George Washington and Jefferson National Forests

Detailed Monitoring and Evaluation Report
For
Fiscal Year 2004

Resource Management Plan

September 2005

Certification

I have evaluated the monitoring results and recommendations in this Report. I am directing that the Action Plans developed to respond to these recommendations be implemented according to the time frames indicated, unless new information or changed resource conditions warrant otherwise. I have considered funding requirements in the budget necessary to implement these actions.

With these actions, both Forest Plans are sufficient to guide management for the remainder of fiscal year 2005 and into fiscal year 2006, unless ongoing monitoring and evaluation identify further need for change.

/s/ Kenneth G. Landgraf (for)	September 28, 2005
MAUREEN HYZER Forest Supervisor	DATE

SUMMARY OF RESULTS
Forest Plan Monitoring and Evaluation Report
Fiscal Year 2004

INTRODUCTION The George Washington and Jefferson National Forest monitors and evaluates programs and projects to determine whether these activities are meeting the management direction shown in the two Forest Plans.

Monitoring and evaluation are specifically designed to ensure (1) Forest Plan goals and objectives (outputs) are being achieved, (2) Plan Standards and Guidelines are being properly implemented, and (3) environmental effects are occurring as predicted. The evaluation of monitoring results allows the Forest Supervisor to initiate action to improve compliance with Standards and Guidelines where needed, prepare out-year budget requests, and determine if any amendments to the Forest Plan are needed to improve resource management.

PLAN AMENDMENTS No amendments were issued to either the Jefferson or George Washington Forest Plan in 2004.

REVISION EFFORT The Jefferson National Forest finished revising its 1985 Forest Plan when Regional Forester Robert T. Jacobs signed a new Record of Decision on January 15, 2004. The next monitoring and evaluation report will be adapted to consider the monitoring items in the Jefferson's Revised Forest Plan.

ADMINISTRATIVE REVIEW In 2004, the Forest was litigated once.

American Electric Power Litigation On December 30, 2002 , Forest Supervisor William Damon, Jr. issued a Record of Decision (ROD) and Final Environmental Impact Statement (FEIS) for the American Electric Power 765 kV Transmission line. Alternative 1 (Proposed Action) was selected from the accompanying FEIS. Alterntive 1 authorized AEP to construct, operate and maintain a 765 kV transmission line across approximately 11 miles of the Jefferson National Forest.

On May 11, 2004, Plaintiff Sierra Club challenged this decision. Plaintiffs alleged that the agency failed to 1) discuss reasonably foreseeable environmental impacts and reasonable range of alternatives, 2)consider alternative routes, 3) complete an adequate Biological Assessment, and 4) enter into formal consultation with U.S. Fish and Wildlife Service (FWS), 5). Furthermore, plaintiffs alleged that the U.S. Fish and Wildlife Service (USFWS) violated the Endangered Species Act for concurring with the "not likely to adversely affect" determination in the Forest Service's Biological Assessment. Finally, plaintiff's alleged that the Forest Service violated 16 U.S.C. § 497 for authorizing AEP over 200 acres of National Forest System Land.

On December 15, 2004, plaintiff amended their complaint adding *Alliance for the Preservation and Protection of Appalachian Lands* as a second plaintiff. On January 22, 2005 Plaintiff abandoned their claims regarding an inadequate Biological Assessment and the USFWS concurrence of the Biological Assessment.

No court ruling has occurred as of the date of this report.

SUMMARY OF RESEARCH FINDINGS Research conducted on the Forests since Fiscal Year 2003 is reflected in the findings that follow as well as in the appendices.

CONGRESSIONAL ACTS No Congressional Acts specific to either Forest were passed in 2004.

OTHER NOTEWORTHY INFORMATION The Forest provided the Capitol Holiday Tree in 2004. This was a massive undertaking requiring the fulltime attention of two employees in our Public Affairs Office as well as substantial contributions of time from a number of other forest employees.

ACTION PLANS The Forest Plan Monitoring and Evaluation Report for any given year typically includes action items to be addressed during the following fiscal year (FY). The following tables provide the current status of incomplete action items from previous year action plans.

GEORGE WASHINGTON AND JEFFERSON MONITORING ACTION PLAN

Actions Requiring Forest Plan Amendment or Revision

REVISED JEFFERSON NATIONAL FOREST ACTION PLAN

No actions are required on the Jefferson National Forest since the Revised Plan was just decided in January 2004.

REVISED GEORGE WASHINGTON NATIONAL FOREST ACTION PLAN

No actions are required on the George Washington National Forest.

PROCESS AND LAYOUT OF REPORT

This report documents the results of the Forest Plan monitoring and evaluation program for FY 2004. The George Washington and Jefferson National Forests annually monitor and evaluate the programs and projects to determine whether these activities are meeting the management direction in the Forest Plan.

Monitoring and evaluation is an ongoing process that is documented through reviews made by the Forest Staff Officers, staff specialists, and District Rangers. The information from these reviews is compiled into one comprehensive report after the fiscal year is completed.

The detailed monitoring and evaluation report is presented in the following three Chapters and Appendices.

Chapter 1 presents the results of monitoring and evaluation in accordance with Chapter 5 of the Jefferson Forest Plan.

Chapter 2 presents the results of monitoring and evaluation in accordance with Chapter 5 of the George Washington Forest Plan.

Both chapters are organized by the different items to be monitored. The information for each item includes:

The Question to be answered through Monitoring and Evaluation.

The level of Monitoring.

Threshold of Acceptable Change: The point at which, if exceeded, further action would be needed.

Findings: Documentation of what was found when the item was monitored.

Recommendation: What action the ID Team is recommending to take in response to the findings. The recommendations are made to the Forest Supervisor after the ID Team evaluates the findings. Possible recommendations include (1) none, (2) increased effort to achieve the objective or comply with management direction and Standards and Guidelines, (3) amend the Forest Plan, or (4) further study to determine the best action to take.

Chapter 3 presents the results of monitoring and evaluating the Forest Plan Standards and Guidelines (S&G's). Only those S&G's are presented where a Plan amendment is recommended to improve compliance, clarification, or resource management. The information presented includes:

The reasons why a standard needs to be amended. The "Why" is tied back to monitoring analysis or to an emerging issue.

The proposed amendment.

The Appendices identify interdisciplinary team members, detailed budget expenditures, resource outputs, and an invitation to the public to comment on this report.

CHAPTER 1

MONITORING AND EVALUATION OF THE BASIC COMPONENTS IN JEFFERSON REVISED PLAN CHAPTER 5

The Forest Plan for the Jefferson National Forest was revised in January 2004. Results since January 2004 will be discussed in the next monitoring and evaluation report.

CHAPTER 2

MONITORING AND EVALUATION
OF THE BASIC COMPONENTS
IN GEORGE WASHINGTON REVISED PLAN CHAPTER 5

MANAGEMENT AREA 4

MONITORING ITEM	**BIOLOGICAL AREAS**
MONITORING QUESTION(S)?	Were individual implementation schedules for each Biological SIA prepared?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Minimum of four Plans prepared each year is not met.
FINDINGS	Work began in 1993 for preparing an establishment report for Maple Flats Research Natural Area (RNA). The Virginia Division of Natural Heritage prepared a final establishment report. The GWJEFF concluded that Maple Flats was not suitable for RNA designation. Due to declining budgets the Forest has not been able to establish additional agreements with the Virginia Division of Natural Heritage or West Virginia Department of Natural Resources to develop implementation schedules for SIA's.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEM	**BIOLOGICAL AREAS**
MONITORING QUESTION(S)?	Was vegetation manipulation for the management of the area's biological value or for threatened, endangered, or sensitive species or their habitats?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Vegetation manipulation must be designed to achieve the desired future described for this management area.
FINDINGS	About 500 acres (New Road Run on Dry River Ranger District) was treated in MA 4 in FY 2001. In 2002, about 535 acres across 3 Ranger Districts were burned (Spruce Ridge, Buck Mtn Block 5, and Hogback on Dry River, Lee, and Deerfield R.Ds). In 2003 and 2004, no acres within MA 4 were burned.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEM **BIOLOGICAL AREAS**

MONITORING QUESTION(S)? Were viable populations maintained in suitable habitat?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Negative population trends in two consecutive surveys.

FINDINGS No occurrence of any species for which a Management Area 4 was established has been lost. Individual populations of plant and animal species fluctuate from year-to-year due to a variety of factors including seasonal weather events and species reproduction/establishment traits. Tracking the number and location of occurrences monitors populations. This gives a better indication of overall species condition across the Forest as opposed to the number of individuals within a given occurrence that may naturally fluctuate widely due to often-unknown causes. In some cases the individuals of a given occurrence are monitored to better understand the biology of a species. To date no negative trends have been found. See discussion related to Management Indicator Species (MIS) in Appendix G of this report.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **HISTORIC SITES**

MONITORING QUESTION(S)? Were potentially eligible sites protected from disturbance?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE No evidence of damage to sites.

FINDINGS No potentially eligible sites were impacted. Historic structures continue to need preservation and rehabilitation. Neglect continues due to a lack of funding and the search for preservation partners continues. Monitoring continued with regard to iron complexes, rockshelters, and disturbances.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **HISTORIC SITES**

MONITORING Are existing National Register sites protected?

QUESTION(S)?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE No evidence of damage to sites.

FINDINGS Mt. Torrey Furnace partially collapsed during Hurricane Isabel.

RECOMMENDATION No changes to plan direction are recommended as we continue to seek funding for site maintenance.

MONITORING ITEM **GEOLOGIC SITES**

MONITORING QUESTION(S)? Were geologic sites protected from disturbance?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE No evidence of damage to sites.

FINDINGS No reports of damage to Devils Garden or Rainbow Rocks. In July 2004 at the Trout Pond Recreation Area on the Lee Ranger District, Trout Pond (a stream-fed sinkhole pond) experienced a temporary reduction in pond elevation that exposed slumps in the sides of the pond bottom. Geologic assessment indicated that these were not new slumps but rather the same slumps associated with 2002 sinkhole activity that led to temporary closure of the pond. There did not appear to be significant change in the slumps from 2002

RECOMMENDATION No changes to plan direction are recommended. Recommend that the Lee Ranger District and Forest geologist monitor the sinkhole activity at Trout Pond. Recommend that the District contact the Forest geologist if new sinkhole activity occurs.

MANAGEMENT AREA 5

MONITORING ITEM **VISUAL QUALITY**

MONITORING QUESTION(S)? Did management practices result in attaining a VQO of retention?

MONITORING LEVEL Effectiveness

THRESHOLD OF Visual quality does not meet the definition of retention.

ACCEPTABLE CHANGE

FINDINGS A retention VQO is met in MA 5 as seen from major travel routes and recreation sites. Most people on these travel routes do not notice forests that have been defoliated and those with overstories killed by southern pine beetle. If appropriate and if funding becomes available, the short-term rehabilitation VQO will be adopted and applied to management activities.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **VISUAL QUALITY**

MONITORING QUESTION(S)? Where was a short-term VQO of rehabilitation adopted to address restoration of the scenery resources?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Viewshed does not meet the definition of retention.

FINDINGS In FY 2001, 2002, 2003, and 2004 there were no areas in MA 5 where rehabilitation VQO was adopted.

RECOMMENDATION No changes to plan direction are recommended.

MANAGEMENT AREA 6

MONITORING ITEM **VISUAL QUALITY**

MONITORING QUESTION(S)? Did management practices result in attaining a visual quality objective of retention?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Visual quality does not meet the definition of retention.

FINDINGS Management practices have met Retention VQO with exception of some gypsy moth defoliated forests and overstories killed by southern pine beetle. These areas are being left to grow naturally.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **VISUAL QUALITY**

MONITORING QUESTION(S)?	Where was a short-term VQO of rehabilitation adopted to address restoration of the scenery resources?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Viewshed does not meet the definition of retention.
FINDINGS	A short-term rehabilitation VQO was not adopted anywhere in MA 6 during FY 2001, 2002, 2003, or 2004.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**VISUAL QUALITY**
MONITORING QUESTION(S)?	Are management practices visible from the AT at least meeting the adopted VQO of the applicable management area?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Management practices do not meet the adopted VQO.
FINDINGS	All management activities that are visible from the AT meet the VQOs as adopted for the applicable management areas.
RECOMMENDATION	No changes to plan direction are recommended.

MANAGEMENT AREA 7

MONITORING ITEM	**VISUAL QUALITY**
MONITORING QUESTION(S)?	Did management practices result in attaining the appropriate VQO?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Visual quality does not meet the definition of retention or partial retention.
FINDINGS	Appropriate long-term VQOs are being met.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**VISUAL QUALITY**

MONITORING QUESTION(S)?	Where was a short-term VQO of rehabilitation adopted to address restoration of the scenery resources?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Viewshed does not meet the definition of retention (MA 7) Viewshed does not meet the definition of partial retention (MA 7).
FINDINGS	There were no areas in MA 7 in FY 2004 where a short-term VQO of rehabilitation was adopted to address the restoration of the scenery resources.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Did harvesting occur only on land identified as suitable in the Revised Forest Plan?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Noncompliance with standard.
FINDINGS	Suitability determination is being documented in each project level analysis. Criteria on Plan Appendix page A-5 are compared with actual specific site conditions. No acres were sold in MA 7 on suitable timberland in FY 2004.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Were there changes in the amount of land identified as suitable?
MONITORING LEVEL	Validation
THRESHOLD OF ACCEPTABLE CHANGE	A change of $\pm$ 10% in land suitability as compared with the 12,000 suitable acres of this management area based on project-level analysis (MA 7).
FINDINGS	See above discussion.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Is regeneration harvesting designed to meet the desired future? (MA 7)
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Any decision to regenerate areas must be consistent with achieving the desired future of the management area (MA 7)
FINDINGS	All project-level environmental analyses identify the Purpose and Need for that particular activity. Projects are being designed to meet the Desired Future Condition of the particular management area.
RECOMMENDATION	No changes to plan direction are recommended.

MANAGEMENT AREA 8

MONITORING ITEM	**WILDERNESS**
MONITORING QUESTION(S)?	Have wilderness implementation schedules been prepared or revised, as needed?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	One schedule prepared or revised per year is not met.
FINDINGS	Implementation schedules were not updated. due to changes in out-year budgeting advice and process (BFES). Updates are scheduled for FY 2004 and 2005. Wilderness Primary Output Elements are being finalized at the national level in FY 2005. These will become the basis of the Forest's 10-year implementation schedule starting in FY 2006.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**WILDERNESS**
MONITORING QUESTION(S)?	Have actions been taken on areas where social and physical impacts exceed the "Limits of Acceptable Change" standards?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	No action has been taken to correct the impact.

FINDINGS Some “satellite” sites were naturalized in St. Mary's and Ramsey's Draft Wildernesses in FY 2001 and 2003. A minor amount of site rehabilitation and obliteration occurred in St. Mary’s and Ramsey’s Draft in FY 2002 and 2003. Identified sites will continue to be rehabilitated as funding permits. No site rehabilitation took place in FY 2004.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **WILDERNESS**

MONITORING QUESTION(S)? Are areas recovering to a natural and undisturbed appearance due to corrective actions and rehabilitation efforts?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE "Limits of Acceptable Change" standards are not met.

FINDINGS Ongoing qualitative monitoring indicates naturalizing the "satellite" sites near established campsites in wilderness is reducing physical impacts. Closures in St. Mary's and Forestwide group size limits appear to be controlling established campsite growth and impact in the George Washington Wildernesses. Resurveys of campsites in the GW wildernesses indicate an overall reduction in numbers of campsites.

RECOMMENDATION No changes to plan direction are recommended.

MANAGEMENT AREA 9

MONITORING ITEM **RECREATION**

MONITORING QUESTION(S)? Are opportunities for primitive recreation and solitude being provided?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Failure of inventoried SPNM ROS areas to meet the criteria for SPNM ROS recreation opportunities.

FINDINGS No failures known. Semi-primitive non-motorized recreation opportunities continued to be provided.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **WILDLIFE**

MONITORING QUESTION(S)? To what extent are changes to the ecosystem induced by management activities?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Management activities, which treat more than 10% of the area, are not considered light-on-the-land.

FINDINGS The amount of activity within this Management Area is displayed in the following table.

Fiscal Year	Prescribed Burning in MA 9 (Acres)
2001	0
2002	0
2003	0
2004	1,850

RECOMMENDATION No changes to plan direction are recommended.

MANAGEMENT AREA 10

MONITORING ITEM **RECREATIONAL AND SCENIC RIVERS**

MONITORING QUESTION(S)? Have management activities precluded river segments from further consideration as scenic rivers? Have management activities precluded river segments from further consideration as recreational rivers?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Presence of management practices that disqualify the river segments for scenic river designation. Presence of management practices that disqualify the river segments for recreational river designation.

FINDINGS No known actions in eligible stream corridors which would preclude consideration for designation in either classification.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **SCENIC RIVERS**

MONITORING QUESTION(S)? Did management practices result in attaining a VQO of retention?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Visual quality does not meet the definition of retention.

FINDINGS Management practices are meeting the retention VQO.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **RECREATIONAL RIVERS**

MONITORING QUESTION(S)? Did management practices result in attaining a VQO of partial retention?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Visual quality does not meet the definition of partial retention.

FINDINGS Management practices are meeting the partial retention VQO.

RECOMMENDATION No changes to plan direction are recommended.

MANAGEMENT AREA 11

MONITORING ITEM **RECREATION**

MONITORING QUESTION(S)? Are OHV routes being maintained in a manner that minimizes the effects of OHV use?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Unacceptable resource damage is not corrected in a timely manner.

FINDINGS Ongoing maintenance is occurring in ATV/OHV areas. Watershed impacts and erosion problems are identified and corrected. User impacts are significant and maintenance costs are high. In FY 2001, maintenance was performed on OHV routes at the Taskers Gap and Rocky Run OHV areas. In FY 2002, maintenance continued at Rocky Run. Impacts and maintenance costs of the three areas remain high however no unacceptable watershed impacts were identified in FY 2004.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **RECREATION**

MONITORING QUESTION(S)?	Are licensed OHV routes stated in Plan Table 3-5 and Appendix J offering a 4-wheel drive experience, which meets the needs of its users? Do constructed motorized routes (ATV) provide an interesting and challenging ride?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Survey reveals poor route conditions, hazards, or user conflicts.
FINDINGS	There continues to be increased demand for more 4-wheel drive routes forestwide. All OHV areas with the possible exception of Rocky Run are receiving increase use from the previous report. No surveys were conducted on user satisfaction, but demand for both ATV and 4WD routes is still increasing based on vehicle sales. South Pedlar ATV area received another TEA-21 grant for trail maintenance in 2003 and it was implemented in FY 2004.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Did harvesting occur only on land identified as suitable in the Revised Forest Plan?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Noncompliance with standard.
FINDINGS	Suitability determination is being documented in each project level analysis. Criteria on Plan Appendix page A-5 are compared with actual specific conditions. In FY 2004, no acres were sold in MA 11 on suitable timberland.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Were there changes in the amount of land identified as suitable?
MONITORING LEVEL	Validation
THRESHOLD OF	A change of $\pm$ 10% in land suitability as compared with the 3,000

ACCEPTABLE CHANGE	suitable acres of this management areas based on project-level analysis.
FINDINGS	See above discussion.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Are roads for timber removal also planned and designed to meet motorized recreation objectives?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Any decision to remove timber which doesn't consider the motorized recreation desired future.
FINDINGS	The project level environmental analysis identified impacts and provided mitigating measures for nearby ATV motorized recreation desired future conditions.
RECOMMENDATION	No changes to plan direction are recommended.

MANAGEMENT AREA 12

MONITORING ITEM	**RECREATION**
MONITORING **QUESTION(S)?**	Are developed recreation facilities safe and properly maintained for visitor safety and comfort?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Unsafe conditions are not corrected before facilities are made available to the public.
FINDINGS	All recreation sites were inspected, and all needed corrective actions were taken. Developed recreation areas have been and will continue to be surveyed on an on-going basis for unsafe conditions. Problems are continually corrected or area (site) is closed.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**RECREATION**
MONITORING	Are existing developed recreation facilities accessible to visitors with

QUESTION(S)? disabilities as covered by Federal Law? Are newly constructed or reconstructed developed recreation facilities accessible to visitors with disabilities in accordance with Federal guidelines?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Inaccessible facilities are reconstructed to permit access to disabled visitors. Constructed and reconstructed facilities must be accessible.

FINDINGS In FY 2001, a programmatic transition plan was completed. The Forest has made considerable progress in providing for universal access.

An accessible fishing pier was constructed at Sherando Lake. All new construction and reconstruction projects are planned to meet the objective.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **RECREATION**

MONITORING QUESTION(S)? Have proposed new developed recreation sites been constructed? Have existing developed recreation sites been expanded?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Construction is dependent upon funding and volunteer/partner interest. If funding is not received, Appendix B of the Revised Plan will be will be updated.

FINDINGS Regular appropriated funding is not likely to be available for expansion or construction of new sites or for rehabilitation of existing areas. Several districts have planned to use fee-demo funds to expand or rehabilitate existing areas. Major rehabilitation work is underway and planned for Sherando Lake. The forest has undertaken a program of new and replacement SST installation using appropriated dollars.

RECOMMENDATION No changes to plan direction are recommended.

MANAGEMENT AREA 13

MONITORING ITEM **RECREATION**

MONITORING QUESTION(S)? Are dispersed areas of concentrated use resulting in significant damage to the environment?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Major damage to vegetation or soil is occurring.

FINDINGS Some riparian impacts due to dispersed use still occur but are steadily being reduced. Through roads and trails and capital investment funding, progresses continued in FY 2004 to relocate and/or rehabilitate some problem roads, trails and dispersed sites and reduce or eliminate riparian/watershed impacts. Some impacts to soils are inherent to this type of use.

Legal use of the Forest for recreation will normally have some impact on the environment when there is concentrated use. Maintenance of recreation facilities, trails and roads improve many areas of concentrated use and prevent them from impacting larger areas. Watershed improvement funding improves old, non-system roads and helps in relocating poorly located trails and roads. When impacts resulting in decreases to soil and water quality are identified they are scheduled to be corrected with various funding sources. Illegal vehicle use is increasing and the impacts from this are seen across the Forest. When these areas are identified they are entered onto the Forest WIN inventory and funded from soil and water improvement funds. They are blocked, drained and revegetated.

RECOMMENDATION No changes to plan direction are recommended. The Forest will continue monitoring and inventorying of dispersed recreation sites to determine needs where impacts are expanding into adjacent areas; and continue to reclaim floodplain/riparian ecosystems.

MONITORING ITEM **ECOSYSTEM**

MONITORING QUESTION(S)? To what extent are changes to the ecosystem induced by management practices?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Management activities that treat more than 10% of the unsuitable timberland area are not considered subtle and gradual.

FINDINGS Of the 42,000 acres in this MA, 4,000 acres are suitable and 38,000 unsuitable. The amount of activity within this Management Area in Fiscal Year4 2004 is displayed in the following table.

Fiscal Year	Suitable Timberland In MA 13 (Sold Acres)	Prescribed Burning (Acres)
2004	138	157

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **VISUAL QUALITY**

MONITORING QUESTION(S)? Did management practices result in attaining the appropriate VQO?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Visual quality does not meet the definition of retention or partial retention.

FINDINGS VQOs are met throughout Management Area 13.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Did harvesting occur only on land identified as suitable in the Revised Forest Plan?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Noncompliance with standard.

FINDINGS Suitability determination is being documented in each project level analysis. Criteria on Plan Appendix page A-5 are compared with actual specific site conditions. See above discussion and table for this Management Area.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Were there changes in the amount of land identified as suitable?

MONITORING LEVEL Validation

THRESHOLD OF ACCEPTABLE CHANGE A change of $\pm$ 10% in land suitability as compared with the 4,000 suitable acres of this management area based on project-level analysis.

FINDINGS See above discussions.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Is regeneration harvesting designed to provide for safety and to provide scenic rehabilitation and enhancement?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Any decision to regenerate areas must be consistent with achieving the desired future of the management area.

FINDINGS See above discussions.

RECOMMENDATION No changes to plan direction are recommended.

MANAGEMENT AREA 14

MONITORING ITEM **WILDLIFE**

MONITORING QUESTION(S)? Did management activities result in attaining the desired habitat?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE A change of ± 10% in acres prescribed burned or sold as compared with the 614 estimated prescribed burn acres and 52 estimated harvested acres of this management area from FORPLAN analysis.

FINDINGS The amount of activity within this Management Area in Fiscal Year 2004 is displayed in the following table.

Fiscal Year	Suitable Timberland In MA 14 (Sold Acres)	Prescribed Burning (Acres)
2004	113	3,111

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **WILDLIFE**

MONITORING QUESTION(S)? Were open roads in excess of stated density objective closed to public use?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE	No documented evidence that opportunities were looked for. Results indicate no open road mileage can be reduced
FINDINGS	No open interior system roads in excess of stated densities were closed in FY 2004. No additional road closure opportunities were identified.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING	**TIMBER**
MONITORING QUESTION(S)?	Did harvesting occur only on land identified as suitable in the Revised Forest Plan?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Noncompliance with standard.
FINDINGS	Suitability determination is being documented in each project level analysis. Criteria on Plan Appendix page A-5 are compared with actual specific site conditions. The amount of activity within this Management Area in Fiscal Year 2004 is displayed in the table above.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Were there changes in the amount of land identified as suitable?
MONITORING LEVEL	Validation
THRESHOLD OF ACCEPTABLE CHANGE	A change of $\pm$ 10% in land suitability as compared with the 48,000 suitable acres of this management area based on project-level analysis.
FINDINGS	See second TIMBER finding discussed under Management Area 7.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Is regeneration harvesting designed to diversify food sources and increase other habitat needs?
MONITORING LEVEL	Implementation

THRESHOLD OF ACCEPTABLE CHANGE Any decision to regenerate areas must be consistent with achieving the desired future of the management area.

FINDINGS All timber sold was designed to be consistent with the Plan.

RECOMMENDATION No changes to plan direction are recommended.

MANAGEMENT AREA 15

MONITORING ITEM **WILDLIFE**

MONITORING QUESTION(S)? Did management activities result in attaining the desired habitat?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE A change of ± 10% in acres prescribed burned or sold as compared with the 2,386 estimated prescribed burn acres and 1,361 estimated harvested acres of this management area from FORPLAN analysis. Percent of grass/herbaceous openings is not met.

FINDINGS The amount of activity within this Management Area in Fiscal Year 2004 is displayed in the following table.

Fiscal Year	Suitable Timberland In MA 15 (Sold Acres)	Prescribed Burning (Acres)
2004	597	1,650

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **WILDLIFE**

MONITORING QUESTION(S)? Were open roads in excess of stated density objective closed to public use?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE No documented evidence that opportunities were looked for. Results indicate no open road mileage can be reduced.

FINDINGS No open interior system roads in excess of stated densities were closed in FY 2004. There are no additional opportunities for road closure.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Did harvesting occur only on land identified as suitable in the Revised Forest Plan?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Noncompliance with standard.
FINDINGS	Suitability determination is being documented in each project level analysis. Criteria on Plan Appendix page A-5 are compared with actual specific site conditions. The suitable timberland managed in Fiscal Year 2004 is displayed in the table above.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Were there changes in the amount of land identified as suitable?
MONITORING LEVEL	Validation
THRESHOLD OF ACCEPTABLE CHANGE	A change of $\pm$ 10% in land suitability as compared with the 192,000 suitable acres of this management area based on project-level analysis.
FINDINGS	See second TIMBER finding discussed under Management Area 7.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Is regeneration harvesting designed to provide for the wildlife habitat described in the desired future for the management area?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Any decision to regenerate areas must be consistent with achieving the desired future of the management area.
FINDINGS	See third TIMBER finding discussed under Management Area 7.
RECOMMENDATION	No changes to plan direction are recommended.

MANAGEMENT AREA 16

MONITORING ITEM **WILDLIFE**

MONITORING QUESTION(S)? Did management activities result in attaining the desired habitat?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE A change of ± 10% in acres sold as compared with the 217 estimated harvested acres of this management area from FORPLAN analysis. Percent of 1-10 year age class is not met.

FINDINGS The amount of activity within this Management Area in Fiscal Year 2004 is displayed in the following table.

Fiscal Year	Suitable Timberland In MA 16 (Sold Acres)	Prescribed Burning (Acres)
2004	60	2

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Did harvesting occur only on land identified as suitable in the Revised Forest Plan?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Noncompliance with standard.

FINDINGS Suitability determination is being documented in each project level analysis. Criteria on Plan Appendix page A-5 are compared with actual specific site conditions. The suitable timberland managed in Fiscal Year 2004 is displayed in the table above.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Were there changes in the amount of land identified as suitable?

MONITORING LEVEL Validation

THRESHOLD OF ACCEPTABLE CHANGE A change of ± 10% in land suitability as compared with the 27,000 suitable acres of this management area based on project-level analysis.

FINDINGS See second TIMBER finding discussed under Management Area 7.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Is regeneration harvesting designed to provide for the wildlife habitat described in the desired future for the management area?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Any decision to regenerate areas must be consistent with achieving the desired future of the management area.

FINDINGS See third TIMBER finding discussed under Management Area 7.

RECOMMENDATION No changes to plan direction are recommended.

MANAGEMENT AREA 17

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Did harvesting occur only on land identified as suitable in the Revised Forest Plan.

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Noncompliance with standard.

FINDINGS Suitability determination is being documented in each project level analysis. Criteria on Plan Appendix page A-5 are compared with actual specific site conditions. The amount of activity within this Management Area in Fiscal Year 2004 is displayed in the following table.

Fiscal Year	Suitable Timberland In MA 17 (Sold Acres)	Prescribed Burning (Acres)
2004	383	0

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Were there changes in the amount of land identified as suitable?
MONITORING LEVEL	Validation
THRESHOLD OF ACCEPTABLE CHANGE	A change of $\pm$ 10% in land suitability as compared with the 63,000 suitable acres of this management area based on project-level analysis.
FINDINGS	See second TIMBER finding discussed under Management Area 7.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEM	**TIMBER**
MONITORING QUESTION(S)?	Is regeneration harvesting designed to provide for the production of high value timber species and products?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Any decision to regenerate areas must be consistent with achieving the desired future of the management area.
FINDINGS	See third TIMBER finding discussed under Management Area 7.
RECOMMENDATION	No changes to plan direction are recommended.

MANAGEMENT AREA 18

MONITORING ITEM	**FISHERIES**
MONITORING QUESTION(S)?	Are activities working towards providing the required amounts of LWD per stream mile?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Noncompliance with standard.
FINDINGS	In 2004, 56 km (35 miles) of streams were surveyed using a modified Basinwide Visual Estimation Technique (BVET [Dolloff et. al. 1993]) to estimate woody debris loading, percentage of pool and riffle area, and the width of the riparian area of streams. The distribution of woody debris was also mapped. Approximately 78% of the streams surveyed did not meet the desired future conditions of 78 to 186 pieces of large woody

debris per kilometer. Approximately 71% of the streams surveyed did not meet the desired future condition of pool habitat between 35% and 65% (Roghair et. al. 2004).

Additional survey items inventoried in 2004 include measuring glide, run, cascade, and braid habitats, embeddedness, Rosgen channel type, residual pool depth, substrate composition, and gradient. These items were added to better characterize the streams and the stability of their channels.

Limiting factors for meeting the physical DFC's were predominately historic land use practices of the last 150 years. Historically, up until the last 20 to 30 years, riparian areas have been logged to the stream banks. It takes over 100 years for riparian trees to grow to large size, die and fall into the riparian area as LWD. Riparian areas are managed to provide future LWD recruitment. Additionally, projects continue to be accomplished that add LWD into those streams currently not meeting DFC.

RECOMMENDATION No changes to plan direction are recommended. The Forest will be analyzing the current physical habitat of the streams as they relate to historic timber management activities and other land use practices. The agency will continue to inventory and monitor existing physical stream habitat conditions.

MONITORING ITEM **FISHERIES**

MONITORING QUESTION(S)? Will these amounts of LWD provide necessary habitat for all life stages of native aquatic species and will it be self-sustaining?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Habitat rating by Virginia Dept. of Game & Inland Fisheries or West VA DNR stream classification system is lowered.

FINDINGS In 2004, 56 km of streams were surveyed for large woody debris (LWD). Of the greater than 1424 km (885 miles) of streams surveyed on the Forest, habitat ratings were lowered on several streams because of flood impacts. On streams that met the DFC for LWD, there was a healthy aquatic macroinvertebrate population (unless chemically impacted from acid deposition) and a healthy native fish fauna. The majority of the LWD is in smaller size classes, which are not as effective in creating habitat units used by aquatic fauna. The DFC for LWD appears to be an accurate representation of the amount of wood needed to provide necessary habitat for all life stages of native aquatic species, however, it would be desirable to have more of the LWD in the larger size classes.

RECOMMENDATION No changes to plan direction are recommended. The Forest will continue to look at the relationship between LWD, aquatic macroinvertebrate communities, fish fauna, and historic land use practices on those streams that are not limited chemically from acid deposition.

MONITORING ITEM	**FISHERIES**
MONITORING QUESTION(S)?	Were viable populations maintained in suitable habitat?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Negative population trends in three consecutive surveys.
FINDINGS	Aquatic management indicator species were chosen to represent conditions of specific habitat that supports an array of other species. Brook trout were chosen to represent cold-water streams, the sunfish family was chosen to represent warm water habitat, and the James spinymussel represents an aquatic TES species. See Appendix G for discussion of population trends for these three aquatic species.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**SOIL**
MONITORING QUESTION(S)?	Was action taken to limit recreation before bare soil is exposed on more than 5% of the area?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Noncompliance with standard.
FINDINGS	According to the Forest's Watershed Improvement Needs inventory, managed recreation use was not a large impact to soil and water resources across the Forest in FY 2004. In the areas where recreation use does cause compaction, erosion and/or sediment delivery to stream channels, the Forest targets these for improvement work. The Forest does not have any areas where bare soil caused by recreation use is exceeding 5% of the area. Unmanaged motorized recreation use is an impact across the Forest and is inventoried and treated as funding allows.
RECOMMENDATION	No changes to Forest Plan direction are recommended. The Forest will continue to inventory soil resource improvement needs and implement improvement work where recreation use is causing soil movement and

compaction. All non-road and non-trail bare soil on slopes greater than 5% will be vegetated to prevent soil movement.

MONITORING ITEM	**WATER**
MONITORING QUESTION(S)?	Were filter strips, shade strips, and vehicle exclusion zones maintained at required width? Were areas of disturbed soil revegetated by the end of the first growing season? In riparian areas, were revegetation measures implemented within 14 days of disturbance? On roads and skid trails, were appropriate drainage structures installed and maintained? Was the appropriate type of stream crossing used? Were approaches to ford crossings graveled at least 50 feet on each site of stream?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Major departure from intent of BMPs as noted on Field Evaluation Form.
FINDINGS	In FY2004 a variety of soil-disturbing activities were monitored for implementation of Best Management Practices. Most were timber sales, including fuel wood and salvage sales, but culvert installation and trail construction also were monitored. Of 131 BMP monitoring elements, 98 percent showed that implementation met or exceeded BMP requirements. Two percent showed only minor departures from the intent of the BMP. The Virginia Department of Forestry conducted water quality monitoring in association with timber harvests from 1989 to 1996 (VA. Dept. of Forestry, 1998). At sites in the mountains, Piedmont, and coastal plain, water temperatures were taken at 10-minute intervals, and water samples were collected automatically before, during, and after storm events, both upstream and downstream from logging. Aquatic macroinvertebrates were also sampled periodically. This monitoring showed that, when forestry BMP's are properly implemented, timber harvests can be accomplished without a large or persistent increase in sediment, an increase in stream water temperatures, or a shift in macroinvertebrate species composition. Since the Forests' monitoring indicates that forestry BMP's were properly implemented, it can be concluded that these practices were effective in protecting water quality.

REFERENCE: Virginia Department of Forestry. 1998. Conclusions suggested by water quality monitoring near private timber harvests: 1989-1996, an executive summary.
Internet Source: http://state.vipnet.org/dof/wq/wqm89-96.htm

RECOMMENDATION No changes to plan direction are recommended. The Forest will continue BMP monitoring.

MONITORING ITEM **WATER**

MONITORING QUESTION(S)? Are BMPs effective in protecting the most sensitive of the State-designated beneficial uses of water, namely, that of native brook trout streams?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Lowering of biological condition by one category as determined by EPA Rapid Bioassessment Protocol II.

FINDINGS Aquatic macroinvertebrate communities integrate the physical, chemical, and biological components of the riparian ecosystem and have been successfully used as bioindicators to monitor change and impacts (EPA 1989). An analysis of over 536 streams on the GWJNF has established the current range of conditions for aquatic macroinvertebrate communities found on the GWJNF. A Macroinvertebrate Aggregated Index for Streams (MAIS) (range of scores 0 to 18) incorporates nine ecological aspects (metrics) of the aquatic macroinvertebrate community to evaluate the current condition of a stream relative to others within that ecological section (Smith and Voshell 1997). A Rapid Bioassessment report provides raw data on the taxa collected in addition to the metric scores and the overall MAIS score. Adjectives of "very good" (MAIS = 17-18), "good" (MAIS = 13-16), poor/fair (MAIS - 7-12), and "very poor" (MAIS = 0-6) are added to the report to make it user friendly to non-technical managers and decision makers. The GWJNF uses the MAIS score as "coarse filter" screening tool on some projects to establish current "stream health" and to establish a baseline to evaluate effectiveness of standards, guidelines and mitigation measures in preventing changes and impacts to the aquatic community. When the MAIS score is low or has changed from previous monitoring, biologists examine the individual metric scores and/or raw data to identify limiting factors. The individual metrics often point to a limiting factor or trigger a more rigorous and quantitative monitoring effort.

Sample sites were selected downstream of management activity areas to monitor the impacts on stream health of projects including but not limited to timber sales and prescribed burns. Other samples were collected to create a baseline of stream conditions within the forest. Only samples collected from March through the first week in June were compared to minimize seasonal variability in structure of macroinvertebrate communities. Across the Forest, 728 samples were collected, analyzed and assigned an overall MAIS score (0-18). Of these samples, 84% were in the “good” and “very good” categories.

A paired t-test was used to compare the MAIS scores of 18 streams before and after timber harvests that occurred at various locations across the Forest. There was no significant difference between the pre and post timber harvest MAIS scores; both the pre and post mean scores were in the “Good” category (Table 1).

Table 1. Paired samples t-test on pre and post MAIS scores from 18 different timber sales.

Mean MAIS pre	16
Mean MAIS post	15
95% CI	-0.365 to 2.365
P value	0.140

A paired t-test was used to compare the MAIS scores of 7 streams before and after prescribed burn that occurred at various locations across the Forest. There was no significant difference between the pre and post prescribed burn MAIS scores; both the pre and post mean scores were in the “Good” category (Table 2).

Table 2. Paired samples t-test on pre and post MAIS scores from 7 different prescribed burns.

Mean MAIS pre	16
Mean MAIS post	16
95% CI	-1.098 to 1.669
P value	0.631

Water quality has been systematically monitored on Forest streams since 1987. Approximately 100 streams were monitored for water quality in 2004. As expected, the general water quality of any given stream is strongly tied to the underlying geology coupled with prevailing air quality. The collected data has been used to determine trends and changes in stream water composition, and to develop a model for projecting the future status of native trout streams. A 1998 report (Bulger et al. 1998) found that of the study streams in non-limestone geology, 50 percent are “non-acidic.” An estimated 20 percent are extremely sensitive to further acidification. Another 24 percent experience regular episodic acidification at levels harmful to brook trout and other aquatic species. The remaining 6 percent of streams are “chronically acidic” and cannot host populations of brook trout or any other fish species. Similar findings were reported by the Southern Appalachian Mountain Initiative in their 2002 publication on acid deposition.

Acidification impacts have reduced aquatic biodiversity and ecosystem capabilities through chronic or episodic lowering of stream pH. Increased aluminum concentrations, often associated with low pH, can also be toxic to aquatic life. These impacts have severe implications for 1) meeting the desired future conditions of aquatic ecosystems and 2) satisfying the public's expectations and demands for healthy, functioning, aquatic ecosystems.

RECOMMENDATION No changes to plan direction are recommended. The Forest will continue to look at the effects of short-term management practices on the immediate response of the MAIS score.

References

Bulger, A., J. Cosby, and R. Webb. 1998. Acid Rain: Current and Projected Status of Coldwater Fish Communities in the Southeastern US in the Context of Continued Acid Deposition. A Coldwater Conservation Fund Report for Trout Unlimited.

Environmental Protection Agency (EPA) 1989, Rapid Bioassement Protocols for use in Streams and Rivers: Benthic Macroinvertebrates and Fish. US EPA Report 444/4-89/001. Office of Water Regulations and Standards. US EPA. Washington, DC.

Roghair, C.N., D.R. Nuckols, J. Yowell, and M. Leonard. 2004. Condition of Streams in the South Fork Shenandoah River Drainage, 2004, Dry River Ranger District, George Washington –Jefferson National Forest, Virginia. Center for Aquatic Technology Transfer, Blacksburg, VA.

SAMI Staff. 2002. "Southern Appalachian Mountains Initiative: Final Report." Southern Appalachian Mountains Initiative. Asheville, NC. 172pp.

Smith, E.P, and J. Reese Voshell, Jr. 1997. Studies of benthic macroinvertebrates and fish in streams within EPA Region 3 for the development of biological indicators of ecological condition. Part 1 Benthic Macroinvertebrates. Final Report January 24, 1997, Virginia Polytechnic Institute and State University, Blacksburg VA 24061; Cooperative Agreement CF821462010, 23 p.

MANAGEMENT AREA 20

MONITORING ITEM **ADMINISTRATIVE SITES**

MONITORING QUESTION(S)? Do administrative sites meet required regulations?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE No code violations. Violations are corrected as quickly as possible.

FINDINGS Code violations are corrected when they are found. Maintenance to Work

Center buildings continues as necessary. A new office for the Dry River Ranger District has been completed and occupied.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **UTILITY CORRIDORS**

MONITORING QUESTION(S)? Is low-growing vegetation being maintained in electric rights-of-way where wildlife and aesthetic objectives have been established?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Noncompliance with standard.

FINDINGS Vegetation within utility corridors is being maintained in accordance with Forest Plan direction and approved special use permits.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **COMMUNICATION SITES**

MONITORING QUESTION(S)? Were new communication sites developed? Are existing communication sites being used to the maximum?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Existing sites should approach 90% occupancy.

FINDINGS No new communication sites were designated in FY 2004.

RECOMMENDATION No changes to plan direction are recommended

MANAGEMENT AREA 21

MONITORING ITEM **ECOSYSTEM**

MONITORING QUESTION(S)? To what extent are changes to the ecosystem induced by management practices?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Management activities which treat more than 10% of the area are not considered to mimic natural ecological processes.

FINDINGS	Management Area 21 consists of 59,000 acres. In April 2003, about 1,500 acres was prescribed burned in the Little Schloss area. This is below the 10% threshold. Effect of the prescribed burn are within the natural range of variability for this ecosystem. No prescribed burns occurred in this Management Area in FY 2004.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**BIOLOGICAL VALUES**
MONITORING QUESTION(S)?	Were practices used that were necessary to recover threatened or endangered species habitats or populations? Were practices used that were necessary to maintain sensitive species habitats or populations?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Noncompliance with standard.
FINDINGS	No practices were carried out in Management Area 21 from 2001 through 2001 that were specifically directed at TES species management.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**GEOLOGIC VALUES**
MONITORING QUESTION(S)?	Was Big Schloss protected from disturbance?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	No evidence of damage to sites.
FINDINGS	No reports of damage to Big Schloss (the rock outcrop).
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**MINERALS**
MONITORING QUESTION(S)?	Within the Laurel Fork Special Management Area, did leases issued contain special stipulations?
MONITORING LEVEL	Implementation
THRESHOLD OF	Noncompliance with standard.

ACCEPTABLE CHANGE	
FINDINGS	On January 31, 1997, Regional Forester Robert Joslin decided to withdraw consent to the Bureau of Land Management to offer leases for oil and gas in the Laurel Fork Special Management Area and to make the Laurel Fork area administratively unavailable for oil and gas leasing. Connected with these two decisions, the George Washington Forest Plan was amended. Since this occurred, the question is no longer necessary since leasing will not occur.
RECOMMENDATION	No changes to plan direction are recommended at this time. Wait until Plan is revised and then remove this monitoring question.
MONITORING ITEM	**RECREATION**
MONITORING QUESTION(S)?	Are opportunities for primitive recreation and solitude being provided?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Failure of adopted SPNM ROS areas to meet the criteria for SPNM ROS recreation opportunities.
FINDINGS	Since there were no activities or projects within these areas from FY 2001 to FY 2003 that would have changed the existing opportunities being provided, these SPNM opportunities are being met.
RECOMMENDATION	No changes to plan direction are recommended.

MANAGEMENT AREA 22

MONITORING ITEM	**ECOSYSTEM**
MONITORING QUESTION(S)?	For each unique area, has the theme(s) been identified?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	No implementation schedule has been developed.
FINDINGS	Nothing has been done since the draft implementation schedule was completed in FY 1994 on areas along Shenandoah River. In FY 2004, 100 acres were burned at the Wallace-Marshall Tract on the Deerfield District.
RECOMMENDATION	No changes to plan direction are recommended.

MONITORING ITEMS THAT ARE COMMON TO ALL MANAGEMENT AREAS

MONITORING ITEM	**ARCHEOLOGICAL SITES**
MONITORING QUESTION(S)?	Were potentially eligible sites protected from disturbance?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	No evidence of damage to sites.
FINDINGS	One archaeological resource was impacted by vandalism between FY 2001 and FY 2004. The FS archaeologists and the Law Enforcement Officers monitored the site. Surveillance cameras were placed on the site. No further damage has occurred. No other sites were disturbed. During FY 2004 one rock shelter was monitored on several occasions. Inventory and site testing are on going at the iron complex associated with Longdale Furnace and at the prehistoric Keyser Farm site. Work will commence in spring 2005 on the Brown Mountain Historic Complex.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**BIOLOGICAL VALUES**
MONITORING QUESTION(S)?	Is each old growth forest type represented in an old growth condition on the Forest? How much and where is the old growth on the Forest?
MONITORING LEVEL	Validation
THRESHOLD OF ACCEPTABLE CHANGE	Depends on inventory finding and site-specific analysis, but no total downward trend in acres
FINDINGS	Ten old growth forest types occur on the George Washington National Forest. Eight of these ten types currently have acreage in an old growth condition. Acreage in an old growth condition is increasing forestwide in all forest types. No management activities have been implemented in areas identified as old growth other than Old Growth Forest Type (OGFT) 21 - Dry/Mesic Oak Forest. While a few acres in this type have been harvested the net acres forestwide are increasing as forests age and develop old growth characteristics. See discussion of old growth in Appendix G to this report.

RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**BIOLOGICAL VALUES**
MONITORING QUESTION(S)?	Are associated species of the yellow pine community, dependent on fire or xeric conditions, being maintained, and reproducing?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Loss of associated species or total fire exclusion.
FINDINGS	The Forest did not quantify this loss since these species are typically on unsuitable timberland and not systematically inventoried. Prescribed burning is stable to increasing across the National Forest. See discussion of yellow pine community and trend in prescribed burn acreages in Appendix G.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**BIOLOGICAL VALUES**
MONITORING QUESTION(S)?	What are the bird (worm-eating warbler, ovenbird, brown-headed cowbird, and pileated woodpecker) population trends on the Forest?
MONITORING LEVEL	Validation
THRESHOLD OF ACCEPTABLE CHANGE	Natural population fluctuations are expected. Long-term (5-10 yr) downward trend will result in implementation of Level 2 surveys.
FINDINGS	See discussion of this species in Appendix G to this report.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**BIOLOGICAL VALUES**
MONITORING QUESTION(S)?	What are the bird (common flicker) population trends on the Forest?
MONITORING LEVEL	Validation
THRESHOLD OF ACCEPTABLE CHANGE	Natural population fluctuations are expected. Long-term (5-10 yr) downward trend will result in implementation of Level 2 surveys.
FINDINGS	See discussion of this species in Appendix G to this report.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **BIOLOGICAL VALUES**

MONITORING QUESTION(S)? Have all caves been inventoried on the Forest? What is the classification of each cave inventoried? Have management plans been developed for each cave?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Noncompliance with standard.

FINDINGS Inventory of cave resources is continuing. Assistance is being obtained fro the Cave and Karst Program of the Virginia Department of Conservation and Recreation – Division of Natural Heritage. Starr Chapel Cave was recognized as a significant cave under the Federal Cave Protection Act in 2003.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **BIOLOGICAL VALUES**

MONITORING QUESTION(S)? What are the bat's population trends on the Forest?

MONITORING LEVEL Validation

THRESHOLD OF ACCEPTABLE CHANGE Negative population trends in two consecutive surveys.

FINDINGS The rarest bats on the National Forests are the Indiana bat (Myotis sodalis), the gray bat (M. grisescens) and the Virginia big-eared bat (Plecotus townsendii). All three of these species are federally endangered and all three make some use of the National Forests. Other bats that use the Forests, such as the eastern Pipistrelle (Pipistrellus subflavus), the big brown bat (Eptesicus fuscus) and the little brown bat (Myotis lucifugus) are much more numerous and widespread than the former three species and therefore not as much of a management concern.

Indiana bat: This species occurs in caves on both the GW (Warm Springs R.D.) and on the JNF (New Castle, New River Valley and Clinch Ranger Districts). All caves where they occur are being monitored. All caves on National Forest System land are now gated to prevent unauthorized human entry. While there are seasonal fluctuations, bat numbers at all locations are either stable or increasing. In cooperation with the VDGIF, the U.S.

Fish and Wildlife Service (USFWS), Ferrum College and the Virginia Division of Natural Heritage (VDNH), the Forests are conducting additional radio tracking, light tagging, and mist netting surveys as funding permits. This work will help determine use of upland forest and riparian habitats to assess the extent that we have summer roosting Indiana bats. In May 1997 the Forest formally consulted with the U.S. Fish and Wildlife Service on effects to the Indiana bat that may result from implementation of the Forest Plans. A Biological Opinion received in September 1997 and the GWNF Forest Plans were amended in March 1998. The Jefferson Forest Plan was recently revised in January 2004 and also considered the Indiana bat.

Gray bat: The only known locations of this species in Virginia are in the extreme southwest; in Lee and Scott counties. Sightings are incidental with the exception of the well-known maternity colony in a storm drain in the city of Bristol, VA/TN. The Forest's interest in this species is centered on a cave on a private inholding on the Mt. Rogers NRA. This parcel was made available for sale and local cavers and bat experts indicated that the cave could contain gray bats, which would make it a high priority for acquisition. Subsequently, the cave was surveyed, but the results are still inconclusive. The cave will be examined again to make a final determination on whether or not it harbors gray bats.

Virginia big-eared bat: There are no known hibernacula or roosts on the National Forests, but from light tracking work done by VDGIF it is known that this species forages on the JNF in the Burkes Garden/Beartown Wilderness area. This species lives in caves year-round and forages on moths and beetles across a variety of habitats including fields and cropland as well as mature forests.

See discussion of cave dwelling bats in Appendix G of this report.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **FIRE**

MONITORING QUESTION(S)? Is funding being allocated as indicated by the fire analysis to achieve the Desired level of protection?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Variance greater than 10% from Fire Protection Capability Index (FPCI) of 100%.

FINDINGS Fire budget is being allocated in accordance with NFMAS (National Fire Management Analysis System).

RECOMMENDATION	No changes to plan direction are recommended as no trends established. Continue to implement Most Efficient Level (MEL) budget as identified in the January 2001 NFMAS re-analysis. This strategy will provide a more efficient and more effective fire organization.
MONITORING ITEM	**FIRE**
MONITORING QUESTION(S)?	Was preattack planning effective in preventing loss of life or homes on private property?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Any loss of life or house from fire originating on the Forest.
FINDINGS	There were no losses of life or homes on private land from wildfires originating on the Forest.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**FIRE**
MONITORING QUESTION(S)?	What are the effects of prescribed fire on vegetation, small mammals, herptofauna, and birds on the Forest?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Natural population fluctuations are expected along with changes in species composition and vegetative structure. Threshold will be if approved prescribed burn objectives as stated in the burn plan are not met.
FINDINGS	Some level of monitoring is part of each prescribed fire project. On-going research and monitoring continues plus information sharing for effects analysis. Monitoring procedures continue to be refined and are being implemented.
RECOMMENDATION	No changes to plan direction are recommended.
MONITORING ITEM	**INSECT & DISEASE**
MONITORING QUESTION(S)?	Are silvicultural treatments effectively reducing the susceptibility or vulnerability of stands to damaging pests? Are intervention treatments effectively reducing the susceptibility or vulnerability of stands to damaging pests?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE For silvicultural treatments, gypsy moth impacts prohibit adequate oak stocking on more than 5% of projects. For intervention treatment, post treatment population within $\pm$ 10% of pre-treatment population.

FINDINGS Previously conducted silvicultural treatment are reducing short-term vulnerability, however, the gypsy moth population and subsequent defoliation has increased from previous years. Based on previous monitoring of treated stands the vulnerability of the stands to defoliation and mortality should be reduced.

No spraying for gypsy moth occurred in 2004.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **LANDS**

MONITORING QUESTION(S)? Are available private lands being acquired that have been identified on the land ownership adjustment map?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Tract exchanged or acquired not identified on Land Ownership Adjustment Map.

FINDINGS No land was acquired within the George Washington National Forest in 2004. No land exchanges were completed in 2004.

RECOMMENDATION Priorities for land exchange and acquisition need to be reviewed and updated to meet regional guidance and resource needs.

MONITORING ITEM **LANDS**

MONITORING QUESTION(S)? Were exchanges or purchases effective in consolidating large blocks of National Forest land or disposing of isolated tracts of existing National Forest land?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Tract acquired did not consolidate ownership or tract disposed was not isolated.

FINDINGS No lands were exchanged out of federal ownership nor were any acquired in 2004.

<u>RECOMMENDATION</u>	Depending on what the priorities for acquisition and exchange are as a result of the revision process, this monitoring item may or may not be necessary or may need to be re-written.
<u>MONITORING ITEM</u>	**LANDS**
<u>MONITORING QUESTION(S)?</u>	Is the Forest establishing and maintaining boundary lines at a rate to meet objectives in Appendix E of the Plan?
<u>MONITORING LEVEL</u>	Implementation
<u>THRESHOLD OF ACCEPTABLE CHANGE</u>	Variance greater than 25% from objective.
<u>FINDINGS</u>	We are not meeting the objective of establishing 121 miles of landline per year, nor have we even come close to establishing all landlines for Forest Service standard within the first plan period. Maintenance is also not occurring at the rate of once every 10 years.
<u>RECOMMENDATION</u>	In Revision effort, need to establish objectives that can be met within funding expectations.
<u>MONITORING ITEM</u>	**PLAN CONSISTENCY**
<u>MONITORING QUESTION(S)?</u>	Are projects consistent with the Forest Plan? Are the projects being implemented in accordance with the NEPA document?
<u>MONITORING LEVEL</u>	Implementation
<u>THRESHOLD OF ACCEPTABLE CHANGE</u>	Noncompliance with NEPA documents or Revised Forest Plan.
<u>FINDINGS</u>	See discussion of Plan Amendments on page 2 of this report.
<u>RECOMMENDATION</u>	No changes to plan direction are recommended. No trend in application of standards has occurred.
<u>MONITORING ITEM</u>	**RECREATION**
<u>MONITORING QUESTION(S)?</u>	Are the estimated outputs projected in the Plan being achieved? Are trails being maintained to the standard necessary to adequately support users?
<u>MONITORING LEVEL</u>	Implementation
<u>THRESHOLD OF ACCEPTABLE CHANGE</u>	Variance greater than 25% between projected and actual outputs. Any increase in the backlog of trails not maintained to standard.

FINDINGS Comparing outputs displayed in Plan and associated EIS and the trends in "Management Attainment Reports" (See appendix B) in this and past monitoring reports leads to the conclusion that outputs anticipated are not being achieved. Trail maintenance objectives in the Forest Plan remain high based upon funding received. Trail maintenance backlog has remained essentially static in FY 2004 in comparison to previous years.

RECOMMENDATION No changes to Plan recommended since outside Forest's control.

MONITORING ITEM **RECREATION**

MONITORING QUESTION(S)? Are trails meeting the needs of its users?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Survey reveals poor trail conditions, hazards, or user conflicts.

FINDINGS No specific surveys were done in FY 2004. Districts have identified problems on some trails. Trail maintenance backlog is essentially stable. Most trails are multiple use, but reported user conflicts remain few.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **RECREATION**

MONITORING QUESTION(S)? Are ROS classifications being met in the Management Area? How well do the standards help in meeting the ROS objectives?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Any human caused deviations from adopted ROS.

FINDINGS Not specifically monitored in FY 2004. No known human caused deviations from ROS classifications. Standards appear to be effective.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **SOIL**

MONITORING QUESTION(S)? Did activities leave in place at least 85% of the soil surface layer, including organic or litter layer, topsoil, and root mat?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Noncompliance with standard.

FINDINGS Compliance with this standard is mostly associated with topsoil removal by mechanical blading. Projects, which include road building and soil disturbance, and are not considered maintenance, are assessed for their impacts on long-term soil productivity in an environmental analysis. This is done by estimating the amount of topsoil removal associated with a project and how it cumulatively affects an area. If this estimate exceeds 15% of the project area, then the project would be considered to have a significant effect upon long-term soil productivity. We have not analyzed a project in FY 2004 that would have exceeded this threshold level.

RECOMMENDATION No changes to Plan direction are recommended.

MONITORING ITEM **SOIL**

MONITORING QUESTION(S)? Did exposing up to 15% of the soil cause erosion to exceed the forested T-factor?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Soil erosion exceeds forested T-factor.

FINDINGS We have not done an environmental analysis on the Forest where soil erosion was expected to exceed the forested T-factor for the site. Environmental assessments have estimated soil movement and forested T-factors for timber harvest areas, log landings, and skid trails. This factor has been used as a way to estimate soil movement on slopes during and after resource management activities on the Forest. The T-factor, which was developed by the Forest Service, is an adaptation of the Universal Soil Loss Equation, which is used on agricultural lands. The T-factor itself is a threshold amount of soil which can be "lost" and not reduce long term productivity. We do not typically monitor this factor on projects because it is very variable across project areas and it has not appeared as a problem during previous environmental analyses across the Forest. For T-factor analyses completed from FY 2001 through end of FY 2003, the predicted maximum one-year soil loss averaged only 11% of the allowed maximum one-year soil loss, and ranged from 3% to 27%.

RECOMMENDATION Common Standard #216 (page 3-146) says project environmental analyses for timber harvesting will consider impacts to long term soil productivity. One of the situations listed where long term soil productivity may be impaired is where the soil's erodibility and slope combine to indicate the estimated T-factor to be exceeded. We recommend not using the t-factor estimates in environmental analyses for timber harvesting projects in the GWNF Plan Revision. We find that the monitoring item above related to maintaining 85% of the project activity area's topsoil and organic layer is a more realistic estimate of the impact of a project on soil productivity. This is also a Common Standard #211 (page 3-145) as well as a Soil Quality Standard for the Forests in Region 8 of the Forest Service.

MONITORING ITEM	**THREATENED, ENDANGERED, & SENSITIVE SPECIES**
MONITORING QUESTION(S)?	Were requirements outlined in federal species recovery plans implemented?
MONITORING LEVEL	Implementation
THRESHOLD OF ACCEPTABLE CHANGE	Evidence that recovery plans are not being implemented.
FINDINGS	Requirements outlined in federal species recovery plans are being implemented. See also Appendix G of this report.
RECOMMENDATION	No changes to the Plan direction are recommended.

MONITORING ITEM	**THREATENED, ENDANGERED, & SENSITIVE SPECIES**
MONITORING QUESTION(S)?	Is habitat for all existing threatened and endangered species being maintained or improved with no unwanted habitat alterations/degradations happening?
MONITORING LEVEL	Effectiveness
THRESHOLD OF ACCEPTABLE CHANGE	Natural population fluctuations are acceptable. Negative trends resulting from management activities will require immediate action.
FINDINGS	1) Deer browsing on Helonias bullata, swamp pink, may be having a negative effect on plant growth and reproduction. Beaver activity has affected a large swamp pink population on the Forest by raising the water level and inundating plants. Following discussions with the U.S. Fish and Wildlife Service and other experts, no action was taken to control the beavers. Water levels rose and some swamp pink plants were lost. A water control structure was installed in 2002. At this time (Spring 2004) it's unknown if the swamp pink population at this location will recover to pre-inundation numbers. 2) An Echinacea laevigata, smooth coneflower, population has been

mowed by Virginia Department of Transportation (VDOT) maintenance activities. This population grows in the road right-of-way. Yet, VDOT has also cut some trees to increase light to the existing coneflowers. An additional population was discovered on National Forest System land in 1999. This population adjoins land that is managed by the Virginia Department of Conservation and Recreation as a natural area and is well protected. Monitoring is continuing.

RECOMMENDATION No changes to plan direction are recommended. The Forest is looking into proposing projects to improve smooth coneflower habitat adjacent to the existing population, and coordinating with U.S. Fish and Wildlife Service on studies of effects of deer browsing on swamp pink.

MONITORING QUESTION(S)? What are the wood rat's population trends on the Forest? (V) Are the rock vole and water shrew present on the Forest" If so, where? (I)

MONITORING LEVEL Validation and Implementation

THRESHOLD OF ACCEPTABLE CHANGE For the wood rat, negative population trends in two consecutive surveys. For the rock vole and water shrew, evidence that species exists and continues to exist at a specific location.

FINDINGS Alleghany wood rat: To date all 10 Ranger Districts have conducted presence/absence trapping for wood rats in many areas of apparently suitable habitat. All areas of potentially suitable habitat have not yet been sampled, but this work is being conducted as time and funding allows. During 1997 and 1998 25 new sites were trapped, with wood rats being captured (and released) at nine (36%) of these locations. To date 64 active sites have been located from 111 potentially suitable sites and 11 sites currently identified remain to be checked. Therefore, based on the 100 potential sites trapped, 64% were active with wood rats present. In general, wood rats are being found in new locations every year as we identify potentially suitable habitat and then trap to determine occurrence status. There are now two bi-monthly and six permanent annual monitoring locations (located on the Lee, James River, Pedlar, and Warm Springs Districts of the GW, and Blacksburg and Glenwood Districts of the Jefferson) where we trap in cooperation with Dr. Mike Mengak of Ferrum College and VDGIF to determine population trends. In order to have data more comparable to that of adjoining states, Dr. Mengak has asked us to switch to an early spring trapping season. This started in the spring of 2001. To date this trapping is showing a mixed trend: 2 sites show an increase and 4 show a decrease. While total captures at the 6 sites increased from 43 individuals in 1995 to 50 in 1997, they declined to 20 in 1998 and 6 in 2000. Reasons for this decline are unknown but match a pattern seen before in other studies on wood rats that show large population fluctuations that may reflect changes in food, weather, and/or birth rates. See detailed wood rat analysis in Appendix H of this report.

Rock vole: Dr. John Pagels of Virginia Commonwealth University has been conducting searches for the rock vole in Virginia. These inventories trap likely habitats of shaded, cool, and moist rocky (talus) areas with flowing water nearby. He has instructed most of the District biologists in identifying potential habitat and how to trap for this species. Considerable effort has been expended in suitable habitat areas on the Mt. Rogers NRA, Warm Springs, Dry River, and Deerfield Ranger Districts, but no additional rock vole occurrences have been discovered. To date only one rock vole location has been found in Virginia. This occurrence is on the Warm Springs Ranger District and is managed as a Special Biological Area (MA 4).

Water shrew: Dr. Pagels has also conducted inventories for water shrews in Virginia and has provided training to District biologists in identifying potential water shrew habitat and setting traps to determine presence/absence. Habitat requirements of this species are similar to those of the rock vole (shaded, cool, moist streamsides). To date the only occurrences of the water in Virginia are on the Warm Springs Ranger District in the same watershed as the rock vole and in the Laurel Fork area. Forest Service biologists have trapped many other potential habitat areas but to date have had no success in finding other locations.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Did the volume sold from suitable timberland in any one year exceed the Average Annual ASQ? Was the total volume sold from suitable land for the first decade less than the decade's ASQ?

MONITORING LEVEL Validation

THRESHOLD OF ACCEPTABLE CHANGE None. Adjust ASQ during next planning period.

FINDINGS The Revised Plan established an ASQ of 330 million board feet (mmbf) over 10 years or an average annual ASQ of 33 mmbf. The following table shows that the trend in timber volume sold across the George Washington National Forest.

Timber Volume Sold on George Washington N.F.

Year	Volume Sold (MMBF)
1993	34.2
1994	29.2
1995	20.5
1996	26.1
1997	19.2
1998	10.1
1999	15.0
2000	10.1
2001	9.9
2002	12.9
2003	13.6
2004	15.8

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Based on volume harvested, are timber yield coefficients used in FORPLAN for existing stand yield tables accurate?

MONITORING LEVEL Validation

THRESHOLD OF ACCEPTABLE CHANGE None. Use to adjust coefficients for the next Plan revision.

FINDINGS See findings in Appendix E to this report.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Are the opening size limits needed to meet wildlife habitat or visual quality objectives used more often than the maximum size limit of 40 acres?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Actual size limit as determined by wildlife habitat or visual quality is exceeded at least 10% of the time an opening is created.

FINDINGS Maximum size limits for "green" sales have not been exceeded per review of each project-level environmental analysis.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? 1. Are harvested Forest lands restocked within five years following final harvest? 2. Are modified shelterwood harvest cuts regenerating forests to desirable species?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Evidence that land is not restocked within five years following harvest. Evidence that natural regeneration is not becoming established to meet minimum number of stems per acre for modified shelterwood cuts.

FINDINGS Plantation survival reports and TRACS certification show that all regenerated stands are stocked with desirable or acceptable species.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TIMBER**

MONITORING QUESTION(S)? Were pine types successfully regenerated to the appropriate forest type?

MONITORING LEVEL Effectiveness.

THRESHOLD OF ACCEPTABLE CHANGE More than 10% of the pine regeneration was not to the appropriate forest type.

FINDINGS Plantation survival reports and TRACS certification show that all regenerated stands are stocked with desirable or acceptable species.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TRANSPORTATION**

MONITORING QUESTION(S)? Based on acres harvested, are road construction and reconstruction coefficients used in FORPLAN accurate?

MONITORING LEVEL Validation

THRESHOLD OF ACCEPTABLE CHANGE None. Use to adjust coefficients for the next Plan revision.

FINDINGS Tables in the appendices to this report show the amount of acres sold or harvested as well as miles of road constructed or reconstructed in each of the fiscal years. See also transportation discussion in Chapter 1 of this report.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TRAVEL MANAGEMENT**

MONITORING QUESTION(S)? Have existing closed roads been opened to public use? Have existing roads currently open to public use been closed?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Variance greater than 5% from amount of open and closed roads in TIS at the time the Record of Decision is signed.

FINDINGS The following table shows that the trend in obliterated road mileage across both Forests.

Road Obliteration across Both Forests

Year	Obliteration (Miles)
2001	11.0
2002	2.1
2003	2.3
2004	1.0

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **TRAVEL MANAGEMENT**

MONITORING QUESTION(S)? Is the existing compliment of open roads adequate to meet the experiences desired by the motorized recreation user on the Forest?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Comments reveal hazards, resource problems or user conflicts.

FINDINGS Extensive yearly traffic counts are no longer being done. Some traffic counters have been secured, and some limited traffic counting efforts were initiated in FY 2004. These efforts will be continued as funding allows. There are a number of calls on a regular basis regarding maintenance needs. Many of these deal with winter maintenance (snow removal, etc.) and summertime dust abatement. These types of activities are not carried out on Forest-Owned roads due to lack of equipment and funding. In FY 2004 there were, as in previous years, a number of naturally-occurring flood events which have caused a severe strain on the road maintenance budget. Some FHWA funding was received for flood damage repairs allowing more of the Forest's maintenance budget to go to tradition road maintenance activities. Obvious hazard situations and flood damage are addressed as they occur. Priority is assigned based on the need.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **VISUALS**

MONITORING QUESTION(S)? Are visual quality objectives being met in the Management Area? How well do the contrast-reducing techniques help in meeting the visual quality objectives?

MONITORING LEVEL Effectiveness

THRESHOLD OF ACCEPTABLE CHANGE Any human-caused deviations from contrast reducing techniques.

FINDINGS VQOs are being met throughout the Forest. The effectiveness of contrast-reducing techniques was monitored in 2004 on various projects. The projects met adopted VQOs with all observations favorable.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **WILDLIFE**

MONITORING QUESTION(S)? Based on National Forest Stamps sold, are projected big game hunting trends accurate?

MONITORING LEVEL Validation

THRESHOLD OF ACCEPTABLE CHANGE None. Use to adjust demand estimates for the next Plan revision.

FINDINGS In West Virginia, total resident hunting license sales in 1987 were 308,026 and in 2002 were 741,796. National Forest Stamp sales over the same periods were 136,721 in 1987 and 59,220 in 2002. Resident hunting license sales in Virginia in 2002 were approximately 296,250, compared to sales of 355,000 licenses in 1987, a drop of 58,750 licenses (17%). Over approximately the same period (1989-2000), National Forest Stamp Sales have mirrored that decrease by dropping from 130,000 to 87,278, a decrease of 42,722 stamps, or 33%. The states maintain data that allow us to compare statewide hunting pressure with that on the National Forests. It is recommended that we continue to work with the VDGIF and the WVDNR to further refine these data collection systems.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **WILDLIFE**

MONITORING QUESTION(S)? What are the projected population trends for big and small game species on the Forest?

MONITORING LEVEL Validation

THRESHOLD OF ACCEPTABLE CHANGE None. Use to adjust model population trend estimates for next plan revision.

FINDINGS See discussion of big game MIS species in appendix G to this report.

RECOMMENDATION No changes to plan direction are recommended.

MONITORING ITEM **ACCOMPLISHMENT REPORTING**

MONITORING QUESTION(S)? Are the estimated outputs projected in the Plan being achieved? Are the costs of implementing the Plan consistent with those projected? How much is being clearcut? What are the acres by cutting method within management areas?

MONITORING LEVEL Implementation

THRESHOLD OF ACCEPTABLE CHANGE Variance greater than 25% between projected and actual outputs for MAR items and dollars spent for costs. Yearly variance greater than 10% between Plan acreage projections and actual accomplishments for clearcut acres sold. Variance greater than 25% between Plan projections and actual accomplishments for Timber Harvest Methods sold other than clearcutting.

FINDINGS The FEIS (page 2-69 for alternative 8A) provides a Plan objective of 300 acres/year of clearcutting and a total of 2,000 for other even-age methods. The following table shows the acreage sold by year.

GEORGE WASHINGTON NATIONAL FOREST ONLY
ANNUAL SOLD ACRES - METHOD OF CUT

Fiscal Year	Clearcut	Shelterwood	Selection	Thinning	Salvage	Other	Total
1993	428	941	111 (OSR)	0	982	0	2,462
1994	123	848	130 (OSR)	30 (GS)	980	30	2,141
1995	50	756	187 (OSR)	75	789	1	1,858
1996	168	773	85 (OSR)	60	711	0	1,797
1997	89	526	0	169	798	5	1,587

Fiscal Year	Clearcut	Shelterwood	Selection	Thinning	Salvage	Other	Total
1998	12	88	10	25	688	1	824
1999	157	659	296	208	220	0	1,540
2000	0	702	0	61	127	0	890
2001	5	610	76	164	30	28	913
2002	0	685	0	146	35	183	1,049
2003	0	832	0	57	113	30	1,032
2004	0	746	19	386	130	11	1,292

OSR= Overstory Removal, GS= Group Selection

Since 1991, the George Washington (GWNF) and Jefferson National Forests (JNF) have been aggressively using "alternative cutting practices" such as modified shelterwood, deferment cuts (two-aged), conventional shelterwoods, and group selection to regenerate hardwood stands to meet Forest Plan resource objectives. The practice of clearcutting is utilized only when it can be clearly demonstrated to be the "optimum" method for biological reasons. For total acres harvested in FY 2004, clearcutting was only done on less than one percent. The following table illustrates the change in harvest methods for fiscal years 1988-2004 for harvested volume across both forests.

George Washington and Jefferson National Forests Combined

ANNUAL HARVEST ACRES - METHOD OF CUT

Fiscal Year	Clearcut	Shelterwood	Selection	Thinning	Salvage	Total	Cut Volume (mmbf) 1/
1988	5,323	498	236	657	197	6,911	69.2
1989	4,394	282	192	434	40	5,342	62.9
1990	3,923	204	270	434	331	5,162	62.5
1991	3,359	336	376	930	1,094	6,095	69.4
1992	2,217	835	1,395	1,163	495	6,105	57.3
1993	1,613	1,237	819	1,002	997	5,668	60.6
1994	1,212	1,533	442	1,033	1,211	5,431	57.3
1995	723	1,623	194	844	1,038	4,422	55.7
1996	405	1,253	207	372	945	3,182	45.1
1997	257	1,588	825	296	1,931	4,897	34.2
1998	158	1,195	120	766	503	2,742	35.3
1999	65	1,051	156	227	727	2,226	36.5
2000	90	944	298	598	439	2,369	27.5
2001	105	902	166	522	262	1,957	23.1
2002	5	774	68	262	104	1,213	19.0
2003	4	731	57	119	104	1,015	16.9
2004	6	752	0	222	44	1024	21.5

1/ Beginning in FY 1996 volume was sold using cubic foot measurements for both sawtimber and small roundwood with conversion to MBF based upon a standard Regional conversion factor of 0.55 when converting from CCF to MBF. The above table shows a conversion of 0.66 to more accurately reflect the true volume for actual timber measurements to enable a long-term comparison.

During this period of time, "modified shelterwood" has become the predominate harvesting method. Along with the monitoring of regeneration following the modified shelterwood to determine the effects of the residual overstory on resultant regeneration numbers and species, we have also initiated implementation monitoring to determine the actual basal area of trees 6" DBH and larger and 9" DBH and larger remaining immediately following completion of harvest cutting units to determine if our timber designation procedures and administration is at the desired standards.

The definition of modified shelterwood in the George Washington National Forest Plan Revision (Glossary-5) indicates that about 15-25 basal area of midstory and overstory trees will be left standing and these trees will cover a range of diameters but are usually 8 inches DBH or larger.

In addition, the Indiana Bat Biological opinion for the GWNF and JNF and the Forest Plan Amendments require timber activities to leave all shagbark hickory trees and a minimum average of 6 snags or cavity trees (9 inches and larger) per acre (except where such trees pose a safety hazard) to promote potential summer roost habitat. For the group selection harvest method, no provision for minimum number of snags is required due to the small opening size (less then two acres). In clearcut harvest units, the required snags or cavity trees may be scattered or clumped, but will average 6 per acre.

In February and March of 1999, the SO-Timber Staff visited 13 cutting units that had been harvested during the last couple of years using the modified shelterwood or similar cutting method to determine the average basal area (BA) and number of trees remaining per acre after timber harvesting. In most cases, 10 individual plots were taken in each unit with trees being tallied with a 10 factor prism and # of trees per acre being determined by a DBH conversion factor. The following table indicates pertinent information.

MODIFIED SHELTERWOOD PLOTS - REMAINING TREES

Ranger District	Date	Sale Name & Unit #	Ave. BA per ac. all trees > 6" dbh	Ave. # Trees/ac. > 6" dbh	Ave. # Trees/Ac. >9" dbh
Deerfield	2/25/99	Hiner Hollow # 1	37	73	26.7
Deerfield	2/25/99	Hiner Hollow # 2	31	35.5	22.3
Deerfield	2/25/99	Barn Hollow # 1	30	31	31.0
Dry River	3/02/99	Tower Salv. 2 # 1	14	27.3	10.8
Dry River	3/02/99	Tower Salv. 2 # 6	13	19.8	13.2
Warm Springs	2/26/99	Apron # 4	33	35.5	28.9
Warm Springs	2/26/99	Double Eagle # 2	24	36.7	10.2
Warm Springs	2/26/99	Double Eagle # 3	17	17	10.8
Pedlar	3/04/99	Rucker Lap # 2	47	47	37.1
Pedlar	3/04/99	Greasy Cable # 3	46	83.3	40.3
Pedlar	3/04/99	Greasy Cable # 4	38	51.5	31.6
New Castle	3/02/99	Nutter Mtn. # 1	17	50.4	7.4
New Castle	3/02/99	Sand Pit # 1	19	26.7	20

All units visited had sufficient average leave BA to mesh with the indicated leave BA for modified shelterwood and all units visited have sufficient number of trees per acre to meet stipulations of Indiana Bat BO. Timber designation procedures are sufficient to provide reliable outcome.

In 2450/1920/2670 letter dated July 9, 1999, the Timber Staff Officer provided "Residual Tree Measurement Protocol" direction to the Districts for determining and documenting the remaining average residual trees per acre upon completion of timber harvesting for each even-aged cutting unit including salvage with targeted residual basal area (BA) less than 20 BA. The following chart indicates monitoring of sales is meeting the direction in the protocol from July 9, 1999, to date:

MODIFIED SHELTERWOOD PLOTS - REMAINING TREES

District	Date	Sale Name & Unit #	Ave. BA per ac. all trees > 6" dbh	Ave. # Trees/ac. > 6" dbh	Ave. # Trees/Ac. >9" dbh
Deerfield	6/18/99	Barn Hollow # 1	22	16	16
Deerfield	8/16/99	Barn Hollow # 3	14	13	13
Deerfield	8/16/99	Barn Hollow # 4	15	14	11
Deerfield	12/8/00	Hamtig # 1	33	40	30
Deerfield	6/19/02	Ramsey Gap #3	35	28	28
Deerfield	6/19/02	Ramsey Gap #4	36	33	30
Deerfield	6/21/02	Bear Trap #3	38	40	23
Deerfield	6/21/02	Bear Trap #4	30	32	19
Dry River	12/17/99	Tower Salv. # 1	17	38	12
Dry River	12/17/99	Tower Salv. # 2	18	38	16
Dry River	12/17/99	Tower Salv. # 3	25	35	22
Dry River	12/17/99	Tower Salv. # 4	25	42	22
Dry River	4/12/00	Tower Salv. 2 # 2	22	41	14
Dry River	12/17/99	Tower Salv. 2 # 3	26	43	20
Dry River	4/20/00	Tower Salv. 2 # 4	26	55	15
Dry River	1/4/00	Rainman Salv. # 1	31	66	27
Dry River	9/26/00	Rainman Salv. # 2	15	26	16
Dry River	11/14/00	Spring Grouse # 1	11	21	11
Dry River	10/18/00	Spring Grouse # 2	9	15	12
Dry River	10/18/00	Spring Grouse # 3	23	40	27
Dry River	9/26/00	Spring Grouse # 4	10	17	7
Dry River	9/26/00	Spring Grouse # 5	12	19	9
Dry River	9/26/00	Spring Grouse # 6	19	26	10
Dry River	9/26/00	Spring Grouse # 7	19	23	13
Dry River	9/26/00	Spring Grouse # 8	19	18	18
Dry River	9/26/00	Spring Grouse # 9	17	28	24
Dry River	10/5/00	Stinger Salv. # 1	12	25	12
Dry River	10/5/00	Stinger Salv. # 2	14	24	11
Dry River	5/11/00	Stinger Salv. # 3	24	52	16
Dry River	4/26/02	Shoe Salv. 2 # 1	19	49	22
Dry River	4/26/02	Shoe Salv. 3 # 1	19	39	19
Dry River	8/13/02	Amblin #1	13	21	15
Dry River	8/13/02	Amblin #2	14	21	11
Dry River	8/13/02	Amblin #3	15	24	11
Dry River	9/17/02	Amblin #4	17	23	14
Dry River	9/17/02	Amblin #5	21	31	18
Dry River	9/17/02	Amblin #6	16	14	14
Dry River	1/4/02	Cougar #3	11	23	7
Dry River	1/4/02	Cougar #5	14	17	10
Dry River	6/17/04	Cougar II #1	26	60	23
Dry River	6/17/04	Cougar #1	18	24	11
Dry River	6/17/04	Cougar #2	18	24	17
Dry River	6/17/04	Canbe FW #1	26	40	26
Dry River	11/15/04	Coyote #1	21	42	12
Dry River	6/7/04	Coyote #2	21	27	18
Dry River	11/14/04	Coyote #3	19	17	14

District	Date	Sale Name & Unit #	Ave. BA per ac. all trees > 6" dbh	Ave. # Trees/ac. > 6" dbh	Ave. # Trees/Ac. >9" dbh
Dry River	9/22/04	Coyote #6	20	21	18
Dry River	11/15/04	Coyote #7	20	22	12
Dry River	7/19/04	Coyote #8	20	17	10
Dry River	9/22/04	Canbe #5	21	32	19
Dry River	9/22/04	Canbe #6	23	27	20
Dry River	9/22/04	Canbe #7	23	37	21
James River	9/18/02	Piney Point #2	17	36	20
James River	9/18/02	Piney Point #3	14	27	7
James River	9/18/02	Piney Point #4	18	46	13
James River	9/18/02	Piney Point #6	12	9	6
James River	7/13/04	Hoover Helo #1	19	36	19
James River	7/13/04	Hoover Helo #2	22	31	15
James River	5/11/04	Hoover Helo #3	24	17	17
James River	4/22/04	Hoover Helo #4	32	37	27
James River	4/22/04	Hoover Helo #5	36	42	39
James River	5/6/04	Hoover Helo #6	48	79	46
James River	6/22/04	Hoover Helo #7	31	43	27
James River	5/11/04	Hoover Helo #8	27	28	21
Lee	7/16/99	Powderhouse # 1	23	27	24
Lee	3/23/00	Powderhouse # 2	11	16	10
Lee	12/7/99	Powderhouse # 3	13	23	3
Lee	8/24/00	Powderhouse # 4	15	29	12
Lee	12/9/99	Mine Run Salv. # 1	9	22	5
Lee	12/27/00	Mine Run Salv. # 2	8	16	9
Lee	12/29/00	Panhandle 814 # 8	13	26	9
Lee	2/6/01	Rocky Ridge # 1	21	23	19
Lee	3/1/01	Rocky Ridge # 2	16	16	10
Lee	2/5/01	Rocky Ridge # 3	20	24	20
Lee	5/4/01	Anderson Ridge #1	17	23	13
Lee	4/30/01	Anderson Ridge #2	21	23	16
Lee	7/10/01	Rocky Ridge 1 #2	14	15	15
Lee	10/17/03	Bonnett Hill II #1	24	55	12
Lee	8/29/03	Bonnett Hill III #1	7	10	7
Lee	6/23/03	Bonnett Hill III #2	11	21	11
Lee	9/8/03	Bonnett Hill III #3	16	26	16
Lee	8/25/03	Bonnett Hill III #4	22	29	19
Lee	9/8/03	Bonnett Hill III #5	17	27	17
Lee	8/12/03	Bonnett Hill I #1	13	19	16
Warm Springs	11/12/99	Sand Trap # 1	43	69	47
Warm Springs	11/12/99	Double Eagle # 1	27	21	10
Clinch	11/5/99	CMB Skidder # 2	21	28	19
New Castle	1/3/00	Nutters Mtn. # 1	15	37	14
New Castle	1/3/00	Nutters Mtn. # 2	14	31	14
New Castle	10/2/00	Nutters Mtn. # 3	20	28	14
New Castle	1/3/00	Wildlife # 1	17	44	15
New Castle	1/6/00	Sand Pit # 2	33	40	24
New Castle	10/3/00	Peters Mtn. # 1	20	32	25

District	Date	Sale Name & Unit #	Ave. BA per ac. all trees > 6" dbh	Ave. # Trees/ac. > 6" dbh	Ave. # Trees/Ac. >9" dbh
New Castle	6/27/01	Peters Mtn. # 3	22	27	21
New Castle	12/4/00	Peters Mtn. # 4	21	36	19
New castle	6/1/2004	Enterprise #1	20	28	22

As indicated, all units visited had sufficient average leave BA to mesh with the indicated leave BA for modified shelterwood and have sufficient number of trees per acre to meet stipulations of the Indiana Bat BO. Monitoring continues to indicate that timber designation procedures are sufficient to provide reliable outcomes. Monitoring will continue per direction in the residual tree measurement protocol.

RECOMMENDATION

No changes to plan direction are recommended. Historically since 1987, there has been a decreasing trend in the amount of clearcuts offered for sale and sold and an overall increasing trend in the amount of other even-age methods. These trends are expected to continue. Implementation procedures for Modified Shelterwood are sufficiently refined to provide for desired leave basal areas while meeting the stipulations in the Indiana Bat Biological Opinion.

CHAPTER 3

MONITORING AND EVALUATION OF PLAN GOALS, DESIRED FUTURE AND STANDARDS

During the course of the year, staff has been monitoring the implementation of the Forest Plan's goals, Desired Future Conditions, standards and guidelines, herein referred to as standards.

Based upon the findings in Chapter 2, staff are not recommending any Forest Plan amendments. Staff specialists continue to question some of the monitoring questions themselves, saying that they are not providing any useful information.

APPENDIX A

FOREST MONITORING AND EVALUATION INTERDISCIPLINARY TEAM AND REPORT PREPARERS

NAME	POSITION
Al McPherson	Recreation Forester
Cindy Huber	Air Quality Specialist
Dave Plunkett	Planner
Ted Coffman	Landscape Architect
Dawn Kirk	Fisheries Biologist
Dick Patton	Hydrologist
Fred Huber	Botanist
Greg Sanders	Fire Mgmt. Officer
Gary Kappesser	Hydrologist
Pat Egan	Timber Staff Officer
John Bellemore	Ecology Staff Officer
Karen Overcash	Analyst
Mike Barber	Archaeologist
Barry Garten	Ast. Fire Mgmt. Officer
Naomi Johnson	Lands Prgm. Mgr.
Carol Hardy-Croy	Wildlife Biologist
Steve Croy	Ecologist
Tom Bailey	Soil Scientist
Tom Collins	Geologist
Wayne Johnson	Engineering Staff Officer
Tom Wright	Landscape Architect

APPENDIX B

GEORGE WASHINGTON AND JEFFERSON N.F.

FINAL 2004 MANAGEMENT ATTAINMENT REPORT			
Accomplishment Item	**Unit Of Measure**	**Amount Completed**	**Accomplishment Description**
CR-RD-RECONS-FN	Miles	5	Miles of Road Improved
EC-AML-NON-FN	Projects	1	Mine Clean-ups Completed (non-CERCLA)
EC-HAZ-MIT-FN	Hazards	2	Physical Hazards Mitigated
FM-DOC-ALL	Documents	12	Approved Timber Management NEPA documents thru appeal & litigation, all funding sources.
FM-FV-FN	Acres	1,176	Improve Forest Vegetation
FM-RV-FN	Acres	316	Improve Range Vegetation
FM-VOL-HAR-ALL	CCFs	32,620	Timber Volume Harvested
FM-VOL-OFF-FN	CCFs	38,540	Timber volume offered for sale -- Appropriated
FM-VOL-OFF-SS-FN	CCFs	6,738	Timber volume offered for sale -- Salvage Sale
FM-VOL-SLD-ALL	CCFs	46,659	Timber Volume Sold
FP-FUEL-NONWUI-FN	Acres	6,996	Non-wildland/urban interface (non-WUI) high-priority hazardous fuels mitigated
FP-FUEL-NONWUI-FNOTH	Acres	6,002	Non-wildland/urban interface (non-WUI) high-priority hazardous fuels mitigated
FP-FUELS-ACRES-FN	Acres	6,366	Haz fuels cond class 2 or 3 treated outside WUI
FP-FUELS-ACRES-FNOTH	Acres	3,131	Haz fuels cond class 2 or 3 treated outside WUI- other funds
FP-FUELS-ALL-FN	Acres	1,282	Haz fuels in fire regimes 1, 2, or 3 mo
FP-FUELS-ALL-FNOTH	Acres	1,526	
FP-FUELS-WUI-FN	Acres	6,661	Wildland/urban interface (WUI) high-priority hazardous fuels mitigated
FP-FUELS-WUI-FNOTH	Acres	1,002	Wildland/urban interface (WUI) high-priority hazardous fuels mitigated

FINAL 2004 MANAGEMENT ATTAINMENT REPORT			
Accomplishment Item	**Unit Of Measure**	**Amount Completed**	**Accomplishment Description**
IM-ABV-PRJ-FN	Acres	328,372	Above-Project Integrated Inventories (acres)
IM-AQRV-M-FN	Sites	1	Air Quality Related Value Monitoring
IM-AS-BRD-FN	Assessments	1	Broadscale Ecosystem Assessments underway
IM-AS-WA-FN	Assessments	5	Landscape Scale Ecosystem Assessments completed
IM-GIS-MAP-FN	Quarter Quads	46	GIS Resource Mapping
IM-LMP-COMP-FN	Plans	1	Land Management Plan (LMP) Revisions/New Plans Completed
IM-LMP-CP-FN	Plans	1	Land Management Plan (LMP) Revisions/New Plans Underway
IM-LMP-M&E-FN	Reports	2	Land Management Plan (LMP) Monitoring and Evaluation Reports
LA-LND-PURCH-FN	Acres	1,739	Acres Acquired
LM-BL-TOTAL-FN	Miles	185	Boundary Line Marked/Maintained
LM-LND-CLASS-FN	Cases	3	Cases resolved through litigation or processed through administrative procedure
LM-OWNER-ADJ-FN	Acres	54	Acres Adjusted
LM-ROW-ACQ-FN	Number	3	Rights-of-way acquired
LM-SUP-APPL-FN	Permits	70	Land use proposals and applications processed
LM-SUP-STD-FN	Permits	50	Authorizations Administered to Standard
MG-GEO-PER-FN	Reports	52	Geologic Permits and Reports Completed
MG-OP-ADM-FN	Operations	247	Operations Administered to Standard
MG-OP-PRO-FN	Operations	106	Operations Processed
RD-DECOMM-FN	Miles	1	Miles of Road Decommssioned
RD-HIGH-FN	Miles	265	Miles of high clearance road maintained at objective maintenance level (Level 1 & 2)
RD-PASS-FN	Miles	175	Miles of passenger car road maintained at objective maintenance level (Level 3, 4, & 5)

FINAL 2004 MANAGEMENT ATTAINMENT REPORT			
Accomplishment Item	**Unit Of Measure**	**Amount Completed**	**Accomplishment Description**
RG-GZ-ADM-ST-FN	Allotments	5,365	Grazing Allotment Administration to Standard
RG-GZ-NEPA-FN	Allotments	0	Grazing Allotment Decisions Signed (Analyzed/NEPA)
RM-GA-STD-FN	Days	38,513	General Forest Areas Managed to Standard
RM-PAOTS-STD-FN	PAOTs	980,214	Operation of Developed sites to standard
RM-PROD-STD-FN	Products	7	Products Provided to standard
RM-SU-ADMIN-FN	Permits	6	Recreation Special Uses Authorizations Administered to Standard
SYVP-SCSEP-PART-FN	Participants	196	SCSEP Program Participants
SYVP-YCC-PART-FN	Dollars	0	YCC Program Participants
TL-IMP-STD-FN	Miles	10	Miles of trail improved to standard
TL-MTC-STD-FN	Miles	1,227	Miles of Trails Maintained to standard
VW-AQ-PSD-FN	PSD Applications Eval	9	Manage Air Quality
VW-NOX-WD-TR-FN	Acres	301	Noxious Weed Treatment
VW-RES-IMP-FN	Acres	60	Soil & Water Resource Improvements
VW-RPO-COM-FN	Groups	1	Regional Haze Planning Groups
WL-CON-S-FN	Species	6	Sensitive Species for which Conservation Actions were Accomplished
WL-CON-TE-FN	Species	4	Threatened & Endangered (T&E) Species for which Actions were Accomplished
WL-IF-LAK-RE-FN	Acres	53	Inland Fish Lakes Restored or Enhanced
WL-IF-STR-RE-FN	Miles	54	Inland Fish Streams Restored or Enhanced
WL-PROD-PROV-FN	Products	11	Provide Interpretation and Education: Products provided
WL-THAB-RES-C	Acres	1	Terrestrial WIldlife Habitat Restored or Enhanced
WL-THAB-RES-FN	Acres	3,922	Terrestrial WIldlife Habitat Restored or Enhanced

APPENDIX C

GEORGE WASHINGTON & JEFFERSON N.F.
COMBINED DETAILED BUDGET INFORMATION FOR 2001 THROUGH 2003

FY 2004 Expenditure Data

Summary Category	Expenditure*
Recreation	$4,779,778.00
Wildlife & Fish	$1,267,169.00
Range	$74,144.00
Forest Health	$204,643.00
Timber	$3,480,640.00
Soil, Water & Air	$1,212,419.00
Minerals	$652,926.00
Senior Citizens	$865,012.00
Lands	$1,062,354.00
Engineering	$5,988,273.00
Fire	$5,962,581.00
Law Enforcement	$0.00
General Admin	$0.00
Planning and Inventory	$1,546,365.00
Misc	$756,836.00
Total	**$27,853,140.00**

*Expenditure by Summarized EBLI

APPENDIX D

GEORGE WASHINGTON & JEFFERSON N.F.
2004 Payment to States

PAYMENT TO STATES			
STATE	FOREST	COUNTY	2004
KENTUCKY	Jefferson	LETCHER	$523.38
KENTUCKY	Jefferson	PIKE	$0.00
KENTUCKY	Jefferson	KY. STATE TOTAL	$523.38
VIRGINIA	George Washington	ALLEGHENY	$81,440.31
VIRGINIA	George Washington	AMHERST	$32,973.89
VIRGINIA	George Washington	AUGUSTA	$111,901.92
VIRGINIA	George Washington	BATH	$99,968.52
VIRGINIA	Jefferson	BEDFORD	$10,153.85
VIRGINIA	Jefferson	BLAND	$39,254.65
VIRGINIA	George Washington	BOTETOURT	$7,001.32
VIRGINIA	Jefferson	BOTETOURT	$36,545.15
VIRGINIA	GW/JEFF	Botetourt Subtotal	$43,546.47
VIRGINIA	Jefferson	CARROLL	$3,663.75
VIRGINIA	Jefferson	CRAIG	$62,493.39
VIRGINIA	Jefferson	DICKENSON	$4,501.18
VIRGINIA	George Washington	FREDERICK	$2,826.33
VIRGINIA	Jefferson	GILES	$34,230.06
VIRGINIA	Jefferson	GRAYSON	$17,795.43
VIRGINIA	George Washington	HIGHLAND	$33,287.93
VIRGINIA	Jefferson	LEE	$6,071.37
VIRGINIA	Jefferson	MONTGOMERY	$3,355.12
VIRGINIA	George Washington	NELSON	$10,781.93
VIRGINIA	George Washington	PAGE	$15,597.17
VIRGINIA	Jefferson	PULASKI	$10,467.90
VIRGINIA	Jefferson	ROANOKE	$1,674.85
VIRGINIA	George Washington	ROCKBRIDGE	$25,635.58
VIRGINIA	Jefferson	ROCKBRIDGE	$12,048.87
VIRGINIA	GW/JEFF	Rockbridge Subtotal	$37,684.45

PAYMENT TO STATES			
STATE	**FOREST**	**COUNTY**	**2004**
VIRGINIA	**George Washington**	**ROCKINGHAM**	$80,184.16
VIRGINIA	**Jefferson**	**SCOTT**	$18,632.86
VIRGINIA	**George Washington**	**SHENANDOAH**	$43,651.17
VIRGINIA	**Jefferson**	**SMYTH**	$39,882.72
VIRGINIA	**Jefferson**	**TAZEWELL**	$5,129.26
VIRGINIA	**George Washington**	**WARREN**	$1,919.80
VIRGINIA	**Jefferson**	**WASHINGTON**	$12,038.08
VIRGINIA	**Jefferson**	**WISE**	$19,470.30
VIRGINIA	**Jefferson**	**WYTHE**	$31,089.67
VIRGINIA	**GW/JEFF**	**VA. STATE TOTAL**	$915,668.49
WEST VA.	**George Washington**	**HAMPSHIRE**	$2,093.56
WEST VA.	**George Washington**	**HARDY**	$33,392.61
WEST VA.	**George Washington**	**MONROE**	$264.68
WEST VA.	**Jefferson**	**MONROE**	$11,459.35
WEST VA.		**Monroe Subtotal**	$11,724.03
WEST VA.	**George Washington**	**PENDLETON**	$76,753.03
WEST VA.	**Monongahela**	**PENDLETON**	$127,685.20
WEST VA.		**PENDLETON Subtotal**	$204,438.23
WEST VA	**GW/JEFF ONLY**	**WEST VA. STATE TOTAL**	$123,963.23
George Washington Total			$659,673.91
Jefferson Total			$380,481.19
GRAND TOTAL			$1,040,155.10

2004 Payment in Lieu of Taxes

PAYMENT IN LIEU OF TAXES			
STATE	**FOREST**	**COUNTY**	**2004**
KENTUCKY	Jefferson	LETCHER	$1,148.00
KENTUCKY	Jefferson	PIKE	$22,049.00
KENTUCKY	Jefferson	KY. STATE TOTAL	$23,197.00
VIRGINIA	George Washington	ALLEGHENY	$174,581.00
VIRGINIA	George Washington	AMHERST	$45,371.00
VIRGINIA	George Washington	AUGUSTA	$215,294.00
VIRGINIA	George Washington	BATH	$151,771.00
VIRGINIA	Jefferson	BEDFORD	$28,800.00
VIRGINIA	Jefferson	BLAND	$78,707.00
VIRGINIA	GW/JEFF	BOTETOURT	$89,418.00
VIRGINIA	Jefferson	CARROLL	$16,089.00
VIRGINIA	Jefferson	CRAIG	$122,404.00
VIRGINIA	Jefferson	DICKENSON	$20,617.00
VIRGINIA	George Washington	FREDERICK	$4,949.00
VIRGINIA	Jefferson	GILES	$88,800.00
VIRGINIA	Jefferson	GRAYSON	$45,260.00
VIRGINIA	George Washington	HIGHLAND	$54,087.00
VIRGINIA	Jefferson	LEE	$22,393.00
VIRGINIA	Jefferson	MONTGOMERY	$25,672.00
VIRGINIA	George Washington	NELSON	$27,000.00
VIRGINIA	George Washington	PAGE	$81,885.00
VIRGINIA	Jefferson	PULASKI	$25,078.00
VIRGINIA	Jefferson	ROANOKE	$10,247.00
VIRGINIA	GW/JEFF	ROCKBRIDGE	$85,775.00
VIRGINIA	George Washington	ROCKINGHAM	$192,667.00
VIRGINIA	Jefferson	SCOTT	$45,609.00
VIRGINIA	George Washington	SHENANDOAH	$92,852.00
VIRGINIA	Jefferson	SMYTH	$78,976.00
VIRGINIA	Jefferson	TAZEWELL	$13,516.00
VIRGINIA	George Washington	WARREN	$28,789.00
VIRGINIA	Jefferson	WASHINGTON	$23,326.00
VIRGINIA	Jefferson	WISE	$48,051.00
VIRGINIA	Jefferson	WYTHE	$60,922.00
VIRGINIA	GW/JEFF	VA. STATE TOTAL	$1,998,906
WEST VA.	George Washington	HAMPSHIRE	$4,909.00
WEST VA.	George Washington	HARDY	$72,527.00
WEST VA.	GW/JEFF	MONROE	$28,011.00
WEST VA.	GW/MON	PENDLETON	$129,249.00
WEST VA	GW/JEFF/MON	WEST VA. STATE TOTAL	$234,696.00
GW Forest*			$1,361,706
Jefferson Forest*			$895,093.00
GW/JEFF Only GRAND TOTAL			$2,256,799.00

* Botetourt and Monroe Counties assumed to be totally on the Jefferson. Rockbridge County assumed to be totally on the GW.

APPENDIX E

St. Mary's Biological Monitoring Summary

Prepared by Dawn Kirk, 2004

Fish and Macroinvertebrates

Pre 1999 Liming Biological Surveys

Excerpt from Mohn et al. (2000):

> Surber (1951) provided the earliest data on biological communities in the St. Marys River. He collected detailed aquatic macroinvertebrate data from a number of sites in both 1936 and 1937. This early data provides a valuable baseline which precedes likely impacts due to industrial based acidification. The Department of Game and Inland Fisheries collected extensive fisheries and invertebrate data as part of a statewide trout stream inventory in 1976 (Mohn and Bugas 1980). With the designation of St. Marys River as an acidified trout stream by Webb (1987), the Department began a program of intensive fisheries and invertebrate data collection on a biennial basis from 1986 through 1998. In support of this effort, the USFS Coldwater Fisheries Research Unit from Virginia Tech conducted basinwide snorkel and electrofishing surveys in St. Marys and its tributaries in 1989, 1994 and 1997 (Flebbe, pers. com.).
>
> The 1976 survey by the Department of Game and Inland Fisheries provided the first recorded fisheries survey of the St. Marys River. Six sample stations were established on the mainstem. These stations were established at approximately equal intervals along the mainstem from the lower wilderness boundary to the headwaters. Stations varied in length from 76 to 171 m and included at least three riffle, pool, and run sequences. Block nets were placed at each end of the sample stations and three-run depletions were used to estimate fish abundance and biomass. In addition, a Carle sampler (Carle 1976) was used to collect three 0.26m2 invertebrate samples from riffle areas at each site. This collection technique and the sample locations compared favorably with methods used by Surber in 1936/37. Surveys were repeated at established stations in 1977, and biennially from 1986 through 1998 (Bugas et al., 1999).
>
> Fourteen species of fish have been collected from the St. Mary's River since 1976 but several are considered transient. The most species collected in any one survey year was 12 in 1976. During the survey period 1976-1998, the number of fish species has steadily declined from 12 to 4. In addition, several species that were found through large portions of the drainage in 1976, such as blacknose dace, fantail darter, and mottled sculpin, have had their ranges and numbers severely reduced. Rainbow trout, for which the St. Mary's River was best known, were extirpated from the drainage by 1994. Due to its greater acid tolerance, the native brook trout remained abundant through 1994. However, the 1996 survey indicated year class failures in two of the precious three years and a sharp drop in brook trout population numbers. The magnitude of this drop in population prompted the Department to immediately begin discussions with the USFS on acid mitigation.

The aquatic invertebrate data has shown a more gradual but no less significant reduction in both species numbers and diversity (Kauffman et al. 1999). Many genera of stonefly, mayfly and caddisfly were extirpated from the drainage by the mid-1980s while populations of acidophobic taxa such as the plecoptera, Leuctra/Alloperla and Chironomidae showed significant increases. The invertebrate diversity as measured by the Shannon Diversity Index showed a significant decline throughout the study period.

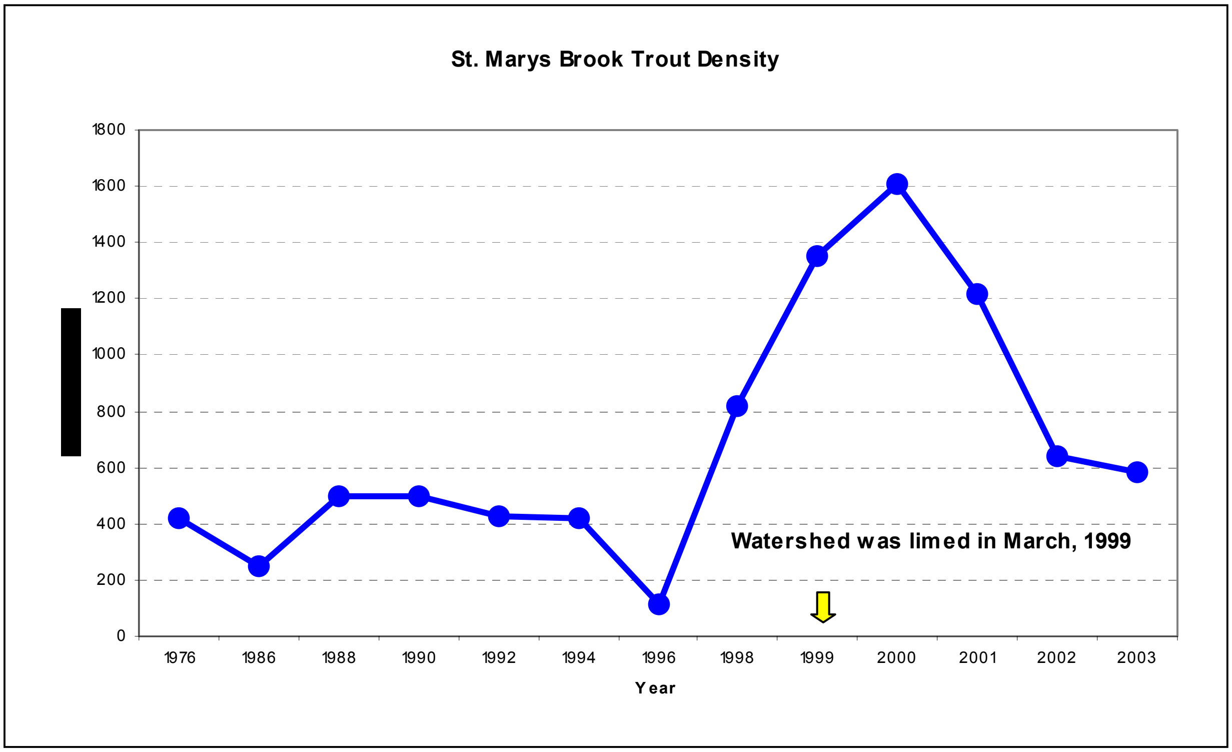
Biological Response

Excerpt from Mohn et al. (2000):

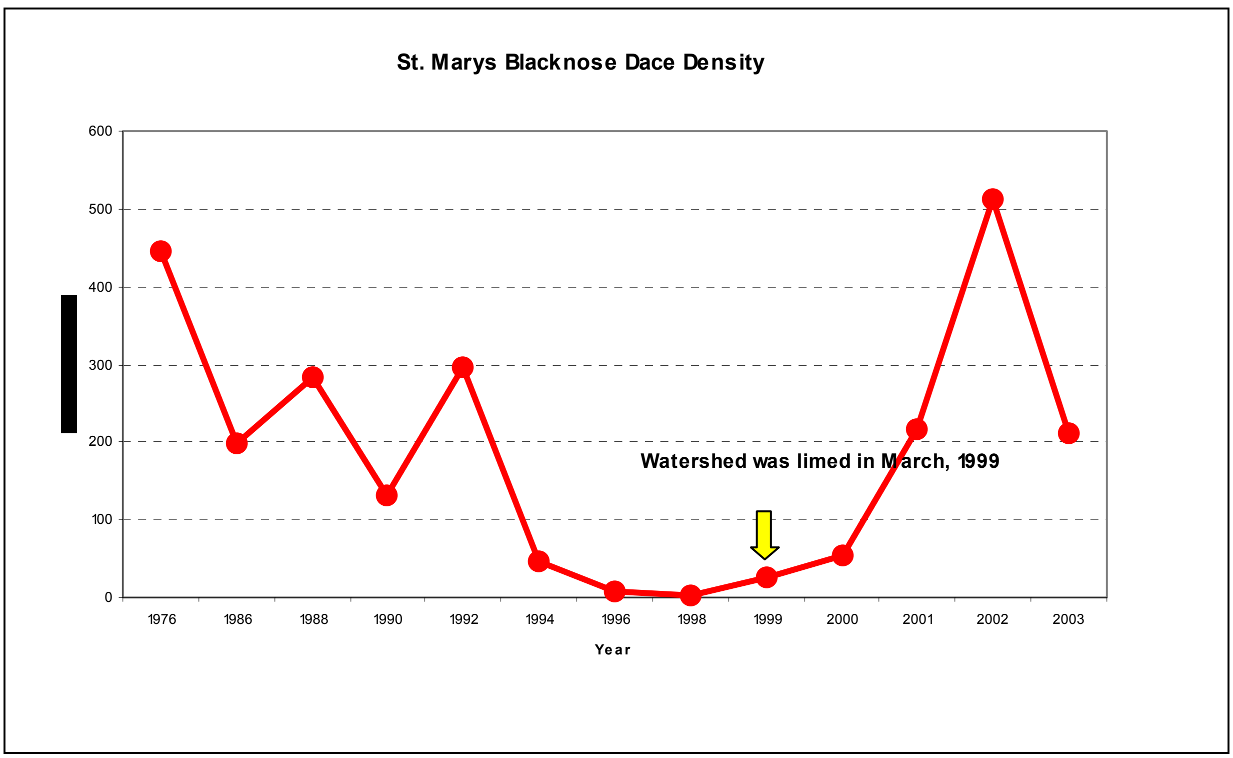
> Post treatment trout biomass and number estimates show a dramatic response. However, all of this response cannot be attributed to the limestone treatment as populations began recovery in 1998. Virginia has experienced a prolonged drought period that resulted in stable, low flow, mild winters from 1997 through 2000. These conditions generally produce exceptional year-classes of brook trout. In the case of St. Marys River and other acidified streams, the low flows not only produced good flow conditions for reproduction and recruitment but the lack of significant rainfall resulted in winter pH values higher than normal. With the limited data available to date, we feel that the increase in population is the result of a combination of factors but that the current record number of trout would not be present without the limestone mitigations effort.
>
> The aquatic invertebrate population, as measured by the Shannon diversity index, has been our most reliable indicator of stream decline over the history of our studies of the St. Marys River. It is interesting to note that the index rebounded to 1976 levels within only 3 months of treatment.

Biological monitoring post liming has shown an initial increase in brook trout density (Graph 1), an increase in blacknose dace density (Graph 2), an increase in fish species (Graph 3), an expansion of fish species to historic habitat (Table 1, Graph 4), an increase in Shannon diversity index (Graph 5), an increase in macroinvertebrate taxa richness (Graph 6), and an increase in ephemeroptera/plecoptera/trichoptera (EPT) index (Graph 7). This indicates that the fish and macroinvertebrate fauna responded positively to the limestone treatment.

Graph 1. Brook trout density of St. Marys River, 1976-2003 (Bugas, 2003).



Graph 2. Blacknose dace density of St. Marys River, 1976-2003 (Bugas, 2003).



Graph 3. Number of fish species in St. Marys River, 1976-2003 (Bugas, 2003).

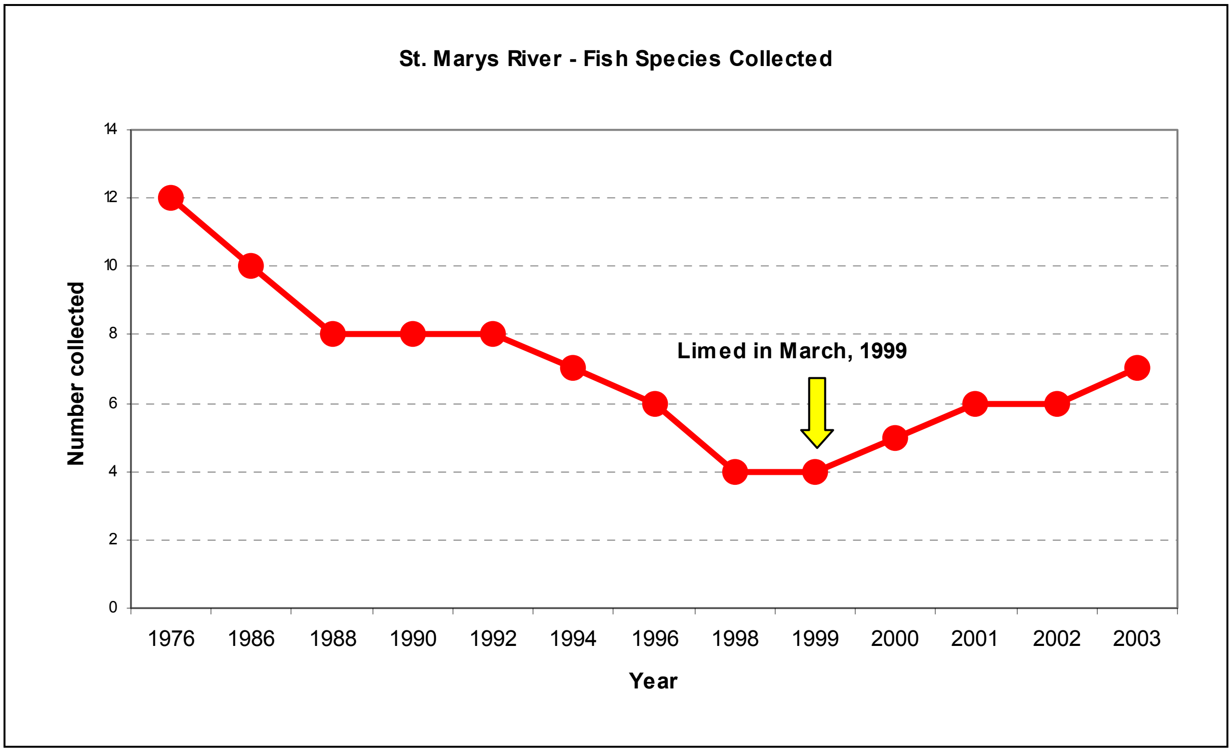
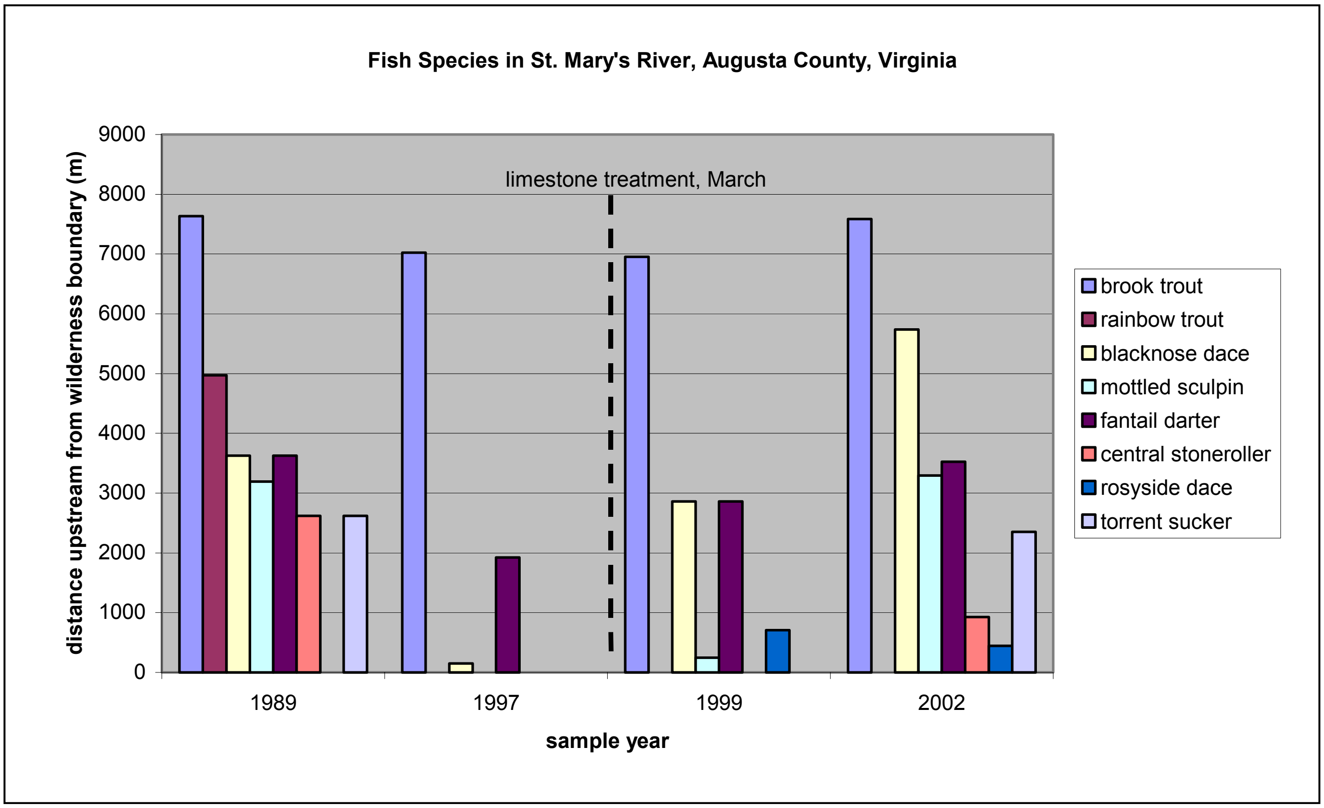


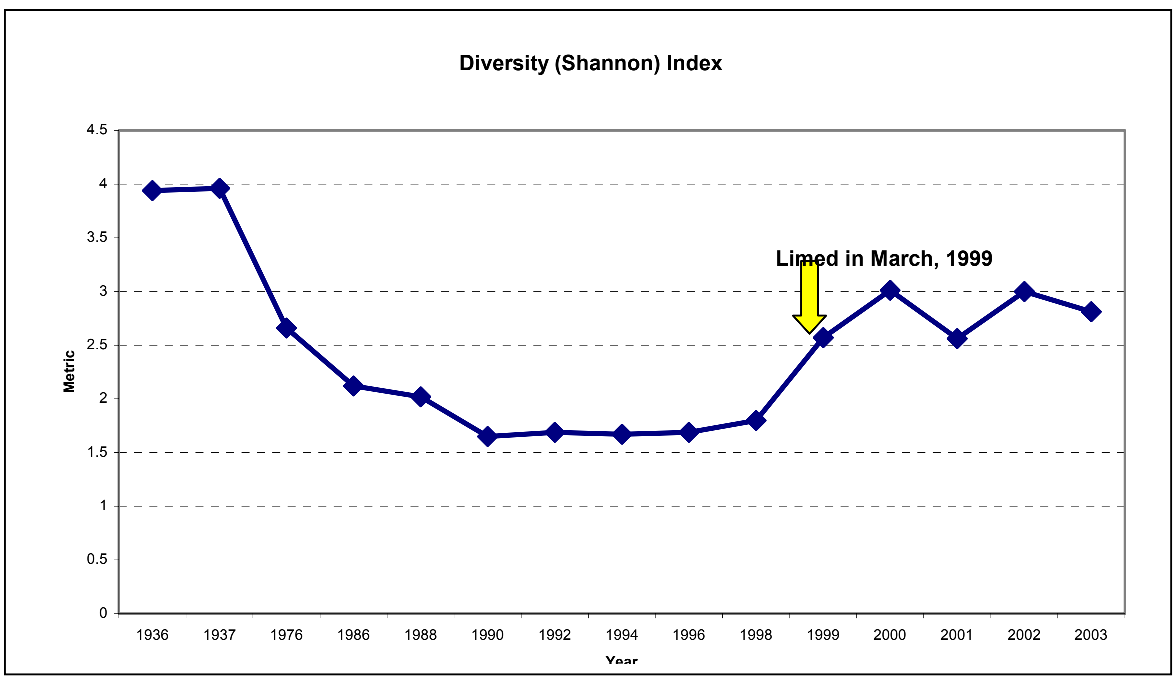
Table 1. Fish species collected at sample locations on St. Marys River. Station A is the farthest downstream, while station F is the farthest upstream (Bugas, 2003).

Fish Species	**1976**	**1986**	**1988**	**1990**	**1992**	**1994**	**1996**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Brook Trout	F	F	F	F	F	F	F	F	E	F	F	F	F
Blacknose Dace	E	E	E	C	A	B	A	A	A	B	D	D	B
Fantail Darter	C	C	C	C	C	B	B	B	B	B	B	B	B
Mottled Sculpin	B	B	B	B	B	B	B	B	B	B	B	B	B
Rosyside Dace	B	B	B	B	A	B	A						
Torrent Sucker	C	B	B	B	B		A			A	A	A	A
Rainbow Trout	E	E	C	C	C								B
Longnose Dace	B	A			A						B	B	
Johnny Darter	A					A							
White Sucker	B	A											
Bluehead Chub	A			A									
Central Stoneroller		A											A
Smallmouth Bass			B										
Brown Trout	C					A							
Total Species	**12**	**10**	**8**	**8**	**8**	**7**	**6**	**4**	**4**	**5**	**6**	**6**	**7**

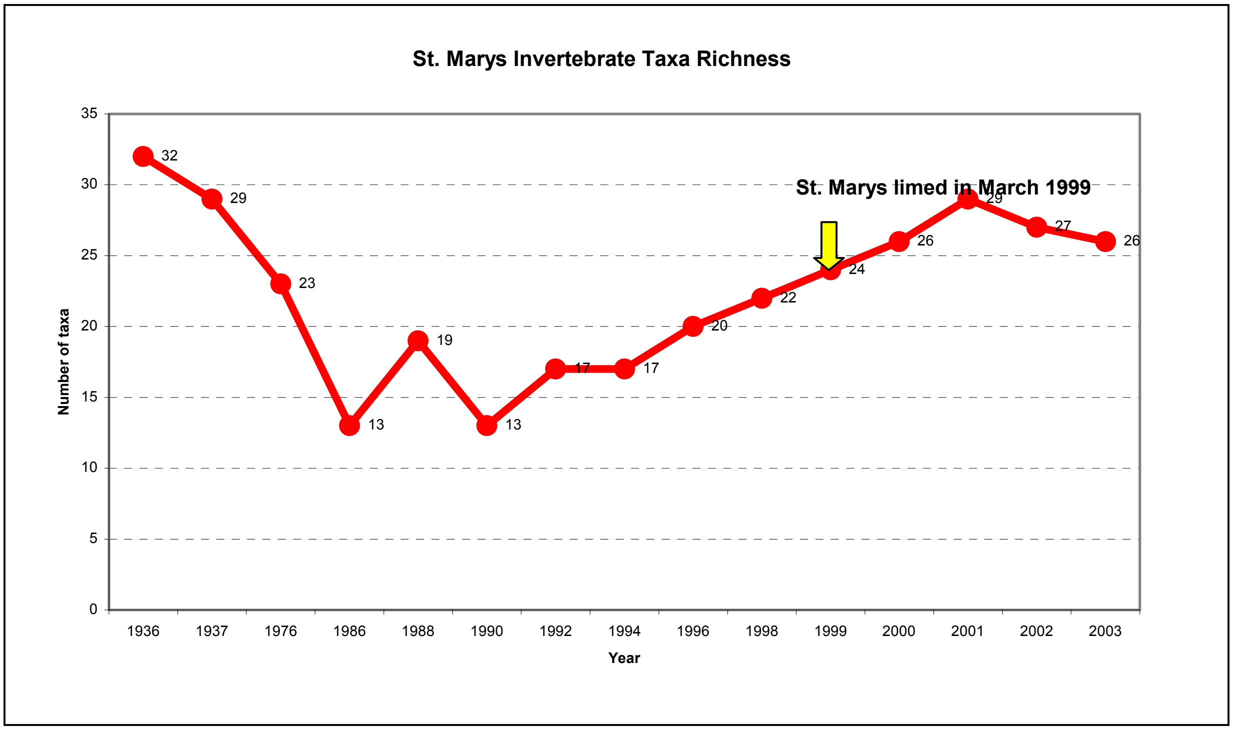
Graph 4. Fish species distribution in St. Marys River following liming (Moran and Roghair, 2003).



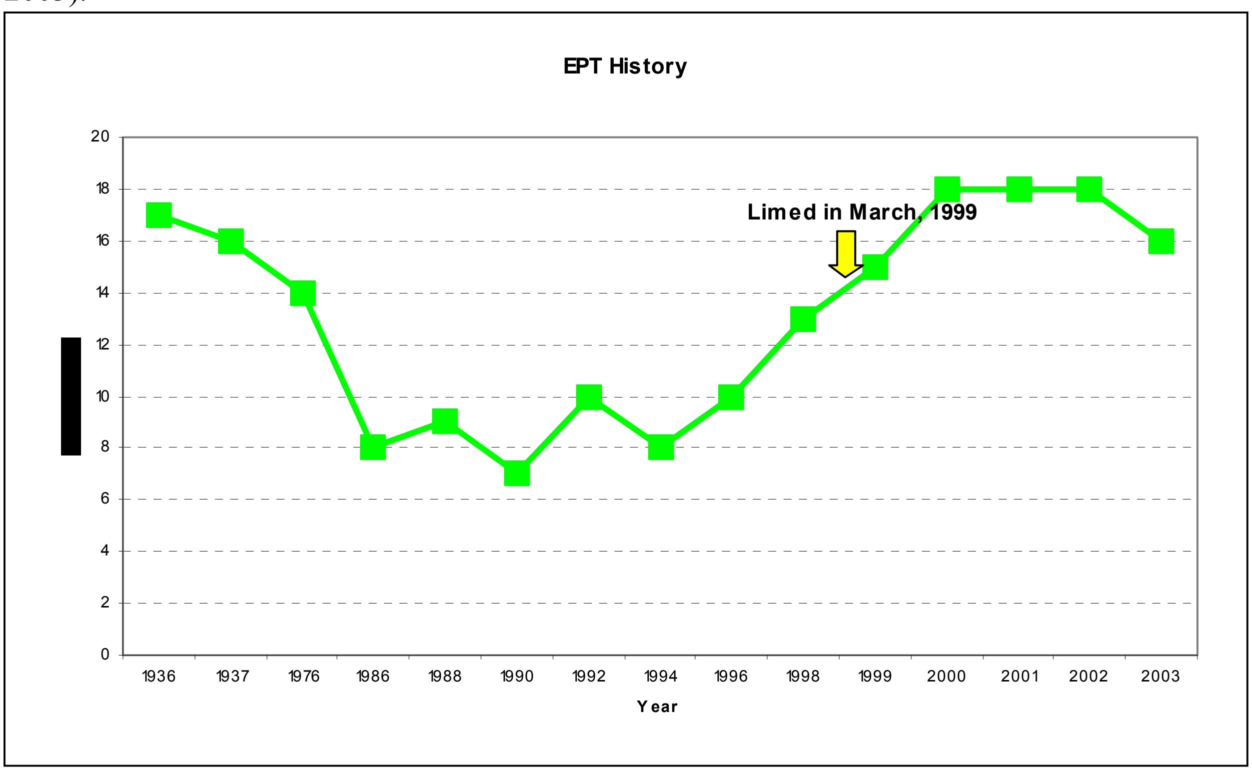
Graph 5. Shannon diversity index (macroinvertebrate metric) for St. Marys River, 1935-2003 (Bugas, 2003).



Graph 6. Macroinvertebrate taxa richness in St. Marys River, 1935-2003 (Bugas 2003).



Graph 7. Ephemeroptera/Plecoptera/Trichoptera index in St. Marys River, 1935-2003 (Bugas, 2003).

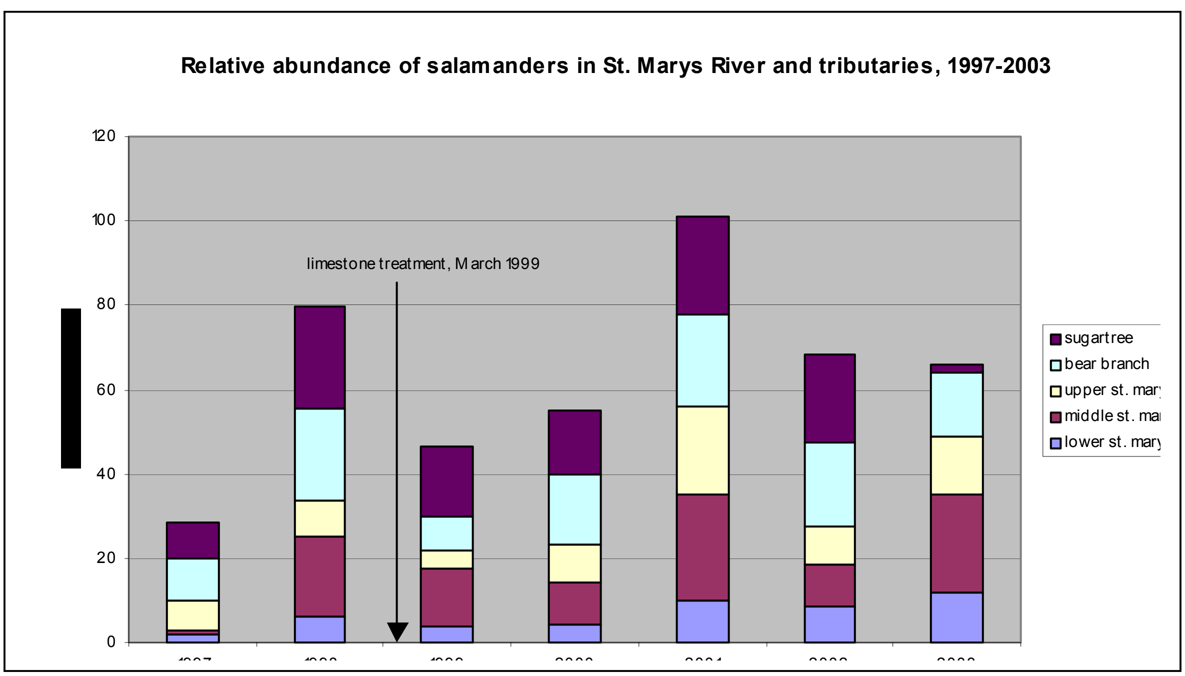


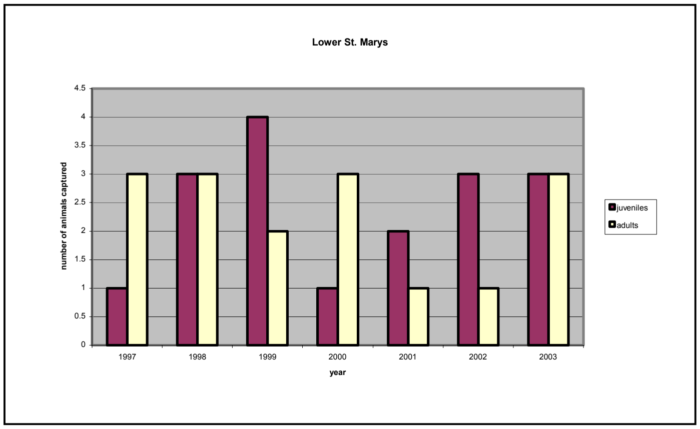
Salamanders

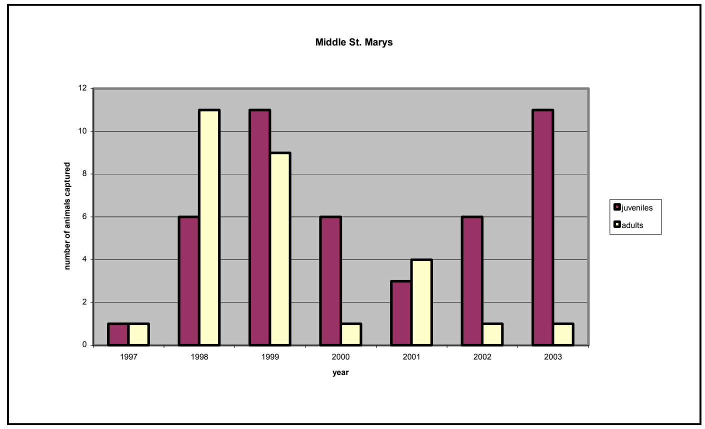
A concern was raised during scoping for the 1999 liming regarding the effect of the project on stream salamanders. Therefore, streamside salamander assemblages were monitored in the watershed using time-constrained visual encounter surveys to obtain relative abundances before and after the limestone treatment. This was done at three sites along St. Marys River (Lower, Middle, and Upper), and at two tributaries (Sugartree Branch and Bear Branch). The sample sites were all below the limestone treatments. During sampling, surface objects were turned over and all microhabitats that might harbor amphibians were searched. All individuals encountered were identified and capture was attempted. Snout-vent length and total length was recorded for each captured animal.

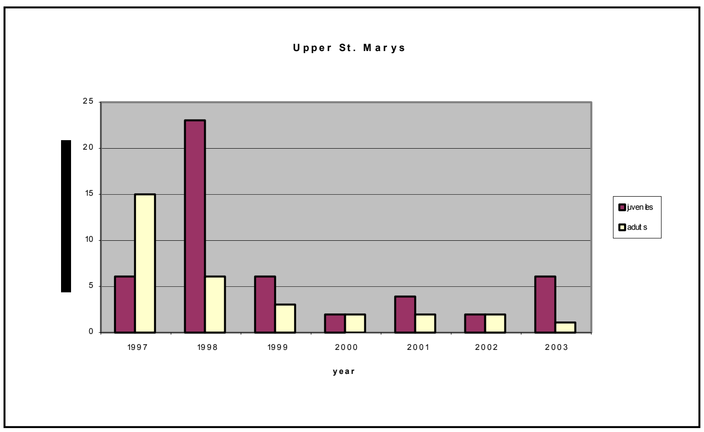
All four species of streamside salamanders typical of streams in the Blue Ridge Mountains of Virginia were encountered at all sample sites: Northern dusky (*Desmognathus fuscus*), seal (*D. monitcola*), southern two-lined (*Eurycea cirrigera*), and spring (*Gyrinophilus porphyriticus*). The relative abundance of salamanders did not decrease in the watershed following the 1999 liming (Graph 8). In addition, salamander larva were found at all of the sample sites during all years, except for 2003 at Sugartree Branch (Graph 9). The 2003 survey was done following Hurricane Isabel, a storm that produced great amounts of channel scouring and bedload movement. Age structure was determined using snout-vent length measurements from captured individuals. The snout-vent length values at maturity correspond to those used by Kirk and Mitchell (1999) and are as follows: northern dusky, 33 mm; seal, 48 mm; spring, 61 mm. All two-lined salamanders captured were adults. The presence of larva at the sample locations indicates continued reproduction. The data suggests that liming did not negatively affect streamside salamander abundance nor reproduction in St. Marys watershed.

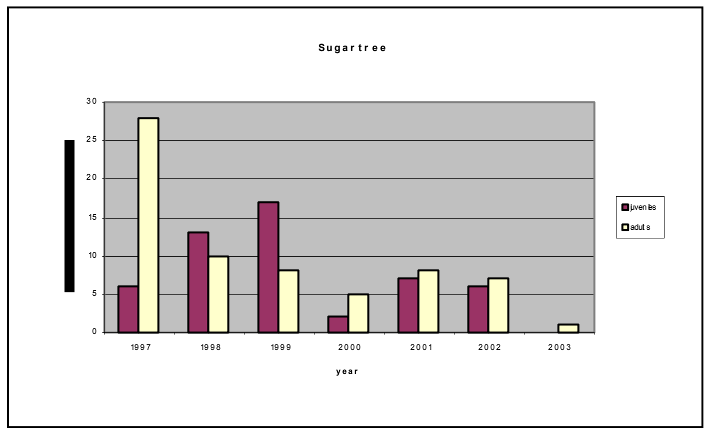
Graph 8. Salamander abundance in St. Marys River and tributaries, 1997-2003.

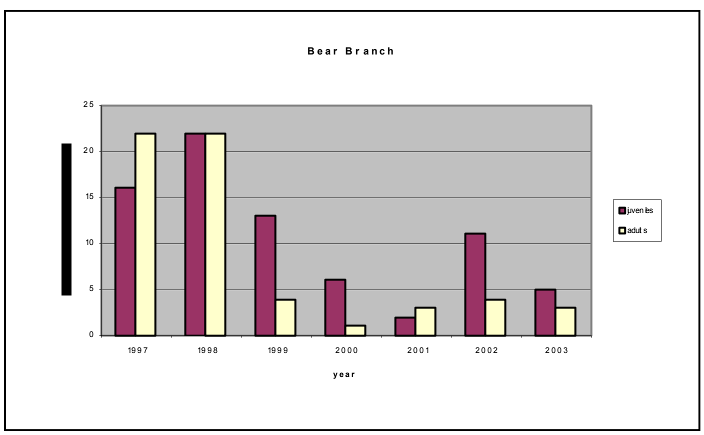



Lower St. Marys
number of animals captured
year
juveniles
adults


Middle St. Marys
number of animals captured
year
juveniles
adults


Upper St. Marys
year


Sugartree
year


Bear Branch
year

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Bugas, P.E. 2003. Personal Communication. Virginia Department of Game and Inland Fisheries, Verona, Virginia.

Kirk, D.M. and J.C. Mitchell. 1999. Streamside salamanders in an acidic Blue Ridge Mountain stream: historical comparisons and relative abundance. Banisteria, No.13: 201-207.

Mohn, L.O., P.E. Bugas Jr., D.M. Kirk, and D.M. Downey. 2000. Mitigating Stream Acidification in a Wilderness Watershed Using Limestone Sand. Wild Trout VII Symposium. Old Faithful Inn, Yellowstone National Park, October 1-4. Pages 176-184.

Moran, J.D. and C.N. Roghair. 2003. Condition of Fish Populations and Habitat in the St. Marys River and Selected Tributaries Before and After Limestone Sand Treatment. Report to the George Washington and Jefferson National Forest from the Center for Aquatic Technology Transfer, Coldwater Fisheries Research Unit, FS Southern Research Station at Virginia Polytechnic Institute and State University, Blacksburg, VA.

APPENDIX F

St. Mary's Stream Water Chemistry (1999-2004)

Interim Project Report on Cooperative Project Between US Forest Service and James Madison University

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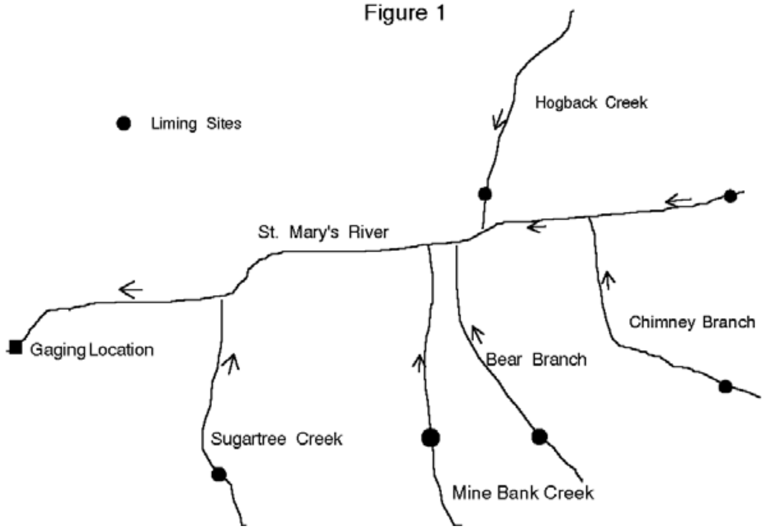
Previous liming studies by our (JMU Chemistry) group led to an estimated 125 tons of limestone that would be necessary to provide a minimum five years of treatment for the St. Mary's River and its tributaries[1,2]. This estimate was based on existing stream water chemistry, annual rainfall, stream discharge and acid loading. The limestone was distributed to six locations within the watershed by helicopter. The stream sites with greater discharge and lower pH received more treatment than those of lower discharge and higher pH. A total of 140 tons, which includes 15 tons above the estimated value to allow for transport loss, was distributed as follows: 50 tons were placed in the upper St. Mary's River (main stem), 25 tons in Hogback Creek, 15 tons in Chimney Branch, 20 tons in Bear Branch, 15 tons in Mine Bank Creek and 15 tons in Sugartree Branch. The limestone was placed far enough upstream to provide the maximum length of treated stream, yet not at sites of intermittent flow (see Figure 1 below). Stream gradient was 2-5% at all the liming sites. The limestone placed at these six sites moved downstream due to the flow of the stream water and incorporated into the substrate to form treatment zones of 150-250 meters. As for other stream liming projects we have designed, it was intended that the limestone would slowly dissolve as stream water flowed over the substrate and would provide a "time release" treatment. A total of 10 miles of stream was treated within the Wilderness Area.

Figure 1

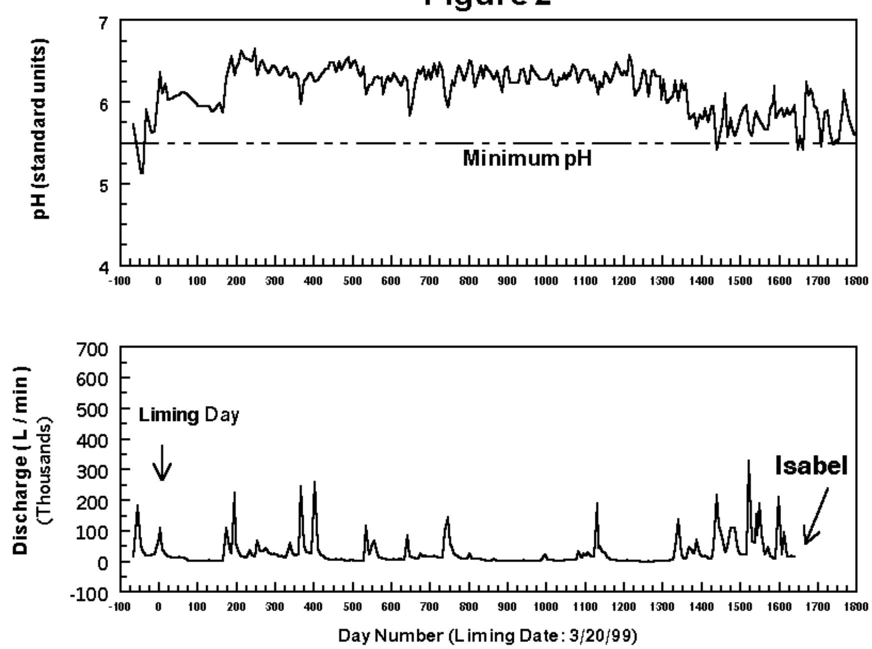


The limestone used to treat St. Mary's River and its tributaries was high grade (>99%) calcium carbonate from a quarry in the Shenandoah Valley near Middletown, Virginia. As expected from prior work, dissolution was slow as the stream water contacted the limestone, which has been incorporated in the substrate and freed both Ca^{2+} and carbonate, $CO_3^{=}$, ions into the water column. Calcium ion is beneficial to aquatic life as it is an essential nutrient and offsets the effect of toxic aluminum on fish and other aquatic life. Aluminum is abundant in nature, but is seldom found in high concentrations in surface waters as it is quite insoluble except in acidic conditions. Dissolved aluminum enters the gills of fish where it precipitates due to the basic environment of the fish tissue. The precipitate causes irritation, stress and may result in mortality. The calcium from the limestone has helped to prevent aluminum adsorption by competing for the cation exchange sites. The carbonate anion has neutralized much of the hydronium ion in the acid water by acid-base reaction. The product was bicarbonate anion, HCO_3^-, a buffer that controls pH. The changes in St. Mary's for these water quality parameters are noted below.

Water chemistry monitoring of the St. Mary's River by JMU (Chemistry Dept. Downey group) began in January, Y1999, three months before the date of the liming treatment. Twenty-two sites were monitored for water quality throughout the wilderness on a quarterly basis, including a site located at the lower boundary where the stream exits the Wilderness Area. A staff gauge was installed here for recording stream discharge on sampling days and, due to ready access, samples have been collected here once a week since the date of liming. The first graph in Figure 2 below provides the observed pH for the 59 months since the project started (data collected to 2/24/2004) at this site. The data points are connected for clarity. A value of pH 5.5 was chosen as a minimum for protection of certain aquatic insects and fishes that were native to the St. Mary's drainage. Figure 2 shows that the pH values were often less than the minimum acceptable value at the sampling site prior to the introduction of limestone. The average value for this period was pH 5.53 $\pm$ 0.26. In the 49 months that have elapsed since the liming, the average has been pH 6.22 $\pm$ 0.24. This is a significant improvement that has benefited the aquatic life in the stream. The second graph in Figure 2 also shows the peaks and valleys in measured discharge that accompanied wet and dry periods. The liming date (March 20, 1999) is marked with a vertical line on this graph. There was significant flow on the day the streams were limed, but the spring and summer of Y1999 were an extremely dry time with discharge gradually decreasing significantly. In September Y1999, several tropical depressions produced significant rainfall that increased discharge. The day the limestone was added, the pH values increased dramatically. The initial pH increase, however, was short lived due to a lack of flow, which caused pH to decrease during the drought. When the tropical depressions elevated flows in the late summer, the pH increased above pH 6, where it remained when normal flow conditions occurred. Storm events generally caused short-term decreases in pH as shown by the dips in the plotted line. But these episodic pH dips were not as low as they were prior to liming, thus the aquatic life was protected from hydronium ion stress.

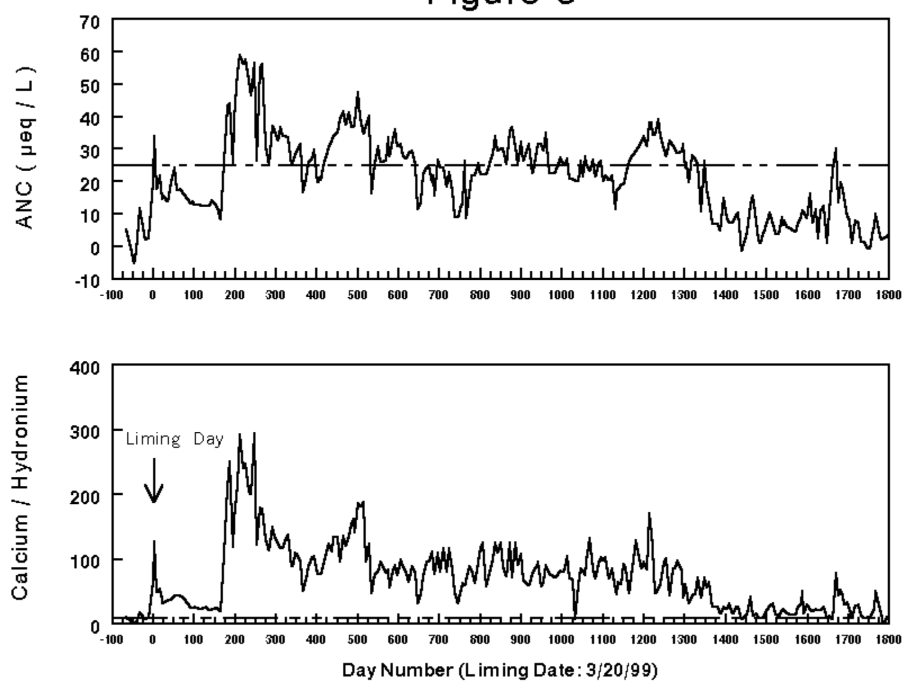
The summer of Y2002 was one of low flow conditions accompanying severe drought. This period was followed by five months in Y2003 of chronic high flow events in which the cumulative precipitation nearly met the annual total average precipitation levels for the region. The pH values in this period were chronically low (near the target value) due to the reduction of available limestone after four years of gradual consumption coupled with the large volume of water in the stream system. These pH values indicate that the mitigation capacity of the treatment is approaching maturity and re-liming will soon be necessary to maintain tolerable pH levels during future high flow episodes.

Figure 2



Another water quality parameter of interest is the acid neutralizing capacity (ANC) observed for the stream. Figure 3 provides the weekly ANC data at the gauging site on the upper graph. The second graph in Figure 3 shows the calculated parameter of calcium to hydronium ion (Ca/H) ratio versus time at this location. These are included in the same figure because both parameters are important for assessing the impact of acidity on aquatic life. The ANC values were quite low for the St. Mary's River prior to liming, often showing negative values. The pre-liming ANC average was 2.1 ± 4.7 :eq/L. The low values are the result of a lack of carbonate bearing mineral in the Antietam formation of quartzite rock that makes up most of the St. Mary's wilderness watershed. Thus little natural buffer is available to mitigate anthropogenic acidity from the atmosphere. The post-liming ANC values have increased due to the slow dissolution of the introduced limestone sand to an average 24.4 ± 11.7 :eq/L. There was an ANC decrease during the Y1999 drought coincident with the pH decrease described above, but an increase above target value of 25 :eq/L (marked on the graph) followed the Y1999 drought. Except for some depressions in the years that followed caused by storm events, the ANC remained near 25 :eq/L until Y2003 when an extended period of low values was observed due to the unusually high flows. Although the ANC values were less than the target value during this period it is likely that the values were not as low as would have been observed had mitigative liming not been done.

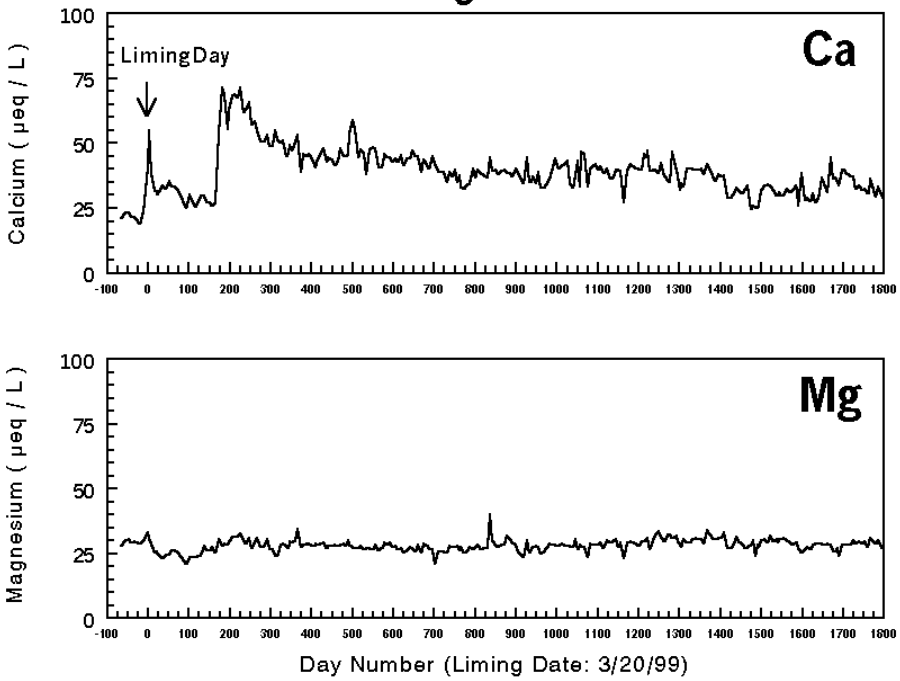
Figure 3



The Ca/H ratio is important because it indicates a level of protection for the gills of fish from aluminum absorption[3]. A generally accepted minimum value of 10 was chosen for this parameter (shown on the graph). Prior to liming, the Ca/H averaged 8.6 ± 4.5, while the average was 82.8 ± 50.8 post-liming. It is likely that Ca/H ratio would have been much less than 10 during the recent high flow periods without the mitigative liming.

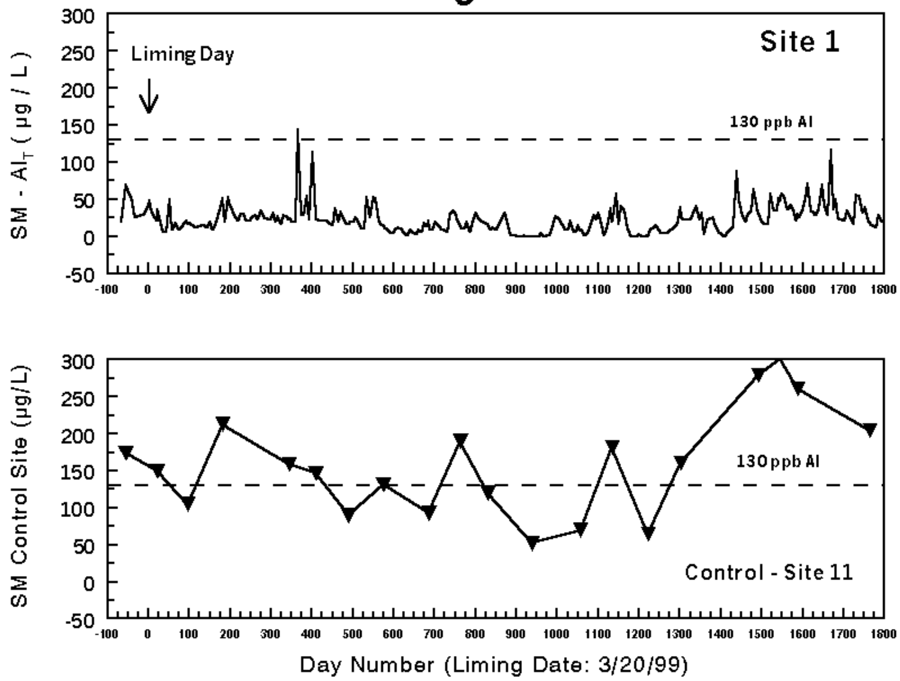
Figure 4 shows the observed concentration of calcium (first graph) and magnesium (second graph) versus time. The calcium concentration was low prior to liming; the average was only 21.8 ± 1.6 :eq/L. After the liming the average increased to 40.7 ± 9.0 :eq/L. The dramatic increase is due solely to limestone dissolution, not natural effects. This conclusion is confirmed by examining the magnesium concentration. Like calcium, magnesium is a base cation and a group II metal that enters the stream water naturally from the weathering of the minerals in the soils and bedrock. It was not present in the limestone sand used for this study. Prior to liming, magnesium concentration averaged 29.5 ± 0.8 :eq/L. The post-liming concentration of 28.4 ± 2.4 :eq/L is the same within the limits of random scatter due to stream fluctuations and sample processing.

Figure 4



Aluminum is a fish toxin as described above. Total aluminum concentration levels above 130 :g / L are considered hazardous for aquatic life and thus was chosen as the maximum acceptable amount for this study. Figure 5 shows the total aluminum concentration for the St. Mary's River in the weekly samples taken at the gauging location (site 1) on the top graph and the quarterly aluminum values taken at the control site (site 11) upstream of the limestone treatment. The graphs show that aluminum was mobilized during high flow periods due to low pH and flushing in the untreated reach of the stream. Episodic short-term spikes in aluminum concentrations as well as the base flow concentrations were less than the target value downstream of limestone treatment. Aluminum concentration at site 1 averaged 39.3 ± 16.9 ppb prior to liming and 21.3 ± 18.0 ppb since the liming.

Figure 5



The data above describe the weekly results obtained for the sampling site at the Wilderness Boundary where St. Mary's River exits onto private land. In addition to the weekly monitoring, samples were collected throughout the watershed on a quarterly basis. Figure 6 provides a comparison of the quarterly sampling results and shows before and after liming pH values at eleven locations in St. Mary's River. The post liming values are for the spring quarter samples each year. The upstream reach was extremely acidic with an average pH 4.92 $\pm$ 0.09. Prior to liming there was a small pH increase from the uppermost site to the point where the stream exited the wilderness. After the liming, the pH increased above the target value of pH 5.5 downstream of the liming site. Figure 7 shows the ANC data complementary to Figure 6 pH data. Prior to liming negative ANC values were found throughout much of the stream, but the limestone dissolution has increased ANC near to the target value of 25 :eq/L. Treatment of the acidic tributaries has helped maintain the pH and ANC both within the tributaries and in the St. Mary's River. The most recent spring samples taken for this study (2003) had pH and ANC values close to pre-liming values. These samples were taken under very high flow conditions, when the extent of treatment is less than under normal flow conditions. Nonetheless, the numbers indicate that it is time for consideration of re-liming to maintain target values.

To summarize the results of treatment for all water quality parameters in this study, Table 1 has been included. It shows averaged data for all the quarterly sample sites in the St. Mary's River. Precipitation data are provided from a NADP monitoring site for comparison to the stream chemistry. The data demonstrate the effectiveness of liming for increased pH, ANC, Ca and Ca/H ratio and decreased Al for the four years post treatment.

Figure 6

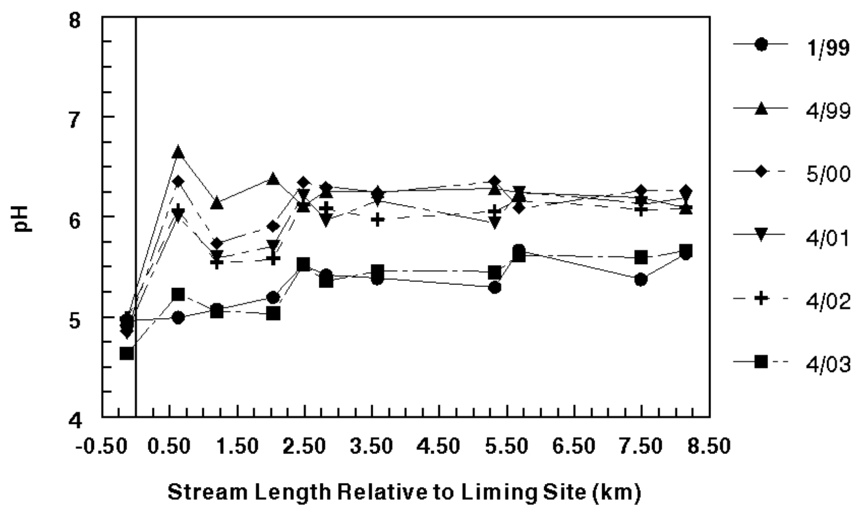
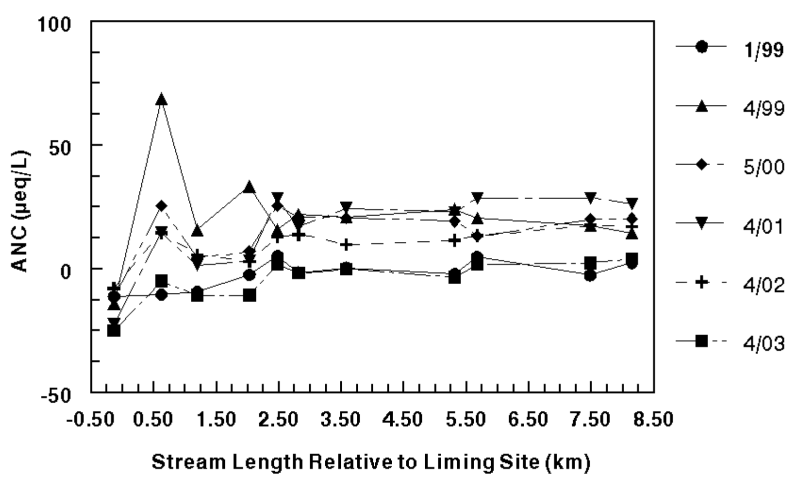


Figure 7



Parameter	Precipitation	St. Mary's Upper	SM Lower (Pre)	SM Lower (Post)
Table 1.				
*p*H	4.44 ± 0.10	4.97 ± 0.18	5.36 ± 0.21	6.26 ± 0.41
ANC	ND	-17.7 ± 6.6	-9.1 ± 7.9	95.9 ± 27.0
Ca2+	5.4 ± 1.0	25.3 ± 7.4	46.8 ± 13.2	85.9 ± 30.5
Mg2+	1.6 ± 0.5	21.8 ± 5.7	25.8 ± 7.4	87.4 ± 32.7
Na+	2.6 ± 0.8	9.4 ± 3.2	10.5 ± 4.0	9.0 ± 4.6
K+	1.4 ± 0.8	9.4 ± 5.3	10.4 ± 2.7	6.7 ± 1.9
H+	31.5 ± 3.9	16.3 ± 4.4	10.5 ± 3.3	0.26 ± 0.12
NH_4^+	10.8 ± 0.7	ND	ND	ND
Cl-	3.4 ± 0.7	14.9 ± 5.0	13.5 ± 5.1	14.2 ± 4.6
NO_3^-	16.9 ± 1.4	4.9 ± 5.7	8.0 ± 6.3	9.4 ± 7.5
SO_4^{2-}	34.6 ± 0.6	58.9 ± 15.4	72.0 ± 10.2	71.0 ± 7.0
Al_T	NM	162 ± 58	162 ± 108	88 ± 58
Cu	NM	5.7 ± 8.3	4.6 ± 8.4	9.5 ± 13.3
Fe	NM	401. ± 448.	310. ± 352.	522. ± 349.
Mn	NM	78.1 ± 53.4	69.2 ± 37.8	12.1 ± 14.1
Zn	NM	22.5 ± 21.3	13.7 ± 13.3	27.2 ± 19.6
Ca2+ / H+	0.17 ± 0.13	1.5 ± 1.2	5.1 ± 2.9	405. ± 208.
Sum of Cations	53	82	104	189
Sum of Anions	55	79	94	190
Precipitation (m)	0.994 ± 0.161	----	----	----

Comparison of Wet Precipitation (1999 – 2001) and St. Mary's average water chemistry (1999-2003) with standard deviations. Precipitation annual averages and standard deviations calculated from monthly average data collected at Charlottesville Station, VA00 (National Acid Deposition Program, 2002). The lower SM values are for the ten monitored sites downstream of treatment in St. Mary's River. ND = none detected. NM = not measured. All concentrations are given as μeq/L except *p*H (standard units) and Al_T (μg/L).

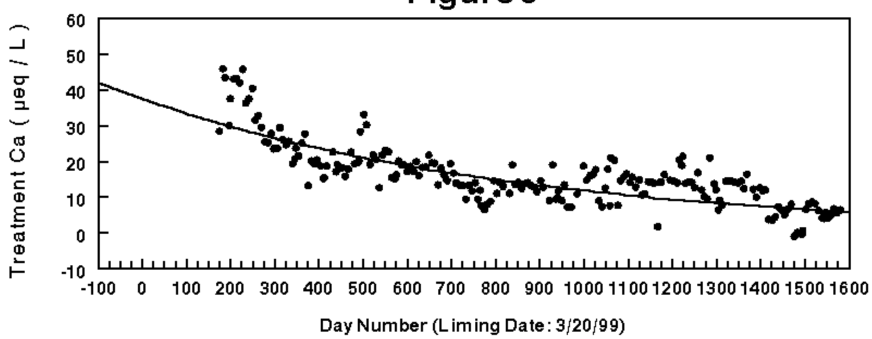
Hurricane Isabel passed through Virginia on September 18-19, 2003. From data collected for rain gauges near the Wilderness it was estimated that approximately 36 – 48 cm rainfall fell during this time frame in the St. Mary's watershed. The resultant flooding destroyed about 50% of the trail downstream of the falls, removed much of the riparian vegetation and considerably changed the channel. The stream flow gauge was also lost during this event. However the liming sites, which are located near the headwaters, were not as affected by the flooding as were the lower reaches of the stream system. Decreases in pH and other water quality parameters post Isabel were due to dilution from higher flows and the lack of limestone remaining after four years of treatment.

In the environmental assessment documentation for this project, re-liming was anticipated. The following statement was made: "One threshold that may trigger consideration of re-liming is when the pH, acid neutralizing capacity (ANC), and calcium values in April under normal flow are down to 30% of the first year water quality improvement." The Y2003 has been anything but a "normal" year, but the numbers were less than 30% of the first year treatment. In fact, assessment of the time for re-liming has been an integral and continuous part of water chemistry data collection since the beginning of the study. As an example of the liming data evaluation, the calcium decay graph is provided (Figure 8). This graph was used to assess limestone consumption and predict the need for another treatment as follows. Calcium increases in the stream have been shown to be due only to limestone dissolution. The graph is a plot of the difference between weekly calcium concentrations and the average background concentration versus the day number post liming. This graph fits an exponential decay plot, and gives the equation:

$$\mathbf{Y} = 35.58\ \mathbf{e}^{-(0.001146\mathbf{X})}$$

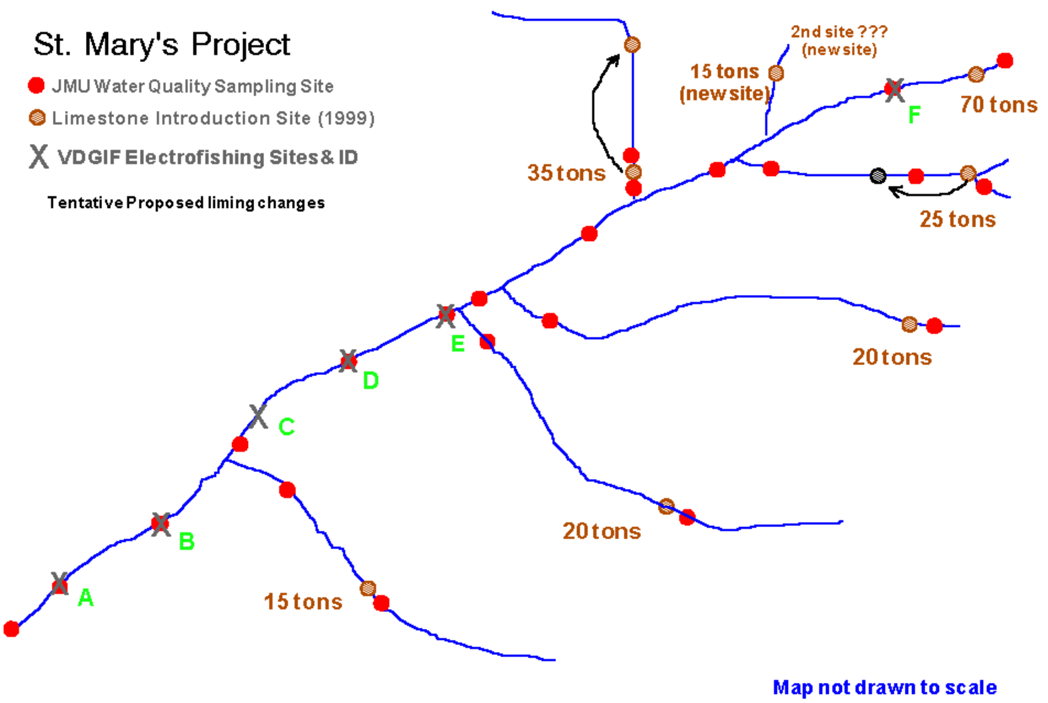
The first 150 days of post treatment data were discarded in generating this plot due to low flow conditions in the summer of Y1999. After the tropical storms increased the flow in September of that year, the limestone treatment was activated. From the exponential decay plot, a consumption half-life was calculated to be 1.65 years. Thus at this writing, it can be estimated that about 84% of the limestone has been consumed By using the first order kinetic decay model, >90% total consumption should be achieved by the end of Y2004. At 90% consumption, there will be too little limestone remaining in the system to provide adequate treatment, especially during episodic events.

Figure 8



An alternative way of estimating the consumption of limestone is by calculation from the increased concentration and flow discharge averages. The average flow for the project period has been 32586 L min^{-1}. The average calcium increase has been 18.9 :eq/L. Using the time elapsed since liming and conversion factors; these numbers indicate that about 70 tons of the limestone have been consumed to date, which is 50%. Although this is less than that predicted by the half life method, it doesn't take into account limestone "lost" in transport or washed up out of the stream channel in flood events or error in stream discharge. Given these considerations, this approach also indicates that the St. Mary's stream system should be re-limed by the end of 2004.

Although our estimates of limestone dose and treatment time used for the 1999 liming were close to the actual results, we suggest that the dose should be increased to 200 tons for any future liming. In addition, we recommend that the limestone be distributed in a similar manner with some minor changes in individual stream doses and locations of treatment as shown on the sketch below:



References:

1. D. M. Downey, C. R. French and M. Odom, “Low Cost Limestone Treatment of Acid Sensitive Trout Streams in the Appalachian Mountains of Virginia,” Water, Air and Soil Pollution, 77, 49-77, 1994.
2. M. Hudy, D. M. Downey and D. W. Bowman, “Successful Restoration of an Acidified Native Brook Trout Stream Through Mitigation with Limestone Sand,” North American Journal of Fisheries Management, 20, 453-466, 2000.
3. Brown, D. J. A. 1983. Effects of Calcium and Aluminum Concentrations on the Survival of Brown Trout *(Salmo trutta)* at Low *p*H. Bulletin of Environmental Contamination Toxicology. 30:582-587.

APPENDIX G

POPULATION TRENDS OF MANAGEMENT INDICATOR SPECIES ON THE GEORGE WASHINGTON AND JEFFERSON NATIONAL FORESTS

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INTRODUCTION

Under the National Forest Management Act (NFMA) the Forest Service is charged with providing for a diversity of plant and animal communities consistent with overall multiple-use objectives. Management Indicator Species (MIS) are a planning tool used to accomplish this requirement (36 CFR 219.19 of 1982 Regulations). They are selected during forest planning "because their population changes are believed to indicate the effects of management activities" (36 CFR 219.19(a)(1)) on important elements of plant and animal diversity. They and their habitat needs are used to set management objectives and minimum management requirements, to focus effects analysis, and to monitor effects of Forest Plan implementation. The George Washington and Jefferson Forest Plans are designed to provide habitat conditions needed to maintain viable populations of all MIS, along with other species that use similar habitats.

Wildlife, fish, and plant species are managed in cooperation with the Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Department of Conservation and Recreation – Division of Natural Heritage (VDCR-DNH), West Virginia Department of Natural Resources (WVDNR), and the Kentucky Department of Fish and Wildlife Resources (KDFWR). The respective states set policy for hunting and fishing regulations and law enforcement programs. The Forest Service manages fish and wildlife habitat conditions. This discussion focuses on the habitat conditions that support the wildlife populations that are managed by the States.

This report focuses on the effects of Forest Service management on the habitat conditions that support Management Indicator Species.

All cites to the 219 regulations are to the 1982 planning rule (September 30, 1982 (47 FR 43026)), and amended in part on June 24, 1983 (48 FR 29122), and on September 7, 1983 (48 FR 40383) in effect prior to November 9, 2000.

A. Identification of Management Indicator Species

1. George Washington Revised Plan Management Indicator Species

Table 1 shows the MIS for the George Washington National Forest (GWNF) (Plan pages 2-8 and 2-9; GWNF FEIS, Appendix J). Each MIS has a relationship with a certain type of preferred habitat. The habitat preferred by the species is discussed under each species discussion.

Table 1. George Washington National Forest MIS

Ecological Indicators	Threatened and Endangered Species	Demand Species
Cave Dwelling Bats	Indiana Bat	Black Bear*
Brown Headed Cowbird	Northern Flying Squirrel	Eastern Wild Turkey*
Worm-eating Warbler	Peregrine Falcon	White-tailed Deer*
Ovenbird*	Bald Eagle	
Cow Knob Salamander	James Spinymussel	
Tiger Salamander	Shale Barren Rockcress	
Common Flicker	Swamp Pink	
Pileated Woodpecker*	Northern Bulrush	
Native Brook (Wild) Trout*		
Sunfish Family (Centrarchid)		
Yellow Pine Community		
Old Growth Forest Types		

*Common MIS to the Revised Jefferson National Forest Plan

2. Jefferson Plan Management Indicator Species

Table 2 shows the MIS for the Revised Jefferson National Forest (JNF) (JNF Plan Table 2-3, page2-12). Six species are the same as those MIS identified for the GWNF. Each MIS has a relationship with a certain type of preferred habitat. The habitat preferred by the species is discussed under each species discussion.

Table 2. Jefferson National Forest MIS

Biological Community Indicators	Threatened and Endangered Species	Special Habitat Indicators	Demand Species
Hooded Warbler	Peaks of Otter Salamander	Pileated Woodpecker*	Black Bear*
Scarlet Tanager		Ovenbird*	Eastern Wild Turkey*
Pine Warbler		Chestnut-sided Warbler	White-tailed Deer*
Eastern Towhee		Acadian Flycatcher	
Wild Trout*			

*Common MIS to the Revised George Washington National Forest Plan

3. Trend in Forest Service Management Activities Associated with MIS Habitats

Table 3 through Table 8 displays historic trends in key management activities across the Forests.

Table 3. Transportation System Trend on the Jefferson National Forest

	Total Forest	Open Year-round Or Seasonally		Closed Year-round	
Year	(Miles)	(Miles)	(Percent of Total)	(Miles)	(Percent of Total)
1984	1,043	930	89	113	11
1986	1,132	990	87	142	13
1996	1,198	970	81	228	19
1999	1,212	1,017	84	195	16
2003	1,202	669	56	533	44
2004	1,203	669	56	534	44

Table 4. Transportation System Trend on the George Washington National Forest

	Total Forest	Open Year-round Or Seasonally		Closed Year-round	
Year	(Miles)	(Miles)	(Percent of Total)	(Miles)	(Percent of Total)
1984	1,330	1,170	88	160	12
1993	1,760	1,050	60	710	40
1999	1,700	1,012	60	688	40
2003	1,798	973	54	825	46
2004	1,798	973	54	825	46

Table 5. Management Activities Trend on George Washington National Forest Only

Year	Timber Harvest (Acres)	Timber Cut (Million Bd. Ft.)	Prescribed Burning (Acres)	Gypsy Moth Aerial Spraying (Acres)	Road Construction (Miles)
1976	N/A	26.6	N/A	0	N/A
1977	N/A	16.9	N/A	0	N/A
1978	N/A	18.2	N/A	0	N/A
1979	N/A	17.3	N/A	0	11
1980	N/A	25.7	N/A	0	16
1981	N/A	37.4	0	0	24
1982	N/A	29.8	115	0	N/A
1983	N/A	34.2	N/A	0	N/A
1984	N/A	36.4	117	0	N/A
1985	N/A	44.9	N/A	0	49.7
1986	N/A	32.2	189	0	36.6
1987	N/A	35.9	146	200	24.9
1988	3,966	40.5	40	8,395	24.6
1989	3,492	41.7	37	4,098	16.3
1990	3,265	33.6	1,092	8,121	2.3
1991	3,396	36.9	170	4,368	11.9
1992	4,082	38.2	970	2,198	7.8
1993	3,271	35.2	1,870	6,855	4.4
1994	2,993	37.2	795	4,735	3.8
1995	2,707	33.4	1,741	4,800	4.5
1996	1,964	27.4	1,339	2,015	6.17
1997	3,215	24.8	1,465	3,000 Research	2.7
1998	1,449	24.0	6,564	3,000 Research	0.7
1999	1,284	21.7	5,523	0	3.2
2000	1,254	17.9	4,172	0	0.1
2001	1,162	15.8	3,135	3,695	2.8
2002	881	14.7	2,322	2,183	0.3
2003	789	13.0	7,188	0	0.0
2004	780	17.4	7,103	0	1.0

N/A: Information Not Available
Volume Harvested utilizes 0.66 conversion factor from cubic feet for comparison with previous years.

Table 6. Management Activities Trend on Jefferson National Forest Only

Year	Timber Harvest (Acres)	Timber Cut (Million Bd. Ft.)	Prescribed Burning (Acres)	Gypsy Moth Aerial Spraying (Acres)	Road Construction (Miles)
1976	N/A	16.8	N/A	0	N/A
1977	N/A	8.8	N/A	0	N/A
1978	N/A	6.8	N/A	0	N/A
1979	N/A	14.5	N/A	0	20
1980	N/A	15.1	N/A	0	21
1981	N/A	17.3	N/A	0	26
1982	N/A	17.1	N/A	0	N/A
1983	N/A	21.8	N/A	0	N/A
1984	N/A	21.2	N/A	0	40.1
1985	N/A	28.0	N/A	0	33.1
1986	2,854	30.6	466	0	23.9
1987	2,498	25.7	983	0	18.1
1988	2,945	28.7	935	16,334	18.7
1989	1,850	21.2	1,232	13,818	7.2
1990	1,897	28.9	1,718	0	3.0
1991	2,699	32.5	1,411	0	8.5
1992	2,023	19.1	963	343	4.8
1993	2,397	25.4	1,245	0	7.7
1994	2,438	20.1	1,233	0	2.6
1995	1,715	22.3	1,353	0	1.3
1996	1,218	17.7	775	0	1.25
1997	1,682	9.4	2,323	0	1.0
1998	1,293	11.3	5,310	0	0.6
1999	942	14.8	2,462	0	0.0
2000	1,115	9.6	994	0	0.0
2001	795	7.3	2,715	643	0.0
2002	332	4.3	3,228	2,706	0.0
2003	226	3.8	3,207	0	0.2
2004	244	4.1	6,516	0	1.0

N/A: Information Not Available
Volume Harvested utilizes 0.66 conversion factor from cubic feet for comparison with previous years.

Table 7. Combined Management Activities Trend Across Both Forests

Year	Timber Harvest (Acres)	Timber Cut (Million Bd. Ft.)	Prescribed Burning (Acres)	Gypsy Moth Aerial Spraying (Acres)	Road Construction (Miles)
1976	N/A	43.4	N/A	0	N/A
1977	N/A	25.7	N/A	0	N/A
1978	N/A	25.0	N/A	0	N/A
1979	N/A	31.8	N/A	0	31
1980	N/A	40.8	N/A	0	37
1981	N/A	54.7	N/A	0	40
1982	N/A	46.9	N/A	0	N/A
1983	N/A	56.0	N/A	0	N/A
1984	N/A	57.6	N/A	0	N/A
1985	N/A	72.9	N/A	0	82.8
1986	N/A	62.8	655	0	60.5
1987	N/A	61.6	1,129	200	43.0
1988	6,911	69.2	975	24,729	43.3
1989	5,342	62.9	1,269	17,916	23.5
1990	5,162	62.5	2,810	8,121	5.3
1991	6,095	69.4	1,581	4,368	20.4
1992	6,105	57.3	1,933	2,541	12.6
1993	5,668	60.6	3,115	6,855	12.1
1994	5,431	57.3	2,028	4,735	6.4
1995	4,422	55.7	3,094	4,800	5.8
1996	3,182	45.1	2,114	2,015	7.42
1997	4,897	34.2	3,788	3,000 Research	3.7
1998	2,742	35.3	11,874	3,000 Research	1.3
1999	2,226	36.5	7,985	0	3.2
2000	2,369	27.5	5,136	0	0.1
2001	1,957	23.1	5850	4,338	2.8
2002	1,213	19.0	5550	4,889	0.3
2003	1,015	16.9	10,395	0	0.2
2004	1,024	21.5	13,619	0	2.0

N/A: Information Not Available
Volume Harvested utilizes 0.66 conversion factor from cubic feet for comparison with previous years.

B. Forested Age Class Distribution Trend

Management Indicator Species are monitored on the George Washington and Jefferson National Forests (GWJNF or Forests) through the use of both population data and habitat data. An evaluation of the trends in population data for each MIS is presented later in this document. Habitat condition is one of the primary factors influencing population levels for these species; and Table 8 assesses the trends in key habitat parameters.

Table 8. GWJNF Age Class Distribution for All Forested Land 1989 and 2005

(Changes in last 16 years)

	Jefferson National Forest				George Washington National Forest				Combined GWJNF's			
Age	1989	%	2005	%	1989	%	2005	%	1989	%	2005	%
0-10	26269	3.9	4132	0.6	44367	4.3	12094	1.2	70636	4.1	16226	0.9
11-20	25682	3.8	16749	2.4	32524	3.1	25483	2.4	58206	3.4	42232	2.4
21-30	13122	1.9	15489	2.2	22987	2.2	26472	2.5	36109	2.1	41961	2.4
31-40	6967	1.0	25544	3.6	3309	0.3	40647	3.9	10276	0.6	66191	3.8
41-50	29840	4.4	9775	1.4	5490	0.5	6432	0.6	35330	2.1	16007	0.9
51-60	121277	17.9	13138	1.8	31822	3.1	4063	0.4	153099	8.9	17201	1.0
61-70	173584	25.6	59183	8.3	101660	9.8	13186	1.3	275244	16.1	72369	4.1
71-80	115851	17.1	161580	22.6	214257	20.7	55668	5.3	330108	19.3	217248	12.4
81-90	55392	8.3	165051	23.2	218002	21.1	159462	15.3	273394	16.0	324513	18.5
91-100	29911	4.4	94451	13.3	115456	11.2	230465	22.1	145367	8.5	324916	18.5
101-110	43927	6.5	46208	6.5	79291	7.7	184691	17.7	123218	7.2	230899	13.2
111-120	17835	2.6	33925	4.8	63294	6.1	80273	7.7	81129	4.7	114198	6.5
121-130	9499	1.4	38807	5.5	33702	3.3	74343	7.1	43201	2.5	113150	6.5
131-140	4860	0.7	16366	2.3	26012	2.5	48793	4.7	30872	1.8	65159	3.7
141-150+	3149	0.5	10308	1.5	42546	4.1	80927	7.8	45695	2.7	91235	5.2
TOTAL	677165	100	710506	100	1034719	100	1042999	100	1711884	100	1753505	100

(Source: Continuous Inventory of Stand Conditions (CISC) for GWJNF dataset of 12-1-89 and FSVeg Stands Attribute Table of 6-30-05)

C. Monitoring and Evaluation of Management Indicator Species

Management Indicator Species are monitored on the Forests through use of both population and habitat data. Habitat condition is one of the primary factors influencing population levels for these species; therefore, an assessment of trends in key habitat parameters also is important. In this section, population and habitat data for each MIS is discussed, with the Forest' data combined for MIS in common. Important differences in population trends or numbers between the Forests are highlighted where they occur.

Ecological, Biological Community, or Special Habitat Indicators

State wildlife agencies do not monitor populations of most ecological indicators. For avian species, population trend data available from the Breeding Bird Survey (BBS) Program (administered by the U.S. Geological Survey (USGS) Patuxent Wildlife Research Center) and from the GWJNF's avian point count monitoring program, part of the Southern Region's avian point count monitoring program. Analysis of the BBS data has been conducted for the years 1966 through 2004. The avian point count monitoring program has been active since 1994 on the GWNF and since 1997 on the JNF. In 2004 804 point counts were completed across the GWJNF. When reviewing and comparing the BBS data and the avian point count data, an important distinction is that BBS data is presented as the average number of birds seen or heard per route, while the GWJNF point count data is presented as average number of birds' seen/heard per point per year. In addition, BBS trend data is available at the state level and regional level, while the avian point count data is specific to the GWJNF's.

1. Cave Dwelling Bats

Reason For Selection: Cave dwelling bats are designated as an MIS in the GWNF Revised Plan of 1993. Cave dwelling bats were selected because they are dependent on relatively undisturbed caves, a habitat element important for maintaining the wide array of animal diversity on the Forest. Populations of cave dwelling bats are believed to reflect effectiveness of measures to protect these habitats (i.e. caves) from disturbance (primarily human-induced). The Indiana bat was individually selected because it is a federally listed endangered species and there is direct interest in its population levels based on the fact that it is generally a woodland and forest dwelling bat during the non-hibernation months that may be affected in during some management activities.

Bats use the relatively constant temperature and humidity of caves to meet specific seasonal habitat requirements. Depending on the bat species, caves may be used as hibernacula, roosts, and/or maternity sites during some or all seasons of the year. All bats monitored use caves for hibernating, although some may also be found in man-made structures such as mines, culverts, barns, outbuildings and house attics.

Bat species known to occur in caves on or near the GWNF include: big brown bat, northern myotis (formerly Keen's myotis), eastern small-footed bat, little brown bat, eastern pipistrelle, Virginia big-eared bat, and Indiana bat. Some species such as pipistrelles, gray bats, and Virginia big-eared bats use caves year round. Others, such as the big brown bat and Indiana bat use caves only from late fall to early spring (while in hibernation), and then spend summer days under the bark of trees or in buildings, foraging at night.

Bats are especially sensitive to disturbance during winter hibernation. For this reason, protection of caves and the area surrounding cave entrances is extremely important. Less is known about bat life history outside caves during the spring, summer, and fall months. Future research and study findings on feeding and migration habits of bats will likely further refine management techniques and procedures. Until then, protection of caves and the immediate above-ground area around cave entrances is essential.

For purposes of this analysis, the fundamental relationship between bats and their winter habitat is that the cave environment (temperature, humidity, darkness) must remain stable and free from human disturbance. The cave's environment is most likely to be influenced by management activities associated with allowing public use (spelunking) of caves during winter and by surface disturbances near the cave that could change the relatively constant environmental conditions within the cave. Such surface disturbances include activities that may drastically alter vegetative cover and water flow such as road construction, mining, or indiscriminant timber harvesting.

For spring, summer, and fall, another key relationship between bats and their habitat is the need for an available food source (GWNF FEIS, page J-10). Available food sources (insects, consisting primarily of beetles and moths) during the spring, summer, and fall are most likely to be negatively influenced by management activities associated with aerial pesticide applications to treat gypsy moth defoliations.

<u>b. Plan Habitat Objectives Related to MIS:</u> It is estimated the minimum population for this guild (as a group) is 40% of the 1982 - 1990 forest average (as determined from sampling the two most populated bat caves in Bath and Augusta Counties, Va.) (GWNF FEIS, page J-14). Thus, the Plan identifies a minimum population of 390 bats (GWNF FEIS, page J-14). Specific to the Indiana bat, habitat objectives are presented in a Forest Plan amendment dated March 12, 1998. While these objectives were adopted for conservation and recovery of the Indiana bat on the Forest as a result of formal consultation with the U.S. Fish and Wildlife Service (USFWS), they benefit all other cave dwelling bats as well. The objectives are presented as standards in the Plan Amendment and they provide for: cave gating to prevent human disturbance, cave and buffer area land acquisition (on a willing seller basis), eliminating or limiting types of disturbances near caves/roost sites/maternity sites, timber activities to leave all shagbark hickories and a minimum of six snag or cavity trees per acre >9" dbh, at least 60% of all forest types to be maintained over 70 years of age and a minimum of 40% acreage of CISC Forest Types #53 (white oak-red oak-hickory) and #56 (yellow poplar-white oak-red oak) to be maintained at an age >80 years old, encouraging prescribed burning to provide for open understory foraging corridors, and creating drinking water sources for bats in areas greater than 0.6 miles from open water (Indiana bat EA, page 1-83 and DN page 1-6).

<u>c. Description of Monitoring Method:</u> For all cave dwelling bats, population counts by species are conducted in hibernacula during January &/or February every other year (odd # years in VA, some even # years in WV). These surveys are conducted by and in cooperation with the USFWS, VDGIF, and West Virginia Department of Natural Resources. Based on the Biological Opinion received from the USFWS as a result of formal consultation in 1997 and subsequently included in the 1998 Forest Plan Amendment, three monitoring items are required for the Indiana bat: 1) the total number of acres of potential bat habitat removed or disturbed as the result of management activities (excluding prescribed burn acreage) (Acres disturbed cannot exceed 4,500 annually or 22,500 over a five year period), 2) the amount of forest type acreage over certain age classes across the Forest (minimum of 60% all forest types over 70 years of age and a minimum of 40% forest type #53 and # 56 greater than 80 years old), and 3) the number of Indiana bats "taken" (i.e. killed) shall not be more than 10 annually.

<u>d. Habitat Trend for MIS:</u> The number of caves on the GWNF is finite. In Virginia there are over 3,200 caves with more than 97% on private land according to the Cave & Karst Program of VDCR-DNH. Currently there are 41 caves known to occur on the JNF and 42 on the GWNF (83 total). Not all caves on NFS land are suitable for bats and fewer still are suitable for certain bat species. The Forest Service is looking for opportunities to acquire or assist with management of caves adjacent to NFS land. Work is still underway to acquire an important bat hibernacula cave entrance and surrounding acreage in Wise County, Virginia. In 1999 this cave was gated with the assistance of the USFWS, VDGIF, The Nature Conservancy, and Bat Conservation International. In 2000 Mountain Grove Saltpeter Cave in Bath County was gated. Therefore, while the trend in cave numbers on the Forest is stable, that number may

increase through acquisition of known caves and discovery of new caves. The trend for habitat conditions surrounding cave entrances is that of an aging ("maturing") late successional forest. This trend is due to the fact that forested acreage surrounding cave entrances is protected from forest management disturbance. At the same time food sources (i.e. insects) are experiencing population fluctuations and shifts in species diversity associated with an aging forest and limited management activities. These trends in forest age and management activities are displayed in Table 5 thru Table 8.

e. Population Trend for MIS: Table 9 through Table 15 displays trends in cave dwelling bats on the GWNF by bat species and year monitored. These numbers are the result of winter surveys conducted in four caves that occur on (Mountain Grove Saltpeter Cave and Starr Chapel Cave) or near (Clark's Cave and Hupman's Saltpeter Cave) the GWNF. Personnel of the Non-game & Endangered Species Section of the VDGIF, in cooperation with the Forest Service, conduct these surveys. These surveys are not conducted every year in order to minimize disturbance to the bats. Most caves were surveyed in January or February of 2005 with the next survey scheduled for 2007.

Table 9. Bat Population Trend in Clark's Cave

Bat Species	1990	1992	1994	1995	1999	2001	2003	2005
Big Brown	3	10	1	0	4	12	1	6
Little Brown	202	742	255	200	309	463	541	612
Northern Myotis	0	1	0	0	0	0	0	0
Indiana Bat	22	0	20	0	1	47	47	50
Eastern Pipistrelle	27	210	18	4	36	216	98	196
TOTAL	254	963	294	204	350	738	687	864

Table 10. Bat Population Trend in Hupman's Saltpetre Cave

Bat Species	1990	1991	1992	1994	1996	2001	2003	2005
Big Brown Bat	128	174	58	34	29	18	10	34
Eastern Small Footed Myotis	56	55	64	27	22	44	37	32
Little Brown	1360	3082	3342	4571	2750	2611	3564	3168
Northern Myotis	2	1	0	0	0	0	2	0
Indiana Bat	26	0	220	300	225	5	4	0
Eastern Pipistrelle	149	319	272	172	217	240	128	101
TOTAL	1721	3631	3956	5104	3243	2918	3745	3335

The drop in Indiana bats at Hupman's Cave could be because the bats were hibernating in a different section of the cave from where they had seen them in the past *(2003 and 2005 Personal Communication between Steve Croy and Rick Reynolds)*. The cave is complex with many levels and passages, not all of which are accessible. The bats may have moved due to some disturbance earlier in the winter or a difference in internal cave temperatures due to a colder/warmer fall/winter. While caves are generally the most static of environments, airflow and temperatures can change as a result of surface openings or internal passages forming or closing. This would result in temperature/humidity changes that would force bats to seek optimal hibernating conditions elsewhere in the cave. VDGIF was not concerned about large drop from previous counts, especially with other bat species in the cave showing similar trends to previous years. If the counts continue to be equally low then, as a start, additional sections of the cave will need to be explored to see where the bats are or whether they may have moved to an entirely different cave.

Table 11. Bat Population Trend in Mountain Grove Saltpetre Cave

Bat Species	1990	1992	1994	1998	2001	2003	2005
Big Brown Bat	9	27	22	29	24	*	*
Eastern Small Footed Myotis	1	5	5	2	8	*	*
Little Brown	10	3	19	36	0	*	*
Indiana Bat	5	23	1	2	2	*	*
Eastern Pipistrelle	27	34	81	51	52	*	*
TOTAL	52	92	128	120	86	*	*

* = not surveyed due to snow cover and inaccessibility

Table 12. Bat Population Trend in Starr Chapel Cave

Bat Species	1990	1992	1994	1995	1997	1999	2001	2003	2005
Big Brown Bat	4	18	16	15	9	10	13	9	9
Eastern Small Footed Myotis	3	11	7	8	12	21	22	13	12
Little Brown	718	1292	1407	1393	1552	1689	1872	1727	1695
Northern Myotis	0	1	3	4	3	13	28	13	9
Indiana Bat	37	38	42	60	54	55	47	67	57
Eastern Pipistrelle	34	326	146	95	73	128	264	111	115
TOTAL	796	1686	1621	1575	1703	1916	2246	1940	1897

Based on individual bat counts in caves, in year 2005, bat populations are estimated at 6,096 individuals in three caves, including 107 Indiana bats (533 Indiana bats when Jefferson NF caves are included). Results of these surveys suggest a continuing overall stable to increasing trend for cave dwelling bat populations on the GWNF. Fluctuations can be seen in year-to-year numbers for a given species and for the total cave count. These are due to one or several factors such as differences in fall and winter weather from year-to-year causing bats to move to new cave locations or change their positions within a cave to a location on the cave wall or ceiling where they cannot be easily counted or even missed entirely. Other causes for differences between years include normal population fluctuations, observer bias, differences in cave survey techniques, and cave inaccessibility due to deep snow or ice preventing access during the survey period.

The endangered Indiana bat has received much attention over the past several years. The Forest completed formal consultation with the USFWS and was issued a Biological Opinion for the Indiana bat in September 1997. The GWNF Forest Plan was amended in March 1998 and the Jefferson Plan was Revised in January 2004 to include new prescriptions, standards and guidelines as conservation measures specifically for the Indiana bat. Table 13 displays the results of surveys for the Indiana bat.

The trend for the Indiana bat from 1959 to 1998 in 9 caves shows a decline from the 1960's through the 1980's and a stable to slow increase during the 1990's to present for western Virginia.

Table 13. Indiana Bat Populations Within Hibernacula On or Near the GWJNF

(Caves within Primary and Secondary Cave Protection Areas as noted in USFWS BO)
(Number of Bats Counted)

Winter Survey Year	Starr Chapel Cave	Mt. Grove Cave	Clarks Cave	Hupman's Saltpetre Cave	Shires Cave	Kelly Cave	Rocky Hollow Cave	Newberry-Bane Cave	Patton Cave (WV)
1960	600								
1962	600								
1970							1,200		
1972	35								
1974	30								
1978	2						750		
1979	1								
1980	0								
1981		0							3
1982	16	0							
1983	29								
1984							647		
1985	30						270		
1986		0	21			1		90	
1987	5		52						
1988			31	0	13				0
1989	36				13				
1990	37	5	22	26	3			120	
1991	23			0			202		
1992	38	23	0	220				100	
1993	31	0			20	18	241	107	
1994	42	1	20	300					
1995	60							110	
1996			0	225	27				
1997	54					10*			
1998		2							17
1999	55		1		23	10		120	
2000								235	8
2001		2		5	36	3	166		
2002									10
2003	67		47	4	19	9	325	189	
2004									8
2005	57		50	0	33	0	156	237	

Blank cells = no survey done that winter. *Incomplete survey of Kelly Cave was done in 1997 and 2005 number of "0" likely due to gate vandalism and subsequent human disturbance.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Populations of cave dwelling bats reflect more than management of caves and NFS land since they forage widely and some species migrate. For cave dwelling bats the trend in population numbers (stable to slowly increasing) reflect habitat conditions (an aging forest and cave stability) subject to management activities designed to maintain and/or enhance bat habitat (cave gating and foraging habitat enhancement through prescribed burning and modified timber harvest techniques). In order to prevent human disturbance during the hibernation period those caves on NFS land that have bat populations have been gated and locked from September 1 to May 31 (at a minimum). Management activities are designed to enhance habitat for bats near hibernacula. Rocky Hollow Cave was gated in 1999 and Mountain Grove Saltpetre in 2000 to prevent unauthorized winter use. All caves on NFS land used by endangered bat species have now been gated to prevent human disturbance, however there continues to be problems with cave gate vandalism and unauthorized entrance. Gates have been repaired and law enforcement efforts are increasing in order to try and eliminate this population threat. In 2004 no aerial pesticide applications occurred near any cave to treat gypsy moth defoliations, so there was no effect on food sources (i.e. insects) for the bat.

For the Indiana bat, since the Biological Opinion of 1997 and the Plan Amendment of 1998, the amount of acreage removed or disturbed has not exceeded 4,500 in any year nor have the percent of forest types by age been below the required level. In all cases the totals and percents are far below the allowed amounts. Table 14 displays the trend in disturbance to vegetation and Table 15 displays the trend towards meeting Plan direction.

Table 14. Trend in "Take" as Expressed by Disturbance to Vegetation in Indiana Bat Habitat

By Forest Management Activity

(Acres)

Year (fiscal)	Timber Harvest GWNF	Timber Harvest JNF	Total Timber Harvested	Road Const.	Rx Burn Line Const**.	Rx Burn Acreage (JNF only)	Recreation Develop.	Wildlife Opening Develop.	Special Use Develop.	Total "Take" Acreage for Year	Allowed Acreage of "Take" per BO	"Take" Acres Not Used but Allowed
1998*	1,449	1,293	2,742	3.15	15.8	N/A	40	7.5	5.8	2,814.3	4,500	1,685.7
1999*	1,284	942	2,226	3.2	10.2	N/A	23	9.0	15.5	2,286.9	4,500	2,213.1
2000*	1,254	1,115	2,369	0.1	12.7	N/A	11	14.4	12.3	2,419.5	4,500	2,080.5
2001*	1,162	795	1,957	2.8	13.8	N/A	15	12.5	7.1	2,008.2	4,500	2,491.8
2002*	881	332	1,213	0.3	15.1	N/A	10.5	8.0	4.2	1,251.1	4,500	3,248.9
2003*	789	226	1,015	0.2	12.3	N/A	6.2	10.1	8.3	1,052.1	4,500	3,447.9
2004 (GW)	780	N/A	780	1.5	3.4	N/A	0.3	4.4	4.6	794.2	4,500	3,705.8
2004 (JNF)	N/A	244	244	1.5	3.8	6,516	0.4	2.5	2.2	6,770.4	16,800	10,029.6

* = acres for both GW & JNF unless column Title indicates otherwise.

** = Correction to BO by USFWS letter of February 11, 1999, prescribed burning is a conservation recommendation in BO to improve bat habitat, only tree cutting for control-line construction is considered to be an negative disturbance factor.

From 1998 to 2003 acreages are for both GW & JNF since both Forests were under the 1997 BO from the USFWS. Starting in January 2004 the JNF had a new BO issued by the USFWS as part of the Forest Plan Revision. The 1997 BO for the GW remains in effect. Biggest change was that the 2004 BO for the JNF includes acres that are prescribed burned whereas the 1997 BO only included those acres disturbed as a result of control line construction. However, in both BO's the USFWS acknowledges that vegetation changes resulting from prescribed burning (open understory & overstory with increased number of snags) is beneficial for Indiana bats and that long-term gains in habitat quality offset short-term negative effects such as smoke, loss of some snags and trees with exfoliating bark, and possible injury to bats should they be in the area.

Table 15. Trend in Indiana Bat Habitat Meeting Conditions Required by USFWS Biological Opinion

Year of CISC/GIS Data	CISC/GIS Total Forest Acres	> 60% of All Forest Types > 70 Years Old (Acres/Percent)	Total 53/56 Forest Acres	>40% of 53/56 Forest Types > 80 Years Old (Acres/Percent)
3/12/98*	1,707,112	1,300,681 / 76.2	701,925	352,250 / 50.2
4/1/99	1,743,546	1,358,995 / 77.9	720,382	388,094 / 53.9
3/16/00	1,742,489	1,369,028 / 78.6	720,777	397,646 / 55.2
5/31/02	1,747,991	1,425,660 / 81.6	724,438	442,888 / 61.1
3/29/04	1,721,795**	1,440,357 / 83.6	716,235	459,077 / 64.1
6/30/05	1,753,505	1,481,318 / 84.4	731,079	479,646 / 65.6

* Indiana Bat EA dated 3/12/98, page 32.
** 22,769 acres not included in GIS age class report

The number of Indiana bats "taken" (i.e. killed) has been 0 each year from 1998 thru 2004 since no dead or injured bats have been seen during or following any management activity.

Bat populations reflect more than cave management, or even NFS land management, as some species migrate widely. Cave protection measures appear adequate to protect this portion of the species life history and therefore National Forest management is contributing, to the extent possible, to maintain species viability. While there is uncertainty about some bat population levels range-wide in North America, the bat populations on the Forest are expected to remain relatively stable or increase in the near future.

The GWNF is within the east-central portion of the range of the Indiana bat in eastern North America. While its winter distribution is limited to a few select caves, the summer distribution is widespread and potentially covers the entire Forest. This species is inherently rare and not well distributed across the Forest at some times of the year, yet potentially Forest-wide at others. Current management provides for ecological habitat conditions capable to maintain bat populations, when concentrated at wintering caves, as well as when dispersed during summer months. Overall, ecological conditions on the Forest are sufficient to contribute to species viability (persistence over time). Rangewide population numbers of the Indiana bat shows a slow and hopefully steady increase and the Forest Service is contributing to its viability and following the recovery plan from the USFWS.

g. Recommendation: No change in current Plan direction for bats is recommended at this time. Continue working with state, federal, and private cooperators plus monitoring and maintain cave gates along with seasonal closures and increased law enforcement to the fullest extent possible.

2. Cow Knob Salamander

a. Reason For Selection: The Cow Knob salamander was selected because of viability concerns stemming from its naturally limited distribution. It is a Forest Service sensitive species and is only known to occur on Shenandoah Mountain along the Virginia - West Virginia state line. Nearly all of the global range of this salamander is located on land administered by the U.S. Forest Service. As with other members of the genus *Plethodon,* they are terrestrial, breathe through their skin, and do not require water to breed. They prefer late successional forest habitat with a loose rocky substrate. This species is a slow recolonizer of disturbed ground and is confined to older age class (late successional) forests (Terwilliger, 1991).

For purposes of this evaluation, the fundamental relationship between the Cow Knob salamander and its habitat is that it prefers late successional habitat on Shenandoah Mountain, such as that associated with old growth forests. The amount and distribution of old growth/late successional forests on Shenandoah Mountain are most likely to be influenced by management activities associated with timber harvesting techniques conducted to regenerate stands. The amount and distribution is not affected by prescribed burning since this management activity is carried out under specific parameters and techniques that burn only the understory in hardwoods while occasionally burning the overstory in pine dominated stands.

b. Plan Habitat Objectives Related to MIS: The Revised Forest Plan for the GWNF recognized the significance of the Cow Knob salamander by establishing the Shenandoah Crest Special Interest Area - Biologic. This 43,000-acre area on the crest of Shenandoah Mountain above 3,000 ft. elevation encompasses most of the known range of the salamander. Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GWNF Plan, page 3-6). Thus, the Plan provides for those ecological conditions to maintain the salamander considering its limited distribution and abundance. By providing this habitat, the minimum population objective is estimated at 10 core populations throughout its range consisting of a minimum of 1,000 individuals per population (GWNF FEIS, Appendix J, page J-14).

c. Description of Monitoring Method: The emphasis has been on locating new populations and better defining habitat needs (see below). Since 1988 the Forest has supported and participated in studies to better define the distribution, abundance, habitat needs, and effects of management activities on the Cow Knob salamander (Buhlmann and Mitchell 1988, Buhlmann et al. 1998, Mitchell 1996, Tucker, Pauley, and Mitchell 1997). In 1992 a prelisting conservation plan was developed for this species with the cooperation of the USFWS, West Virginia Department of Natural Resources, Virginia Division of Natural Heritage, Virginia Department of Game and Inland Fisheries. Based on this conservation plan, a Conservation Agreement was signed by the USFWS and the U.S. Forest Service in 1994. Under the Conservation Agreement the Cow Knob salamander would not need to be listed as endangered or threatened under the Endangered Species Act provided the U.S. Forest Service follows certain management guidelines. The main guideline is allowing old growth conditions to develop and continue within the majority of the salamander's range on NFS land.

d. Habitat Trend for MIS: Since the Shenandoah Mountain Special Interest Area - Biologic is managed to minimize disturbance, the habitat trend is toward more suitable conditions (i.e. late successional, old-growth forest) for the Cow Knob salamander.

e. Population Trend for MIS: During 1995 and 1996 a total of 49 sites with habitat characteristics indicating a possibility of the presence of Cow Knob salamanders on Shenandoah Mountain were surveyed and Cow Knob salamanders were found at 22 of those sites (Tucker, Pauley, and Mitchell 1997). In addition to distribution and abundance information, this study also collected information such as leaf litter moisture, cover object preference, reproductive biology, and prey items. Due to concern about the effects of the loss of hemlock stands because of the hemlock wooly adelgid, 22 hemlock stands were surveyed in 1996. Cow Knob salamanders were found at 6 of the sites, all under rocks, at elevations ranging from 2,950 ft. to 3,620 ft. The results of this study indicate that the impact of the loss of hemlock on the salamander will probably be slight because Cow Knob salamanders occur in greater abundance in hardwood (oak dominated) sites. **Error! Reference source not found.** shows the Cow Knob salamander's trends.

Table 16. Trend in Cow Knob Salamanders Captured and Recaptured On Shenandoah Mountain

Year	Location	Number Captured	Number Recaptured
1987 & 1988	North Mountain	0	0
1987 to 1988	Various	19 found on 3 of 7 sites	0
1988	Briery Branch Gap to High Knob to Hall Spring	Occurrence documented, but not enumerated	0
1988	Little Bald Knob	16	3 from 1987
1996	Various	9 found on 6 of 22 sites	0
2003	VA and WV monitoring sites	311	91

In 2002 William Flint, a graduate student at James Madison University, began studying the Cow Knob salamander for his Master's thesis with financial support from the Forests (Flint, 2004). His work included three parts; 1) effects of roads on population abundance and condition, 2) population monitoring, and 3) range and distribution. This research is contained in his thesis "Ecology and Conservation of the Cow Knob salamander, *Plethodon punctatus*" and is summarized here.

Effects Of Roads On Population Abundance And Condition

Salamander abundance increased as distance from the road increased. However, in Flint's study the numbers of salamanders increased more rapidly upslope from the road as opposed to downslope, in spite of the habitat appearing better downslope. The reason for this was unclear, but pollutants, runoff, and silt are discussed as possible causes.

Population Monitoring

Long-term monitoring stations were established at two sites on the George Washington National Forest, one in Virginia and one in West Virginia. These sites were surveyed during the entire active season of the Cow Knob salamander (April – October). At the West Virginia site a total of 223 individuals were counted. At the Virginia site 88 individuals were counted. Flint also measured the condition of the animals by comparing snout-vent lengths and body mass. He found the animals in West Virginia to be in better condition than those in Virginia. Flint accounts for the difference between the sites being due to higher rainfall and better habitat conditions at the West Virginia site.

Range And Distribution Study

Flint compiled all known distribution data for the Cow Knob salamander and attempted to determine its exact distribution. He created a map using the known data and located potential areas for undiscovered populations, potentially inaccurate records, and potential range boundaries. Field surveys extended the range of the Cow Knob salamander 6.5 kilometers south along the ridge of Shenandoah Mountain and suggest that Hardscrabble Knob represents the southernmost limit of the range.

The majority of the Cow Knob salamander's habitat is in the Shenandoah Crest Special Interest Area-Biologic and is being managed to allow old-growth forest conditions to develop. Over time the habitat is improving for this species as the forest matures. Analysis results suggest an overall stable trend for Cow Knob salamander populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Management in the Shenandoah Mountain Special Interest Area - Biologic consists generally of dispersed recreation and prescribed burning. The habitat trend is one of an aging forest that benefits Cow Knob salamanders and should lead to a stable or increasing population. Because habitat conditions are stable to improving, the Cow Knob salamander will remain viable on the Forest; however, due to the naturally limited range of this species it will remain vulnerable to unexpected events possibly causing population decline.

Almost the entire range of the Cow Knob salamander is on the GWNF. It's inherently rare and thus not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the salamander population considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to provide for species viability (persistence over time).

g. Recommendation: No change in Plan direction for Cow Knob salamander is recommended. Continue monitoring.

3. Eastern Tiger Salamander

Eastern Tiger Salamander

a. Reason For Selection: The tiger salamander (*Ambystoma tigrinum tigrinum*) was selected because it is a locally rare species, whose limited range on the Forest is cause for concern about local viability. The Maple Flats area, a sinkhole pond complex on the GWNF, is the only known location of the tiger salamander on the Forest. This population is naturally disjunct from its global range and contains a self-sustaining salamander population. The GWNF Plan designates the Maple Flats area as a Special Biological Area. The tiger salamander's habitat (seasonally dry, fishless natural ponds, and surrounding forest) may be influenced by management activities.

For purposes of this analysis, the fundamental relationship between the tiger salamander and its habitat is that it requires sinkhole ponds and associated uplands. The amount and distribution of sinkhole ponds in this Special Biological Area are most likely to be influenced by beaver activity, or off site management that would influence the hydrology of the area. Other factors that could affect the water quality, terrestrial habitat, or biotic interactions include acid deposition, illegal fish stocking, illegal ATV use, maintenance of wildlife openings, timber management, and control activities associated with insects and disease.

b. Plan Habitat Objectives Related to MIS: The habitat for the eastern tiger salamander is protected within the Maple Flats Special Biological Area. Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GWNF Plan, p. 3-6). This would include minimizing disturbance of the natural community and hydrologic regimes.

c. Description of Monitoring Method: The Forest Plan indicates the monitoring techniques for the tiger salamander are mark-recapture and plot surveys measured every two years. The Forest has been intensively studying the tiger salamander populations at Maple Flats in cooperation with researchers at the University of Virginia, Dr. Joe Mitchell, and others (Buhlmann 1987, 1997, Buhlmann and Mitchell 1998, Mitchell 1996, 1997, 1998, 2000). In 1996 we began using passive integrated transponder (PIT) tags as a technique to identify individual salamanders. PIT tags are tiny electronic devices that are inserted subcutaneously and contain a unique identifying number that is read using a scanner.

d. Habitat Trend for MIS: Monitoring trips in 1997 revealed that fish (bluegill and bass) had been introduced into one sinkhole pond raising the concern that these fish would eliminate tiger salamanders from that location. The water level had been high for several years enabling the fish to survive and grow. In late 1997 and early 1998 the water level dropped in that pond and all fish apparently died. Adult tiger salamanders and egg masses were observed in this pond in 1999. Monitoring in 2000 showed that, for the whole Maple Flats Sinkhole Complex, the habitat is stable; however, there is a continuing problem with illegal ATV use in the area. In addition, water quality trends for the mountains of Virginia show an increase in acidity related to atmospheric acid deposition. At low pH levels amphibians cannot reproduce.

e. Population Trend for MIS: Between 1996 and 1998 112 salamanders were tagged and released. In 1999, 69 were tagged. The increase in individuals tagged was due to increased time spent in the field and improved methods of capturing tiger salamanders. Ten salamanders captured in 1999 were recaptures from previous years. One salamander had been tagged in 1996 and recaptured in 1997 in the same pond. In 1999, this salamander was captured twice in a different pond. Data collected are beginning to provide information on how long tiger salamanders live and how mobile they are. In addition to adult tiger salamanders being tagged, they are measured for length and mass, and sex is determined. Egg masses are counted, and larval salamanders are captured for mass and length measurements. In 1999 drift fences were installed at three ponds as part of a University of Virginia cooperative study. During the winter of 1999-2000 very accurate counts of the tiger salamanders entering and leaving the three ponds were possible. Water chemistry of potential tiger salamander ponds has been sampled to develop a baseline from which to determine whether the ponds are undergoing acidification (Downey, Douglas, and Wirtz 1996). In 2001 the Virginia Herpetological Society conducted its spring survey in the Love's Run Pond Complex 5 miles west of Maple Flats. At one pond five larval tiger salamanders were dipnetted and released. This was the first time tiger salamanders were proven to occur outside the Maple Flats Sinkhole Pond Complex in the Big Levels area. In 2003 the pond was revisited, but it was dry.

Table 17shows the trends in numbers of salamanders. Data from the above surveys for 2000 are still being analyzed, and initial figures show that 1458 tiger salamanders were caught at the three ponds with drift fences. From 2001 to 2003 the numbers of salamanders caught at the drift-fenced ponds varied: 405 in 2001, 138 in 2002, and 1053 in 2003. This variation is most likely the result of the severe drought in 2001 and 2002 (Church 2003). In addition, field surveys in the winter of 1999-2000 discovered tiger salamander egg masses and larvae at two previously unknown sites in the Maple Flats area (Church and Huber, unpublished data 2000). The more intensive survey methodology has increased the number of animals observed, and the number of known locations. Analysis results suggest a stable to increasing trend for tiger salamander populations on the GWNF.

Table 17. Trend in Tiger Salamanders Captured and Recaptured at Big Levels

Year	Number Captured	Number Recaptured
1996	45	0
1997	53	3
1998	14	0
1999	69	10
2000	1458 (336 adult, 1122 metamorph)	Data Not Analyzed
2001	405 (194 adult, 211 metamorph)	Data Not Analyzed
2002	138 (138 adult, 0 metamorph)	Data Not Analyzed
2003	1053 (140 adult, 913 metamorph)	Data Not Analyzed
2004	No new data collected	

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Delineation of the Maple Flats Special Biological Area containing the eastern tiger salamander appears to have encompassed much, if not all, habitat used by this species on the GWNF. Observations made since this species was discovered on the Forest indicate that this species is still present at all locations where previously found. Population size and trend studies are on going, as are inventories of potential habitat. As new information on population trends and habitat use surface, management activities will be adjusted to protect the eastern tiger salamander where they occur on the Forest. Forest Service management activities are having no effect on the eastern tiger salamander since all sinkhole ponds in the Maple Flats area are avoided and buffered from management activities. Illegal ATV use is a continuing problem at Maple Flats. Illegal ATV use has the potential to directly impact this species along with federally listed plant species and their habitat. The 1999-2002 Monitoring and Evaluation Report suggested increased law enforcement efforts. Forest Service law enforcement has apprehended several illegal ATV users in the Maple Flats area and they were successfully prosecuted in court. In 2001, the district placed boulders to restrict illegal ATV activity. As a result of increased law enforcement and making access more difficult, illegal ATV activity seems to have greatly decreased in the area.

Salamander populations are expected to remain relatively stable or increase in the near future. The GWNF encompasses a single population of the tiger salamander that is disjunct from its almost contiguous Atlantic coastal and Midwest distribution. This species is therefore inherently rare and not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the salamander population considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to provide for viability (persistence over time) of this disjunct population.

g. Recommendation: No change in Plan direction for tiger salamanders is recommended. Continue law enforcement efforts to decrease illegal ATV use at Maple Flats to protect tiger salamanders. Continue monitoring.

Wild brook trout from Shoe Creek, Amherst County, VA

4. Brook Trout and Wild Trout

a. Reason For Selection: Trout were selected as MIS because they are commonly fished and are therefore in demand, and because they are associated with streams with high water quality (JNF FEIS, page 3-155).

Brook trout was selected for the GWNF because it is the only trout species indigenous to the Forest and southern region (R8). Wild trout (brook, rainbow, and brown) were chosen for the JNF because many of the trout streams on the JNF support wild rainbow or brown trout populations in addition to the indigenous brook trout. Trout are indicative of cold-water streams, good water quality and sedimentation rates that are in equilibrium with the watershed. MIS population trends and changes are analyzed for resident fish rather than hatchery reared fish, since many stocked streams are not suitable for year-round survival or recruitment of a self-sustaining trout population.

The fundamental relationship between trout and their habitat is that they need cold water and the water must be of good quality. The amount and distribution of cold water habitat and water quality are most likely to be influenced by management activities that have the potential to raise stream temperature, affect water chemistry, and increase sediment transport to streams. Such Forest Service activities are those associated with timber sales.

<u>b. Plan Habitat Objectives Related to MIS:</u> The water temperature objective in the GWNF Plan (Plan, page 3-95) is for a maximum summer water temperature of 69º F. Additional objectives for cold-water habitat described in the GWNF Plan (Page 3-93) include 125 to 300 pieces of large woody debris (LWD) per mile (78-186 LWD/km), and between 35% and 65% pool habitat. The minimum population is considered to be five pounds of trout per acre (or 5.6 kilograms per hectare) in flowing waters (GWNF FEIS, Appendix J, page J-7, JNF FEIS, page 3-155). Plan objectives are to maintain sedimentation rates that are in equilibrium with the watershed and do not alter biological communities as measured using EPA's Rapid Bioassessment, Protocol II (EPA 1989).

<u>c. Description of Monitoring Method:</u> Electrofishing using the 3-pass depletion method, and measuring biomass in kilograms per hectare is the monitoring method, because this is the method used by the VDGIF to determine biomass of trout within running waters. VDGIF started monitoring Virginia's trout streams in the mid-1970's. Since that time they have developed a monitoring program that involves electrofishing specific reaches every 2 years on streams selected to represent the diverse range of geologic conditions found in the mountains of Virginia.

<u>d. Habitat Trend for MIS:</u> There is an estimated 1,601 miles of cold-water streams on the GWJNF, although, wild trout are not found in all of those cold-water miles. Trout habitat is a combination of the physical and chemical components of the stream ecosystem. Trout and all stream habitats are maintained and improved through deliberate protection and management of the riparian areas on the GWJNF.

Over 1424 km (885 miles) of streams have been surveyed for large woody debris and pool/riffle ratios (ecologically important physical stream characteristics as described in the desired future condition for GWNF Forest Plan) on the GWJNF since 1995. Fifty-six km were surveyed in 2004. Approximately 78% of the streams surveyed did not meet the desired future conditions of 78 to 186 pieces of large woody debris per kilometer. Approximately 71% of the streams surveyed did not meet the desired future condition of pool habitat between 35% and 65%. Limiting factors for meeting the physical desired future conditions were predominately historic land use practices of the last 150 years. Historically, until the last 20 to 30 years, riparian areas have been logged to the stream banks. It takes over 100 years for riparian trees to grow to large size, die and fall into streams as large woody debris. Managing riparian areas for riparian dependant resources aids the slow progress towards meeting the large woody debris desired condition of riparian areas.

Table 18. Miles Of Stream Habitat Surveyed In 2001-2004 On The Forest

year surveyed	# of stream miles surveyed	% of streams below minimum pool area DFC	% of streams below minimum LWD DFC
2001	75.4	75	35
2002	57.3	62	33
2003	55.2	70	19
2004	34.8	71	78

Water quality has been systematically monitored on Forest streams since 1987. Approximately 100 streams were monitored for water quality in 2004. As expected, the general water quality of any given stream is strongly tied to the underlying geology coupled with prevailing air quality. The collected data has been used to determine trends and changes in stream water composition, and to develop a model for projecting the future status of native trout streams. A 1998 report (Bulger et al. 1998) found that of the study streams in non-limestone geology, 50 percent are "non-acidic." An estimated 20 percent are extremely sensitive to further acidification. Another 24 percent experience regular episodic acidification at levels harmful to brook trout and other aquatic species. The remaining 6 percent of streams are "chronically acidic" and cannot host populations of brook trout or any other fish species. Similar findings were reported by the Southern Appalachian Mountain Initiative in their 2002 publication on acid deposition. Consequently, as a result of anthropogenic atmospheric deposition, trout habitat is declining in the Forest as streams become acidified.

e. Population Trend for MIS: There are 11 trout streams (10 on National Forest and one near National Forest) that have been monitored extensively between 1976 and 2003 by the VDGIF and GWJNF. These streams are used to elucidate trends in native brook trout and naturalized (wild) rainbow and brown trout populations across the Forest. All of these streams are scheduled for sampling again in 2004. Other trout streams are electrofished at permanent stations every 5 years. Some of these data have also been used to determine the trends seen in Table 19.

Table 19. Wild Trout Biomass from Selected Streams in kilograms/hectare

(To convert to lbs/acre, multiply by .8923)

Year	Cove Branch (bt)*	Gum Run (lower) (bt)*	Little Wilson (bt/rt)*	Roar'g Fork (bt)*	Helton (bt/rt)*	Little Stony (bt)*	St. Marys (mean) (bt)*	Ramsys Draft (lower) (bt)*	Rock Castle (site 3) (bt/rt)*	Georges (bt)*	Otter (bt)*
1974				bt							
1975						bt					
1976		bt					bt/rt/bw	bt		bt	
1977	bt				bt/rt						
1978			0/20.1							bt	
1983			0/0								
1984				bt				bt			bt
1985			bt								bt
1986							6.4		16/14		
1987										18	
1988					bt/rt	12.1	6.2		29/16		
1989	30.5					6.9			24/20	51	15.5
1990	66.9		14/15		80/17	17.6	17.1	75	24/30	73	12.25
1991	50.9			bt		32.6					
1992	22.6		11.4/8		52/12	14.6	17.1	65		81	12.25
1993	20.2					15.4					
1994	16.5	19.9	19/8.7	0	60/37	13.3	7.9	47	48/25	65	10
1995	15.8	8.9				9.8					
1996	25.2	15	26/11	0	39/59	6.5	8	81	36/32	30	5
1998	20.5	19.2				27.4	22.1	46	18/30	121	
1999							27.9				
2000	7	8.8		21	14/2	39.5	36.5	70.7	22/12	92.3	0
2001							31.8				

Year	Cove Branch (bt)*	Gum Run (lower) (bt)*	Little Wilson (bt/rt)*	Roar'g Fork (bt)*	Helton (bt/rt)*	Little Stony (bt)*	St. Marys (mean) (bt)*	Ramsys Draft (lower) (bt)*	Rock Castle (site 3) (bt/rt)*	Georges (bt)*	Otter (bt)*
1974				bt							
2002	10.6	41.7	19.2/5.2	7.3	36/30	29	25.2	70.5	10/15	122.7	0
2003							19				
2004	14.3	49.1	30.4/2.7	13.3	82/7.3	22.2	13.4	20.5	68.8/0.8	59.3	1.2

*: "bt" denotes brook trout, "rt" denotes rainbow trout, and "bn" denotes brown trout. Where these initials are found in a tabular cell, only presence was noted; biomass was not calculated.

Trout population trends can be broken into several categories that are strongly related to water quality:

1.) Good water quality, circum-neutral pH (non-acidic).

Where native brook trout are the only trout species in the stream, their populations generally fluctuate. Brook trout numbers from year to year are naturally variable and tend to respond to climatic extremes such as droughts or floods (i.e. Georges Creek, Otter Creek. (See Figure 1.) As an example, the lack of brook trout found in Otter Creek in 2000 and 2002 reflects the extreme drought that occurred during 1999-2002, and the subsequent drying up of the stream during the summer months. Approximately 70 wild brook trout of various sizes were stocked in Otter Creek in 2003, a non-drought year. The 2004 survey shows that a few of these fish survived and reproduced.

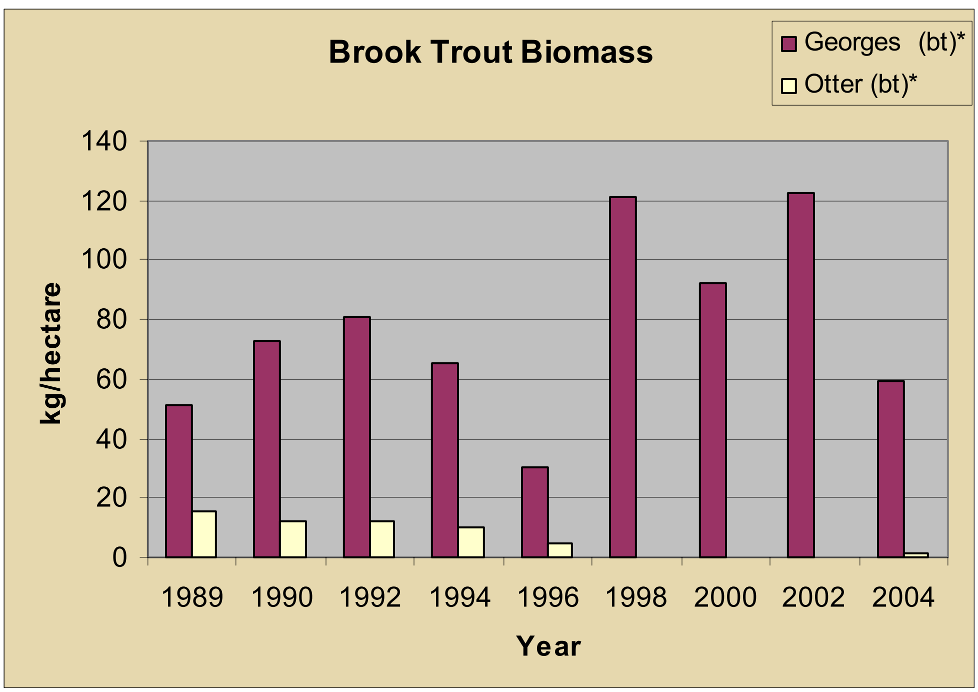


Figure 1. Brook Trout Biomass in Georges Creek and Otter Creek, 1989 to 2004

(Data from S. Smith, VDGIF 2004).

Where brook trout and wild rainbow trout are found in the same stream with good water quality, there is competition between rainbow trout and brook trout, resulting in rainbow trout occupying lower reaches of the stream and brook trout occupying upper reaches of the stream. In some of the streams sampled that fit this category, there are middle reaches where both species are found (See Figure 2). Rainbow trout adults are generally found in moderate numbers, while brook trout numbers fluctuate from moderately high, to low with a large percentage of young fish in the sample. Brook trout were abundant at the upper site (Site 3) of Rock Castle Creek in 2004, however, at the 2 lower sites on that stream, rainbow trout greatly outnumbered brook trout. Looking at the stream as a whole, recruitment of rainbow trout appeared exceptionally strong, while brook trout experienced an average year class. Recruitment of both species has been highly variable.

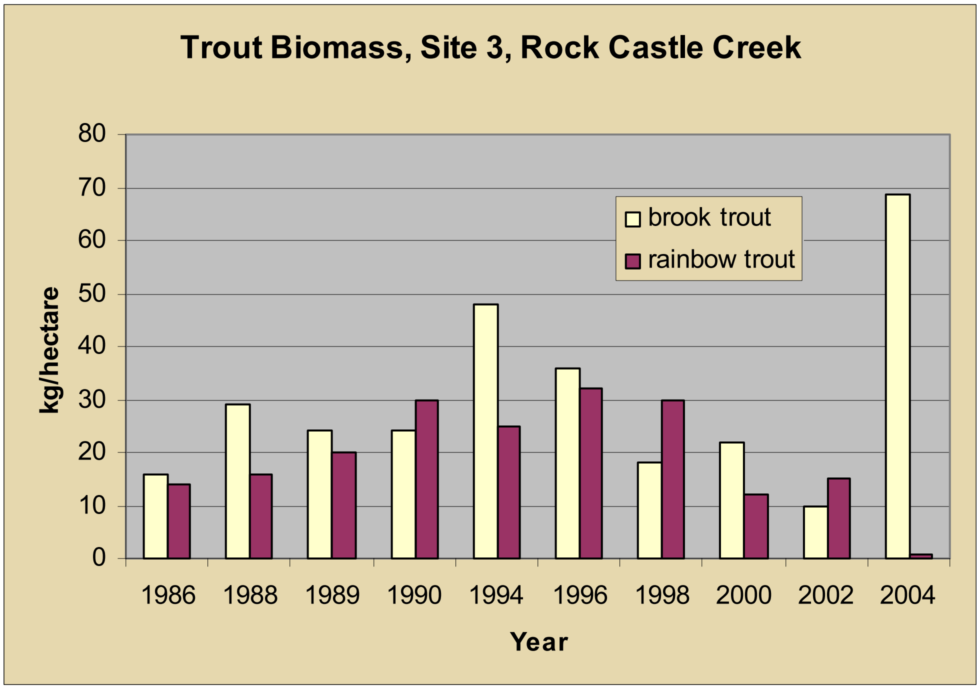


Figure 2. Brook Trout and Rainbow Trout Biomass for Rock Castle Creek (Site 3), 1986 to 2004

(Data from S. Smith, VDGIF 2004).

A small number of streams on the Forest have stream conditions suitable to support reproducing brown trout. These populations fluctuate in response to natural events.

<u>2.) Water quality with low acid neutralizing capacity (ANC) and variable pH (acid sensitive).</u>

Because brook trout are fairly acid-tolerant, native brook trout populations in these streams are similar to the populations found in non-acidic streams, except the fish have an additional extreme to contend with in the form of acid pulses, or periods of flow with low pH, generally associated with storm events in the winter or spring.

Where rainbow trout are present, their populations are declining, and brook trout populations are expanding. This category of stream seems to be reverting from wild rainbow back to brook trout (e.g., Little Wilson Creek, Figure 3).

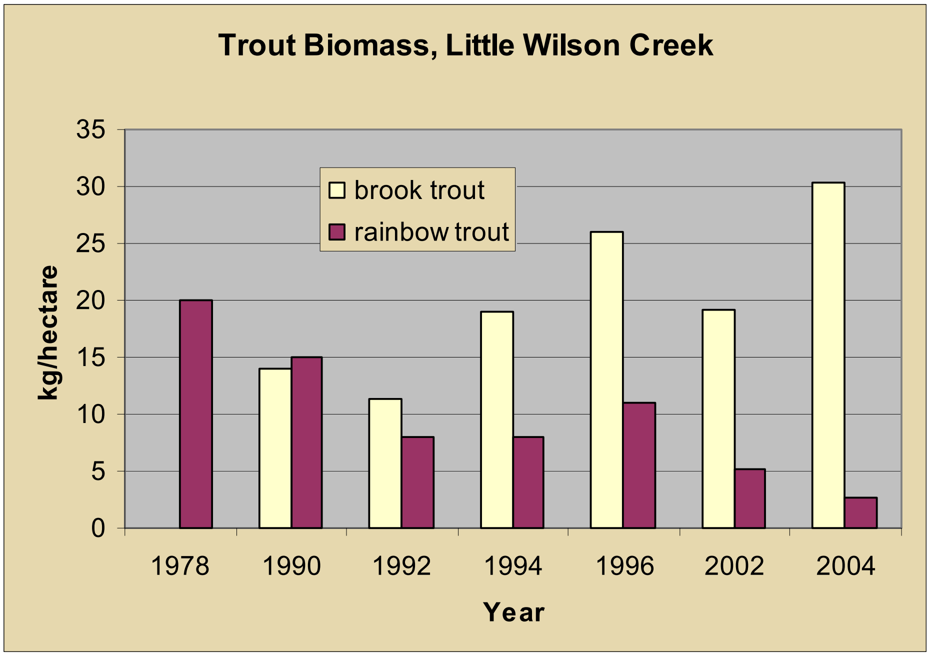


Figure 3. Brook and Rainbow Trout Biomass of Little Wilson Creek, 1978 to 2004

(Data from G. Palmer, VDGIF 2004).

3.) Water quality with no ANC and low pH (acidified).

If streams in this category once harbored rainbow trout, they are now gone. Brook trout numbers are low. The population is chiefly made of older fish, and there is generally low recruitment. Some of these streams have had all fish extirpated. An example would be Roaring Fork prior to 1999. Several years of no spring floods carrying acidic pulses gave brook trout a chance to re-colonize the upper reaches of Roaring Fork (Figure 4).

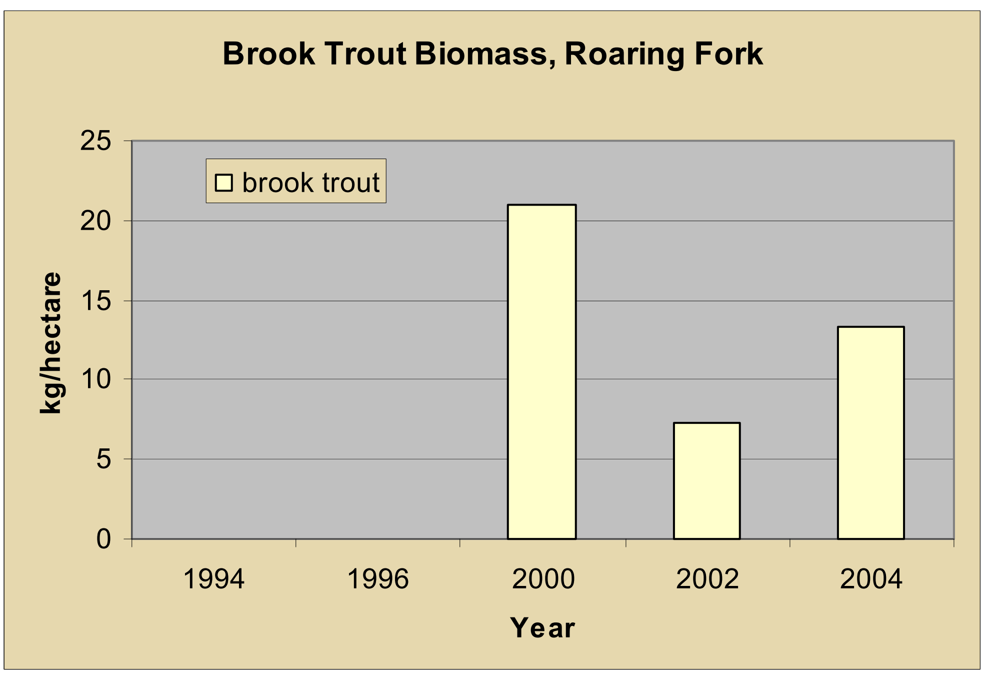


Figure 4. Brook Trout Biomass of Roaring Fork, 1994 to 2004

(Data from G. Palmer, VDGIF 2004).

In summary, using the trout streams mentioned in Table 19 as representative of trout streams on the GWJNF, the 2002 biomass is an average of 18.05 kg/ha (16.1 lbs/ac) on the JNF, and 48.68 kg/ha (43.4 lbs/ac) on the GWNF. Both of these are above the minimum objectives of 5 lbs/ac. Analysis results suggest an overall stable trend for wild trout populations on the GWJNF, although trends vary by stream.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Brook trout populations in chronically acidic streams that have been treated with high-grade limestone sand have increased dramatically following treatment. If population trends continue upward for several years, relatively stable populations can be maintained through periodic liming. If the stream is not re-limed, brook trout numbers will return to their pre-liming condition within 5 to 8 years. Thus, Forest Service management activities such as liming (e.g., Little Stony Creek, Fridley Gap (Hudy et al, 1999), and St. Marys; Figure 5) and watershed restoration (e.g. after the 1996 flood on Dry River Ranger District) are increasing brook trout populations within selected watersheds. Since brook trout are among the most acid-tolerant of native fish, they are the last species to disappear from acidic waters, and an overall declining trend will be seen when streams gradually move from episodically acidic to chronically acidic.

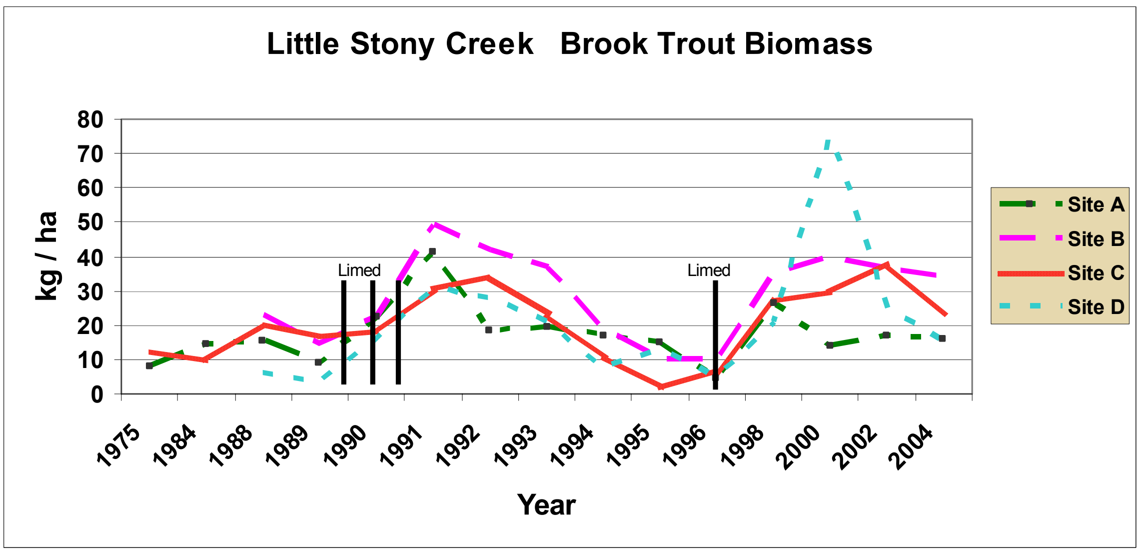


Figure 5. Little Stony Creek Brook Trout Biomass Before and After Liming Treatment, 1975 to 2004

(Figure from S. Reeser, VDGIF 2004).

As shown in Table 19, populations of wild trout tend to fluctuate greatly over time. These findings do not necessarily suggest negative impacts to those streams from management activities, but rather that trout numbers are often highly variable due to natural occurrences (drought, floods, high temperatures, etc). Hakala (2000) showed that low flows related to drought conditions, overpowered other mechanisms that could potentially influence juvenile trout abundance (i.e. fine sediment), and that adult trout abundance was principally a function of stream discharge. He also showed that the critical fine sediment size for brook trout in his study is between 0.063 mm and 1.0 mm, and that fine sediment (<0.063mm) should not exceed 0.6-1.0% of spawning substrate, or negative population effects may be incurred. Documented sediment shifts from extreme events that result in altered Rosgen channel types have involved median particle sizes (D50) much larger (i.e. D50 shift from 78 mm to 52 mm) than those that have been scientifically linked to biological effects (FY 97/98 Monitoring and Evaluation Report, GWJNF). Therefore, although extreme channel-altering events may be significant enough to change the stream morphology and hydrology, they may not necessarily affect stream biota in the short term.

Vegetation management activities, such as timber harvesting or prescribed burning, are not affecting water temperatures. Timber harvesting does not occur in riparian areas as documented in site-specific project-level analyses. Prescribed burning does not affect over-story vegetation and thus does not increase the amount sunlight reaching the stream. Timber harvesting introduces short-term (4-7 years or less) sediment increases, but properly implemented Best Management Practices have been shown to mitigate effects on water quality and biota that may result from timber harvest (Austin, 1998). These activities are being monitored Forest-wide using aquatic macroinvertebrates as an indicator of effects to the aquatic biological community.

Aquatic macroinvertebrate communities integrate the physical, chemical, and biological components of the riparian ecosystem and have been successfully used as bioindicators to monitor change and impacts (EPA 1989). An analysis of over 536 streams on the GWJNF has established the current range of conditions for aquatic macroinvertebrate communities found on the GWJNF. A Macroinvertebrate Aggregated Index for Streams (MAIS) (range of scores 0 to 18) incorporates nine ecological aspects (metrics) of the aquatic macroinvertebrate community to evaluate the current condition of a stream relative to others within that ecological section (Smith and Voshell 1997). A Rapid Bioassessment report provides raw data on the taxa collected in addition to the metric scores and the overall MAIS score. Adjectives of “very good” (MAIS = 17-18), “good” (MAIS = 13-16), poor/fair (MAIS - 7-12), and “very poor” (MAIS = 0-6) are added to the report to make it user friendly to non-technical managers and decision makers. The GWJNF uses the MAIS score as “coarse filter” screening tool on some projects to establish current “stream health” and to establish a baseline to evaluate effectiveness of standards, guidelines and mitigation measures in preventing changes and impacts to the aquatic community. When the MAIS score is low or has changed from previous monitoring, biologists examine the individual metric scores and/or raw data to identify limiting factors. The individual metrics often point to a limiting factor or trigger a more rigorous and quantitative monitoring effort.

Sample sites were selected downstream of management activity areas to monitor the impacts on stream health of projects including but not limited to timber sales and prescribed burns. Other samples were collected to create a baseline of stream conditions within the forest. Only samples collected from March through the first week in June were compared to minimize seasonal variability in structure of macroinvertebrate communities. Across the Forest, 728 samples were collected, analyzed and assigned an overall MAIS score (0-18). Of these samples, 84% were in the “good” and “very good” categories.

A paired t-test was used to compare the MAIS scores of 18 streams before and after timber harvests that occurred at various locations across the Forest. There was no significant difference between the pre and post timber harvest MAIS scores; both the pre and post mean scores were in the “Good” category (See Table 20).

Table 20. Paired Samples T-Test On Pre And Post MAIS Scores From 18 Different Timber Sales

Mean MAIS Score Pre-Harvest	16
Mean MAIS Score Post-Harvest	15
95% Confidence Interval	-0.365 to 2.365
P value	0.140

A paired t-test was used to compare the MAIS scores of 7 streams before and after prescribed burn that occurred at various locations across the Forest. There was no significant difference between the pre and post prescribed burn MAIS scores; both the pre and post mean scores were in the "Good" category (see Table 21).

Table 21. Paired Samples T-Test On Pre And Post MAIS Scores From 7 Different Prescribed Burns

Mean MAIS Score Pre-Burn	16
Mean MAIS Score Post-Burnt	16
95% Confidence Interval	1.098 to 1.669
P value	0.631

Based on the above monitoring analysis, timber harvesting and other management activities are not significantly decreasing habitat or populations of wild trout or brook trout.

The trout is a game fish that is harvested throughout Virginia and West Virginia, and therefore, viability is not a concern. Overall, viability is sustained for trout on the GWJNF. Trout populations are expected to remain relatively stable in the near future. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for trout is recommended. Continue monitoring.

5. Sunfish Family

a. Reason For Selection: The Sunfish family was selected because it includes species whose habitats may be influenced by management activities and members of this family include popular game fish. Largemouth and smallmouth bass were selected as representatives of this group because they are highly desired by the public for angling recreation, and VDGIF monitors their populations. The members of the sunfish family are used as indicators of recreational fishing opportunities associated with warm water streams, small impoundments, and large impoundments (such as Lake Moomaw).

The fundamental relationship between sunfish and their habitat is that the water must be of good quality and there should be adequate structural habitat for spawning and cover. The amount and distribution of warm water quality is most likely to be influenced by management activities associated with timber sales, dumping sewage (after treatment) into lakes from nearby developed recreation sites, dredging operations to remove sediment buildup, and repairing or reconstructing spillways.

b. Plan Habitat Objectives Related to MIS: The water temperature objective in the GWNF Revised Forest Plan (Page 3-93) for cool to warm water habitat requires maintaining a water temperature regime within 2 degrees Fahrenheit of ambient water temperature, dissolved oxygen values greater than 7.0 parts per million, and sedimentation rates that are in equilibrium with the watershed. For the GWNF, the minimum population for sunfish is considered to be 15 pounds per acre (16.81 kg/ha) in cool/warm water streams, lakes, and ponds (GWNF FEIS, Appendix J, page J-7).

c. Description of Monitoring Method: Fish shocking of population as measured in catch per unit effort (#/hour), which is then used to estimate biomass, will be the monitoring method, because calculation of catch per unit effort is the method used by the VDGIF in monitoring fish within large rivers and reservoirs.

d. Habitat Trend for MIS: The GWJNF has approximately 981 miles of warm-water stream habitat and approximately 3,000 acres of warm-water lake habitat. Much of the warm water stream habitat on the

Forest is within a mosaic of private ownership. Off-Forest non-point source pollutants from agriculture and urban runoff continue to be a problem. Acid deposition is not an immediate problem for most warm-water streams on NFS lands because they are often found in the valley bottoms where the geology is rich in limestone or other carbonate-bearing rock. As small impoundments within the Forest age, underwater structural habitat diversity (generally, trees and shrubs) that may have been present at time of lake or pond development is decaying and needs to be replaced in order to maintain a healthy, self-sustaining warm water fish population. Several existing small impoundments are being developed into new warm water fisheries, thereby increasing this type of habitat on the Forest. However, there are no new impoundments planned in the near future.

The habitat trend for a large impoundment on the Forest, such as Lake Moomaw, is centered on the continued addition and maintenance of structural habitat as older structures decays. Water quality remains good, yet is dependent on the water quality that feeds the lake.

e. Population Trend for MIS: Recruitment (ability of the fish to successfully reproduce) is good, but growth is slow due to the relatively infertile nature of most of the Forest's warmwater habitat. Data for this analysis was taken from VDGIF electroshocking surveys of warmwater habitat on the Forest. A representative of each of the warmwater types was used to determine biomass and trends.

1.) Warmwater Streams

Members of the sunfish family dominating these streams include smallmouth bass, redbreast sunfish, and rock bass. Again, recruitment is good, but growth is relatively slow. The smallmouth bass populations are dominated by fish less than 12 inches. Regulations are proposed to restructure the populations through length limits (to get more, larger fish). Natural events (i.e. floods) greatly affect fish age class structure and numbers, which in turn affects fishing for several years. (See Table 22 and Figure 6 show trends for smallmouth bass.

Table 22. Smallmouth Bass Trend from the South Fork Shenandoah River

(Data from S.Reeser, VDGIF 2004)

Year	Catch per unit effort (#/hour)	Estimated biomass (kg/ha)
1997	85.8	142.67
2000	84.5	140.51
2001	73.8	122.72
2003	74	123.05

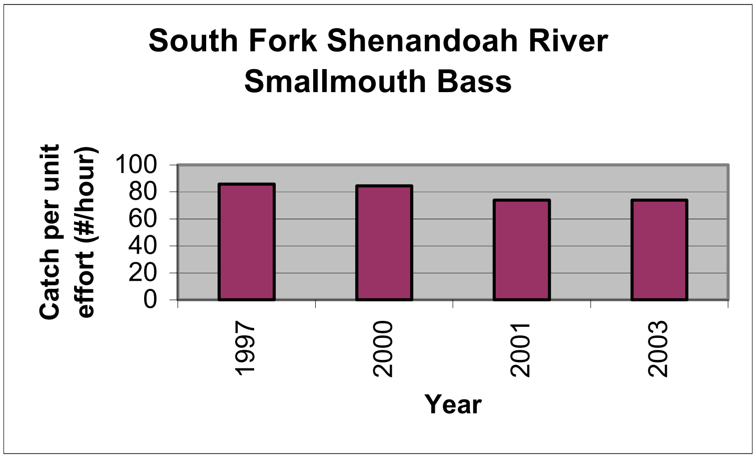


Figure 6. Catch per Unit Effort for Smallmouth Bass for the South Fork Shenandoah River, 1997 to 2003

(Data from S. Reeser, VDGIF 2004)

2.) Small Impoundments

Largemouth bass, bluegill, and redear sunfish are often the dominant members of the sunfish family found in small impoundments. Largemouth bass spawning and reproduction is good, but better recruitment to an optimal size (greater than 12 inches) is needed. Harvest pressure is light on bluegill and redear. When trout are stocked in the same impoundment, angling effort is directed toward trout more than bass or “sunfish”. Table 23 and Figure 7 show trends for largemouth bass in Lower Sherando Lake.

Table 23. Largemouth Bass Trend from Lower Sherando Lake

(Data from P. Bugas, VDGIF 2004)

Year	Catch per unit effort (#/hour)	Estimated biomass (kg/ha)
1996	167	277.69
1999	143	237.79
2002	132	219.49

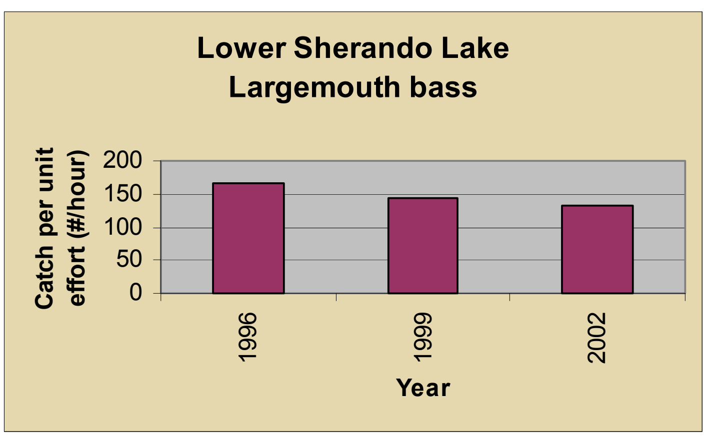


Figure 7. Catch per Unit Effort for Largemouth Bass from Lower Sherando Lake, 1996 to 2002.

(Data from P.Bugas, VDGIF 2004)

3.) Lake Moomaw

Lake Moomaw is a 2,500-acre reservoir that is 23 years old. It is managed as a 2-story fishery, supporting trophy trout as well as trophy bass. Members of the sunfish family were originally stocked 20 years ago, and have not needed supplemental stockings to thrive. The primary representatives of this family are smallmouth bass, largemouth bass, black crappie, bluegill, and redear sunfish. The smallmouth population is increasing, growth rates are excellent, and habitat is excellent in the reservoir for this fish. The largemouth bass population is continuing to expand in the lake; spawning and recruitment are good, and growth is good for a mountain reservoir. Black crappie populations are very good, and very stable at a quality size. The lake produces an occasional trophy size crappie of 2 ½ pounds. Bluegill and redear sunfish population trends are up, and there are high numbers of these fish of at a size suitable for angler enjoyment. Table 24 and Figure 8 display this trend.

Table 24. Black Bass (Largemouth and Smallmouth) Trend from Lake Moomaw

(Data from P. Bugas, VDGIF 2004)

Year	Catch per unit effort (#/hour)	Estimated biomass (kg/ha)
1985	40	66.51
1986	39	64.85
1987	28	46.56
1988	56	93.12
1989	57	94.78
1990	59	98.11
1991	81	134.69
1992	64	106.42
1993	64	106.42
1994	53	88.13
1995	90	149.66
1996	84	139.68
1997	57	94.78
2000	90	149.66
2001	103	170.77
2002	61	101.10
2003	73	121.55
2004	38	63.19

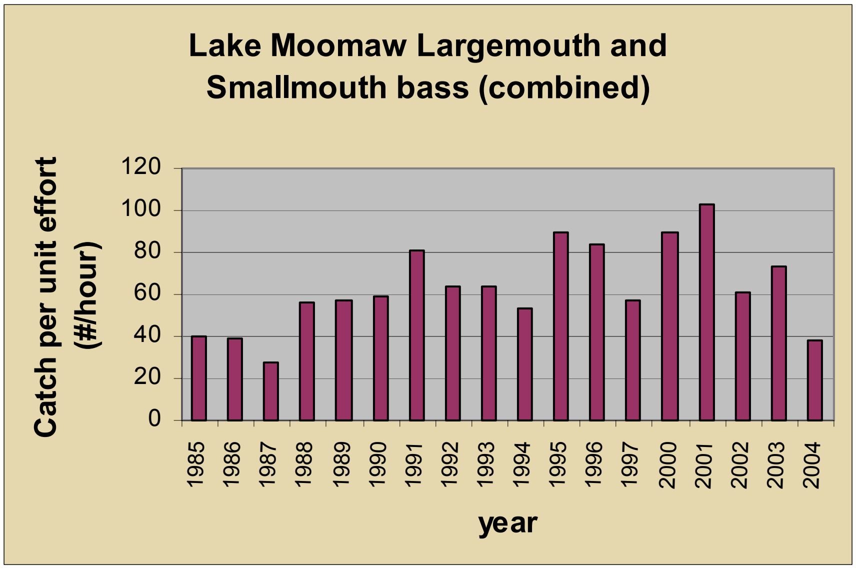


Figure 8. Catch per Unit Effort for Largemouth and Smallmouth Bass at Lake Moomaw, 1985 to 2004

(Data from P. Bugas, VDGIF 2004)

Across the Forest, average biomass for black bass (representatives of the sunfish family) within the different habitat types for the most recent years are:

- Warm water stream: 123.1 kg/ha (109.8 lb/ac)
- Small Impoundment: 219.5 kg/ha (195.9 lb/ac)
- Large Impoundment: 63.2 kg/ha (56.4 lb/ac)

They are all above minimum objective of 15 lbs/ac for the GWNF. Analysis results suggest an overall stable trend for sunfish populations on the GWJNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Although the addition and maintenance of underwater structures in Forest reservoirs is necessary for healthy self-sustaining warm water fish populations, these populations are heavily manipulated through fishing regulations and harvest pressure. Forest Service activities, such as the creation of structures in reservoirs, are beneficial to members of the sunfish family.

Sunfish are game fish that are harvested throughout Virginia and West Virginia; and, therefore, viability of these populations is not a concern. Overall, numbers and distribution of sunfish species on the GWJNF is sufficient to support viable populations and sustained recreational use. Sunfish populations are expected to remain relatively stable or increase in the near future. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for the sunfish family is recommended. Continue monitoring; suggest developing a MVP based on catch per unit effort (CPUE) rather than biomass, since biomass is rarely monitored within reservoirs on the Forest. To get a true fish biomass estimate of these habitats would take a rotenone or other lethal sampling method.

6. Yellow Pine Community

a. Reason For Selection: The Yellow Pine Forest Community (combined forest types dominated by yellow pine tree species) was selected in the GWNF Plan because it is an important element of plant and animal diversity and is a fire-dependent habitat type (GWNF FEIS, page J-12) that may be influenced by management activities. This forest community type consists of pitch, table mountain, Virginia, and shortleaf pine forests. This community is dependent on recurrent fire for maintenance and regeneration.

The yellow pine community is an aggregate of forest types that are dominated by "hard" pine (often called yellow pine) species that occur in the mid-Appalachians. This community is made up of four pine dominated forest types (pitch pine, table mountain pine, shortleaf pine, and Virginia pine) and four pine-oak forest types where pine species dominate the overstory (pitch pine - oak, table mountain pine - oak, shortleaf pine - oak, and Virginia pine - oak).

The yellow pine community is typically found on south to southwest facing ridges and slopes. These areas are well drained and receive maximum solar radiation, and are exposed to prevailing winds making them more prone to desiccation and are hence drier. While pines dominate the overstory, shrubs such as mountain laurel, blueberry, huckleberry, teaberry, azaleas, wintergreen, fetterbush, mulberry, minniebush, and trailing arbutus dominate the understory. These shrubs have waxy leaves and most are evergreen. This combination of dry, windy site conditions, and the volatile chemical nature of resinous pines and waxy/oily shrubs, which retain their foliage year-round, make them conducive to burn. In fact, most occurrences of this community are maintained by fire and must be disturbed periodically in this way to regenerate and maintain a structure of an open midstory with a shrub/grass understory and patchy overstory. Without fire this community will become dominated by hardwoods (oaks) or white pine (which is a "soft" pine) and the openness of typical yellow pine stands will be lost as it closes in with thick understory and midstory vegetation. Many plant species that occur in this community are also adapted to fire for seed release and flowering. The cones of table mountain pines open and release their seeds when exposed to high heat. Blueberries and huckleberries are stimulated to rapid growth from underground stems (rhizomes) and subsequent flowering once top killed by fire. Therefore the species composition and vertical structure relies on the periodic disturbance of fire.

For purposes of this analysis, the amount and distribution of the yellow pine community is most likely to be influenced by those management activities associated with prescribed burning. Events that affect this community but are not management activities include episodes of bark beetle infestations and wildland fire occurrences of human or lightning origin.

<u>b. Plan Habitat Objectives Related to the Yellow Pine Community:</u> The GWNF Plan objective is that "Maintaining biological diversity on the Forest is a major goal….". Habitat objectives are "…to conserve specific elements of biodiversity and restore others where needed" (GWNF Revised Forest Plan, page 2-1). Thus maintaining and restoring the spatial and structural attributes of the yellow pine community is a Plan habitat objective. Likewise, a prescribed burning program objective is to improve fire-dependent ecosystems (GWNF Plan, page 2-32).

<u>c. Description of Monitoring Method:</u> Monitoring of the yellow pine community looks at the Forestwide database titled "Continuous Inventory of Stand Condition" (CISC), forest health reports from the Southeast Forest Experiment Station, number of acres prescribed burned annually, and data collected from vegetation plots established in yellow pine community occurrences.

<u>d. Habitat Trend for the Yellow Pine Community:</u> To track the yellow pine community we used the GWNF CISC database and Forest Inventory data on forest types and acres. Table 25 shows the trend in acres by forest type for yellow pines on the GWNF since 1993 utilizing CISC. Table 26 shows the trend in acres by pine forest types from the forest survey data done by the Southeastern Forest Experiment Station.

Table 25. Yellow Pine Community Trend by CISC Forest Type Across the GWNF

(CISC/GIS Acres)

Forest Type (CISC #)	1993	1997	1999	2000	2004	2005
Shortleaf Pine (32)	1,590	1,550	1,484	1,547	1,553	1,536
Virginia Pine (33)	14,408	14,600	14,195	14,167	14,313	13,689
Pitch Pine (38)	28,084	27,430	27,864	27,832	27,366	27,689
Table Mountain Pine (39)	13,650	13,510	13,663	13,688	13,419	13,340
Shortleaf Pine - Oak (12)	1,050	1,190	1,065	1,065	1,175	1,065
Pitch Pine - Oak (15)	31,871	32,270	31,758	31,681	31,288	32,353
Virginia Pine - Oak (16)	18,706	17,930	18,449	18,448	17,839	18,900
Table Mtn. Pine - Oak (20)	15,129	14,810	15,288	15,297	14,885	15,629
TOTAL ACRES	124,488	123,290	123,766	123,725	121,838	124,201

Table 26. Yellow Pine Community Trend From Forest Survey Data Across GWJNF in Virginia

(Acres)

Forest Type	Virginia Mountain Region*	1977	1986	1992	2001
Virginia Pine	Northern Mt.	17,857	12,649	8,966	3,521
	Southern Mt.	N/A	4,227	4,204	4,763
Pitch Pine	Northern Mt.	39,188	30,496	26,818	28,673
	Southern Mt.	4,738	3,772	3,773	5,631
Table Mt. Pine	Northern Mt.	16,718	25,555	29,627	22,894
	Southern Mt.	5,494	12,767	7,924	4,575
Subtotal Pines	All Regions	66,138	91,452	83,304	72,058

* Separate Reports: Table 10 of Forest Statistics for National Forest land only for the Northern and Southern Regions of Virginia, 1977, 1986, 1992, and 2001.

Based on CISC information the number of acres of yellow pine forest types across the GWNF has been decreasing to stable over the past 12 years. The changes may be greater than indicated due to the inventory technique used in CISC coupled with recent ongoing natural changes in those eight forest types that are not reflected in these acreage figures. For at least the past decade CISC has only been updated on those lands considered suitable for timber production as allocated in the Forest Plan. Yellow pine dominated forest types are generally considered unsuitable for timber production and are therefore not consistently inventoried. Additionally, the past nine years have seen pine bark beetles (a native insect) infesting many yellow pine stands to epidemic proportions and have caused extensive pine mortality in the overstory. More than 85% of the yellow pine stands on the GWNF are over 80 years old. As these stands age they become more susceptible to bark beetle infestations. This combined with the lack of fire occurrences in these stands (both wildfire and prescribed fire), where no more than 3% has burned over the past 15 years, has lead to increased stress from competition with non-yellow pine tree species in the understory and has lead to a rapidly increasing pine overstory mortality and ever-increasing fuel loads. These pine dominated stands require periodic fire for regeneration since the effects of burning result in opening the canopy to increased sunlight on the forest floor, killing thin-barked fire intolerant / shade tolerant trees that compete with pine seedlings, and in the case with table-mountain pine, heat from a fire opens serotinous cones allowing for seed release and dissemination. The lack of fire coupled with the ever-increasing beetle activity accounts for what is likely a downward trend in the number of acres (quantity) and in stand condition (quality) of this management indicator.

2001 Forest survey data reveals decreasing trends for total pine over the past 15 years, likely due to southern pine beetle infestations, with the most serious declines suffered by table mountain pine.

e. Population Trend for the Yellow Pine Community: See previous paragraph on habitat trend as a function of total acreage.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Agency management activities are limited to prescribed burning and managing fire within these forest types. Control or suppression of pine bark beetles, by means other than timber salvage harvesting, has not been done due to prohibitive costs and negative impacts to other associated animal species. While the acres of prescribed burning have increased in recent years (see trend in management activities presented earlier at the beginning of this report, Table 7), the number of acres burned that have been targeted at restoring the yellow pine community have not kept up with the downward decline in total number of acres and regeneration of yellow pine trees. Thus while current Forest Service management activities are attempting to increase the Yellow Pine Community in some areas, not enough prescribed burning is occurring Forestwide and the overall decreasing trend in habitat quality and total acreage is likely to continue.

Overall, viability of species dependent on the Yellow Pine Community is a concern on the GWNF. Amount of yellow pine acreage is expected to continue to decrease in the near future.

g. Recommendation: Implement prescribed fire and fire managed for resource benefits in those areas with a yellow pine component. Continue revision the existing Fire Management Plan (expected in 2006) and include Fire Use as an option so fire can be used as a more effective management tool in maintaining and restoring the yellow pine ecosystem. Implement inventory methods that more accurately depict yellow pine acreage and conditions on the Forest.

7. Old Growth Forest Types

a. Reason For Selection: Old growth forests were selected a management indicator in the GWNF Revised Plan because they are important elements of plant and animal diversity and a social issue. These late successional (i.e. "mature") forest conditions may be influenced by management activities and are biological communities (GWNF FEIS, page J-12). There are 10 old growth forest type groups on the GWNF. They consist of: 1) northern hardwood forests, 2) conifer (hemlock, white pine, red spruce) and northern hardwood forests, 3) mixed mesophytic forests, 4) hardwood wetland forests, 5) dry-mesic oak forests, 6) dry and xeric oak woodlands and savannas, 7) xeric pine and pine-oak forests and woodlands, 8) dry and dry-mesic oak-pine forests, 9) eastern riverfront forests, and 10) rocky, thin-soiled excessively drained cedar woodlands. These groups represent aggregations of similar forest types in conditions that are necessary for species requiring mature forests.

For purposes of this analysis, the amount and distribution of old growth forest types is most likely to be influenced by management activities associated with timber harvesting. Natural disturbances, such as strong winds, large accumulations of ice, native insects/disease, fire (including prescribed fire), and landslides, also affect old growth forest conditions, but they are regarded as being with the natural range of variability for forest successional dynamics. Old growth is a management indicator only for the GWNF. (NOTE: No plant or animal species in the Appalachians are known to require old growth forest conditions exclusively i.e. are "old growth obligates" for their survival or continued existence.) Mature forests are considered to be those forests that are in the later stages of succession and are generally synonymous with old growth. Old growth forests are distinguished by old-age trees and related structural attributes within the forest stand. The stand age at which old growth develops varies according to forest type (determined by dominant tree species) and reflects climate, site conditions (bedrock geology, soil type, aspect, moisture regime, elevation), and disturbance regime. A discussion on old growth as it relates to the GWNF is found in FEIS Appendix H and GWNF Revised Plan pages 2-3 to 2-6. Additional information is contained in the document, "Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region, Forestry Report R8-FR 62" and "Information About Old Growth for Selected Forest Type Groups in the Eastern United States, General Technical Report NC-197."

b. Plan Habitat Objectives Related to Old Growth Forests: For the GWNF, to maintain old growth forest type conditions, a minimum of 2.5% of the forest should be in old growth (defined as hardwood stands older than 200 years old) (GWNF FEIS, Appendix J, page J-5). This would amount to approximately 26,075 acres on the GWNF (1,042,999 total forested acres). Additional discussion and objectives for all forest types are outlined on pages 2-3 to 2-6 of the Final Revised Forest Plan and Appendix H of the GWNF FEIS.

c. Description of Monitoring Method: The Continuous Inventory of Stand Conditions (CISC) data set maintained by the Forest in FSVeg or GIS will be used to measure acres of each old growth forest type.

d. Habitat Trend for Old Growth Forests: Table 27 displays trends for this management indicator as acres by year and Old Growth Forest Type (OGFT). Acreage figures for 1993 differ from those presented in the GWNF Forest Plan and EIS. The CISC data set from which those numbers were derived in 1993 no longer exists due to computer system conversions implemented since 1993. The number of acres presented here are from the current 2004 CISC/GIS data set. The only management that has occurred in any old growth forest acres since 1993 that would alter stand age and structure (i.e. timber harvest) has occurred in OGFT 21. All other OGFT acres identified in 1993 still exist. The number of acres reaching the minimum age to be considered old growth is increasing annually as the forest ages. Forestwide the forest is aging and the number of acres in earlier successional stages is decreasing. Based on these acreage figures the amount of old growth is steadily increasing on the Forest.

Table 27. Old Growth Trend Across the GWNF

(Acres)

Old Growth Forest Type Groups*	1993	1994	1995	1996	1997	1998	1999	2000	2004	2005
01 - Northern Hardwood Forests	0	0	0	0	0	0	0	369	369	369
02 - Conifer & North. Hardwood Forests										
2a-Hemlock-North. Hardwd Subgroup	1,364	1,364	1,364	1,364	1,364	1,364	1,364	1,515	1,515	1,515
2b-Wh. Pine-North. Hardwd Subgroup	19	19	19	19	19	19	19	847	847	847
2c-Spruce-North. Hardwood Subgroup	71	71	71	71	71	71	71	71	71	71
05 - Mixed Mesophytic Forests	680	708	727	727	727	727	727	1,395	1,542	1,619
10 - Hardwood Wetland Forests	0	0	0	0	0	0	0	78	78	78
21 - Dry-mesic Oak Forests	70,416	72,460	75,986	77,406	79,060	81,904	85,432	108,193	120,364	126,938
22 - Dry and Xeric Oak Woodlands	0	0	0	0	0	0	0	80	80	80
24 - Xeric pine & Pine-oak Forests	78,239	82,316	86,009	88,820	91,295	94,991	97,384	100,019	106,076	110,011
25 - Dry & Dry-mesic Oak-pine Forests	3,814	4,268	4343	4,581	4,666	5,100	5,133	6,702	7,375	7,819
28 - Eastern Riverfront Forests	5	5	5	5	5	5	5	25	25	25
37 – Rocky, Thin-soil Conifer Wood.	0	0	0	0	0	0	0	0	0	0
TOTAL ACRES	154,609	161,212	168,526	172,994	177,208	184,182	190,135	219,294	238,342	249,372

* Names and associated identification numbers are from Forestry Report R8-FR 62. Three OGFT groups were added in the 2000 CISC inventory as meeting the minimum age necessary to be considered old growth. These stands were not reflected in earlier years due to their stand ages in CISC. These OGFT groups are: 1) Northern Hardwood Forests, 2) Hardwood Wetland Forests, and 3) Dry & Xeric

oak Woodlands & Savannas. One OGFT group still has no acreage that meets the minimum age criteria. That type is the rocky, thin-soiled, excessively drained conifer woodland that is found over limestone bedrock and dominated by eastern red cedar. Very few acres of that type exist on the GWNF and no management activity is occurring in those acres that would affect stand age.

e. Population Trend for Old Growth Forests: Measurement by "population" is not applicable as old growth is a forest successional stage and habitat condition measured in acres, not individual species. The trend in old growth as measured in acres is one of steady increase. From 2000 to 2005 total acreage increased 30,078 acres. From 1993 to 2005 total acreage increased by 94,763 acres.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

As specified in the GWNF Forest Plan with regards to management activities in old age stands, timber harvesting can only occur within the Dry Mesic Oak Type (OGFT #21), as all other stands meeting the minimum age in other groups were classified during the Forest Plan revision process as unsuitable for timber production. Timber harvesting on unsuitable timberland has not been done on the GWNF. Timber harvesting of any old growth Dry Mesic Oak stands is disclosed in site-specific environmental analyses. While some individual old age stands of the Dry Mesic Oak type have been lost due to timber harvest during the past 11 years (<1,000 acres), the total acreage of stands meeting the minimum age within the that group continues to increase. From 2000 to 2005 there was an increase of 18,745 acres. From 1993 to 2005 an increase of 56,522 acres occurred. Thus, timber harvesting is not significantly limiting the old growth forest conditions on the GWNF, and in particular OGFT #21.

Very few acres have reached 200 years old since most of the Forest was cutover prior to entering federal ownership in the 1910s to 1930s. It will take another 60 to 80 years before a significant amount of 200 year-old stands are found on the Forest. According to data from CISC/GIS there exists approximately 80,927 acres forest types greater than 141 years of age on the GWNF (1,042,999 total forested acres in Age Class Report of 6-30-2005). For stands greater than 200 years old there exists 11,014 acres (1.06%). Therefore 69,913 acres is between 141 and 200 years of age. In less than 15 years there will be at least 26,075 acres (2.5%) greater than 200 years old. However, an important point is that the age at which old growth conditions develop varies by forest type and is not simply 200 years old for all forest types. The acreage by OGFT displayed in the table takes this into account where some types (mostly pine/conifer dominated) develop old growth conditions at 80 to 130 years of age. This is why the acreage figures for these types are greater. More information on old growth designation is presented in Appendix H of the GWNF Plan EIS.

Fire is a natural disturbance process common to most OGFTs (but is very limited or non-existent in northern hardwoods, spruce/fir, and riverfront forests). Thus, the increased use of prescribed fire is not affecting the overall amount of old growth across the Forest, but instead is restoring and maintaining that condition in a species composition and structure more typical of the fire regime these forests experienced prior to active fire suppression (~1930's).

Overall, acreage of old growth forest types on the GWNF is increasing as the forest continues to increase in age. Old growth acreages of each forest type are expected to continue to steadily increase over time.

g. Recommendation: No change in Plan direction for old growth is recommended. Continue monitoring.

8. Northern Flicker

a. Reason For Selection: The northern (common) flicker (*Colaptes auratus*) was selected to represent effects of management on cavity nesters for the GWNF (GWNF FEIS, Appendix page J-12).

b. Plan Habitat Objectives Related to MIS: For the GWNF to maintain habitat for the flicker, a minimum of one percent of the forest should be in early successional stages of ages 1 through 12 (GWNF FEIS, Appendix J, page J-5). For the JNF, a minimum of 3,900 acres should be in an early successional stage (JNF FEIS, Appendix B, page B-32). Likewise two standing dead snags per acre within harvest units need to be provided when possible (JNF FEIS, Appendix B, page B-32, as amended by FEIS on Vegetation Management in the Appalachian Mountains).

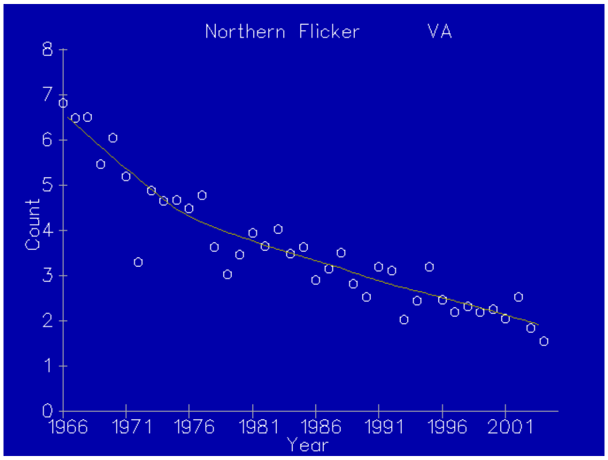
Minimum flicker populations are defined as one bird per square mile (GWNF FEIS, Appendix J, page J-14) or about 1,650 birds forestwide. The JNF should provide a minimum population of 500 birds (JNF FEIS, Appendix B, page B-32).

c. Description of Monitoring Method: The USGS breeding bird surveys will be used. GWJNF's avian point counts will be used in addition to BBS.

d. Habitat Trend for MIS: See age-class distribution Table 8.

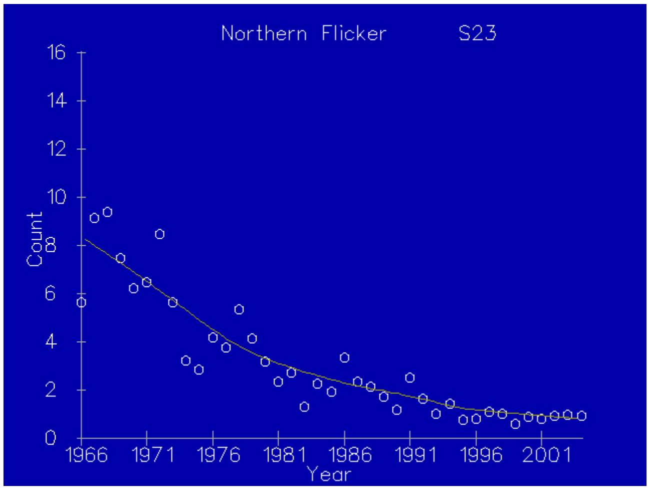
e. Population Trend for MIS: USGS BBS data indicates a steady downward trend in northern flickers in Virginia and in the Blue Ridge Mountain and Northern Ridge and Valley Sections (See Figure 9, Figure 10, Figure 11).

Figure 9. Trend In BBS Data Of Northern Flickers Across Virginia, 1966 To 2004



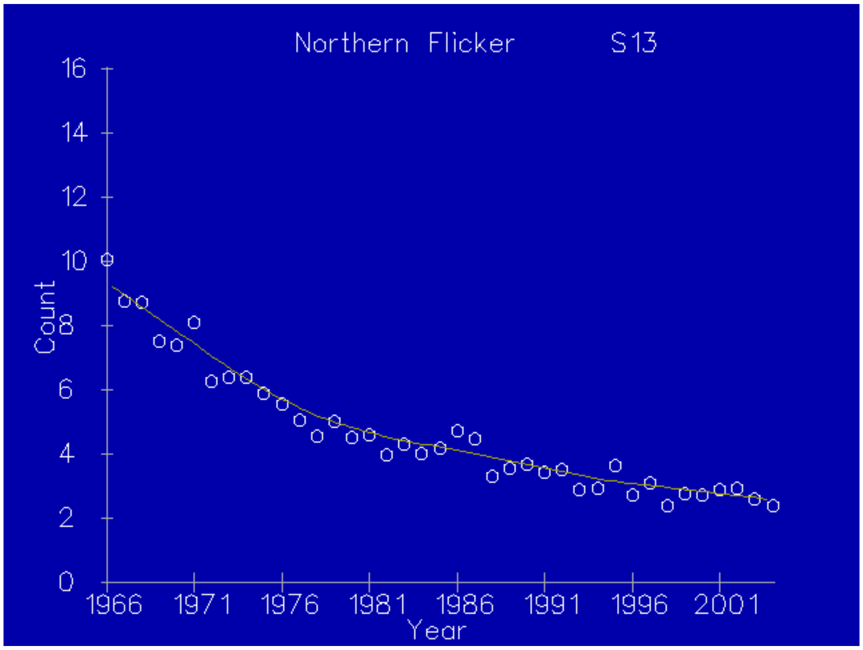
Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 10. Trend In BBS Data Of Northern Flickers Across The Blue Ridge Physiographic Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 11. Trend In BBS Data Of Northern Flickers Across The Ridge And Valley Physiographic Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from GWJNF's avian points for the northern flicker are presented in Table 28 below and indicates a variable but overall stable trend on the GWJNF's:

Table 28. Trend in Northern Flicker Across GWJNF, 1994 to 2004

Year	Average Number of Birds per Point
1994	0.08
1995	0.03
1996	0.07
1997	0.02
1998	0.02
1999	0.06
2000	0.06
2001	0.02
2002	0.08
2003	0.05
2004	0.04

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Northern flicker prefers open woodland habitat and ecotone habitat between forested and patches of early successional woody or grassy/shrubby habitat (Hamel 1992). It requires large-sized (over 12" DBH) snags and living trees for excavating nest cavities. Northern flickers have exhibited significant continental population declines in the last couple of decades, mirroring an overall trend of decline of disturbance-dependent bird species associated with open habitats in eastern North America (Vickery 1992, Askins 2000, Hunter et al. 2001). A significantly greater proportion of bird species exhibiting steep population declines are associated with disturbance-mediated habitats than in forested or generalist habitat types (Brawn et al. 2001). Forty percent of all North American species associated with some type of disturbance-mediated habitat (grassland, shrub-scrub, open woodlands) have been significantly decreasing in population since 1966 (Brawn et al. 2001). Combined with recent research highlighting the importance of early successional woody habitat for post-breeding and migratory stop-over needs of forest-interior migratory bird species in a larger landscape of mature forest (see sections on ovenbirds and worm-eating warblers and hooded warblers), the role of early successional habitat in largely mature, forested landscapes and the need to restore/maintain disturbance regimes creating such habitats is of vital importance in conservation planning (Brawn et al. 2001, Hunter et al. 2001).

Based on the current age-class structure of forested land in the GWJNF's, 84% of all forest types are mature (71-150+ years) (See Table 8). Current active forest management in the last 5 years has effected about 1,000 to 2,000 acres per year, or 0.06% of the total forested acres per year (See Table 5Table 6). Current prescribed burning has effected 5,000 to 16,000 acres per year, or 0.28% to 0.91% of the total forest acres per year and is increasing (See Table 5). Both of these activities, in addition to natural disturbances and continued maturation of the forest, should provide patches of early successional woody habitat, as well as restoring and maintaining open oak, oak/pine, and pine woodlands, which would benefit northern flickers.

Based on the results of monitoring data and habitat evaluation, northern flickers exhibit low and variable but overall stable population trends on the GWJNF's, and have an abundance and distribution across the Forests that should provide for their persistence into the foreseeable future. However, the steep declining trends shown by USGS BBS data in populations of northern flicker across the state of Virginia as well as the larger regions of the Blue Ridge Mountains and Ridge and Valley Regions are cause for concern and merit closer attention to how northern flicker populations are faring on the GWJNF's.

g. Recommendation: No change in Plan direction for flickers is recommended. Continue monitoring.

9. Brown-headed Cowbird

a. Reason For Selection: Brown-headed cowbird (*Molothrus ater*) was selected to represent possible effects of fragmentation across the landscape (GWNF FEIS, page J-10). This species inhabits open agricultural lands, but will fly into nearby forested areas to lay their eggs in other bird's nests (nest parasite), and is thus considered an indicator of edge habitat effects (GWNF FEIS, page 3-172). With over 100 species of birds known to be parasitized by brown-headed cowbirds, many forest interior birds exhibit lower reproductive success near forest edges, in part due to increased brood parasitism by the cowbird (Thompson, 1992).

Numbers of cowbirds and rates of parasitism vary with distance from edges. In an extensively forested area of Wisconsin, for example, percent of parasitized nests declined from 65% within 99 meters of an edge to less than 18% at > 300 meters (Temple, 1988).

In landscapes characterized as mostly forested, recent research suggests very little change in cowbird populations from increased edge (e.g. from timber harvesting). Work in the Missouri Ozark Forests (Thompson et al., 1992) compared areas managed with clearcutting to areas with no recent timber harvest or disturbance. Brown-headed cowbirds occurred in similar numbers in both of these areas.

For purposes of this analysis, the fundamental relationship between cowbirds and its habitat is that it prefers to parasitize nests in the edges of open areas such as pastures (where it feeds) that fragment the forested landscape.

b. Plan Habitat Objectives Related to MIS: Since this species is a nest parasite, our objective is to minimize the number of cowbirds. Due to its increased abundance and detrimental effects on other bird species, it will be monitored not primarily to insure viability, but to gauge effects on other species.

c. Description of Monitoring Method: The USGS breeding bird surveys will be used. GWJNF's avian point counts will be used in addition to BBS.

d. Habitat Trend for MIS: Table 29 displays the trend in the amount and distribution of open areas potentially used by cowbirds.

Table 29. Trend in Open Areas Across both Forests

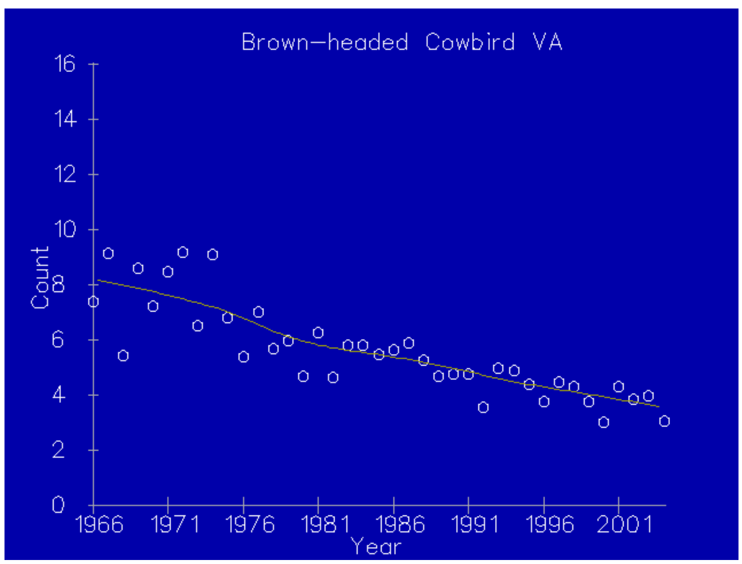
(Acres)

	George Washington N.F.			Jefferson N.F.		
Year*	Nonforest Land	Total NFS Land	Percent Nonforest of Total NFS	Nonforest Land	Total NFS Land	Percent Nonforest of Total NFS
1985	9,719* (6,847)**	1,055,525	0.9 (0.6)	7,151* (6,800)**	690,258	1.0 (1.0)
1999	9,734* (6,978)**	1,064,379	0.9 (0.7)	7,187* (6,778)**	716,960	1.0 (0.9)

* Includes Water, data from planning records from both National Forests
** Excludes Water

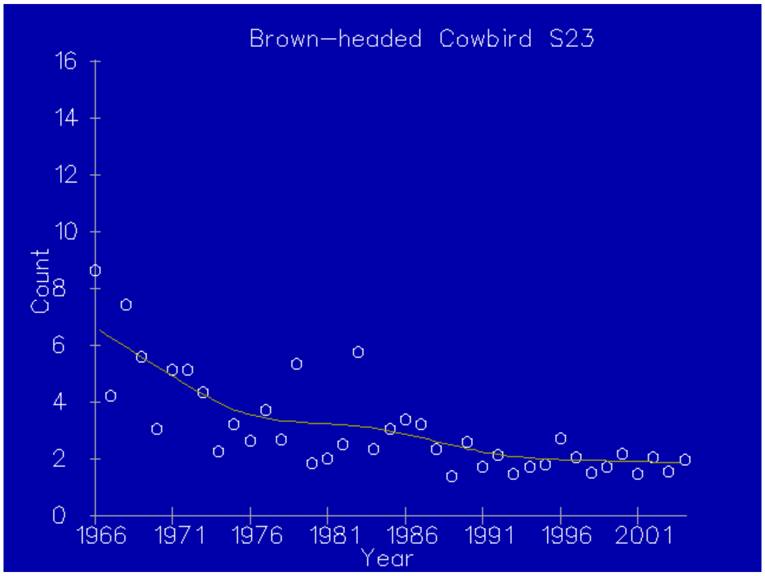
e. Population Trend for MIS: USGS BBS data indicates a steady downward trend in brown-headed cowbird numbers in Virginia and in the Blue Ridge Mountain and Northern Ridge and Valley Sections. That data is shown in Figure 12 , Figure 13, and Figure 14 below:

Figure 12. Trend In BBS Data Of Brown-Headed Cowbirds Across Virginia, 1966 To 2004



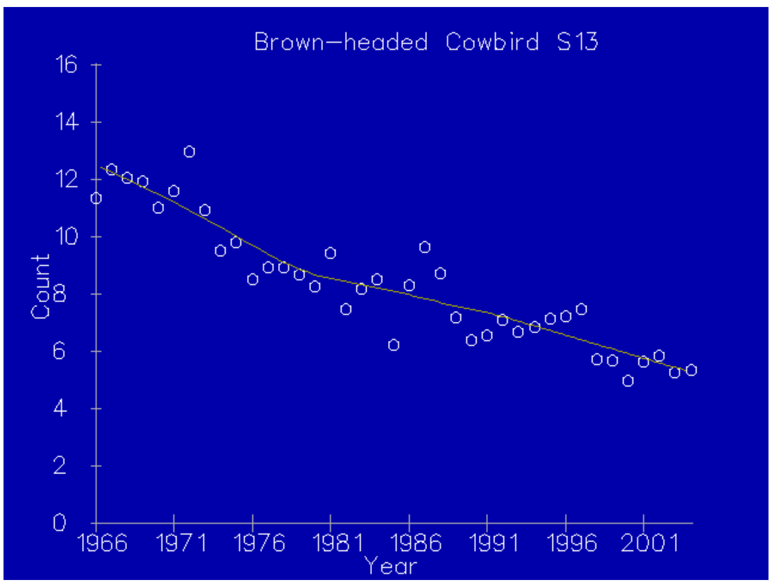
Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 13. Trend In BBS Data Of Brown-Headed Cowbirds Across The Blue Ridge Physiographic Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 14. Trend In BBS Data Of Brown-Headed Cowbirds Across The Ridge And Valley Physiographic Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from GWJNF's avian points for the brown-headed cowbird are presented in Table 30 below and indicates an overall decreasing trend on the GWJNF's:

Table 30. Trend In GWJNF Data Of Brown-Headed Cowbirds Across GWJNF, 1994 to 2004

Year	Average Number of Birds per Point
1994	0.07
1995	0.13
1996	0.08
1997	0.07
1998	0.03
1999	0.08
2000	0.04
2001	0.04
2002	0.03
2003	0.03
2004	0.04

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Relatively low numbers documented by point count data and the downward trend by BBS data suggests the minimal amount of forest fragmentation (both existing and that created by management activities) across the GWJNF is not sufficient to support significant populations of cowbirds. Additionally, patch size of interior forest on the GWJNF appears not be readily penetrated by cowbirds searching for nests to parasitize. Thus, management activities appear to not be creating habitat to support significant increases in cowbird populations.

The overall forest on the GWJNF's continues to mature. Patches of varying sizes of early successional woody and grassy/shrubby habitat are inherent in older forest stand dynamics, and are created as a result of natural disturbance regimes such as ice storms, fire, tornados, and insect infestations and active management activities such as forest harvest, grassy/shrubby openings, and prescribed fire. Yet, these patches are generally small in size. Recent research has indicated that in a landscape that is mostly forested (>70%), early successional habitat that is not permanent does not have the negative effects on forest interior species documented in landscapes characterized by small, isolated forest patches (Braun et al. 2001, Hunter et al 2001).

Overall, viability of this species in the area surrounding the GWJNF is not in question. NFS land likely contributes marginally to area populations. Those birds found on NFS land are primarily composed of birds coming from surrounding private agricultural land in search of nest parasitism opportunities. Cowbird occurrences are expected to continue to decrease in the near future as the landscape becomes more forested.

g. Recommendation: No change in Plan direction for cowbirds is recommended. Continue monitoring.

10. Pileated Woodpecker

a. Reason For Selection: The pileated woodpecker (*Dryocopus pileatus*) was selected because trends in presence and abundance of this species across the forest will help indicate the effectiveness of management in maintaining desired conditions relative to abundance of snags (GWNF FEIS, Appendix page J-12 and JNF FEIS, Appendix page D-3).

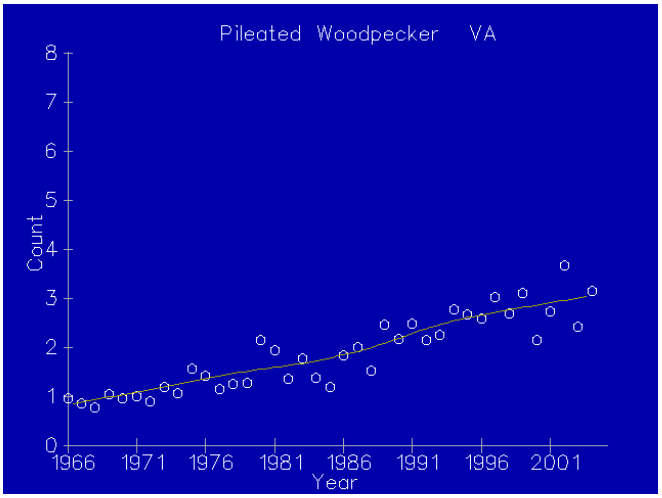
b. Plan Habitat Objectives Related to MIS: The GWNF Revised Plan specifies a minimum of 2.5% of the forest should be in an old growth condition (GWNF FEIS, Appendix J, page J-5). The Jefferson Revised Plan specifies maintaining 84,000 acres of mixed mesophytic forest communities, sustaining 75% in a mid- to late- successional condition and 78,000 acres in nine community types in an old growth or late-successional condition (JNF Revised Plan, page 2-12).

c. Description of Monitoring Method: USGS Breeding Bird Surveys (BBS) data and GWJNF avian point count data are used.

d. Habitat Trend for MIS: See trend in old growth at Table 27. Table 8 shows that 88.6% of the forested acres on the GWJNF's are in a mid- to late-successional age class structure.

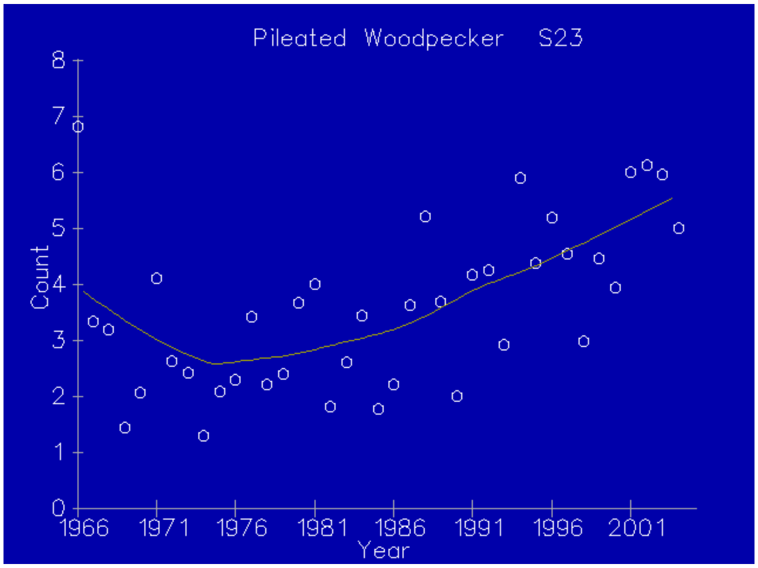
e. Population Trend for MIS: USGS BBS data indicates increasing populations trend of pileated woodpeckers statewide, as well as in the Blue Ridge Mountain and Northern Ridge and Valley regions (Figure 15, Figure 16, and Figure 17).

Figure 15. Trend In Breeding Bird Survey Data Of Pileated Woodpeckers Across Virginia, 1966 To 2004



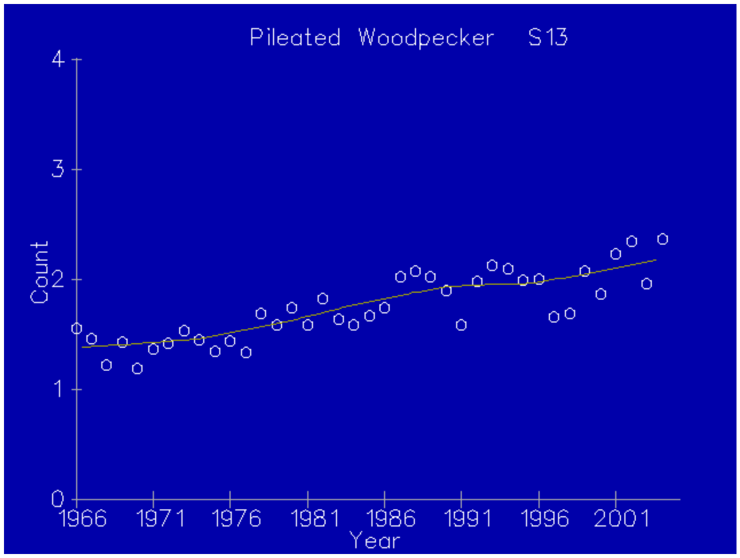
Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 16. Trend In Breeding Bird Survey Data Of Pileated Woodpeckers Across The Blue Ridge Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 17. Trend In Breeding Bird Survey Data Of Pileated Woodpeckers Across The Ridge And Valley Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from the GWJNF Point Counts indicated an overall stable population trend for pileated woodpeckers on the GWJNF (See Table 31).

Table 31. Trend In GWJNF Point Count Data Of Pileated Woodpeckers Across GWJNF, 1994 To 2004

Year	Average Number of Birds/point
1994	0.35
1995	0.55
1996	0.32
1997	0.08
1998	0.05
1999	0.36
2000	0.33
2001	0.36
2002	0.36
2003	0.20
2004	0.23

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

The Forest Plan selected pileated woodpecker as an indicator of the presence of mature forests with dead or dying trees at least 20" in diameter, in which the birds excavate their nest cavities. Pileated woodpeckers generally prefer mature forests near riparian areas (Hamel 1992). This species is a primary cavity nester/excavator, requiring large snags for nesting cavities and large dead trees for feeding. Generally, this species requires trees greater than 15 inches DBH for cavities, but prefers trees greater than 20 inches DBH. Nests may occur in a variety of trees including oak, hickory, maple, hemlock, and pine. The maintenance of older age forests, in relatively unfragmented blocks, will provide optimum pileated woodpecker habitat. Aging forests should provide adequate snag numbers for all cavity-nesting species. The amount of older aged forest, along with its large snag component, continues to increase across the Forest and so should continue to provide habitat for this woodpecker.

Based on the results of monitoring data and habitat evaluation, this species is showing stable population trends on the GWJNF's and increasing trends both statewide and across the Blue Ridge Mountain and Ridge and Valley Regions. Pileated woodpeckers have the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for the pileated woodpecker is recommended. Continue monitoring.

11. Ovenbird and 12. Worm-eating Warbler

a. Reason For Selection: Ovenbird (*Seiurus aurocapillus*) is an MIS on the George Washington and Jefferson National Forest. Worm-eating warbler (*Helmitheros vermivorus*) is an MIS only on the GWNF. Ovenbird and Worm-eating warbler were selected because trends in presence and abundance of these species in mature deciduous forests will be used to help indicate the effectiveness of management in maintaining desired condition relative to forest interior habitats (GWNF FEIS, page J-12 and JNF revised Plan, pg. 5-4).

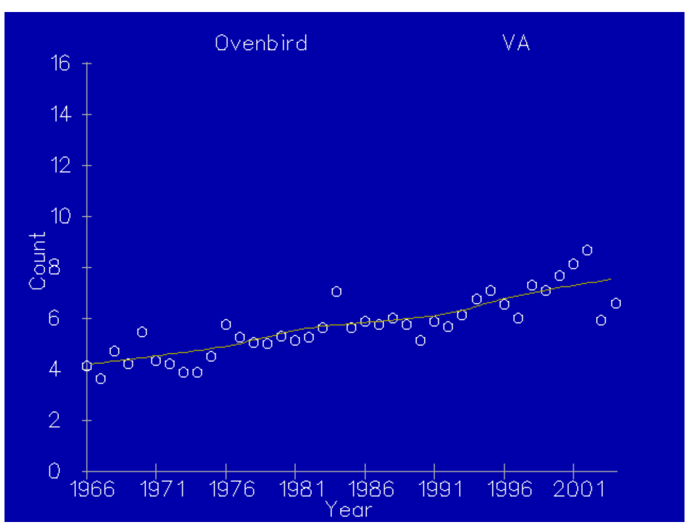
b. Plan Habitat Objectives Related to MIS: The minimum population objective is one pair of breeding birds per square mile (GWNF FEIS, Appendix J, J-14) or about 1,625 birds forestwide. For the For the JNF, maintain 84,000 acres of mixed mesophytic forest communities, sustaining 75% in a mid- to late-successional condition and 78,000 acres in nine community types in an old growth or late-successional condition (JNF Revised Plan, page 2-12).

c. Description of Monitoring Method: The USGS Breeding Bird Surveys (BBS) are used. GWJNF avian point counts are also used in addition to BBS.

d. Habitat Trend for MIS: See trend in old growth at Table 27. Table 8 shows that 88.6% of the forested acres on the GWJNF's are in a mid- to late-successional age class structure.

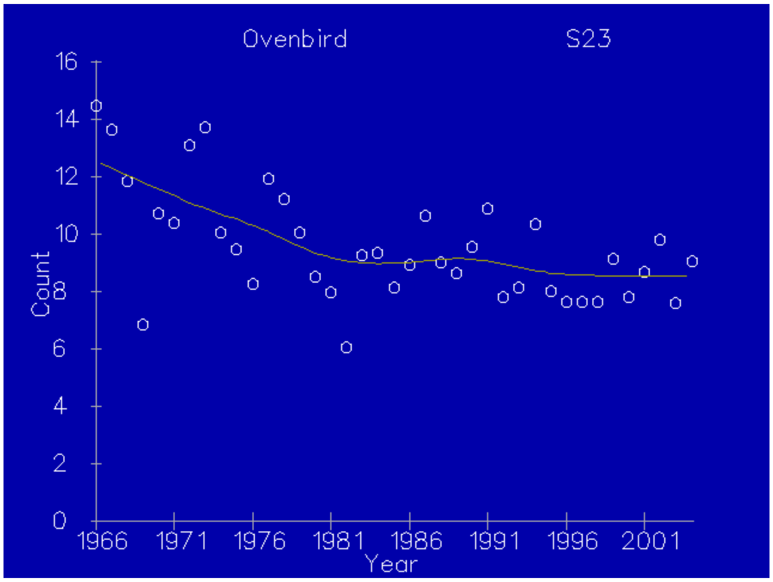
e. Population Trend for MIS: USGS Breeding Bird Survey data indicates increasing trends in populations of ovenbirds statewide, as well as in the Blue Ridge Mountain and Northern Ridge and Valley regions (Figure 18, Figure 19, and Figure 20).

Figure 18. Trend In Breeding Bird Survey Data Of Ovenbirds Across Virginia, 1966 To 2004



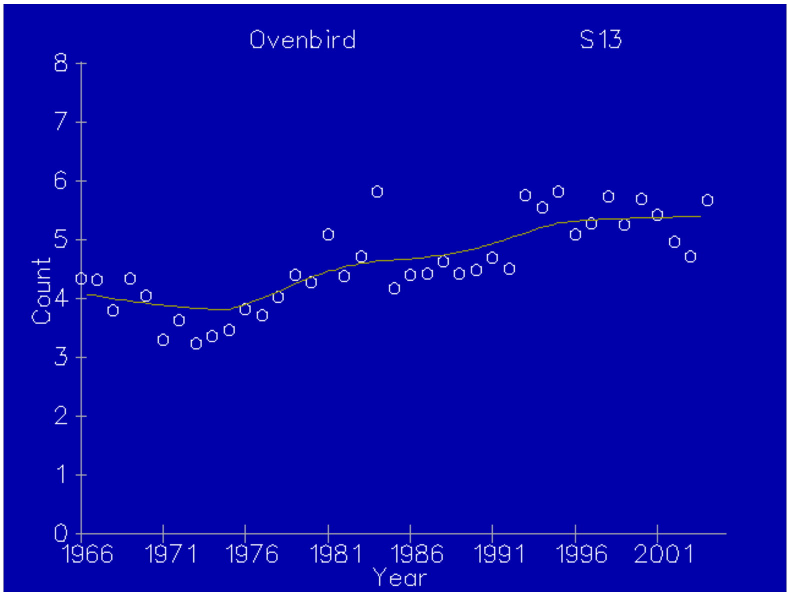
Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 19. Trend In Breeding Bird Survey Data Of Ovenbirds Across The Blue Ridge Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 20. Trend In Breeding Bird Survey Data Of Ovenbirds Across The Ridge And Valley Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from the ORPC for the ovenbird are presented in the Table 32 below. Analysis results suggest a stable to increasing trend for ovenbird populations on the GWNF.

Table 32. Trend In GWJNF Point Count Data Of Ovenbirds Across GWJNF, 1994 To 2004

Year	Average Number of Birds/Point
1994	0.78
1995	0.87
1996	0.83
1997	0.65
1998	0.68
1999	1.03
2000	0.85
2001	0.82
2002	0.78
2003	0.58
2004	0.61

The worm-eating warbler is also a MIS only on the GWNF. USGS Breeding Bird Survey data indicates increasing trends in populations of worm-eating warblers statewide, initially declining then stable trends in the Blue Ridge Mountain region, and stable population trends in the Ridge and Valley region (Figure 21, Figure 22, and Figure 23).

Figure 21. Trend In Breeding Bird Survey Data Of Worm-Eating Warblers Across Virginia, 1966 To 2004

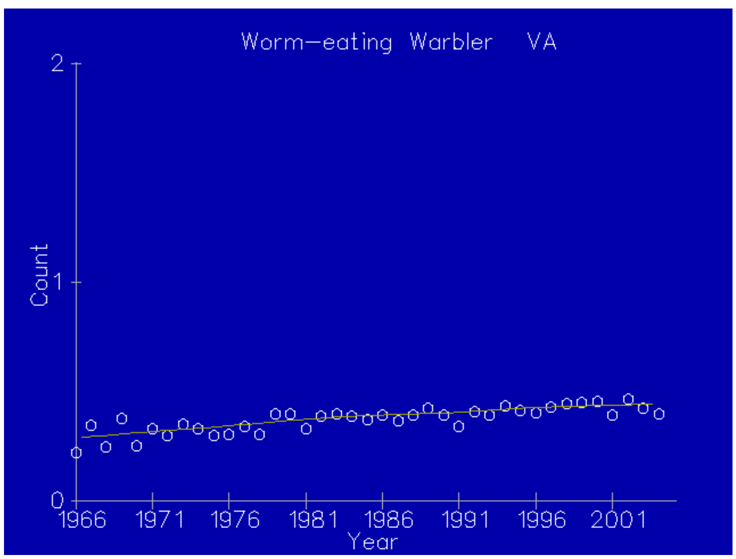


Figure 22. Trend In Breeding Bird Survey Data Of Worm-Eating Warblers Across The Blue Ridge Region, 1966 To 2004

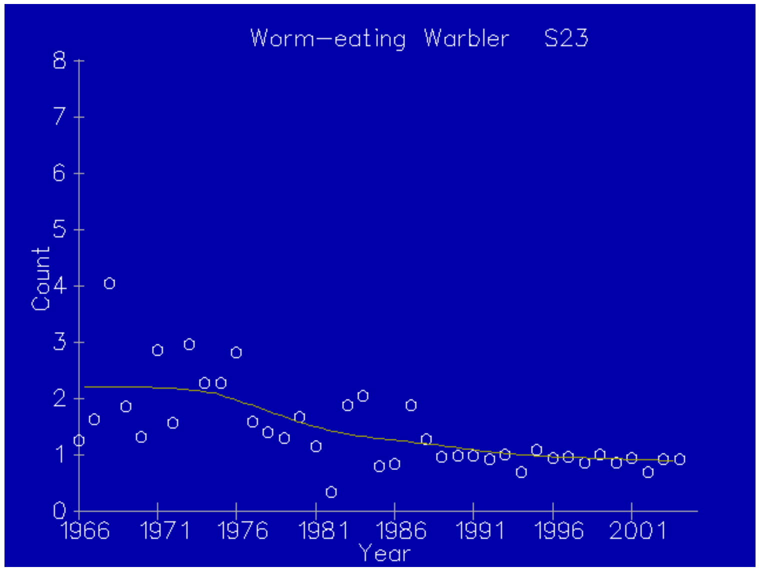
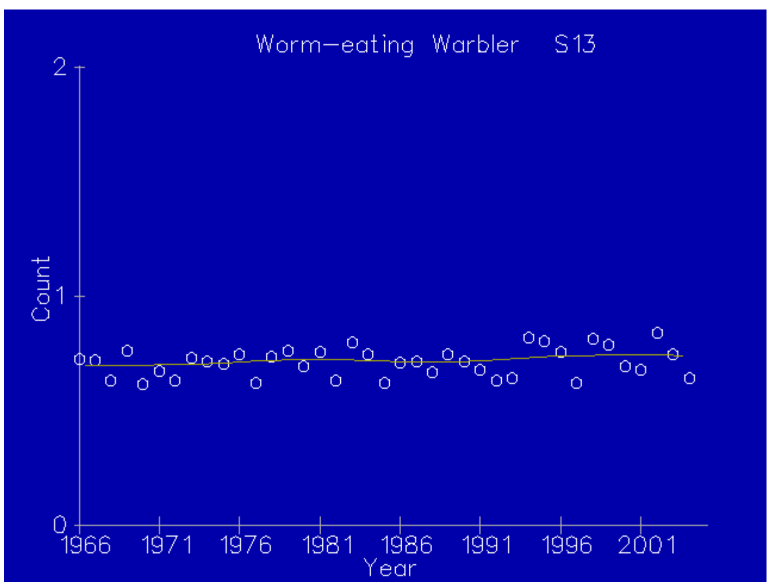


Figure 23. Trend In Breeding Bird Survey Data Of Worm-Eating Warblers Across The Ridge And Valley Region, 1966 To 2004



Avian point count data from the GWJNF's for the worm-eating warbler indicates an overall stable to increasing population trend (Table 33):

Table 33. Trend In GWJNF Point Count Data Of Worm-Eating Warblers Across GWJNF, 1994 To 2004

Year	Average Number of Birds/Point
1994	0.19
1995	0.25
1996	0.26
1997	0.18
1998	0.23
1999	0.31
2000	0.34
2001	0.29
2002	0.27
2003	0.21
2004	0.25

Avian point count data indicates an overall stable to increasing trend for warbler populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Ovenbirds breed in upland deciduous or mixed deciduous/pine forests with a moderately dense understory. They nest on the ground and build a covered nest from leaf litter. (Robbins, et al. 1989). Worm-eating warblers also prefer deciduous or deciduous/pine forests to breed, but they require a denser, evergreen understory. They also nest on the ground in the leaf litter. Both require large patches of mature forest for nesting (Robbins et al. 1989). While the need for large patches of mature forested habitat has been well documented for many migratory birds species, including ovenbirds and worm-eating warblers, evidence is mounting that early successional habitats are also important for these same species during the critical time period just after breeding and during migration (Anders et al. 1996 and 1998, Vega Rivera et al. 1998 and 1999, Pagen et al. 2000, and Hunter et al. 2001). Recent research has documented that adult and fledgling ovenbirds and worm-eating warblers (as well as many other mature forest bird species such as wood thrushes, red-eyed vireos, Kentucky warblers, black-and-white warblers, and hooded warblers) move from their nesting habitats in mature forests to areas characterized by dense, woody vegetation, abundant insect availability, and the presence of ripe fruits (Anders et al. 1998, Vega Rivera et al. 1998, 1999). These areas provide ‘safe havens’ for molting, abundant food for the buildup of fat reserves for migration, and protection from predators. Habitats supporting this kind of vegetation include open oak, oak/pine, and pine woodlands, patches of early successional habitat resulting from insect infestation and natural disturbance such as ice storms, patches of early successional habitat where the overstory had been thinned or harvested in some way (modified shelterwood, clear cut, high-grading), areas of second growth scrub/deciduous saplings located along forest borders and old fields, and mature riparian forests with a dense understory (Anders et al 1998, Vega Rivera et al. 1998, 1999). Several studies have also documented the need for patches of early successional woody habitat within a largely forested landscape to provide abundant food resources and protective cover for migratory bird species during migration (Kilgo et al. 1999, Suthers et al. 2000, Hunter et al. 2001). These studies strongly recommend conservation strategies that maintain large tracts of mature forest, within which there is a mosaic of different forest types and ages (early and mid-successional forest stands), to provide the habitat requirements needed by migratory birds such as ovenbirds and worm-eating warbler during all of their life stages here in North America.

Based on the current age-class structure of forested land in the GWJNF’s, 84% of all forest types are mature (71-150+ years)(See Table 8). Current active forest management in the last 5 years has effected about 1,000 to 2,000 acres per year, or 0.06% of the total forested acres per year (See Table 7). Current prescribed burning has effected 5,000 to 16,000 acres per year, or 0.28% to 0.91% of the total forest acres per year (See Table 7). Both of these activities, in addition to natural disturbances and continued maturation of the forest, should provide patches of early successional woody habitat, as well as restoring and maintaining open oak, oak/pine, and pine woodlands. Combined with the maintenance of over 80% of forested acres in mature forest condition, the GWJNF's should be able to provide the mosaic of forest types and ages recommended by research for migratory birds such as ovenbirds and worm-eating warblers during the life history stages (breeding, post-breeding, migration) that they utilize GWJNF's lands.

Based on the results of monitoring data and habitat evaluation, these two species exhibit stable to increasing population trends on the GWJNF's as well as state-wide and region-wide, and have the abundance and distribution across the Forests that will provide for their persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for either the ovenbird or warbler is recommended. Continue monitoring.

13.Hooded Warbler

a. Reason For Selection: The hooded warbler (*Wilsonia citrina*) was selected in the 2004 JNF revised plan because trends in presence and abundance of this species in mature mesic deciduous forests will help indicate the effectiveness of management in providing dense understory and midstory structure within these forest communities (JNF Revised Plan, pg. 5-4).

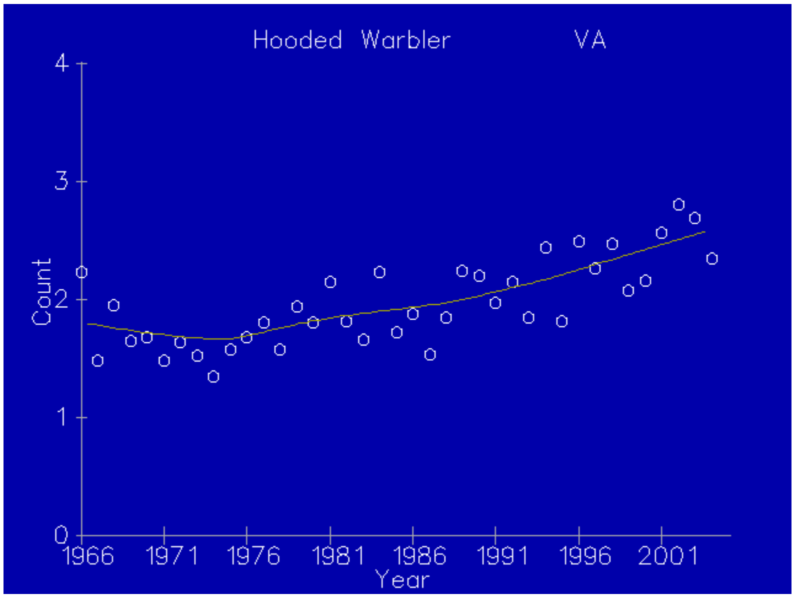
b. Plan Habitat Objectives Related to MIS: For the JNF, implement 400- 600 acres of habitat improvement per year to increase structural diversity for migratory birds in mid to late successional mixed mesophytic, northern hardwood, mesic oak forests, or xeric oak and oak-pine woodlands and maintain 84,000 acres of mixed mesophytic forest communities, sustaining 75% in a mid- to late-successional condition and at least 50% in the late-successional condition by the end of the planning period. (JNF Revised Plan, pp. 2-12, 2-13, and 2-24).

c. Description of Monitoring Method: The USGS Breeding Bird Surveys (BBS) are used. GWJNF avian point counts are used in addition to BBS.

d. Habitat Trend for MIS: See trend in old growth at Table 27. Table 8 shows that 88.6% of the forested acres on the GWJNF's are in a mid- to late-successional age class structure. Table 6 shows the acreage of timber harvest and prescribed fire on the JNF.

e. Population Trend for MIS: USGS Breeding Bird Survey data indicates increasing trends in populations of hooded warblers statewide, and stable to slightly increasing trends in the Blue Ridge Mountain and Ridge and Valley regions (Figure 24, Figure 25, and Figure 26).

Figure 24. Trend In Breeding Bird Survey Data Of Hooded Warblers Across Virginia, 1966 To 2004

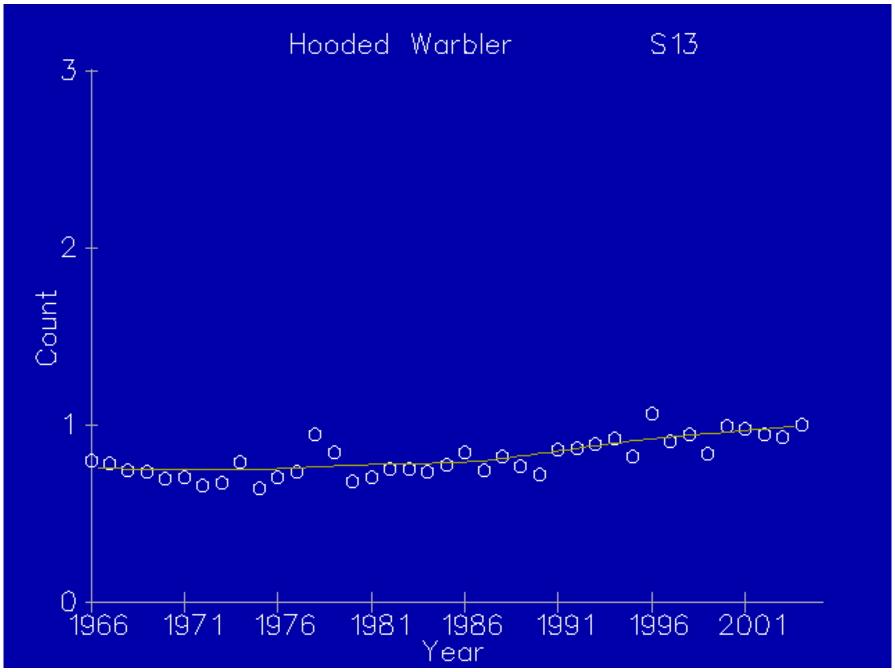


Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 25. Trend In Breeding Bird Survey Data Of Hooded Warblers Across The Blue Ridge Region, 1966 To 2004

Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 26. Trend In Breeding Bird Survey Data Of Hooded Warblers Across The Ridge And Valley Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from the GWJNF point count data for the hooded warbler indicate an overall stable trend on the GWJNF's (See Table 34):

Table 34. Trend In GWJNF Point Count Data Of Hooded Warblers Across GWJNF, 1994 To 2004

Year	Average Number of Birds/point
1994	0.20
1995	0.14
1996	0.20
1997	0.19
1998	0.18
1999	0.21
2000	0.17
2001	0.19
2002	0.15
2003	0.17
2004	0.21

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Hooded warblers occur in deciduous, mixed deciduous/coniferous forest types, near or in riparian areas (Hamel 1992, Robbins et al. 1989). Hooded warblers are associated with canopy gaps and other small patches of dense woody vegetation in an otherwise mature forest (Robbins et al. 1989, Hunter et al. 2001). After breeding, both fledglings and adults move to areas characterized by dense, woody vegetation, abundant insect availability, and the presence of ripe fruits (Morton 1990, Evans Odgden and Stutchbury 1997, Anders et al. 1998, Vega Rivera et al. 1998, 1999). These areas provide 'safe havens' for molting, abundant food for the buildup of fat reserves for migration, and protection from predators. Habitats supporting this kind of vegetation include open oak, oak/pine, and pine woodlands, patches of early successional habitat resulting from insect infestation and natural disturbance such as ice storms, patches of early successional habitat where the overstory had been thinned or harvested in some way (modified shelterwood, clear cut, high-grading), areas of second growth scrub/deciduous saplings located along forest borders and old fields, and mature riparian forests with a dense understory (Anders et al 1998, Vega Rivera et al. 1998, 1999). The Jefferson Revised Forest Plan selected hooded warbler because trends in presence and abundance of this species in mature mesic deciduous forests will help indicate the effectiveness of management in providing dense understory and midstory structure within these forest communities. Table 8 shows that 88.6% of the forested acres on the GWJNF's are in a mid- to late-successional age class structure. Current active forest management has affected about 1,000 to 2,000 acres per year, or 0.06% of the total forested acres per year (See Table 6). Current prescribed burning has affected 5,000 to 16,000 acres per year, or 0.28% to 0.91% of the total forest acres per year (See Table 7). Recent studies strongly recommend conservation strategies that maintain large tracts of mature forest, within which there is a mosaic of different forest types and ages (early and mid-successional forest stands), as well as mature riparian forest, to provide the habitat requirements needed by migratory birds during all of their life stages here in North America, including the hooded warbler (Kilgo et al. 1999, Suthers et al. 2000, Hunter et al. 2001)(see also discussion under ovenbird and worm-eating warbler). Combined with the maintenance of over 80% of forested acres in mature forest condition, the GWJNF's should be able to provide the mosaic of forest types and ages recommended by research for migratory birds such as hooded warbler during the life history stages (breeding, post-breeding, migration) that they utilize GWJNF's lands. With overall stable population trends of hooded warbler on the GWJNF's and stable to increasing trends at the state and regional level, hooded warblers have the abundance and distribution across the Forests that will provide for their persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for the hooded warbler. Continue monitoring.

14.Scarlet Tanager

a. Reason For Selection: The scarlet tanager (*Piranga olivacea*) was selected in the 2004 JNF revised plan because trends in presence and abundance of this species in mid- and late-successional oak and oak-pine forests will help indicate the effectiveness of management in maintaining desired conditions in these forest communities (JNF Revised Plan, pg. 5-4).

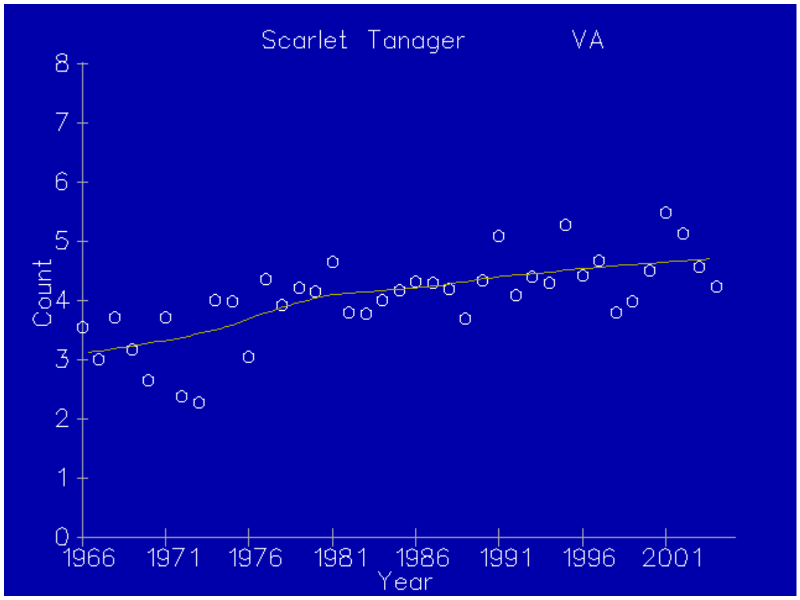
b. Plan Habitat Objectives Related to MIS: For the JNF, implement habitat improvement treatments to increase structural diversity for migratory birds in mid to late successional zeric oak and oak-pine woodlands, maintain existing dry-mesic oak, dry and dry-mesic oak-pine, dry and zeric oak forest communities through a combination of timber harvest, prescribed burning and wildland fire use across 28,000 acres per decade (JNF Revised Plan, pp. 2-12, 2-13, and 2-24).

c. Description of Monitoring Method: The USGS Breeding Bird Surveys (BBS) are used. GWJNF avian point counts are used in addition to BBS.

d. Habitat Trend for MIS: See trend in old growth at Table 27. Table 8 shows that 88.6% of the forested acres on the GWJNF's are in a mid- to late-successional age class structure. Table 6 shows the acreage of timber harvest and prescribed fire on the JNF.

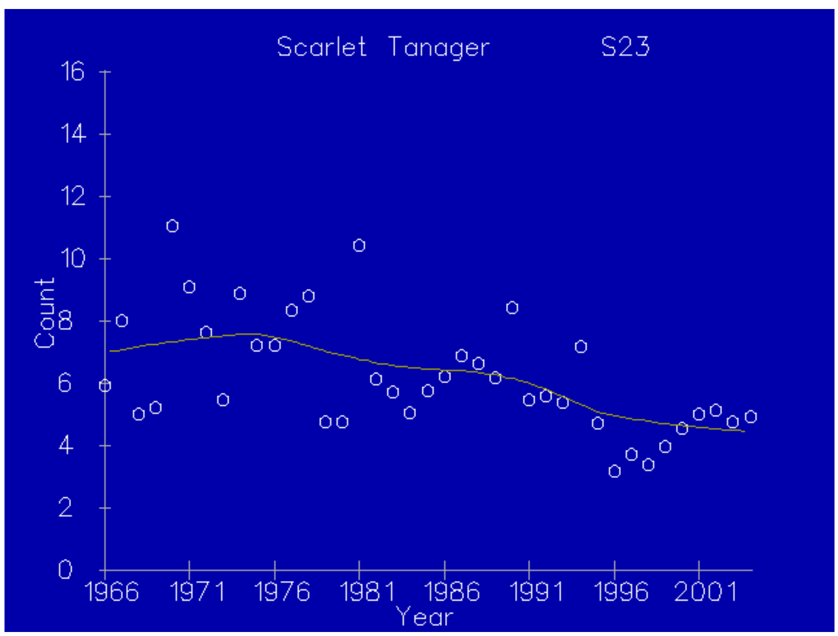
e. Population Trend for MIS: USGS Breeding Bird Survey data indicates increasing trends in populations of scarlet tanagers statewide, stable to slightly decreasing trends in the Blue Ridge Mountain and increasing trend across the Ridge and Valley regions (Figure 27, Figure 28, and Figure 29).

Figure 27. Trend In Breeding Bird Survey Data Of Scarlet Tanagers Across Virginia, 1966 To 2004



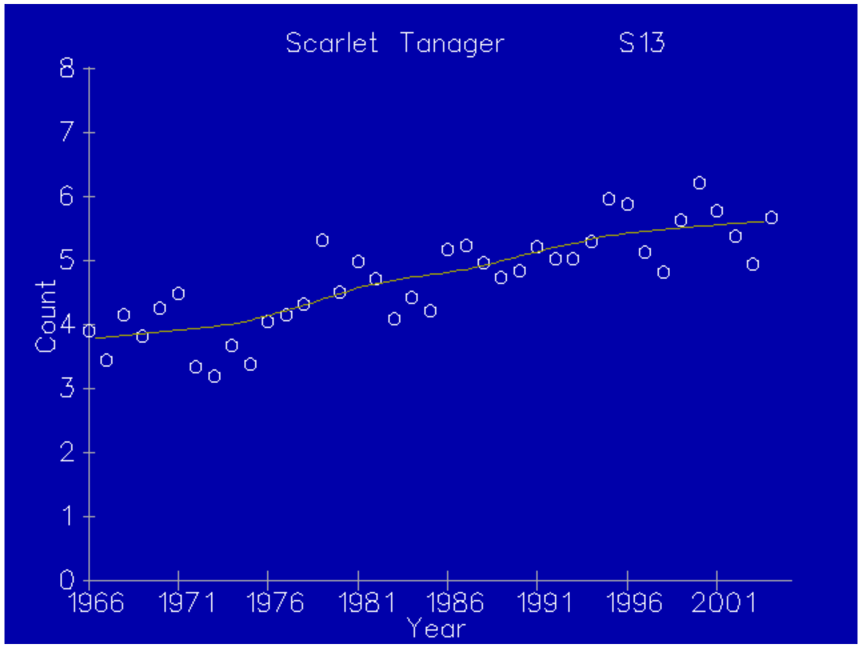
Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 28. Trend In Breeding Bird Survey Data Of Scarlet Tanagers Across The Blue Ridge Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 29. Trend In Breeding Bird Survey Data Of Scarlet Tanager Across The Ridge And Valley Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from the GWJNF point count data for the scarlet tanager are presented in Table 35.

Table 35. Trend In GWJNF Point Count Data Of Scarlet Tanagers Across GWJNF, 1994 To 2004

Year	Average Number of Birds/point
1994	0.44
1995	0.46
1996	0.44
1997	0.42
1998	0.47
1999	0.43
2000	0.45
2001	0.45
2002	0.47
2003	0.47
2004	0.48

Analysis results suggest an overall stable trend for scarlet tanager woodpecker populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Scarlet tanagers occur in deciduous, mixed deciduous/coniferous and coniferous forest types in the Appalachian region (Rosenburg et al. 1999). In the Appalachian region, research has indicated that scarlet tanagers do not show area sensitivity in moderately or heavily forested landscapes (Rosenburg et al. 1999). The Jefferson Revised Forest Plan selected scarlet tanager because trends in presence and abundance of this species in mid- and late-successional oak and oak-pine forests will help indicate the effectiveness of management in maintaining desired conditions in these forest communities (JNF

Revised Plan, pg. 5-4). Table 8 shows that 88.6% of the forested acres on the GWJNF's are in a mid- to late-successional age class structure. Table 6 shows the acreage of timber harvest is staying at around 1,000 acres/year and prescribed fire is increasing in acreage on the Forest, which is within parameters of habitat objectives stated in the revised Jefferson Plan. Recent research strongly recommend conservation strategies that maintain large tracts of mature forest, within which there is a mosaic of different forest types and ages (early and mid-successional forest stands), as well as mature riparian forest, to provide the habitat requirements needed by migratory birds during all of their life stages here in North America, including the scarlet tanager (Kilgo et al. 1999, Suthers et al. 2000, Hunter et al. 2001)(see also discussion under ovenbird and worm-eating warbler). Combined with the maintenance of over 80% of forested acres in mature forest condition, the GWJNF's should be able to provide the mosaic of forest types and ages recommended by research for migratory birds such as ovenbirds and worm-eating warblers during the life history stages (breeding, post-breeding, migration) that they utilize GWJNF's lands. With overall stable to increasing population trends of scarlet tanagers on the GWJNF's and at the state and regional level, scarlet tanagers have the abundance and distribution across the Forests that will provide for their persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for the scarlet tanager. Continue monitoring.

15. Pine Warbler

a. Reason For Selection: The pine warbler (*Dendroica pinus*) was selected in the 2004 JNF revised plan because trends in presence and abundance of this species in mature pine forest will help indicate effectiveness of management at maintaining these communities on the landscape (JNF Revised Plan, pg. 5-4).

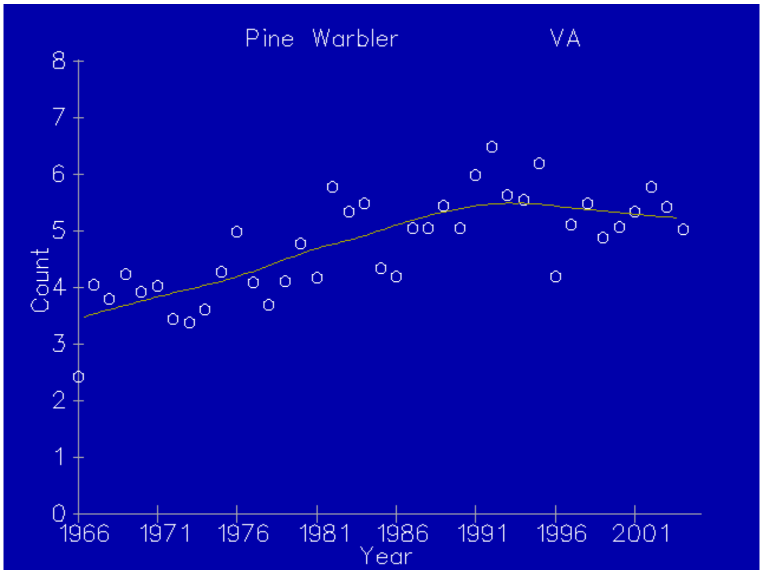
b. Plan Habitat Objectives Related to MIS: For the revised JNF, restore 1,300 acres of open woodland and grassland complexes within the xeric pine and pine-oak forest and woodland community over the planning period, including table mountain pine. Maintain 41,500 acres of zeric pine and pine-oak forest and woodland community, sustaining 10-12% in an early/late successional woodland condition by the end of the planning period. Maintain a prescribed burn cycle of 4-12 years in dry and xeric oak forest, woodlands, and savannas and xeric pine and pine-oak forest and woodland communities (JNF Revised Plan, pp. 2-12, 2-24, and 2-28).

c. Description of Monitoring Method: The USGS Breeding Bird Surveys (BBS) are used. GWJNF avian point counts are used in addition to BBS.

d. Habitat Trend for MIS: See trend in yellow pine at Table 25and Table 26. Table 6 shows the acreage of prescribed fire on the JNF.

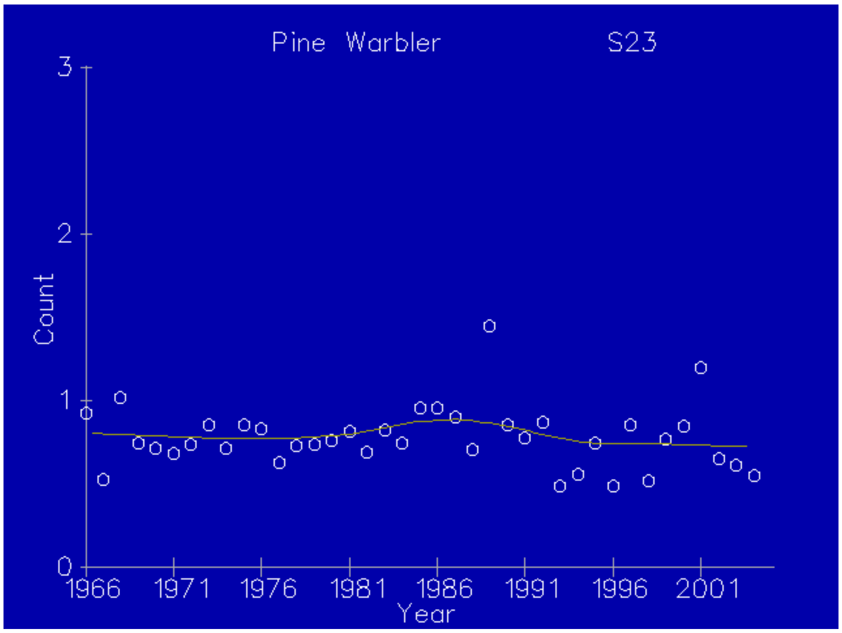
e. Population Trend for MIS: USGS Breeding Bird Survey data indicates increasing to stable trends in populations of pine warblers statewide, stable trends in the Blue Ridge Mountain and stable to increasing trends in the Ridge and Valley regions (Figure 30, Figure 31, and Figure 32).

Figure 30. Trend In Breeding Bird Survey Data Of Pine Warblers Across Virginia, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 31. Trend In Breeding Bird Survey Data Of Pine Warblers Across The Blue Ridge Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 32. Trend In Breeding Bird Survey Data Of Pine Warblers Across The Ridge And Valley Region, 1966 To 2004

Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from the GWJNF avian point count for the pine warbler are presented in Table 36 below:

Table 36. Trend In GWJNF Point Count Data Of Pine Warblers Across GWJNF, 1994 To 2004

Year	Average Number of Birds/point
1994	0.08
1995	0.14
1996	0.10
1997	0.07
1998	0.08
1999	0.09
2000	0.08
2001	0.09
2002	0.08
2003	0.07
2004	0.05

Analysis results suggest an overall stable trend for pine warbler populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Pine warblers occur in mid- to late-successional pine and pine/oak forest types throughout its range (Hamel 1992). It is rarely found in pure hardwood forest types. Pine warblers are temperate migrants in the Appalachians, shifting to the Piedmont and Coastal Plain during the winter months. They are mainly insectivorous during the breeding season, but shift to insects, berries, and small seeds the rest of the year. The Jefferson Forest Plan selected pine warbler because trends in presence and abundance of this species in mature pine forest will help indicate effectiveness of management at maintaining these communities on the landscape (JNF Revised Plan, pg. 5-4). The yellow pine community (see section in this document) shows declining trends across the Forest. However, prescribed fire acreage on the Forest is increasing (See Table 7). As yet, population trends of pine warbler appear to be stable on the GWJNF's and stable to increasing statewide and in the Blue Ridge and Ridge and Valley regions, indicating an abundance and distribution across the Forests that will provide for their persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for the pine warbler. Continue monitoring.

16. Eastern Towhee

a. Reason For Selection: The eastern towhee (*Pipilo erythrophthalmus*)was selected in the 2004 JNF revised plan because trends in presence and abundance of this species in early-successional forests will be used to help indicate the effectiveness of management in achieving desired conditions within these habitats (JNF Revised Plan, pg. 5-4).

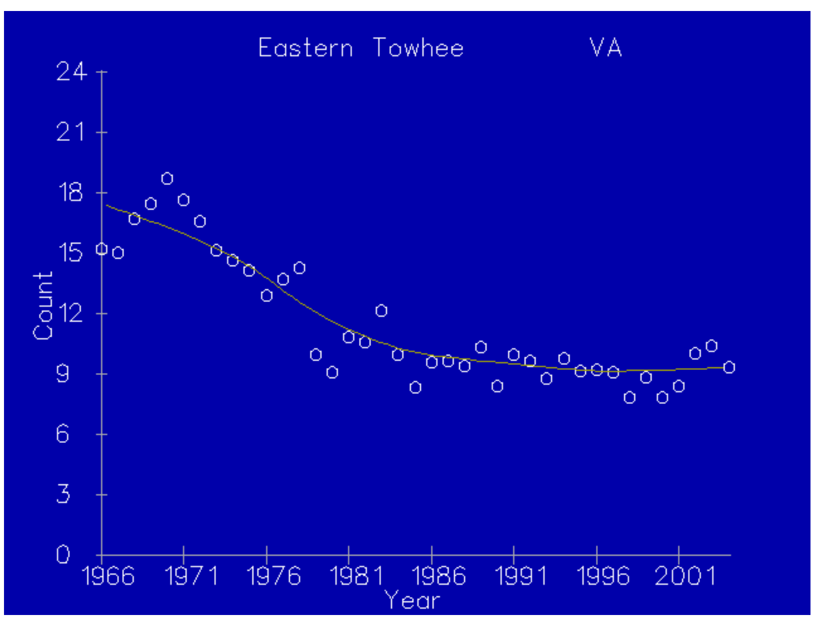
b. Plan Habitat Objectives Related to MIS: For the JNF, restore 1,300 acres of open woodland and grassland complexes within the xeric pine and pine-oak forest and woodland community over the planning period, including table mountain pine. Maintain 41,500 acres of zeric pine and pine-oak forest and woodland community, sustaining 10-12% in an early/late successional woodland condition by the end of the planning period. Maintain a prescribed burn cycle of 4-12 years in dry and xeric oak forest, woodlands, and savannas and xeric pine and pine-oak forest and woodland communities (JNF Revised Plan, pp. 2-12, 2-24, and 2-28).

c. Description of Monitoring Method: The USGS Breeding Bird Surveys (BBS) are used. GWJNF avian point counts are used in addition to BBS.

d. Habitat Trend for MIS: See trend in yellow pine at Table 25and Table 26. Table 6 shows the acreage of timber harvest and prescribed fire on the JNF.

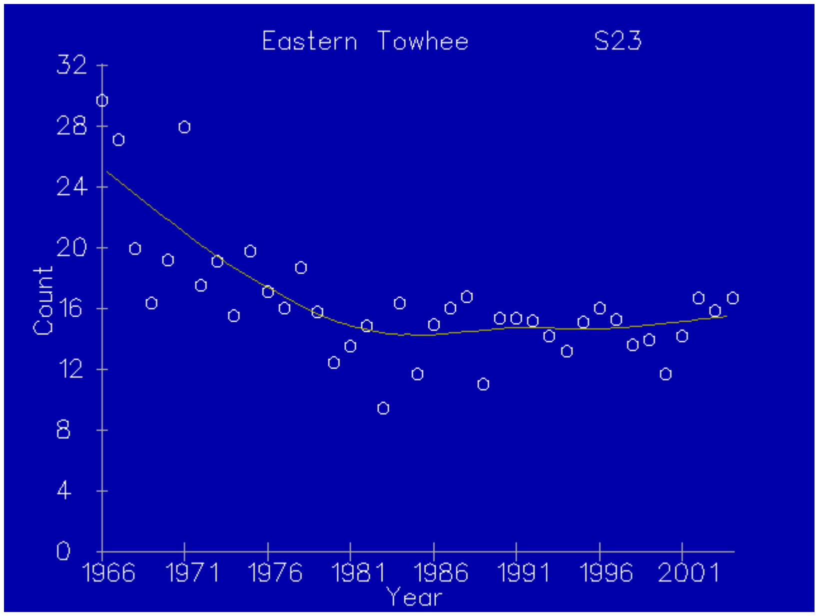
e. Population Trend for MIS: USGS Breeding Bird Survey data indicates initial decreasing then stable trends in populations of eastern towhees statewide and the Blue Ridge Mountain region, and steadily declining trends in the Ridge and Valley regions (Figure 33, Figure 34, and Figure 35).

Figure 33. Trend In Breeding Bird Survey Data Of Eastern Towhees Across Virginia, 1966 To 2004



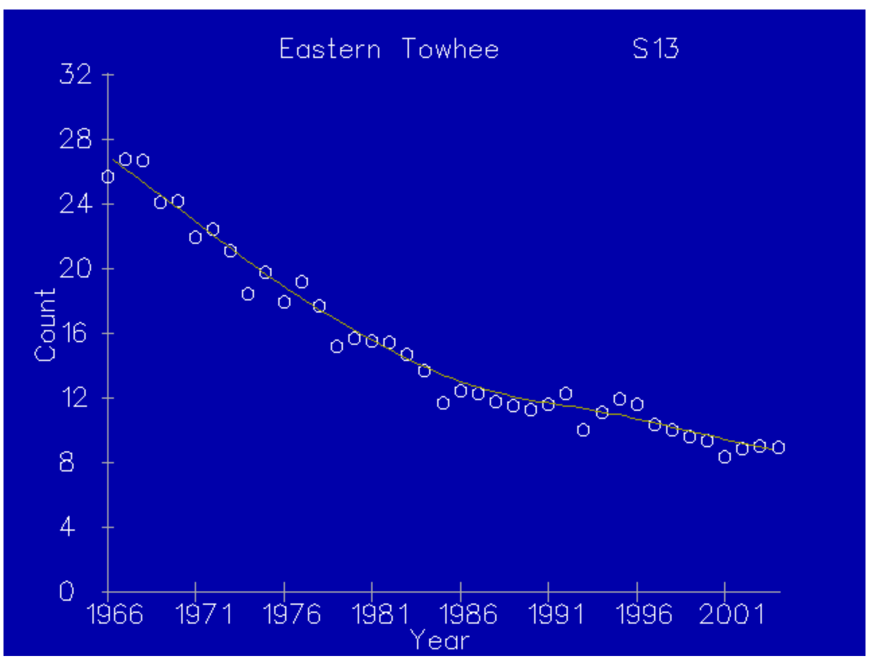
Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 34. Trend In Breeding Bird Survey Data Of Eastern Towhees Across The Blue Ridge Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 35. Trend In Breeding Bird Survey Data Of Eastern Towhees Across The Ridge And Valley Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from the GWJNF avian point count for the eastern towhee are presented in Table 37.

Table 37. Trend In GWJNF Point Count Data Of Eastern Towhees Across GWJNF, 1994 To 2004

Year	Average Number of Birds/point
1994	0.46
1995	0.54
1996	0.46
1997	0.36
1998	0.35
1999	0.32
2000	0.33
2001	0.36
2002	0.35
2003	0.31
2004	0.31

Analysis results suggest an overall stable trend for eastern towhee populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Eastern Towhees inhabit early successional habitat associated with dense second growth, dense vegetation associated with open woodlands, and forest edge habitat (Hamel 1992)(Hunter et al. 2001). Eastern towhees have exhibited significant continental population declines in the last couple of decades, mirroring an overall trend of decline of disturbance-dependent bird species associated with open habitats in eastern North America (Vickery 1992, Askins 2000, Hunter et al. 2001). A significantly greater proportion of bird species exhibiting steep population declines are associated with disturbance-mediated habitats than in forested or generalist habitat types (Brawn et al. 2001). Forty percent of all North American species associated with some type of disturbance-mediated habitat (grassland, shrub-scrub, open woodlands) have been significantly decreasing in population since 1966 (Brawn et al. 2001). Combined with recent research highlighting the importance of early successional woody habitat for post-breeding and migratory stop-over needs of forest-interior migratory bird species in a larger landscape of mature forest (see sections on ovenbirds and worm-eating warblers and hooded warblers), the role of early successional habitat in largely mature, forested landscapes and the need to restore/maintain disturbance regimes creating such habitats is of vital importance in conservation planning (Brawn et al. 2001, Hunter et al. 2001). The Jefferson Revised Forest Plan selected eastern towhee because trends in presence and abundance of this species in early-successional forests will be used to help indicate the effectiveness of management in achieving desired conditions within these habitats (JNF Revised Plan, pg. 5-4). Table 6 shows the acreage of timber harvest is staying at around 1,000 acres/year and prescribed fire is increasing in acreage to about 16,0000 acres/year on the Forest, which is within parameters of habitat objectives stated in the revised Jefferson Plan. The yellow pine community, however, shows decreasing trends (see section in this document). Based on the results of monitoring data, eastern towhees show a stable population trend on the GWNF, statewide and in the Blue Ridge region, indicating an abundance and distribution across the Forests that will provide for their persistence into the foreseeable future, though the steadily declining trends in the Ridge and Valley region are cause for concern.

g. Recommendation: No change in Plan direction for the eastern towhee. Continue monitoring.

17. Acadian flycatcher

a. Reason For Selection: The Acadian flycatcher (*Empidonax virescens*) was selected in the 2004 JNF revised plan because trends in presence and abundance of this species in mature riparian forests will be used to help indicate the effectiveness of management in achieving desired conditions within these habitats (JNF Revised Plan, pg. 5-4).

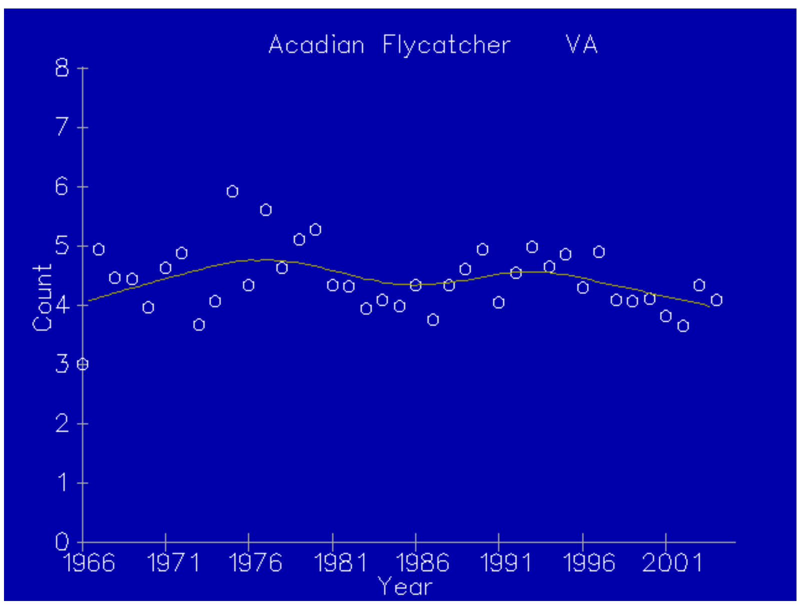
b. Plan Habitat Objectives Related to MIS: For the JNF, manage and restore riparian ecosystems, to protect and enhance the inherent ecological processes and functions of the associated aquatic, riparian, and upland components with the corridor (JNF Revised Plan, pp. 2-6, 2-12, 3-179).

c. Description of Monitoring Method: The USGS Breeding Bird Surveys (BBS) are used. GWJNF avian point counts are used in addition to BBS.

d. Habitat Trend for MIS: Riparian habitat is associated with all forest types on the GWJNF's. Table 8 shows that 88.6% of the forested acres on the GWJNF's are in a mid- to late-successional age class structure. Table 6 shows the acreage of timber harvest and prescribed fire on the JNF.

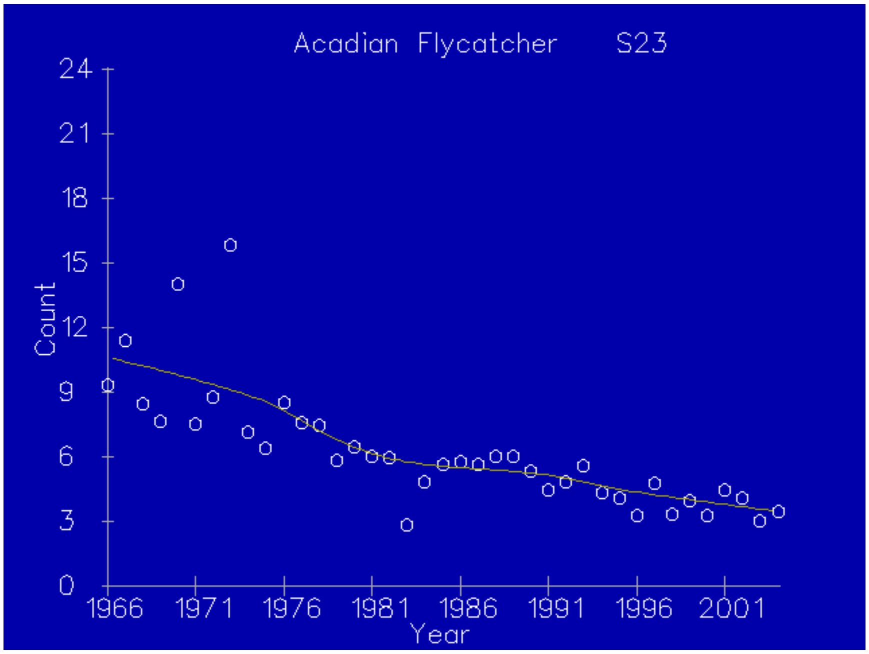
e. Population Trend for MIS: USGS Breeding Bird Survey data indicates variable but overall stable trends of Acadian flycatchers statewide, with declining trends in the Blue Ridge Mountain and Ridge and Valley regions (Figure 36, Figure 37, and Figure 38).

Figure 36. Trend In Breeding Bird Survey Data Of Acadian Flycatchers Across Virginia, 1966 To 2004



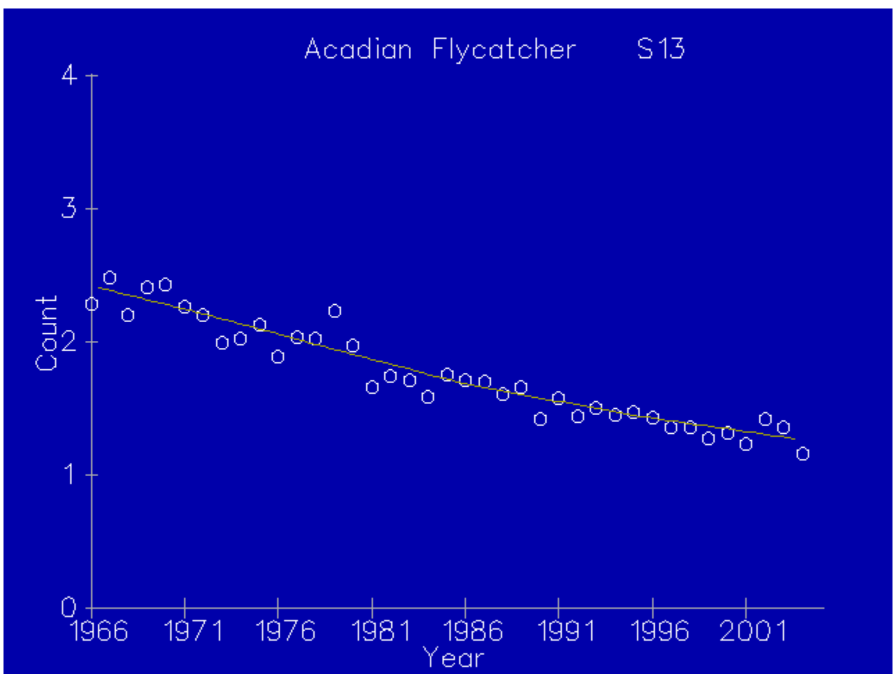
Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 37. Trend In Breeding Bird Survey Data Of Acadian Flycatchers Across The Blue Ridge Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 38. Trend In Breeding Bird Survey Data Of Acadian Flycatchers Across The Ridge And Valley Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from the GWJNF point count data for the Acadian flycatcher indicate an overall stable trend on the GWJNF's (See Table 38):

Table 38. Trend In GWJNF Point Count Data Of Acadian Flycatchers Across GWJNF, 1994 To 2004

Year	Average Number of Birds/point
1994	0.06
1995	0.11
1996	0.13
1997	0.15
1998	0.17
1999	0.16
2000	0.14
2001	0.16
2002	0.15
2003	0.12
2004	0.13

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Acadian flycatchers occur in deciduous, mixed deciduous/coniferous forest types, in riparian areas (Hamel 1992). Acadian flycatchers are often associated with closed overstory canopies and open understories. After breeding, Acadian flycatchers utilize open scrub and early successional woody habitat during migration (NatureServe 2005). The Jefferson Revised Forest Plan selected Acadian flycatchers because trends in presence and abundance of this species in mature riparian forests will be used to help indicate the effectiveness of management in achieving desired conditions within these habitats (JNF Revised Plan, pg. 5-4). Both GWNF and JNF Plans have strong protection standards for riparian areas throughout the Forests (GWNF Revised Plan 3-146 through 3-148, JNF Revised Plan 2-7 through 2-9). Table 8 shows that 88.6% of the forested acres on the GWJNF's are in a mid- to late-successional age class structure. Current active forest management has effected about 1,000 to 2,000 acres per year, or 0.06% of the total forested acres per year (See Table 6). Current prescribed burning has effected 5,000 to 16,000 acres per year, or 0.28% to 0.91% of the total forest acres per year (See Table 6). Recent studies strongly recommend conservation strategies that maintain large tracts of mature forest, within which there is a mosaic of different forest types and ages (early and mid-successional forest stands), as well as mature riparian forest, to provide the habitat requirements needed by migratory birds during all of their life stages here in North America, including the Acadian flycatcher (Kilgo et al. 1999, Suthers et al. 2000, Hunter et al. 2001)(see also discussion under ovenbird and worm-eating warbler). Combined with the maintenance of over 80% of forested acres in mature forest condition, the GWJNF's should be able to provide the mosaic of forest types and ages recommended by research for migratory birds such as Acadian flycatchers during the life history stages (breeding, post-breeding, migration) that they utilize GWJNF's lands. With overall stable population trends of Acadian flycatcher on the GWJNF's, and stable trends at the state level, Acadian flycatchers have the abundance and distribution across the Forests that will provide for their persistence into the foreseeable future. Though such trends are not apparent on the GWJNF's, of concern are declining trends shown by USGS BBS data in populations of Acadian flycatcher throughout the larger regions of the Blue Ridge Mountains and Ridge and Valley Regions.

g. Recommendation: No change in Plan direction for the Acadian flycatcher. Continue monitoring.

18. Chestnut-sided Warbler

a. Reason For Selection: The chestnut-sided warbler (*Dendroica pensylvanica*) was selected in the 2004 JNF revised plan because trends in presence and abundance of this species in areas that provide high elevation early-successional habitats will be used to help indicate the effectiveness of management in achieving desired conditions within these habitats (JNF Revised Plan, pg. 5-4).

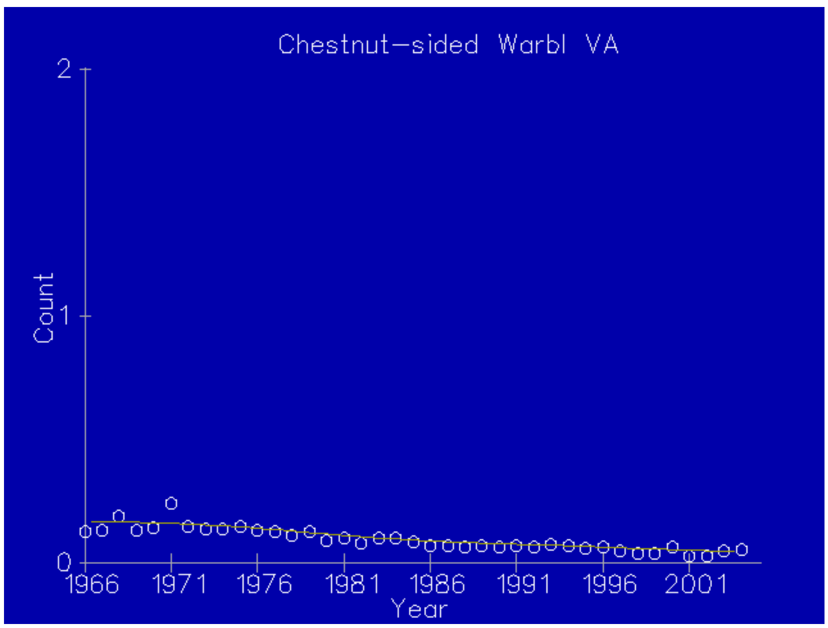
b. Plan Habitat Objectives Related to MIS: For the JNF, restore and maintain approximately 2,500 acres above 2,800 feet elevation in early successional habitats to provide habitat for high-elevation, early successional migratory bird species over the planning period (JNF Revised Plan, pp. 2-12, 2-13).

c. Description of Monitoring Method: The USGS Breeding Bird Surveys (BBS) are used. GWJNF avian point counts are used in addition to BBS.

d. Habitat Trend for MIS: See trend in early successional habitat at Table 8. Table 6 shows the acreage of timber harvest and prescribed fire on the JNF.

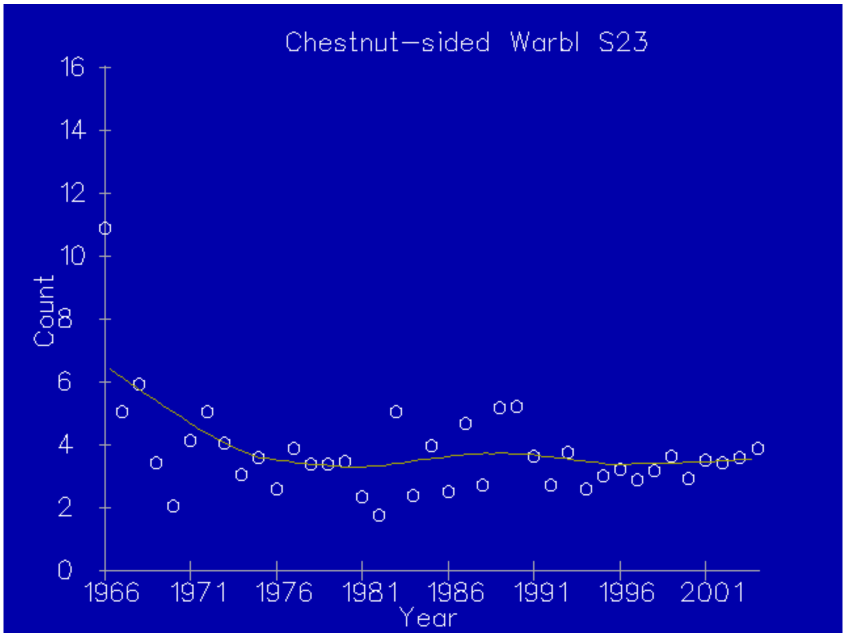
e. Population Trend for MIS: USGS Breeding Bird Survey data indicates decreasing trends in populations of chestnut-sided warblers statewide and the Ridge and Valley regions, and relatively stable trends in the Blue Ridge region (Figure 39, Figure 40, and Figure 41).

Figure 39. Trend In Breeding Bird Survey Data Of Chestnut-Sided Warblers Across Virginia, 1966 To 2004



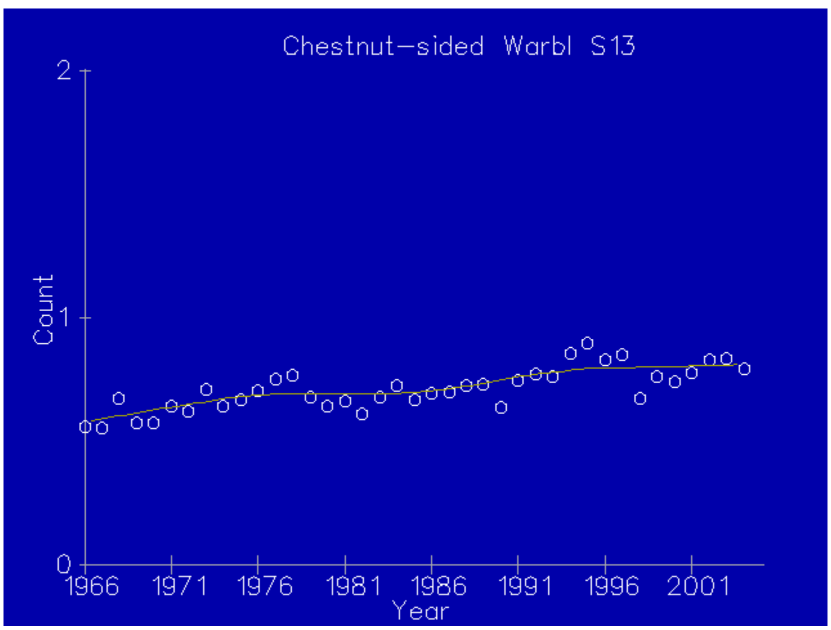
Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 40. Trend In Breeding Bird Survey Data Of Chestnut-Sided Warblers Across The Blue Ridge Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Figure 41. Trend In Breeding Bird Survey Data Of Chestnut-Sided Warblers Across The Ridge And Valley Region, 1966 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Data from the GWJNF avian point count for the chestnut-sided warbler indicate an overall stable to slightly increasing trend (See Table 39):

Table 39. Trend In GWJNF Point Count Data Of Chestnut-Sided Warblers Across GWJNF, 1994 To 2004

Year	Average Number of Birds/point
1994	0.05
1995	0.10
1996	0.06
1997	0.09
1998	0.07
1999	0.08
2000	0.11
2001	0.12
2002	0.12
2003	0.09
2004	0.08

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Chestnut-sided warblers are associated with larger patches (e.g. greater than 12 acres) of early successional woodlands, mountain laurel thickets, and forest edge habitat above 2,000 feet (Hamel 1992, Hunter et al. 2001). Chestnut-sided warblers have exhibited significant continental population declines in the last couple of decades, mirroring an overall trend of decline of disturbance-dependent bird species associated with open habitats in eastern North America (Vickery 1992, Askins 2000, Hunter et al. 2001). A significantly greater proportion of bird species exhibiting steep population declines are associated with disturbance-mediated habitats than in forested or generalist habitat types (Brawn et al. 2001). Forty percent of all North American species associated with some type of disturbance-mediated habitat (grassland, shrub-scrub, open woodlands) have been significantly decreasing in population since 1966 (Brawn et al. 2001). Combined with recent research highlighting the importance of early successional woody habitat for post-breeding and migratory stop-over needs of forest-interior migratory bird species in a larger landscape of mature forest (see sections on ovenbirds, worm-eating warblers, and hooded warblers), the role of early successional habitat in largely mature, forested landscapes and the need to restore/maintain disturbance regimes creating such habitats is of vital importance in conservation planning (Brawn et al. 2001, Hunter et al. 2001). The Jefferson Revised Forest Plan selected eastern towhee because trends in presence and abundance of this species in early-successional forests will be used to help indicate the effectiveness of management in achieving desired conditions within these habitats (JNF Revised Plan, pg. 5-4). Current active forest management has affected about 1,000 to 2,000 acres per year, or 0.06% of the total forested acres per year. Current prescribed burning has effected 5,000 to 16,000 acres per year, or 0.28% to 0.91% of the total forest acres per year. Based on the results of monitoring data, this species shows a stable population trend on the GWNF, and in the Blue Ridge region, with an abundance and distribution across the Forests that will provide for their persistence into the foreseeable future, though the steadily declining trends in the Ridge and Valley region and statewide are cause for concern.

g. Recommendation: No change in Plan direction for the chestnut-sided warbler. Continue monitoring.

Threatened and Endangered Species

19. Indiana Bat

See discussion under Section dealing with “Cave Dwelling Bats”.

20. Virginia Northern Flying Squirrel

a. Reason For Selection: The Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*) was listed as endangered in 1985 by the USFWS. This squirrel was selected for the George Washington Forest Plan because it is a federally endangered species and therefore there is direct interest in its population status. The species occurs in high-elevation forests in the southern Appalachians, being restricted to mature red spruce/northern hardwood areas (Laurel Fork) on the GWNF. Virginia northern flying squirrel is not listed as an MIS for the Jefferson Forest Plan

For purposes of this analysis, the fundamental relationship between the squirrel and its habitat is that it prefers mature red spruce and northern hardwoods, typically associated with the spruce-northern hardwood old growth forest type group. The spruce forest type is to be protected (GWNF FEIS, page J-19). See earlier discussion of old growth. The amount and distribution of mature red spruce and northern hardwoods are most likely to be influenced by management activities associated with timber harvesting, or herbicide applications to deal with a pest that strikes red spruce.

b. Plan Habitat Objectives Related to MIS: A specific habitat objective related to mature red spruce and northern hardwoods to achieve minimum populations for the Virginia northern flying squirrel *(Glaucomys sabrinus fuscus)* is stated in the GWNF Revised Forest Plan. That objective states "…stands that contain a red spruce component are managed to increase the red spruce component. In such an instance, the activities must comply with the Recovery Plan for the Virginia northern flying squirrel" (GWNF Plan, Common Standard #244, page 3-150).

Furthermore, on the GWNF, the Revised Forest Plan recognized the significance of the Laurel Fork area by designating it as a Special Management Area (GWNF Revised Plan, page 3-109). This is 10,000 acre area encompasses most of the known range of the squirrel on the GWNF. In Laurel Fork, the Plan's objective is to maintain and, where appropriate, enhance habitat for this unique species west of Laurel Fork stream (Plan page 3-110).

c. Description of Monitoring Method: The Forest has been coordinating with VDGIF and Dr. John Pagels at Virginia Commonwealth University to monitor northern flying squirrels. From 1985 to 1996, 349 nest boxes were set up at 26 sites. Red spruce, northern hardwood, or hemlock-dominated forest characterized each site. Depending on the size of the available habitat, 6 to 20 nest boxes were installed at each site approximately 50 m apart. Nest boxes were checked three to four times a year at most sites, usually twice in the fall and twice in the spring. In some years, several sites were checked only once or twice annually because of time or weather constraints. Nest boxes were checked during daylight hours when the squirrels were inactive. If squirrels were present the following data were collected: age, mass, reproductive condition. They were marked with metal ear tags and released at the capture site. Tail length, a character used in separating the subspecies *G.s.coloratus* and *G.s.fuscus,* was recorded for squirrels captured in southwestern Virginia (Mt Rogers/Whitetop area). Monitoring continues to the present time on the NRA, but no monitoring has been conducted in Laurel Fork since 1996 due to budgets. Additional monitoring was conducted from 2000-2002 to determine nest site characteristics and home range and resource partitioning of northern flying squirrels in the Mt Rogers/Whitetop area (Hackett and Pagels, 2002a and Hackett and Pagels, 2002b).

d. Habitat Trend for MIS: The habitat is stable to increasing. See trend in spruce-northern hardwood old growth forest type group in Table 27.

e. Population Trend for MIS: Flying squirrels were trapped in the Laurel Fork area between 1986 and 1996 to obtain population trend data. The number of squirrels trapped ranged from 0 to six. No squirrels were trapped in six out of the ten years of trapping. Based on this information, the GWNF Plan estimated that there were fewer than 20 northern flying squirrels (NFS) on the Forest (all in the Laurel Fork area) at the time the Plan was written (1993). This area is immediately adjacent to a large area of

NFS habitat on the Monongahela National Forest, and is a part of the Spruce Knob/Laurel Fork Geographic Recovery Area for *G. s. fuscus* (USFWS, 1990). Table 40 shows the trends by location for the northern flying squirrel.

Table 40. Northern Flying Squirrel Trend by Site Across the GWJNF

Number of Individuals captured/10 boxes checked and the total number of G.sabrinus captured (in parenthesis) in Virginia from 1986 to 1996 (From Reynolds, in press), and 2002 (Pagels, annual report)												
Sites 1 through 4 are located in Grayson and Smyth Counties, sites 5 and 6 are located in Highland County.												
Year		86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	2002
Cabin Creek	Site #1	0.2(2)	1.6(13)	0.9(7)	1.5(12)	1.0(6)	1.6(9)	0.0(0)	1.4(5)	1.4(8)	0.6(2)	0.1(5)
Whitetop	Site #2	0.4(4)	0.8(6)	0.0(0)	0.6(5)	0.0(0)	0.0(0)	0.0(0)	0.5(2)	0.5(3)	1.3(2)	0.09(12)
Opossum Creek	Site #3*	0.0(0)	0.0(0)	0.0(0)	0.13(1)	0.0(0)						
Lower Whitetop	Site #4**							0.0(0)	7.0(7)	1.0(2)	0.0(0)	
Newman’s Run	Site #5	0.17(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	
Laurel Fork	Site #6	0.0(0)	1.6(3)	0.0(0)	0.0(0)	3.8(6)	1.5(3)	0.0(0)	0.0(0)	0.0(0)	1.7(3)	
Total Number Captured Per 10 Boxes		0.77	4.00	0.90	2.23	4.8	3.1	0.0	8.9	2.9	3.6	0.19

Analysis results suggest an overall stable trend for northern flying squirrel populations on both the GWNF and JNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

This species is inherently rare and not naturally well distributed across the Forest due to its dependence on the spruce-fir/northern hardwood ecotone. The spruce forest and its ecotone with northern hardwood forests is the only habitat for this species in the Appalachian Mountains. This habitat type is fairly stable on the GWJNF, but is being impacted by balsam wooly adelgid affecting the Fraser fir in the Whitetop area (sites #1 thru #5 in above table) of the JNF. Air pollution may be having a generalized negative impact in some areas of the higher elevation habitats, but it is unclear whether the Fraser fir forest types are declining at Whitetop (even though trends show an overall stable habitat), and, if so, what the relationship is to air pollution. The Forest analyzed the continued use of cattle grazing to maintain the open areas in the High Country of the Mt. Rogers NRA and informally consulted with the USFWS. Both agencies concluded that continued grazing would have no effect on northern flying squirrels. Thus, as documented in a site-specific Biological Evaluation, Forest Service management activities are having no effect on the northern flying squirrel.

Squirrel populations are expected to remain relatively stable in the near future. The GWNF encompasses a single population of the Virginia northern flying squirrel that is disjunct from its almost contiguous boreal distribution across northern North America, the Rocky Mountains, and New England. It’s therefore inherently rare and thus not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the flying squirrel population considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to provide for viability (persistence over time) of this disjunct population.

g. Recommendation: No change in Plan direction for northern flying squirrels is recommended. Continue monitoring on the NRA; reinstitute annual monitoring in Laurel Fork.

21. James Spinymussel

a. Reason For Selection: The James spinymussel (*Pleurobema collina*) was selected because it is a federally endangered aquatic species; therefore, its population status is of direct interest. Its habitat is directly affected by water quality with it being sensitive to siltation (GWNF FEIS, page J-19).

For purposes of this analysis, the fundamental relationship between the spinymussel and its habitat is water quality and the streambed substrate where it lives. Water quality, in streams with their watersheds on NFS land, is most likely to be negatively influenced by management activities that have the potential to introduce sediment into the streams. Water quality in streams draining private lands near the Forest is most likely to be influenced by agricultural activities and point-source discharges.

b. Plan Habitat Objectives Related to MIS: Plan objectives are to maintain sedimentation rates that are in equilibrium with the watershed and to not alter biological communities as measured using EPA's Rapid Bioassessment, Protocol II (EPA 1989). The application of riparian area and soil and water Plan standards and guidelines will protect downstream aquatic habitat, where historic and current occurrences and suitable habitats for the spinymussel are found. Projects in riparian areas that occur within or near occupied or suitable habitat, are addressed with site-specific measures, such as Best Management Practices (GWNF FEIS, Appendix K, page K-5 and K-6).

c. Description of Monitoring Method: Chapter 5 of the GWNF FEIS lists two monitoring questions that apply to all federally listed threatened and endangered species:

1) Were requirements outlined in federal species recovery plans implemented?

For this species the recovery plan (USFWS, 1990) lists the following tasks relating to the Forest Service:

a. Conduct surveys.
b. Continue to utilize existing legislation and regulations to protect species.
c. Provide long-term protection of essential habitats through acquisition, registry, management agreements, etc.
d. Seek support from landowners, local governments, and agencies.

These tasks may be accomplished through the Forest's planning process, including inventory and monitoring, through project review and implementation, and through cooperative agreements and memoranda of understanding.

2) Is habitat for all existing threatened and endangered species being maintained or improved with no unwarranted habitat alterations/degradations happening?

This question is answered using qualitative and quantitative field surveys that are conducted by snorkeling along transects in potential or known habitat, in addition to biological monitoring using benthic macroinvertebrates.

d. Habitat Trend for MIS: The James spinymussel is a freshwater mussel endemic to the James River where it is found in runs with moderate currents and sand, gravel, or cobble substrate with water hardness values greater than 50 mg/l calcium carbonate (Hove, 1990). It historically was found in the James River above the Fall Line at Richmond, Virginia, but is now restricted to small, headwater tributaries typical of the habitat of its eight fish hosts, which include rosyside dace, bluehead chub, mountain redbelly dace, blacknose dace, central stoneroller, rosefin shiner, satinfin shiner, and swallowtail shiner (Hove and Neves, 1994).

Loss and fragmentation of spinymussel habitat on larger rivers has slowed since no major impoundments are currently proposed or being built. The fish hosts found on the Forest are not endangered, threatened, sensitive, or locally rare, therefore they are not thought to be a limiting factor. Water quality as related to acid deposition is reducing the calcium carbonate found in some streams that are not well buffered. Sediment loading seems to be the current major threat to populations of this species and is continuing to occur on private land.

e. Population Trend for MIS: Since this mussel is only an MIS for the GWNF, Table 41 is a summary of survey findings for streams on or near that National Forest. Survey data collected by M. O'Connell and R.J. Neves in 1991 and 1992, M. McGregor in 1999 through 2001, B. Evans in 2002 and 2003, and B. Watson in 2004 is compiled in this table. The O'Connell and Neves survey was designed to locate *P. collina* in upstream tributaries of the James River. Table 41 shows the streams on the GWNF that were surveyed. Other than the larger rivers, the majority of the Forest Service streams do not have mussels in them. The discussion in the report explained, "tributaries of the Pedlar River and other streams surveyed in the Pedlar District have little or no mussel habitat" (O'Connell and Neves, 1992). Tributaries surveyed on the GWNF "in Bath and Alleghany counties were also too small to have mussel habitat " (O'Connell and Neves, 1992).

Table 41. James Spinymussel Occurrence Trend In Streams On/Near The George Washington National Forest

Date	Stream	County	# Found Live/ Dead	Location	Owned by FS (Y/N) Approx.Miles downstream
1990	Potts Creek	Allegheny	1/0	Cast Steel Confluence	N ¼
1990, 1991, 1992	Pedlar River	Amherst	1/0	Jacks Branch	N 3
1990, 1991, 1992	Pedlar River	Amherst	0/2	Pedlar Mills	N 4
1991	Skulking Branch	Amherst	0		Y
1991	Browns Creek	Amherst	0		Y
1992	Brown Mtn Creek	Amherst	0		Y
1992	Swapping Camp Creek	Amherst	0		Y
1992	Enchanted Creek	Amherst	0		Y
1992	Jacks Branch	Amherst	0		N
1992	Dancing Creek	Amherst	0		Y
1992	Thomas Mill Creek	Amherst	0		Y
1992	Otter Creek	Amherst	0		Y
1992	Terrapin Creek	Amherst	0		Y
1992	Rocky Row Run	Amherst	0		Y
1992	Cashaw Creek	Amherst	0		Y
1992	Maury River	Rockbridge	0		N
1992	Wilson Creek	Bath	0		Y
1992	Smith Creek	Bath	0		Y
1992	Cast Steel Run	Allegheny	0		Y
1992	Mill Branch	Allegheny	0		Y
1992	Paxton Branch	Allegheny	0		N
1992	Nelsen Branch	Allegheny	0		N

Date	Stream	County	# Found Live/ Dead	Location	Owned by FS (Y/N) downstream
1999	Potts Creek	Allegheny	0		N
1999	Blue Spring	Allegheny	0		N
1999	Piney River	Nelson	0		N
1999	Pedlar River	Amherst	0/1	So. of Dancing Creek	N 2.5
1999	Pedlar River	Amherst	2/0	No. of Cedar Creek	N 3.5
1999	Pedlar River	Amherst	0/3	130 crossing	N 5
1999	Buffalo River	Nelson	0		N
1999	NF Buffalo river	Nelson	0		Y
2000	Mill Creek	Augusta	8/0	39 crossing	N 3.5
2000	Thompson Creek	Bath	0		N
2000	Mill Creek	Bath	0	Dagger Springs	N
2000	Sinking Creek	Alleghany	0		N
2000	Cowpasture River	Bath	0	632 boat ramp	Y
2001	Cowpasture River	Augusta	0	Coursey Springs	N
2001	Calfpasture River	Rockbridge	0	Goshen	N
2001	Jackson River	Bath	0	Meadowlane	N
2001	Jackson River	Bath	0	North of Moomaw	N
2001	Cowpasture River	Augusta	0	@614/250	N
2001	Tye River	Nelson	0		N
2001	NF Tye River	Nelson	0		N
2002	Cowpasture River	Bath	1/0	Fort Lewis	N .5
2003	Cowpasture River	Bath	1/0	Fort Lewis	N .5
2004	Cowpasture River	Bath	2/0	Scotchtown Draft	Y
2004	Cowpasture River	Bath	0	Wood property	N
2004	Cowpasture River	Bath	0	Walton Tract	Y
2004	Cowpasture River	Bath	0	Maguires Farm	N
2004	Cowpasture River	Bath	0	Wallace Tract	Y

O'Connell and Neves conducted James spinymussel surveys in 1990 through 1992 to find the distribution of this mussel in streams of the GWJNF (O'Connell & Neves 1991, O'Connell and Neves 1992). As seen Table 41above, most of the Forest Service streams surveyed did not contain spinymussels. This was attributed to lack of suitable habitat; the streams were too rocky, too cold, or too high of a gradient.

A preliminary report to the USFWS by Monte McGregor (VDGIF biologist) (1999) contains recent population data on the federally endangered James spinymussel (*Pleurobema collina*). This report describes a survey of the James spinymussel in Virginia with emphasis in the upper Rivanna River watershed and the upper James River tributaries begun in July 1998.

In the summer of 1998, VDGIF staff of the Nongame and Endangered Wildlife Program examined 61 sites on the Rivanna River in Albermarle, Green, Fluvanna, and Louisa counties, finding 11 species of bivalves. *Pleurobema collina* was identified from seven sites, with three new records. All sites with *P. collina* had low densities, with less than ten individuals of the James spinymussel. There was evidence for recruitment, as several *P. Collina* were less than 2-5 years in age. Densities of *P. collina*, however, were proportionally lower than densities of young and adults of other species.

In the late spring through the fall of 1999, VDGIF staff surveyed the Hardwater River, Rockfish River, Buffalo River, Pedlar River, Appomattox River, and Potts and Craig Creek tributaries for *P.collina*. The Buffalo River (including North Fork Buffalo), Blue Spring, Potts Creek, and the Pedlar River are the only streams that are on or near George Washington National Forest land. No spinymussels were found in the Buffalo, North Fork Buffalo, Blue Spring, or lower Potts Creek. One live and several fresh relicts were found in the Pedlar River in three new sites about a mile below the confluence with Dancing Creek. This is downstream from Forest Service property. *P. collina* were found in Johns Creek, Craig Creek, Dicks Creek, and Catawba Creek, within the Craig Creek watershed, near the Jefferson National Forest.

Of the 15 VDGIF survey locations in 2000, *P. collina* was only found in Mill Creek, Bath County. Dr. Neves from Virginia Polytechnic Institute and Sate University surveyed for the spinymussel on the South Fork of Potts Creek in Monroe County, WV in 2000. *P. collina* abundance has declined by 25% in 5 years in the survey sections in that stream. Throughout the Craig Creek drainage, *P. collina* numbers are declining (Pers. Com., Neves, 12/5/00).

VDGIF surveys in 2001 did not locate any *P. collina* in streams on or near the George Washington National Forest. *P. collina* were found in Potts Creek in West Virginia.

P. collina were found by Brian Evans of the US Fish and Wildlife Service in the Cowpasture River, downstream from National Forest in 2002 and 2003.

Surveys conducted jointly by the FWS, VDGIF, USFS, and Virginia Tech in 2004 located many *P. collina* individuals (including gravid females) in Johns Creek, Craig Co. Additional surveys of the Cowpasture River in Bath Co. located several individuals of *P. collina* in the vicinity of National Forest land.

Recent surveys have increased the number of occurrences downstream of the GWNF to 10. Analysis results suggest an overall increasing trend for spinymussel populations near the GWNF. The Forest is currently working with the US Fish and Wildlife Service and VDGIF to locate spinymussel populations on National Forest and habitat suitable for augmentation.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

This species is inherently rare and not naturally well distributed across the Forest due to its historic distribution (restricted to the James River drainage) and the limited amount of suitable habitat on the Forest. The current distribution of the James spinymussel includes the following areas: Potts Creek, Craig Creek, Johns Creek, Dicks Creek, Patterson Creek, Catawba Creek, Pedlar River, Mill Creek, and Cowpasture River (upper James), Meechums River, Moormans River, Wards and Ivy Creek (middle James and Rivanna River). It apparently is now extirpated from approximately 90 percent of its range (Clarke, 1984). Recent surveys have determined the presence of the James spinymussel in tributaries of the upper Rivanna River near Charlottesville, Virginia (M. McGregor, Per. Com.). In addition, *P. collina* were found in the Dan River in 2000 by NC Department of Transportation biologists. Genetics work is being conducted on the Dan River spinymussel population to determine the relationship with the James River populations.

Since mussels are sedentary and unable to move long distances to more suitable areas in response to heavy siltation, sedimentation is a significant factor contributing to spinymussel habitat degradation and the consequent decline of the species. Juvenile mussels are especially susceptible to sedimentation because of their position in the substrate and their small size; this can decrease recruitment of young individuals into the population. The results of monitoring trout are also germane to mussels. Table 20 in the wild trout section shows the monitoring results for several streams on the Forest before and after adjacent timber harvest. Table 21 in the wild trout section shows the monitoring results for several streams on the Forest before and after adjacent prescribed burns. There was not significant difference between the pre and post timber harvest or prescribed burn MAIS scores. They remained in the "Good" category.

Based on the above monitoring analysis, timber harvesting and other management activities are not significantly decreasing habitat or populations of spinymussels or their habitat.

The Forest is has developed a conservation strategy for all federally listed mussels and fish in conjunction with the USFWS, VDGIF, and universities to proactively contribute to providing ecological conditions that maintain or increase mussel populations.

The James spinymussel does occur in watersheds that contain NFS land and occurs both upstream and downstream from the Forest. Current management provides for water quantity and quality from the Forest that contributes to population viability (persistence over time) of mussel populations within the watersheds where they occur.

Overall, viability remains a concern for the James spinymussel on the GWNF, yet management has little ability to affect its overall viability. Factors outside the authority of this agency affect the viability of the James spinymussel. Agency management activities can only contribute to the viability of the James spinymussel.

g. Recommendation: No change in Plan direction for the James spinymussel is recommended. Continue monitoring.

James spinymussel

Photo courtesy of VDGIF Fish and Wildlife Information System

22. Peaks of Otter Salamander

a. Reason For Selection: "Trends in populations of this species will be used to indicate effectiveness of management activities designed specifically to meet conservation objectives for this species" (JNF Revised Plan, page 5-6). The Peaks of Otter salamander was selected because of viability concerns stemming from its naturally limited distribution. It is a Forest Service sensitive species and is only known to occur in Bedford, Botetourt, and Rockbridge Counties, VA. Nearly all of the global range of this salamander is located on land administered by the U.S. Forest Service. As with other members of the genus *Plethodon,* they are terrestrial, breathe through their skin, and do not require water to breed. They prefer mature Appalachian hardwood forests with closed canopies, deep moist soil, and abundant cover objects.

A pre-listing conservation plan was developed for this species with the cooperation of the USFWS, Blue Ridge Parkway, Virginia Division of Natural Heritage, and Virginia Department of Game and Inland Fisheries. Based on this conservation plan, a Conservation Agreement was signed by the USFWS, the Blue Ridge Parkway, and the U.S. Forest Service in 1997. Under the Conservation Agreement the Peaks of Otter salamander would not need to be listed as endangered or threatened under the Endangered Species Act provided the U.S. Forest Service follows certain management guidelines. The main guideline is allowing mature hardwood forest conditions to develop and continue within the majority of the salamander's range on NFS land.

For purposes of this evaluation, the fundamental relationship between the Peaks of Otter salamander and its habitat is that it prefers habitat associated with mature hardwood forests. The amount and distribution mature hardwood forests in this species' range are most likely to be influenced by management activities associated with timber harvesting.

<u>b. Plan Habitat Objectives Related to MIS:</u> The Revised Forest Plan for the JNF recognized the significance of the Peaks of Otter salamander by establishing management prescription 8.E.2 – Peaks of Otter Salamander Habitat Conservation Areas (JNF Revised Plan page 3-129). This management prescription is allocated to approximately 7,700 acres of the Glenwood Ranger District. These acres are divided into a primary conservation area (2,400 acres) unsuitable for timber production (8.E.2a) and a secondary conservation area (5,300 acres) suitable for timber production (8.E.2b). The emphasis in the Peaks of Otter salamander primary habitat conservation area (8.E.2a) is maintenance and enhancement of the salamander's habitat, including connectivity of unaltered or enhanced habitat. The emphasis for the Peaks of Otter salamander secondary habitat conservation area (8.E.2b) is maintenance of Peaks of Otter salamander habitat to assure its continued existence on the JNF while also providing habitat for other species and maintenance and enhancement of the health of oak forest communities through vegetation management. Research and monitoring to determine the effects of multiple use management on the Peaks of Otter salamander are an important component of this prescription.

Management prescription 8.E.2 is part of the larger Peaks of Otter salamander Habitat Conservation Area (about 20,700 acres) which includes Blue Ridge Parkway lands and Forest Service lands in management prescription 1A (Designated Wilderness), 4A (Appalachian Trail), 4K1 (North Creek Special Area), 5B (Designated Communication Sites), and 12A (Remote Backcountry Recreation – Few Open Roads). All of these prescriptions contain the following Standard: "Within the Peaks of Otter salamander habitat conservation area, activities must comply with the Habitat Conservation Agreement for the Peaks of Otter salamander."

Thus, the Plan provides for those ecological conditions to maintain the salamander considering its limited distribution and abundance.

<u>c. Description of Monitoring Method</u>

Since 1993 the Forest has supported and participated in studies to better understand the effects of timber harvest on Peaks of Otter salamander populations since vegetation management is the main activity that will occur in the secondary habitat conservation area. A key study is that being conducted by Sattler and Reichenbach (see below). This study uses three treatments (control, shelterwood harvest, and clearcut), with four replicates for each treatment. At each of these 12 sites one 5x5 m plot was established. These plots are sampled 8 times a year at night when conditions are suitable for salamanders to be surface active. Numbers of surface active salamanders are recorded. The Forest may continue to use these plots for long-term monitoring at the completion of this particular study.

d. Habitat Trend for MIS:

Since the signing of the pre-listing conservation plan in 1997 there has been no vegetation management carried out within the secondary habitat conservation area to date. In February 1998 an ice storm caused severe damage to trees within a certain elevation and aspect on the Glenwood Ranger District including an area within the Peaks of Otter salamander habitat conservation area. In the worst hit areas the forest canopy was considerably reduced. U.S. Forest Service plant pathologists recommended salvage operations to remove trees that had lost 50% or more of their crowns because they were unlikely to survive. However, proposed salvage activities designed to regenerate severely damaged trees were not undertaken within the secondary habitat conservation area because of concerns that further reduction of the forest canopy might have adverse impacts on Peals of Otter salamander populations (Reichenbach and Sattler 2000).

e. Population Trend for MIS:

The Forest funded two studies of the effects of timber harvesting on Peaks of Otter salamanders:

1. Mitchell, et al. 1996. A two year study of recent clearcuts, older clearcuts, recent shelterwood cuts, and mature sites. No significant differences were seen in salamander abundance among the sites. Recent clearcuts did support consistently fewer salamanders than the other sites. They concluded that timber harvesting practices do not eliminate this species, but may diminish population size and diet quality.
2. Sattler, P. and N. Riechenbach. 1993 to present. A long-term study of pre and post-timbering population levels. Three treatments, (control, shelterwood cut, and clearcut), each with four replications, are being assessed to determine the long-term effects of the harvest methods. Population data were collected prior to timber harvest and have been collected periodically afterward. The data are presented in the following Table 42 (the numbers represent the averages of the replication average):

Table 42. Trend In Peaks Of Otter Salamanders Following Timber Harvest

Year	Control	Shel od	Clearcut
1993	6.9	4.4	4.5
1994	8.6	2.4	2.6
1995	7.6	4.7	1.4
1997	6.2	3.6	1
1999	5.1	4.1	2.7
2001	4.7	4.1	2.2

Inexplicably, the control treatment shows a continuous decline since the start of the study. Since this treatment had no vegetation removal the decline must be due to another cause, perhaps a normal population cycle or an outside factor. The sampling to be done in 2005 may shed light on this. The shelterwood treatment appears to have recovered after a slight dip in the first year post-harvest. The clearcut treatment seems to be recovering slowly after a sharp decline over the first three years post-harvest.

The majority of the Peaks of Otter salamander's habitat is in the Peaks of Otter Salamander Habitat Conservation Area and is being managed to allow mature forest conditions to develop. Over time the habitat is improving for this species as the forest matures. Analysis results suggest an overall stable trend for Peaks of Otter salamander populations on the JNF.

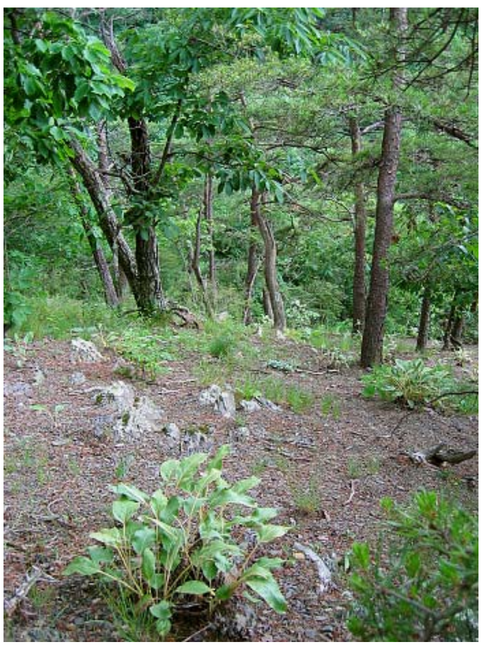
f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Management in the Peaks of Otter Salamander Habitat Conservation Area consists generally of dispersed recreation and vegetation management. The habitat trend is one of an aging forest that benefits Peaks of Otter salamanders and should lead to a stable or increasing population. The Revised Plan limits the acreage that may be harvested over time, places restrictions on harvest methods and implementation, and calls for monitoring to determine the effects of vegetation management on the Peaks of Otter salamander. Because habitat conditions are stable to improving, the Peaks of Otter salamander will remain viable on the Forest; however, due to the naturally limited range of this species it will remain vulnerable to unexpected outside events possibly causing population decline (e.g. global climate change, introduced diseases).

Almost the entire range of the Peaks of Otter salamander is on the JNF. It is inherently rare and thus not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the salamander population considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to provide for species viability (persistence over time).

g. Recommendation: No change in Plan direction for the Peaks of Otter salamander is recommended. Continue monitoring the effects of management activities.

Shale Barren Rock Cress Habitat



23. Shale Barren Rockcress

a. Reason For Selection: Shale barren rockcress (*Arabis serotina*) was selected because it is an endangered species. It was listed as endangered on August 14, 1989. This species is endemic to mid-Appalachian shale barrens in a small region of Virginia and West Virginia. The shale barren rockcress was selected because it is a federally endangered shale barren endemic species and therefore there is direct interest in its population status and trend (GWNF FEIS, page J-19).

For purposes of this analysis, the fundamental relationship between the shale barren rockcress and its habitat is the geologic structure and bedrock where it lives. The amount and distribution of this species is most likely to be influenced by management activities associated with authorizing the collection of common variety mineral materials by the private sector, road construction, the creation of shale pits for use in surfacing State or NFS roads, by herbicide applications associated with road maintenance or gypsy moth defoliation control, increased canopy closure (fire suppression?), deer browsing or activities that could encourage the spread of invasive plant species.

b. Plan Habitat Objectives Related to MIS: The GWNF Plan allocated most of the habitat that supports shale barren rockcress on the Forest as Wilderness or Special Biological Areas. Wilderness Areas (Management Area 8) are managed to "maintain or achieve a naturally functioning ecosystem" (GWNF FEIS, p. 3-35). Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GWNF FEIS, p. 3-6). In addition "No herbicide is aerially applied within 300 feet, nor ground-applied within 60 feet, of any known threatened, endangered, proposed, or sensitive plant. Buffers are clearly marked before treatment so applicators can easily see and avoid them" (GWNF FEIS, Appendix J, page J-18 to J-21) [GWNF Revised Plan Standard #118, page 3-136].

c. Description of Monitoring Method: Chapter 5 of the GWNF FEIS lists two monitoring questions that apply to all federally listed threatened and endangered species:

1) Were requirements outlined in federal species recovery plans implemented? For this species the recovery plan (USFWS, 1991) lists the following tasks relating to the Forest Service:

a. Preserve habitat on public lands.
b. Enforce regulatory authorities to protect populations/habitat.
c. Implement and evaluate the monitoring program.

These tasks may be accomplished through the Forest's planning process, including inventory and monitoring, and through project review and implementation.

2) Is habitat for all existing threatened and endangered species being maintained or improved with no unwarranted habitat alterations/degradations happening? This question is answered using qualitative field surveys.

d. Habitat Trend for MIS: Habitat where shale barren rockcress occurs is protected either by designation as a Special Biological Area or during the project-level Biological Evaluations prior to project decision and implementation. Habitat for this species on the Forest is stable. Habitat has not changed since the 2000 report except through natural processes.

e. Population Trend for MIS: In 1993 there were 17 known occurrences of shale barren rockcress on the Forest. The GWJNF's focus since this species was listed has been to attempt to locate additional populations and further define its range on the Forest. From 1994 to 1998 agency personnel worked cooperatively with the Virginia Division of Natural Heritage and the USFWS to inventory shale barrens on the Forest (Belden, Ludwig, and Van Alstine 1999). The Virginia Division of Natural Heritage identified 809 potential shale barrens from aerial photographs. Of these, 188 were examined for rare species. The inventory resulted in 27 new occurrences of shale barren rockcress, bringing the total known sites on the Forest (in Virginia) to 37. This number does not include two sites where shale barren rockcress was known to occur recently, but could not be found in 1994. In 2004 the West Virginia Department of Natural Resources discovered a new population of shale barren rockcress at the Little Fork North Shale Barren bringing the total occurrences on the Forest from the 77 reported by the West Virginia Natural Heritage Program in 2000 to 78. This includes both Virginia and West Virginia information. Of the 78 occurrences, 17 were known in 1993 when the GWNF Plan took effect, so there has been an increase of 61 occurrences. The number of individual plants in shale barren rockcress populations are known to fluctuate greatly from year to year, so the inability to find plants in a given year is not necessarily indicative of loss of a population (Jarrett, et al. 1996). Overall, given that habitat is stable and protected and field studies have located new populations, shale barren rockcress populations appear stable on the GWNF. There has been no change in the number of occurrences since the 2000 report. See following Table 43.

Table 43. The Results Of Counting Or Estimating The Number Of Rosettes And Bolting Plants Of Arabis Serotina On The Shale Barrens In Pendleton County, West Virginia, On The GWNF

Site		1985	1987	1988	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Brandywine	Rosettes				293	749	90	1,055	804	321	237	677	659		1552	
	Bolts				39	173	81	152	336	11	22	188	42		148	
Little Fork North	Rosettes															15
	Bolts															37
Brushy Knob	Rosettes						12*	25*					62			
	Bolts						12*	2*					7			
Dunkle Knob	Rosettes						11-50						1			
	Bolts												7			
Heavner Mt	Rosettes										97					385
	Bolts										5					308
Heavner Run	Rosettes			7	110			195			15	35				
	Bolts				26			55			3	21				
Road Run Trib	Rosettes							32					84			
	Bolts							17					11			
	Bolts												80			
Sugar Run	Rosettes							39						24		
	Bolts							12						7		
Swamp Run	Rosettes					34							17			
	Bolts					1							1			
Thompson	Rosettes	6						8				5				
	Bolts							2				1				
Whetmiller Knob	Rosettes						11-50						105			
	Bolts												9			

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Habitat for this species is stable on the Forest. There are possible threats to shale barren communities from invasive native and exotic species. Populations appear stable, but since they naturally tend to fluctuate greatly from year to year this is uncertain. Potential habitat is being inventoried and continues to reveal new populations that will be protected. Management activities are having no effect on the habitat that contains the shale barren rockcress and thus are having no effect on the rockcress.

Overall, viability is being maintained through identification and protection of occurrences, however, viability is still of concern due to the naturally limited distribution of this species. Shale barren rockcress populations are expected to remain relatively stable in the near future.

The GWNF encompasses several populations of the endemic shale barren rockcress that are in the core of its limited distribution in the Northern Ridge and Valley Section of the mid-Appalachians. This species is inherently rare and not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the shale barren rockcress populations considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to maintain viability (persistence over time) of populations on national forest land.

g. Recommendation: No change in Plan direction for shale barren rockcress is recommended. Continue monitoring.

24. Swamp Pink

a. Reason For Selection: The swamp pink was selected because it is a federally threatened species and therefore its populations are of direct interest (GWNF FEIS, page J-19). It was listed as threatened on October 11, 1988. It occurs on the GWNF in Augusta County in the Maple Flats/Big Levels area south of Stuarts Draft, VA.

Swamp Pink photo by Hal Horwitz

For purposes of this analysis, the fundamental relationship between the swamp pink and its habitat is that it needs wetland conditions to live. The amount and distribution of wetlands is most likely to be influenced by management activities associated with land exchanges involving isolated federal parcels that are better utilized for economic development in the private sector, by authorized recreational or other group public use where people could trample the plant, by pond construction that could flood wetlands or modify hydrology, by herbicide applications associated with road maintenance, or by gypsy moth defoliation.

b. Plan Habitat Objectives Related to MIS: The majority of the habitat that supports swamp pink on the Forest is located in Wilderness or Special Biological Areas. Wilderness Areas (Management Area 8) are managed to "maintain or achieve a naturally functioning ecosystem" (GW FEIS, p. 3-35). Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GW FEIS, p. 3-6). The GWNF Plan also states that "No herbicide is aerially applied within 300 feet, nor ground-applied within 60 feet, of any known threatened, endangered, proposed, or sensitive plant. Buffers are clearly marked before treatment so applicators can easily see and avoid them" (GWNF FEIS, Appendix J, page J-18 to J-21) [GWNF Revised Plan Standard #118, page 3-136]. In 1993 there were 16 known occurrences of swamp pink on the Forest. The Forest's objective is to not lose any existing occurrences and to inventory to locate new populations that will be protected.

c. Description of Monitoring Method: Chapter 5 of the GWNF FEIS lists two monitoring questions that apply to all federally listed threatened and endangered species:

1) Were requirements outlined in federal species recovery plans implemented? For this species the recovery plan (USFWS, 1991b) lists the following tasks relating to the Forest Service:

a. Develop and maintain conservation plans.
b. Identify and implement management techniques.
c. Enforce protective regulations.

d. Investigate population dynamics.
e. Monitor threats to existing sites.

These tasks may be accomplished through the Forest's planning process, including inventory and monitoring, and through project review and implementation.

2) Is habitat for all existing threatened and endangered species being maintained or improved with no unwarranted habitat alterations/degradations happening? This question is answered using qualitative field surveys.

<u>d. Habitat Trend for MIS:</u> There has been annual qualitative monitoring of two sites. One site, a sinkhole pond, has had beavers raising the water level. Due to a concern that the raised water level would negatively impact the swamp pink in the vicinity of the pond, efforts have been made to eliminate the beaver and control the water level. In the fall of 1999 the water level in the sinkhole pond rose, perhaps due to heavy hurricane rains. The level did not fall after the rain subsided and it was found that the beavers had raised their dam, possibly in response to water flowing rapidly out of the pond. The USFWS were contacted for guidance. They did not feel action by the Forest Service was required. However, in 2002 the Forest Service installed a pipe through the beaver dam to lower the water to the level typically observed over the past few decades. This was in response to public concern for the swamp pink and for other rare plants. We will continue to monitor the beaver activities and the water level. A site in the St. Mary's Wilderness exists in a seep along a trail. This site has been monitored for several years, with no apparent negative impacts to the swamp pink, in spite of the fact that hikers have placed logs across the seep area. In1997 field surveys in the area located several hundred to a thousand additional plants. In 2004 another large population of possibly several thousand plants was discovered in St. Mary's Wilderness near and unnamed tributary. An exact count was not possible because of autumn leaf fall, but one will be conducted in 2005. Because the majority of the Forest's swamp pink habitat is in Wilderness or Special Biological Areas it is being conserved and protected from potentially damaging activities. Basically, natural processes are operating in these areas. The habitat trend for this species is stable or increasing.

<u>e. Population Trend for MIS:</u> The population of swamp pink on the National Forest is large, dispersed over a ten-mile area, and well protected. At the time of the GWNF Plan in 1993 there were 16 known occurrences (according to Virginia Division of Natural Heritage information) with perhaps 15,000 plants. Since that time four more locations have been discovered, including one that contains up to one thousand plants. There has been no loss of population occurrences since the GWNF Revised Plan was adopted in 1993 or since the species was listed under the Endangered Species Act in 1988. The population trend is stable to increasing for swamp pink on the GWNF.

<u>f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities</u>

Habitat appears to be stable on the Forest and known occurrences and populations are protected. Occurrences appear to be stable with no loss of occurrences observed. Field surveys have revealed new occurrences, some quite large. Management activities do not appear to be having adverse effects on populations of swamp pink.

Overall, swamp pink occur in enough locations and in high enough numbers that their persistence on the Forest seems likely; however, viability remains a concern due to the limited nature of required habitats. Swamp pink populations are expected to remain stable or increase.

The GWNF encompasses a population of swamp pink that is part of a disjunct distribution in eastern North America from New Jersey south to North Carolina and Georgia. It's inherently rare and not well distributed across the Forest. Current management provides for ecological conditions capable to maintain swamp pink populations on the Forest considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to provide for distribution and abundance of the species that will provide for population viability (persistence over time).

g. Recommendation: No change in Plan direction for swamp pink is recommended. Continue monitoring.

25. Northeastern Bulrush

a. Reason For Selection: Northeastern bulrush was selected because it is a federally endangered species associated with wetlands, and therefore its populations are of direct interest (GWNF FEIS, page J-19). It was listed as endangered on June 6, 1991.

For purposes of this analysis, the fundamental relationship between the bulrush and its habitat is that it needs wetland conditions to live. The amount and distribution of wetlands is most likely to be influenced by management activities associated with land exchanges involving isolated federal parcels that are better utilized for economic development in the private sector, by authorized recreational or other group public use where people could trample the plant, by pond construction that could flood wetlands or modify hydrology, by herbicide applications associated with road maintenance, or by gypsy moth defoliation.

b. Plan Habitat Objectives Related to MIS: The GWNF Plan designates the Potts Mountain site and the Maple Springs site as Special Biological Areas. Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GWNF FEIS, p. 3-6). Specific habitat objectives for the bulrush are clearly articulated in the GWNF Revised Forest Plan. "No herbicide is aerially applied within 300 feet, nor ground-applied within 60 feet, of any known threatened, endangered, proposed, or sensitive plant. Buffers are clearly marked before treatment so applicators can easily see and avoid them" (GWNF FEIS, Appendix J, page J-18 to J-21) [GWNF Revised Plan Standard #118, page 3-136]. In 1993 there were two occurrences of northeastern bulrush on the Forest, although subsequent information makes one of those occurrences suspect.

The 1993 Recovery Plan describes four extant populations in Virginia that are all on private land and are threatened by off-road vehicles and possible development. These populations occur in two types of ponds in the Northern Ridge and Valley section: 1) shallow, oligotrophic sinkhole ponds over sandstone which overlies limestone, or 2) sandstone depression ponds on mountain ridges that are not formed by the subsidence of underlying material. At the time of the 1993 GWNF Plan there were 2 possible occurrences on the Forest. One of the populations is on a 40-acre tract on Potts Mountain that was acquired by the U.S. Forest Service in 1995. This site is managed as a Special Biological Area. The other is in the Maple Springs Special Biological Area, however, the record of collection there has not been verified and it is doubtful northeastern bulrush occurs here. As of August 1996, inventories by Virginia Division of Natural Heritage (VDNH) discovered a new occurrence (Morning Knob). An additional site is in West Virginia at Pond Run Pond on the Forest.

c. Description of Monitoring Method: Chapter 5 of the GWNF FEIS lists two monitoring questions that apply to all federally listed threatened and endangered species:

1) Were requirements outlined in federal species recovery plans implemented? For this species the recovery plan (USFWS, 1992) lists the following tasks relating to the Forest Service:

a. Identify essential habitat.
b. Secure permanent protection for known populations.
c. Resurvey sites thought to have suitable habitat
d. Identify potentially suitable habitat for additional surveys
e. Survey potential sites for species presence.
f. Monitor 10 other representative populations for general population and habitat information.
g. Verify, monitor, and protect any additional populations.

h. Identify historical and potential habitat suitable for reintroductions.

These tasks may be accomplished through the Forest's planning process, including inventory and monitoring, and through project review and implementation.

2) Is habitat for all existing threatened and endangered species being maintained or improved with no unwarranted habitat alterations/degradations happening? This question is answered using qualitative field surveys. In 1999 photo monitoring was begun and will continue annually.

d. Habitat Trend for MIS:

i. Potts Mountain

The Potts Mountain population has been qualitatively monitored annually since 1990. A designated off-highway vehicle (OHV) trail/road runs near the pond. There has been concern that users of such vehicles might drive them through the pond as they have at other locations. The monitoring found that in June of 2001 at least one OHV had driven toward the pond. The tire tracks followed the drainage path from Potts Pond. The OHV did not enter the pond and there was no damage to the northeastern bulrush. In response to this activity large rocks were placed in the area where the OHV left the designated OHV road to prevent further incursions. In August of 2003 more damage in the same area was seen. Some of the rocks had been moved and, as in 2001, an OHV drove toward the pond following the pond drainage. In January of 2004 the OHV road was closed by the installation of a gate at the FDR 176 entrance. A sign was put up informing the public of the reason for the road closure. Before the road was opened for OHV use, 90 additional large rocks were put in place. In addition, the wilderness boundary has been remarked and there is a Forest Supervisor's order prohibiting vehicles from entering the Special Biological Community that supports the northeastern bulrush. This order includes signs placed along the road and around the Special Biological Community. The habitat is still intact and undisturbed and the bulrush is present in the pond. Area occupied by the bulrush has not changed since the Forest Service acquired the site.

ii. Morning Knob

No change in habitat except natural succession.

iii. Maple Springs

This pond is protected as part of the Shenandoah Mountain Crest Special Biological Area.

iv. Pond Run Pond

Pond Run Pond is monitored by the West Virginia Department of Natural Resources. Their 2002 report to the Forest indicated concern about increasing canopy closure over the pond that may negatively affect the Northeastern bulrush. They also noted the possible hydrologic connection between Pond Run Pond and a bog uphill. A trail runs between the pond and the bog and may be interfering with the normal movement of water between the two areas. A field review by U.S. Forest Service, WV Division of Natural Resources, and U.S. Fish and Wildlife Service personnel was conducted on May 25, 2004. The decision was made to try daylighting the pond to slowly increase sunlight reaching the pond. A 6 inch diameter red maple on the south side of the pond was girdled. No evidence of damage from horses was seen. On September 24, 2004 WVDNR returned and noted that the girdled red maple was alive and the wound had healed over. They suggest repeating the girdling and cutting deeper.

e. Population Trend for MIS: Table 44 shows the occurrences of bulrush. Since 1993, there has been no loss of occurrences on the Forest. An additional two occurrences were discovered as noted above. Analysis results suggest an overall stable trend for bulrush populations on the GWNF.

Table 44. Northeastern Bulrush Populations

Potts Mountain	Morning Knob	Maple Springs	Pond Run Pond
No quantitative population data available Habitat stable 2004, habitat stable	In 1994, 1000+ culms Habitat stable	No population data available– this site may have been an error Habitat stable	1996, 30 culms 1997, 35 culms 1998, 30 culms 1999, pond dry, no plants observed 2000, habitat possibly being impacted by horses 2001, 6 clumps and 12 stems 2002, 3 clumps and 14 stems 2003, 3 clumps and 13 stems 2004, no clumps, 14 plants had one or more fruiting culmns prostrate and rooting Canopy cover >90% we would like to slowly reduce that and see how the bulrush responds.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

The Potts Mountain habitat is stable and the population appears stable. The Morning Knob and Maple Springs habitats are stable. The Morning Knob population has not been monitored since 1996. The Maple Springs site is protected within a Special Biological Area; however, the report of northeastern bulrush at this site has not been confirmed. Management activities are having no effect on populations of bulrush.

The GWNF encompasses several populations of the northeastern bulrush as part of a disjunct distribution in eastern North America from New England south to Virginia. It's inherently rare and not well distributed across the Forest. Current management provides for ecological conditions capable to maintain bulrush populations considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to maintain population viability (persistence over time).

g. Recommendation: No change in Plan direction for bulrush is recommended. Continue monitoring.

26. Peregrine Falcon

a. Reason For Selection: The peregrine falcon (*Falco peregrinius*) was selected because it was a federally threatened species, and there is therefore direct interest in its populations. It was, however, de-listed by the USFWS on August 8, 1999 (64 FR 46541 to 46558). It's a species whose habitat may be influenced by management activities, and it's a non-game species of interest. It requires a specialized nesting habitat (cliffs).

For purposes of this analysis, the fundamental relationship between the falcon and its habitat is that it requires isolated cliffs in order to nest. The amount and distribution of isolated cliffs on the Forest are most likely to be influenced by management activities associated with allowing recreational climbing in and around cliff areas that were used as hack sites in the early and late 1980's to release fledgling falcons.

b. Plan Habitat Objectives Related to MIS: The habitat objective for this species is to maintain all known historic nest sites (eyries), with the hope that falcons will eventually nest on the Forest.

From 1988 through 1991, a total of 59 young peregrines were "hacked" onto the GWNF (hacking is a process whereby young raptors are trained to feed and to fly). The purpose of the hacking was to restore a breeding population of peregrines to the GWNF, as the birds often return to breed in the area where they fledged. None of the hacked birds returned to the GWNF to nest, although banding records show that several of these birds have shown up both north and south of Virginia. For the past few years, a pair of peregrines has nested in a remote section of Shenandoah National Park, and in year 2000, we received a report that a nesting pair fledged 2 young in the vicinity of Lost River State Park, just over the state line in West Virginia.

c. Description of Monitoring Method: The Forest Service has participated in a comprehensive statewide survey for peregrines every year since 1990, and individual and pairs of birds have been seen, but no nests have been identified on either of the Forests.

d. Habitat Trend for MIS: Cliffs are habitat created naturally over millions of years. No man-made cliffs have been made on the Forest through such activities as large cut banks as a result of road construction or reconstruction projects on the GWNF.

e. Population Trend for MIS: The Forest hacked 59 falcons between 1988 and 1991 inclusive (GWNF FY 1992 M&E Report). None of these hacked falcons are known to have returned and nested on the Forest. Peregrine falcons are not tracked by the BBS, nor have we found them on any of our ORP routes. Juvenile peregrines have been hacked at various locations on both Forests over the last 10 years, but none have taken up residence since these hacked birds have been identified from banding records in other locations both north and south of Virginia. Birds have been nesting in Shenandoah National Park, however, and have probably been hunting on the adjacent National Forest. Nationwide, peregrine populations are doing very well, and the USFWS has delisted the species. As part of delisting, the species will continue to be monitored for 5 years. Monitoring results indicate there are no resident peregrine falcons on the Forest.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

No scientific relationship can be established between recreational rock climbers, cliff sites, and numbers of peregrine falcons. No scientific information exists on which to make an informed analysis, although intuitively, the few numbers of rock climbers on the Forest aren't going to affect the number of falcons. If it were determined that falcons were nesting, or attempting to nest at either a historic or a new eyrie on either Forest, one of the first actions would be to close the area to rock climbing and to other activities that could potentially disturb the birds.

Based on the results of our monitoring and evaluation, ecological conditions on the Forest are sufficient to contribute to species viability (persistence over time). Overall, factors outside the authority of this agency affect the viability of the falcon. Agency management activities can only contribute to the viability of the falcon.

g. Recommendation: No change in Plan direction for peregrine falcons is recommended at this time since, under delisting, the species is to be monitored for another 5 years. At the time of the next Plan revision, the falcon should no longer be considered a MIS on the GWNF since little evidence exists that the species nests on the Forest.

27. Bald Eagle

a. Reason For Selection: The bald eagle (*Haliaeetus leucocephalus*) was selected by the GWNF Plan because it is a federally endangered species, and there is therefore direct interest in its populations. The eagle is a species whose habitat may be influenced by management activities, and it's a non-game species of interest. It prefers large bodies of water adjacent to forested areas with minimal disturbance to its nesting sites. The bald eagle is not a MIS for the Jefferson Plan. For purposes of this analysis, the fundamental relationship between the eagle and its habitat is that it needs riparian areas associated with medium-to-large-sized rivers or lakes for nesting and foraging (GWNF FEIS, page J-19). The amount and distribution of riparian area forests and nesting sites are most likely to be influenced by management activities associated with timber harvesting and allowing people to recreate near known nest sites.

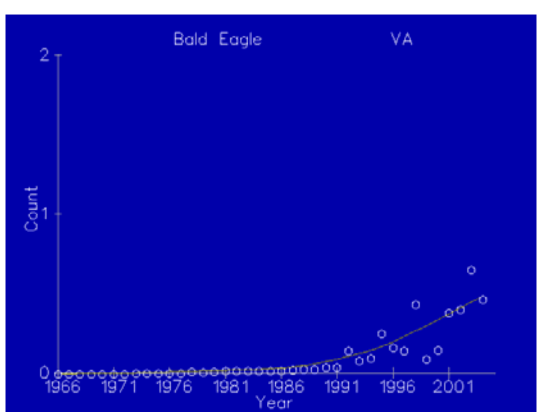
b. Plan Habitat Objectives Related to MIS: The Plan's habitat objective is to protect known nest sites with a ½ mile "restricted management activity" buffer (See GWNF FEIS; pg. J-21 and Revised Plan Standard #246; pg. 3-15).

c. Description of Monitoring Method: The USGS breeding bird surveys are used, along with eagle nest surveys.

d. Habitat Trend for MIS: See riparian area discussion elsewhere in this report associated with barred owl. This data includes data around the edges of large-sized rivers, lakes, and ponds.

e. Population Trend for MIS: Several bald eagle occurrences are noted on the GWNF annually, however, these represent transient individuals. Currently, active bald eagle nests are known on private land in the Lake Moomaw area, near the Jackson River and the area of the Virginia Power (VEPCO) reservoir (near the Warm Springs Ranger District), and on Forest Service land located on the Dry River and Lee Ranger Districts. Bald eagles have not been documented on the avian point counts. Bald eagles typically nest near a large body of water that they use for foraging. They seldom nest in extensive forested areas. Habitat for bald eagles on the National Forests is relatively insignificant when compared to the quantity and quality of habitat in the nearby Chesapeake Bay and the Virginia coastline. The BBS data for Virginia is presented in Figure 42. Data is currently unavailable from BBS route data for years 1997 to 2000. Analysis results suggest an overall increasing trend for bald eagle populations in the state, which likely results in increased use by transient birds and increase probability of future nesting on the GWNF.

Figure 42. Average Number Of Bald Eagles Seen Or Heard Across Virginia, 1967 To 2004



Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

The amount of nesting, roosting, and foraging habitat suitable for bald eagles on the GWNF and JNF is limited. Lakes such as Moomaw, Sherando, North Fork of the Pound, Cave Mountain, etc., or rivers such as the James, the Calfpasture, the Shenandoah, the Clinch, and Back Creek could provide habitat, and transient eagles may appear at these locations occasionally. When nests are found, protection measures outlined by the USFWS are followed.

Based on the results of our monitoring and evaluation, ecological conditions on the Forest are sufficient to contribute to species viability (persistence over time). Overall, factors outside the authority of this agency affect the viability of the eagle. Agency management activities can only contribute to the viability of the eagle.

g. Recommendation: No change in Plan direction for bald eagle is recommended. The bald eagle has been downlisted from endangered to threatened by the USFWS. If range-wide population numbers continue to increase, it is likely the bald eagle will be delisted and removed from the Endangered Species List.

Demand Species

28. White-tailed Deer

a. Reason For Selection: The White-tailed Deer (*Odocoileus virginianus*) was selected because it is a species commonly hunted and its populations are of public interest. It's a species whose habitats may be influenced by management activities such as prescribed fire, permanent opening maintenance, and timber management activities (GWNF FEIS Appendix page J-12, JNF Revised Plan FEIS page 3-134). White-tailed deer use a variety of habitat types (GWNF FEIS, Page 3-171). An important component of suitable habitat for white-tailed deer includes herbaceous and woody vegetation at or near ground level, and availability of hard mast, such as acorns.

b. Plan Habitat Objectives Related to MIS: For the GWNF, to maintain habitat for deer, approximately one percent of the forest should be in early successional stages of ages 1 through 12, while 10% should be hard mast bearing stands (in hardwood stands within age range from 40 to 120 years old) (GWNF FEIS, Appendix J, page J-5). For the JNF, a range of habitat objectives, management prescriptions, and desired conditions are identified to provide needed herbaceous and woody browse vegetation and hard mast (JNF Revised Plan, pg. 2-12).

c. Description of Monitoring Method: Hunter harvest information is reported by state wildlife agencies. For deer harvested on National Forest System (NFS) land, the VDGIF and the WVDNR use a sex, age, and kill models to generate population estimates. They also compare population trends from spotlight counts. Additionally, the state agencies use physical condition data from check stations as an aid in assessing the health of the population. This information helps them (and the Forests) to determine if the population is approaching carrying capacity.

d. Habitat Trend for MIS: Table 8 compares age class data or age class acres on NFS land. Table 45 compares age class data or age class acres from the Forest Inventory and Analysis (FIA) for 1986, 1992, and 2001 for all forested land in Virginia.

Table 45. Forest Age Class, 1986, 1992, and 2001 All Virginia Forestland

(In Thousand Acres)

10-Year	Oak-Pine on All Virginia Forestland			Upland Hardwood on All Virginia Forestland		
Age Class	1986	1992	2001	1986	1992	2001
0-10	313	363	237	630	670	859
11-20	189	227	190	508	491	741
21-30	120	161	203	404	402	630
31-40	144	114	162	650	520	554
41-50	167	133	182	1,078	852	919
51-60	178	243	144	1,527	1,357	1,057
61-70	175	195	171	1,266	1,419	1,418
71-80	91	138	157	890	1,027	1,378
81+	103	151	153	1,135	1,461	2,191

e. Population Trend for MIS: Table 46 through Table 48 display deer population trends received from the Virginia Department of Game and Inland Fisheries (VDGIF). Trend data were derived from a population index for each county. The population status in Virginia is monitored using an antlered buck harvest rate per square mile of habitat index. VDGIF routinely uses antlered buck harvest rates per unit area to provide a population index and monitor population status and changes in status over time. Counties were categorized as having an increasing or decreasing trend if the annual rate of change was >2.26% (either increasing or decreasing) and the statistical significance level of the exponential regression model was $p < 0.10$. Annual rates of change exceeding 2.26% represent a change of at least 25% in the population index over the decade ($1.0226^{10} = 1.25$). A similar population index for West Virginia or Kentucky counties is not available at this time. Our assumption is that the overall trend would be similar due to similarity of forest age structure and management activities on George Washington and Jefferson National Forest lands in the three states.

Table 46. White-tailed Deer Population Index Trend Across the GWNF, 1994 to 2003

County	Percent National Forest in County	Ranger Districts Included	Trend 1994-2003	
Allegheny	56	James River, Warm Springs	-2.2	Stable
Amherst	19	Pedlar	-4	Decreasing
Augusta	30	Deerfield, Dry River, Pedlar	0.1	Stable
Bath	50	Deerfield, Warm Springs	-3.6	Stable
Frederick	2	Lee	-2.6	Stable
Highland	5	Deerfield, Dry River, Warm Springs	-1.9	Stable
Nelson	6	Pedlar	-1.1	Stable
Page	13	Lee	0.1	Stable
Rockbridge	17	Deerfield, James River, Pedlar	-2.6	Stable
Rockingham	25	Dry River, Lee, Warm Springs	-2.6	Stable
Shenandoah	23	Lee	0.0	Stable
Warren	5	Lee	0.0	Stable

Table 47. White-tailed Deer Population Index Trend Across the JNF, 1994 to 2003

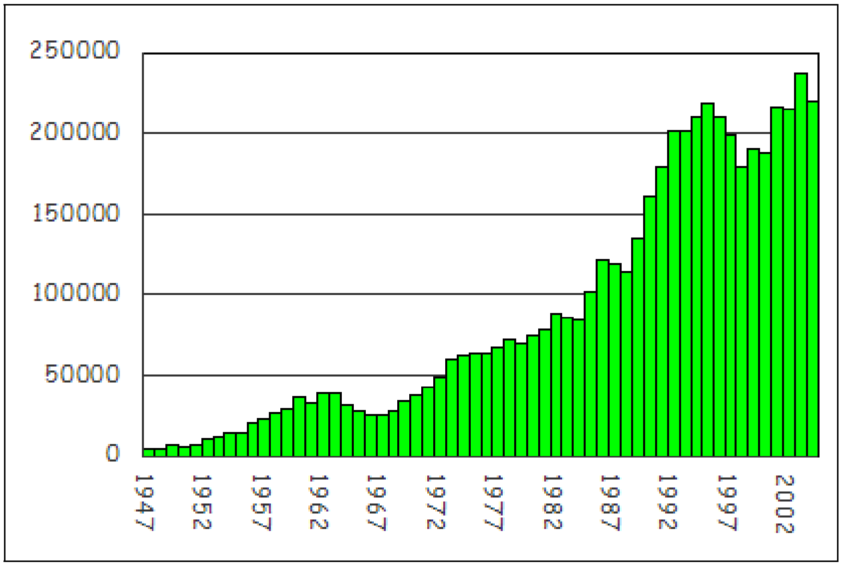
County	Percent National Forest in County	Ranger Districts Included	Trend 1994-2003	
Bedford	4	Glenwood	0.0	Stable
Bland	31	Blacksburg, Wythe	-2.8	Stable
Carroll	2	Mt. Rogers	0.0	Stable
Craig	55	Blacksburg, New Castle	-1.4	Stable
Dickenson	4	Clinch	+3.9	Stable
Giles	27	Blacksburg, New Castle, Wythe	-2.8	Stable
Grayson	11	Mt. Rogers	-5.2	Decreasing
Lee	4	Clinch	0.0	Stable
Montgomery	8	Blacksburg	-4.1	Stable
Pulaski	9	Blacksburg, Wythe	2.4	Increasing
Roanoke	2	New Castle	-2.1	Stable
Scott	10	Clinch	0.0	Stable
Smyth	25	Mt. Rogers, Wythe	-1.5	Stable
Tazewell	3	Wythe	-6.1	Stable
Washington	6	Mt. Rogers	-3	Stable
Wise	14	Clinch	3.1	Stable
Wythe	19	Mt. Rogers, Wythe	-0.1	Stable

Table 48. White-tailed Deer Population Index Trend Across Shared Counties, 1994 to 2003

County	Percent National Forest in County	Ranger Districts Included	Trend 1994-2003	Status
Botetourt	23	James River, New Castle	-2.5	Stable

Overall, public lands demonstrate a stable population trend, whereas private lands in the same counties demonstrate an increasing trend (M. Knox, VDGIF Deer Program Manager, Pers. Communication). Statewide, VDGIF reports a 6% decrease in total number of deer harvested in 2004 compared to 2003, but the total number harvested was still 6% greater than the 10-year average (Figure 43). In 2000, VDGIF and WVDNR estimated deer populations at 49,418 individuals on the GWNF and 31,450 individuals on the JNF, respectively. Based on the overall stable population trend calculation, deer populations for 2004 are estimated to be at the same level on the GWNF and JNF, respectively.

Figure 43. Number Of Reported Deer Harvested In Virginia, 1947 – 2004.



Source: http://www.dgif.state.va.us/hunting/va_game_wildlife/harvest_summaries.html

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Review of Table 8 (GWJNF age class distribution of all forested land) shows a decreasing percentage of early successional habitats across the GWJNF. However, review of Table 7 (Combined management activities trend across both forests) shows a marked increase in acres prescribed burned. At the height of timber management activities on the GWJNF in the 1980s, acreage affected by timber harvest activity ranged from 5,000 to almost 7,000 acres annually (See Table 6). In the last 5 years, acreage effected by prescribed fire have ranged from 4,000 to 16,0000 acres annually (See Table 6). The positive effects of prescribed fire on white-tailed deer browse and other habitat requirements is well documented (Brennan et al. 1998, DeBano et al. 1998). The increase of available browse in the understory and in small patches of otherwise mature forested conditions following prescribed fire will not be reflected in age-class distribution acres shown in Table 8. Reliance on age-class alone will not provide an accurate picture of the amount of suitable browse and shrubby/grassy habitat on the GWJNF. In addition, the continued maturation of forested acres across the GWJNF increases availability of hard mast.

The white-tailed deer is a game animal that is harvested throughout Virginia and West Virginia; therefore, population viability is not a concern. As a general rule, deer harvest on NFS land (as measured by Antlered Buck Harvest/Square Mile of Deer Habitat) is lower than on private ownership (VDGIF, 1999). Overall, however, viability is well sustained for white-tailed deer on the GWJNF. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction is recommended for deer. Continue monitoring.

29. Black Bear

a. Reason For Selection: The Black Bear (*Ursus americanus*) was selected because it is a species commonly hunted and its populations are of public interest. It's a species whose habitats may be influenced by management activities (GWNF FEIS Appendix page J-12, JNF Revised Plan FEIS, page 3-134). Black Bear are an opportunistic species, thriving in a variety of habitat types. Important habitat elements are habitat remoteness, habitat diversity, den site availability, and availability of hard mast (GWNF FEIS, Appendix page J-12, JNF Revised Plan FEIS, page 3.134). An important activity managers can undertake for black bear is access management (Lentz 1980, Carlock et al. 1983, Hamilton and Marchinton 1980, Miller 1975, Pelton 1980, Brody 1984). Access management does not refer to the prohibition of building or upgrading existing roads, but rather to their subsequent management. Roads themselves are not detrimental; it's the use of these roads by the public that affects black bear. Proper management of open road densities is critical to black bear populations.

For purposes of this analysis, the amount and distribution of remote habitat (assumed to be Semi-primitive non-motorized or Semi-primitive recreation opportunity areas) and old growth is most likely to be influenced by management activities associated with prohibiting or limiting public use of existing roads and timber management.

b. Plan Habitat Objectives Related to MIS: For the GWNF, to maintain old growth habitat for bear, a minimum of 2.5% of the forest should be in old growth (in hardwood stands older than 200 years old) (GWNF FEIS, Appendix J, page J-5). For the JNF, maintain approximately 252,000 acres under conditions where open road density is less than 0.8 miles per square mile, and off-road vehicle use is restricted throughout the years (Revised JNF Plan, page 2-13). Extrapolating the remoteness factor from the JNF and the old growth factor from the GWNF leads to the conclusion that, across the combined forests, a minimum of 2.5% of the Forest should be in hardwood old growth (hardwood stands older than 200 years old) and a minimum of 15.5 % (271,000 acres) should be remote.

c. Description of Monitoring Method: Hunter harvest information is reported by state wildlife agencies, including sex, age, and total harvest data for bear harvested on NFS land. No simple methods exist for estimating key demographic parameters (recruitment rates, mortality rates, population growth rates, density) to assess black bear population status over large areas. Definitive estimates of these parameters can only be obtained through expensive, site-specific research. As in other states, the Virginia Department of Game and Inland Fisheries uses a combination of indices derived from harvest, nuisance activity, age structure, and miscellaneous mortalities to monitor status of black bear population (Virginia Black Bear Status Report - 1998 Virginia Department of Game and Inland Fisheries). Only Virginia data is used under the assumption that trends are the same in Kentucky and West Virginia.

d. Habitat Trend for MIS: See trend in old growth at Table 27 in this report. Table 49 shows the trend in remote habitat. See transportation system trends in Table 3 and Table 4 earlier in this report.

Table 49. Inventoried Remote Habitat Trend by National Forest

(Thousand Acres)

	George Washington N.F.		Jefferson N.F.		
Year*	Semi-Primitive Motorized	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Semi-Primitive Nonmotorized	Total Acres
1985	156.3	144.5	71.7	105.9	478.4
1993/1996	203.0	167.0	76.0	126.0	572.0

*1985: JNF Final EIS, GWNF FEIS
1993: GWNF FEIS
1996: JNF, Analysis of the Management Situation

e. Population Trend for MIS:

1. Harvest Hunting harvest data is the principal source of information for monitoring black bear population status in Virginia and West Virginia.

Bear harvest data generally indicated little change in harvest during the 10-year period from 1964-1973. In an effort to stimulate population growth, regulations were passed in 1974 to reduce overall bear harvest. As anticipated, subsequent harvests from 1974-1980 were below the previous 10-year harvest. However, beginning in 1981, harvests have steadily increased. Nine of the last 17 years have yielded record bear harvest. The harvest during all hunting periods has increased since 1970.

3. Age Distribution Bear teeth were collected from 1970 through 1990 by encouraging hunters to voluntarily submit a premolar for analysis. Beginning in 1991, tooth collections became a required part of the bear checking process.

During the period from 1978-1990, on an average of 19.9% of the harvested bears had teeth submitted for age determination. Since 1991, the average tooth submission rate has increased to 91.4%.

Harvested bears have ranged in age from 0.5 to 26.5 years of age. Among other interpretations, age structures with an increasing proportion of young animals may suggest a growing population (Caughley, 1977) (Virginia Dept. of Game and Inland Fisheries - Virginia Black Bear Report - 1998).

Confirming results of other harvest and issuance information, population reconstruction in Virginia suggests that the female population has grown significantly at an average annual rate of 1.2%; that male mortality rates are higher than female mortality rates, and that mortality does not differ by age class.

4. Miscellaneous Bear Mortality A franked, addressed postcard was used to report miscellaneous bear mortalities. This postcard was distributed to personnel in the VDGIF Law Enforcement Division, U.S. Forest Service, and the Shenandoah National Park. Vehicle collisions have been the principal cause of miscellaneous bear mortality. While reporting of miscellaneous bear mortality has been far from complete, the trend has been increasing.

5. Cooperative Alleghany Bear Study In 1994, the Cooperative Alleghany Bear Study was initiated to investigate population dynamics on Virginia's hunted bear population. A recently completed dissertation associated with this project (Klenzendorf 2002) was used to include updated population estimates.

Conclusion Combining trends in harvest, nuisance activity, age class, and miscellaneous mortality indices provide strong trend evidence of an increasing black bear population in Virginia and on GWJNF.

VDGIF uses the Downing method to perform black bear population reconstruction and determine population trends (D. Martin, VDGIF Black Bear Biologist, Pers. Communication, 5/21/2004).Table 50 shows annual growth trends for males and females. Five years of harvest data is required to reconstruct one year of population estimates, as such the reconstructed population data is for the years 1989-1998. Both male and female populations exhibited an increasing trend. Overall total Black Bear populations are stable or increasing. In 2000, VDGIF and WVDNR estimated bear populations at 1,175 individuals on the GWNF and 747 individuals on the JNF, respectively. Based on the calculated population growth trend, bear populations for 2003 were estimated to be at 1,243 individuals on the GWNF and 790 individuals on the JNF, respectively.

Table 50. Virginia's Black Bear Population Trend, 1989 to 1998

(Downing Method)

Sex	Population Growth Trend (%) per year	R-Square	Significance
Male	+ 7.4	0.97	P<0.97
Female	+ 4.2	0.91	P<0.91

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Many factors are likely responsible for the increased bear populations on the GWJNF. The relative abundance and distribution of oak mast, primarily white oak, have a significant impact on bears in terms of natality, mortality, and movements (Pelton, 1989). The birth and survival of young bears are directly associated with oak mast crops. Increased movements associated with poor acorn crops often result in significantly increased mortality. The acres of older hardwood stands on the Forest have benefited bears through increased availability of den trees. In addition to older hardwood forests, bears also use a variety of other successional stages. Secondary foods (such as soft mast) can help buffer the effects of acorn shortages (Eiler, Wathen, and Pelton, 1989). Soft mast foods can be enhanced by forest management activities including prescribed burning and timber harvest (Wigley, 1993; Weaver, 2000). Important soft mast species—such as blackberries, blueberries, and huckleberries—often are more abundant in young forests.

From 1985 to 1996 there has been an increase in acres of Semi-Primitive Motorized (SPM) and Semi-Primitive Nonmotorized (SPNM) from 478,400 acres to 572,000 acres. In conjunction with this there have been approximately 105 miles of roads closed to public use.

The component of old trees as represented by a shift to more acres in the older age classes has been occurring (See Table 8). Increased acres of older hardwood stands, sustained hard mast production, and enhanced soft mast production through forest management activities—such as prescribed burning and timber harvest—have contributed to improved black bear habitat on the Forest.

The black bear is a game animal that is harvested throughout Virginia and West Virginia; therefore, viability is not a concern. Overall, viability is well sustained for black bear on the GWJNF. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction is recommended for bear. Continue monitoring.

30. Wild Turkey

a. Reason For Selection: The Wild Turkey (*Meleagris gallopavo*) was selected because it is a species commonly hunted and its population is of public interest. It is a species whose habitats may be influenced by management activities (GWNF FEIS Appendix page J-12, JNF Revised Plan FEIS, page 3-138). Wild Turkeys prefer mature forests with open understories and well-dispersed patches of early successional woody and grass/shrub vegetation. Freedom from frequent disturbance during nesting and brood rearing seasons is also important. Brood habitat is the most limiting factor to eastern turkey populations in the central Appalachians (J. Pack, West Virginia DNR, Pers. Comm.). Hens with broods use a variety of habitats: pastures, hay fields, wildlife clearings, powerline rights-of-way, natural glades, and savannas. Structure of vegetation is as important as ground vegetation types (Healy 1981). Ground cover should consist of sparse herbaceous vegetation that does not impede poult movements and produces maximum insect production, while providing protection from predators. In addition, open woodland and savannah habitats that have moderate herbaceous understory vegetation provide brood habitat. Well-distributed water sources, especially in brood habitat are also beneficial to turkeys. Hard mast is an important winter food of the eastern turkey in the central Appalachians.

For purposes of this analysis, the fundamental relationship between wild turkey and its habitat is that it prefers mature forests with open understories and temporary or permanent open areas vegetated with grasses, forbs, and low woody fruit-producing plants. The amount and distribution of 1) patches of appropriate early successional habitat 2) open woodlands and savannahs, and 3) mature habitat that provides hard mast is most likely to be influenced by management activities associated with prescribed fire, active timber management, and creation of small wildlife openings.

b. Plan Habitat Goals and Objectives Related to MIS: For the GWNF Plan, a minimum of 10% should be hard mast bearing stands (in hardwood stands within age range from 40 to 120 years old) is identified (GWNF FEIS, Appendix J, page J-5). For the Revised JNF Plan, goals identified to manage forest ecosystems to maintain or restore composition, structure, and function within desired ranges of variability are identified as benefiting turkey (JNF Revised Plan, page 2-12).

c. Description of Monitoring Method: Hunter harvest information is reported by the VDGIF and the WVDNR, and includes sex, age, and total harvest data for turkey harvested on NFS land.

d. Habitat Trend for MIS: Maturing forests are of benefit to turkey habitat. Wild turkeys have an even greater dependence on hard mast than do deer, so the more mature forest is of more benefit to them. Also of great importance to turkeys is an interspersion of savanna-like areas with a herbaceous/shrubby understory, an open midstory, and a partially open overstory. Other favored areas include small open patches or strips vegetated with grasses or other herbaceous species. These are used heavily, especially in spring, as "bugging" areas. With an increase in prescribed burning as noted in Table 7, the trend in wild turkey habitat is now increasing.

e. Population Trend for MIS: Table 51 through Table 53 show harvest information for wild turkeys (Source: http://www.dgif.virginia.gov/hunting/va_game_wildlife/national_forests_spring_turkey_2004.pdf).

Table 51. Spring Wild Turkey Harvest Information Across The GWNF, 1996 To 2004

County	1996	1997	1998	1999	2000	2001	2002	2003	2004	Harvest /square mile
Allegheny	128	102	45	87	74	148	117	112	83	0.32
Amherst	54	34	26	30	30	37	43	51	32	0.35
Augusta	88	158	93	95	139	158	157	122	86	0.28
Bath	154	134	91	153	133	221	164	106	99	0.36
Frederick	2	4	6	4		3	3	6	5	0.65
Highland	30	26	26	41	47	61	38	32	17	0.19
Nelson	4	6	3	6	4	2	12	3	3	0.10
Page	10	10	6	6	7	13	5	8	6	0.14
Rockbridge	43	43	31	26	24	45	63	35	38	0.36
Rockingham	98	125	63	68	57	91	93	92	76	0.35
Shenandoah	68	57	41	31	20	48	48	47	60	0.51
Warren	2	3	4	3	3	9	5	9	6	0.61
Total	431	702	435	550	536	838	748	623	457	

Table 52. Spring Wild Turkey Harvest Information Across The JNF, 1996 To 2004

County	1996	1997	1998	1999	2000	2001	2002	2003	2004	Harvest /square mile
Bedford	17	26	21	14	5	11	19	27	13	0.44
Bland	52	25	23	29	26	52	40	38	29	0.26
Carroll	1	1	1		4	2	7		1	0.09
Craig	49	111	71	74	76	136	127	105	84	0.47
Dickenson	15	16	4	8	15	19	16	13	14	1.09
Giles	38	36	25	39	33	46	53	30	29	0.29
Grayson	24	14	14	21	17	32	27	6	20	0.39
Lee	13	3	3	2	7	6	10	13	9	0.51
Montgomery	5	8	3	5	2	9	14	11	2	0.07
Pulaski	4	11	4	2	12	13	19	19	9	0.30
Roanoke		5		2	4	6	5	3	1	0.21
Scott	12	10	7	15	12	17	24	10	13	0.24
Smyth	42	14	20	34	36	43	44	28	23	0.20
Tazewell	3	2	2	3			1	2	2	0.14
Washington	13	7	4	6	3	8	1	7	1	0.03
Wise	62	41	11	37	28	36	62	49	31	0.55
Wythe	55	14	21	27	30	40	50	60	36	0.40
Total	405	344	241	318	290	476	519	421	317	

Table 53. Spring Wild Turkey Harvest Information Across The Forests' Shared

Counties, 1996 To 2004

County	1996	1997	1998	1999		2001	2002	2003	2004	Harvest /square mile
Botetourt	60	99	45	41	52	93	84	91	65	0.53

The data suggests that total harvest numbers for both forests vary across years, but indicate an overall stable to slightly increasing population trend. In 2000, VDGIF and WVDNR estimated turkey populations at 4,149 individuals on the GWNF and 8,278 individuals on the JNF, respectively.

Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

The forest across the GWJNF's continues to mature. Martin et al. (1951) and Dickson (1992) state acorns (hard mast) are the most important food for turkeys, especially in the winter and early spring months. As long as a high percentage of the forest remains in the optimum hard mast-producing age range (oaks 50-100 years old, generally), wild turkeys will be favored.

Wild turkeys use a wide range of habitats, with diversified habitats providing optimum conditions (Schroeder, 1985). This includes mature mast-producing stands during fall and winter, shrub-dominated stands for nesting, and herb-dominated communities, including agricultural clearings for brood rearing. Habitat conditions for wild turkey are enhanced by management activities such as prescribed burning and thinning (Hurst, 1978; Pack, Igo, and Taylor, 1988), and the development of herbaceous openings (Nenno and Lindzey, 1979; Healy and Nenno, 1983).

Wildlife habitat improvement activities, such as waterhole developments, grassy openings, prescribed burning, and road management that decreases disturbance, will favor an upward trend in the wild turkey population. On the Forest, both habitat and nonhabitat factors—such as protection and conservative harvests—have been responsible for increased turkey populations.

The eastern wild turkey is a game animal that is harvested throughout Virginia and West Virginia; therefore, viability is not a concern. Pack et al. (1999) has pointed out that hunting seasons, especially either-sex fall hunting, has the potential of significantly reducing wild turkey population growth. Both Virginia and West Virginia have reduced fall seasons in recent years and experienced increases in their wild turkey populations. Overall, viability is well sustained for wild turkey on the GWJNF. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction is recommended for turkey. Continue monitoring.

D. Viability of Forests' MIS

The overall goal is to conserve species with viability concerns through conserving their habitat. The concept of viability is making the assumption that all the species needs can be met on the National Forests. But the Forests are not "islands" and cannot be called upon to meet all needs for all MIS, especially wide-ranging species such as neotropical migrants, bald eagles, or the Indiana bat. Each individual species status and trend narratives articulated the rationale for selection of that species. Most MIS were not selected because of concerns over viability. Most MIS species were selected for other reasons (1982 36 CFR §219.19(1)(a)).

See Table 54. Viability is not a concern for most identified MIS because, based on rankings of the Natural Heritage Program's, MIS species are either "very common and demonstrably secure" (G5, S5) or "common and apparently secure" (G4, S4) throughout their "global" and "state" ranges. This is the case for 11 out of 23 identified MIS/MIS groups on the GWNF and for 8 out of 8 identified MIS/MIS groups for the JNF.

Table 54. Global and State Rankings for GWJNF's' MIS and Identification of Viability Concerns

Management Indicator Species	Global Ranking*	Virginia Ranking*	West Virginia Ranking*	Species Viability Concerns (Yes or No)
Black bear	G5	S4	S5	No
Eastern Wild Turkey	G5	S5	S5	No
White-tailed Deer	G5	S5	S5	No
Brown Headed Cowbird	G5	S5	S4B S5N	No
Worm-eating Warbler	G5	S4	S5B	No
Ovenbird	G5	S5	S5B	No
Hooded warbler	G5	S5	S5B	No
Acadian flycatcher	G5	S5	S5B	No
Scarlet tanager	G5	S5	S5B	No
Pine warbler	G5	S5	S4B, S1N	No
Eastern towhee	G5	S5	S5B,S5N	No
Chestnut-sided warbler	G5	S4	S5B	No
Cow Knob Salamander	G3	S2	S1	Yes
Tiger Salamander	G5	S1	N/A	Yes
Common Flicker	G5	S5	S5B S5N	No
Pileated Woodpecker	G5	S5	S5	No
Native Brook Trout	G5	S4	S5	No
Wild Trout (Brook, Rainbow and Brown)	G5	S4	S5	No
Indiana Bat	G2	S1	S1	Yes
Northern Flying Squirrel	G5	S1	S2	Yes
Peregrine Falcon	G4	S1	S1B S2N	Yes*
Bald Eagle	G4	S2	S1B S2N	Yes*
James Spinymussel	G1	S1	S1	Yes
Shale Barren Rockcress	G2	S2	S1	Yes
Swamp Pink	G4	S1	N/A	Yes
Northeastern Bulrush	G3	S2	S1	Yes
Cave Dwelling Bat Group				
-Big Brown Bat	G5	S5	S5	No
-Little Brown Bat	G5	S5	S5	No
-North. (Keen's) Myotis	G4	S3	S3S4	Yes
-Eastern Pipistrelle	G5	S5	S5	No
-East. Small Footed Bat	G3	S1	S1	Yes
Sunfish Family Group				
-Smallmouth Bass	G5	S5	S5	No
-Largemouth Bass	G5	S5	S5	No
-Redbreast Sunfish	G5	S5	S5	No
-Rock Bass	G5	S5	S5	No
-Black Crappie	G5	S5	S4	No
-Bluegill	G5	S5	S5	No
-Redear Sunfish	G5	SE	SE	No
Yellow Pine Community	NA	NA	NA	Yes
Old Growth Forest Types	NA	NA	NA	No

*Species being downlisted, so viability concerns on Forest are diminished.

Source: http://www.natureserve.org

*Heritage Ranking Codes Used in Preceding Table 54

Natural Heritage Program Rankings:
G = Global Ranking, And S = State Ranking

Code	Code Description
G1	Extremely Rare Throughout Entire Range Of Species (Occurrences 1-5)
S1	Extremely Rare Throughout The State (Occurrences 1-5)
G2	Very Rare Throughout Entire Range Of Species (Occurrences 6-20)
S2	Very Rare Throughout The State (Occurrences 6-20)
G3	Rare Or Uncommon Throughout The Entire Range Of Species (Occurrences 21-100)
S3	Rare Or Uncommon In The State (Occurrences 21-100)
G4	Common And Apparently Secure Throughout Range
S4	Common And Apparently Secure Throughout State
G5	Very Common And Demonstrably Secure Throughout Range
S5	Very Common And Demonstrably Secure Throughout State
GX	Believed Extinct With No Likelihood Of Rediscovery
SX	Believed Extirpated From State
SE	Exotic Species
GH	Historically Known Globally - Not Recently Verified (Within Past 15 Years)
SH	Historically Known From State - Not Recently Verified (Within Past 15 Years)
GU	Possibly Rare - Status Uncertain - More Data Needed
SU	Possibly Rare - Status Uncertain - More Data Needed
Q	Taxonomic Question
T	Signifies The Rank Of A Subspecies Or Variety
?	Rank Uncertain
N/A	Not Known To Occur In State
S*B S*N	B = Breeder, N = Nonbreeder
NA	Not Applicable

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APPENDIX H

Condition of Streams in the South Fork Shenandoah River Drainage, 2004, Dry River Ranger District, George Washington-Jefferson National Forest, VA

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1650 Ramble Rd.
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December 2004

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Introduction

Throughout summer 2004 we conducted stream habitat inventories on South Fork Shenandoah River drainage streams within the Dry River Ranger District, George Washington-Jefferson National Forest (GWJNF), Virginia, to quantify stream habitat conditions. Habitat conditions in 17 streams (56 km) were classified and inventoried between May and November 2004 using basinwide visual estimation technique (BVET) habitat inventories (Dolloff et. al 1993). These inventories completed the third and final year of BVET habitat inventories in the Shenandoah River drainage of the Dry River Ranger District. Results of previous BVET habitat inventories in the Shenandoah River drainage of the Dry River District can be found in Duty et al. (2002) and Fitzpatrick et al. (2003).

We modified standard BVET methods to measure stream habitat parameters identified in the George Washington Forest plan. Included in the Forest plan is an outline of the desired-future-condition (DFC) for all the streams within the Forest[1]. The pertinent DFCs for the Forest include: woody debris loading - 78 to 186 pieces per kilometer, and percent pool habitat - 35 to 65 percent of the total stream habitat. We mistakenly reported the DFC for pool habitat as 30 to 70 percent of total stream habitat in reports prior to 2003.

The purpose of this report is to describe the current condition of Dry River Ranger District streams in a format useful to the Dry River Ranger District and the GWJNF. The enclosed report is intended to provide baseline information for Forest planning, habitat improvement projects, and land use decisions.

Methods

Surveys began at confluences for streams contained within National Forest boundaries and at the downstream USFS boundary for all other streams. Surveys were terminated when we encountered an upstream USFS boundary, or when the wetted channel was < 1 m average wetted width or dry for > 500 m.

Two-stage visual estimation techniques were used to quantify habitat and DFCs in selected Dry River Ranger District streams. During the first stage, habitat was stratified into similar groups based on naturally occurring habitat units including pools (areas in the stream with concave bottom profile, gradient equal to zero, greater than average depth, and smooth water surface), and riffles (areas in the stream with convex bottom profile, greater than average gradient, less than average depth, and turbulent water surface). Glides (areas in the stream similar to pools, but with average depth and flat bottom profile) were identified during the survey but were grouped with pools for data analysis. Runs (areas in the stream similar to riffles but with average depth, less turbulent flow, and flat bottom profile) and cascades (areas in the stream with > 12% gradient, high velocity, and exposed bedrock or boulders) were grouped with riffles for data analysis.

[1]the GeorgeWashington portion of the GWJNF has a separate Forest plan and different DFCs from the Jefferson portion of the GWJNF

Habitat in each stream was classified and inventoried by a two-person crew. One crew member identified each habitat unit by type (as described above), estimated average wetted width, average and maximum depth, riffle crest depth (RCD), substrate composition, and percent fines. The length (0.1 m) of each habitat unit was measured with a hip chain. Average wetted width was visually estimated. Average and maximum depth of each habitat unit were estimated by taking depth measurements at various places across the channel profile with a graduated staff marked in 5 cm increments. The RCD was estimated by measuring water depth at the deepest point in the hydraulic control between riffles and pools. The RCD was subtracted from average pool depth to obtain an estimate of residual pool depth. Substrates were assigned to one of nine size classes (Appendix A). Dominant substrate (covered greatest amount of surface area in habitat unit) and subdominant substrate (covered 2nd greatest amount of surface area in habitat unit) were visually estimated. Percent fines was the percent of surface area of the stream bed that consisted of sand, silt, or clay substrate particles (particles < 2 mm diameter). In addition, several attributes of road-stream crossings (location, type, size, etc.) were recorded, where encountered.

The second crew member classified and inventoried large woody debris (LWD) within the stream channel, determined the Rosgen's channel type (Appendix A) associated with each habitat unit, and recorded data on a Husky fex21 data logger. LWD was assigned to one of four size classes (Appendix A). All woody debris less than 1.0 m long and less than 10 cm in diameter were omitted from the survey. Rosgen's channel type was visually estimated using criteria found in Rosgen (1996).

The first unit of each habitat type selected for intensive (second stage) sampling (i.e. accurate measurement of wetted width) was determined randomly. Additional units were selected systematically (every 10th habitat unit type for streams >1000 m and every 5th habitat unit type for streams <500 m). The wetted width of each systematically selected habitat unit was measured with a meter tape across at least three transects and averaged. In each of the systematically selected (second stage) riffles we also estimated the bankfull stream channel width and riparian width, measured channel gradient and water temperature, and took a digital photograph. We estimated bankfull channel width by measuring the width of the bankfull channel perpendicular to flow. We estimated riparian width by measuring from the edge of the bankfull channel to the intersection with the nearest landform at an elevation equal to two-times maximum bankfull depth as described by Rosgen (1996). Gradient was estimated by using a clinometer to site from the downstream to the upstream end of the selected riffle. Water temperature was measured with a thermometer in flowing water out of direct sunlight.

We used the ratio of measured to estimated area to develop a calibration ratio, which allowed us to correct visual estimates and estimate stream area with confidence intervals (Hankin and Reeves 1988). BVET calculations were computed with a Microsoft Excel spreadsheet using formulas found in Dolloff et al. (1993). Data were summarized using Excel spreadsheets and SigmaPlot graphics software.

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Acknowledgements

We would like to thank the CATT summer field crew for collecting all of the data presented in this report. The field crew included Paul Anderson, Timothy Freed, Tomas Ivasauskas, Chastine Kyger, Chris Mueller, John Wilburn, and John Yowell. In addition, we thank Dawn Kirk, the Dry River Ranger District, and the GWJNF for providing assistance and funding for the surveys.

User's Guide

Stream summaries are organized in alphabetical order by U. S. Geological Survey (USGS) 1:24,000 Topographic Quadrangle, and then by stream name. The upper right hand corner of each page in the 'Stream Summaries' section contains the USGS quadrangle name for the selected stream.

Data for each stream section were collected, analyzed, and presented separately. Each stream or stream section summary contains:

1. several tables summarizing stream characteristics;
2. figures showing frequency of substrate types, area in pools and riffles, average, maximum, and residual depths, and LWD per kilometer;
3. table describing features encountered on the stream;
4. table describing road-stream crossings;
5. figures showing the distribution of LWD, substrate types, and Rosgen's channel types;
6. table documenting photographs taken during inventories.

George Washington Forest DFCs are indicated on all pertinent tables and graphs.

We also included several summary tables (see 'Summary Tables' section) that summarize all data collected. The tables allow managers to quickly compare between Dry River Ranger District streams inventoried in summer 2004. Digital photographs taken during the stream inventories were copied to CDs and provided to the GWJNF.

Summary Tables

Survey information and summary of general stream habitat characteristics for streams surveyed using the BVET habitat survey on the Dry River District during summer 2004. NA = data was not recorded. No access = stream was not surveyed due to lack of access. 'Length' is total survey length, 'Width' is mean bankfull channel width, 'Gradient' is mean channel gradient, and 'Temperature' is mean water temperature.

Stream	**Quad**	**Date**	**Length (km)**	**Width (m)**	**Gradient (%)**	**Temperature (C)**
Laurel Run	Brandywine	06/29/04	4.5	6	10	13
Low Place Run	Brandywine	11/05/04	3.9	8	9	9.5
Union Springs Run	Briery Branch	08/02/04	2.3	5	4	18
Trout Run	Palo Alto	06/29/04	2.4	7	4	14.5
Little Laurel Run	Rawley Springs	06/29/04	0.5	NA	NA	NA
Big Run	Reddish Knob	06/30/04	5.6	6	4	12
North Fork Little River	Reddish Knob	06/21/04	7.2	5	6	11
South Fork Little River	Reddish Knob	06/22/04	2.7	21	3	11.5
Wolf Run	Reddish Knob	06/30/04	3.0	5	3	14
Buckhorn Creek	Stokesville	06/23/04	3.3	6	4	18
Little River	Stokesville	06/17/04	0.9	17	2	17
Skidmore Fork	Stokesville	06/15/04	4.1	10	2	19
Stony Run	Stokesville	06/23/04	3.6	6	9	14
Tunnel Hollow	Stokesville	06/28/04	1.7	6	3	16
White Oak Run	Stokesville	06/22/04	4.2	7	2	19
Horse Trough Hollow	West Augusta	06/15/04	1.8	6	6	14
Mitchell Branch	West Augusta	06/16/04	1.1	5	4	14
Stillhouse Hollow	West Augusta	06/16/04	3.0	5	5	17

Summary of pool habitat characteristics for streams surveyed using the BVET habitat survey on the Dry River District during summer 2004. The George Washington National Forest DFC is between 35% and 65% of total stream area in pools. NA = could not be calculated. 'Total Area (%)' is percent of total stream surface area in pools (includes glides), 'Total Area (m^2)' is surface area of stream in pools, 'Mean Area' is mean surface area of individual pools, 'Mean Max Depth' is the mean maximum depth of all pools, 'Mean Ave Depth' is mean average depth of all pools, 'Mean Resid Depth' is mean residual depth of all pools, 'Glides' is percent of pool habitat units surveyed as glides, '>35% Fines is percent of pools with greater than 35% of substrate materials < 2 mm in diameter.

Stream	**Total Area (%)**	**Total Area (m^2)**	**Total Count (n)**	**# per km**	**Mean Area (m^2)**	**Mean Max Depth (cm)**	**Mean Ave Depth (cm)**	**Mean Resid Depth (cm)**	**Glides (%)**	**>35% Fines (%)**
Laurel Run	58	10808	247	55	44	39	22	12	19	16
Low Place Run	10	1663	56	14	30	75	52	34	0	2
Union Springs Run	51	3082	55	23	56	38	19	12	2	4
Trout Run	21	1058	70	29	15	34	21	14	6	20
Little Laurel Run	NA	NA	4	8	NA	34	20	11	0	0
Big Run	28	2067	68	12	30	40	26	18	12	7
North Fork Little River	31	2638	140	19	19	28	16	9	26	9
South Fork Little River	31	907	20	7	45	28	18	11	10	60
Wolf Run	11	821	67	22	12	38	21	14	24	28
Buckhorn Creek	39	3735	132	40	28	32	18	9	18	28
Little River	20	1456	10	11	146	84	58	16	10	0
Skidmore Fork	18	3554	64	16	55	51	32	14	11	0
Stony Run	18	1436	81	22	18	42	28	20	0	25
Tunnel Hollow	24	749	40	23	19	34	18	13	20	40
White Oak Run	61	10927	128	30	85	49	33	23	5	52
Horse Trough Hollow	65	1625	110	62	15	27	16	9	25	5
Mitchell Branch	13	374	28	25	13	37	23	13	0	4
Stillhouse Hollow	23	1422	180	60	8	25	15	8	23	27

Summary of riffle habitat characteristics for streams surveyed using the BVET habitat survey on the Dry River District during summer 2004. NA = could not be calculated. 'Total Area (%)' is percent of total stream surface area in riffles (includes runs and cascades), 'Total Area (m^2)' is surface area of stream in riffles, 'Mean Area' is mean surface area of individual riffles, 'Mean Max Depth' is the mean maximum depth of all riffles, 'Mean Ave Depth' is mean average depth of all riffles, 'Runs' is percent of riffle habitat units surveyed as runs, 'Cascades' is percent of riffle habitat units surveyed as cascades.

Stream	**Total Area (%)**	**Total Area (m^2)**	**Total Count (n)**	**# per km**	**Mean Area (m^2)**	**Mean Max Depth (cm)**	**Mean Ave Depth (cm)**	**Runs (%)**	**Cascades (%)**
Laurel Run	42	7715	216	48	36	22	12	38	12
Low Place Run	90	15276	60	15	255	38	19	0	7
Union Springs Run	49	2912	49	21	59	17	9	2	2
Trout Run	79	3886	66	28	59	20	9	2	2
Little Laurel Run	NA	NA	6	11	NA	13	7	0	0
Big Run	72	5411	73	13	74	16	8	3	1
North Fork Little River	69	5940	129	18	46	15	7	1	16
South Fork Little River	69	2067	18	7	115	11	5	6	0
Wolf Run	89	6504	68	22	96	25	12	1	0
Buckhorn Creek	61	5792	118	36	49	17	9	0	0
Little River	80	5720	19	21	301	33	22	32	0
Skidmore Fork	82	16488	67	17	246	28	14	24	0
Stony Run	82	6452	90	25	72	18	8	0	2
Tunnel Hollow	76	2353	42	24	56	19	9	0	0
White Oak Run	39	6992	106	25	66	17	10	0	0
Horse Trough Hollow	35	884	35	20	25	14	7	17	3
Mitchell Branch	87	2588	29	26	89	14	6	3	0
Stillhouse Hollow	77	4723	163	54	29	14	7	2	6

Summary of LWD per km and Rosgen's channel types for streams surveyed using the BVET habitat survey on the Dry River District during summer 2004. The GWJNF DFC for total LWD is 78 to 186 pieces per km. LWD sizes: 1) <5 m long, <55 cm diameter, 2) < 5 m long, >55 cm diameter, 3) >5 m long, <55 cm diameter, 4) >5 m long, >55 cm diameter. See Appendix A for description of Rosgen channel types.

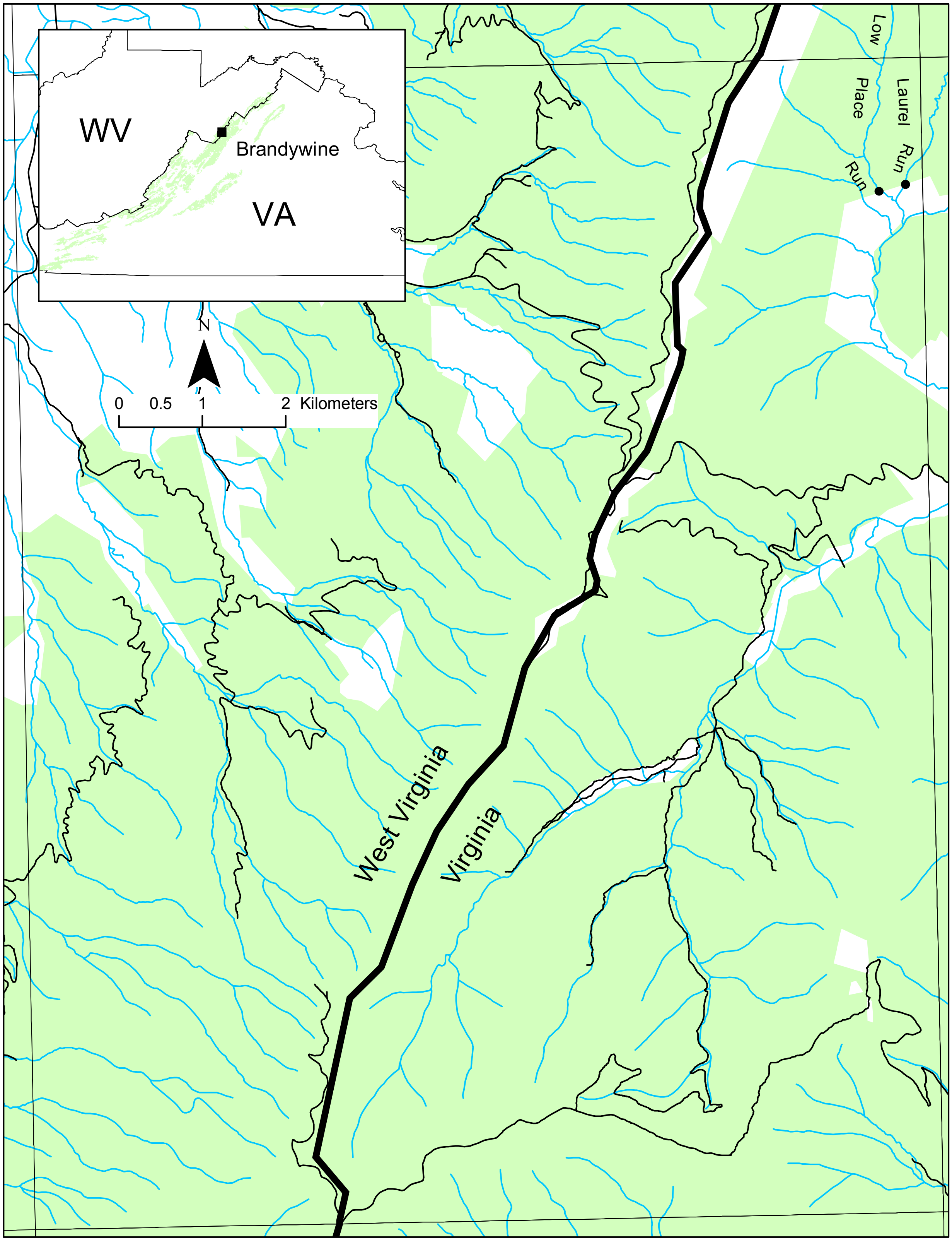
Stream	**Large Woody Debris per km**					**Rosgen's Channel Type**						
	1	**2**	**3**	**4**	**Total**	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Laurel Run	47	7	38	17	109	49	44	6	0	0	0	0
Low Place Run	39	4	31	13	88	44	56	0	0	0	0	0
Union Springs Run	24	0	30	7	61	0	62	38	0	0	0	0
Trout Run	36	1	23	5	65	100	0	0	0	0	0	0
Little Laurel Run	98	0	141	85	324	0	0	100	0	0	0	0
Big Run	30	0	33	2	65	10	14	74	0	0	1	0
North Fork Little River	29	1	14	3	47	73	0	27	0	0	0	0
South Fork Little River	13	0	12	0	25	0	78	22	0	0	0	0
Wolf Run	15	0	24	11	51	0	100	0	0	0	0	0
Buckhorn Creek	43	1	30	5	79	0	8	0	0	0	92	0
Little River	4	0	4	0	9	0	100	0	0	0	0	0
Skidmore Fork	30	0	10	2	42	0	100	0	0	0	0	0
Stony Run	22	0	17	3	42	76	24	0	0	0	0	0
Tunnel Hollow	11	0	7	3	21	0	100	0	0	0	0	0
White Oak Run	4	0	41	14	59	0	0	0	0	0	100	0
Horse Trough Hollow	43	1	23	6	73	100	0	0	0	0	0	0
Mitchell Branch	39	0	8	3	50	0	0	0	0	0	100	0
Stillhouse Hollow	18	1	33	4	56	43	0	54	0	0	0	3

Summary of riparian width calculations for streams surveyed using the BVET habitat survey on the Dry River District during summer 2004. NA = data not recorded. The left riparian width, right riparian width, and bankfull channel widths were added together before values for 'Riparian Width Total' were calculated. Left and right riparian widths were pooled together before values for 'Riparian Left & Right Width' were calculated.

Stream	Riparian Width Total (m)					Riparian Left & Right Width (m)				
	Mean	Max	75th	25th	Min	Mean	Max	75th	25th	Min
Laurel Run	10	16	12	8	6	2	8	2	1	0
Low Place Run	26	46	33	17	11	9	25	13	4	1
Union Springs Run	9	14	13	4	4	2	6	3	1	0
Trout Run	9	15	11	8	6	1	6	1	1	0
Little Laurel Run	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Big Run	35	124	41	8	4	14	80	22	0	0
North Fork Little River	11	27	10	6	5	3	20	2	1	0
South Fork Little River	57	93	75	39	21	18	33	29	8	2
Wolf Run	7	10	9	5	5	1	3	1	1	0
Buckhorn Creek	9	26	9	6	3	1	18	1	0	0
Little River	34	40	37	31	28	8	26	9	2	2
Skidmore Fork	18	34	19	13	10	4	21	4	1	1
Stony Run	10	17	12	8	5	2	5	2	1	1
Tunnel Hollow	9	13	11	9	4	2	7	1	1	1
White Oak Run	12	86	12	7	3	3	50	1	0	0
Horse Trough Hollow	12	19	13	10	9	3	10	4	1	1
Mitchell Branch	17	22	20	14	12	6	12	9	2	1
Stillhouse Hollow	13	70	13	6	4	4	60	3	1	0

Index of Stream Summaries

Stream Summaries



Streams inventoried on the Brandywine Quadrangle using BVET habitat surveys during summer 2004.

Stream:	**Laurel Run**
District:	Dry River
USGS Quadrangle:	Brandywine
Survey Date:	06/29/04
Downstream Starting Point:	National Forest Boundary
Total Distance Surveyed (km):	4.5

	Pools	**Riffles**
Percent of Total Stream Area:	58	42
Total Area (m^2):	10808±356	7715±948
Correction Factor Applied:	1.13	1.23
Number of Paired Samples:	26	21
Total Count:	247	216
Number per km:	55	48
Mean Area (m^2):	44	36
Mean Maximum Depth (cm):	39	22
Mean Average Depth (cm):	22	12
Mean Residual Depth (cm):	12	--
Percent Surveyed as Glides:	19	--
Percent Surveyed as Runs:	--	38
Percent Surveyed as Cascades:	--	12
Percent with >35% Fines:	16	2

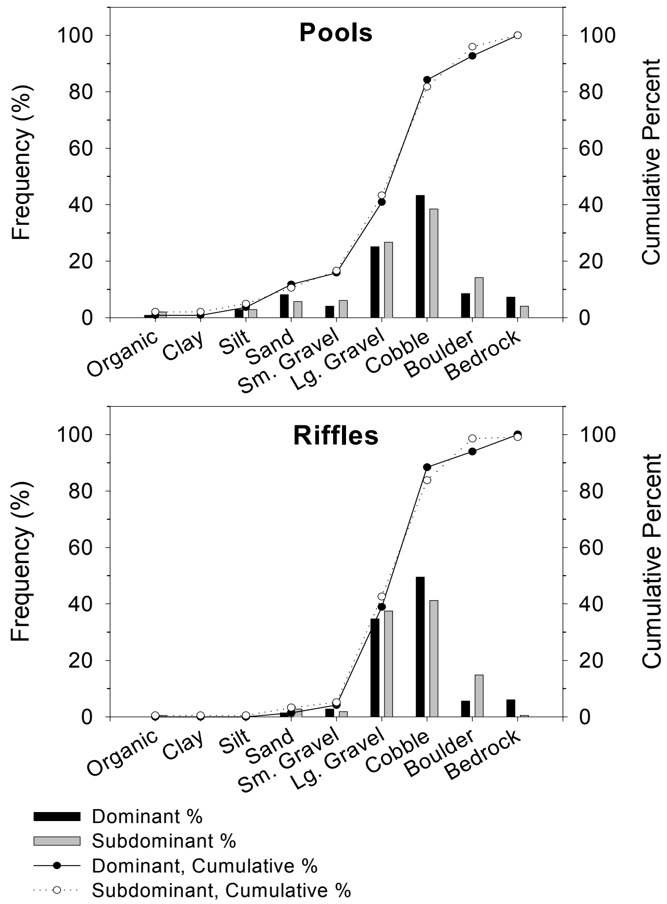
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	47
< 5 m long, > 55 cm diameter:	7
> 5 m long, 10 cm – 55 cm diameter:	38
> 5 m long, > 55 cm diameter:	17
Total:	109

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	10	2
Maximum	16	8
75th Percentile	12	2
25th Percentile	8	1
Minimum	6	0

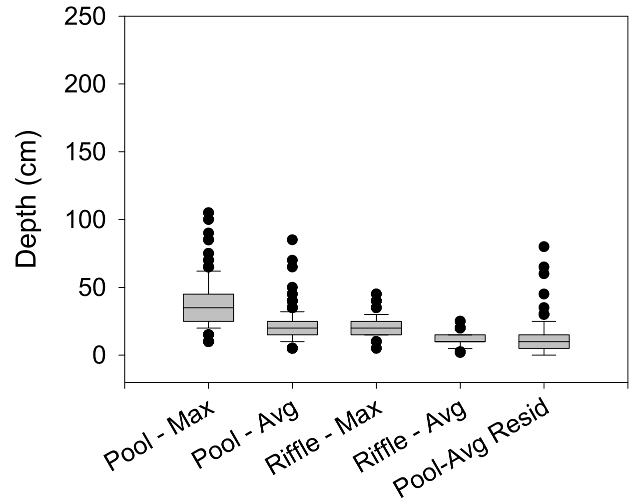
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	49
B:	44
C:	6
D:	0
E:	0
F:	0
G:	0

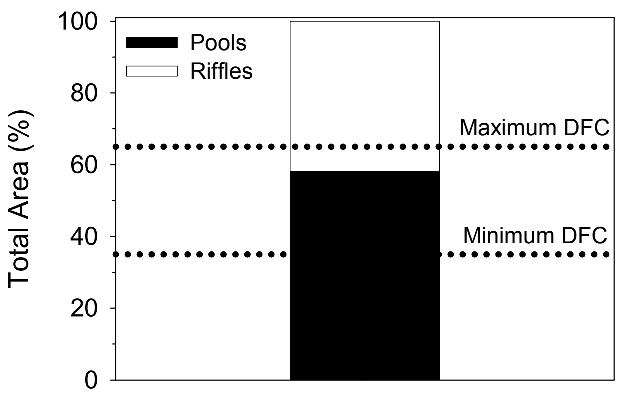
Other Stream Attributes	
Mean Bankfull Channel Width (m):	6
Mean Channel Gradient (%):	10
Median Water Temperature (C):	13



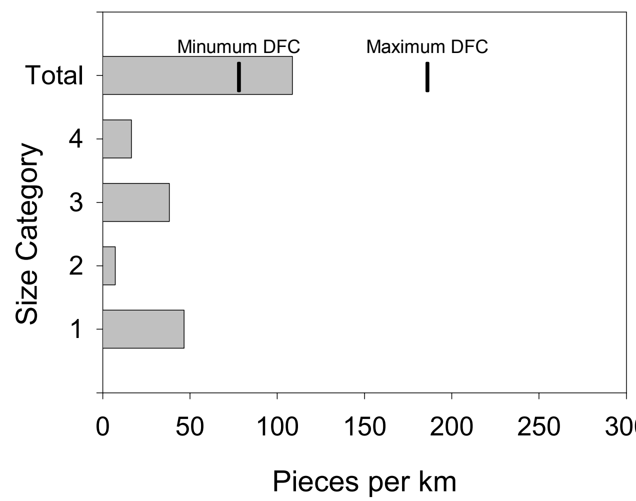
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Laurel Run, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Laurel Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Laurel Run in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Laurel Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

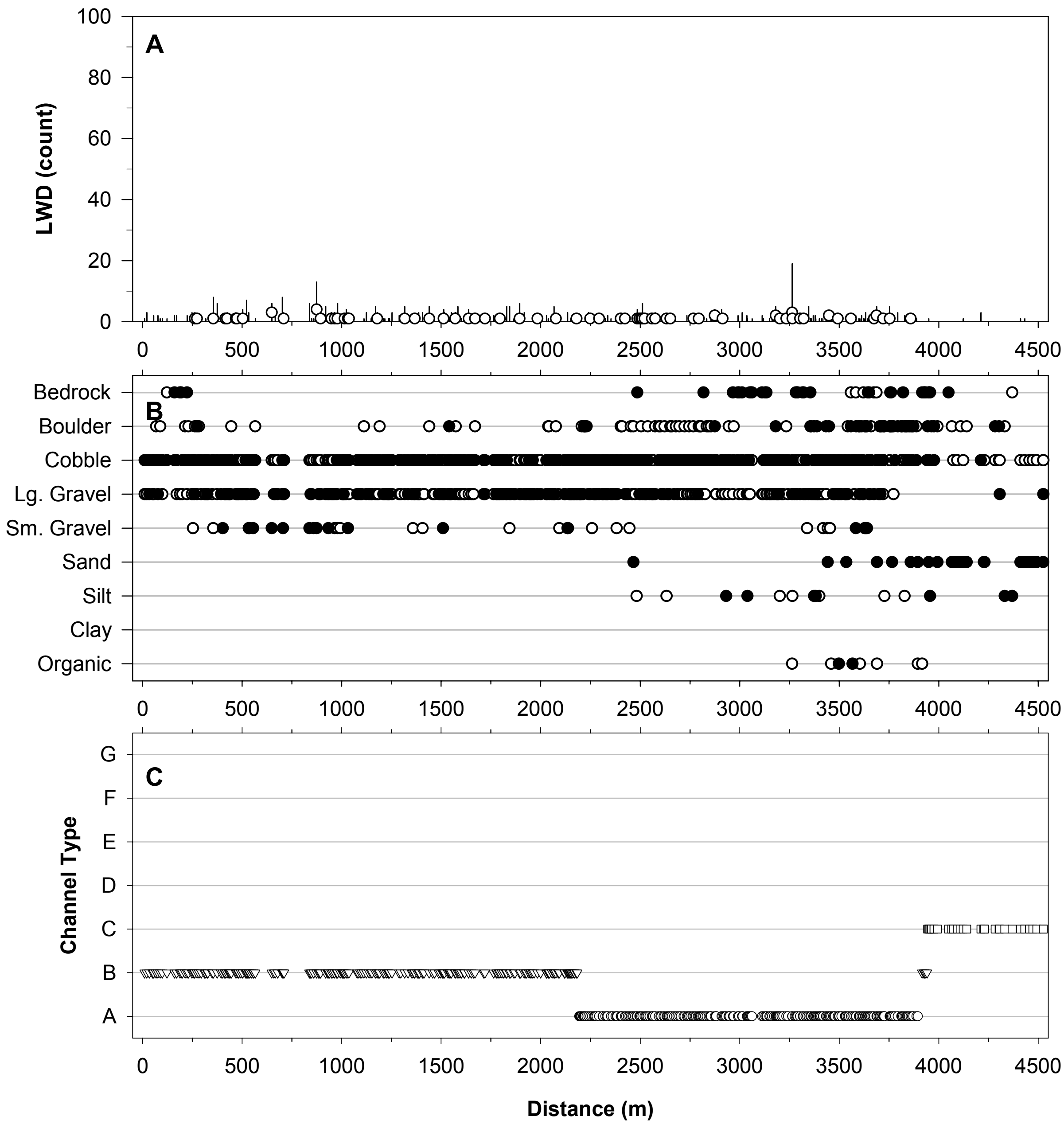
Stream features found on Laurel Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SIDE CHANNEL	199.5		IN ON LEFT
SIDE CHANNEL	245.5		OUT ON LEFT
SIDE CHANNEL	283.2		IN ON RIGHT
TRIBUTARY	431.8		IN ON LEFT
SIDE CHANNEL	493.8		IN ON RIGHT
SIDE CHANNEL	502.9		OUT ON RIGHT
SIDE CHANNEL	537.8		IN ON RIGHT
UNDERGROUND	606.5		FROM 566 m TO 606.5 m
SIDE CHANNEL	635		IN ON LEFT ,DRY
SIDE CHANNEL	681.8		IN ON LEFT, DRY
UNDERGROUND	800		FROM 711 m TO 800 m; 4 DRY CHANNELS
LAND SLIDE	993.3		LEFT
LAND SLIDE	1022.6		END LEFT BANK SLIDE
SIDE CHANNEL	1037.3		IN ON RIGHT
SIDE CHANNEL	1078.1		OUT ON RIGHT
SIDE CHANNEL	1407.2		IN ON RIGHT
SIDE CHANNEL	1615.4		OUT ON LEFT
SIDE CHANNEL	1720		IN ON LEFT
SIDE CHANNEL	1740		OUT ON LEFT
TRIBUTARY	1801.3		IN ON LEFT
TRIBUTARY	1952.1		IN ON RIGHT
SEEP	2055		LEFT
TRIBUTARY	2066		IN ON LEFT
SIDE CHANNEL	2088.5		IN ON RIGHT
SIDE CHANNEL	2106		OUT ON LEFT
SIDE CHANNEL	2232.1		IN ON LEFT
SIDE CHANNEL	2239.5		OUT ON LEFT
LAND SLIDE	2265.6		RIGHT
SIDE CHANNEL	2326.8		IN ON LEFT
SIDE CHANNEL	2336.5		OUT LEFT
FALL	2409		1.5M
TRIBUTARY	2708		IN ON LEFT
BRAID	2745.4		
FALL	2996.2		1.5M
SIDE CHANNEL	3020.3		IN ON RIGHT
SIDE CHANNEL	3042		OUT ON RIGHT
BRAID	3172.9		
FALL	3293.3		1M
FALL	3320.9		1M
LOG DAM	3325.4		1M FILLED IN WITH ROCK UPSTREAM
FALL	3562.3		1.25M
SIDE CHANNEL	3657		IN ON LEFT
SIDE CHANNEL	3669.9		OUT ON LEFT
LAND SLIDE	3681		LEFT
UNDERGROUND	3890.7		FROM 3887.8 m TO 3890.7 m
FALL	3896.8		4M
UNDERGROUND	4045.3		FROM 3992.7 m TO 4045.3 m
SEEP	4064.2		RIGHT

Stream Feature	Distance (m)	Width (m)	Comments
UNDERGROUND	4064.2		FROM 4048.9 m TO 4064.2 m
UNDERGROUND	4069		FROM 4065.1 m TO 4069 m
UNDERGROUND	4087.5		FROM 4072.9 m TO 4087.5 m
UNDERGROUND	4096.8		FROM 4092.3 m TO 4096.8 m
UNDERGROUND	4115.2		FROM 4110.3 m TO 4115.2 m
UNDERGROUND	4131		FROM 4122.8 m TO 4131 m
UNDERGROUND	4172.5		FROM 4140 m TO 4127.5 m
UNDERGROUND	4325.7		FROM 4305.8 m TO 4325.7 m
UNDERGROUND	4366.5		FROM 4330.9 m TO 4366.5 m
UNDERGROUND	4405.7		FROM 4369 m TO 4405.7 m
UNDERGROUND	4421.3		FROM 4410 m TO 4421.3 m
UNDERGROUND	4450.3		FROM 4431.9 m TO 4450.3 m
UNDERGROUND	4465.8		FROM 4455 m TO 4465.8 m
UNDERGROUND	4491		FROM 4472.5 m TO 4491 m
UNDERGROUND	4503.2		FROM 4492.4 m TO 4503.2 m

Stream crossings encountered on Laurel Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Laurel Run, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from National Forest boundary. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Laurel Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	7	171.4	
RUN	17	402.9	
RIFFLE	27	555.4	
RIFFLE	37	919.4	
RUN	47	1036.8	
CASCADE	57	1191.2	
RUN	67	1364.7	
RIFFLE	77	1516.5	
RIFFLE	87	1662	
RIFFLE	97	1917.1	
RIFFLE	107	2066	
RIFFLE	117	2205.6	
RIFFLE	127	2353.2	
RIFFLE	137	2547	
CASCADE	147	2773.9	
RIFFLE	157	2926.1	
RIFFLE	166	3128	
RIFFLE	177	3275.4	
RIFFLE	187	3492.5	
CASCADE	197	3638.7	
CASCADE	207	3850	
FALL		3896.8	4M

Stream:	**Low Place Run**
District:	Dry River
USGS Quadrangle:	Brandywine
Survey Date:	11/05/04
Downstream Starting Point:	17 662776E 4275015N: Forest Service Boundary
Total Distance Surveyed (km):	3.9

	Pools	**Riffles**
Percent of Total Stream Area:	10	90
Total Area (m^2):	1663±78	15276±1099
Correction Factor Applied:	1.03	1.19
Number of Paired Samples:	6	6
Total Count:	56	60
Number per km:	14	15
Mean Area (m^2):	30	255
Mean Maximum Depth (cm):	75	38
Mean Average Depth (cm):	52	19
Mean Residual Depth (cm):	34	--
Percent Surveyed as Glides:	0	--
Percent Surveyed as Runs:	--	0
Percent Surveyed as Cascades:	--	7
Percent with >35% Fines:	2	0

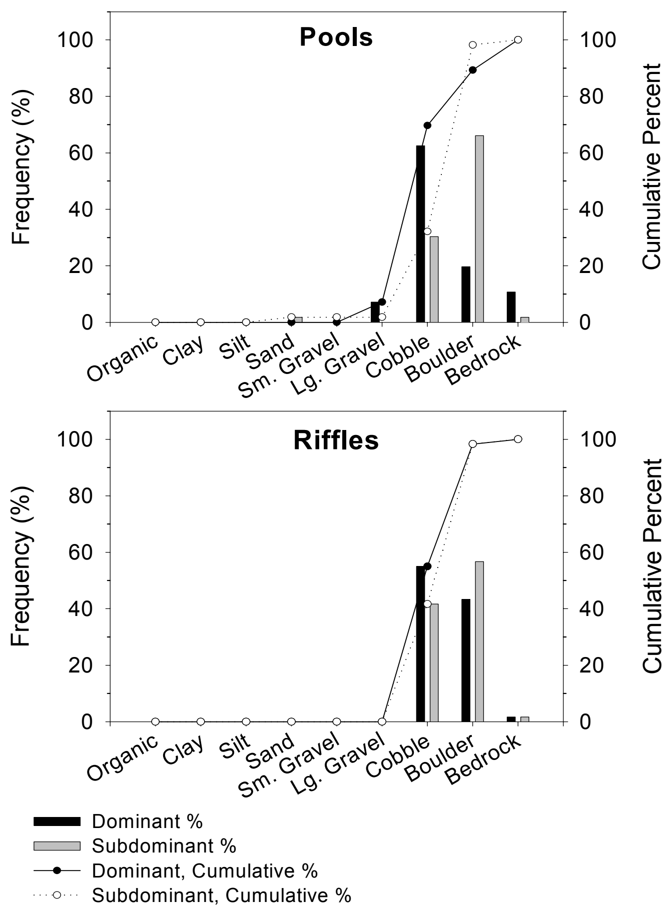
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	39
< 5 m long, > 55 cm diameter:	4
> 5 m long, 10 cm – 55 cm diameter:	31
> 5 m long, > 55 cm diameter:	13
Total:	88

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	26	9
Maximum	46	25
75^{th} Percentile	33	13
25^{th} Percentile	17	4
Minimum	11	1

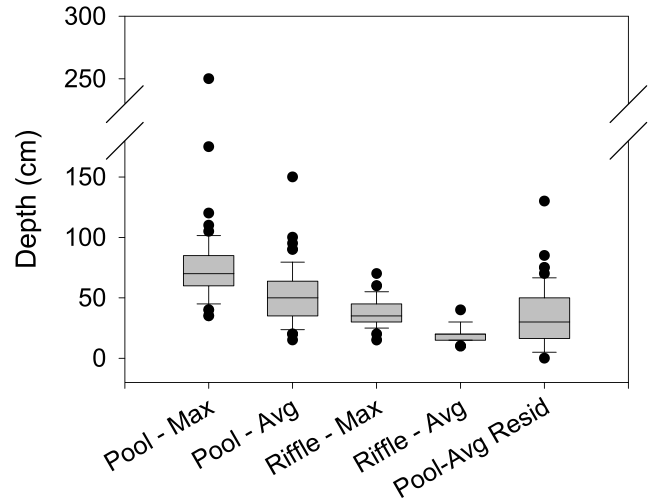
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	44
B:	56
C:	0
D:	0
E:	0
F:	0
G:	0

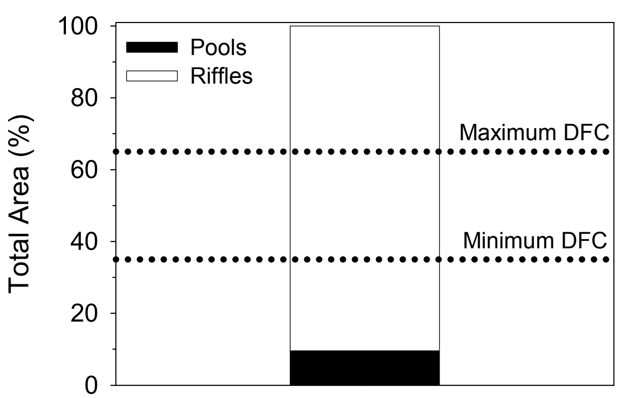
Other Stream Attributes	
Mean Bankfull Channel Width (m):	8
Mean Channel Gradient (%):	9
Median Water Temperature (C):	9.5



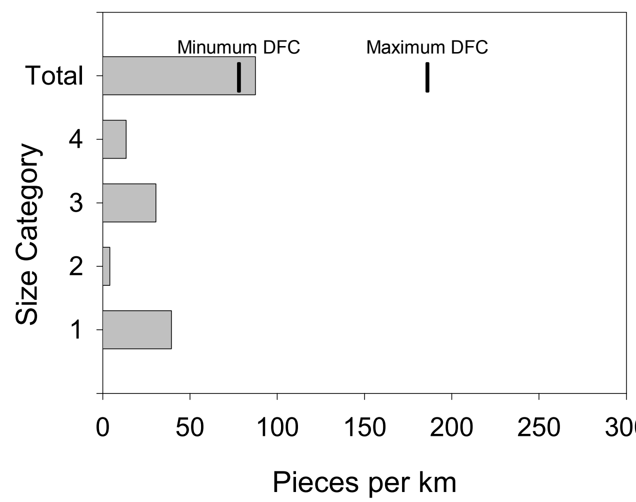
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Low Place Run, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Low Place Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Low Place Run in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Low Place Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

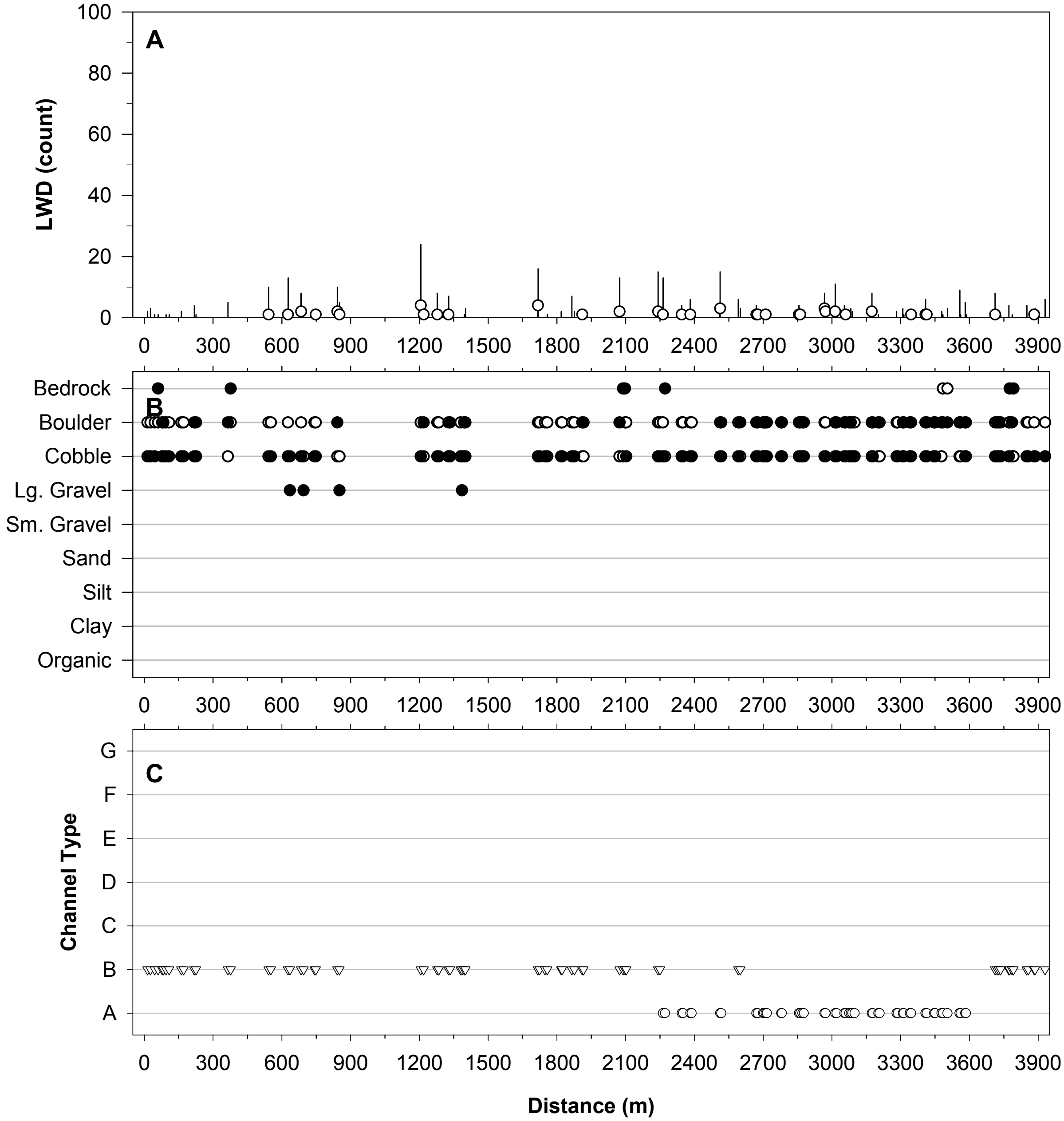
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Low Place Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SIDE CHANNEL	1390.5		IN ON LEFT
OTHER	1521.1		2 LARGE BROOK TROUT ON SPAWNING REDD
TRIBUTARY	1790.7	2.5	IN ON LEFT
BRAID	1849.2		
LANDSLIDE	1967.9		ON LEFT, 20M LONG
SIDE CHANNEL	2202.5		IN ON RIGHT
SIDE CHANNEL	2239.2		OUT ON RIGHT
SIDE CHANNEL	2962.2		IN ON LEFT
TRIBUTARY	2962.2		DRY, IN ON LEFT
SIDE CHANNEL	2987.2		OUT ON LEFT
SEEP	3018.2		DRY GULLY DOWN SIDE OF MOUNTAIN
SIDE CHANNEL	3020.2		IN ON LEFT
SIDE CHANNEL	3054.4		OUT ON LEFT
FALL	3208		1M HIGH
FALL	3251.2		1M HIGH
SIDE CHANNEL	3799.2		IN ON RIGHT
SIDE CHANNEL	3821.9		OUT ON RIGHT
TRIBUTARY	3857.2		DRY, IN ON RIGHT

Stream crossings encountered on Low Place Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

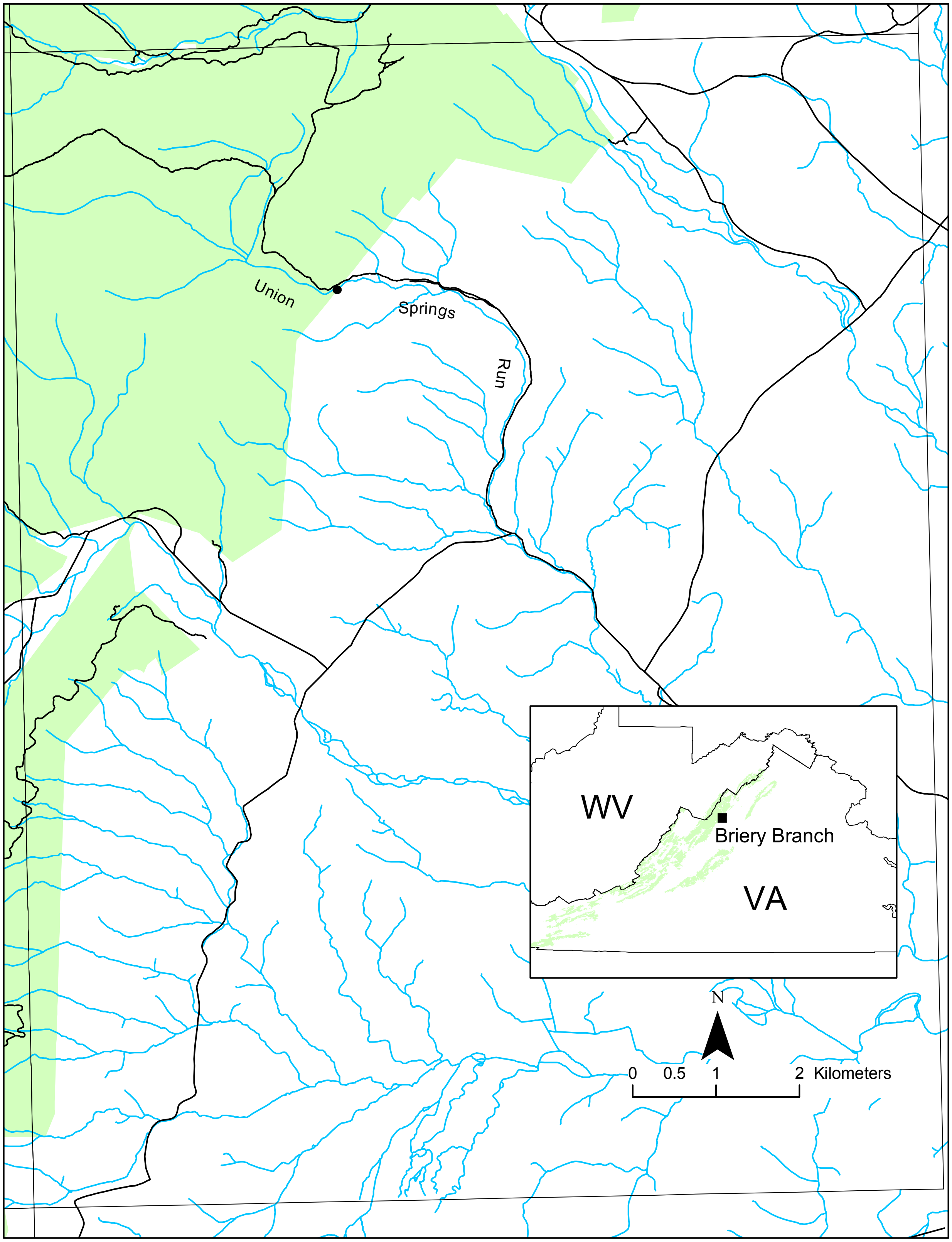
Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Low Place Run, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from Forest Service Boundary. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Low Place Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	4	94.7	
RIFFLE	14	1278.3	
CASCADE	24	2097.7	
RIFFLE	34	2710.7	
RIFFLE	44	3202.2	
RIFFLE	54	3712.2	ABRUPT CHANGE IN GRADIENT



Streams inventoried on the Briery Branch Quadrangle using BVET habitat surveys during summer 2004.

Stream:	Union Springs Run
District:	Dry River
USGS Quadrangle:	Briery Branch
Survey Date:	08/02/04
Downstream Starting Point:	17 4260011N 667526E: Forest Service Boundary
Total Distance Surveyed (km):	2.3

	Pools	Riffles
Percent of Total Stream Area:	51	49
Total Area (m^2):	3082±635	2912±712
Correction Factor Applied:	1.39	1.10
Number of Paired Samples:	4	5
Total Count:	53	49
Number per km:	23	21
Mean Area (m^2):	56	59
Mean Maximum Depth (cm):	38	17
Mean Average Depth (cm):	19	9
Mean Residual Depth (cm):	12	--
Percent Surveyed as Glides:	2	--
Percent Surveyed as Runs:	--	2
Percent Surveyed as Cascades:	--	2
Percent with >35% Fines:	4	2

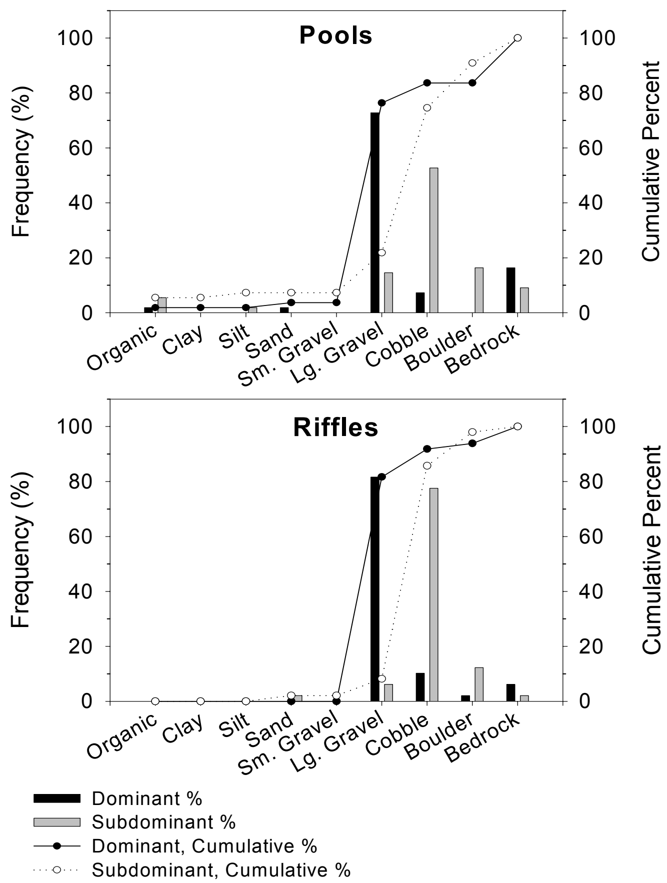
Large Woody Debris Size	Pieces per km
< 5 m long, 10 cm – 55 cm diameter:	24
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	30
> 5 m long, > 55 cm diameter:	7
Total:	61

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	9	2
Maximum	14	6
75th Percentile	13	3
25th Percentile	4	1
Minimum	4	0

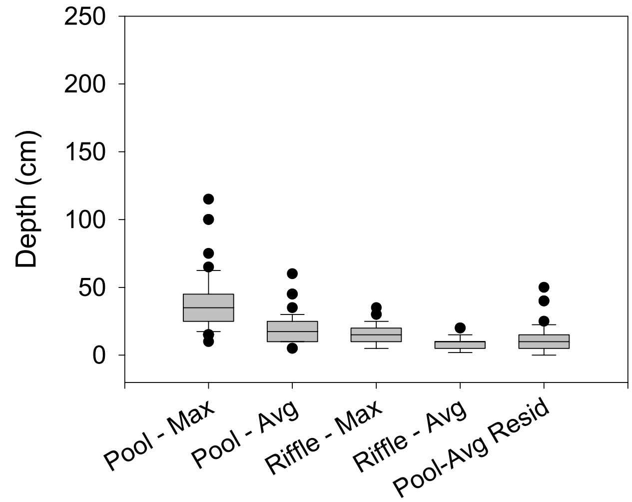
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	Frequency (%)
A:	0
B:	62
C:	38
D:	0
E:	0
F:	0
G:	0

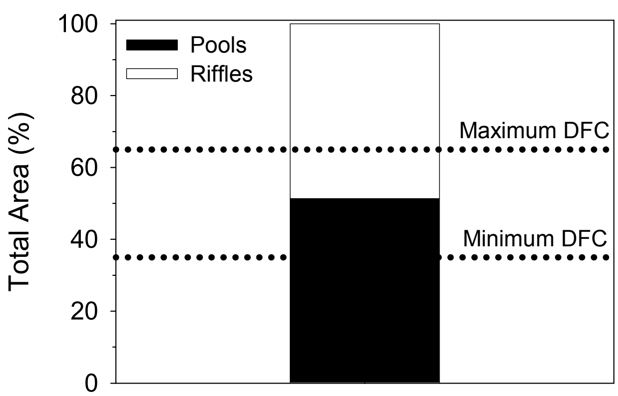
Other Stream Attributes	
Mean Bankfull Channel Width (m):	5
Mean Channel Gradient (%):	4
Median Water Temperature (C):	18



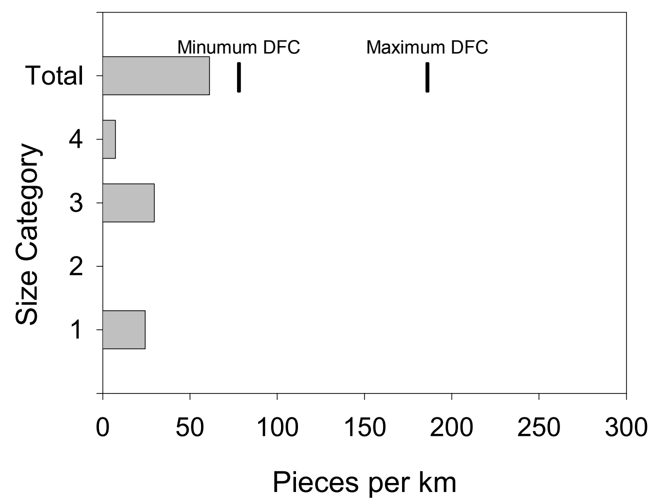
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Union Springs Run, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Union Springs Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Union Springs Run in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Union Springs Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

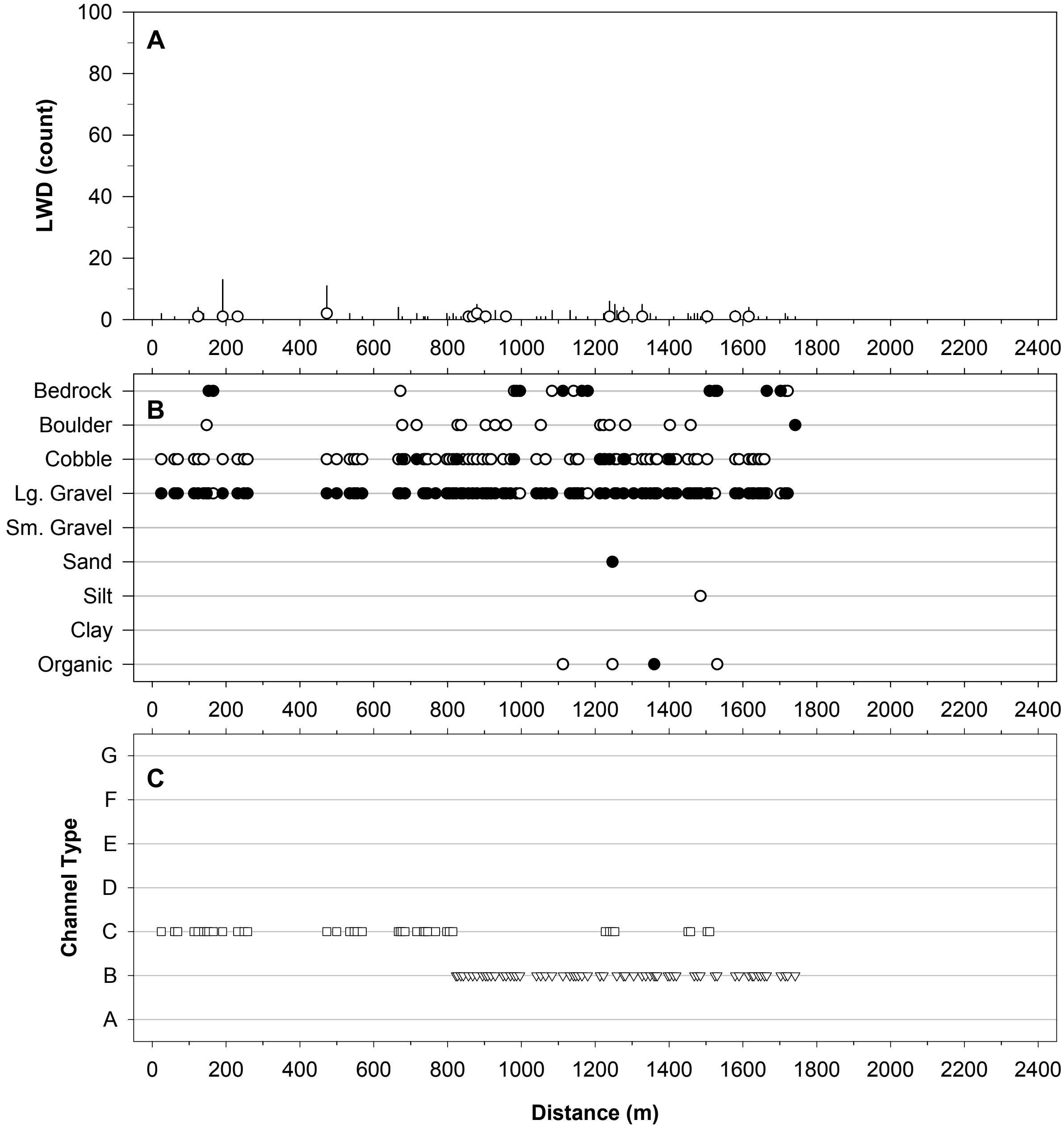
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Union Springs Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SIDE CHANNEL	258.7		IN ON LEFT
SIDE CHANNEL	447.6		IN ON RIGHT
SIDE CHANNEL	479.85		OUT ON LEFT
SIDE CHANNEL	479.5		OUT ON RIGHT
SIDE CHANNEL	1626.4		IN ON RIGHT
SIDE CHANNEL	1638.1		OUT ON RIGHT
SIDE CHANNEL	1702.5		IN ON LEFT
TRIBUTARY	1181.2	0.3	IN ON LEFT
TRIBUTARY	1213.3	0.5	IN ON LEFT
TRIBUTARY	1259.2		IN ON RIGHT, DRY
TRIBUTARY	1497	0.2	IN ON LEFT
TRIBUTARY	1573.6		IN ON RIGHT, TRICKLE
UNDERGROUND	2300		FROM 1741.8 M TO 2300 M:GREATER THAN 500M UNDERGROUND, END TIME 1630

Stream crossings encountered on Union Springs Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

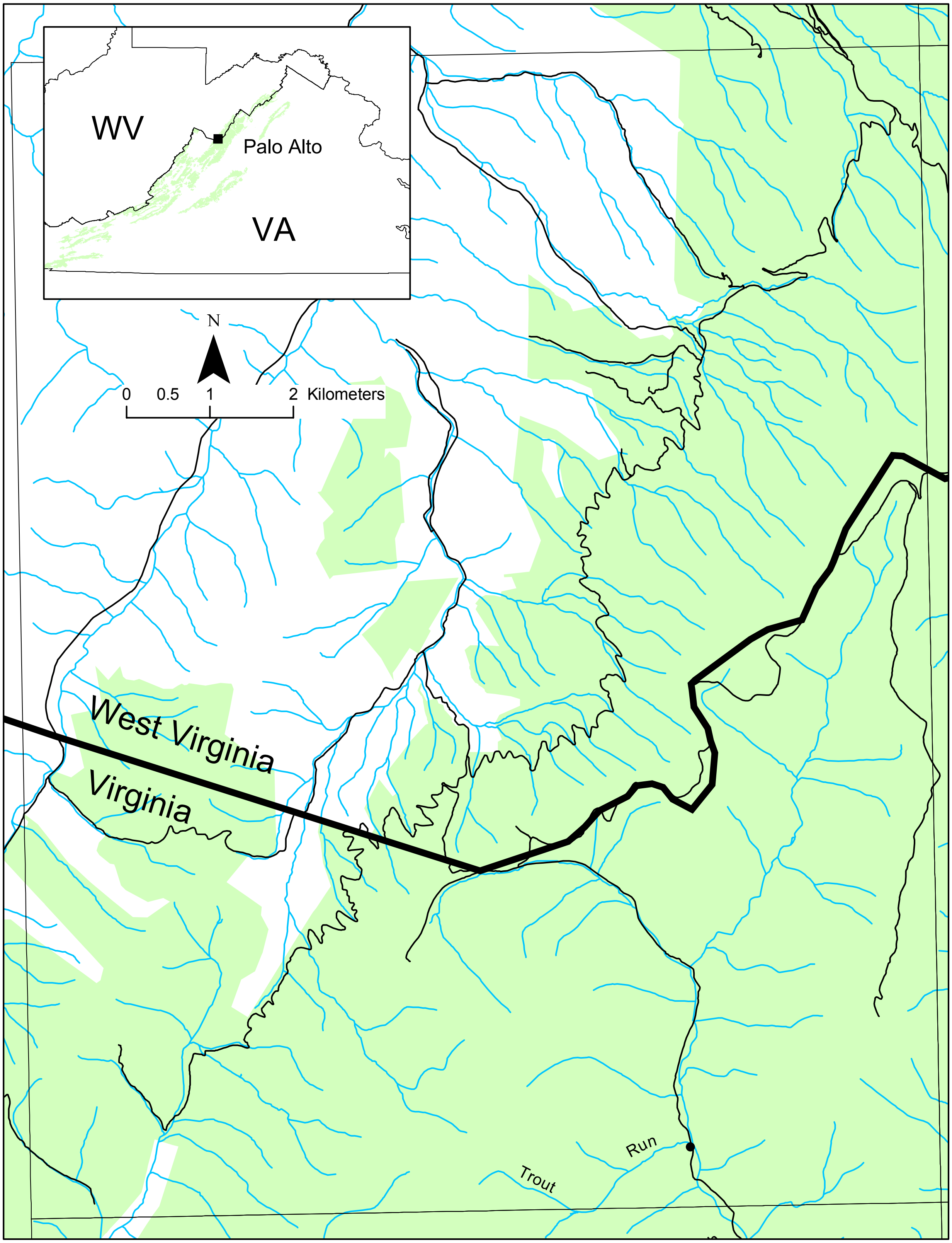
Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Union Springs Run, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from Forest Service Boundary. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Union Springs Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	8	535.4	
RIFFLE	18	868.5	
RIFFLE	28	1222.6	
RIFFLE	38	1451.5	
RIFFLE	48	1721.4	



Streams inventoried on the Palo Alto Quadrangle using BVET habitat surveys during summer 2004.

Stream:	Trout Run
District:	Dry River
USGS Quadrangle:	Palo Alto
Survey Date:	06/29/04
Downstream Starting Point:	17 4249443N 649789E: confluence of North River and Trout Run
Total Distance Surveyed (km):	2.4

	Pools	Riffles
Percent of Total Stream Area:	21	79
Total Area (m^2):	1058±119	3886±1841
Correction Factor Applied:	1.07	0.92
Number of Paired Samples:	7	6
Total Count:	70	66
Number per km:	29	28
Mean Area (m^2):	15	59
Mean Maximum Depth (cm):	34	20
Mean Average Depth (cm):	21	9
Mean Residual Depth (cm):	14	--
Percent Surveyed as Glides:	6	--
Percent Surveyed as Runs:	--	2
Percent Surveyed as Cascades:	--	2
Percent with >35% Fines:	20	2

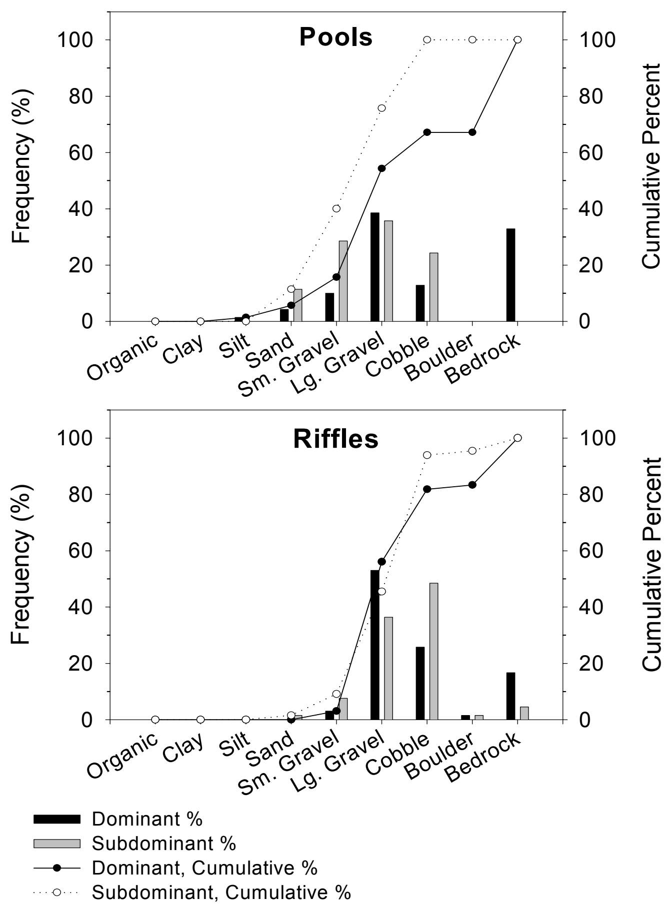
Large Woody Debris Size	Pieces per km
< 5 m long, 10 cm – 55 cm diameter:	36
< 5 m long, > 55 cm diameter:	1
> 5 m long, 10 cm – 55 cm diameter:	23
> 5 m long, > 55 cm diameter:	5
Total:	65

Riparian Width	Total Width* (m)	Left & Right Width** (m)
Mean	9	1
Maximum	15	6
75th Percentile	11	1
25th Percentile	8	1
Minimum	6	0

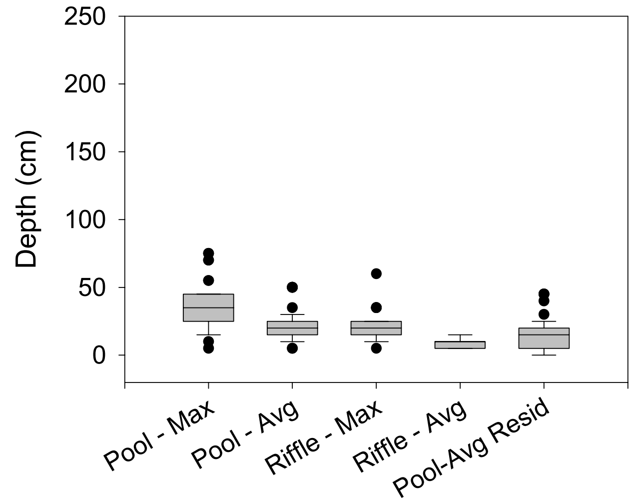
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	Frequency (%)
A:	100
B:	0
C:	0
D:	0
E:	0
F:	0
G:	0

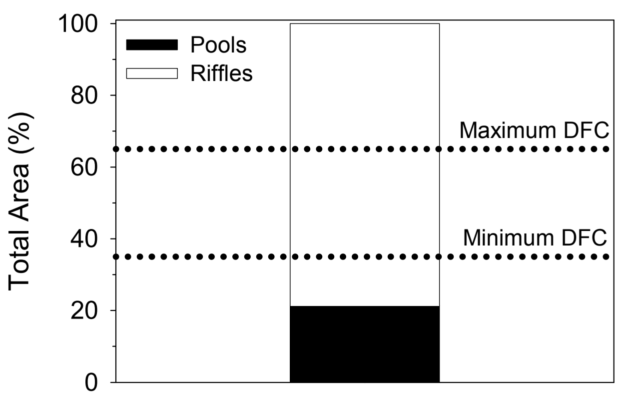
Other Stream Attributes	
Mean Bankfull Channel Width (m):	7
Mean Channel Gradient (%):	4
Median Water Temperature (C):	14.5



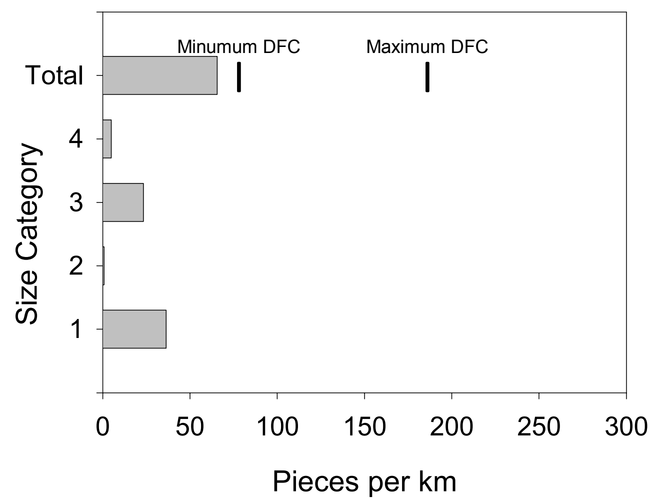
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Trout Run, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Trout Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Trout Run, in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Trout Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

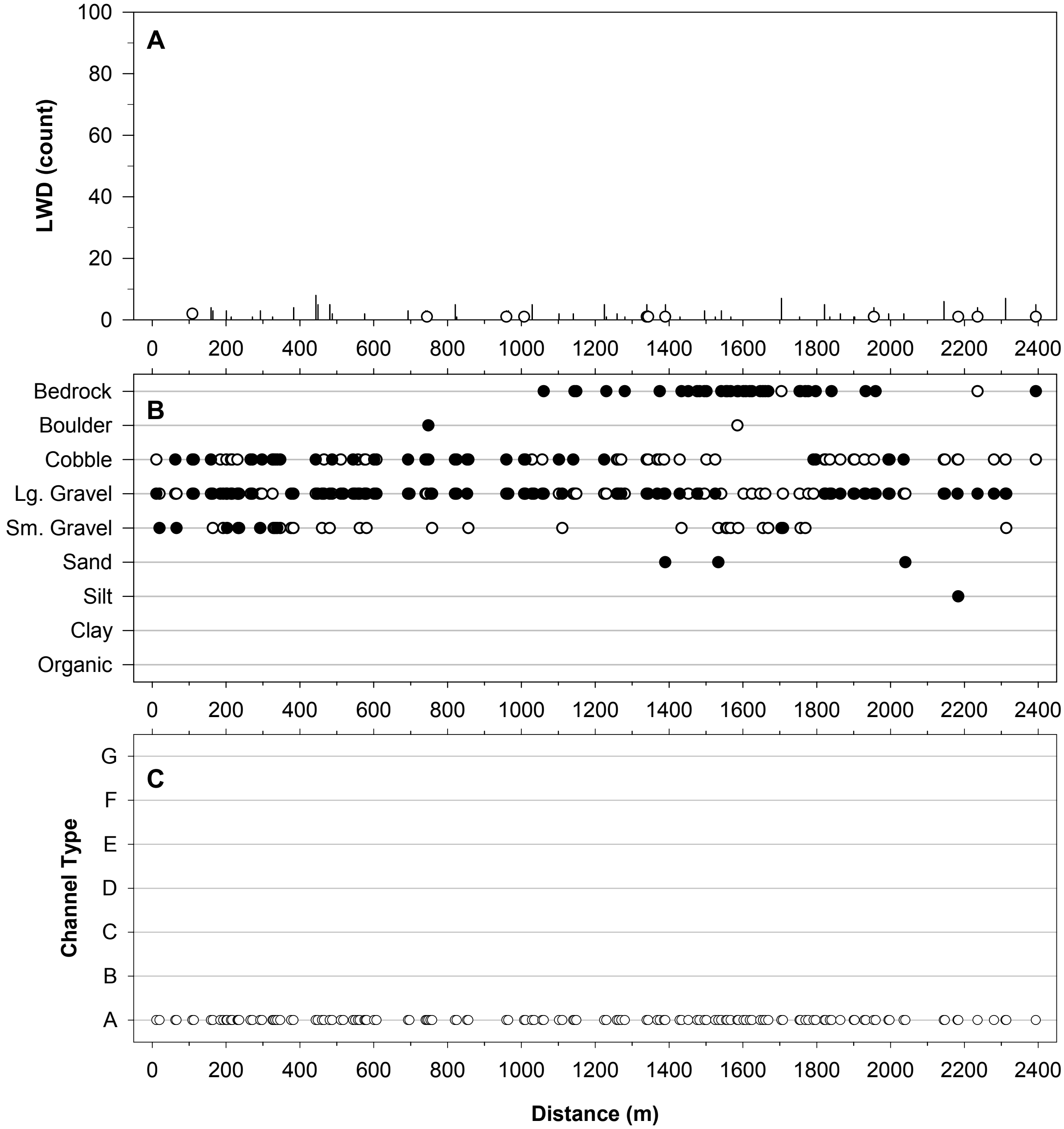
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Trout Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
BRIDGE	68.3		
SIDE CHANNEL	221.7		IN ON LEFT, DRY
SIDE CHANNEL	239.1		DEBRIS JAM, DRY OUT ON LEFT
TRIBUTARY	894.3	1	ON LEFT
SIDE CHANNEL	1045		IN ON LEFT
SIDE CHANNEL	1056.7		OUT ON LEFT
SIDE CHANNEL	1317		IN ON RIGHT
UNDERGROUND	1460.7		FROM 1452 M TO 1461 M
SIDE CHANNEL	1807		IN ON RIGHT
SIDE CHANNEL	1820.8		OUT ON RIGHT
TRIBUTARY	1829	1.5	IN ON LEFT
SEEP	1850		ON RIGHT
UNDERGROUND	1878.2		FROM 1864 M TO 1878 M
TRIBUTARY	2116.6	1	IN ON LEFT
UNDERGROUND	2245.5		FROM 2236 M TO 2246 M

Stream crossings encountered on Trout Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

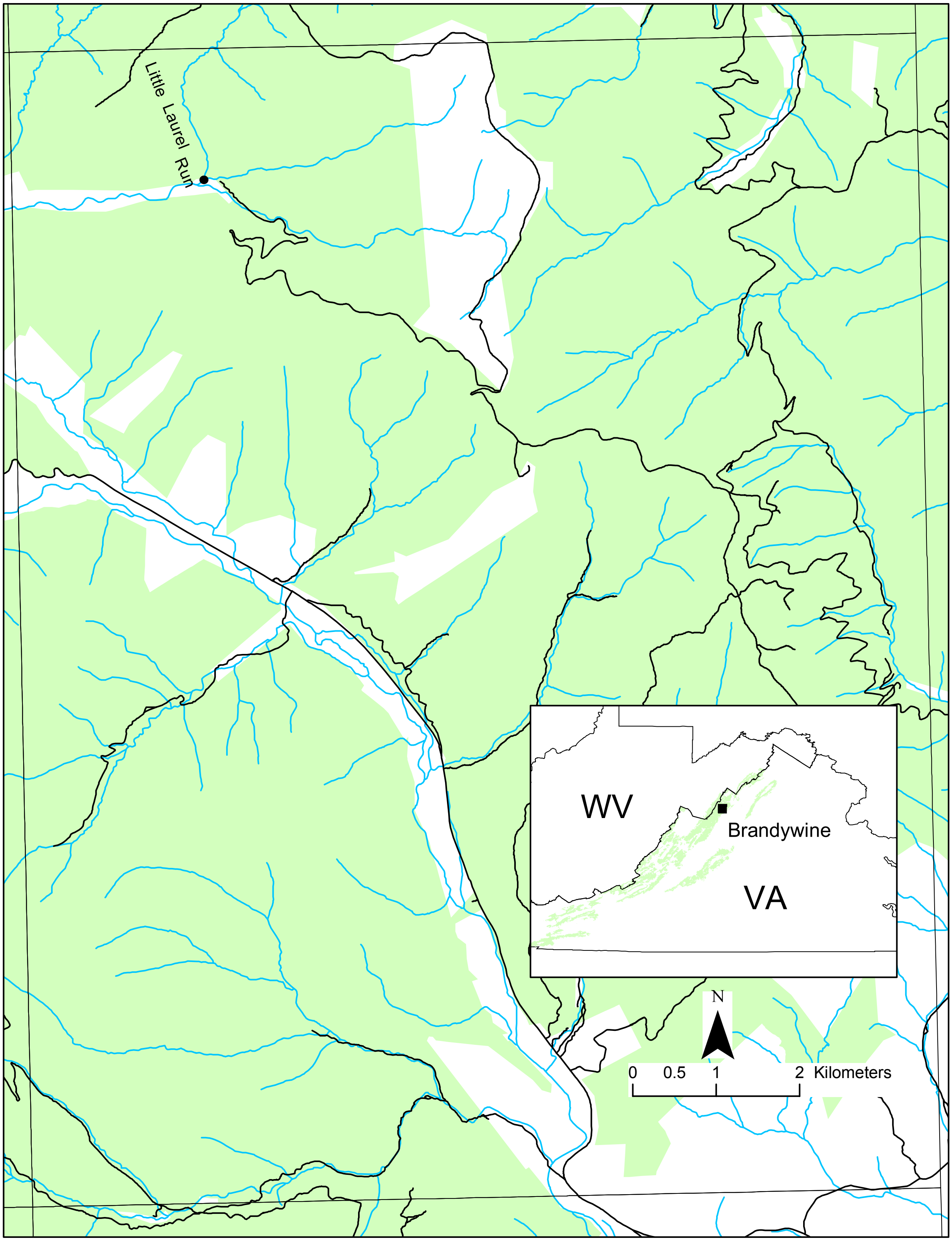
Crossing type:	Bridge
Distance (m):	68.3
Road number/trail name:	95
Culvert type:	Metal pipe
Culvert outlets (n):	1
Culvert diameter (cm):	360
Culvert height (cm):	210
Culvert material:	Metal and concrete
Culvert perch (cm):	25
Substrate (y/n):	N
Photos (y/n):	Y
Comments:	none



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Trout Run summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence of North River and Trout Run. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Trout Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	6	201.1	
RIFFLE	16	510.9	
RIFFLE	26	1007.7	
RIFFLE	36	1386.6	
RIFFLE	46	1647.2	
RIFFLE	56	1929.3	



Streams inventoried on the Rawley Springs Quadrangle using BVET habitat surveys during summer 2004.

Stream:	**Little Laurel Run**
District:	Dry River
USGS Quadrangle:	Rawley Springs
Survey Date:	06/29/04
Downstream Starting Point:	Forest Service Boundary just north of tributary of Sand Run which enters on right
Total Distance Surveyed (km):	0.5

	Pools	**Riffles**
Percent of Total Stream Area:	NA	NA
Total Area (m^2):	NA	NA
Correction Factor Applied:	NA	NA
Number of Paired Samples:	0	0
Total Count:	4	6
Number per km:	8	11
Mean Area (m^2):	NA	NA
Mean Maximum Depth (cm):	34	13
Mean Average Depth (cm):	20	7
Mean Residual Depth (cm):	11	--
Percent Surveyed as Glides:	0	--
Percent Surveyed as Runs:	--	0
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	0	0

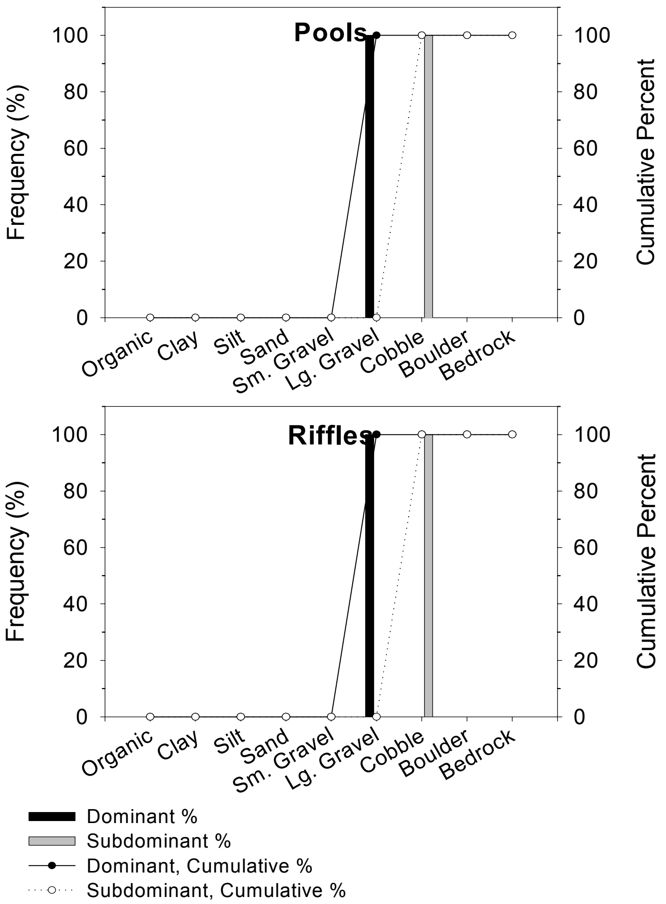
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	98
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	141
> 5 m long, > 55 cm diameter:	85
Total:	324

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	NA	NA
Maximum	NA	NA
75^{th} Percentile	NA	NA
25^{th} Percentile	NA	NA
Minimum	NA	NA

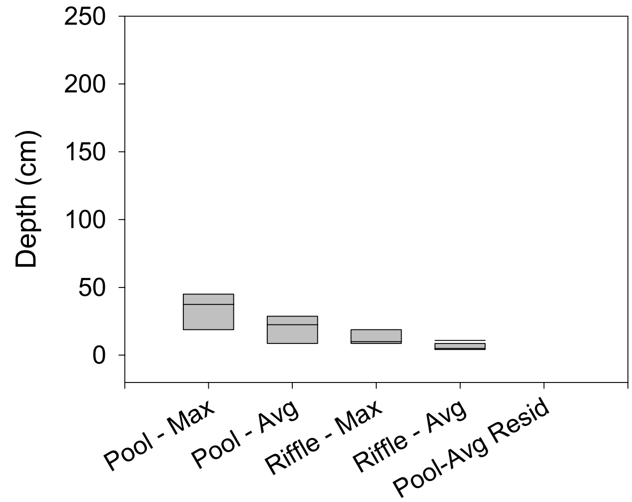
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	0
B:	0
C:	100
D:	0
E:	0
F:	0
G:	0

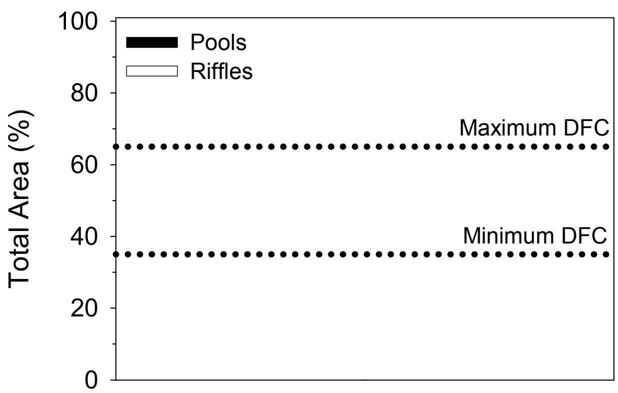
Other Stream Attributes	
Mean Bankfull Channel Width (m):	NA
Mean Channel Gradient (%):	NA
Median Water Temperature (C):	NA



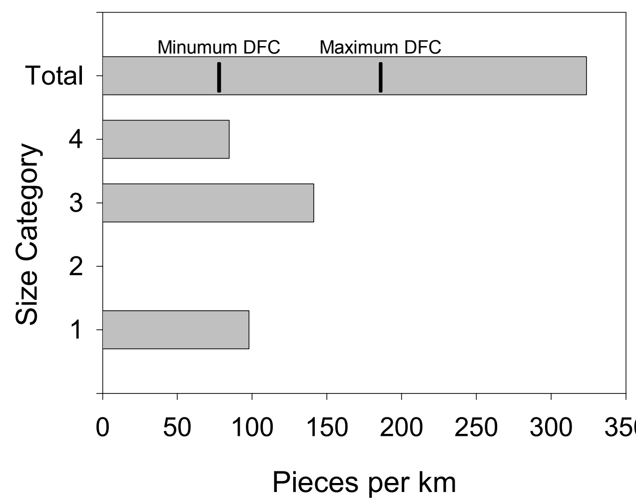
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Little Laurel Run, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Little Laurel Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Little Laurel Run in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools. (could not calculte, lack of paired samples)



LWD per kilometer in Little Laurel Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

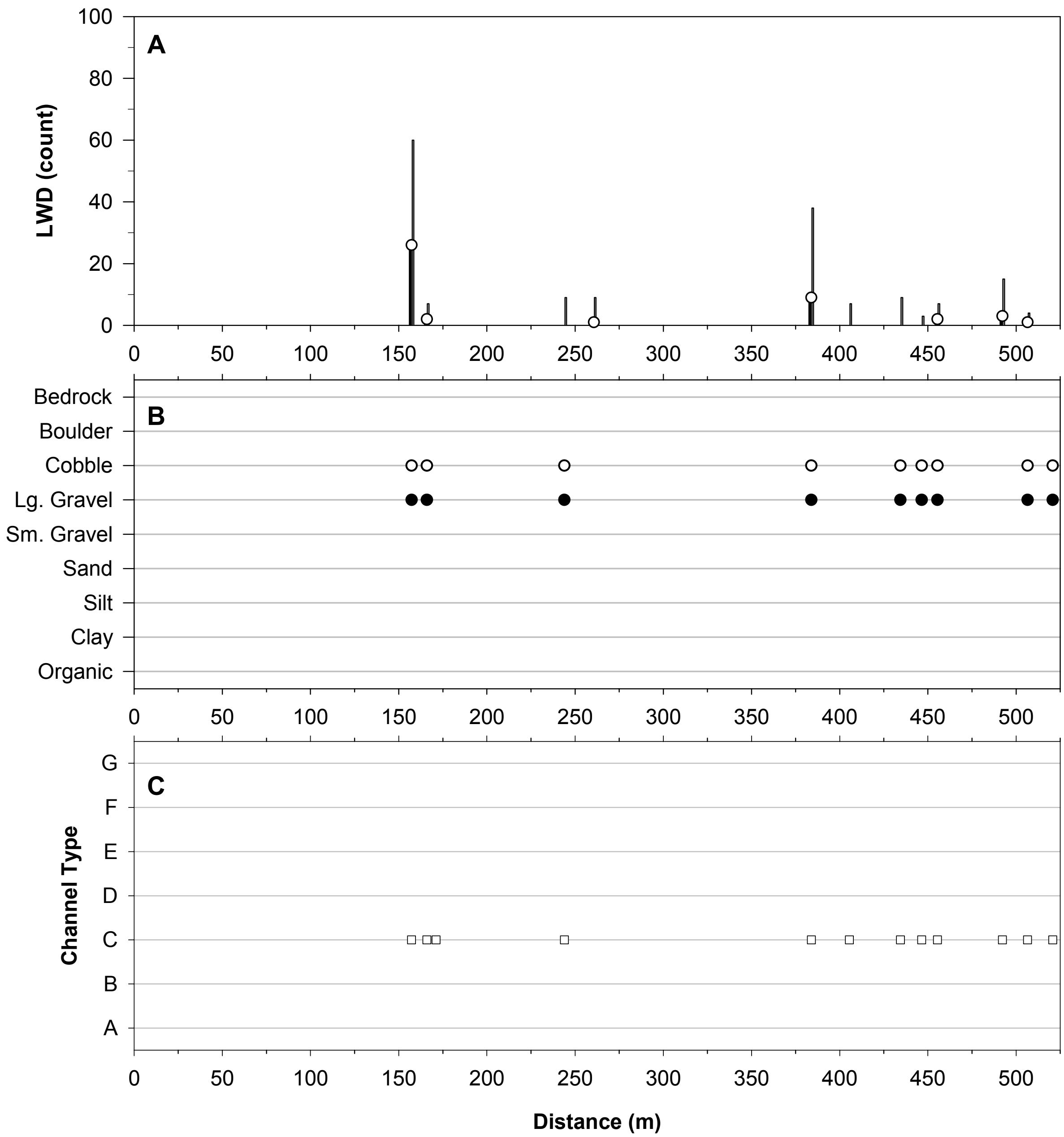
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Little Laurel Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
UNDERGROUND	171.2		
SIDE CHANNEL	231.7		IN ON LEFT
UNDERGROUND	260.6		
SIDE CHANNEL	265		OUT ON LEFT
SIDE CHANNEL	304		IN ON LEFT
SIDE CHANNEL	309		OUT ON LEFT
UNDERGROUND	405.5		
UNDERGROUND	492.2		DEBRIS JAM, BOTTOM OF DRY

Stream crossings encountered on Little Laurel Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

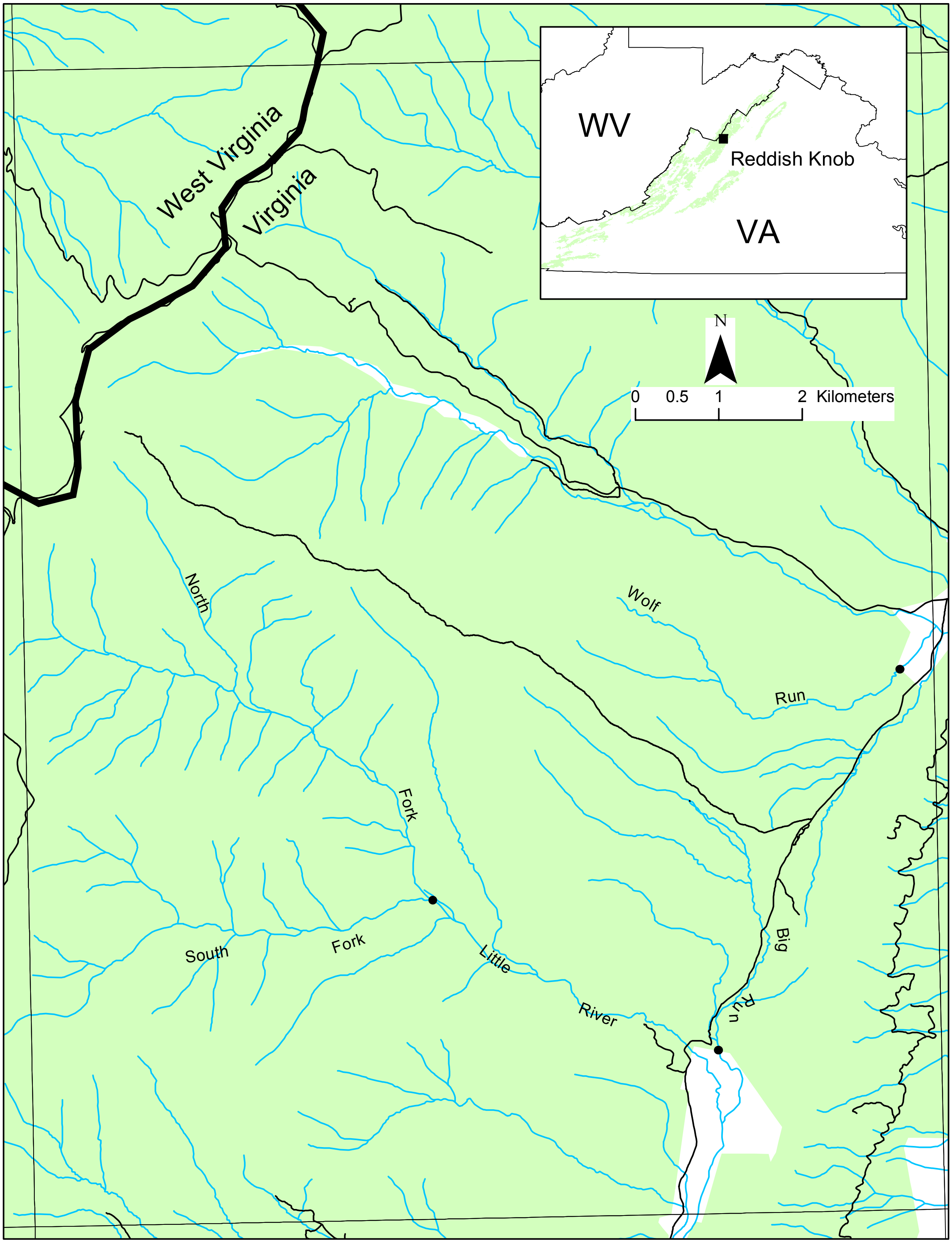
Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Little Laurel Run, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from Forest Service Boundary just north of tributary of Sand Run which enters on right. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Little Laurel Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
*no photos taken			



Streams inventoried on the Reddish Knob Quadrangle using BVET habitat surveys during summer 2004.

Stream:	**Big Run**
District:	Dry River
USGS Quadrangle:	Reddish Knob
Survey Date:	06/30/04
Downstream Starting Point:	4250807N 661004E: Forest Service Boundary about 40 meters down stream of trail number 432
Total Distance Surveyed (km):	5.6

	Pools	**Riffles**
Percent of Total Stream Area:	28	72
Total Area (m^2):	2067±203	5411±995
Correction Factor Applied:	0.92	1.42
Number of Paired Samples:	7	7
Total Count:	68	73
Number per km:	12	13
Mean Area (m^2):	30	74
Mean Maximum Depth (cm):	40	16
Mean Average Depth (cm):	26	8
Mean Residual Depth (cm):	18	--
Percent Surveyed as Glides:	12	--
Percent Surveyed as Runs:	--	3
Percent Surveyed as Cascades:	--	1
Percent with >35% Fines:	7	1

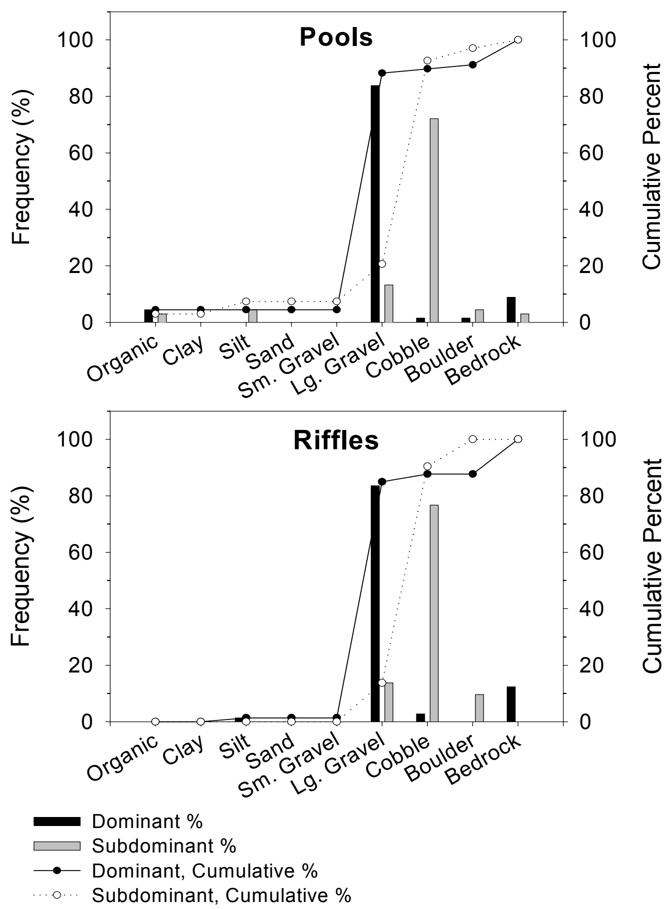
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	30
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	33
> 5 m long, > 55 cm diameter:	2
Total:	65

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	35	14
Maximum	124	80
75^{th} Percentile	41	22
25^{th} Percentile	8	0
Minimum	4	0

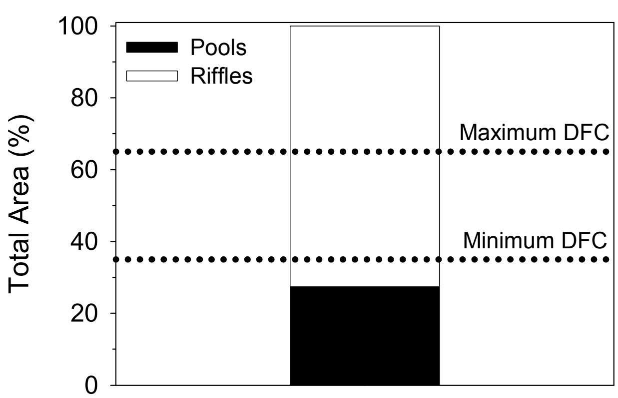
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	10
B:	14
C:	74
D:	0
E:	0
F:	1
G:	0

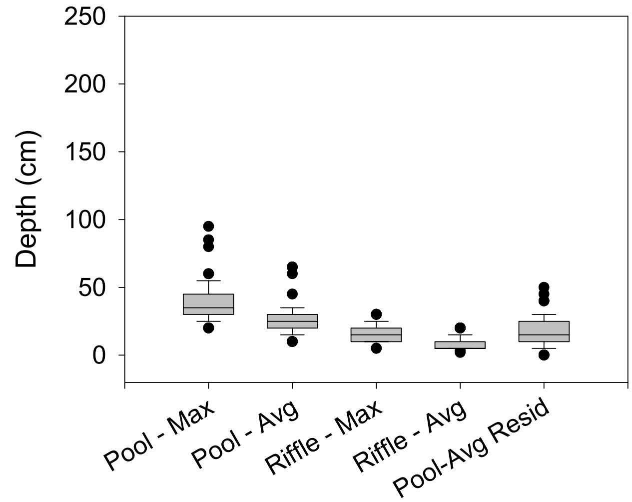
Other Stream Attributes	
Mean Bankfull Channel Width (m):	6
Mean Channel Gradient (%):	4
Median Water Temperature (C):	12



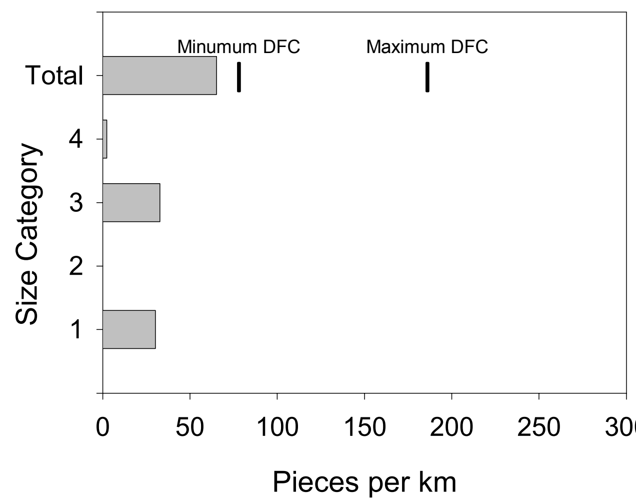
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Big Run, summer 2004.



Estimated area of Big Run in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



Maximum and average depths and residual pool depths for pools and riffles in Big Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



LWD per kilometer in Big Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

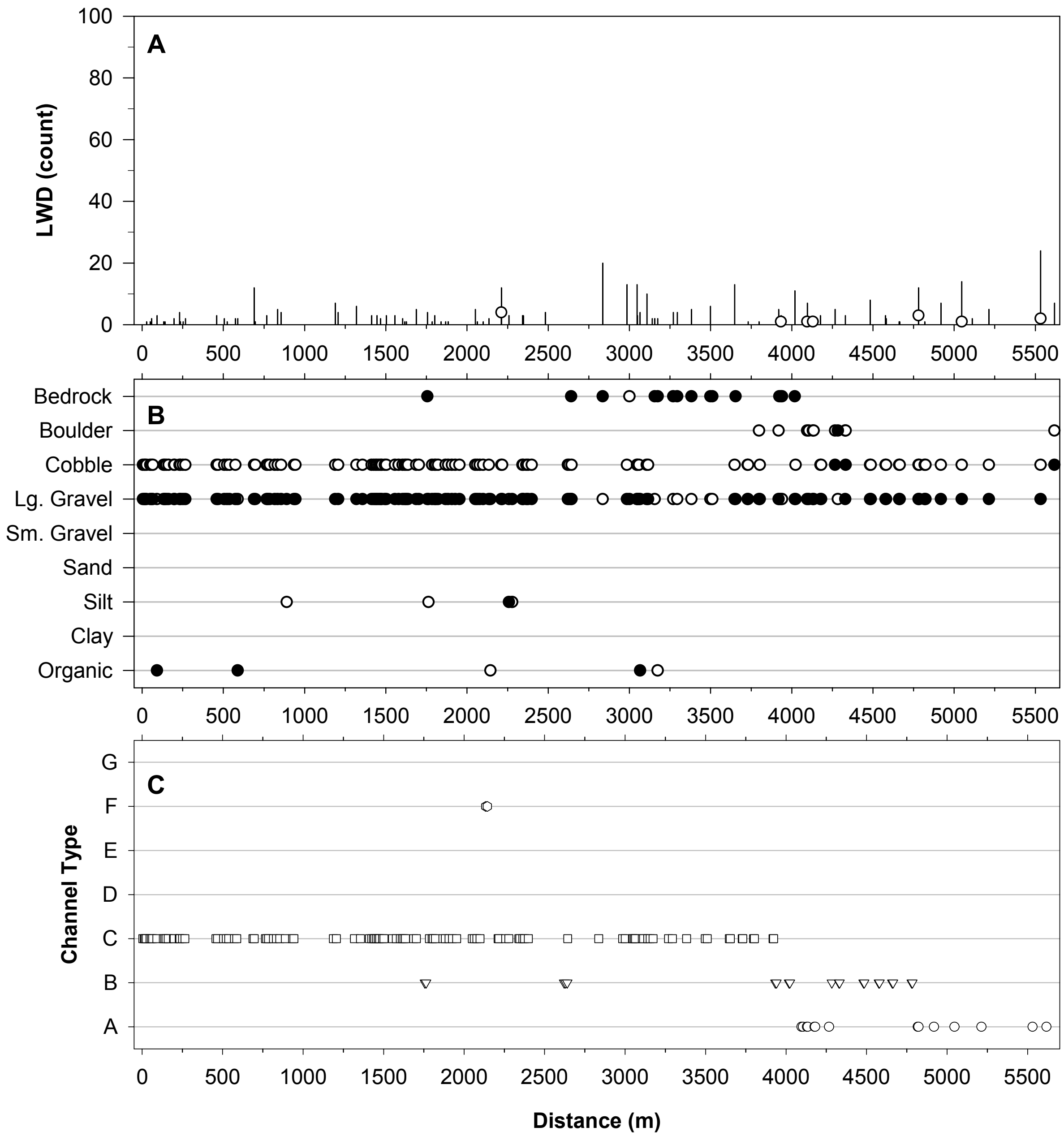
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Big Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
TRIBUTARY	114.7	0.5	IN ON RIGHT
TRIBUTARY	148.7		DRY, IN ON LEFT
TRIBUTARY	199.5	0.75	IN ON LEFT
SIDE CHANNEL	274.1		IN ON RIGHT
SIDE CHANNEL	316.9		OUT ON RIGHT
SIDE CHANNEL	564.5		IN ON RIGHT
SIDE CHANNEL	573.8		OUT ON RIGHT
TRIBUTARY	706.7	0.2	IN ON RIGHT
SIDE CHANNEL	763.2		IN ON LEFT
SIDE CHANNEL	795.4		OUT ON LEFT
SIDE CHANNEL	815.9		IN ON RIGHT
FORD	861.1		NOTHING MAN MADE, OVER NATURAL SUBSTRATE
TRIBUTARY	986	0.1	IN ON LEFT
FORD	1340.5		OLD ROAD NOW CLOSED TO VEHICLES
SEEP	1508		ON RIGHT
TRIBUTARY	1711.3	1	IN ON LEFT
UNDERGROUND	1773.4		FROM 1763.5 M TO 1773.4 M
SIDE CHANNEL	1817.9		IN ON RIGHT
UNDERGROUND	1839.8		FROM 1822.2 M TO 1839.8 M
CULVERT	1966.8		
SIDE CHANNEL	2102.3		IN ON LEFT
SEEP	2111		ON LEFT
SIDE CHANNEL	2225		IN ON RIGHT
SIDE CHANNEL	2229		OUT ON LEFT
SIDE CHANNEL	2251.9		OUT ON RIGHT
SIDE CHANNEL	2379.5		IN ON LEFT
FORD	2414.9		NATURAL SUBSTRATE
SIDE CHANNEL	2482.3		OUT ON LEFT
UNDERGROUND	2482.3		FROM 2398.6 M TO 2482.3 M
TRIBUTARY	2605.7	1.5	IN ON LEFT
SIDE CHANNEL	3026.2		IN ON LEFT
SIDE CHANNEL	3058.4		OUT ON LEFT
FORD	3628.5		TRAIL CROSSING
FORD	3802.8		TRAIL CROSSING
FORD	3910		TRAIL CROSSING
FORD	4568.5		TRAIL CROSSING
SEEP	4903.4		ON LEFT
UNDERGROUND	4979		FROM 4918.0 M TO 4979.0 M
TRIBUTARY	5028.4		IN ON RIGHT / DRY
UNDERGROUND	5110.6		FROM 5046.4 M TO 5110.6 M
UNDERGROUND	5250.7		FROM 5213.3 M TO 5250.7 M
UNDERGROUND	5537		FROM 5531.3 M TO 5537.0 M

Stream crossings encountered on Big Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	Culvert
Distance (m):	1966.8
Road number/trail name:	Road 101
Culvert type:	Pipe
Culvert outlets (n):	2
Culvert diameter (cm):	200 each
Culvert height (cm):	150 each
Culvert material:	Metal
Culvert perch (cm):	15 each
Substrate (y/n):	Y
Photos (y/n):	Y
Comments:	Low water flow



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Big Run, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from the boundary of forest service land and private property about 40 meters downstream of trail number 432. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Big Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	6	148.7	
RIFFLE	16	855	
RIFFLE	26	1626.1	LEAF PACK ON LEFT
CULVERT		1966.8	
RIFFLE	36	2134.5	
RIFFLE	46	3046.2	
RIFFLE	56	3797.9	
RIFFLE	66	4576.7	

Stream:	**North Fork Little River**
District:	Dry River
USGS Quadrangle:	Reddish Knob
Survey Date:	06/21/04
Downstream Starting Point:	confluence of North and South Fork of Little River
Total Distance Surveyed (km):	7.2

	Pools	**Riffles**
Percent of Total Stream Area:	31	69
Total Area (m^2):	2638±775	5940±1208
Correction Factor Applied:	1.15	0.90
Number of Paired Samples:	13	13
Total Count:	140	129
Number per km:	19	18
Mean Area (m^2):	19	46
Mean Maximum Depth (cm):	28	15
Mean Average Depth (cm):	16	7
Mean Residual Depth (cm):	9	--
Percent Surveyed as Glides:	26	--
Percent Surveyed as Runs:	--	1
Percent Surveyed as Cascades:	--	16
Percent with >35% Fines:	9	0

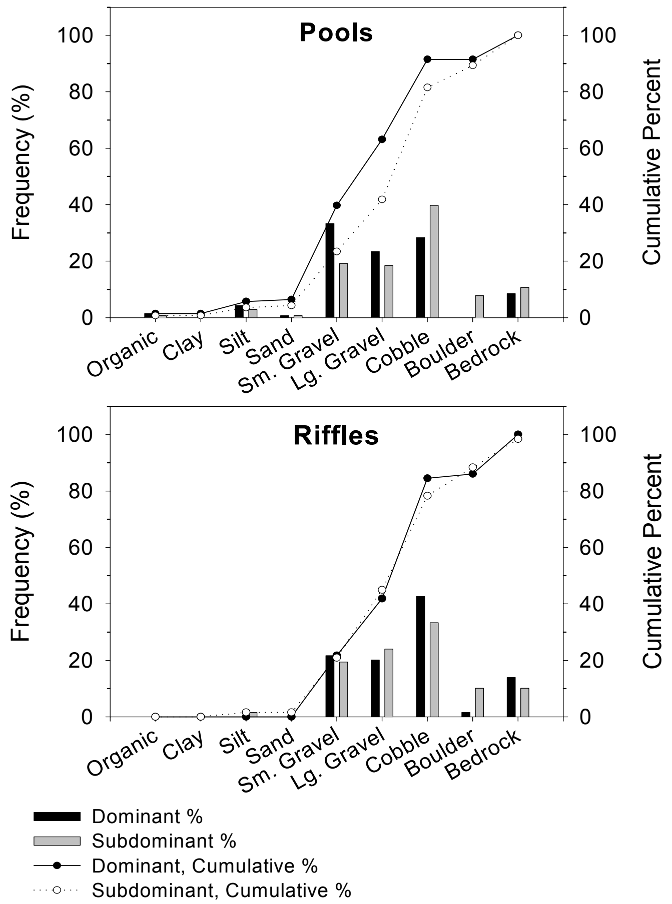
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	29
< 5 m long, > 55 cm diameter:	1
> 5 m long, 10 cm – 55 cm diameter:	14
> 5 m long, > 55 cm diameter:	3
Total:	47

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	11	3
Maximum	27	20
75th Percentile	10	2
25th Percentile	6	1
Minimum	5	0

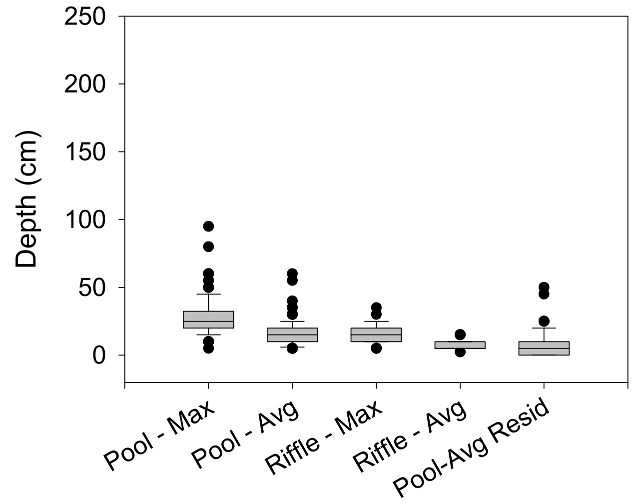
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	73
B:	0
C:	27
D:	0
E:	0
F:	0
G:	0

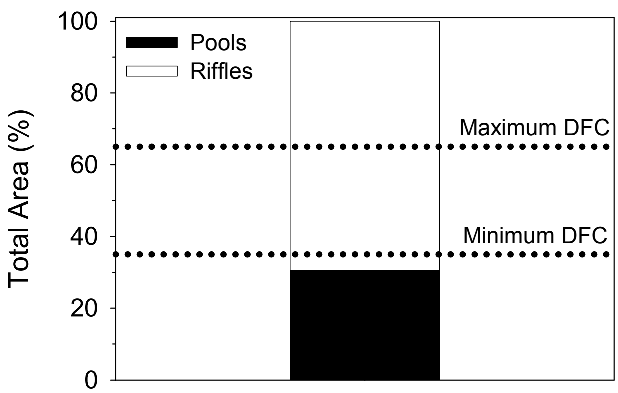
Other Stream Attributes	
Mean Bankfull Channel Width (m):	5
Mean Channel Gradient (%):	6
Median Water Temperature (C):	11



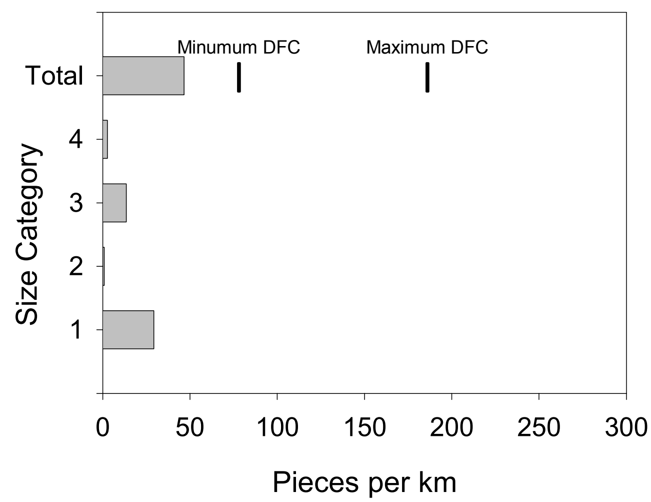
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in North Fork Little River, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in North Fork Little River, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of North Fork Little River in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in North Fork Little River, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

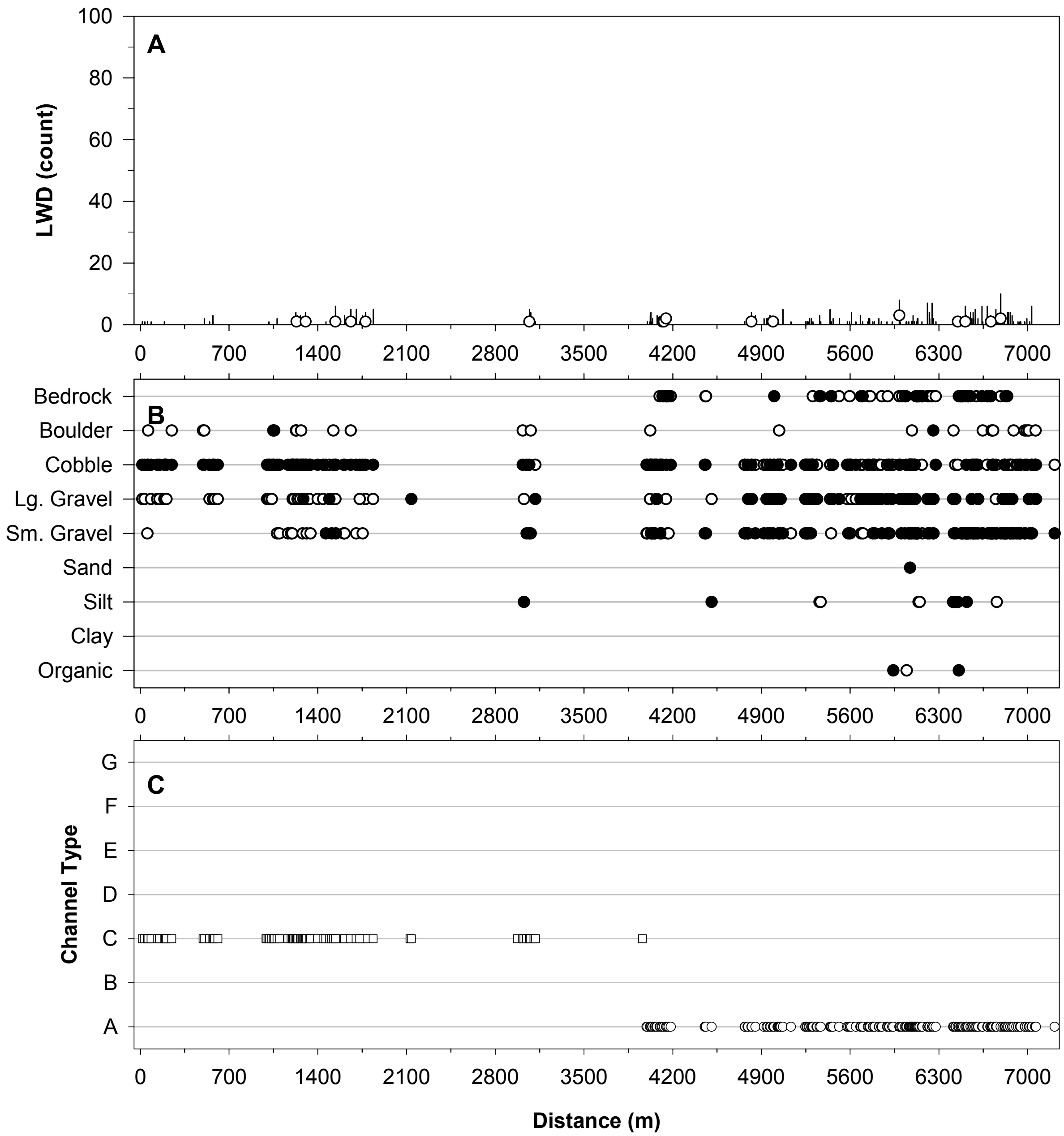
Stream features found on North Fork Little River during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SIDE CHANNEL	60.9		IN ON LEFT
SIDE CHANNEL	83.9		OUT ON LEFT
UNDERGROUND	494		464.5 STRING RUNS OUT - END SURVEY FOR 6/21/04 21:00
TRIBUTARY	585		IN ON LEFT
TRIBUTARY	990.5		IN ON LEFT
UNDERGROUND	990.5		AT 784.7 FORK IN STREAM BED FOLLOWED UP RIGHT SIDE. 904.8 FORK BEGINS.
SIDE CHANNEL	1056		IN ON RIGHT
SIDE CHANNEL	1078.5		OUT ON RIGHT
SEEP	1235.1		ON RIGHT SIDE OF CHANNEL
SIDE CHANNEL	1508.8		IN ON RIGHT
SIDE CHANNEL	1521.5		OUT ON RIGHT
BRAID	1538		
SIDE CHANNEL	1583.3		IN ON LEFT
LAND SLIDE	1583.3		STARTS AT 1542.1, COLLAPSED UNDERCUT BANK
SEEP	1675		RIGHT
SIDE CHANNEL	1759.5		IN ON LEFT
SIDE CHANNEL	1836.8		NO VISIBLE FLOW, UNDERGROUND
TRIBUTARY	1842		IN ON LEFT
UNDERGROUND	2127.7		OLD DRY TRIB AT SAME DISTANCE
SIDE CHANNEL	2575		LEFT, BIG SLIDE ON LEFT BANK OF SCH
TRIBUTARY	2841.6		RIGHT' 3M DEEP HOLE IN STREAM DRY
TRIBUTARY	2965		LEFT
UNDERGROUND	2974.5		
SEEP	3088.9		RIGHT
UNDERGROUND	3105		
SIDE CHANNEL	3124.5		IN ON RIGHT
SEEP	3141.2		RIGHT
SIDE CHANNEL	3340.7		OUT ON RIGHT
TRIBUTARY	3960.8		DRY
UNDERGROUND	3960.8		
SEEP	4185		LEFT
UNDERGROUND	4447.5		
UNDERGROUND	4503.5		
UNDERGROUND	4725		
FALL	4765		
TRIBUTARY	4852.3		IN ON RIGHT
UNDERGROUND	4903.9		PROOF OF CAMPING
UNDERGROUND	4932		
UNDERGROUND	5041		
UNDERGROUND	5130.2		
SIDE CHANNEL	5136		LEFT
TRIBUTARY	5172.6		RIGHT, WET, NO FLOW
UNDERGROUND	5215.6		
UNDERGROUND	5511.3		
TRIBUTARY	5514		LEFT
UNDERGROUND	5554.1		

Stream Feature	Distance (m)	Width (m)	Comments
SEEP	5595.8		LEFT
FALL	5763		
FALL	5850.1		
FALL	5944.9		3 M HIGH
FALL	5948.9		2.5 M HIGH
FALL	6100.9		3.5M
FALL	6114.3		1.5M
FALL	6223.5		1M
SIDE CHANNEL	6245.6		LEFT
UNDERGROUND	6262		
SEEP	6278.5		LEFT
TRIBUTARY	6356.2		LEFT
UNDERGROUND	6408.5		
FALL	6444.4		1M
UNDERGROUND	6453.6		
FALL	6585.9		1M
SEEP	6787		RIGHT
UNDERGROUND	6798.4		
FALL	6839.7		1.5M
SEEP	6895.8		RIGHT
UNDERGROUND	6909		
UNDERGROUND	6916.9		
UNDERGROUND	6936.1		
UNDERGROUND	6942.3		
UNDERGROUND	6974.9		
UNDERGROUND	7007.4		
SEEP	7009.1		RIGHT
UNDERGROUND	7014.5		
UNDERGROUND	7057		
UNDERGROUND	7061.5		
UNDERGROUND	7064.3		
UNDERGROUND	7210		
UNDERGROUND	7227.5		END SURVEY 6/23/04 15:15, NO MORE STREAM CHANNEL
BREAK			NATURAL BREAK
BREAK			NATURAL BREAK
BREAK			NATURAL BREAK
LAND SLIDE			RIGHT BANK

Stream crossings encountered on North Fork Little River during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in North Fork Little River, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence of North and South Fork of Little River. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on North Fork Little River during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	10	1013.5	
RIFFLE	20	1296.4	
GLIDE	30	1703.2	
RIFFLE	30	1836.8	
RUN	40	4129.8	SMALL FISH PRESENT
POOL	50	4507.5	
RIFFLE	50	4939.9	ROCK WALL ON RIGHT 20M FROM STREAM
POOL	60	5039.6	SIDE POOL ON LEFT
RIFFLE	59	5273.5	
CASCADE	69	5608.9	
RIFFLE	79	5890.9	
POOL	90	6010.4	BEDROCK WALLS ON BOTH SIDES
RIFFLE	89	6096	
POOL	100	6123.6	
RIFFLE	98	6275.4	
GLIDE	111	6448.6	NO WADING ROD IN PHOTO
RIFFLE	108	6558.9	
POOL	121	6709.9	
RIFFLE	119	6728.7	
POOL	131	6910.5	
RIFFLE	129	6977.4	
POOL	140	7065.9	

Stream:	**South Fork Little River**
District:	Dry River
USGS Quadrangle:	Reddish Knob
Survey Date:	06/22/04
Downstream Starting Point:	4252618N, 657604E; confluence of North Fork Little River
Total Distance Surveyed (km):	2.7

	Pools	**Riffles**
Percent of Total Stream Area:	31	69
Total Area (m^2):	907±983	2067±952
Correction Factor Applied:	1.10	1.51
Number of Paired Samples:	2	2
Total Count:	20	18
Number per km:	7	7
Mean Area (m^2):	45	115
Mean Maximum Depth (cm):	28	11
Mean Average Depth (cm):	18	5
Mean Residual Depth (cm):	11	--
Percent Surveyed as Glides:	10	--
Percent Surveyed as Runs:	--	6
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	60	22

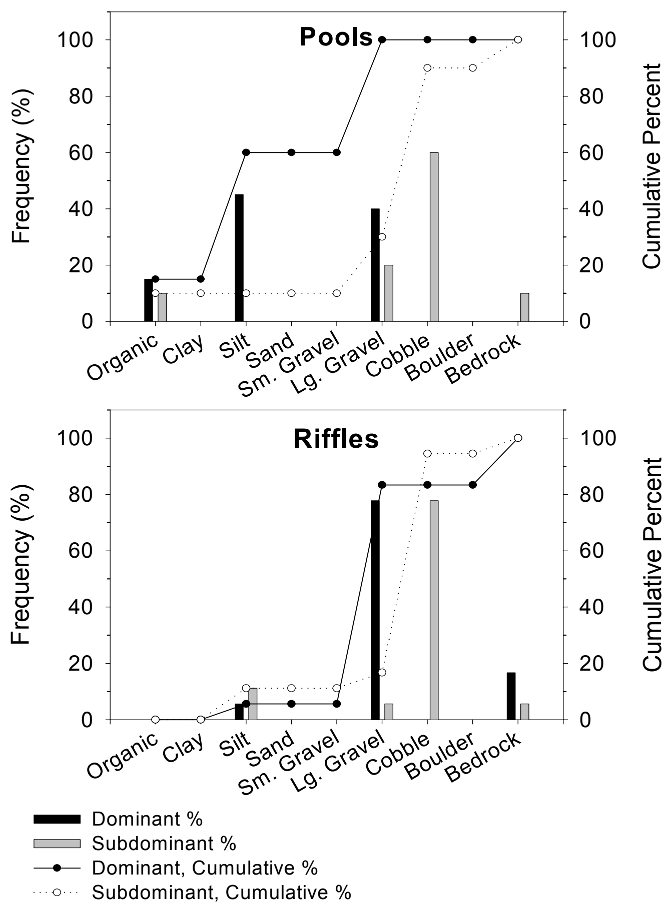
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	13
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	12
> 5 m long, > 55 cm diameter:	0
Total:	25

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	57	18
Maximum	93	33
75th Percentile	75	29
25th Percentile	39	8
Minimum	21	2

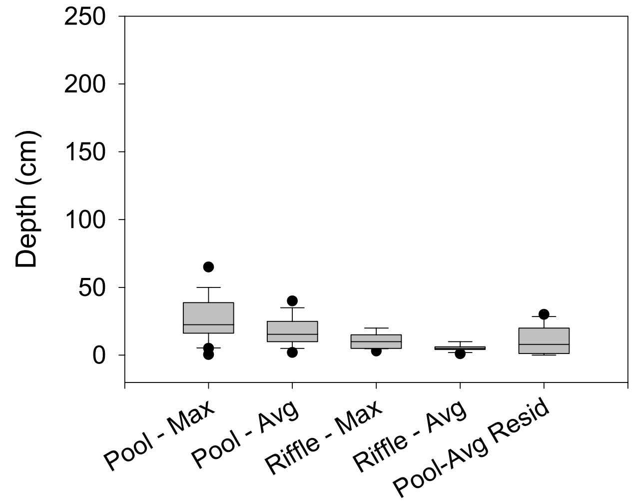
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	0
B:	78
C:	22
D:	0
E:	0
F:	0
G:	0

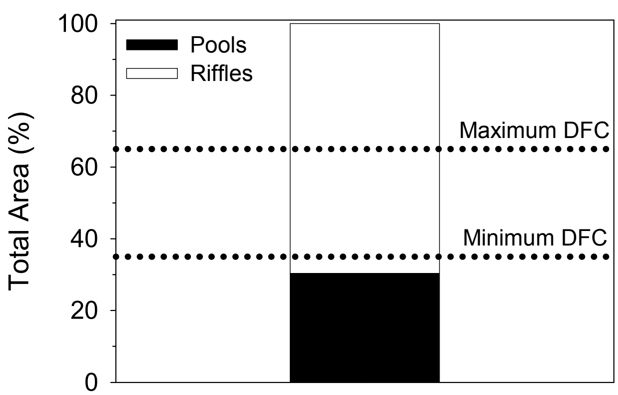
Other Stream Attributes	
Mean Bankfull Channel Width (m):	21
Mean Channel Gradient (%):	3
Median Water Temperature (C):	11.5



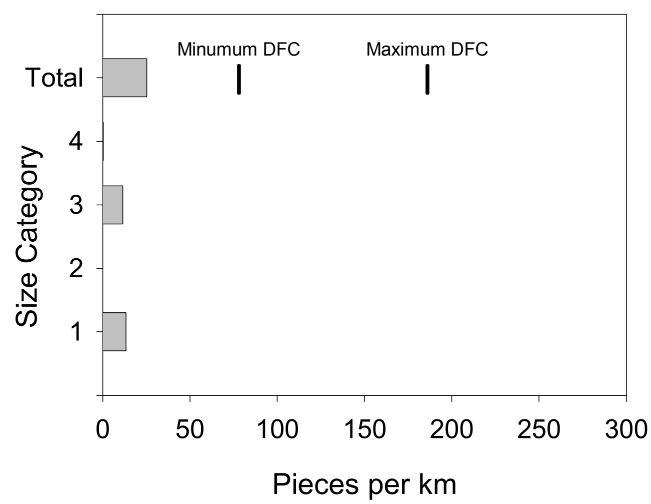
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in South Fork Little River, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in South Fork Little River, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of South Fork Little River in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in South Fork Little River, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

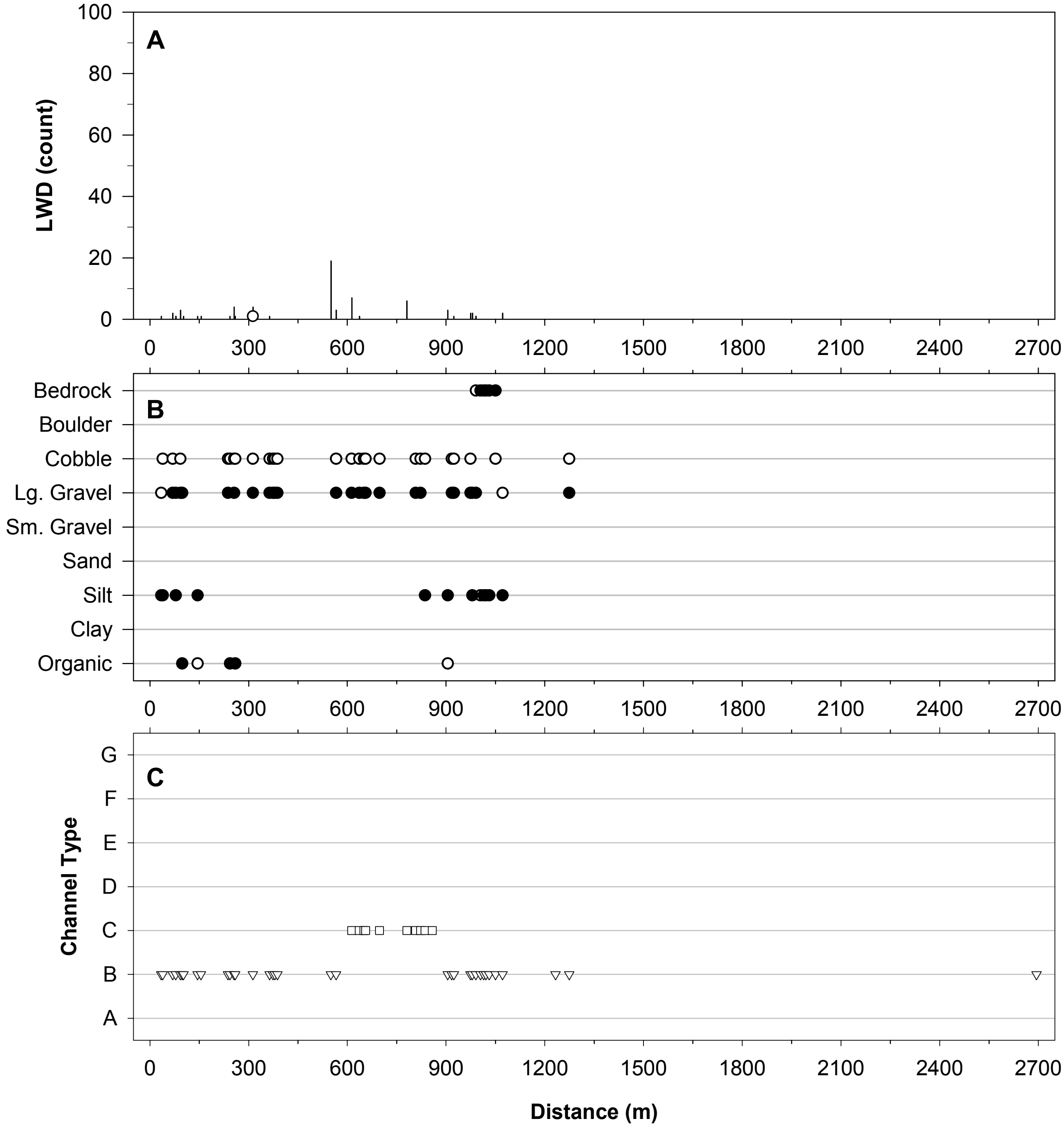
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on South Fork Little River during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
UNDERGROUND	102.1		
UNDERGROUND	155.3		
SIDE CHANNEL	200.7		IN ON LEFT
SIDE CHANNEL	228		OUT ON LEFT
UNDERGROUND	550		STREAM CHANNEL DISTORTED DUE TO FLOODS
SIDE CHANNEL	644.2		IN ON RIGHT
SIDE CHANNEL	689.9		OUT ON RIGHT
UNDERGROUND	780.7		
TRIBUTARY	831.4	0.5	IN ON RIGHT
FORD	840.1		TRAIL CROSSING
UNDERGROUND	858.1		
UNDERGROUND	1232.5		
SIDE CHANNEL	1255		IN ON RIGHT
UNDERGROUND	2694		END SURVEY AT 12:00. STREAM DRY FOR 1420M, WITH NO SIGNS OF WATER RETURNING ABOVE GROUND

Stream crossings encountered on South Fork Little River during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in South Fork Little River, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence with North Fork Little River. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on South Fork Little River during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	8	613	
RIFFLE	18	1274	

Stream:	**Wolf Run**
District:	Dry River
USGS Quadrangle:	Reddish Knob
Survey Date:	06/30/04
Downstream Starting Point:	4255488N, 663366E; property boundary on Wolf Run
Total Distance Surveyed (km):	3.0

	Pools	**Riffles**
Percent of Total Stream Area:	11	89
Total Area (m^2):	821±147	6504±634
Correction Factor Applied:	0.97	1.12
Number of Paired Samples:	7	6
Total Count:	67	68
Number per km:	22	22
Mean Area (m^2):	12	96
Mean Maximum Depth (cm):	38	25
Mean Average Depth (cm):	21	12
Mean Residual Depth (cm):	14	--
Percent Surveyed as Glides:	24	--
Percent Surveyed as Runs:	--	1
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	28	10

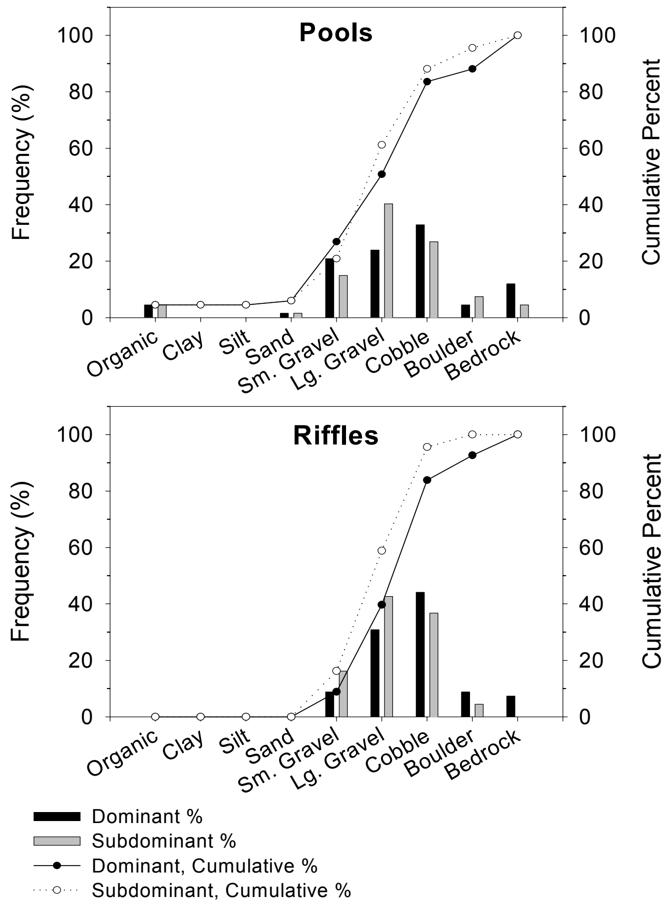
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	15
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	24
> 5 m long, > 55 cm diameter:	11
Total:	51

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	7	1
Maximum	10	3
75th Percentile	9	1
25th Percentile	5	1
Minimum	5	0

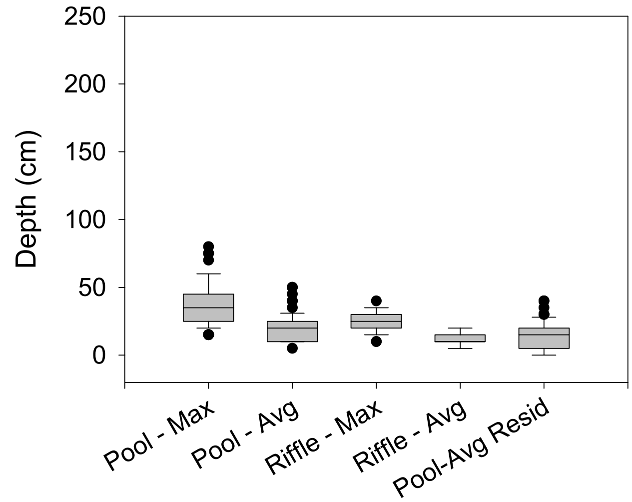
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	0
B:	100
C:	0
D:	0
E:	0
F:	0
G:	0

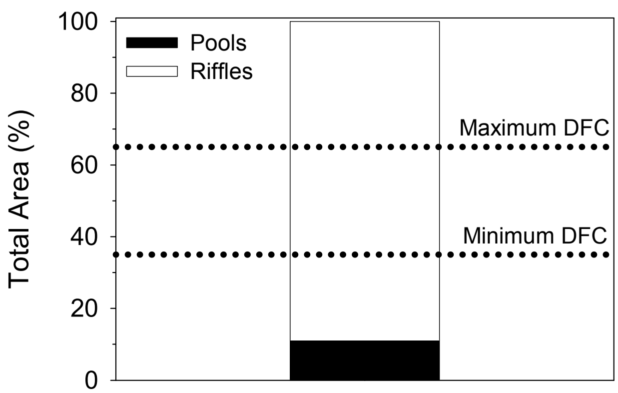
Other Stream Attributes	
Mean Bankfull Channel Width (m):	5
Mean Channel Gradient (%):	3
Median Water Temperature (C):	14



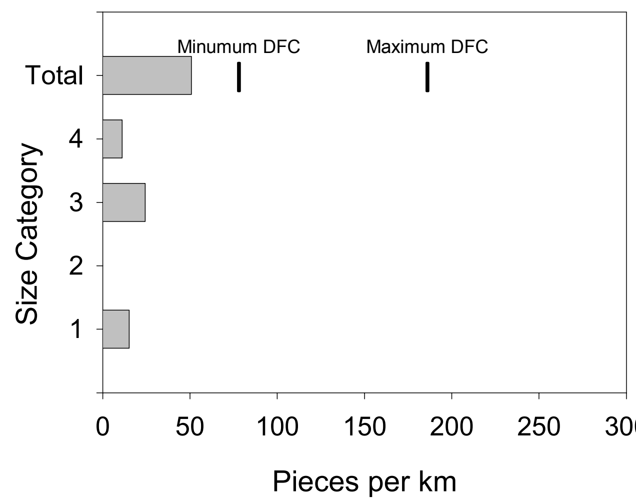
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Wolf Run, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Wolf Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Wolf Run in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Wolf Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

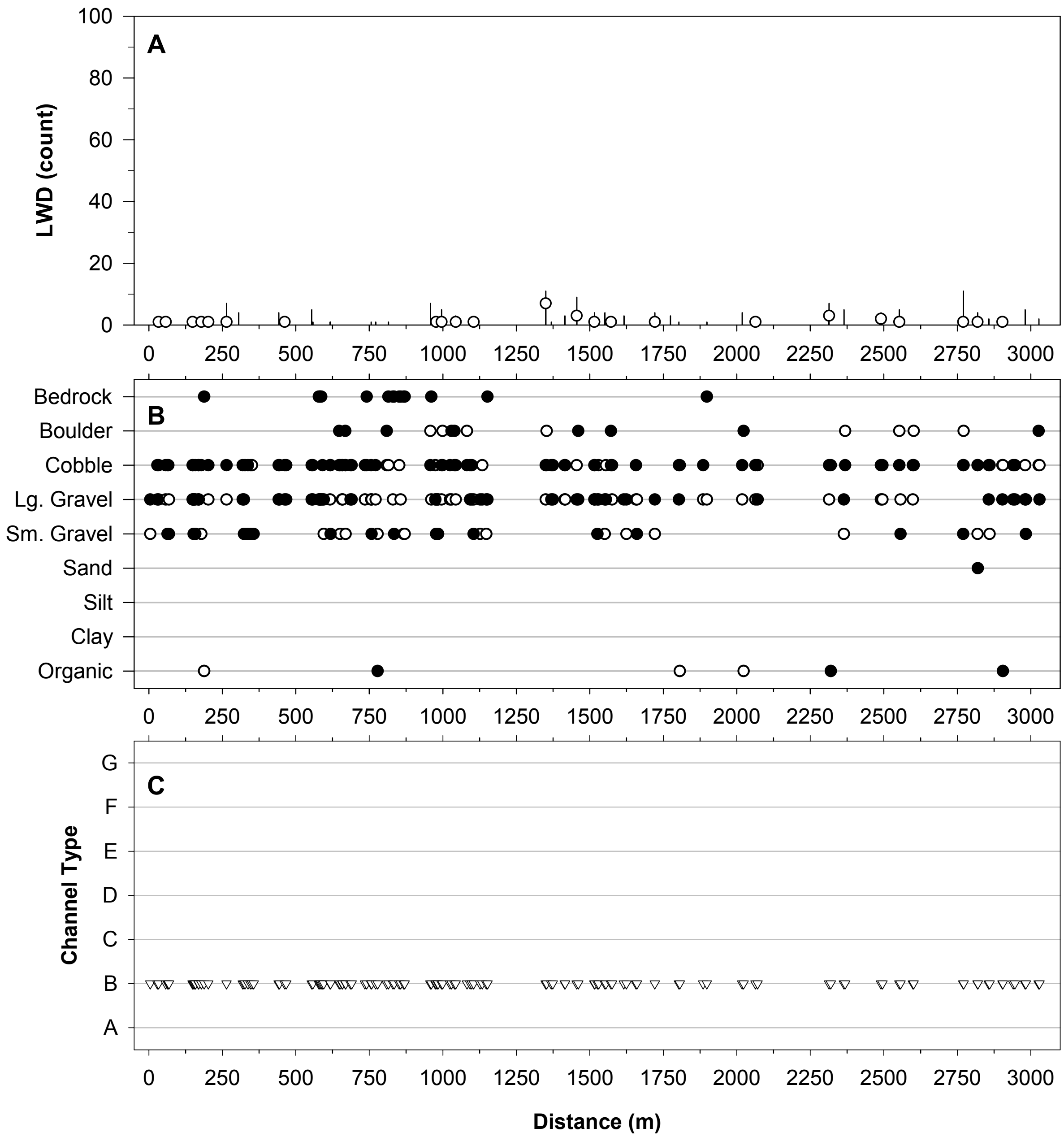
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Wolf Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
TRIBUTARY	51.9		DRY. IN ON RIGHT
SIDE CHANNEL	159.4		IN ON RIGHT. DRY.
TRIBUTARY	165.9	0.75	IN ON LEFT
SIDE CHANNEL	171.3		OUT ON RIGHT
TRIBUTARY	175.4	0.5	IN ON LEFT
TRIBUTARY	212.2		DRY. IN ON RIGHT
SIDE CHANNEL	237.4		IN ON RIGHT.
SEEP	261.1		
UNDERGROUND	305.8		
SIDE CHANNEL	325.6		OUT ON LEFT
FORD	685.8		TRAIL CROSSING, TRAIL ON MAP
TRIBUTARY	882.5	1	IN ON RIGHT
TRIBUTARY	966	0.5	IN ON RIGHT
SIDE CHANNEL	1029.4		IN ON RIGHT
SIDE CHANNEL	1051.8		OUT ON LEFT
SIDE CHANNEL	1248.9		IN ON LEFT
TRIBUTARY	1657	0.5	IN ON LEFT
TRIBUTARY	1719	1	IN ON RIGHT
UNDERGROUND	1774		
TRIBUTARY	1904.4		IN ON LEFT. DRY.
SIDE CHANNEL	2224.9		IN ON LEFT
SIDE CHANNEL	2335.6		IN ON RIGHT
SIDE CHANNEL	2599		IN ON LEFT
SIDE CHANNEL	2614.4		OUT ON LEFT
TRIBUTARY	3001.9	0.5	IN ON RIGHT
BRAID	3038.4		END SURVEY AT 16:30, 6/30/04. CHANNEL BECOMES DRY AND SPLITS INTO NUMEROUS SMALLER DRY CHANNELS.

Stream crossings encountered on Wolf Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

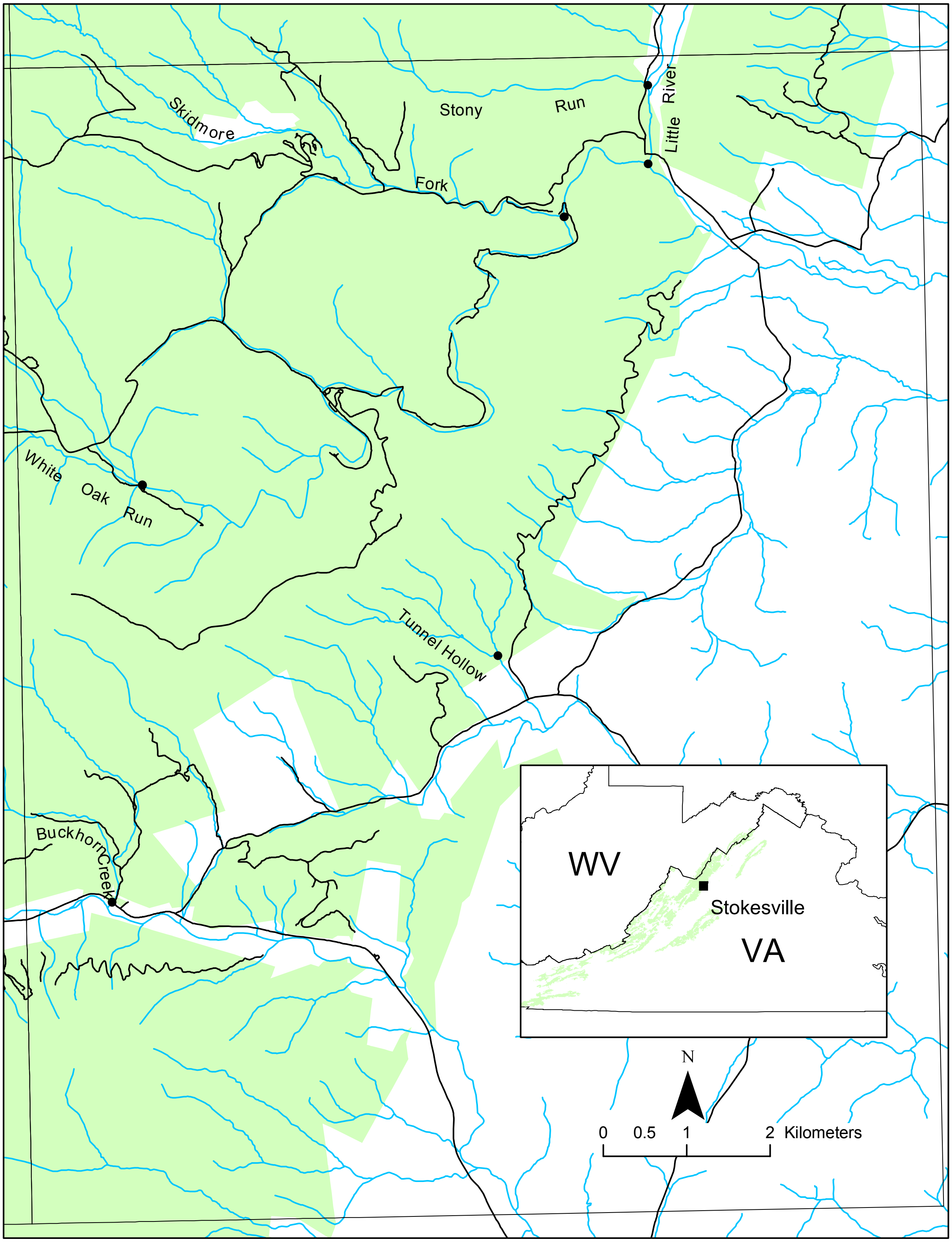
Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Wolf Run, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from Wolf Run. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Wolf Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	8	178.5	
RUN	18	583.1	
RIFFLE	29	830	
RIFFLE	38	1081.9	
RIFFLE	48	1551.1	
RIFFLE	58	2364	
POOL	69	3029.2	



Streams inventoried on the Stokesville Quadrangle using BVET habitat surveys during summer 2004.

Stream:	**Buckhorn Creek**
District:	Dry River
USGS Quadrangle:	Stokesville
Survey Date:	06/23/04
Downstream Starting Point:	at bridge, north of 250
Total Distance Surveyed (km):	3.3

	Pools	**Riffles**
Percent of Total Stream Area:	39	61
Total Area (m^2):	3735±367	5792±737
Correction Factor Applied:	1.00	1.00
Number of Paired Samples:	15	13
Total Count:	132	118
Number per km:	40	36
Mean Area (m^2):	28	49
Mean Maximum Depth (cm):	32	17
Mean Average Depth (cm):	18	9
Mean Residual Depth (cm):	9	--
Percent Surveyed as Glides:	18	--
Percent Surveyed as Runs:	--	0
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	28	8

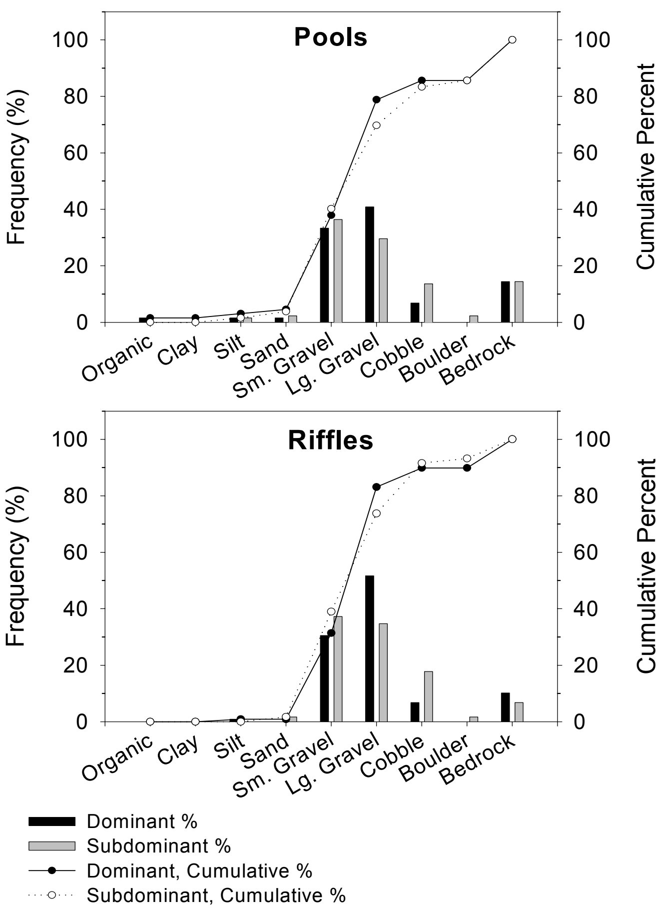
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	43
< 5 m long, > 55 cm diameter:	1
> 5 m long, 10 cm – 55 cm diameter:	30
> 5 m long, > 55 cm diameter:	5
Total:	79

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	9	1
Maximum	26	18
75^{th} Percentile	9	1
25^{th} Percentile	6	0
Minimum	3	0

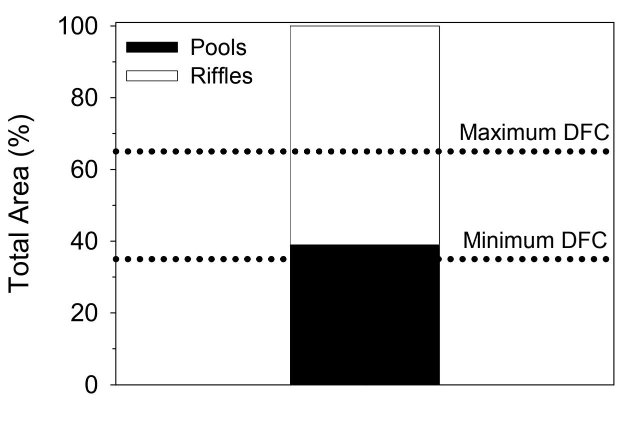
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	8
B:	0
C:	0
D:	0
E:	0
F:	92
G:	0

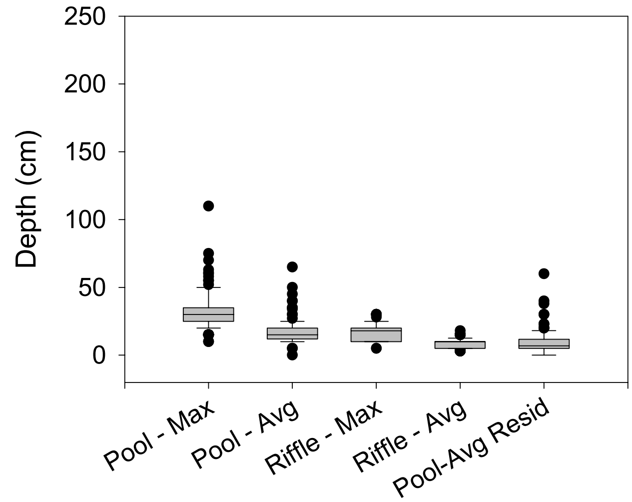
Other Stream Attributes	
Mean Bankfull Channel Width (m):	6
Mean Channel Gradient (%):	4
Median Water Temperature (C):	18



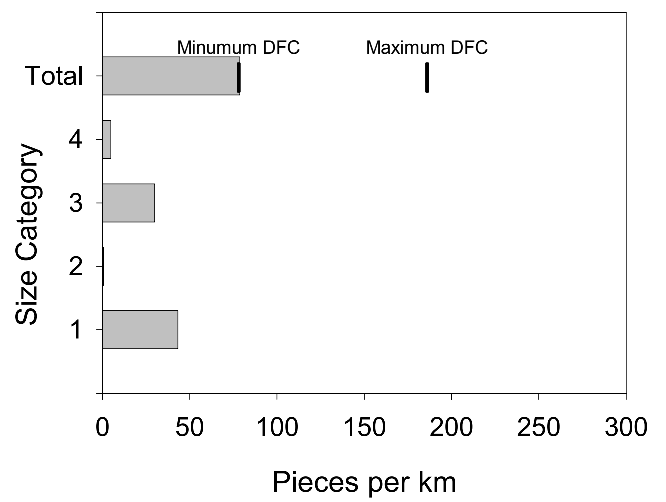
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Buckhorn Creek, summer 2004.



Estimated area of Buckhorn Creek in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



Maximum and average depths and residual pool depths for pools and riffles in Buckhorn Creek, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



LWD per kilometer in Buckhorn Creek, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

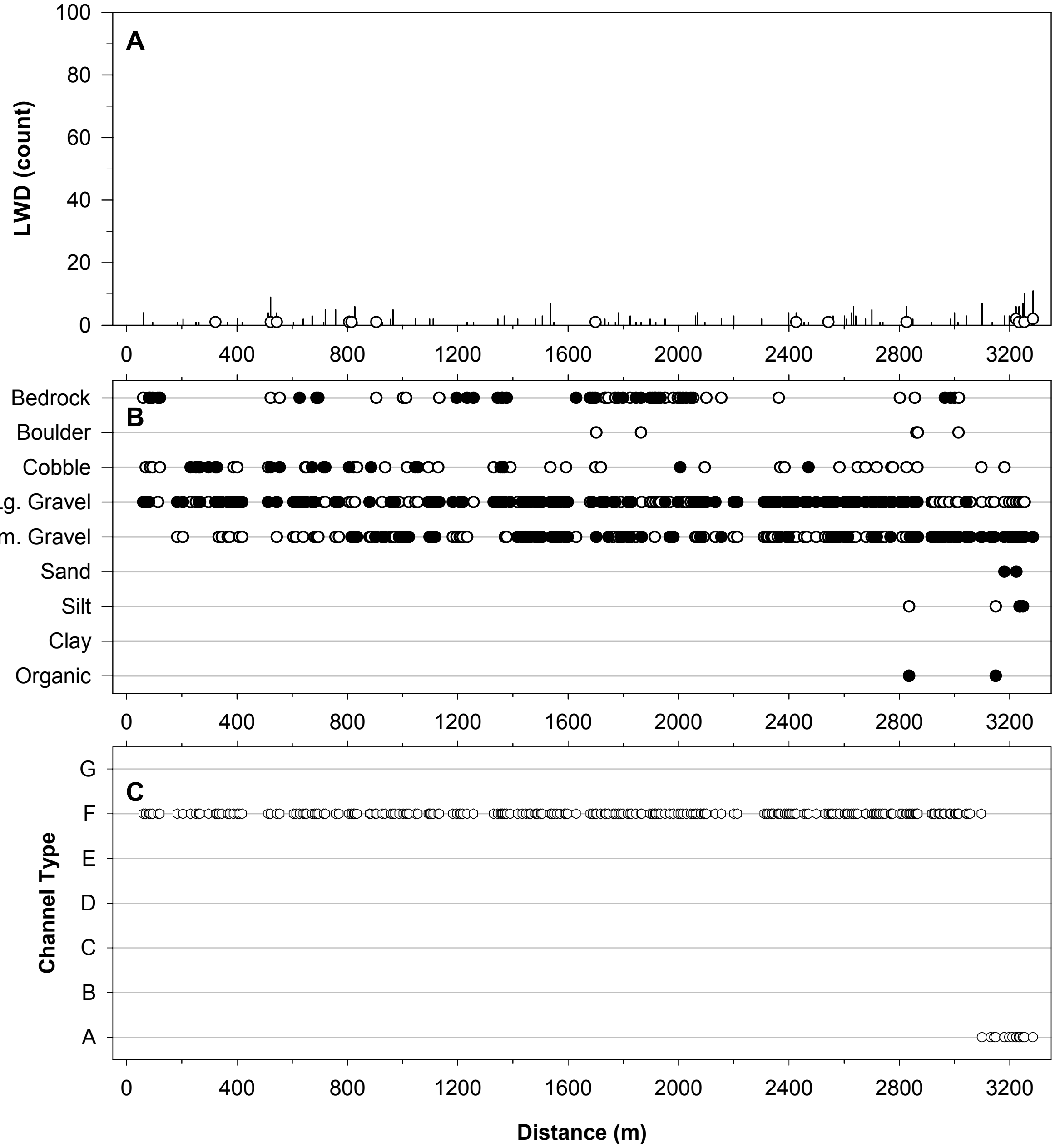
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Buckhorn Creek during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SIDE CHANNEL	122		IN ON LEFT
TRIBUTARY	286	1	
SIDE CHANNEL	309		OUT LEFT
UNDERGROUND	309		FROM 297 m TO 309 m
TRIBUTARY	556		IN ON RIGHT
TRIBUTARY	1041		
FORD	1118		CLOSED TO USE
SEEP	1325	0.5	
UNDERGROUND	1386		FROM 1377 m TO 1386 m
TRIBUTARY	1453		
SIDE CHANNEL	1471		IN ON LEFT, DRY
SIDE CHANNEL	1496		OUT ON LEFT
FORD	1905		ROAD CROSSING
SEEP	2038		IN ON LEFT
SEEP	2080		IN ON RIGHT
SEEP	2123		IN ON LEFT
UNDERGROUND	2203		FROM 2200 m TO 2203 m
UNDERGROUND	2301		FROM 2213 m TO 2301 m
UNDERGROUND	2316		FROM 2310 m TO 2316 m
FORD	2404		VERY OLD ROAD CROSSING
UNDERGROUND	2520		FROM 2471 m TO 2520 m
TRIBUTARY	2532		IN ON LEFT
UNDERGROUND	2646		FROM 2642 m TO 2646 m
UNDERGROUND	2653		FROM 1649 m TO 2653 m
FORD	2656		VERY OLD ROAD CROSSING
SIDE CHANNEL	2780		IN ON RIGHT
SIDE CHANNEL	2801		OUT ON RIGHT
TRIBUTARY	2811		IN ON RIGHT
TRIBUTARY	2880		DRY, IN ON RIGHT
TRIBUTARY	3054		DRY, IN ON RIHT
UNDERGROUND	3136		FROM 3131 m TO 3136 m
UNDERGROUND	3200		FROM 3198 m TO 3200 m
TRIBUTARY	3209		DRY, IN ON LEFT
UNDERGROUND	3211		FROM 3210 m TO 3211 m
UNDERGROUND	3235		FROM 3234 m TO 3235 m
UNDERGROUND	3305		FROM 3284 m TO 3305 m ; RECENT CLEAR CUT, ~15-20 YEARS

Stream crossings encountered on Buckhorn Creek during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	Ford
Distance (m):	1118
Road number/trail name:	433
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	Y
Photos (y/n):	N
Comments:	Closed to use



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Buckhorn Creek, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from bridge, north of 250. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Buckhorn Creek during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	10	387	
RIFFLE	15	627	
RIFFLE	20	757	
RIFFLE	25	957	
RIFFLE	35	1218	
RIFFLE	45	1587	
RIFFLE	55	1864	
RIFFLE	65	2095	
RIFFLE	75	2427	
RIFFLE	85	2713	
RIFFLE	95	2917	
RIFFLE	105	3131	

Stream:	**Little River**
District:	Dry River
USGS Quadrangle:	Stokesville and Reddish Knob
Survey Date:	06/17/04
Downstream Starting Point:	660539E 4247514N: confluence of Little River
Total Distance Surveyed (km):	0.9

	Pools	**Riffles**
Percent of Total Stream Area:	20	80
Total Area (m^2):	1456	5720
Correction Factor Applied:	0.94	1.08
Number of Paired Samples:	1	2
Total Count:	10	19
Number per km:	11	21
Mean Area (m^2):	146	301
Mean Maximum Depth (cm):	84	33
Mean Average Depth (cm):	58	22
Mean Residual Depth (cm):	16	--
Percent Surveyed as Glides:	10	--
Percent Surveyed as Runs:	--	32
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	0	0

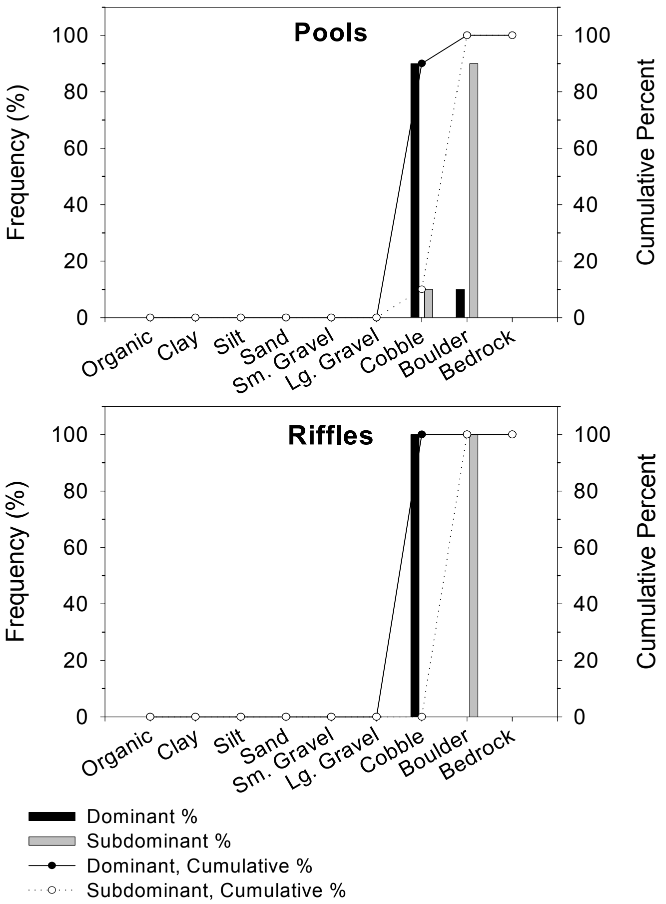
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	4
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	4
> 5 m long, > 55 cm diameter:	0
Total:	9

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	34	8
Maximum	40	26
75th Percentile	37	9
25th Percentile	31	2
Minimum	28	2

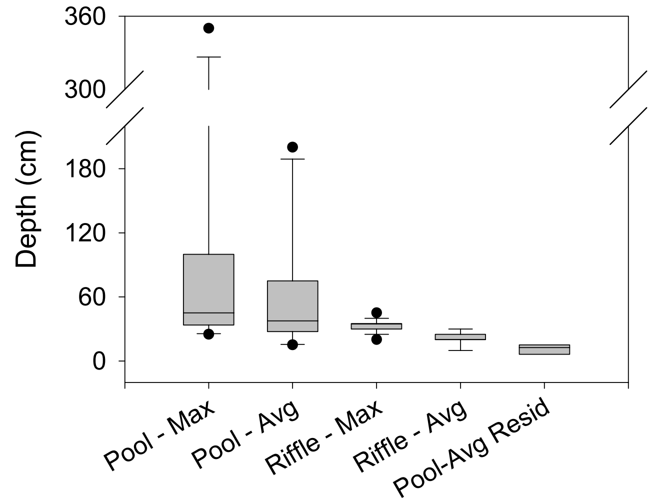
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	0
B:	100
C:	0
D:	0
E:	0
F:	0
G:	0

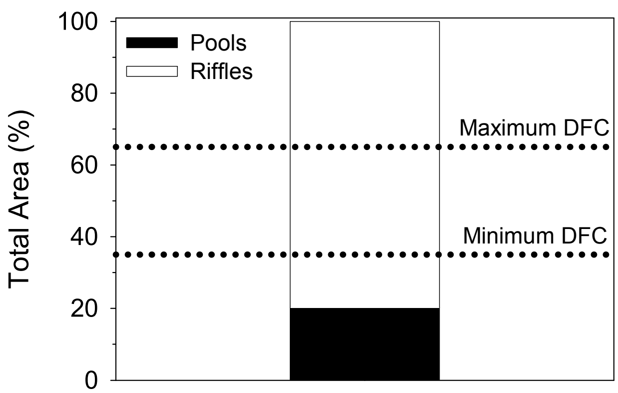
Other Stream Attributes	
Mean Bankfull Channel Width (m):	17
Mean Channel Gradient (%):	2
Median Water Temperature (C):	17



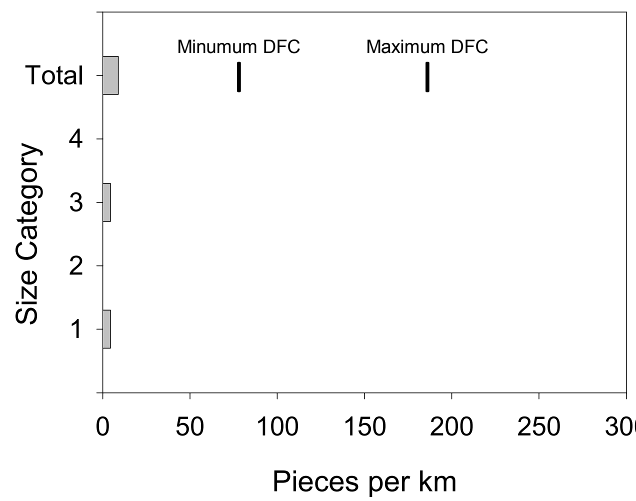
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Little River, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Little River, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Little River in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Little River, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

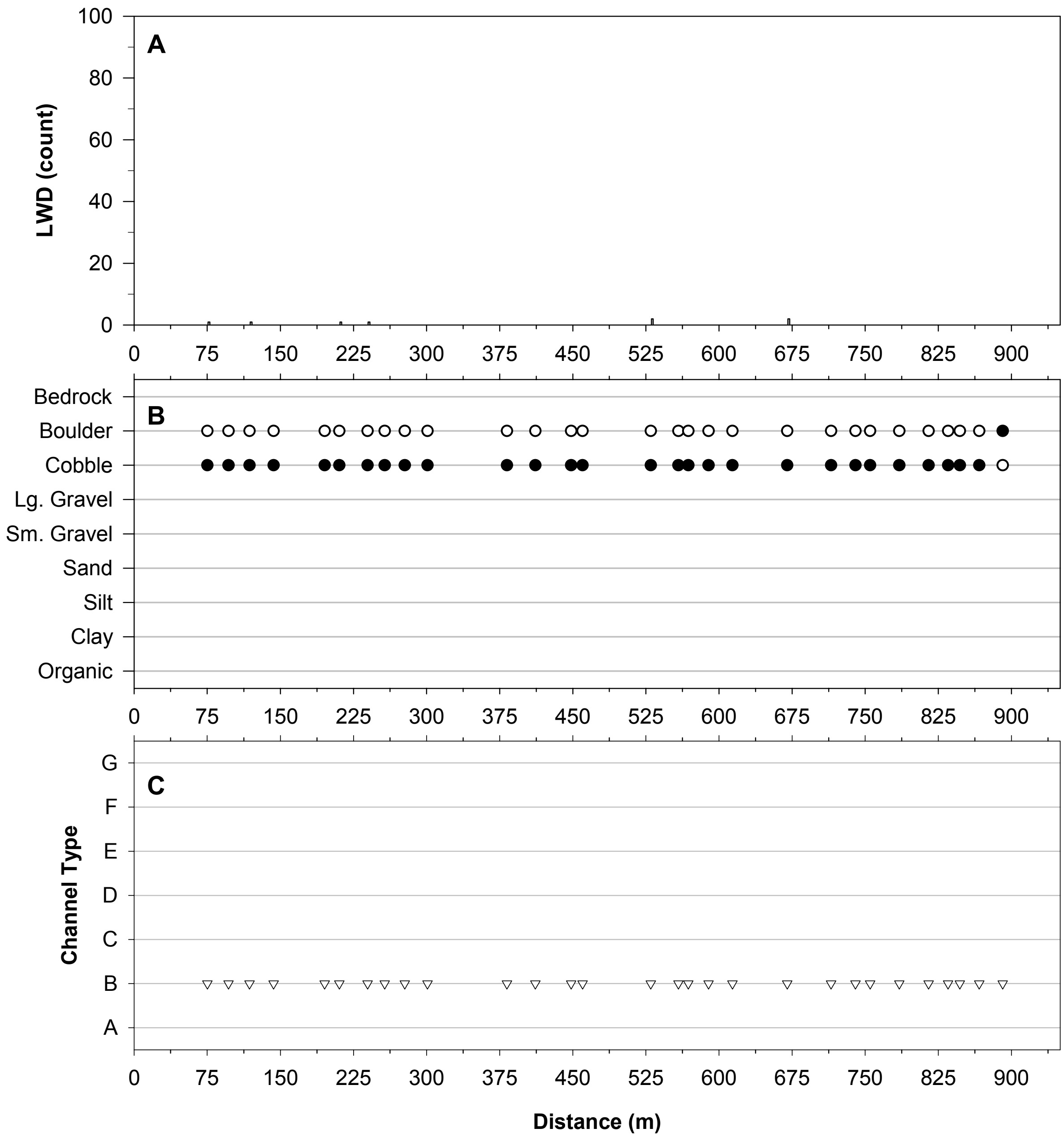
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Little River during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
BRIDGE	718		CONCRETE BRIDGE, Photo taken week of 6/21/04, forgot during survey
SIDE CHANNEL	785		
SIDE CHANNEL	815		
SIDE CHANNEL	835		
SIDE CHANNEL	853		

Stream crossings encountered on Little River during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	Bridge
Distance (m):	140
Road number/trail name:	718
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	Y
Photos (y/n):	N
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Little River, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence of Little River. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Little River during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	6	277.6	
BRIDGE	140	718	
RIFFLE	16	755	REACHED PRIVATE PROPERTY BOUNDARY

Stream:	**Skidmore Fork**
District:	Dry River
USGS Quadrangle:	Stokesville
Survey Date:	06/16/04
Downstream Starting Point:	confluence of Skidmore Fork and North River
Total Distance Surveyed (km):	4.1

	Pools	**Riffles**
Percent of Total Stream Area:	18	82
Total Area (m^2):	3544±854	16488±1854
Correction Factor Applied:	0.92	1.09
Number of Paired Samples:	6	5
Total Count:	64	67
Number per km:	16	17
Mean Area (m^2):	55	246
Mean Maximum Depth (cm):	51	28
Mean Average Depth (cm):	32	14
Mean Residual Depth (cm):	14	--
Percent Surveyed as Glides:	11	--
Percent Surveyed as Runs:	--	24
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	0	0

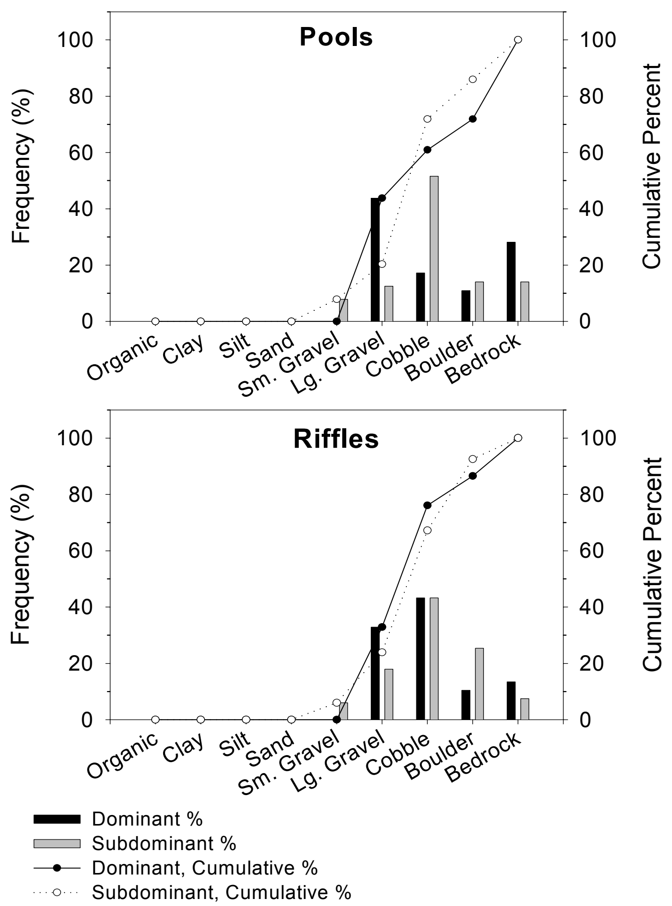
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	30
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	10
> 5 m long, > 55 cm diameter:	2
Total:	42

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	18	4
Maximum	34	21
75^{th} Percentile	19	4
25^{th} Percentile	13	1
Minimum	10	1

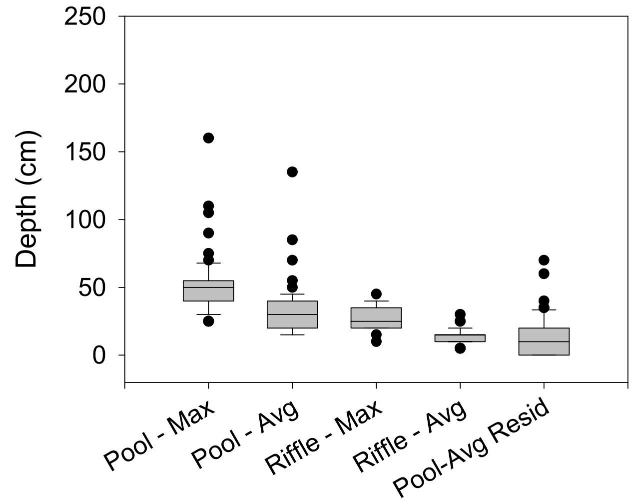
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	0
B:	100
C:	0
D:	0
E:	0
F:	0
G:	0

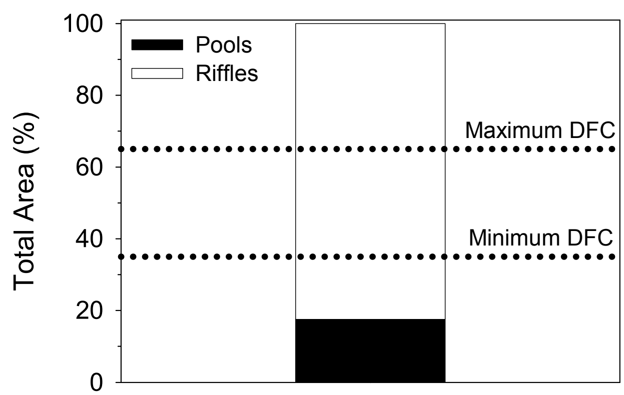
Other Stream Attributes	
Mean Bankfull Channel Width (m):	10
Mean Channel Gradient (%):	2
Median Water Temperature (C):	19



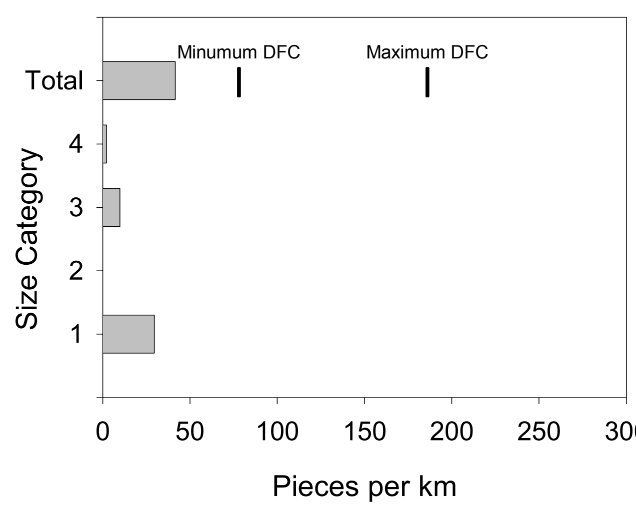
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Skidmore Fork summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Skidmore Fork, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Skidmore Fork in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Skidmore Fork, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

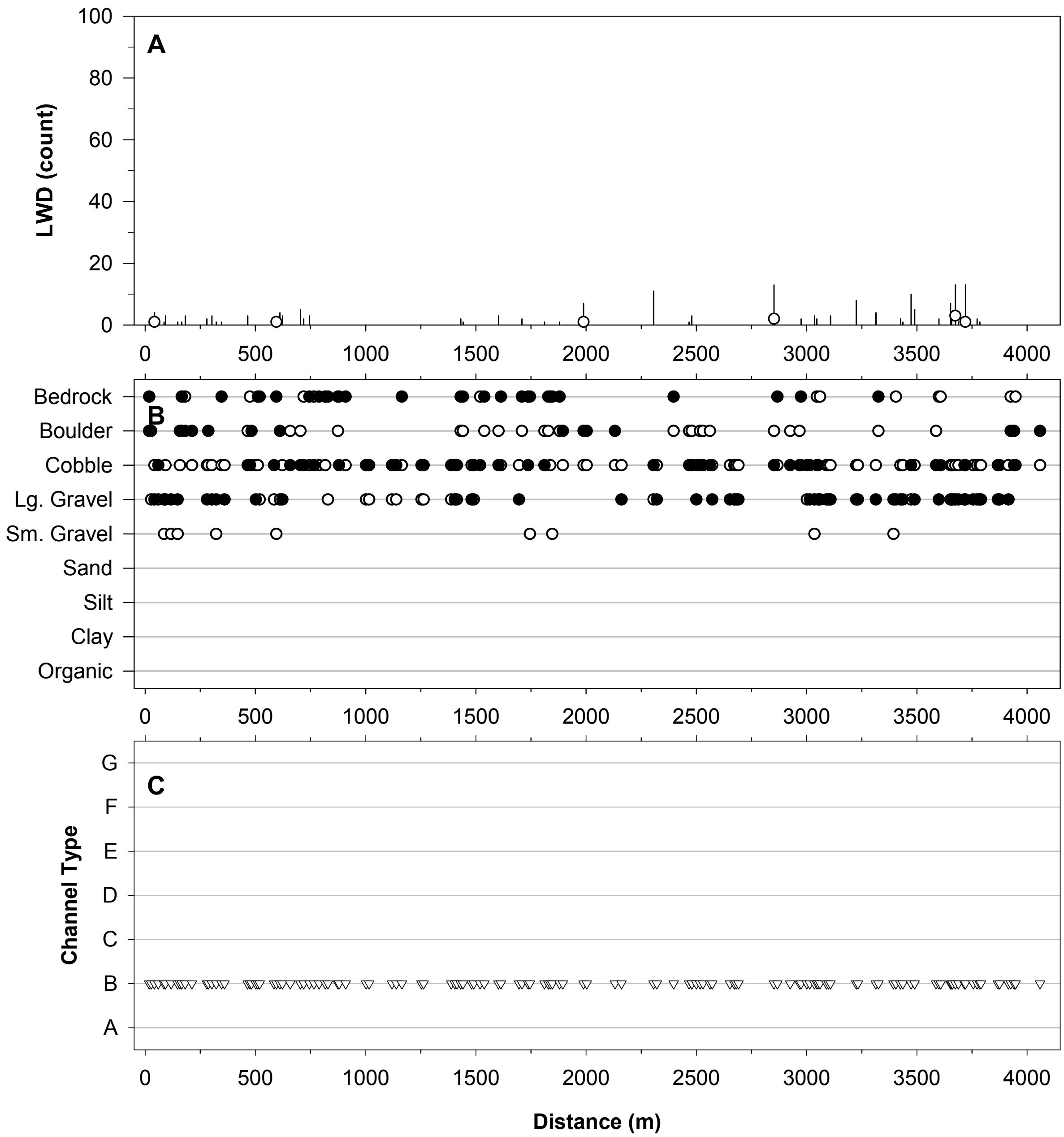
Stream features found on Skidmore Fork during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SIDE CHANNEL	85.4		SIDE CHANNEL IN ON RIGHT
FORD	494		HORSE TRAIL CROSSING
SIDE CHANNEL	561.7		LEFT,EXITS AT 574
FORD	705		TRAIL CROSSING
SIDE CHANNEL	750		NATURAL BREAK AT 750.5, SCH LEFT
TRIBUTARY	781		
TRIBUTARY	801.5		ENTERS ON RIGHT
CULVERT	1015.7		
CULVERT	1262.9		
BRIDGE	1538		
SIDE CHANNEL	1650.5		EXIT ON RIGHT
SIDE CHANNEL	1650.7		ENTERS IN ON RIGHT
TRIBUTARY	1652.8		ENTERS ON LEFT
SIDE CHANNEL	2226		ENTERS LEFT
SIDE CHANNEL	2306		EXITS LEFT, DEBRIS DAM
SIDE CHANNEL	2502		ENTERS RIGHT AT 2505
TRIBUTARY	2582.1		ENTERS ON RIGHT
FORD	2586		TRAIL CROSSING
TRIBUTARY	2706.2		LEFT
TRIBUTARY	3625		TRIB ENTERS RIGHT
BRIDGE	3745.2		WOODEN BRIDGE FOR WHITE OAK RECREATION TRAIL
FORD	3846		VEHICLE CROSSING

Stream crossings encountered on Skidmore Fork during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	Culvert
Distance (m):	1015.7
Road number/trail name:	FR 95
Culvert type:	Pipe
Culvert outlets (n):	2
Culvert diameter (cm):	225
Culvert height (cm):	175
Culvert material:	Metal Pipe
Culvert perch (cm):	15
Substrate (y/n):	N
Photos (y/n):	Y
Comments:	

Crossing type:	Culvert
Distance (m):	1262.9
Road number/trail name:	FR 95
Culvert type:	Pipe
Culvert outlets (n):	2
Culvert diameter (cm):	300
Culvert height (cm):	175
Culvert material:	Metal Pipe
Culvert perch (cm):	10
Substrate (y/n):	N
Photos (y/n):	Y
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Skidmore Fork, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence of Skidmore Fork and North River. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Skidmore Fork during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	10	510.8	
RUN	17	816.6	SEEPS ALONG LEFT BANK
RIFFLE	77	3608.1	
BRIDGE		3745.2	WOODEN BRIDGE FOR WHITE OAK RECREATION TRAIL
FORD		3846	VEHICLE CROSSING

Stream:	**Stony Run**
District:	Dry River
USGS Quadrangle:	Stokesville
Survey Date:	06/24/04
Downstream Starting Point:	4248416N, 660506E; National Forest Boundary above Tillman Road Bridge
Total Distance Surveyed (km):	3.6

	Pools	**Riffles**
Percent of Total Stream Area:	18	82
Total Area (m^2):	1436±227	6452±1125
Correction Factor Applied:	0.96	1.12
Number of Paired Samples:	8	9
Total Count:	81	90
Number per km:	22	25
Mean Area (m^2):	18	72
Mean Maximum Depth (cm):	42	18
Mean Average Depth (cm):	28	8
Mean Residual Depth (cm):	20	--
Percent Surveyed as Glides:	0	--
Percent Surveyed as Runs:	--	0
Percent Surveyed as Cascades:	--	2
Percent with >35% Fines:	25	3

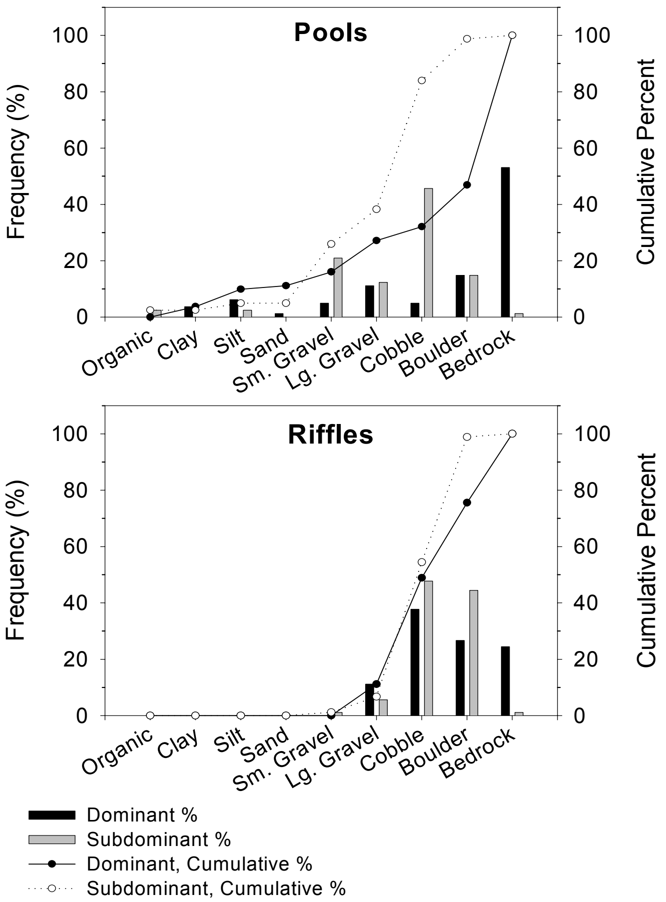
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	22
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	17
> 5 m long, > 55 cm diameter:	3
Total:	42

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	10	2
Maximum	17	5
75th Percentile	12	2
25th Percentile	8	1
Minimum	5	1

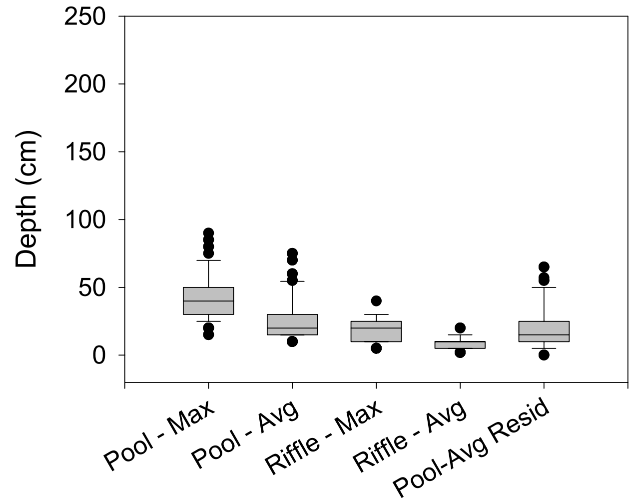
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	76
B:	24
C:	0
D:	0
E:	0
F:	0
G:	0

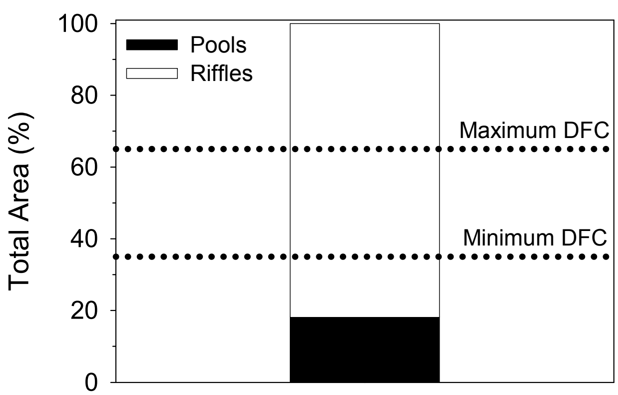
Other Stream Attributes	
Mean Bankfull Channel Width (m):	6
Mean Channel Gradient (%):	9
Median Water Temperature (C):	14



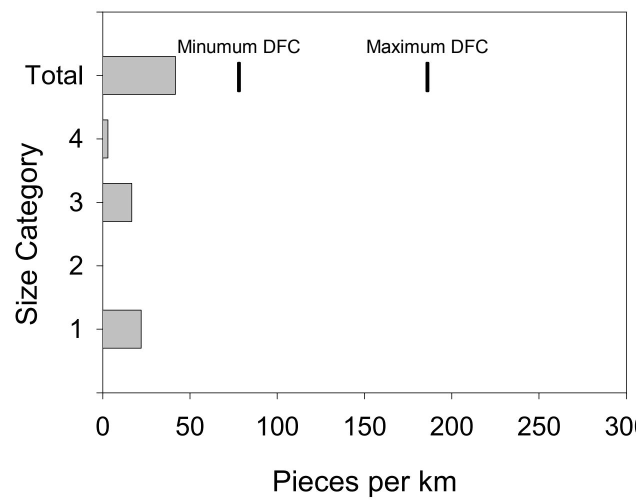
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Stony Run, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Stony Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Stony Run in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Stony Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

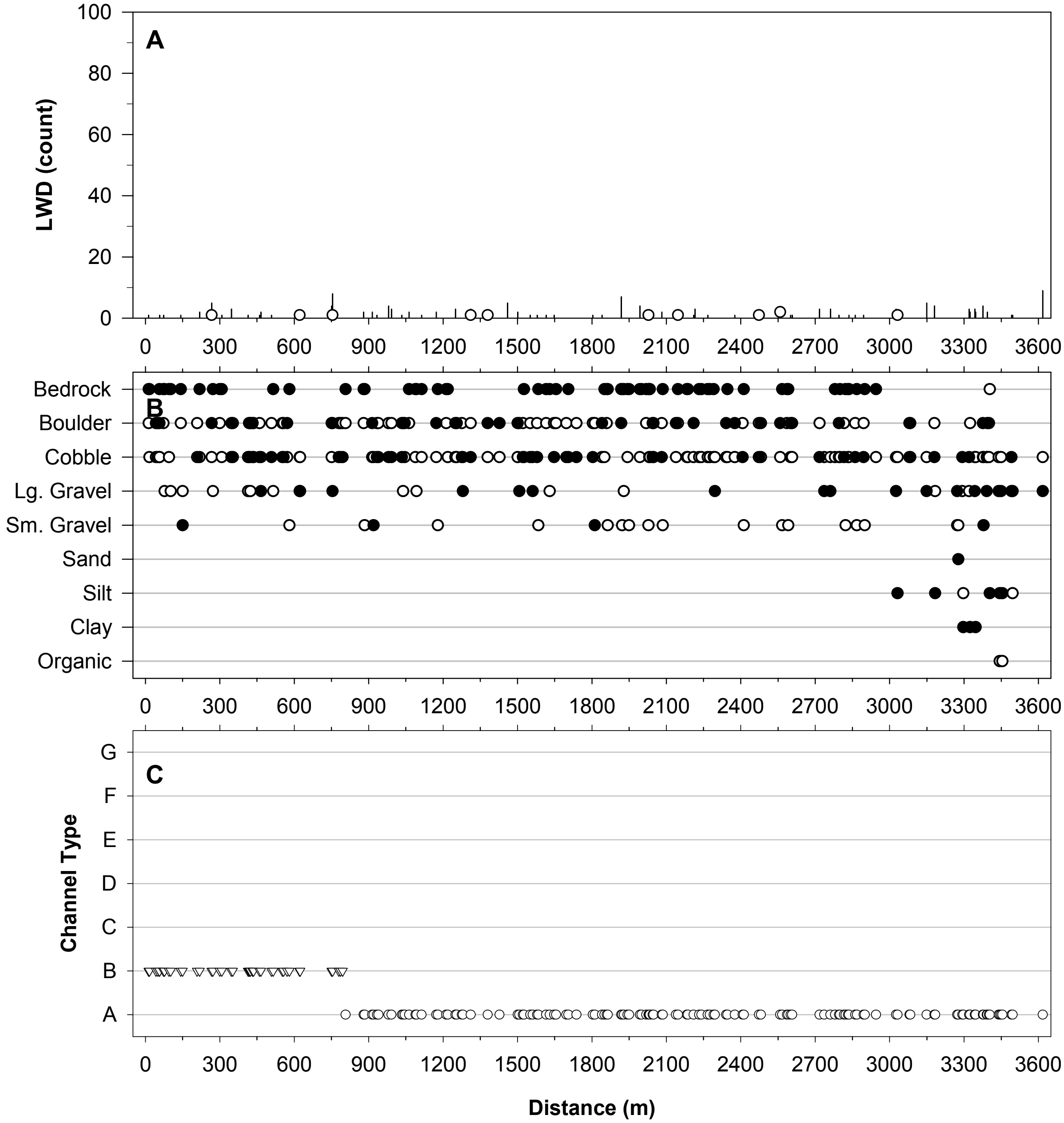
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Stony Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SIDE CHANNEL	301		IN ON LEFT
SIDE CHANNEL	355		OUT ON LEFT
FORD	366		TRAIL CROSSING
UNDERGROUND	1017.9		FROM 992 m TO 1017.9 m
FORD	1033.1		TRAIL CROSSING
UNDERGROUND	1102.8		FROM 1093 m TO 1102.8 m
SIDE CHANNEL	1222.4		IN ON LEFT. DRY.
SIDE CHANNEL	1249.8		OUT ON LEFT
SIDE CHANNEL	1356.6		IN ON RIGHT
UNDERGROUND	1422		FROM 1380 m TO 1422 m
UNDERGROUND	1460		FROM 1427.5 m TO 1460 m
FORD	1803.4		TRAIL COMES IN ON LEFT AND ENDS AT STREAM CHANNEL.
TRIBUTARY	1803.4		IN ON RIGHT. DRY.
FORD	2044.4		TRAIL CROSSING
SIDE CHANNEL	2113		IN ON LEFT
SIDE CHANNEL	2170		OUT ON LEFT
UNDERGROUND	2215.6		FROM 2210 m TO 2215.6 m
TRIBUTARY	2319.4	0.2	IN ON RIGHT
SIDE CHANNEL	2687.6		IN ON LEFT
SIDE CHANNEL	2717		OUT ON LEFT
SIDE CHANNEL	3257.5		IN ON LEFT
SIDE CHANNEL	3271.6		OUT ON LEFT
UNDERGROUND	3430		FROM 3403.7 m TO 3430 m

Stream crossings encountered on Stony Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Stony Run, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from Tillman Road Bridge, beginning at National Forest Boundary. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Stony Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	8	267.3	
RIFFLE	28	1045.5	
RIFFLE	38	1551.1	
RIFFLE	48	1928.8	
CASCADE	58	2266.7	
RIFFLE	68	2761.3	
RIFFLE	78	3180.4	
RIFFLE	88	3491	

Stream:	**Tunnel Hollow**
District:	Dry River
USGS Quadrangle:	Stokesville
Survey Date:	06/28/04
Downstream Starting Point:	4241098N, 659068E; 20M north of 728 Culvert
Total Distance Surveyed (km):	1.7

	Pools	**Riffles**
Percent of Total Stream Area:	24	76
Total Area (m^2):	749±225	2353±383
Correction Factor Applied:	0.68	0.83
Number of Paired Samples:	4	5
Total Count:	40	42
Number per km:	23	24
Mean Area (m^2):	19	56
Mean Maximum Depth (cm):	34	17
Mean Average Depth (cm):	18	9
Mean Residual Depth (cm):	13	--
Percent Surveyed as Glides:	20	--
Percent Surveyed as Runs:	--	0
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	40	10

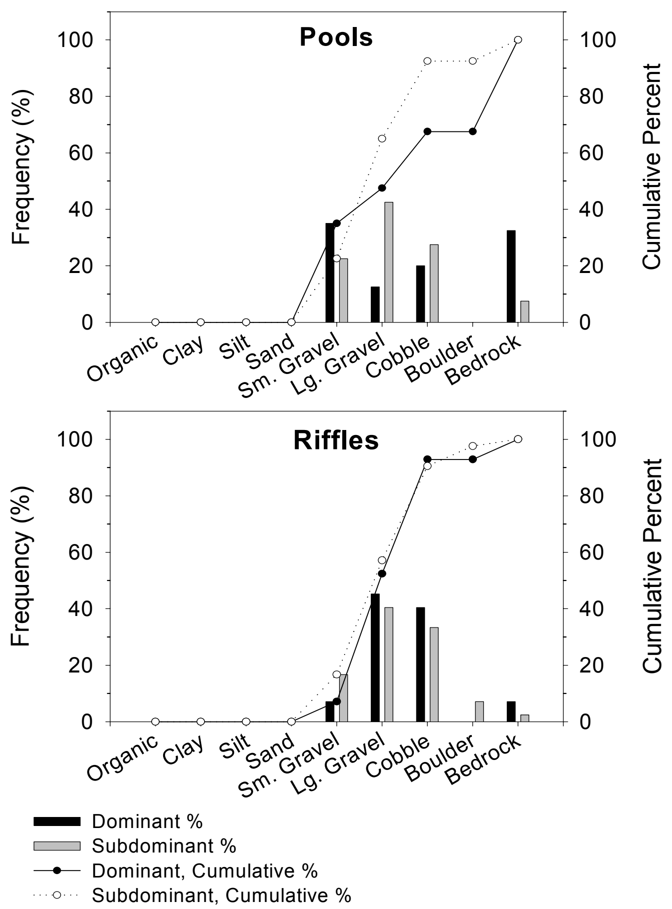
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	11
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	7
> 5 m long, > 55 cm diameter:	3
Total:	21

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	9	2
Maximum	13	7
75th Percentile	11	1
25th Percentile	9	1
Minimum	4	1

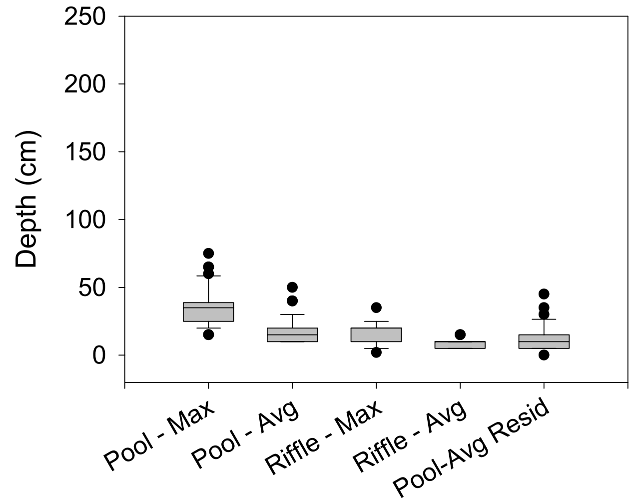
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	0
B:	100
C:	0
D:	0
E:	0
F:	0
G:	0

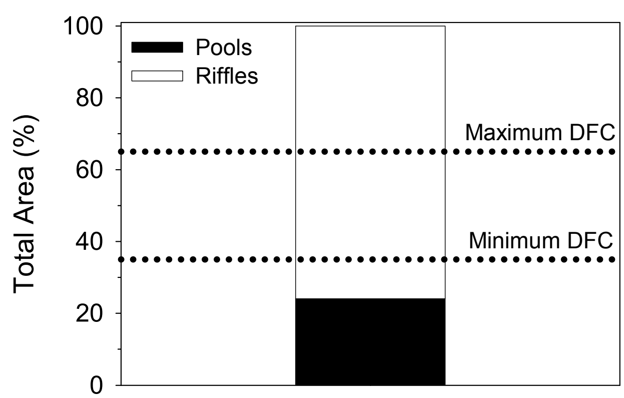
Other Stream Attributes	
Mean Bankfull Channel Width (m):	6
Mean Channel Gradient (%):	3
Median Water Temperature (C):	16



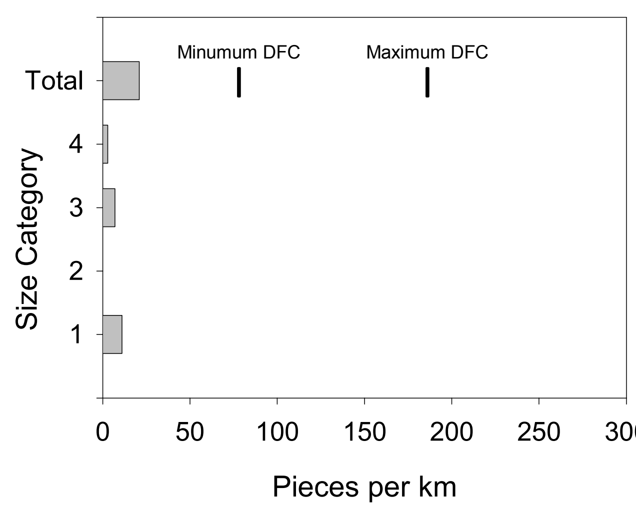
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Tunnel Hollow, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Tunnel Hollow, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Tunnel Hollow in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Tunnel Hollow summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

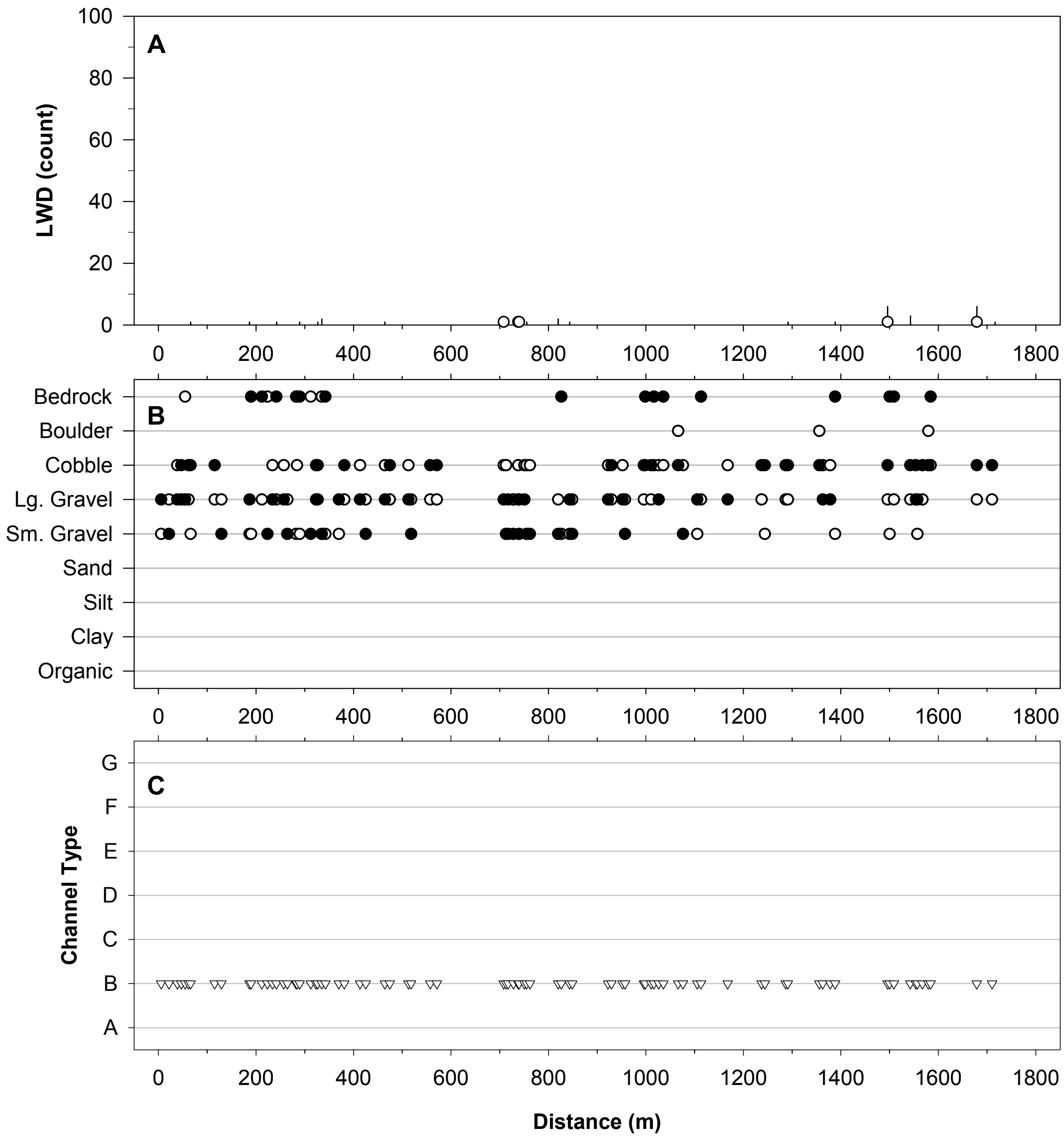
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Tunnel Hollow during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
FORD	381.2		VEHICLE CROSSING, ROAD ON MAP
FORD	881.7		VEHICLE CROSSING, ROAD ON MAP
FORD	922.2		VEHICLE CROSSING, ROAD ON MAP
FORD	1045.1		VEHICLE CROSSING, ROAD ON MAP
FORD	1087.1		VEHICLE CROSSING, ROAD ON MAP
FORD	118.4		VEHICLE CROSSING, ROAD ON MAP
FORD	1148.2		VEHICLE CROSSING, ROAD ON MAP
SIDE CHANNEL	833.7		IN ON RIGHT
TRIBUTARY	619.1		IN ON RIGHT. DRY.
TRIBUTARY	1249.3	0.5	IN ON LEFT
TRIBUTARY	1368.1	1	IN ON RIGHT
TRIBUTARY	1598.5	1.5	IN ON RIGHT
UNDERGROUND	1716.2		STREAM BED INTERSECTS MOUNTAIN. ROAD ON LEFT SIDE OF STREAM. END TIME 20:00, 6/28/04.

Stream crossings encountered on Tunnel Hollow during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Tunnel Hollow summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance from 20m upstream of Rt. 728 culvert. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Tunnel Hollow during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
RIFFLE	1	21.4	
RIFFLE	11	326.4	TOILET DISCARDED IN STREAM
RIFFLE	21	750.6	
RIFFLE	31	1167.7	BREAK
RIFFLE	41	1678.9	BREAK

Stream:	**White Oak Run**
District:	Dry River
USGS Quadrangle:	Stokesville
Survey Date:	06/22/04
Downstream Starting Point:	4207491N, 675585E; confluence of White Oak Run and North River, just above Elkhorn Lake on FS 533
Total Distance Surveyed (km):	4.2

	Pools	**Riffles**
Percent of Total Stream Area:	61	39
Total Area (m^2):	10927±1528	6992±1078
Correction Factor Applied:	1.00	1.01
Number of Paired Samples:	25	21
Total Count:	128	106
Number per km:	30	25
Mean Area (m^2):	85	66
Mean Maximum Depth (cm):	49	17
Mean Average Depth (cm):	33	10
Mean Residual Depth (cm):	23	--
Percent Surveyed as Glides:	5	--
Percent Surveyed as Runs:	--	0
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	52	8

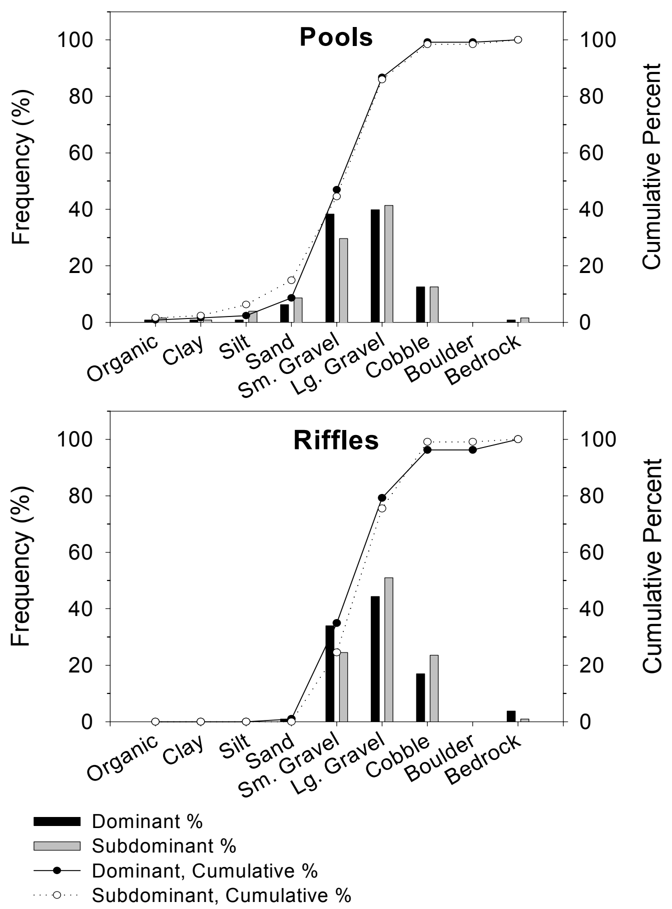
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	4
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	41
> 5 m long, > 55 cm diameter:	14
Total:	59

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	12	3
Maximum	86	50
75th Percentile	12	1
25th Percentile	7	0
Minimum	3	0

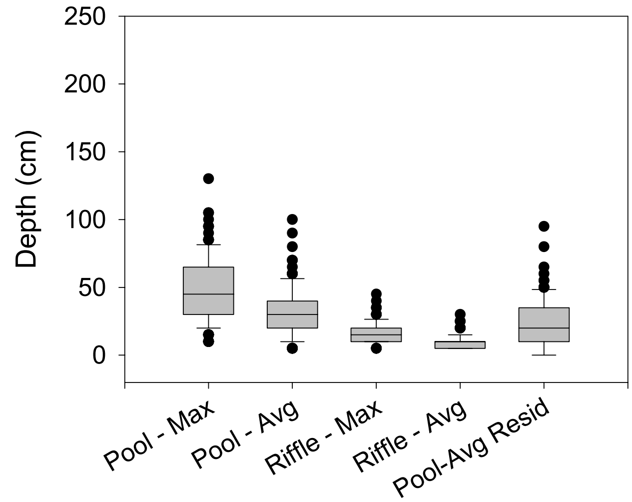
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	0
B:	0
C:	0
D:	0
E:	0
F:	100
G:	0

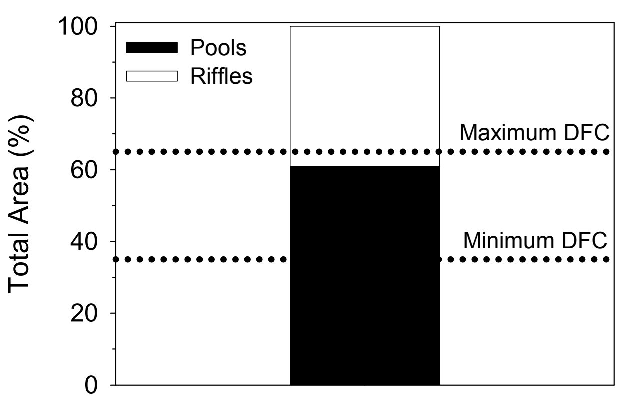
Other Stream Attributes	
Mean Bankfull Channel Width (m):	7
Mean Channel Gradient (%):	2
Median Water Temperature (C):	19



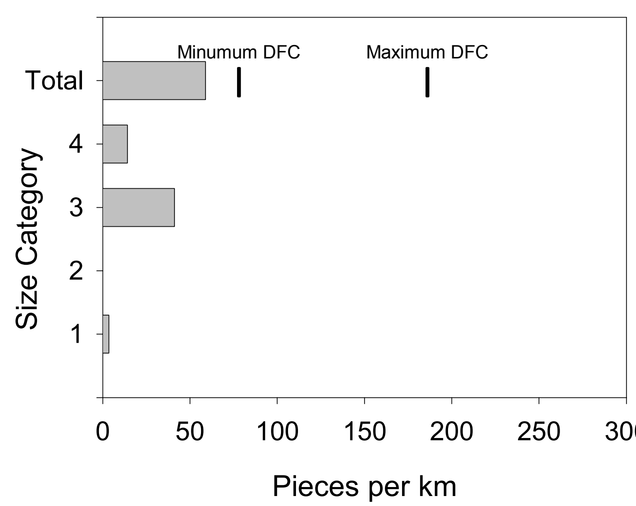
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in White Oak Run, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in White Oak Run, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of White Oak Run in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in White Oak Run, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on White Oak Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SIDE CHANNEL	157		RIGHT
SIDE CHANNEL	177		
TRIBUTARY	227		RIGHT
CULVERT	381		
UNDERGROUND	758.5		FROM 750.2 m TO 758.5 m
TRIBUTARY	1209.5	5	RIGHT
TRIBUTARY	1376.4	2	
BRIDGE	1600		
UNDERGROUND	2221.4		FROM 2214.5 m TO 2221.4 m
UNDERGROUND	2238.1		FROM 2228.9 m TO 2238.1 m
UNDERGROUND	2372.1		FROM 2358.5 m TO 2372.1 m
UNDERGROUND	2547.6		FROM 2531.3 m TO 2547.6 m
TRIBUTARY	2695.2	1	DRY
SEEP	2977		LEFT
TRIBUTARY	3059.1	1	DRY
SIDE CHANNEL	3202		IN RIGHT
UNDERGROUND	3228.5		FROM 3217 m TO 3228.5 m
SIDE CHANNEL	3234		OUT RIGHT
UNDERGROUND	3263.4		FROM 3235.3 m TO 3263.4 m
UNDERGROUND	3286.1		FROM 3278.8 m TO 3286.1 m; BEAVER DAM AT TOP OF UNDERGROUND SECTION
UNDERGROUND	3444.2		FROM 3439.8 m TO 3444.2 m
TRIBUTARY	3570.7	3	DRY
TRIBUTARY	3590	1	
UNDERGROUND	3648.7		FROM 3600 m TO 3648.7 m
UNDERGROUND	3750.1		FROM 3653.3 m TO 3750.1 m
CULVERT	3781.8		
CULVERT	3794.2		UP STREAM SIDE
SEEP	4001		
CULVERT	4850		2 PICS, US AND DS, US END BLOCKED BY BEAVER DAM
END	4900		LOW FLOW ABOVE ROAD, LESS THAN .5M WIDE

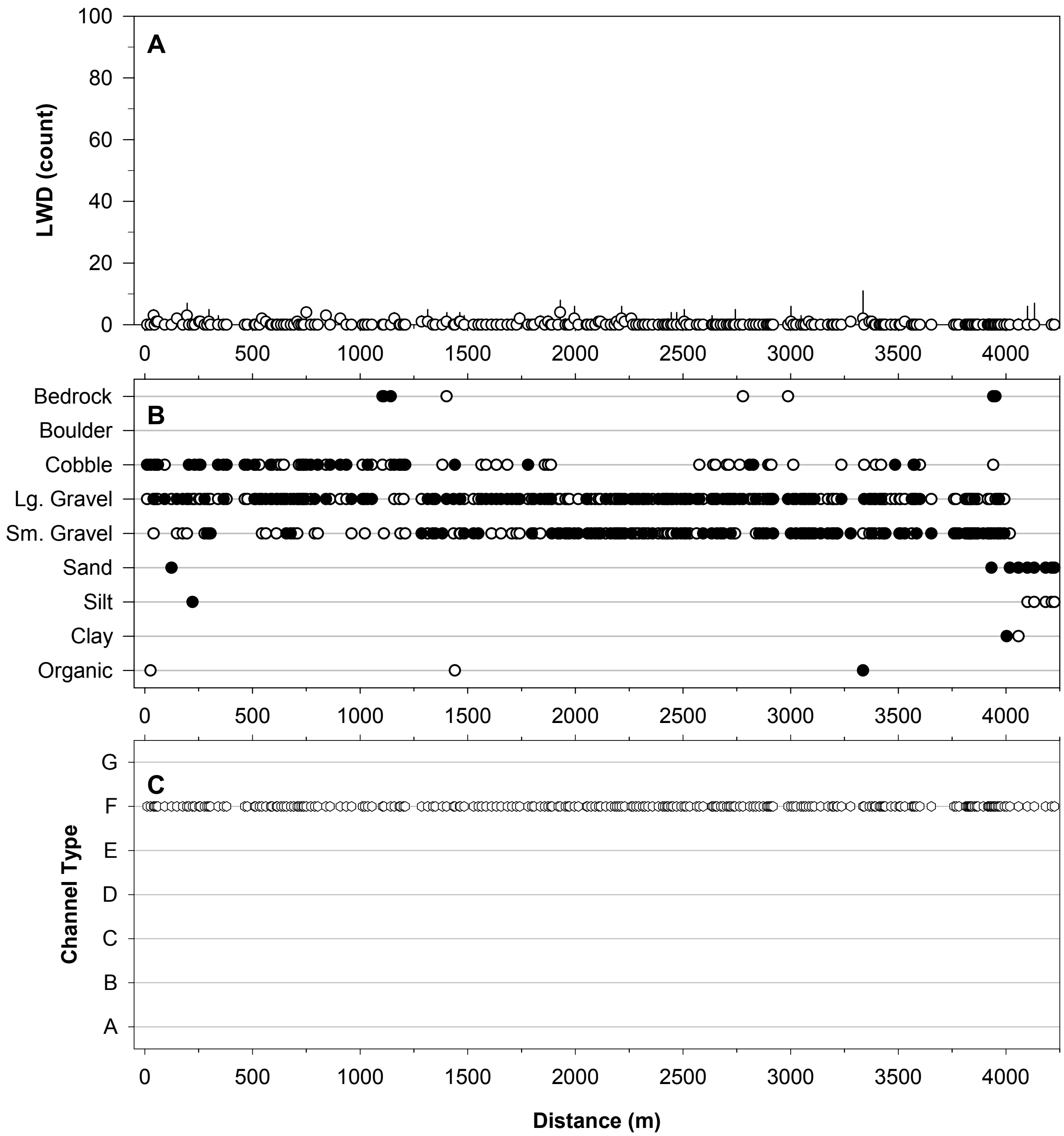
Stream crossings encountered on White Oak Run during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	Culvert
Distance (m):	381.8
Road number/trail name:	95
Culvert type:	Pipe
Culvert outlets (n):	2
Culvert diameter (cm):	300
Culvert height (cm):	210
Culvert material:	Steel
Culvert perch (cm):	0
Substrate (y/n):	N
Photos (y/n):	Y
Comments:	Concrete bottom

Crossing type:	Bridge
Distance (m):	1600
Road number/trail name:	96
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	Y
Photos (y/n):	Y
Comments:	none

Crossing type:	Culvert
Distance (m):	3781.8
Road number/trail name:	96
Culvert type:	Pipe
Culvert outlets (n):	1
Culvert diameter (cm):	140
Culvert height (cm):	95
Culvert material:	Steel
Culvert perch (cm):	0
Substrate (y/n):	Y
Photos (y/n):	Y
Comments:	none

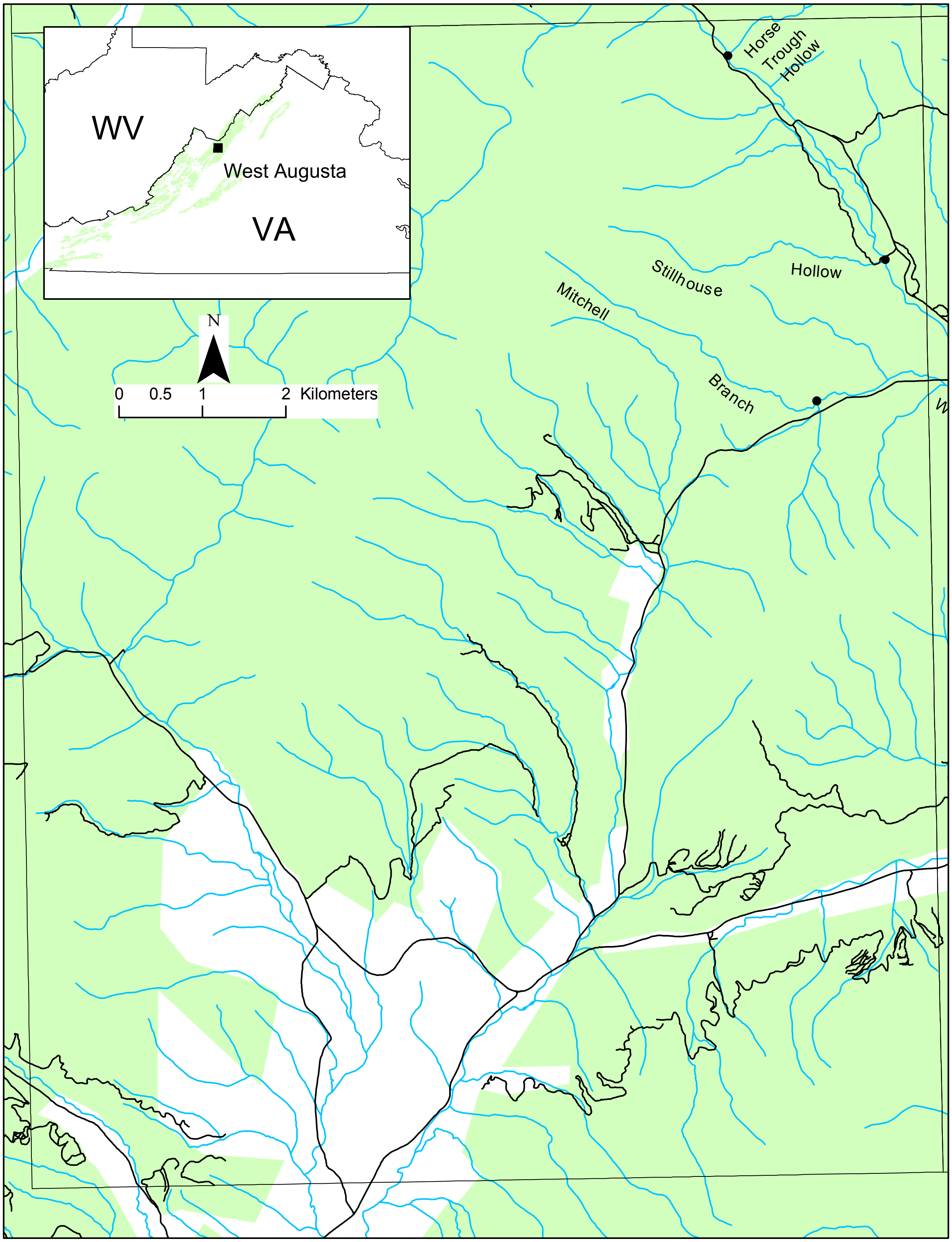
Crossing type:	Culvert
Distance (m):	4850
Road number/trail name:	96
Culvert type:	Pipe
Culvert outlets (n):	1
Culvert diameter (cm):	90
Culvert height (cm):	95
Culvert material:	Steel
Culvert perch (cm):	0
Substrate (y/n):	N
Photos (y/n):	Y
Comments:	Steel bottom



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in White Oak Run, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence of White Oak Run and North River .Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on White Oak Run during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
POOL	14	514.8	
RIFFLE	14	532.3	
RIFFLE	19	691.8	
RIFFLE	24	935.5	
RIFFLE	29	1182	
RIFFLE	34	1433.9	
RIFFLE	39	1633.1	
RIFFLE	44	1857.4	
RIFFLE	49	2013.5	
RIFFLE	55	2267.6	VERY LOW FLOW, SKIPPED PREVIOUS MEASURED RIFFLE
RIFFLE	59	2415.8	
RIFFLE	69	2713.2	
RIFFLE	74	2873	~10 M FROM FS 96
RIFFLE	79	3047.8	
RIFFLE	84	3214.2	SPLIT CHANNEL, SEE PHOTO
UNDERGROUND		3286.1	BEAVER DAM AT TOP OF UNDERGROUND SECTION
RIFFLE	69	3485.2	
RIFFLE	74	3768.8	JUST NEXT TO ROAD
RIFFLE	79	3869..5	
RIFFLE	84	3967.7	
CULVERT		4850	2 PICS, US AND DS, US END BLOCKED BY BEAVER DAM



Streams inventoried on the West Augusta Quadrangle using BVET habitat surveys during summer 2004.

Stream:	**Horse Trough Hollow**
District:	Dry River
USGS Quadrangle:	West Augusta
Survey Date:	06/15/04
Downstream Starting Point:	4248375N 650562E: confluence of North River and Horse Trough Hollow northeast of Forest Service Road
Total Distance Surveyed (km):	1.8

	Pools	**Riffles**
Percent of Total Stream Area:	65	35
Total Area (m^2):	1625±297	884±277
Correction Factor Applied:	0.99	1.32
Number of Paired Samples:	22	7
Total Count:	110	35
Number per km:	62	20
Mean Area (m^2):	15	25
Mean Maximum Depth (cm):	27	14
Mean Average Depth (cm):	16	7
Mean Residual Depth (cm):	9	--
Percent Surveyed as Glides:	25	--
Percent Surveyed as Runs:	--	17
Percent Surveyed as Cascades:	--	3
Percent with >35% Fines:	5	0

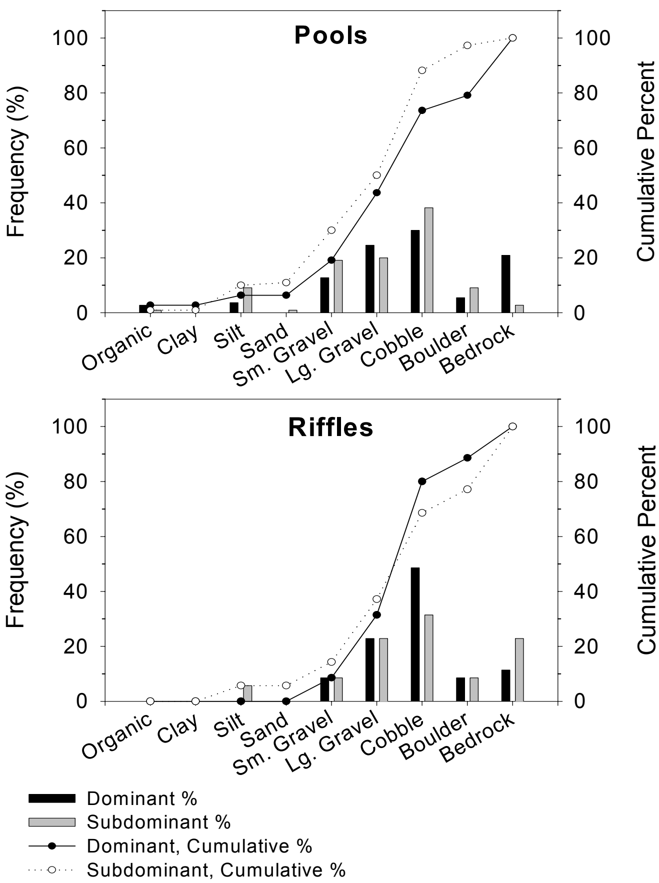
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	43
< 5 m long, > 55 cm diameter:	1
> 5 m long, 10 cm – 55 cm diameter:	23
> 5 m long, > 55 cm diameter:	6
Total:	73

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	12	3
Maximum	19	10
75th Percentile	13	4
25th Percentile	10	1
Minimum	9	1

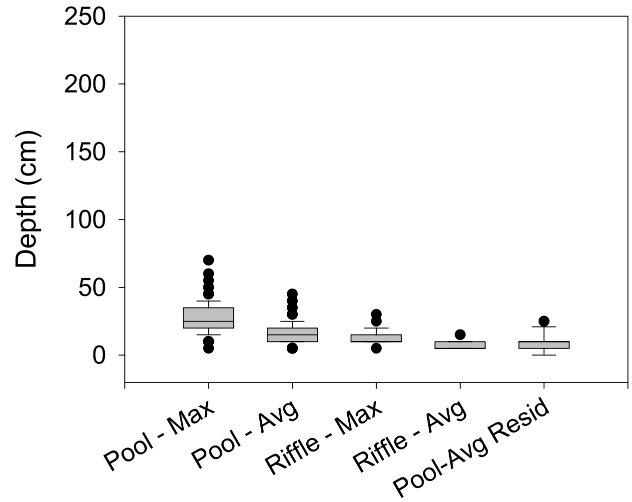
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	100
B:	0
C:	0
D:	0
E:	0
F:	0
G:	0

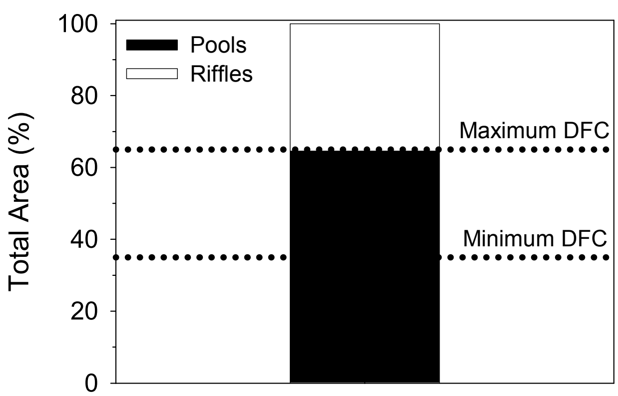
Other Stream Attributes	
Mean Bankfull Channel Width (m):	6
Mean Channel Gradient (%):	6
Median Water Temperature (C):	14



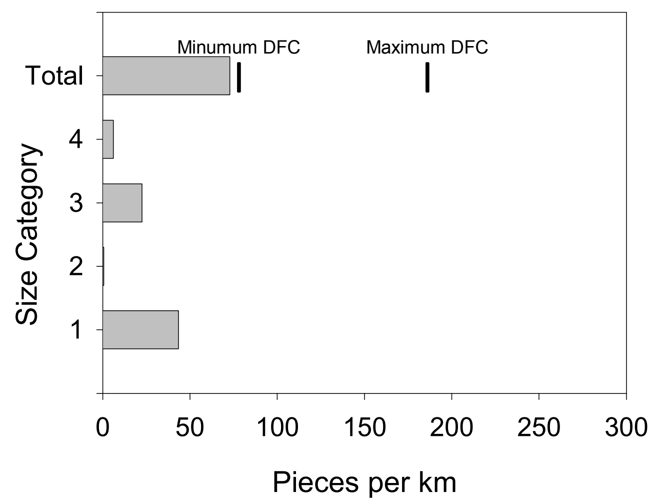
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Horse Trough Hollow, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Horse Trough Hollow, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Horse Trough Hollow in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Horse Trough Hollow, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

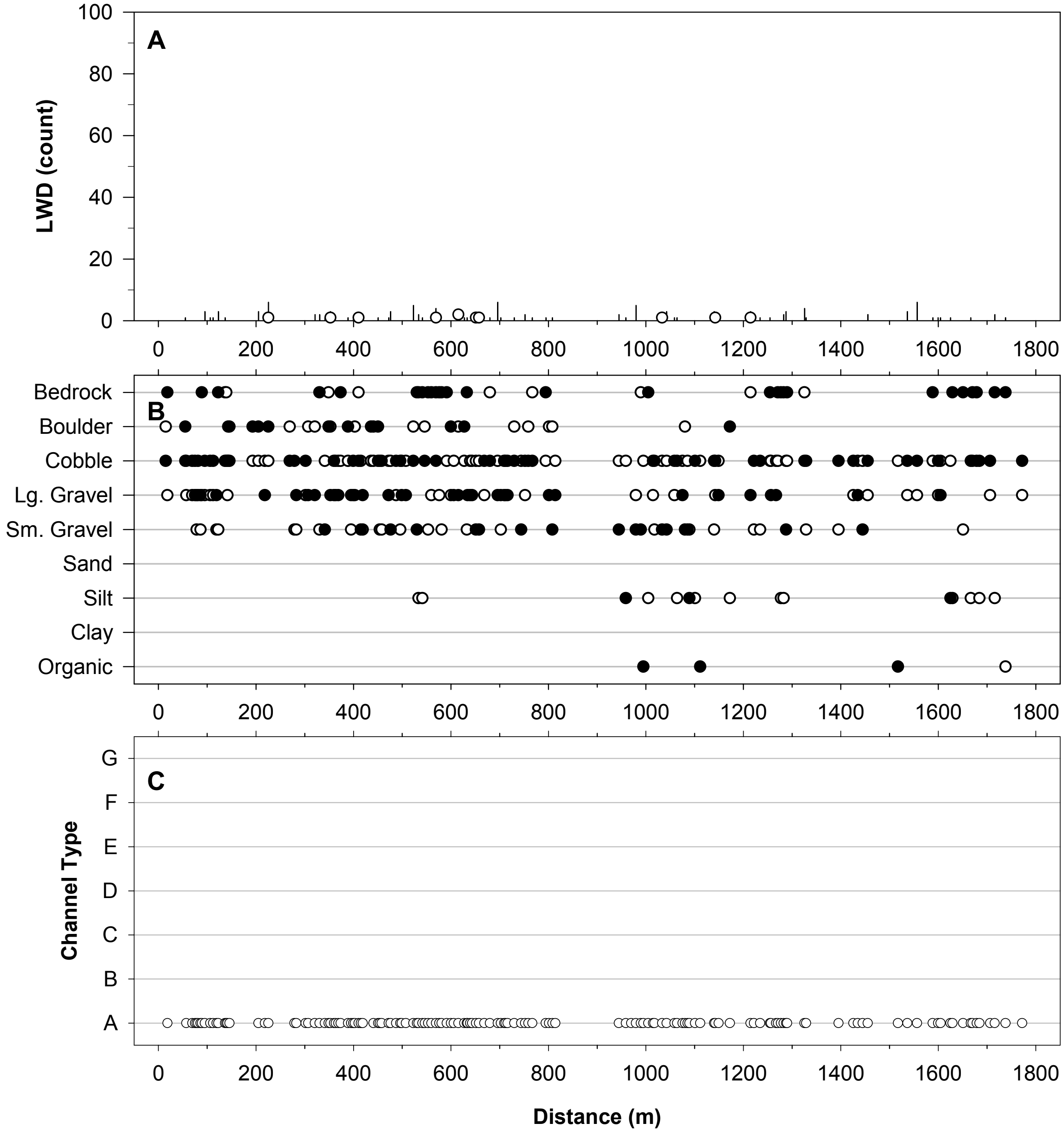
Stream features found on Horse Trough Hollow during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
UNDERGROUND	14.7		FROM 0 M TO 14.7 M; LARGE BOULDERS
UNDERGROUND	55		FROM 18.2 M TO 55.0 M
UNDERGROUND	142.9		FROM 141.4 M TO 142.9 M
UNDERGROUND	193		FROM 145.5 M TO 193.0 M
SIDE CHANNEL	218.1		IN ON RIGHT
UNDERGROUND	269		FROM 225.4 M TO 269.0 M
UNDERGROUND	435.9		FROM 418.7 M TO 435.9 M: BANK FELL IN TWICE ON RIGHT
TRIBUTARY	602.5		DRY, IN ON LEFT
OTHER	623.4		BARELY RUNNING
OTHER	625.5		BARELY RUNNING
UNDERGROUND	672.9		FROM 668.4 M TO 672.9 M
SLID	699.3		ON RIGHT
UNDERGROUND	739		FROM 729.7 M TO 739.0 M
UNDERGROUND	755		FROM 751.8 M TO 755.0 M: LEAF PACK ON RIGHT
OTHER	791.2		BARELY FLOWING; LEAF PACK ON RIGHT
OTHER	833.1		BARELY FLOWING, SMALL PUDDLES
UNDERGROUND	924.7		FROM 813.9 M TO 924.7 M
OTHER	956.4		BARELY FLOWING
UNDERGROUND	1024.3		FROM 1017.4 M TO 1024.3 M: BACK TO HARDWOODS
OTHER	1048.9		BARELY ANY WATER FLOWING
UNDERGROUND	1095		FROM 1089.3 M TO 1095.0 M
OTHER	1107		BARELY FLOWING
OTHER	1146.9		BARELY FLOWING
UNDERGROUND	1164.8		FROM 1149.2 M TO 1164.8 M
UNDERGROUND	1217.9		FROM 1214.5 M TO 1217.9 M
UNDERGROUND	1230.6		FROM 1221.6 M TO 1230.6 M
FALL	1242		6 METERS HIGH
OTHER	1264		BARELY ANY FLOW
FALL	1272.8		1.5 METERS HIGH
FALL	1291		3 METERS HIGH
TRIBUTARY	1293.7		IN ON RIGHT
OTHER	1336.4		CASCADE LACKING WATER
UNDERGROUND	1392.1		FROM 1328.5 M TO 1392.1 M
UNDERGROUND	1433.2		FROM 1425.5 M TO 1433.2 M
OTHER	1443.8		BARELY ANY FLOW
UNDERGROUND	1512		FROM 1455.1 M TO 1512.0 M
UNDERGROUND	1525.2		FROM 1517.0 M TO 1525.2 M
UNDERGROUND	1549.8		FROM 1536.3 M TO 1549.8 M
UNDERGROUND	1586.1		FROM 1556.2 M TO 1586.1 M
UNDERGROUND	1594.8		FROM 1588.4 M TO 1594.8 M
UNDERGROUND	1602.7		FROM 1599.3 M TO 1602.7 M
UNDERGROUND	1621.6		FROM 1604.3 M TO 1621.6 M
FALL	1628.9		3 METERS HIGH
OTHER	1640.7		BEDROCK; TOO SMALL TO MEASURE
OTHER	1663		NOT ENOUGH WATER TO MEASURE

Stream Feature	Distance (m)	Width (m)	Comments
OTHER	1667.9		BREAK IN UNITS
OTHER	1682.9		NOT ENOUGH TO MEASURE
OTHER	1696		NOT ENOUGH WATER; MOSS COVERED BEDROCK
OTHER	1713.9		NOT ENOUGH WATER
UNDERGROUND	1728.6		FROM 1715.7 M TO 1728.6 M
OTHER	1735.9		
OTHER	1760		NOT ENOUGH WATER
BRAID			DOWNSTREAM 373.4 UPSTREAM 384

Stream crossings encountered on Horse Trough Hollow during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Horse Trough Hollow, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence of North River and Horse Trough Hollow northeast of Forest Service Road. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Horse Trough Hollow during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
POOL	4	81	
GLIDE	9	111.9	
POOL	14	145.5	WASHED OUT BANK ON RIGHT
RIFFLE	4	205	
POOL	19	330.3	SIDE POOL ON RIGHT
RIFFLE	9	359.9	
POOL	24	373.4	WASHED OUT BANK ON RIGHT
GLIDE	29	418.7	
GLIDE	34	487.5	WASHED OUT BANK ON RIGHT
RIFFLE	14	496	TURNING FROM HARDWOOD TO DEAD HEMLOCKS
POOL	39	553	
RIFFLE	19	591.4	
POOL	44	605.7	A LOT OF MOSS COVERED BEDROCK
POOL	49	639.2	
POOL	54	712.2	
POOL	59	758.7	
RIFFLE	24	766.8	DEBRIS PILE UNDER ROOTS OF TREE ON LEFT
GLIDE	64	944.4	
POOL	69	1017.4	
RIFFLE	29	1058.5	
POOL	74	1089.3	SIDE POOL ON RIGHT
GLIDE	79	1172.2	
FALL		1242	6 METERS HIGH
RIFFLE	34	1254.5	
POOL	84	1270.5	PLUNGE POOL
POOL	89	1328.5	
GLIDE	94	1455.1	
POOL	99	1604.3	
POOL	104	1669.9	
POOL	109	1737.7	

Stream:	**Mitchell Branch**
District:	Dry River
USGS Quadrangle:	West Augusta
Survey Date:	06/16/04
Downstream Starting Point:	651608E 4243915N; confluence of White Oak Run
Total Distance Surveyed (km):	1.1

	Pools	**Riffles**
Percent of Total Stream Area:	13	87
Total Area (m^2):	374±328	2588±408
Correction Factor Applied:	1.28	1.88
Number of Paired Samples:	3	2
Total Count:	28	29
Number per km:	25	26
Mean Area (m^2):	13	89
Mean Maximum Depth (cm):	37	14
Mean Average Depth (cm):	23	6
Mean Residual Depth (cm):	13	--
Percent Surveyed as Glides:	0	--
Percent Surveyed as Runs:	--	3
Percent Surveyed as Cascades:	--	0
Percent with >35% Fines:	4	0

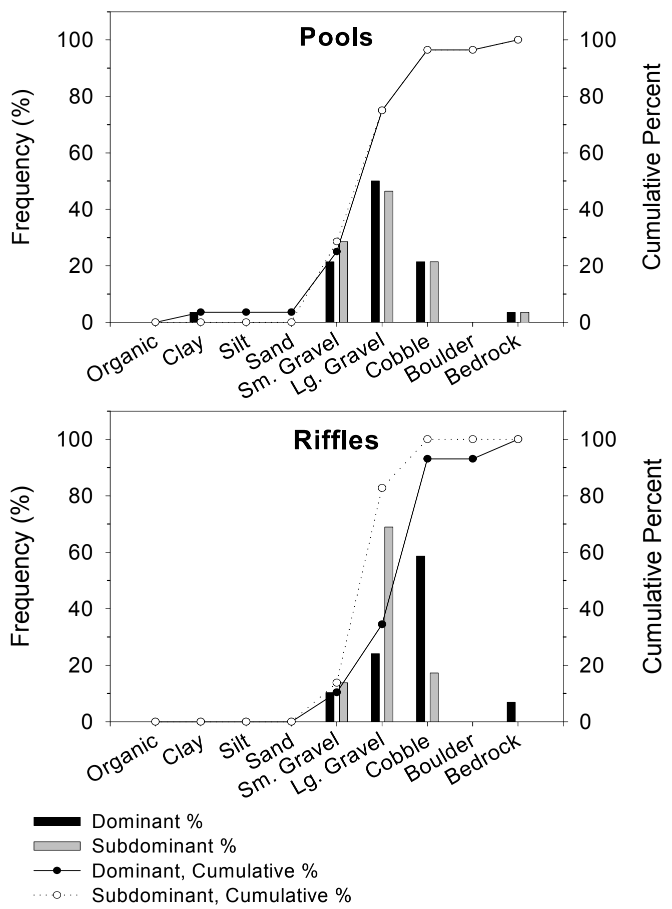
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	39
< 5 m long, > 55 cm diameter:	0
> 5 m long, 10 cm – 55 cm diameter:	8
> 5 m long, > 55 cm diameter:	3
Total:	50

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	17	6
Maximum	22	12
75th Percentile	20	9
25th Percentile	14	2
Minimum	12	1

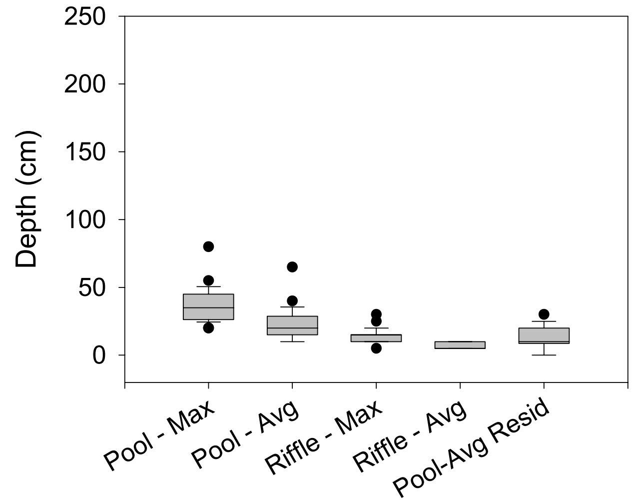
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	0
B:	0
C:	0
D:	0
E:	0
F:	100
G:	0

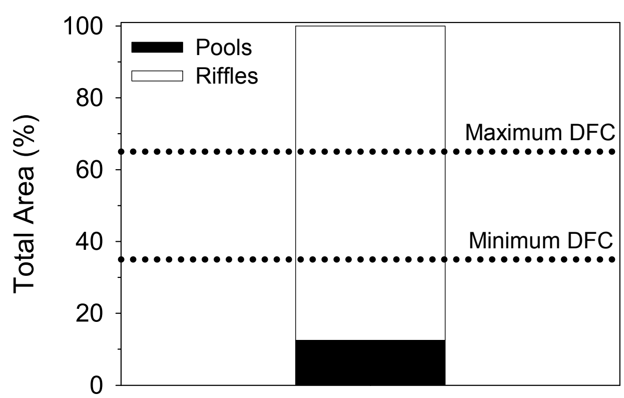
Other Stream Attributes	
Mean Bankfull Channel Width (m):	5
Mean Channel Gradient (%):	4
Median Water Temperature (C):	14



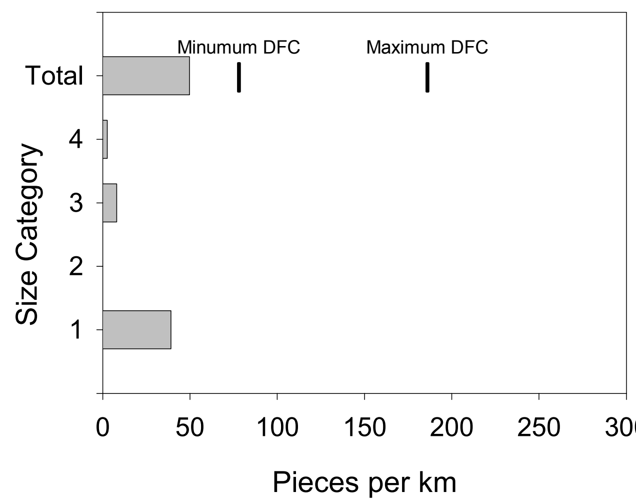
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Mitchell Branch, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Mitchell Branch, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Mitchell Branch in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Mitchell Branch, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

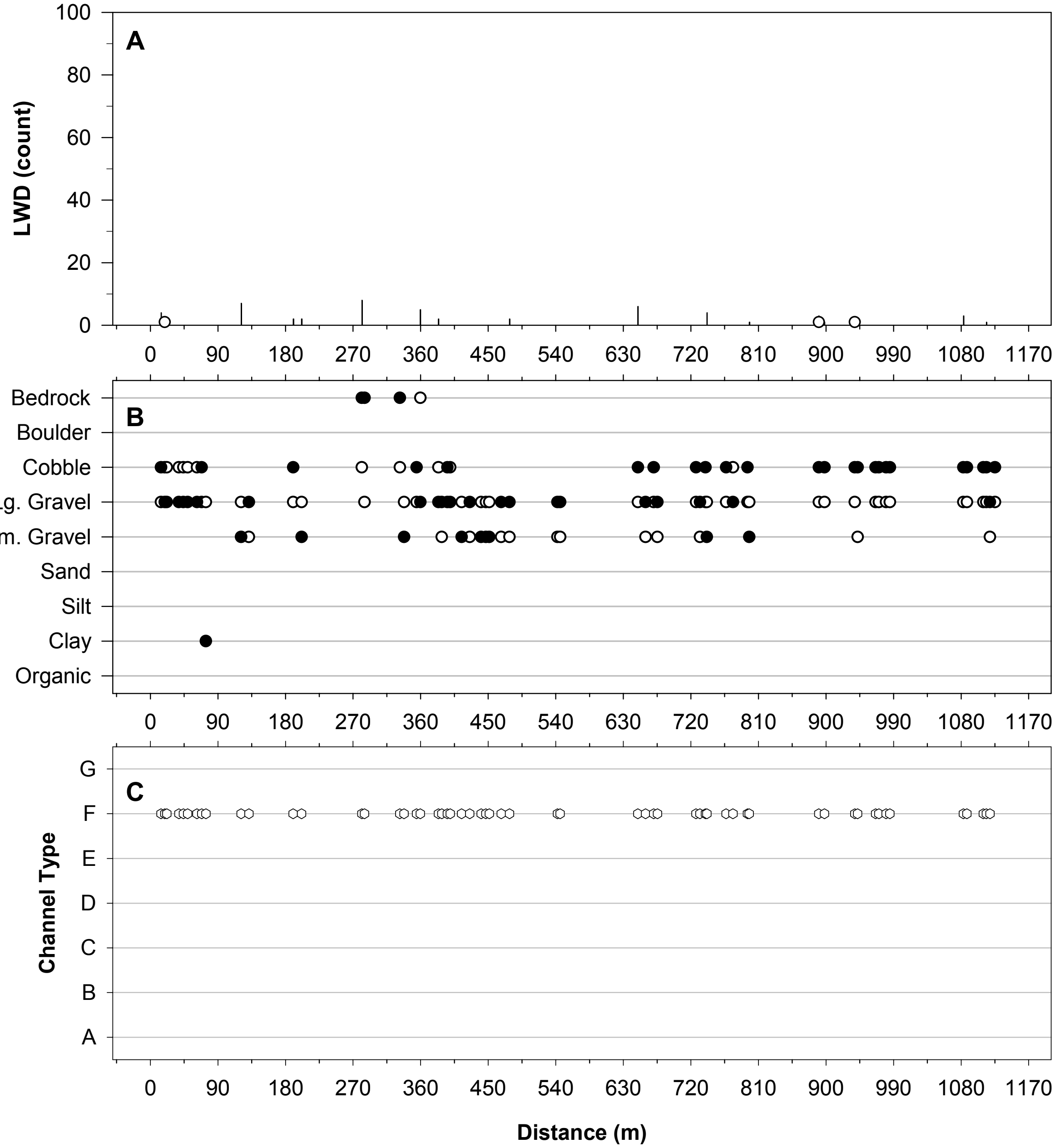
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Mitchell Branch during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
TRIBUTARY	765.6		ENTERS ON RIGHT
FORD	961.6		HIKING TRAIL
TRIBUTARY	1072		ENTERS ON RIGHT
UNDERGROUND	1125		FROM 1119 m TO 1125 m

Stream crossings encountered on Mitchell Branch during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	Ford
Distance (m):	961.6
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	Y
Photos (y/n):	Y
Comments:	Looks like it has not been used recently



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Mitchell Branch, summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence of White Oak Run. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Mitchell Branch during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
POOL	10	359.6	
RIFFLE	19	727	
RIFFLE	29	1118.5	

Stream:	**Stillhouse Hollow**
District:	Dry River
USGS Quadrangle:	West Augusta
Survey Date:	06/16/04
Downstream Starting Point:	17 652385E 4245769N; confluence of Stillhouse Hollow and a side channel of North River west of Forest Service Road 95
Total Distance Surveyed (km):	3.0

	Pools	**Riffles**
Percent of Total Stream Area:	23	77
Total Area (m^2):	1422±115	4723±554
Correction Factor Applied:	0.91	0.99
Number of Paired Samples:	18	17
Total Count:	180	163
Number per km:	60	54
Mean Area (m^2):	8	29
Mean Maximum Depth (cm):	25	14
Mean Average Depth (cm):	15	7
Mean Residual Depth (cm):	8	--
Percent Surveyed as Glides:	23	--
Percent Surveyed as Runs:	--	2
Percent Surveyed as Cascades:	--	6
Percent with >35% Fines:	27	0

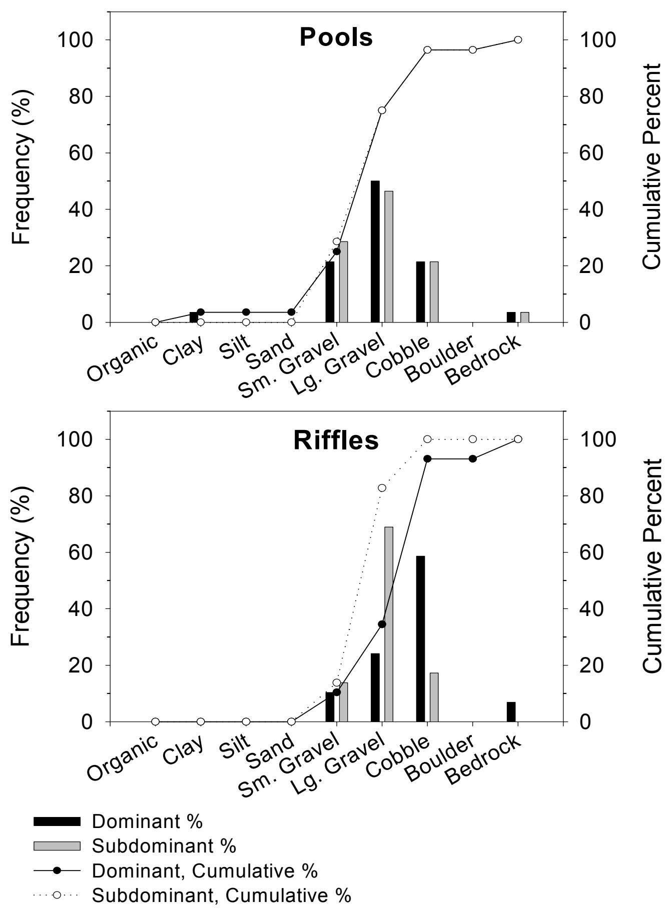
Large Woody Debris Size	**Pieces per km**
< 5 m long, 10 cm – 55 cm diameter:	18
< 5 m long, > 55 cm diameter:	1
> 5 m long, 10 cm – 55 cm diameter:	33
> 5 m long, > 55 cm diameter:	4
Total:	56

Riparian Width	**Total Width* (m)**	**Left & Right Width** (m)**
Mean	13	4
Maximum	70	60
75th Percentile	13	3
25th Percentile	6	1
Minimum	4	0

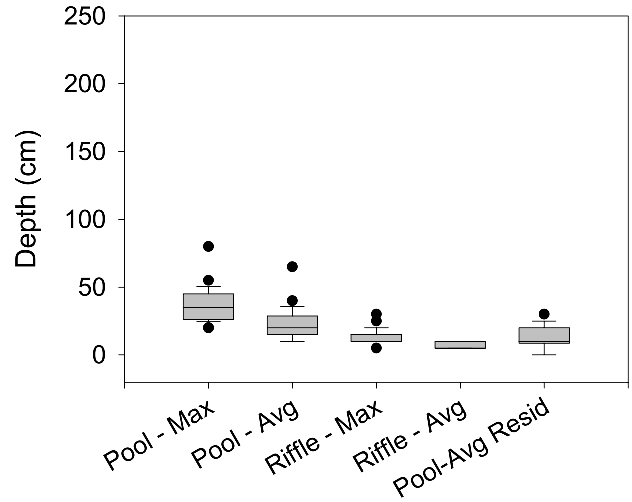
*Left riparian, right riparian, and bankfull channel widths were added together for calculations
**Left and right riparian widths were grouped (not added) together for calculations

Rosgen's Channel Type	**Frequency (%)**
A:	43
B:	0
C:	54
D:	0
E:	0
F:	0
G:	3

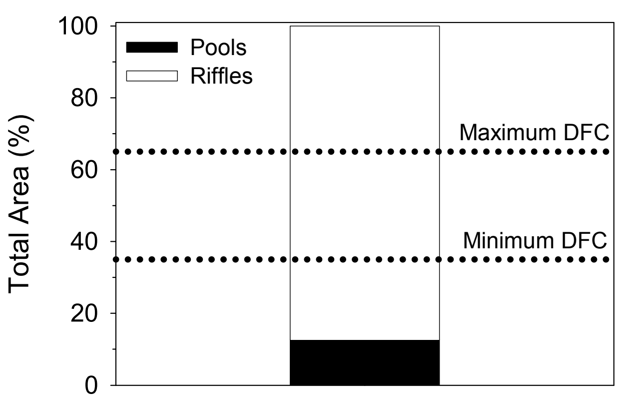
Other Stream Attributes	
Mean Bankfull Channel Width (m):	5
Mean Channel Gradient (%):	5
Median Water Temperature (C):	17



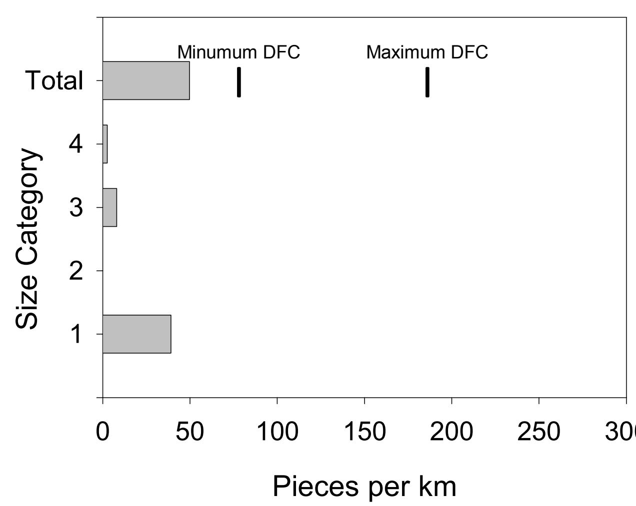
Frequency (percent) and cumulative percent of dominant and subdominant substrate occurrence for pools and riffles in Stillhouse Hollow, summer 2004.



Maximum and average depths and residual pool depths for pools and riffles in Stillhouse Hollow, summer 2004. The top and bottom of the boxes represent the 25th and 75th percentiles, the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles, and closed circles represent the entire range of the data.



Estimated area of Stillhouse Hollow in pools and riffles as calculated using BVET techniques, summer 2004. The GWJNF DFC is between 35 and 65 percent of total stream area in pools.



LWD per kilometer in Stillhouse Hollow, summer 2004. Y-axis labels are LWD size classes described below. The GWJNF DFC for total LWD is between 78 and 186 pieces per km.

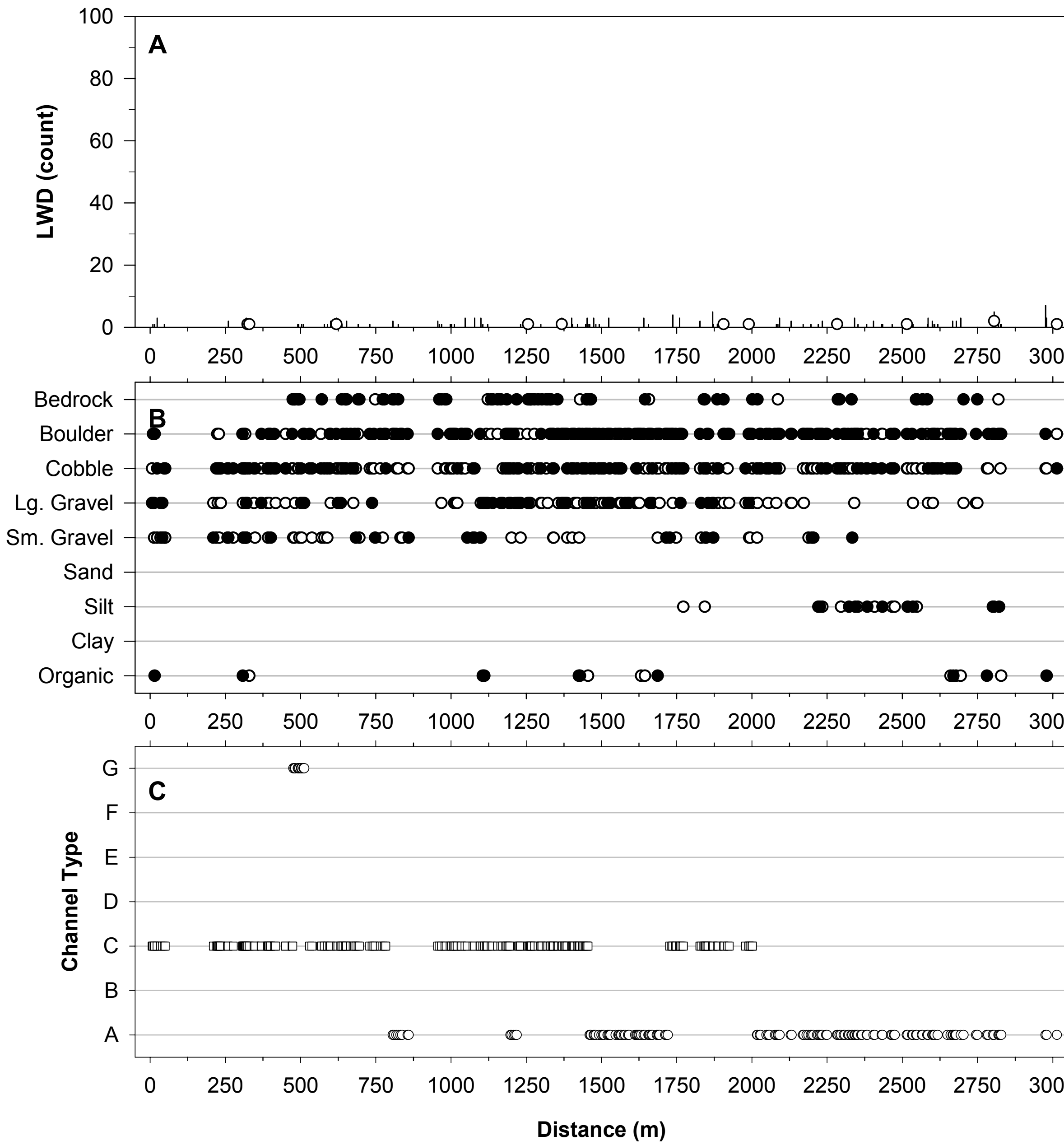
Size 1: < 5 m long, 10-55 cm diameter
Size 2: <5 m long, > 55 cm diameter
Size 3: > 5 m long, 10-55 cm diameter
Size 4: > 5 m long, > 55 cm diameter

Stream features found on Stillhouse Hollow during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Stream Feature	Distance (m)	Width (m)	Comments
SEEP	19.2		OUT OF RIGHT BANK
OTHER	38		LOW WATER
SIDE CHANNEL	84.6		ON RIGHT
FORD	159.6		TRAIL CROSSING
FORD	198.2		TRAIL
UNDERGROUND	208.3		FROM 49.8 m TO 208.3 m
UNDERGROUND	215.5		FROM 209.9 m TO 215.5 m
SIDE CHANNEL	648.9		IN ON RIGHT
FALL	695.2		0.5M HIGH
TRIBUTARY	1188		IN ON RIGHT
LAND SLIDE	1265.4		ON LEFT, STREAM EROSION
SIDE CHANNEL	1484.3		IN ON RIGHT
LAND SLIDE	1545		EROSION
UNDERGROUND	1971.8		FROM 1924.6 m TO 1971.8 m
LAND SLIDE	2082.3		BANK STEEP SLOPE AND STREAM EROSION
UNDERGROUND	2175.9		FROM 2172.6 m TO 2175.9 m
TRIBUTARY	2333.8	0.5	IN ON LEFT' DRY
TRIBUTARY	2508.3		ON RIGHT
SEEP	2514.9		
UNDERGROUND	2629.2		FROM 2617.2 m TO 2629.2 m
UNDERGROUND	2657.5		FROM 2649.7 m TO 2657.5 m
UNDERGROUND	2699		FROM 2693.6 m TO 2699 m
UNDERGROUND	2742.2		FROM 2702.8 m TO 2742.2 m
UNDERGROUND	2777.5		FROM 2749.1 m TO 2777.5 m
UNDERGROUND	2789		FROM 2785.3 m TO 2789 m

Stream crossings encountered on Stillhouse Hollow during BVET habitat inventory, summer 2004. Distance is number of meters from start of inventory. Culvert perch is distance from water surface to bottom of culvert. Natural substrate is whether there was natural substrate present throughout entire length of culvert.

Crossing type:	None described
Distance (m):	
Road number/trail name:	
Culvert type:	
Culvert outlets (n):	
Culvert diameter (cm):	
Culvert height (cm):	
Culvert material:	
Culvert perch (cm):	
Substrate (y/n):	
Photos (y/n):	
Comments:	



Distribution and abundance of LWD, distribution of substrates, and distribution of Rosgen's channel types (Rosgen 1996) in Stillhouse Hollow summer 2004. LWD, substrate, and channel type were recorded for each habitat unit in the stream. X-axis indicates distance upstream from confluence of Stillhouse Hollow and a side channel of North River west of Forest Service Road 95. Vertical bars on (A) indicate total count of LWD; open circles represent the amount of the total LWD that was >5 m in length, >55 cm in diameter (size 4). Closed circles on (B) are dominant substrates, open circles are subdominant substrates. See Appendix A for substrate sizes. See Appendix A for channel type descriptions from (C).

Photos taken on Stillhouse Hollow during BVET habitat survey, summer 2004. Distance is meters from start of survey.

Unit Type	Unit Number	Distance (m)	Comments
POOL	4	40.5	
RIFFLE	4	47.1	
POOL	9	229.9	
RIFFLE	9	276.3	
POOL	14	314.6	
RIFFLE	14	319.2	SWITCHING TO EVERY TENTH SAMPLE
RIFFLE	24	475.9	ROSGEN G CHANNEL
POOL	35	624	
RIFFLE	34	633.6	
POOL	45	782.9	
RIFFLE	44	806.5	
RIFFLE	54	1033.7	
POOL	55	1036	POOL PIC WAS TAKEN BEFORE RIFFLE PIC
POOL	65	1192.2	
RIFFLE	64	1195.8	
GLIDE	75	1289.3	
RIFFLE	74	1329.4	
POOL	85	1385.9	
RIFFLE	84	1436.7	
POOL	95	1476.9	
RIFFLE	94	1546.6	ENDED SURVEY ON 6\16\04 AT 1745
POOL	105	1623.3	
RIFFLE	104	1683.9	
POOL	115	1720.1	
RIFFLE	114	1850.9	
POOL	125	1871.9	
RIFFLE	124	2048.2	
POOL	135	2057.8	
POOL	145	2220.3	
CASCADE	134	2291.3	
POOL	155	2352	
RIFFLE	144	2462.4	
POOL	165	2567.1	
RIFFLE	154	2649.7	

Appendix A:

Size classes used to categorize large woody debris during BVET habitat surveys on the Dry River Ranger District, summer 2004. Woody debris < 1.0 m in length or < 10 cm in diameter were omitted.

Size Class	Length (m)	Diameter (cm)
1	< 5	10-55
2	< 5	> 55
3	> 5	10-55
4	> 5	> 55

Size classes used to categorize substrate particles during BVET habitat surveys on the Dry River Ranger District, summer 2004. Size was visually estimated on the intermediate axis (b-axis).

Size Class	Name	Size (mm)	Description
1	Organic	--	Dead organic matter, leaves, detritus, etc.
2	Clay	< 0.00024	Sticky
3	Silt	0.00024-0.0039	Slippery
4	Sand	0.0039-2	Gritty
5	Small Gravel	3-16	Sand to thumbnail
6	Large Gravel	17-64	Thumbnail to fist
7	Cobble	65-256	Fist to head
8	Boulder	>256	Larger than head
9	Bedrock	--	Solid parent material

Bankfull channel characteristics used to determine Rosgen channel types in the field during BVET habitat surveys on the Dry River Ranger District, summer 2004.

Channel Type	A	B	C	D	E	F	G
Entrenchment	< 1.4	1.4 – 2.2	> 2.2	n/a	> 2.2	< 1.4	< 1.4
W/D Ratio	< 12	> 12	> 12	> 40	< 12	> 12	< 12
Slope (%)	4 – 9.9	2 – 3.9	< 2	< 4	< 2	< 2	2 – 3.9