

Appendix J.
Table of Research Activities Identified for Otter Point Creek, Jug Bay, and Monie Bay Components of CBNERR-MD

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Research Activity	Otter Point Creek	Jug Bay	Monie Bay
Establish and enhance the collection of baseline water quality data and bio-monitoring to better determine the effects of watershed land use changes and management actions on water quality, biota and ecosystem functioning	X	X	
Understand the impacts of invasive species and how these could translate into changes to the local ecosystems	X		
Identify the main sources of increased nutrients and sediments to the site and possible mechanisms to improve conditions and reduce pollutants	X		
Conduct experimental studies to restore native SAV species and to determine how an increased in SAV species diversity may impact the ecosystem	X		
Examine different methods to restore native wetland species and develop studies to determine the role of these species in the ecosystem	X		
Model water flow and circulation patterns and examine how changes in the watershed (upstream and downstream) may impact circulation patterns	X		
Examine the potential implications of removing, filling or failing of the Atkinson Dam on the Otter Point Creek component and Bush River	X		
Understand marsh processes particularly sediment accretion rates and resuspension and their related impact on water quality	X		
Determine the effects of turbidity on primary productivity and identify those nutrients limiting phytoplankton blooms by season	X		
Examine the effects of changes in population density and their impact on water quality via increased wastewater volumes		X	
Determine rates of subsidence, accretion and erosion within wetland habitats, while understanding the effect of wetland plant species on these processes and nutrient uptake		X	
Examine the effects of water level changes (as a result of accretion, subsidence, erosion, and/or sea level rise) on wetland processes, community composition, and succession. Monitor and delineate habitat changes (species composition and distribution of marsh vegetation) in response to water level changes		X	X
Continue herpetological research into migratory and reproductive behaviors of native turtle populations, possibly examining ties to marsh habitat		X	
Examine the effects of varying levels of nutrient concentrations (nitrogen and phosphorus) on phytoplankton community structure and distribution. Including modeling the		X	X

Research Activity	Otter Point Creek	Jug Bay	Monie Bay
effects of changes in water column nutrient concentrations on phytoplankton blooms, water clarity, and submerged aquatic vegetation (SAV)			
Examine the competitive interactions between <i>Hydrilla verticillata</i> (non-native SAV species) and other native species of SAV within the marsh		X	
Identify viable physical and biological mechanisms to reduce geese herbivory on marsh plants (<i>Zizania aquatica</i>) and allow for successful restoration and protection efforts		X	
Identify causes for changes in wetland plant community composition, distribution, and biomass production		X	
Examine the feeding behavior and wetland habitat use of various wildlife species under various habitat conditions		X	
Examine the buffering effects of wetland and riparian corridors on flood control, nutrient cycling and absorption, and sediment retention		X	
Study the effects of best management practices on agricultural lands and areas draining impervious surfaces regarding run-off rates and concentrations		X	
Examine changes in migratory bird populations (including shorebirds) over time and the causes for these changes on a local, regional and even global scale		X	X
Examine the ability of different wetland species, submerged and emergent, to absorb and translocate nutrients from the sediments and water column			X
Examine impacts of agricultural runoff on biological communities, specifically how differing water quality may alter habitat conditions and species use			X
Determine the value of different wetland habitat, both submerged and emergent on ecosystem processes, functioning, and use by invertebrate and vertebrate communities			X
Understand the effects of human controlled water impoundments on the marsh ecosystem			X
Examine the relationship between anoxia and Harmful Algal Blooms (HABs) and agricultural associated nutrient loading			X
Examine the effects of agriculture on bacterial and fecal coliform concentrations in the estuary			X

Appendix ??. Monitoring Programs/Activities Identified for Otter Point Creek, Jug Bay, and Monie Bay Components of the CBNERR-MD.

Monitoring Program/Activities	Description	Otter Point Creek	Jug Bay	Monie Bay
Tidal Water Quality Monitoring Program				
Establish/expand short and long-term water quality monitoring efforts that will cover the necessary spatial extent of water quality conditions and habitats	This effort will provide a better understanding of how upstream and downstream areas influence the site's water quality and will potentially identify other processes such as resuspension that might be impacting the site. The effectiveness of this effort will determine the Reserve's ability to implement this type of monitoring at the other components.	X	X	X
Develop and implement when and where possible short-term monitoring efforts to examine the spatial variability of water quality	Short-term monitoring efforts will provide a better spatial resolution on water quality that could be used to make extrapolations based on continuous water quality sampling provided by SWMP YSI data loggers.	X	X	X
Establish through long-term monitoring efforts baseline data to assess changes in water quality over time and space		X	X	X
Involve volunteers in monitoring efforts as much as possible		X	X	X
Conduct synoptic surveys in the tidal portion of tributaries	These surveys will help to better determine how nutrients and sediments are transported downstream and how water quality changes over a larger spatial scale		X	
Assess the effects of the Western Branch wastewater treatment plant on local water quality and flow	This could be accomplished in conjunction with the SWMP expansion on water quality monitoring		X	
Non -Tidal Water Quality Monitoring Program				
Establish a short and long-term non-tidal water quality program at	This effort will help to identify sources of sediments, nutrients	X		

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fixed sites in non-tidal waters.	and other pollutants being discharged into the tidal waters. Water quality monitoring will focus on sediments, nutrients and rates of flow so loadings to the system can be quantified. Measurements of fecal coliforms may also be conducted.			
Short term monitoring of water quality will focus on identifying loading rates associated with base flow and storm flow as well as synoptic surveys conducted within non-tidal tributaries to identify sources of pollution in the watershed		X		
Long-term monitoring efforts will focus on establishing permanent fixed sites to detect water quality changes over time on non-tidal waters impacting downstream areas		X		
Biological Monitoring Activities				
Establish a series of biological monitoring sites to assess the quality and quantity of aquatic and terrestrial habitat and resources	Efforts should be geared towards establishing baseline data capable of detecting changes in the biota and relating these changes to changes in land use and development	X	X	X
Biological monitoring should target vegetative, herpetological, avian, and mammalian surveys, also fish and macroinvertebrate communities surveys in tidal and non-tidal areas	<u>Jug Bay</u> : The possibility of conducting mammalian surveys in the terrestrial environment will be explored	X	X	X
Maryland Biological Stream Survey (MBSS) sampling to assess the biological integrity (spring and summer sampling of water quality, benthic macroinvertebrate, and fish communities) of non-tidal waters	This effort will be conducted in conjunction with the Maryland Department of Natural Resources	X		
Monitor submerged (SAV) and emergent vegetation (i.e., track changes in habitat and community composition). Also, identify changes in the distribution and	<u>Otter Point Creek</u> : this monitoring effort will be conducted in accordance with efforts on-going through the Chesapeake Bay Program and the Maryland	X	X	X

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biomass of non-native species such as <i>Phragmites</i> and/or <i>Hydrilla verticillata</i>	Department of Natural Resources. SAV monitoring began in June 2002 and will continue. <u>Jug Bay</u> : Particular attention will be given to the monitoring of wild rice (<i>Zizania aquatica</i>) populations <u>Monie Bay</u> : SAV monitoring started in the spring of 2003 and focuses on distribution, species composition, and percent cover			
Fish surveys in tidal waters; conduct efforts to standardize protocols across components	<u>Otter Point Creek</u> : This effort is on-going as a volunteer based effort and will continue with additional sampling in non-tidal areas <u>Jug Bay</u> : The possibility of conducting larval fish studies will be explored	X	X	
Pursue mechanisms to assess (survey) benthic macroinvertebrate communities in non-tidal and/or tidal waters and explore options to related this data to sediment and habitat quality	<u>Otter Point Creek</u> : This effort should be conducted in cooperation with the MBSS sampling. Tidal sampling is also needed and should be pursued in conjunction with the Maryland Department of Natural Resources	X	X	
Conduct species counts such as the annual Bioblitz		X		
Conduct herpetological surveys to track and monitor these populations	This effort will allow to establish a link between biota and habitat		X	
Continue to monitor resident and migratory waterfowl for population density and habitat use	<u>Monie Bay</u> : Extensive avian surveys and monitoring is on-going and includes pelican banding, waterfowl population monitoring and tracking, and shorebird habitat use		X	X
Continue to conduct species counts such as the Great Herp Search, Christmas Count (birds), and others			X	
Ecosystem Processes Activities				
Establish/expand a network of Surface Elevation Tables (SETs) to estimate sedimentation rates and to study surface elevation processes		X	X	X

Monitoring Program/Activities	Description	Otter Point Creek	Jug Bay	Monie Bay
along a spatial and temporal scale				
Pursue opportunities for installing a vertically-controlled tide gauge and for the tying existing SETs to a national reference system	Possible partners include the US Geological Survey, NOAA's National Geodetic Survey, and NOAA's CO-OPS/National Water Level Observing Network (NWLON)		X	
Conduct studies/monitoring of the particle size, nutrient concentrations, and heavy metal/toxic levels in sediments and marsh soil	These studies will be useful to link the effects of wetlands on nutrient cycling, filtering, and uptake	X	X	X
Conduct if possible wave and energy directed monitoring	This effort will be useful to better understand the effects of flow and circulation patterns on resuspension and nutrient cycling		X	