Two Run Creek Reflects Relationship With Land

By Elaine Friebele

You're likely to remember Two Run Creek from one of your visits to the Sanctuary. It is the small, shallow stream flowing beneath the bridge you cross when walking toward Mark's Pond or the River Farm. Or perhaps while hiking the Two Run Trail, you viewed the creek from the bluffs as it meandered toward the tranquility of the Beaver Pond. You might have seen a kingfisher flying over the pond or heard an evening chorus of frogs as you passed the three beaver dams restraining Two Run's waters. Approaching Otter Point, you heard a small waterfall as the creek splashed over the last dam. Here, you watched the waters of Two Run unfurl into the wide Patuxent, gently mixing with the incoming tide, and finally being born away by the river.

Two Run is one of many streams, creeks, and branches that flow into the Patuxent River. The river, as the whole, is really the sum of its parts. Two Run seems natural and untouched as it flows through the forests of the Sanctuary. Is water entering the Patuxent from Two Run cleaner, or more healthy, than that of other tributaries?

In the following pages we explore many facets of this creek, using information gathered by volunteers, interns, and staff during field studies. We'll review the geography of the land that delivers water to the creek; examine the water's quality and its suitability for aquatic animals; discover that the floodplain, endowed with rich sediments and moisture, is home to abundant, diverse plant life that supports a variety of animals; and learn what wildlife species have colonized the pond created by beavers.

The network of channels carved by rivers and streams resembles a tree. The smallest "twigs" at the top of the tree are fed by groundwater springs. The "branches" (the correct name for our beloved tributary is actually "Branch") are the larger channels into which headwater streams flow. Two Run's name is derived from the fact that two main branches, or runs, flow together to form the main channel of the creek. (See map) The "trunk," or main channel, delivers water to the mouth, where it joins a larger body of water.

The land area (envision the entire canopy of a tree) that provides groundwater and runoff to a stream is a watershed. The creek known to Sanctuary volunteers and visitors is part of the "trunk," according to the watershed map for Two Run Branch (so generously provided by volunteer Dave Limbic). Two Run actually extends far beyond the twists, turns, and pools with which we're familiar. In fact, about 84% of the watershed lies outside the Sanctuary's boundaries.

The upper part of the watershed is a patchwork quilt of forests, farm fields, and a few residential areas. The northern boundary coincides with Wrighton Road; from the east, branches flow under Pindell Road in four places. The good news: approximately 57% of the entire watershed is forested. Open space, including agricultural and residential land constitutes about 41%, and only about 2% is impervious surface such as roads and rooftops.

Continued on page 2
Jug Bay Wetlands Sanctuary is operated by the Anne Arundel County Department of Recreation and Parks. It was established in 1985 with the goals of wetlands research and environmental education. The Sanctuary is a limited-use park. Visitors are requested to make a reservation by calling the office before planning a visit.

Jug Bay Wetlands Sanctuary is a member of the Chesapeake Bay - National Estuarine Research Reserve system, which promotes scientific research, public education, resource management and stewardship in estuarine reserves across the nation.

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Marsh Notes is produced quarterly by Jug Bay Wetlands Sanctuary. Comments and suggestions are welcome.
Editor: Elaine Friebel
Graphic Design: Liz Fisher,
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This newsletter is printed on recycled paper.

Location and types of land use in the Two Run Creek watershed.

An increase in impervious surface within a watershed is directly related to a decline in water quality. Hard surface prevents rainwater from soaking into the ground, so that water flows overland, eroding soil. Higher volumes of water rush into channels, tearing soil from the stream banks, cutting the channel deeper, and transporting sediment downstream. High flows sweep dead leaves lying on the stream bottom, and the aquatic invertebrates that inhabit them, downstream, scrubbing the channel of life. Oil and other pollutants wash off roads, contaminating the water.

Such land use changes have greater implications farther downstream. Recent studies sponsored by the Environmental Protection Agency demonstrated that the diversity of the bird community breeding in estuarine wetlands drops precipitously when more than 14% of the land is developed in the area that is within 500 meters of a wetland boundary. In the same study, scientists found that levels of polychlorinated biphenyls (PCBs)—compounds that were formerly used as coolants and lubricants in electrical equipment and that do not readily break down in the environment—in the tissues of yellow perch climb to dangerous levels when development exceeds 20% of the watershed area. The problem is more serious when the area occupied by commercial development rises, especially when located near the shoreline.

Land uses also affect submerged aquatic vegetation (SAV) in the Patuxent and in the Chesapeake Bay. As impervious surface area increases, so do nutrient and sediment levels. Algal blooms triggered by higher nutrient levels and sediment—laden waters deprive SAV of the light it needs to grow and survive. The disappearance of SAV ripples through the estuarine community, affecting waterfowl, shellfish, invertebrates, and fish.

Studies carried out by Sanctuary volunteers indicate that Two Run Creek is a jewel, an oasis—especially during the hot, dry, summer months—for a great diversity of plants and animals. Most physical, chemical, and biological indicators suggest that the creek is fairly healthy. The continued good health of this stream is dependent upon future land use upstream of the Sanctuary. Limiting development—especially the quantity of impervious surface—will ensure that Two Run continues to support a great diversity and abundance of life.

Soon, we’ll learn more about the relationship between land use and water quality in Two Run, as well as two of the Sanctuary’s other creeks. The Maryland Biological Stream Survey will begin monitoring the Sanctuary’s streams this spring, thanks to the efforts of CBNNERR research coordinator Julie Bortz. New monitoring sites for Two Run Creek include: two at Pindell Road, one just downstream of the confluence of the two branches, and one within the Sanctuary. In addition, several sites in Pindell Creek at the River Farm, and in Galloway Creek at the Glendening Preserve, will be monitored.
Dear Friends,

Remember when you were a kid, and 20 years seemed an endless length of time? Now that we are grown, the decades fly. We’ve already passed the 20th anniversary of the opening of the Sanctuary, celebrated last fall. Now we’re well into 2006, and it’s time to celebrate the 20th anniversary of the founding of the Friends of Jug Bay.

It was 1986 when a group of nature lovers gathered at the home of Marjorie Crain, talking about this new, unique park in South County. They wanted to help the park, and they decided to make it official by incorporating as a nonprofit support group for the Sanctuary. They put their money where their mouths were—each kicking in $5 to raise the money needed to file the proper paperwork.

Why did the Friends become the Friends? What was the goal? The Sanctuary had just opened with a small staff, a lot of land, and big dreams of protecting wetlands, educating people and doing research. To make that vision a reality, this special place would need not only a dedicated staff but also dedicated volunteers and dedicated funds. Anne Arundel County was supporting the Sanctuary, but only as one of many parks.

A “friends” group, on the other hand, could devote itself entirely to the Sanctuary. It could not only provide an enthusiastic band of volunteer but—and this was very important—it could send whatever money it raised straight to the Sanctuary, instead of funneling the donations through the general county coffers.

And so began the Friends of Jug Bay Wetlands Sanctuary—the first “friends” group for any Anne Arundel County park. Several of the people who attended that first meeting in 1986 are still members of the board. Marjorie Crain herself is a nominee this year to return to the board after several years away; we are delighted to have her back. And FOJB has grown vastly since that first session. It now encompasses more than 900 people in 380 households.

So what has FOJB done in the past 20 years? Among other accomplishments, the Friends of Jug Bay has:

- Helped save 600 acres that would have been turned into a quarry business. FOJB campaigned against a later attempt to turn the land into a mix of retail and housing, and that property is now part of the Sanctuary as the Parris N. Glendenning Preserve.
- Raised $50,000 for the Wetlands Interactive Exhibit. This collection of scientific information and games has been a hit with schoolchildren since it opened in 1999.
- Supported numerous research interns and several education interns, through membership dues and through grants from other nonprofit organizations, including an $18,000 grant from the Rauch Foundation. The Friends will use membership dues to pay a stipend for summer interns again this year.
- Obtained a grant to pay for the Sanctuary’s first volunteer coordinator.
- Set up scholarship programs for schoolchildren who otherwise wouldn’t have been able to visit the Sanctuary.
- Honored several members of the environmental community with the Jug Bay Award.
- Set up programs to bring in local community groups to enjoy the Sanctuary.
- Held music festivals, summer picnics and other party events to raise money and to build friendships between people who share a love of the Sanctuary.

Our most recent accomplishment is a very exciting one: The FOJB helped bring to the attention of county leaders the need for legal language that would ensure protection for the Sanctuary’s lands in the future. (Although the Sanctuary is now a natural area, population growth and a change in governmental administration could someday create pressure to develop the lands for other public uses incompatible with its intent.) Our interest in a special covenant met a sympathetic reception by County Executive Janet Owens, who announced her plans for such legal protection at the Sanctuary’s 20th anniversary celebration last October. County staff and Friends board members have now drafted a “confirmatory deed and declaration of covenants.” This document makes clear that the Sanctuary should remain as it is: a natural landscape of ecological diversity and valuable plant and animal habitats. Once these “perpetual covenants” are placed upon the property, citizens who love the Sanctuary will have a strong legal tool to use against threats of change.

All of the members of the Friends should be proud of what the group has done in its first 20 years. As co-presidents, we are personally pleased to have been able to contribute to those activities during our two terms. We know that the Friends will continue its important work in the next 20 years and beyond. And we urge all of you to come to the annual meeting Sunday, March 26, at which new board officers and several new board members will be chosen to lead the group into the future.

To end on a fun note: Every birthday deserves a celebration. To celebrate FOJB’s 20th, we’re going to throw a party at the Sanctuary this summer. We’ll announce the details at the annual meeting March 26—see you there!

Peggy Brosnan and Judy Burke, Co-presidents

Annual meeting set for March 26

The Friends will hold its annual meeting on Sunday, March 26, from 3 pm to 5 pm at the Wetlands Center. Anne Arundel County Executive Janet Owens will speak about her vision for protecting open space in the county. We’ll elect new officers and board members and announce the winner of the Jug Bay Award. Refreshments will be served.

Nominees for the board:
Susan Blackstone
Marjorie Crain
David Davis
Ami Hazell
Ken Riggleman
Sandy Telik

Nominees for officers:
President: Jeff Shenot
Vice president: Al Tucker
Treasurer: Mike Quinlan
Secretary: Betty Chaney

SPRING 2006
Insects and Fish Indicate Creek’s Ecological Health

By Karyn Molines

The variety of fish and insect species living in a stream are excellent indicators of habitat conditions. Each species has a specific tolerance to water turbidity, temperature fluctuations, stream flow, pH (acidity), and nitrate levels. If the physical habitat becomes degraded, specialized feeders and species that are sensitive to pollution may decline, while populations of non-native species and omnivores (animals that eat plants, animals, and detritus) may increase. Changes in habitat structure and prey sources can also cause the species composition of an aquatic community to change.

For over a decade, volunteers have waded into the waters of Two Run Creek to monitor fish and macroinvertebrates—small, bottom-dwelling insects, worms, and crustaceans that are visible to the eye. We analyzed our data for species diversity, composition, and abundance to evaluate the index of “biotic integrity” (IBI) or ecological health of the creek. An IBI compares the stream to a “reference condition” stream—an idealized stream assumed to be of optimal quality and health.

Biotic Integrity: The capability of an ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region.

Both fish and macroinvertebrate IBIs indicate that Two Run Creek supports a healthy complement of species, reflecting good ecological conditions.

Bottom Dwellers

Because of their small size and limited mobility, benthic macroinvertebrates are unable to leave a stream when pollution or other crises occurs. In addition, their life cycles range from several months to several years, making them vulnerable to both short term (flooding or toxic spill) or long-term, cumulative events (climate or ecosystem change). Some insects, especially stoneflies and mayflies, are very sensitive to pollution and will only survive in the healthiest of streams. Other insects, such as black flies and mosquitoes, can tolerate poor water quality. The presence or absence of certain insects provides clues about the impacts affecting the stream.

Most of these impacts occur as houses, shopping centers, parking lots, and roads replace forests and floodplains. Converting natural habitats to other land uses causes a myriad of problems including increased run-off, excess nutrient and chemical pollution.

Many mayfly species are sensitive to pollution.

late spring or early summer. In the winter, most larvae have grown large enough to be easily caught. At the same time, water conditions are optimal for most stream

<table>
<thead>
<tr>
<th>The Number of Stream Insect Families Found in Two Run Creek</th>
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<tbody>
<tr>
<td><img src="image" alt="Graph showing number of families found in Two Run Creek from 1996 to 2002." /></td>
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The diversity of macroinvertebrates found in Two Run Creek indicates that the creek rates as Fair.

Increased rates of sedimentation can smother fish and invertebrate eggs or harm aquatic animals.

The number of macroinvertebrate families found in Two Run Creek varies both seasonally and yearly. Accurate evaluation of stream quality depends on combining multiple years and seasons. Evaluating stream quality from one sample, for example the Fall 1998, would not accurately reflect stream conditions. Seasonal variations occur as insects in their aquatic larval stages undergo metamorphosis and leave the stream to lead terrestrial lives in insects: temperatures are cool and dissolved oxygen levels are high (See “Chemistry Key to Water Quality,” p. 8). Yearly differences can also be explained by natural variations in weather conditions. During a summer drought in 2000, we were not able to collect any insects because the stream dried up. The rebounding of macroinvertebrate populations in subsequent years demonstrates the biological resiliency of the stream.

M A R S H  N O T E S  4
Index of Biological Integrity Based on Fish Species Found in Two Run and Pindell Creeks, 1996-2003

<table>
<thead>
<tr>
<th></th>
<th>Two Run</th>
<th>Pindell Creek</th>
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<tbody>
<tr>
<td><strong>Number of Native Fish Species</strong></td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Number of Pollution Intolerant Fish Species</strong></td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Percent Pollution Tolerant Fish Species</strong></td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td><strong>Percent Generalist, Insectivorous, Omnivorous</strong></td>
<td>Fair</td>
<td>Poor</td>
</tr>
<tr>
<td><strong>Percent Abundance of Dominant Fish Species</strong></td>
<td>Fair</td>
<td>Fair</td>
</tr>
<tr>
<td><strong>IBI Ranking</strong></td>
<td>Good</td>
<td>Fair</td>
</tr>
</tbody>
</table>

In addition to ecological monitoring, this study also provides an opportunity for the public to learn about natural science and develop knowledge of stream ecology. South River High School students participated in the study, and then went on to win first place in the Anne Arundel County Envirothon, a national environmental competition for high school students.

**Fish**

Biotic indices for fish in Two Run Creek rate the stream as “Good.” In comparison, Pindell Creek, which flows through the River Farm and drains a smaller land area, is rated as “Fair.”

The presence of 17 native fish species in Two Run indicates a diversity of habitats. The most abundant species include Rosy-sided Dace, Black-nosed Dace, Creek Chub, Tessellated Darter, and Spottail Shiner. Fourteen native species were found in Pindell. The Bluegill was the only non-native fish found in both creeks, but it represented less than 0.01% of fish caught.

Species that are intolerant to pollution, including the Rosy-sided Dace, Spottin Shiner, and Swallowtail Shiner, constitute 63% of the fish captured in Two Run Creek. A high number of intolerant species indicates minimal human disturbance of the stream. Intolerant species are most affected by degradation, as they do not survive in streams with excess sediment, high water temperatures, or chemical pollution. Similarly, a low proportion of individuals that are tolerant to pollution indicates better ecological conditions.

Species with Generalist, Insectivorous, or Omnivorous feeding strategies tend to be more tolerant of environmental stresses than specialized feeders or predators. Dominance of these species increases as specific food sources become less reliable when stream conditions decline. Two Run Creek had two specialized feeders, the Least Brook Lampreys (filter feeders) and Chain Pickerels (top predators). However, the predominance of the other feeding types reflects some degradation of the creek.

As stream conditions decline, the dominant species increases in abundance, and overall species diversity tends to be lower. Two Run Creek had a high species diversity, but the fact that Rosy-sided Dace represented over 51% of fish caught indicates less than healthy environmental conditions.

The animals living in Two Run testify to its habitat diversity and good water quality. Still, conditions in the stream could be improved. To determine the causes of less than optimal conditions would take further study.

Streamside Salamanders Inhabit Floodplain

**By Karyn Molines**

This past fall, Amanda Martin, a research intern from Eleanor Roosevelt High School, conducted an investigation to find out which of the Sanctuary’s salamander species live alongside Two Run Creek. She established four plots of sixteen wooden coverboards by the banks of different sections of the creek. Using coverboards, which act as refugia for salamanders, is an easy method for finding salamanders.

Last fall she and Nicole Preti, an intern from Southern High School, checked the coverboards weekly, identifying the salamanders found under the boards. The first Red-backed Salamanders (and a Green Treefrog) were found in mid-October. Throughout the next month, all four species of streamside salamanders were found. It was not surprising to find so many Red-backed Salamanders—the most abundant salamander species in the Sanctuary. But finding four Four-toed Salamanders on one day was unexpected—and extraordinary! Nicole will be continuing the study this spring, and we are curious about how different salamander populations might vary in different seasons.
Spring 2006 Education Programs at Jug Bay

- Reservations and entrance fees are required for all events, unless noted. Call 410-741-9330 or e-mail jugbay@toad.net
- Check out www.jugbay.org for information, directions and updates to our schedule. We now have a new on-line calendar.
- Open to the public 9 am-5 pm Wednesday, Saturday & Sunday (closed on Sun in Dec-Feb)
- Programs are open to families and individuals. Scouts and other groups must call to arrange a separate program.
- Please note age limits for each program. An adult must accompany children under 13.

Birding at Jug Bay
Saturday, April 1; 8:00-11:00 am
Saturday, May 6; 8:00-11:00 am
Saturday, June 3; 8:00-11:00 am
Learn the skills of identifying birds by sight and sound. Binoculars and field guides will be available. Not appropriate for children under 12.

Nature Scavenger Hunt
Saturday, March 18; 1:00-3:00 pm
As spring approaches the wetlands become active once again. Spend the day at Jug Bay as we hike to see what’s underway. All ages are invited.

Welcome Back Osprey
Saturday, March 18; 10:00 am-12:00 noon
Jug Bay is home to one of the largest Osprey populations in the world, yet they are only summer residents. Each year, around St. Patrick’s Day, Ospreys can be seen building their nests and performing their “fish flight” courtship ritual. Learn about their migration cycle, life history, and unique adaptations to living by water. For adults and families with children at least 8 years old.

Life in an Under Water Forest
Sunday, March 19; 1:00-3:00 pm
This program will feature a slide show explaining the history of Submerged Aquatic Vegetation in the Chesapeake Bay, their ecological niche and their importance to healthy shallow water habitats. Research methods for the upcoming field season will be discussed as well. For teens and adults.

Entrance Fees
- Adults: $3
- Children under 18: $2
- Over 60: $2
- FOJB family membership: $25

Insect Identification
Hymenoptera (Bees, Ants & Wasps):
Thursday, April 13; 1:00-3:00 pm
Coleoptera (Beetles):
Saturday, May 20; 2:00-4:00 pm
Join entomologist Dr. Benedict Hollister for this adult lecture series on the fascinating and diverse world of insects. Each lecture will focus on one order of insects using indoor slide shows and specimens as well as field activities to observe live insects.

Friday Rambles
Friday, April 21; 10:00 am-1:00 pm
Friday, May 19; 10:00 am-1:00 pm
Celebrate the beginning of spring by exploring the further reaches of the Sanctuary trails. Bring water and lunch to carry on the trail. Wear sturdy hiking shoes and dress for the weather. Children should be at least 10 years old.

Celebrate Earth Day
Saturday, April 22; 1:00-3:00 pm
What better place to celebrate Earth Day than right here at your neighborhood Sanctuary! We will take a hike, practice “green-living” tips to be environmentally friendly every day, and snack on organic treats. All ages are invited.

Amphibians
Sunday, April 23, 1:00-3:00 pm
Frogs, toads, and salamanders are awakening from their winter hibernation. Come explore the forest and ponds to learn all about amphibians. All ages are invited.

Let’s Have Some Fun
Saturday, April 29; 10:00 am-2:00 pm
We’ll touch on local history and make nature observations while hiking three miles from the Wetlands Center to the beach at the Sweet Flag Picnic area. We’ll start a campfire, kick back, and have a cook out. Bring your own food and beverages. For individuals and families with children over 8 years old. Limited to 16 participants. Advance reservation with entrance fee payment (free for FOJB members) required by April 21.

Puppetry by the Patuxent
Saturday, April 29; 1:00-3:00 pm
The stage is set, the script is written, and the only thing missing is you! The red carpet will be rolled out for Jug Bay’s first ever, participant led puppet show. Participants will build their puppet characters and afterwards put on their very own puppet show. All ages are invited.

Ospreys Along the Patuxent
Sunday, May 7; 1:00-3:00 pm
One of the largest populations of Ospreys is right here at Jug Bay, although they are only summer residents. Learn about their migration and their life history during a brief lecture, and then head outdoors to observe their behavior. For adults.
Planting Moon
Saturday, May 13; 7:30-9:30 pm
May’s full moon is known as the “Planting Moon” since this is the time to sow many seeds. We’ll take a stroll at sunset through the forests and end as the moon rises over the marsh. In anticipation of Mother’s Day, each mother attending will receive a free kiss (Hershey’s, of course)! All ages invited.

How to Use GPS
Sunday, May 21; 1:00-3:00 pm
If you want to learn how to use a GPS device this activity is for you! We’ll practice finding locations by latitude and longitude; determine where on earth we are, and learn about other features of a hand-held GPS. We provide the GPS units. Registration is limited to six families. To reserve a space, mail the program fee of $5 per family before May 15, to the Sanctuary. Designed for children ages 8-10 accompanied by an adult.

10,000 years on the Patuxent
Sunday, May 21; 10:00am-2:00pm
Fee: $5.00 per person
The Patuxent River is rich in history, from Indian settlements, colonial towns, war battles, and a 20th century railroad. This trip will highlight the local history during the leisurely paced canoe trip. Experienced volunteers or staff naturalists lead trips. Canoe instruction and all equipment provided. Please bring a lunch and plenty of water. To reserve a space, mail your payment of $5 per person (including FOB) in advance to the Sanctuary. Please include your names, address, daytime phone number, number of people in your party and the ages of children. Children must be at least 7 years old, unless noted otherwise.

Spiders
Sunday, June 4; 1:00-3:00 pm
Spiders come in all sorts of shapes and sizes. Come explore the Sanctuary to find these colorful predators and learn more about the day in the life of a spider. We will make a craft after the hike. All ages are invited.

Discover Wetlands by Canoe
Sunday, June 4; 10:00am-2:00pm
(Wetland Ecology)
Saturday, June 17; 10:00am-2:00pm
(Wetland Plants)
Sunday, June 18; 10:00am-2:00pm
(Birds of the Patuxent)
Fee: $5.00 per person
Paddling through the Patuxent River wetlands provides a new window into the natural history of Jug Bay. Each trip will highlight a specific topic during the leisurely paced canoe trips. Experienced volunteers or staff naturalists lead trips. Canoe instruction and all equipment provided. Please bring a lunch and plenty of water. To reserve a space, mail your payment of $5 per person (including FOB) in advance to the Sanctuary. Please include your names, address, daytime phone number, number of people in your party and the ages of children, as well as a first and second choice of dates. Children must be at least 7 years old, unless noted otherwise.

Rhythms of Nature
Sunday, June 17; 1:00-3:00 pm
Nature has a rhythm all its own, but in our fast paced lives we sometimes can’t hear it. This program is intended for everyone, adults as well as children, who need to slow down, reconnect and rejuvenate. We’ll begin by building simple percussion instruments. Afterwards we’ll hike into the woods to weave our own rhythms with those of the forest. No musical ability is required. All ages are invited.

Summer Solstice Hike
Wednesday, June 21; 6:30-8:30 pm
The Summer Solstice marks the longest day of the year and the start of summer. Celebrate the season while hiking the summerwoods. We’ll end the day watching sunset with a light snack. All ages are invited.

Home School Classes

Testing the Waters
Wednesday, March 15; 9:30 am - 12:30 pm
What do aquatic animals need in their environment? What components in the water might cause harm? We’ll perform chemical tests to determine water quality in Patuxent River marshes and learn how it is affected by tides and seasons. We’ll consider watersheds and wetlands as sources and purifiers of water. Sources of pollution will also be discussed. For children ages 10 and above.

Who Lives Here?
Wednesday, March 29; 9:30 am - 12:30 pm
Animals living in a stream are the best testament to its water quality. We’ll collect and identify macroinvertebrates—aquatic insects and crustaceans that live on the bottom of a stream. We’ll use the diversity and types of animals that we find to determine water quality of the stream. We’ll also examine the diversity of fish. For children ages 10 and above. Wear rubber boots.

Home Range
Wednesday, April 19; 9:30 - 12:30
Your home range is the area where you eat, sleep, play, study, shop, or go to the movies. Animals have home ranges too! We’ll explore the Sanctuary for animal signs and then discuss the size of an area these animals need to find food, shelter, water, and adequate space. Using radio telemetry, we’ll find a box turtle’s hibernating place and discover the size of the turtles’ home ranges. For children 8 years and older.
Chemistry Key to Water Quality

By Lindsay Funk Hollister

Volunteers perform water quality analyses regularly at Two Run Creek, along with two marsh sites and the river channel. Each month, they monitor the stream’s chemical and physical characteristics, measuring water temperature, clarity, pH, dissolved oxygen, nitrate, and ammonium concentrations.

Two Run Creek Water Chemistry

<table>
<thead>
<tr>
<th>Temperature</th>
<th>pH (Acidity)</th>
<th>Dissolved Oxygen (D.O.)</th>
<th>Nitrate + Nitrite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min: 0.1°C (32.2°F)</td>
<td>Min: 4.4</td>
<td>Min: 3.9 mg/l</td>
<td>Min: 0.005 mg/l</td>
</tr>
<tr>
<td>Max: 26.4°C (79.5°F)</td>
<td>Max: 8.6</td>
<td>Max: 18.0 mg/l</td>
<td>Max: 1.14 mg/l</td>
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</tbody>
</table>

Two Run Creek temperatures measured throughout the year lie within a moderate range. Extensive shading by the forest canopy prevents wide temperature fluctuations from day to day. If the water received direct sun exposure, fish and other stream animals might not be able to tolerate the higher temperatures that would result. Trees also keep stream bank soil in place, preventing turbidity.

For most organisms, a pH range of 6.5 to 8.2 is optimal. Two Run’s pH levels lie mostly in the neutral range (6.0 - 8.0); however, the occurrence of values in the 4 to 5 range is cause for concern. Acid rain and decomposition or organic matter are the primary source of acidity contributing to low pH conditions.

Dissolved oxygen (D.O.) and nitrogen (nitrate + nitrite) concentrations in the creek over time are shown in the graphs to the right.

Seasonal fluctuations in dissolved oxygen content are due mainly to differences in the oxygen-holding capacity of the water—the colder it is, the more oxygen it can hold. Our data show that the creek contains an average dissolved oxygen concentration above 8 milligrams per liter, and it rarely dips below 5 milligrams per liter, which is the threshold to sustain native fish and other aquatic life.

The nitrate/nitrite content shows a less distinct seasonal fluctuation. Nitrogen sources include groundwater, rainwater, and fertilizers in runoff. Nitrate + nitrite levels at any point in time depend upon the rate of groundwater flow, temperature, and microbial activity, which converts nitrogen into various nitrogen compounds.

Volunteer Elizabeth Kugiansky assisted with the analysis of water quality data.
Floodplain Good Habitat for Turtles and Birds

By Chris Swarth

Two Run Creek and its floodplain are a rich habitat for turtles—particularly the Spotted and Eastern Box Turtle. These species prefer cool, moist soil, and dense tangles of shrubs and vines. Here they find tender herbaceous plants and aquatic and terrestrial invertebrate prey. Spotted turtles spend days in the creek where they swim slowly along the creek edge foraging among roots and branches. The omnivorous Spotted only feed under water where they also take tadpoles and small crustaceans and fish. Spotted use the vernal pools in the upper floodplain and if you’re lucky, you might see one basking on one of the small hummocks that dot these pools.

When we began our Box Turtle study in 1995, we blithely assumed that Two Run Creek served as an effective barrier to the movement of these “terrestrial” reptiles. We believed the creek was too deep and wide for a turtle to cross. How naive we were! We now know that turtles easily cross the creek and a few years ago we learned that they can even swim across the mighty Patuxent River. Through our telemetry study we’ve tracked over a dozen radio-tagged turtles as they crossed and re-crossed Two Run Creek. So why does the turtle cross the creek? To search for food, for mates and for sunny nesting sites. And we’ve seen several Box Turtles completely underwater. However, the surrounding floodplain provides the most important resources they need. Box Turtles occur in higher densities in the floodplain than anywhere else in the Sanctuary. For example, among the Spicebush, Viburnum and Red Maples where the footbridge crosses the creek, we’ve observed at least 50 different, individually-marked turtles.

Box Turtles move out of the floodplain for two important activities: nesting and hibernating. Cool, shady conditions and the risk of summer time flooding make the floodplain unsafe for nesting; females must find high, well-drained soil for excavating their nests. Adults also need dry soil for overwintering. Of the 15 overwintering turtles we’ve studied, only one overwintered in the floodplain; next to a vernal floodplain pool. Her hibernating site flooded briefly in the spring, but she emerged safely.

Songbirds Over the Creek

The Two Run Creek floodplain is a favorite haunt for birds that like moist, shady environs. High overhead, the maples and tulip poplars soar to great heights, providing an almost unbroken canopy. Warblers and other insect-eating birds forage here. A lower canopy of shrubs and saplings rise to 10 or 15 feet. Cardinals, wrens, sparrows, and towhees favor this habitat. In places where sunlight strikes the ground, a third plant community composed of grasses, sedges and vines grows where the soil is kept moist when the creek overflows its banks.

Based on our 15-year bird banding study—where we capture songbirds in the creek floodplain, forest along the river’s edge—we know that many locally breeding species are most abundant in the floodplain. These include the Louisiana Waterthrush, Common Yellowthroat, Hooded Warbler, Worm-eating Warbler, Northern Parula, White-eyed Vireo and Red-eyed Vireo. The floodplain supports a variety of food, and the stream provides a place for drinking and bathing. Many birds nest in the tall trees and shrubs, while the waterthrush builds its nests in the fern-covered banks that slope down to the creek. A number of northerly-breeding songbirds that pass through in the spring are also captured at a much greater frequency here: Canada Warbler, Northern Waterthrush, American Redstart and Black-throated Blue Warbler. A healthy creek with plenty of flow volume is critically important for supporting the plants, and in turn the food, that these birds require.

Downstream in the beaver pond we also find Wood Ducks, herons, kingfishers, and in the tall dead trees, Red-headed Woodpeckers have become a common sight, much to the delight of local birders.
Progress Made Toward Protective Covenant

This fall, Anne Arundel County Executive Janet Owens announced that the county will enter into a protective covenant to prevent development and inappropriate land uses in the Sanctuary. The county and the Friends of Jug Bay are moving ahead to draft the covenant, which will be approved and signed by Ms. Owens.

In early February, Betty Dixon of Anne Arundel’s County Land Use office met with FOJB members Judy Burke, Mike Quinlan, Al Tucker, Bill Steiner, and Brian Woodward, and with Ken Shanks of Maryland DNR. The Department of Parks and Recreation was represented by Mark Garrity, Chris Swarth, and Elaine Freiberle. The group considered provisions for future projects, facilities, and programs, as well as protections, that should be included in the covenant. A revised draft is now being reviewed by the county.

New Environmental Chief Named

Mark Garrity, a former park manager and recreation supervisor, has become the new Chief of Environmental Facilities and Programs in the county’s Department of Parks and Recreation. Mark has managed after-school programs and summer camps for the northern part of Anne Arundel County, served as Chief of Recreation for Queen Anne’s County, and supervised the park ranger program for the Maryland National Capital Parks and Planning Commission (MCNPPC). He has married (his wife is a long-term employee of MCNPPC), and he has two children. Mark says he’s looking forward to working with Chris and with the Parks department.

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Volunteer Coordinator Lindsay Funk married Ben Hollister last October in a ceremony at the River Farm. Ben is an entomologist who volunteers often at the Sanctuary. We wish them well!

Beaver Pond Home to Many Herps

By Lindsay Funk Hollister

The beautiful meanderings of Two Run Creek culminate near its mouth where a family of beavers transformed the lower end of this small tributary into a productive herp pond. Before the beavers moved in, the narrow creek channel meandered through a tidal marsh. The marsh drained during low tide, making it less suitable for turtles. Thanks to the beavers and their impressive dam building, hundreds of turtles and frogs now live in a permanent deepwater pond where they share the habitat with the beavers, river otters, Wood Ducks and watersnakes. A turtle study captured five of the Sanctuary’s seven species, and Calling Surveys identified all 13 of our recorded frogs and toads.

In the summer of 2000, Jug Bay Fellow Grégory Bulté conducted a population study of the Eastern Painted Turtle (Chrysemys picta picta), a mediumsized freshwater species in the family Emydidae, which includes box and water turtles. Painted turtle subspecies are found throughout the continental United States and are well known for their conspicuous basking behavior and ability to use a variety of watery habitats.

Using nine baited hoop traps set throughout the Beaver Pond, Grégory captured 158 turtles of five species during a total of 1380 hours of trapping. Eastern Painted Turtles were the most abundant, comprising 72% of the total turtles captured. Following were Musk Turtles at 9%, Snapping Turtles at 9%, Eastern Mud Turtles at 6%, and Red-bellied Turtles at 4%. Although not captured in the study, Eastern Box Turtles have been seen along the edges of the Beaver Pond, and the Spotted Turtle inhabits nearby vernal pools.

The trapping results suggest a healthy Painted Turtle population, and data extrapolation indicates a population size between 125 and 170 turtles. Bulté also discovered that 14 of the Painted Turtles had been previously marked. Eleven turtles had been given notch codes in 1998 at the Beaver Pond, but three others had migrated from other wetlands; two had been notched in the marsh in 1995 and 1996, and one from Mark’s Pond had been notched during a 1997 study conducted by Jug Bay Fellows Pat Crumrine and Steve Bartimbo. These recapture results demonstrate high site fidelity, but also movement between bodies of water as well. This dispersal behavior is well documented; Painted Turtles move long distances by land and water depending on age, sex and local habitat conditions.

An Evening Chorus

Anurans have also benefited from the creation of the Beaver Pond. All thirteen species of frogs and toads recorded at the Sanctuary have been heard calling from the Beaver Pond during the breeding season. The pie graph below shows the relative abundance based on the number of times each species was recorded. Bullfrogs, Green Frogs, Northern Cricket Frogs, and Pickerel Frogs were most abundant.
Researcher's Update 2005…
A Year in the Grass

By Julie Bortz, Research Coordinator

As I look back on the 2005 year, we at the Chesapeake Bay National Estuarine Research Reserve in Maryland have accomplished much. From scuba diving for submerged aquatic vegetation (SAV) to aerial flyovers to map marsh vegetation, and everything in between, the reserve truly spent a year in, or above, the grass! Check out what interesting research and monitoring took place at each site.

At Otter Point Creek, student interns explored additional methods of quantifying changes in the submerged plant community so we can better track these changes over time. This combined with the other SAV and water quality monitoring we’ve been doing the past four years will help us better understand the relationship between SAV and water quality and clarity. We also completed a third and final year of a non-tidal water quality monitoring in the Bush River watershed aimed at identifying sources of sediments and nutrients to the Bush River. Once the data is analyzed, we can target areas within the watershed for further study.

At Jug Bay, the restoration and recovery of the native marsh plant wild rice, or Zizania aquatica continued. In addition, the NERR system sponsored a graduate research fellow who conducted highly intensive water quality monitoring in an effort to understand the effect of marsh processes on nutrient metabolism by measuring oxygen production. The student measured parameters such as temperature, conductivity, salinity and dissolved oxygen at regular intervals throughout the day. Oxygen production is linked with the amount of algal production occurring in an area, which is a reflection of nutrient levels in the water column. In addition, the fellow worked with Reserve staff to collect additional water quality data covering a larger spatial area than is currently sampled with our three YSI datasondes at Jug Bay. An additional seven sites were sampled, extending from Western Branch southward to Mataponi Creek. This spatially rich data, combined with temporally rich data collected at the aforementioned three semi-continuous water quality monitoring sites, provide a more complete picture of water quality at the Jug Bay component. We have a similar water quality site at Otter Point Creek and plan to expand sampling to Monie Bay in 2006.

Speaking of Monie Bay, we worked with visiting scientists from various universities and organizations to conduct a hyperspectral flyover of the Monie Bay component, Otter Point Creek component, and other areas throughout the Bay. The goal of this effort was to use this form of remote sensing, which measures the specific reflectance of water and plants, to create maps for each component. The reserve worked with student interns and the National Aquarium in Baltimore staff to collect the necessary plant and location data needed to map the vegetation. Interpretation of the imagery is ongoing, but we hope to create maps that show the distribution and diversity of marsh vegetation as well as a snapshot of water quality conditions at the sites flown.

In addition to our continued focus on SAV, water quality and the relationships therein, we’ve begun compiling a digital database that will serve as a clearinghouse for reserve wide information such as maps, reports and other data. As a supplement to that effort, we initiated a site profile at the Monie Bay component which will provide valuable background information for the public and visiting researchers.

This is just a sampling of research at each of the components. For further information, check out our website at http://www.dnr.state.md.us/bay/cbnerr/ or stay tuned to future articles.
Plan to attend
the Friends of Jug Bay Annual Meeting
Sunday, March 26
3 to 5 pm
Anne Arundel County Executive Janet Owens will speak about her vision for protecting open space in the county. We'll elect new officers and board members and announce the winner of the Jug Bay Award. Refreshments will be served.

Winter Volunteers
November – January
Andrea Adkins
Lindsey Alvis
Marty Barron
Peg Benton
Jessica Boesch
Cynthia Bravo
Peggy Brooks
Peggy Bresnan
Judy Burke
Gordon Burton
Mary Burton
Lynn Cassell
Betty Chaney
Ginger Chaney
Kathleen Chow
Clint Cosner
Russ Cosner
David Davis
Fae Davis
Mark Dells
Kathy Elliott
Kim Elliott
Tom Englar
Blake Fenske
Shalom Fisher
Bob Ford
Robert Frezza
Rosemary Frezza
Lynette Fullerton
Jim Harle
Ann Hazell
Robert Hazell
Ben Hollister
Lynn Kenny
Elizabeth
Kurgansky
David Linthicum
Rick Malingren
Bill Miles
Louise Miles
Dave Mozurkewich
Doty Mumford
Jennifer Muro
Logan Olds
Dave Perry
Nikki Preti
Michael Quinlan
Emily Randolph
Jules Randolph
John Reuter
Lisa Siciliano
Bob Smith
Bill Steiner
Hans Stein
Jerry Stubbs
Mickey Taylor
Sandy Teliah
Peter Uimonen
Bob Williams III
Sea Williams
Volunteer Activities

(Free Admission to the Sanctuary for Participants.)

Vernal Pool Census
Saturday, March 18; 1:00 - 3:00pm
Sunday, April 2; 2:00 - 4:00pm
Thursday, April 13; 10 am - noon
Sunday, April 30; 2 - 4 pm
Saturday, May 13; 10 am - noon
Donning hip waders, volunteers walk the vernal pool at the Glenning Preserve to document the eggs and larvae of spring-breeding amphibians. For adults and children over 12.

Marsh Clean Up
Saturday, March 25; 10:00 am-3:00pm
Saturday, April 8; 10:00 am-3:00pm
Volunteers will pick up trash that has floated into the marsh. Please dress in work clothes (long sleeves and long pants), including boots or shoes that can get wet, and bring work gloves, a bag lunch, a change of clothes and a towel. Children should be at least 6 years old. Scout troops and community groups are encouraged to participate.

Canoe Guide Orientation
Saturday, April 1; 10am-noon
We need experience canoeists who are interested in leading groups on nature and history related tours of the Patuxent River wetlands. This workshop will be a land-based training, for both experienced and new volunteers, and will cover volunteer responsibilities, canoe routes and an overview of Sanctuary policies. Plan to attend the other workshops to learn about different topics to teach during the canoe trips. For adults.

Patuxent River History for Canoe Guides and Naturalists
Saturday, April 1; 1-3pm
We'll cover the entire 10,000 years that humans have lived at Jug Bay-in just two hours? This brief introduction to the history of Jug Bay will provide canoe leaders and naturalists with some fun facts and interesting highlights that can be covered during a typical program. This land-based program will provide resources, trail guides, and planning outlines appropriate for canoe trips. For adults.

Water Chemistry and Nutrient Dynamics Training Workshop
Saturday, April 1; 1:00-4:00pm
Since 1988, volunteers have monitored nutrient pollution, dissolved oxygen levels, pH and water clarity in Jug Bay's waters. We will refresh those skills and train new volunteers. Additional training is provided during the sampling dates. The workshop is recommended for all volunteers, new and experienced. For adults or teens.

Canoe Trips for Canoe Guides
Saturday, April 8; 12:30-4:30pm
Saturday, April 22; 10am-2pm
Sunday, April 23; 10am-2pm
These trips are specifically for new and current canoe guides to refresh their skills and knowledge of the river. Learn what other canoe guides do on their trips and share your own experiences. Participants must have either led trips in the past or attended the canoe guide orientation. Please bring a lunch and plenty of water.

Adopt-a-Plot Training
Saturday, April 8; 9:30am-noon
Saturday, May 20; 9:30am-noon
Join our team to remove the non-native invasive plants from our forests and nip these NIPs in the bud before they spread and threaten the special habitats and rare plants found on the Sanctuary. We'll cover identification of invasive and native species, how to document the species in a plot, and appropriate removal techniques. Individuals, families, and groups can adopt their very own plot to monitor, map and manage the invasives. Wear long sleeves, long pants, and sturdy work shoes. Bring water, and if you have them, work gloves and hand pruners. We'll provide the snacks. Children should be at least 8 years old.

Wetland Plants for Canoe Guides and Naturalists
Sunday, April 9; 1:00-4:00pm (SAV)
Saturday, May 13; 12:30-4:30pm (Marsh Plants)
We’ll be on the water to learn about wetland plants and submerged aquatic vegetation (SAV) and their role in the Patuxent River ecosystem. We’ll cover identification, their importance, and how they maintain water quality. We’ll cover techniques to incorporate ecological content in a program. Please bring plenty of water. For adults.

SAV Monitoring
Thursday, May 4; 2:00-5:00pm
Saturday, May 20; 1:00-4:00pm
Volunteers are needed to help us monitor the submerged aquatic vegetation (SAV) found in the river. Cruise the waters of the mid-Patuxent by motorboat while determining species composition and abundance, no experience necessary.

Stream Monitoring
Friday, May 12; 12:30-4:00pm
Volunteers are needed to help collect, identify, and count stream invertebrates that are used to evaluate stream health. Please bring waterproof shoes or boots and dress for the weather. For teens and adults.

Fish Survey
Saturday, May 27; 10am-noon
(Two Run Creek)
Saturday, July 1; 9:30am-noon (Patuxent River)
Using large seine net, we can monitor the fish populations living in shallow water and wetlands. Volunteers willing to get wet are needed to help catch, identify and measure (and then release) fish. Children must be at least 12 years old.

Herp Search
Saturday, June 3; 10am-3pm
Saturday, June 10; 10am-3pm
Join our annual reptile and amphibian (a.k.a. herps) research study. We’ll search the forest, stream banks and marsh edges for turtles, frogs, toads, salamanders, lizards and snakes. Participants will be assigned to teams to help identify and map where the herps are found. Children should be at least 8 years old.

Frogwatch Training Session
Friday, June 30; 7:30-9:30pm
In this workshop sponsored by the Sanctuary and the National Wildlife Federation you will explore reasons for the current crisis of amphibian decline and learn how to monitor frogs and toads with Frogwatch USA, a joint effort of the NWF and the United States Geologic Survey. We will cover basic frog and toad identification and call recognition. Participants will have the opportunity to practice their skills in the field when we visit a Frogwatch site in the Sanctuary. Please bring a flashlight, dress for the weather, and wear comfortable walking shoes. For adults and teens.
Reptiles and Amphibians
(for those entering 5th or 6th grades in Fall 2006)
Monday, June 26 - Friday, June 30
(9:30 am - 3:30 pm)
Snakes, turtles, lizards, frogs, toads and salamanders will be the stars of this program. We'll investigate the differences and similarities between reptiles and amphibians. Each day we will explore a different habitat. We'll search ponds for tadpoles as we learn about the life cycles of frogs, toads and salamanders. A canoe trip, overnight camp-out on Thursday, and a nocturnal Herp Hike are highlights of the camp. Art projects, games and experiments will enhance our daily activities.

Our Blood Runs Cold
(for those entering 7th or 8th grades in Fall 2006)
Monday, July 10 - Friday, July 14
(9:30 am - 3:30 pm)
...or so they say. Come discover what it means to be an ectotherm (cold-blooded animal), as we investigate the lives of reptiles, amphibians, fish, insects and spiders. Seining for fish in the marshes and river and exploring the ponds for salamanders and frogs will take us to the habitats where many animals are found. A canoe trip on the Patuxent River will give us a chance to search for Painted Turtles and water snakes. During the Thursday overnight camp-out we'll go on a nighttime search for moths, katydids and spiders (as well as their predators: owls, bats, frogs and toads).

R.A.C.E. for Survival
(must be entering at least 9th grade in Fall 2006)
July 24-28: Monday, Tuesday, and Wednesday
(9:30 am-3:30 pm)
Evening program, sleepover and all-day canoe trip: Thursday 3:30 pm until Friday 3:30 pm
R.A.C.E. (Reptile and Amphibian Conservation and Ecology) program focuses on the high diversity of reptiles and amphibians found at the Sanctuary. We'll track turtles and search for stream salamanders. Each day we'll explore the forest, streams, and wetlands and learn how to help protect these populations. On Thursday we'll have a cookout and listen for frogs calling at the breeding ponds. The week ends Friday as we canoe through wetlands to watch basking turtles and snakes.