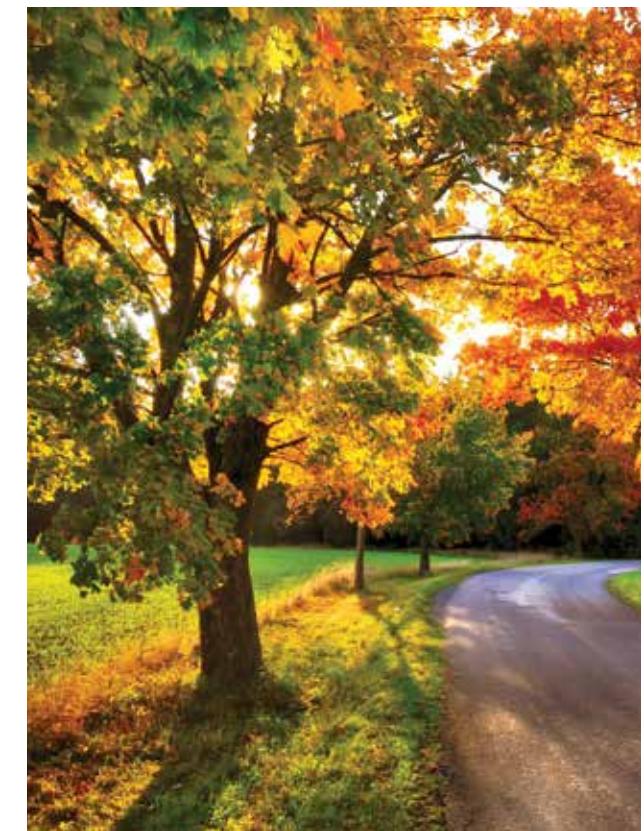
TYPES OF TREES FOR BACK CREEK AND THEIR CARBON SEQUESTRATION DATA

Most important tree plantations

Oak Tree	: White, English, Northern, Bur
Maple Tree	: Red, Norway, Sycamore, Sugar, Silver
Japanese Lilac	: Golden Eclipse, Ivory Pillar, Ivory Silk, Signature
Crabapple Tree	: Harvest Gold, Snowdrift, Golden Hornet, Sugar Tyme
Fir Tree	: Korean, Nordmann, White, Fraser
Hickory Tree	: Shellbark, Bitternut, Pecan, Shagbark
Elm Tree	: American, Chinese, Siberian, Ulmus Minor
Japanese Maple Tree	: Dissectum & Palmatum
Dogwood Tree	: Common, White, Pagoda, Cornelian
Chestnut Tree	: American, European, Chinese, Japanese
Apple Tree	: Honeycrisp, Red Delicious, Granny
Pear Tree	: Bartlett, Kieffer, Anjou, Bosc
Plum Tree	: Damson, Fench, Friar, Japanese
Peach Tree	: Redhaven, Reliance, White, Sunhaven
Fig	: Chicago, Turkey, Brown
Cherry	: Bing, Van, Montmorency
Nectarine Tree	: Sungo, Fantasia, Redgold
Apricot Tree	: Royal, Tropic Gold, Blenheim
Mulberry Tree	: Black, White, Red
Lemon Tree	: Meyer, Lisbon, Ponderosa

All these trees,

- Thrive in Heat & Cold
- Can Grow in Any Soil and Conditions
- Hardy against Pests, Insects, and Diseases
- Have beautiful colors throughout the entire years
- Great Cross-Pollinator
- Require less maintenance
- Bears heavy fruit



Note: The data might differ after a complete on ground survey is conducted to understand local ecosystem and soil biology before determining the type of plantations suitable.

KEY CLIMATE ACTION TARGET

#13 SUSTAINABLE FOOD PRODUCTION

Comprehensive cropping patterns would be followed where, we cultivate all vegetables suitable for the type of soil at Back Creek, apart from fruit varieties. These will ensure, community is self-reliant on the produce from the farm as per design. However, we need to bear in mind that the farm is subject to natural disasters.

Climate Hub has a holistic farm, where Farming is practiced at various levels. This establishes the sanctity that is maintained and governed by the members themselves with expert advice. Community Farming, Personal farming, Nursery, Forest plantations, Medicinal plantations, Animal husbandry, Aqua farming, Api culture etc., are just a few components of farming at Back Creek Climate Hub.

The community farming comprises majority of the essential farm produces based on the water availability. We need approx. 100 acres to be dedicated to fruits and vegetables with diverse cropping patterns designed to benefit the plants nutrient supply in such a way that it also promotes passive health care. The plant care and nutrient supply in the farm is done using predominantly animal manure prepared from the animal husbandry unit.

With a potential to produce about 50 varieties of fruits and vegetables required for its 300 families throughout the year, Back Creek would quickly become a one of its kind Sustainable Farming Community Native tree/plant species which need less or no water



“ Climate Hubs are food and nutrition positive communities besides being low on carbon footprint by reduction in food miles ”

SUSTAINABLE FOOD PRODUCTION

- Improve Biodiversity
- Health benefits of taking organic food.
- Witnessed and unaltered food
- Food Miles

Moisture preservation techniques are employed to reduce water dependency of the farm by at least 50% using,

1. Live mulch, garden waste and coconut waste to cover the surface.
2. Soil breeding-live organic mulch as a continuous farm cover
3. Active farmland manure from the animal husbandry unit

The farm is designed to be water independent; all water systems are designed based on the rainwater available in Monroe County every year.

Irrigation techniques will be designed in consultation with experts in the field. Scientific methods would be

used to calculate the sizes and placement of the storm water trenches that channelize the water falling on the site in a controlled way without any soil erosion.

Other essential Steps to improve farming at Back Creek Climate Hub include,

- Companion cropping techniques
- Natural pest control methods using locally available substances, Bio control Agents, Herbal Concoctions, trap crops etc.,

Compost preparation: Large quantities of waste material is available as vegetable refuse, farm litter such as weeds, Sewage sludge and animal waste from home units and common areas. Excreta can be converted into useful compost manure by conserving and subjecting it to a controlled process of anaerobic decomposition. Compost is used in the same way as Farmyard Manure and is good for application to all soils and all crops.

Vermicompost: Organic manure produced by the activity of earthworms that generally live in soil, eat biomass and excrete it in digested form. It is generally estimated that 1800 worms is an ideal population for one sq. meter can feed on 80 tones of humus per year. These are rich in macro and micronutrients, vitamins, growth hormones and immobilized microflora. The average nutrient content of vermicompost is much higher than that of Farmyard Manure. It contains 1.60% N, 5.04% P2O and 0.80% K2O with small quantities of micronutrients. Application of vermicompost facilitates easy availability of essential plant nutrients to crop.

- Crop rotation
- Grid-free power sourcing
- Pooling of knowledge systems & regular hassle free up-keep and maintenance
- Sharing of profits and loss
- Water security ensured as water is harvested, and conservation works effectively for large areas.
- Expert care for the farm, energy, water and every aspect of the farm and living
- Active community that is run by professionals with a process driven approach.
- Reliable work force in the farm due to the structured incentivized employment with proper growth ladders.

KEY CLIMATE ACTION TARGET

#14 SOIL HEALTH

Soil at Monroe County is alkaline due to the presence of limestone. Such soils are suitable for cultivation of Corn, soybeans, wheat, and truck crops such as tomatoes, lettuce, melons, beets, broccoli, celery, radishes, onions, cabbage, and strawberries.

Limestone presence indicates that the soil is rich in calcium and magnesium and their cation-exchange capacity is higher than in other lowland forest soils. Other nutrients are scarce; however, soil is light and enables better water drainage due to its porous substrate.

Other benefits of lime content in soil include,

- Increase in microbial activity
- Better soil structure (air and water flow)

- Accelerates soil's decay system
- Reduces certain acid-loving weeds such as quack grass and jimson weed
- Acts as natural irritant to insects
- Depresses acid tolerant microbial species
- Supplies Ca for "high calcium" legumes and alfalfa

Climate Hub employs soil conservation techniques involving the use to animal manure, soil from nearby creeks, and wet waste compost for soil fortification. Other techniques include,

- a. Trenches across the slopes help in controlling water from flooding to the downstream farm areas.

SOIL HEALTH

b. Contour Bunding: Contour farming or Contour bunding is the farming practice of ploughing and/or planting across a slope following its contour lines. Contour bunding is a proven sustainable land management practice for marginal, sloping, and hilly land where the soil productivity is very low.

It consists of narrow based trapezoidal bunds on contours to impound runoff water behind them so that it can gradually infiltrate into the soil for crop use. Spacing between two bunds is commonly expressed in terms of the V.I. (Vertical interval) which is the difference in elevation between two similar points on two consecutive blinds.

c. Cover crops: Good ground cover by canopy protects the soil like an umbrella besides conserving soil

moisture and minimizing soil erosion. These crops hold those soluble nutrients, which are lost by leaching. The advantage of legumes as cover crops is the addition of organic matter.

d. Mulching: Use of available plant residues as mulch reduces the soil loss considerably by protecting the soil from direct impact of rain and reducing sedimentation. A minimum plant residue cover of 30 per cent is necessarily carried with runoff. Vertical mulching to keep runoff and soil loss within the acceptable limits also reduces soil loss particularly by increasing infiltration.

e. Use of FYM: Increases biomass content in the soil thereby greatly improving the soil health.

“ Back Creek Climate Hub makes use of animal manure, soil from nearby creeks and compost from within the community to improve Soil fertility ”



KEY CLIMATE ACTION TARGET

#15 ECO-HABITATS

The housing units will be designed on passive architecture principles,

- Highly energy efficient units with less dependency on mechanical heating, cooling, ventilation, and lighting demand systems and instead use 'natural' sources to create comfortable conditions inside the buildings.
- Passive design measures include building orientation, air sealing, continuous insulation, windows, daylighting, and ventilation to improve indoor air quality, comfort and health of the occupants by designing a building to take advantage of natural ventilation opportunities

- Priority would be given to the locally available materials to minimise the associated environmental impacts resulting from transportation.
- Design optimization to reduce the quantity of materials required for construction
- Identifying ideal land pockets while also maintaining the natural topography with minimal disturbance to the existing land conditions
- Building a cyclist and pedestrian friendly infrastructure.
- Infrastructure convenient and easy to access for physically disabled.

Eco-Habitats at Back Creek are climate responsive structures that promote human well-being while incorporating sustainable design principles



LAND USE AND ZONING

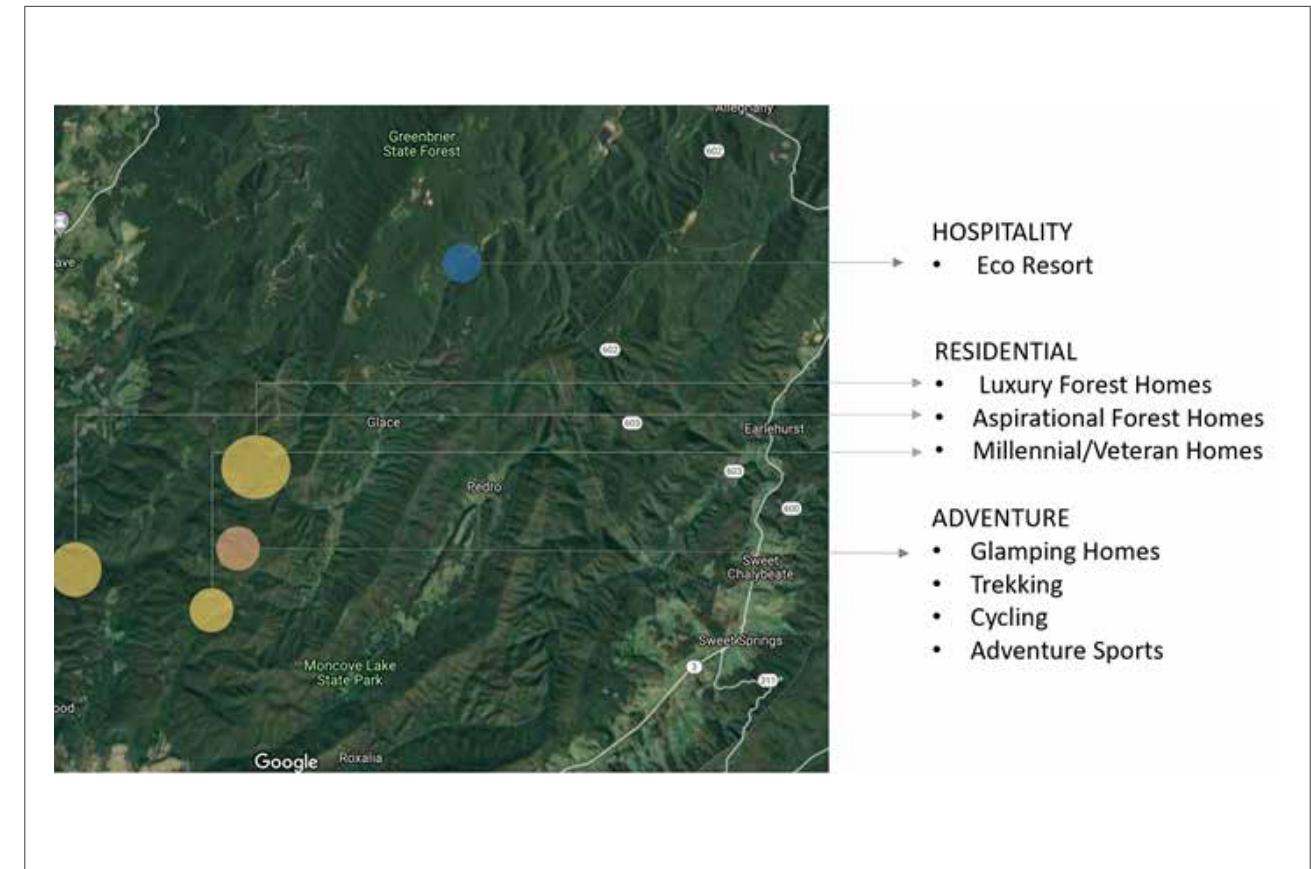
Though the extent of the property is known to be close to 5771 acres, land pockets suitable for development are not more than 58 acres overall because of lack of access roads to interiors and less availability of flat lands.

Hence, the best strategy for salability would be to allot divisible plots along with an undivided share of unusable forest lands as a single unit which makes perfect economic sense to the person investing in it.

Road connections would be assessed and concluded for other usable pockets of lands only after a thorough on ground survey is conducted.

Luxury Forest Homes: Being adjacent to the creek along the slope, there is ample scope to create several Vantage viewpoints for every house while providing seclusion due to presence of a dense forest on the other side. The aspect of privacy and beautiful view that the location provides, this is an ideal land pocket for Luxury Villas.

Veteran/Millennial Homes: Less flat land makes for a dense clustered construction that is very close knitted. However, due to the altitude, the location provides a separate access to the cluster giving scope for adventure sports and other amenities for the activity loving group of future homeowners.





“ Small portions of relatively flat lands that are accessible by roads have been identified throughout the property. Presence of creek and slopes along the waterbody make the property a hot spot for tourists to enjoy forest living in its true sense ”

Based on the available data online from topographical maps, google maps and google earth and google maps, the usable land pocket is not exceeding 58 acres. Development is planned with divisible lands in scattered pockets & UDS (undivided share) subdivisions

Aubrey Forest: 20 Acres

A: 15.95 acres
B: 9.07 acres

Blueline Forest: 28 Acres

C: 4.76 acres
D: 6.66 acres
E: 1155 acres
F: 4.9B acres

Spencer Forest: 6.3 Acres

G. 6.3 acres

Nester Forest: 3.5 Acres

H: 15.95 acres
I: 9.07 acres

ASPIRATIONAL FOREST HOMES

Each plot will be $\frac{1}{4}$ acre i.e 1000 sq.yds with Built up Area of 2,000 sft and UDS of 2 acres. There will be a total of 80 Homes in the plotted area of 20 acres. The total area including the UDS will be 160 acres.

LUXURY FOREST HOMES

Each plot will be $\frac{1}{2}$ acre i.e 2000 sq.yds with Built up Area of 8,000 sft and UDS of 10 acres. There will be a total of 56 Homes in the plotted area of 28 acres. The total area including the UDS will be 280 acres

MILLENIAL/VETERAN HOUSING

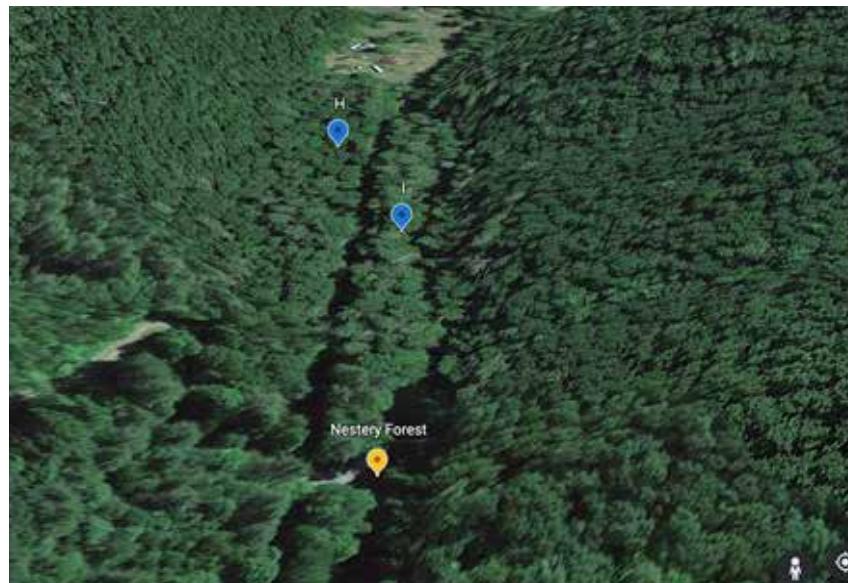
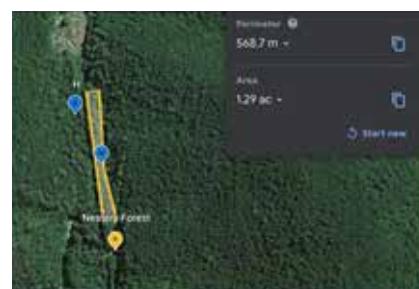
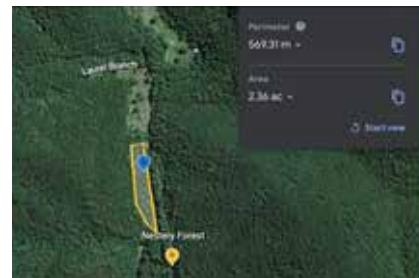
Each plot will be $\frac{1}{8}$ acre i.e 500 sq.yds with G+3 townhouses with Built up Area of 900 sft for each house. There will be a total of 144 Homes in 6.3 Acres

ECO RESORT


ECO RESORT

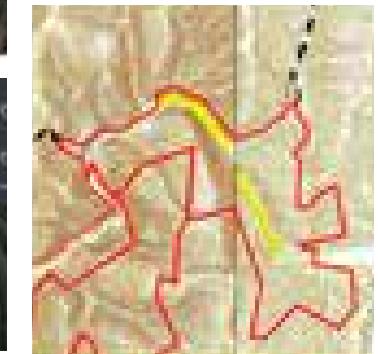
Total Area: 3.5 acres

Location for the Eco Resort has been chosen in such a way that it is located besides the creek where all the rooms would be along the water with beautiful views of the creek and the vast forest that follows it. It has the potential to quickly become 'the tourist location' with Creek view cottages promoting experiential/forest living.



LUXURY FOREST HOMES

Total Area: 28 acres | Area per unit: 1/2 Acre 8000SFT with UDS 10 acres | No of units: 56 homes



Norwegian architecture with minimalistic contemporary style homes are the next highly chosen home designs in America in the Luxury segment.

This style is suggested for Luxury Forest homes with the use of introverted landscape pockets and fully grown forest trees accommodated as part of the living spaces. This stands as a highly ambitious architectural feature suitable for West Virginia's temperate conditions.

LUXURY FOREST HOMES

Total Area: 20 acres
Area per unit: 1/4 Acre 2000 SFT with
UDS 2 acres | No of units: 80 homes

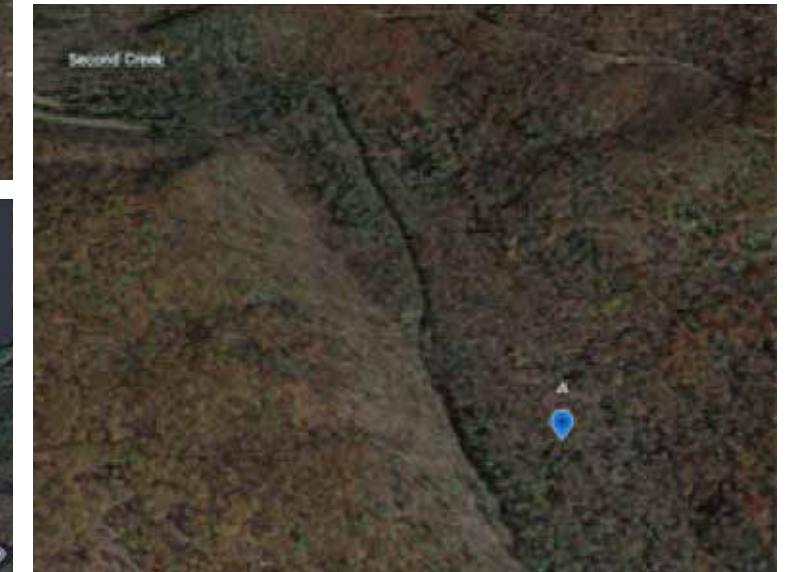
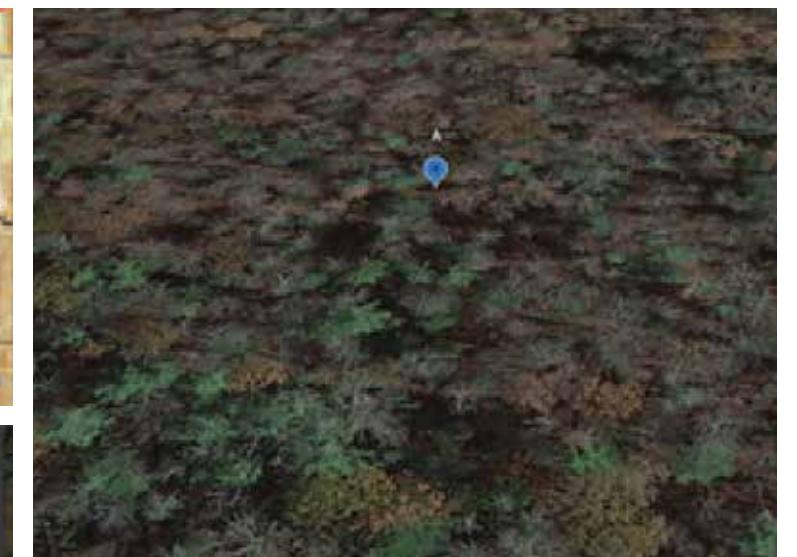
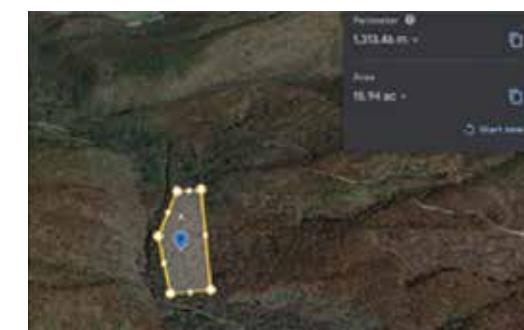


No of units:
80 HOMES



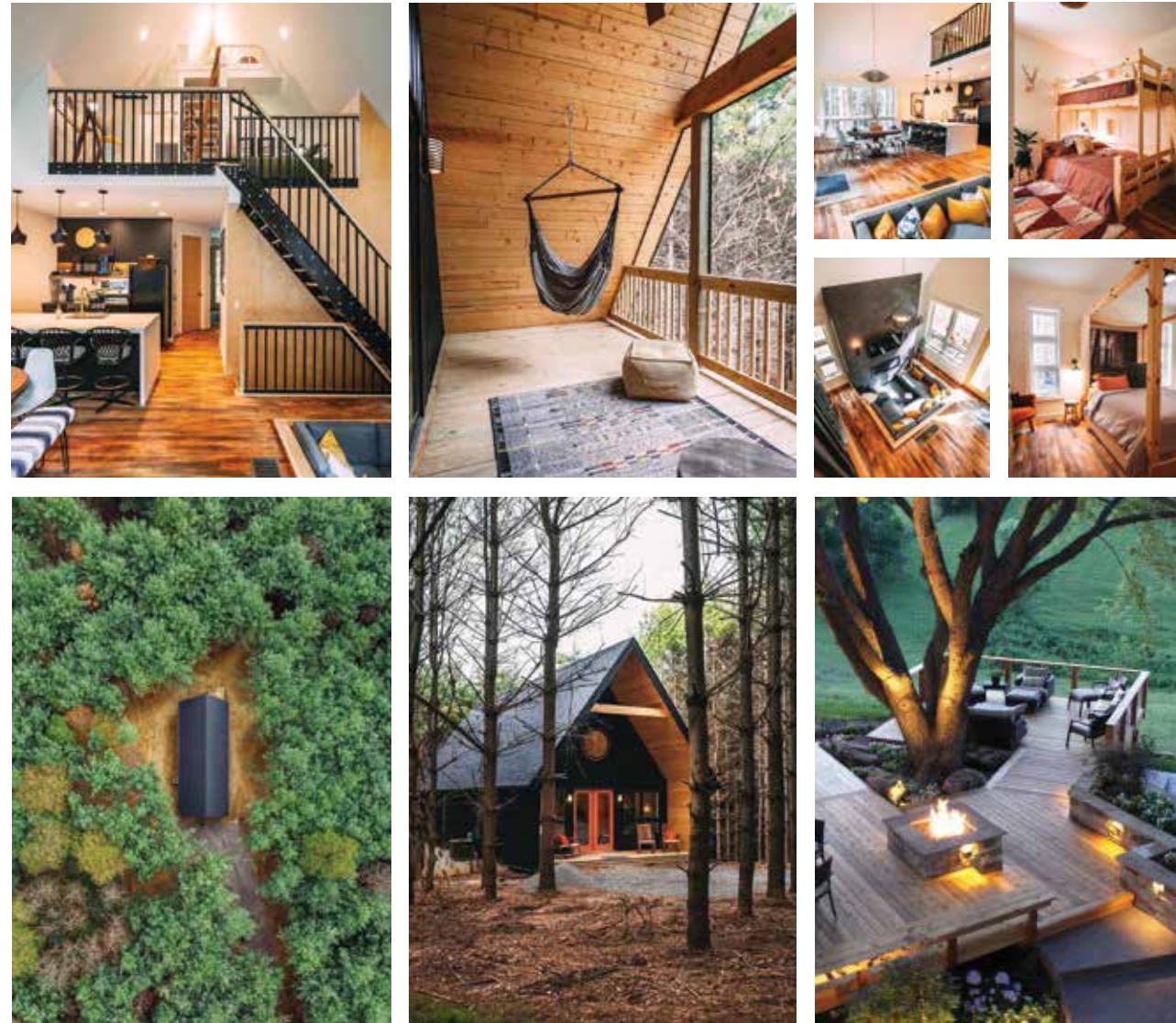
ASPIRATIONAL FOREST HOMES

Back Creek's : scarcity in available land pockets suitable for development makes way to designs that use minimal footprint while also providing enough room for all aspects of living. We tried to incorporate a greater number of homes while considering minimal reduction in the forest cover for these mid segment Forest homes.



ASPIRATIONAL FOREST HOMES

Total Area: 6.3 acres
8 Acre 900 SFT 2 Bed 3 Bath
G+3 Town houses

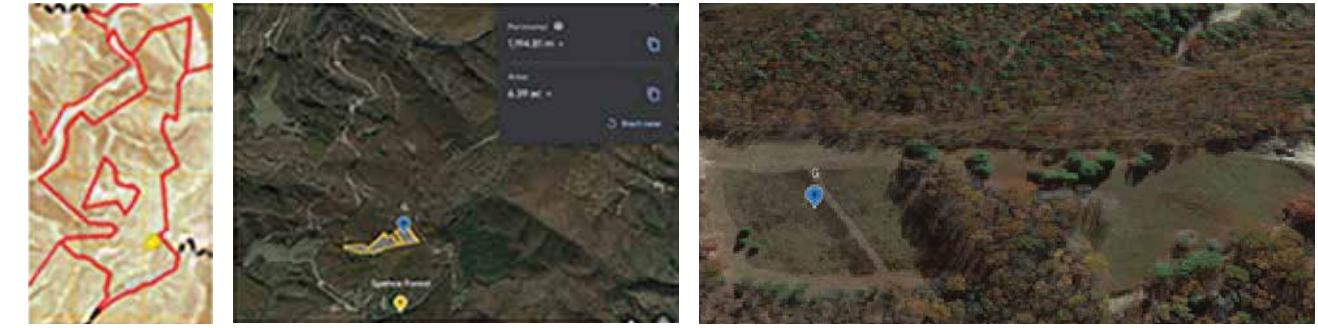


No of units:
144 HOMES

MILLENNIAL / VETERAN HOUSING

These houses would be home to extremely active and outdoor loving families who believe in sustainable lifestyles in the real sense. Use of less footprint for more number of homes with highly roomy indoors, and minimal to zero damage to existing ecosystems is the design brief that we considered for this Millennial/ Veteran housing segment.

The very affordable but rich design incorporates 3 bedroom and 3 bath components with ample light and ventilation, less cost of construction, spatial rooms, and more utility spaces.

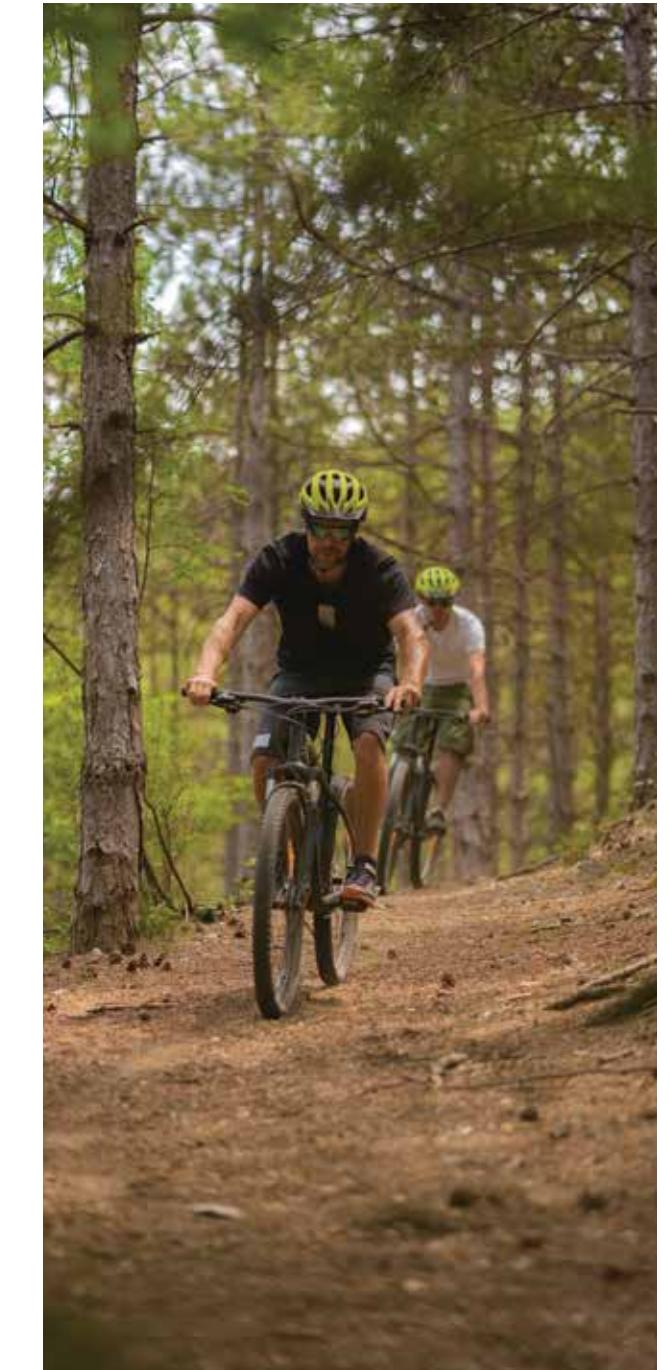




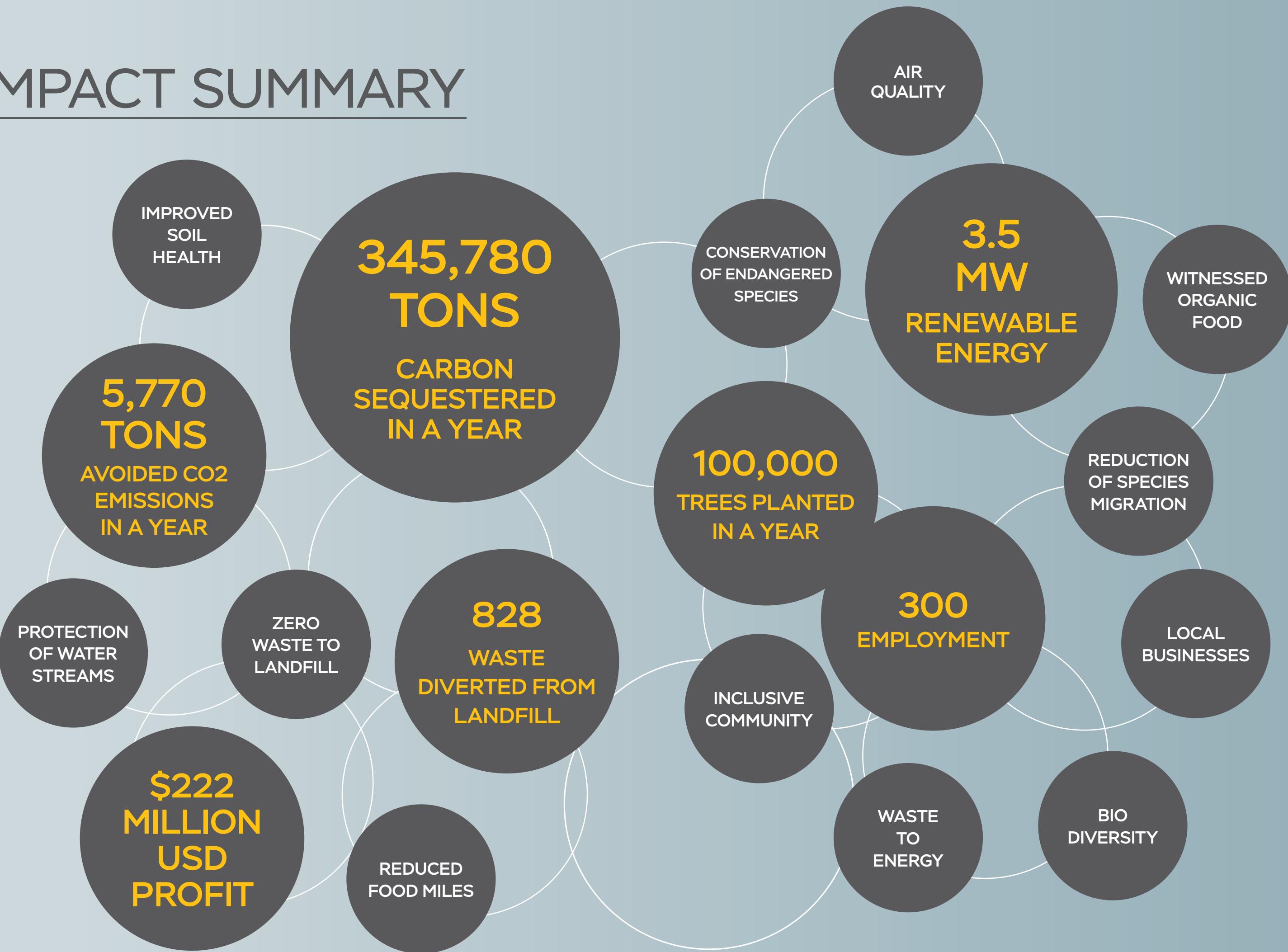
DESTINATION

TREKKING . CYCLING . ADVENTURE SPORT

“ Monroe County is one of the most visited destinations in America for Nature enthusiasts and adventure seekers alike ”



IMPACT SUMMARY



“
We do not inherit the earth from our ancestors;
We borrow it from our children ”

- David R. Brower

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Publication

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CREST FOUNDATION

CENTER FOR RESEARCH IN ENVIRONMENTAL & SUSTAINABLE TECHNOLOGIES

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A Publication of CREST FOUNDATION
center for research in environmental & sustainable
technologies