Appendices
Final Environmental Impact Statement
for the
Land and Resource Management Plan

United States
Department of
Agriculture

Forest Service

Southern Region

Land Between The Lakes
National Recreation Area

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Appendices
Final Environmental Impact Statement for the Land and Resource Management Plan

Land Between The Lakes National Recreation Area

Trigg and Lyon Counties in Kentucky
Stewart County, Tennessee

United States Department of Agriculture
Forest Service
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ABSTRACT

This Final Environmental Impact Statement (FEIS), prepared by the United States Department of Agriculture Forest Service, is required in conjunction with the revision of the Tennessee Valley Authority's (TVA) 1994 Natural Resource Management Plan (NRMP). It discloses and explains the direct, indirect, and cumulative environmental impacts of the four alternatives developed during the revision of the 1994 Plan into a Forest Service Land and Resource Management Plan (LRMP), or Area Plan, for Land Between The Lakes (LBL). The four alternatives call for varying degrees of change, and are titled alternative W, X, Y, and Z. A "no action" alternative is included (Alternative W), which would continue the management in a manner consistent with TVA's 1994 Plan. The alternatives provide different mixes of goods and services through various goals, objectives, land allocation prescriptions, and program standards. The Forest Service has chosen Alternative Y as the Selected Alternative, and developed this alternative into the Area Plan.

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Appendix A

PUBLIC PARTICIPATION

A.1 Summary of Public Involvement

Introduction

From the onset of developing the planning timeline for this Area Plan revision, the LBL Leadership Team made the determination to encourage and include the public at every step of the way. Throughout the entire Area Plan process, every effort was made to promote and publicize ways in which the public could stay informed and provide their input. The Forest Service knows and understands that LBL holds a special place in the hearts of many visitors, local residents and former residents of these unique lands. The success of the implementation of this Final Plan will affect all these publics in different ways. As such, the public's input is crucial in determining the final strategic course the management of LBL must take.

The success of the public involvement objectives is evident in the integration of the best available science, combined with the meaningful opinions, ideas, and comments from the public.

Notice of Intent

On June 4, 2003, a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for revision of the Tennessee Valley Authority's (TVA) 1994 Natural Resource Management Plan (NRMP) into an Area Plan for LBL was published in the Federal Register. The Forest Service also released a Planning Background Document (PBD) which described the existing conditions of LBL, and asked for public comment on the Forest Service's assessments of the needs for change in the existing management direction.

Initial Scoping Efforts

Subsequent to the NOI, a series of five public scoping sessions were conducted in "gateway" communities surrounding LBL to solicit and review comments and concerns from the public. Special small group discussions were conducted at each session to develop better understanding of the participants' comments and to allow for dialogue among the public. Written comments (mail and electronic submissions) and telephone input were received during the 45-day period ending July 21, 2003.

Subsequent to this required scoping period, the LBL staff developed and conducted two focused small group discussion sessions to help shape the alternatives. Each session focused specifically on the positive aspects, values, and desire of the two issues which

received the vast majority of comments during scoping - Recreation and Environmental Education, and Vegetation Management.

Table A-1 outlines the dates, locations, participant numbers, and types of sessions conducted as part of formal and informal scoping. Copies of the public notices, which were distributed in support of the scoping process area, as well as summaries of all public scoping sessions are contained in the Project Record.

Table A-1 - Public Involvement Sessions

Date & Time	Location	Participants*	Type of Session
June 28, 2003 1 to 5 p.m.	Lakeland Jamboree Cadiz, Kentucky	38	Open, small group and "drop-in"
June 30, 2003 6:30 to 9:30 p.m.	Weaks Community Center Murray, Kentucky	26	Open, small group and "drop-in"
July 1, 2003 6:30 to 9:30 p.m.	USDA County Extension Offices Benton, Kentucky	25	Open, small group and "drop-in"
July 10, 2003 6:30 to 9:30 p.m.	Dover Elementary School Dover, Tennessee	75	Open, small group and "drop-in"
July 12, 2003 1 to 5 p.m.	Lee S. Jones Community Building Eddyville, Kentucky	25	Open, small group and "drop-in"
August 21, 2003 7 to 9 p.m.	Golden Pond Administrative Building (Forest Service offices) Golden Pond, Kentucky	27	Appreciative Inquiry focus-group process
August 23, 2003 9-11 a.m.	Brandon Spring Group Center Dover, Tennessee (FS facility)	31	Appreciative Inquiry focus-group process

** Some attendance numbers are approximations based upon written comments received and the numbers of participants in small groups. The numbers for the two Appreciative Inquiry sessions are exact counts.*

Issue Development (including content analysis)

In developing the revised Area Plan, the Interdisciplinary Planning Team had to consider the 'need for change' to the 1994 Plan as outlined in the NOI. The Planning Team reviewed information and analysis relevant to the need for change from many different sources, including the original mission and purposes for LBL as outlined in the Protection Act:

- Managing the resources for optimum yield of outdoor Rec/EE;
- Demonstrating innovative programs and cost-effective management of LBL;
- Stimulating development of surrounding region and extending the beneficial results.

After review and analysis of input received during the scoping period, the issues identified in the NOI remained the primary issues. During scoping, several key project-level issues were identified through the comments received. While these issues are valid and important to both LBL and the surrounding communities, they will be better addressed within a project plan, and not an overarching Area Plan. Consideration will be

given, however, to how the guidelines and direction established in the Area Plan will support, facilitate, or address these future project-level decisions.

Responses related to the Planning Background Document validated that the three key issues listed below were, in fact, the most important ones to resolve at this time, and that there exists a lesser need to change others. They are supported by both the comments received during the scoping and previous management direction for LBL. These three issues are:

1. **Recreation and Environmental Education:** How will LBL best manage resources for the optimum yield of outdoor Rec/EE?

2. **Vegetation Management:** How will the vegetation on LBL be managed and what desired conditions would best provide the optimum sustainable yield of resource outcomes and contribute to regional economies?

3. **Special Designations:** Should areas with special management designation continue to be managed under these designations or be changed? Should additional areas be designated for special management?

Alternative Development

In contrast to the methods other Forest units have used in alternative development, the LBL Planning Team made the decision to develop individual management strategies to address each issue rather than developing management themes and then fitting potential management options for each issue within those themes. Each of the issues was analyzed as a single topic, rather than being analyzed together under predetermined themes. The end result gave the Planning Team a set of management 'building blocks' specific to each of the issues, which could then be used in constructing the alternatives. This approach focused the planning process on dealing strictly with the identified 'need for change' aspect issues.

Three "building blocks" from each issue were then combined into alternatives and identified by themes. In some cases, the blocks did not fit with each other in terms of principle or direction, and could not be combined to form a reasonable alternative. Combinations that fell outside the law, were not in keeping with the purpose of LBL, or were not validated by the public, were dropped from further consideration. Other obvious combinations of blocks emerged, which helped the team develop the four alternatives analyzed in the DEIS. Any significant cumulative effects would be determined on the combination of blocks.

Alternative Building Blocks

Based upon the final issues, public comments and concerns, and desired conditions, the following alternative "Building Blocks" have been developed to address the issues involved in revising the Area Plan for LBL:

Issue #1 - Recreation and Environmental Education

Rec/EE Building Block A:
Dispersed Environmental Education Focus; Reduced Emphasis on Developed Recreation Amenities and Services

The focus of this block is to create an environmental education (EE) platform that places emphasis on non-facility-based opportunities. This option also provides for a decrease in the levels and types of services and amenities offered or provided at developed recreational facilities.

Non-facility-based opportunities would be the driving element of EE, supported by the established EE facilities. Environmental education facilities would be evaluated, and improved if necessary, to reflect advancements in educational and interpretive methods, and environmental sciences. No new highly-developed facilities would be added, and no net increase in operational EE facilities would occur in this option. As an example, if Youth Station were reopened, another EE facility would be closed. EE activities and efforts would focus on the goal of delivering appropriate and targeted EE messages and information to every LBL visitor. New EE sites, areas, trails, and programs would be developed based upon user demands and to raise environmental awareness

Highly developed recreational areas and facilities such as Hillman Ferry, Piney and Wranglers campgrounds, and Turkey Bay Off-Highway Vehicle area, would be reduced in scope, in terms of the levels and types of the amenities offered. The extent of the services provided at all developed facilities would be scaled back as a means of creating a less developed recreational environment. Little change would be expected at lake access, day use, and other lesser-developed recreation areas.

The overall fee structure for all recreation and EE facilities and opportunities would be focused on significant reductions based upon the extent and level of services or amenities provided at all facilities or areas. This amounts to a trade-off between a reduction in fees for a reduction in services and amenities, and a commensurate reduction in recreation opportunities.

Rec/EE Building Block B:
Increase in Facilities and Scope of Recreation and Environmental Education

The focus of this block would be to provide increased Rec/EE opportunities and programs through development of new facilities and areas while remaining consistent with the requirements of the Protection Act. These opportunities would be similar to existing opportunities currently offered at LBL, such as developed campgrounds, lake access areas, trails, environmental education facilities, etc. Highly developed commercial facilities such as marinas, condominiums, golf courses, or similar sites that would be in direct competition with regional businesses and inconsistent with the mission of LBL, would not be considered.

Current recreational facilities, including campgrounds, lake access areas and boat ramps, trails, and developed day-use areas, would be improved to provide more of the facilities and amenities that users of those areas have requested. Potential new recreational facilities and areas would be evaluated for development and expansion as future recreational demands indicate, although no new level 5 campgrounds or outposts would be considered..

The facilities for EE would be evaluated for expansion within their current areas. New areas would be identified for development or reopening based upon several factors, including: established objectives to provide environmental messages, information and education to visitors; new technologies in environmental sciences; advancements in educational delivery methods; and visitor demands. EE efforts would be expanded through development of sites, trails, areas, and programs to meet the growing demand for these types of experiences.

Fee structure for expanded and new facilities or services would be evaluated in conjunction with operational costs. Preference would be given to reducing the EE fee structure, in combination with appropriate and acceptable increases in the "specialized use" recreation fee structure. Any fee re-structuring would keep services on LBL at a non-competitive level with surrounding communities, and considerate of disadvantaged or underprivileged sections of the public.

Rec/EE Building Block C:
Increase in Dispersed Environmental Education and Recreation Opportunities with Trade-offs

This building block focuses on providing for an increase in dispersion of environmental education and recreational opportunities. Management direction under this block would support potential significant adjustments in the amenities and services now offered at existing developed facilities. This would also allow for possible realignment of existing developed areas to better meet public demand for dispersed opportunities, and to offset operational costs.

Non-facility-based EE activities and opportunities would be given an increased priority, compared to current levels, through an area-wide focus that is more obvious within prescriptions and the resulting management of those areas. Some prescriptions would have a primary emphasis to provide non-facility-based EE activities and incorporate the other resource management activities of the area as components of the program. An example might be nature-viewing or wildlife management areas that could use, as much as possible, existing programs (e.g. Nature Watch) that integrate recreation, education, and conservation components.

Dispersed recreational opportunities would be expanded to provide more balance in overall recreational opportunities. Examples of this expansion could include, but not be limited to: swimming beaches, converting a lake access area emphasis from overnight camping to day-use recreation, and shoreline fishing areas.

Highly developed recreation and EE facilities and areas would be evaluated for possible improvement, realignment, or reduction in order to meet optimum efficiency in the operation of facilities. Improvements made to existing developed facilities would be done within current facility boundaries. No net increase in the number of facilities would be permitted under this block. Examples of these improvements or realignments would be increasing the number of electric camping sites at campgrounds; redesigning EE exhibits or facilities to better support educational objectives.

Fees across LBL for EE and recreation would also be evaluated for realignment or reduction in conjunction with the dispersed activities and the quality of the programs and exhibits. The quality and value of the programs and exhibits, effects on visitation, impacts on underprivileged or disadvantaged persons, and operational costs would be the determining factors in establishing a revised fee structure for all recreation and EE opportunities.

Rec/EE Building Block D:
No Change

Under this block, the management practices and guidelines from the 1994 Plan and current policy would be continued. No new facilities would be added under this block, and no significant changes to existing services or amenities would be expected. This option would allow for the localized expansion of existing “specialized use” facilities or programs based upon visitor increases, user demands and resource capabilities, or to accommodate developments in recreational or EE opportunities on a regional or national level.

Issue #2 - Vegetation Management

Vegetation Management Building Block A:
Enhancing Ecological Diversity

This building block would focus on actively managing our land and water resources to support and enhance wildlife and outdoor recreation opportunities across LBL. This will include looking at the composition, structure, spatial distribution, and physical characteristics of our forested and open land areas to meet our forest health and species viability needs. This may be accomplished by reallocating some open land acres to forest in selected areas and reclaiming or creating openings in other areas with no net loss of early successional habitat; changing the composition and abundance of open land types; and implementing prescribed fire on a larger landscape scale than has been done since adopting the 1994 Plan. Where conflicts occur that can not be mitigated the enhancement of forest health and species viability would remain the priority over other management elements.

Ecological diversity may be enhanced through various methods of active management. The historical management of the land resources in LBL and proven techniques will be considered in determining the types of treatments. The treatment methods may include, but are not limited to: prescribed fire; selected minimal management; forest management to increase or decrease forested acres; some conversion of open lands to grasses; mowing and grain cropping; and other proven methods of treatments such as the use of herbicides.

This block would consider that a percentage of open land acres would be gradually converted and restored to natural vegetation types that include native warm season grasses and forb species. Open lands could be cropped. The treatments determined to create and maintain these conditions would support and maintain forest health, species viability, water quality, and improved soil productivity and stabilization.

This block would also consider how forest composition and structure would be maintained in oak-hickory forest types. The treatments that would be considered would provide for open forest canopy conditions and open lands maintained primarily in natural vegetation types for a variety of viewing opportunities. Viewing opportunities for some forms of wildlife would be limited due to their ability to hide in tall grasses.

Vegetation Management Building Block B:
Passive Vegetation Management

Under this block there would be a limited application of those activities and treatments determined necessary to maintain forest health and species viability, to control epidemic outbreaks, to provide visitor safety, and to maintain utility and vehicular access rights-of-way. The focus of this building block would be to allow a large percentage of the vegetation across LBL to develop unrestricted and unmanaged, as much as possible.

The passive management option would promote the reversion of open lands to forest and forest cover types aging to old growth beyond the lifespan of this Area Plan. Recreational and EE opportunities would be secondary to vegetation management to decrease the effects of human intervention and occupation in both developed and dispersed areas.

Vegetation Management Building Block C:
No Change

Under this block, the management practices and guidelines from the 1994 Plan would be continued as they were planned. No significant increase or decrease of timber management, or changes to open lands, wetland, and riparian areas would occur.

Issue #3 - Special Designations

Special Designations Building Block A:
Recommendation for Wilderness and Roadless Areas within Core Areas

The focus of this block is to recommend part of the southern portion of the LBL Core Area for Wilderness designation. Part of the evaluation leading to this Wilderness recommendation will examine possible road closures or rerouting to accommodate management of a roadless area. All other special designations would be managed under the current Area Plan guidance.

Special Designations Building Block B:
No Change to the 1994 Plan

Current Core Areas and other special areas, such as Research Natural Areas, would maintain total acreages and current management activities.

Alternatives and Building Blocks Not Carried Forward

When you consider the total number of blocks developed, the Planning Team could have possibly developed a total of 24 different alternative combinations. The majority of the building block combinations, however, were quickly discounted based upon major inconsistencies or inadequacies produced by the combinations themselves. All combinations developed could readily be placed into one of four categories:

(1) Reasonable, proper and appropriate combinations to consider in addressing the Issues;
(2) Outside the scope of law applicable to the Area Plan revision (including the stated purpose of LBL);
(3) No significant difference between “no change” alternative or another combination that better addressed the issues or need for change;
(4) Combinations obviously impractical or unreasonable to implement or whose building blocks were in conflict with other blocks in the same combination.

The possible combinations in the latter 3 categories listed above were dropped from further consideration. These combinations are listed in Table A-2.

Table A-2 - Possible building block combinations not carried forward as alternatives for consideration

The letters under the "Possible Combination" column refer to the building block designation from the Alternatives Management Summary paper dated November 21, 2003. They are summarized in the second column, "Description of Blocks."

Possible Combination	Description of Blocks	Possible Conflicts	Why Disregarded
A-A-A	Increase non-facility-based EE, Decrease Rec Improve Ecological Diversity Recommend Wilderness	Wilderness designation requires passive vegetation management. Very little public comment toward reducing rec.	Does not support Mission to optimize Recreation
A-A-B	Increase non-facility-based EE, Decrease Rec Improve Ecological Diversity No Wilderness recommendation	No significant conflicts	Does not support mission to optimize recreation
A-B-B	Increase non-facility-based EE, Decrease Rec Passive Vegetation Management No Wilderness recommendation	No significant conflicts	Does not support mission to optimize recreation
A-C-A	Increase non-facility-based EE, Decrease Rec No Change to Veg. Recommend Wilderness	No significant conflicts	Does not support mission to optimize recreation
A-C-B	Increase non-facility-based EE, Decrease Rec No Change to Veg. No Wilderness recommendation	No significant conflicts	Does not support mission to optimize recreation
B-A-A	Increase facilities for Rec/EE Improve Ecological diversity Recommend Wilderness	No significant conflicts	Similar to Alternative X, but with recommendation for Wilderness
B-B-A	Increase facilities for Rec/EE Passive Vegetation Management Recommend Wilderness	Veg. management is integral to increased Rec/EE opportunities	Not feasible to increase rec/EE opportunities and not have commensurate Veg. management
B-B-B	Increase facilities for Rec/EE Passive Vegetation Management Recommend Wilderness	Veg. management is integral to increased Rec/EE opportunities	Not feasible to increase rec/EE opportunities and not have commensurate Veg. management
B-C-A	Increase facilities for Rec/EE No Change to Veg. Recommend Wilderness	Veg. management is integral to increased Rec/EE opportunities	Not feasible to increase rec/EE opportunities and not have commensurate Veg. management
B-C-B	Increase facilities for Rec/EE No change to Veg. No Wilderness recommendation	Veg. management is integral to increased Rec/EE opportunities	Not feasible to increase rec/EE opportunities and not have commensurate Veg. management
C-A-A	Increase Dispersed Rec/EE Improve Ecological diversity Recommend Wilderness	No significant conflicts	Similar to Alternative W, but with a recommendation for Wilderness

Table A-2 (Continued)

Possible Combination	Description of Block	Possible Conflicts	Why Disregarded
C-B-A	Increase Dispersed Rec/EE Passive Vegetation Management Recommend Wilderness	Increase in Rec/EE would require more Veg. mgt than is outlined in Veg. block B	Passive Veg. management does not support the mission of optimized Rec/EE
C-B-B	Increase Dispersed Rec/EE Passive Vegetation Management Recommend Wilderness	Increase in Rec/EE would require more Veg. Mgt than is outlined in Veg. block B	Passive Veg. Management does not support the mission of optimized Rec/EE
C-C-A	Increase Dispersed Rec/EE No Change to Veg. Recommend Wilderness	No significant conflicts	No Change to Veg. would not facilitate optimized Rec/EE equal to description in Rec/EE Block C
C-C-B	Increase facilities for Rec/EE No change to Veg. No Wilderness recommendation	No significant conflicts	No Change to Veg. would not facilitate optimized Rec/EE equal to description in Rec/EE Block C
D-A-A	No Change to Rec/EE Improve Ecological diversity Recommend Wilderness	No significant conflicts	No Change to Rec does not meet Need for Change, Public Comments received
D-A-B	No Change to Rec/EE Improve Ecological diversity No Wilderness recommendation	No significant conflicts	No Change to Rec does not meet Need for Change, Public Comments received
D-B-A	No Change to Rec/EE Passive Vegetation Management Recommend Wilderness	No significant conflicts	No Change to Rec does not meet Need for Change, Public Comments received
D-B-B	No Change to Rec/EE Passive Vegetation Management No Wilderness recommendation	No significant conflicts	No Change to Rec does not meet Need for Change, Public Comments received
D-C-A	No Change to Rec/EE No Change to Veg. Recommend Wilderness	No significant conflicts	No Change to Rec does not meet Need for Change, Public Comments received

Draft Documents Comment Period

The Draft Environmental Impact Statement (DEIS) and Draft Land and Resources Management Plan were officially released to the public through a Notice of Availability (NOA) published in the Federal Register on March 26, 2004. Beginning in mid-April, the US Forest Service held a series of Public Information (P-I) sessions in order to provide the public with the most accurate, up-to-date information about the Area Plan process, its progress, and the ways in which the public could remain involved and provide comments on the draft documents. The Forest Service also posted this information and presentation materials to their Internet website.

Objective

Throughout the comment period, and integral to the messages in the press releases and presentations, the LBL staff strived to provide complete, concise and clear information

about the draft documents, the planning process, and the intent of the comment period, as well as explain how the public could best provide meaningful and useful comments on the draft documents. While the sessions were not designed to take comments on the spot, the LBL staff had comment forms available for anyone who desired to leave their comments or information with the staff at any of the in-person presentation opportunities.

One of the first things that staff told participants at any presentation of the Draft Plan was the three-fold objective for the presentation:

1. Answer general questions the public may have about the composition, design, and content of the draft documents;
2. Provide guidance to the public as to where they could find information relevant to their particular areas of interest on LBL;
3. Explain how to provide meaningful and useful comments on the draft documents to the Forest Service Planning Team.

Another key point in each presentation was the explanation of the strategic focus of this new plan format. Unlike other large-scale management plans that the Forest Service or other agencies have produced, this format does not address specific decisions that should be made at the project or program level. In the presentation, this was likened to a seasonal game plan for a major sports team. That season-long plan does not tell the coach what play to call in a specific instance of a specific game, but gives overall direction against which specific play-by-play decisions can be gauged or determined.

Draft Document Distribution

In order to best disseminate the Draft Plan information and copies of the draft documents to the public, LBL management undertook an extensive campaign to ascertain how most people wanted to receive and review copies of the Draft Plan and DEIS. Prior to the printing and distribution of the documents, LBL sent out postcards and emails to members of the public on our *Focus on the Future* mailing list, asking them how they wanted to receive this information. We used the results to determine the number of printed copies and compact disk (CD) copies to prepare. Table A-3 details this effort.

Table A-3 – Draft Document Distribution

Postcards mailed announcing release of the Draft:	**985**
Reminder emails sent announcing release of the Draft:	**704**
Draft Document copies mailed:	
Executive Summary only (15-page document)	**13**
Complete document (DEIS, Area Plan, Executive Summary)	**136**
CD sets	**259**

Draft Documents Information Presentations

During the comment period, LBL staff had several opportunities to present information about the draft documents to the public. There were several format types involved in the various presentations, but the messages and presentation materials were consistent throughout each presentation. The various presentations were given in one of the following formats.

Official Briefings

As required by the Forest Service, LBL Leadership Team members presented a number of required and courtesy briefings to local and national elected officials, as well as to officials with various state and federal agencies with interest in LBL's resources and management. The purpose of these briefings was to inform these agencies and officials of the contents and objectives of the draft documents, and to explain the Area Plan format and philosophy of this draft version. Additionally, LBL management asked that local officials would help in generating public interest and involvement in the draft comment period and the scheduled public information sessions.

Scheduled Public Information Sessions

The Forest Service planned, announced, and conducted four initial P-I sessions in the counties surrounding LBL. Each session was conducted using the same drop-in format, with a relatively small number of FS staff and resource specialists. All four sessions were held in the county high schools for easy access by the public. The setup at each session used three adjacent classrooms very close to a main entrance and parking at the schools.

Group Invitations

During the course of any year, LBL is approached by civic, private and members-only groups to give presentation on topics of interest to that particular group or audience. During the comment period, these opportunities were used to give presentations about the draft documents and the Area Plan process.

User Group Meetings

At different times during the year, some of the more-heavily visited recreation facilities conduct user group meetings to discuss policies, changes or needs, and overall visitor satisfaction with the facilities. During the comment period, these meetings were focused toward providing information and allowing for question-and-answer sessions on the draft documents as they pertained to these specific sites. Table A-4 outlines the various opportunities at which Area Plan presentation were made:

Table A-4 – Draft Plan Presentations

Date	*Location*	*Forum Type*	*Attend.*	*Staff Presenter/Facilitator*
3/23/04	USDA Forest Service, LBL; LBLA Customer Service Orientation	Briefing	Approx 40	Barbara Wysock
3/11/04	USDA Forest Service Washington Office	Briefing	7	Bill Lisowsky
3/8–3/11/04	Western KY/TN and Washington Congressional Offices	Briefing	Approx 20	Bill Lisowsky, Kathryn Harper,
3/15/04	LBL Employees' Briefing	Briefing	30	Bill Lisowsky, Barbara Wysock
3/25/04	Press Briefing, LBL Administrative Bldg.	Briefing	3 media	Bill Lisowsky, Kathryn Harper
3/29/04	USDA Forest Service, LBL; LBLA Customer Service Orientation	Briefing	Approx 18	Barbara Wysock
3/31/04	USDA Forest Service Regional Office	Briefing	20	Bill Lisowsky
4/02/04	LBL Advisory Board	Briefing	16	Barbara Wysock, Richard Lomax, Adam Morgan, Phil Sammon
4/05/04	TN Wildlife Resources Agency	Group Invitation	15	Bill Lisowsky
4/09/04	Murray State University, Class Presentation	Group Invitation	23	Barbara Wysock
4/12/04	KY Federal Agency Tourism Council	Briefing	10	Bill Lisowsky
4/13/04	Lyon County (3 presentations)	Public Info Session	43	Philip Sammon
4/15/04	Trigg County (1 presentation)	Public Info Session	9	Philip Sammon
4/20/04	Marshall County (3 presentations)	Public Info Session	34	Adam Morgan
4/20/04	Leadership Murray Alumni Meeting. Murray, KY	Group Invitation	Approx 25	Richard Lomax
4/22/04	Stewart County (1 presentation)	Public Info Session	5	Philip Sammon
4/24/04	KY Ornithological Society	Briefing	45	Bill Lisowsky
4/28/04	Jackson Purchase (TN) Historical Society	Group Invitation	Approx 50	Barbara Wysock
5/06/04	Western KY Leadership Association Kentucky Dam Village State Park	Group Invitation	Approx 20	Barbara Wysock
5/10/04	LBL Sportsmen's Club	Group Invitation	Approx 50	Barbara Wysock
5/11/04	Grand Rivers, KY Town Hall Meeting	Group Invitation	65	Bill Lisowsky
5/19/04	Clinton Rotary Club	Group Invitation	Approx 25	John Ruffli (Ex. Dir., LBL Association)
5/20/04	Murray Rotary Club	Group Invitation	Approx 70	John Ruffli (Ex. Dir., LBL Association)
5/22/04	Wranglers Campground	User Group Meeting	105	Randall Mitchell
5/22/04	Turkey Bay Off-Highway Vehicle Area	User Group Meeting	14	Matt Edwards

Date	*Location*	*Forum Type*	*Attend.*	*Staff Presenter/Facilitator*
5/22/04	Piney Campground	User Group Meeting	14	Kristy Barnes
5/22/04	Hillman Ferry Campground	User Group Meeting	7	Crystal Powell
5/22/04	KY United Partnership for Environmental Education	Group Invitation	50	Brian Beisel
5/27/04	KY and TN State Officials	Briefing	20	Bill Lisowsky
6/11/04	League of Kentucky Sportsmen	Group Invitation	145	Bill Lisowsky
6/14/04	Cadiz-Trigg County Tourism Commission	Group Invitation	Approx 15	John Ruffli (Ex. Dir., LBL Association)
6/23/04	TN Wildlife Resources Agency Commission, Nashville, TN	Briefing	Approx 25	Richard Lomax
6/28/04	Kentucky Western Waterlands Tourism Board, Executive Board Meeting	Group Invitation	Approx 20	John Ruffli (Ex. Dir., LBL Association)
6/30/04	TN Conservation League	Briefing	Approx 20	Bill Lisowsky
	Total Number of Presentations: 38	**Total Attendance**	**Approx 1078**	

Media Coverage

Prior to the publication of the NOA in the Federal Register (March 26, 2004), LBL began a concerted public information campaign to promote and announce the dates, times, and objectives for the scheduled public information sessions in the gateway communities. The Communications Department distributed each of the Area Plan-related press releases to some 360 local and regional outlets, which include: newspapers, radio and television outlets, tourism commissions and bureaus, chambers of commerce, major hotels and resorts in the area, and local and regional association newsletters.

The LBL staff was approached by several media outlets for interviews about the Draft documents, the proposed changes, and the ways in which the public could get involved and provide their comments on the draft documents. The resulting media coverage gave additional reach and exposure to thousands of readers and listeners in the regional area, as outlined in Table A-5.

Table A-5 – Media Coverage on the Draft Plan

Date	Publication Name	Location	Type	Staff Interviewed
03/30/04	WKDZ-FM (electronic)	Cadiz, KY	Live radio	Brian Beisel
04/07/04	Lyon County Herald Ledger	Eddyville, KY	News article (interview with former resident)	None
04/10/04	Louisville Courier-Journal (print) This article was run by the Associated Press wire service and picked up by several local media outlets closer to LBL.	Louisville, KY	News article (interview with overview of the proposed action)	Bill Lisowsky, Barbara Wysock
04/11/04	Lexington Herald (reprint of the AP article)	Lexington, KY	News article	Bill Lisowsky, Barbara Wysock
04/12/04	WPSD-TV website	Paducah, KY	Reprint of evening news segment (info on sessions, overview of proposed action)	None
04/13/04	Louisville Courier-Journal	Louisville, KY	Opinion-Editorial (staff editor)	None
04/13/04	The Paducah Sun	Paducah, KY	News article (info on session, overview of proposed action)	None
04/14/04	The Paducah Sun	Paducah, KY	News article (wrap-up of 04/12/04 session, with attendee comments)	Bill Lisowsky
04/17/04	Louisville Courier-Journal	Louisville, KY	Opinion-Editorial (article by David Nickell)	None
04/21/04	WKDZ-FM radio	Cadiz, KY	Taped interview, news story	Phil Sammon
04/23/04	Murray Ledger & Times	Murray, KY	News article (wrap-up of previous session)	Kathryn Harper, Barbara Wysock
04/23/04	WPSD-TV Channel 6	Paducah, KY	Potential for logging as a result of the Area Plan	Judy Hallisey
04/27/04	Stewart-Houston Times	Dover, TN	News article (wrap-up of previous session, general plan info, and overview of proposed action)	Barbara Wysock, Phil Sammon
04/28/04	The Tribune-Courier	Benton, KY	News article (general info and overview of proposed action, alternatives)	None

Date	Publication Name	Location	Type	Staff Interviewed
04/29/04	The Leaf-Chronicle (business section)	Clarksville, TN	News article (general info on proposed action and alternatives	Brian Beisel, Barbara Wysock
05/01-05/21/04	WKMS-FM	Murray State Radio Station, Murray, KY	Weekly news segments, one per week (potential for change under the new Area Plan, including logging, facilities upgrades or development; possible expansion of facilities)	Judy Hallisey and others
05/26/04	The Paducah Sun	Paducah, KY	News article (announcement for 05/29 Brandon Spring session, recap of proposed action)	None

Additional Outreach Methods

The LBL leadership made the early determination to explore and utilize every available means to provide and distribute information about the Draft Plan and the entire planning process to as many interested members of the public as possible. To support this determination, a segment of the LBL website, www.lbl.org, was devoted to the planning process. This site is used to post all pertinent information about the Area Plan and the process, including much of the background information, summaries, public scoping results, and the DEIS and draft Area Plan documents and maps.

The LBL Leadership Team also decided to make as much use of staff interaction with visitors as possible at the major facilities and sites across LBL. The Planning Team and Communications Department developed several stand-alone handout pieces for visitors, which provided visitors with broader exposure of the Area Plan information to visitors. These products included: Draft EIS and Area Plan informational handout; take-home comment forms and address information sheet; frequently asked question sheets specific to various major facilities (Wranglers and other campgrounds, Turkey Bay Off-Highway Vehicle Area); signs posted at four of the major facilities listed in the table below; and Planning Team business cards listing team members' emails and phone numbers for people to use for further information.

Tables A-6 and A-7 outline the cumulative results of the employment of the website and the potential on-site visitor contacts.

Table A-6 - Major Facilities' Visitation

DATE RANGE	SOURCE	LOCATION	TOTAL NUMBERS
March 26 – June 30, 2004	Actual Visitor counts:	Hillman Ferry Campground	71,384
		Piney Campground	62,869
		Wranglers Campground	38,410
		North Welcome Station	15,048
		South Welcome Station	15,988
		Golden Pond Visitor Center	46,418
	Traffic counter	Turkey Bay Off-Highway Vehicle Area	27,542
		TOTAL	**277,659**

Table A-7 - LBL Planning Page Website Statistics*

DATE RANGE	SOURCE	DEFINITION	TOTAL NUMBERS
March 1 – June 30, 2004	Number of Hits	Someone viewing information on that page only, or downloading information from that page.	117,569
March 1 – June 30, 2004	Number of Visits	Someone following links on the planning website to other sources of information.	12,110

* Web trends information, provided by the LBL website Internet Service Provider

Summary

Overall, LBL staff is pleased with the depth and breadth of exposure, coverage, and reaction to our public information efforts in relation to the draft documents. Based upon the number of presentations and public involvement that was generated through the scheduled sessions, group invitations and considerable media coverage, we believe we have served the public interest in providing sufficient information about this draft Area Plan and the planning process. We further anticipate receiving a significant number of substantive and constructive comments on the Area Plan, the proposed action and our scientific and technical data to refine and develop the final Area Plan within the specified timeline we established at the outset of this process.

A.2 Response to Public Comments

Introduction

This appendix contains the summary of the public comments received during the formal comment period to the Draft Environmental Impact Statement (DEIS) and the draft Land and Resources Management Plan (LRMP), or Area Plan. This formal period was March 26, 2004, to June 30, 2004.

The Forest Service received 285 responses from across the country in the form of letters, emails, and faxes. It is important to note that the comments summarized here do not necessarily represent overall public sentiment. The public comment process is purely voluntarily, so respondents are self-selected. While responses submitted do portray a wide range of views, and the ensuing reports attempt to provide fair representation of the full spectrum of public opinion, this public involvement process used responses to inform the planning process, not to count as votes. The content analysis process did ensure that every comment was considered at some point throughout the decision process.

Content Analysis Process

Content analysis is a method of eliciting meanings, ideas, suggested actions, and other information from written responses. A proven method of content analysis has been developed by the Content Analysis Team (CAT), a specialized Forest Service unit, for analyzing public comment on proposed federal land and resource management projects and proposals. This systematic process is designed to:

- Provide specific demographic information;
- A mailing list of respondents;
- Identify individual comments by topic in each response;
- Evaluate similar comments from different responses;
- Summarize like comments as specific concern statements.

The process also provides a relational database capable of generating various types of reports, while linking the original comments to their original letters.

Responses received were immediately processed and prepared for further content analysis. Core planning team members worked together to read each letter and identify all relevant comments brought forth in the process, not simply those representing the majority of respondents. Each response was reviewed for specific actions that the commenter wanted to see the Forest Service take in preparing for the final Area Plan, along with any supporting rationale statements about their recommended actions. Each of these action statements and supporting rationale statements were numerically coded in order to build the database of comments for analysis. Public concern statements were then developed from unique actions proposed, with like comments grouped under single

action statements by the numerical codes. Appropriate Forest Service resource specialists were then given the task of analyzing and responding to those concerns and comments.

Appendix Overview

The appendix begins with a background of the Land and Resource Management Plan and provides a brief overview of public comment on the LBL LRMP. The CD included with the appendix to this FEIS contains the database used in the content analysis project. The database includes all coded comments (and identifies the author of each comment) and affiliated public concern statements, as well as the agency's official response to each concern. Those interested may use the database to review the information as they see fit.

The comments are divided by category as follows:

- Process, Planning, Policies and Laws, includes comments on general planning considerations related to the Area Plan revision. Included in the planning section are topics such as the Forest Service's authority over LBL, public involvement, agency organization and funding, and other concerns;

- Alternatives includes comments regarding the alternatives detailed in the Draft Environmental Impact Statement (DEIS) and suggestions that respondents offered for new alternatives;

- Natural Resource Management includes comments concerning a wide range of environmental issues, such as air quality, water resources, forestry, wildlife, and vegetation management, as well as comments pertaining to the commercial use of LBL's natural resources;

- Transportation comments focus on transportation infrastructure within LBL, mainly on road and trail maintenance, construction and decommissioning;

- Recreation covers a wide range of topics concerning the recreational issues and opportunities and environmental education within LBL;

- Lands and Special Designations include comments relating to special designations in the National Recreation Area.

As mentioned earlier, each formal public concern statement is based on one or more actual comments from respondents. These comments help to provide perspectives and rationales regarding the public's concerns.

General Overview of Public Comments

Public comments received represent a wide range of viewpoints. Comments were often highly detailed and strongly supported, and include a broad array of perspectives and

values. Respondents were generally concentrated in the region surrounding LBL, though some were received from throughout the country. A number of comments received came from former residents, or those sharing the views and opinions of former residents. These comments generally addressed a number of topics, focusing heavily on logging and commercialization-related management concerns at LBL. Many comments focus on various other resource management issues, including vegetation management, wildlife management and water quality. A large number of comments addressed recreation opportunities, particularly hunting and developed recreation. Finally, some respondents addressed special designations, particularly with respect to the Core Areas.

Overview of Comments on specific Topics

The following paragraphs contain summaries of public comments on specific topics regarding the draft Area Plan and DEIS.

Process, Planning, Policies and Laws

Comments concerning process, planning, policies and laws were quite varied. A number of respondents suggested the Forest Service wasn't managing LBL as it was originally intended, and that this should be remedied through the planning process. Some respondents suggested the Forest Service better incorporate multi-use philosophies, and habitat and recreational needs of the region and nation, in its planning and management. It was also suggested that the Forest Service avoid using economic drivers in selecting a management plan. Additionally, some comments requested the Forest Service to do more socioeconomic and environmental analysis before implementing any management plan.

In terms of working with the public, or with outside groups and agencies, comments received tended to suggest the Forest Service improve its outreach. Some suggested the public information sessions and other forms of outreach were poorly organized, confusing and inconvenient to some interested parties, while others suggested the Forest Service must better incorporate the views and comments of the public. A number of respondents suggested that more cooperation between the Forest Service and local communities, and state and federal agencies, was needed.

Staff and budget issues also received mention. A number of respondents recommended that the Forest Service seek to use more volunteers to staff facilities within LBL. Others suggested the Forest Service improve its budget management.

Alternatives

Some respondents requested improvements on the DEIS, suggesting the DEIS was confusing and didn't adequately demonstrate differences between the alternatives. A handful of comments recommended additions to the plan, particularly requesting additional standards and objectives concerning water quality. A number of respondents were dissatisfied with the Forest Service's initial choice of two preferred alternatives for the Rec/EE issue, claiming this caused confusion for the public and didn't allow for

adequate public involvement because the Forest Service's management intentions were too vague.

Comments varied in support of proposed alternatives, with the majority of comments received requesting the Forest Service choose Alternative Y. Most comments suggested one alternative over others; other comments suggested combinations of Alternatives W & Z, X & Y, and Y & Z. All who supported one particular alternative or combination, supported their choice by suggesting the chosen alternative best provided for ecosystem management, recreation, and net public benefits to the surrounding communities. Additionally, Alternatives W and Z were promoted as being most representative of the original mission of LBL and most sensitive to former residents. Alternatives W and Y were supported by some respondents, and Alternative Z rejected by some because of the desire in either preference to avoid limitations in off-highway-vehicle (OHV) use in the Turkey Bay OHV area.

Natural Resource Management

Environmental and natural resource management received a large number of comments, ranging widely in sentiment. Many respondents advocated stringent environmental protection in LBL, and voiced a desire to keep LBL as natural as possible to preserve its beauty and uniqueness for generations to come. Some respondents also suggested the resources be managed in the context of the larger region, utilizing ecological science more rigorously in order to provide species and communities missing in the region. Following these more broad sentiments were opinions more limited in scope, covering a number of topics.

A handful of comments proposed a more thorough cost-benefit analysis of proposed management actions. A number of respondents proposed further monitoring, inventories, and analyses on a number of elements, including plant and animal populations, management indicator species, open lands, and air and water quality.

Many respondents requested better management of wildlife populations, particularly of white-tailed deer, especially with respect to improvement of hunting opportunities. Vegetation management received a broad range of comments, with some advocating more active management, including cutting, burning, and land cultivation. Still others promoted minimal, or passive, management, and a return to old growth forests. A handful of comments addressed cultivated lands in LBL, and were divided in their suggestions. Those suggesting LBL continue and/or increase the acreages of cultivated lands did so primarily to increase food for wildlife. Those suggesting LBL decrease or eliminate cultivated lands were concerned with forest fragmentation, and the desires of former residents. A number of comments concerning logging were received, proposing both more and less logging in LBL.

Heritage resources management was a topic of some concern for a handful of respondents, with a unified desire for further analysis and better protection of the heritage resources within LBL.

A large number of respondents voiced concerns over commercialization within LBL. Almost all strongly opposing revenue-generating operations of any sort within the National Recreation Area, advocating removing those sites currently in operation at facilities on LBL.

Transportation

Transportation issues did not receive a great deal of attention from the public in the planning process. A number of those that did respond requested unimpeded access to all cemeteries within LBL. Another issue garnering great support was a proposal to increase and better maintain hiking and biking trails in LBL. Other topics received divided comments, with some voicing a desire to keep roads open and well-maintained, while others requested the Forest Service close some roads to decrease impacts to nature.

Recreation and Environmental Education

Recreation issues received a considerable number of comments, varying in scope and intent. Some addressed general management of recreation, suggesting LBL be managed for a wide spectrum of recreational opportunities, or that recreation opportunities be provided according to the demand. Other comments pertained to a specific form of recreation, and most forms of recreation available in LBL were addressed by at least one comment.

Turkey Bay OHV Area received a large number of varied responses. Most respondents advocated the area remain open to OHV use, and that camping within the area be continued and/or improved. Those respondents who commented on Alternative Z, with respect to Turkey Bay, had widely varying comments, with some rejecting any limits on use and others supporting some restrictions, as needed, to ensure the continued use and sustainability of the area.

A number of comments advocated upgrades in the major campground campsites, as well as others who requested less development in campgrounds, and more opportunities for primitive camping. Hunting was another popular topic for public comment, with most voicing support for continued and/or increased opportunities for hunters, though some proposed increases in non-hunting areas through LBL. Some respondents requested further dispersed recreation opportunities, such as wildlife viewing, and decreases in the levels of recreational development.

The topic of fees garnered a number of comments, with respondents divided in opinion. Some opposed the collection of any fee for any activity, while others promoted the use of fees to increase revenue and support for services and Rec/EE opportunities, as means of offsetting operating costs.

Environmental education received fewer comments, with little controversy among respondents. Many respondents promoted a stronger focus on environmental education

within LBL, while others advocated specific programs and methods. Comments were somewhat divided with respect to facilities. Most respondents requested the re-opening of certain facilities (The Silo, Youth Station, Empire Farm), though at least one did suggest that closed facilities remain closed. A few comments concerning the proposed Nature Watch Demonstration Area were received, with all in support of at least one area being created.

Lands and Special Designations

The comments pertaining to special designations varied in their demands. A handful of comments from former residents requested that LBL lands be given back to them. Most other respondents suggested more lands be specially designated for some form of protection. Others advocated less (or none), and still others proposed that LBL maintain its current designations. A number of comments voiced strong opposition to any international management or oversight of any areas within LBL.

Summary

Overall, the respondents to the DEIS and draft Area Plan during this formal comment period, were direct in their opinions and assertions, and made specific and detailed recommendations for and against elements of the documents. Across the board, all comments were directed to specific proposals in the two documents, and gave the core Planning Team and the resource specialists solid direction in their comments, suggestions, and recommendations. The analysis of these comments, when viewed against the scientific and technical analyses of the DEIS, contributed significantly to the refinement of the Final EIS and Area Plan.

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Appendix B

DESCRIPTION OF THE ANALYSIS PROCESS

B.1A Introduction – The Analysis Process and Goals

Appendix B presents a technical discussion of the analysis process, computer models used, and the reports compiled in this planning process. This appendix focuses on the quantitative methods used to perform the analysis of the alternative effects and documents how the analysis was done.

The Forest's major planning goal is to provide enough information to help decision makers and the public determine which combinations of goods, services, and land allocations will maximize *net public benefits* (NPB). The regulations (*36 CFR 219*) developed under the National Forest Management Act (NFMA, 1982) provide the analytical framework within which these decisions are made.

The NFMA and its regulations also state that the requirements of the National Environmental Policy Act (NEPA) and its regulations (*40 CFR 1500–1508*) must be applied in the analytical process. The NEPA regulations require that the environmental effects of a proposed action, and alternatives to that proposed action, must be disclosed in an *environmental impact statement* (EIS).

Information presented in this chapter supplements the broader and less technical descriptions included in the body of the EIS. This discussion includes basic assumptions, modeling components and inputs, rules, methods, and constraints. Additional information and documents used in the analysis process are contained in the planning records. The planning record in its entirety is incorporated here by reference.

The results from the modeling processes are estimates of what can be expected if alternatives are implemented, and facilitate the comparison of alternatives. Land and resource management planning requires that processes formally used to make individual resource decisions be combined into integrated management decisions.

B.1B Framework of the Planning Process

The general planning process described in *36 CFR 219.12* guides the revision of a Forest Plan. This section describes 10- steps that lead from the completion of a Forest Plan to the completion of a revised Area Plan. LBL uses "Forest Plan" and "Area Plan" interchangeably.

The 10-Step Planning Process

The IDT used the 10–step process defined in the NFMA regulations. This appendix describes the analysis phase of this process that includes steps 3 and 6. Steps 1, 2, 4, 5, 7, and 8 are described in Chapters 1 and 2 of this EIS. Plan implementation and monitoring, steps 9 and 10, are discussed in the Area Plan. A brief discussion of the 10-step process follows.

Step 1, Identification of purpose and need: issues, concerns, and opportunities

The IDT and the staff at LBL assessed the need for change in public issues, management concerns and resource use, and developmental opportunities since TVA's 1994 Plan was developed. Appendix A of this EIS documents this step.

Step 2, Planning criteria

Criteria are designed to guide the collection and use of inventory data and information; the analysis of the management situation; and the design, formulation, and evaluation of alternatives. The NFMA regulations require that planning criteria be developed to guide each step in the planning process. Process criteria are standard rules and tests to guide and measure the effectiveness of the planning process. They apply to collection and use of inventory data and information; analysis of the management situation; and the design, formulation, and evaluation of alternatives.

Planning criteria are based on:

- Laws, executive orders, regulations and agency policy as set forth in the *Forest Service Manual;*
- Goals and objectives in the RPA Program and regional guides;
- Recommendations and assumptions developed from public issues, management concerns, and resource use and development opportunities;
- The plans and programs of other federal agencies, state and local governments, and Indian tribes;
- Ecological, technical, and economic factors;
- The resource integration and management requirements in *36 CFR 219.13* through *219.27;*
- Alternatives that are technically, fiscally possible to implement;
- Alternatives that meet management requirements or standards;

- Various levels of multiple-use objectives and outputs achieved.

This step establishes guidelines for accomplishing the next five steps. The work plan and other process records document this step.

Step 3, Inventory data and information collection

The kind of data and information needed is determined in Step 2 based on the issues, concerns, and opportunities identified, and the resulting assessment of the management situation and the need for change. Data collection is part of normal forest operations. Existing data is used whenever possible and supplemented with new data, when practicable, if new data will contribute to more responsive analysis. Data accuracy is continually evaluated. Much of this data and background documentation is part of the planning process records on file in the Area Supervisor's office.

Step 4, Analysis of the management situation

This step consists of assessing the existing situation on the forest and determining opportunities for resolving issues and concerns. This information provides the basis for formulating an appropriate range of reasonable alternatives.

This analysis brings existing information together, puts it into a total forest perspective, and examines the range of possible situations to resolve issues. It examines supply potentials and market assessments for goods and services, and determines suitability and feasibility for meeting needs. Other objectives of the analysis of the management situation are:

- Assessing current direction, including a schedule of the goods and services that are most likely to be provided if current direction is continued;
- Assessing the demand for goods and services from national forest lands;
- Determining if there is a need to change current management direction.

Step 5, Formulation of Alternatives

A reasonable range of alternatives is formulated according to NEPA procedures. Alternatives are formulated to assist in identifying one that comes nearest to maximizing NPB. They provide for the resolution of significant issues and concerns identified in Step 1. The alternatives reflect a range of resource management programs. Each identified significant issue and management concern is addressed in different ways in the alternatives. The programs and land allocations in each alternative represent the most cost–efficient way of attaining the goals and objectives for that alternative. Both priced and non–priced goods and services (outputs) are considered in formulating each alternative.

Step 6, Estimated effects of Alternatives

The physical, biological, economical, and social effects of implementing each alternative are considered in detail, responding to the issues and need for change. The effects of the alternatives are displayed in Chapter 3 of this EIS.

Step 7, Evaluation of Alternatives

Significant physical, biological, economical, and social effects of implementing alternatives are used to evaluate each alternative and compare them with each other. Typically, each alternative can be judged on how it addresses the significant issues identified in Chapter 1 of the EIS. Chapter 2 of the EIS summarizes the comparisons of the alternatives with regard to the issues.

Step 8, Preferred Alternative

The Forest or Area Supervisor reviews the interdisciplinary team's evaluation of each alternative and the public issues and concerns. The Area Supervisor then recommends a preferred alternative to the Regional Forester, who in turn either selects the recommendation, another alternative, or modifies the recommended alternative. That alternative is described as the *preferred alternative* in the FEIS and is displayed as the *proposed revised Area Plan*.

Step 9, Plan approval and implementation

After the interdisciplinary team has reviewed public comments and incorporated any necessary changes into the FEIS or proposed Area Plan, the Regional Forester reviews and approves the revised Areat Plan and final LRMP. A *record of decision* (ROD) documents this step.

Step 10, Monitoring and evaluation

The revised Area Plan establishes a system of measuring, on a sample basis, actual activities and their effects, and compares these results with projections contained in the revised Area Plan. Monitoring and evaluation comprise an essential feedback mechanism to ensure the revised Area Plan is dynamic and responsive to change. The revised Area Plan displays the monitoring and evaluation program.

B.2 Inventory Data and Information Collection

Database Development

The Issues in DEIS Chapter 2 were an important basis for determining what data needed to be updated or collected and which effects would be evaluated. Existing data and new information were used in revising the LRMP.

Two key types of information were needed to facilitate the analysis and development of alternatives. The first consisted of information related to the classification of land into categories with unique properties. This classification was based on attributes significant to the planning issues. This type of information was tied directly to the map base.

The second type of information is not directly tied to a map base, but has more to do with the estimation of how land will respond to certain management activities within a given alternative. This can be viewed as the goods and services discussed in the FEIS, Chapter 3. This type of information came from many sources: regional procedural handbooks, professional research studies, master's theses, etc. The most up-to-date and verifiable information was utilized. Data models used in this FEIS are described in Chapter 3 and Appendix B.

GIS Data Layers

A computerized geographic information system (GIS) is used at LBL. GIS links natural resource data with spatial (map) information. This linkage enabled valuable spatial analysis and rapid display of resource information for the IDT. Inventories were continually updated to reflect current conditions and verification of existing information was an ongoing effort. Many different physical, biological, or administrative layers, or resource-related information, are contained in the LBL GIS mapping system.

Methodology for Determining Land Cover and Producing Alternatives

Land Cover is derived from a combination of GIS layers including the TVA Forest Stand polygon coverage, the open lands coverage, and the KY Dept. of Fish & Wildlife Resources -GAP data. Decision rules were created by J. Donahue , E. Raikes, and T. Mersmann for assigning Cover Types based on the Ecological Framework for Species Viability.

Numerous GIS layers were combined using UNION (copyrighted software) in ArcInfo Software to produce a single coverage for labeling polygons for the alternatives by using queries. The layers include Land Cover, Structure Type, Site Type, Facilities, Core Area, Wildlife Refuge, Roads, Road Buffers, Nature Watch Area, and Vegetation Demonstration Area.

B.3 Analysis of the Management Situation

An initial step in the plan revision process was to analyze the current condition at LBL. The following is a brief summary of the Analysis of the Management Situation (AMS), an unpublished collection of technical reports describing the existing condition, existing management direction, existing management plans, summary of current outputs and activities, projected outputs and activities, expected future condition based on continuation of the current management, and known problems. The information is contained in the project record.

The Planning Background Document in Appendix G, describes the summary of the management situation at LBL and the need for change during this plan revision. The table below lists products in LBL's AMS record.

LBL National Recreation Area
Index of Analysis of Management Situation
December 2003

Description	Product	Comments
Current Management Direction	1994 LRMP, LBL Business Plan 2004	Describes current management and business plans
Planning Background Document (PBD)	LBL Planning Background Document, June 4, 2003	Summarizes Need for Change for All Resource Areas
Issues Paper	Issues Paper Sept 12, 2003	
Ecological Classification	Species Viability Assessment	Summarized in EIS
PETS, T&E, MIS Species	Species Viability Assessment	Summarized in EIS
Fish and Wildlife Current Condition	Species Viability Assessment	Summarized in EIS
Soils Current Condition	Affected Environment	Summarized in EIS
Water Resources	Sediment Yields Cumulative Effects for Water Quality Report, CATT Report, March 2002	Summarized in EIS
Air Resource	Air Quality Report	Appendix to EIS
Forest Cover	Structure Map, Site Type Map, TVA Plot Data, GAP Analysis, 1994 Plan and EIS	GIS Coverages and maps
Open Land Cover	Cover Map, GIS Layer, 1994 Plan and EIS	GIS Coverages and maps
Timber Current Condition	Spreadsheet Model, LBL Timber Records	Summarized in EIS

Description	Product	Comments
Land Allocation Current Condition	Background Document; Alternative W Rx Map	
Recreation Current Condition	ROS, PBD, Affected Environment	Summarized in EIS
Environmental Education Current Condition	PBD, Affected Environment	Summarized in EIS
Visuals Resource	1994 Plan, LBL Sightseeing Master Plan, ROS	Summarized in EIS
Facilities Current Condition	Facilities Plan	Summarized in PBD
Transportation System	LBL Engineering Study for Roads and Bridges, June 2002	Prepared for USFS by FHA
Fire and Fuels Current Condition	Current Management Situation, Nov. 25, 2003	
Fire Management Action Plan	December 2003 Action Plan	
Heritage Resource Current Condition	Heritage Resource Management Plan, March 2003	
Roads Analysis	Roads Analysis Report, July 2003	
Legal Road Map	Legal Road and Hunting Map, 2003-2004 Season	
Timber Supply and Demand	Spreadsheet Model, IMPLAN Model	Summarized in EIS
Recreation Supply and Demand	IMPLAN Model, 1998 Visitor Survey	Summarized in EIS, PBD
Social Assessment	LBL National Recreation Area Demographic Changes and Economy Trends, Dec 1, 2003	Summarized in EIS, PBD
Special Uses	Special Use Permits, Dec 2003	Summarized in EIS
Core Areas	1994 Plan, Core Areas Plan	Core Areas Plan in Appendix to 1994 Plan EIS

B.4 Recreation and Environmental Education

Integral to LBL's mission is to provide optimal Rec/EE in a sustainable environment. In order to make reasonable and equitable comparisons of the Alternatives, the IDT had to establish a baseline from which to make projections of the anticipated demand for future uses and visitation. Much of this data was compiled from national research and statistics on demand and future trends, and some was taken from state recreation plans. One main source of locally gathered information was the "1998 Visitor Profile Survey". This research and statistical information is referenced in the text where appropriate.

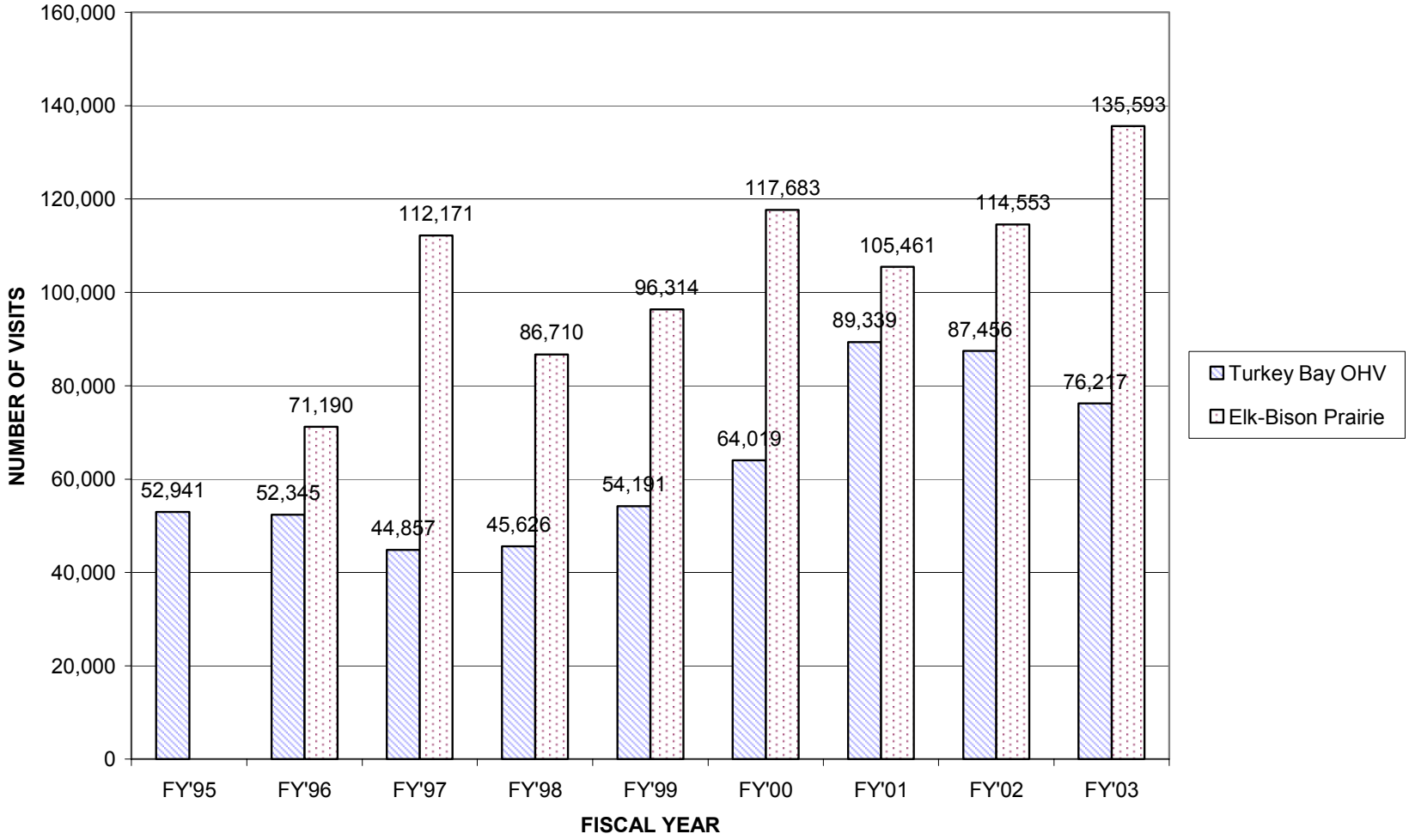
Other data was locally available in the form of LBL's "Monthly Visitor Use Summary" reports. These reports provide cumulative data each month allowing accurate comparison of visitation numbers from previous months, quarters, and years. Information from these reports was extracted and placed in chart form for fiscal year comparison. The following tables and graphs are the result of that compilation of data from the past nine years.

VISITATION NUMBERS FY'95 TO FY'03
(Number of Visits to LBL Facilities)

FACILITIES	FY'95	FY'96	FY'97	FY'98	FY'99	FY'00	FY'01	FY'02	FY'03	Average	4yr Avg
MAIN CAMPGROUNDS											
Hillman Ferry	136,918	145,539	152,617	169,994	178,356	165,452	170,999	166938	176,751	**162,618**	**170,035**
Piney	118,522	127,217	140,857	148,726	162,324	159,042	136,248	150,895	141,081	**142,768**	**146,817**
Energy Lake	17,926	19,220	15,820	18,093	17,879	19,343	19,133	15,495	15,701	**17,623**	**17,418**
Wranglers	38,438	46,519	68,833	79,112	87,126	100,120	97,273	76,214	69,985	**73,736**	**85,898**
TOTAL	**311,804**	**338,495**	**378,127**	**415,925**	**445,685**	**443,957**	**423,653**	**409,542**	**403,518**	**396,745**	**420,168**
SPECIAL USE AREAS (Compiled from Traffic Counter data)											
Turkey Bay OHV	52,941	52,345	44,857	45,626	54,191	64,019	89,339	87,456	76,217	**62,999**	**79,258**
Elk & Bison Prairie		71,190	112,171	86,710	96,314	117,683	105,461	114,553	135,593	**104,959**	**118,323**
EE FACILITIES											
Brandon Spring	19,847	21,649	22,082	20,087	20,366	21,561	17,997	18,573	17,463	**19,958**	**18,899**
Homeplace	60,439	55,895	53,410	51,868	53,131	42,723	44,454	48,564	45,294	**50,642**	**45,259**
Nature Station	49,032	48,902	44,740	45,765	47,649	42,817	42,102	46,841	39,384	**45,248**	**42,786**
Planetarium	26,593	28,379	27,233	25,386	29,734	26,904	23,335	26,843	20,825	**26,137**	**24,477**
TOTAL	**155,911**	**154,825**	**147,465**	**143,106**	**150,880**	**134,005**	**127,888**	**140,821**	**122,966**	**141,985**	**131,420**

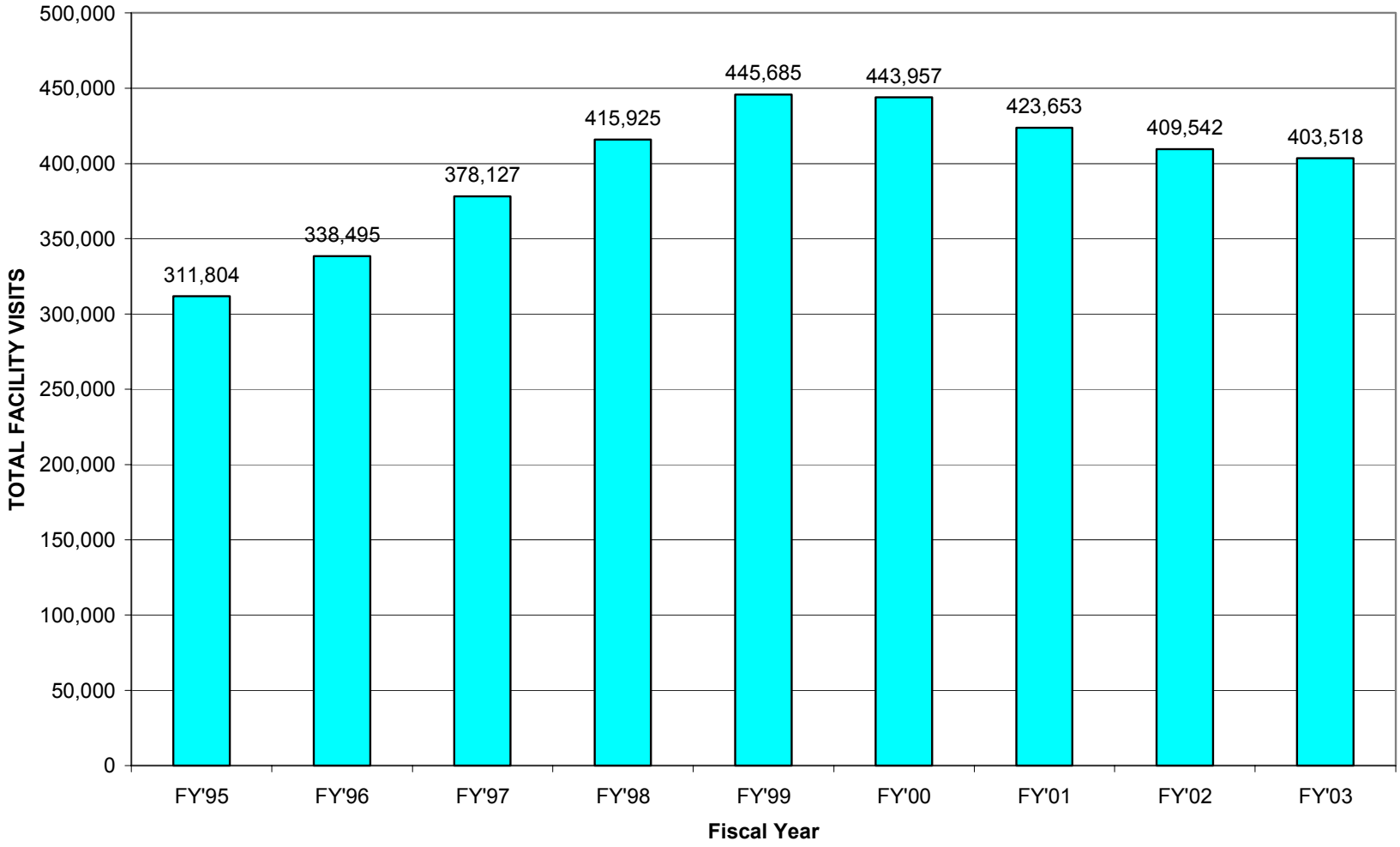
Source: LBL Monthly Visitation Reports

SPECIAL USE AREAS VISITATION
(calculated from traffic counter data)



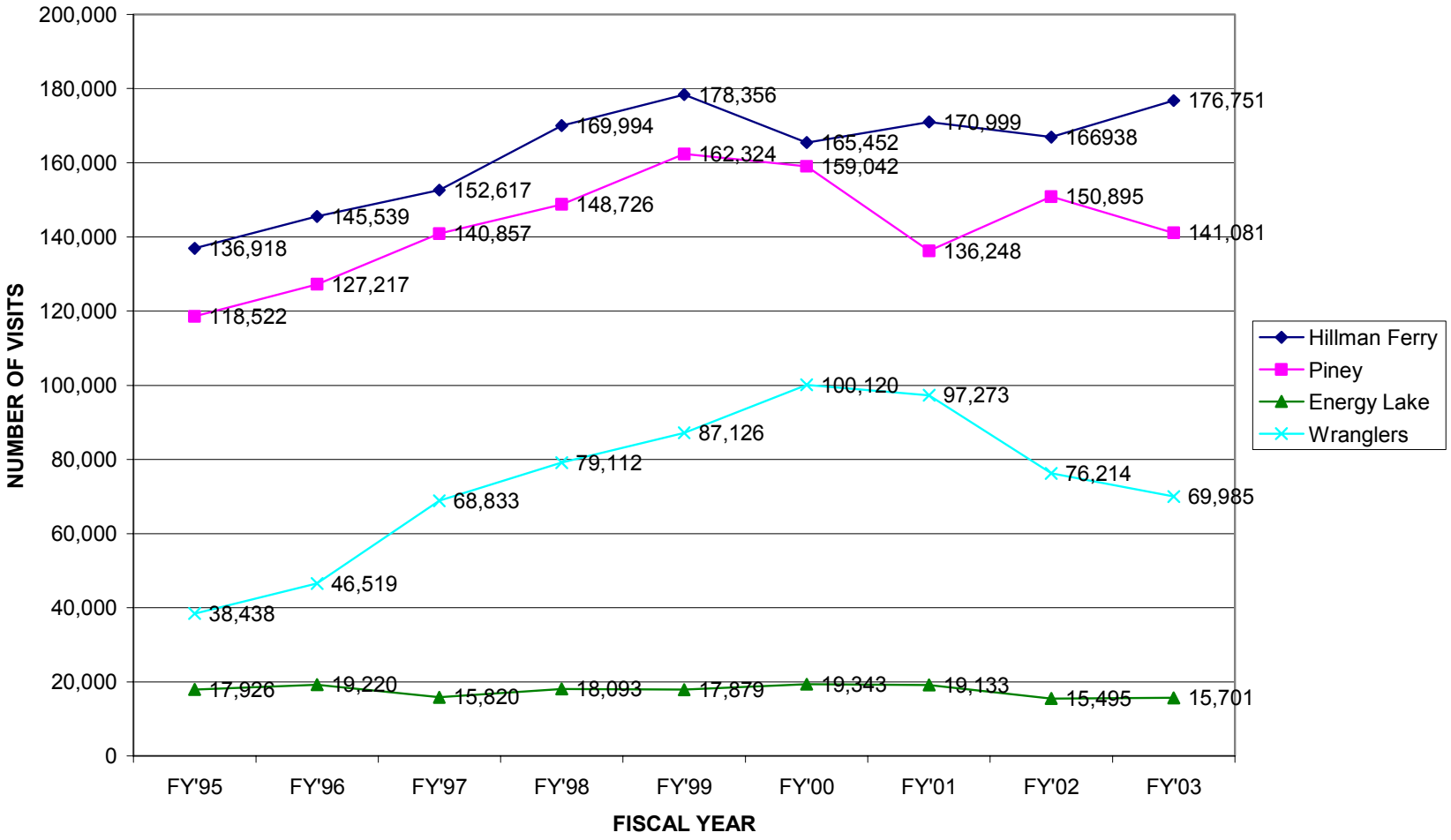
Source: LBL Monthly Visitation Reports

CAMPGROUND VISITATION TOTALS



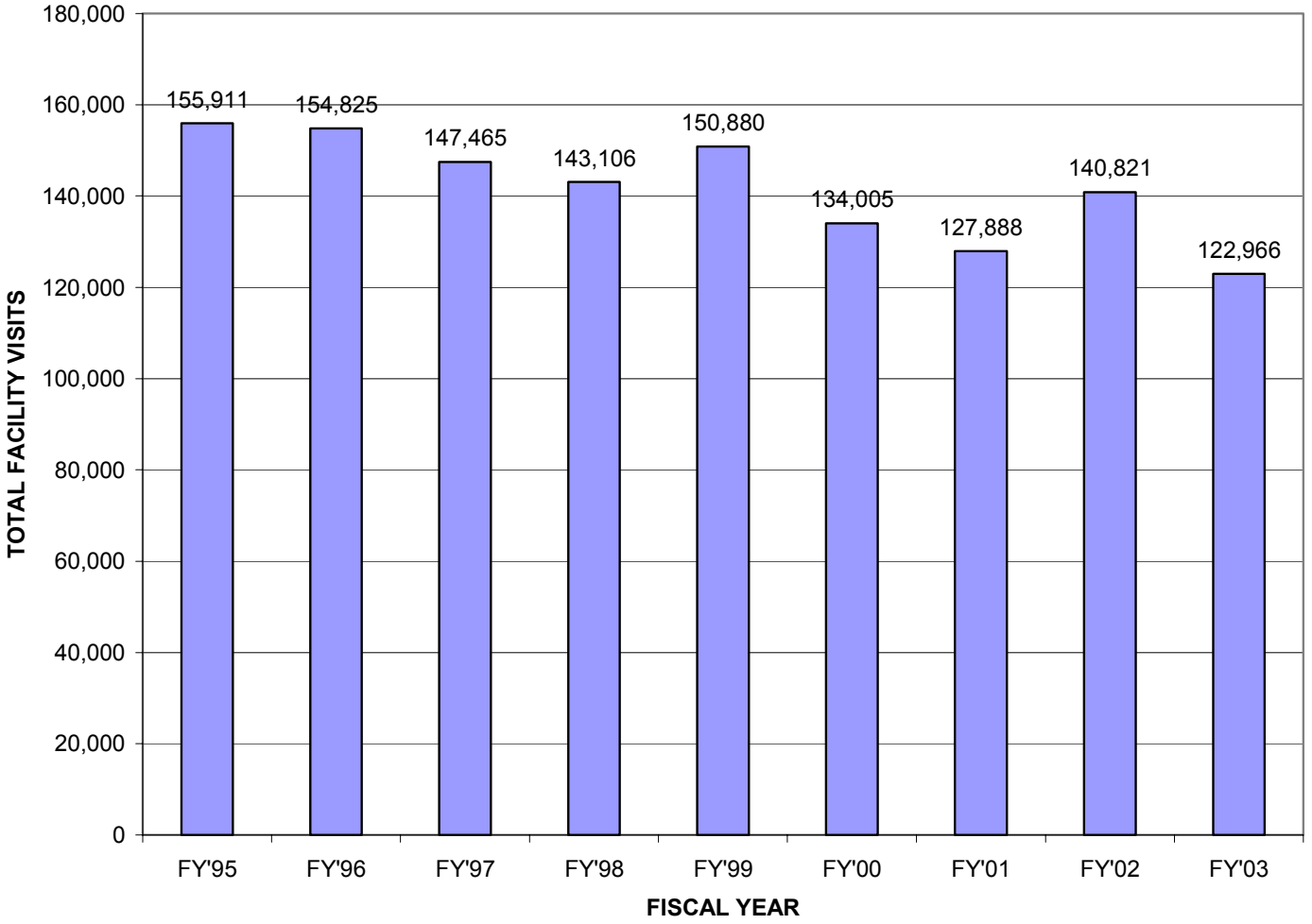
Source: LBL Monthly Visitation Reports

CAMPGROUND VISITATION
(by Campground)



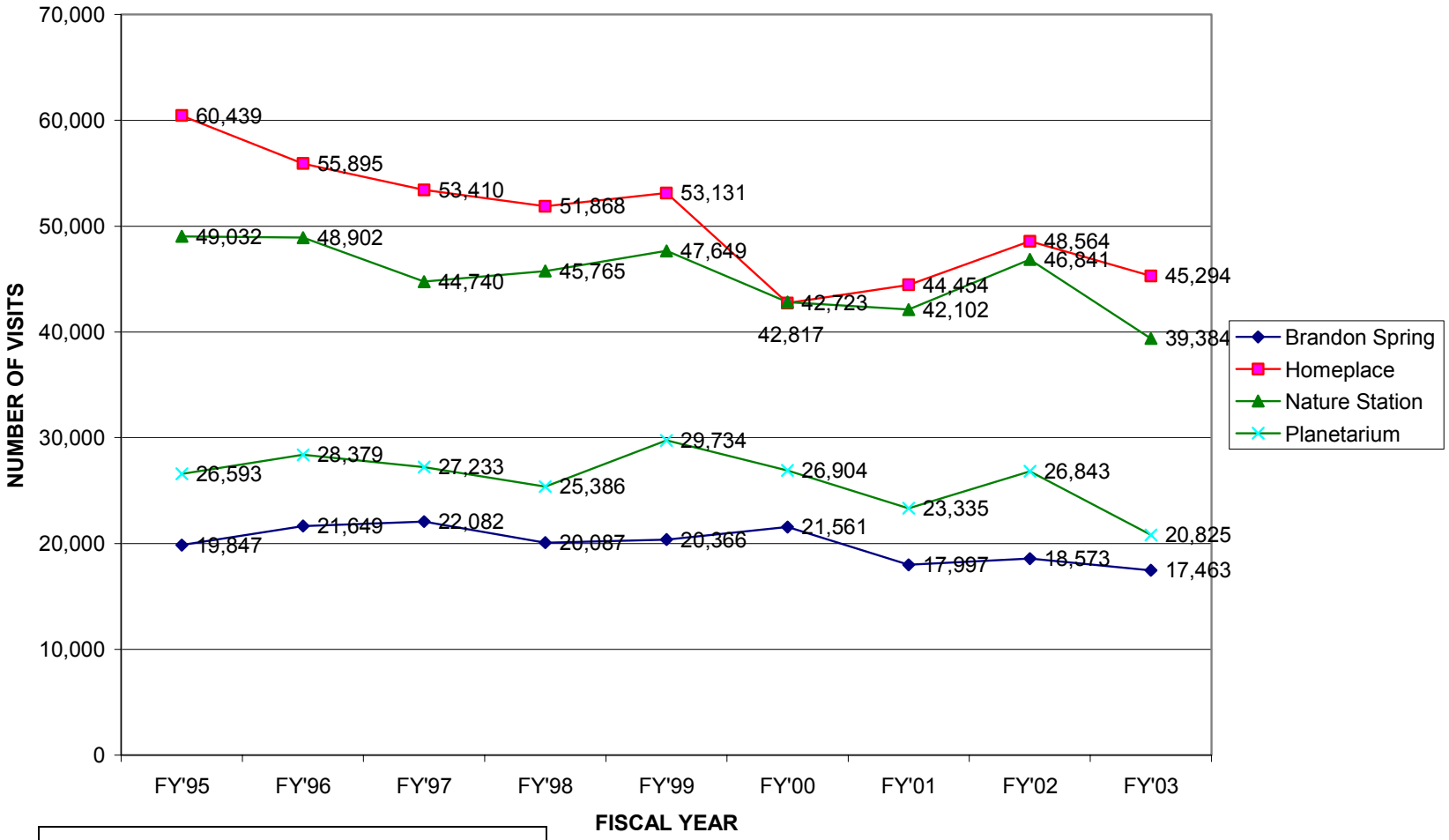
Source: LBL Monthly Visitation Reports

EE FACILITIES VISITATION TOTALS



Source: LBL Monthly Visitation Reports

EE FACILITIES VISITATION
(by Facility)



Source: LBL Monthly Visitation Reports

B.5 Fire Management

The following is a discussion of an analysis used to provide the estimated acreage that would need burning, listed in section 3.3.2, to achieve ecosystem-based management goals for ecological communities where fire has played a major role in natural stand replacement or maintenance. This analysis is based solely on ecological criteria and does not take into account the average number of burning days per year, the existing work force, and budget constraints.

The fire regime classification system is used to characterize the personality of a fire in a given vegetation type, including the frequency that the fire visits the landscape, the type of pattern created, and the ecological effects. The following natural fire regimes are arranged along a temporal gradient, from the most frequent to the least frequent fire return interval.

The definitions below are from the General Technical Report, Rocky Mountain Research Station #87 (GTR-RMRS-87).

Fire Regime	Frequency	Effect to Dominant Vegetation
Fire Regime I	0-35 years	Low Severity
Fire Regime II	0-35 years	Stand Replacement
Fire Regime III	35-100+ years	Mixed Severity
Fire Regime IV	35-100+ years	Stand Replacement
Fire Regime V	200+ years	Stand Replacement

Fire Regime I

Fires in the understory fire regime generally do not kill the dominant vegetation or substantially change its structure. Approximately 80 percent or more of the above ground dominant vegetation survives fire (Brown, 2000). The understory fire regime occurs primarily in southern pine and oak-hickory forests, which supports oak-hickory forest types found at LBL. Fire is a natural maintenance disturbance for these types of stands, and is used to maintain and regenerate oak-hickory for timber stand improvement (TSI) and wildlife stand improvement (WSI) concerns.

B.6 Timber

Base Sale Schedule for Five Decades

All timber production from suitable lands on LBL result from activities intended to enhance habitats, promote healthy forest conditions, or for purposes of environmental education, according to LBL's mission. Analysis of timber production for the five decade period covered in this analysis resulted from estimating the yields from treatments prescribed by wildlife biologists as those needed to produce the desired wildlife habitat conditions under each alternative. (See the document "Viability Evaluation – 021904," available in the project records.)

The following table summarizes the estimated timber outputs for the four alternatives. This level of output in the first decade equates to the allowable sale quantity (ASQ) for the alternatives.

Table 3.4.10B - Base Timber Sale Schedule

	mcf/Decade				
Alternative	1	2	3	4	5
W	7,272	8,593	9,942	11,280	12,508
X	9,867	11,740	13,554	15,577	17,735
Y	9,867	11,740	13,554	15,577	17,735
Z	5,673	6,713	7,771	8,940	10,173

Note: 1 mcf (thousand cubic feet) = approximately 5 mbf (thousand board feet).

	Acres/Decades				
Alternative	1	2	3	4	5
W	20,726	20,726	20,726	20,726	20,726
X	22,184	23,175	23,175	23,675	25,000
Y	22,184	23,175	23,175	23,675	25,000
Z	12,334	12,751	12,751	13,001	13,676

The above table discloses that Alternatives X and Y would place more timber in the local market than the other alternatives, followed by Alternatives W and Z. It is expected the products from these timber volumes would primarily be purchased by local timber operators.

Departure from Non-declining Even Flow

The regulations state that each unit should not schedule harvesting of more timber in one decade than can be sustained throughout each decade of the planning horizon, without good reason. The description of this constraint on management is "non-declining even flow."

Table 3.4.10B indicates that Alternatives W, X, Y, and Z do not propose to harvest more timber in the first decade than following decades.

Long Term Sustained Yield (LTSY)

Table 3.4.10C. - Long Term Sustained Yield

	Alternative			
	W	X	Y	Z
LTSY (mcf/Year)	2,155	1873	1819	1936

Note: 1 mcf (thousand cubic feet) = approximately 5 mbf (thousand board feet).

The model that calculated the values for the base timber sale schedule also calculated the long term sustained yield. LTSY is an estimate of the highest wood product yield that could be produced on a sustained basis each year from those lands being managed for timber production in a manner consistent with the area's multiple-use objectives. The purpose and result of this analysis is to disclose that none of the alternatives propose harvesting more timber than the land is capable of growing.

Suitability Analysis

Stage I Suitability Analysis

Classification	Acres
1. Total National Forest system land…….	171,254
2. Non-forest land (includes water)……	13,994
3. Forest land – Total…….	157,259
4. Forest land – Withdrasn from timber production (e.g., wilderness) …….	0
5. Forest land – Not capable of producing industrial wood ……..	0
6. Forest land – Irreversible damage likely to occur, not restockable ……..	0
7. Forest land – Inadequate information ……...	0
8. Tentatively suitable Forest Land ……...	157,259

Stage III Suitability Analysis

Classification	Alternative (Acres)			
	W	X	Y	Z
Tentatively Suitable Forest Land	157,259	157,259	157,259	157,259
Forest land – Not Appropriate for timber production (eg. Forest Core areas, Developed Recreation areas, Environmental Education areas, Acres managed for open areas, etc.)	42,559	54,069	58,319	52,169
Total Suitable Forest Land (General Forest and "Demo" areas)	114,700	103,190	98,940	105,090

Note: The "Stage II" Suitability Analysis does not identify any lands as either suitable or unsuitable for timber production. According to 36 CFR 219.14(b), it is used to identify those management practices that are the most economically efficient for producing timber. However, since timber production is not an objective for LBL, this analysis did not need to be pursued. Silvicultural activities will still occur, but they are all designed to meet other resource objectives. As a result, these activities will generally cost more than the revenues they will take in (e.g. thinning out a stand to improve its wildlife habitat conditions), but the use of a commercial timber sale would still be the most economical and efficient method to create those habitat conditions. A comparison of the revenues received from the timber that is produced from these silvicultural activities, compared to the costs of managing the vegetation, can be found in the Present Net Value analysis in Chapter 3 of this FEIS.

Timber output estimations for the Area Plan are based on forest information collected during the TVA tenure at the recreation area. TVA established 150 permanent plots throughout LBL, and remeasured them periodically.

The growth potential for these plots was estimated and analyzed over a 50-year period by using the "Forest Vegetation Simulator (FVS)". This information was then averaged by species group and structure class to develop the timber yield tables that are utilized to calculate the output for the alternatives.

Anticipated harvesting includes even- (EAM) and uneven-aged systems (UEAM). Refer to section 1.A in Appendix D of the FEIS for a thorough description of the included timber management treatments. Treatments include shelterwood harvests (SW), thinnings, and selection harvests. Yield tables were developed to represent the variety of timber management treatments proposed for the alternatives.

The species viability evaluation established the area, scheduling, and timber management activities needed to meet the objectives of the alternatives. This evaluation provided the input for the timber yield calculations, and is contained in the Project record.

Summary of activities Alternative W:

Community Type	Management Type	Treatment	ACRES/DECADE				
			1	2	3	4	5
Dry Oak Stable	EAM	Thin	4,200	4,200	4,200	4,200	4,200
Dry Oak Stable	EAM	Regen	0	0	0	0	0
Dry Oak Stable	UEAM		9,660	9,660	9,660	9,660	9,660
Dry Oak Successional	EAM	Thin	2,800	2,800	2,800	2,800	2,800
Dry Oak Successional	EAM	Regen	3108	3108	3108	3108	3108
Dry Oak Successional	UEAM		0	0	0	0	0
Mesophytic	UEAM		0	0	0	0	0
Mesophytic	EAM	Regen	424	424	424	424	424
Pine	UEAM		84	84	84	84	84
Pine	EAM	Thin	0	0	0	0	0
Pine	EAM	Regen	450	450	450	450	450
TOTALS			20,726	20,726	20,726	20,726	20,726

Summary of Outputs for Alternative W:

Community Type	Management Type	Treatment	mcf/DECADE				
			1	2	3	4	5
Dry Oak Stable	EAM	Thin	1,455	1,676	1,862	2,067	2,267
Dry Oak Stable	EAM	Regen	0	0	0	0	0
Dry Oak Stable	UEAM		1,739	2,000	2,318	2,550	2,695
Dry Oak Successional	EAM	Thin	834	1,042	1,226	1,418	1,603
Dry Oak Successional	EAM	Regen	1,873	2,392	3,034	3,665	4,309
Dry Oak Successional	UEAM		0	0	0	0	0
Mesophytic	UEAM		0	0	0	0	0
Mesophytic	EAM	Regen	528	599	610	671	703
Pine	UEAM		34	40	46	50	55
Pine	EAM	Thin	0	0	0	0	0
Pine	EAM	Regen	809	844	846	859	875
TOTALS			7,272	8,593	9,942	11,280	12,508

Summary of Activities for Alternative X:

Community Type	Management Type	Treatment	ACRES/DECADE				
			1	2	3	4	5
Dry Oak Stable	EAM	Thin	11,075	10,900	10,900	10,900	10,900
Dry Oak Stable	EAM	Regen	3,100	3,150	3,150	3,150	3,150
Dry Oak Successional	EAM	Thin	5,081	5,000	5,000	5,000	5,000
Dry Oak Successional	EAM	Regen	2,100	2,100	2,100	2,100	2,100
Dry Oak Successional	UEAM		300	1,500	1,500	1,800	3,000
Mesophytic	UEAM		200	325	325	525	650
Mesophytic	EAM	Regen	200	200	200	200	200
Pine	EAM	Thin	128	0	0	0	0
Pine	EAM	Regen	0	0	0	0	0
TOTALS			22,184	23,175	23,175	23,675	25,000

Summary of Outputs for Alternative X:

Community Type	Management Type	Treatment	mcf/DECADE				
			1	2	3	4	5
Dry Oak Stable	EAM	Thin	4,973	5,645	6,324	7,062	7,768
Dry Oak Stable	EAM	Regen	1,672	2,050	2,378	2,712	3,020
Dry Oak Successional	EAM	Thin	1,505	1,861	2,189	2,531	2,863
Dry Oak Successional	EAM	Regen	1,265	1,616	2,050	2,476	2,912
Dry Oak Successional	UEAM		36	210	245	340	660
Mesophytic	UEAM		42	74	81	139	182
Mesophytic	EAM	Regen	249	283	288	317	332
Pine	EAM	Thin	124	0	0	0	0
Pine	EAM	Regen	0	0	0	0	0
TOTALS			9,867	11,740	13,554	15,577	17,735

Summary of Activities for Alternative Y:

Community Type	Management Type	Treatment	ACRES/DECADE				
			1	2	3	4	5
Dry Oak Stable	EAM	Thin	11,075	10,900	10,900	10,900	10,900
Dry Oak Stable	EAM	Regen	3,100	3,150	3,150	3,150	3,150
Dry Oak Successional	EAM	Thin	5,081	5,000	5,000	5,000	5,000
Dry Oak Successional	EAM	Regen	2,100	2,100	2,100	2,100	2,100
Dry Oak Successional	UEAM		300	1,500	1,500	1,800	3,000
Mesophytic	UEAM		200	325	325	525	650
Mesophytic	EAM	Regen	200	200	200	200	200
Pine	EAM	Thin	128	0	0	0	0
Pine	EAM	Regen	0	0	0	0	0
TOTALS			22,184	23,175	23,175	23,675	25,000

Summary of Outputs for Alternative Y:

Community Type	Management Type	Treatment	mcf/DECADE				
			1	2	3	4	5
Dry Oak Stable	EAM	Thin	4,973	5,645	6,324	7,062	7,768
Dry Oak Stable	EAM	Regen	1,672	2,050	2,378	2,712	3,020
Dry Oak Successional	EAM	Thin	1,505	1,861	2,189	2,531	2,863
Dry Oak Successional	EAM	Regen	1,265	1,616	2,050	2,476	2,912
Dry Oak Successional	UEAM		36	210	245	340	660
Mesophytic	UEAM		42	74	81	139	182
Mesophytic	EAM	Regen	249	283	288	317	332
Pine	EAM	Thin	124	0	0	0	0
Pine	EAM	Regen	0	0	0	0	0
TOTALS			9,867	11,740	13,554	15,577	17,735

Summary of Activities for Alternative Z:

Community Type	Management Type	Treatment	ACRES/DECADE				
			1	2	3	4	5
Dry Oak Stable	EAM	Thin	5,625	5,526	5,526	5,526	5,526
Dry Oak Stable	EAM	Regen	2,200	2,250	2,250	2,250	2,250
Dry Oak Successional	EAM	Thin	2,581	2,500	2,500	2,500	2,500
Dry Oak Successional	EAM	Regen	1400	1400	1400	1400	1400
Dry Oak Successional	UEAM		150	750	750	900	1,500
Mesophytic	UEAM		100	175	175	275	350
Mesophytic	EAM	Regen	150	150	150	150	150
Pine	EAM	Thin	128	0	0	0	0
Pine	EAM	Regen	0	0	0	0	0
TOTALS			12,334	12,751	12,751	13,001	13,676

Summary of Outputs for Alternative Z:

Community Type	Management Type	Treatment	mcf/DECADE				
			1	2	3	4	5
Dry Oak Stable	EAM	Thin	2533	2869	3215	3590	3950
Dry Oak Stable	EAM	Regen	1187	1478	1713	1953	2174
Dry Oak Successional	EAM	Thin	760	931	1094	1266	1431
Dry Oak Successional	EAM	Regen	844	1077	1367	1651	1941
Dry Oak Successional	UEAM		18	105	122	170	330
Mesophytic	UEAM		21	40	43	73	98
Mesophytic	EAM	Regen	187	212	216	238	249
Pine	EAM	Thin	124	0	0	0	0
Pine	EAM	Regen	0	0	0	0	0
TOTALS			5673	6713	7771	8940	10173

MILL CAPACITY IN COUNTIES WITHIN 35 MILES OF LBL

	County	Company Name	Type Facility	Capacity in MMBF/YR
KY	Ballard	None		
KY	Caldwell	Beshears Sawmill	Commercial	5
KY	Calloway	McKnight & Sons Sawmill	Commercial	3
KY	Carlisle	Dixie Lumber Mill	Commercial	3
KY	Carlisle	Owens Saw Mill, Inc	Commercial	3
KY	Carlisle	Wright's Sawmill Inc.	Commercial	5
KY	Christian	Christian Co. Log & Lumber	Commercial	5
KY	Christian	Stolzfus, Timothy	Custom	0.1
KY	Crittenden	D Y Pallet	Commercial	0.5
KY	Crittenden	Dycusburg Log and Lumber	Commercial	3
KY	Crittenden	Hunt Hardwood Lbr.	Commercial	1
KY	Crittenden	Turner & Conyer Lumber Co., Inc.	Commercial	5
KY	Graves	Gibson Sawmill	Commercial	3
KY	Graves	Glisson Lumber Co., Inc.	Commercial	3
KY	Graves	Glisson Sawmill	Commercial	0.5
KY	Graves	Goodman & Sons Lbr Co., Inc.	Commercial	5
KY	Hopkins	85 Lumber Co.	Commercial	3
KY	Hopkins	A-R Lumber Co. Inc.	Commercial	3
KY	Hopkins	Caudill Milling	Commercial	5
KY	Hopkins	Grapevine Lumber	Commercial	3
KY	Hopkins	Vinise Menser Lumber Co.	Commercial	0.1
KY	Hopkins	Woodmizer Products	Commercial	5
KY	Livingston	Averitt Hardwood International	Commercial	10
KY	Livingston	Emmons Sawmill	Commercial	0.5
KY	Lyon	None		
KY	Marshall	Copeland Sawmill	Commercial	1
KY	Marshall	Holt Sawmill, Inc.	Commercial	5
KY	Marshall	Maple Springs Sawmill	Commercial	3
KY	McCracken	Gibbs Sawmill	Commercial	0.1
KY	Todd	J & D Lumber Company	Commercial	7
KY	Todd	Laster & Sons	Commercial	3
KY	Todd	Yoder Log & Lumber	Commercial	3
KY	Trigg	Averitt Hardwood International	Commercial	10
KY	Trigg	B & F Sawmill	Commercial	3
KY	Trigg	Calhoun Sawmill	Commercial	1
KY	Trigg	McCraw Lumber	Commercial	3
KY	Trigg	Newell Bailey Mills	Commercial	5

KY	Trigg	TW Lumber Company, LLC	Commercial	0.5
KY	Union	Sheril Lumber Co., Inc.	Commercial	5
KY	Webster	Blanford, C.L. Woodard	Commercial	3
KY	Webster	Western Bluegrass Lumber	Commercial	1
TN*	Benton			4.9
TN*	Carroll			13.5
TN*	Dickson			17.8
TN*	Henry			29.5
TN*	Houston			19.9
TN*	Humphreys			35.3
TN*	Montgomery			15.2
TN*	Stewart			39.7
TN*	Weakley			36.9
IL#	Hardin			0
IL#	Massac			2.6
IL#	Pope			2.6
	Total			346.2

Kentucky data is extracted from the Kentucky Division of Forestry publication "Primary Wood Industries of Kentucky 2001". This report presents annual capacity for each mill.

* Tennessee data is extracted from the USFS Southern Research Station Resource Bulletin SRS-52 "Forest Statistics for Tennessee, 1999," by Callie Jo Schweitzer. This reports the annual production from each county.

* Illinois data is extracted form a document located on the Internet at the address http://dnr.state.il.us/ conservation/forestry/2002/SAWMILL.htm. This reports the daily capacity for individual mills. The daily capacity is annualized by assuming there are 220 production days in a calendar year.

B.7 Benchmark Analysis

The forest planning regulations at 36 CFR 219.12(e)(1) describe benchmarks as a way to "define the range within which alternatives can be constructed." These benchmark analyses include:

- The minimum level of management needed to maintain and protect the unit as a part of the National Forest System;
- The maximum production level of significant resources;
- The resource uses that will maximize the present net value of those outputs that have an established market price or are assigned a monetary value;
- The current level of goods and services provided by the unit.

Minimum Level

For this benchmark analysis, the management objectives for LBL would be to:

- Protect the life, health, and safety of incidental users;
- Conserve soil and water resources;
- Prevent significant or permanent impairment of the productivity of the land;
- Administer unavoidable non-Forest Service special uses, licenses, permits, contracts, and operating plans.

Under this level of management:

- Incidental outputs would occur, but there would be no management activities that would produce timber, maintain wildlife management areas, or maintain developed recreation areas;
- Vegetation would follow natural succession;
- The only facilities that would be maintained would be those needed to support basic ownership activities;
- Dispersed recreation use that cannot be discouraged or controlled would occur.

A minimum level of management for this benchmark analysis means that there would be no developed recreation or facility-based environmental education on LBL. Developed facilities would be closed and possibly obliterated. Roads would be maintained only at levels necessary for minimal travel and the majority would be decommissioned. Boat ramps, trailheads, picnic areas, and scenic drives would not be maintained.

Minimum resource management would create a landscape of minimal habitat diversity. Open lands would revert to successional cover types, landscape character would be diminished and forested acres would naturally succeed toward climax cover types.

Another effect of minimum level management is that we would not be able to meet the habitat needs of those species associated with specific habitat requirements. Refer to section 3.*2 Biological Environment*.

Maximum Resource Production

For LBL, the two "significant resources" are recreation and wildlife.

For the wildlife resources, an analysis was performed that determined the "optimum" vegetative conditions needed to support the wildlife populations found on LBL. The analysis then determined the management activities needed to achieve those "optimum" conditions. A description of the results of this analysis can be found at in section 3.2.4 *Environmental Effects*.

For the recreation/education resources, LBL has the following opportunities to increase the level of developed and dispersed visits to the area:

- Upgrade and/or build new developed campgrounds;
- Construct public beach areas;
- Develop new trails for hiking, biking, horseback riding, and OHV riding;
- Expand size and programs of educational facilities;
- Expand hunting program and opportunities.

Maximum Present Net Value (with Assigned Values)

The best way to view this benchmark is to consider it as being the mix of products that would provide the most benefits for the dollar of input. For this benchmark, since wildlife and recreation provide the vast majority of the benefits values that can be assigned to outputs from LBL (see the Present Net Value discussion in Chapter 3 of this FEIS), it can be assumed that those activities that would maximize the recreation and wildlife resources would also maximize the present net value for LBL. See the above discussion on "Maximum Resource Production" for a description of those activities. For the most part, both of these levels of activities could be produced at the same time. However, the following are situations where attempts to maximize both recreation and wildlife resources would come into conflict:

- Expansion of recreation/ education facilities could hamper the ability to demonstrate ecosystem restorations such as the *Oak-Grassland Demonstration Areas;*
- Further recreational enhancement of the shoreline would be popular with visitors but may be detrimental to shoreline dependant species such as bald eagles;
- Development of more easily accessible recreational opportunities along the few perennial streams in LBL may cause harm to sensitive riparian areas;
- Increased timber harvests to maximize net value could decrease opportunities for remote recreation and affect forested habitat.

Current Level of Management

For this level of management, see Alternative W as described in Chapters 2 and 3 of this FEIS.

B.8 Air Quality

Through a series of legislative and regulatory requirements, federal land management agencies have two distinct and unique responsibilities: to protect the air, land, and water resources under their respective authorities from degradation associated with the impacts of air pollution emitted outside the borders of Agency lands (Clean Air Act, 1990); and to protect those same resources from the impacts of air pollutants produced within those borders (Clean Air Act, 1990, Organic Act, 1977, Wilderness Act, 1997). The authority and responsibility to protect resources within National Forest lands are not limited to Class I Wilderness Areas. Federal land managers are also required to take the necessary steps to protect all federal lands from those impacts. The Clean Air Act (CAA) of 1990 contains numerous sections dealing with these responsibilities, and Section 101(c) states the primary purpose of the Act:

> "A primary goal of this Act is to encourage or otherwise promote reasonable Federal, State, and local governmental actions, consistent with the provisions of this Act, for pollution prevention." (Clean Air Act, 1990)

Further, the National Forest Management Act states that Land and Resource Management Plans are, in part, specifically based on:

> "…recognition that the National Forests are ecosystems, and their management for goods and services requires an awareness and consideration of the interrelationships among plants, animals, soil, water, air, and other environmental factors within such ecosystems" (National Forest Management Act, 1976).

The LBL National Recreation Area (NRA) contains no Class I areas (wilderness or national parks) that are afforded special protection via the CAA. The closest Class I area to LBL is Mammoth Cave National Park in west/central Kentucky. The CAA requires Federal Land Managers to identify Air Quality Related Values (AQRV), or resources important to the areas that might be affected by air pollution. In this analysis the term AQRV will apply to any resources within the National Forest boundary that might be affected by air pollution.

This analysis has three primary purposes:

- Assess the existing state of air quality in and near LBL;
- Estimate the future state (within the time horizon of the Area Plan) of air quality in and near LBL, and how emissions from activities on LBL might affect air quality;
- Estimate existing and future air quality impacts to the natural resources (AQRVs) of LBL.

Area and Scope

Unlike the analysis area for the LBL Area Plan, which only assesses national forest lands, this analysis encompasses several much larger areas. Due to the regional nature of air quality issues, it is imperative that a much larger area than

just NF lands be analyzed. Therefore, two specific geographic areas have been selected:

- An area encompassing all lands within a 200 kilometer (124 mi.) radius of LBL;
- An area encompassing all lands within a 50 kilometer (31 mi.) radius of LBL.

Rationale for two separate assessment areas

- 200 km. radius buffer – Due to the regional transport of air pollutants and the chemical reactions that occur in the atmosphere, conversion of "primary" pollutants (i.e. sulfur dioxide) into "secondary" pollutants (i.e. sulfates), a large analysis area is needed. This analysis area is consistent with the U.S. Environmental Protection Agency (EPA), which routinely analyzes air emissions over multi-State regions across the U.S.A.

Broad-based emissions inventories, such as the EPA's National Emissions Inventory (NEI) (U.S. EPA, 2000), are most commonly summarized using pollutant specific emission totals per county. The analysis area was defined as those counties having a boundary within 200 kilometers of LBL (See Figure 1), and was prepared using data from EPA's 1999 NEI (EPA, 2000), the most recent comprehensive inventory.

- 50 km. radius buffer – this smaller geographic area focuses on air quality monitoring data. There are no State air quality monitors located on LBL, therefore to get an adequate sampling of air quality monitoring data near LBL, an analysis area must be established to obtain a reasonable sampling of air monitoring data. The area defined by the 50 km. radius from LBL was deemed adequate to take in a reasonable number of State air quality monitoring stations. (See Figure 2)

The 200 km. analysis area lies within the borders of eight states: (1) Kentucky, (2) Tennessee, (3) Alabama, (4) Arkansas, (5) Illinois, (6) Indiana, (7) Mississippi, and (8) Missouri (See Figure 1). The area is comprised of 135 counties, 3 of which cover LBL. Air pollutant emissions within this area are considered to have the most profound effects on the AQRVs of LBL, while at the same time the analysis area encompasses all lands that may be affected by emissions from activities on LBL.

The 50 km. assessment area lies within the borders of three states: (1) Kentucky, (2) Tennessee, and (3) Illinois (See Figure 2). The area is comprised of 24 counties. Since there is only one air quality monitoring station (non-State) located on the Forest, a larger region must be analyzed to obtain a reasonable amount of air quality data. Air monitoring equipment/data within this region are considered to be the most representative of LBL.

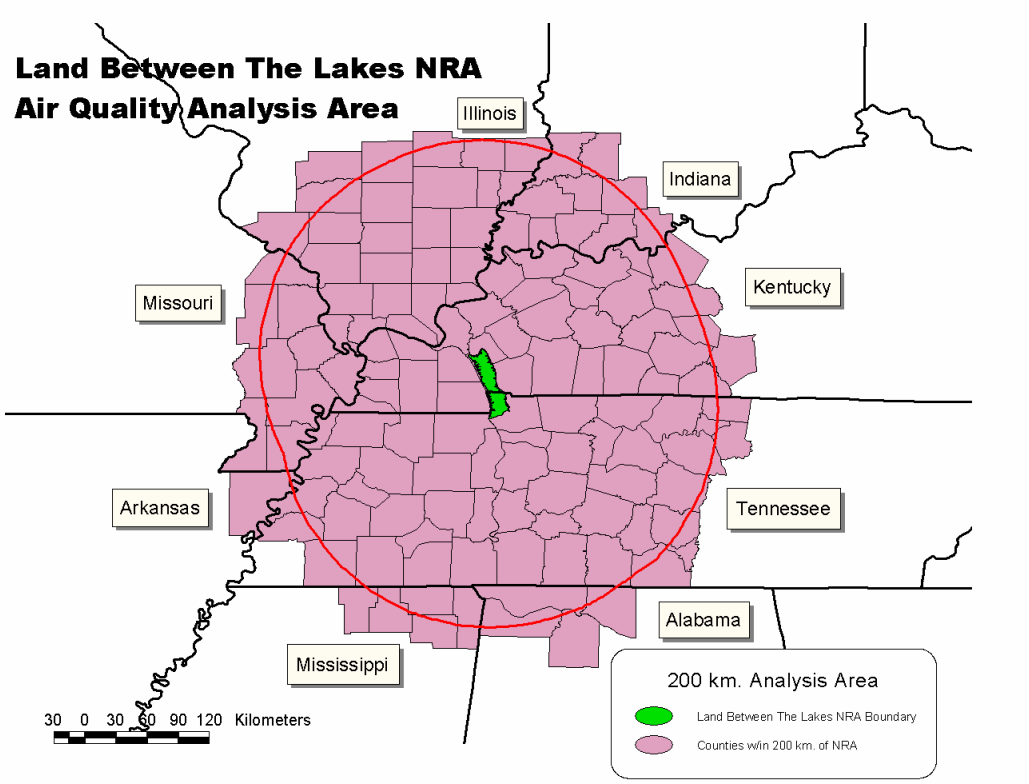


Figure 1: Analysis Area 200 kilometers (km.) from LBL's boundary

Structure of the Analysis

This analysis compares numerical emission inventories, air quality monitoring data, meteorological data, and distances between sources and LBL to make informed decisions regarding the Analysis of the Management Situation (AMS). Air quality on and near the Forest will be assessed in relationship to the National Ambient Air Quality Standards (NAAQS), and in terms of effects on AQRVs.

National Ambient Air Quality Standards

The Clean Air Act established six criteria air pollutants: sulfur dioxide, nitrogen oxides, ozone, particulate matter, carbon monoxide, and lead. States measure these pollutants in selected areas to monitor their levels. The NAAQS are the concentration thresholds of these pollutants that indicate unsafe air quality conditions for human health and welfare. Those areas not meeting the NAAQS are designated as non-attainment, and area-specific management plans must be written by each State air regulatory agency having authority. These plans must be incorporated into the affected State Implementation Plan (SIP). The goal of the SIP is to bring the affected area(s) back into attainment with the standards.

Currently there are no NAAQS non-attainment areas within 200 km of LBL. (See Figure 3). Although there are seven NAAQS "maintenance areas".

"Maintenance areas" are geographic areas that had formerly been in a non-attainment status, but through State pollution control efforts have complied with the NAAQS. Maintenance areas meet the NAAQS, but pollutant specific "State Implementation Plans" remain in effect to maintain compliance with the NAAQS.

NAAQS "Maintenance Area" Counties	NAAQS Pollutant
Benton Co., Tennessee	Sulfur dioxide
Humphreys Co., Tennessee	Sulfur dioxide
Colbert Co., Alabama	Sulfur dioxide
Lauderdale Co., Alabama	Sulfur dioxide
Muhlenberg Co., Kentucky	Sulfur dioxide
Fayette Co., Tennessee	Lead
Williamson Co., Tennessee	Lead

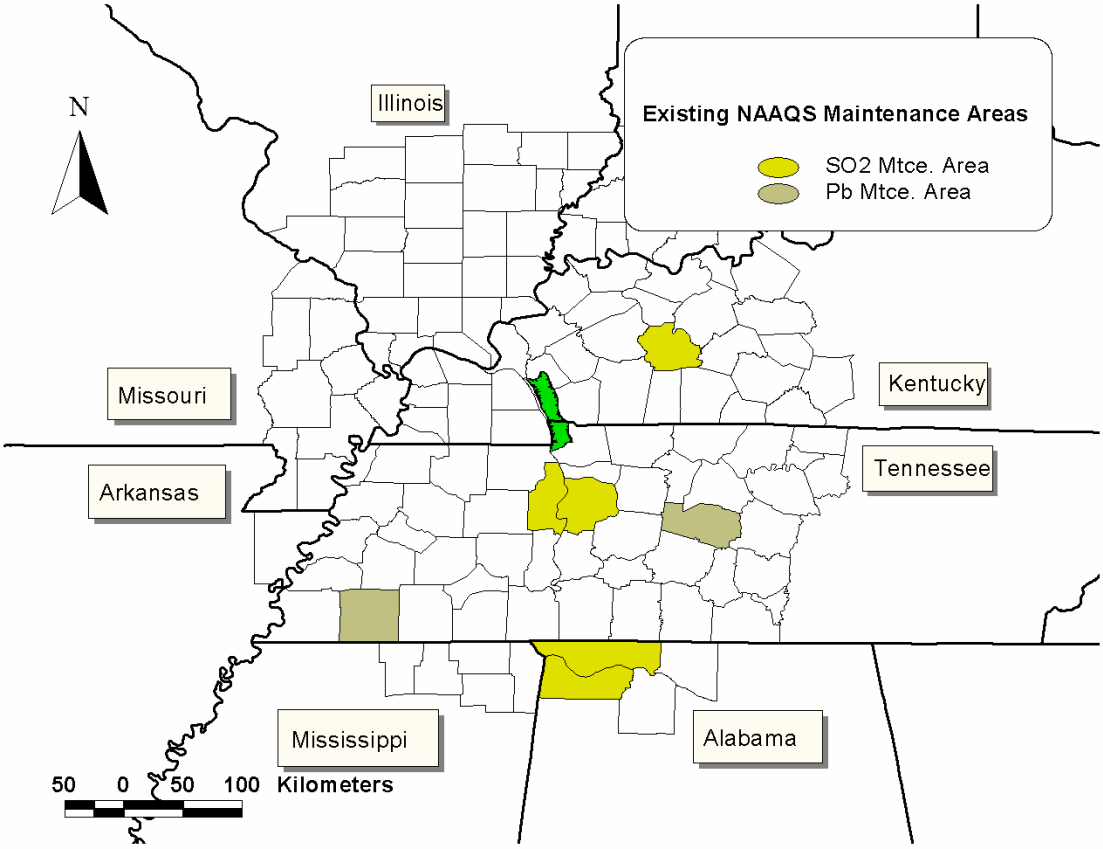


Figure 3: Existing NAAQS maintenance areas for SO_2 & lead within 200 km. of LBL.

Even though there are no non-attainment areas at this time, recent monitoring data for ozone (revised 8-hour NAAQS) and fine particulates ($PM_{2.5}$; new NAAQS) indicates that numerous counties may become non-attainment by 2005 (based on observation of the data by the author of this document). Three consecutive years of monitoring data is

needed to classify an area as non-attainment. State air regulatory agencies, in conjunction with the EPA, have the authority to classify an area as non-attainment. No State decisions regarding new ozone or fine particulate non-attainment designations have been made to date. Potential new non-attainment areas include (based on 1999 – 2001 State monitoring data):

County, State	PM2.5	Ozone
Christian Co., Kentucky		X
Colbert Co., Alabama	X	
Davidson Co., Tennessee	X	X
Edmonson Co., Kentucky		X
Livingston Co., Kentucky		X
McCracken Co., Kentucky	X	
McLean Co., Kentucky		X
Posey Co., Indiana		X
Rutherford Co., Tennessee		X
Simpson Co., Kentucky		X
Sumner Co., Tennessee	X	X
Warren Co., Kentucky	X	
Williamson Co., Tennessee		X

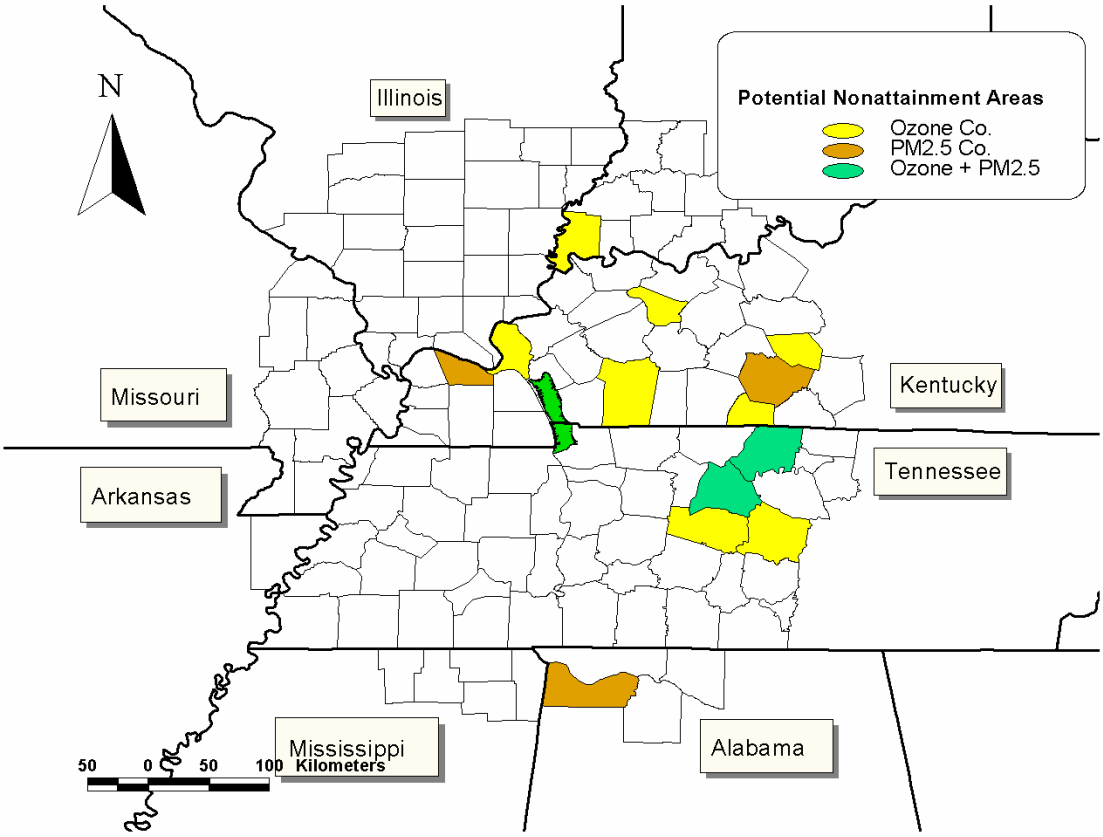


Figure 4: Possible New Non-Attainment Areas for Ozone & $PM_{2.5}$ within 200 km of LBL (based on 1999 – 2001 monitoring data).

For urban areas across the US that fail to meet the NAAQS, the EPA/States normally classify an entire "metropolitan statistical area" (MSA) as a non-attainment area. Such a classification is made if at least one air quality monitoring station, within a county that lies within an urban/metropolitan area, registers a specific exceedance for one, or more, of the NAAQS. For example, the entire Washington-Baltimore, DC-MD-VA-WV MSA area is classified as non-attainment for ozone, even though not all counties within the MSA exceed the NAAQS for ozone. MSA's are presented here since most of the above counties that may go into a non-attainment status will be classified by MSA's. Figure 5 locates MSA's within 200 km. of the NF. Therefore, the map of individual counties identified in Figure 4 above as being in a possible future non-attainment status, would be most likely designated by the States on an MSA basis.

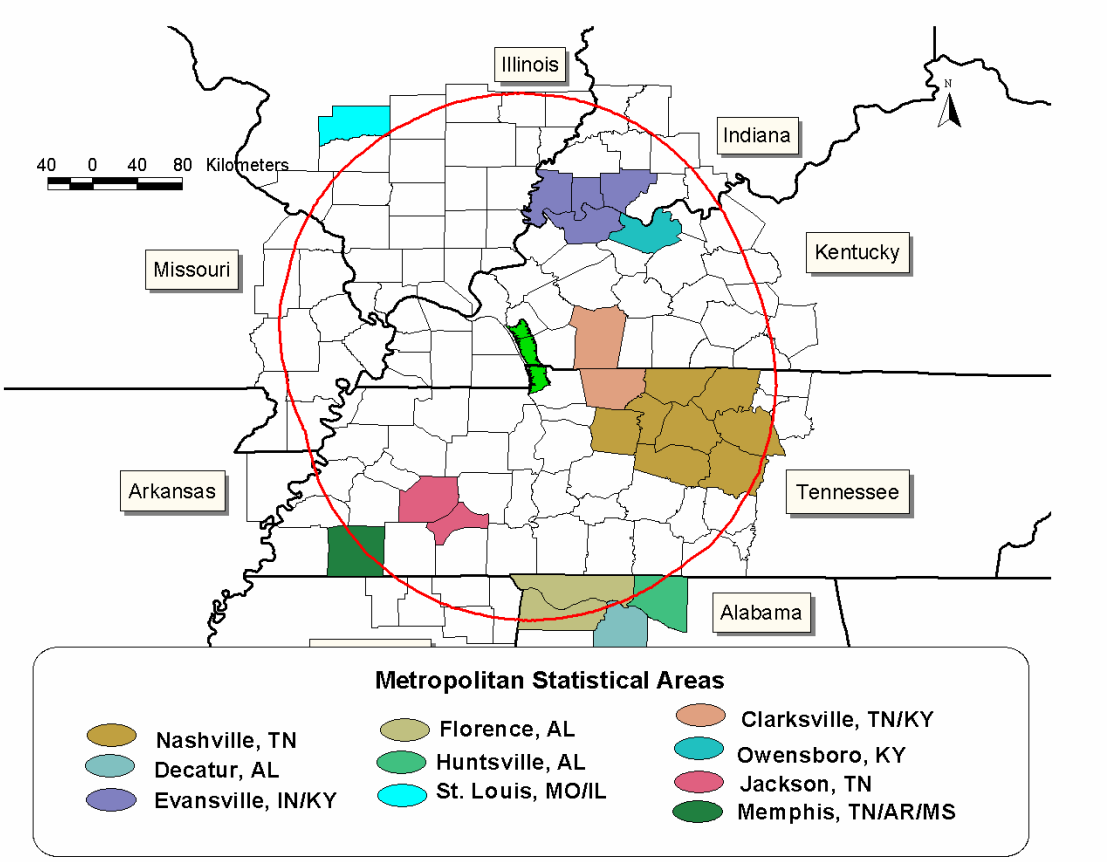


Figure 5: Metropolitan Statistical Areas (MSA's) within 200 km of LBL.

It is important for LBL to track air quality within and near its boundary because the attainment status of specific areas can potentially affect forest management activities. While automobiles used by LBL personnel, smoke produced from campfires, and other non-regulated combustion sources within LBL may have an impact on the quality of air within the analysis area; smoke from managed wildland fire is assumed to be the only LBL management activity to produce significant amounts of emissions. It is probable that numerous counties and MSA's will be classified as non-attainment for ozone (8-hour standard) and $PM_{2.5}$ within the planning lifecycle of LBL's Area Plan.

Background and Statistics of the Analysis Area

LBL lies near the industrial heart of the United States. It is within a day's drive of a large percentage of the United State's population, and is surrounded by a high concentration of coal-fired electrical power production facilities; leading sources of SO_2 and NOx emissions in the country. This network of coal fired electrical power plants includes the generally defined "Ohio River Valley" and Tennessee Valley Authority (TVA) sources. Within the assessment area are many coal-fired power plants, most of which were built before 1980 and therefore are "grandfathered" (exempt from most modern pollution controls) by the Clean Air Act Amendments. Although with recent EPA regulations to control the regional transport of ozone and the reduction of sulfur dioxide (SO_2)

emissions, many "grandfathered" power plants are adopting modern nitrogen oxides (NOx) and SO_2 controls. The 200 km analysis area contains many of the highest SO_2 and NOx emitting point source facilities in the United States. All 10 SO_2 and NOx sources are electric generation facilities. (See Tables 2 and 3 in the major air pollutants section).

Table 1 shows the national ranking of States in the analysis area for the three pollutants of concern of this analysis (NOx, SO_2, and $PM_{2.5}$). It is apparent that there are significant emissions of the pollutants associated with acid deposition (CASTNet, 2001) and ozone in the states within the analysis area.

Table 1: 1998 National Rankings of State- Level Emissions (thousand short tons), "National Air Pollutant Emissions Trends, 1900 – 1998", EPA.

State	SO_2 emitted	Natl. Rank	NO_X emitted	Natl. Rank	PM2.5 Emitted*	Natl. Rank
AL	764	9	619	15	184	15
AR	125	36	267	35	132	25
IL	1,153	4	1076	4	261	6
IN	1,164	3	848	7	154	20
KY	753	10	682	14	103	35
MO	482	15	546	16	252	8
MS	305	21	353	28	130	26
TN	789	7	761	10	130	28

* - Does not include $PM_{2.5}$ produced through chemical transformation in the atmosphere, "secondary $PM_{2.5}$" is very significant to resource effects in the analysis area.

Data Sources and Methods of Analysis

- Gather 1999 industrial and mobile source emissions data, representing the most recent comprehensive National Emissions Inventory for counties within the analysis areas (50 and 200 km.), focusing on those counties and individual sources that may most profoundly affect the Forest (EPA, 2001).
- Determine the location of a variety of monitoring sites in proximity to the Forest (EPA, 2001; IMPROVE, 2000; IMPROVE 2001; CASTnet, 2001; NADP, 2001; NOAA, 2001).
- Gather monitored pollutant deposition rate and ambient pollutant concentration data for multiple years within the analysis area (IMPROVE, 2000; IMPROVE 2001; CASTnet, 2001; NADP, 2001).
- Determine the location and extent of non-attainment areas within and adjacent to the analysis area (U.S. EPA, 1999).
- Spatial analysis of the above data, determining its proximity and relationship to LBL.
- Determine predominant wind patterns to predict the most likely paths of pollutant plumes entering and exiting LBL (NOAA, 2001).
- Determine present and proposed air quality regulatory initiatives, which affect the status of air quality within the analysis area.

Pollutant specific, county emission totals were categorized above or below 250 tons/yr. the criteria of 250 tons/yr was chosen because it corresponds to that emission level for which any single source will be designated as a Prevention of Significant Deterioration (PSD) source. Even though almost every county within the analysis area contains multiple sources, the Forest Service's Air Program is geared to track the construction and modification of any new or modified air pollution source because of the potential for emissions to negatively affect the Air Quality Related Values of specific Class I Wildernesses. The 250 tons/year trigger value chosen for this analysis indicates that any emissions over that level may have a negative effect on the resources of LBL. Any single source over 50,000 tons/yr within the analysis area is considered to have a significant effect not only on LBL, but the entire analysis area and beyond. Few sources within the analysis area emit more than 50,000 tons/yr. However, if a non-urban county's emissions exceed this value, it is reasonable to assume that the county contains one or more facilities emitting 10,000 tons/yr.

Dry and wet deposition values for sulfate and nitrate deposition were reviewed from the CASTNet and NADP/NTN data, respectively, for those monitors within or closest to the analysis area. Deposition values indicate how emissions of primary pollutants are chemically transformed to secondary pollutants within the affected region. Deposition trends were reviewed to ascertain impacts to LBL.

Ozone monitoring data from sites near LBL were used to estimate potential ozone non-attainment areas, and to assess potential impacts to vegetation on LBL.
Predominant wind directions were determined from sources at the National Oceanic and Atmospheric Administration (NOAA). While not precise, predominant wind direction data can give some indication of which sources within the analysis area may have the most significant effects on the Forest.

Professional judgment of the authors was used to answer the following questions:

- Are primary pollutant emission levels within and outside the analysis area resulting in changes in ambient air quality and secondary pollutant deposition within LBL, and how is this deposition affecting the resources of LBL?
- How will future legislative and regulatory initiatives affect LBL management options?

Pollutants Considered

Due to the complicated nature of air pollutant formation and transport, it is often difficult to discuss air quality issues in a simple format. Exhaust from mobile sources such as automobiles, trucks, and aircraft; emissions from various point source industrial processes, dust from roads; and even biogenic emissions from natural processes such as wildfires and plant growth, contribute to the quality of air within any given region. While primary pollutant emissions can give an indication of the status of air quality, these primary pollutants undergo reactions in the atmosphere to produce secondary pollutants. Often the secondary pollutants have a greater impact on the AQRV's of LBL than the primary pollutants.

In an attempt to present the information in a logical sequence the primary pollutants and their sources are discussed first in the *Primary Pollutants section*. Information on monitoring sites for $PM_{2.5}$ is presented in this section as well. The secondary pollutants formed from these primary pollutants are mentioned in the primary pollutant discussion, but are not discussed in detail there. The *Secondary Pollutant* section contains a more detailed discussion of secondary pollutant formation and effects, as well as monitoring information.

Regional climate change resulting from emissions of carbon dioxide and other greenhouse gases is not discussed in this analysis. It is recognized that resources within LBL could be susceptible to climate change. However, uncertainty concerning the nature of regional climatic changes and global aspects of the phenomenon place this issue outside the scope of this analysis.

Primary Pollutants Considered

Three primary pollutants were selected to incorporate into this report. They represent three of the six "Criteria Pollutants" recognized by the EPA (USEPA, 1995).

- Sulfur dioxide (SO_2)
- Nitrogen oxides (NO_X)
- Particulate matter, 2.5 microns and smaller ($PM_{2.5}$)

These pollutants were selected for analysis because they are the precursors that form secondary pollutants suspected of having the most profound effects on the resources of LBL. These effects include visibility reductions and impacts to vegetation and aquatic ecosystems. Subsequent information presented on the primary pollutants includes the location and intensity of emissions relative to LBL, as well as probable future trends.

Both stationary and mobile sources emit significant levels of the primary pollutants; with coal-fired power production ranking first for emissions of SO_2 and NOx, and mobile sources a close second in the production of NOx.

Sulfur Dioxide (SO2)

About 65 percent of sulfur dioxide released to the air (11.2 million tons in 2000), comes from electric utilities, especially those that burn coal (EPA, Trends Report 2001). Other sources of SO_2 are industrial facilities that derive their products from raw materials like metallic ore, coal, and crude oil, or that burn coal or oil to produce process heat. Examples are petroleum refineries, cement manufacturing, and metal processing facilities. Also, locomotives, large ships, and some non-road diesel equipment currently burn high sulfur fuel and release SO_2 emissions to the air in large quantities. Secondary pollutants formed from SO_2 emissions such as sulfates and sulfites, reduce visibility and contribute to acid deposition. Figure 6 shows county specific SO_2 emissions from the

EPA 1999 emission inventory, within the analysis area. Heavy concentrations of SO_2 generally correspond to large "point sources", such as coal-fired electric generation facilities.

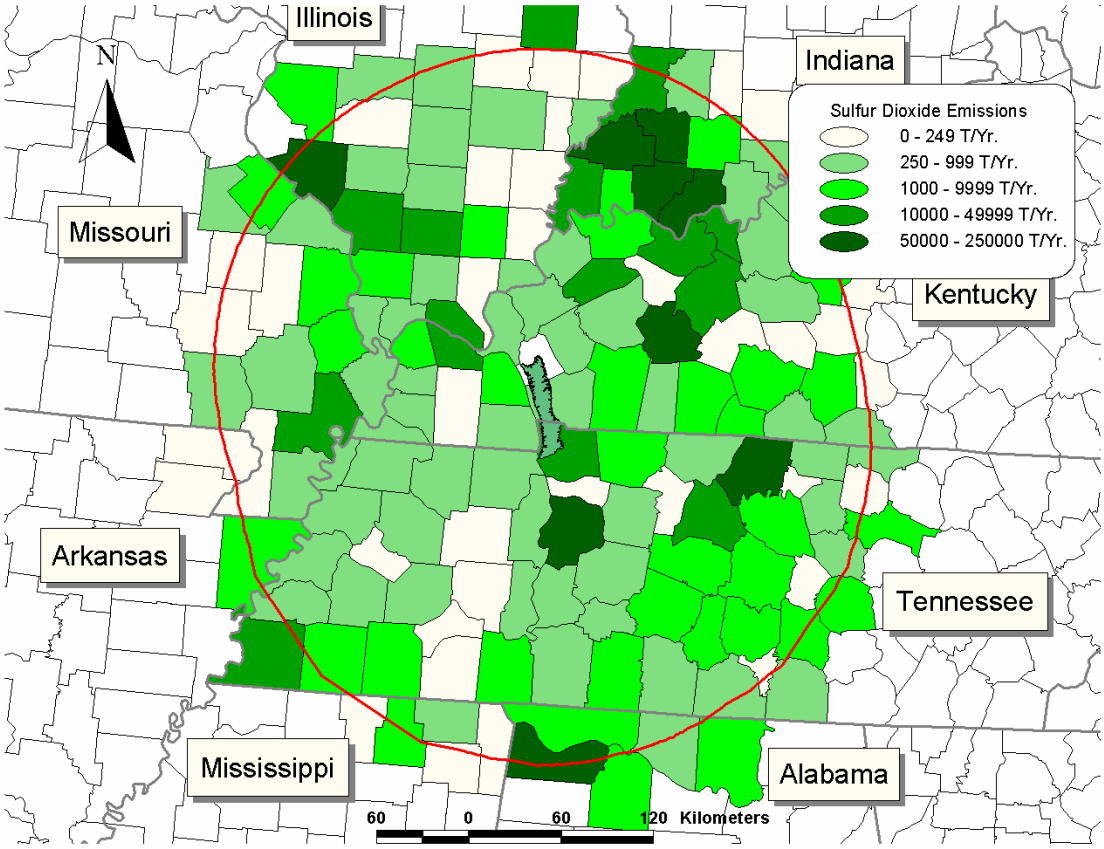


Figure 6: Total SO_2 emissions for each county in tons per year.

The ten point source facilities with the highest annual emission rates within the 200 km. analysis area are listed in Table 2. These sources are among the top twenty SO_2 emitting point sources in the country, all are electric service utilities.

Table 2: Ten Largest "point" sources of SO_2 emissions in the 200 km analysis area (1999 data).

Tons/Year of SO_2	Source Name	Location
245,244	Illinois Power Co. – Baldwin	Randolph Co., IL
181,066	TVA	Muhlenberg Co., KY
158,901	PSI Energy - Gibson	Gibson Co., IN
150,222	TVA-Johnsonville Steam Plant	Humphreys Co., TN
119,656	Sigeco-Warrick Pwr., Alcoa Generating	Warrick Co., IN
84,841	TVA-Gallatin Steam Plant	Sumner Co., TN
69,632	TVA-Colbert	Colbert Co., AL
66,879	IN-MI Power, Rockport	Spencer Co., IN
50,199	Ipalco-Petersburg	Pike Co., IN
37,437	Western KY Energy Corp.	Hancock Co., KY

Nitrogen Oxides

More than 95 percent of nitrogen oxide (NO_x) emissions are in the form of nitric oxide. In the presence of volatile organic compounds and sunlight, nitrogen oxides are rapidly converted in the atmosphere to ozone. Available evidence suggests that nitrogen oxides are a controlling factor in the formation of ground-level ozone in rural areas of the Southern United States (Chameides and Cowling, 1995). When trapped in sufficient quantities, nitrogen dioxide can be seen as a brownish haze. Secondary pollutants formed from nitrogen oxides also reduce visibility and contribute to acid deposition. Figure 7 shows county specific nitrogen oxide emissions for 1999 within the 200 km. analysis area.

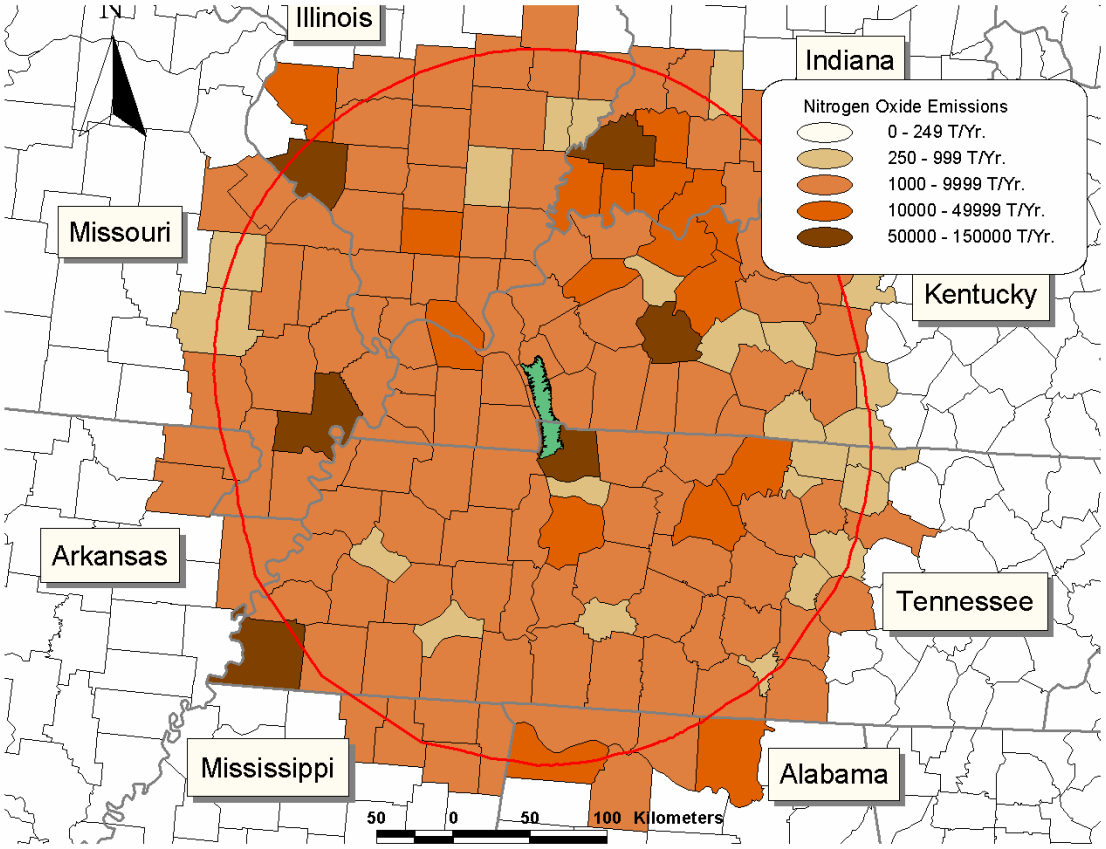


Figure 7: County specific nitrogen oxide emissions in tons/year.

Ten largest NO_x point sources in the 200 km. analysis area are listed in Table 3. Many are among the top NO_x emitting point sources in the nation, all are electric service utilities.

Table 3: Ten largest "point sources" of NO_x within the 200 km. analysis area. (1999 data)

Tons/year of NOx	Source Name	Location
104,357	TVA	Muhlenberg Co., KY
82,671	TVA-Cumberland Steam Plant	Stewart Co., TN
55,027	IL Power Co. - Baldwin	Randolph Co., IL
52,222	Assoc. Electric Coop Incorp.	New Madrid Co., MO
49,450	PSI Energy - Gibson	Gibson Co., IN
37,960	IN – MI Power - Rockport	Spencer Co., IN
24,319	TVA-Envir. Affairs	McCracken Co, KY
20,461	TVA-Johnsonville Steam Plant	Humphreys Co., TN
20,201	Ipalco - Petersburg	Pike Co., IN
17,142	TVA-Colbert	Colbert Co., AL

Particulate Matter (PM2.5)

Particulate matter (PM) is the general term used for a mixture of solid particles and liquid droplets found in the air. Some particles are large or dark enough to be seen as soot or smoke. Others are so small they can be detected only with an electron microscope. $PM_{2.5}$ describes the "fine " particles that are less than or equal to 2.5 micrometers in diameter. "Coarse " particles refers to particles greater than 2.5, but less than or equal to 10 micrometers in diameter. PM_{10} refers to all particles less than or equal to 10 micrometers in diameter. A particle 10 micrometers in diameter is about one-seventh the diameter of a human hair. Particulate matter can result from primary emissions, and secondary atmospheric formation.

"Primary " particles, such as dust from roads or elemental carbon (soot) from wood combustion, are emitted directly into the atmosphere. "Secondary " particles are formed in the atmosphere from primary gaseous emissions. Examples include sulfate, formed from SO_2 emissions from power plants and industrial facilities; and nitrates, formed from NO_x emissions from power plants, automobiles, and other types of combustion sources.

The chemical composition of particles depends on location, time of year, and weather. Generally, fine particulate is composed mostly of secondary particles, and coarse particulate is composed largely of primary particles. This section will focus on primary particulate emissions; the formation of secondary particulates will be discussed under secondary pollutants.

Primary fine particles come from many different sources, including industrial and residential combustion and vehicle exhaust. Due to the wide range of fine particle sources, their compositions vary widely. Figure 8 shows total primary, solid $PM_{2.5}$ emissions from point and mobile combustion sources.

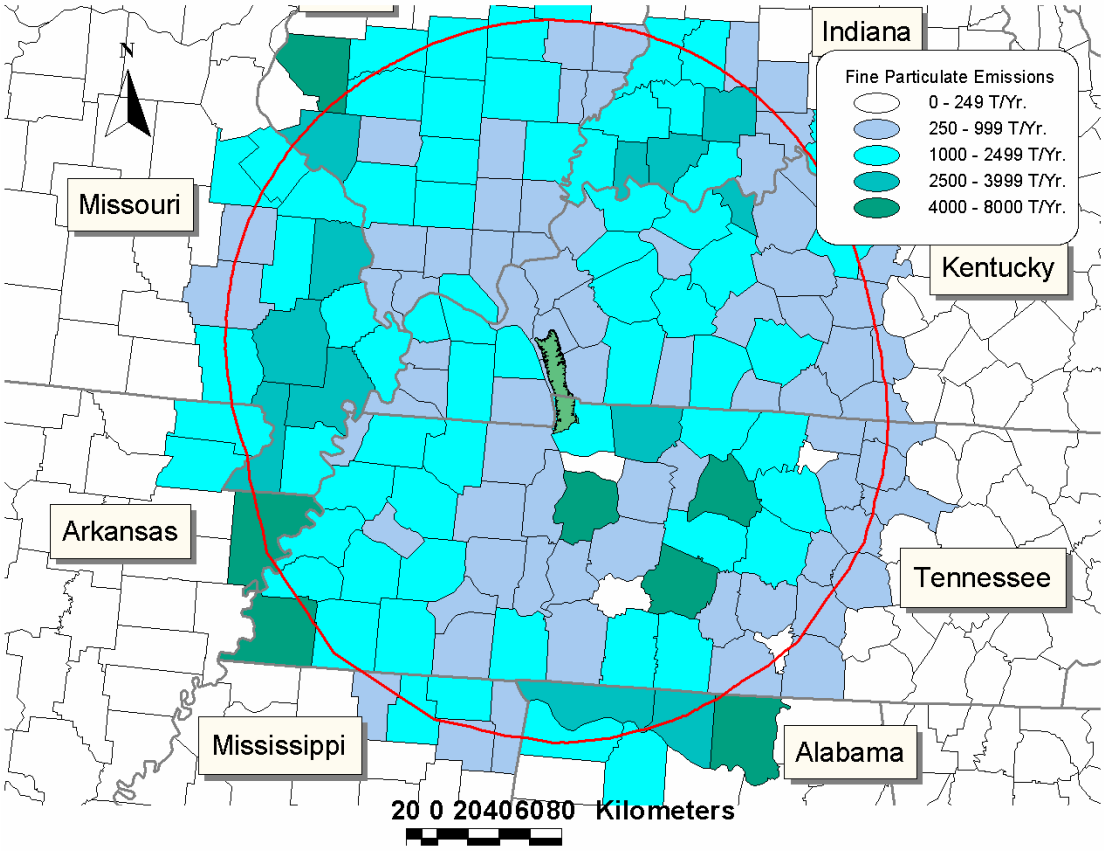


Figure 8: Primary, solid $PM_{2.5}$ emissions from all sources.

Soot particles from wildland fires are a small, but significant part of the total $PM_{2.5}$ load. However, it is important to note that $PM_{2.5}$ particles from wildland fires are not included in the values reported in Figure 8. Wildland fire $PM_{2.5}$ production is categorized by the EPA as "area source" emissions, Figure 8 only captures "point sources" of emissions.

Collectively, these fine particles can lead to deterioration of visibility across LBL and Class I areas, and are associated with significant respiratory and cardiovascular-related problems (U.S. EPA, 2001). When inhaled, particles can accumulate in the respiratory system and are associated with numerous adverse human health effects. Exposure to coarse particles is primarily associated with the aggravation of respiratory conditions, such as asthma. Fine particles are closely associated with increased hospital admissions and emergency room visits for heart and lung disease, increased respiratory disease, decreased lung function, and even premature death. Sensitive groups are at greater risk, and include the elderly, individuals with cardiopulmonary disease such as asthma and children. Fine particles are the major cause of reduced visibility in many parts of the United States. Airborne particles also can impact vegetation and ecosystems and can cause damage to paints and building materials. For this reason, fine particle levels are monitored, and NAAQS have been set for this pollutant. Figure 9 shows the $PM_{2.5}$ monitors that are in counties that border, or are near, LBL.

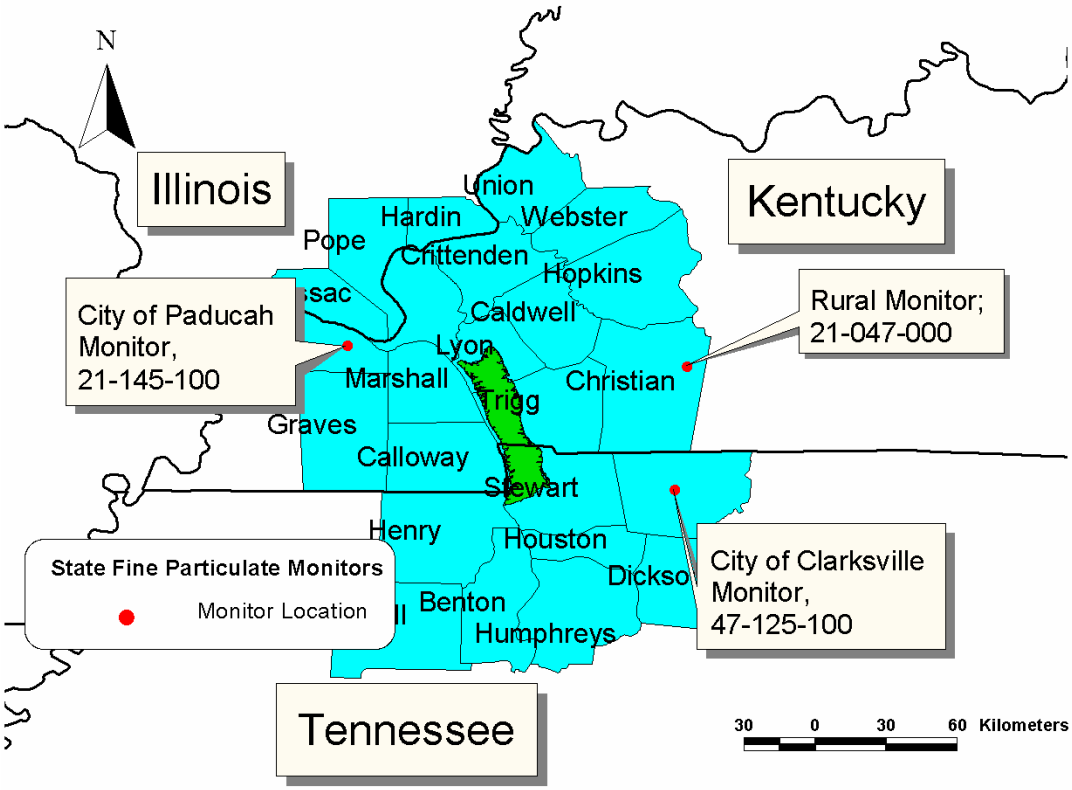


Figure 9: State $PM_{2.5}$ monitors in counties near LBL (50 km. analysis area)

Both annual and 24-hour $PM_{2.5}$ and PM_{10} NAAQS have been established. For $PM_{2.5}$, the annual arithmetic mean for all 24-hour sampling periods can be no more than 15 micrograms per cubic meter (ug/m^3), or the annual 24-hour sampling period maximum can be no more than 65 ug/m^3. The data in Table 4 shows whether the NAAQS were met by comparing the annual average and annual 24-hour maximum (1st highest) to the $PM_{2.5}$ NAAQS for the monitoring sites in Figure 9.

It is important to note that the monitoring data shown below not only reflects the total primary emissions of $PM_{2.5}$ shown in Figure 8, but also includes secondary $PM_{2.5}$, such as sulfates and nitrates. A majority of the $PM_{2.5}$ observed through monitoring is the result of this gas to particle transformation in the atmosphere. (refer to *$PM_{2.5}$ and Visibility Impacts* under the *Secondary Pollutant* section in the following pages.)

Table 4: Fine Particulate annual average and 24 hour max values for monitors within 50 km. of LBL. Values for sites in italics exceed the NAAQS (Annual = 15 µg/m^3, 24 hr. = 65 µg/m^3)

State	County	Monitor ID	1999		2000		2001s	
			Annual Avg	24 Hr Max	Annual Avg	24 Hr Max	Annual Avg	24 Hr Max
KY	Christian	21047000-6881011	*15.34*	35.0	*17.03*	40.4	14.51	33.4
KY	McCracken	21145100-4881011	*15.8*	39.7	*15.31*	40.8	14.62	33.0
TN	Montgomery	47125100-9881011	*16.74*	43.0	*15.33*	33.4	13.93	27.5

* Air quality sampling, analysis and reporting is the result of joint effort of State air regulatory agencies and the EPA. Data summaries obtained from EPA - http://www.epa.gov/air/data/index.html

Of the three closest $PM_{2.5}$ monitors to LBL, all exceed the annual $PM_{2.5}$ standard in 1999 and 2000. Three full years of monitoring data are needed to classify a county as non-attainment (exceeding the standard). Once 2002 and 2003 data are available and a three-year average is computed, all three of the above counties may become non-attainment for $PM_{2.5}$. Once an area is designated non-attainment, an SIP is developed in an attempt to bring the area back into attainment. This usually involves placing controls on various $PM_{2.5}$ sources to lessen/minimize their $PM_{2.5}$ emissions. LBL will need to interact with the Kentucky and Tennessee air regulatory agencies to ensure that managed wildland fire emissions are considered in their respective SIP development.

It is of particular importance for fire managers to mitigate managed wildland fire emissions, to the greatest extent practical, during those days characterized by existing or predicted high ambient particulate loads. Federal land managers utilizing managed wildland fire are most interested in the 24-hour NAAQS, due to the short-term nature of managed wildland fire. While managed wildland fire emissions rarely affect the PM_{10} NAAQS (150 ug/m^3), it is more likely that fire emissions could affect the lower $PM_{2.5}$ NAAQS (65 ug/m^3). The $PM_{2.5}$ standard may require fire managers to be even more vigilant to protect the health and welfare of citizens on and off federal lands from the effects of PM emissions associated with wildland fire.

Secondary Pollutants Considered

Three broad classes of secondary pollutants are analyzed:

- Sulfate and nitrate deposition as they contribute to acid precipitation,
- Ozone and its effects on vegetation,
- Fine particulate ($PM_{2.5}$) and its effect on visibility (regional haze).

Primary pollutants emitted from stationary and mobile sources undergo transformations in the atmosphere and are converted to secondary air pollutants (CIRA 1999). Sulfates and nitrates are "the main contributors" to regional haze and acid rain, and can be transported hundreds of miles. However, based on numerous Agency sanctioned modeling studies, those pollution sources within 200 kilometers of any given area appear to have the most significant impact on that area's resources.

Acid deposition - sulfate and nitrate deposition

The secondary pollutants sulfate and nitrate are of great importance due to their combined contribution to acid deposition and regional haze. Data illustrated below suggests that LBL is within an area of moderately high sulfate and nitrate deposition (both wet and dry) for the United States. Such deposition can have a detrimental effect on natural systems if those systems are not adequately buffered. On LBL, historic and current loading of sulfates, combined with soils and geology with adequate buffering capacity, has not caused headwater streams to acidify.

Wet deposition values for sulfate and nitrate, from National Acid Deposition Program (NADP) monitoring stations for 2001 are shown in Figures 10 and 11, respectively. It is clear the Ohio River Valley is a region of high sulfate and nitrate deposition. This is not surprising since a large portion of electrical generation with coal takes place there. Prevailing southeast winds carry pollutants up from the Tennessee Valley while at the same time minimizing the intrusion of the more heavily polluted Ohio Valley region.

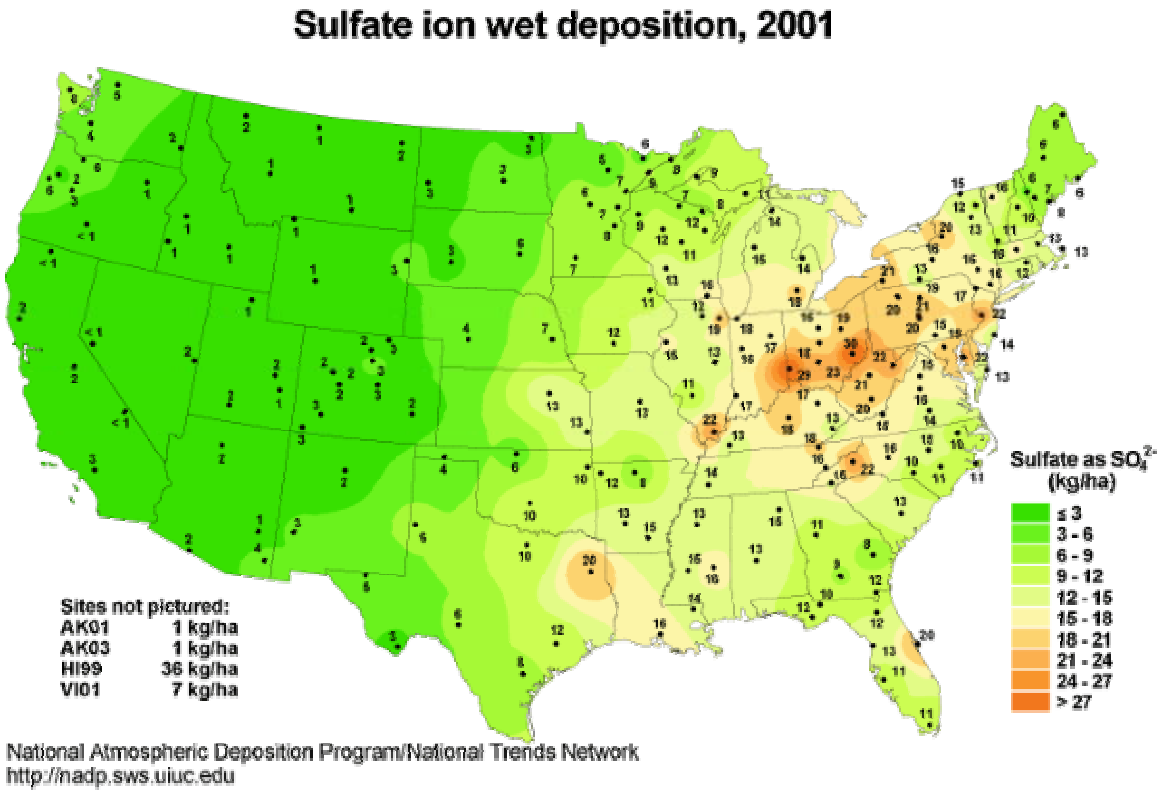


Figure 10: Estimated Sulfate ion Deposition Rates, 2001. Source: NADP.

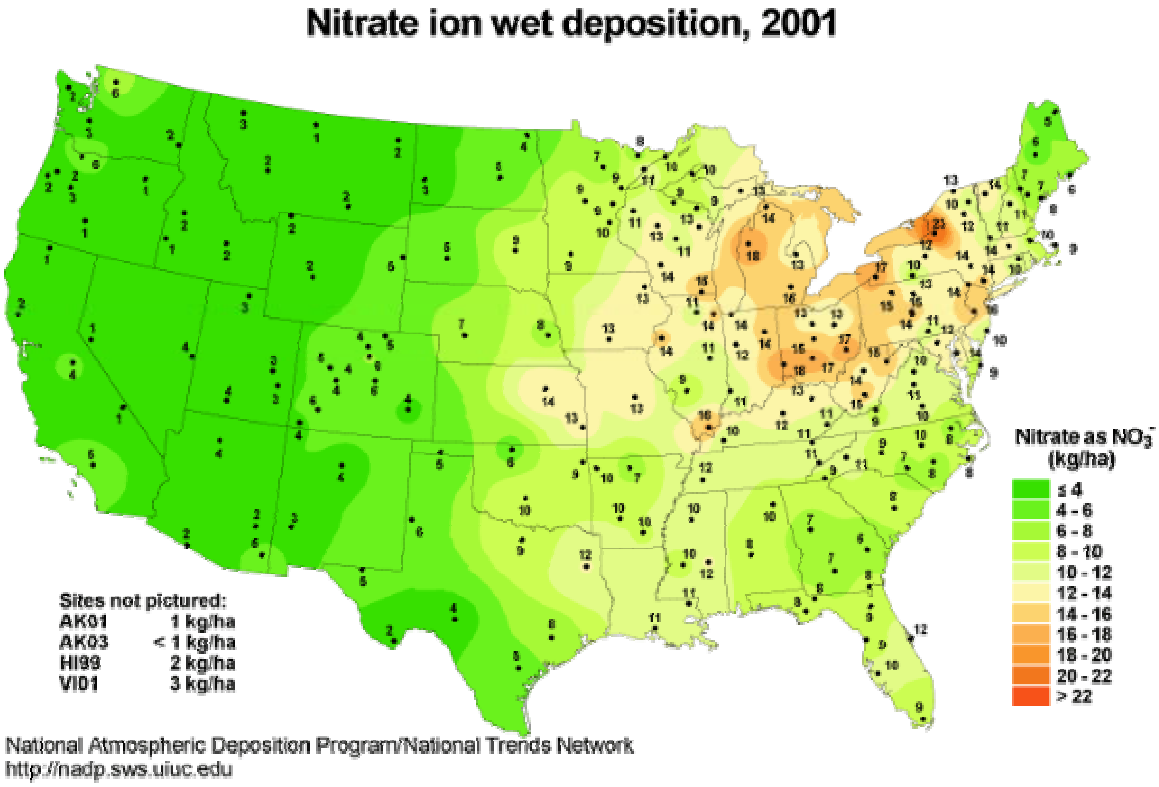


Figure 11: Estimated Nitrate ion Deposition Rates, 2001. Source: NADP.

Figure 12 shows the location of the two NADP monitoring sites closest to LBL; Mulberry Flat - Trigg County, KY (KY99) and Dixon Springs Agricultural Station – Pope County, IL (IL63). Associated data for those sites for 1999 – 2001 is shown in Tables 5, 6, and 7.

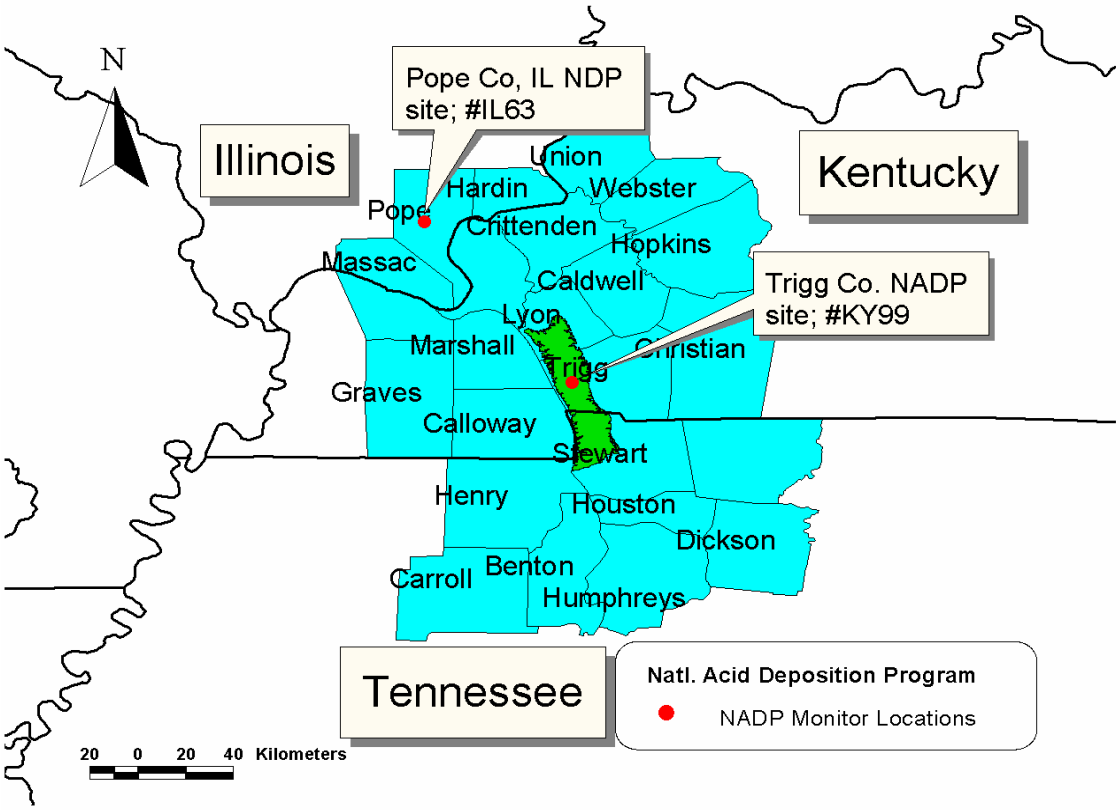


Figure 12: NADP Sites near LBL.

Table 5: Wet deposition values in kg/ha/year; **2000 data**; source - National Acid Deposition Program (http://nadp.swc.uiuc.edu/)

Summary Period	Trigg Co., KY NADP site KY99		Pope Co., IL NADP site IL63	
	NO_3	SO_4	NO_3	SO_4
Annual	11.75	14.75	12.75	17.17
Winter	2.89	4.45	3.15	4.81
Spring	3.84	4.33	4.20	5.04
Summer	2.67	2.47	3.27	3.54
Fall	2.45	3.42	1.93	3.49

Table 6: Wet deposition values in kg/ha/year; **2001 data**; source - National Acid Deposition Program (**http://nadp.swc.uiuc.edu/**)

Summary	Trigg Co., KY	Pope Co., IL

Period	NADP site KY99		NADP site IL63	
	NO_3	SO_4	NO_3	SO_4
Annual	10.28	13.13	16.12	22.13
Winter	1.90	2.95	2.31	3.76
Spring	2.20	2.43	3.60	4.35
Summer	3.68	3.46	6.49	7.64
Fall	2.40	3.18	2.99	4.79

Table 7: Wet deposition values in kg/ha/year; **2002 data**; source - National Acid Deposition Program (http://nadp.swc.uiuc.edu/)

Summary Period	Trigg Co., KY NADP site KY99		Pope Co., IL NADP site IL63	
	NO_3	SO_4	NO_3	SO_4
Annual	11.57	14.73	16.36	22.68
Winter	2.60	3.94	3.97	6.25
Spring	4.56	6.20	7.55	10.35
Summer	2.78	2.77	2.65	2.92
Fall	2.10	3.04	2.33	4.24

Review of the seasonal NO_3 and SO_4 deposition data indicates that the spring and summer seasons produce higher deposition across these sites. This same pattern is replicated at NADP sites across the central and southeastern U.S.

NADP trend analysis for these two sites shows a general decrease in the levels of SO_4 SO_4 deposition, especially over the last ten years (Figure 13). This decline in SO_4 deposition at NADP sites is consistent with the decreases in utility SO_4 emissions brought about by the "Acid Rain Program," (Title IV) of the 1990 Amendments to the Clean Air Act. For all three years analyzed, the Pope County NADP site shows consistently higher deposition than for Trigg County for both pollutants. With implementation of new EPA/State regulations regarding NO_x emissions ("NO_x SIP Call"), it is expected that NO_x emissions and NO_3 deposition will mirror the SO_4 reductions beginning around 2007.

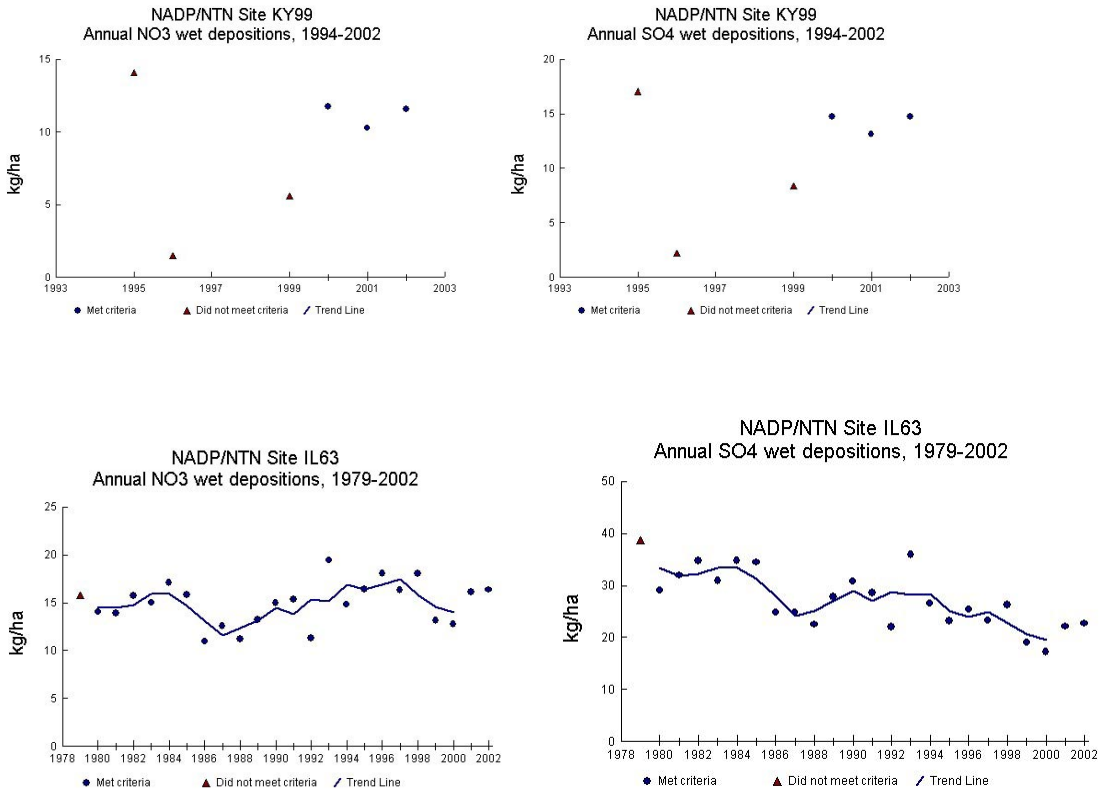


Figure 13: Deposition trends data for SO_4 and NO_3 at KY and IL NADP sites.
(http://nadp.swc.uiuc.edu/ **)**

Similar trends are seen in total sulfur and nitrogen deposition (wet plus dry) at other NADP sites located within the 200 km. analysis area. Data has been collected at these sites for at least ten years, and it shows that sulfur deposition is decreasing slightly, and nitrogen is remaining fairly constant.

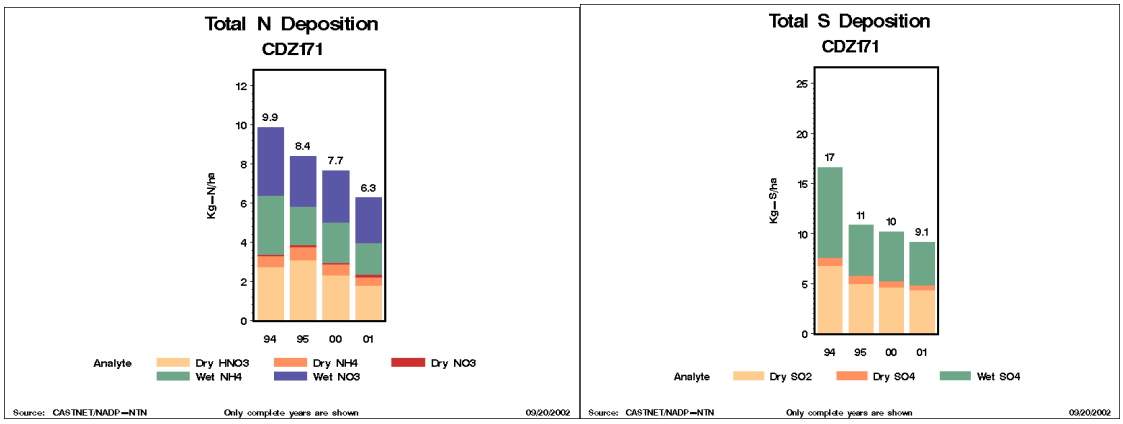


Figure 14: Total sulfur and nitrogen deposition at Cadiz CASTNET site (Trigg Co., KY). From CASTNet website http://www.epa.gov/castnet/

CASTNet data from the Cadiz site in Trigg Co., KY mirrors trends seen at the nearby NADP site for both annual wet nitrate (NO_3) and sulfate (SO_4) deposition. The data presented here shows relatively flat wet nitrate deposition, it is expected that recent installations of NO_x reduction hardware at many coal-fired utilities in the LBL region will lead to decreases in nitrate deposition, as well as lessened ozone concentrations.

Ozone

The production of ozone (O_3) is highly dependent on the presence of NO_x, and volatile organic compounds (in the right ratios), sunshine, and elevated temperatures. Therefore, high ozone levels will occur only during periods of warm weather and plentiful sunshine. For this reason, the ozone monitoring season is from April to October.

The ozone molecule is composed of three oxygen molecules, and is less stable than diatomic oxygen (the oxygen we breath). This unstable molecule reacts with the tissues inside the leaf of a plant, and in the human lung and therefore can have a great impact on forest productivity and on human health. For the purposes of this report, potential for ozone non-attainment designations and impacts of ozone on plants will be considered.

Potential Ozone Non-Attainment Areas

Figure 16 shows the locations of ozone monitors near LBL. The statistics in Table 8 represent the 4^{th} highest of all the 8-hour running averages observed for these monitoring sites during each of the given years, followed by the three-year average. Values highlighted signify areas where the 3-year average exceeded 0.85 (8-hour NAAQS). These areas may be designated as non-attainment for ozone in the future. This is based strictly on observation of the data by the authors of this document. Official non-attainment designations will be made by the states and EPA.

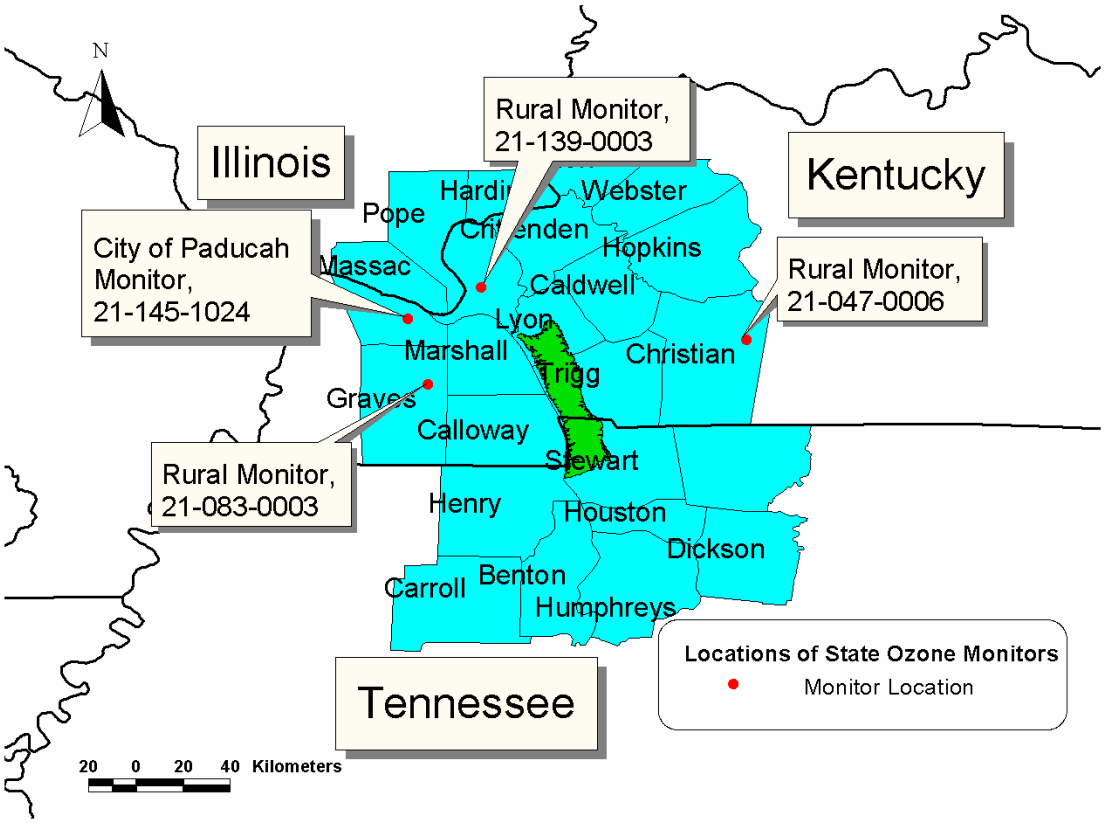


Figure 16: Ozone monitors near LBL, as of 2002.

Table 8: Fourth highest maximum 8-hour Ozone values and the three year averages for sites within 50 km. of LBL, Data for 2000 – 2002

State	County	Monitor ID	2000	2001	2002	3-Year Average
KY	Christian	21047000-6442011	0.081	0.082	*0.093*	0.085
KY	Graves	21083000-3442011	0.080	0.073	*0.092*	0.082
KY	Livingston	21139000-3442011	0.078	0.084	*0.090*	0.084
KY	McCracken	21145102-4442011	0.084	0.077	*0.086*	0.082

- Units reported in parts per million (ppm). Values in italics
- exceed the EPA standard of 0.085 ppm. Air quality sampling, analysis, and reporting is the result of joint effort of KY & TN air regulatory agencies and the EPA. Data summaries obtained from EPA - www.epa.gov/air/data/

Ozone Effects to Forest Vegetation

Although most ozone effects research has focused on agricultural crops because of the large economic losses that have been documented, considerable work has been done relating to ozone effects on forest tree species. Research has identified many native plants in natural ecosystems that are sensitive to ozone. Ozone effects on plants are most pronounced when soil moisture and nutrients are adequate and ozone concentrations are high. Under good soil moisture and nutrient conditions, the ozone will enter through openings into the leaf and damage the cells that produce the food for the plants. Once the ozone is absorbed into the leaf, some plants spend energy to produce bio-chemicals that can neutralize a toxic effect from the ozone. Other plants will suffer from a toxic effect, and growth loss and/or visible symptoms may occur. The presence of ozone in an area can be detected when consistent and known symptoms are observed on the upper-leaf surface of a sensitive plant species.

The presence of ozone symptoms on the leafs of sensitive plants is not an accurate indicator of how much growth loss has occurred to a sensitive plant from ozone exposure. Therefore, some air resource specialists rely upon measurements taken with ozone monitoring equipment in order to predict if growth loss has occurred. Ozone monitors, such as those shown in Figure 16, provide hourly ozone concentrations from April through October. Researchers and technical specialists have examined ways to estimate growth loss to vegetation, with the use of exposure indices, based on those hourly values.

Even though LBL was not within the Southern Appalachian Mountains Initiative (SAMI) analysis area, SAMI ozone effects to vegetation results are generally applicable to LBL. SAMI addressed changes that would occur to forest stands under various ozone exposures. The major effect of different ozone exposures was a shift in competition between species within forest stands (SAMI, 2002). Total basal area in forests in the SAMI region is not likely to change even if ozone concentrations are reduced. Likewise, forest types are unlikely to shift in abundance, and tree mortality in direct response to ozone is not expected. Individual species did show a positive response to reductions in ozone.

Particulate Matter (PM_{10} and $PM_{2.5}$) and Regional Haze

Secondary fine particles are formed when combustion gases are chemically transformed into particles. The bulk of regional fine particles within the analysis area are the result of these chemically transformed combustion gases, such as sulfates and nitrates; mainly sulfate particles (transformed sulfur dioxide) from coal-fired power plants. These chemically transformed fine particles are largely responsible for regional haze.

During the last four decades, the Eastern United States has seen a significant, regional reduction in visibility, brought on by a corresponding increase in ambient levels of PM_{10} and $PM_{2.5}$ (IMPROVE, 2001). This regional reduction in visibility is called regional haze. The Inter-agency Monitoring of Protected Visual Environments (IMPROVE), a national network of particulate monitors established for the protection of Class I park and

wilderness areas, has monitored the constituents of regional haze for more than two decades. EPA's Clean Air Status and Trends Network (CASTNET) performs a similar function. IMPROVE monitor locations:

- One monitor located within 50 km. analysis area, "Cadiz site" in Trigg Co., KY;
- One monitor located within 200 km. analysis area, Mammoth Cave National Park, Edmonson Co., KY.

Together, results from these monitors suggest that regional haze, caused by elevated particulate loading, heavily impacts the analysis area. This is similar to observed deposition rates of sulfate and nitrate, and it is important to note that the pollutants associated with regional haze have also been associated with acid deposition and respiratory health issues. Thus, it can be concluded that high, primary SO_2 and NO_x emissions can have a significant impact on the forest resources, as they are transformed into their secondary forms.

Figure 17 below shows 3-year average deciview values for the United States. Deciview is a measure of visibility condition. Lower deciview values correspond to clearer air, and vice versa. The deciview values for the analysis area correspond to an average visual range between 30 and 40 kilometers (from data collected 1995-1998). Natural visibility in the East is estimated to be between 90 and 130 kilometers.

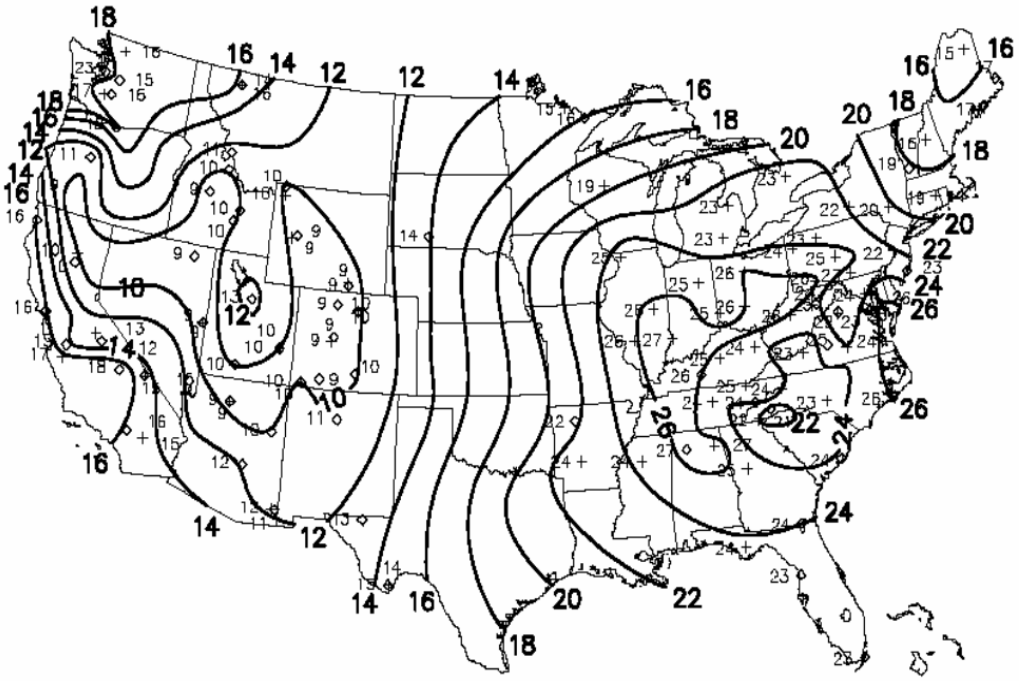


Figure 17: Average Deciview values using IMPROVE and CASTNET Network data

The Cadiz IMPROVE aerosol monitor was installed in 2001, due to delays in reporting the data, a full year's worth of data is not available at this time. The Mammoth Cave

National Park IMPROVE aerosol monitor has been in operation since 1995, the two trend lines (Figures 18 and 19) plot visibility (expressed as inverse mega-meters [Mm^{-1}] or "beta extinction") over a six year period. The first graph plots the "best 20 percent days" visibility, whereas the second graph plots the "worst 20 percent " visibility days. EPA's Regional Haze Regulation strives to improve visibility on the "worst 20 percent days" while not allowing any degradation of the "best 20 percent days". Note regarding Figures 18 and 19 - "Mm^{-1}" (inverse mega-meters) on the vertical axis is a measure of visibility, lower values indicate better visibility.

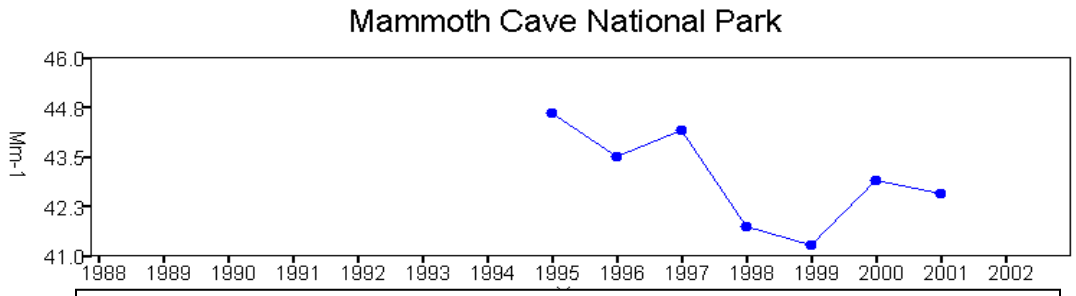


Figure 18 - Five-year visibility trend of best 20% days. Source – Regional Haze – VIEWS website, http://vista.cira.colostate.edu/views/

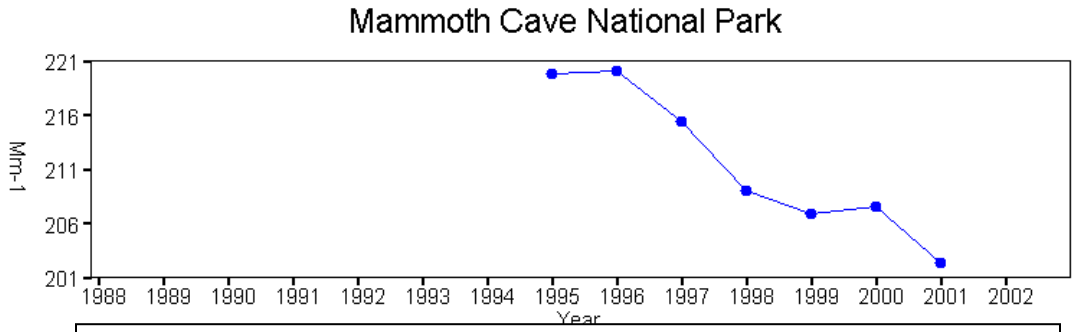


Figure 19 - Five-year visibility trend of worst 20% days. Source – Regional Haze – VIEWS website, http://vista.cira.colostate.edu/views/

Mercury Pollution

Another important pollutant that is not part of the NAAQS is mercury. Adverse impacts to human health are the main concern with mercury pollution. The primary source of mercury pollution is from coal-fired electric generation facilities. Mercury is a natural component of coal, the combustion process releases mercury to the atmosphere, from there is deposited across the landscape primarily through precipitation. The "mercury deposition network " (http://nadp.sws.uiuc.edu/mdn/) was established under the umbrella of the National Acid Deposition Program to monitor this pollutant. Two forms of mercury are monitored by the national network: total mercury and methylmercury. The two closest MDN monitors to LBL are located in southern Indiana (beyond the 200 km. analysis area), the first full year of operation was 2001 (no data is available for 2002). Annual, total mercury wet deposition monitored for both sites was 11.9 and 12.6 $\mu g/m^3$.

To put those values into perspective, for 2001 the lowest monitored annual wet deposition was at a coastal California site (2.7 $\mu g/m^3$) and the highest recorded value was at a coastal, south Florida site (21.1 $\mu g/m^3$). The closest MDN to LBL with some history of total wet mercury deposition is a north, central Illinois site (beyond the 200 km. analysis area), values for that site are:

- 1999 – 9.0 $\mu g/m^3$
- 2000 – 9.6 $\mu g/m^3$
- 2001 – 9.0 $\mu g/m^3$

From this very limited data set, no discussion of trends is warranted.

The main human health concern with mercury results from the consumption of fish with elevated mercury levels. State public health agencies rank fish from certain lakes and rivers as unfit for human consumption. All of the States within 200 km. of LBL have water-body specific advisories or State-wide advisories. KY, MO, and IN have State-wide mercury advisories. From an ecosystem perspective, fisheries health is a concern. Presently mercury is an uncontrolled pollutant from coal-fired power generation. At this time the EPA is drafting regulations to control mercury emissions from power generation.

Weather Trends, Predominant Wind Directions

The effects of air pollutants on an area are not only related to levels of primary pollutant emissions within the area, but are also related to predominate weather patterns in the region. Weather conditions such as temperature, humidity precipitation, and air mass pressure can dictate the formation of secondary pollutants (such as ozone), the pollutant's effects, and pollutant dissipation and dispersion from an area. Primary pollutants emitted in one area can travel to another via moving air masses, and the effects of the pollutants can be observed in an area far from the actual emission source. Similarly, pollutants emitted in an area can become trapped under an inversion layer or a stable high-pressure air mass, causing a build up of pollutants that are unable to dissipate, causing serious health risk in the region. For this reason, it is important not only to consider pollutant emissions when conducting an analysis of air quality in a given area, but also to consider predominant weather patterns. It must be stressed however, that pollutants can be transported from any direction. Therefore, the heaviest deposition or most serious ozone concentration episodes may occur at any time from any direction.

Table 9 lists the available, predominant wind directions for the Trigg County meteorological site. Prevailing annual winds are out of the south-southeast to southeast quadrant. Therefore, even though major pollution sources in the Ohio Valley are relatively close to LBL, prevailing winds move most of the pollution away from LBL.

Table 9: Predominant wind direction based on wind rose data for Trigg County, KY. Data obtained from US Forest Service Ventilation Climate Information System website (http://www.fs.fed.us/pnw/fera/vent/index.html) (Forest Service obtains data from NOAA.)

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
SSE & SSW	SE & NE	SE	SSE	SE	SSE	SSE & NNE	NE & SE	SE & NE	SE	SE	SE	SSE & SE

Legislative and Regulatory Initiatives

Acid Rain: EPA's Acid Rain Program, established under Title IV of the 1990 Clean Air Act Amendments, calls for major reductions in emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x), the pollutants that cause acid rain. In an innovative, but arguably flawed approach to environmental protection, the program uses market incentives to achieve a nationwide limit on SO_2 emissions more cost effectively than traditional regulatory methods. The Acid Rain Program requires a two-phased tightening of restrictions on fossil fuel-fired power plants, resulting in a permanent cap on SO_2 of 8.95 million tons nationwide, half the amount emitted in 1980. Phase I of the SO_2 program ran from 1995 through 1999 and affected roughly 440 of the larger, higher emitting utility units, primarily in the Eastern United States. Phase II began in 2000 and extends to all Acid Rain sources throughout the country (over 2,000 units nationwide).

NO_x emission reductions are also phased, with Phase I beginning in 1996, and Phase II in 2000. Rather than setting an absolute limit on emissions, EPA controls how much NO_x is emitted for each unit of fuel consumed (lb. of NO_x/Btu of heat input), NO_x emissions are not capped. Beginning in 2000, Phase II of the Acid Rain Program will achieve NO_x emission reductions of over 2 million tons annually (U.S. EPA, 2001-b).

Between 1990 and 2001, total utility nitrogen oxide emissions (Phase I and II sources) were reduced an average of 23 percent nationally, following implementation of Phase I of the Acid Rain Program. However, electric utilities contribute only about one-third of total NO_x emissions. Since total NO_x emissions from other sources have risen or remained relatively constant (motor vehicles and other industrial sources also contribute significantly), the reductions achieved under the Acid Rain Program have not resulted in a significant change in total NO_x emissions.

Management Constraints and Regulatory Mandates

The USDA Forest Service is mandated, as are other federal land management agencies, to follow the directives of the CAA and National Environmental Policy Act in mitigating the effects of Agency activities on the health and welfare of surrounding communities, as well as to Agency resources. Those areas not meeting NAAQS are designated as non-attainment, and area specific management plans must be written by each air agency having authority. These plans must be incorporated into the affected state's SIP. The goal of the SIP is to bring the affected areas back into attainment with the standards. If any part of a Forest is within a non-attainment area, that Forest must conduct a conformity analysis to determine if significant air polluting activities conform to the SIP.

Wildland fire is the primary activity on LBL that will produce large amounts of air pollution. The smoke associated with wildland fire produces particulate matter and lesser amounts of other pollutants, including NO_x. Nitrogen oxide emissions are generally small and are unlikely to affect ozone attainment. However, particulate emissions are much greater and will be of concern to state air regulators because of the possibility of affecting the $PM_{2.5}$ attainment status of LBL or adjacent areas. No part of LBL is presently within a non-attainment area.

It will be important for LBL to work with the Kentucky and Tennessee air regulatory agencies, and the VISTAS regional air quality planning organization, to improve air quality and minimize negative effects to forest resources, while striving to continue to use managed wildland fire as a tool for forest management. If the States of Kentucky or Tennessee designate any counties as non-attainment for ozone or $PM_{2.5}$, then the States may take more interest in emissions from managed wildland fire within the time span of the Area Plan. Managed wildland fires can produce significant quantities of $PM_{2.5}$, but unlike stationary sources of $PM_{2.5}$, managed wildland fires are spatially spread out over a large geographic area and their timing and duration is relatively short.

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B.9 Economic and Local Government Impact Analyses

The purpose of this portion of Appendix B is to provide interested readers with additional details regarding the social and economic analyses. This section does not provide sufficient information to replicate the analysis. For that level of detail, the companion specialist reports contained in the Project Record should be consulted.

The Models

Economic effects to local counties were estimated using an economic input-output model developed with IMPLAN Professional 2.0 (IMPLAN). IMPLAN (Impact Analysis for Planning) is a software package for personal computers that uses the latest national input-output tables from the Bureau of Economic Analysis. The software was originally developed by the Forest Service and is now maintained by the Minnesota IMPLAN Group, Inc (MIG). Data used for the impact analysis was from secondary data for those counties considered to be in the forests impact areas.

Input-output analysis gives estimates of employment and income for an increase in final demand on certain sectors of the economy. For Forest Service timber, for example, we have looked at the sawmill and pulpwood industries where our timber goes as the first processing step in manufacturing. Impacts include all those industries initially impacted as well as those industries linked with supplying inputs to production, and workers in those industries who spend wages in their households (known as direct, indirect and induced effects, respectively). The impact assumes a new demand is made on the economy and estimates what this new increase in final demand will mean in employment and income to that economy. Input-output modeling (an efficiency analysis which tells how income and jobs are distributed throughout an economy for a given economic impact) has nothing to do with cost benfit, an equity analysis which estimates how efficient monies are spent on investment activities.

Dependency Analysis

The IMPLAN model was used to assess the economic dependencies of the planning area. Economic dependency is a way of assessing the strength of regional or local economies. Regional economies generally depend on their exports to sustain most local income and employment. Based on this data, it is reasonable to estimate economic dependency by examining an area's export base. The export base analysis done for this FEIS measured the total contribution of one sector, or industry to the economy. Industries can import and export similar commodities. Those industries having more exports than imports are considered "basic", and thereby allow "new" money to enter the economy. Basic industries allow an economy to grow.

Diversity Analysis

Using IMPLAN employment and income reports, forest planners illustrated the relative importance of major sectors and industries, such as wood products, and tourism.

Employment, industrial output, and total income to workers and proprietors were contrasted to the total for the entire forest economy to gauge the percentage relationship between the two. The Shannon-Weaver Entrophy Indexes were also used to show relative diversity of counties and states.

Forest Contribution and Economic Impact Analysis

An impact analysis describes what happens when a change in final sales (e.g. exports and residents) occurs for goods and services in the model's region. Changes in final sales are the result of multiplying production data (e.g., recreation visitor trips) times sales. Economic impacts were estimated for 2000 using the expenditure data for recreation, wildlife and hunting from the U.S. Forest Service's National Visitor Use and Monitoring (NVUM) data, and the Fish & Wildlife Service's wildife use data, respectively, and stumpage estimates for timber. NVUM data was used by Daniel J. Stynes and Eric White, Michigan State University, July 2002, to estimate spending profiles of recreation users. The USDA Forest Service Inventory and Monitoring Institute, Ft. Collins, CO, estimated spending profiles from the 1996 U.S. Fish & Wildlife Services wildlife data.

Impacts to local economies are measured in two ways: employment and total income. Employment is expressed in jobs. A job can be seasonal or year-round, full-time, or part-time. The income measure used was the total income expressed in 2000 dollars. Total income includes both employee compensation (pay plus benefits) and proprietors income (e.g. self-employed).

Data Sources

The planning area IMPLAN models were used to determine total consequences of dollar, employment, and income changes in selected sectors. Because input-output models are linear, multipliers or response coefficients need only be calculated once per model and then applied to the direct change in final demand. A Forest Service developed spreadsheet known as "FEAST" (Forest Economic Analysis Spreadsheet Tool) was used to apply the IMPLAN impact results (response coefficients) to each alternative, expressed in units of output. FEAST transforms the dollar impact for a given industry from IMPLAN to the resource output units, obtained from SPECTRUM or other outputs estimated by forest planners. The multiplication of resource outputs and the IMPLAN response coefficients within FEAST yields a specific employment and dollar output for each resource or activity. Specifications for developing IMPLAN response coefficients and levels of dollar activity are stated below.

Timber

Sales data was determined by using timber values multiplied by estimated production levels for each alternative.

Other Recreation and Wildlife/Fish

Expenditure Data—Recreation, wildlife, and hunting trips were derived from the 1998 LBL Visitor Profile Survey and the National Visitor Use Monitoring survey (NVUM). The resulting calculations yielded trips for resident and non-resident day, On National Forest Overnight Use, and Off National Forest Overnight Use. These use metrics were entered into FEAST to link with IMPLAN impact response coefficients to yield an impact for recreation and wildlife resources. Further explanation on how input data was calculated, can be found in "Conversion of Survey Results to Visits and Trips" (this appendix).

Some analysts may not include resident participation in local economy impacts because there may be substitute opportunities for local residents to spend their discretionary dollar. The Forest Service decided to include resident expenditures in the local economy, with the condition that these expenditures were "associated" with the impacts, and not "responsible" for causing the impacts. The statement is made that impacts are "associated" with recreation and wildlife resource impacts rather than "caused" by these impacts, because local recreation users have many choices in an impact area for recreation. If some people choose not to recreate on national forest land, they may recreate in another manner, such as go to sporting events or a movie. The dollars would still be spent in the local economy causing a similar impact, but the provider of recreation would be a different party. Local residents are defined as recreation users within 50 miles of the forest or area boundary.

Federal Expenditures & Employment

Expenditure Data –A forest budget was estimated for each alternative and was used for forest expenditures, some of which had local economic effects. Total forest obligations by Budget Object Code (BOC) for FY 2000 were obtained from the National Finance Center and used to identify total forest expenditures. The proportion of funds spent by program varied by alternative according to the theme for that alternative. Forest Service employment was estimated by the forest staff based on examination of historical Forest Service obligations.

Use of the Model – To obtain an estimate of total impacts from Forest Service spending, salary and non-salary portions of the impact were handled separately. Non-salary expenditures were determined by using the BOC information noted above.

This profile was run through the model for non-salary expenditures per one million dollars, and the results multiplied by total forest non-salary expenditures. FEAST was again used to make the calculations. Local sales to the federal government are treated in the same manner as exports.

Salary impacts result from forest employees spending a portion of their salaries locally.

Output Levels

Output levels for each item listed above can be viewed in various forest FEAST spreadsheet files contained in the project records. These amounts are also located in the corresponding resource sections of the FEIS.

Present Net Value

The 1982 National Forest Management Act (NFMA) implementing regulations (36 CFR 219.1) state that forest plans must "…provide for multiple-use and sustained yield of goods and services from the NFS in a way that maximizes long-term net public benefits in an environmentally sound manner." Net public benefits is defined as the overall value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not.

Present net value (PNV) is one of the criteria used to determine net public benefits (NPB) in the alternatives. It is the difference between the discounted value of all outputs which were assigned a price in the revision, and all Forest Service management and investment costs over the analysis period. The PNV converts all costs and benefits over the 50-year planning period to a common point in time. The results of the PNV analysis can be found in the FEIS Section 3.4.7.

Other benefits of public land management cannot be measured using dollar values. These non-priced benefits are another criteria used to determine NPB.

Financial and Economic Efficiency Analysis

Financial efficiency is defined as how well the dollars invested in each alternative produce revenues to the agency. Economic efficiency is defined as how well the dollars invested in each alternative produce benefits to society. Present net value (PNV) is used as an indicator of financial and economic efficiency.

A Microsoft Office Excel electronic spreadsheet was used to calculate PNV for each alternative over a 50-year period. A four percent real discount rate, prescribed by Forest Service Handbook (FSH) 1909.17, was used. Decadal and 50-year cumulative present values for program benefits and costs, as well as present net values, are the products of this spreadsheet. For each decade, an average annual resource value was estimated, multiplied by 10 years, and discounted from the mid-point of each decade.

The financial values for timber came from an average of 2000 stumpage prices provided by LBL, and prices for recreation and wildlife from RPA updated to 2000 dollars and transformed to NVUM unit measurements. All values are in 2000 constant dollars.

Conversion of Survey Results to Visits and Trips

The methods used to compute the visitation and trip estimates inserted into IMPLAN for LBL Rec/EE alternatives were derived utilizing several steps. A step by step guide of how visitation numbers were derived for use in the IMPLAN model can be found below under the title *Methods used to Compute Economic Impact of LBL Rec/EE Alternatives.* Within each step listed, there may be certain assumptions that were made based upon professional knowledge and judgment of the IDT. Professional judgment includes knowledge of current trends related to Rec/EE, personal experiences on LBL, and visitor data received by LBL.

Furthermore, unquestionable calculation of economic impacts to local communities is not possible. Likewise, it is unrealistic to assume that a 100 percent positive prediction of how each alternative may affect visitation to LBL can be derived. However, through professional judgment and experience in predicting visitation changes by alternative and the use models to predict each alternative's impact to the economy, a practical conclusion can be drawn.

B.10 Methods used to Compute Economic Impacts of LBL Rec/EE Alternatives

This is an explanation of the method used to help determine how changes in recreation/environmental education opportunities on LBL may affect changes in visitation and possibly the economy of the surrounding area.

Note: Within each step, there may be certain assumptions that must be made based upon the personal experiences and professional knowledge and judgment of the preparer(s).

Step 1 - Estimate the percentage of participation in each type of recreational activity. Normally NVUM data from each forest is used for this. The best data on LBL was determined to be from the 1998 Visitor Use Survey.

However, trends data and all spreadsheets from the Regional Office (RO) were based on Resource Protection Act (RPA) recreational categories.

In order to use the spreadsheets, survey data was converted to RPA categories. The document **98 Survey Conversion to RPA Categories** shows this conversion.

Step 2 - Insert participation percentages for each activity into a spreadsheet produced by planners at the RO**.** The document is titled **Visitor Participation by Activity.**

Step 3 - Insert numbers of visits derived from the **Visitor Participation by Activity** spreadsheet into '**1998'** column in spreadsheet titled **Expected Activity Trends by Decade.**

Step 4 - Convert visits to trips using a spreadsheet designed from protocol as outlined in the word document; **Converting National Forest Visits to Trips.**
Note: The percentages for each category in Step 2 of this process are derived from ***Spending Profiles of NF Visitors 2000-2001Combined, Daniel J Stynes and Eric White, July 2002***. The formulas and steps outlined in the word document are completed by the spreadsheet titled **Visitation and Trips Estimates**.

Step 5 - Put the numbers derived from this spreadsheet into the Alt. W column of the word document table titled **Resource Outputs by Alternative.** The estimates for each alternative were produced during meetings held with Customer Services Staff: Brian Beisel, Gary Hawkins, Emily Loomis and Richard Lomax. Projected changes (as seen in columns **Alt X, Alt Y and Alt Z)** were determined by discussion of the estimated positive and negative impacts to the recreational opportunity that would be perceived by users of LBL's resources. Future estimated trends for different types of Rec. and EE activities were also taken into account. Wildlife-related activities were reviewed in a similar manner.

Percentages of estimated increase or decrease in visitation derived from discussions are the best professional judgment of those involved based upon personal experiences and available research.

Step 6 – Input the figures derived from the anticipated change in visitation into the **Resource Outputs by Alternative** Table and sent to Regional economist for further computations utilizing the FEAST and IMPLAN economic analysis tools.

Step 1

98 Survey Conversion to RPA Categories

RPA Category	98 Survey Heading	% Participation
RPA Camping, Picnicking, Swimming		
Developed Camping	Developed Campground	24.1
	Lake Access	10.9
Primitive Camping	Backcountry	11.7
Picnicking	Picnicking	21.8
Swimming	Swimming	15.4
Backpacking, Camp in Unroaded Areas	Backpacking	3.1
Total for Group		**87**
RPA Mechanical Travel & Viewing Scenery		
Viewing Scenery	Driving (Scenic)	53
Off-Highway Vehicles	Drving (OHV)	9.2
Driving For Pleasure		
Other Motorized Travel		
Bicycling	Bicycling (all)	15.2
Total for Group		**77.4**
RPA Hiking, Horseback Riding, Water Travel		
Hiking/ Walking	Hiking	28.6
Horseback Riding	Horseback Riding	7.1
Motorized Water Travel	Motor Boat/ Jet Skiing	19
Non- Motorized Water Travel	Canoeing/ Kayaking	7.6
	Sailing	3.3
Total for Group		**65.6**
RPA Winter Sports		
Cross Country Skiing		0
Snowmobile Travel		0
Downhill Skiing		0
Total for Group		**0**
RPA Resorts		
Resorts, Cabins		0
Total for Group		**0**
RPA Fish and Wildlife		
Hunting	Hunting	12.8
	Scouting Site	9.7
Viewing Wildlife, Birds, Fish	Wildlife Viewing	35
	Outdoor Photo/ Painting	10.6
Fishing	Fishing	52.5
Total for Group		**120.6**

Wilderness		0
Total for Group		**0**
Other		
Visiting Historical Sites	Historical Program	23
	Historical Site	6.6
Visiting Nature Centers	Wildlife Program	9
General Relaxing		
Gathering Berries, Natural Products	Resource Foraging	7.2
Nature Study		0
Total for Group		**45.8**

Step 2

LBL Visitor Participation by Activity									
1998 Survey Activites Converted to RPA Catagories									
			Estimated Annual Visits in Millions			**2**			
						% Participation	**Weighted % by**		**Thousands of Visits**
RPA Camping, Picnicking, Swimming						**For Forest**	**# Visits**	**Normalized %**	**by Activity**
	Developed Camping					35	70	0.088	176.59
	Primitive Camping					11.7	23.4	0.030	59.03
	Picnicking					21.8	43.6	0.055	109.99
	Swimming					15.4	30.8	0.039	77.70
	Backpacking, Camping in Unroaded Areas					3.1	6.2	0.008	15.64
					Total for group	87	174	0.219	438.95
RPA Mechnical Travel& Viewing Scenery									
	Viewing Scenery					53	106	0.134	267.41
	Off-Highway Vehicles					9.2	18.4	0.023	46.42
	Driving For Pleasure					0	0	0.000	0.00
	Other Motorized Travel					0	0	0.000	0.00
	Bicycling					15.2	30.4	0.038	76.69
					Total for group	77.4	154.8	0.195	390.51
RPA Hiking, Horseback Riding, Water Travel									
	Hiking/Walking					28.6	57.2	0.072	144.30
	Horseback Riding					7.1	14.2	0.018	35.82
	Motorized Water Travel					19	38	0.048	95.86
	Non-Motorized Water Travel					10.9	21.8	0.027	54.99
					Total for group	65.6	131.2	0.165	330.98
RPA Winter Sports									
	Cross Country Skiing					0	0	0.000	0.00
	Snomobile travel					0	0	0.000	0.00
	Downhill Skiing					0	0	0.000	0.00
					Total for group	0	0	0.000	0.00
RPA Resorts									
	Resorts, Cabins				**Total for group**	0	0	0.000	0.00
RPA Fish & Wildlife									
	Hunting					22.5	45	0.057	113.52
	Viewing Wildlife, Birds, Fish					45.6	91.2	0.115	230.07
	Fishing					52.5	105	0.132	264.88
					Total for group	120.6	241.2	0.304	608.48
Wilderness (Do not include - already separated in NVUM data)						**0**	**0**	**0.000**	**0.00**
Other									
	Visiting Historical Sites					29.6	59.2	0.075	149.34
	Visiting Nature Centers, VIS					9	18	0.023	45.41
	General Relaxing					0	0	0.000	0.00
	Gathering Mushrooms, Berries, Natural Products					7.2	14.4	0.018	36.33
	Nature Study					0	0	0.000	0.00
					Total for group	45.8	91.6	0.116	231.08
					Total		792.8	1.00	2000.00

Step 3

Expected Activity Trends By Decade

1998 Survey Activities converted to RPA Catagories

RPA Catagories	Thousands of Visits															
	1998	2005	2010	2010	2015	2020	2020	2025	2030	2030	2035	2040	2040	2045	2050	2050
RPA Camping, Picnicking, Swimming	M Visits	M Visits	Factor	M Visits	M Visits	Factor	M Visits	M Visits	Factor	M Visits	M Visits	Factor	M Visits	M Visits	Factor	M Visits
Developed Camping	176.59	200.43	1.27	224.27	253.41	1.60	282.54	316.10	1.98	349.65	390.26	2.44	430.88	481.21	3.01	531.54
Primitive Camping	59.03	58.44	0.98	57.85	58.44	1.00	59.03	59.03	1.00	59.03	60.51	1.05	61.98	58.14	0.92	54.31
Picnicking	109.99	116.04	1.11	122.09	128.69	1.23	135.29	142.99	1.37	150.69	159.49	1.53	168.28	178.18	1.71	188.08
Swimming	77.70	80.03	1.06	82.36	85.08	1.13	87.80	90.52	1.20	93.24	96.74	1.29	100.23	104.90	1.41	109.56
Backpacking, Camp in Unroaded Areas	15.64	17.44	1.23	19.24	21.90	1.57	24.55	27.60	1.96	30.65	31.59	2.08	32.53	37.46	2.71	42.38
Total for Group	438.95	472.38		505.81	547.51		589.22	636.24		683.26	738.58		793.91	859.89		925.87
RPA Mechnical Travel& Viewing Scenery																
Viewing Scenery	267.41	287.47	1.15	307.52	328.91	1.31	350.31	373.04	1.48	395.77	419.83	1.66	443.90	470.64	1.86	497.38
Off-Highway Vehicles	46.42	47.58	1.05	48.74	49.90	1.10	51.06	52.45	1.16	53.85	55.47	1.23	57.10	59.65	1.34	62.20
Driving For Pleasure	0.00	0.00	1.15	0.00	0.00	1.31	0.00	0.00	1.48	0.00	0.00	1.66	0.00	0.00	1.86	0.00
Other Motorized Travel	0.00	0.00	1.15	0.00	0.00	1.31	0.00	0.00	1.48	0.00	0.00	1.66	0.00	0.00	1.86	0.00
Bicycling	76.69	81.29	1.12	85.89	91.26	1.26	96.63	102.76	1.42	108.90	116.19	1.61	123.47	131.91	1.83	140.34
Total for Group	390.52	416.34		442.16	470.08		498.00	528.26		558.51	591.49		624.47	662.20		699.93
RPA Hiking, Horseback Riding, Water Travel																
Hiking/Walking	144.30	158.01	1.19	171.72	185.43	1.38	199.13	214.29	1.59	229.44	243.15	1.78	256.85	268.40	1.94	279.94
Horseback Riding	35.82	37.43	1.09	39.04	40.83	1.19	42.63	44.06	1.27	45.49	46.03	1.30	46.57	46.75	1.31	46.92
Motorized Water Travel	95.86	96.34	1.01	96.82	97.78	1.03	98.74	100.17	1.06	101.61	104.01	1.11	106.40	109.28	1.17	112.16
Non-Motorized Water Travel	54.99	55.26	1.01	55.54	56.09	1.03	56.64	57.46	1.06	58.29	59.94	1.12	61.59	64.06	1.21	66.54
Total for Group	330.97	347.04		363.12	380.13		397.14	415.98		434.83	453.12		471.41	488.49		505.56
RPA Winter Sports																
Cross Crountry Skiing	0.00	0.00	0.74	0.00	0.00	0.55	0.00	0.00	0.44	0.00	0.00	0.38	0.00	0.00	0.36	0.00
Snomobile Travel	0.00	0.00	1.09	0.00	0.00	1.17	0.00	0.00	1.32	0.00	0.00	1.55	0.00	0.00	1.90	0.00
Downhill Skiing	0.00	0.00	1.27	0.00	0.00	1.37	0.00	0.00	1.66	0.00	0.00	2.07	0.00	0.00	2.71	0.00
Total for Group	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00
RPA Resorts																
Resorts, Cabins	0.00	0.00	1.27	0.00	0.00	1.60	0.00	0.00	1.98	0.00	0.00	2.44	0.00	0.00	3.01	0.00
Total for Group	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00
RPA Fish & Wildlife																
Hunting	113.52	111.82	0.97	110.11	107.84	0.93	105.57	103.30	0.89	101.03	97.63	0.83	94.22	90.25	0.76	86.28
Viewing Wildlife, Birds, Fish	230.07	254.23	1.21	278.38	307.14	1.46	335.90	363.51	1.70	391.12	412.98	1.89	434.83	449.79	2.02	464.74
Fishing	264.88	276.80	1.09	288.72	299.31	1.17	309.91	319.18	1.24	328.45	331.10	1.26	333.75	333.75	1.26	333.75
Total for Group	608.47	642.84		677.22	714.30		751.39	785.99		820.60	841.70		862.80	873.78		884.77
Wilderness																
Wilderness	0.00	0.00	1.22	0.00	0.00	1.47	0.00	0.00	1.74	0.00	0.00	2.01	0.00	0.00	2.29	0.00
Total for Group	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00
Other																
Visiting Historical Sites	149.34	165.77	1.22	182.19	200.86	1.47	219.53	241.93	1.77	264.33	291.21	2.13	318.09	349.46	2.55	380.82
Visiting Nature Centers, VIS	45.41	50.41	1.22	55.40	61.08	1.47	66.75	73.56	1.77	80.38	88.55	2.13	96.72	106.26	2.55	115.80
General Relaxing	0.00	0.00	1.11	0.00	0.00	1.23	0.00	0.00	1.35	0.00	0.00	1.49	0.00	0.00	1.65	0.00
Gathering Berries, Natural Products	36.33	38.33	1.11	40.33	42.51	1.23	44.69	47.23	1.37	49.77	52.68	1.53	55.58	58.85	1.71	62.12
Nature Study	0.00	0.00	1.21	0.00	0.00	1.46	0.00	0.00	1.70	0.00	0.00	1.89	0.00	0.00	2.02	0.00
Total for Group	231.08	254.50		277.92	304.44		330.97	362.72		394.48	432.44		470.40	514.57		558.74
Total	1999.99	2133.11		2266.22	2416.46		2566.71	2729.19		2891.68	3057.34		3223.00	3398.93		3574.86

Notes:

For Resorts and Cabins - Used the Developed Camping Factors

For Wilderness - Used the Backpacking Factors

For Viewing Scenery, Driving for Pleasure, Other Motorized Travel - Used the Sightseeing Factors

For Non-Motorized Water - Used the Rafting/Floating Factors instead of Canoeing (Assumed more users are rafters/floaters)

For Vising Nature Centers - Used the Visiting Historical Sites Factors

Step 4

Converting National Forest Visits (from NVUM) To Trips For Estimating Expenditures in the Communities

Step 1.

Take the total national forest visits estimates from NVUM (including Wilderness) but subtract the estimated number of visits associated with wildlife and fish (hunting, fishing, wildlife viewing). (The wildlife and fish visits use different expenditure calculations, see Steps 4-6 on what to do with these visits.)
Note: Only the first decade estimates are needed for this analysis.

Step 2.

Apply the following percentages to the number of visits in Step 1. This will then provide estimates of visits in the following categories:

NL-Day (Non-Local Residents on Day Trips) = 15 percent
NL-OVN-NF (Non-Local Residents Staying Overnight on the NF) = 12 percent
NL-OVN (Non-Local Residents Staying Overnight off the NF) = 19 percent

L-Day (Local Residents on Day Trips) = 41 percent
L-OVN-NF (Local Residents Staying Overnight on the NF) = 5 percent
L-OVN (Local Residents Staying Overnight off the NF) = 8 percent

Step 3.

Convert the number of "Visits" in each of the above categories to "Trips". A "Trip" (for purposes of this analysis) consists of a typical travel party in a vehicle. The following is the average number of people per vehicle for each of the above categories. (To make the conversion, take the number of visits in the above categories, divided by the number of people per vehicle, to get total "Trips" in each category.)

NL-Day = 2.4
NL-OVN-NF = 2.6
NL-OVN = 2.8
L-Day = 2.2
L-OVN-NF = 2.6
L-OVN = 2.6

Source: Spending Profiles of National Forest Visitors, Years 2000 and 2001 Combined, Daniel J. Stynes and Eric White, July 2000.

Step 4.

A similar process needs to be applied to the Wildlife and Fish Visits. Here will need the National Forest Visits for Hunting, Fishing, and Wildlife Viewing.

Step 5.

For Wildlife and Fish Visits, only need to determine "Local Residents" vs. "Non-Local Residents" for Hunting, Fishing and Wildlife Viewing.

Using the percentages from Step 2 above, use the following percentages to determine the resident vs. non-resident breakdown:

NL-Day (Non-Local Residents on Day Trips) = 15 percent
NL-OVN-NF (Non-Local Residents Staying Overnight on the NF) = 12 percent
NL-OVN (Non-Local Residents Staying Overnight off the NF) = 19 percent
Total for Non-Local Residents = 46 percent

L-Day (Local Residents on Day Trips) = 41 percent
L-OVN-NF (Local Residents Staying Overnight on the NF) = 5 percent
L-OVN (Local Residents Staying Overnight off the NF) = 8 percent
Total for Local Residents = 54 percent

Step 6.

As in Step 3, will need to convert the number of "Visits" in each of the above categories to "Trips". (To make the conversion, take the number of visits in the above categories, divided by the number of people per vehicle, to get total "Trips" in each category.) Again using the information from Step 3, a weighted average for residents vs. non-residents is calculated below and can be used for this conversion.

	People/Vehicle	Percent of Total	Weight	Weighted Factor
NL–Day	2.4	15%	(.326)	.782
NL-OVN_NF	2.6	12%	(.261)	.679
NL-OVN	2.8	19%	(.413)	1.156
Total for Non-Local Residents		46%	(1.000)	2.617 or 2.6
L-Day	2.2	41%	(.759)	1.670
L-OVN-NF	2.6	5%	(.093)	.242
L-OVN	2.6	8%	(.148)	.385
Total for Local Residents		54%	(1.000)	2.297 or 2.3

Visitation and Trips Estimates

Alternative F (Current)
Step 1: Take the total number of National Forest visit estimates from Visitor Survey (including Wilderness), but subtract the estimated number of visits associated with wildlife and fish (hunting, fishing and wildlife viewing).

(The wildlife and fish visits use different expenditure calculations; see Step 4 on what to do with these visits). Note that only the first decade estimates are needed for this analysis--

Total NF visits	Wildlife, hunting, fish visits	NF visits	
2133.11	643	1490.27	
Step 2: Apply the following percentages to the number of Visits in Step 1.			
Categories		**Percentage per category**	**Visits per Category**
NL-Day (Non-Local Residents on Day Trips)		0.15	224
NL-OVN-NF (Non-Local Residents Staying Overnight on NF)		0.12	179
NL-OVN (Non-Local Residents Staying Overnight off the Forest		0.19	283
L-Day (Local Residents on Day Trips		0.41	611
L-OVN-NF (Local Residents Staying Overnight on the Forest)		0.05	75
L-OVN (Local Residents Staying Overnight off the Forest)		0.08	119

Step 3: Convert visits to trips by dividing visits by the average number of people per vehicle for each category.			
Categories	**NF Visits per Category**	**Average number of People per vehicle**	**Trips per category**
NL-Day (Non-Local Residents on Day Trips)	224	2.4	93
NL-OVN-NF (Non-Local Residents Staying Overnight on NF)	179	2.6	69
NL-OVN (Non-Local Residents Staying Overnight off the Forest	283	2.8	101
L-Day (Local Residents on Day trips	611	2.2	278
L-OVN-NF (Local Residents Staying Overnight on the Forest)	75	2.6	29
L-OVN (Local Residents Staying Overnight off the Forest)	119	2.6	46
TOTAL TRIPS			615
Step 4: Repeat the above processes (determine visits by category and then convert to trips) individually for Hunting visits, Fishing visits and Wildlife Viewing visits . Then combine Local and non-local trips into separate categories.			
Hunting Visits	112		
Wildlife Viewing Visits	254		
Fishing Visits	276		
Hunting			
Categories		**Percentage per category**	**Hunting visits per Category**
NL-Day (Non-Local Residents on Day Trips)		0.15	17
NL-OVN-NF (Non-Local Residents Staying Overnight on NF)		0.12	13
NL-OVN (Non-Local Residents Staying Overnight off the Forest		0.19	21
L-Day (Local Residents on Day trips		0.41	46
L-OVN-NF (Local Residents Staying Overnight on the Forest)		0.05	6
L-OVN (Local Residents Staying Overnight off the Forest)		0.08	9

Categories	Hunting visits per category	Average number of People per vehicle	Hunting Trips per category
NL-Day (Non-Local Residents on Day Trips)	17	2.4	7
NL-OVN-NF (Non-Local Residents Staying Overnight on NF)	13	2.6	5
NL-OVN (Non-Local Residents Staying Overnight off the Forest	21	2.8	8
L-Day (Local Residents on Day trips	46	2.2	21
L-OVN-NF (Local Residents Staying Overnight on the Forest)	6	2.6	2
L-OVN (Local Residents Staying Overnight off the Forest)	9	2.6	3
Total Non Local Hunting Trips			20
Total Local Hunting Trips			26

Wildlife Viewing

Categories		Percentage per category	WL visits per Category
NL-Day (Non-Local Residents on Day Trips)		0.15	38
NL-OVN-NF (Non-Local Residents Staying Overnight on NF)		0.12	30
NL-OVN (Non-Local Residents Staying Overnight off the Forest		0.19	48
L-Day (Local Residents on Day trips		0.41	104
L-OVN-NF (Local Residents Staying Overnight on the Forest)		0.05	13
L-OVN (Local Residents Staying Overnight off the Forest)		0.08	20

Categories	Wildlife visits per category	Average number of People per vehicle	WL Trips per category
NL-Day (Non-Local Residents on Day Trips)	38	2.4	16
NL-OVN-NF (Non-Local Residents Staying Overnight on NF)	30	2.6	12
NL-OVN (Non-Local Residents Staying Overnight off the Forest	48	2.8	17
L-Day (Local Residents on Day trips	104	2.2	47
L-OVN-NF (Local Residents Staying Overnight on the Forest)	13	2.6	5
L-OVN (Local Residents Staying Overnight off the Forest)	20	2.6	8
Total Non Local WL trips			45
Total Local WL Trips			60

Fishing

Categories		Percentage per category	Fishing visits per Category
NL-Day (non-local residents on day trips)		0.15	41
NL-OVN-NF (Non-Local Residents Staying Overnight on NF)		0.12	33
NL-OVN (Non-Local Residents Staying Overnight Off the Forest		0.19	52
L-Day (Local Residents on Day trips		0.41	113
L-OVN-NF (Local Residents Staying Overnight On the Forest)		0.05	14
L-OVN (Local Residents Staying Overnight Off the Forest)		0.08	22

Categories	Fishing visits per category	Average number of People per vehicle	Fishing Trips per category
NL-Day (non-local residents on day trips)	41	2.4	17
NL-OVN-NF (Non-Local Residents Staying Overnight on NF)	33	2.6	13
NL-OVN (Non-Local Residents Staying Overnight Off the Forest	52	2.8	19
L-Day (Local Residents on Day trips	113	2.2	51
L-OVN-NF (Local Residents Staying Overnight On the Forest)	14	2.6	5
L-OVN (Local Residents Staying Overnight Off the Forest)	22	2.6	8
Total Non Local Fishing trips			49
Total Local Fishing Trips			65

Steps 5 & 6

Needed Data from LBL to Calculate Economic Impacts:

Resource Outputs by Alternative for the first 10 years of your Plan:

Resource	Unit of Measure	Alt. W	Alt. X	Alt. Y	Alt. Z
Recreation *					
Res-Day	Visits	611,000	NC	+10%	-5%
Non-Res-Day	Visits	224,000	NC	+5%	-5%
Res-OVN	Visits	119,000	NC	NC	NC
NR-OVN	Visits	283,000	-5%	+3%	-2%
Res-OVN-NF	Visits	75,000	+5%	NC	-5%
NR OVN-NF	Visits	179,000	+10%	+3%	-3%
Wildlife & Fish*:					
Res- Hunting	Visits	61,000	+5%	+5%	-10%
NR-Hunting	Visits	51,000	+5%	+5%	-10%
Res-Fish	Visits	149,000	+3%	+3%	NC
NR-Fish	Visits	126,000	+3%	+3%	NC
Res-Wildlife View	Visits	137,000	+10%	+15%	-5%
NR-Wildlife View	Visits	116,000	+10%	+15%	-5%
Range:		NA	NA	NA	NA
Cattle	Head Months				
Sheep	Head Months				
Minerals:		NA	NA	NA	NA
Coal	Metric Tons				
Nat. Gas/Petrol.	Cubic Meters				
Crushed Stone	Metric Tons				

* Recreation & Wildlife Use estimates in Visits are calculated from NVUM Protocol enclosed

B.11 Background Information for Determining Riparian Corridor Widths

Proposal for design criteria to establish riparian corridor widths, measured from each side of stream bank:

Introduction

Riparian Corridor will be used by LBL and its Land and Resource Management Plan to meet our desire to maintain and protect water quality, fluvial processes and riparian functions along perennial and intermittent streams and to maintain infiltration and sediment filtering along ephemeral streams. Riparian corridors are not prescription management areas of themselves, but rather area-wide design criteria to guide management activities within riparian areas. Riparian corridors include true riparian areas and stream management zones, and may occur across several of the LRMP's prescription management areas. One of the functions of the riparian corridor is to buffer the stream from the impact of human land use activities, through use of best management practices while allowing management activities that benefit riparian functioning. Certain riparian area functions are given a higher priority than others, i.e. water quality and aquatic habitat which are state beneficial uses. Others of slightly less concern are floodwater storage, terrestrial wildlife habitat, recreation, and aesthetic values.

Definitions

"Riparian areas are three dimensional ecotones of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at a variable width." (Source: Riparian Management in Forests of the Continental Eastern United States; Verry, Hornbeck, Dolloff; 2000; p. 29.) The Forest Service defines riparian areas as geographically delineated areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems (FSM 2526).

States of Kentucky and Tennessee Best Management Practices, along with TVA's 1994 Plan, address Stream Management Zones, as designated areas for protection of water quality along perennial and intermittent streams.

Riparian Corridor Management Prescription Areas used in Southern Appalachian Plans, are designed to include riparian areas and stream management zones and are specified to maintain riparian functions along perennial, intermittent, and ephemeral streams.

Perennial Streams are any watercourse that generally flows most of the year, in a well-defined channel that is below the water table. Droughts and other precipitation patterns may influence the actual duration of flow. Perennial streams contain fish or aquatic insects that have larvae with multiple year life cycles. Water dependent vegetation is typically associated with perennial streams.

Intermittent Streams flow in response to a seasonally-fluctuating water table in a well defined channel. The channel will exhibit signs of annual scour, sediment transport and other stream characteristics, absent perennial flows. Intermittent streams typically flow during times of elevated water table levels and may be dry during significant periods of the year, depending on precipitation cycles. Field identification of intermittent streams must consider geology, land use patterns, and precipitation cycles. Intermittent streams do not maintain fish populations year-round or aquatic insects that have larvae with multiple year life cycles.

Ephemeral Streams are typically defined by flows that occur for short periods of time in direct response to storm precipitation or snowmelt runoff. Ephemeral stream bottoms are always above the water table and do not contain fish or aquatic insects that have larvae with multiple year life cycles. Ephemeral streams may or may not have a defined channel. Ephemeral streams may serve as a conduit for much of the sediment that enters the stream system network. Large woody debris associated with ephemeral streams may also contribute significantly to the stability of the stream system.

Riparian Area Functions

- Filter sediment and pollutants from runoff
- Interchange of surface and ground waters.
- Reduce impacts of floods
- Stabilize streambanks
- Provide habitat for aquatic and terrestrial life
- Provide logs and other woody debris that serve as aquatic habitat, stabilize channels and dissipate stream energy
- Shade water to maintain healthy temperatures for aquatic life
- Provide leaves and other detritus that serve as energy sources for the stream
- Improve the appearance of the stream.

Factors Considered in Sequence when Setting Widths

- Floodplain and floodprone widths
- Critical species habitat
- Groundwater and flood hydrology
- Catchment size
- Slope of banks and areas contributing flow to the stream segment
- Vegetation, including litter and other surface cover characteristics
- Rainfall
- Soil infiltration rate
- Soil moisture content
- Land use
- Impervious surfaces

Recommended Corridor Widths

A search of literature and research offered a range of corridor widths needed for various values and functions. Protection of water quality and effective filtering of sediment ranged from 25 to 300 feet, (Wenger, 1999; NCASI, 1992; TN Division of Forestry, 2003). Widths of 100 feet were found to be effective in limiting transport of chemicals such as phosphorus and nitrate and in providing for shade and large woody debris (Wenger, 1999). Small streams required less of a buffer width than larger streams (NCASI, 1992). However, Castille, 2000, found that most contributions of filter strips in protecting riparian functions are realized within the first 50 feet.

Vegetative filter strips utilizing grasses along agriculture fields and urban areas were found to be effective at reducing sediment and nutrient transport. Widths of 20 feet on slopes less than 20 percent were recommended (Franti, 1997). Tall erect perennial grasses that form sod are most effective, especially when mowed to 6" height for trapping sediments (MI DEQ, 1997, Leeds *et al*, 1994). However, when flow is concentrated in small channels (typical of hilly terrain and along plow lines) effectiveness of strips is drastically reduced (Cho, 2003). Over long term, filter strips may accumulate sediment and nutrients and also lose effectiveness (Cho, 2003, Mendez-Delgdo, *et al*, 1999), so maintenance is required (minor grading, mowing, re-seeding). Streamside strips of trees and shrubs below grass strips increase effectiveness and protect water quality (Cho, MI DEQ, 1997).

Other studies offered protective widths to maintain habitat for small mammals and amphibians ranging in width from 10 to 300 feet (Verry *et al*, 2000).

We have selected widths that provide the necessary protection for the highest priority riparian functions and values (water quality and aquatic habitat) as recommended for perennial and intermittent streams. Other riparian functions should be considered during project planning on site specific basis, and widths increased if need is determined.

Perennial streams: 100 feet, measured from bankfull stage of the channel stream banks along forested streams. If agricultural activities are adjacent to the riparian corridor, grassy vegetative filter strips should be considered as an additional BMP.

Intermittent streams: 50-75 feet, measured from bankfull stage of the channel stream banks. 50 feet will be adequate if 20 feet of maintained, grassy vegetative filter strip is incorporated below management activities with the remaining 30 feet in shrubs and trees. Default width will be 75 feet.

These riparian corridors do not apply to constructed ponds developed for recreation uses or to man-made ditches. Filtering zones on ponds and ditches, if needed to protect aquatic species will be determined at the project level. However, a 20 foot vegetation filter strip is recommended around wildlife waterholes.

Ephemeral Streams

Ephemeral streams: 25 foot vegetative filter strip maintained, as measured from the center of swale or evidence of water flow.

Ephemeral streams do not have true riparian areas and will not be considered as having riparian corridors. However, these streams are hydrologically connected to downstream perennial and intermittent streams. The primary purpose of protecting areas along ephemeral streams is to maintain the ability of the land to filter sediment from upslope disturbances, while achieving the goals of the encompassing management prescription area. In addition, the emphasis along ephemeral streams is to maintain infiltration and sediment control by keeping vehicles away from stream banks, reducing soil compaction, and maintaining large woody debris for downstream channel stability.

Allowed Activities within Riparian Corridors

Existing wildlife openings are allowed within the riparian corridors. However, wildlife openings identified as causing environmental degradation through concentrated runoff, soil erosion, or sediment transport will be mitigated or closed and restored. New wildlife openings within the riparian corridor zones are permitted only where needed to provide habitat for riparian associated wildlife species. When determined to be necessary for wildlife habitat, temporary openings must not be more than 300 feet in length along any one side of the stream or 60 feet along opposite sides.

Use of mechanical no-till cultivation methods is recommended for restoration and renovation of wildlife openings. Native or non-invasive plants are to be used within the riparian corridors as vegetative filter strips whenever possible.

New non-motorized trail construction may be allowed to improve existing trail configuration and improve access to streams and lakes.

Proposed or new facilities must be developed in accordance with Executive Orders 11988 (floodplains) and 11990 (wetlands) and follow recommended riparian corridor widths.

Existing campsites and facilities will be maintained to limit effects to water quality, streambanks, and shorelines. Where possible, an uninterrupted vegetative strip along banks and shorelines will be maintained. Mowing and maintenance of the vegetative strip will continue. If sites are determined to be causing resource degradation by concentrated runoff, or sediment or pollutant transport, sites will be closed and rehabilitated.

Existing corral and tethering sites will be maintained to limit impacts to water quality and riparian areas. If determined to be causing environmental degradation through concentrated runoff, soil erosion, sediment or pollutant transport, sites must be closed and rehabilitated. New corral and tethering sites should be located outside of riparian corridors.

Tree removals are allowed if it enhances the recovery of the diversity of the vegetation, rehabilitates human caused disturbances, or provides for visitor safety.

Directional felling and end-lining of logs should be utilized to avoid displacing soil.

Stream habitat improvement work is allowed. In-stream use of heavy equipment should be minimized. Low pounds-per-square-inch equipment, with long boom arms, will be favored for in-stream work.

Activities To be Avoided within Riparian Corridor Zones

(Not inclusive)
Removal of riparian vegetation during bank stabilization projects should be avoided. Minimize use of riprap and favor natural sources of bank stabilization (willow plantings, rootwads, etc.).

Activities that channelize streams should be minimized and avoided where possible. Where channelization has occurred from past activities or facilities, relocation of such activities or facilities and restoration of natural channel profiles should be pursued.

Use of ground based logging methods is not allowed except at designated crossings.

Log landings are not allowed.

Slash piling or burning is not allowed.

Construction of firelines with heavy equipment should be avoided, especially when planning for prescribed fire activities. During wildfire suppression, a Resource Advisor, appointed by the Area Supervisor to the Incident Command Fire Team, should be consulted during fireline construction.

Clearcutting of timber is not allowed.

Current Conditions of LBL Streams

Flow of water is intermittent in most of the stream channels. Drainage catchments are too small to retain enough water to maintain year-round flow. Many springs and seeps are present in LBL, and most appear to be seasonal. However, springs and seeps in every valley offer a clue to the extensive groundwater network that must exist. Eleven streams are classified perennial. Headwaters are ephemeral.

Erosion by running water has etched LBL's landscape and created dissections of today's streams. The retreat of discontinuous gullies (headcuts) is the most active and most obvious erosional process within LBL (Chester and Fralish, 2002). The sequence of headcuts up the channels may be analogous to the scour and riffle sequence of larger

stream channels and a natural process. Sediment is transported down valley in this manner of scour and fill. Based upon observation and professional judgment, LBL's hydrologist believes active erosion against stream valley slopes and across the mouths of tributaries is causing deepening of the tributary channels. Changing base elevation from pool levels of the lakes exacerbates the process. Coarse gravels entrained during runoff events are spread farther out into the bays at times of low water than would be true if normal pool were maintained.

Channels generally are stable laterally. This is due to heavily forested watersheds that store and release runoff and traditional lower stream segments are inundated by the lakes. Lateral migration of the lower segments of streams is a natural process and current migrating channels are within historic levels. Many channels are not stable in their vertical profile and continue to downcut and deepen their gullies; this adds to normal bedload quantities. This bedload, along with debris, is often dropped in lower gradient sections of the stream and may cause the stream to migrate laterally. This generally occurs when high water levels in the large lakes back up into the bays and further into the stream channel. Large woody debris embedded in the channel is one natural process the stream has to stabilize itself, dissipate flow energy, and to add habitat for aquatic life. There appears to be less large wood within LBL streams than would normally be expected. This may be exacerbating the eroding of channels and increasing bedload movement.

Road running prisms, ditches and crossings encroaching on stream channels or laying within floodplains and wetlands, can intensify runoff events and increase sediment input to the streams. Many roads are located along stream channels or within their valleys to take advantage of gentle slopes and easier construction. Culverts, installed at many of the stream crossings were never designed to pass more than a 25-year interval event. Streams entrain and transport enormous amounts of cherty fragments, adding to flow volumes that these culverts were never designed to accomodate. Washout and breaching of culverts are common after major runoff events. Other culvert installations have channelized flows and increased velocities resulting in scour below the outlet. This exacerbates downcutting of the stream channel. (LBL Roads Analysis, 2003).

Information on watershed condition from the LBL Roads Analysis, ranking from the Watershed Assessment modeling, and stream condition from the CATT survey, indicate the following 6th level HUC watersheds as high priority for improvement work:

Turkey Bay/Turner Hollow watershed
Crooked Creek watershed
Lick Creek watershed

Focus will be to improve watershed condition class from Class II to Class I over the next 10 year period in these watersheds. Improvement work should include rehabilitation of trails, relocation of roads and trails out of riparian corridors where feasible, replacing culverts, providing alternative water crossings, adding large wood to channels,

decommissioning of road segments identified in the Roads Analysis, and improving vegetation along streambanks.

Other channels and watersheds will receive improvement work as site specific analysis indicate during proposed project assessment.

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B.12 Sediment Yields and Cumulative Effects for Water Quality and Associated Beneficial Uses.

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Introduction

LBL is in the process of revising their Land and Resource Management Plan. In order to comply with planning requirements (36 CFR.219.23) for effects analysis on aquatic resources item (d) of the aquatic resources section requires that forest planning provide for an evaluation of existing or potential watershed conditions that will influence soil productivity, water yield, water pollution, or hazardous events**.**

In earlier planning efforts forests were directed to calculate sediment and water yield increases over time. This served as a surrogate of existing condition and provided a quantification of potential effects of alternatives. However, watershed condition was described in general physical terms, not in terms of health or vulnerability to management actions. With the current level of planning, available data layers and GIS information there is an opportunity to specifically evaluate watershed condition and estimate the effects of management activities based on a number of watershed parameters. Sediment yield or an index of disturbance would still be used but the result would be directly related to overall watershed condition or health rather than just erosion potential. The following is a description of the process used to address Section (d) of the aquatic resources under 36 CFR, 219.23 planning rule (1982) and the associated cumulative effects for water quality and associated beneficial uses.

The purpose of this process is to estimate sediment yields and analyze the cumulative effects of proposed management actions on water quality. The process provides an objective process to systematically evaluate water quality conditions for watersheds covered in whole or part by the Area Plan. The process also provides results that can aid in aquatic viability analysis at the community scale.

Cumulative Effects

The analysis of cumulative impacts is a requirement of the National Environmental Policy Act (NEPA). A cumulative impact analysis should consider incremental impacts of actions when added to past, present, and reasonably foreseeable future actions. The analysis includes all actions regardless of who undertakes the actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time.

“A cumulative effect is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such

other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

Sediment is an appropriate measure to determine the effects of management activities on water quality and its associated beneficial uses on forested lands (Coats and Miller, 1981). Sediment increases can adversely affect fish productivity and diversity (Alexander and Hansen, 1986), degrade drinking water and affect recreational values. There may be other cumulative impacts such as increases in water yield as a result of harvesting methods. However, water yield models do not characterize the impacts of all management activities such as road construction and the increase in water yield is generally less than the natural variability. Changes in water nutrients or nutrient fluxes within streams as a result of management activities are minor and not an appropriate consideration of cumulative effects at the Area Plan level. This model uses predicted sediment yields as the surrogate for determining cumulative impacts for water quality.

Changes in land use and disturbance are modeled with respect to estimated increases in sediment and predicted impacts are summarized by alternative. The significance of predicted impacts are related to criteria designed to determine levels of watershed health (WCR) as described in a following section of this paper.

Bounding the Effects Analysis

A valid cumulative effects analysis must be bounded in space and time. For the purposes of this exercise in forest planning, watersheds are the appropriate spatial bounds for cumulative effects. The implementation period for a forest plan is 5 to 15 years, however the appropriate time period captured for the sediment model is for 5 decades (50 years).

Modeling Sediment Yield

A detailed description of data sources and steps can be found in Data Sources and Manipulation. Following is a summary of the process:

- Using the National Land use Classification Data (NLCD), Digital Elevation Models (DEM), and Ecoregions data layers, a determination of combinations of land use, slope class, and physiographic zone were made for 30-meter grids. These values were tabulated for each watershed including non-Forest Service lands. Results were used to identify estimated erosion values for entire watersheds.
- Tiger Census Roads data, Forest Service ATV trails, and Ecoregions were used to determine road surface type, physiographic zone and length. This information was used to estimate sediment values for each watershed.
- Using a combination of Early Forest Succession values (from Forest Service prescriptions), slope class, and physiographic zones, these values were tabulated for each watershed and alternative.
- Forest Service personnel provided values for the following categories;

  - The number of acres of prescribed fire planned by alternative and period (By alternative and physiographic zone) (this information was taken from the Alternatives discussion),
  - Miles of dozer fireline per acre burned (a coefficient from the Daniel Boone NF was used of 1.636 miles of dozer line per 1000 acres burned),
  - Miles of temporary and permanent road constructed per acre regenerated (a coefficient from the Cherokee NF was used of 4 miles of temporary road per 1000 acres treated, no other road construction was considered),
  - The rotation period on other forested lands (A hundred year rotation with one thinning and one clearcut was assumed for private land), and
  - Other changes in land use activities or disturbances that individual forests felt were important such as opportunities to reduce ATV use and cropland were included in the model).

- Coefficients for erosion were taken from the average and high erosion rates found in Dissmeyer and Stump (1978) for the appropriate physiographic zone. Recovery rates were determined from studies on the Ouachita National Forest. These recovery rates were determined through field observations, and provide a realistic recovery value for the Southeast, and are appropriate for this level of analysis. It should be recognized that the high erosion rates would yield overestimations for most Forest Service activities and should be viewed as a worst-case scenario. The high rates were used to account for steep slopes and management practices on other lands that may not have the same standards as Forest Service lands.
- Erosion values (from land use) were multiplied by a sediment delivery coefficient based on watershed size determined from Roehl (1962). Sediment values from roads are part of the WEPP calculation. WEPP only assumes that sediment values are delivered to the nearest channel. This model sums the total number of sediment tons from roads and calculates sediment from erosion delivered to the mouth of the watershed.
- Road (by surface type), fireline, and ATV sediment values were determined from field surveys using the WEPP model to determine sediment values. These values were converted to coefficients by physiographic zone (Process to be described by later in this paper) and multiplied by the number of miles of road (by surface type), fireline or ATV trail.
- All values were summarized in a spreadsheet by watershed for the baseline sediment yield and current sediment yield (Forest Service and private).
- The values from SPECTRUM (Total number of acres per planning period by physiographic zone, early succession class and slope class) are placed in the sediment spreadsheet for each alternative and period.
- In addition, the spreadsheet summarizes predicted management activities by watershed, alternative, and planning period.

This allows for a discussion of past, present and future activities for public and private lands by watershed for a time period of 50 years.

Data Interpretation

The summary worksheet of the sediment model calculates the baseline, current, and predicted sediment values for each watershed by alternative and period. To determine the potential cumulative effects of water quality and associated beneficial uses these sediment values are expressed as a percent increase over the baseline. The baseline assumes an undisturbed forest floor with no roads. It should be recognized that using such a baseline will result in high percentage increases since baseline values can indicate little to no erosion or sediment. The percentage values are only used as a mathematical index and should not be viewed as an indication of effects or impairment. This becomes clearer when the interpretation of this information is captured in a process call the Watershed Condition Rank (WCR) as described below

Watershed Condition Rank (WCR)

Watershed Condition Rank (WCR) is a measure that characterizes the condition of watersheds with respect to current and future sediment load increases.

In order to establish WCRs, the current sediment average annual yield is determined and expressed as a percent above the baseline conditions. This provides a relative measure to determine changes within watersheds. The next step in this process is determined by using the relative abundance of locally adapted species with respect to predicted sediment increases to create a species-sediment load relationship or index (SSI). This score is modified by a weighted average where the watershed occurs in more than one physiographic zone. Watershed condition is generalized into three categories of excellent, average and below average. The SSI, however, does not necessarily translate into an excellent or poor watershed but broadly categorizes the watersheds based on the sediment prediction/aquatic viability relationship. The SSI is a relatively large-scale coarse filter developed to evaluate alternatives in Forest Plans and to establish priority work at the planning scale. Therefore, further detailed analyses of the watershed will be conducted at the project level.

From the WCR a series of determinations can be made that determine or assign additional Forest Objectives. The following section details the outcome of the WCR with respect to adverse effects on aquatic biota as they are related to forest management:

- Where a watershed SSI is ***excellent***, the probability (or potential) is **low** for adverse effects to aquatic species. If the results of forest alternatives remain within this range there should be no adverse effect on water quality with respect to beneficial uses (fish communities). Forest Service objectives would be to maintain or improve aquatic health through the implementation of riparian prescriptions;

- Where a watershed SSI is ***average,*** the potential to adversely affect beneficial uses is **moderate**. Additional forest analysis should be considered. Examples would be conducting watershed assessments during project planning to

identify the source of the problem, and monitoring prior to project implementation to determine actual health of the biota;

- Where a watershed with a SSI is ***below average***, the potential to adversely affect beneficial uses is **high**. In addition to points listed above, management objectives at the project level would seek to maintain or restore watershed health and aquatic systems where the Forest Service can make meaningful contributions to watershed health.

The results of the WCR and other information can also be used to develop partnerships with other landholders or managers to improve overall watershed condition and improve aquatic health. This is one advantage of analyzing entire watersheds. Not only can Forest Service activities and contributing effects be isolated but other watershed effects can be identified as well.

Assumptions, Uncertainties and Limitations

Many assumptions are made throughout the sediment model and the WCR. Every effort has been made to describe those assumptions and minimize misrepresentation. With that in mind the application of the sediment model and associated WCR should not be taken as absolutes but as a method that can describe the effects from the range of alternatives and suggest where a greater risk with respect to water quality and aquatic biota exists. This process is developed for the Area Plan level. Project level planning would require more site specific information and identification of sediment sources.

Watershed condition is an accumulation of disturbance across the entire watershed and is expressed at the outfall of that watershed. Subwatersheds within a watershed will have a range of watershed conditions. The conditions of subwatersheds and the determination of effects will usually occur at the project level.

Following is an example of spreadsheet data and the WCR based on the current condition and the potential effects of each alternative for the first 10-year period.

Cumulative effects analysis for water quality and associated beneficial uses for period 1

Watershed number	Current Condition (expressed as percent increase)	Current health (excludes fire and forest management activities)[1]	Alt W	Alt X	Alt Y	Alt Z	Alt W	Alt X	Alt Y	Alt Z
			. . Percent increase above baseline . .				. Watershed Health for Period 1 .			
1	207	E	218	224	225	194	E	E	E	E
2	192	E	202	207	208	189	E	E	E	E
3	113	E	124	129	129	122	E	E	E	E
4	149	E	161	166	167	159	E	E	E	E
5	293	E	305	312	313	240	E	E	E	E
6	241	E	251	256	256	196	E	E	E	E
7	376	E	388	395	395	330	E	E	E	E
8	698	A	713	722	722	685	A	A	A	A
9	214	E	229	238	239	187	E	E	E	E
10	324	E	341	351	352	261	E	E	E	E
11	292	E	308	317	317	257	E	E	E	E
12	301	E	312	321	320	259	E	E	E	E
13	189	E	202	210	211	182	E	E	E	E
14	213	E	226	234	235	201	E	E	E	E
15	420	E	432	440	440	322	E	E	E	E
16	193	E	193	193	193	154	E	E	E	E
17	210	E	212	214	214	177	E	E	E	E
18	275	E	287	276	276	223	E	E	E	E
19	1,088	A	1,098	1,090	1,090	1,019	A	A	A	A
20	110	E	110	110	110	110	E	E	E	E
21	236	E	247	254	254	196	E	E	E	E
22	176	E	176	177	177	177	E	E	E	E
23	333	E	344	347	347	270	E	E	E	E
24	304	E	308	309	309	232	E	E	E	E
25	200	E	207	202	202	161	E	E	E	E
26	1,138	A	1,144	1,139	1,139	149	A	A	A	E
27	2,613	BA	2,613	2,613	2,613	108	BA	BA	BA	E
28	174	E	183	175	176	175	E	E	E	E
29	175	E	182	176	176	176	E	E	E	E
30	322	E	334	324	324	228	E	E	E	E
31	239	E	249	241	241	194	E	E	E	E
32	502	E	503	503	503	502	E	E	E	E
33	330	E	344	333	333	248	E	E	E	E
34	221	E	228	222	222	168	E	E	E	E
35	136	E	141	137	137	121	E	E	E	E
36	205	E	218	207	207	163	E	E	E	E
37	139	E	150	141	141	123	E	E	E	E
38	157	E	165	160	160	131	E	E	E	E
39	273	E	287	276	276	193	E	E	E	E

Watershed number	Current Condition (expressed as percent increase)	Current health (excludes fire and forest management activities)[1]	Alt W	Alt X	Alt Y	Alt Z	Alt W	Alt X	Alt Y	Alt Z
			. . Percent increase above baseline . .				. Watershed Health for Period 1 .			
40	173	E	178	173	173	148	E	E	E	E
41	218	E	221	219	219	219	E	E	E	E
42	252	E	261	254	254	183	E	E	E	E
43	84	E	84	84	84	84	E	E	E	E
44	169	E	175	169	169	143	E	E	E	E
45	354	E	366	355	355	309	E	E	E	E
46	85	E	86	86	86	86	E	E	E	E
47	187	E	195	188	188	166	E	E	E	E
48	117	E	123	118	118	104	E	E	E	E
49	146	E	152	148	148	136	E	E	E	E
50	212	E	224	214	214	160	E	E	E	E
51	142	E	152	144	144	129	E	E	E	E
52	149	E	155	151	151	127	E	E	E	E
53	513	E	517	516	516	497	E	E	E	E
54	362	E	366	363	363	308	E	E	E	E
55	832	A	837	837	837	837	A	A	A	A
56	383	E	388	388	388	388	E	E	E	E
57	135	E	139	136	136	111	E	E	E	E
58	153	E	161	155	155	147	E	E	E	E
59	850	A	854	851	851	851	A	A	A	A
60	871	A	872	871	871	73	A	A	A	E
61	68	E	68	68	68	68	E	E	E	E
62	100	E	101	101	100	100	E	E	E	E
63	235	E	241	236	236	192	E	E	E	E
64	395	E	402	396	396	354	E	E	E	E
65	138	E	144	139	139	134	E	E	E	E
66	147	E	154	149	149	115	E	E	E	E
67	54	E	59	55	55	55	E	E	E	E
68	275	E	284	276	276	245	E	E	E	E
69	211	E	213	212	212	211	E	E	E	E
70	69	E	72	69	69	68	E	E	E	E
71	57	E	57	57	57	57	E	E	E	E
72	823	A	826	823	823	820	A	A	A	A
73	100	E	104	101	101	99	E	E	E	E
74	72	E	75	73	73	69	E	E	E	E
75	89	E	89	89	89	89	E	E	E	E
76	491	E	495	492	492	443	E	E	E	E
77	101	E	106	102	102	83	E	E	E	E
78	145	E	149	146	146	145	E	E	E	E
79	216	E	217	217	217	215	E	E	E	E

Watershed number	Current Condition (expressed as percent increase)	Current health (excludes fire and forest management activities)[1]	Alt W	Alt X	Alt Y	Alt Z	Alt W	Alt X	Alt Y	Alt Z
			. . Percent increase above baseline . .				. Watershed Health for Period 1 .			
80	132	E	132	132	132	132	E	E	E	E

[1] E=Excellent, A=Average, BA=Below Average;

Data Sources and Manipulation

Data calculations and summary were derived from numerous sources. The following discussion identifies ArcView data layers, the source of those data layers and how they were manipulated or queried. The first step in any data manipulation is to place the data in a common projection. The projection chosen was UTM zone 16, NAD 27, meters.

Layers requested from the Forests include:

Watersheds	Data were place in a common projection. Shared watersheds were assigned a common number when there were number conflicts.
ATV trails	Trails that were not utilized by ATVs, bikes, or horses were deleted. The remaining trials were intersected by watershed and eco-regions data layers. Miles were calculated and summed by watershed, and eco-regions.
Alternatives	The prescriptions from each alternative were matched with the Forest Type. This shapefiles were then converted to a 30-meter grid using the Forest Type. NonForest Service ownerships were deleted.

From the Tiger Census (1995) and Forest Roads Data:

Roads	Based on the CFCC data attribute road segments were assigned a road surface value of paved highway, paved local, gravel or native. Forest roads were identified by maintenance level. These data were then intersected by watershed and eco-region. Miles were calculated and summed by watershed, and eco-region.

Land use and land cover factors were from:

NLCD (EPA R4) and Jefferson. NF

This information is in a 30-meter grid. The data were reclassified using the following classification.

Value	MRLC classification	Reclass	Mix
11	Open Water	1	Water
13	Perennial Ice/Snow	1	Water
21	Low Intensity Residential	2	Residential
22	High Intensity Residential	2	Residential
23	Commercial/Industrial/Transportation	2	Residential
31	Bare Rock/Sand/Clay	3	Quarry
32	Quarries/Strip Mines/Gravel Pits	3	Quarry
33	Transitional	4	Forest
41	Deciduous Forest	4	Forest
42	Evergreen Forest	4	Forest
43	Mixed Forest	4	Forest
51	Shrubland	5	Pasture
61	Orchards/Vineyards/Other	6	Cultivated
71	Grasslands/Herbaceous	5	Pasture
81	Pasture/Hay	5	Pasture
82	Row Crops	6	Cultivated
83	Small Grains	6	Cultivated
84	Fallow	6	Cultivated
86	Urban/Recreational Grasses	5	Pasture
91	Woody Wetlands	4	Forest
92	Emergent Herbaceous Wetlands	9	Wetlands

Digital Elevation Models provided:

Slope

Using Spatial Analysis Model Builder, discrete slope classes were identified based on percent slope. These values were then reclassified for individual forest assumptions. Lesser slopes were assigned a value of 0 and greater slopes were assigned a value of 1000. The slope break was determined at 25 percent .

From the EPA Basins data:

Ecoregions

This shapefile was adjusted to match Dissmeyer and Stump physiographic zones (Alabama was further modified to match recent Omernik classification). Physiographic zones were assigned a value of 100 – 500 (in increments of 100) and converted to a grid (30 meters). LBL was completely within the

Highland Rim and Pennyroyal (Dissmeyer and Stump 1978).

From these data sets the following queries were made for the sediment model:

Rd Inputs (Roads) – this is the sum the miles of roads (by surface type) and ATV trails for each watershed and eco-region.

Lu Inputs (Land use) – this is the total number of grids summarized by eco-region/land use/slope for each watershed.

Lu PVT Inputs (Private Land use) – this is the total number of grids from nonforest service lands (private) summarized by eco-region/slope/slope for each watershed.

Tx Alt (W-Z) – this is the combination of eco-region/forest succession/slope for each watershed. This number is duplicated by the number of silviculture treatment options (usually 4). In addition treatments not found in the spectrum model are included such as prescribed fire, ATV use and conversion of croplands on national forest lands and silviculture activiteies on private lands.

With the completion of these data queries they are ready to place in the sediment model. This next section breaks the individual worksheets down and demonstrates their relationship.

Road Inputs

This is summarized data directly from ArcView – units are miles

	Col A	Col B	Col C	Col D-----
Row 1	Ecoregion Road surface or Trail	blank	watershed #	watershed #
Row 2	example		miles	miles
Row 3	BR gravel		46.6827	42.5454

LU Inputs

This is the tabulated data from the slope/eco-region/slope combinations. Row 2 – the total number of acres for each watershed) is calculated for each watershed

	Col A	Col B	Col C	Col D-----
	Ecoregion Land use Slope	blank	watershed #	watershed #
	example			
Row 1	Concant		306010201	306010207
Row 2	acres		1089.512391	210.8303218
Row 3	BR cultivated <25		4097700	815400
Row 4	BR cultivated >25		311400	37800

LU PVT Inputs

This is the tabulated data from the slope/eco-region/slope combinations. This data only includes values from private or nonforest service land.

	Col A	Col B	Col C	Col D-----
	Ecoregion Land use Slope example	blank	watershed #	watershed #
Row 1	Concant		306010201	306010207
Row 2				
Row 3	BR cultivated <25		3647700	744300
Row 4	BR cultivated >25		219600	31500

Summary

This is the summary table for the entire spreadsheet. Rows 4-7 identifies the baseline undisturbed annual sediment yields. Row 6 Column C (C6) is the sum of erosion from worksheet (LU natl coef C200) times the sediment delivery coefficient (sed del C7) expressed as total tons per year.

Rows 10-14 expresses the current condition in the same manner. The current condition separates forest service and private and includes roads. The values (average tons of sediment per year) are a representation of past and present effects for each watershed.

Row 16 is the percent increase of sediment of the current condition above the modeled baseline condition.

Rows 20-24 describe the effect of roads, forest service and private management activities in sediment. This is a prediction of future activities expressed in total tons.

Row 26 is the percent increase of sediment of the current condition and predicted future effects above the modeled baseline condition.

	Col A	Col B blank	Col C watershed #	Col D----- watershed #
	example			
Row 1			306010201	306010207
Row 2				
Row 3				
Row 4	Baseline			
Row 5	Road sediment		-	-
Row 6	Land Sediment		1,493.99	1,292.55
Row 7	Total		1,493.99	1,292.55
Row 8				
Row 9				
Row 10	Current			
Row 11	Road sediment		6,321.54	4,316.30
Row 12	Land Sediment FS		1,883.51	1,319.43
Row 13	Land Sediment PVT		4,168.71	1,376.74
Row 14	Total		12,373.76	7,012.48
Row 15				
Row 16	Percent increase over Baseline		828.23	542.53
Row 17				
Row 18	**Period 1**			
Row 19				
Row 20	Alternative A			
Row 21	Road sediment		20.93	20.22
Row 22	Land Sediment FS		7.14	7.86
Row 23	Land Sediment PVT		433.68	267.59
Row 24	Total		461.75	295.67
Row 25				
Row 26	Percent increase over Baseline		859.14	565.41

In the example above you have one alternative for one period. The remainder of the table has values for all alternatives for five 10-year periods for each watershed.

Road Construction Coefficient

This worksheet calculates the additional sediment from roads and fireline construction for each watershed, alternative and period combination.

Column B is the construction coefficient. It is assumed that construction values for roads are twice that of the constructed annual yield. Firelines are expressed as the measured value for one year.

Row 2 represents the Blue Ridge permanent (graveled) roads to be constructed for period 1. Most forests elected not to identify permanent road construction with silviculture activities. Temporary roads (native) are calculated in row 7 for period 1. Cell C7 (and subsequent cells) calculates the total number of acres treated with management

treatments and applies a temporary road coefficient from the forests. All values are in tons of sediment.

Row 32 calculates the effect of firelines. This value is derived from the number of miles of fireline constructed based on acres burned.

Row 1021 sums the total number of tons of sediment from construction for Alternative A period 1 for each watershed. The remainder of the table summarizes the effects of roads and firelines for the remaining watersheds, alternatives and periods. These numbers are linked to the Summary worksheet.

	Col A Ecoregion roadtype or fireline example	Col B sediment coefficient	Col C watershed #	Col D----- watershed #
Row 1	Alt A	Const values	306010201	306010207
Row 2	BR gravel	46.72	0	-
Row 3	p2	46.72	0	-
Row 4	p3	46.72	0	-
Row 5	p4	46.72	0	-
Row 6	p5	46.72	0	-
Row 7	BR native	38.04	0.005144022	0.00
Row 8	p2	38.04	0.005144022	0.00
Row 9	p3	38.04	0.005144022	0.00
Row 10	p4	38.04	0.005144022	0.00
Row 11	p5	38.04	0.005144022	0.00
Row 32	Fireline br	47.64	20.92426002	20.20850626
Row 33	p2	47.64	20.92426002	20.20850626
Row 34	p3	47.64	20.92426002	20.20850626
Row 1018	Period 1			
Row 1019				
Row 1020	Alternative A			
Row 1021	Road sediment		20.93454806	20.21844239

Current Road Sediments

This worksheet calculates the current road sediment. The miles of road are multiplied by the road values in column B. Values are expressed in tons. Row 33 sums the total and is linked to the Summary worksheet (Row 11).

	Col A Ecoregion roadtype or trail example	Col B sediment coefficient	Col C watershed #	Col D----- watershed #
Row 1	type	Const values	306010201	306010207
Row 2	BR gravel	23.36	1090.507872	993.860544
Row 3	BR native	19.02	581.043882	164.0475

Sediment Delivery

Roehl's sediment delivery for land treatments is calculated based on his equation in Figure 4 of his paper. Row 7 is the value expressed as a decimal. This value is used in the summary worksheet.

	Col A	Col B blank	Col C watershed #	Col D----- watershed #
	example			
Row 1	Concant		306010201	306010207
Row 2	acres		178540.8129	121279.9202
Row 3				
Row 4	sq mi		278.9700202	189.4998753
Row 5	log and coeff		0.747099864	0.803953825
Row 6				
Row 7	sed delivery		0.055859863	0.063672782

Coefficients

This worksheet uses values from Dissmeyer and Stump for each eco-region (Blue ridge is shown). Values in yellow from Column C are taken from Dissmeyer and Stump. Column B converts these values to pounds per acre. Values not in yellow are interpreted.

	Col A Ecoregion roadtype or trail example	Col B sediment coefficient	Col C watershed #
Row 1	Coefficients	130 Blue Ridge Mountains	130 t/a/y
Row 2			
Row 3	CC	7360	3.68
Row 4	Shelter wood	4974.545455	
Row 5	Med Thinning	2123.636364	
Row 6	SingleTree	2327.272727	
Row 7	p burn	581.8181818	
Row 8	CC steep	28600	14.3
Row 9	Seedtree steep	19330.43478	
Row 10	Shelterwood steep	8252.173913	
Row 11	Med Thinning steep	9043.478261	
Row 12	SingleTree steep	2260.869565	
Row 20	site prep burn	7200	3.6
Row 21	Natural<12	100	0.05
Row 22	Natural>12	660	0.33
Row 23	strip mine	216000	108
Row 24	fs nonforest<	100	0.05
Row 25	pasture<	5240	2.62
Row 26	fs nonforest>	3696	0.33
Row 27	pasture>	13266	20.6
Row 28	cultivated	47600	
Row 29	urban	57120	
Row 30	water	0	

This table also includes coefficients for each eco-region, forest succession, slope and silvicultural prescription. Values for other activities not covered in spectrum are also included. See rows 103 – 110. These values are repeated for each period. Values from these columns are linked to the alternative tables.

	Col O	Col P
	example	
Row 1	Period 1	
Row 2	acres	
Row 3	Br 1 <25 ba 0	8174.545455
Row 4	Br 1 <25 ba 20	5671.462451
Row 5	Br 1 <25 ba 40	2679.048951
Row 6	Br 1 <25 ba 60	2935.944056
Row 7	Br 2 <25 ba 0	8174.545455
Row 8	Br 2 <25 ba 20	5671.462451
Row 9	Br 2 <25 ba 40	2679.048951
Row 10	Br 2 <25 ba 60	2935.944056
Row 11	Br 3 <25 ba 0	8174.545455
Row 12	Br 3 <25 ba 20	5671.462451
Row 103	Rv prescribed fire	276.6798419
Row 104	Rv site prep	320
Row 105	BR pvt forest < 25	8174.545455
Row 106	BR pvt forest > 25	31765.21739
Row 107	BR pvt site prep	7200
Row 108	BR pvt site prep	7200
Row 109	BR pvt urban < 25	57120
Row 110	BR pvt urban > 25	57120

This worksheet also includes the coefficients for all land uses for current and undisturbed conditions. These values are linked as coefficients to the LU natl, current pvt, and current coef worksheets.

	Col Z	Col AA	Col AB
	example		
Row 1	Composite	current	natural
Row 2			
Row 3	Br cultivated < 25	47600	100
Row 4	Br cultivated > 25	47600	660
Row 5	Br forest < 25	100	100
Row 6	Br forest > 25	660	660
Row 7	Br mines < 25	216000	100
Row 8	Br mines > 25	216000	660
Row 9	Br pasture < 25	500	100
Row 10	Br pasture > 25	13266	660
Row 11	Br urban < 25	57120	100
Row 12	Br urban > 25	57120	660
Row 13	Br water < 25	0	0
Row 14	Br water > 25	0	0
Row 15	Br wetland < 25	0	0

Row 16	Br wetland > 25	0	0
Row 17	PD cultivated < 25	47600	20

The following example is similar to the LU natl coef, current pvt, and current coef worksheets. Values in C3 and subsequent cells are converted to acres and multiplied to the erosion coefficient in column B. The natural condition uses column AB as a coefficient. The current condition worksheets use values from column AA. These values are totaled in Row 200 and linked to the summary worksheet.

	Col A	Col B	Col C	Col D-----
		erosion coefficient	watershed #	watershed #
	example			
Row 1	Fshuc5text		306010201	306010207
Row 2	Acres		178540.8129	121279.9202
Row 3	Br cultivated < 25	100	101256.3771	20148.97379
Row 4	Br cultivated > 25	660	50786.08891	6164.785359
Row 200	total		53490690.56	40599755.19

Alternatives

These worksheets (for each Alternative) are the links to the spectrum models. Values for the spectrum models are placed in Column B. The value from spectrum should be the total number of acres treated for each period by eco-region forest succession, slope class, and silvicultural treatment. Column A is linked to the general coefficients values. Values for C3 (and subsequent cells) include taking the values from the associated Tx Alt worksheet as a proportion of the total number of acres. That proportion (for each watershed is then multiplied by column B divided by 10 and multiplied by the corresponding coefficient in coef general worksheet column P for the pounds of erosion associated with each watershed, eco-region, forest succession class, slope and silviculture treatment.

Row 103 is an example of non-spectrum values. B103 is the number of acres that will be treated for the entire period. A percent or proportion of each watershed is then allocated and multiplied against the corresponding coefficient.

Row 104 is the total number of regeneration acres that are treated with a site preparation that could create erosion.

Rows 105 – 109 represent the predicted future activities of non-forest service or private land. The number of acres harvested for private land was based on a rotation age and assumed a clearcut or a percent increase in urbanization.

Row 1001 and 1002 represent the total number of pounds created from forest service and non-forest service lands

	Col A	Col B	Col C	Col D-----
		Spectrum Value	watershed #	watershed #
	example			

Row 1	**Period 1**	**tot ac by decade**	306010201	306010207
Row 2	acres		178540.8129	121279.9202
Row 3	Br 1 <25 ba 0	1	26.01021391	46.20137257
Row 4	Br 1 <25 ba 20	1	18.04576809	32.05430212
Row 5	Br 1 <25 ba 40	1	8.524343854	15.14160505
Row 6	Br 1 <25 ba 60	1	9.341746689	16.59353978
Row 7	Br 2 <25 ba 0	1	20.81447585	47.09453448
Row 8	Br 2 <25 ba 20	1	14.44098866	32.67397379
Row 9	Br 2 <25 ba 40	1	6.821541332	15.43432157
Row 10	Br 2 <25 ba 60	1	7.475661734	16.914325
Row 11	Br 3 <25 ba 0	1	175.9027904	74.60534877
Row 103	Rv prescribed fire	17400	0	0
Row 104	Rv site prep		0	0
Row 105	BR pvt forest < 25		5188596.559	2636738.947
Row 106	BR pvt forest > 25		10081634.56	5725924.784
Row 107	BR pvt site prep		0	0
Row 108	BR pvt site prep		0	0
Row 109	BR pvt urban < 25		116259.6265	33663.46264
Row 1001	Period 1 fs		255831.3787	247099.3445
Row 1002	Period 1 pvt		15527496.19	8405219.429

Tx Alternatives

This is the grid data from spatial analysis for each alternative. Column B is the sum of the watersheds converted to acres. Cell C3 (and subsequent cells) is the number of meters (grids) including private. Row 301 – 305 is used to set up a proportional relationship for road construction values.

	Col A	Col B	Col C watershed #	Col D----- watershed #
	example			
Row 1	Composite	Value	306010201	306010207
Row 2				
Row 3	Br 1 < 25	5169.123343	7534800	13383900
Row 4	Br 1 < 25	5169.123343	7534800	13383900
Row 103	Rv prescribed fire	0		
Row 104	Rv site prep	0		
Row 105	BR forest <25		256864500	130533300
Row 106	BR forest >25		128439000	72947700
Row 107	Br PVT site prep			
Row 108	Br PVT site prep			
Row 109	BR urban <25		4118400	1192500
Row 110	BR urban >25		499500	31500
Row 301	huc		306010201	306010207
Row 302	br acres	632890.3555	68466.92125	66124.88116
Row 303	pd acres	125454.2655	0	0
Row 304	rv acres	70178.47197	0	0
Row 305		total		
Row 306		828523.093	68466.92125	66124.88116

B.13 Determining Sediment Coefficients for Roads, ATV Trails, and Firelines

February, 2004

Introduction

In December 2003, sediment coefficients for roads, ATV trails, and firelines were determined for the LBL Area Plan revision. The sediment coefficients were developed for use in a cumulative effects model for water quality. The coefficients express, in tons of sediment per mile of road/ATV trail/fireline, the average annual yield of sediment entering a stream from a road, ATV trail, or fireline for each eco-region.

The Watershed Erosion Prediction Project (WEPP) model for roads was used to develop the coefficients. This model was developed by the Rocky Mountain Research Station and San Dimas Technology and Development Center. Documentation of the WEPP:Road model is on the internet website http://forest.moscowfsl.wsu.edu/fswepp/.

Process

The forest identified roads that were representative of the roads on their respective units. Roads selected contained at least one stream crossing.

An on-site survey was conducted to determine inputs for the WEPP:Road model. The road was divided into segments based on water diversions. Functioning waterbars, broad-based dips, wing ditches, and culverts were considered to be water diversions. If no water diversion was present and the water had created its own diversion, this also marked a segment break. Additionally, a crest in the road, where water ran off in two different directions, was considered a segment break.

Horizontal distances for road segment lengths, road widths, road fillslope lengths, and buffer lengths were paced off or visually estimated for each road segment. Some buffer lengths over 300 feet long were estimated from topographic maps.

Road gradients, fillslope gradients, and buffer gradients were measured with a clinometer or were visually estimated for each road segment to determine an average slope gradient. In areas where roads or trails occurred in the buffer below the road segment being inventoried, the buffer length and slope were calculated as if the road or trail in the buffer did not exist.

The buffer began at the end of the water diversion device or at the bottom of the fillslope, whichever was applicable. If there was scour or a sediment trail at the end of a diversion, then the buffer began where the scour or sediment trail ended. The buffer ended at the nearest channel. If a channel alternated between being scoured and unscoured, then it was considered to be a scoured channel.

Other on-site data collected included the road design and status of road ditch vegetation. These parameters were visually determined. All roads were calculated as rutted.

Measurements were then input into the WEPP: Road model on the interactive internet site http://forest.moscowfsl.wsu.edu/fswepp/. Thirty years of simulation were used. This was based on the WEPP documentation that states "[f]or climates with more than 500 mm of precipitation; 30 years of simulation is generally adequate to obtain an estimate of erosion" (Elliot et. al, 1999).

The climate station used was the weather station closest to the site location. For eco-regions which were subdivided and where the data used in the model was collected from another subdivision, a climate location central to the Forest Service watersheds in the subdivided eco-region was used. It was assumed that the weather stations used were representative of each eco-region's or subdivided eco-region's climate.

Soil textures were either determined from consultation with the Forest Soil Scientist or were determined on-site. The predominant soil texture was used for the entire road/trail/fireline segment surveyed. The rock content of a soil was not taken into consideration as the soil texture choices available in WEPP:Road did not include any appreciable rock content. There were three segments on one ATV trail section that were predominately bedrock. These three segments were calculated as a gravel surface instead of native to account for the bedrock.

For each eco-region or eco-region subdivision, a sediment yield per mile of road was determined. Adding the amount of sediment from each road segment and then dividing by the total length of the road segments calculated this yield. This sediment yield, described in tons per mile, was used as the sediment coefficient in the cumulative effects model.

Sediment yields were determined separately for native, graveled, and paved roads. The same data was used to determine sediment yields for each road surface. It was assumed that road templates were representative of all five road surface types. The same procedure used for roads was repeated with firelines and ATV trails. Firelines and ATV trails were considered to be rutted and outsloped.

The sediment coefficients for each eco-region or eco-region subdivision are shown in the attached data summary. This summary also shows weather stations soil textures, National Forests and Ranger Districts, lengths of road, ATV trails, and firelines surveyed.

Assumptions, Uncertainties, and Limitations

Many of the assumptions used in determining the sediment coefficients have already been presented in the previous section under "Process." Other assumptions are listed further in this section. The sediment coefficients should not be considered as absolute values.

Some assumptions were made due to limitations of the WEPP:Road model. These assumptions are:

- Any road/trail/fireline gradient over 40 percent would yield the same results as a 40 percent gradient. WEPP:Road does not accept road gradients over 40 percent;
- Any road/trail/fireline gradient of less than one percent would yield the same results as a 0.3 percent gradient. WEPP:Road does not accept road gradients of less than 0.3 percent;
- The absence of fillslopes would yield the same results as fillslopes with a 0.3 percent gradient and a one-foot length. WEPP:Road does not accept fillslope measurements with less than a 0.3 percent gradient and one foot length;
- Any buffer length greater than 1000 feet would yield the same results as a 1000-foot buffer. WEPP:Road does not accept buffer lengths greater than 1000 feet.

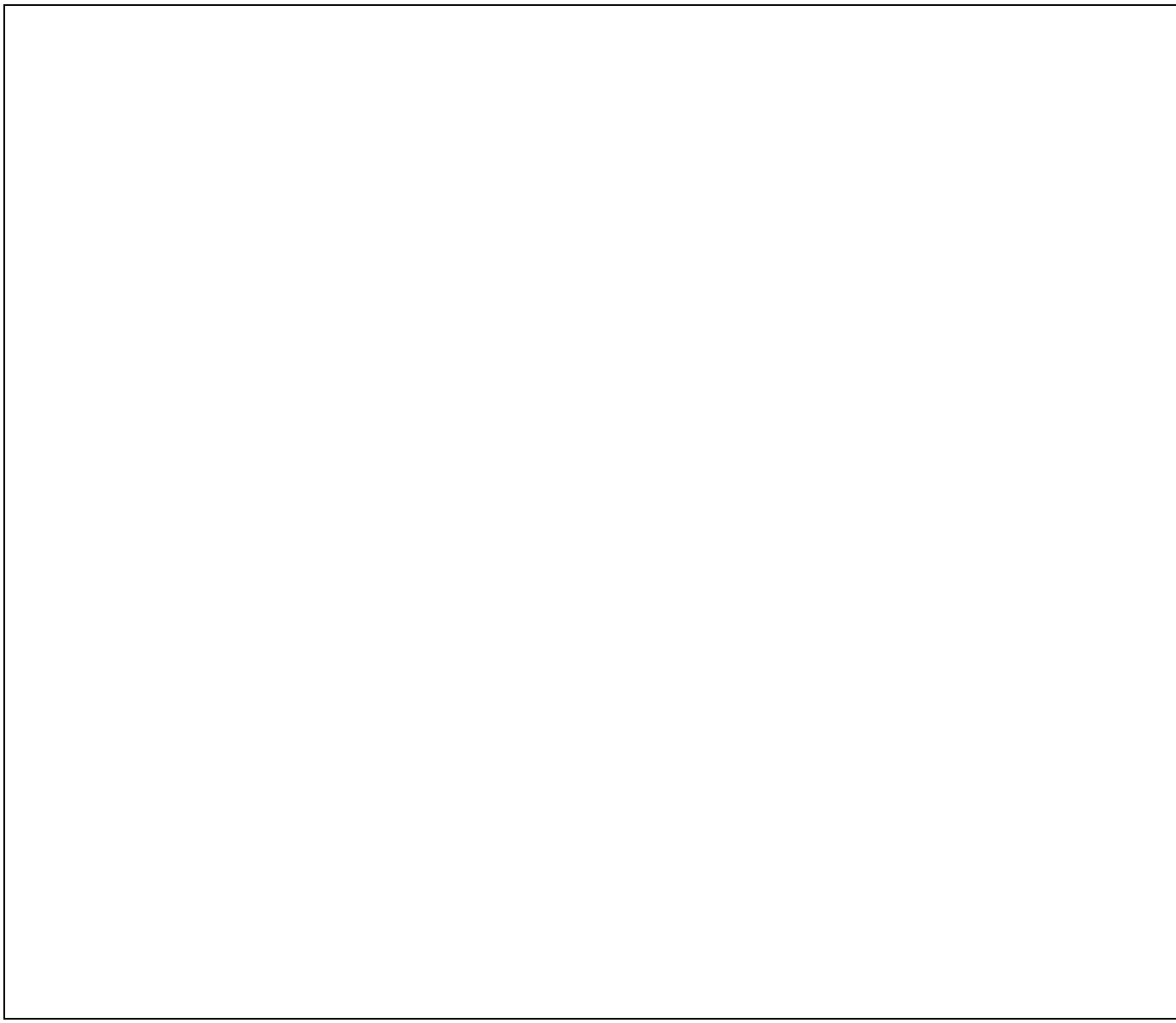
Survey Results

Ownership and maintenance level	Miles surveyed	Sediment Coefficient used in model	Road Erosion		Road Sediment	
			High Traffic Volume	Low Traffic Volume	High Traffic Volume	Low Traffic Volume
			tons per year			
LBL 1	0.28	21.84	115.65	40.45	68.37	21.84
LBL 2	0.24	6.11	34.94	23.03	8.29	6.11
LBL 3		36.34	89.64	48.40	69.63	36.34
LBL 4	0.30	36.34	89.64	48.40	69.63	36.34
LBL 5	0.73	13.10	45.38	20.09	29.93	13.10
LBL ATV	0.21	52.72	74.67	72.12	52.72	48.12
LBL horse	0.28	21.84	115.65	40.45	68.37	21.84
pvt gravel		36.34	89.64	48.40	69.63	36.34
pvt native		21.84	115.65	40.45	68.37	21.84
pvt paved		13.10	45.38	20.09	29.93	13.10

Fish Community/Sediment Profile

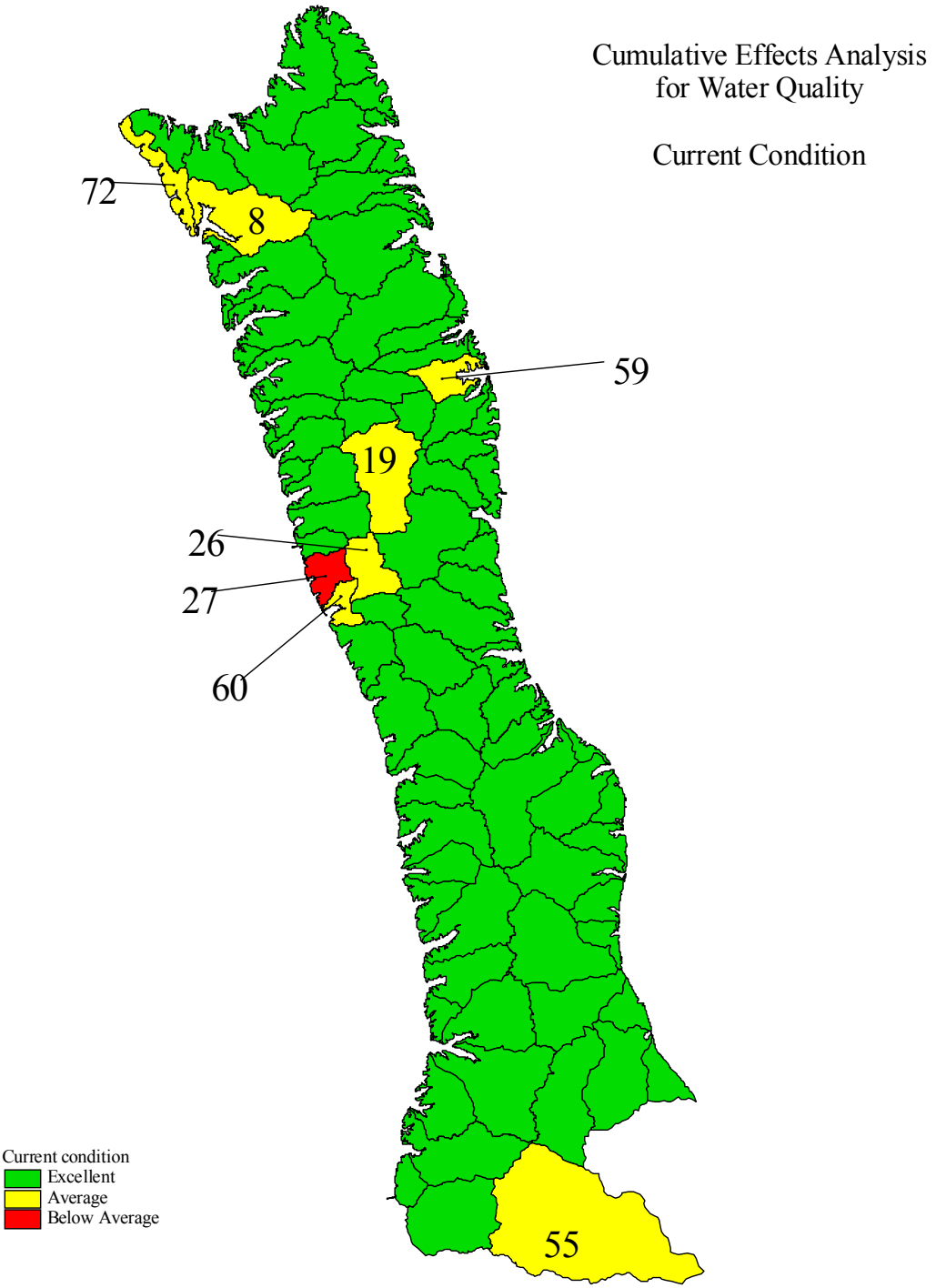
The original intent was to reproduce the study efforts previously undertaken for the Southern Appalachian Forest Plans. However, available data was limited to a single sample year collected by the Center of Aquatic Technology Transfer (CATT). They were limited to only having upper stream reaches to sample. Because of the lack of endemics,

the sediment increases were correlated to feeding, specialists, tolerance, and fecundity groups. The most meaningful of these was the relationship of benthic insectivores (fish that feed on insects on the stream bottom). While trends within this data were not strong, the information is instructive to potential breaks in watershed health. A Principle Components Analysis (PCA) had similar results. The following graph shows the relationship of benthic insectivores to sediment increases.



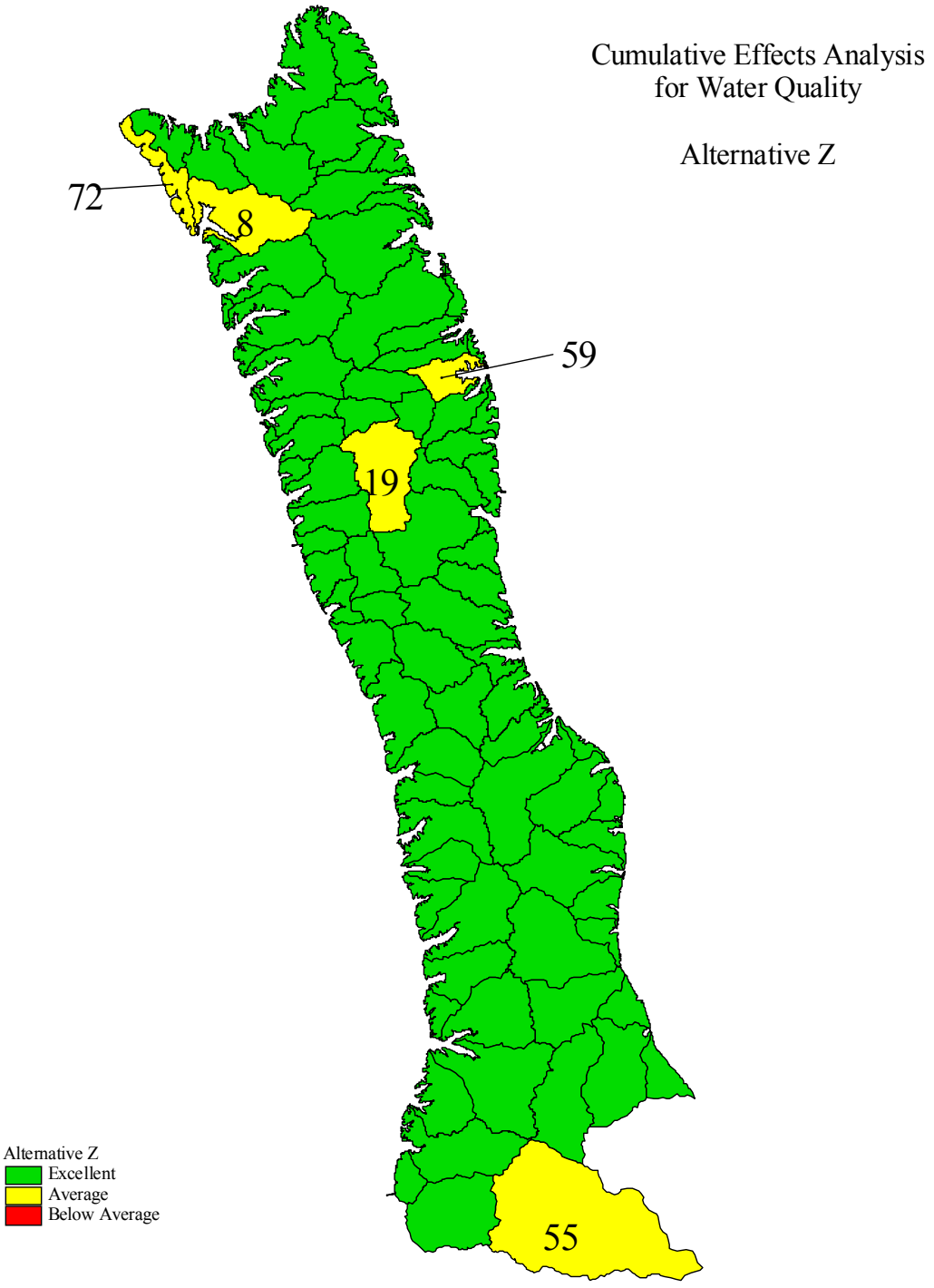
From the trendline the number of benthic insectivores has declined when sediment increases exceed 600. For purposes of interpretation, sediment values less than 600 supports the relative abundance of benthic insectivores and values greater than 600 show a decline in the relative abundance of benthic insectivores. For the purposes of forest planning, values less than 600 are noted as excellent; values between 600 and 1200 are noted as average; and values greater than 1200 are below average with respect to watershed health.

Watershed Delineations Maps - Current Condition



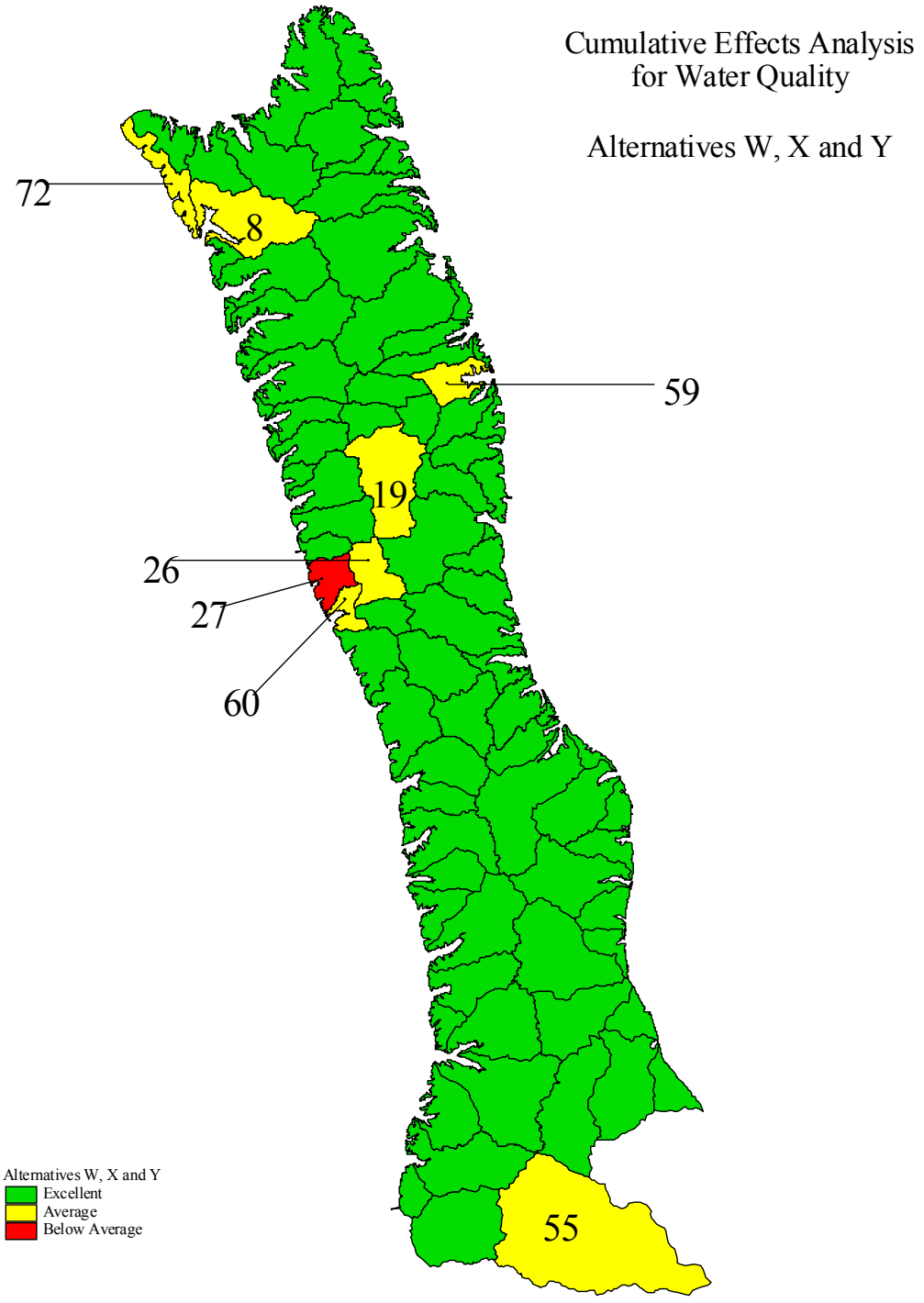
Note: Watershed Number 55 extends beyond the southern boundary of LBL and is primarily private land.

Alternative Z



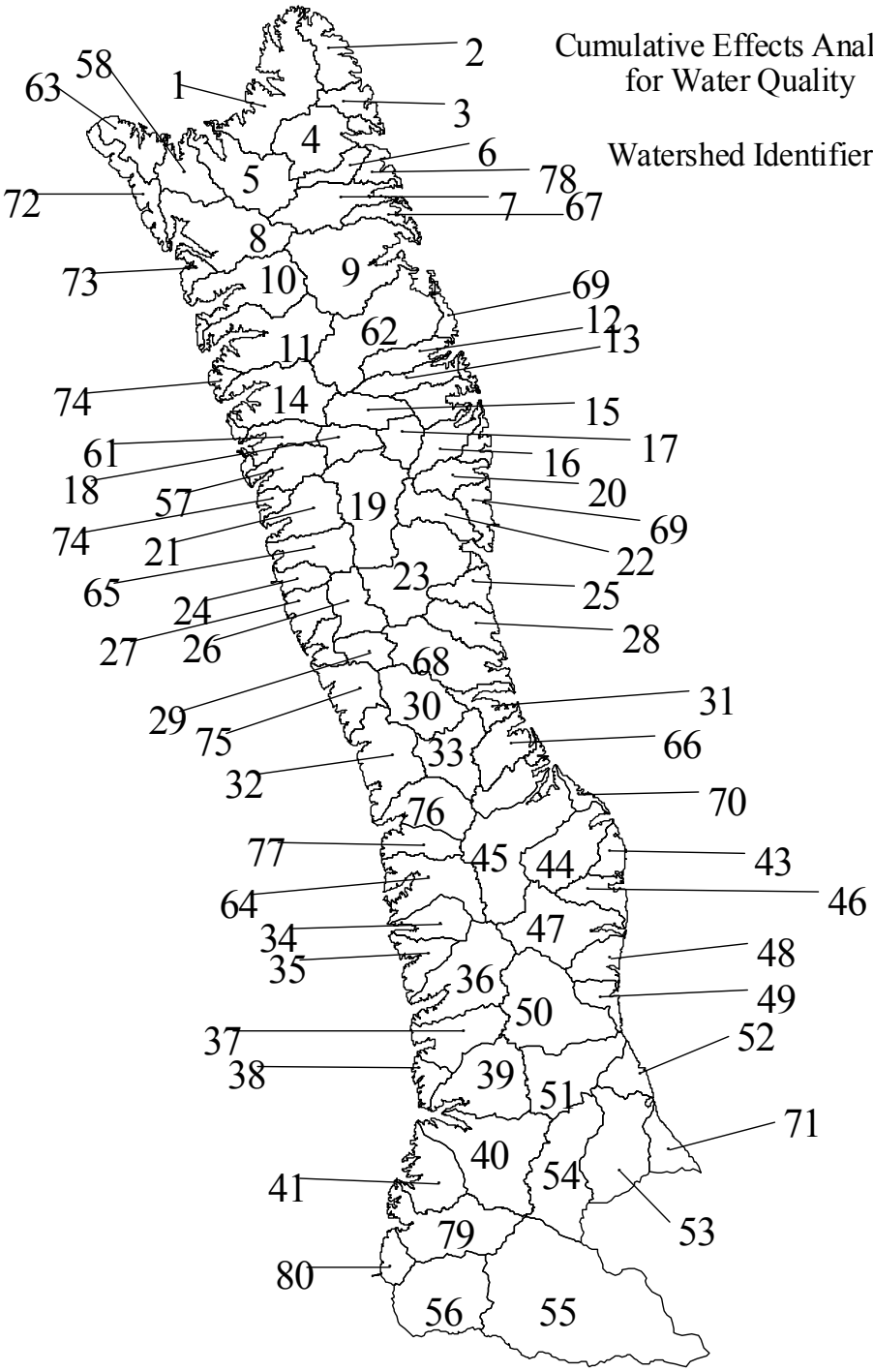
Note: Watershed Number 55 extends beyond the southern boundary of LBL and is primarily private land.

Alternatives W, X and Y



Note: Watershed Number 55 extends beyond the southern boundary of LBL and is primarily private land.

Watershed Identifiers



Note: Watershed Number 55 extends beyond the southern boundary of LBL and is primarily private land.

B.14 Demographic Changes and Economy Trends

I. Demographic Changes

Past population growth and various racial and ethnic components of the population within the counties which comprise a national recreation area or a national forest are characteristics used to determine how dynamic and subject to change an area may be in the future. A static area generally implies fewer possible issues and conflicts for land managers to consider. Conversely, a dynamic growing population or changes in population characteristics may produce many conflicting issues for consideration. Certain areas of a national recreation area or national forest system and surrounding lands may be very attractive for second homes or retirement home residences. This attraction to urban dwellers in the communities surrounding the federal lands may produce issues which conflict with traditional residents of the area.

The geographic area used in this analysis includes three counties with some national recreation area lands within their boundaries, and four other bordering counties that influence the local economy. The three counties that have LBL National Recreation Area lands within their boundaries are Lyon and Trigg counties in Kentucky and Stewart County in Tennessee. The additional Analysis Area counties are Calloway, Livingston and Marshall in Kentucky and Henry County in Tennessee. References to the NRA Analysis Area relate to the seven-county area. Any reference in the report to only the three counties with LBL National Recreation Area lands will be specifically identified.

LBL was managed as a recreation area by the Tennessee Valley Authority prior to its transfer in 1999 to the Secretary of Agriculture to be managed as a unit of the National Forest System. The area is currently under multiple use management by the U. S. Forest Service as a national recreation area.

Demographic changes for the Analysis Area are generally compared with the Commonwealth of Kentucky which has more counties than Tennessee in which the national recreation area lies. Further, five of the seven study area counties are Kentucky counties. References in this report to “the state” will refer to the Commonwealth of Kentucky unless otherwise specified. Information for both states, however, will be provided for reference and information in the appendix tables

The population in the NRA Analysis Area counties was 118,082 in 1980 and increased by 2.8 percent from 1980 to 1990. The NRA Analysis Area increased another 13.9 percent in the 1990 to 2000 decade for a total population of 138,268 in 2000. Tables 1-5 at the end of this report show population characteristics and rates of change for each county within the NRA Analysis Area. The Commonwealth of Kentucky increased less than 1 percent in the first decade and 9.7 percent in the later decade--a much slower growth rate than the Analysis Area. Table A below illustrates minority representation for the seven county Analysis Area for 1990 and 2000 and total population change in the 1980s and 1990s.

The NRA Analysis Area exhibited some population growth in the decade of the 1980s and this growth trend grew stronger in the 1990s. The three counties with LBL National Recreation Area lands were the fastest growing counties in the study area with rates above the Analysis Area average of 14 percent in the 1990s. Both Lyon and Trigg counties in Kentucky grew about 21 percent in the 1990s. Stewart County in Tennessee grew at an even faster rate of 30.5 percent during this period.

Table A

MINORITY REPRESENTATION AND PERCENT POPULATION CHANGE				
	Percent Minority		Percent Population Change	
	1990	2000	1980-90	1990-00
NRA Analysis Area	5.1	6.9	2.8	13.9
Kentucky	7.9	9.9	0.7	9.7

Source: U.S. Census Bureau

Minorities made up approximately five percent of the population within the National Recreation Analysis Area and about eight percent at the state level in 1990. The minority portion of the population increased slightly in these areas to approximately seven percent in the Analysis Area and 10 percent at the state level by 2000. Opportunities for area visits by minorities have been substantive throughout the Analysis Area, but have not changed much through time.

Table B

POPULATION DENSITY			
	1980 Population Density Persons/Sq. Mile	1990 Population Density Persons/Sq. Mile	2000 Population Density Persons/Sq. Mile
NRA Analysis Area	44.6	45.7	52.4
Kentucky	92.1	92.8	101.7

Source: U.S. Census Bureau

Population density in the Commonwealth of Kentucky was 93 persons per square mile in 1990. This was about twice the number of persons per square mile in the national recreation area counties, which had a population density of 46. A decade earlier the same general relationship existed with densities of 92 and 45 for the state and national recreation area, respectively. Between 1990 and 2000, state population density increased about 10 percent to 102. The NRA Analysis Area density increase in this period was 15 percent to 52 persons per square mile, but remained at about half the population density of the state as a whole. The lower density in the NRA Analysis Area is due to the absence of large metropolitan areas in the Analysis Area. This divergence can be expected to continue in the near future.

Table C

RURAL REPRESENTATION		
	1990 % Rural	**2000 % Rural**
NRA Analysis Area	75.0	75.1
Kentucky	48.2	44.3

Source: U.S. Census Bureau

The low population density for the NRA Analysis Area is consistent with the rural representation of the population in the Analysis Area counties relative to the state. The population in the NRA Analysis Area was classified as 100 percent rural in four counties and 75 percent rural, overall, in 1990. Only three counties were 100 percent rural in 2000, but the study area remained about 75 percent rural. This is in contrast to the relatively lower rural percentage of approximately 48 percent for the state in 1990 and 44 percent in 2000.

All three counties with LBL National Recreation Area lands reflected 100 percent rural population in 1990 and only one county had a small contingent of urban population in 2000 (see Table 6 of the Appendix). Trigg County, Kentucky, is the county with some urban population in 2000, but this county was still 79 percent rural.

Table D

PER CAPITA INCOME			
	1990 Per Capita Income	**2000 Per Capita Income**	**Real Avg. Annual % Change '90-'00 Per Capita Income**
NRA Analysis Area	$10,356	$16,725	2.7
Kentucky	$11,153	$18,093	2.7

Source: U.S. Census Bureau

Per capita income is a relative measure of the wealth of an area. It constitutes the personal income from all sources divided by the population of the area. These nominal data can be adjusted to remove inflation and provide an indication of real change over time.

Per capita income in the NRA Analysis Area in 1990 averaged $10,356 compared to $11,153 in the Commonwealth of Kentucky. The gains in the 1990s were sharply upward for the state and Analysis Area with similar rates of approximately 60 percent nominal and a 30 percent real (adjusted for inflation) gain over the 10-year period. The NRA Analysis Area and state grew at an annual real rate of 2.7 percent per year. The seven individual counties had positive per capita growth rates ranging from 2.1 to 3.2 percent (Table 7 of the Appendix). In 2000, per capita income was $16,726 in the NRA Analysis Area compared to $18,093 for the Commonwealth of Kentucky.

Another source of income is government transfer payments, which include a wide range of government payments to individuals and families. Some of these are workers compensation, unemployment, retirement and disability, income maintenance for low income families, food stamps, and other family assistance. These payments would be expected to compensate counties with low per capita income more than counties with above average per capita income. This holds true in the Analysis Area in the year 2000. The average per capita government transfer payment was $4,134 for the Commonwealth of Kentucky and $4,533 in the NRA Analysis Area. The increasing importance of this source of income in the NRA Analysis Area is emphasized by the 71 percent nominal increase in these payments from 1900 to 2000, compared to the 61 percent nominal increase in per capita income (See Table 11 for additional county information).

The percent of the workforce out of work is another indicator of relative economic prosperity. Unemployment rates change dramatically over time, depending in large part on the national and regional economy. Some areas, however, have protracted unemployment problems because of the education level of the workforce and labor skills and mobility.

In 1995, the NRA Analysis Area had an unemployment rate of 7.0 percent, considerably higher than the state rate of 5.4 percent. The unemployment rate for the NRA Analysis Area in 2000 declined to 5.2 percent, but was still one percentage point above the statewide rate. Stewart County, Tennessee, had 15.5 percent unemployment in 1995, almost three times the rate for Kentucky or Tennessee. In 2000, this county's unemployment declined to 6.9 percent but remained the highest study area county, and well above the Analysis Area average. Unemployment rates for the Analysis Area by county and both states can be found in Table 16, at the end this appendix, for 1995 thru 2000.

Table E

UNEMPLOYMENT RATE		
	1995 Unemployment % Rate	**2000 Unemployment % Rate**
NRA Analysis Area	7.0	5.2
Kentucky	5.4	4.1

Source: U.S. Bureau of Labor Statistics

Employment opportunities directly affect unemployment, especially in the short run. There were 59,111 persons employed in the NRA Analysis Area in 1995, and the number of employed persons increased to 62,136 in 2000. The growth in employment was considerably faster in the first three years of this period than for the last three. Employment by NRA Analysis Area counties can be found in this appendix, Table 12.

The percent of people living in poverty is another population characteristic which provides an indicator of relative economic prosperity of an area. A substantial number of persons in the Analysis Area are classified as living in poverty. This statistic was 15.4 percent in 1980 and 13.0 percent in 2000. The data for Kentucky was slightly higher, at

17.6 percent in 1980 and 15.8 percent in 2000. Information for individual NRA Analysis Area counties is presented in this appendix, Table 8, and presents a wide range between counties from 13-19 percent in 1980. Calloway was the only county that had a poverty level greater than 13 percent in 2000. This county's poverty of 16.6 percent was above the state level of 15.8 percent.

Table F

POVERTY RATE			
	Percent of People of All Ages in Poverty		
	1980	1990	2000
NRA Analysis Area	15.4	16.5	13.0
Kentucky	17.6	19.0	15.8

Source: U.S. Census Bureau

The percentage of households headed by a female can be a factor that contributes to relative poverty and relates to social disunity for an area. Generally, the greater this percentage is, the higher the number of households that may be on some form of government assistance.

Table G

PERCENT OF FEMALE HEADS OF HOUSEHOLDS W/CHILDREN		
	Percent	
	1990	2000
NRA Analysis Area	4.1	5.2
Kentucky	6.3	7.0

Source: U.S. Census Bureau

The percentage of households that had a female as the head of household, and also with children in the household, was lower in the Analysis Area than at the state level in 2000. This data set has trended upward over the last decade, but the analysis area appears to have fewer households of this type than the state in both time periods--1990 and 2000.

An area with a large number of people per household can be indicative of a condition of poverty. The number of persons per household in 2000 was similar between the NRA Analysis Area and the state. The general trend for household size has been for a slight decline and the Analysis Area appears to be very comparable to the state with regard to this household characteristic. Both areas had slight downward trends in household size between 1990 and 2000.

Table H

HOUSEHOLD DENSITY		
	Persons per Household	
	1990	2000
NRA Analysis Area	2.6	2.5
Kentucky	2.7	2.5

Source: U.S. Census Bureau

The number of housing units increased in the Analysis Area and the state during the decade of the 1990s. Housing units increased by 20 percent in the Analysis Area and 16 percent at the state level. This rate of growth exceeded the rate of growth of population and implies that household size should have declined during the last decade at both the Analysis Area and state level. This trend is reflected in the table above, although the decline is not as great as might have been expected.

Table I

HOUSING UNITS			
	Housing Units	**Housing Units**	**Housing Units Percent Change**
	1990	**2000**	**1990-00**
NRA Analysis Area	56,849	69,218	20.0
Kentucky	1,506,845	1,750,927	16.2

Source: U.S. Census Bureau

Housing values are determined principally by the extent of demand. The greater the demand, the higher prices are bid up. Population and job increases play a factor in the extent of demand for housing. Another factor is land and building cost. Land cost in the more rural setting would generally be less than in a more urban area. Median housing values for the Analysis Area and the state are contrasted in the table below. The rural nature of the Analysis Area is reflected in these values. The median value of housing in the Analysis Area was $43,900 in 1990 and increased to $75,957 in 2000. Comparable values for Kentucky were $50,100 and $86,700. Information by individual NRA Analysis Area counties is shown at the end of this appendix, Table 10.

Table J

HOUSING VALUE		
	Housing Units Median Value 1990	**Housing Units Median Value 2000**
NRA Analysis Area	$43,900	$75,957
Kentucky	$50,100	$86,700

Source: U.S. Census Bureau

II. Economic Trends

Analyzing the major sectors of an economy allows insight into how diverse the economy is and what industries may be driving its growth. Table 13 of this appendix shows the industries in the entire economy broken out by major Standard Industrial Code (SIC) and by important industry sub-sectors for wood products. Table 13 shows the nine major one digit SIC's in bold print. The major sectors and sub-sectors of interest, plus all other sectors with 10 percent or more of industry output or employment, are shown in Table K.

Table K

ECONOMIC DIVERSITY				
Sector	Industry Output % of Total 1990	Industry Output % of Total 2000	Employment % of Total 1990	Employment % of Total 2000
Agriculture	7.8	2.6	7.5	8.0
Manufacturing	44.4	41.2	19.7	18.3
Wood Products	1.5	1.5	1.2	1.0
Furniture & Fixtures	0.4	1.1	0.6	0.6
Wholesale & Retail Trade.	7.7	8.9	19.4	20.8
Services	8.1	9.0	15.2	17.3
Government	9.0	12.9	19.3	17.3
Total Economy*	$4,659.3	$7,073.1	56,030	71,945

* Dollars in millions and number of employees
Source: IMPLAN Data, 1990 and 2000

Manufacturing is the dominate sector in the local economy. Manufacturing declined in importance between 1990 and 2000, both with regard to industrial output and employment. This sector represented 41.2 percent of industry output and 18.3 percent of employment in 2000. The small decline in the Manufacturing sector resulted in some gain in industry output or employment for all other major sectors except Minerals, thereby suggesting the economy is slightly more diverse in year 2000.

Natural resources and economic characteristics are influential in an area's economy. Diversity in an economy is desirable because it tends to support stability and helps to minimize normal economic business cycles that occur over time. Smaller areas like this study area are generally more limited in natural resources and other economic characteristics and cannot obtain the diversity of large area economies. As a comparison to the NRA Analysis Area, the United States economy as a whole had a concentration in manufacturing of only 20 percent in 1990, and has declined to about 13 percent in 2000.

In the Manufacturing sector, "wood products" represented 1.5 percent of the local economy's total output in 1990 and 2000. Employment in this sub-sector was 1.2 percent in 1990 and declined to 1.0 percent in 2000. Another wood related Manufacturing sub-sector, "furniture and fixtures", increased from 0.4 to 1.1 percent of industry output in 2000.

Other major sector changes in industry output included the Transportation & Public Utilities sector which increased from 4.7 percent of industry output in 1990 to 6.5 percent in 2000; Wholesale and Retail Trade sector which increased from 7.7 percent of output in 1990 to 8.9 percent in 2000 and represented 21 percent of employment in 2000; and Finance, Insurance & Real Estate which increased from 7.0 percent to 8.5 percent. The Services sector increased from 8.1 percent to 9.0 percent and the Government sector increased from 9.0 to 12.9 percent in 2000. Both the Services and Government sectors represented about 17 percent of employment in 2000.

Agriculture, construction, and minerals were three major sectors that reflected no change or slight declines between 1990 and 2000. Considering all of these changes, the local economy is becoming more diverse, but remains heavily reliant on the Manufacturing sector for a major part of the economic activity. An economy with large shares of manufacturing is more susceptible to national recessions.

Table L

ECONOMY DYNAMICS		
	Employment Avg. Annual % Change 1900-2000	**Industrial Output Avg. Annual % Change 1990-2000**
NRA Analysis Area	2.5	4.3

Source: IMPLAN 1990 and 2000 Data

The average annual growth in industrial output in the Analysis Area was 4.3 percent during the decade of the 1990s. Change in employment was much less than for output (2.5 percent). If technology does not change, then employment would have to increase as fast as output increases. In the NRA Analysis Area, the faster growth rate for output compared to employment suggests that the area has probably made some labor saving capital equipment investments. Such investments provide productivity gains which result in higher levels of output growth relative to employment growth.

Tourism can be defined as any non-business-related travel of 100 miles or more from home. Tourism is not an individual sector or sub-sector in the economy analysis, but interacts with a wide array of sub-sectors including transportation, lodging, food and beverage, entertainment, etc. For this reason, it cannot be easily identified in an economy's analysis. Recreation would be a subset of a tourism estimate; therefore, its share of the economy would be less than the tourism numbers. Federal Wildlands Recreation is even a further subset of total tourism. Recreation in a local rural area is a major part of the tourism estimate and presents our best estimate of the importance of Federal Wildlands Recreation available.

An estimate of the contribution Federal Wildlands Recreation made to the total economy for 2000 was based upon labor income estimates. Using this approach, employee compensation and proprietor's income associated with Federal Wildlands Recreation was estimated to have accounted for 2.6 percent of total labor income in the Analysis Area in 2000.

Another way to indicate diversity of an economy is with the Shannon-Weaver Entropy Indices of diversity. This process allows a relative measure of how diverse an area is with a single numerical index. The entropy method measures diversity of a region against a uniform distribution of employment where the norm is equi-proportional employment in all industries. All indices range between 0 (no diversity) and 1.0 (perfect diversity). These two extremes would occur when there is only one industry in the economy (no diversity) and when all industries contribute equally to the region's

employment (perfect diversity). In most cases, diversity would be registered somewhere between these two extremes. Another factor affecting the magnitude of the index is the number of industries in a local economy: the more industries, the larger the index.

The Shannon-Weaver Entropy index is presented for all national recreation area counties in this appendix, Table 17. The indices contrast the change in diversity from 1977 to 1993 at the four digit SIC level, or at the industry level. Indices for Kentucky, Tennessee, and the United States are presented as comparison guides. In the table below, the three LBL boundary counties are presented as an example of the comparisons that can be made.

In 1977, Stewart County, Tennessee, was the least diversified and Lyon County, Kentucky, was the most diversified within the three-county LBL boundary area. Stewart was 65 percent less diverse than the Commonwealth of Kentucky. Lyon County was only 25 percent less diversified than the state in 1977 [1-(.47891/.63724)].

Table M

SHANNON-WEAVER ENTROPY INDICES		
NRA Boundary Counties	**1977 Four Digit SIC**	**1993 Four Digit SIC**
Lyon (Kentucky)	0.47891	0.54106
Trigg (Kentucky)	0.46494	0.60243
Stewart (Tennessee)	0.22446	0.55681
NRA Boundary Area (Weighted average)	0.36904	0.57186
Tennessee	0.66887	0.74161
Kentucky	0.63724	0.72715
United States	0.66483	0.73973

Source: USDA Forest Service, IMI

Between 1977 and 1993, all three counties became much more diversified. Stewart County was the least diversified in 1977, but Lyon was the least diversified in 1993 by a small margin. It was 25.6 percent less diversified than Kentucky in 1993. Stewart County improved its diversity standing by 59.7 percent between 1977 and 1993. Lyon County showed the least improvement in diversity between 1977 and 1993, increasing only 11.5 percent. Similar comparisons can be made with the other four counties in the NRA Analysis Area (See Appendix Table 17).

Looking at the seven-county NRA Analysis Aea on a weighted average aggregate employment basis, the LBL NRA Analysis Area economy was about 39 percent less diversified than the Kentucky State economy in 1977 and about 21 percent less diversified in 1993. Henry County, Tennessee, was the more diversified county in 1993, being 12 percent more diversified than the seven-county Analysis Area average and only eight percent less diversified than the Commonwealth of Kentucky.

In summary, based on the Shannon-Weaver Entropy indices, the Analysis Area economy is less diverse than the regional Kentucky economy, but these rural counties and the

national recreation area as a whole, have become more diversified over the 16 year period analyzed. The NRA Analysis Area has increased its diversity by about 31 percent compared to a 14 percent increase by the Commonwealth of Kentucky.

Table N

EXPORTING INDUSTRIES				
Commodity	**Net Exports* (Exports Less Imports)**		**Net Exporting Industries as a Percent of Total Positive Exporting Industries**	
	1990	**2000**	**1990**	**2000**
Agriculture	$239.9	$21.4	32.5	3.0
SELECTED MFG.				
Wood Products	$ 7.2	$26.3	1.0	3.7
Furniture and Fixtures	$ 8.1	$19.6	1.1	2.8
Manufacturing	$364.3	$401.2	49.4	57.0
Trans. & Public Utilities	$48.0	$235.7	6.5	33.5
EXPORTS				
Total Net Trade	($64.2)	($931.0)		
Total Positive Trade Ind.	$737.4	$704.3		

*Million Dollars
Source: IMPLAN 1990 and 2000 data

The level of net exports for sectors in the IMPLAN analysis is presented in this appendix, Table 14. In this table, all nine one-digit SIC sectors are presented, as well as several sub-sectors of interest. The chart above compares a summary of selected sectors in the Analysis Area.

The LBL NRA Analysis Area economy, overall, was a net importing economy in 1990 (negative $64.2 million) and grew as an importing economy by 2000 (negative $931.0 million). Agriculture was a positive trade sector, exporting more goods and services than it imported in 1990 and 2000. The magnitude of these net exports for Agriculture declined, however, during the decade of the 1990s from $239.9 million to $21.4 million.

The “wood products” sub-sector was a net exporter in 1990 ($7.2 million) and increased its net exports ($26.3 million) in 2000. The “furniture & fixtures” sub-sector followed the same pattern ($8.1 million in 1990 and $19.6 million in 2000). The sub-sector ”pulp & paper” was a net importer in 1990 and became a larger net importer in 2000. Total Manufacturing and Transportation & Public Utilities were net exporters in both periods, and increased net exports between 1990 and 2000.

The net exporting sectors and sub-sectors that have positive values (export more goods and services than are imported) are examined in more detail. Sub-sector detail is maintained to provide information at this level. The sum of all sectors or sub-sectors, when sub-sector detail is provided, with a positive net export value is computed (“EXPORTS-Total Positive Trade Ind.” in this appendix, Table 14) and provides the basis for determining a commodity’s share of total net exports. This computation is only

valid for sectors or sub-sectors which are net exporters (positive values). This appendix, Table 14 provides the results of this analysis. Agriculture and Manufacturing sub sectors "wood products" and "furniture & fixtures" made up 32.5, 1.0 and 1.1, respectively, of the total positive net exporting industries in 1990. The age declined to 3.0 for Agriculture, but increased to 3.7 for the "wood products" and 2.8 for the "furniture & fixtures" sub-sectors in 2000.

Manufacturing in 1990 had net exports of $364.2 million and this was 49.4 of the $737.4 million for all net exporting industries in the Analysis Area. The Transportation & Public Utilities sector represented 6.5 percent of the positive net exports in 1990. This increased to a level of $235.7 million and 33.5 percent of positive net exports in 2000. The Construction and Government sectors had positive net exports in 1990, but this turned negative in 2000. The Wholesale & Retail Trade, the Finance, Insurance and Real Estate, and the Services sectors had large net imports contributing to a drain of money from the local economy.

The Analysis Area economy was a net importer in 1990 in the amount of a negative $64.2 million and increased in net imports in 2000 to a negative $931.0 million. Manufacturing dominated the positive trade industries. "Wood products" and "furniture & fixtures" were important sub-sectors of Manufacturing with regards to positive trade.

Twenty-five of the monies received from natural resource consumption (25 percent Funds), such as timber harvesting, mining and recreation, on national forest lands are paid to the counties with these lands. If these payments by the Forest Service do not amount to at least $1.75 per acre, then Payments in Lieu of Taxes (PILT) are used to address the shortfall. The PILT payment is administered by the Bureau of Land Management.

In the transfer of management of LBL from the Tennessee Valley Authority to the USDA Forest Service the Twenty-Five fund payments were not instituted. PILT was maintained, however, and TVA was instructed to continue making payments to states and local governments as though the transfer had not been made.

Only counties with federal lands receive PILT payments. The three LBL boundary counties receive the bulk of these payments. Livingston County has some federal lands unrelated to the national recreation area, and receives PILT payments. The level of payments and trends over time are important to the individual counties involved. Trends in these payments are important because declines or even slow growth can put additional pressure on the area tax base. Table 15 of this appendix provides information on PILT revenues by county. Aggregate amounts of PILT for 1991 and 2001. and change from 1991-2001, is presented in the table below.

Table O

PILT FUNDS			
	1991	2001	%Change 1991-2001*
NRA Analysis Area			
PILT	$55,642	$286,199	320.3%

*Real (inflation adjusted dollars)
Source: U.S. Dept. of Interior

In 1991 PILT payments amounted to $55.6 thousand and increased to $286.2 thousand for the NRA Analysis Area in 2001. The trend in payments reflect very little change in nominal terms between 1991 and 1999 and was actually a decline in real (adjusted for inflation) terms. In year 2000 as the impact of the land management transfer from TVA to USDA was implemented, a major increase was realized. Based on 2001 payments, it appears that payments will probably stabilize at the new payment level. The increase in payments between 1991 and 2001 amounted to a 414 percent nominal increase and a 320 percent real increase. As mentioned above, however, this increase was essentially a one time increase over a 1-2 year period and did not reflect a gradual 10-year trend.

III. Summary of Demographic and Economic Changes

Population and economic dynamics depict a rural setting and are changing at a moderate rate within the LBL NRA Analysis Area. Population growth was only three percent in the 1980s and increased to a growth rate of nearly 14 percent in the 1990s. The NRA Analysis Area population grew faster than the Commonwealth of Kentucky in both the 1980s and the 1990s.

The minority population in the NRA Analysis Area has remained below ten percent for the last two decades and was below the state level during this period. In the year 2000 minorities made up seven percent of the NRA Analysis Area population and ten percent of the state's population. This was a slight gain from 1990 for both areas indicating slight net migration to the NRA Analysis Area and state as a whole. The percent of minority population is below the national average of 13 percent for both the NRA Analysis Area and state. The use of the NRA Analysis Area by minorities may be below national averages but should increase over time if the net migration trend continues.

A major difference exists between the NRA Analysis Area and the state with regards to its rural character of the population. In 2000 the NRA Analysis Area was much more rural, 100 percent rural in three counties and over 75 percent rural in the Analysis Area. Further, the NRA Analysis Area maintained its rural character during the 1990s while the state as a whole realized about a ten percent decline.

The NRA Analysis Area's economic health, as measured by per capita income, grew at a robust rate during the 1990s (2.7 percent per year) and was equal to the state rate during this period. Even though per capita income kept up with state growth during the 1990s it was below the state level in 1990 and remained about $1,350 below state per capita

income in 2000. Unemployment followed a similar pattern. It was seven percent in 1995 which was higher than the state rate of 5.4 percent. It declined to five percent in 2000 but remained higher than the state as a whole.

With a steady income growth rate and a downward trend in the unemployment, the area economy appears strong and stable. People with increasing incomes and adequate employment are likely to have the time and resources to pursue recreational activities. national recreation areas can be a prime outlet for many types of recreational activities.

The NRA Analysis Area poverty rate improved over the last two decades and remains below the level of the Commonwealth of Kentucky. It was about 2 percentage points below the state in 1980 and increased to almost 3 percentage points below in 2000.

Female household heads with children and persons per household are two household characteristics that can detract from economic growth in some areas. These data in the Analysis Area are better than for the Commonwealth of Kentucky as a whole and should not be a deterrent to economic growth.

The NRA Analysis Area's economy was very dependent on manufacturing in 1990. This sector continued its dominance in 2000, with 57.0 percent of its net exports coming from the Manufacturing sector in that year. As measured by total output in 2000, Manufacturing was about 41 percent of the economy but substantially less if measured by employment—only 18 percent. Transportation & Public Utilities; Wholesale & Retail Trade; Finance, Insurance & Real Estate; Services; and Government all gained in shares of total industry output during the decade of the 1990s. "Wood products" maintained its 1.5 percent relative share of economic activity and "furniture and fixtures" gained in importance, from 0.4 percent to 1.1 percent. The "paper & pulp products" sub-sector was not present in the 1990 economy and was of no significance in 2000. The three sub-sectors that make up the wood products manufacturing component of the total NRA Analysis Area economy was about 2.6 percent of total industry output in 2000.

In general, economies that export more than they import are able to grow faster than those that are net importers. The NRA Analysis Area was a net importer ($64.2 million) in 1990 and the level of net imports increased ($931.0 million) in 2000. The three wood product sub-sectors were examined in more detail with regards to net exports. "Wood products" and "furniture and fixtures" were net exporters in 1990 and increased their net export level to $26.4 million and $19.6 million, respectively, in 2000. "Paper & pulp products" was a net importer in 1990 and 2000.

A different indicator of economic diversity is the Shannon-Weaver Entropy indices. The index value ranges from 0.0 to 1.0 with 1.0 reflecting complete diversity. The NRA Analysis Area had a Shannon-Weaver Entropy index value of .60061 in 1993. The state of Kentucky value for this period was 0.72715.

The forest area economy and demography reflect a strong rural base. The economy appears healthy, but very dependent on manufacturing and not positioned for rapid

growth. Population, housing, employment, and income continue to increase which will generate some additional pressure for leisure time activities. The demand for such activities will not be as prevalent as would be expected in a more urban setting.

TABLE 1: COUNTY AND STATE POPULATION CHARACTERISTICS: POPULATION BY RACE, 1980

	1980				
	Persons	**White**	**Black**	**Other Race**	**% Minority**
State of Kentucky	3,660,777	3,379,006	259,477	22,294	7.7%
State of Tennessee	4,591,120	3,835,452	725,942	29,726	16.5%
Kentucky Counties					
Calloway	30,031	28,964	871	196	3.6%
Livingston	9,219	9,183	16	20	0.4%
Lyon	6,490	6,141	319	30	5.4%
Marshall	25,637	25,576	6	55	0.2%
Trigg	9,384	8,191	1,175	18	12.7%
Tennessee Counties					
Henry	28,656	25,425	3,148	83	11.3%
Stewart	8,665	8,501	133	31	1.9%
NRA Analysis Area					
Total	118,082	111,981	5,668	433	5.2%
Average	16,869	15,997	810	62	5.2%

Source: U.S. Bureau of Census

TABLE 2: COUNTY AND STATE POPULATION CHARACTERISTICS: POPULATION BY RACE, 1990

	1990				
	Persons	**White**	**Black**	**Other Race**	**% Minority**
State of Kentucky	3,685,296	3,392,615	262,057	30,624	7.9%
State of Tennessee	4,877,185	4,048,317	777,041	51,827	17.0%
Kentucky Counties					
Calloway	30,735	29,523	999	213	3.9%
Livingston	9,062	8,990	3	69	0.8%
Lyon	6,624	6,153	433	38	7.1%
Marshall	27,205	27,112	6	87	0.3%
Trigg	10,361	9,113	1,230	18	12.0%
Tennessee Counties					
Henry	27,888	24,942	2,831	115	10.6%
Stewart	9,479	9,279	102	98	2.1%
NRA Analysis Area					
Total	121,354	115,112	5,604	638	5.1%
Average	17,336	16,445	801	91	5.1%

Source: U.S. Bureau of Census

TABLE 3: COUNTY AND STATE POPULATION CHARACTERISTICS: POPULATION BY RACE, 2000

	2000				
	Persons	**White**	**Black**	**Other Race**	**% Minority**
State of Kentucky	4,041,769	3,640,889	295,994	104,886	9.9%
State of Tennessee	5,689,283	4,563,310	932,809	193,164	19.8%
Kentucky Counties					
Calloway	34,177	31,950	1,218	1,009	6.5%
Livingston	9,804	9,656	14	134	1.5%
Lyon	8,080	7,422	543	115	8.1%
Marshall	30,125	29,694	37	394	1.4%
Trigg	12,597	11,128	1,233	236	11.7%
Tennessee Counties					
Henry	31,115	27,757	2,787	571	10.8%
Stewart	12,370	11,785	159	426	4.7%
NRA Analysis Area					
Total	138,268	129,392	5,991	2,885	6.4%
Average	46,089	43,131	1,997	962	6.4%

Source: U.S. Bureau of Census

TABLE 4: COUNTY AND STATE POPULATION CHARACTERISTICs: PERCENT POPULATION CHANGE: 1980 - 2000

	% Change 1980-1990		% Change 1990-2000	
	Total Population	Minority Population	Total Population	Minority Population
State of Kentucky	0.7%	3.9%	9.7%	37.0%
State of Tennessee	6.2%	9.7%	16.7%	35.8%
Kentucky Counties				
Calloway	2.3%	13.6%	11.2%	83.8%
Livingston	1.7%	100.0%	8.2%	105.6%
Lyon	2.1%	35.0%	22.0%	39.7%
Marshall	6.1%	52.5%	10.7%	363.4%
Trigg	10.4%	4.6%	21.6%	17.7%
Tennessee Counties				
Henry	2.7%	8.8%	11.6%	14.0%
Stewart	9.4%	22.0%	30.5%	192.5%
NRA Analysis Area				
Average	2.8%	2.3%	13.9%	42.9%

Source: U.S. Bureau of Census

TABLE 5: COUNTY AND STATE POPULATION CHARACTERISTICS: POPULATION DENSITY AND DENSITY CHANGE 1980, 1990 AND 2000

	Area (Sq. Miles)	Population Density (persons/ Sq. Mile)			Change in Population Density (%)	
		1980	1990	2000	1980-1990	1990-2000
State of Kentucky	39,728	91.2	92.8	101.7	1.8%	9.6%
State of Tennessee	41,217	111.4	118.3	138.0	6.2%	16.7%
Kentucky Counties						
Calloway	386	77.8	79.6	88.5	2.3%	11.2%
Livingston	316	29.2	28.6	31.0	-2.1%	8.4%
Lyon	216	30.1	28.6	37.5	-5.0%	31.1%
Marshall	305	84.2	89.3	98.9	6.1%	10.8%
Trigg	443	21.2	23.4	28.4	10.4%	21.4%
Tennessee counties						
Henry	562	51.0	49.7	55.4	-2.5%	11.5%
Stewart	458	18.9	20.7	27.0	9.5%	30.4%
NRA Analysis Area						
Total	2,686	44.6	45.7	52.4	2.4%	14.6%
Average	384	N/A	N/A	N/A	N/A	N/A

N/A = Not applicable or not available
Source: U.S. Bureau of Census

TABLE 6: COUNTY AND STATE POPULATION CHARACTERISTICS: URBAN AND RURAL DISTRIBUTION AND PERCENT RURAL 1990 AND 2000

	1990			2000		
	URBAN	RURAL	%RURAL	URBAN	RURAL	%RURAL
State of Kentucky	1,910,028	1,775,268	48.2%	2,251,967	1,789,802	44.3%
State of Tennessee	2968743	1908442	39.1%	3618968	2070315	36.4%
Kentucky Counties						
Calloway	14439	16,296	53.0%	16,253	17,924	52.4%
Livingston	0	9,062	100.0%	0	9,804	100.0%
Lyon	0	6,624	100.0%	0	8,080	100.0%
Marshall	6419	20,786	76.4%	4,196	25,929	86.1%
Trigg	0	10,361	100.0%	2,653	9,944	78.9%
Tennessee Counties						
Henry	9440	18,448	66.2%	10,209	20,908	67.2%
Stewart	0	9,479	100.0%	0	12,370	100.0%
NRA Counties						
Total	30,298	91,056	75.0%	33,311	104,959	75.9%
Average	4,328	13,008	75.0%	4,759	14,994	75.9%

Source: U.S. Bureau of Census

TABLE 7: COUNTY & STATE INCOME IN NATIONAL RECREATION AREA COUNTIES						
	1990		2000		Real Average Annual income	
	Per Capita	Median	Per Capita	Median	% Change 1990-2000	
	Income	income	Income	income	Per Capita Income	Median income
State of Kentucky	11,153	27,028	18,093	40,939	2.7%	2.0%
Sate of Tennessee	12,255	29,546	19,393	43,517	2.5%	1.7%
Kentucky Counties						
Calloway	10,434	25,012	16,586	39,914	2.5%	2.5%
Livingston	10,123	25,507	17,072	39,486	3.1%	2.2%
Lyon	10,081	24,940	16,016	39,940	2.5%	2.6%
Marshall	11,374	27,131	18,059	43,870	2.5%	2.7%
Trigg	10,124	24,885	17,184	40,886	3.2%	2.8%
Tennessee Counties						
Henry	10,423	22,753	15,855	35,836	2.1%	2.4%
Stewart	9,935	24,497	16,302	38,655	2.8%	2.4%
NRA Counties						
Average	10,356	24,961	16,725	39,798	2.7%	2.5%
Source: U.S. Bureau of Census						

TABLE 8: PERCENT OF INDIVIDUALS IN POVERTY, 1980, 1990 AND 2000			
	PERCENTAGE OF INDIVIDUALS		
	1980	1990	2000
State of Kentucky	17.6%	19.0%	15.8%
State of Tennessee	16.5%	15.7%	13.5%
Kentucky Counties			
Calloway	15.3%	17.7%	16.6%
Livingston	14.7%	15.5%	10.3%
Lyon	13.5%	14.3%	12.7%
Marshall	13.5%	14.3%	12.7%
Trigg	17.3%	18.0%	12.3%
Tennessee Counties			
Henry	15.0%	18.9%	14.3%
Stewart	18.6%	16.6%	12.4%
NRA Analysis Area			
Average	15.4%	16.5%	13.0%

Source: U.S. Bureau of Census

TABLE 9: HOUSEHOLD DATA,1990 and 2000				
	Persons per Household		% Female Head of House-hold with Children Present	
	1990	2000	1990	2000
State of Kentucky	2.7	2.5	6.3%	7.0%
State of Tennessee	2.6	2.5	6.7%	7.4%
Kentucky Counties				
Calloway	2.6	2.3	4.5%	5.0%
Livingston	2.5	2.4	3.1%	4.0%
Lyon	2.9	2.3	3.3%	4.8%
Marshall	2.5	2.4	3.4%	4.7%
Trigg	2.5	2.4	4.2%	5.1%
Tennessee Counties				
Henry	2.4	2.4	5.3%	6.4%
Stewart	2.6	2.5	2.5%	4.9%
NRA Analysis Area				
Average	2.6	2.5	4.1%	5.2%

Source: U.S. Bureau of Census

TABLE 10: HOUSING DATA, 1990 AND 2000					
	Total Housing Units			**Housing Units**	
			% change	Median Value	
	1990	2000	1990-2000	1990	2000
State of Kentucky	1,506,845	1,750,927	16.2%	50,100	86,700
Sate of Tennessee	2,026,067	2,439,443	20.4%	58,000	93,000
Kentucky Counties					
Calloway	13,242	16,069	21.3%	50,000	83,100
Livingston	4,177	4,772	14.2%	36,400	58,200
Lyon	3,460	4,189	21.1%	43,400	80,700
Marshall	12,528	14,730	17.6%	47,600	82,800
Trigg	5,284	6,698	26.8%	44,200	74,300
Tenessee Counties					
Henry	13,774	15,783	14.6%	41,800	75,800
Stewart	4,384	5,977	36.3%	43,900	76,800
NRA Analysis Area					
Total	56849	68218	20.0%	N/A	N/A
Average	8,121	9,745	20.0%	43,900	75,957
N/A Not applicable or not available					
Source: U.S. Bureau of Census					

TABLE 11: PERSONAL INCOME AND TRANSFER PAYMENTS, 1990 AND 2000						
	Per Capita Personal Income			Per Capita Government Transfer Payments		
	%Change			%Change		
	1990	2000	1990-00	1990	2000	1990-00
Kentucky	11,153	18,093	62.2%	$2,394	$4,134	73%
Tennessee	12,255	19,393	58.2%	$2,339	$4,089	75%
Kentucky Counties						
Calloway	10,434	16,566	58.8%	$2,462	$3,918	59%
Livingston	10,123	17,072	68.6%	$2,640	$4,779	81%
Lyon	10,081	16,016	58.9%	$2,602	$4,576	76%
Marshall	11,374	18,089	59.0%	$2,686	$4,494	67%
Trigg	10,124	17,184	69.7%	$2,602	$4,223	62%
Tennessee Counties						
Henry	10,423	15,855	52.1%	$2,918	$5,126	76%
Stewart	9,935	16,302	64.1%	$2,647	$4,618	74%
NRA Analysis Area						
Average	10,356	16,726	61.5%	$2,651	$4,533	71%
Source: U.S. Bureau of Census						

TABLE 12: COUNTY AND STATE EMPLOYMENT,1995-2001									
	Annual Estimate of Employed Persons							% Change	
	1995	1996	1997	1998	1999	2000	2001	1995-1998	1998-2001
Kentucky#	1,761	1,760	1,813	1,841	1,879	1,900	1,860	4.5%	1.0%
Tennessee#	2,561	2,603	2,565	2,644	2,702	2,688	2,692	3.2%	1.8%
KY Counties									
Calloway	16,004	16,274	16,773	16,901	17,155	17,152	16,808	5.6%	5.4%
Livingston	4,462	4,426	4,556	4,596	4,704	4,703	4,609	3.0%	6.3%
Lyon	2,962	3,057	3,122	3,135	3,214	3,214	3,149	5.8%	0.4%
Marshall	12,984	13,291	13,535	13,682	13,976	13,974	13,694	5.4%	5.2%
Trigg	5,513	5,580	5,588	5,544	5,787	5,902	5,931	0.6%	7.0%
TN Counties									
Henry	13,854	14,043	13,414	13,566	13,849	13,811	13,415	-2.1%	-1.4%
Stewart	3,332	3,222	2,933	2,903	3,160	3,380	3,497	-12.9%	20.5%
NRA Analysis Area									
Total	59,111	59,893	59,921	60,327	61,845	62,136	61,103	2.1%	1.3%
Average	8,444	8,556	8,560	8,618	8,835	8,877	8,729	2.1%	1.3%
# - numbers are in1000s									

Source: U.S. Bureau of Labor Statistics

TABLE 13: DIVERSITY OF THE LBL NRA ECONOMY BY SECTOR 1990 AND 2000												
	Industry Output		**Industry Output**		**Employment**		**Employment**		**Total Income**		**Total Income**	
	Amt	%	Amt	%	Qty	%	Qty	%	Amt	%	Amt	%
Industry	**1990‡**		**2000‡**		**1990**		**2000**		**1990‡**		**2000‡**	
Agriculture	$362.1	7.8%	$185.3	2.6%	4201	7.5%	5728	8.0%	$52.7	5.1%	$74.4	2.5%
Minerals	$104.8	2.2%	$108.6	1.5%	623	1.1%	658	0.9%	$29.7	2.9%	$52.3	1.8%
Construction	$419.7	9.0%	$631.5	8.9%	4730	8.4%	6193	8.6%	$54.4	5.3%	$212.2	7.2%
Wood products	$69.6	1.5%	$103.2	1.5%	669	1.2%	735	1.0%	$7.7	0.7%	$27.1	0.9%
Pulp & Paper	$0.0	0.0%	$1.2	0.0%	0	0.0%	4	0.0%	$0.0	0.0%	$0.4	0.0%
Furniture & Fixtures	$16.6	0.4%	$74.8	1.1%	342	0.6%	433	0.6%	($1.2)	-0.1%	$17.8	0.6%
Total Wood Based	$86.2	1.9%	$179.2	2.5%	1011	1.8%	1172	1.6%	$6.5	0.6%	$45.3	1.5%
Other Manufacturing	$1984.4	42.6%	$2735.1	38.7%	10014	17.9%	12026	16.7%	$300.4	29.1%	$769.0	26.2%
Manufacturing	$2070.6	44.4%	$2914.3	41.2%	11025	19.7%	13198	18.3%	$306.9	29.7%	$814.3	27.7%
Transportation & Public Utilities	219.8	4.7%	$458.9	6.5%	2122	3.8%	3196	4.4%	$50.1	4.8%	$158.5	5.4%
Wholesale & Retail Trade	$357.9	7.7%	$629.5	8.9%	10894	19.4%	14947	20.8%	$59.9	5.8%	$360.5	12.3%
Finance, Insurance, Real Estate	$325.6	7.0%	$603.9	8.5%	2588	4.6%	2859	4.0%	$140.9	13.6%	$377.7	12.9%
Services	$376.1	8.1%	$634.9	9.0%	8542	15.2%	12427	17.3%	$92.7	9.0%	$351.3	12.0%
Government	$417.7	9.0%	$910.6	12.9%	10826	19.3%	12458	17.3%	$243.7	23.6	$537.8	18.3%
Other Misc.	$5.0	0.1%	($4.4)	-0.1%	479	0.9%	281	0.4%	$2.6	0.3%	($4.4)	-0.1%
Totals	$4659.3	100.0%	$7073.1	100.0%	56030	100.0%	71945	100.0%	$1033.6	100.0%	$2934.6	100.0%

Bold Type = 9-one digit SIC industries
‡ Dollars in Millians
Source: 1990 and 2000 IMPLAN Data

TABLE 14: NET EXPORTS, 1990 AND 2000				
	Net exports		Net exporting Industries as a Percentage	
INDUSTRY	Exports minus Imports		of Total Positive Exporting Industries	
	1990	**2000**	**1990**	**2000**
Agriculture	$239.6	$21.4	32.5%	3.0%
Minerals	($143.7)	($61.7)	0.0%	0.0%
Construction	$50.4	($81.2)	6.8%	0.0%
Wood products	$7.2	$26.4	1.0%	3.7%
Furniture & Fixtures	$8.1	$19.6	1.1%	2.8%
Pulp & Paper	($22.6)	($43.3)	0.0%	0.0%
Total Wood Based	($7.3)	$2.7	0.0%	0.4%
Other Manufacturing	$371.5	$398.5	50.4%	56.6%
Total Manufacturing	$364.3	$401.2	49.4%	57.0%
Transportation & Public Utilities	$48.0	$235.7	6.5%	33.5%
Wholesale & Retail Trade	($87.2)	($325.5)	0.0%	0.0%
Finance, Insurance, Real Estate	($210.4)	($359.3)	0.0%	0.0%
Services	($316.9)	($697.8)	0.0%	0.0%
Government	$12.6	($8.6)	1.7%	0.0%
Other Misc.	($20.9)	($55.2)	0.0%	0.0%
TOTAL NET TRADE (EXPORTS)	($64.2)	($931.0)	100.0%	100.0%
TOTAL POSITIVE TRADE INDUSTRIES	737.4	704.3		
Bold type = 9-one digit SIC industries				
* Dollars in Millions				
Source: 1990 and 2000 IMPLAN Data				

TABLE 15: PAYMENTS IN LIEU OF TAXES 1991-2001: PAYMENTS TO COUNTIES FOR SELECTED YEARS AND CHANGE						
	Payments				**% change 1991-2001**	
	1991	1994	1998	2001	Nominal	Real
Kentucky	595,037	519,892	727,353	1,447,043	143%	99%
Tennessee	464,627	409,439	699,638	1,281,451	176%	125%
Kentucky Counties						
Calloway						
Livingston	2,626	2,519	2,470	4,006	53%	25%
Lyon	19,574	18,780	19,552	79,321	305%	231%
Marshall						
Trigg	20,750	19,908	20,728	100,178	383%	295%
Tennessee Counties						
Henry						
Stewart	12,692	12,063	12,560	102,694	709%	561%
NRA Analysis Area						
Total	55,642	53,270	55,310	286,199	414%	320%
Source: U.S. Dept. of Interior, Bureau of Land Management						

TABLE 16: COUNTY AND STATE UNEMPLOYMENT, 1995 – 2000						
	Unemployment Rate					
	1995	**1996**	**1997**	**1998**	**1999**	**2000**
State of Kentucky	5.4%	5.6%	5.4%	4.6%	4.5%	4.1%
State of Tennessee	5.2%	5.2%	5.4%	4.2%	4.0%	3.9%
Kentucky Counties						
Calloway	4.0%	4.8%	5.2%	5.2%	4.3%	3.2%
Livingston	6.5%	5.9%	6.9%	5.9%	5.3%	6.5%
Lyon	6.8%	7.6%	8.1%	5.7%	4.9%	4.9%
Marshall	5.5%	6.1%	7.0%	6.3%	5.6%	5.6%
Trigg	4.7%	4.6%	5.0%	3.9%	3.0%	3.8%
Tennessee Counties						
Henry	5.7%	6.3%	7.4%	6.9%	6.5%	5.4%
Stewart	15.5%	14.9%	14.2%	10.1%	8.1%	6.9%
NRA Analysis Area						
Average	7.0%	7.2%	7.7%	6.3%	5.4%	5.2%
Source: U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics						

TABLE 17: SHANON-WEAVER ENTROPHY INDICIES			
	Four Digit SIC Level		
	1977	1985	1993
Kentucky Counties			
Calloway	0.52651	0.53725	0.58422
Livingston	0.47807	0.54569	0.57707
Lyon	0.47891	0.46334	0.54106
Marshall	0.45761	0.53970	0.62030
Trigg	0.46494	0.52776	0.60243
Tenessee Counties			
Henry	0.57457	0.59851	0.67156
Stewart	0.22446	0.45477	0.55681
NRA Analysis Area			
Weighted Average	0.45756	0.52977	0.60061
State of Kentucky	0.63724	0.69111	0.72715
State of Tennessee	0.66887	0.72030	0.74161
United States	0.66483	0.72039	0.73973
Source: USDA Forest Service, IMI			

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Appendix C

INVENTORY OF POTENTIAL ROADLESS AREAS

Introduction

This appendix presents a detailed description of the process used by the Forest Service on Land Between The Lakes National Recreation Area to assess tracts of land to be added to a roadless inventory and then possible further recommendation, in the Land and Resource Management Plan as Wilderness. Federal regulations require that any inventoried roadless areas be evaluated and considered for recommendation as potential Wilderness areas during the forest planning process (36 CFR 219.17). Once any areas are identified and added to the inventory, they are evaluated for their suitability or non-suitability for designation as wilderness, and a recommendation is made as part of the Area Plan decision.

National Forest System lands in the eastern United States have been acquired over time from private ownership. Criteria for inventorying roadless areas in the east recognize that much, if not all of the land, shows some signs of human activity and modification even though they have shown high recuperative capabilities. Roadless areas east of the 100th meridian qualify for inventory as roadless and hence, potential wilderness, if the area meets all of the eight criteria for roadless areas in the east. (The 100th meridian runs through the center of North Dakota – south through west-central Texas.)

In 2003, an assessment of potential roadless areas was completed on LBL (Shaffer, 2003). An initial screen analyzed twelve potential areas by measuring the mileage of existing roads in the area. To meet the roadless inventory criteria, an area can contain no more than 0.5 miles of improved road for each 1,000 acres (FSH 1909.12, Ch. 7.11b). Five of the areas studied, totalling approximately 11,490 acres, met this initial criteria. They were named in the report as follows:

Study Area Name	Acreage
Pond Hollow 2	2400
Pond Hollow 3	1178
Pond Hollow 4	640
Devil's Backbone Central	7872
Devil's Backbone East	551

The Forest Service Handbook 1909.12 (7.11b) requires that a roadless area be "conducive to the perpetuation of wilderness values." Further guidance from the Southern Region office in 1995 states that; "In an attempt to quantify this criteria, use of the Recreation Opportunity Spectrum (ROS) and the semi-primitive class of lands is recommended. It further states that it is desirable that the opportunity in the proposed area be conducive to the semi-primitive non-motorized or semi-primitive motorized ROS classification. Four of the five areas were then removed from further consideration because of their inability to offer this type of experience. Pond Hollow 2, 3 and 4 along with Devil's Backbone

East all are within the Roaded Natural or Remote Roaded Natural ROS classifications in LBL's inventory. The Devil's Backbone Central area, however, does offer a Semi-Primitive Non-Motorized (SPNM) recreation opportunity.

Devils Backbone Central then became the only area to be further examined to see if it met the remaining roadless inventory criteria.

The Devils Backbone Central Area

Description

Location and Vicinity - The Devil's Backbone Central area is located in the Southern portion of LBL in Stewart County, Tennessee. It is bordered by TN State Highway 79 and Forest Service Road 236 on the south, Fort Henry Road on the west, Tennessee Ridge Trail on the eas,t and Telegraph Trail to the north. (See map at end of section)

Boundaries – The first proposed area of Devil's Backbone Central was 7,872 acres and was bordered by Forest Service Road 236 and TN State Highway 79 on the south, Fort Henry Road on the north and west, and the Trace and LBL's boundary with private land to the east. This area included 11 cemeteries within the boundary. Section 528 of the LBL Protection Act discusses cemeteries and declares: "The Secretary shall maintain an inventory of and ensure access to cemeteries within the recreation area for purposes of burial, visitation, and maintenance." Furthermore, it has traditionally been LBL's policy to provide access to cemeteries at the level that existed when the federal government acquired the land by eminent domain in the mid 1960s. Due to this issue, designating the whole 7,872 acres would create situations in conflict with each other.

To avoid the situation described above, the Devil's Backbone Central area was reduced to 5,344 acres. This new area is bordered as stated above in the 'Location and Vicinity section'. Two cemeteries, Stone and Creek Side, still remain just within the modified boundaries of the area. This new area would exclude the other eight cemeteries, along with the improved roads to the cemeteries and still present a distinct mapable boundary.

Vegetation - The area contains mostly oak and coniferous forest ranging from young to mid-aged to mature closed forest. The area also contains a stand of shortleaf pine trees, which has been designated as a State Natural Area in Tennessee due to the rarity of this plant community type in the region. The shortleaf pine species is shade intolerant; thus, will require some opening of the forest canopy in the future to perpetuate this community type.

Access Roads and Trails - This area is easily accessible by cemetery roads and connecting trails (refer to LBL *Hike and Bike Trail Map*).

Current Uses - As indicated on the LBL's *Hike and Bike Trail Map*, this area contains the Fort Henry Trails system. These trails are designated for hiking only and currently have no shared usage. The trails are rated easy to moderate with a 250'+ change in elevation. Trails in the area are made up of 18 miles of footpaths, old logging roads, and

gravel roads. These trails offer many historical features and are recognized as National Recreation Trails.

Historical Uses - Settlers of European ancestry came to the area shortly after the American Revolution in about 1790. LBL area was continually inhabited until 1965 when the federal government acquired the land. Many small communities existed on the land base. The Fort Henry area, including parts of the adjacent Devil's Backbone area, made up one of these communities.

Of more historical significance is the fact that Ft. Henry and nearby Ft. Donelson were sites of an important Civil War battle. The area known as Devil's Backbone is located between these sites and two of the current trails within the area (Telegraph and Artillery) were roads taken by General Ulysses S. Grant's troops to move from Fort Henry to Fort Donelson. These roads and others were also used by residents for access to homes and farms in the area up until the land was purchased by the government in the 1960s.

Applying the Roadless Inventory Criteria (FSH 1909.12, Ch. 7, Sec. 7.11b)

Criteria #1 - Effects of Human Activity: If an area's ecological processes and/or natural appearance have been altered by past or present human activity, is the land regaining a natural, untrammeled appearance? Untrammeled is defined as an area where human influence does not impede the free play of natural forces or interfere with natural processes in the ecosystem (FSH 2320.5).

> In general the land is recovering from most of the impacts caused by the day to day activities of the past. Old home foundations are not readily visible in most of the area. Pastures and fields are overgrown and outbuildings virtually indistinguishable. Few signs of past logging operations exist since none have taken place in the area for at least 10 years.
>
> The one major sign of human activity that remains throughout the area is the prevalence of old roads. Within the Ft. Henry trail system, the *Artillery*, *Telegraph*, and *Shortleaf Pine* Trails are significantly entrenched from previous residential, agricultural, and industrial use. These trails can be classified as decommissioned roadbeds or unclassified roads. Unclassified roads are defined as roads on Forest Service lands that are not managed as part of the road system. This includes abandoned roads, unauthorized OHV tracks, and abandoned travel ways. These roads were actively used until approximately 1965 by residents of the area. From 1965 to 1994, TVA used them for administrative access roads even though they were officially designated as trails. In addition, Telegraph and Artillery trails are of historical significance as Civil War access roads. Telegraph is 8.352 miles long and Artillery is 3.6670 miles long. These trails received large volumes of illegal use by 4x4's and OHV's prior to being gated off in 2003.
>
> According to law enforcement officials and trail managers, illegal OHV use is somewhat problematic in the eastern portion of the area. Enforcement is difficult due to the ability of riders to access the area from private land on the boundary.

Enforcement personnel, conversely, have limited access from Forest Service land and limited resources and time in which to patrol the area.

In summary, the extensive network of trails and old roads and their current condition indicate that at this time the area does not appear to be regaining a natural untrammeled appearance.

Criteria #2 - Forces of Nature: Are improvements in the area being affected by the forces of nature rather than humans, and are they disappearing or muted? A permanent improvement is defined as a structural or non-structural improvement that is to remain at a particular location for more than one field season. Permanent improvements include such items as trails, toilets, buildings, cabins, fences, tent frames, fire grills, and instrumentation stations (FSH 2320.5).

As previously mentioned, home sites and old farms in the area are not readily visible and are generally being taken over by the forces of nature. However, one feature of past uses is present to varying degrees in scattered locations. The occurrence of barbwire fencing in the area is problematic in certain places. Oxidation is taking some affect on the wire, but it remains a trip and injury hazard in places even after thirty years.

The trail system within the area consists of approximately 29.3 miles of trails made up of ten individual trails varying in length from one to four miles. These trails are maintained three times a year with tractor mounted brush mowers, ATV's, self-propelled mowers, chainsaws, and other mechanized tools. Three of these trails are approximately 10ft. wide and are significantly entrenched.

***Criteria #3 - Ownership Patterns*:**

The entire area is National Forest System land with no existing private ownership.

Criteria #4 - Perpetuation of Wilderness Values: Is the location of the area conducive to the perpetuation of wilderness values, considering the relationship of the area to sources of noise, air, and water pollution, as well as unsightly conditions that would have an effect on the wilderness experience?

Noise: This area is influenced by sounds from surrounding areas such as: barges and leisure craft on Kentucky Lake, military aircraft, traffic on Fort Henry Road and TN State Highway 79, and two logging yards.

Two sound evaluations were conducted on December 12, 2003, and July 24, 2004, by staff at LBL. The objective of the analysis was to determine the impact of noise sources on the study area in as much as they limit the opportunity for feelings of solitude and freedom from disturbance. Staff used a mechanical sound measuring device to establish baseline and peak noise levels. These were not true scientific studies done over a period of time but do give some indication of noise levels in the area for a short period of time. The basic conclusion of these observations was that the area has little impact from high decibel noise

disturbance on a consistent basis. It should be noted that the equipment used in the December and July observations is normally used to measure peak decibel levels which usually occur in industrial settings. These observations were also taken over a very limited time period, only about two to three hours in duration and on only two days out of the year.

Personal observations by managers of the trails and other staff members who have spent extensive amounts of time in the area indicate that there is a persistent low level of background noise that can be disturbing to someone seeking a true wilderness experience. It is not unusual to hear sounds of outboard motors, semi-trucks, and other machinery even in the center of the landscape.

Furthermore, there are several factors that influence noise levels in the area with known frequency.

Tennessee State Highway 79 is a major east-west corridor across the southern end of LBL. This highway connects Interstate 24 and the community of Clarksville with the recreational opportunities of western TN and KY. According to the Tennessee Department of Transportation web site, an average of 4,240 vehicles travel this section of highway on a daily basis. Traffic in all the surrounding increases with the coming of the peak recreation seasons of Spring, Summer and Fall. A traffic counter on Fort Henry Road indicates that approximately 59,235 automobiles passed through this area in 2003. The sheer volume of traffic, including diesel-powered vehicles, RV's, and smaller automobiles, would merit concern in areas close to boundaries.

A further reason for concern, and the most intrusive, is that Fort Campbell military base has an air flight path directly over this area. According to the Campbell Army Airfield, it is estimated that 150 aircraft fly over the exact area being evaluated per month at an altitude of 500 feet above ground level or higher. Flight maps show that this area is directly impacted by Fort Campbell's aviation training. Fort Campbell's 400 helicopters conduct aviation training in a local flying area that is approximately a 100-mile radius from the airfield. Also, annual traffic volume (arrivals, departures, overflight aircraft) within the airspace delegated to Ft. Campbell for air traffic control, 35 miles radius, surface to 10,000 mean sea level, averages 600,000 plus operations each year. (Hallock, 2004)

Wilderness areas throughout the United States have airplanes flying over them. The reason for the Ft. Campbell aircraft to be of concern is their frequency and the altitude at which they fly. The Forest Service discourages flights of less than 2,000 ft. over wilderness areas. Due to the proximity of LBL to training areas on Ft. Campbell and the required approach corridor to the airstrip at the base, a 2,000 ft. minimum flight path is not feasible.

A study that has focused on all types of aircraft over-flights has found that helicopters and military aircraft are significantly more annoying to recreationists than high altitude jets and small private aircraft. Respondents in this study had

strong negative attitudes toward hearing and witnessing aircraft in wilderness areas. (Mace, Bell, Loomis, 1999).

Approximately 3.5 miles from the center of the area are two logging yards. One is owned by Mead/Westvaco, a paper mill, and the other by Averitt Hardwood International, a lumber company. When in full operation, sounds of heavy equipment from these sites may travel close to the center of the area.

Wilderness Experience: A study was conducted investigating wilderness hikers' experiences of solitude to understand what factors contribute to the wilderness experience. The results of this study showed that the two most reported factors contributing to a feeling of wilderness were "natural setting features" such as trees, scenery, rocks, water and wildlife, and minimal encounters with other users. Those who did not feel they had experienced wilderness reported that wide trails, proximity to a busy road, and the presence of other groups were the most important factors contributing to their feelings. (Hall, 2001)

When asked to define wilderness the majority of the people surveyed answered the lack of "human influence" and "natural setting features" were important. When asked to describe solitude, it was defined as experiencing quiet or natural sounds and being away from sounds of civilization. Those who did not experience solitude generally said it was because they had too many encounters with other users. (Hall, 2001)

One factor contributing to a feeling of wilderness is the need to use outdoor skills to survive. Also, the sense that if one is not knowledgeable in the outdoors, being lost is a definite possibility. Likewise, a lack of no encounters with other recreationists in the area adds to ones sense of solitude.

In the Devil's Backbone area, the level and reoccurrence of entrenchment of the trails may detract from the feeling of naturalness. Observing and hearing planes overhead while being in the area, may have negative impacts when seeking a sense of solitude. The sense of adventure, so important in a wilderness experience, is diminished because it is known that it is difficult to get lost due to the density of trails and size of the area. This area also has a lack of distinguishing natural features which may not present an advanced level of challenge.

Unsightly Conditions: Walking throughout the Devils Backbone area, visitors may find old remnants of wire fencing from old homesteads. Old roadbeds that have been decommissioned that are in the process of natural regeneration still have noticeable entrenchment from the high levels of previous and current (unauthorized) use. They may feel at certain points and times a sense of wilderness; but more frequently, there may be a feeling of not experiencing wilderness.

Criteria #5 - Improved Roads: Does the area contain no more than one-half mile of improved road for each 1,000 acres? If so, is the road under Forest Service jurisdiction?

The initial screen for roadless characteristics consideration conducted in October of 2002, found that the 7,872 acre Devil's Backbone Central area had less than one-half mile of improved roads per 1,000 acres. (Shaffer, 2002) Recent information gathered as part of the roads layer of the Forest Service's infrastructure database (INFRA), upholds most of those findings.

The more recent data, however, does support the decision to reduce the size of the evaluated area to 5,344 acres. Information discovered during on the ground road measurements indicates the requirement for LBL to provide access to cemeteries, especially Brokaw and Wofford, which were deep within the originally proposed boundary.

Within the 5,344 acre area being evaluated, there are four legally-accessible roads. All these roads are of native surface and not currently maintained along their entire length. Road 405 is maintained to a distance of .427 miles, Road 404 a distance of .431 miles, and Stones Cemetery Road a distance of .249 miles. Road 402 is maintained for approximately .521 miles and continues on a route from Road 230 through the center of the Devil's Backbone area to Road 236 in an unimproved status. These totals add up to approximately .305 miles of improved roads per 1,000 acres in the Devil's Backbone area.

Criteria #6 - Non-Native Vegetation: Is more than 15 percent of the area in non-native vegetation?

Simply put, no. Even though the area contains remnants of old farms and homes, these places have been taken over by native or naturalized species. There were some row cropped fields within the original boundary recommendation but since they have been excluded from the newly proposed area, they are of no concern.

Criteria #7 - Timber Regeneration: Has more than 20 percent of the area been regenerated within the past 10 years? If more has been regenerated, could a boundary change exclude the regeneration area?

No active timber harvest has taken place in the area for more than 10 years. The area is currently encircled by a land area that has been set aside as a Core Area. These areas receive very minimal land management.

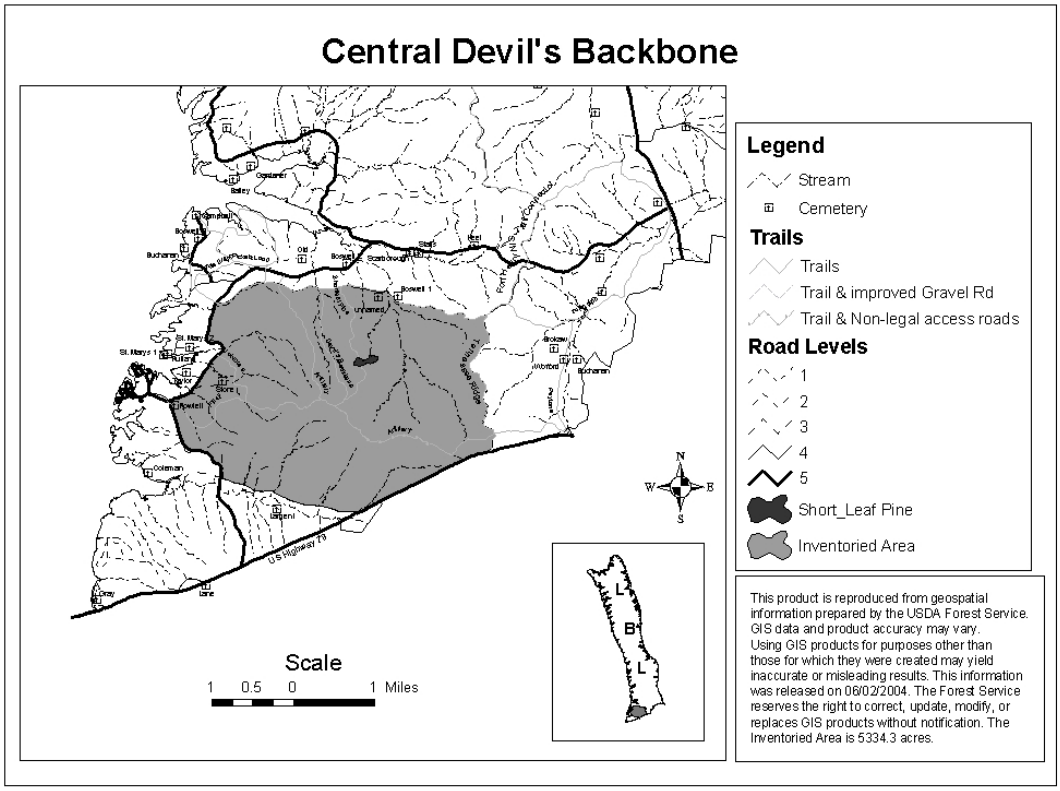
Criteria #8 - Private Lands/Dwellings: Are there private dwellings on private lands inside the proposed roadless area?

There is no private land within this area.

Findings and Recommendations

In order to be evaluated for possible wilderness recommendations, an area must first meet the roadless inventory requirements set forth in chapter 7.11b, FSH 1909.12. If these requirements are met, an area would then be evaluated for its ability to meet the tests of

capability, availability, and need. Based on the impacts of activity occurring on the land and the inability of the area to perpetuate the values of wilderness, it has been determined that the Devil's Backbone Central area does not meet criteria to be identified as an "inventoried roadless area."



Appendix D

DRAFT PRESCRIPTIONS

1. Natural Resources Stewardship

The management direction and emphasis placed in a given area or on a given land use or allocation, in forest planning, is referred to as a prescription. In order to fairly and accurately assess the potential effects and outcomes of a given alternative on the land, forest planners and resource specialists develop a set of Prescriptions that apply to either the general forest overall, or to specific areas or designations of land allocations. From these baseline conditions they determine the potential effects future management activities would most likely have on those given land allocations or prescriptions.

In order to represent a complete picture of the information used to arrive at the Selected Alternative, the following are the prescriptions used by the Forest Service to analyze and evaluate the four alternatives. This information is necessary in order to understand the basis from which decisions and assessments were made.

Below is a table with the land allocations and approximate acres for each alternative. Following the table are descriptions of the prescriptions.

Acreage Disclaimer: Prescription allocations were mapped for each alternative using GIS applications and existing coverages. Acreage discrepancies reflect a margin of error created by the digital representation of conceptually based alternatives. These acres have been rounded to give approximated acres for each prescription area. See appendix for a description of the prescription coverages.

Table D1 –Summary of Acres By Alternative And Prescription – Draft

	Alt. W	Alt. X	Alt. Y	Alt. Z
1. Natural Resources Stewardship				
1.A General Forest	**120800**	**108660**	**104240**	**110140**
Forested	(114700)	(103190)	(98940)	(105090)
Open Lands	(6100)	(5470)	(5300)	(5050)
1.B Core Areas	**35180**	**40780**	**41800**	**45560**
1.C Oak-Grassland Demonstration Areas	**0**	**8630**	**8630**	**0**
1.D Managed Wetlands	**160**	**160**	**160**	**160**
1.EWildlife Refuges and No Hunting Areas	**30**	**30**	**30**	**30**
2. Administrative Areas				
2.A Utility Corridors	**760**	**760**	**760**	**760**
2.B Infrastructure – Administration, Maintenance, Closed facilities*	**4560**	**4550**	**4550**	**4550**
2.C Designated Communication/Electronics Site	**9**	**9**	**9**	**9**
3. Recreation and Environmental Education				
3.A Developed Recreation Areas	**3810**	**4000**	**3780**	**3220**
3.B Turkey Bay	**2160**	**2160**	**2160**	**1700**
3.C Environmental Education Facilities	**3800****	**1530**	**1270**	**1200**
3.D Nature Watch Demonstration Area	**0**	**0**	**3890**	**3920**
Total Acres***	**171270**	**171270**	**171280**	**171250**

* Acreages for Roads and Road Right of Ways are included to account for land area associated with roads
** EE Facilities contain acreage of the Environmental Education Area (Prescription 3.E) in Alternative W
*** Acreages are rounded to the nearest 10's, therefore total acreage is different across alternatives

1.A General Forested Areas

Emphasis:

General Forest Areas provide for a wide range of uses and conditions. Primary emphasis is to provide dispersed recreation and environmental education opportunities, a diversity of habitats, vigorous forests that are resistant to insects and disease, and functioning watersheds.

Awareness of resource management and protection is encouraged through environmental education within these areas. Resource management planning considers both the needs of the resource and that for dispersed recreation and environmental education activities and opportunities.

A diversity of wildlife habitats and native communities are provided, contributing importantly to the area-wide goal of providing for viability of native and desired nonnative plants, fish, and wildlife. Habitat diversity may be accomplished through favorable natural causes or through active management. Active vegetation management occurs using a wide range of tools and methods, most commonly including vegetation thinning, prescribed fire, commercial timber harvest, pesticide (herbicide) treatments, and open lands maintenance. Forest regeneration is typically accomplished through partial cutting methods, especially modified shelterwood and group and single-tree selection methods. Use of these methods results in a diversity of structural conditions for tree ages and sizes primarily distributed within two-aged or uneven-aged forests. Prescribed fire is used across large areas of the landscape, but in ways that result in variable effects to vegetation, contributing to overall habitat diversity.

Open lands are maintained using a variety of tools and methods, including prescribed fire, mechanical treatments, and herbicide treatments. Open lands management will provide a sufficient distribution of native vegetation, grain, and green forage for wildlife habitat diversity; while enhancing visual variety. It will test and demonstrate sustainable open land management through native warm season grass restoration, maintenance of open lands, and agricultural practices and techniques. A portion of the open lands may be maintained in traditional row-crop cultivation and hay fields through a cooperative farming program to help maintain open lands at a minimal cost.

Desired Condition:

Forests within this area are predominately mature oak-hickory forests, however mesophytic and riparian forest and planted pine are not uncommon. These large forests provide diverse habitats with abundant wildlife. Rare and special habitats are in good ecological condition supporting rare species. Older trees are abundant and widely distributed, providing snags, den trees, and downed wood for wildlife such as squirrels and owls. In many places, spacing between trees is wide enough to allow light at various levels of the canopy and forest floor, promoting vigorous crowns with reduced susceptibility to insect and diseases, and stimulating ground vegetation including oak regeneration. A variety of forest age classes and structures is present on the landscape, with naturally appearing transitions between vegetation cover types. Patches of young trees and dense areas of regenerating forest provide habitat for early-successional species such as yellow-breasted chats, and food and cover for species such as white-tailed deer and wild turkey. Although disturbance to forest vegetation is evident, such disturbances resemble natural patterns because mature trees are usually present on most acres and edges are feathered and follow natural contours. Tree cutting operations are occasionally encountered with logging equipment present. Stumps and reclaimed skid trails are visible in past tree cutting areas. Evidence of fire is present in many areas in the form of blackened lower trunks. Occasional freshly-burned areas, with blackened ground and scorched vegetation, are encountered, but these conditions are short-lived as green-up occurs quickly and results in lush understories of grasses and wildflowers. Open lands, which include cultivated fields, wildlife plantings, maintained grasslands, and hayfields, are dispersed across the landscape. Ponds and

waterholes are generally present in association with open land types. Wet depressions are scattered across the landscape.

The forest areas are actively managed providing a variety of motorized and non-motorized recreational opportunities. The area has a well-developed transportation system including roads and trails, which are removed when no longer needed. Commonly-occurring sounds from people and motorized activities, such as "watchable" wildlife viewing and driving for pleasure, are prevalent. Scenic vistas are dispersed across the landscape. Signs provide users with information and educational messages.

Watersheds are properly functioning by catching, storing, and slowly releasing precipitation. Stream channels have stable, well-vegetated banks and increased amounts of large woody debris budgeting sediment transport and flows. Road and trail crossings, fewer in number than once existed, are located at stable sites and allow for adequate passage of peak flows and migration of aquatic life.

On xeric and dry sites (upland sites) oak-hickory forests are the predominant forest type. Major oak species on these sites include scarlet, chestnut, black, and black-jack oaks. Major oak forest community types are represented by mature open forest and mature woodland conditions, primarily maintained by fire. In treated areas, some levels of overstory are usually present, as are sustainable levels of oak regeneration in the understory. Most shade-tolerant species on these sites are sparse, as a result of open conditions and periodic fire. Sensitive vegetation and soils are minimally impacted from prescribed fires. Old growth conditions are most frequently in the form of oak woodland, but also include other mature oak forest conditions. Native grasses and herbaceous species are present in the understory of mature open forests and woodlands. Animal species that may be observed include squirrels, bats, bobcats, fence lizards, prairie warblers, Northern bobwhite quail, and great-crested flycatchers. Ephemeral headwaters are well-vegetated with few defined channels. Old gullies are healed and channels are not expanding.

Oak species are also dominant on dry-mesic (transitional) sites. A mixture of upland oaks and more mesic northern red and white oaks, and yellow poplar are not uncommon. Forests on these sites are a little more multi-storied in structure than on xeric and dry sites. There is advanced oak regeneration in the understory and occasional regenerating forest patches are present.

Mesophytic and riparian forests are most common on mesic and alluvial sites. Species associated with these sites include a mixture of trees such as yellow poplar, northern red and white oaks, maples, American beech, black walnut, sycamore, and hackberry. Some examples of wildlife and understory vegetation that may be observed include the Louisiana waterthrush, wood thrush, Acadian flycatcher, Dutchman's breeches, trout lilies, trilliums, and Virginia bluebells. Multi-storied canopies with canopy gaps are common compared to two-storied or two-age (structure). There is less evidence of fire and timber harvest. Intermittent stream channels run cool and clear water for long periods after storm events and snowmelt. Seeps are located within stream valleys and feed stream flows. Streambanks are stable with little bank cutting and vegetated with

plants adapted to moist sites and large trees with stabilizing root masses. Stream channel substrates are dominated by gravel and cobble. Large wood within the channels is prevalent and helps to stabilize banks and stream bottoms.

Planted pine forest types occur on all site types and include loblolly, Virginia, shortleaf, and white pines. These forests generally have a more closed canopy with variable understory densities, providing hiding and thermal cover. Foliage and structural form of pine species provides visual contrast with adjacent hardwood forest types. Some canopies may be more open when managed in association with adjacent mature open forest and woodland cover types

In open lands visitors may observe a diversity of wildlife such as white-tailed deer, bobcat, and coyote; many migrant and resident bird species such as red-tailed hawk, bald eagle, Eastern bluebird, Northern bobwhite, and neotropical songbirds. Open lands consist of traditional row-crops, hay fields, wildlife plantings, old fields, and ecological restoration areas. The ecological restoration areas have a dominance of native short warm-season grasses, such as little bluestem and broomsedge; native tall warm season grasses, such as big bluestem, switchgrass, and Indian grass; or, a mosaic of short and tall grasses with a native forb and legume composition. Visitors may observe portions of the traditional row-crops remaining in fields after harvest for wildlife. Access to these areas consists of public roads, administrative roads, hiking trails, horse trails, and bike trails. Visitors enjoy a diverse pastoral landscape, set against the backdrop of naturally-appearing forested landscapes. These openings vary in size and shape generally resulting from traditional cultural land use patterns; some exhibiting geometric straight-edged shapes, and others following natural landforms and watercourses.

Riparian areas and corridors are dominated by native vegetation that includes forest, grassland, and canebrakes. Mesophytic forests are also common as well as the presence of some oak forest. These forests are inclusive of species such as sycamores, Northern red oak, canebrakes, and native warm-season grasses. Limited evidence of timber harvest may be present from the creation of canopy gaps and occasional forest regeneration patches. There are low densities of roads and trails, and low levels of exposed soil.

Stream channels are well-developed and stable, passing both intermittent and perennial flows. Springs and seeps feed cool clear water to these systems. Substrates within intermittent channels and upper perennial channels are gravel and cobble. Transport of sediment load is regulated by copious amounts of large wood in the system. Gravel bars are stable along outside meander bends. The channels migrate laterally only after large storm events. Banks are vegetated by native vegetation with stabilizing root masses, including river canebrake, bottom hardwoods, and other large riparian forest types. Most roads and trails are located 100 feet beyond the edge of the channels. Beavers are active in lower reaches and floodplains, providing regulated flows, large wood, and elevated water tables. Wetlands are increasing and expanding.

1.B. Core Areas

Alternatives W, X, Y and Z with exceptions below

Emphasis

The Core Areas consist of a network of various sized tracts of land designed to facilitate greater understanding of forest environments through collaborative research, administrative studies, and other working relationships. These areas serve as controls in comparative management and, in most cases, have little to no management disturbance. Core areas provide remote, semi-primitive recreational opportunities that have minimal impacts to ecological systems. They serve as large, medium, and small patches of future old growth and they include two state natural areas (SNA) including a native shortleaf pine restoration area.. The two SNAs, Devils Backbone and Bear Creek, are managed in cooperation with the Tennessee Department of Environment and Conservation.

These areas provide good to optimal habitat for mid- to late-seral eastern deciduous hardwood forest associates. Management activities are limited to include only those needed to deal with forest health emergencies, wildfire, restoration and maintenance of native communities, and recovery of T&E species. Vegetation management may be necessary to prevent a widespread outbreak of insect of disease. In particular, active management, including prescribed fire and timber harvest, will be needed to restore and maintain native shortleaf pine forests in the Devil's Backbone State Natural Area.

Desired Condition:

Core areas appear as having a naturally-evolving structural condition on the landscape due to low intensity management within forested areas. Forests are primarily older with areas of continuous canopy and occasional gaps as a result of storms, insect or disease outbreak, fire, and reverting fields. A mix of species, including more shade-tolerant species than general forest, occurs in forest cover types across all site types. Forest cover types vary in canopy and understory structure and include many canopy gaps, snags, downed wood, and den trees.
Low impact environmental education and recreation activities are enjoyed by visitors. Visitors to these areas enjoy remote dispersed recreation opportunities such as scenic driving, bird-watching, wildlife viewing, nature photography, horseback riding, hunting, fishing, hiking, and reminiscing. Visitors enjoy a natural setting; however, they are not isolated from sights and sounds of other human activity.

Within the Devil's Backbone State Natural Area, native shortleaf pine occurs primarily on xeric and dry sites with some evidence of fire and timber harvest. Open forest and woodland conditions exhibit grassy understories and shortleaf pine regeneration. Stands have well developed crowns with abundant cone production and some mixture of oak. Occasional areas of two-aged regenerating forest patches are present.

Exceptions under Alternative W

Desired Condition:
Under this alternative the Deferred Area designation described in the 1994 NRMP would no longer exist. Deferred Areas would be incorporated into General Forest Areas, and will be omitted from consideration into the General Forest Core Areas. The Core Areas (approx. 35,200 acres) will be less than TVA's target of 42,500-acres.

The shortleaf pine community in the Devil's Backbone State Natural Area would be managed in cooperation with the state of Tennessee.

Exceptions under Alternative X

Desired Condition:
Under Alternative X, approximately 5600 acres described as Deferred Area designation in the 1994 NRMP would become General Forest Core Acres. These acres were selected primarily from deferred acres located outside of developed facility boundaries to support the emphasis on developed facilities. The total Core Area acres under Alternative X would be approximately 40,800 acres, within 4 percent of the 42,500 acres goal set in the 1994 plan. The remaining 4800 acres of deferred areas would be incorporated into General Forest Areas or Developed Recreation Areas.

The shortleaf pine community would be managed for additional pine woodlands within and beyond the boundaries of the Devil's Backbone State Natural Area.

Exceptions under Alternative Y

Desired Condition:
Under Alternative Y, approximately 6600 acres described as Deferred Area designation in the 1994 NRMP would become General Forest Core Acres. These acres were selected primarily from deferred acres located within developed facility boundaries to support the emphasis on dispersed recreation opportunities. However, no Core Areas were selected within the boundaries of Hillman Ferry or Rushing Creek Campgrounds, Turkey Bay OHV Area or the Homeplace-A Living History Farm. The total Core Area acres under Alternative Y would be approximately 41,800 acres, within 2 percent of the 42,500 acres goal set in the 1994 plan. The remaining 3800 acres of deferred areas would be incorporated into General Forest Areas or Developed Recreation facilities.

The shortleaf pine community would be managed for additional pine woodlands within and beyond the boundaries of the Devil's Backbone State Natural Area.

Exceptions under Alternative Z

Desired Condition:
Under Alternative Z, all areas identified as deferred areas, approximately 10,400 acres, in the 1994 NRMP would become General Forest Core acres. The total Core Area acreage

under Alternative Z would be approximately 45,600 acres, approximately 7 percent greater than the 42,500 acres goal set in the 1994 plan.

The shortleaf pine community would be managed for additional pine woodlands within and beyond the boundaries of the Devil's Backbone State Natural Area.

1.C Oak-Grassland Restoration Demonstration Area

Alternatives X and Y Only

Emphasis:
Focus of these areas is to restore upland vegetation to conditions approximating those found at the time of European settlement. Based on historical accounts and ecological research, it is believed upland oak forests in this region were more open and interspersed with grasslands than they are today. Open conditions were created and maintained in large part through the use of fire by American Indians. Emphasis is to approximate these conditions across the landscape within these Demonstration Areas through the use of tree thinning and prescribed fire.

These open conditions are expected to benefit many species of wildlife, including some that are rare or declining. They are also expected to provide a beautiful and diverse setting for dispersed recreation, wildlife viewing, natural history study, environmental education activities and hunting. Although these conditions may be found in relatively small patches elsewhere on LBL, these Demonstration Areas seek to create such conditions over a large contiguous landscape in order to demonstrate the feasibility of ecological restoration at this scale and the benefits it can provide to native wildlife and public recreational use. In order to gauge effectiveness of this restoration at meeting ecological objectives and public desires, an emphasis on monitoring and research is part of the vision for these areas. These areas have been selected adjacent to Forest Core areas that can serve as unmanaged controls in monitoring and research studies. Additional emphasis on enhancing opportunity for wildlife viewing, EE activities, and natural history study will be made at the Demonstration Area adjacent to The Homeplace.

These open areas will provide substantial opportunities for dispersed recreation and non-facility-based EE. A significant role will be played by the EE program during the development of the Oak-Grassland areas. Providing experiences in which visitors may observe and learn how application of various management practices may improve and sustain upland vegetation is an important aspect of these areas. As these areas evolve, the opportunities for dispersed recreation and education will continue to expand, providing a wide variety of experiences for visitors.

Desired Condition:
On upper slopes and ridges across the area, grasslands (less than 10 percent canopy closure) and open oak woodlands (10-60 percent canopy closure) are interspersed in variable mixtures. In general, tree density increases as one moves down slope, but densities are variable and transitions gradual. Understories are dominated by native

grasses and wildflowers. Most mid and lower slopes support open oak forests (60-80 percent canopy closure), with understories containing oak regeneration in sufficient numbers to provide for sustaining oak on these sites over time. Mesophytic and riparian forests occur on some lower slopes, where, because of topography and moisture, understory fires burn at low intensities or not at all. In addition to the grasslands found predominately on upper slopes and ridges, other open lands, such as hayfields and croplands, may also be present. These are maintained by a variety of methods, with emphasis on restoring native grasses where compatible with other objectives.

The productive grassy understories, created by opening canopies and using periodic fire, provide abundant herbage, seeds, and insects to support a diverse and abundant assemblage of wildlife. Rare species that are adapted to open forests and grasslands, but have declined due to disappearance of these habitats, are present in viable numbers. These include Henslow's sparrow, barn owl, whip-poor-will, southern prairie aster, barbed rattlesnake-root, buffalo clover, and prairie parsley. Small mammals, such as field mice, voles, and rabbits are abundant, supporting increased populations of predators, such as hawks, foxes, and bobcats. Diversity of native wildflowers is high, supporting a diversity of pollinators, such as bees and butterflies. Deer and turkey use open forests and grasslands for feeding, and northern bobwhite populations are significantly enhanced.

In the long term, the setting for dispersed recreation and EE, wildlife viewing, nature study, and hunting is enhanced by diverse and abundant wildlife, abundant understory grasses and wildflowers, an historic natural context, and open forests that provide great depth of view. Some evidence of fire is present in the form of blackened lower trunks. Occasionally, fresh burns will be evident, with blackened ground and scorched leaves, but these conditions are short-lived due to quick re-growth of fire-adapted vegetation. In the short term, green-up may be slower until fire-adapted plant assemblages become well established. Evidence of tree thinning may be seen in the form of stumps and downed branches and trunks. Especially in the Demonstration Area adjacent to the The Homeplace, aids to wildlife viewing are present, such as signs, trails, or observation platforms or blinds.

The EE program should enjoy the most wide-spread application in these areas as they are actively managed and developed. As restoration activities progress the public will be encouraged to learn about them, their effects on native plants and animals, and their historical context.

1.D Managed Wetlands

Alternatives W, X, Y, And Z

Emphasis:
LBL contains natural wetlands which are protected by plan direction and standards, and artificially created wetlands referred to as "managed wetlands." Managed wetlands are seasonally flooded to produce desired wetland habitat for a variety of wildlife. Existing managed wetlands on LBL are in the Cumberland River watershed at Long Creek in

Kentucky, and at Prior Creek in Tennessee. These managed wetlands provide resting and feeding habitat for shorebirds and migrating waterfowl, and also provide habitat for amphibians, crustaceans, and insects.

Moist-soil management techniques are used in managed wetlands. These techniques involve seasonal water level manipulation to stimulate production of moist-soil plants and aquatic invertebrates. Using moist-soil techniques, impounded water is drained from flooded soils during the growing season to encourage native moist-soil plant growth. Gradual reflooding to a preferred depth of one foot or less in the fall and winter inundates the plants. This technique provides natural foods for shorebirds, waterfowl and other wildlife through winter and early spring. Periodic maintenance of the wetlands levees and water control structures will occur.

Desired Condition:
The desired future condition is to have multiple shallow-water managed wetlands on LBL to provide beneficial habitat for shorebirds, waterfowl, amphibians, crustaceans, and insects. These wetlands will provide numerous opportunities to support the Rec/EE goals of LBL. Access to these areas will help provide sites that can be used to educate the public about the value of wetlands in ecosystems and the need to maintain and restore wetlands in the United States and throughout the world. Access will also provide multiple recreational opportunities for hiking and wildlife viewing of many species of shorebirds, waterfowl, amphibians, and other wetlands-associated wildlife.

Additional wetlands could be created as time and funds become available. The need for additional managed wetlands would largely be driven by EE objectives and habitat needs.

1.E Wildlife Refuges and No Hunting Areas

Alternatives W, X, Y, And Z

Emphasis:
Wildlife refuges initially were designated to provide resting and feeding areas for migratory waterfowl. As bald eagle populations began to recover and their presence on LBL increased, the purpose of refuges was expanded to provide undisturbed sanctuaries for eagles as well as other wildlife such as shorebirds, and their designation was changed from waterfowl refuge to wildlife refuge.

Additional areas within LBL are designated as No Hunting areas. Most of these areas provide safety zones around recreation and educational facilities.

Desired Conditions:
Wildlife Refuges provide sanctuaries undisturbed by human entry for shorebirds, wintering waterfowl, eagles, and other wildlife. Refuges contain above average numbers of wildlife compared to surrounding non-refuge areas during refuge periods. Refuges provide abundant and unique wildlife viewing and environmental education opportunities during the refuge periods, and are very popular for migratory bird viewing, especially bald eagles, shorebirds,

and waterfowl. Wildlife observation takes place from the perimeter of refuges or in specially designated areas within refuges (e.g. an observational blind where human presence is not visible to wildlife).

2. Administrative Areas

2.A Utility Corridors

Alternatives W, X, Y and Z with exceptions noted below

Emphasis:
Existing linear authorizations for electronic transmission lines and a pipeline for natural gas would continue within these designated corridors. Utility corridors that were authorized by prior agreement under the Tennessee Valley Authority will remain. Local distribution lines that are covered under the LBL Protection Act or an agreement with the utilities on the maintenance of their right-of-way (ROW) would be continued. These uses serve a public benefit like high voltage electric transmission lines and buried pipelines for natural gas.

Desired Condition:
Where possible, existing corridors would be expanded to add new transmission lines as needed, rather than creating additional areas. Where appropriate for other needs, burial of utilities will be encouraged. Compatible multiple uses and Memoranda of Understanding (MOU) are encouraged including collocation of communication and electronic towers on existing electric transmission towers and vegetation/wildlife habitat management areas. Coordination with utility companies will help in the development of appropriate management strategies for each right-of-way.

Utility corridors, electric transmission lines, and gas pipelines provide additional Rec/EE opportunities. Because of their wide clearings and easy access along many roads and trails, they are prime areas for viewing wildlife species that favor grass, shrubs, old fields, and forest edges. Wildlife species that rely upon habitats consisting of the grass/forb, shrub/seedling/sapling, pine woodland, and habitat generalist associations are most likely to be found on these corridors. Trees and shrubs typically do not exceed 20 feet in height and make up about one-third of the corridor's vegetation. The remaining two-thirds is a mixture of grass and forb species. The landscape character could range from natural appearing to pastoral/cultural. These lands are unsuitable for timber production.

Recreation use is generally hunting related, although existing trail systems often cross these corridors and can contribute to the natural experience. Dispersed recreation opportunities could take advantage of the wide openings and easy access for new trails, trail extensions or for loop trails adjacent to demonstration areas. EE efforts could provide educational and information benefits to those dispersed recreationists who use these areas.

Exceptions under Alternative Z

Emphasis:
Existing linear authorizations for electronic transmission lines and pipeline for natural gas would be reduced or eliminated within local distribution corridors. Corridors that

serve the public outside the boundaries of LBL would be continued or relocated. Utility corridors that were authorized by prior agreement under Tennessee Valley Authority would remain. Local distribution lines that are covered under the LBL Protection Act or an agreement with the utilities on the maintenance of their right of way would continue only if required. The uses that serve a public benefit like high voltage electric transmission lines and buried pipelines for natural gas would continue only where necessary.

Desired Condition:
Where practical, existing corridors would be removed or buried. Compatible multiple uses and MOUs would be encouraged to include collocation of communication and electronic towers on existing electric transmission towers and vegetation/wildlife habitat management areas. Coordination with utility companies would develop appropriate management strategy for each right-of-way.

2.B Infrastructure, Administrative, Maintenance and Closed Facilities

Alternatives W, X, Y and Z

Emphasis:
The emphsis in this allocation is to provide sites and facilities that are located and managed in a manner to best serve and support recreation, environmental education, and environmental stewardship programs. They will be maintained to provide for staff and visitor safety, meet or exceed applicable codes, and to protect capital investment. Areas served and supported include offices, campgrounds, interpretive sites, wildlife viewing areas, work centers, visitor centers, welcome centers, and intern quarters.

Desired Condition:
LBL will provide administrative sites and facilities to efficiently, effectively, and safely serve the public and accommodate the work force. Forest Service maintenance facilities provide garage, shop spaces, storage and laydown area, as well as office space for the maintenance contractor serving LBL. Sites are readily accessed by road. The facilities should have barrier-free access.

Common architectural elements will be incorporated in a way that enhances the Forest Service image envisioned for LBL whenever facilities are built or renovated. Standardized mechanical, electrical, and structural materials and products will be used to improve safety and energy efficiency, increase reliability, and reduce maintenance costs. The landscape character could range from natural appearing to urban. Vegetation management techniques can include mechanical treatment or prescribed fire.

Forest Service offices and/or visitor centers provide educational and interpretive opportunities such as exhibits and displays, books, videos, and brochures. Where feasible and appropriate, short hiking trails are provided in conjunction with visitor centers. Hunting and fishing are generally not allowed within administrative sites.

Several administrative and other sites at LBL were closed in approximately 1993 prior to the transfer of LBL to the Forest Service. Since the transfer, these facilities have been maintained in a manner to slow degradation of buildings, utilities, and roads until a decision can be made during implementation of this Area Plan regarding their use, reuse or disposal. With an emphasis in this Area Plan toward the increase of dispersed recreation and non-facility-based EE opportunities, the Forest Service will evaluate the historical and practical uses or benefits of any closed building or facility for its future potential. Minimum facilities require less active maintenance, thereby reducing the cost of maintenancae and upkeep. Future decisions about these facilities will be determined at the project-level using all legally required processes.

2.C Designated Communications/Electronics Sites

Alternatives W, X, Y and Z

Emphasis:
Communications across LBL are vital to maintain visitor safety and security, and to facilitate the maintenance and upkeep of the facilities and resources. Communication sites provide both a public and Forest Service benefit. Types of communication sites include self-supporting and guide-wired towers with related facilities and structures. The functions of the communications sites are primarily categorized into two areas. The first are public elements which include cell-phone, radio communications, and other electronics networks. The second function is in support of LBL's communications and computer network. These designated areas are managed to minimize adverse impacts on other resources.

Desired Condition:
Existing special-use authorizations and forest requirements for communications and electronics will continue within these designated areas. Each site is developed and utilized to its greatest existing potential or expanded rather than creating additional areas. All user and forest equipment will be compatible to forest surroundings and other users' equipment and frequencies. New equipment should be as inconspicuous to the surrounding terrain as possible. Special-use permits will be issued for commercial entities.

The landscape character could range from natural appearing to urban. Scenery management techniques are used to mitigate adverse impacts. Existing and proposed towers will be utilized to accommodate as many users as possible within technical constraints to reduce tower clutter. These areas are managed to retain low-growing vegetation, which conforms to the safe-operating requirements of the utility and which reduces surface water runoff and erosion. Prescribed fire may be used for vegetation management. Recreation is not emphasized or encouraged at these sites.

3. Recreation and Environmental Education Areas

3.A. Developed Recreation Areas

Alternatives W, X, Y and Z with exceptions noted below

Emphasis:
A developed recreation area is managed to provide the public with a variety of recreational opportunities in visually-appealing and environmentally healthy settings. Large family campgrounds, picnic sites, boat ramps, lake-access campgrounds, swimming beaches, primitive backcountry areas, and trails for hikers, horseback riders, and bicycle riders are all examples of the diverse opportunities and facilities found in developed recreation areas. Facilities are provided to enhance the quality of the recreational experience and/or to mitigate damage to the affected ecosystems. Campgrounds of various development levels are maintained to accommodate the varying interests of the camping public (Development Levels are explained below). Visitors feel comfortable bringing their entire family to participate in recreational activities. These areas also serve as a "gateway" to the wide diversity of recreational opportunities on the remainder of LBL.

Developed recreation facilities or areas are managed for one of the following four development levels as defined by Recreation Opportunities Spectrum (ROS) experiences.

Development Level 5 – Highly developed sites provide experiences in a developed forest setting. Numerous facilities of mostly non-native materials and very refined design can be expected. Convenience facilities are prevalent, including showers, flush toilets, paved roads, entrance stations, area attendants, equestrian facilities, playgrounds, information boards, beaches, boat ramps, outposts, concessionaires, and recreation vehicle hookups. Paved, striped roads access facilities. These sites provide organized environmental education opportunities such as programs and individual interaction with staff. The experience best representing this level is Urban to Rural. Hillman Ferry and Wranglers campgrounds are examples of this development level. Use on these trails includes all non-motorized and non-equestrian opportunities with the exception of Wranglers Trail System (where use is appropriate.).
Development Level 4 – Heavily developed sites provide experiences expected in a rural forest setting. Access is by double-lane gravel or paved roads. Some complex facilities with non-native and very refined design can be expected. Convenience facilities may be present including showers, flush toilets, vault toilets, paved roads, area attendants, information boards, beaches, boat ramps, and, potable water. Moderate to heavy site improvements occurs. Some on-site environmental education opportunities occur. The experience best representing this level is Rural. Energy Lake and Cravens Bay Campgrounds are examples of this development level.

Development Level 3 – Moderately developed recreation areas providing experiences expected in a more rustic setting. Some privacy is expected. Gravel roads capable of accommodating conventional motorized vehicles as well as smaller trailers provide

access. Facilities are developed for protection of the site as well as for user convenience. These may include vault toilets or chemical toilets, graveled site pads, picnic tables, grills or fire rings, fishing piers, information boards, boat ramps, and potable water. Only off-site or information signing provide environmental education opportunities. The experiences best representing this level are Road Modified or Roaded Natural. Birmingham Ferry, Smith Bay, Gatlin Point, Jones Creek, Nickell Branch, Twin Lakes, Moss Creek Day Use, Energy Dam Day Use, Cedar Pond Picnic Area, Colson Overlook Picnic, and South Trailhead fall within this development level.

Development Level 2 – Minimally developed recreation sites offer an opportunity for solitude, tranquility, and closeness to nature. These sites offer visitors a higher degree of self-reliance, challenge, and risk. There is normally a low concentration of users in this area. Vegetative alterations, such as mowing and hazard tree removal, are primarily for public safety. These sites are widely dispersed and blend with the natural vegetation. Minimal site modification is required for the limited facilities, as well as for safety and resource protection. Such items as boat ramps, vault toilets, and information boards are present. The experience best representing this level are Roaded Natural or Semi-primitive Motorized. Demumbers Bay, Kuttawa Landing, Eddyville Ferry, Pisgah Point, Shaw Branch, Honker Dam, Duncan Bay, and Colson Hollow Group Camp are examples of this development level.

Desired Conditions:

Visitors to LBL's developed recreation areas will be presented with diverse opportunities to enjoy the natural resources and landscapes across LBL. Choices for their recreation activities will include such activities as: shoreline fishing; day hiking; swimming; mountain biking; driving for pleasure; wildlife viewing and hunting. Visitors will be able to choose from a wide variety of recreation opportunities in high-quality, well-maintained settings. Boat ramps, trailheads, and smaller dispersed campgrounds are examples of developed sites that serve as hub zones for dispersed recreation opportunities. Improvements are considered in developed sites based on needs for resource protection, actual and projected use, and visitor satisfaction. The land within the boundary of the recreation area will be managed for "watchable" wildlife species. Environmental education messages and information will be provided through interpretive signage and displays within developed recreation areas. These messages will provide education and information relevant to recreational users on topics such as littering, wastewater and runoff, soil compaction, and wildlife habitat needs.

Vegetation, wildlife, and pest management will be conducted in support of the function of each facility. All wildfires will be extinguished at these sites. However, use of prescribed fire is appropriate for reduction of hazardous fuels and vegetation management. All management activities are conducted in a manner which promotes sensitivity to the experience of visitors to each site.

Exceptions under Alternative X

Desired Conditions:

The focus of this alternative is an increase and/or improvement of staffed facilities designed to enhance visitor experience in targeted recreational and educational activities. Constructed facilities will almost always be visually subordinate to the land. There will be a variety of recreation facilities provided dependent on the development scale appropriate to the ROS class and consistent with the design narrative in developed recreation sites. Facilities outside the developed recreation sites will be provided to protect resources. Facilities that provide for user convenience, as well as protect resources, will be constructed or maintained in the developed recreation areas.

An increase in services and amenities for user convenience is appropriate for developed recreation areas. Trails can be expanded within facilities boundaries. There could be increased opportunities with partners such as concessionaires, entertainment, and special events. Access to facilities will be maintained or improved. Additional or upgraded waste and water treatment facilities are appropriate for developed recreation areas. Staffing may be provided at facilities within development levels 2 and 3. There will be an opportunity to upgrade and maintain archery and/or shooting range opportunities as appropriate to developed recreation areas.

Outdoor skills are generally of low importance, except where knowledge of specialized activities (i.e., boating or horseback riding) is critical. Motorized access and their support facilities (i.e., roads, parking lots, or water access) will be provided, but some experiences (i.e., walking and viewing nature) will be non-motorized. New recreation trends will be monitored for feasibility and appropriateness on national forest lands.

The emphasis with this alternative will be toward moving recreation areas to higher development level. A priority will be to consider the following improvements:

1. Upgrade selected boat ramps with improved parking and lake access capabilities or decommission low use boat ramps;
2. Develop public swimming areas on both lakes by upgrading selected backcountry camping areas with beaches and picnic areas. These areas will be made day use only;
3. Create loop trails to enhance hike/bike opportunities; to make trail connections to gateway communities, and to add additional interpretative trails with environmental education emphasis;
4. Upgrade or create a nearby campground to provide an OHV camping loop complete with area for riders to unload and work on ATVs;
5. Upgrade selected campgrounds with additional or new utility hookups.

Exceptions under Alternative Y

Desired Conditions:

The focus of this alternative is an increase in dispersed recreation opportunities across LBL in a manner that protects the surrounding water, soil, vegetation, and wildlife. These opportunities include such activities as shoreline fishing, day hiking, swimming, mountain biking, driving for pleasure, wildlife viewing, and hunting. Visitors will be able

to choose from a wide variety of recreation opportunities in high-quality, well-maintained settings. In developed recreation sites, the emphasis will be on those sites that serve as hub zones for dispersed recreation opportunities. Boat ramps, trailheads, and smaller dispersed campgrounds are examples of a hub zone developed recreation area. Other facilities, such as the Development Area 5 campgrounds, would be maintained under existing management guidelines. The level of camper amenities will remain stable at developed sites. Development Level 5 campgrounds will be the only recreation facilities providing outpost type amenities. Wranglers campground will remain the only recreation site providing food service in its outpost.

Improvements can be considered in these developed sites based on needs for resource protection, actual and projected use, and visitor satisfaction.

The emphasis with this alternative will be maintaining developed recreation areas. A priority will be to consider the following improvements:

1. Upgrade, relocate, or consolidate selected boat ramps with improved parking and lake access capabilities.
2. Develop public swimming areas on both lakes by upgrading selected backcountry camping areas with beaches and picnic areas. These areas will be made day-use only.
3. Create loop trails to enhance hike/bike opportunities; to make trail connections to gateway communities, and to add additional interpretative trails with environmental education emphasis.
4. Upgrade selected campgrounds with improved or additional utility hookups.

As these changes are made, some of these facilities will move to a higher development level. However, no additional recreation sites will be upgraded to Development Level 5 status. Following site evaluation, many sites could drop in level of development or be decommissioned and no longer be classified as developed recreation sites. No significant change in the ROS classification of the site is expected to occur with these improvements or changes.

Exceptions under Alternative Z

Desired Conditions:

Visitors to LBL will observe a less noticeable active management and development by the Forest Service. Developed recreation sites will have fewer amenities, less staffing, and reduced rentals and sales. Current concessionaires and conveniences will be evaluated and possibly scaled back or eliminated. All non-specialized fees will be evaluated with a proposed trend of reduction or elimination. Consumptive uses such as electrical/sewer hookups should require fees but because fees encourage a “customer attitude” alternatives should be provided where users could use work on volunteer projects as a payment method within the facilitates. Developed recreation sites such as trailheads, picnic areas, and boat ramps will serve as hubs for dispersed recreation experiences, and these areas will be maintained or enhanced. LBL will have a more

rustic, less developed appearance, and the focus of the recreation experience will be on self-discovery and outdoors skills, giving participants experiences of solitude, serenity, adventure, self reliance, and an appreciation of the unique history and culture of the area.

Facilities such as toilets or litter collection points will be maintained in the developed recreation areas in order to provide a safe and sanitary environment. Motorized access and their support facilities (i.e., roads, parking lots, or water access) will be maintained to provide access to non-motorized experiences (i.e., walking and nature viewing).

3.A.1. Developed Recreation – Elk & Bison Prairie and South Bison Range

Alternatives W, X, Y and Z

The Elk & Bison Prairie (EBP) and South Bison Range (SBR) are two recreation/education facilities managed to provide nature viewing and environmental education opportunities. The EBP, located in the center of LBL, is a 700-acre restoration of the "barrens" of Kentucky containing bison, elk and other native wildlife. A three-and-one-half mile scenic drive, with self-guided tours and interpretive stops, winds through the area. The SBR, located in the Tennessee portion of LBL, contains 180 acres of cool-season pasture and a herd of American bison. The South Bison Range features wildlife viewing pull-offs along the Trace, an interpretive kiosk, and a hiking trail that circles the entire range.

Emphasis:
The emphases of the EBP and SBR include nature viewing, environmental education, and restoration of native habitats and wildlife. The EBP features self-guided entry and drive-through tours, with a volunteer staff (called "The Bugle Corps") that provides interpretation and security during peak visitation periods. Staff-led tours and educational programs are scheduled periodically at the EBP. The SBR provides self-guided wildlife viewing and interpretation.

Desired Conditions:
The EBP seeks to restore the natural habitat and wildlife that sustained native peoples in the region long before the first European settlers came to Kentucky. With its unique mix of cultural and natural history and its design for year-round self-guided drive-through tours, the EBP provides an exciting outdoor experience that appeals to a broad range of local, regional, and national visitors. Further, the EBP can serve as a magnet to bring additional visitors to LBL and to increase the length of stays for those visitors, resulting in additional benefits for LBL and the region. Historic native habitats will be restored through active habitat management, including use of fire and grazing. The elk herd will continue to serve as a catalyst and source of elk for reintroductions of free-ranging herds in the eastern United States.

The SBR is home to the largest publicly-owned herd of bison east of the Mississippi River and continues to be an extremely popular visitor attraction for the Tennessee portion of LBL. From massive historic herds to near extinction, the south bison herd exemplifies how conservation efforts can lead to eventual recovery of a species. Pastures

will be maintained through conventional pasture management practices, and future efforts will focus on a gradual shift toward native species of grasses and forbs.

3.B. Turkey Bay

Alternatives W, X, Y and Z, with Exceptions Noted Below

Emphasis:

Turkey Bay's emphasis is to provide for off-highway vehicle (OHV) recreational opportunities on a system of designated trails within a well-defined area. A gatehouse, well house, bulletin boards, trailheads, and sanitary facilities are provided to enhance the quality of the recreation experience. Area attendants are on-site to promote safe and responsible riding and to provide other appropriate customer services for users during their visit. Area boundaries, route information, and regulations are adequately communicated to make the visitor's experience safer and more enjoyable. Areas within Turkey Bay that have been denuded of vegetation and topsoil, as a result of OHV impacts, are a high priority for restoration and reclamation.

Although Turkey Bay provides primarily for motorized recreational opportunities, other day-use recreational opportunities such as hunting, fishing, berry picking, wildlife viewing, and cemetery visits occur within the boundary. Turkey Bay is the only off-road motorized recreation opportunity at LBL; motorized vehicles are prohibited off roads outside the Turkey Bay Area except under special permit.

Desired Conditions:

The Turkey Bay OHV Area is managed in a sustainable manner to provide for a variety of motorized recreational opportunities. Designated routes will be identified and managed; cross-country travel will be eliminated. The area will be managed for the long-term sustainability of natural and cultural resources and to meet all applicable standards for resource management.

Designated trails are established with input from the public. Trail difficulty levels vary within the area. User groups assist in the various aspects of constructing and maintaining trails as well as rehabilitating damaged areas. They also help provide safety training to users and promote responsible rider behavior.

Environmental education messages are communicated to foster current and future generations of riders who display safe and environmentally sustainable riding habits. Messages promote responsible rider behavior in order to develop habits that are appropriate both at Turkey Bay and other OHV riding locations on public lands. Programs such as "Respect the Resources" are used to assist in the delivery of educational messages.

Opportunities to provide camping facilities for OHV users will be considered in a separate analysis. Any further development of camping opportunities within Turkey Bay,

or at other locations in LBL, will be limited by the ability of the Forest Service to sustain the natural and cultural resources, as well as allot adequate funding to support the development.

Vegetation management may be conducted within 200 feet of trail corridor only as a means of enhancing the trail user experience or mitigating damage caused by insects, disease, or natural disaster. Timber harvesting practices are modified to recognize the recreational and aesthetic values of these suitable lands. Prescribed fire may be implemented for wildlife habitat management, fuel reduction, and scenery management.

This area will be managed and monitored to absorb moderate to high levels of use while protecting natural and cultural resources. The landscape character is natural appearing with variations created by recreational facilities and uses. Recreationists enjoy traveling routes through a variety of landscapes. Along many of the routes, the views are restricted to the immediate foreground by vegetation and natural landforms, but occasional openings reveal middle ground or distant background and lakeside vistas. Constructed routes blend well with the natural environment. Visitors may see evidence of resource management activities. However, treatments blend with the natural landscape, and vegetation diversity is enhanced over time.

Funding emphasis is aimed at resource protection such as rehabilitation and restoration measures. Maintenance is performed to protect designated routes and minimize effects to soil, water, vegetation, and wildlife resources. The entire Turkey Bay area or portions thereof may be closed during periods of inclement weather or for rehabilitation work in order to protect natural and cultural resources.

Exceptions under Alternative W

A slight increase in support facilities within the Turkey Bay OHV Area, including paved parking lots, designated campsites, and restroom facilities may be added over time.

Exceptions under Alternative X

Alternative X proposes that Turkey Bay OHV area be re-allocated to a day-use facility. Camping in the area would be prohibited. The alternative would allow for the improvement of an existing campground to accommodate displaced overnight users or the development of a new campground outside the boundary of Turkey Bay OHV Area. Slight increase in support facilities within the boundary may occur, including improved parking lots and restroom facilities.

Exceptions under Alternative Y

Alternative Y would propose an increase in the development level of the Turkey Bay OHV Area. Recommended improvements could only be made after project level planning and budgetary guidelines prove further development appropriate. This

alternative allows for the development of a campground within the existing boundaries of the OHV area based on the project level analysis.

Exceptions under Alternative Z

Alternative Z proposes to manage Turkey Bay OHV as a riding area with designated trails for smaller motorized vehicles. Trails, facilities, and policies are focused on use by ATV's and motorcycles rather than large off-road vehicles. Camping opportunities would continue to be managed as a Development Level 2 class. Some minor facility improvements are acceptable based on budget and sustainability.

3.C Environmental Education Facilities

Alternatives W, X, Y and Z with Exceptions Noted Below

Emphasis:
The primary focus for the EE facilities is the delivery of environmental programs and activities to the general visiting public as well as formal education groups (i.e., school groups) through a variety of personal and non-personal methods. The facilities and sites are managed to not only facilitate this delivery but are also an important delivery tool. Through a diversity of interpretive, educational, and recreational opportunities, visitors learn about LBL's natural and cultural resources, management of those resources, and their stewardship roles and responsibilities. The EE facilities include Woodlands Nature Station, Golden Pond Planetarium and Observatory, The Homeplace – A Living History Farm; and Brandon Spring Group Center.

Desired Condition:
Visitors to the EE facilities will find: accessible, barrier-free infrastructure, exhibits, and programs; well-maintained facilities and sites; and, delivery of high-quality interpretive and educational programs, activities, and exhibits.

Interpretive and educational programs, activities, and facilities will be designed to provide opportunities at many levels of the educational process. Visitors should have the opportunity to:

- Understand and learn more about the ecological, cultural, economic, scenic, scientific, educational, and recreational values of LBL;
- Directly experience LBL's natural and cultural resources through hands-on activities, programs, or recreational activities occurring at the facilities or in other LBL locations (i.e., campgrounds, trails, wildlife refuges, wetlands, historic sites, etc.). Outreach opportunities with the surrounding communities and school districts are also explored.
- Be inspired to demonstrate their knowledge and understanding through personal stewardship actions (responsible behavior, volunteering, public involvement, donations, etc.).

Formal education groups (i.e., school groups) will find programs and activities that connect to classroom educational objectives. Emphasis is placed on active, experiential learning.

Opportunities for enhancing existing facilities will be evaluated and will include direction and priorities for improvements such as: wildlife exhibit upgrades and additions at Woodlands Nature Station; new interpretive center exhibit at The Homeplace; habitat study sites at Brandon Spring; and additional ways for utilizing the Golden Pond Planetarium and Observatory. Facilities are staffed at appropriate levels to insure a high quality, comprehensive education program. Interpretive exhibits and displays meet or exceed industry standards and supplement as well as complement each facility's purpose.

Facility sites are appropriate for most dispersed (non-motorized, non-mechanized) recreation activities, such as hiking, canoeing, nature photography, bird-watching, etc., However, open camping is not appropriate for these areas.

Vegetation and wildlife management activities will be in support of the function and purpose of each facility and its program. All wildfires will be extinguished at these sites.

Access to cemeteries will be maintained. Few roads and trails will be created or improved to support the facilities and EE program. Utility corridors will only exist for serving the facilities.

Collection permits and permits for military operations/maneuvers are not appropriate for this designated area. Other special uses will be considered on a case-by-case basis and within policies and guidelines established for evaluation.

Maintenance buildings and other outbuildings necessary to support the EE facilities will be as visually unobtrusive as possible. Administrative facilities will not be co-located with EE facilities.

Exceptions under Alternative X

Desired Conditions:

In addition to the above, the need for developing new facilities will be evaluated for addressing other educational opportunities. Any new facility must have demonstrated need and the ability to sustain that need over an extended period. This may include, but is not limited to:

- An EE facility in the Fort Henry area. Public interest in Civil War history remains high and recreation demand related to viewing historical and heritage sites has increased. The purpose of this facility would be to interpret the significance of the Fort Henry site and connect it to the chain of events that occurred in this area during the Civil War. The existing trail system could be better utilized for facilitating Rec/EE of the natural and cultural resources of this area. Interpretive signs or other non-personal methods could be included. The facility would also tie directly to The Homeplace, the historical time it portrays, and its educational programs as well as to Fort Donelson National Battlefield.

- Overnight camp in the EE Area. Local interest remains high for an overnight camp opportunity, for school children, that provides a less developed or more primitive experience than Brandon Spring Group Center currently offers. Partnerships with local school districts are a requirement for the development of this opportunity. The camp would operate solely for the benefit of local school children during the fall and spring months and have minimal infrastructure (i.e., tent platforms instead of dormitories) and staffing (i.e., a caretaker).

Adequate staffing and maintenance levels are primary considerations for the sustainability of these new facilities.

Exceptions under Alternative Z

Desired Conditions:
In addition to the above, all of LBL is viewed as an Environmental Education Area. The primary delivery system for EE would be non-facility-based. Visitors would find more EE and recreational learning opportunities throughout LBL than currently exist. These opportunities may or may not be supported or found within existing recreation and EE facilities. Examples may include, but are not limited to: scenic vistas and drives; interpretive trails; interpretive wayside exhibits and signs; and infrastructure to support nature viewing.

Increased emphasis would be placed on historical interpretation with a particular focus on more recent human history and the establishment of LBL as a National Recreation Area.

School groups would find more outdoor classroom opportunities and nature study sites.

An EE message or theme is identified and communicated for every recreation activity, resource management activity, heritage resource, and special area. Conservation and education messages throughout LBL will highlight positive, personal actions that benefit natural and cultural resources and motivate LBL visitors to develop ethical behaviors associated with their activities.

3.D. Nature Watch Demonstration Area

Alternatives Y and Z only

Emphasis:
The primary purpose for this area is to offer nature-viewing opportunities and activities to LBL visitors. In addition to the EE facilities, a Nature Watch Demonstration Area provides an additional delivery tool for EE. This area may be managed intensely in order to provide nature-viewing opportunities, such as watching wildlife and viewing wildflowers, using a variety of vegetation, transportation, aquatic, landscape, and view shed improvements. Nature viewing, natural history interpretation, and environmental education activities are emphasized. Existing facilities are well maintained and updated

as needed. A variety of scenery, with an emphasis on natural features and characteristics would be appropriate.

Desired Conditions:

Visitors to the Nature Watch Demonstration Area depart with a memorable, enjoyable, and educational experience. Well-designed accessible features that permit visitors a closer, more intimate experience with the natural world facilitate this experience. Examples of such features include improved roads; road pullouts; interpretive panels, signs, and brochures; viewing blinds and platforms; and interpretive trails.

Viewing opportunities are designed primarily for two types of visitors:

- Those who enjoy seeing wildlife and scenic vistas and are "curious," but have limited experience with nature viewing. Lack of knowledge about where, when, and how are barriers to participation.
- Those who have more nature-viewing experience and seek out opportunities as part of their recreational choices. These visitors may be described as "aspiring" viewers. They are also eager to learn more about what they are seeing and begin discovering how ecological systems function.

For both types, viewing success is important to engage the visitor and then inspire the visitor so that additional knowledge and understanding leads to personal actions that result in stewardship of our natural resources. To facilitate viewing success, emphasis is placed on managing resources for more viewable wildlife species such as waterfowl, turkey, bald eagles and other raptors, hummingbirds, herons and other wading birds, butterflies, turtles, beavers, squirrels, raccoons, and deer, as well as for fall colors, wildflowers and other native plants; and for circumstances that allow wildlife species to become more tolerant to human presence and provide closer viewing opportunities for visitors.

Woodlands Nature Station plays an important role as a "hub" or center for nature-viewing and other recreational activities in the northern Nature Watch Demonstration Area. It serves as the primary information source for the season's nature viewing; provides staff-led programs and activities in the area; and facilitates opportunities for school groups and other organized groups.

New developed recreation sites would not be appropriate within this area. This area would be suitable for minimal recreation activities that complement the Nature Watch objectives; however, open camping is not appropriate.

Visitors to the southern Nature Watch Demonstration Area will find nature viewing opportunities that are accessed primarily by trails. Viewing blinds or platforms, interpretive displays, and self-guided interpretive trails may be appropriate tools to facilitate viewing opportunities.

An integral part of the education process and purpose of the Nature Watch Demonstration Area is demonstrating examples showcasing active as well as minimal management activities. Examples of active management activities would include stream rehabilitation, prescribed fire, and vegetation management including logging, open lands management, and vegetation type conversion. Determination for handling wildfires is decided on a case-by-case basis in this designated area.

Interpretation and education about threatened and endangered species and their habitats and rare plant and animal communities will be included within the education program goals and objectives. Management activities within the Nature Watch Demonstration Area related to these species and habitats of special concern must meet conservation and protection objectives as defined in other parts of this plan.

Various activities in general forest and open fields areas are interpreted and highlighted to increase knowledge of natural resource management. An integral part of these demonstrations is education about the "whole" comparisons, benefits and trade-offs, and successes and failures.

Collection permits and permits for military operations/maneuvers are not appropriate for this designated area. Other special uses will be considered on a case-by-case basis and within policies and guidelines established for evaluation.

Utility corridors existing in this area will be evaluated for demonstration opportunities, such as choosing native vegetation for view shed enhancement or managing as long strips of barrens or prairies.

Heritage resources within the area would be managed as part of the educational emphasis. Research that would further the enhancement of nature viewing and environmental education would be appropriate. Core Area designation is compatible within this area with exceptions of existing facilities, intensely managed areas supporting the facilities, and current access. Other compatible designations include wildlife refuges and study areas.

Exceptions under Alternative Y

Desired Conditions:
Under alternative Y the current Environmental Education Area (EEA) is expanded to include an area of approximately 1200 acres bordered by Energy Lake Road to the west and Energy Lake Dam and the Lake Barkley Shoreline to the south. This Northern Nature Watch Area is further divided into an eastern and a western section.

- The eastern section will take advantage of existing infrastructure, habitat diversity, and proximity to Lake Barkley to provide viewing opportunities mostly from roads. Visitors will find the former Empire Farm and Youth Station areas utilized for providing scenic lake vistas, one-way drives, and access to viewing blinds and platforms, interpretive displays, or short

trails. Buildings and other structures associated with these former environmental education sites may be incorporated into the area's opportunities and settings, while others have been removed from the setting. In later stages of the planning cycle, the former Youth Station site may be determined as an appropriate area for providing a rustic camping and learning experience for families with young children, youth groups, or novice campers. Hunting pressure in this section would be greatly reduced to facilitate these types of experiences.

- The western section will provide nature-viewing experiences that require higher levels of viewing skills and increased time investments. Hiking trails and old roads provide access into this section. Visitors find much less infrastructure and "guided" viewing opportunities, but are rewarded with more personal and self-directed viewing experiences. While hunting pressure is also reduced in this area to facilitate nature viewing, wildlife management objectives may allow for additional hunting opportunities in this section including additional youth hunting, quota bow hunting, or opportunities for physically challenged hunters.

Exceptions under Alternative Z

Desired Conditions:
Under Alternative Z the current EEA is expanded with a boundary along Silver Trail Road to the south, Road 310 to the west, Road 131 to the north and Road 312 to the east. This expansion is of about 1350 acres. There would be no differences in the management of any sections of the Nature Watch Areas under alternative Z.

3.E Environmental Education Area

Alternative W Only

Emphasis:
The primary focus for this area is to provide environmental education and recreation opportunities for LBL visitors. This area may be intensely managed in order to provide a variety of opportunities.

Desired Condition:
Visitors to the Environmental Education (EE) Area depart with a memorable, enjoyable, and educational experience. The Woodlands Nature Station serves as a hub of activity and information to orient visitors to the educational and recreational opportunities within the EE Area as well as the rest of LBL. Hiking trails, wildlife and nature viewing opportunities, canoeing, fishing, and picnicking are examples of appropriate recreational activities available in this area. Formal education groups (e.g., school groups) will find nature observation and nature study opportunities.

Reduced hunting pressure is a consideration for this type of high use area. The effects on recreational and educational opportunities and meeting wildlife management objectives within the area will dictate decisions related to hunting.

Examples of management activities appropriate in this area would include stream rehabilitation, prescribed fire, vegetation management including timber removal, open lands management, and vegetation type conversion.

Interpretation and education about threatened and endangered species and their habitats and rare plant and animal communities will be included within the education program goals and objectives. Management activities within the EE Area related to these species and habitats of special concern must meet conservation and protection objectives as defined in other parts of this plan.

Determination for handling wildfires is decided on a case-by-case basis in this designated area.

Collection permits and permits for military operations/maneuvers are not appropriate for this designated area. Other special uses will be considered on a case-by-case basis and within policies and guidelines established for evaluation.

No overnight camping is allowed in the Environmental Education Area. This restriction may be evaluated for modification during the life of this plan.

Utility corridors existing in this area will be evaluated for demonstration opportunities, such as choosing native vegetation for view shed enhancement or managing as long strips of grasslands, barrens or prairies.

Access to cemeteries will be maintained. Roads and trails will only be created or improved to support the recreation and EE programs.

Heritage resources within the area would be managed as part of the educational emphasis. Research that would further the enhancement of nature viewing and environmental education would be appropriate. Core Area designation is compatible with this designation with exceptions of existing facilities, intensely managed areas supporting the facilities, and current access. Other compatible designations include wildlife refuges and ecological areas. New developed recreation sites would not be appropriate.

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Appendix E

SPECIES VIABILITY

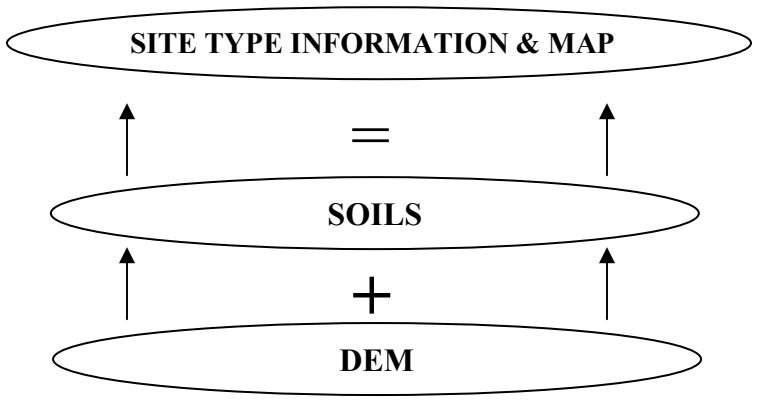
Site Type Discussion

I. Definitions

DEM: Digital Elevation Map. Elements pertinent to our soils mapping needs (site type map) included the use of elevation, aspect, and slope.

Soils Map Coverage: Soil Survey Reports for Trigg and Lyon counties in Kentucky and Stewart County in Tennessee were used as our base for attaining soils map coverage. The soil survey maps represented in these counties have been merged into Geographic Information Systems (GIS) coverage.

Site Type Map: The site type map for LBL is the result of overlaying or clipping the soils map to the DEM then querying the merged attribute tables for specific information. The information queried included the elevation, aspect, and slope associated with every soil type within LBL. Five site types were identified for habitat management and assigned to 118 soil types using these three elements and other criteria as described below under item II (Table E1). The aspects identified and used in this process are as follows: (F = Flat, NW-SE = Northwest to Southeast to represent the generally north facing slopes, and SE-NW = Southeast to Northwest to represent the generally south facing slopes). Essentially the site types were defined by the elements and criteria they represent. The site type map is a visual compilation of this information.



Site Type: Site types in LBL are based primarily on soil moisture conditions and elevation. Each site type is defined below.

Xeric – Representative of extremely dry soil conditions. Soils for this site type are located at an elevation >460 ft. and have mostly flat and SE-NW aspects on 0-12 percent and some 12-60 percent slopes. Soils associated with this site type may be characterized by one or more of the following elements: fragipan; gravely or cherty surface; thin soil surface cover; extremely acidic soil and low fertility; droughty soil conditions most of the year; and associated vegetation and growth is representative of relatively poor soil conditions.

Dry – Representative of soils with conditions which are very limited or devoid of moisture. Soils for this site type are located at an elevation >460 ft. and are primarily representative of all the aspects on 0 to 60 percent slopes. Soils associated with this site type are characterized by one or more of the following elements: acidic to moderately acidic soil and low to moderate fertility; and vegetation and growth representative of relatively poor to moderate soil conditions.

Dry-Mesic – Representative of a vegetation transition zone on the landscape in which both dry and mesic soil conditions occur. Soils for this site type are located at an elevation <460 ft. (Close *et. al.* 2002) and are primarily representative of all the aspects that range in 0 to 50 percent slopes. Soils associated with this site type are those that support vegetation that occurs on dry and mesic site types.

Mesic – Representative of moist soil conditions. Soils associated with this site type are stream terraces (derived from alluvium and colluvium), coves, and foot-slopes located at elevations > and < 460 ft. and are representative of all aspects on 0-6 percent slopes.

Alluvial – Pertains to and generally representative of the bank of a river, lake, or other body of water, wetness for a period of time. Soils associated with this site type are those created from or in alluvium that includes floodplains, wetlands, river bottoms, some streams, and depressions. These soils are represented at elevations > and < 460 ft. for all aspects on 0-3 percent slopes.

II. DEIS Site Type Map vs. Revised DEIS (FEIS) Site Type Map

The ***DEIS site type map*** was based on elevations > and < 460 ft.; aspect (F, NW-SE, and SE-NW); slope > and < 10 percent ; information about soil types; and vegetation associated with the soils.

Errors associated with this site type map:

- The change in elevation was placed between the dry-mesic and mesic site types.
- The > and < 10 percent slope did not function adequately to focus primarily on xeric site types >460 ft.
- Polygons with insufficient data “slivers” were created when the DEM and soils coverage’s were clipped together. The total acres were insignificant.

- The mesic site type was assigned to the Nolin soil type (approx. 3,000 acres in KY).

- The ***revised site type map*** is based on the same elevations and aspects as in the original site type map. The change in elevation was placed between the dry and dry-mesic site types. The percent slope of > and < 10 percent was not used to model the site type. Instead, the overall percent slope associated with each soil type was factored into assigning the site types to soil types. Site types were re-assigned to soil types based on a more in depth look at soil profiles, their vegetation association, and geological location. The alluvial site type was assigned to the Nolin soil type. The slivers were voided in the merged attribute tables.

III. Assumptions and Considerations

The assignment of the site types to the soil types is currently our best approximation of site condition types in LBL. Ground checking is expected to reveal errors in our estimations for all the site types. It is very likely that in the field a xeric site type soil should have been classified as a dry site type soil and vice verse. This is expected mostly between the xeric and dry site types and mesic and riparian site types. Only a certain amount of information could be extrapolated from the soil survey reports to be used in making the site type assignments. The elevation change was very useful in helping to assign site types where the soil survey reports lacked enough information to clearly assign dry and dry-mesic site types.

Soil survey reports are currently our best approximation of what soil types occur on the landscape. The Stewart County Soil Survey Report was published in 1953 and LBL is in the process of having soils in that county re-mapped. As new information becomes available from these surveys and other field checks, it can be incorporated into updating our site type files at the project level. The soil survey reports for Lyon and Trigg counties were published in 1981.

MARC – Mid America Remote Sensing Center, Murray State University was responsible for putting all of the soil survey information for LBL into GIS. After the soil type information was put into GIS, the soils in Kentucky did not edge match with those in Tennessee, therefore there is some disparity in site types properly merging along the state line. The disparity is relevant to how soils were mapped by the two states and how dated the information is for Tennessee.

References:

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United States Department of Agriculture, 1953; Soil Survey of Stewart County, Tennessee, Soil Conservation Service, Washington, D.C.

Table E1. Site Types for Kentucky and Tennessee soil types in LBL based on soil characteristics, elevation, aspect, and slope.					
	Site Types with Aspects (Flat, NW-SE, and SE-NW) and Elevations > and < 460'				
	Xeric	**Dry**	**Dry-Mesic**	**Mesic**	**Alluvial**
Soil Type and Percent Slope	**F,NW,SE,>**	**F,NW,SE,>**	**F,NW,SE,<**	**F,NW,SE,>,<**	**F,NW,SE,>,<**
B: Baxter Cherty SiL, 12-25%		NW>	NW<; SE<		
BaE: Baxter-Hammack Cmplx, 20-30%		F>; NW>; SE>	NW<; SE<	F<	
BaF: Baxter-Hammack Cmplx, 30-60%		NW>; SE>		F<	
Bf: Baxter SiL, >25%		F>; NW>; SE>	F<; NW<; SE<		
Bg: Baxter SiCL, >25%		NW>; SE>	NW<; SE<		
Bh: Bodine Cherty SiL, 12-25%		F>; NW>; SE>	F<; NW<; SE<		
Bk: Bodine Cherty SiL, 5-12%		NW>	NW<; SE<		
Bl: Bodine Cherty SiL, 25-50%		NW>; SE>	F<; NW<; SE<		
Bm: Bodine Cherty SiL, 12-25%		F>; NW>; SE>	F<; NW<; SE<		
Bn: Bodine Cherty SiL, 5-12%	F>	SE>; NW>	F<; NW<; SE<		
Bo: Bodine Cherty SiL, 12-25%		F>; NW>; SE>	NW<; SE<		
Bp: Bodine Cherty SiL, 25-50%		F>; NW>; SE>	F<; NW<; SE<		
Br: Brandon SiL, >20%		F>; NW>; SE>	F<; NW<; SE<		
BrC: Brandon SiL, 6-12%		F>; NW>; SE>	F<; NW<; SE<		
BrD: Brandon SiL, 12-20%		F>; NW>; SE>	F<; NW<; SE<		
***Bs*:** Brandon SiL, 5-12%		F>; NW>; SE>	F<; NW<; SE<		
BsC3: Brandon SiCL, 6-12%			NW<		
BsD3: Brandon SiCL, 12-25%		F>; NW>; SE>	F<; NW<; SE<		
Bt: Brandon SiL, 12-25%		F>; NW>; SE>	F<; NW<; SE<		
Bu: Brandon SiL, 5-12%	F>	SE>; NW>	F<; NW<; SE<		
Bv: Briensburg SiL, Depressions		F>; NW>; SE>	F<; NW<; SE<		
BxE: Brandon-Saffell Complex, 20-50%		F>; NW>; SE>	F<; NW<; SE<		
Ca: Cherty Colluvium (Greendale)		F>; NW>; SE>	F<; NW<; SE<		
Cb: Bewleyville SiL, 5-12%		NW>	NW<		
Cp: Clifty Gravelly SiL, 0-2%		F>; NW>; SE>	NW<; SE<	F<	
Da: Dickson SiL, 5-12%	F>	NW>; SE>	NW<; SE<		
Dc: Dickson SiL, 5-12%	F>	NW>; SE>	NW<; SE<		
Dd: Dickson SiL, 2-5%		NW>	F<; NW<		

Table E1 (continued) Site Types for Kentucky and Tennessee soil types in LBL based on soil characteristics, elevation, aspect, and slope.					
	Site Types with Aspects (Flat, NW-SE, and SE-NW) and Elevations > and < 460'				
	Xeric	**Dry**	**Dry-Mesic**	**Mesic**	**Alluvial**
Soil Type and Percent Slope	**F,NW,SE,>**	**F,NW,SE,>**	**F,NW,SE,<**	**F,NW,SE,>,<**	**F,NW,SE,>,<**
De: Dickson SiCL, 5-12%	F>	NW>; SE>	NW<; SE<		
Eb: Egam SiCL, 0-3%					NW<
Ec: Ennis Cherty Loam, <3%					All aspects > & <
Ed: Ennis Fine Sandy Loam, Btmlnds					All aspects > & <
Ee: Ennis SiL, <3%					All aspects > & <
FrD: Fredonia Rock Outcrop Cmplx, 12-20%		NW>	NW<		
Ga: Greendale Cherty SiL, 2-5%		F>; NW>; SE>	NW<; SE<	F<	
Gb: Greendale-Lobelville Cherty SiL, nrly level		F>; NW>; SE>	NW<; SE<	F<	
Gc: Greendale SiL, 2-5%		NW>; SE>	NW<; SE<	F<	
Gd: Guin Gravelly Loam, 2-10%	F>; NW>; SE>		F<; NW<; SE<		
Ge: Guin Gravelly Loam, 35-45%	F>; SE>	NW>	F<; NW<; SE<		
HcD: Hagerstown-Fredonia SiL, 12-20%		NW>	NW<		
Hd: Hamblen Fine Sandy Loam					NW<; SE<
He: Humphreys Cherty SiL, 2-5%				F<; NW><; SE><	
Hf: Humphreys SiL, 2-5%				All aspects > & <	
Hg: Humphreys Very Fine Sandy Loam, 2-5%				All aspects > & <	
Hh: Huntington SiL, nearly level					NW<; SE<
Hm: Unknown and about 5 total acres			NW<		
HmB: Hammack SiL, 2-6%			F<; NW<; SE<		
HxC: Hammack-Baxter Complex, 6-12%		F>; NW>; SE>	F<; NW<; SE<		
HxC3: Hammack-Baxter Complex, 6-12%			NW<; SE<		
HxD: Hammack-Baxter Complex, 12-20%		F>; NW>; SE>	NW<; SE<	F<	

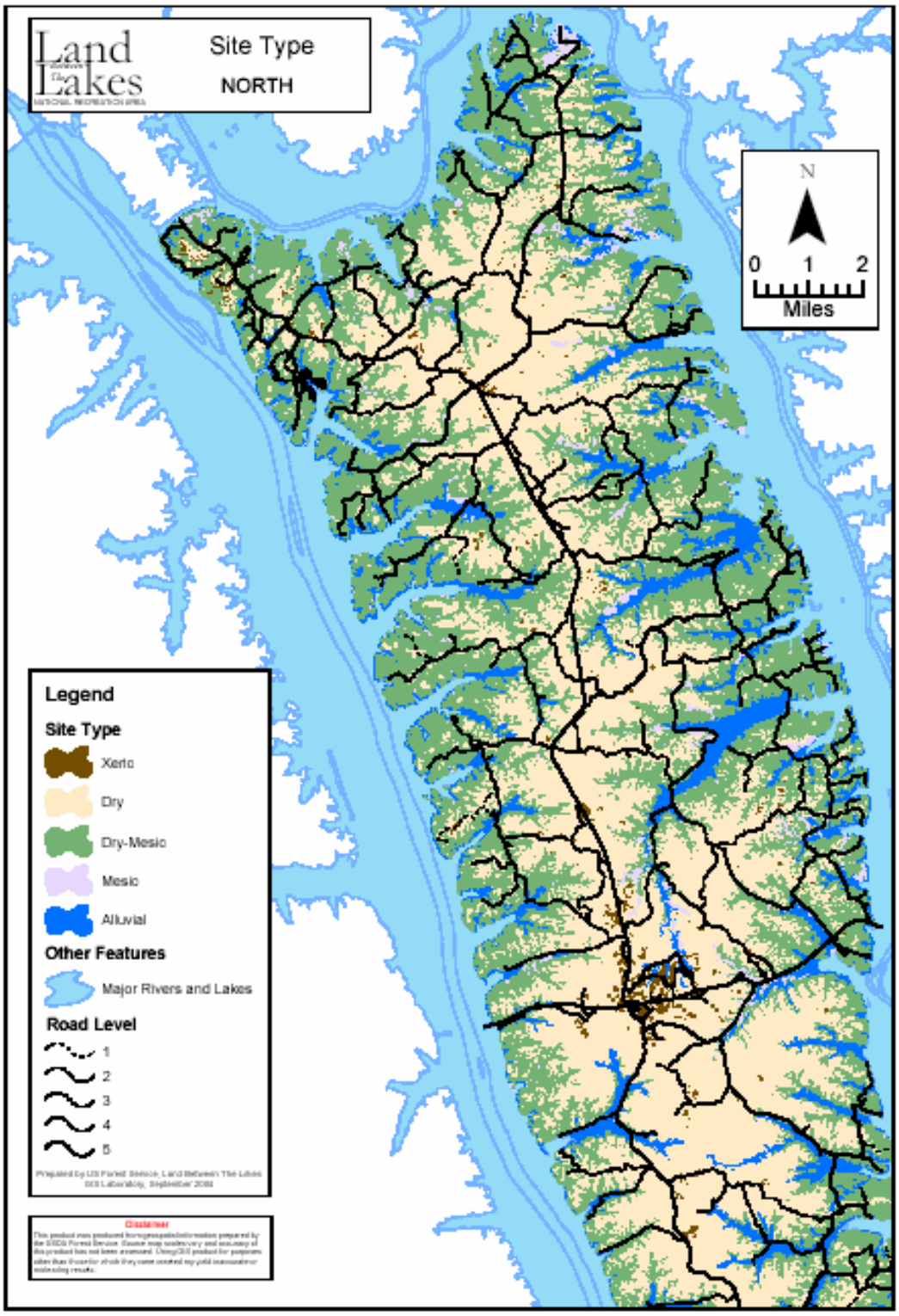
Table E1 (continued) Site Types for Kentucky and Tennessee soil types in LBL based on soil characteristics, elevation, aspect, and slope.					
	Site Types with Aspects (Flat, NW-SE, and SE-NW) and Elevations > and < 460'				
	Xeric	**Dry**	**Dry-Mesic**	**Mesic**	**Riparian**
Soil Type and Percent Slope	**F,NW,SE,>**	**F,NW,SE,>**	**F,NW,SE,<**	**F,NW,SE,>,<**	**F,NW,SE,>,<**
HxD3: Hammack-Baxter Complex, 12-20%		F>; NW>; SE>	NW<; SE<	F<	
La: Lawrence SiL, 0-2%		F>; NW>	NW<; SE<	F<	
Lb: Lax SiL, 5-12%	F>; SE>	NW>	F<; NW<; SE<		
LbB: Lax SiL, 2-6%	F>; NW>; SE>		NW<		
LbC: Lax SiL, 6-12%	F>; SE>	NW>	F<; NW<; SE<		
Lc: Lax SiL, 2-5%	F>; NW>; SE>		SE<		
LcC3: Lax SiCL, 6-12%	F>; SE>	NW>	F<; NW<; SE<		
Ld: Lax SiL, 5-12%	F>; SE>	NW>	F<; NW<; SE<		
Le: Lax SiCL, 5-12%	F>; SE>	NW>	NW<		
LeC: Lexington SiL, 6-12%		F>; NW>; SE>	F<; NW<; SE<		
LeC3: Lexington SiL, 6-12%		NW>; SE>	F<; NW<; SE<		
Lf: Lee, Bottomlands					F<; NW<; SE<
LfD: Lexington Complex, 12-20%		F>; NW>; SE>	F<; NW<; SE<		
Lg: Linside SiL, <3%					F<; NW<; SE<
Lh: Linside SiCL, Bottomlands					F<; NW<; SE<
Lk: Lobelville SiL, 0-2%					F<; NW<; SE<
Ln: Linside SiL					F >,<; NW>,<; SE>,<
M: Mines; pits; dumps		F>; NW>; SE>	NW<; SE<		
Ma: Melvin SiL					F<; NW<; SE<
Mb: Mountview SiL, 12-25%		NW>; SE>	F<; NW<; SE<		
Mc: Mountview SiL, 5-12%		NW>; SE>	NW<; SE<		
Me: Melvin SiL					F<; NW<; SE<
Mf: Mountview SiL, 5-12%		NW>; SE>	NW<; SE<		
Mh: Mountview SiL, 12-25%		NW>; SE>	F<; NW<; SE<		
Mk: Mountview SiCL, 5-12%		NW>; SE>	NW<; SE<		
Na:Nixa Cherty SiL, 12-25%		F>; NW>	F<; NW<; SE<		
Nb: Nixa Cherty SiL, 5-12%		NW>; SE>	NW<; SE<		

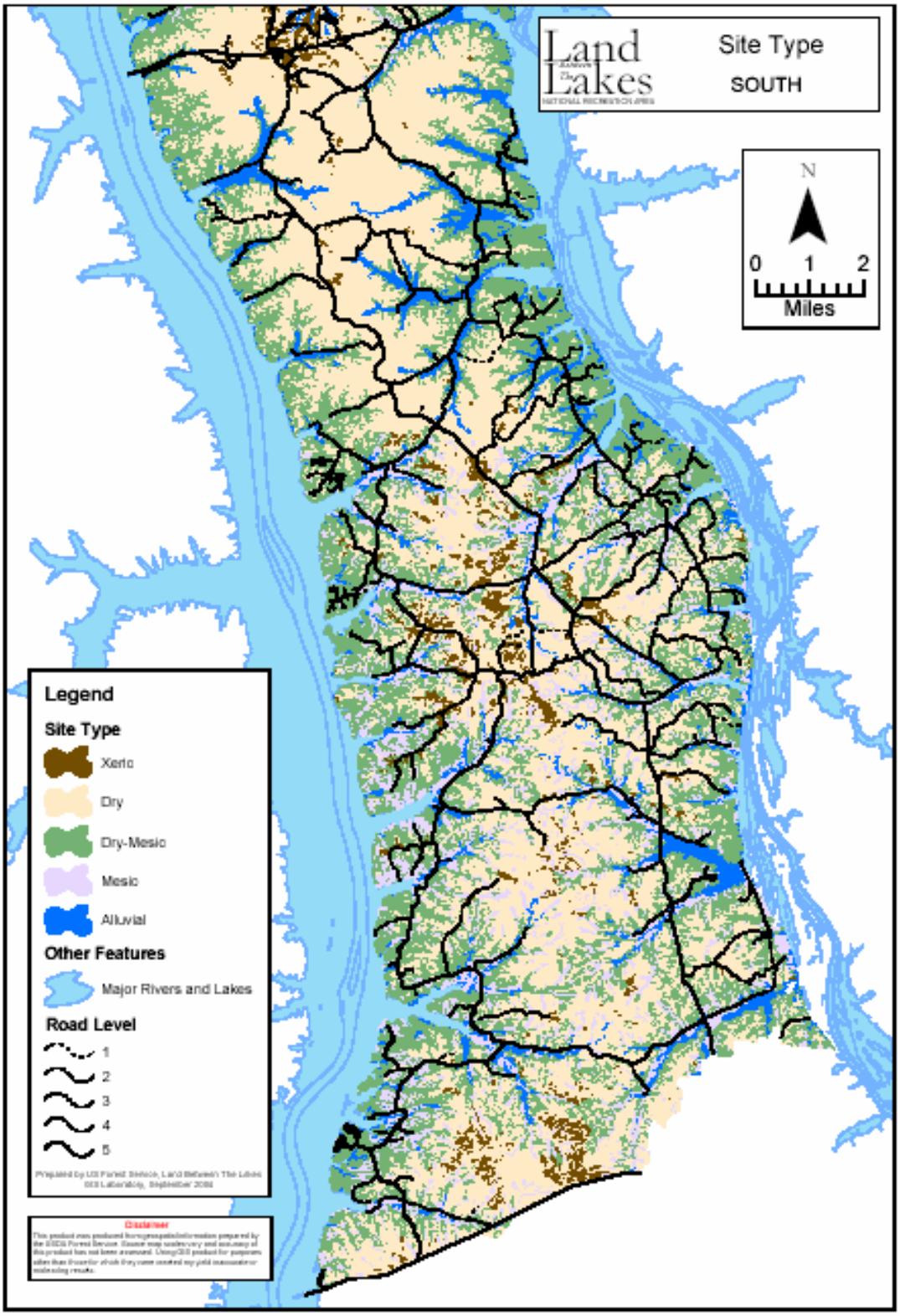
Table E1 (continued) Site Types for Kentucky and Tennessee soil types in LBL based on soil characteristics, elevation, aspect, and slope.					
	Site Types with Aspects (Flat, NW-SE, and SE-NW) and Elevations > and < 460'				
	Xeric	**Dry**	**Dry-Mesic**	**Mesic**	**Alluvial**
Soil Type and Percent Slope	**F,NW,SE,>**	**F,NW,SE,>**	**F,NW,SE,<**	**F,NW,SE,>,<**	**F,NW,SE,>,<**
Nc: Nixa Cherty SiL, 12-25%		F>; NW>; SE>	F<; NW<; SE<		
Nd:Nixa Cherty SiL, 5-12%		F>; NW>; SE>	F<; NW<; SE<		
Ne: Newark SiL					F<; NW>,<; SE<
Nf:Nixa Cherty SiCL, 5-12%		NW>; SE>	SE<		
NhB: Nicholson SiL, 2-6%		F>; NW>; SE>	F<; NW<; SE<		
NhC: Nicholson SiL, 6-12%		F>; NW>; SE>	F<; NW<; SE<		
NIC3: Nicholson SiCL, 6-12%		F>; NW>; SE>	F<; NW<; SE<		
No: Nolin SiL					F>,<; NW>,<; SE>,<
OO: Where Bear Ck. WL Refuge was atchd.					F<; NW<; SE<
OtB: Otwell SiL, 2-6%				All aspects > & <	
Pa: Paden SiL, 5-12%		F>; NW>; SE>	F<; NW<; SE<		
Pb:Paden SiL, 2-5%		F>; NW>; SE>	F<; NW<; SE<		
Pc:Paden SiL, 5-12%		NW>; SE>	F<; NW<; SE<		
Pd: Paden SiL, 2-5%		F>; NW>; SE>	F<; NW<; SE<		
Pe: Paden SiCL, 5-12%		F>; NW>; SE>	F<; NW<; SE<		
Pg: Pits and gravel		NW>; SE>	NW<; SE<		
Ph: Pickwick SiL		NW>; SE>	F<; NW<; SE<		
Pk:Pickwick SiL, <5%			F<; NW<; SE<		
Pl: Providence SiL, <5-12%	F>; SE>	NW>			
Pm:Providence SiCL, 5-12%	F>; SE>	NW>			
Ra: Robertsville Loam, <3%				F<; NW<; SE<	
Rb:Robertsville SiL, <3%				F<; NW<; SE<	
Rc:Rough gullied land, >12-25%		NW>; SE>	NW<; SE<		
Rd: Rough gullied land, 2-12%		NW>; SE>	NW<; SE<		
Re: Rough gullied land, > & < 12-25%	F>; SE>	NW>	NW<; SE<		
Rf: Rough stoney land (outcrops), >25 & 5-12%	NW>; SE>		NW<; SE<		
Rl: Ruston Fine SL, 12-25 & 25-40%	NW>; SE>				

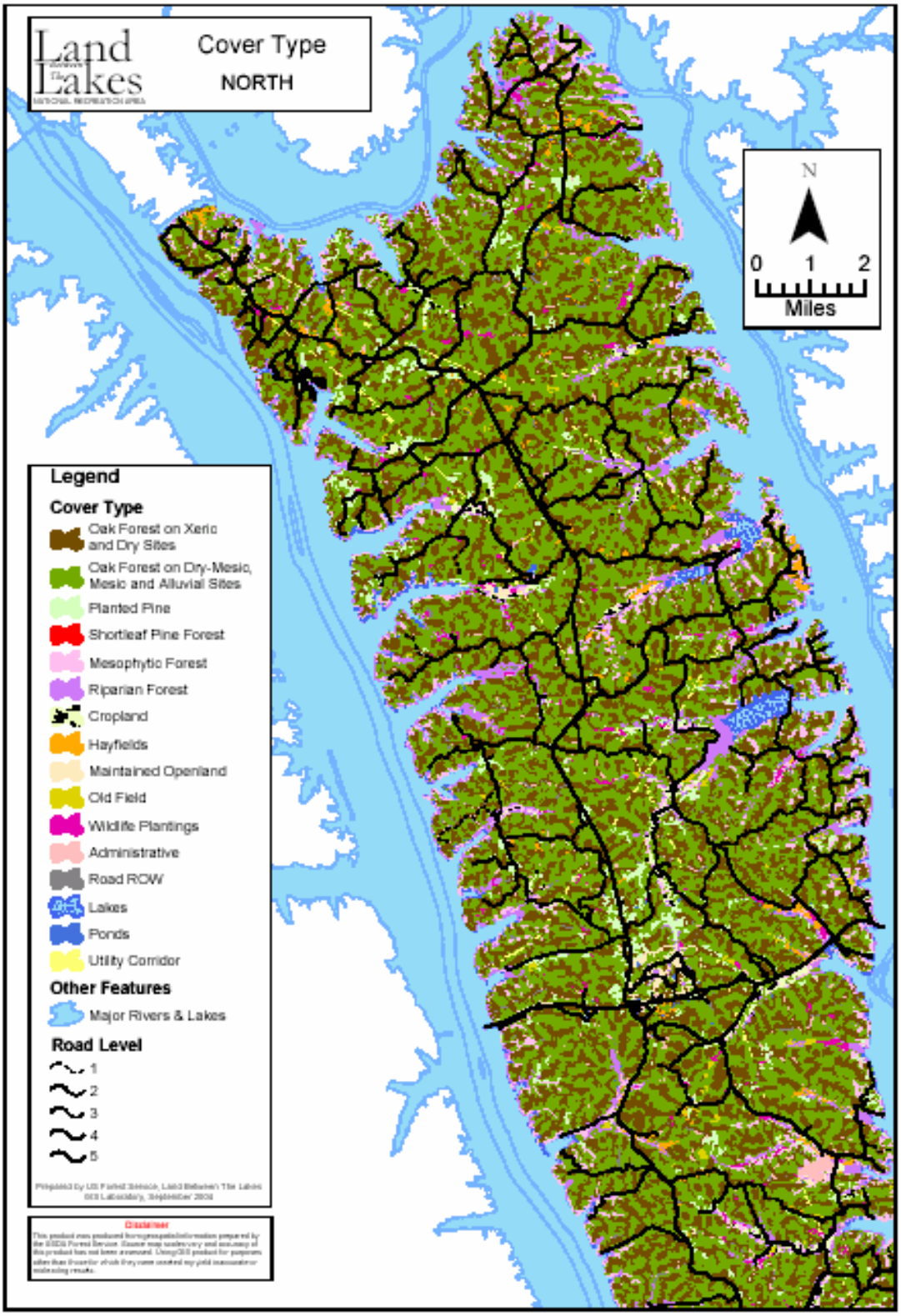
Table E1 (continued) Site Types for Kentucky and Tennessee soil types in LBL based on soil characteristics, elevation, aspect, and slope.					
	Site Types with Aspects (Flat, NW-SE, and SE-NW) and Elevations > and < 460'				
	Xeric	**Dry**	**Dry-Mesic**	**Mesic**	**Alluvial**
Soil Type and Percent Slope	**F,NW,SE,>**	**F,NW,SE,>**	**F,NW,SE,<**	**F,NW,SE,>,<**	**F,NW,SE,>,<**
Ro: Robertsville SiL				NW<	
Sa: Sango SiL, 0-3%	F>; NW>				
Sc: Sequatchie Fine SL, <5%				NW<	
Sd: Staser Fine SL, bottomlands					F<; NW<; SE<
SgC: Saffell SiL, 6-12%		F>; NW>; SE>	F<; NW<; SE<		
SgF: Saffell SiL, 20-60%	F>; SE>	NW>	F<; NW<; SE<		
Ta: Taft Loam				F<; NW>,<; SE>,<	
Tb: Taft SiL				F<; NW<; SE<	
TN_Me: Mountview SiL, 12-25%		F>; NW>; SE>	F<; NW<; SE<		
TN_Ne: Nixa Cherty SiL, 12-25%		F>; NW>; SE>	F<; NW<; SE<		
TN_Pg: Pickwick SiL, 12-25%		NW>; SE>	F<; NW<; SE<		
(W): Water					F<; NW<; SE<
Wa: Wolftever SiL,<3-5%				F<; NW>,<; SE>,<	
Wb: Wolftever SiCL, 5-12%				F<; NW<	

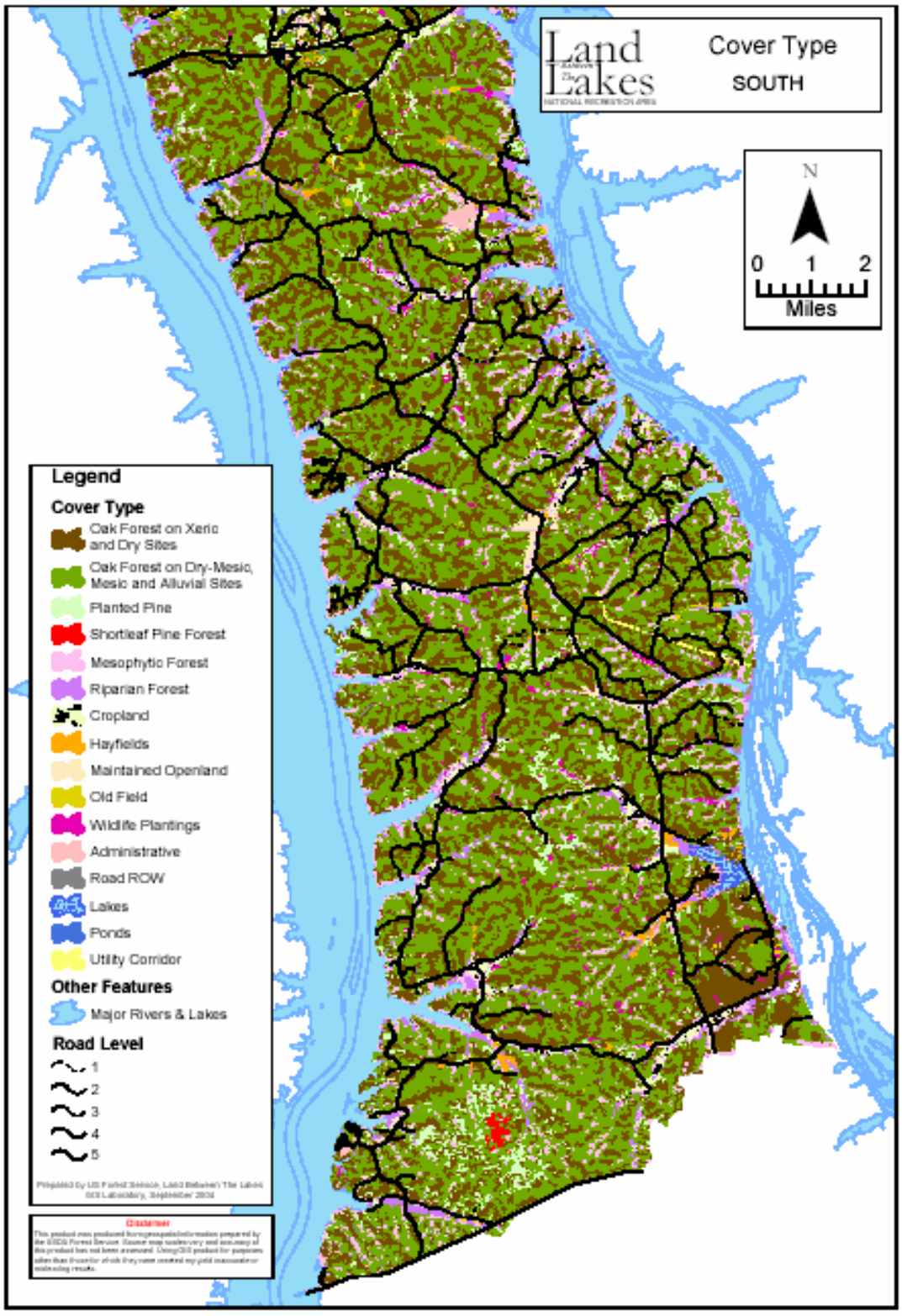
Note: Bold standard type for soils acronym represents those soils occurring in Kentucky and those in italics represent soils occurring in Tennessee. The aspects are abbreviated under each site type and start with the first acronym for the aspect going clockwise (i.e. Flat = F; NW-SE = NW; and SE-NW = SE). The elevations for each aspect greater than or less than 460 feet are abbreviated as > or <.

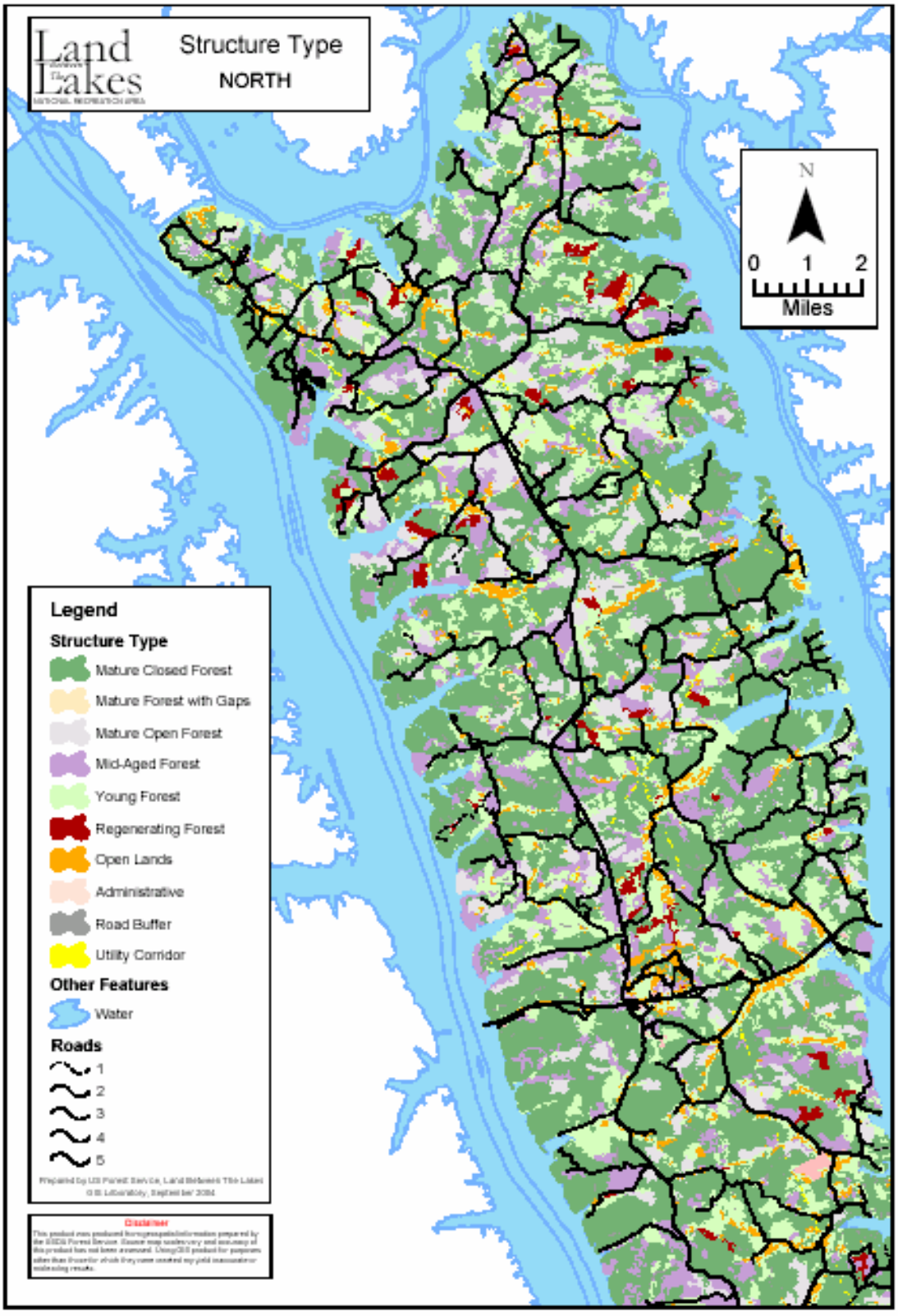
The site types were defined based on the analysis of soil characteristics, elevation, aspect, and slope. The elevations and aspects for some of the soil types in the analysis were not represented in the link between the soils and DEM. This link could occur on the ground based on the information about the soil types and their likely aspect and elevation. The definition for each site type is based on the data above and the likelihood of the soils occurring at elevations and on aspects not shown in this table. An example of this would be *TN Pg:* Pickwick SiL, 12-25 percent slope, the F> is currently not represented for the dry site type, however this is the most likely site type that that aspect and elevation would be shown if found to occur on LBL.


Land Between The Lakes
Site Type
NORTH
N
0 1 2
Miles
Legend
Site Type
Xeric
Dry
Dry-Mesic
Mesic
Alluvial
Other Features
Major Rivers and Lakes
Road Level
1
2
3
4
5


Land Between The Lakes
Site Type
SOUTH
N
0 1 2
Miles
Legend
Site Type
Xeric
Dry
Dry-Mesic
Mesic
Alluvial
Other Features
Major Rivers and Lakes
Road Level
1
2
3
4
5


Land Between The Lakes
Cover Type
NORTH
N
0 1 2
Miles
Legend
Cover Type
Oak Forest on Xeric and Dry Sites
Oak Forest on Dry-Mesic, Mesic and Alluvial Sites
Planted Pine
Shortleaf Pine Forest
Mesophytic Forest
Riparian Forest
Cropland
Hayfields
Maintained Openland
Old Field
Wildlife Plantings
Administrative
Road ROW
Lakes
Ponds
Utility Corridor
Other Features
Major Rivers & Lakes
Road Level
1
2
3
4
5


Land Between The Lakes
Cover Type
SOUTH
N
0 1 2
Miles
Legend
Cover Type
Oak Forest on Xeric and Dry Sites
Oak Forest on Dry-Mesic, Mesic and Alluvial Sites
Planted Pine
Shortleaf Pine Forest
Mesophytic Forest
Riparian Forest
Cropland
Hayfields
Maintained Openland
Old Field
Wildlife Plantings
Administrative
Road ROW
Lakes
Ponds
Utility Corridor
Other Features
Major Rivers & Lakes
Road Level
1
2
3
4
5


Land Between The Lakes
Structure Type
NORTH
N
0 1 2
Miles
Legend
Structure Type
Mature Closed Forest
Mature Forest with Gaps
Mature Open Forest
Mid-Aged Forest
Young Forest
Regenerating Forest
Open Lands
Administrative
Road Buffer
Utility Corridor
Other Features
Water
Roads
1
2
3
4
5

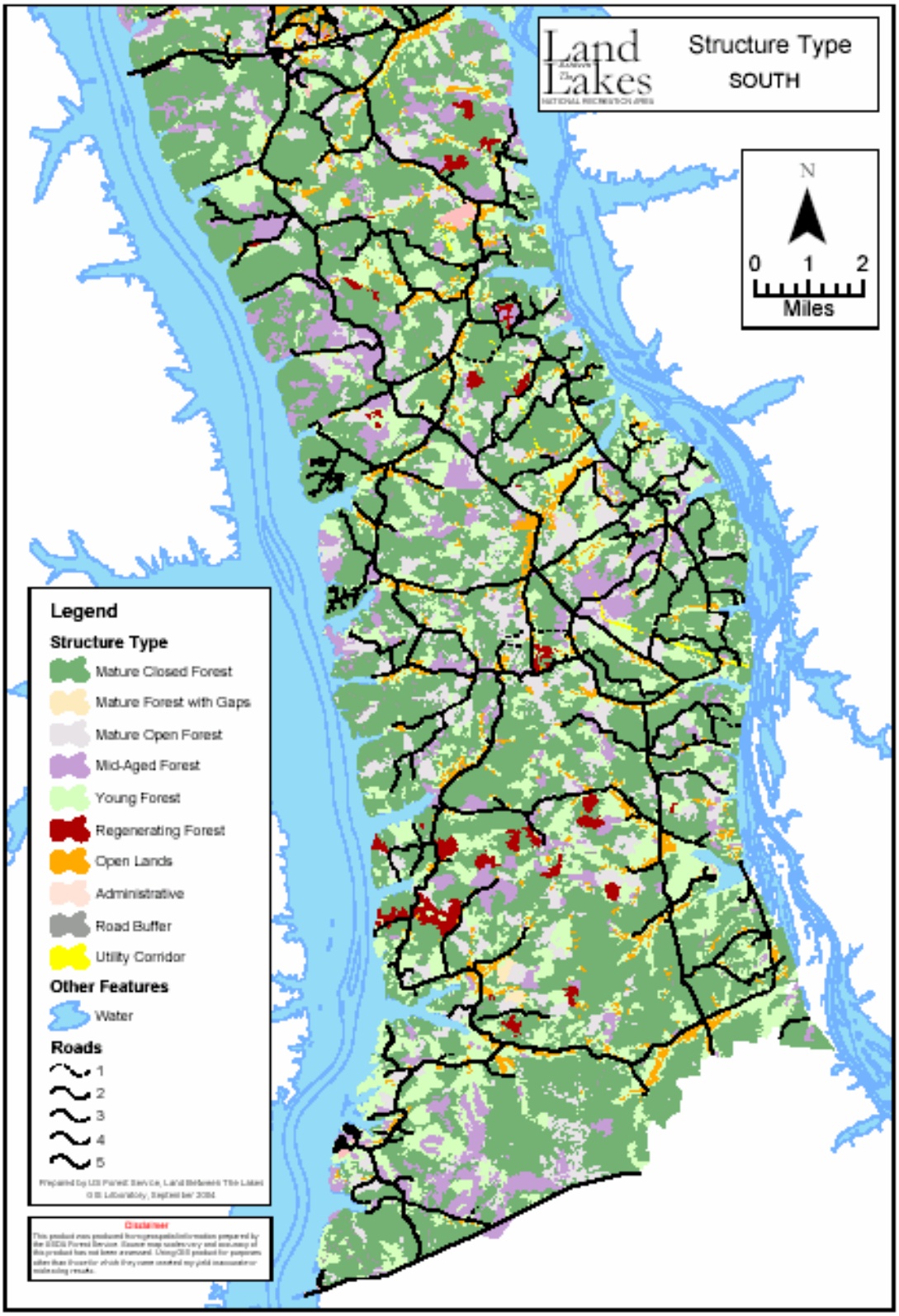

Land Between The Lakes
Structure Type
SOUTH
N
0 1 2
Miles
Legend
Structure Type
Mature Closed Forest
Mature Forest with Gaps
Mature Open Forest
Mid-Aged Forest
Young Forest
Regenerating Forest
Open Lands
Administrative
Road Buffer
Utility Corridor
Other Features
Water
Roads
1
2
3
4
5

Table E2. - Comparison of current conditions with a landscape composition deemed optimal for sustaining a diversity of plant and animal communities and viability of associated species.

Cover Type/Condition	Current		Optimal		Acreage Difference	Current % of Optimal
	Acres	%	Acres	%		
Oak Forest on Xeric and Dry Sites	73,327	0.4	74,506	43.5%	(1,179)	98.4%
Mature Closed	43,618	25.5%	2,334	1.4%	41,284	1868.8%
Mature Open	10,059	5.9%	25,537	14.9%	(15,477)	39.4%
Mature Woodland	0	0.0%	30,420	17.8%	(30,420)	0.0%
Mature With Gaps	55	0.0%	796	0.5%	(741)	6.9%
Mid-aged	7,678	4.5%	7,710	4.5%	(32)	99.6%
Young	10,721	6.3%	5,140	3.0%	5,581	208.6%
Regenerating	1,196	0.7%	2,570	1.5%	(1,374)	46.5%
Oak Forest on Dry-Mesic, Mesic, and Alluvial Sites	67,471	39.4%	62,423	36.5%	5,047	108.1%
Mature Closed	40,878	23.9%	6,658	3.9%	34,219	613.9%
Mature Open	5,787	3.4%	32,582	19.0%	(26,795)	17.8%
Mature Woodland	0	0.0%	0	0.0%	0	100%
Mature With Gaps	65	0.0%	3,018	1.8%	(2,954)	2.1%
Mid-aged	6,076	3.5%	10,082	5.9%	(4,007)	60.3%
Young	13,417	7.8%	6,722	3.9%	6,695	199.6%
Regenerating	1,249	0.7%	3,361	2.0%	(2,112)	37.2%
Mesophytic Forest	6,580	3.8%	17,069	10.0%	(10,489)	38.6%
Mature Closed	3,781	2.2%	2,793	1.6%	988	135.4%
Mature Open	306	0.2%	0	0.0%	306	>100%
Mature Woodland	0	0.0%	0	0.0%	0	100%
Mature With Gaps	0	0.0%	13,656	8.0%	(13,656)	0.0%
Mid-aged	458	0.3%	310	0.2%	147	147.5%
Young	1,971	1.2%	207	0.1%	1,764	952.6%
Regenerating	65	0.0%	103	0.1%	(39)	62.7%
Riparian Forest	5,515	3.2%	5,132	3.0%	383	107.5%
Mature Closed	1,913	1.1%	1,437	0.8%	476	133.1%
Mature Open	97	0.1%	0	0.0%	97	>100%
Mature Woodland	0	0.0%	0	0.0%	0	100%
Mature With Gaps	0	0.0%	3,079	1.8%	(3,079)	0.0%
Mid-aged	604	0.4%	308	0.2%	296	196.2%
Young	2,875	1.7%	205	0.1%	2,670	1400.6%
Regenerating	26	0.0%	103	0.1%	(77)	24.9%
Shortleaf Pine Forest	130	0.1%	1,637	1.0%	(1,507)	7.9%
Mature Closed	128	0.1%	0	0.0%	128	100%
Mature Open	2	0.0%	906	0.5%	(905)	0.2%
Mature Woodland	0	0.0%	368	0.2%	(368)	0.0%
Mature With Gaps	0	0.0%	0	0.0%	0	100%
Mid-aged	0	0.0%	181	0.1%	(181)	0.1%
Young	0	0.0%	121	0.1%	(121)	0.0%
Regenerating	0	0.0%	60	0.0%	(60)	0.0%
Planted Pine Forest	4,236	2.5%	0	0.0%	4,236	>100%

Table E2. - (Continued) Comparison of current conditions with a landscape composition deemed optimal for sustaining a diversity of plant and animal communities and viability of associated species.

Cover Type/Condition	Current			Optimal		Acreage Difference	Current % of Optimal
	Acres	%		Acres	%		
Grasslands	6,522	3.8%		8,563	5.0%	(2,040)	76.2%
Xeric	264	0.2%		168	0.1%	96	157.3%
Dry	2,312	1.4%		3,840	2.2%	(1,527)	60.2%
Dry-Mesic	2,205	1.3%		3,464	2.0%	(1,260)	63.6%
Mesic	576	0.3%		449	0.3%	126	128.1%
Alluvial	1,165	0.7%		641	0.4%	524	181.7%
Cultivated	4,124	2.4%		0	0.0%	4,124	>100%
Water	952	0.6%		1,924	1.1%	(973)	49.5%
Administrative	2,396	1.4%		0	0.0%	2,396	>100%
Total	171,254	100.0%		171,254	100.0%		

By looking at the Acreage Difference column, one can see at a glance which habitat conditions are in relatively short supply. Red numbers in parentheses indicate deficit habitat conditions.

Table E3. - Habitat Associations by Species of Viability Concern. **Bolded** = Federally listed; *Italics* = Regional Forester's Sensitive; and * = Bird of Conservation Concern.			
Scientific Name	**Common Name**	**Taxa**	**Habitat Associations[1]**
Aesculus pavia	Red buckeye	Plant	9
Agalinis obtusifolia	Ten-lobe false foxglove	Plant	3
Apios priceana	**Price's potato bean**	Plant	2 and 6
Aristida ramosissima	Branched three-awn grass	Plant	4
Armoracia lacustris	Lakecress	Plant	23 and 24
Asclepias purpurascens	Purple Milkweed	Plant	4
Aster concolor	Eastern silvery aster	Plant	4
Aster drummondii var. texanus	Texas aster	Plant	2
Aster (Eurybia) hemisphericus	Southern prairie aster	Plant	3
Aureolaria patula	*Spreading yellow false foxglove*	Plant	3 and 6
Baptisia bracteata var. leucophaea	Cream wild indigo	Plant	3 and 4
Carex comosa	Bristly sedge	Plant	24
Carex lacustris	Lake-bank sedge	Plant	23 and 24
Carex reniformis	Reniform sedge	Plant	12; 21; and 24
Castanea dentate	American chestnut	Plant	1
Cimicifuga rubifolia	*Appalachian bugbane*	Plant	6; 7; and 9
Dalea candida	White prairie clover	Plant	4
Echinacea pallida	Pale-purple coneflower	Plant	6
Eleocharis intermedia	Matted spike-rush	Plant	23 and 24
Glandularia canadensis	Rose mock vervain	Plant	4; 6; and 7
Gymnopogon ambiguous	Bearded Skeletongrass	Plant	6
Halesia tetraptera	Mountain silver-bell	Plant	9
Hedeoma hispida	Rough pennyroyal	Plant	6 and 7
Heteranthera dubia	Grassleaf mud-plantain	Plant	19; 23; and 24
Heteranthera limosa	Blue mud-plantain	Plant	19; 23; and 24
Hieracium longipilum	Hairy hawkweed	Plant	4
Hottonia inflate	Featherfoil	Plant	23 and 24
Iris brevicaulis	Lamance iris	Plant	12 and 24
Juglans cinerea	*Butternut*	Plant	9
Lesquerella lescurii	Lescur's bladder-pod	Plant	21
Lilium michiganense	Michigan lily	Plant	11
Lilium superbum	Turk's cap lily	Plant	11
Liparis loeselli	Fen orchis	Plant	9; 20; and 24
Lysimachia fraseri	*Fraser's yellow loosestrife*	Plant	2;13; and 21
Malus angustifolia	Southern crabapple	Plant	2
Matelea carolinensis	Carolina anglepod	Plant	3
Muhlenbergia glabrifloris	Hair grass	Plant	4

Table E3. - (Continued)			
Scientific Name	**Common Name**	**Taxa**	**Habitat Associations[1]**
Najas gracillima	Thread-like naiad	Plant	19; 23; and 24
Nemophila aphylla	Baby blue eyes	Plant	9
Oldenlandia uniflora	Clustered bluets	Plant	23 and 24
Paspalum boscianum	Bull-grass	Plant	21
Phacelia ranunculacea	*Ocean-blue phacelia*	Plant	10
Philadelphus inodorus	Mock orange	Plant	6 and 7
Phlox pilosa ssp. Ozarkana	Ozark downy phlox	Plant	3 and 4
Polytaenia nuttallii	Prairie parsley	Plant	4
Populus grandidentata	Big-tooth aspen	Plant	3 and 11
Prenanthes barbata	*Barbed rattlesnake- root*	Plant	3 and 4
Prenanthes crepidinea	Nodding rattlesnake-root	Plant	7 and 11
Ptilimnium capillaceum	Mock Bishop's weed	Plant	23 and 24
Ptilimnium nuttallii	Nuttall's Mock (Bishop's weed)	Plant	23
Pycnanthemum albescens	Whiteleaf mountainmint	Plant	3
Ranunculus flabellaris	Yellow watercrowfoot	Plant	24
Sagittaria brevirostra	Short-beaked arrowhead	Plant	23 and 24
Sagittaria graminea	Grassleaf arrowhead	Plant	23
Sagittaria platyphylla	Delta or Ovate-leaved arrowhead	Plant	24
Salvia azurea var grandiflora	Blue sage	Plant	4
Scleria ciliata var. ciliate	Fringed nutrush	Plant	3
Silphium pinnatifidum	Prairie-dock	Plant	4
Solidago buckleyi	Buckley's goldenrod	Plant	3
Stellaria longifolia	Longleaf stitchwort	Plant	13 and 21
Synosma (Hasteola) sauveolens	*Sweet-scented or Indian plantain*	Plant	13 and 23
Trepocarpus aethusae	Trepocarpus	Plant	13
Trifolium reflexum	Buffalo clover	Plant	3 and 4
Ulmus serotina	September elm	Plant	7 and 9
Zanthoxylum americanum	American prickly ash	Plant	1
Haliaeetus leucocephalus	**Bald eagle**	Bird	17; 22; and 26
Sterna antillarum athalassos	**Interior least tern**	Bird	22
Accipiter striatus	Sharp-shinned hawk	Bird	2; 5; and 8
Ammodramus henslowii	Henslow's sparrow*	Bird	21
Caprimulgus vociferous	Whip-poor-will*	Bird	5; 8; 11; and 13
Colinus virginianus	Northern bobwhite quail	Bird	4
Dendroica cerulean	Cerulean warbler*	Bird	8; 11; and 13
Dendroica discolor	Prairie warbler*	Bird	4 and 14

Table E3. - (Continued)

Scientific Name	Common Name	Taxa	Habitat Associations[1]
Egretta caerulea	Little blue heron	Bird	19; 24; 25; and 26
Helmitheros vermivorus	Worm-eating warbler*	Bird	8 and 10
Hylocichla mustelina	Wood thrush*	Bird	8; 10; and 11
Limnothlypis swainsonii	Swainson's warbler*	Bird	8; 13; and 15
Melanerpes erythrocephalus	Red-headed woodpecker*	Bird	2 and 17
Nycticorax nycticorax	Black-crowned night heron	Bird	13; 22; 24; and 25
Pandion haliaetus	Osprey	Bird	17; 22; and 26
Seiurus motacilla	Louisiana waterthrush*	Bird	8; 12; and 25
Thryomanes bewickii	Bewick's wren*	Bird	2; 14; and 17
Tyto alba	Barn owl	Bird	4; 16; and 21
Vermivora pinus	Blue-winged warbler*	Bird	14
Myotis grisescens	**Gray bat**	Mammal	13; 22; and 24
Myotis sodalis	**Indiana bat**	Mammal	2; 13; 16; 17; and 24
Myotis austroriparius	*Southeastern myotis bat*	Mammal	13; 16; 22; and 24
Plecotus rafinesquii	*Rafinesque's big-eared bat*	Mammal	2; 13; and 16
Nycticeius humeralis	Evening bat	Mammal	2; 3; 13; and 17
Microsorex hoyi	Pigmy shrew	Mammal	9 and 21
Hyla gratiosa	Barking treefrog	Herp	13; 21; and 24
Eumeces inexpectatus	Southeastern five-lined skink	Herp	4 and 18
Eumeces anthracinus	Coal skink	Herp	9 and 18
Lampropeltis triangulum elapsoides	Scarlet kingsnake	Herp	1 and 18
Macrochelys temminckii	Alligator snapping turtle	Herp	26
Pituophis melanoleucus melanoleucus	Northern pine snake	Herp	3; 4; 5; and 14
Thamnophis sauritus sauritus	Eastern ribbon snake	Herp	12 and 21
Sistrurus miliarius streckeri	Western pigmy rattlesnake	Herp	13; 21; 22; and 24
Erimystax insignis	Blotched chub	Fish	25
Forbesichthys agassizi	Spring cavefish	Fish	20
Noturus exilis	Slender madtom	Fish	25

[1]Habitat Associations: The habitat associations for each species in Table E3 are numbered below and correspond to the number in this column.

(1) Upland Forest Associates
(2) Forest Opening Associates
(3) Xeric and Dry Open Forest Associates
(4) Xeric and Dry Grassland and Woodland Associates
(5) Pine Forest Associates
(6) Calcareous Cliffs and Talus Associates
(7) Limestone Soil Associates
(8) Interior Forest Associates
(9) Mesic Forest Associates
(10) Mesic Closed Canopy Forest Associates
(11) Mesic Forest Opening Associates
(12) Riparian Forest Associates
(13) Riparian Forest Opening Associates
(14) Regenerating Forest Associates
(15) Canebrake Associates
(16) Den Tree Associates
(17) Snag Associates
(18) Downed Wood Associates
(19) Mudflat Associates
(20) Springs and Seeps Associates
(21) Wet Grassland Associates
(22) Lakeshores Associates
(23) Rocky Shores and Bars Associates
(24) Ponds and Marshes Associates
(25) Streams Associates
(26) Lakes (Water) Associates

Appendix F

MANAGEMENT INDICATOR SPECIES

Management Indicator Species Selection Process Record
Land Between The Lakes National Recreation Area
Plan Revision

Introduction

National Forest Management Act regulations, adopted in 1982, require selection of management indicator species (MIS) during development of forest plans (36 CFR 219.19(a)). Reasons for their selection must be stated. This document describes the process and rationale used to select MIS for the revised Land and Resource Management Plan for the Land Between The Lakes National Recreation Area.

Management Indicator Species (MIS) are to be selected "because their population changes are believed to indicate the effects of management activities" (36 CFR 219 (a)(1)). They are to be used during planning to help compare effects of alternatives (36 CFR 219.19(a) (2)), and as a focus for monitoring (36 CFR 219.19(a)(6)). Where appropriate, MIS shall represent the following groups of species (36 CFR 219 (a)(1)):

1. Threatened and endangered species on State and Federal lists,
2. Species with special habitat needs,
3. Species commonly hunted, fished, or trapped,
4. Non-game species of special interest, and
5. Species selected to indicate effects on other species of selected major biological communities.

Since adoption of these regulations, the management indicator species concept has been reviewed and critiqued by the scientific community (Caro and O'Doherty, 1999, Simberloff, 1998; Noss 1990; Landres *et. al.* 1988; and Weaver, 1995). These reviews identify proper uses and limitations of the indicator species concept. They generally caution against overreaching in use of indicator species, especially when making inferences about ecological conditions or status of other species within a community. Caution is needed because many different factors may affect populations of each species within a community, and each species' ecological niche within a community is unique.

To reflect this current scientific understanding while meeting the letter and spirit of regulations, we have made great effort to clearly define the legitimate uses and limitations of each selected MIS. The MIS process is but one tool used to develop management strategies and monitoring programs designed to meet NFMA requirements related to diversity of plant and animal communities. Other elements used for comprehensive planning for plant and animal diversity include: objectives and standards

for maintenance and restoration of desired ecological conditions based on knowledge of overall ecosystem structure and function; biological evaluations and assessments at both the forest plan and site-specific project levels; and evaluation of risk to species of viability concern at the forest plan level. Other elements important to monitoring effects of plan implementation on plant and animal diversity include, where appropriate, monitoring of key ecological conditions, levels of management activities important to restoration and maintenance of community diversity, species assemblages (birds, bats, fish, etc.), harvest levels of game and other demand species, and populations and/or habitats of threatened, endangered, and sensitive species.

The Selection Process

Consideration of MIS for the revised Area Plan started with the current list of MIS (Table F1) and the most recent results of population monitoring and evaluation. The Tennessee Valley Authority (TVA) 1994 Natural Resources Management Plan (NRMP) FEIS assessed the impacts for six "Evaluation Species" similar to Forest Service MIS using a Habitat Suitability Index simulation model. A system for evaluating management alternatives (SEMA) was developed for evaluating resource management alternatives in LBL for short-term (10 years) and long-term (100 years) effects. Through SEMA projections were made for forest and open lands habitat types (habitat units). The habitat units were used to indicate the trend of change in average quality and quantity of wildlife habitat. Although not necessarily specific to habitat units, inventories and monitoring relevant to the Evaluation Species of LBL include annual breeding bird surveys, annual mast crop surveys of oak species for the gray squirrel and Eastern wild turkey, and annual hunter harvest records for the Eastern wild turkey. The breeding bird surveys have been conducted in LBL for the past 11 years and trend information is currently in the process of being analyzed. Information from the mast crop surveys is incorporated into the number of permits granted in LBL for the Eastern wild turkey and white-tailed deer quota hunts.

We also reviewed region-wide lists of MIS and coordinated with the Regional Biologist to identify opportunities for use of common MIS for common purposes. Additional species were considered under each of the five categories of potential MIS identified at 36 CFR 219.19(a)(1). All species considered were assessed using the following criteria to determine their appropriateness as MIS:

1. Changes in the species' population should primarily reflect the effects of national forest management activities, and
2. Population trends of the species must be capable of being effectively and efficiently monitored and evaluated.

Table F1. Management Indicator (Evaluation) Species selected for use in the current forest (TVA NRMP) and primary reason(s) for their original selection, .		
Common Name	Scientific Name	Primary reason(s) for original selection
Eastern Meadowlark	*Sternella magna*	Open lands
Northern Bobwhite Quail	*Colinus virginianus*	Openland/Young Growth
Brown Trasher	*Toxostoma rufum*	Openland/Young Growth
Eastern Wild Turkey	*Meleagris gallopavo*	Openland/Mature Forest
Gray Squirrel	*Sciurus carolinensis*	Mature Forest
Pileated Woodpecker	*Dryocopus pileatus*	Mature Forest/Old-age Forest

Before examining appropriateness of individual species as MIS, some general observations about the appropriateness of some species groups can be made.

Migratory Birds - Many migratory bird species have served as MIS during the first round of forest plans. They have been retained and even highlighted as MIS in some recent plan revisions and amendments in the Southern Region. Their emphasis in MIS selection results from characteristics that make them desirable MIS: (1) Many are very specific in their habitat relationships, being tied very closely to specific vegetation composition or structure, (2) many are common and widespread in suitable habitats facilitating monitoring of population responses, (3) they are monitored relatively effectively using standardized protocols that are currently in use on all national forests, and (4) relatively good information is available on regional and range-wide population trends, which can be used to put national forest data into context. Yet one can reasonably argue that they are not appropriate MIS because their migratory habits result in them spending a significant portion of their lives off of national forest land where they may be subject to many other factors that may affect their population trends. Consideration of migratory birds for MIS selection must include a balanced view of these positive and negative characteristics. Where other species are available and more appropriate for meeting the identified purpose, they should be selected over migratory birds. Where migratory birds are the best species available, they may be selected if limitations to, and strategies for, population monitoring and evaluation are clearly considered.

In general, some opportunity exists to isolate national forest effects from other effects by comparing national forest trends with those occurring at broader scales. Stable or increasing trends observed on national forests while broader trends are decreasing would indicate positive effects of national forest management, and vice versa. Similar trends documented at national forest and broader scales, regardless of their direction, would suggest broader scale factors are prevalent. Additional limitations on monitoring bird trends have been previously documented (Gaines and Morris, 1996; Linder and Buehler, 2002). At current levels of funding, it is not feasible to monitor enough bird points to document trends at an individual national forest scale with high levels of statistical precision. Current strategies are designed to document trends across national forests at eco-regional scales. While not ideal, this approach will still allow assessment of national forest management effects, especially where such management is similar across forests within an eco-region, as is the case in the Southern Appalachians and Piedmont. In addition, other methods of analyzing data, such as looking at habitat associations, and frequency of occurrence within indicated habitats, can shed light on a species' response

to management actions on a more local scale. We believe this meets the intent of regulations that MIS be used to indicate the effects of management on wildlife resources.

Herps - Most amphibians and reptiles do not meet the criteria of appropriate MIS because they often require a sampling effort beyond our current capability. Amphibians can be particularly difficult to monitor due to the high sampling variability (Hyde and Simons, 2001). Our inability to count them with precision makes inferences on relationships between population trends and habitat changes unreliable and difficult. The Forest Service is working closely with cooperators to improve, develop, and standardize survey protocols for both amphibians and reptiles so that effective monitoring programs can be established and expanded. However, at this point, inherent limitations to monitoring this group make them generally ineffective as MIS.

Plants - Plants can serve as effective indicators of specific habitats and conditions. Many are well-documented for their responsiveness to forest management activities, both positive and negative. Species that are fire-dependent, or highly associated with specific successional stages, can be particularly effective as MIS. Plants are often capable of being effectively monitored due to their immobility. The monitoring precision necessary varies with purpose of the MIS selection, but in many cases high precision is not needed to show population response to management activities. However, often, monitoring of overall plant community composition provides better information on management effects than does focus on one or a few species.

Terrestrial Invertebrates - Terrestrial invertebrates are generally deemed inappropriate as MIS because monitoring protocols are not well developed for most species, and little is known of their habitat relationships. Their populations also tend to fluctuate widely due to unknown factors.

The remainder of this appendix documents consideration of the appropriateness of species as MIS by category as listed at 36 CFR 219 (a)(1).

1. Threatened and Endangered Species

Species within this category are identified as threatened or endangered on state or federal lists. They are selected to focus attention on species with viability concerns whose population levels are directly tied to effects of national forest management. These species already receive attention during planning and monitoring by virtue of their status under the Endangered Species Act, Forest Service sensitive species policy, and NFMA viability regulations. Therefore, designation of species from this category for coverage by MIS requirements is in many ways redundant. Our consideration of MIS status for species within this category was focused on identifying those species whose population trends and continued existence are especially dependent on national forest management activities.

Price's Potato Bean (*Apios priceana*): *Selected*

1. Easy to monitor and there is a need to monitor this species anyway.
2. Populations will be effected by our management especially based on LRMP Program Emphasis goals and objectives to improve habitat conditions for an increase in populations and potentially establish new occurrences thru propagation efforts.
3. Helps in the recovery of the species and is a T&E.

Bald Eagle (*Haliaeetus leucocephalus*): *Not selected*

1. Populations of this species are effected by other things than our management but we will continue to monitor nesting (the flight surveys and nest success) and protect the species anyway.

Least Tern (*Sterna antillarum*): *Not selected*

1. This species has a very irregular occurrence in the LBL area and primary breeding habitat is outside our control.

Gray bat (*Myotis grisescens*): *Not selected*

1. There are no roosting caves on LBL, and individuals are wide ranging and populations are affected by more things than our management.

Indiana bat (*Myotis sodalis*): *Not selected*

1. This species has not been documented from LBL and the same reason as above for gray bat.

Regional Forester's Sensitive Species (RFS):

Table F2. Regional Forester's Sensitive species for management considerations in LBL NRA

RFS Group	Scientific Name	Common Name	Global Rank
Mammal	*Corynorhinus rafinesquii*	Rafinesque's big-eared bat	G3G4
Mammal	*Myotis austroriparius*	Southeastern myotis	G3G4
Vascular Plant	*Aureolaria patula*	Spreading yellow false foxglove	G2G3
Vascular Plant	*Cimicifuga rubifolia*	Appalachian bugbane	G3
Vascular Plant	*Hasteola suaveolens*	False Indian-plantain	G3
Vascular Plant	*Juglans cinerea*	Butternut	G3G4
Vascular Plant	*Lysimachia fraseri*	Fraser's yellow loosestrife	G2
Vascular Plant	*Phacelia ranunculacea*	Oceanblue phacelia	G3G4
Vascular Plant	*Prenanthes barbata*	Bearded Rattlesnake	G2

Global Rank - Estimate of element abundance on a global scale: **G1 =** Extremely rare; **G2 =** Rare; **G3 =** Uncommon; **G4 =** Common; **G5 =** Very Common; Subspecies and variety abundances are coded with a 'T' suffix; the 'G? portion of the rank refers to the entire species.

Sensitive Mammal Species –

- The two mammal RFS species were not selected because they are wide ranging and their population changes will not clearly reflect the management effects in LBL.

Sensitive Plant Species -

- The seven plant RFS species were not selected because knowledge of their ecology is not well documented for LBL to be able to identify them as an MIS. However we will continue to monitor their population status on LBL.

2. Species with Special Habitat Needs

Species under this group are closely dependent on special habitat elements that may be affected by national forest management. They are considered for selection because they may help us document the effects of management on these special habitat elements.

Snags in Forested Situations

To help indicate the effects of management on the availability of *Forests with a desired abundance of Snags,* the **pileated woodpecker** (*Dryocopus pileatus*) is selected as an MIS. This species requires large snags for nesting and feeding. The occurrence of this species may be correlated with forested habitats containing abundant large dead trees and fallen logs (Hamel, 1992), which also are used by other woodpeckers, owls, and numerous other birds, mammals, and amphibians.

Pileated woodpeckers were probably common in Tennessee prior to the nineteenth-century agricultural clearing and timber harvesting. Their numbers decreased as the area of mature and old growth forests, most of the virgin forest had been cut, and many second-growth woodlands had not matured enough to provide suitable habitat. By the early twentieth century, many ornithologists became concerned about decreasing Pileated woodpecker numbers fearing they would be unable to adapt to second-growth forests. This species has survived and adapted to second-growth forests (Nicholson, 1997).

The use of the pileated woodpecker as an indicator is limited by its wide-ranging habits, which causes it to be documented in forest types that are not particularly suitable. It also occurs at relatively low densities, reducing the number of data points available for trend estimates. Local analysis would therefore be limited; analysis in regional trends across national forests would provide more analytical power. Population monitoring would be combined with information on forest age-class distribution and snag densities to provide a full picture of management effects on this species and other snag-dependent wildlife.

Snags in Open Forest Situations

To help indicate the effects of management on *Snags in Open Forest Situations*, the **Eastern bluebird** (*Sialia sialis*) is selected as an MIS. This species prefers open country with scattered trees; orchards, groves, farmyards, road-sides, open residential areas, and open woods. They require cavities for nesting in open or semi-open country, usually with a few scattered trees. The most common cavity sites are bird boxes in the open as well as knotholes and old woodpecker holes. The Eastern bluebird uses exposed perches for

sitting in wait of a prey item and they forage over short grass or bare ground, rarely are insects and other vertebrate taken from trees or shrubs (Hamel, 1992).

Prior to the arrival of European settlers in Tennessee, the forests were dotted with openings due to fires, wind, and insect damage, beaver ponds, Indian villages, and prairies. Early naturalists of the 1700s commented on the abundance of bluebirds, both in rural and urban areas, throughout the eastern United States. Bluebird numbers increased where management practices created favorable habitat that included open areas, short vegetation, and many nest sites that were produced by woodpeckers in dead trees (Nicholson, 1997).

Eastern bluebirds likely used prairies of western Kentucky as well as open woodlands throughout the state. By the early 1800s people were already erecting nest boxes in areas of settlement (Palmer-Ball Jr., 1996).

In LBL Eastern bluebird boxes are monitored for reproduction success which is in addition to data obtained from breeding bird census points.

Hard Mast Dependents

The **gray squirrel** (*Sciurus carolinensis*), although most closely associated with *Hard Mast* capability, is an ineffective indicator (MIS) of the quality or abundance of these habitats. This ineffectiveness is because its populations fluctuate greatly even in good habitats in response to annual variability in mast production, which is primarily due to weather. Other species such as deer and turkey benefit from hard mast production, but their population trends also reflect a variety of other factors, including hunting harvest. The acres of mature oak forest are a more useful and direct indicator of trends in hard mast production capability, and therefore will be used to indicate effects to mast dependent species instead of an MIS.

Mature Forest Interior Dependent

To help indicate the effects of management for species dependent on the availability of suitable *Mature Forest Interior habitat,* the **wood thrush** (*Seiurus aurocapillus*) is selected as an MIS. Concern over forest interior habitats is primarily focused on effects to migratory birds. Several bird species are associated with forest interior habitat however the wood thrush is deemed the most appropriate of these as an MIS. The wood thrush is strongly associated with mature forest interior habitats with fairly open under-story and closed canopy (Hamel 1992, Crawford et al. 1981), and it is also common enough to be feasibly monitored for trends. The wood thrush tolerates moderate disturbance and fragmentation, even though it is most common in areas of extensive forest. Due to this adaptability, the species is often found in semi-open habitats as long as forested tracts are not reduced to narrow strips or small, isolated woodlots (Palmer-Ball Jr. 1996). Breeding bird survey points would be considered for monitoring this species. Other elements, such as landscape analysis of forest fragmentation using remote sensing data, could supplement information received from monitoring this species. .

Regenerating Forest for all Forest Types

To help indicate the effects of management on species dependent upon *Regenerating Forest for all Forest Types*, the **yellow-breasted chat** (*Icteria virens*) is selected as an MIS. The yellow-breasted chat is primarily associated with over-grown fields, hedgerows, thickets, and woodland margins; generally in dry situations, particularly in briar thickets (Hamel 1992).

In Tennessee at the time of European settlement, chats were probably restricted to the brushy areas associated with cedar glades and barrens, widespread natural forest disturbances such as fires, and brushy areas resulting form American Indian activities. With widespread forest clearing accompanying European settlement, their numbers greatly increased. In recent decades, chat numbers have declined with the decreased area of early successional forest and agricultural trends toward larger fields and improved pastures (Nicholson 1997).

In Kentucky the chat is more widespread and numerous as a result of human alteration of the landscape. This species has been considered abundant in the barrens in the early 1800s and it is likely that other naturally open situations supported small numbers of birds across much of the state. Though the human alteration of the landscape resulted in the loss of native prairies, the widespread clearing and dissection of forested habitats for agricultural use and settlement have created a large amount of suitable nesting habitat, especially where cleared areas have reverted to early successional vegetation (Palmer-Ball Jr. 1996).

Breeding bird survey points would be considered for monitoring this species.

Rare Communities - By definition, rare communities are small and discrete habitats that are uncommon on the landscape. Because of their rarity and importance to providing for a diversity of plant and animal communities, each occurrence will be monitored directly. Monitoring will focus on the maintenance of desired conditions including presence of associated species. Because monitoring will be done directly, no MIS are selected for these communities.

Canebrakes – Swainson's warbler would not be considered because LBL is on the edge of its range. We will monitor the progress in restoring the desired conditions of canebrakes for size and density.

Calcareous Cliffs and Talus; Springs and Seeps; Rocky Shores and Bars; Lakeshores and Mudflats; Virginia Pine; and Mountain Laurel – These rare community types will not be influenced significantly by management programs.

3. Species That are Hunted, Trapped, and Fished

Species considered under this category include deer, turkey, quail, fish, and other harvestable species that are in high public demand for consumptive uses. Demand MIS are used to help assess effects of management on meeting this demand on national forests. Drawing inference about the effect of national forest management on these

species is difficult, because, in large part, their populations are regulated through harvest regulations by the state fish and wildlife agencies. Nevertheless, species in this group may be appropriate as MIS where the role of harvest regulation and demand can be evaluated along with habitat trends. This situation will normally occur where state fish and wildlife agencies collaborate in monitoring efforts.

Furbearers - Common species of furbearers found on national forests are fox, bobcat, raccoon, mink, otter, and beaver. As a group, these species were judged not appropriate for selection as MIS for several reasons. Consumptive demand for furbearers on the national forest is not large. These species are typically habitat generalists, making evaluation of relationships to habitat changes difficult. In addition, they generally are wary, often occur at low densities, therefore, are not feasible to monitor with precision.

White-tailed deer (*Odocoileus virginianus*) – This species is selected because monitoring data can be attained through annual deer harvest records and browse surveys for cultivated fields plus through some spotlight surveys. The white-tail deer uses a variety of habitats ranging from closed canopy forest to cropland. Key habitats that this species is associated include early successional forest and rich forest under-stories. Hard mast production is also of importance to this species. The white-tail deer is of particular interest to both hunters and wildlife watchers.

Eastern wild turkey (*Meleagris gallopavo*) – This species is selected because monitoring data can be attained through annual collection of harvest and brood survey data. The Eastern wild turkey is most common in extensive bottomland forests, where understory is moderate; also in extensive upland hardwood or mixed forests, less so in pine forests; not numerous in open woods, wood margins, and woodland openings, though they do forage in these areas (Hamel, 1992).

Northern bobwhite quail (*Colinus virginianus*) – This species is selected as a Demand MIS and it can be monitored using breeding bird survey points and other bird point counts in addition to monitoring the amount of habitat that is maintained, enhanced, and/or restored. The Northern bobwhite is also a Bird of Conservation Concern and an MIS for Grassland habitat. Favored habitat for the Northern bobwhite is brushy areas; abandoned fields; and they are numerous in hedgerows, thickets where tall herbs, shrubs and saplings are present; woodland margins and open woods (usually pines) (Hamel, 1992).

This species populates farmlands, particularly where grain crops such as soybeans, corn, and wheat are grown. However in contrast, large scale “clean” agricultural management practices and conversion of the forested landscape to fescue hayfields are factors believed to be contributing to declines in the available food and cover for the bobwhite. Fescue fields yield little food and suitable nesting habitat for this species. In Tennessee, this species reaches highest abundance where croplands, wooded fencerows, and idle lands dominated by broom sedge are interspersed in a mosaic fashion. This habitat is most common in West Tennessee and Middle Tennessee (Nicholson, 1997).

All other currently identified demand species for the plan revision are not good indicators and they include: bald eagle, gray squirrel, eastern cottontail, raccoon and fallow deer.

Demand Fish Species: We would not choose any fish species because their populations primarily reflect stocking programs and not the effects of habitat management in LBL.

4. Non-game Species of Special Interest

Species considered under this category are those for which there exists special public interest for non-consumptive reasons. They may be selected for the purpose of focusing assessment on such species when management is expected to have a major influence on their populations. Public interest in non-game species is typically generalized, rather than focused on one or a few species (e.g., interest in wildflowers, birds, and other wildlife for viewing or nature study). Interest in any one species is not sufficient to drive MIS selection, beyond those species already selected under other categories. Those species cover the special interests that are to be considered under this category.

The **Eastern bluebird** which is also an MIS for snags in open forest situations is selected as an MIS in this category. The bluebird box monitoring program supports the nature study and viewing interests.

5. Species That Indicate Effects to Major Biological Communities

Species considered under this category are those whose populations respond to management-induced changes in key ecological conditions within a community. These ecological conditions should be important to other members of the community as well. Selection of MIS under this category is to help focus attention on maintenance and restoration of desired conditions within major biological communities.

Oak Forest

Oak Woodlands
The **prairie warbler** (*Dendroica discolor*) is selected as an MIS to help indicate the effects of management on other species within *Oak Woodlands*. This species is primarily associated with abandoned fields with scattered saplings, scrubby thickets, cut-over or burned-over woods, woodland margins, and other sapling-shrub growth, generally in poor and dry soil (Hamel, 1992). Breeding bird survey point counts would be considered in monitoring the effects of management on this species habitat.

Mature Open Oak Forest
The great crested flycatcher (*Myiarchus crinitus*) is selected as an MIS to help indicate the effects of management on other species within *Mature Open Oak Forest*. This species prefers medium growth to somewhat open woods and forest. They occur in hardwoods, mixed woods, or pines; there isn't a clear preference. They are also found in wooded residential areas, but are generally scarce in dense forests. The Great-crested flycatcher is a cavity nester within these habitat cover type conditions (Hamel 1992). Breeding bird survey point counts would be considered in monitoring the effects of management on this species habitat.

In Successional Oak Forests the focus would be on oak regeneration as a variable but not for use as selection for an MIS.

Mesophytic Forest and Riparian Forests with Canopy Gaps

The **wood thrush** (*Hylocichla mustelina*) is selected as an MIS to help indicate the effects of management on other species within *Mesophytic and Riparian Forests with Canopy Gaps*. This species favors deciduous or mixed forests with a fairly well-developed deciduous understory, especially where moist. Bottomland and other rich hardwood forest are prime habitats. The wood thrush also frequents pine forests with a deciduous under-story and in well-wooded residential areas (Hamel, 1992). The different forest types that this species occupies have a well-shaded under-story, small trees with low, exposed branches and fairly open forest floor with decaying leaf litter. Wood thrushes are represented across most of Tennessee (Nicholson, 1997).

The wood thrush is also selected as an MIS to represent species dependent upon a mature forest interior. Breeding bird survey point counts would be considered in monitoring the effects of management on this species habitat.

Mature Riparian Forest

The **acadian flycatcher** (*Empidonax virescens*) is selected as an MIS to help indicate the effects of management on other species within *Mature Riparian Forest*. This species is deemed the most appropriate to indicate management-induced changes to mature forests on alluvial sites (riparian areas). It is highly associated with mature deciduous forests along streams and bottomland hardwoods, which it uses for feeding and reproduction (Hamel 1992). It is also effectively monitored using proven, consistent protocols. It is relatively common in these habitats, providing enough data for evaluation. We want to make sure that we are not doing too much vegetation management within these forest types that would negatively affect the species populations. Breeding bird survey point counts would be considered in monitoring the effects of management on this species habitat.

Native Short-leaf Pine

Presence of shortleaf pine associates can not be relied upon because LBL is on the edge of their ranges, so the presence of short-leaf pine regeneration is the best indicator of effective management.

Grassland

The **Eastern meadowlark** (*Sternella magna*) is selected as an MIS to help indicate the effects of management on other species within Grassland habitat. Breeding bird survey point counts would be considered in monitoring the effects of management on this species habitat. The meadowlark prefers short to medium-height grasses, fields, pastures, and other grassy places in a wide variety of situations. The meadowlark favors somewhat taller grasses (up to two feet high) for nesting rather than for foraging (Hamel, 1992).

This species is not particularly sensitive to the density of grass cover and in this respect is more flexible in its habitat requirements than some other grassland species such as the

Grasshopper sparrow. The meadowlark was probably fairly common on the prairies of pre-historic north-central and north-west Tennessee. Scattered populations probably occurred elsewhere on savannahs maintained through regular burning by American Indians or from natural causes. This species has been recognized as present in considerable numbers in open woodlands with grassy under-story (Nicholson, 1997).

In Kentucky, as a result of human alteration of the landscape, the meadowlark appears to have increased. This species is noted for its occurrence in barrens during the 1800s, and they may have occurred throughout the native grasslands of central and western Kentucky. Although the original prairies and savannas have been replaced by settlement and row-crop fields, many areas have been converted to hay fields and pastures that simulate naturally-occurring grasslands. Also, areas of forest converted to agricultural use and settlement have resulted in the creation of an abundance of suitable nesting habitat in areas where formerly the species was excluded (Palmer-Ball Jr., 1996).

The **Northern bobwhite quail** (*Colinus virginianus*) is selected as an MIS to help indicate the effects of management on other species within Grassland habitat. In comparison to the Eastern meadowlark, this species prefers abandoned fields, margins of fields, thickets with tall herbs, or shrubs and saplings. In Tennessee when the landscape was largely mature deciduous forest land, bobwhites likely populated such habitats as remnant prairies and patches of forest land recently ravaged by fires and/or severe windstorms. American Indians frequently burned forests and fields to improve habitat for wild grazing mammals; those fires benefited bobwhites as well (Nicholson, 1997). Palmer-Ball Jr. (1996) further notes that before habitats were altered, bobwhites were probably restricted to the native prairies and other naturally open and semi-open situations with brushy cover. Breeding bird survey point counts would be considered in monitoring the effects of management on this species habitat.

In summary, 12 species have been selected as management indicator species for the revised forest plan (Table F3). They will be used to assess effects of alternatives and to help monitor effects of implementing the selected alternative.

Table F3 - Management Indicator Species selected for use in the revised forest plan and primary reason(s) for their selection, Land Between The Lakes.		
Common Name	Scientific Name	Primary reason(s) for selection
Price's potato bean	*Apios priceana*	T&E Recovery
Pileated woodpecker	*Dryocopus pileatus*	Snags in Forested Situations
Eastern bluebird	*Sialia sialis*	Snags in Open Forested Situations and Non-game Demand Species
Acadian Flycatcher	*Empidonax virescens*	Mature Riparian Forest
Whitetail deer	*Odocoileus virginianus*	Demand Game
Eastern wild turkey	*Meleagris gallopavo*	Demand Game
Northern bobwhite quail	*Colinus virginianus*	Demand Game and Grassland
Prairie warbler	*Dendroica discolor*	Oak Woodlands
Great-crested flycatcher	*Myiarchus crinitus*	Mature Open Oak Forest
Wood thrush	*Hylocichla mustelina*	Mesophytic and Riparian Forests with Canopy Gaps and Mature Forest Interior
Eastern meadowlark	*Sternella magna*	Grassland
Yellowbreasted chat	*Icteria virens*	All Forest Type Regeneration

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Appendix G

Background Document

LBL National Recreation Area

Planning Background Document

June 4, 2003

Introduction

LBL National Recreation Area (LBL) was transferred from the Tennessee Valley Authority (TVA) to the United States Department of Agriculture Forest Service (FS) on October 1, 1999, under the provisions of the LBL Protection Act of 1998. The Act calls for the Forest Service to develop a Land and Resource Management Plan (LRMP) that complies with the basic laws applicable to all National Forests and will guide management direction for the next ten to fifteen years. The plan will describe the public's expectations for desired conditions at LBL and the strategies for achievement of the desired conditions; LBL has named this planning process "*Focus on the Future*". The plan will not resolve issues in detail, but it will provide a general framework by which future decisions will be made.

The National Forest Management Act (NFMA) requires LBL to assess the existing conditions and describe potential changes to the existing plan. The most recent strategic management plan is TVA's 1994 LBL Natural Resources Management Plan (NRMP). Since Congress granted LBL authority to use the NRMP, as appropriate, and since much of this plan is still valid, LBL has opted to use the NRMP as the "plan of record" from which we will base analysis for potential improvement. The Forest and Management Area Assessments section of this background document cites the primary changes that should be addressed in the LRMP.

This DOES NOT mean that most of the decisions have been made. This Planning Background Document is a good way to document some of the things we need in the process and share LBL's assessment of existing conditions. The Notice of Intent (NOI), published in the Federal Register, is a requirement of NEPA, however. It begins to focus

the critical issues to be decided by the plan and identifies existing management direction. Given it is less than 10 years old, some parts of the NRMP are still working well. Using the viable parts of the NRMP will streamline the process. The public is encouraged to provide comments about any conclusions or assumptions described within this document.

Within the Protection Act, Congress designated LBL as an area of demonstration and innovation and to share the results with other agencies. The Forest Service has struggled to balance the time and expense required to develop complex and detailed LRMPs with the need to implement decisions and actively manage National Forests while still keeping the public actively engaged in the planning process. LBL will use its demonstration role to innovatively produce a good plan, completing the process in less than two years (a reduction of nearly 60 percent of the national average). The LBL Advisory Board, created by the Protection Act and charged with advising the Secretary of Agriculture on ways to promote and improve public involvement in the planning process, is supportive of this initiative.

We will focus on the decisions legally required to be addressed by the plan, and analyze only the issues that need to be decided in order for LBL to operate those programs once the Record of Decision is signed. Public involvement is needed to help LBL prioritize the mix of goods and services to be provided in the face of potential budget reductions.

Background on LBL Protection Act

Beyond transferring management responsibility for LBL, the Protection Act defines the LBL mission "to protect and manage the resources of LBL for optimum yield of outdoor Rec/EE for the American people. In so doing, to utilize the demonstration assignment to authorize, cooperate in, test, and demonstrate innovative programs and cost-effective management; to help stimulate the development of the surrounding region; and to extend the beneficial results as widely as possible." This mission must be supported by the LRMP.

Cemeteries, Fees and Mineral Rights

The LBL Protection Act provides clear and legally binding management direction for cemeteries, fees, and mineral rights. The Forest Service shall maintain an inventory and ensure access to cemeteries within LBL. The Act precludes mining and mineral leasing. However, the Forest Service may use mineral materials for the development and maintenance of the Recreation Area. The Act allows a reasonable admission fee for specific facilities and programs, but precludes a general entrance fee. Since the Protection Act defines management direction in these areas, the LRMP will not address them.

Requirements of National Forest Management Act (NFMA)

The LRMP will be analogous to a county or municipal zoning plan. The following six decisions are made in an LRMP, as required by the planning regulations (1982 36 CFR 219):

- *Area-wide multiple-use goals and objectives*. Goals: A condition to be achieved. Objectives: Concise, time-specific statements of measurable results that respond to the goals.
- *Area-wide management requirements.* These are limitations on management activities, or advisable courses of action that apply across the entire area.
- *Management area direction applying to future activities in each management area*. This is the desired condition specified for certain portions of the Area, and the standards to help achieve that condition.
- *Lands suited and not suited for resource use and production*.
- *Monitoring and evaluation requirements to gauge how well the plan is being implemented*.
- *Special Designations and Recommendations to Congress, if any such as Wilderness or Wild and Scenic Rivers*.

Much of the new NFMA-compliant LRMP will contain the same direction as the NRMP with updates to supporting data, presented in a different format. This strategic document will not resolve all issues in detail, but will provide guidance for future resolution. Concerns raised by the public that are not addressed in the LRMP can be addressed by LBL management in the future. In some cases changes will be the subject of Plan amendment or revision.

Need for Public Participation

Everyone is directly or indirectly affected by the LRMP, and your opinion or idea is important. Informed decisions are based on careful consideration of diverse perspectives. The LRMP will reflect the public's interests and values, using the best available science to support LBL's mission. This process is not based on a voting or petition system. The quality of input carries more weight than quantity. Your input is critical in shaping an appropriate and balanced future for LBL. Even if you like things as they are, the only way to ensure the decision includes your views is to become actively involved. You can help develop a balanced plan that will guide the management of LBL's environmental, recreational, cultural, and natural resources for the next 10 to 15 years. A variety of public scoping opportunities have been scheduled at convenient times to help everyone participate. Through research and public collaboration, and by integrating science into decision-making, we can develop a plan to ensure sustainable management of LBL.

LBL is a regional economic centerpiece, a national destination, and a national Demonstration Project site. Viewing LBL within this context is important when developing desired conditions. Facilities and services provided on LBL should complement and not compete with local interests. You can help balance these benefits

LBL is uniquely poised to provide and, given the importance of LBL to the region, help shape the future of western KY and TN.

To learn more about how to participate or to get your name on the mailing list for future information, contact us by e-mail at FocusLBL@fs.fed.us, by telephone at 270-924-2161, or by writing to Area Planner, LBL National Recreation Area, 100 Van Morgan Drive, Golden Pond, KY 42211.

Expected Process and Timeline

Planning Background Document

Here, we make an assessment of the current conditions at LBL compared to the desired conditions as described by the NRMP. This assessment identifies opportunities for improvements based on new information, including Forest Service directives and public input to date. This report will be available for the public soon after the Federal Register publication of the NOI announcing LBL's intent to prepare a draft Environmental Impact Statement (DEIS) to support the planning process.

Notice of Intent (NOI)

The NOI is an official announcement in the Federal Register informing the public of LBL's intention to prepare an environmental impact statement (DEIS) in conjunction with the development of a LRMP. The NOI invites comment on the scope of the decision to be included in the DEIS and announces public participation opportunities.

Initial Public Input - Scoping

After an official NOI announcement, LBL will begin meetings to solicit input from the public on the future direction of LBL and this Planning Background Document. The information collected at these meetings and any written comments received to date will be summarized, posted on the website, and used to refine the issues described below. This collection and analysis of public input is defined as "scoping". The Forest Service will conduct further resource data analysis during this "scoping" stage.

Draft and Final Area Plan

The Forest Service will work closely with the public to develop alternatives for revising the NRMP based on the information received and results of analysis. All alternatives must comply with direction of the Protection Act. The environmental effects of each alternative will be described in a Draft Environmental Impact Statement (DEIS) that will be open to public comment for 90 days (a specific requirement of NFMA). Workshops will likely be conducted to help explain what is being proposed. The preferred alternative is called the Draft Area Plan (DAP), which is further described below. The DAP and the DEIS are expected to be published in early 2004. Public comments on the

DAP and DEIS will be analyzed and used by the Forest Service to make any needed changes. The Area Plan and Final EIS are expected to be complete in late 2004.

Interdisciplinary Planning Team

LBL identified an interdisciplinary Planning Team to lead development of the Area Plan. The Regional Forester and the LBL Area Supervisor make official decisions for the planning process.

Plan Implementation

The goals, objectives and standards contained in the Area Plan will guide later site-specific project decisions. Monitoring and evaluation of the area will also be compliant with the plan.

Mockup of New Plan / What's Included

Philosophy: The LRMP makes few specific decisions other than those legally required. Instead, it creates a framework of desired conditions and spatially describes how areas of LBL are to be managed. Direction is stated in descriptive terms that help the public understand what can be expected and will help guide decision-makers at the project level. The LRMP clarifies priorities, articulates standards by which actions can be conducted, and describes what one might expect to find in the future.

Layout: The LRMP will be divided into major sections to make it easy to use and understand. It will begin with an introductory summary and will help clarify the major emphases of LBL and its overall goals and objectives. The next section lists overall "operational standards" that are conditions all future actions must observe. Standards are further defined as courses of action or levels of attainment required to achieve the goals and objectives and are usually developed when laws or policies do not exist, when implementation benefits from further clarification or when unacceptable impacts are expected if a standard were not in place.

On a landscape basis, the overall area of LBL is allocated into 10,000- to 20,000-acre blocks called management areas (MA). MAs are established to more clearly describe desired conditions and to prioritize strategies and direction for each part of LBL. We expect between 10 and 20 MAs covering LBL, spatially separated by other areas of differing emphases. For example, an area might be designated as "Environmental Education Area" or "Primitive Backcountry, Non-motorized Area." Maps and descriptive text will be provided for each individual MA. Desired outcomes and conditions are described in relative terms to those currently existing in that geographic area. Examples that might be used to communicate what will happen in the future are: "this activity is expected to increase (decrease) slightly," "this will remain approximately the same" or "these opportunities will be the primary emphasis in this area". Specific decisions will not appear within the MA write-ups, except when needed to describe prohibited practices

or uses. There are often MA-specific standards provided that more clearly describe how activities are to be conducted in the Management Area.

The LRMP concludes with a description of how the Area will be monitored, including measurement procedures and performance indicators, to help the Forest Service and the public evaluate its implementation and effectiveness. Appendices include a glossary and rough estimates of expected outcomes over short- and longer-term time periods.

Direction, Current Status and Need for Change

Forest and Management Area Assessments

Below is a discussion of the current management direction for LBL based on the NRMP, and describing any perceived shortfalls or opportunities for improvement.

Recreation

The 1994 NRMP has eight chapters that address program objectives and guidelines for the management of natural resources. It appears, on the surface, this plan overlooked the primary purpose of LBL since there was not a chapter specifically devoted to recreation or environmental education. In reality, these are integrated into all eight chapters of the NRMP.

LBL's recreation program currently provides a wide variety of recreational opportunities. Camping, hiking, biking, boating, fishing, hunting, wildlife viewing, driving for pleasure, horse back riding, off-highway vehicle riding, picnicking, canoeing, and nature photography comprise most of the recreational activities available at LBL. There is no question whether the public desires these activities in the future. The current level of documented visitation in each of these activities shows public demand justifies providing the opportunity. National recreational trends of user groups and the settings to provide quality recreation opportunities can be found in the National Visitor Use Monitoring (NVUM) study. The volume and location of each activity and the long-term sustainability are the issues related to recreation at LBL. A mix of active and passive, motorized and non-motorized, developed and backcountry activities are currently permitted in LBL. The distribution and balance of elements of the recreation program, and the question of whether to increase or decrease specific recreational opportunities, will be reviewed through public input and review of current information. This analysis will examine current and anticipated user demands and needed changes.

No significant changes in the direction of recreation mixes and uses are expected in the LRMP, unless public input during scoping indicates otherwise. Unlike the 1994 NRMP, the LRMP will explicitly address recreation as required by NFMA and the LBL Protection Act.

Scenery

Visual management has been important since the initial designation of LBL. The high quality scenery that now exists is because of active management since 1963. Chapter 5 of the NRMP addresses the visual resource. All management practices have consistent visual management objectives applied to activities across LBL.

Information in the NRMP related to visual management activities can be used to evaluate alternatives in the area planning process. The visual quality zones along roads, trails, and shoreline and around facilities designated in the NRMP can be used in the visual resource inventory. Using the buffer guidelines of the NRMP, 49 percent of the land area is in a visual quality enhancement zone with 51 percent remaining as general forest areas (including thirteen scenic drives that will add to the inventory data).

No significant scenery management changes are expected in the LRMP. The visual resource will be inventoried and evaluated as required by the planning regulations.

Environmental Education

Environmental Education (EE) is part of LBL's mission and thus incorporated into all aspects of the NRMP. While EE is incorporated into all activities in LBL, most of the EE program delivery to the public is facility-based. These facilities include Woodlands Nature Station, The Homeplace Living History Farm, Elk & Bison Prairie, Golden Pond Planetarium, and Brandon Spring Resident Center. The Forest Service has established a goal to provide an EE message to every visitor, each time they come to LBL, whether visiting a facility or not.

The articulation of a more integrated environmental education strategy to accomplish this objective must be added to the new plan. The LBL Protection Act, not the planning regulations, mandates this requirement.

Vegetation Management

Forest Lands: The NRMP for the forest management program (Chapter 3) directs a mature, productive Oak-hickory forest with a range of size and age classes to meet wildlife habitat needs, enhance visual quality of the landscape, promote use of environmentally responsible management practices, demonstrate sustainable forest management compatible with other uses and to research methods and techniques in ecosystem management. This direction remains sound in 2003.

Approximately 89 percent of the land base is forest cover, comprised primarily of the oak-hickory type with the remainder in maple-beech, pine, bottomland hardwoods and reverted old fields. The Continuous Forest Inventory (CFI), surveyed in 1996, demonstrates a 30-year trend towards more big trees with a major shift from small saw-timber to trees over 16 inches in diameter within the past decade. Because LBL is only cutting a small percentage of its net annual growth, the forest will continue to grow older and larger. The CFI 30-year trend indicates an increase of maple, beech and poplar trees

and a decrease in oak trees. CFI further predicts a rapid growth in maples, beech and poplar, based on cubic foot volumes, however this vegetation won't comprise a major cover type for many years.

Since the transfer of LBL to the Forest Service, timber harvesting has been further reduced due to orientation of the new staff and higher priority transitional issues.

This data indicates a need for change to maintain and regenerate the oak-hickory forest types if wildlife habitat needs are to be met. Based on public opinion, forest management for the promotion of wildlife habitat, forest health and landscape diversity is of higher concern than set levels of timber sales.

Old growth: Old growth is referred to as deferred forest management in the NRMP. The plan deferred 9,060 acres from forest management until interdisciplinary review processes selected 4,830 acres of this total to be included in the designation as core areas. These core areas would be minimally disturbed areas. The remaining 4,230 acres would then be available for management, based on site capabilities and conditions. To date, these areas have not been selected. There is no clear definition of old growth but LBL currently relies on the Forest Service Region 8 (R8) Guidelines for Old Growth. R8 guidelines need to be followed for old growth designation and delineation. Core areas are the most likely acres of LBL that would be selected for old growth in the LRMP. Direction for the remaining deferred areas needs to be clarified.

Open Lands: NRMP direction provides for early plant succession to meet wildlife habitat needs, for visual quality, for supplemental wildlife food and cover and to demonstrate ecological restoration. Open lands total 7 percent of the total land base, excluding core areas. Objectives would be met by managing five categories of open lands including cooperative farming, woods openings, wildlife plantings, other (reverting) open lands and miscellaneous lands. (See Appendix A)

-- Co-op farmlands: 3,400 acres of prime farmland for production of row crops and 500 acres for grass/legume hay crops. 20 percent of grain crops are left in place for wildlife use.
-- Woods openings: 350 acres out of 1,050 are managed annually (a 3 year cycle) that allows plant succession to advance only to the grass/legume or forb stage. Hay may be harvested.
-- Wildlife food plantings: 600 acres annually. Variable means to control vegetation competition are not always successful and reduce this acreage. Over 90 acres are annually recovered through ecological restoration sites that are managed for native grasses and forbs.

-- Other open lands: 900 acres per year (over a 4 year cycle) to prevent reversion to forest lands, are accomplished by disking, burning, chemicals or mowing.
-- Miscellaneous: 2,650 acres (including right-of-ways, waterfowl plantings, bison range, scenic vistas, and utility corridors) experience varied treatments.

Open land acreages have decreased from 7 percent to approximately 5 percent due to reduced active management and forest encroachment. More acres per year of maintained openings would prevent further reversion. Other concerns are determination of cumulative effects from use of herbicides, possible restrictions of certain chemicals, access to fields and storage of crop (hay). There is increased interest in habitat partnerships to create more restoration acres. Recent developments in bio-intensive Integrated Pest Management surface the need for further research sites. These, and related issues need to be addressed in the LRMP.

The vegetation issue to be addressed in the LRMP is whether to change the land management direction from the direction set in 1994, including total acreages and appropriate mix of management practices of the forest and open lands. LBL expects to continue most of the open land management direction of the 1994 NRMP.

Fire Management: Wildfires are suppressed as necessary to protect visitors, facilities, and adjacent landowners. Fires are suppressed in core areas at the discretion of the Area Supervisor and may be allowed to burn under certain weather conditions, following a forest fire plan.

The states of KY and TN Divisions of Forestry provide fire suppression and reconnaissance service through Memorandums of Agreement. LBL has trained personnel in wildfire methods who supplement any suppression efforts. Fire use areas need to be determined and delineated.

Prescribed burning may be used as necessary to regenerate oak and pine stands, manage wildlife habitat, maintain fire dependent plant communities (warm season and tall grass prairie grasses), reduce leaf litter in recreation areas, and to reduce undesirable vegetation in open lands.

Prescribed burning is allowed for seedbed preparation within the 400 acres/year of timber stand improvement areas, 90 acres of ecological restoration open lands, and 900 acres of maintained open lands. The 2,650 acres of miscellaneous open lands have variable treatments allowed but burning is specified only for clearing of viewing areas. Prescribed burning is listed in the NRMP as a practice allowed for forest management under passive management of the pine ecological study areas. Currently 800-1200 acres annually are treated by prescribed fire, primarily in open lands and around facilities. Allowing fire to run under the forest canopy is not a current use although it is a preferred treatment for oak-hickory regeneration and fuel reduction. Clearer direction for the use and volume of prescribed fire is needed.

Fish, Wildlife and Habitat Resources

Habitat management direction for wildlife in LBL provides for diverse habitat and overall biological diversity with many successional stages of vegetation. Mature oak-hickory cover is favored for productive mast crops. LBL's forest cover type primarily supports upland plant and animal species. There is little wetland or bottomland habitat after the

impoundments of Kentucky Lake and Lake Barkley. Developed man-made wetlands – Bear Creek, Long Creek, and Prior Creek – are managed using moist soil techniques. There are an estimated 1,300 plant species scattered across LBL's landscape.

Management Indicator Species (MIS): NFMA regulations require selection of MIS and linking MIS to habitat objectives. There is a need to incorporate monitoring of these species habitat into the LRMP monitoring chapter.

Proposed, Endangered and Threatened Species (PETS) LBL's NRMP maintains a list of species titled "Federal and State Listed Endangered, Threatened and Sensitive Species of LBL" to guide management decisions. This list is similar to the Proposed, Endangered and Threatened Species (PETS) and Management Indicator Species (MIS) lists required by NFMA. (See Appendix B) This list includes state listed species along with federal listed species. The Endangered Species Act and Forest Service call for development of a PETS list. The PETS list needs to be addressed in the monitoring chapter of the LRMP. A biological assessment (BA) is required to be completed for each federally listed species under formal consultation with the USFWS.

Sensitive Species: State sensitive species listed in the NRMP will be compared to the R8 RF's Sensitive Species list. A separate biological evaluation (BE) with consultation with USFWS needs to be completed on these species. The LRMP should address the need for an RF sensitive species list.

Migratory Birds: Pursuant to Executive Order 13186, Migratory Bird Treaty Act, migratory bird species have only cursory mention in the NRMP under discussion of long-term population trend monitoring and breeding bird counts. The Cerulean warbler, a C2 species, is identified as a Neotropical migratory bird. Conservation measures for the identified migratory bird species, and other relevant birds of conservation concern, should be incorporated into the LRMP.

Required MIS, PETS, sensitive species, and migratory birds lists must be reviewed and updated in the LRMP. BA's and BE's will be completed for federal and regional listed species. Directions for management of habitat to protect these species will also be addressed.

Air, Soil, and Water Resources

Air: The air resource is not addressed under the current NRMP. TVA continues to monitor air quality over LBL, in conformance with clean air regulations of their power generation. There is significant data from the monitoring stations in place at LBL. Prescribed burning on LBL is coordinated through the appropriate state agency for smoke management and air quality control.

Soil: The soil resource is not addressed under the current NRMP. Site suitability for management activities should guide any decisions. The LRMP needs to incorporate R8

Soil Quality Standards, as appropriate to LBL, for measures of quality, disturbance, and establishment of monitoring protocols for long-term productivity.

Water: Objectives of the water resource program at LBL are to protect and maintain aquatic and wetland ecosystems, provide diverse aquatic and wetland habitat and provide information about water quality values to the public. LBL does not have jurisdiction over the two large lakes. TVA and the Corps of Engineers share regulation jurisdiction of Kentucky Lake. The Corps of Engineers has regulatory, navigational and management jurisdiction over Lake Barkley. All water resources that LBL manages are classified as warm water fisheries. (See Appendix A)

Water quality is managed through implementation of stream management zones (SMZ) of varying widths, dependent on side slope. Perennial and intermittent streams generally have SMZ of 100-200 feet where management activities are restricted primarily for protection of bat habitat. Co-op farmlands, because of their generally flat (<5 percent) slope, have a minimum 10-foot buffer. Recent regional water quality assessments have not shown problems in LBL.

The LRMP should define, delineate and adopt management guidelines for riparian areas. Regional Soil and Water Conservation Practices may be adopted as best management practices to mitigate effects to the soil and water resources and to assure water resources meet the intent of the Clean Water Act.

Heritage Resources

A Heritage Resource Management Plan (HRMP) was finalized in March 2003 and has current information to be incorporated into the planning record. Strategies are needed in the new plan to guide future decision-making, comply with heritage management regulations, and ensure sensitivity to these important resources.

Infrastructure Analysis

With development beginning in 1964, most of LBL's current infrastructure was built during the late 60s and 70s, and some facilities are at the end of their design life. Several facilities have been closed due to low use and high maintenance costs: part of Rushing Creek, Youth Station, Empire Farm, and Silo Overlook.

Recent efforts have been to standardize utilities, upgrade the electrical service, improve reliability and influence the built environment. This is being accomplished by reducing deferred maintenance backlogs, focusing on restoration activities at heavily visited sites, primarily for safety and operational efficiencies. The natural features are the focus on LBL and the buildings should blend in with landform and setting.

The transportation system on LBL is a mix of roads that were in place at the time of designation and new routes that access facilities built since that time. (See Appendix C) The Protection Act designates the maintenance of the Area Highways to the states of TN

and KY. This equates to 43.1 miles in TN and 75.6 miles in KY. The Federal Highway Administration did a study on these roads and estimates 39 million dollars are needed for maintenance over the next 10 years. Roads are essential for LBL to meet its mission and for the public to enjoy LBL.

LBL expects to continue the current direction regarding infrastructure management, unless public scoping results in the need for a different direction. Any direction regarding facilities management at LBL must be consistent with the environmental education, recreation, wildlife diversity, and economic sustainability mission of the LBL Protection Act. The infrastructure decisions will not be specific in the LRMP, except as infrastructure needs relate to the allocation and strategic direction of management areas.

Social and Economic Assessment

LBL maintains a database that allows tracking of the market segment (families with children, mature adults, young adults and groups) of the two million annual visitors, where they live and when they visit. Based on this data, we know the following about LBL visitors:

Families with Children:	36 percent	visits peak Jun-Aug
Mature Adults:	41 percent	visits peak May-Oct
Young Adults:	22 percent	visits peak Apr-May
Groups:	0.9 percent	visits peak Apr-May & Sep-Nov

LBL visitors come from three major areas: 67 percent local visitors from the counties surrounding LBL, 21 percent regional visitors from adjoining states, and 12 percent national visitors from the rest of the nation.

There are vast amounts of data available. Appendix D reflects the pertinent data to be considered when making plans for LBL programs and the use of LBL. Reasonable conclusions can be drawn from this data, such as:

- A relatively equal balance of recreational opportunities should be made available for males and females and for each market segment (age group)
- More than 70 percent of LBL visitors make less than $50,000 per household, making free or extremely affordable recreation alternatives essential.

Suitable Uses and Land Allocation

Timber

In the NRMP, all of the 151,550 forested acres of LBL have been designated for potential forest management activities and delineated into 65 work areas. These work areas are collated into 7 work area sets, to correspond to a 7-year cycle of forest management activities. Available forest acreage for timber harvest approximates 2,880 acres/year. Additionally, 400 acres of timber stand improvement activities on mesic forest areas are currently allowable to reduce undesirable tree species.

The forestlands are divided into suitable categories for even-aged, uneven-aged, and passive management. (See Appendix A) This equates to a 150-year rotation for hardwoods and a 60-year rotation for pine. This allocation includes 29,960 acres of low-intensity uneven-aged management where timber harvest would occur only to maintain or restore unique ecological communities. Suggestions have been made to designate LBL as unsuitable for timber production. This does NOT mean that timber sales do not occur—it simply clarifies that timber removals are only accomplished to enhance habitat, improve forest health or visual objectives. Public comments indicate general satisfaction with the forestland management and allocation of the NRMP and there appears no need for change at this time.

Open lands

Refer to "Open lands" on pages 7 and 8 of this report. Public comments indicate general satisfaction with the distribution of open lands management of the NRMP and there appears no need for change at this time.

Rangelands

Rangeland is not designated under the NRMP. Two fenced pasture areas are designated for bison and managed under miscellaneous open lands. Open lands in general are not well suited for grazing permits because of their scattered locations and small size. While the fields around Empire Farm may be suitable as pastures, public comments indicate general satisfaction with the absence of grazing permits at LBL and there appears no need to address this issue in the LRMP.

Wilderness

LBL has no congressionally designated Wilderness. NFMA requires LBL to conduct an analysis of areas that might be suitable for Wilderness designation when areas may contain wilderness characteristics. The history of land use on the area that became LBL was resource based and intensive. Farming, logging, iron industry, community development and transportation systems have all impacted the area. Many building foundations are left where structures once stood. A few isolated buildings can still be found and are evidence of the area's history. Many cemeteries are spread across LBL, as it was tradition to be buried on the family homestead. Access to these areas, specifically provided in the Protection Act, combined with other transportation needs of visitors and the managing agency will tend to make acreages of non-motorized lands isolated and relatively small.

Solitude can generally be found in the 42,500 acres (25 percent of LBL) of the land designated in the core areas. LBL needs to evaluate whether any land could be designated as Wilderness per the forest planning regulations. It is expected motorized access needs for research within core areas would be in conflict with Wilderness designation.

No roadless or Wilderness designations are expected in LBL after evaluation during the planning process, however as noted below, core area designations are expected to remain unchanged.

Core Areas

The entire LBL and 17 surrounding counties were designated as an International Biosphere Reserve (IBR) in 1991, as part of the Man and the Biosphere Reserve program of the United Nation Education, Scientific and Cultural Organization (UNESCO). Great Smoky Mountains National Park and Mammoth Cave National Park also hold this designation. (See Appendix A)

It is important to remember that Core Area does not mean roadless area. Most Core Areas have some roads permissible for research activities. It is expected that the 42,500 acres of Core Areas will be retained and no changes are needed in management of the Core Areas.

Desired Conditions and Standards

Desired conditions and standards in the existing NRMP are in many ways still applicable. The primary area of change will be to include those program elements that have been described in the sections above as either missing or needing significant change. For example, if a particular activity were to be de-emphasized, those areas within LBL that previously prioritized this program or activity would be revised to reflect a reduced level of emphasis. If the NRMP did not list strategic direction for a specific program, this must be written and included to make desired outcomes more obvious. The second warranted change will be dictated by the conversion from program write-ups and work areas to newly described management areas. Each management area will have specific standards and desired conditions that will apply only to the actual land area delineations that are ultimately selected. This will result in revision of sections of the 1994 NRMP such that direction will apply to the new management areas. Much of the existing text and direction may be usable by cross-walking between the NRMP work areas and the new Plan management areas, however those elements described in the individual resource sections may have to be moved one by one to the MA write-ups that are applicable.

Monitoring Plan

The existing NRMP has good monitoring elements, however, they are distributed throughout the plan within each resource section and in some areas there are none listed. Within the new plan, these will be consolidated into a separate section that will appear near the back of the plan and should be easier to reference and implement. The existing monitoring elements must each be reviewed in concert with proposed program area emphases to test for relevance. Others must be revised to describe programmatic activities that will effectively measure when key work activities are achieving desired goals and objectives. This section of the plan must also be expanded to include pertinent

items that are needed to determine the effectiveness of any new plan components, including some estimate of expected outputs.

The overall monitoring plan will be "reality checked" to ensure that it describes both minimum legally required activities as well as additional monitoring that is desired. The monitoring plan must be both reasonable and practicable under expected budgets and available personnel. The level and intensity of monitoring and analysis will vary during the life of the plan, depending on Forest Service priorities. This section of the plan will be written to communicate to the public what can be expected.

The LRMP monitoring section will be expanded to include ways to measure the effectiveness of programming in LBL and progress toward desired conditions.

Need for Change and Summary

LBL will use the 1994 NRMP as the basis for the LRMP we will develop under the forest planning regulations. Only necessary changes will will be made; Rec/EE will be added to the plan. Below are the statements from the previous discussion summarizing the direction the development of the LRMP is expected to take. These statements are based on public input to date, resource evaluation, project reviews, and staff feedback.

The parts of the NRMP not expected to change include:

- No significant scenery management changes are expected in the LRMP. The visual resource will be inventoried and evaluated as required by the planning regulations.

- The vegetation issue to be addressed in the LRMP is whether to change the land management direction from the direction set in 1994, including total open land acreage and appropriate mix of management practices of the forest and open lands. LBL does not anticipate changing the open land management direction of the 1994 LRMP.

- LBL expects to continue the current direction regarding infrastructure management, unless public scoping results in the need for a different direction. Any direction regarding facilities management at LBL must be consistent with the environmental education, recreation, wildlife diversity, and economic sustainability mission of the LBL Protection Act. The infrastructure decisions will not be specific in the LRMP, except as infrastructure needs relate to the strategic direction of land management areas.

- No roadless or Wilderness designations are expected in LBL after evaluation during the planning process.

Some areas need updating or clarification in the new plan. Management direction to be added to the LRMP, as compared to the NRMP, includes the following.

- No significant changes in the allocations and mix of recreation uses are expected in the LRMP, unless public input during scoping indicates otherwise. Unlike the 1994 NRMP, the LRMP will explicitly address recreation as required by NFMA and the LBL Protection Act.

- The articulation of a more integrated environmental education strategy to accomplish this objective must be added to the new plan. The LBL Protection Act, not the planning regulations, mandates this requirement.

- Guidance is needed in the new plan to guide management decisions under changing budgets during the next 10 to15 years.

- Our review indicates a need for change to maintain and regenerate the Oak-hickory forest types if wildlife habitat needs are to be met. Based on public opinion, forest management for the promotion of wildlife habitat, forest health and landscape diversity is of higher concern than set levels of timber sales.

- Clear direction for the use and amount of prescribed fire is needed.

- Required MIS, PETS, sensitive species, and migratory birds lists must be reviewed and updated in the LRMP. BA's and BE's will be completed for federal and regional listed species. Directions for management of habitat to protect these species will also be addressed.

- The LRMP should define, delineate and adopt management guidelines for riparian areas. Regional Soil and Water Conservation Practices may be adopted as best management practices to mitigate effects to the soil and water resources and to assure water resources meet the intent of the Clean Water Act.

- Strategies are needed in the new plan to guide future decision-making, comply with heritage management regulations, and ensure sensitivity to these important resources.

- The LRMP monitoring section will be expanded to include ways to measure the effectiveness of programming in LBL and progress toward desired conditions, and discuss potential outputs at varying budget levels.

The public needs to provide comment of agreement or disagreement with the approach this document describes. LBL will be conducting public meetings and taking comment on the NOI to refine and focus the desired conditions to be addressed in the development of the plan and DEIS.

LBL National Recreation Area
Planning Background Document

Addendum 1

Quick Facts
Forest and Management Area

The total land area of LBL encompasses 170,310 Acres (2/3 KY & 1/3 TN).

Land Areas		Percentage	Acres	
Forested		**89%**	**151,550**	
Forest Mature to Over Mature 76 percent maple/beech 5 percent , oak-hickory 80 percent , pine 4 percent				
Core Areas		25%	42,500	
	Number			
Large blocks >5000 acres	3		24,320	
Medium >2,500 acres	4		11,640	
Stands <300 acres	130		6,540	
Open lands		**5-6%**	**12,050**	(8,490 acres actively managed each year)
Coop Farmland		31%	3,900	
Woods Opening		9%	1,050	(350 acres managed annually)
Wildlife Food Plantings		5%	600	
Maintained Open Lands		33%	3,600	
Miscellaneous Lands		22%	2,650	
Infrastructure		**4%**	**7,000**	

There are 12,500 acres of Wildlife Refuges within the forested and open lands areas listed above.

	Acres	
Timber		
Designated for Forest Management	151,550	(65 work areas)
Available forest acreage timber harvest	2,880	per year
Timber stand improvement activities	400	(mesic forest areas to reduce undesirable tree species)
Even-aged Management (primarily shelterwood and seed tree cuts)		
Hardwoods	52,980	
Pines	3,250	
Uneven-aged Management (guided by tree diameter to maintain a number of stems/acre)		
Hardwoods	51,460	
Pines	1,360	
Passive Management		
Core Areas	42,500	
Ecology Study Areas (34)		
Designated Natural Areas (3)		

Prescribed Fire

1,390 acres allowed, currently 800-1200 burned annually

Wildlife Composition

355	Terrestrial
230	Birds (41 Neotropical Migratory Birds)
53	Mammals
28	Amphibians
41	Reptiles
76	Fish (21 additional species in interior lakes)

Natural Resource Composition

1310	Plant Species; 229 are Woody Species
82	Stream Basins (mostly intermittent)
11	Perennial Streams
131	Natural Spring
75	Ponds
300	Wildlife Watering Holes
5	Interior Lakes

LBL National Recreation Area

Planning Background Document

Addendum 2

Quick Facts
Threatened and Endangered Species

Threatened Plant

Latin Name	Common Name
Apios priceana	Price's potato bean

Proposed C1 Plant

Latin Name	Common Name
Aureolaria patula	False foxglove

Proposed C2 Plant

Latin Name	Common Name
Armoracia aquatica	Lake cress
Cimicifuga rubifolia	Black cohash
Juglans cinera	Butternut
Lysimachia fraseri	Fraser's loosestrife
Prenanthes barbata	White lettuce

C1 On US Fish & Wildlife Service status review list; existing biological information is sufficient to warrant listing.

C2 On US Fish & Wildlife Service status review list; biological information is still being collected.

Endangered Animal

Latin Name	Common Name
Falco peregrinus	Peregrine falcon
Myotis grisescens	Gray Bat
Myotis sodalis	Indiana Bat
Sterna antillarum	Least tern

Threatened Animal

Latin Name	Common Name
Haliaeetus leucocephalus	Bald Eagle

Proposed C2Animal

Latin Name	Common Name
Cryptobranchus alleganiensis	Hellbender
Dendroica cerulea	Cerulean warbler
DLanius ludonvicianus	Loggerhead shrike
Macroclemys temmincki	Alligator snapping turtle
Myotis austroriparius	Southeastern myotis
Nerodia erythrogaster neglecta	Copperbelly water snake
Pituophis melanoleucus	Pine snake
Plecotus rafinesquii	Rafinewque's big-eared bat

C1 On US Fish & Wildlife Service status review list; existing biological information is sufficient to warrant listing.

C2 On US Fish & Wildlife Service status review list; biological information is still being collected.

LBL National Recreation Area

Planning Background Document

Addendum 3

Quick Facts
Infrastructure

Main Facilities

Name	Type	Capacity
Brandon Springs	EE Group	128 Beds
Piney Campground	Campground	380 Sites
Hillman Ferry Campground	Campground	369 Sites
Energy Lake Campground	Campground	48 Sites
Wranglers Campground	Horse Campground	175 Sites
Turkey Bay OHV Area	OHV/Camping	
Lake Access Areas	Primitive Camping	(22 areas)
Woodlands Nature Station	Nature Center	
The Homeplace	Living History Farm	
Elk & Bison Prairie	Wildlife Viewing	
Golden Pond Planetarium	Planetarium	
Golden Pond Visitor Center	Visitor Information	
North Welcome	Visitor Information	
South Welcome	Visitor Information	

Other Summaries	Number
Sewage Treatment Plants	4
Water Systems	22
Boat Ramps	22
Camping Cabins	9 Piney, 12 Wranglers
Shoreline	300 miles
Picnic Areas	10
Pavilions	7
Cemeteries	228-248
Iron Furnace Ruins	6
Trails	200 miles hiking, 99 miles horseback, 45 miles mnt. bike, & 2,500 acre OHV
Roads	162.69 Level 5
	110.16 Level 4
	93.02 Level 3
	291.77 Level 2
	72.08 Level 1

Road Service Levels

- Level 5 – Highly developed paved road
- Level 4 – Low developed paved road
- Level 3 – Highly maintained gravel road
- Level 2 – Tertiary road
- Level 1 – Minimum maintenance (sometimes impassable)

LBL National Recreation Area

Planning Background Document

Addendum 4

Demographics

Data taken from the 2000 Census	LOCAL	REGIONAL	NATIONAL
Total Population	138,268	47,852,581	281,421,906
Males	49%	49%	49%
Females	51%	51%	51%
Youth (up to 19 yrs)	24%	28%	29%
Young Adults (20-34 yrs)	20%	21%	21%
Adults (35-54 yrs)	28%	29%	29%
Mature Adults (over 55 yrs)	28%	22%	21%
Median Age	40	36	35
White	93%	79%	68%
Black	4%	12%	11%
Hispanic	1%	5%	11%
American Indian	0%	0%	3%
Asian	1%	2%	3%
All other	0%	2%	5%
Families	69%	68%	68%
Living Alone	31%	32%	32%
Less than 9th grade education	11%	7%	8%
9th – 12th grade with no diploma	17%	13%	12%
High School Graduate	31%	33%	29%
Some College	21%	20%	21%
Associate's Degree	4%	6%	6%
Bachelor's Degree	9%	14%	16%
Graduate / Professional Degree	7%	8%	9%
Persons with disabilities	22%	18%	18%

Data taken from the 2000 Census	LOCAL	REGIONAL	NATIONAL
Unemployment	3.4%	3.5%	3.7%
Business / Professionals	25%	31%	34%
Service Occupations	15%	14%	15%
Sales	23%	26%	27%
Farming	1%	1%	1%
Construction	13%	9%	9%
Production	23%	18%	15%
Household income: less than $10K	15%	10%	10%
$10K – $15K	10%	6%	6%
$15K – $25K	15%	13%	13%
$25K – $35K	14%	13%	13%
$35K – $50K	15%	17%	17%
$50K – $75K	19%	20%	19%
$75K – $100K	7%	10%	10%
$100K – $150K	4%	7%	8%
$150K – $200K	1%	2%	2%
Over $200K	1%	2%	2%
Average Household Income	$36,953	$39,624	$41,994
Families below poverty line	9%	9%	9%
Individuals below poverty line	13%	13%	12%

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Appendix H

Final Environmental Impact Statement on the 1994 Natural Resources Management Plan for LBL

Tennessee Valley Authority

October 1994
Volume I

1994 Natural Resources Management Plan for LBL

Tennessee Valley Authority

October 1994
Volume II

The 1994 NRMP was used extensively throughout the preparation of the revised Land and Resource Management Plan by the Forest Service. Interested individuals can view the summary of the NRMP online on the LBL Planning website listed here:
http://www.lbl.org/ADMIN/LBL1994PlanSummary.html

You may also obtain a printed copy by contacting the Forest Service Administrative Office at 100 Van Morgan Drive, Golden Pond, KY 42211.

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Appendix I

MAPS

Map Name
Alternative W – North
Alternative W – South
Alternative X – North
Alternative X – South
Alternative Y – North
Alternative Y – South
Alternative Z – North
Alternative Z – South
Recreation Opportunity Spectrum (ROS)
Watersheds
Cover Type – North
Cover Type – South
Site Type – North
Site Type – South
Structure – North
Structure – South
Legal Roads – North
Legal Roads – South