SAVAGE RIVER STATE FOREST
ANNUAL WORK PLAN

FISCAL YEAR 2021

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Savage River State Forest
FY-21
Annual Work Plan

Savage River State Forest
FY-21 Annual Work Plan

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I. State Forest Overview

Savage River State Forest is approximately 55,155 acres in size and is situated in the northeastern quadrant of Garrett County in Western Maryland. It is a second growth mixed hardwood forest dominated by mixed oak species, sugar and red maple, black cherry, hickory and ash. Owing to high rainfall and certain topographic features, Savage River State Forest contains many excellent quality growing sites stocked with superior quality trees. The forest contains approximately 2,800 acres of conifer plantations that were established in the 1940's following state acquisition. Red pine is the dominant tree species within these plantations but other conifers include white pine, Norway spruce, larch, and Scotch pine. These plantations were established as nurse crops to rehabilitate abandoned and depleted farm fields, with the long-term goal of conversion back to native hardwoods as appropriate.

Savage River State Forest has been intensively managed over the past nine decades. Forest harvest and grooming operations are undertaken to thin overstocked stands, to effectively deal with public safety concerns, to harvest mature or diseased/dying trees, to improve habitat for certain wildlife species, to assist and provide for certain research needs, to address aesthetic concerns and to increase the proportion of age/height diversity of forested stands.

II. Annual Work Plan Summary

The FY-2021 Annual Work Plan for Savage River State Forest was formulated in 2019. It contains projects to be undertaken in the areas of Special Projects, Maintenance and Operations, Recreation, Watershed Protection, Ecosystem Restoration / Protection, and Wildlife Management. In addition to the routine operations and management of the State Forest, the FY-21 Annual Work Plan for Savage River State Forest details seven land management projects that will be the focus of the State Forest management staff for FY-21. All projects and proposals within this Plan have been developed to meet one or more of the Land Management Guidelines and Objectives outlined in the Savage River State Forest Sustainable Management Plan including:

Forest Economy*: management activities intended to maintain an economically sustainable forest and contribute to the local economy through providing forest-related employment and products.*

Forest Conservation*: management activities with a purpose to protect significant or unique natural communities and elements of biological diversity, including Ecologically Significant Areas, High Conservation Value Forests and old growth Forests. Old growth forest management serves to restore and/or enhance old growth forest structure and function.*

Water Quality*: management activities designed to protect or improve ecological functions in protecting or enhancing water quality.*

Wildlife Habitat*: management activities with a purpose to maintain and enhance the ecological needs of the diversity of wildlife species and habitat types.*

Recreation and Cultural Heritage*: management activities with a purpose to maintain and enhance areas that serve as visual, public camping, designated trails, and other high public use areas.*

A. Special Management Projects Include:

1. Continued Development of the Certified, State Forest Sustainable Forest Management Plan - with special focus on addressing items identified as in need of improvement as a result of the 2019 FSC/SFI Certification Audits.

2. Forest Stand Delineation, Inventory and Monitoring – Completion of the project to re-inventory and redefine stands on the entire forest. This critical project will continue in FY-21. To date, 100% of the data collection in harvestable stands is completed. Areas of HCVF including wildlands, ecologically significant areas, old growth, old growth ecosystem management areas and areas that preclude timber harvest operations will be inventoried secondarily to the harvestable areas. The project will allow a thorough analysis of this complete data set from which further management plans will be derived. Inventory work will continue in the form of follow-up monitoring protocols associated with the initial inventory and certification requirements.

3. Non-Native Invasive Species (NNIS) Inventory and Control Work - The Sustainable Forest Management Plan calls for various responses to NNIS and the Forest Inventory Project has allowed for a broad view of the problem forest wide.

. **B. Land Management Projects Include:**

1. Continuation of the ecosystem restoration project involving control of invasive and exotic plants forest wide.

2. Continuation of the ecosystem restoration efforts involving control of invasive, exotic forest pests, particularly the Hemlock wooly adelgid.

3. 7 Silvicultural projects including:
6 Intermediate Harvests on 354.6 acres and 1 Salvage Harvest on 8.7 acres.

Forest harvest operations are undertaken to utilize mature and dead/dying/diseased trees; to thin overstocked stands; to improve and diversify wildlife habitat; to effectively correct public safety concerns and issues; to reduce the forests vulnerability to insect attack, disease or wildfire hazard; to facilitate certain approved research needs; to improve certain aesthetic aspects of an area; and to improve the proportions of age class and species diversity within stands and management blocks. This forest has been intensively managed since its inception, utilizing both even and uneven-aged techniques via selective removals and regeneration harvests. Early records indicate that as cut over land was acquired, foresters culled the forest, removing the poorly formed and damaged timber left behind in the wake of the cut and run practices employed by early timber speculators. By removing these undesirable trees, newly forming seedlings were released from competition and were thus cultured into the future growing stock of trees that is

enjoyed today. The benefits of this work have been significant including improved wildlife habitat diversity, improved forest health and more abundant mast production, improved utilization of gypsy moth damaged trees, reduced forest fire hazard, and the considerable financial contribution of management to the state and local economies as well as to those employed in the forest products industry.

The FY-21 Annual Work Plan outlines 7 harvests on 363.3 acres, producing a harvest of approximately 1,000,000 board feet of sawtimber and accounting for an estimated $250,000 worth of raw wood products entering local markets. Much of the silvicultural work laid out in this work plan is focused on initiating seedling development to better ensure regeneration successes in future harvests. Much of the value of the harvests in the work plan will be directed back into the forest providing the essential investment in pre-harvest cultural work that will safeguard the long term sustainable management of these important forest resources. The cultural operations and management projects outlined within the FY-21 Annual Work Plan are selected to provide significant contributions to the sustainability of forest resources found within the State Forest and the ecosystems associated with it.

III. General Location Map for FY-21 Land Management Project Proposals

Approximately 363.3 Acres

Map Key

1. Compartment 4 Stand 22	*8.7-Acre Hardwood Salvage*
2. Compartment 11 Stands 58, 59, 60	*42.3-Acre Hardwood Thinning*
3. Compartment 11 Stands 77, 78, 83	*43.6-Acre Hardwood Thinning*
4. Compartment 14 Stands 1, 13, 19	*30.5-Acre Hardwood Thinning*
5. Compartment 29A Stands 2, 4, 7, 10, 11, 17	*50.6-Acre Conifer Thinning*
6. Compartment 29 Stands 14, 18	*133.6-Acre Hardwood Thinning*
7. Compartment 77 Stands 12, 13	*54-Acre Hardwood Thinning*

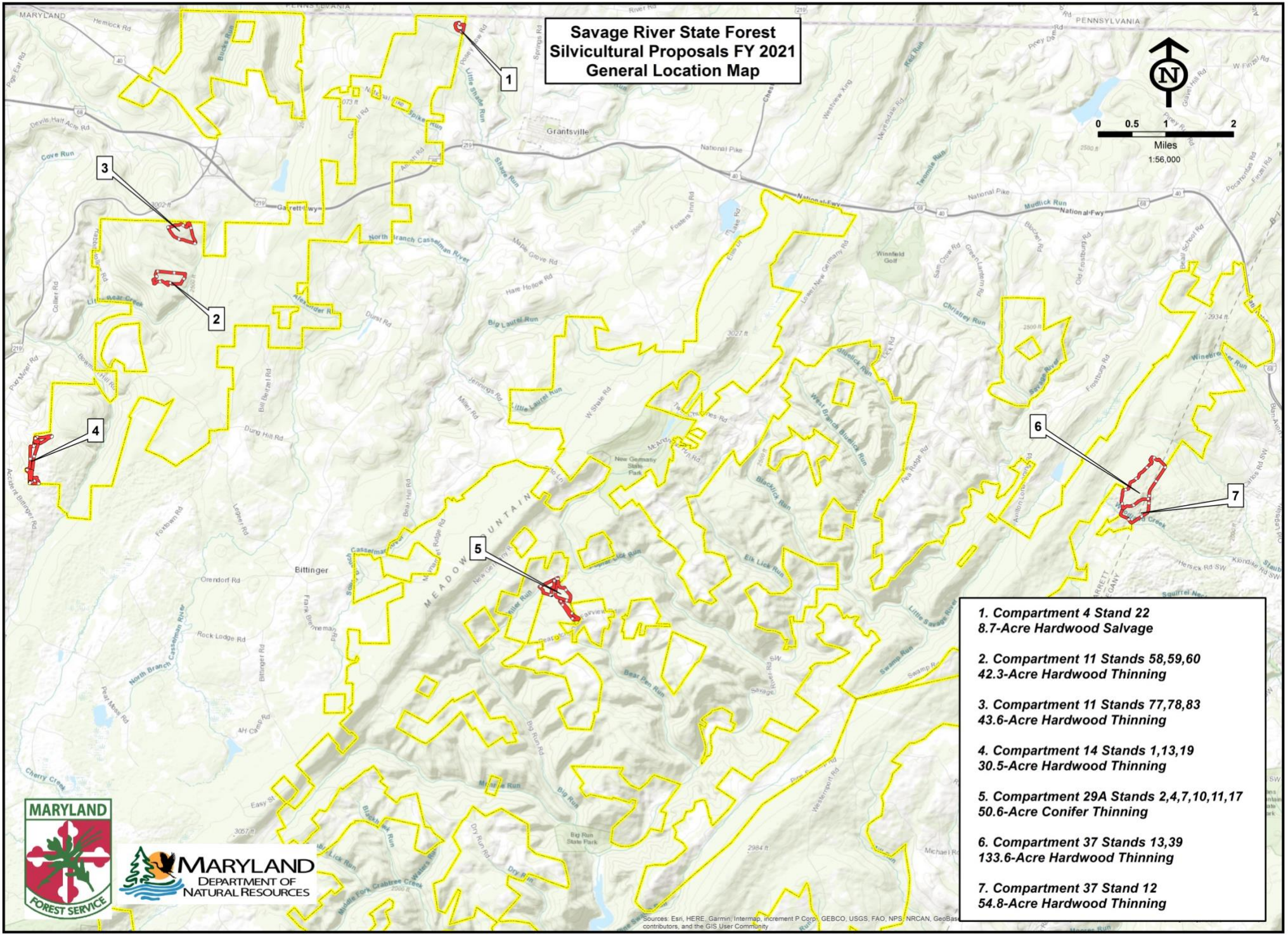


Figure 1. General location map of FY-21 silvicultural proposals

IV. Special Projects - Forest Resource Management and Planning

A. Continued Development of the Certified State Forest Sustainable Forest Management Plan.

Beginning in 2011, the Forest Service began revising the long term sustainable management plans for all three of the State Forests in the Western Region. The initial framework follows the sustainable management plan format established for the State of Maryland's Chesapeake Forest on the Eastern shore. The Department's goal is to have the updated sustainable forest management plans receive dual third party certification under both the Forest Stewardship Councils (FSC) and Sustainable Forestry Initiatives (SFI) standards and guidelines.

Throughout the course of the last seven years, broad resource assessments have been carried out identifying the various management units and features located on the forests including identification and mapping of High Conservation Value Forest Areas (HCVF), much of which was formerly identified as the State Forests "Special Management Zone". Within the HCVF are located a broad range of Ecologically Significant Areas (ESA). These areas typically contain rare, threatened or endangered species and their critical habitats. By spring of 2011 initial drafts of the Forest's Sustainable Management Plan were developed and shared with stakeholders for initial comment and review. The plans were submitted to both the FSC and SFI organizations in the spring of 2011, at which point audits have been completed on all three of the western state forests. Following the audits, draft plans and audit findings were presented to the State Forests Citizen Advisory Committees for review and comments. The Draft Sustainable Management Plans were made available for public comment fall of 2011. Revisions and updates to the Sustainable Management Plan were completed in April of 2019.

Each year the State Forests Management Program is audited for compliance to the standards set forth by the Certifying Organizations. Any shortcomings in the programs identified during the audits are identified in a Corrective Action Reports (CARs) and/or observations identified as being in need of improvement in order to be "certified" as sustainably managed forest lands under the internationally recognized FSC and SFI standards. These corrective actions vary from simple formal documentation of routine practices, to more complex policy and procedure development involving various stakeholders and partners. The program requires that all of these items be addressed before the next annual audit, with some needing more immediate attention. A minor corrective action request was issued by SFI in regard to leaking equipment on a harvest site and the apparent absence of safety equipment. A corrective action plan was formulated that would add the items to the BMP checklist and confirmation of compliance would be done during each site visit by Forest Service Staff or agents.

State Forest staff time and field operations are adjusted and redirected to assist in addressing any Corrective Action items in the course of the next year.

B. Forest Stand Delineation, Inventory and Monitoring

A critical part of developing long term sustainable management plans is the availability of up-to-date forest inventory data. Initial stand data collection has been completed on the harvestable areas of the forest using the SILVAH Inventory System developed by the US Forest Service which incorporates intense surveys of both the overstory and understory to assist in the formulation of appropriate silvicultural prescriptions in specific forest types. The demand for this important data set is increasingly evident as special projects evolving out of demands placed by Forest Certification Standards utilize this data set for project planning including the Annual Work Plan and the Non-Native Invasive Species Inventory.

What had historically been carried out on a 10-year interval offering a snap shot in time view of the forest, has evolved into an annual sampling approach that gives a more frequent look at overall forest condition throughout the years. This approach will allow a much closer watch on developing forest conditions and allows for more rapid and timely responses. This approach is especially valuable in light of the numerous and frequent introductions of foreign insects, diseases, and invasive plants that can rapidly disrupt forest systems. The initial Stand Delineation and Inventory Project will be continued as a Forest Monitoring program as required under certification in order to allow for documented observations of changing conditions throughout the forest. Program focus will include: monitoring of developing regeneration sites allowing for the timely response to the investment in intensive silvicultural work such as herbicide control of invasive and interfering plants and prescribed fire; NNIS monitoring and control work; silvicultural results with respect to management objectives and outcomes and recreation/visitor impacts, etc.

V. Maintenance and Operations

Aside from the detailed cultural work planned for the State Forests, the following is a partial list of projects that are often on-going from year to year and are an integral part of State Forest operations: Routine maintenance projects include building repair and maintenance, vehicle maintenance, mowing at the office facility, snow removal, repair and replacement of fire rings and tables at the camp sites, brush hogging trails and repair of road surfaces.

A. Maintenance and Management of Roads and Trails

There are approximately 107 miles of trail and hardened road surface on the forest and approximately 1/3 of the mileage is maintained each year. Maintenance in these areas includes brush hogging, mowing, and rehabilitation of road surfaces. Herbicide usage has been integrated into the road maintenance regime in order to control growth in areas where mechanical control methods are not feasible (i.e. steep slopes, narrow paths, rocky areas). The use of herbicide along forest roadways can also reduce operational costs for the maintenance staff by controlling unwanted vegetation along these travel corridors for several years, when applied properly.

B. Boundary Line Maintenance

Savage River State Forest currently has 336 miles of boundary line, including interior lines, exterior lines and road frontage. Boundary maintenance is critical to the management of all

public lands. In order to keep up with this effort, State Forest staff maintain approximately 60 miles of line each year. In addition to routine marking and painting, considerable effort is spent on researching, relocating, or establishing missing and/or new line, as well as addressing boundary conflicts. As conflicts arise, every effort is made to resolve the issue in a timely and professional manner. Often, this work leads to the need for a licensed surveyor and legal recourse in order to resolve the issue. With the assistance of Land Planning and Acquisition staff, a minimum of five miles of previously unpainted and/or missing boundary line are to be reestablished until the entire forest boundary is demarcated.

C. Campground Operation and Maintenance

There are 71 primitive camp sites that are maintained on a regular schedule throughout the year. Major campsite maintenance coincides with major holidays, the end of winter and at the traditional end of the camping in late summer/early fall. The campsites are also frequented during the white-tailed deer firearms seasons in the fall and winter, during spring turkey season in early spring and during the opening weekend of trout season in late winter/early spring. Maintenance and operation of these primitive campsites includes: managing group site reservations; maintenance of information / bulletin boards; camper contacts to insure policies are understood; self-registration fee collections and deposits; weekly site inspection and cleaning; hazardous tree evaluation and removals; grass mowing (typically the week before the summer holidays and otherwise as needed); maintenance and replacement of picnic tables, lantern posts, and fire rings; and site impact monitoring.

D. Rifle Range Maintenance and Management

There is a 100-yard shooting range on the forest that is open to the public year round located at 3250 New Germany Road. Maintenance is ongoing and includes replacing backstops as well as the backstop stands, trash clean-up, mowing and weed eating around the facility, plowing the entrance road, restocking range permits, collecting range fees and posting range closures when necessary. Prior to and during the various hunting seasons, range use increases appreciably resulting in more frequent maintenance visits. Typically, at the conclusion of spring turkey season, the backstops and stands from the previous year are replaced, depending on the severity of damage.

The shooting range is open daily from 8 a.m. to dusk and offers hunters an ideal location to sight in weapons. The range features ten stations with distances ranging from 25 to 100 yards. Hunters can pay the $5.00 daily fee at the range using envelopes provided. The annual pass costing $25 and the family pass costing $50 are available at the Forest Headquarters Office. Rules and regulations are posted at the range, with the only restrictions being no fully automatic weapons and no clay pigeons.

VI. Recreation

A. **Recreation Opportunities** (See Figure 2 p. 12)

1. Hiking, Biking and Horseback Riding Trails

Savage River State Forest has over 70 miles of trails open to hikers, mountain bikers and horseback riders of any ability. Not all trails are open to all recreational pursuits and it is recommended that before engaging in any activities visit or contact the state forest headquarters to become aware of any trail restrictions. A backpacking permit must be obtained at the forest headquarters or at any of the self-registration areas. Trail guides featuring a topographic map and trail descriptions can be purchased at the forest headquarters.

2. Off Road Vehicles

Snowmobile and off-road vehicle operators can enjoy many miles of scenic trail along the Meadow Mountain Trail, East Shale Road, Margraff Plantation, Negro Mountain Trail and the newly constructed St. John's Rock ORV Trail. Unlike the aforementioned trails, the St. John's Rock ORV Trail is the first trail on Department lands ever designed specifically for ORV enthusiasts. Features include a multi-site primitive campground designed to support ORV riders, children's riding trails within the campground, technical spur loops and hare scramble style trail sections for all terrain vehicles and motorcycles, a full-size rock crawl area for jeeps and four-wheel drive vehicles and miles of forest access roads for all purpose riding opportunities. The total trail system is approximately 13 miles in length with varying challenges for riders of all skill levels. The trail officially opened to the public on July 23, 2017. Usage statistics for the second year of operation can be found in Appendix 1.

Be sure to display a current Department of Natural Resources ORV permit, available at the forest headquarters or online at www.dnr.maryland.gov.

3. Hunting

Hunting is permitted throughout the forest except where posted with safety zone signs. The 55,000 acres of Savage River State Forest includes two state park areas (New Germany and Big Run) where hunting is prohibited. The forest boundaries are marked with yellow paint on trees - a yellow bar as you enter the forest and a yellow dot as you exit the forest. Hunting on or crossing private land within or near the State Forest requires the written permission of the land owner. Parking is permitted along roadways as long as traffic is not blocked. Hunters must have a valid Maryland Hunting License and should refer to the current Hunting & Trapping guide for season dates and specific regulations.

Several access roads are opened every fall to accommodate hunters. These gated roads are opened prior to squirrel season in September and remain open through January 31. A copy of the road-opening schedule is available in the Forest Headquarters Office. Opened roads can be used by all hunters and allow for vehicular traffic. Due to the nature of these roads, the use of four-wheel drive is recommended. Handicapped hunter access roads are also available. More details about handicapped accessibility appear in this brochure and on the current road-opening schedule.

*Hunter Safety Classes, required for the purchase of a license, are taught periodically through the Department of Natural Resources. These classes are usually offered in the county at one of the local State Parks.

4. Trapping

Trapping is permitted both on land and in the water. A permit can be issued for trapping on Savage River State Forest at the Regional DNR Wildlife Office in Flintstone. Trappers are required to obtain a certificate of trapper education from the Department of Natural Resources. Trapper education courses are held statewide. Refer to the current Hunting & Trapping Guide for complete regulations. A valid hunting license is required when applying for a trapping permit.

5. Fishing

Anglers with a Freshwater Fishing License have the opportunity to catch multiple species of fish in the Savage River Reservoir including walleye, large-mouth bass, smallmouth bass, yellow perch, bluegill and several trout species. Anglers with a trout stamp can fish the Savage River for wild brook trout and stocked brown and rainbow trout. Tributaries of the Savage River, including Middle Fork, Poplar Lick and Blue Lick to name a few, provide a unique backcountry fishing experience for native brook trout that is unsurpassed in the region. The majority of the Savage River watershed is within the Zero Creel Limit Area for brook trout and can only be fished with artificial flies and lures. For regulations, creel limits and special management areas consult the Maryland Freshwater Sportfishing Guide or contact the Western Maryland Fisheries Office at (301) 334-8218.

6. Boating/Paddling

The Savage River Reservoir provides excellent boating and paddling opportunities. Three public boat launches offer convenient access at Dry Run Road, Big Run State Park and ¼ mile north of the dam breast on Savage River Road. Gasoline engines are prohibited on the reservoir. Recreational whitewater releases occur periodically throughout the year on Savage River below the dam that are sponsored and coordinated by the Upper Potomac River Commission, Savage River State Forest, Garrett College Adventuresports Institute, Verso-Luke Mill and several commercial boating outfitters. The events are at no cost to the participants, but donations are accepted to cover the cost of shuttle services and on site restroom facilities.

7. Winter Recreation

Cross-country skiers and snowshoers of all abilities can enjoy a winter wonderland on the New Germany and Mount Aetna trails. The Asa Durst Trails are recommended for a backcountry snowshoe experience. Snowshoers must be careful to walk beside and not on cross-country tracks as it disrupts them.

8. Geocaching

Currently, 28 goecaches are located throughout Savage River State Forest for those interested in testing their navigational and tracking skills. All geocaches must reviewed and approved by the staff before being placed anywhere on the forest. Applications and general rules for geocache placement are available at the state forest headquarters.

9. Maps

Brochures and maps are available at the Savage River State Forest Headquarters Office located at 127 Headquarters Lane, Grantsville, Maryland 21536.

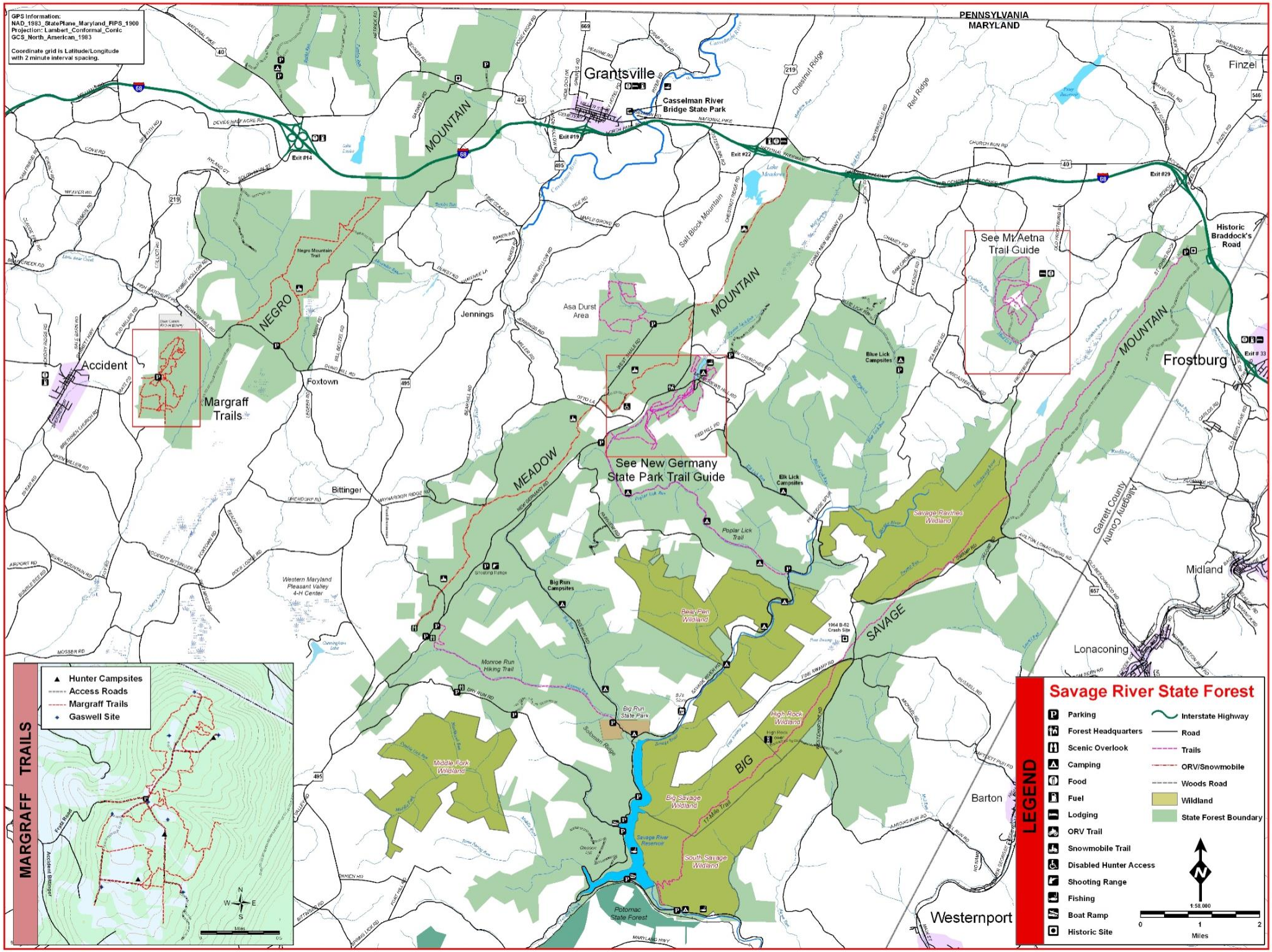


Figure 2. Recreational Opportunities on Savage River State Forest

B. Recreation Proposals

National Recreation Trails Grant Requests: To Enhance Recreation and Trails Opportunities for Visitors of Public Land.

Savage River State Forest has submitted one National Recreation Trails Grant Request to fund enhancements to various recreation trails on the forest:

1. St. John Rock Road, ORV Trail Maintenance – $37,500

This project will provide seasonal maintenance personnel (2) to maintain the newly developed 13-mile long St. John Rock Road and Red Dog Road ORV Trail. Hiring these seasonal employees will benefit trail users by maintaining the surface of the trail and providing a safety backup on weekends. Operating the ORV trail will require regular maintenance and upkeep. The grant will fund five elements of trail upkeep including:

1) Maintenance of water control devices.
2) Monitoring use and providing public outreach.
3) Clean up of litter and debris.
4) Providing protection to environmentally sensitive areas adjacent to the trail
5) Maintaining closure of existing illegal trails and deterring new trails from being developed.

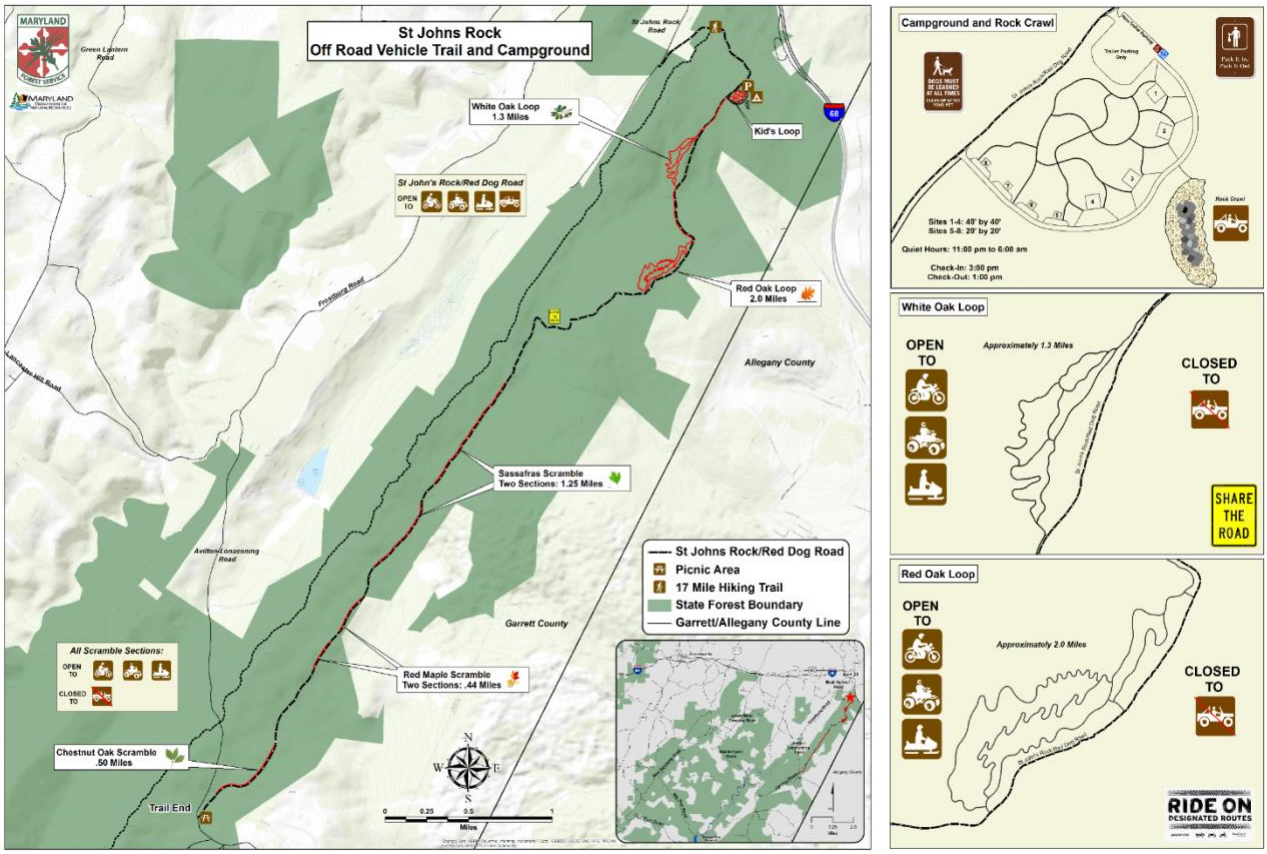


Figure 3. St. John's Rock ORV Trail brochure

2. Meadow Mountain Trail Construction (Continental Divide Loop Trail)

In fiscal year 2011, the forest was asked to participate in a large bike trail effort that would begin in Pennsylvania, travel along Meadow Mountain Trail, cross the University of Maryland 4-H property and continue south into Oakland, MD and then travel north through the Youghiogheny Wild and Scenic Corridor back into Pennsylvania. This project is currently referred to as the Continental Divide Loop Trail which is being spearheaded by Garrett Trails, a non-profit volunteer group dedicated to the development of sustainable trails that provide access to the economic, historic and environmental resources of Garrett County.

The southern section of the bike trail from State Route 495 to Frank Brenneman Road was completed in mid-2016. Funding was secured to continue construction of the trail northward beginning at Frank Brenneman Road and ending at New Germany Road just south of West Shale Road following existing forest access roads. Groundbreaking occurred in July 2017 and this phase of construction extended from Frank Brenneman Road to Otto Lane adding approximately 7.5 miles of resurfaced trail to the ongoing project.

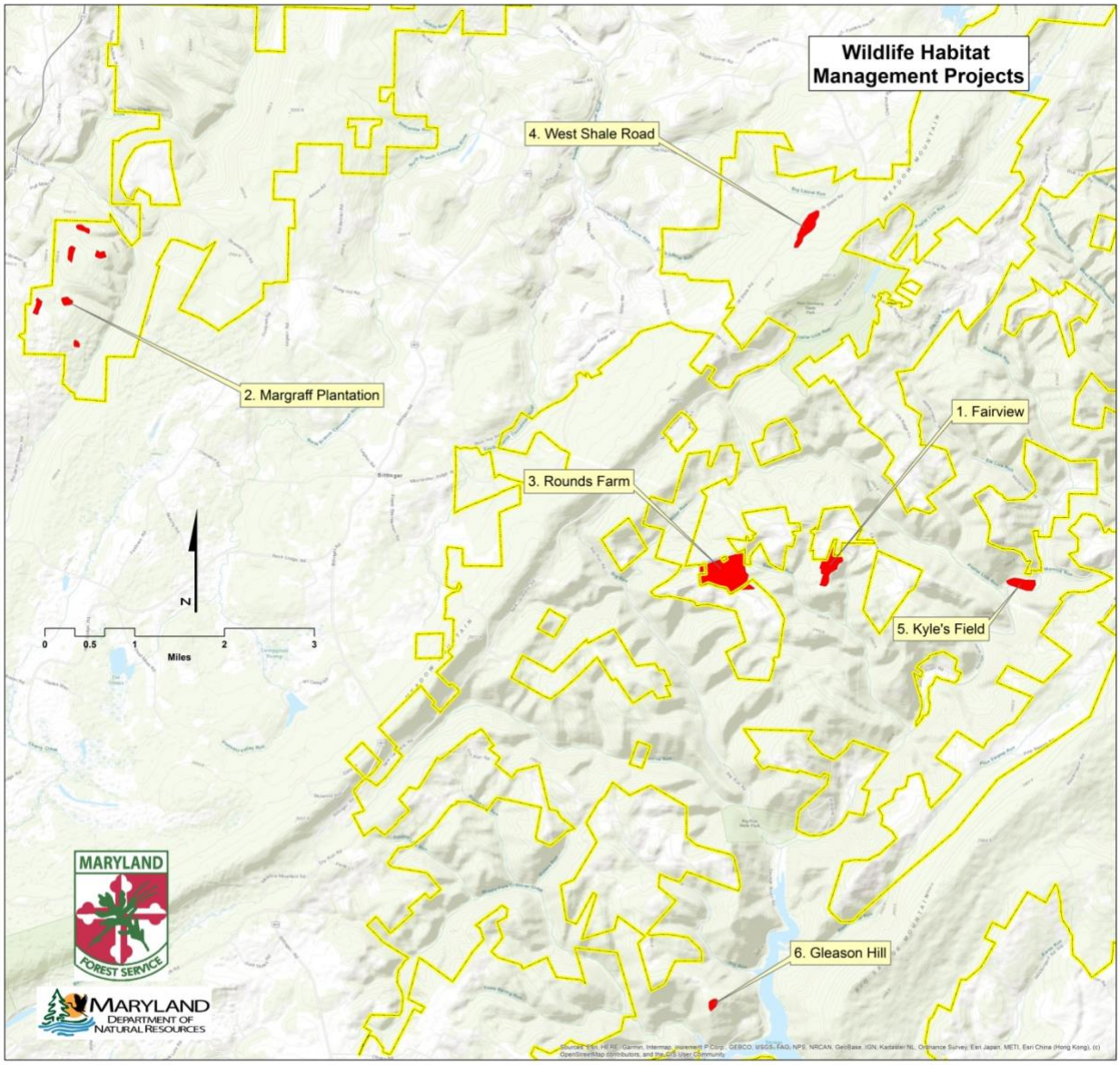
Grant funds have been made available from the Maryland State Highway Administration Recreational Trail Program and the Appalachian Regional Commission Area Development Funds to complete the final 3-mile phase of the project that extends from the southern end of West Shale Road to New Germany Road. Approximately $400,000 dollars will be used to construct the trail, stabilize the trail surface with aggregate, install split rail fencing at the trail head as well as interpretive signage along the riding route, mobilization/demobilization of construction equipment and contingency costs. Upon completion of the project, a total of over 10 miles of new riding trail surface will be available for visitor recreational opportunities. To complement the new construction, three interpretive panels have been placed along the trail to educate trail users about the rich history of Garrett County, particularly the Native Americans that inhabited the land from the Paleo-Indian Period until the 17th Century.

VII. Wildlife Habitat Management Projects

A. General Wildlife Habitat Maintenance

Approximately 38.5 acres of wildlife specific projects have been implemented throughout the state forest. These projects are located in the Margraff tract of Compartment 14 east of Accident, MD, the Nature Conservancy acquisition of Fairview Road, the "Rounds Farm" located off Pea Patch Road, West Shale Road, "Kyle's Field" off Savage River Road and Gleason Hill. General practices include liming and fertilizing as well as planting of cover and grain crops, where appropriate. Plantings include millet, peas, corn, turnips (*Brassica spp*.), warm season grasses, native wildflowers and clover (See Wildlife Habitat Management Projects map and summary, p. 14).

As part of the Mentored Hunt Program, a stocked pheasant hunt will take place on the Rounds Farm in late November. This is a do-it-yourself hunting opportunity for junior license holders, apprentice license holders and lapsed hunters. A random lottery drawing will take place to fill all available slots and all successful applicants will receive a packet of information with maps and other helpful information. More information is also available on the Maryland DNR Wildlife and Heritage Service web page: http://dnr.maryland.gov/wildlife/Pages/hunt_trap/Mentored-Hunt-Program.aspx.



Area	*Species Planted*	*Acres*	*Fertilizer*
1. Fairview Road	*Clover mix*	*9*	*1200 lbs 10-20-20*
2. Margraff Plantation	*Chickory* *Brassica mix* *Corn*	*1* *2* *1*	*700 lbs 19-19-19* *600 lbs 10-20-20*
3. Rounds Farm	*Corn* *Clover mix* *Millet mix* *Peas* *Sun hemp/sorghum* *Brassica Mix*	*5* *3* *2* *2* *0.5* *0.5*	*2600 lbs 19-19-19* *600 lbs 10-20-20* *1 ton lime*
4. West Shale Road	*Clover mix* *Brassica mix* *Millet mix*	*2* *2* *0.5*	*400 lbs 10-20-20* *200 lbs 19-19-19*
5. Kyle's Field	*Clover mix*	*3*	*600 lbs 10-20-20*
6. Gleason Hill	*Clover mix*	*4*	

Figure 4. Wildlife Habitat Management Project Areas and Applications

VIII. Ecosystem Restoration / Protection Projects

A. Non-Native Invasive Species (NNIS) Control

Across the State, a biological invasion of non-native and invasive plants is spreading into fields, forests, wetlands and waterways. Referred to in a variety of ways including exotic, non-native, alien or non-indigenous, invasive plants impact native plant and animal communities by displacing native vegetation and disrupting habitats as they become established and spread over time. Early Detection and Rapid Response (EDRR) to control the spread of problematic species is important for the conservation of native flora and fauna. Control efforts often require considerable resources including labor, time and money.

As in many cases, the introduction of these widespread and invasive plants cannot be prevented. It is important to evaluate and plan control efforts in order that such efforts contribute meaningfully to the success of forest conservation plans. EDRR efforts targeting NNIS discovered during the forest wide inventory have been successful in identifying and controlling a number of NNIS populations. Species-specific management plans have been developed for two notable species including Japanese knotweed and Yellow Archangel (See Appendix 2 and 3).

The State Forest staff has treated and/or is monitoring several plant colonies or sites including: five tree-of-heaven sites, ten Japanese knotweed sites, two mile-a-minute weed sites and one yellow archangel site (See corresponding map for locations).

1. Japanese knotweed (*Fallopia japonica*). Several areas of Savage River State Forest have become infested with the invasive plant Japanese knotweed (*Fallopia japonica*). Seven treatment areas have been delineated and six of them will be treated and monitored to determine the most effective course of action for suppressing and ultimately eradicating the plant from these areas of the forest. Knotweed growth below the Savage River Reservoir has reached a critical level and will not be treated at this time due to the overwhelming investment that would be required to reach any reasonable level of control. As more effective treatment methods become available for large areas, this area will be reevaluated in regard to implementing a control plan.

The initial treatments occurred in the first week of June, 2011. Treatments in all areas of the forest involve a two-step process that includes both mechanical and chemical means of control. First, the knotweed is cut and allowed to grow back for 8 weeks, reaching only 2 to 4 feet in height. Second, the new growth is treated with a 2% solution of glyphosate as the active ingredient. Treatment of these areas has been repeated on a yearly basis and will continue until the plant has been eradicated from the target areas.

2. Yellow archangel (*Lamiastrum galeobdolon).* Dry Run, a tributary of the Savage River and Savage River Reservoir has been infested with the aggressively growing, non-native invasive perennial, yellow archangel (*Lamiastrum galeobdolon).* The infestation of the area most likely originated from a private residence which was abandoned and the once maintained yard area was neglected, allowing the plant to escape to the adjacent property. After establishing a colony at the head of the watershed, the plant quickly enveloped the drainage from the private residence to the high water mark of the Savage River Reservoir, encompassing nearly 15 acres of forest land.

The plant grows quickly and out-competes native vegetation for resources. Yellow archangel spreads in several ways; by seed, by stem fragments, and by rooting at the nodes of the

stem. This makes the plant very difficult to control and requires multiple applications of herbicide and diligent monitoring to limit the spread of the plant in natural forest environments. There is no projected end date for the herbicide treatments due to the persistent nature of this plant and efforts will be made annually until the spread of the plant is contained or the plant is eradicated. Recent late season snowfalls and above average rainfall have limited any attempts to control the species. Successful eradication of this plant is anticipated given the relatively confined area of infestation. Site monitoring will continue after the eradication of the plant for at least 5 years.

3. Mile-a-Minute Weed (*Persicaria perfoliata*) A small patch of mile-a-minute weed (*Persicaria perfoliata*), another aggressive non-native invasive, was discovered in Compartment 29A. The area was treated in FY 19 with a 2% glyphosate solution, but a field survey revealed that the initial treatment was unsuccessful. Herbicide treatment of triclopyr was applied for two consecutive years and monitoring of the site will continue into FY 20 and beyond until the plant has been eradicated. A previously discovered patch of mile-a-minute weed in Compartment 38 near the St. Johns Rock ORV Trail that was seemingly removed during the excavation for the trail campground reemerged and has been treated. Monitoring of the area will continue and the site will be treated as necessary in order to eradicate this plant from the site.

4. Tree-of-Heaven (*Ailanthus altissima*) Individual stems of the exotic invasive tree-of-heaven have been identified in several areas of the forest. Control measures including both mechanical and chemical have been implemented to remove this species from the limited areas in which it is present. These plant colonies are now part of our long term monitoring program, with follow-up treatments planned as necessary in the interest of preventing these species from establishing themselves in the otherwise natural forest communities in which they were found.

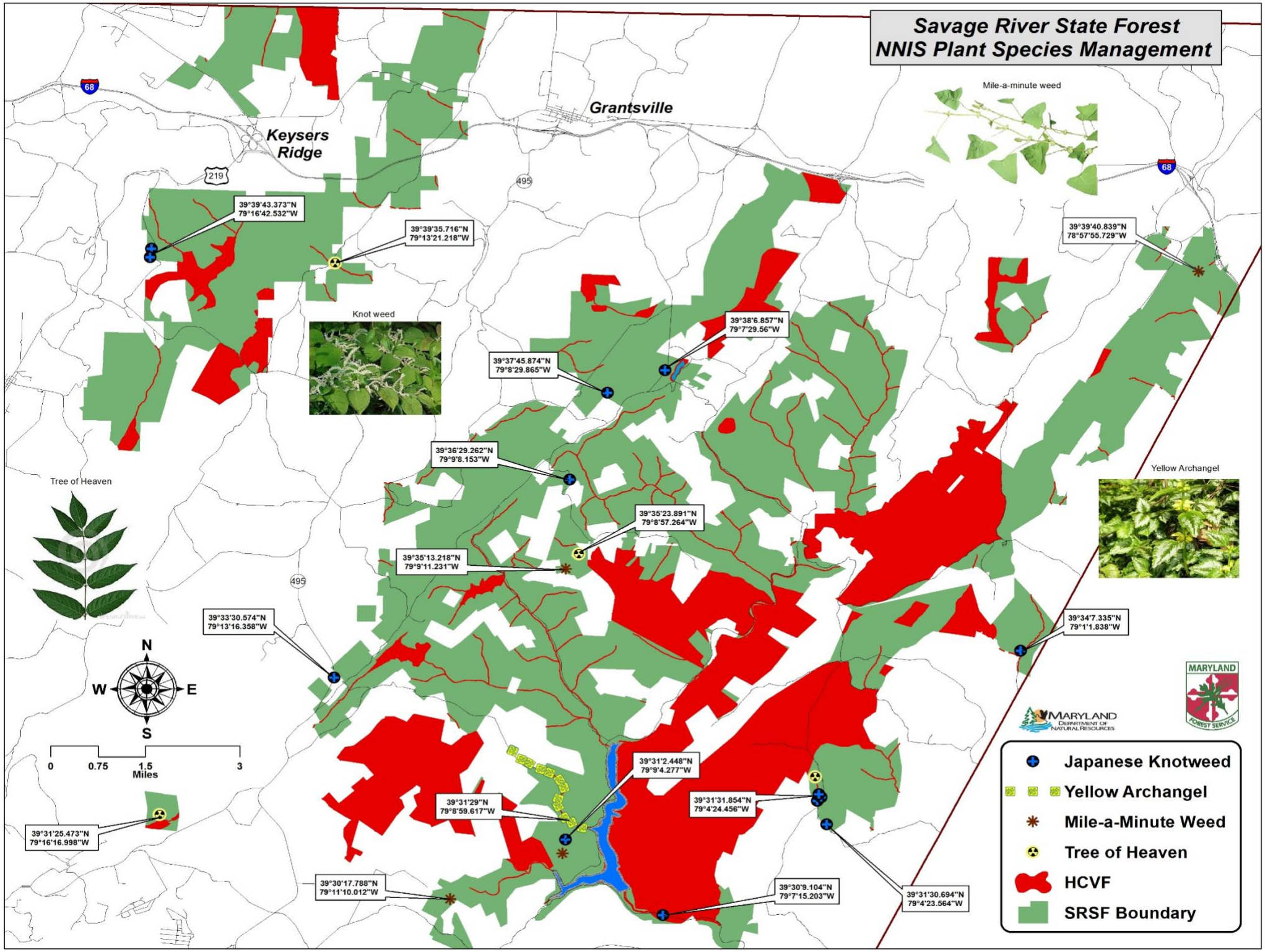


Figure 6. Map of NNIS treatment areas on Savage River State Forest

IX. Monitoring and Research Projects

A. Monitoring

1. *Silvicultural Activities*

All silvicultural operations taking place on Savage River State Forest will be monitored on a weekly basis and more frequently when adverse weather conditions arise to ensure that all Best Management Practices are being followed. Regeneration harvests will be monitored five and ten years after harvest. Non-native invasive species will be monitored yearly and herbicide treatment regimens will be implemented as necessary to eradicate these species from the forest ecosystem. Management documents outlining specific treatments and monitoring schedules have been drafted for the individual species.

B. Research Projects *(Full write-ups of each project are available at the State Forest Office)*

1. Chestnut Blight: Evaluating the potential of "Super Donor" strains of Cryphonectria parasitica to control chestnut blight infections. West Virginia University.

Researchers from West Virginia University are continuing an ongoing study involving chestnut blight (*Cryphonectria parasitica*) and the organisms that inhabit the resulting cankers. The purpose of this experimentation is to release two "Super Donor" strains of C. *parasitica* that have the unique ability to transmit the disease controlling hypoviruses to virulent strains regardless of their vegetative compatibility type.

The "Super Donor" strains were constructed using a Cre-*lox* system and classical mating. Cre-*lox* recombination is a site-specific recombinase technology, used to carry out deletions and insertions at specific sites in the DNA of cells. No foreign genes were incorporated and the absence of any selectable marker verified. This modification resulted in the elimination of most genes that control vegetative compatibility thereby allowing hypovirus transmission among incompatible strains (MacDonald and Nuss, 2016).

The initial release of the virus was conducted in mid July 2016. A second APHIS permit for additional introductions of the virus to the original study area of Russell Road as well as an additional site located of Jacobs Road in Compartment 42 was applied for in May 2017 and treatments commenced in July and August of 2017. An on-site review was conducted by APHIS risk assessment personnel on August 9, 2018 to ensure that all standards of protocol for such a release were adhered to throughout all phases of the ongoing study. All aspects of the field trials were within acceptable tolerances and the current research permit for both projects will be extended through 2019.

2. Eastern Hemlock: Target-tree Release to Improve the Sustainability of Eastern Hemlock (Tsuga canadensis) in the Southern Appalachian Mountains. US Forest Service Southern Research Station and North Carolina State University.

This ongoing project will develop and validate a silvicultural tool that improves the health and sustainability of eastern hemlock, an ecologically keystone species in the southern Appalachians threatened by HWA. Individual or small clusters of "target" trees (i.e., suppressed

or intermediate eastern hemlocks with moderate to good crown health) will be released by removing or girdling other stems competing for sunlight directly above and adjacent to the target trees. Increased sunlight is expected to improve hemlock crown health via improved carbon balance, enhanced foliage production, and reduced HWA settlement rates relative to unreleased trees. Treatments will be replicated at a number of southern Appalachian sites and will evaluate release by girdling versus felling and variations on the size of the resulting canopy gap. Operationally, the tool is expected to prolong hemlock health and survival and increase the efficacy of existing HWA management tools (e.g. biological and chemical control) when integrated with them (Jetton, Robert M., Mayfield, Albert E., Keyser, Tara, and Rhea, James 2017). The project will involve fifteen treatment sites; 10 located in the northern end of Wolf Swamp in Compartment 16 and five located along an unnamed tributary of Elk Lick Run in Compartment 26. Post treatment data collection was completed on all sites in March 2018 and again in July 2018 involving hemlock health at one year, adelgid density, vegetation measurements and data analysis. Follow up data collection and analysis is scheduled for Fall 2018 and will continue through the Fall of 2019.

3. Bobcat: Population Estimate and Structure of Bobcats (Lynx rufus) in Western Maryland. University of Delaware Department of Wildlife Ecology.

Currently, bobcats are the most widely distributed native felid throughout the continental United States. However, this distribution was threatened in the late 19th century. During this time, several states observed a drastically lowered population or full extirpation. Due to forest regeneration and a well-regulated harvest, bobcats have recovered much of their historic range. Currently, bobcats are seen regularly throughout Garrett and Allegany counties and are becoming more common in counties to the east. However, the estimated population size of the species has not been documented. Preliminary results from a predator camera survey performed in western Maryland estimated bobcat density ranged from 0.08-0.20 bobcats/mi^2. Land managers require a better understanding of the current population of bobcats in the region.

A hair-snare survey will be implemented targeting bobcats in 3 study areas within 2 counties of Maryland. These study areas will be focused on public land in the forms of: Potomac State Forest, Savage River State Forest, and Green Ridge State Forest. We will place 20 hair snares at each of the 3 study areas, totaling 60 for the region. Each snare will be active for 60 days from mid-December to mid-February. The snares will be placed at a rate of 1 snare per 3km in habitat most likely to be occupied by a resident bobcat, based on previous literature. At each of the 60 snares we will place a game camera to monitor the snare. The camera data will give researchers a better understanding of the efficiency of the snares. The hair collected during the 60-day survey will be analyzed at the genetics laboratory to determine: species, sex, individual, and relatedness among individuals. Using a capture-mark-recapture model, we will determine a density of bobcats in the region. Additionally, camera data will be analyzed as a separate capture-mark-recapture study to estimate bobcat density. Bobcat density estimates based on camera data will be compared to estimates based on hair-snare data to determine if camera surveys could function as a viable cost-efficient alternative to estimate bobcat density.

The objectives of this research include estimating the bobcat population size, determining the sex ratio of the species and comparing the efficiency of camera surveys to hair-snare surveys

to estimate bobcat densities. This research will provide baseline information about the population size and structure of bobcats in western Maryland. Additionally, this study will improve efficiency of field methodologies. The Maryland Department of Natural Resources lacks data on the current population size and structure of bobcats in the region. This research will estimate the abundance and population dynamic of bobcats to aid state managers in understanding the ecology within western Maryland (Ness, 2018).

4. Late Successional Forest Management Project. The Nature Conservancy.

The MD/DC Chapter of The Nature Conservancy is collaborating with Maryland Forest Service and the Maryland Wildlife and Heritage Service to implement a "Late-successional Forest Management Project" in western Maryland. The long-term goal of this project is to demonstrate the potential of using Structural Complexity Enhancement (SCE) methods to accelerate the development of late-successional characteristics in western MD forests. Young- to-mid successional forests lack the structural complexity present in diverse, late-successional forests. However, "maintain and enhance species and structural diversity" is one of the climate adaptation strategies which would enhance climate resilience at landscape-scale. TNC will partner with Northern Institute of Applied Climate Science (NIACS), to use their Forest Adaptation Resources as a guide in developing this project.
TNC, in consultation with DNR resource professionals, have identified two treatment sites, plus a reference site (a designated old-growth area) at Savage River State Forest (SRSF) to implement this project. The two treatment sites are located in between a wildland and an Ecologically Significant Area (ESA). There are "confirmed old growth sites" within the OGEMA, that are limited in size and connectivity. Hence, applying this type of silvicultural treatments with primary objectives of fostering old-growth conditions, would enhance old growth ecosystem functionality, which is a recommended action in the Sustainable Forest Management Plan for SRSF.

SCE is the use of a combination of silvicultural techniques to promote structural complexity in forest ecosystems including creating multi-layered canopies, increasing the number of snags and coarse woody debris, and increasing the number of large living trees. This complexity in vegetation structure and age-class distribution has a direct effect on the biological diversity in a forested system. At landscape scale, late-successional forests are a necessary element of landscape diversity, which enhances climate resilience. Recent studies have suggested that forests managed with SCE treatments have the potential to increase carbon storage and provide additional climate change mitigation benefits.The proposed project is part of a larger initiative to demonstrate different SCE treatments toforesters and landowners. In consultation with DNR resource professionals, TNC will develop communication materials such as pamphlets, infographics, videos and presentations to disseminate the learning outcomes of the project. In addition, field tours and workshops will be organized for foresters and landowners to promote understanding of SCE techniques as an option in forestmanagement. Landowner adaptation of SCE will have a positive effect on the natural resources of Maryland by improving late-successional wildlife habitat and landscape diversity. Enhanced climate resilience of the landscape and improved ecosystem services will have numerous benefits to the natural environment and the citizens of the state.

5. Crayfish Collection. Carnegie Museum of Natural History Section of Invertebrate Zoology.

Collections of freshwater crayfish are planned during the week of September 23-27, 2019. Collections will target two species of crayfish, including Cambarus bartonii and Cambarus carinirostris as part of an ongoing project of the Section of Invertebrate Zoology at the Carnegie Museum of Natural History. Collections will take place in Savage River, Big Run, Bluelick Run and Mudlick Run.

Sampling of crayfish is requested to study the broad-scale genetic and morphological variability of these species across their respective geographic ranges to assess their taxonomy, systematics, and species status. Cambarus bartonii is thought to represent a species complex made up of multiple, as yet undescribed, species. Complicated morphological characters, and confusing geographic patterns associated with these characters, have hindered the study and resolution of this complex for many years. However, recently gathered genetic data applied to this group has proven useful in detecting geographic patterns and have helped elucidate differences among populations. Cambarus carinirostris is a very closely related species to C. bartonii, and until recently, was considered one of its subspecies, but questions remain as to whether they are indeed separate species. A closer examination of these species is needed to help resolve lingering questions about this species complex.

Cambarus bartonii has a broad range in the eastern US, ranging from southern Canada (southeastern Ontario to New Brunswick) southward through the Appalachian Mountains from Maine to northeastern Georgia. Cambarus carinirostris has a smaller geographic distribution, ranging from the western pan-handle of New York south through western Pennsylvania, extreme western Maryland and eastern West Virginia.

Major genetic differences in freshwater crayfish are often detected within, and definitely between, watersheds, which makes a dense sampling scheme necessary, so that variation can be detected at an appropriate geographic scale to elucidate genetic patterns of variation across the landscape and help identify any unique populations. To detect rare genetic variants, 20+ individuals should be collected to reduce the effects of sampling error, which may adversely impact estimates of relationships. These larger samples also aid studies using morphological characters by bolstering levels of statistical significance.

Populations in Maryland currently represent a huge hole in the sampling of these species ranges, and existing data from Pennsylvania suggests that Maryland populations would be informative and helpful in delimiting geographic ranges of potential new species.

Crayfish will be sampled from throughout Maryland to broadly cover the geographic ranges of the two species within the state to account for geographic variation that may be present within each species. Both species are common throughout their ranges and are not currently of conservation concern. Indeed, these are some of the most commonly encountered crayfish species seen in Eastern US streams. Samples collected in Maryland will be added to a broader dataset for these species, which includes a number of sites sampled throughout Pennsylvania, West Virginia, Virginia, North Carolina, and Georgia.

Impacts of sampling at a local scale will be minimal. Specimens are usually collected with a seine after moving or flipping larger rocks in streams and directing crayfish into the seine using a kicking motion and the flow of the stream. Large rocks are then returned to their original positions. Sampling usually takes anywhere from 30 to 60 minutes, depending on ease of access and other variables. Only a single trip to each site will be made (i.e., a one-time sampling event). Other incidental species of crayfish (non-listed species) and aquatic insects are generally also collected in the process, but numbers retained are usually quite minimal and should not place an undue strain on local populations. All specimens of crayfish (and incidental insects) will be deposited into the collections of the Carnegie Museum of Natural History in Pittsburgh, PA where they will be available of current and future research projects (Fetzner, 2019).