

NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, West Virginia

February 20, 1991

MEMORANDUM

To: G. Seielstad

From: R. Fleming *RF*

Subject: Environmental Issues related to LIGO in Green Bank

An Environmental Impact Statement must be completed (many months and many pages) for a project that has a "significant environmental impact". NSF determined that the proposed construction of the GBT would cause no significant environmental impact, therefore an Environmental Impact Statement was not required. See Oster's draft for the GBT and note NSF's conclusions and recommendations.

NSF could conduct an Environmental Assessment of the proposed construction of LIGO in Green Bank very much like they did for the GBT. Most if not all considerations that were made for the GBT would apply to LIGO.

Some information Oster wanted is also attached. I do not know who he met with or talked to other than the head Forest Ranger for our district and Brian McDonald, the endangered species person at DNR. Oster said these people were very cooperative.

From: CVAX::GATEWAY::"LOSTER@NOTE.NSF.GOV" 21-JUN-1990 13:52
To: PJACKSON AT NRAO
Subj: draft to bill porter

Date sent: Thu, 21 Jun 90 13:32:33 EDT

TO: Bill Porter
FROM: Ludwig Oster

COMMENTS: The draft below is not complete and is my own first idea. So, please comment. I mostly need more information; see request at end. At the latest when we get together next week.

The announcement in the Federal Register hopefully gets out within a few days.

DRAFT. LFO. 6/20-90

ENVIRONMENTAL ASSESSMENT OF PROPOSED
CONSTRUCTION OF A 100-METER CLASS RADIO TELESCOPE
IN GREEN BANK, WEST VIRGINIA

SUMMARY

In compliance with Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508) for implementing the procedural provisions of the National Environmental Policy Act and National Science Foundation (NSF) regulations (45 CFR 640) supplementing those of the CEQ, an environmental assessment has been completed of the impact of constructing a 100-meter-class radio telescope in Green Bank, Pocahontas County, West Virginia.

The Green Bank Telescope (GBT) will be the largest fully steerable radio telescope in the U.S. It will be part of the instrumentation of the National Radio Astronomy Observatory (NRAO), a National Astronomy Center operated by Associated Universities, Inc. (AUI) under contract with the National Science Foundation (NSF). *Cooperative Agreement*

The site in Green Bank, owned by the NSF, is located in the National Radio Quiet Zone (NRQZ) which was created specifically to protect the electromagnetic environment of the radio telescopes located and to be built on the site. This protection is unique in the U.S.

As a result of the assessment, it has been determined that the proposed construction is not a major Federal action with significant environmental impact.

NEED FOR CONSTRUCTION

The need for a large, fully steerable radio telescope has been recognized by astronomers for more than thirty years. The National Academy of Sciences astronomy survey committees chaired by Prof. Whitford in the 1960s, by Prof. Greenstein in the 1970s, and by Prof. Field in the 1980s all noted the limitations placed on radio astronomical research by the lack of a large, fully steerable, single-dish radio telescope in the U.S.

The collapse of the 300-foot transit telescope, located in Green Bank, in November 1988, severely crippled U.S. astronomers' access to large steerable telescopes. The NSF Advisory Committee for Astronomical Sciences (ACAST) in a recommendation in April 1989 strongly supported the construction of a 100-meter-class telescope and pointed out that the scientific justification for this instrument is outstanding. NRAO, in collaboration with a large number of individual members of the astronomical community, submitted to the NSF a proposal to design and construct a single-dish, fully steerable telescope with a diameter of order 100 meters. Detailed design work will be carried out in 1989 and 1990, with site development and construction to begin in 1991. Completion is anticipated for 1995. The Congress appropriated a total of \$ 75.0 of which \$74.5M will be available for design and construction.

The planned instrument will bring an improvement over existing telescopes by large factors. For instance, it will be the largest existing telescope operational at mm wavelengths. Due to its large collecting area and the planned state-of-the-art surface and pointing accuracy, it will provide for many astronomical observations the highest sensitivity. Moreover, in concert with NRAO's Very Large Array near Socorro, New Mexico, and the Observatory's Very Long Baseline Array currently under construction, as well as with the existing global network for Very Long Baseline Interferometry (VLBI), it will play a crucial part in extending high-resolution observations to weaker sources. This is particularly important when in the 1990's radio antennas are placed in orbit, as is currently planned by the USSR (Radioastron) and Japan (VSOP).

The GBT can help find answers to questions about the matter falling into massive black holes in the centers of galaxies, of the structure of our galactic center, the distribution and physical state of the gas in our galaxy, the mechanism of star formation, and the physics of pulsars. As part of the VLBI network it will greatly enhance the network's ability to study crucial details in cosmic sources, from the most distant quasars to individual stars in our neighborhood.

In view of the expected major impact of the GBT on our understanding of the universe, the construction of the instrument is seen to be in the national interest.

Due to the location in the NRQZ, NRAO's Green Bank site is by far the most desirable one. This advantage is expected to rapidly increase in years and decades to come, when overall electromagnetic pollution will multiply.

Thus, construction of the GBT at the proposed site is necessary to achieve the scientific goals of the instrument.

SITE DEVELOPMENT PLANS

Site Plan of NRAO Green Bank.

Figure 1 shows an area map identifying the NRQZ. NRAO's Green Bank site is bounded in the West by West Virginia Route 28 at the village of Arbovale, by private property on the other three sides. The area where the existing telescopes are located is shown in Figure 2. Identified are the location of the collapsed 300-foot telescope and of the major currently existing telescopes, including the instruments operated by NRAO for the U.S. Naval Observatory (interferometer) and for the National Aeronautics and Space Administration (to be used as data link for Radioastron). The plan also shows the specific part of the site designated for the GBT.

Description of Site

The NRAO site is located at the East edge of a shallow valley. The valley is bounded by hills generally aligned in the North-South direction. Of the total area of about 3000 acres, only about 15% can be used for locating general purpose telescopes. Telescope operation close to Route 28 is undesirable due to possible interference from vehicular traffic. On the East, on the other hand, the rising terrain sharply limits the Eastern horizon. Within the area of generally favorable terrain, the absence of obstructions to the South was considered. The final decision was then made on the basis of very detailed measurements of the distribution of wind speeds (a crucial factor in the telescope's pointing accuracy).

From the environmental point of view, the entire area has identical characteristics.

Telescope Design

A drawing of the design proposed by NRAO is shown in Figure 3. The telescope will be a wheel and track, elevation over azimuth configuration with a solid-surface reflector of a projected diameter of approximately 100 meter (330 foot). The reflector consists of approximately 2200 shaped high-precision panels. Four adjacent panels are rigidly connected. These groups of four panels can be adjusted against the backup structure with computer-controlled activators. In this fashion it is possible to compensate for changes in the gravitational deformation of the reflector surface as a function of source position on the sky. The design specifies a so-called unblocked aperture. That is, the surface of the reflector is cut from a paraboloid off center. Since the focus of the reflector is outside the reflecting surface, the prime-focus receivers and subreflectors are mounted on an instrument arm separate from the reflector backstructure; see Figure 3. When the telescope is aimed at the horizon, the top edge of the instrument arm will be at a height of approximately 140 meter (460 feet) above the ground. The foundation will be a cast-in-place concrete

ring of approximately 50 meter diameter.

Infrastructure

The GBT will use the existing infrastructure, that is, road access, water and power supply, suitably extended, waste disposal facilities, laboratory and service buildings, transportation and maintenance equipment and storage, and the security system currently in place.

A control building of approximately ³5000 sq. feet to house the electronic command equipment for the operation of the GBT ^{is planned} will be constructed near the telescope location as shown ~~on the site plan (Figure 3)~~.

// not sure yet.

SIGNIFICANCE OF PROPOSED ACTION ^{for app.}

Impact on Site Ecology

Comparison with Previous Site Status. The planned new telescope has no different impact on site ecology in comparison with the former 300-foot telescope. Archeological/Historical. No known archeological or historical site exists at the Green Bank site. If such a site were found during construction, AUI will stop construction immediately and notify appropriate authorities in accordance with established requirements.

// probably ser impact - on soil pits.

Land Use. Land disturbances by the telescope construction will be minimal; after completion, the telescope surroundings will be restored. Details of protective measures during construction will be discussed below. No long-term adverse consequences to soil, growth, and wildlife in the environs of the site have been observed since the early 1960's when the first radio telescopes were sited in Green Bank.

Endangered Species. The site is not currently known to be the habitat of any threatened or endangered species, either plant or animal. All hunting on the site is prohibited.

Impact on Human Environment

Socioeconomic. The operation of the GBT will not add significantly to the overall number of employees working on the site at the time prior to the collapse of the the 300-foot telescope. Similarly, the total number of visiting scientists for which the site provides housing and other support will not drastically increase, in particular, with the expected ability of observers to access the site by computer link. However, the GBT will help stabilize the local socio-economic situation for at least a generation.

Waste Disposal. Replacing the 300-foot telescope by the GBT will not add to the total waste processed at the site.

Air Quality. The operation of the GBT has no adverse impact on the air quality in the site area. Vehicular traffic to the station will not exceed a few trips by maintenance vehicles per day as was the case with the

300-foot telescope.

Noise. The telescope is virtually noiseless during operation.

Sight. Since the telescope structure approaches a height of over 100 m while tracking, the GBT will be visible to the general public. This aspect does not have an adverse environmental impact, as evidenced by the approximately 15,000 visitors to the Green Bank site and its telescopes per year. The site is considered a major tourist attraction in West Virginia.

Safety. The operation of the GBT does not pose any more of a safety threat to persons or animals in the area as the operation of the other telescopes on the site. Existing safety procedures are judged adequate and routinely and periodically reviewed. ~~The site is patrolled by guards.~~

EXISTING ENVIRONMENTAL SAFEGUARDS

The State of West Virginia has enacted environmental regulations and enforces compliance by periodical controls. A major purpose of the regulations is to prevent run-off of pollutants into streams. For instance, waste disposal plants must have State-trained and certified personnel to ensure compliance with all regulations.

All regulations have been and will be carefully followed at the NRAO site in general, at the GBT, and the infrastructure to be used by the GBT.

PROTECTIVE MEASURES TO BE IMPLEMENTED WITH REGARD TO CONSTRUCTION

????????????????????????????????

CONCLUSION AND RECOMMENDATION

We conclude that the proposed action, in the light of the regulations cited above (see SUMMARY), is not a major Federal action with significant environmental impact.

Accordingly, I recommend that the NSF approve a "Finding of No Significant Impact" from the proposed construction of the GBT in Green Bank, West Virginia.

Ludwig F. Oster
Program Manager, NRAO
1990

What I need at this time is information on the following things:

Who in the Congress, State, County should be invited to comment?
Names/addresses for agencies.

What are specifically the regulations etc. affecting anything
environmental, who enforces it etc.

What are the environmentally crucial things: Water (brooks, groundwater
flow), animals (are you doing nice things to the beavers?), plants if any.

Pls. fill in construction safeguards (groundwater protection when you dig
15 feet down).

Whatever gives weight to our doings

Thanx. Ludwig



NATIONAL RADIO ASTRONOMY OBSERVATORY

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TO: LUDWIG OSTER

DATE: 9/17/90

COMPANY: NSF

FAX NO. 202 357 9770

Page 1 of _____

FROM: R. FLEMING

DEPARTMENT: NRAO

PHONE: (304) 456-2 231

FAX NO. (304) 456-2271

COMMENTS: MON. NAT'L FOREST INFO - MAP
4 PAGES FROM FINAL E.I.S.

5 PAGES FROM MNGT. PLAN

ENDANGERED SPECIES INVENTORY LIST MANAGER

WV DEPT. OF NATURAL RESOURCES (DNR)

HERITAGE FOUNDATION

BRIAN McDONALD

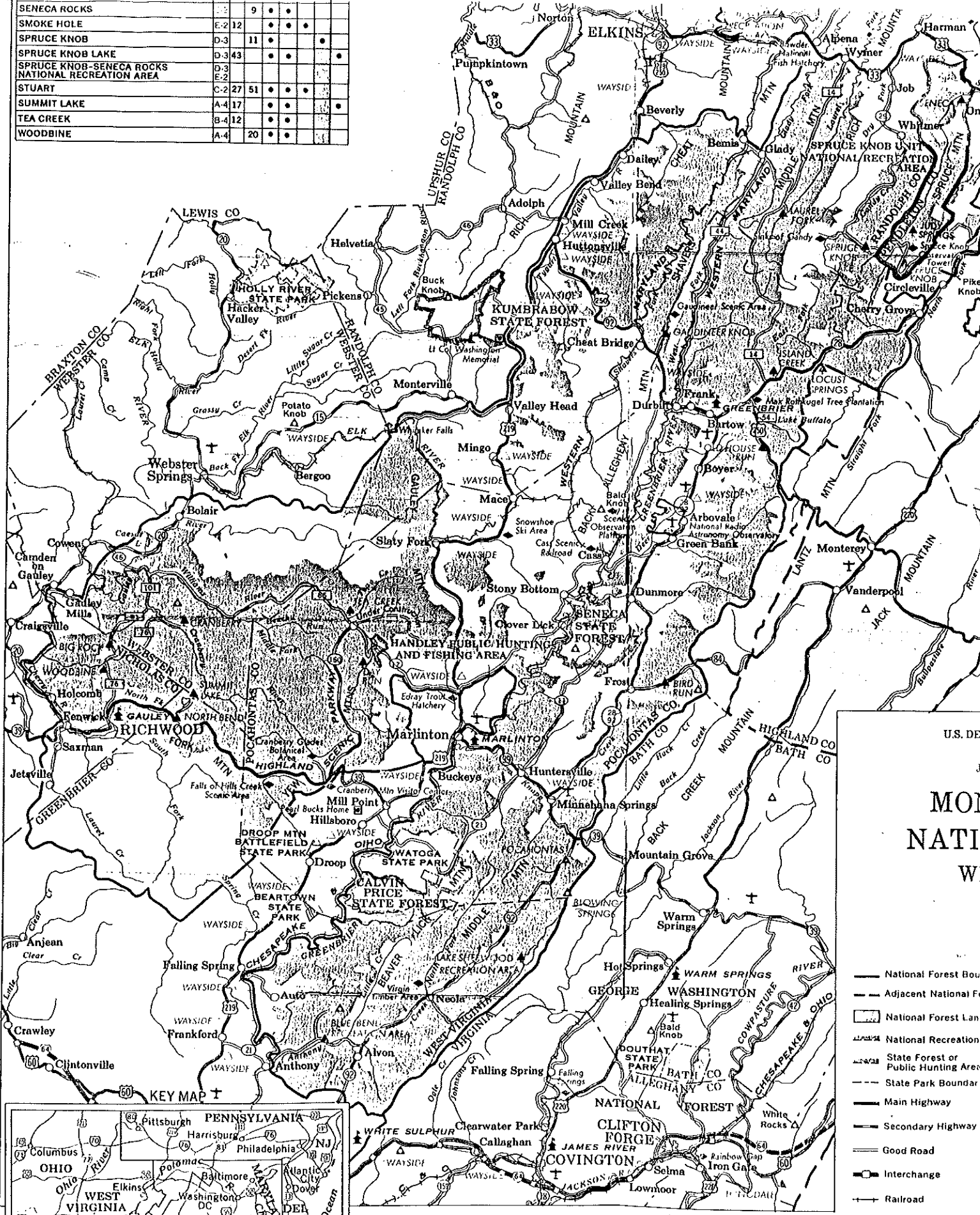
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THERE IS A BIOLOGIST AT ELKINS + BARTON FOREST
SERVICE LOCATIONS

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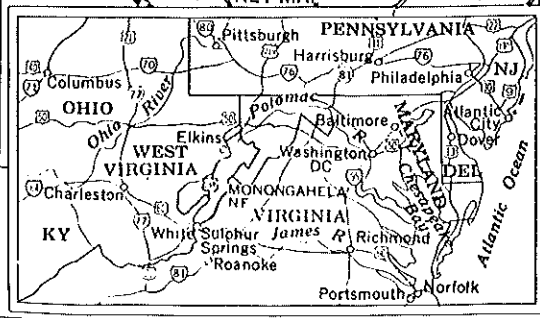
IF YOU HAVE A PROBLEM RECEIVING, PLEASE CONTACT SENDER or (304) 456-2268

SENECA ROCKS	E-2	9	•	•	•	•	•	•	•	•
SMOKE HOLE	E-2	12	•	•	•	•	•	•	•	•
SPRUCE KNOB	D-3	11	•	•	•	•	•	•	•	•
SPRUCE KNOB LAKE	D-3	43	•	•	•	•	•	•	•	•
SPRUCE KNOB-SENECA ROCKS NATIONAL RECREATION AREA	E-2		•	•	•	•	•	•	•	•
STUART	C-2	27	51	•	•	•	•	•	•	•
SUMMIT LAKE	A-4	17	•	•	•	•	•	•	•	•
TEA CREEK	B-4	12	•	•	•	•	•	•	•	•
WOODBINE	A-4	20	•	•	•	•	•	•	•	•



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- National Forest Boundary
- - - Adjacent National Forest
- ▭ National Forest Land
- ▨ National Recreation Area
- ▧ State Forest or Public Hunting Area
- - - State Park Boundary
- Main Highway
- Secondary Highway
- Good Road
- ▣ Interchange
- Railroad
- † Landing Field



For

United States
Department of
Agriculture

Forest
Service

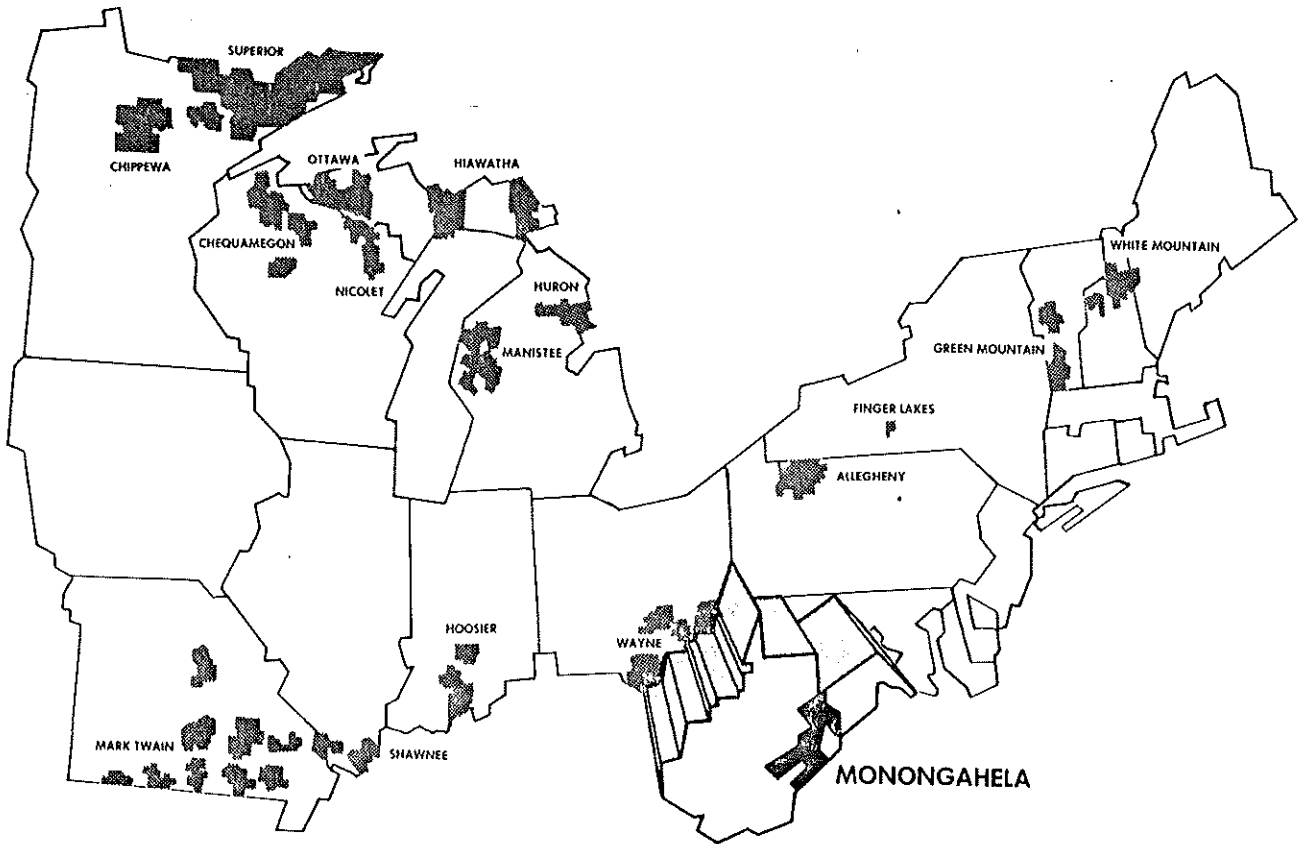
Eastern
Region



Final Environmental Impact Statement

Land and Resource
Management Plan

MONONGAHELA NATIONAL FOREST



Although the Monongahela represents less than 10 percent of the forested land in the State, it is extremely important to the wildlife resource of West Virginia, supplying 80 percent of the State's black bear habitat and 40 percent of the wild turkey habitat.

Most wildlife habitat management is accomplished by coordinating timber management activities with wildlife habitat needs.

Wildlife habitat management is also accomplished by direct actions. Creating and maintaining permanent openings, creating brushy openings, constructing wildlife waterholes, planting food and cover plants, releasing mast producing trees, liming, fertilizing, and seeding plots and closed logging roads, and installing nesting and den boxes. Habitat management is also accomplished through a cooperative program with the West Virginia Department of Natural Resources. This work is financed by Pittman-Robertson funds and National Forest stamp revenue, and is directed by State Wildlife Biologists in cooperation with the Forest Service.

As part of this planning process, wildlife species were designated as management indicator species for the Monongahela. These were selected in consultation with the West Virginia DNR and the George Washington and Jefferson National Forests.

Criteria and the selections used include:

1. Endangered Species:

Indiana Bat - (*Myotis sodalis*) Hibernates in several caves on the forest.

Virginia Big-eared Bat - (*Plecotus townsendi virginiana*) Uses several forest caves for nursery colonies.

Virginia Northern Flying Squirrel - (*Glaucomys sabrinus fuscus*) Inhabits high elevations on the Forest, usually where there is a mixture of large hardwoods and conifers. Den trees are important.

2. Species of Special Concern:

Cheat Mountain Salamander - (*Plethodon nettingi nettingi*) An endemic species found only in West Virginia in about 54 small isolated niches (habitats) on the Monongahela.

3. Game Species Preferring Isolation:

Black Bear - (*Ursus americanus*) Bear populations in West Virginia are low. Biologists are concerned and believe shrinking habitat is a major cause. Roads built into relatively inaccessible bear habitat are not the problem but human use on these roads is.

Wild Turkey - (*Meleagris gallopavo silvestris*) Highest turkey populations occur in areas of least human disturbance. Good habitat includes a moderate amount of mature mast bearing trees with little woody understory. Grassy and herbaceous fields are very important as brood range. Harvest records are maintained and collected on a county basis statewide, and on a management area basis on the National Forest.

4. Species to Monitor Specialized Habitats:

Varying Hare - (*Lepus americanus*) This species is used as a management indicator species to follow red spruce ecosystems. It is a hunted game animal. It occurs primarily in the higher elevations and often will reside where hardwoods with a rhododendron understory is the primary habitat.

5. Species of Game Animals:

White-tailed Deer - (*Odocoileus virginianus*) Important game animal commonly hunted. Indicates early successional stages of vegetation and diversity although many types of habitat are utilized.

6. Species to Monitor Old Growth:

Gray Squirrel - (*Sciurus carolinensis*) A game animal that inhabits mast (nuts, fruits, etc.) producing forest land which also contains den trees. Resident populations of gray squirrel rarely occur where den trees are absent.

In addition to the above categories, the Forest has identified sensitive species which may be of concern in this area. They are considered sensitive on the Monongahela because of unique habitat needs or other concerns, and are recognized in the Plan Standards and Guidelines.

Endangered and Threatened Plants

The area within the Monongahela National Forest proclamation boundary comprises little more than one-tenth of the total area of West Virginia. However, because of the forest's considerable diversity of altitude, temperature, geologic strata, rainfall, and other factors, it contains more than three-fourths of the total number of plant species collected in the State. Several of these species are rare and are being studied for possible classification under Public Law 97-304, the Threatened and Endangered Species Act. Following are species lists of some of these studies.

The National Threatened and Endangered Plants Program is being coordinated by the U. S. Department of Interior, Fish and Wildlife Service, Washington, D. C.

1. Endangered Species:

Running Buffalo Clover, *Trifolium stoloniferum*, is the only West Virginia plant proposed for classification as endangered at this time. It was proposed on March 11, 1986.

2. Threatened Species:

These were proposed by the Fish and Wildlife Service for classification as "Threatened". The Service listed West Virginia as one of the States in which they occur.

<u>Species</u>	<u>Family</u>	<u>Common Name</u>
Asplenium ebenoides	Polypodiaceae	Walking Speenwort
Clamagrostis porteri	Poaceae	Porter's Reedgrass
Cymophyllus fraseri	Cyperaceae	Fraser's Sedge
Platanthera habeneria peramoena	Orchidaceae	Purple Fringeless Orchid
Anemone minima	Ranunculaceae	Dwarf Anemone
Heuchera hispida	Saxifragaceae	Rough Heuchera
Prunus allegheniensis	Rosaceae	Allegheny Sloe
Ptilimnium fluviatile	Apiaceae	Harperella
Oxypolis canbyi	Apiaceae	Canby's Cowbane
Scutellaria ovata pseudoarguta	Lamiaceae	Heart-leaved Skullcap
Synandra hispidula	Lamiaceae	Gyandotte Beauty

Fish

The rivers and streams of the Forest constitute a major natural resource. There are 1,380 miles of streams within the boundary that contain dependable flows of water and which are large enough to support fish life. Five hundred miles are populated with native brook trout, 400 miles stocked with hatchery reared trout, 350 miles are classed as warm water fisheries, and 130 miles are sterile. More than 50 percent of the cold water streams are low in productivity and lack nutrients.

Where fishing pressure is heavy and the fishery cannot be maintained naturally, hatchery reared-catchable sized trout are stocked. Approximately one-half million trout are stocked annually, from both State and Federal hatcheries.

Small-mouth bass is the major warm water game fish. Small populations of walleye pike and large-mouth bass inhabit several of the larger streams. Panfish, catfish, suckers, carp, and forage fish are also found.

None of the fishes known to occur on the Forest have been classified under Public Law 97-304, the Threatened and Endangered Species Act. Fishery biologists are studying the resource and may propose classification in the future.

Fishery management on the Monongahela is performed through a cooperative agreement with the West Virginia Department of Natural Resources and with the U.S. Fish and Wildlife Service. The program utilizes funds provided by the DNR and the Federal Government.

Approximately 85 percent of the funds for the program originate through the sale of hunting and fishing licenses, trout stamps, National Forest hunting and fishing stamps, and excise taxes on sporting equipment. Money spent for management on National Forest lands and waters exceeds that derived from National Forest stamp sales. The program is directed by State biologists in cooperation with the Forest Service.

1/ Despite the title, this is a State revenue source. These funds are not available to the Forest Service, except for fishery projects the State has asked the Forest Service to undertake on a cooperative agreement.

United States
Department of
Agriculture

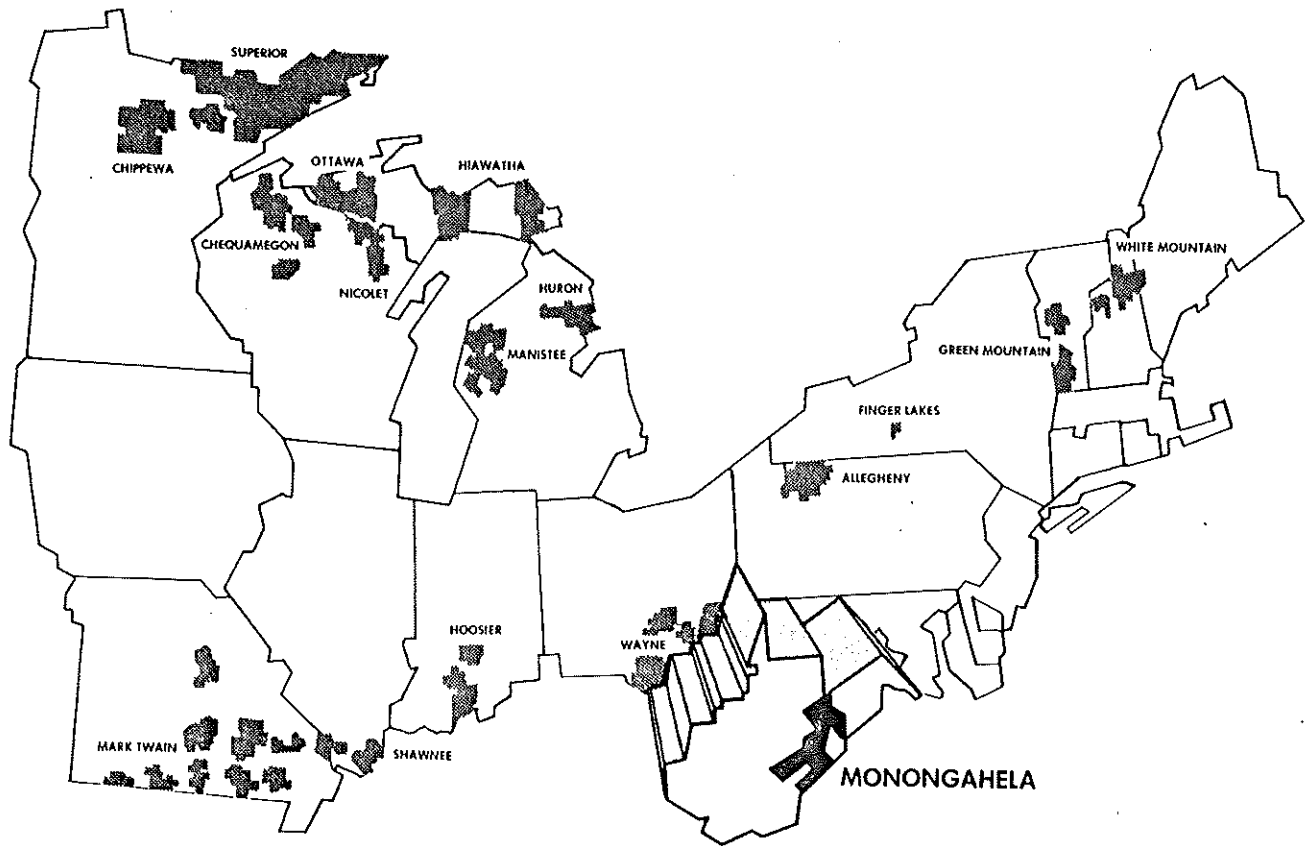
Forest
Service

Eastern
Region



Land and Resource Management Plan

MONONGAHELA NATIONAL FOREST



2

APPENDIX X
INTERIM STANDARDS FOR THE
VIRGINIA NORTHERN FLYING SQUIRREL

APPENDIX X

INTERIM STANDARDS AND GUIDELINES

VIRGINIA NORTHERN FLYING SQUIRREL
(Glaucomys sabrinus fuscus)

These standards and guidelines have been developed in consultation with U.S. Fish and Wildlife Service and the West Virginia Department of Natural Resources and will apply to management activities on the Monongahela National Forest.

Modifications may be made after consultation with the US FWS in order to comply with the recovery plan developed for the species or to reflect new research data.

I. HABITAT IDENTIFICATION

A. Potentially Suitable Habitat is described as:

- 1. Over 3300 feet in elevation, and
- 2. With spruce, fir, hemlock, or northern hardwoods trees in any combination (generally timber types 13,81,82,83,85,86,87,89,) and
- 3. Average stand basal area of trees larger than 12 inches dbh is 75 square feet or greater.

B. Occupied habitat is described as where G.s.fuscus is known to exist through positive identification, as through capture.

II. OCCUPIED HABITAT MANAGEMENT

A. If the area is identified as Occupied Habitat, the following steps are to be taken:

- 1. The area will be identified as Management Prescription 8 on Forest Implementation Maps and Compartment records but not published maps.
 - a. The size and shape of the area will be determined by including all area within 1/2 mile of the trapping or identification site.
 - b. As additional Occupied Habitats are found, identified areas may overlap.

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2. Implement one of the following options:
 - a. Redesign the project to avoid the area.
 - b. Consult with a wildlife biologist and with the US FWS to determine the appropriate management measures.

III. LONG TERM HABITAT EVALUATION

- A. Preliminary Project Planning Analysis will be accomplished three years prior to project activity. This will be done in cooperation with US FWS and WV DNR to the extent practical.
 1. If the identified area does not meet all the criteria established for potentially suitable habitat (I.A.), the area may be treated according to standards and guidelines for the applicable Management Prescription and Opportunity Area.
 2. If the area meets the criteria for potentially suitable habitat, an evaluation (based on best information and professional judgement) will be conducted by a wildlife biologist to determine one of two suitability classes.
 - a. If the evaluation indicates low potential suitability, the project may proceed as in III.A.1.
 - b. If the evaluation indicates high potential suitability, the following options are available:
 - (1) Redesign the project to avoid the area.
 - (2) Establish reasonable evidence that the identified area is unoccupied through the use of live trapping, and/or nesting boxes. Trapping and/or use of nesting boxes will follow procedures established by the Northern Flying Squirrel Recovery Team.
 - (3) Consult with a wildlife biologist to determine appropriate management measures.

IV. SHORT TERM HABITAT EVALUATION

- A. All timber sales scheduled for the period 1987 - 1990 with potentially suitable habitat will provide in the sale KV plan for the installation of Northern Flying Squirrel nesting boxes to collect information.
 1. The number and location of nesting boxes per sale will be determined by a wildlife biologist.
 2. Use of nesting boxes will follow procedures established by the Northern Flying Squirrel Recovery Team.

B. All other projects will be evaluated on a case by case basis following basically the procedure outlined under III.A.1. or III.A.2.

V. MANAGEMENT MEASURES

- A. Some examples of appropriate management measures that may be recommended by a wildlife biologist are:
 - 1. Save trees with cavities.
 - 2. Save standing snags.
 - 3. Preserve down logs.
 - 4. Retain a certain stocking level of residual trees to accomplish a specific objective.
 - 5. Specify frequency of entries to accomplish a specific management objective.
 - 6. Specify size and shape of clearcut units in order to accomplish a particular objective.

- B. Additional measures may be developed and reviewed by cooperating agencies as further habitat information becomes available.