DOE/EA-1764
DRAFT

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Spruce and Peatland Responses Under Climatic and Environmental Change Experiment (SPRUCE)

Marcell Experimental Forest, Itasca County, Minnesota

Date Issued—January 2011

U.S. Department of Energy
Oak Ridge Office
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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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ACRONYMS

AMSL	above mean sea level
BMP	best management practice
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
cm	centimeter
CO_2	carbon dioxide
CWA	Clean Water Act of 1972
dB	decibel
dBA	decibel A-weighted
DOE	U.S. Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act of 1973
ESRI	Environmental Systems Research Institute
FONSI	Finding of No Significant Impact
FY	fiscal year
GPS	Global Positioning System
ha	hectare
JHA	Job Hazard Analysis
km	kilometer
kWh	kilowatt-hour
m	meter
MEF	Marcell Experimental Forest
mm	millimeter
MNDNR	Minnesota Department of Natural Resources
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act of 1969
NF	National Forest
NRHP	National Register of Historic Places
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Act of 1970
ppm	part per million
RFSS	Regional Forester's Sensitive Species
ROI	Region of Influence
T&E	threatened and endangered
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
$\mu g/m^2$	microgram per cubic meter

1. INTRODUCTION

1.1 PURPOSE AND NEED FOR ACTION

The U.S. Department of Energy (DOE) and the U.S. Forest Service (USFS) propose to collaborate in research on the effects of climate change and increased atmospheric carbon dioxide (CO_2) on a black spruce (*Picea mariana*)-*Sphagnum* (peatmoss) ecosystem located in the Marcell Experimental Forest (MEF), which is located approximately 40 kilometers (km) [25 miles] north of Grand Rapids, in Itasca County, Minnesota. The black spruce-*Sphagnum* ecosystem is at the southern extent of the spatially expansive boreal peatland forests and is considered to be especially vulnerable to climate changes. The purpose of the proposed research is to obtain information on how this ecosystem would respond to higher temperatures and increased atmospheric CO_2 projected to occur in the future. Because this ecosystem plays an important role in carbon storage, its responses to these changes are likely to have important feedbacks on the atmosphere and climate through the global carbon cycle.

DOE has identified a need for additional experiments to address multiple science questions and engage a broad cross-section of the scientific community. Present data, from which relationships between climate and ecosystems might be derived, do not provide the requisite cause-and-effect understanding needed to forecast effects of future climate changes on terrestrial ecosystems. Experiments involving controlled manipulations of climate factors and atmospheric CO_2 concentration are therefore needed to establish cause-and-effect relationships between climate changes and effects on ecosystems for a broad range of future environmental conditions. Furthermore, quantitative information on ecosystem responses associated with climate change is needed to develop ecological forecasting tools for policy makers to evaluate safe levels of greenhouse gases in the atmosphere. These objectives complement DOE's mandate to understand both the consequences of climatic change for important ecosystems and the feedbacks between ecosystem response and climate through effects on carbon cycling (DOE 2009).

This project was developed in compliance with the 2004 Chippewa National Forest Plan and would follow the direction, objectives, standards, and guidelines of the 2004 Forest Plan for the Experimental Forest Management Area (FP 3-32, 33).

1.2 BACKGROUND

The DOE Office of Science supports a program of research aimed at developing a predictive, systems-level understanding of the fundamental science associated with climate change, including an integrated portfolio of research ranging from molecular- to field-scale studies. The proposed action addressed in this Environmental Assessment (EA)—the Spruce and Peatlands Responses Under Climatic and Environmental Change Experiment (SPRUCE)—is one such research project. The experiment would be designed, constructed, operated, and managed by the Oak Ridge National Laboratory (ORNL). ORNL is DOE's largest science and energy laboratory and is managed by a partnership of the University of Tennessee and Battelle Memorial Institute.

Established in 1905, the USFS is an agency of the U.S. Department of Agriculture. The USFS manages public lands in national forests and grasslands. It needs answers to questions about climate change mitigation and adaptation to carry out its mission of sustaining the health, diversity, and productivity of America's forests and grasslands to meet the needs of present and future generations.

The MEF was formally established in 1962 to study the ecology and hydrology of peatlands. It has been reserved for long-term research with the cooperation of the USFS Northern Research Station, the

Chippewa National Forest (NF), the Minnesota Department of Natural Resources (MNDNR), Itasca County, and a private landowner. The MEF is made up of two units, a north unit and a south unit. Within these units are six experimental watersheds, each consisting of an upland portion and a peatland that is the source of a stream leaving the watershed. These unique features provide a wide range of hydrological environments to study.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

DOE has prepared this EA to assess the potential consequences of the proposed action on the human environment in accordance with the Council on Environmental Quality (CEQ) regulations (40 *Code of Federal Regulations* [*CFR*] Parts 1500–1508) implementing the National Environmental Policy Act of 1969 (NEPA) and the DOE NEPA Implementing Procedures (10 *CFR* 1021). If the impacts associated with the proposed action are not identified as significant as a result of this EA, DOE and the USFS may issue a Finding of No Significant Impact (FONSI) and proceed with the action. If impacts are identified as potentially significant, an Environmental Impact Statement (EIS) could be prepared.

DOE is the lead agency for this EA. The USFS by virtue of its management of the land on which the proposed project would be located and its participation in the research is a cooperating agency for this EA.

This EA (1) describes the existing environment within the EA study area relevant to potential impacts of the proposed action and alternatives, (2) analyzes potential environmental impacts that could result from the proposed action and alternatives, and (3) identifies and characterizes cumulative impacts that could result from the SPRUCE project in relation to other past, ongoing or proposed activities within the surrounding area.

Certain aspects of the proposed action have a greater potential for creating adverse environmental impacts than others. For this reason, CEQ regulations (40 *CFR* 1502.1 and 1502.2) recommend a “sliding-scale” approach so that those actions with greater potential effect can be discussed in greater detail in NEPA documents than those that have little potential for impact.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

Through the proposed SPRUCE project, DOE and the USFS propose to study the effects of altered atmospheric and climate conditions to obtain information on the response to elevated temperature and elevated atmospheric CO_2 of a black spruce-*Sphagnum* ecosystem. Research would involve climate change manipulation activities, focusing on the response of multiple levels of warming combined with elevated CO_2 levels, the collection of field data, and the evaluation of the response of existing biological communities (plants and animals) to a range of warming levels.

Activities at the SPRUCE site would include (1) constructing and using temporary infrastructure for multi-year use to modify local temperatures and atmospheric CO_2 concentrations consistent with a range of climate change projections; (2) collecting field data regarding plant and animal growth and survival; (3) measuring changes in natural biogeochemical cycles of carbon, water, and other essential plant elements; and (4) evaluating air and soil temperatures, soil/peat water contents, and atmospheric humidity sufficient to characterize the nature of the experimental treatments.

Activities needed to support the proposed research would include (1) extending utilities to the experimental site, (2) installing multiple boardwalks above the surface of the experiment area, (3) removing secondary growth trees in the experiment area to facilitate the installation of infrastructure, and (4) installing experimental chambers. Experimental plots within the overall experiment site would be warmed and exposed to elevated carbon dioxide throughout the 10-year project duration.

The experiment would also provide a destination for occasional educational tours for the public, local schools, and interested groups. Such interactions would be scheduled and hosted by ORNL and/or USFS personnel.

2.1.1 Site Description

The SPRUCE site is located within the South Unit of the MEF in the S1 watershed (Fig. 2.1). The study site (designated S1) at N 47° 30.476´; W 93°27.162´ and 418 meters (m) [1,371 feet] above mean sea level (AMSL) is a 10-hectare (ha) [25-acre] black spruce-peat moss ombrotrophic bog (a raised dome peat bog in which water and nutrient inputs originate from atmospheric sources). The S1 bog was previously harvested in two successive strip cuts 5 years apart (1969 and 1974, Verry et al. 1981). The bog surface has a hummock/hollow microtopography with a typical relief of 10 to 30 centimeters (cm) [4 to 12 inches] between the tops of the hummocks and the bottoms of the hollows (Nichols 1998) [Fig. 2.2].

The climate at the MEF is strongly continental, with moist warm summers and relatively dry, cold winters with abundant sunshine. Annual precipitation averages 780 millimeters [mm] (31 in.), and the annual temperature is 3.3°C (37.9°F). About two-thirds of the precipitation occurs as rain and one-third as snow. Mean annual air temperatures have increased about 0.4°C (1°F) per decade over the last 40 years.

2.1.2 Construction Activities

2.1.2.1 S1 bog and adjacent upland area

Construction activities associated with the SPRUCE project would disturb about 2 ha (5 acres) [Fig. 2.3]. The majority of the disturbance would be in the S1 bog for the construction of four experimental

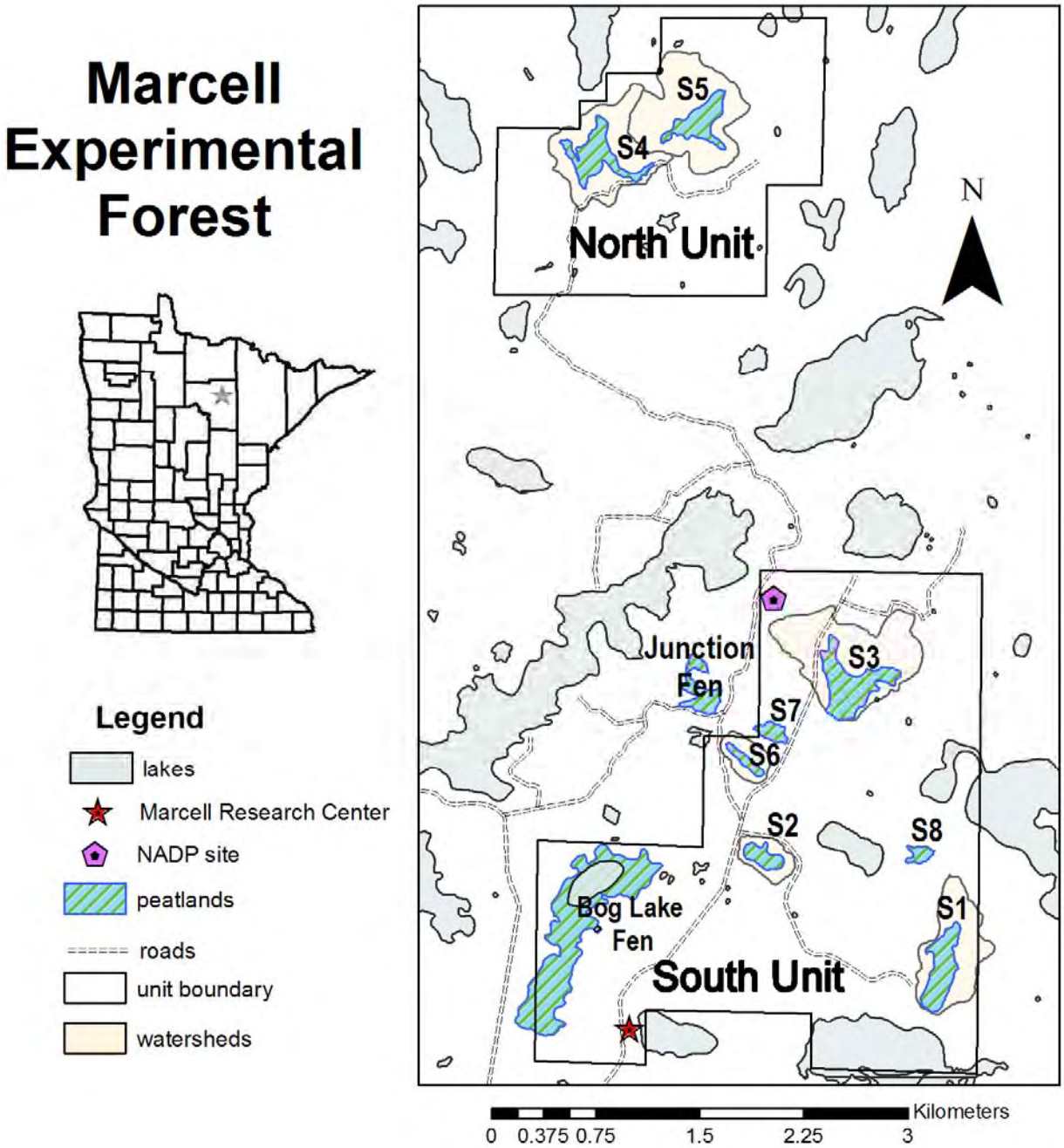


Fig. 2.1. Location of S1 watershed within the South Unit of the Marcell Experimental Forest (Source: USFS http://nrs.fs.fed.us/ef/marcell/sites/).

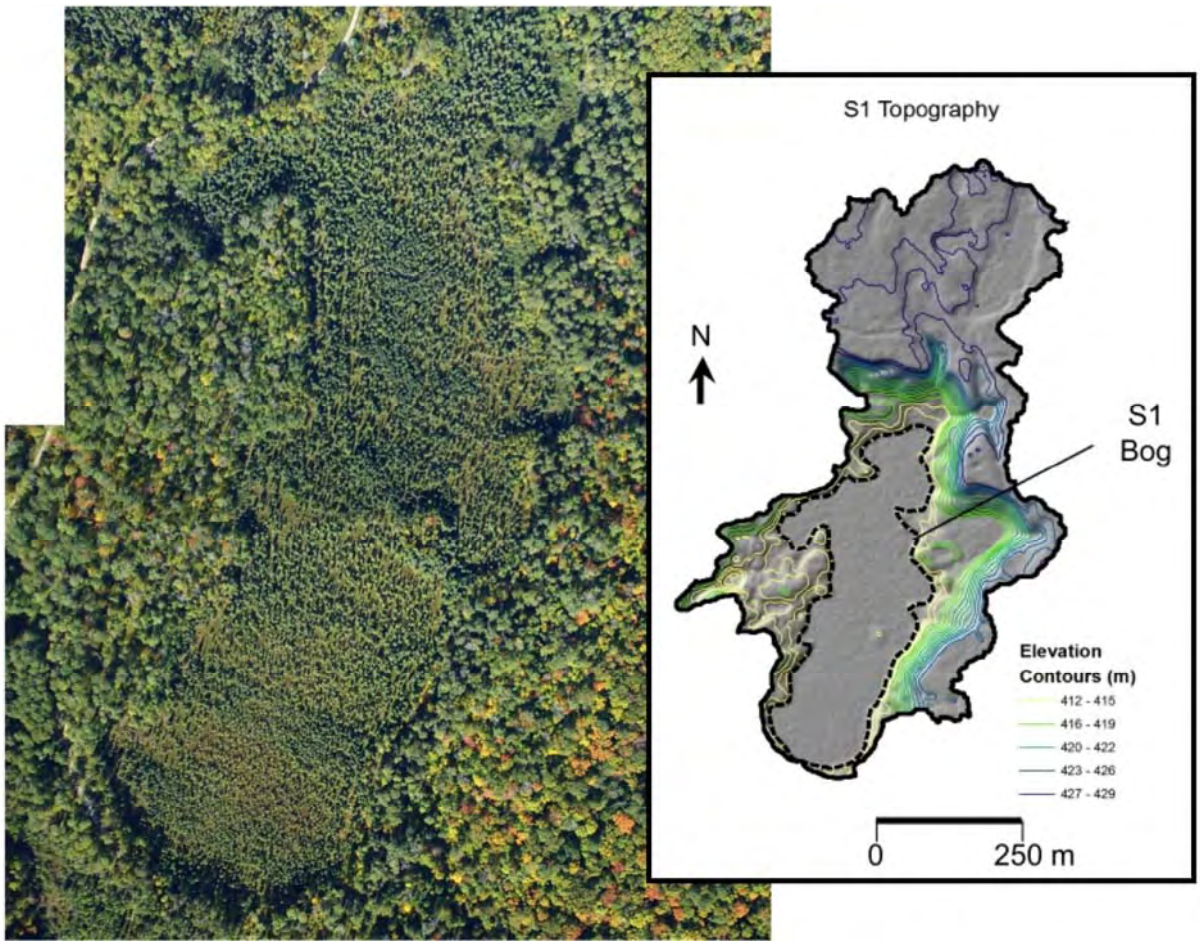
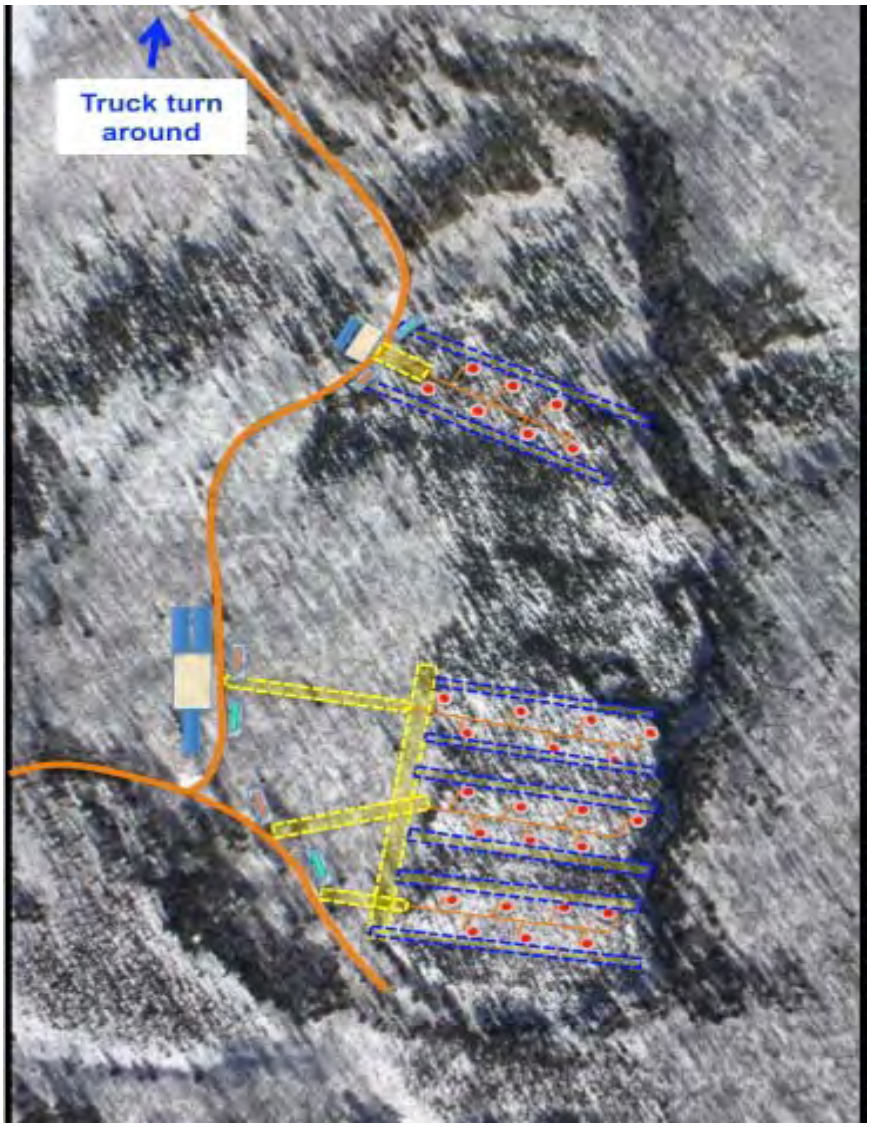


Fig. 2.2. Aerial view and topography of the S1 bog (September 2009).



Key: The SPRUCE Experimental design as planned would include 24 chambered areas with 4 ambient monitoring plots. That is, 7 experimental spaces in each of four experimental blocks.

Boardwalks (thin line ~6 feet wide)

Ground-cleared, year round access (likely to be gravel)

Winter-only construction corridors

Experimental Enclosures (each ~12 to 14-m diameter)

Office/Storage Temporary Buildings

Parking (not to scale)

CO_2 tank on concrete pad or similar supports (not to scale)

Propane tank on concrete pad or similar supports (not to scale)

Road

A turnaround for large delivery trucks exists at a point near the top of the photograph.

Not shown: electrical lines, gas lines, and CO_2 lines extending to each of the boardwalks. Each boardwalk into the bog will also serve as the utility corridor.

Fig. 2.3. Approximate SPRUCE site layout showing planned experimental facilities.

blocks. There would be seven experimental plots located in each of the four blocks within the bog. Six of the seven plots in each block would have open-top, aboveground enclosures and one plot would be used for ambient monitoring for a total of 24 enclosures and 4 ambient plots (Fig. 2.4). The aboveground enclosures would be approximately 12 m (39 feet) in diameter and between 8 to 9 m (25 to 30 ft) high, and would be supported by helical piles drilled through the peat layers to the underlying mineral soils. Figure 2.5 shows photos of a prototype enclosure constructed in Oak Ridge, Tennessee. Small pipes [~3 cm (1.25-in. diameter)] would be inserted into the bog within each enclosure containing low-wattage heaters for deep soil warming. Belowground sheet piling would also be installed within each experimental enclosure to control and constrain the hydrologic effects of the experiment on bog water balance and chemistry. In addition to the enclosures, five temporary construction corridors would be cleared in the bog and four main boardwalks [~2 m wide by 130 m (7 ft by 427 ft)] would be installed along with access spurs to the enclosures. Figure 2.6 is a concept photo taken from an existing boardwalk installed by the MNDNR at the Big Bog Natural Recreation Area north of Upper Red Lake.

Approximately 1,660 m^2 (0.4 acre) of the adjacent upland area would also be disturbed. This would include clearing secondary growth trees for the following:

- temporary office/storage buildings and portable toilets [300 m^2 (0.07 acre)],
- parking lot [200 m^2 (0.05 acre)],
- propane and CO_2 tank locations [200 m^2 (0.05 acre)],
- temporary roads [480 m^2 (0.12 acre)], and
- access paths (gravel or mulch) to the boardwalks [480 m^2 (0.12 acre)].

The material cleared from the upland area would be removed or left in the woods as a minor quantity of wood and slash.

Construction materials, CO_2, and propane supplies would be transported to the site by trucks using existing local roads. It is anticipated that some fencing would be installed around limited facilities to protect the public from on-site hazards, and a gated barrier would be installed at the entrance to each boardwalk.

Construction work would take place predominantly in January, February, and March to avoid damaging the bog vegetation. Construction activities may take two winters to complete.

2.1.2.2 Electrical distribution line

Electricity would be extended to the site from the south over a new 5-km (3-mile) distribution line corridor (Fig. 2.7). The new line would be installed primarily along existing roads on USFS land. The route would begin at the junction of Itasca County Road 50 and Forest Road 3495. It would be installed immediately adjacent to Forest Road 3495 and run parallel to it in a northeasterly direction for a distance of about 2.4 km (1.5 miles). The line would then depart Forest Road 3495 in a northerly direction crossing the Plantation/Cutaway Lake drainage to junction with Forest Road 3851, a distance of about 1.6 km (1 mile). The line would then parallel Forest Road 3851 in an easterly direction to the S1 bog, a distance of about 1 km (0.6 miles).

The new line would be installed (buried) by trenching to a depth of between 107 and 122 cm (42 and 48 in.). For the segment that does not follow the existing roads, a 6-m (20-ft)-wide strip would be cleared for the operation of the trenching machinery. The stumps would be left in place and there would be no grubbing or other disturbance of the ground or subsurface other than the trenching itself. The lowland/wetland area that is part of the Plantation/Cutaway Lake drainage would be crossed using unidirectional boring to go horizontally

beneath this area. The depth of the boring would be about 1.5 m (5 ft) below the surface. For the borings, the electrical cable would be installed inside 5-cm (2-in.)-diameter PVC (polyvinyl chloride) conduit.

Fig. 2.4. Approximate locations of experimental blocks and plot positions.

Fig. 2.5. Exterior and interior views of the prototype 12-m (39-ft) diameter warming enclosure constructed in Oak Ridge, Tennessee.

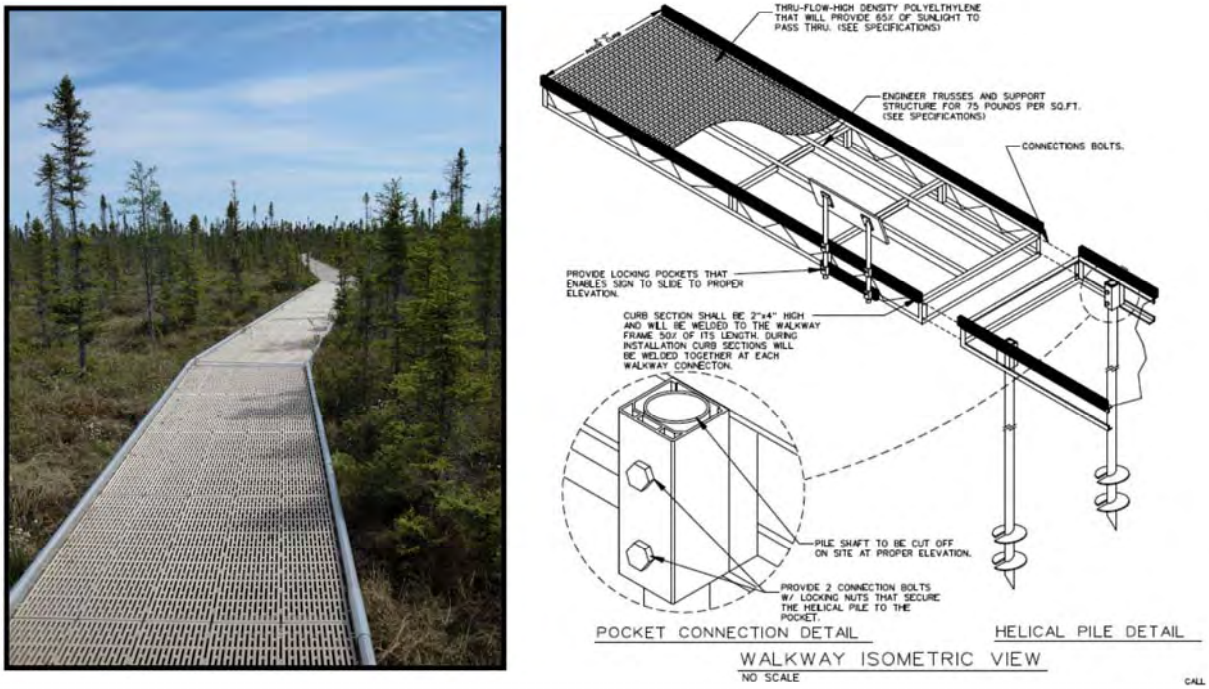


Fig. 2.6. Minnesota Big Bog Boardwalk and construction detail.

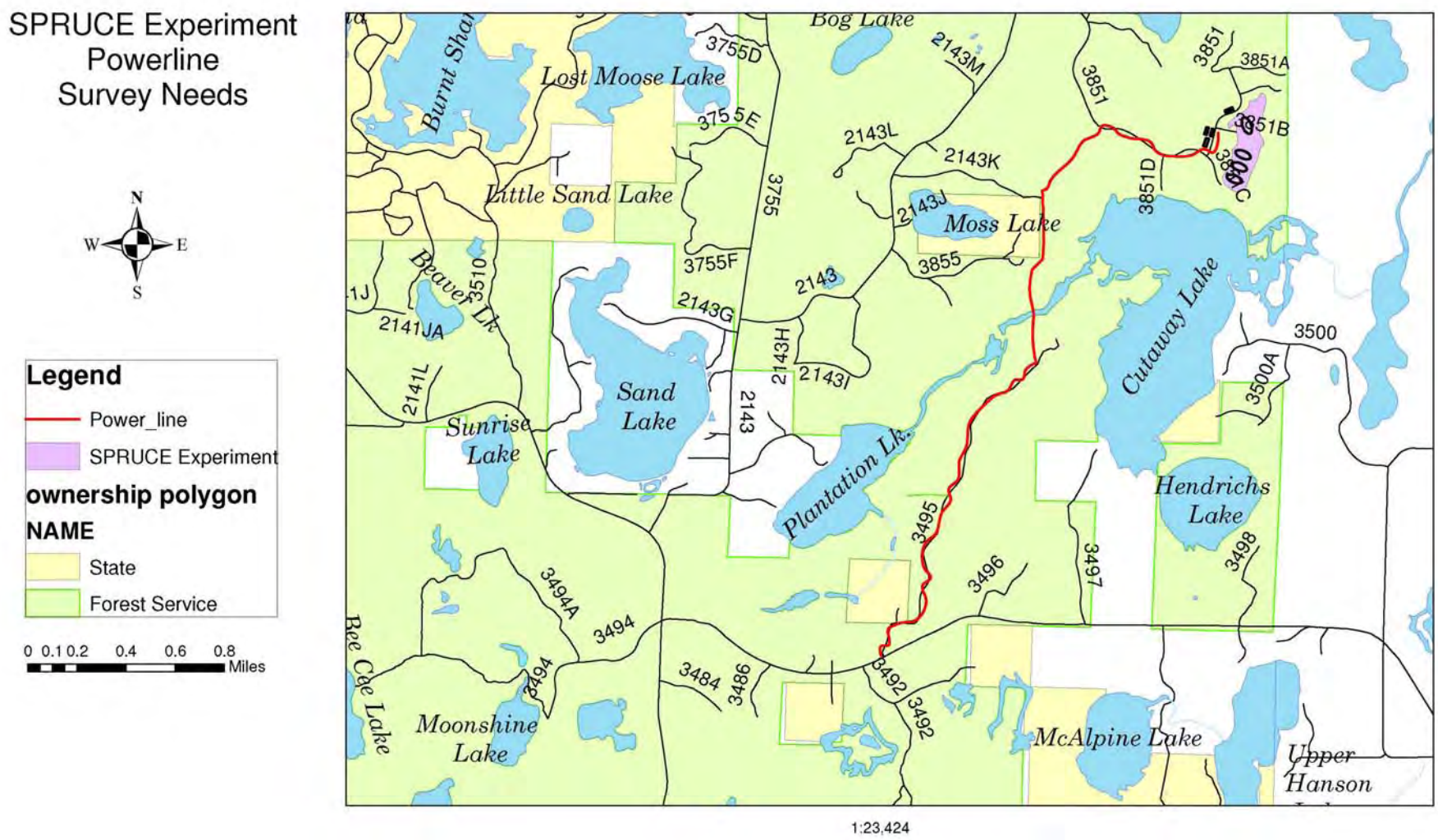


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Fig. 2.7. New electrical distribution line for SPRUCE project.

Once the line reaches the S1 bog, it would be buried or placed inside protected conduit at the ground surface and would be extended to each of the boardwalks and to other infrastructure, as needed. The boardwalks would serve as the utility corridor to the enclosures by attaching the utility lines to the undersides of the walkways.

2.1.3 Experimental Activities

Experimental work in the S1 bog would be a climate change manipulation focusing on the combined responses to multiple levels of warming at ambient or elevated CO_2 levels. The controlled experiment would make it possible to test mechanisms controlling the vulnerability of organisms, biogeochemical processes, and ecosystems to climatic change (e.g., thresholds for organism decline or mortality, limitations to regeneration, biogeochemical limitations to productivity, and the cycling and release of CO_2 and methane to the atmosphere). The manipulation would evaluate the response of the existing biological communities, within the enclosures, to a range of warming levels from ambient temperature to 9°C above ambient. Within a sequence of temperature treatments, the warming treatments would be combined with additional elevated CO_2 exposures of 800 to 900 parts per million (ppm) in ambient air.

Vertical heaters inserted into the bog would be used for warming the soil within the experimental enclosures from the surface to a depth of approximately 2 m (7 ft). Forced-air heating would be used to warm the aboveground encircled treatment space (Fig. 2.8). Partial recirculation of the heated air would be included to limit the energy requirements for heating. Carbon dioxide would be added to the heated air during daytime hours of the active growing season (May through September) and possibly during warm winter periods.

A subsurface flow barrier (sheet piling) would be installed around the perimeter of each of the enclosures to prevent lateral flow of groundwater into or out of the enclosure and would encircle each enclosure from the ground surface to the silty-clay mineral soil that underlies the bog.

Measurements during the first years of experimental treatments would focus on (1) the physiological and growth responses of individual plant species, (2) changes in understory community composition including recruitment and survival, and (3) changes in biogeochemical (e.g., nutrient availability, organic matter decomposition) and hydrologic processes. Pre-treatment observations would be initiated during fiscal year (FY) 2010–2012, and manipulations would be initiated in FY 2012.

2.1.4 Decommissioning

At project termination, the boardwalks would either be removed or left in place for USFS use; the aboveground enclosures would be disassembled and the materials recycled; the CO_2 and propane tanks and on-site trailers would be returned to the appropriate vendor or resold; and other experimental equipment would be reused, recycled, or discarded, as appropriate to the material. Some minor revegetation (e.g., reseeding) might occur in the disturbed upland areas once the infrastructure is removed. Any restoration of disturbed areas would follow the applicable USFS policies and procedures.

2.2 NO ACTION ALTERNATIVE

Assessment of the No Action Alternative is required by DOE NEPA regulations. The No Action Alternative provides an environmental baseline against which impacts of the proposed action and alternatives can be compared.

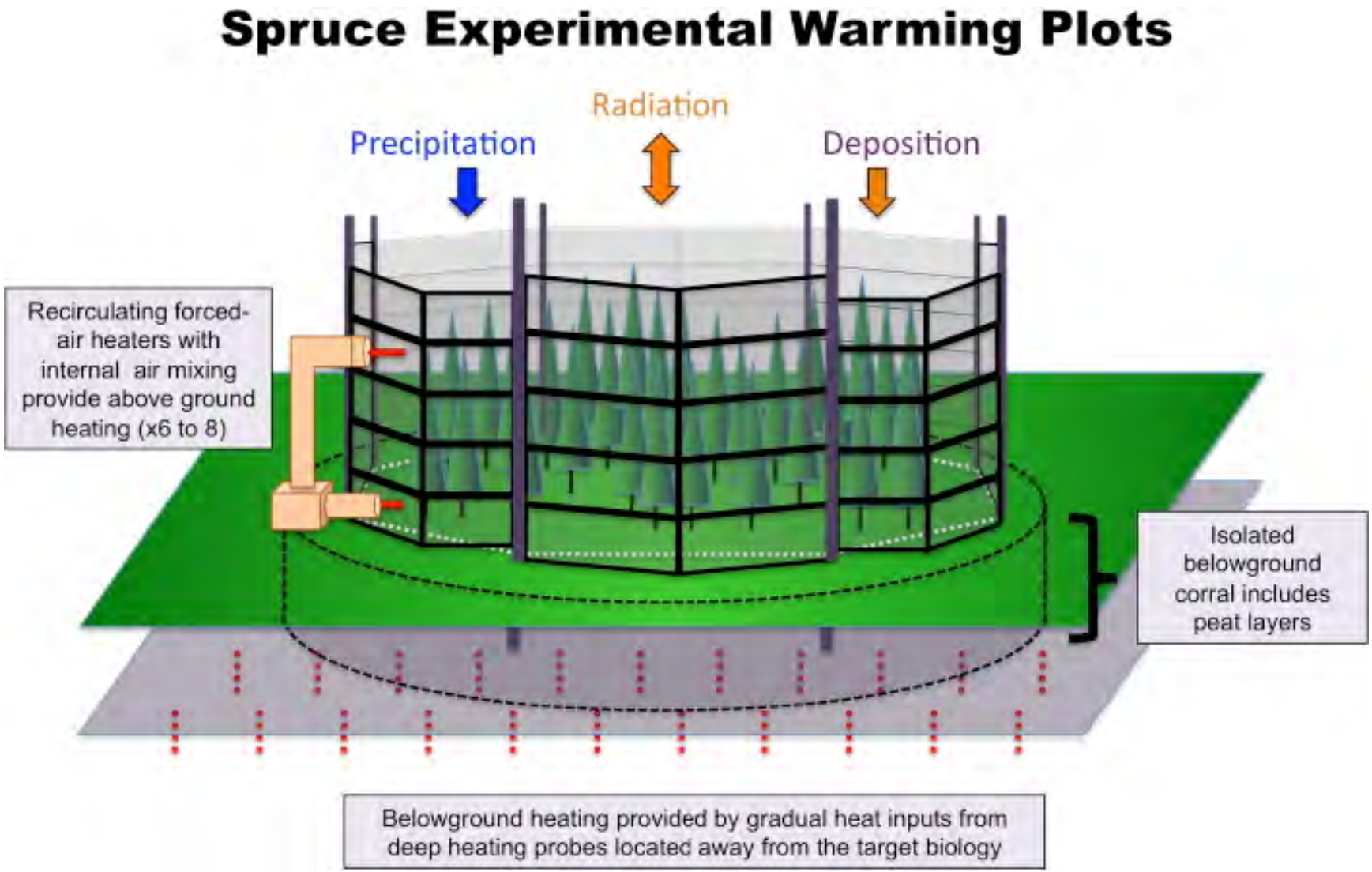

Fig. 2.8. Graphical representation of experimental plot enclosure with above and below ground heating.

Under the No Action Alternative, DOE would neither fund nor implement the experiment, and the USFS would not provide the experimental site. Thus, the S1 bog in the MEF would be available for other manipulative research by the USFS or other organizations. Also, the data and information expected to be obtained from the proposed research would not be available.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED

DOE has not been able to identify any alternative way of obtaining the scientific results expected from the SPRUCE project without disturbing a bog. Alternative sites for the experiment were considered, but DOE determined that locating the project at a different location would not materially change the potential for effects or the nature of those effects. Further, DOE determined that undertaking the proposed research in the MEF would maximize the research results from the proposed research for the following reasons. The S1 watershed location on the MEF has the necessary combination of species and homogenous composition over sufficient land area, is a good example of a commonly occurring ombrotrophic bog, is accessible from pre-existing roadways, and is close to the necessary utilities and support organizations. The USFS has detailed records of hydrological, chemical, and meteorological measurements in the S1 bog and other closely related bogs on the MEF, extending from the 1960s to the present. Bogs of this type are very common in the region.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter presents information on the existing conditions of the environmental resources that could be affected by the proposed action, together with analyses of the potential environmental impacts of the proposed action and alternatives on those resources, including discussion of project attributes that could have the potential for significant impacts.

3.1 LAND USE/VISUAL RESOURCES

3.1.1 Existing Conditions

Occasional forest harvests have and will occur on the MEF or adjacent land parcels that are accessed via the MEF road network as part of forest management activities of the Chippewa NF, the state of Minnesota, or Itasca County. The sale and harvest of timber from the MEF and adjacent private and public lands creates jobs and provides raw materials to local pulp industries. Dead, fallen timber is also salvaged for biofuels for home heating. Current commercial interest in biomass for biofuels is expected to increase in the future. Non-commercial forest products are also important to local economies. Some are used to supplement dietary needs (e.g., wild rice and morel mushrooms) while others are used to construct traditional crafts (e.g., birch bark and balsam boughs) [Kolka et al. 2010, in press].

In the S1 watershed, the black spruce peatland was harvested in alternating strips in 1969 and 1974 to assess hydrological response, watershed energy balance, and black spruce regeneration. The strip cut approach left a seed source for black spruce regeneration, after the remaining strips were clearcut.

Recreational activities at the MEF include boating, camping, fishing, and hunting. Because there are private landholdings around the MEF, permanent and seasonal residents also use county and USFS roads that bisect the MEF to access their properties. Recreational use of off-road highway vehicles such as four-wheel all terrain vehicles and snowmobiles does occur, but the frequency and impact on roads are minimal. The majority of the recreational use in the vicinity of the S1 watershed is associated with Cutaway Lake, which is south of the S1 bog (Fig. 2.7). However, there is no direct access to Cutaway Lake from the access roads to be utilized by the SPRUCE project.

3.1.2 Environmental Consequences

3.1.2.1 Proposed action

The SPRUCE project would have minimal impacts on land uses within the MEF. The MEF has been reserved for long-term research and the project site is located within one of the six designated experimental watersheds. Also, the S1 watershed has been previously disturbed for research activities. Hunting in the immediate vicinity of the site would need to be restricted due to safety concerns to personnel working on the experiment. Occasional off-road vehicle use on the roads and trails in the surrounding area would be able to continue. SPRUCE activities would not affect recreational use at nearby Cutaway Lake.

Construction of the open-top enclosures and associated infrastructure for the SPRUCE project would change the existing visual character of the S1 watershed area. The enclosures within the S1 bog would be 8 to 9 m (25 to 30 ft) high and could be visible at certain points from the roads around the site for the

planned 10-year duration of the project. The structures would not be visible by anyone from Cutaway Lake.

3.1.2.2 No action

Under the No Action Alternative, land use and the visual character of the area would not be affected since the proposed action would not be implemented.

3.2 AIR QUALITY

Ambient air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The levels of pollutants are generally expressed in terms of concentration, either in units of ppm or micrograms per cubic meter ($\mu g/m^3$).

The baseline standards for pollutant concentrations are the National Ambient Air Quality Standards (NAAQS) and state air quality standards. These standards represent the maximum allowable atmospheric concentration that may occur and still protect public health and welfare. Minnesota has adopted the NAAQS (MORS 2010). Based on measured ambient air pollutant concentrations, the U.S. Environmental Protection Agency (EPA) classifies areas of the United States according to whether they meet NAAQS. Those areas demonstrating compliance with NAAQS are considered “attainment” areas, while those that are not in compliance are known as “non-attainment” areas. Those areas that cannot be classified on the basis of available information for a particular pollutant are “unclassifiable” and are treated as attainment areas until proven otherwise.

3.2.1 Existing Conditions

3.2.1.1 Regional Air quality

The proposed SPRUCE site is located in an undeveloped area of Itasca County in north-central Minnesota. Itasca County, like all counties in Minnesota, is an attainment area for all criteria pollutants (EPA 2010). Itasca County emissions obtained from the EPA’s 2002 National Emissions Inventory (NEI) are presented in Table 3.1. The county data include emissions data from point sources and mobile sources. *Point sources* are stationary sources that can be identified by name and location. *Mobile sources* are any kind of vehicle or equipment with a gasoline or diesel engine, an airplane, or a ship. Two types of mobile sources are considered: on-road and non-road. *On-road* mobile sources consist of vehicles such as cars, light trucks, heavy trucks, buses, engines, and motorcycles. *Non-road* mobile sources are aircraft, locomotives, diesel and gasoline boats and ships, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles (EPA 2008).

Table 3.1. Itasca County baseline emissions

	Emissions (tons/year)				
Source type	**CO**	**NO_x**	**PM_{10}**	**SO_2**	**VOCs**
Point Sources	1,876	15,331	3,054	21,213	491
Non-Road and Mobile Sources	11,199	3,880	6,157	273	1,386
Total	**13,075**	**19,211**	**9,211**	**21,486**	**1,877**

Key: CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a diameter of less than or equal to 10 microns; SO_2 = sulfur dioxide; and VOC = volatile organic compound.
Source: EPA 2002.

3.2.1.2 Greenhouse Gases

Greenhouse gases are chemical compounds in the Earth's atmosphere that trap heat. Gases exhibiting greenhouse properties come from both natural and human sources. Water vapor, CO_2, methane, and nitrous oxide are examples of greenhouse gases that have both natural and manmade sources, while other gases such as chlorofluorocarbons once used in refrigeration systems and as propellants in aerosol cans, are exclusively manmade. In the United States, greenhouse gas emissions come mostly from energy use. These are driven largely by economic growth, fuel used for electricity generation, and weather patterns affecting heating and cooling needs. Energy-related CO_2 emissions resulting from petroleum and natural gas represent 82% of total U.S. manmade greenhouse gas emissions (Energy Information Administration 2008).

3.2.2 Environmental Consequences

The air quality analysis considered potential impacts of air emissions from construction activities and from the planned experiments. To evaluate the air emissions and their projected impact on the region, the emissions associated with the project activities were compared to Itasca County's total emissions (Table 3.1) on a pollutant-by-pollutant basis. If total emissions of any pollutant equal 10% or more of the region's emissions for that specific pollutant, there could be potential impacts on air quality. This 10% criterion approach, which was derived from the EPA's General Conformity Rule as an indicator for impact analysis for nonattainment and maintenance areas, has been used historically in NEPA documents to provide a consistent approach to analysis. Although Itasca is currently an attainment area for all criteria pollutants (EPA 2010) and a General Conformity determination is not required, the 10% criterion was utilized to provide a consistent approach for evaluating the potential impact of the project.

The U.S. Department of Defense-developed Air Conformity Applicability Model was utilized to provide a level of consistency with respect to emissions factors and calculations. Air emissions estimated using the Air Conformity Applicability Model were compared to the established 10% criterion for Itasca County, as represented in the EPA's 2002 NEI (EPA 2002).

3.2.2.1 Proposed action

Construction Emissions

Construction activities produce air emissions from operation of heavy construction machinery, other construction and delivery vehicles, and employees' personal vehicles. Grading and construction result in short-term air quality impacts such as dust generated by clearing and grading activities, exhaust emissions from gas- and diesel-powered construction equipment, and vehicular emissions associated with the commuting of construction workers. Estimates of air emissions for the proposed action construction activities are shown in Table 3.2.

As shown in Table 3.2, the total construction emissions would be less than 10% of regional emissions and would, therefore, not exceed the General Conformity annual emission thresholds. Also, 40 *CFR* 93 § 13 defines *de minimis* levels, that is, the minimum threshold for which a conformity determination must be performed, for various criteria pollutants in various areas. Under the proposed action, the *de minimis* thresholds are not exceeded for any pollutant. Impacts on regional air quality would include short-term, temporary, and localized increases in criteria pollutants during construction activities. These increases would not exceed thresholds; thus no adverse impacts are expected from the construction activities.

Table 3.2. Construction emissions

Emission activities	Emissions (tons/year)				
	CO	**NO_x**	**PM_{10}**	**SO_2**	**VOC**
Grading Equipment	0.07	0.27	0.02	0.03	0.03
Grading Operations	0.00	0.00	7.89	0.00	0.00
Acres Paved	0.00	0.00	0.00	0.00	0.00
Mobile and Stationary Equipment	70.72	84.46	5.65	7.88	21.59
Non-Residential Architectural Coatings	0.00	0.00	0.00	0.00	0.05
Workers Trips	0.03	0.00	0.00	0.00	0.00
Total	**70.82**	**84.73**	**13.56**	**7.91**	**21.67**
Itasca County Emissions[1]	**13,075**	**19,211**	**9,211**	**21,486**	**1,877**
Percentage of County Emissions	*0.54%*	*0.44%*	*0.15%*	*0.04%*	*1.15%*

Key: CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a diameter of less than or equal to 10 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound. [1]Source: EPA 2002.

Experiment Emissions

Experimental activities could include the use of as many as 4 propane-fueled heaters per warmed chamber for a maximum of 80 heaters during full-scale operation of the experiment. However, other arrangements and numbers of heaters with similar heating capacities and emissions could be used. The combustion emissions associated with these heating units would be minimal (Table 3.3). The pollutant with the highest level of emissions would be NO_x, with estimated emissions of 1.70 tons per year, which is only approximately 0.009% of the annual NO_x emissions in Itasca County emissions. These emissions would have negligible impact on local and regional air quality.

Table 3.3. Experimental emissions

Source	Emissions (tons/yr)				
	CO	**NO_X**	**SO_2**	**VOC**	**PM_{10}**
Propane	0.98	1.70	0.12	0.13	0.09
Itasca County Emissions	**13,075**	**19,211**	**9,211**	**21,486**	**1,877**
Percentage of County Emissions	*0.007%*	*0.009%*	*0.001%*	*0.001%*	*0.005%*

Key: CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with a diameter of less than or equal to 10 microns; SO_2 = sulfur dioxide; VOC = volatile organic compound.

The experiment would also include releasing CO_2 into the experimental enclosures to evaluate the impacts of these elevated CO_2 levels. The CEQ recommended in their draft guidance of February 2010 that emissions equal or greater than 25,000 metric tons annually should be included in NEPA assessments (CEQ 2010). Direct CO_2 emissions and those from propane combustion combined would be approximately 1,615 metric tons. Thus, these emissions would have no more than a *de minimis* impact on the global atmosphere.

3.2.2.2 No action

Under the No Action Alternative, there would be no new emissions or changes in air quality over the existing conditions.

3.3 NOISE

Noise is defined as any unwanted sound. Defining characteristics of noise include sound level (amplitude), frequency (pitch), and duration. Each of these characteristics plays a role in determining the intrusiveness and level of impact of the noise on a noise receptor. The term “noise receptor” is used in this document to mean any person or animal that hears or is affected by noise.

Sound levels are recorded on a logarithmic decibel (dB) scale, reflecting the relative way in which the ear perceives differences in sound energy levels. A sound level that is 10 dB higher than another would normally be perceived as twice as loud, while a sound level that is 20 dB higher than another would be perceived as four times as loud. Under laboratory conditions, the healthy human ear can detect a change in sound level as small as 1 dB. Under most non-laboratory conditions, the typical human ear can detect changes of about 3 dB.

3.3.1 Existing Conditions

Ambient noise at the proposed SPRUCE site consists mostly of rural or nature sounds (e.g., wind and birds). Limited vehicle traffic on the roads near the site also occasionally contributes to the ambient noise levels. General noise levels in these types of areas are 45–55 decibels A-weighted (dBA) [Cavanaugh and Tocci 1998]. There are no schools, churches, or hospitals within 4 km (2.5 miles) of the proposed site. The closest residential structure is a seasonal occupied cabin located at Cutaway Lake about 0.8 km (0.5 mi) south of the project site.

3.3.2 Environmental Consequences

Noise impacts from construction were analyzed by comparing the expected noise levels to a baseline level and its possible effects on people in the area. Construction noise was evaluated for a single site and may be applied to each location within the project area where construction activities would take place. Typical construction equipment was assumed to be used (see Table 3.4).

Table 3.4. Maximum noise levels at 15.2 m (50 ft) for common construction equipment

Equipment type	Maximum noise level L_{max} at 15.2 m (50 ft) [dBA, slow]
Compactor (ground)	80
Dozer	85
Dump Truck	84
Excavator	85
Generator	82
Grader	85
Pickup Truck	55
Warning Horn	85
Crane	85

Key: dBA = decibels A-weighted; L_{max} = maximum sound level.
Source: U.S. Department of Transportation FHWY 2006.

For purposes of analysis, it was assumed that the primary sources of noise during these activities would be truck and vehicle traffic, heavy earth-moving equipment, and other construction equipment or infrastructure powered by internal combustion engines used on-site.

The Federal Highway Administration's Roadway Construction Noise Model was used to estimate construction noise levels at various distances from the project site. Noise levels were evaluated for receptors at 30.5 m (100-ft) increments. Noise abatement measures were not considered in this analysis for a worst-case scenario. The same types of equipment were assumed to be used on each construction site. Noise levels above 65dBA would be considered significant impacts. Noise levels were calculated as an equivalent noise level (average acoustic energy) over an 8-h period ($L_{eq(8)}$). The maximum sound level (L_{max}) shows the sound level of the loudest piece of equipment, which is generally the driver of the $L_{eq(8)}$ sound level.

3.3.2.1 Proposed action

Construction Noise

Potential noise sources would include variable pitch and volumes from vehicles and equipment involved in site clearing and grading, creating and/or placing of engineered structures, and running of generators and various power tools. Table 3.5 shows the noise levels expected at receptor distances in 30.5 m (100-ft) increments.

Table 3.5. Noise levels at specific distances from the construction site

Distance from construction site [m (ft)]	Maximum noise level (Lmax) dBA	Equivalent noise level (Leq) dBA
30.5 (100)	79.0	81.7
61 (200)	73.0	75.7
91.4 (300)	69.4	72.2
122 (400)	66.9	69.7
152.4 (500)	65.0	67.8

Key: dBA = decibels A-weighted.

Construction noise would cause a temporary and short-term increase to the ambient sound environment. Construction activities would cause noise levels in excess of 65 dBA within 152.4 m (500 ft) of the construction sites. Sustained exposure to noise levels exceeding 80 dB may result in hearing loss. Receptors within 30.5 m (100 ft) of the construction site would be exposed to such levels. Workers associated with construction activities would be expected to wear appropriate hearing protection as required by the Occupational Safety and Health Act of 1970 (OSHA). Personnel within the 152.4-m (500-ft) range may be annoyed by the elevated noise levels, which may interfere with conversation and other activities. Noise would have no adverse effects.

Experiment Noise

In July of 2010, ORNL conducted a noise level assessment of a prototype SPRUCE enclosure. Noise samples were obtained in accordance with the OSHA standard 29 *CFR* 13.10.95. Ambient noise levels were obtained as well for comparison. Samples were taken at various locations inside and outside the enclosure immediately adjacent to the blowers and at distances from 15 to 30 ft away (Tables 3.6, 3.7, and 3.8).

Table 3.6. Noise level comparison - Outside of chamber

Facility	Sample	Location	Blowers off (dB)	Blowers on (dB)	Increase (dB)
0800 Area	1	Adjacent to blower 11	38.3	55.4	17.2
0800 Area	2	Adjacent to blower 2	40.6	54.8	14.2
0800 Area	3	Adjacent to blower 1	46.1	56.7	10.6
0800 Area	4	Adjacent to blower 9	43.1	64.3	21.2

dB = decibel.

Table 3.7. Noise level comparison - Inside of chamber

Facility	Sample	Location	Blowers off (dB)	Blowers on (dB)	Increase (dB)
0800 Area	1	Adjacent to blower 11	35.2	60.6	25.4
0800 Area	2	Adjacent to blower 2	35.9	59.5	23.6
0800 Area	3	Adjacent to blower 1	35.8	63.4	27.6
0800 Area	4	Adjacent to blower 9	35.9	65.1	29.2

dB = decibel.

Table 3.8. Noise level comparison – Various distances

Facility	Sample	Location	Blowers off (dB)	Blowers on (dB)	Increase (dB)
0800 Area	1	~15 ft away facing Northeast	42.8	47.8	5.0
801 Area	2	~15 ft away facing Southwest	46.8	46.9	0.1
802 Area	3	~30 ft away facing Northeast	37.4	46.7	9.3
803 Area	4	At gravel road intersection	38.4	43.0	4.6

dB = decibel.

All measurements obtained were determined to be well below the OSHA Occupational Exposure Limit (OEL) of 85 dB 8-hr time-weighted average. ORNL safety experts determined that hearing protection would not be necessary for personnel to work around or within the test enclosures.

Likewise, at the relatively nominal distances of 15 and 30 ft away from the operating enclosure, noise levels are only slightly elevated above ambient levels, which consist primarily of wildlife and wind noise. Under the current plans, SPRUCE enclosures would be located well over 30 ft apart, so noise interaction between multiple units would not be of much concern. Further, vegetation left in place would continue to decrease the intensity of blower noise and lessen the likelihood of interaction.

At the highest detected noise level with all eight blowers running, measured immediately adjacent to a blower outside the prototype enclosure, a level of 65.1 dB was obtained. Assuming a worst-case scenario of two enclosures located immediately adjacent and both running all eight blowers, an increase of approximately 3 dB would be expected. Under this hypothetical scenario, a maximum noise level of 68.1 dB would be reached; this is still well below the OSHA OEL standard. No adverse impacts to

SPRUCE personnel would be expected as a result of experimental noise, and due to the remote location and low anticipated noise levels, no impacts would occur to the public.

3.3.2.2 No action

Under the No Action Alternative, noise in the area would continue to be primarily from vehicle traffic and the natural environment. The land would remain undeveloped and no changes to the existing noise levels would occur.

3.4 GEOLOGICAL RESOURCES

3.4.1 Existing Conditions

Information on the local geologic setting is extracted from *Peatland Biogeochemistry and Watershed Hydrology at the Marcell Experimental Forest* (Kolka et al. 2010, in press). The lakes and peatlands on the MEF formed in ice-block depressions among low-elevation hills that were deposited as glacial moraines and outwash. Shallow postglacial lakes and ice-block depressions slowly filled with organic soils that formed various types of peatlands (fens, poor fens, and bogs). The organic soils in peatlands are typically less than 3 m (9.8 ft) deep in glacial lake beds but may exceed 10 m (32.8 ft) in ice-block depressions. Glacial drift deposits are 45 to 55 m (148 to 180 ft) thick and form a regional groundwater aquifer above pre-Cambrian Ely greenstone and Canadian Shield granite and gneiss bedrock. The layer directly above the bedrock is 8 m (26.2 ft) of dense basal till, which is overlain by sandy outwash that is up to 35 m (114.8 ft) thick.

Upland soils in the MEF are mainly loamy sands (Menahga and Graycalm series) and weakly calcareous fine sandy loams (Warba and Nashwauk series). Depths range from 3 to 5 m (10 to 16 ft) thick and the upper 20 to 30 cm (8 to 12 in) are characteristically fine sandy loam derived not as direct glacial till, but as material blown from dry hills exposed after glacial melt. Peatland organic soils vary in properties based on decomposition state. Soils range from highly decomposed Typic Borosaprists and Haplosaprists to moderately decomposed Typic Borohemists and Haplohemists (Mooselake, Lupton, Loxley, and Greenwood series).

3.4.2 Environmental Consequences

3.4.2.1 Proposed action

Construction activities and the planned experiments would not have any impact on the underlying geology of the site. To minimize the potential for impacts and limit the potential for soil erosion, erosion prevention and sediment control management practices (e.g., silt fences, sediment ponds, erosion control mattings and blankets, etc.) would be implemented as applicable. Vegetation clearing for the project would be limited to the minimum area required for construction of the project and disturbed areas would be revegetated with native species.

3.4.2.2 No action

Under the No Action Alternative, there would be no project-related impacts on the existing site geology and soils.

3.5 WATER RESOURCES

3.5.1 Existing Conditions

3.5.1.1 Groundwater

The deep glacial deposits of northern Minnesota form a large regional aquifer (Kolka et al. 2010, in press). Peatlands like the S1 bog are perched above this aquifer and do not have groundwater inputs from the regional aquifer. Clay loams along with a thin layer of glacial "flour" (silt, very fine sand, and clay) line the peat-filled, ice-block depressions and restrict the vertical flow of water into the underlying sands. Water in such perched peatlands originates solely from precipitation inputs to the watershed. These peatlands are bogs with a lagg zone (the transition zone between the bog and the adjacent upland) that borders the edge of the bog. Because the bogs are domed, water flows from the center of the bog to the lagg, as well as water flowing downhill from the upland to the lagg, creates a hydrologically active area around the bog. On mineral soil hillslopes, the depth to the clay loam soil usually is less than a meter (3.3 ft) deep. These clay layers have low hydraulic conductivity and water flows preferentially along lateral pathways in the overlying sandy loams to the lagg.

3.5.1.2 Surface water

The S1 watershed drains to the Prairie River via Cutaway Lake and eventually to the Gulf of Mexico via the Mississippi River (Kolka et al. 2010, in press). The S1 bog is ombrotrophic, meaning that its sole source of water is from atmospheric sources (precipitation). The peat fills two adjoining depressions such that the peat is 2 to 3 m (7 to 10 ft) deep near the middle of the bog with deeper pockets to the north and south. The peat is deepest [11 m (36.1 ft)] near the outlet. The S1 outlet is 412 m (1,352 ft) AMSL and the watershed has a maximum elevation of 430 m (1,411 ft) AMSL. A natural sand berm separates the S1 bog from an adjacent downgradient bog on the north side of Cutaway Lake. Bog water coalesces and flows through the berm via a stream and lateral subsurface seepage and eventually ends up in Cutaway Lake.

3.5.1.3 Wetlands

The U.S. Army Corps of Engineers (USACE) defines wetlands as "those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (USACE 2009). Wetlands usually include swamps, marshes, bogs, and similar areas. In identifying a wetland, three characteristics should be met. First is the presence of hydrophytic vegetation that has morphological or physiological adaptations to grow, compete, or persist in anaerobic soil conditions. Second, hydric soils are present and possess characteristics that are associated with reducing soil conditions. Third, site hydrology, meaning the area is inundated or saturated to the surface at some time during the growing season of the prevalent vegetation, must be present (USACE 2009). Wetlands are protected under Sects. 404 and 401 of the Clean Water Act of 1972 (CWA) and by Executive Order (EO) 11990, *Protection of Wetlands*.

A wetland delineation of the S1 Bog was conducted July 9–10, 2010. Wetland determinations were performed according to USACE standards (USACE 2009), which require documentation of hydrophytic vegetation, hydric soils, and wetland hydrology. Wetland boundaries were mapped with a Trimble GeoXH Global Positioning System (GPS) and Environmental Systems Research Institute (ESRI) ArcGIS 9.3 mapping software. GPS data were differentially corrected to submeter accuracy.

The S1 Bog wetland is a mosaic of emergent, scrub-shrub, and forested wetland habitat that covers approximately 10 ha (25 acres). Dominant vegetation consists of black spruce and tamarack (*Larix laricina*) in the tree layer; black spruce, tamarack, speckled alder (*Alnus incana*), Labrador tea (*Ledum groenlandicum*), and leatherleaf (*Chamaedaphne calyculata*) in the shrub layer; blue-joint reedgrass (*Calamagrostis canadensis*) and three-leaf false Solomon's seal (*Smilacina trifolia*) in the herbaceous layer; and peat moss and other mosses in the bryophyte layer.

Wetland hydrology in the bog is dominated by saturated conditions and a high water table with occasional shallow inundation in the hollows between hummocks. The water source is direct precipitation into the bog.

Soils in the bog wetland are moderately deep, organic soils derived from peat and other plant materials. Soil depths in most areas vary between 2 to 3 m (7 to 10 ft) with deeper [11+ m (36 ft)] pockets in the northern and southern ends of the bog. The peat layer thins out quickly toward the upland edges of the lagg where the peat overlies loamy deposits of calcareous glacial till. Soils in the bog are mapped as the Greenwood series; soils in the adjacent upland are mapped as the Warba series (Natural Resources Conservation Service 2010).

The new electrical distribution line would also cross a wetland associated with the drainage between Cutaway Lake and Plantation Lake. That wetland consists of open water surrounded by a floating mat of various moss species, and cattails with scattered tamarack trees and willow bushes at the edges.

3.5.2 Environmental Consequences

3.5.2.1 Proposed action

The SPRUCE project would affect the hydrology within portions of the S1 bog and wetland. This would occur from the construction activities and during the experimental activities. Manipulation of the hydrologic regime within the experimental enclosures would have effects on the S1 bog groundwater levels and wetland conditions within and in the immediate vicinity of the experimental enclosures (Hanson et al. 2009). The subsurface heating system would likely cause considerable changes in wetland conditions especially to the vegetation. Increased soil and aboveground temperatures would increase transpiration in higher plants and evaporation from the upper aerobic layer of peat (acrotelm). Without concurrent increases in precipitation, available surface water and the perched water table would decline earlier in the summer and to a greater depth in enclosures.

None of the effects are expected to be of sufficient magnitude to cause impacts that affect the long-term survival, quality, natural, and beneficial values of the S1 bog wetland and surrounding hydrology. The hydrologic manipulations would also not disrupt the overall function of the wetland or result in the conversion of the wetland into a non-wetland condition. The affected portion of the wetland would recover in a few years (short-term effects) once the experiment is concluded and experimental structures are removed. Overall, any effects associated with these manipulations would be localized, and temporary. Upon completion of the experiment and removal of all associated equipment, wetland vegetation and hydrology would be expected to recover quickly.

Approximately 152 to 168 m (500 to 550 ft) of the wetland and stream area associated with the Cutaway Lake draingage would need to be crossed for the installation of the new electrical distribution line (Fig. 2.7). This would be accomplished using unidirectional boring to minimize potential impacts. The boring cannot be done in frozen soils and would most likely take place in the spring/early summer of 2011. Directionally boring under wetlands or waters does not cause a discharge of fill into Waters of the

United States. Therefore, it is not a regulated activity under Sect. 404 of the CWA and would not require a 404 permit (Baer 2010).

A wetland assessment has been prepared for the proposed action in accordance with 10 *CFR* Part 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements," for the purpose of fulfilling DOE's responsibilities under EO 11990, *Protection of Wetlands*. A copy of the wetland assessment is included in Appendix A.

3.5.2.2 No action

Under the No Action Alternative, no enclosures or other infrastructure would be constructed in the S1 bog and the wetland would function subject to the current ecological conditions and ongoing forest management and scientific activities.

3.6 BIOLOGICAL RESOURCES

3.6.1 Existing Conditions

3.6.1.1 Vegetation

The MEF is within the Laurentian Mixed Forest Province, which is a transitional zone between boreal and broadleaf deciduous forests. The landscape is a typical moraine landscape of the Upper Great Lakes Region and includes uplands, peatlands, and lakes. Vegetation within the S1 bog is dominated by black spruce that had a mean height of 3 m (10 ft) in 1999 (Kolka et al. 1999). The bryophyte layer on drier hummocks is dominated by various species of *Sphagnum* (*S. angustifolium*, *S. capillifolium*, and *S. magellanicum*) [Verry 1984]. Other bryophytes include ribbed bog moss (*Aulacomnium palustre*), big red stem moss (*Pleurozium schreberi*), and juniper polytrichum moss (*Polytrichum juniperinum*). The understory also supports a layer of ericaceous shrubs, including Labrador tea, leatherleaf, bog rosemary (*Andromeda polifolia* var. *glaucophylla*), bog laurel (*Kalmia polifolia*), and creeping snowberry (*Gaultheria hispidula*). The bog also has graminoids, including three-seed bog sedge (*Carex trisperma*) and tufted cottongrass (*Eriophorum spissum*), as well as forbs such as northern pitcher plant (*Sarracenia purpurea*) and three-leaved false Solomon's seal.

The upland forest surrounding the bog is dominated by mature quaking aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*) with a small amount of balsam fir (*Abies balsamea*). The predominant shrub is beaked hazel (*Corylus cornuta*), and principal herbaceous plants are wild sarsaparilla (*Aralia nudicaulis*) and big-leaved aster (*Aster macrophyllus*) [Nichols 1998].

3.6.1.2 Wildlife

There is no site-specific information about wildlife species at the S1 bog. However, the unique character of the peatland provides relatively sparse cover and no unique habitat for wildlife species (MNDNR 2010). Habitat limitations serve only specialized species, and extreme conditions exclude many others. Animals that spend part or all of the year here form distinctive communities of habitat specialists: their adaptations to these harsh conditions make them less adaptable to other areas.

Few large mammal species are specifically associated with forested peatlands (MNDNR 2010). Moose (*Alces alces*), timber (or gray) wolf (*Canis lupus*), and Canada lynx (*Lynx canadensis*) may sometimes inhabit the edges of the peatlands, where forest cover and browse species are available. Likewise, few small mammal species inhabit peatlands. Many small mammals require dry nest sites,

protective shelter, upland foods, or a burrowing habitat that is not available in peatlands. Bog lemmings (*Synaptomys borealis*) prefer peatland habitat, however, and many species of shrews and voles can also be found in bogs. Other mammals found in peatlands include red squirrel (*Sciurus vulgaris*) and snowshoe hare (*Lepus americanus*).

Numerous migratory bird species may utilize peatlands in spring and summer breeding months (MNDNR 2010). Some common birds found in forested or shrubby peatlands may include Connecticut warbler (*Oporornis agilis*), yellow-rumped warbler (*Dendroica coronata*), Nashville warbler (*Vermivora ruficapilla*), palm warbler (*Dendroica palmarum*), hermit thrush (*Catharus guttatus*), yellow-bellied flycatcher (*Empidonax flaviventris*), dark-eyed junco (*Junco hyemalis*), chipping sparrow (*Spizella passerina*), Lincoln's sparrow (*Melospiza lincolnii*), and great gray owl (*Strix nebulosa*).

Amphibians and reptiles that inhabit peatlands are relatively limited (MNDNR 2010). More frogs and toads have adapted to this environment than turtles, lizards, and snakes, though they may also occur here. Species requirements for moisture, pH levels, temperature, and nutrition govern their distribution. For example, terrestrial burrowers and aquatic species that require deep water that does not freeze to the bottom find the bog environment discouraging; species that breed early in spring are limited by the short summer season. The natural toxicity of bog waters affects the survival rate of creatures using it as a breeding medium.

Insects inhabit the peatlands in abundance, including an ample supply of mosquitoes, damselflies, dragonflies, and deer flies (MNDNR 2010).

3.6.1.3 Aquatic resources

The closest aquatic habitat to the S1 bog or the adjacent upland area is Cutaway Lake, which is located approximately 137 m (450 ft) from the southern edge of the S1 bog. No aquatic animal species or habitat would be affected by the SPRUCE activities at the S1 bog and adjacent upland. The use of unidirectional boring for the installation of the new electrical distribution line would minimize potential impacts to the Cutaway/Plantation Lake drainage.

3.6.1.4 Threatened, endangered, and sensitive species

There are two federally listed animals that are reported from the Chippewa NF: gray wolf (*Canis lupus*) and Canada lynx (*Lynx canadensis*) [Table 3.9].

Table 3.9. Federal T&E species Chippewa National Forest

Scientific name	Common name	Federal status	State status
Canis lupus	Gray wolf	T	S
Lynx canadensis	Canada lynx	T	NS*

Source: USFS 2010.

Note: E = Endangered, T = Threatened, S = Special Concern, NS = No status. *Canada lynx is currently considered a furbearer under Minnesota law; however, the season has been closed since 1983 (Moen 2009). Harvest of lynx is prohibited under Minnesota Department of Natural Resources regulations because Federal Endangered Species Act of 1973 listing takes precedence over state status.

There is no site-specific information about threatened and endangered (T&E) species or other sensitive species at the S1 bog. The Regional Forester's Sensitive Species (RFSS) list for the Chippewa NF identifies 48 plants and animals (Appendix B). Although the RFSS list for the Chippewa NF does not contain any federal listed species, it does include 30 state-listed species including 2 endangered plants, 9 threatened plants and animals, and 19 special concern species. There are 18 additional plant and animal

species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (USFS 2001).

3.6.1.5 Invasive species

Invasive plants are non-native plant species that are capable of spreading into native plant communities and that spread in the absence of regular human-caused disturbance. They are a threat to numerous resources including native plant communities, wildlife, soil, and water (USFS 2010). Invasive species are defined by EO 13112, *Invasive Species* (1999), as one whose introduction does or is likely to cause economic or environmental harm, or harm to human health. The EO directs all federal agencies to address the impacts their actions may have to cause introduction and spread of invasive species. The Forest Plan for the Chippewa National Forest includes Objectives for Non-native Invasive Species (USFS 2004).

Invasive plants and animals in the project area include common tansy (*Tanacetum vulgare*), Canada thistle (*Cirsium arvense*), Siberian peashrub (*Caragana arborescens*), oxeye daisy (*Chrysanthemum leucanthemum*), field sowthistle (*Sonchus arvensis*), purple loosestrife (*Lythrum salicaria, Lythrum virgatum*, or any variety, hybrid, or cultivar thereof), leafy spurge (*Euphorbia esula*), and European earthworms (USFS 2010).

3.6.2 Environmental Consequences

3.6.2.1 Proposed action

Construction activities would have minor, localized effects on plants and animals. Direct disturbance of vegetation in the S1 bog and adjacent upland aspen-birch habitat would total about 2 ha (5 acres). This would include some harvesting of black spruce and aspen to construct the experimental enclosures and supporting infrastructure. Changes in plant community structure are expected from the drying of the surface peat layers in the heated enclosures (Hanson et al. 2009). Higher temperatures and surface layers could lead to lower productivity of spruce and moisture-dependent plants like sphagnum mosses, sundew (*Drosera rotundifolia*), and northern pitcher plant, and increased competition from less temperature and moisture-dependent species like red maple (*Acer rubrum*). It is expected that vegetation in the bog would recover via natural revegetation once the experiment is complete. Some minor revegetation (e.g., reseeding) might occur in the disturbed upland areas once the infrastructure is removed. Any restoration of disturbed areas would follow the applicable USFS policies and procedures.

Likewise, construction and long-term operation of the experiment may lead to minor impacts to wildlife species. Impacts during construction would be reduced because the activities would occur during the winter when the number and activity of animal species using the site would be lower. The enclosures would limit habitat availability to most animals, especially larger mammals. It is also likely that birds would not nest in trees within the enclosures. The loss of available habitat would be relatively small compared to the remaining habitat in the S1 bog.

The potential effects to threatened, endangered, and sensitive species due to the SPRUCE experiment were analyzed in the Biological Assessment (BA) and Biological Evaluations (BEs) prepared for the Central Vegetation Management Project EA (USFS 2010). The SPRUCE was a small part of the total treatments considered within the Central BA and BE.

The BA for the Central project was prepared in compliance with the requirements of Forest Service Manual Directives Sects. 2670.31, 2670.5(3), and 2672.4; the Endangered Species Act of 1973 (ESA), as amended; and the National Forest Management Act of 1976. As indicated in the Central BA, proposed activities are not likely to adversely affect gray wolf, Canada lynx, or their habitats (project file). Consultation specific to the Central project BA was conducted with the U.S. Fish and Wildlife Service, which concurred with this determination of effects.

As indicated in the Central BE, the purpose of a BE is to ensure that USFS actions (1) do not contribute to loss of viability of any native or desired non-native plants or animal species, (2) do not cause any species to move toward federal listings, and to (3) incorporate concerns for sensitive species throughout the planning process, reducing negative impacts to species and enhancing opportunities for mitigation. None of the proposed activities would result in a trend to federal listing or loss of viability to a population or species.

The original BE for the Central project considered potential effects to sensitive species due to inclusion of the SPRUCE project. However, at the time of the original analysis, it was believed that the underground electrical line to deliver power to the project site would follow existing roads. Further project development determined that some of the electrical line would not follow existing roads (see Sect. 2.1.2). For that portion of the line that would not follow existing roads, based on the pathway of the proposed new underground electrical line, and an assumed 6-m (20-ft) disturbance corridor along that pathway, the following habitats would be disturbed:

- 0.2 ha (0.5 acre) mature aspen-birch forest,
- 0.45 ha (1.1 acres) young aspen-birch forest,
- 0.08 ha (0.2 acre) mature jack pine forest, and
- 0.12 ha (0.3 acre) wetlands.

These habitats represent minimal acres of potential habitat for northern goshawk (*Accipiter gentilis*), red-shouldered hawk (*Buteo lineatus*), spruce grouse (*Dendragapus canadensis*), and black-backed woodpecker (*Picoides arctus*). The proposed path of the line is not proximate to any known sensitive species locations. Based on the minimal quantities of additional habitat disturbance, there is no change to the findings presented in the original BE for the Central project. Therefore, none of the proposed activities would result in a trend to federal listing or loss of viability to a population or species.

Any changes in ecological conditions that affect plant community dynamics (e.g., soil disturbance during construction activities) could also create conditions conducive to the growth and spread of invasive plant species. The use of best management practices (BMPs), such as cleaning construction equipment before bringing it on-site, would limit the potential for invasive plants to be introduced into the project area and no adverse impacts are anticipated.

3.6.2.2 No action

Under the No Action Alternative, no enclosures would be constructed in the S1 bog and the adjacent upland habitat would function subject to the current ecological conditions and ongoing forest management activities.

3.7 CULTURAL RESOURCES

3.7.1 Existing Conditions

Cultural resources are defined as any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. When these resources meet any one of the National Register Criteria for Evaluation (36 *CFR* Part 60.4), they may be termed historic properties and thereby are potentially eligible for inclusion on the National Register of Historic Places (NRHP).

The majority of the Leech Lake Band of Ojibwe Reservation is located within the Chippewa NF boundary. About 2,800 cultural resource sites have been identified within the Chippewa NF boundary with approximately 1,600 of these located on NF System lands. In addition to the reservation lands and cultural resource sites, the Leech Lake Band of Ojibwe utilize many of the natural resources of the Chippewa NF for food, clothing, shelter, utensils, transportation, medicinal, and ceremonial purposes.

3.7.2 Environmental Consequences

3.7.2.1 Proposed action

The S1 bog is inaccessible to archaeological testing using standard field techniques. Uplands immediately surrounding the bog have been subject to previous heritage survey with negative results (Survey Number R4-382 completed in 1999).

Because the installation of the new electrical line would cause disturbance along the corridor, which could have the potential to affect cultural resources, a review of the corridor was conducted by the USFS. Most of the proposed route has been subject to previous heritage surveys. These surveys were conducted in review of potential future timber management projects and are considered adequate relative to the current review. These surveys included walkover surface investigation and shovel testing of various parts of the Cutaway Lake drainage. The results were entirely negative.

However, a 300-m (984-ft) segment of the proposed electrical distribution route had not been subject to previous survey and appeared to have moderate potential for the presence of cultural resources. A field survey of this area was conducted in September 2010 that included a walkover of the route corridor and shovel testing. These tests and the walkover survey were negative.

The USFS evaluated the proposed SPRUCE site and the proposed electrical distribution corridor and determined that there are no traditional resource gathering areas that would be impacted by the proposed action and that the location is outside of the Leech Lake Band of Ojibwe Reservation. They also determined that no historic properties would be affected by the project (Appendix C).

3.7.2.2 No action

Under the No Action Alternative, there would be no changes or additional impacts to cultural resources within the EA study area beyond those being addressed for current activities.

3.8 SOCIOECONOMICS

3.8.1 Existing Conditions

The region of influence (ROI) for this analysis includes Itasca County, which includes the city of Grand Rapids.

3.8.1.1 Demographic and economic characteristics

Table 3.10 summarizes population, per capita income, and wage and salary employment in Itasca County from 2004 to 2008, the last year for which Bureau of Economic Analysis (BEA) figures are available. Population remained stable, growing slightly at an average rate of about 0.25% per year, and employment remained similarly stable, with 22,515 employed in 2004 and 23,313 employed in 2008. Per capita income grew from $26,323 to $30,656 over the same period, generating a total county income of $1.4 billion in 2008 (BEA 2010).

Table 3.10. Demographic and economic characteristics: Itasca County

County	2004	2005	2006	2007	2008	Annual growth 2004–2008 (%)
			Itasca			
Population	44,038	44,079	44,084	44,455	44,475	0.25%
Per capita income ($)	26,323	26,419	28,175	29,228	30,656	3.88%
Total employment	22,515	22,930	23,045	23,118	23,313	0.66%

***Source*:** Bureau of Economic Analysis 2010.

Table 3.11 shows the estimated distribution of minority populations in Itasca County in 2009. For the purposes of this analysis, a minority population consists of any geographic area in which minority representation is greater than the national average of 30.7%. Minorities include individuals classified by the U.S. Bureau of the Census as Black or African-American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, and Hispanic or Latino, and those classified under "Two or more races." Based on the 2009 Census estimates, minorities represented 6.9% of the total Itasca County population, well below the national average (Bureau of the Census 2010a).

Table 3.11. Estimated race or ethnic distribution for Itasca County: 2009

Race or ethnic group	Itasca County	
	Number	Percent
Not Hispanic or Latino		
White	41,645	93.1%
Black or African American	127	0.3%
American Indian or Alaska Native	1,567	3.5%
Asian	173	0.4%
Native Hawaiian and Other Pacific Islander	10	0.0%
Two or more races	680	1.5%
Hispanic or Latino[a]	525	1.2%
Total	44,727	100.0%

[a]May be of any race. Those classified as Hispanic or Latino are excluded from other categories to avoid double counting.

Source: Bureau of the Census 2010.

Because the proposed action would include a relatively small land area, impacts to the surrounding area would be limited. The two census tracts closest to the project area are Tract 9803 and 9804 in Itasca County. Although current estimates are not available at the tract level, as of the 2000 Census, minority populations represented 6.4% of the total in tract 9803, 2.6% in tract 9804 (Bureau of the Census 2000a). For comparison, minorities represented 11.8% of the population in Minnesota (Bureau of the Census 2000a). The Leech Lake Ojibwe Reservation is located within 80 km (50 miles) of the proposed site. According to the 2000 Census, there were 10,205 individuals living on the reservation, which includes part of Beltram, Cass, Itasca, and Hubbard Counties. The Native American population is reported to be 47.5% of the reservation population (House Research Department 2007).

According to the 2006–2008 American Community Survey conducted by the Census, 13.2% of the U.S. population had incomes below the poverty level during the three-year period (Bureau of the Census 2010b). In this analysis, a low-income population consists of any geographic area in which the proportion of individuals below the poverty level exceeds the national average. Within Itasca County, 11.5% of the population had incomes below the poverty level during the same period (Bureau of the Census 2010b). Although current data are not available at the tract level, as of the 2000 Census, 13.2% of the population in tract 9803 had incomes below the poverty level, which is slightly higher than the national average of 12.4% for the same year. In tract 9804 the proportion was lower, at 6.4% (Bureau of the Census 2000b).

3.8.2 Environmental Consequences

3.8.2.1 Proposed action

Environmental Justice

EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," requires agencies to identify and address disproportionately high and adverse human health or environmental effects its activities may have on minority and low-income populations. Since no high and adverse human health impacts are anticipated as a result of the construction or operation phases of the proposed action, no such impacts to minority or low-income populations are expected.

Employment and Income

This analysis assumes that the proposed action would create less than 10 direct, full-time equivalent jobs. This figure represents a negligible increase (<1.0%) from the 2008 total employment in the region of influence shown in Table 3.10.

Population

Based on the small number of estimated jobs created, no impact on population is anticipated.

3.8.2.2 No action

Under the No Action Alternative, there would be no construction or jobs created and, therefore, no change in employment, income, or population, and no adverse impacts on minority or low-income populations.

3.9 INFRASTRUCTURE

3.9.1 Existing Conditions

3.9.1.1 Utilities

There is no existing utility infrastructure in the immediate vicinity of the SPRUCE site. The local supplier of electricity is Lake Country Power and the closest existing electrical lines are located approximately 5 km (3.1 miles) to the south of the project site.

3.9.1.2 Transportation

Roads to the site from Grand Rapids, Minnesota, included MN 38 North, County Road 49, and forest roads within the MEF [Forestry Road, Wilderness Trail (2143), and 3851]. Several of the forest roads in the vicinity have been recently upgraded (widening and resurfacing).

3.9.2 Environmental Consequences

3.9.2.1 Proposed action

Utilities

Electric power would be brought to the site from the south over a new 5-km (3-mile) distribution line corridor that would primarily follow existing forest roads. Utility lines would be buried or placed in protected conduit at the ground surface and would be extended to each of the boardwalks and to other infrastructure, as needed. The utility lines would be attached to the boardwalks, which would, thus, effectively serve as the utility corridors to the enclosures. The estimated electrical demand for the experimental activities would be approximately 8700 kilowatt hours (kWh) per day. This would include power for the belowground heating, blowers, and monitoring instrumentation.

Propane and CO_2 would be transported to and stored at the site. On-site propane storage tanks would be either one large tank (approximately 11,000 gal) or four clusters of smaller 1000-gal tanks located near each of the four boardwalks. Anticipated use is around 7000 gal of propane per week. CO_2 would likely be stored in one large tank to supply the southern experimental blocks and a smaller tank located near the northern block. Vendors exist for the propane and CO_2 and supply should not be a problem. At the end of the experiment, a decision would need to be made by the USFS to remove or keep the utility infrastructure associated with the project.

Transportation

The proposed action would have a minimal effect on the roads in the vicinity of the project site. A short-term increase in vehicle traffic would occur during the construction period, which might take two winters to complete. This would include trucks delivering equipment and supplies to the site and smaller vehicles transporting workers to and from the area. The transport of equipment, supplies, and personnel would be over regional and local roadways to the site and no new road construction would be required. Once the experimental activities begin, routine access would be one to three persons daily. However, during heavy use in the summer months, the site might be occupied by as many as 10 to 20 persons daily. The short-term increase in traffic volume is considered to be within the existing transportation infrastructure's capacity and no adverse transportation impacts would occur.

3.9.2.2 No action

Since the project would not occur, there would be no changes to the existing utilities within the MEF. Traffic would likely continue to remain close to current levels in the vicinity of the S1 watershed and no impacts would occur.

3.10 HAZARDOUS MATERIALS AND SOLID WASTES

3.10.1 Existing Conditions

The project site is located on undeveloped, publicly owned land within the MEF. No past or current evidence of any hazardous releases or solid waste disposal has been identified within the project area. Solid waste generation within the MEF is minimal. Trash and recyclables are collected by personnel from the USFS's Northern Research Station and transported to the office in Grand Rapids where they are removed by a commercial service. Acids used for experiments at the Northern Research Station are collected, neutralized, and discarded on-site. Other chemical wastes are rare but are properly accumulated, stored, and returned to the Grand Rapids office according to the appropriate waste handling procedures.

3.10.2 Environmental Consequences

3.10.2.1 Proposed action

Construction activities would result in the generation of a small amount of non-hazardous solid waste including construction materials used for the experimental enclosures and boardwalks. It is expected that recyclable materials would be segregated from the waste. The remaining solid waste would be collected and stored on-site until it could be removed to a transfer station for disposal in the appropriate landfill. The generation of non-hazardous waste associated with the experimental period is expected to be negligible.

Hazardous material use and hazardous waste generation are expected to be negligible during construction activities and the experimental period that would follow. However, it is possible that small amounts of hazardous materials could be used and subsequent hazardous waste could be generated. If this occurs, all hazardous materials and waste would be handled, stored, transported, and disposed of according to all applicable MEF regulations and procedures.

3.10.2.2 No action

No additional non-hazardous solid waste or hazardous waste would be generated beyond what is currently produced by the users of the MEF and Northern Research Station.

3.11 SAFETY

3.11.1 Existing Conditions

The project site is located on undeveloped, publicly owned land within the MEF. Individuals conducting research at the MEF are responsible for adhering to all applicable USFS safety regulations. MEF-specific safety documents include:

- Occupant Emergency Preparedness Plan,
- Safety and Health Plan,
- Chemical Hygiene Plan,
- Flammable Storage Plan,
- Health and Safety Code Handbook,
- Hazard Communication Program,
- Hazardous Waste Guide,
- Hazardous Materials, and
- Respiratory Protection.

In addition to the MEF safety documents, researchers must review and sign applicable Job Hazard Analyses (JHAs). These include but are not limited to:

- dehydration,
- disabled vehicle,
- fieldwork,
- chemistry lab,
- insects and poisonous plants,
- ticks, and
- weather.

3.11.2 Environmental Consequences

3.11.2.1 Proposed action

Implementation of the proposed action would slightly increase the short-term safety risk associated with the USFS and ORNL personnel and any contractors involved in constructing, installing, and operating the various components of the SPRUCE experiment. No unique construction practices or materials would be required to construct the various parts of the project.

At all times, site operations, work activities, and personnel would comply with all applicable regulatory requirements for occupational safety and health, including, but not limited to, the following:

- OSHA 29 *CFR* 1910, Occupational Safety and Health Standards for General Industry and 29 *CFR* 1926, Occupational Safety and Health Standards for Construction.

- American Conferences of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents, Nonionizing Radiation and Fields, current edition.

In addition, all work activities conducted at the SPRUCE site would comply with specific environmental, safety, and health requirements established for this project and all applicable federal, state, and local regulatory requirements and standards for occupational safety and health, as well as the respective corporate requirements of each party. This would include applicable MEF safety documents and JHAs. SPRUCE researchers would also be subject to all relevant ORNL health and safety regulations as expressed and outlined through the Research Hazard Analysis and Control System as expressed by annually reviewed Research Safety Summaries.

Prior to commencement of work, a job hazard evaluation and worksite analysis would be performed to identify not only existing hazards but also conditions and operations in which changes might occur to create hazards. Methods, means, and work practices to ensure hazard prevention and control would be

established during each phase of work activities. All personnel would have authority to stop or suspend work activities if they determine that work conditions are unsafe.

OSHA has set the 8-h average limit for CO_2 in air at 5000 ppm. The National Institute for Occupational Safety and Health has also set a short-term limit of 30,000 ppm. The short-term exposure limit is a value not to be exceeded for more than 15 min. The elevated CO_2 exposures of 800 to 900 ppm within the experimental enclosures are well below these limits. CO_2 exposures are not a concern with respect to adverse health effects for workers or the general public.

Deliveries of liquid CO_2 would be subcontracted to the supplier and the management of the approved storage tanks would be under their control. Liquid CO_2 can cause freezing injury to exposed skin if improperly handled. The liquid CO_2 is vaporized prior to release points and safety shut-off valves would help to prevent accidental releases. A warning siren would also be part of the system and would only be engaged in the event of an unexpected CO_2 release from the storage tank. Because the tanks would be located outdoors where CO_2 dissipates quickly, there is no hazard associated with a sudden release. The "fog" that may be seen near such a release point is condensed moisture in the air, the higher the humidity, the whiter the "cloud" would appear. It does not indicate oxygen-depleted air.

For members of the public, no unique or serious public health and safety hazards have been identified that would result from the operation of the SPRUCE project. It is expected that access to certain areas of the project site would be restricted and controlled through the use of fencing or other measures. Visitors to the site would be exposed to hazards that could cause slips, trips, and falls that are typically present at any public facility.

3.11.2.2 No action

No additional health and safety concerns would occur beyond those already present within the MEF.

3.12 INTENTIONAL DESTRUCTIVE ACTS

DOE is required to consider intentional destructive acts, such as sabotage and terrorism, in each EIS or EA that it prepares. After review, it was determined that the likelihood of such acts for the proposed action is extremely low. The project would not offer any particularly attractive targets of opportunity for terrorists or saboteurs to inflict adverse impacts on human life, health, or safety. It is possible that random acts of vandalism could happen, as in any other location.

4. CUMULATIVE IMPACTS

Cumulative impacts are those that may result from the incremental impacts of an action considered additively with the impacts of other past, present, and reasonably foreseeable future actions. Cumulative impacts are considered regardless of the agency or person undertaking the other actions (40 *CFR* 1508.7, CEQ 1997) and can result from the combined or synergistic effects of individually minor actions over a period of time.

Existing human activity and disturbance within the MEF is minimal. The SPRUCE project would be temporary (2-year construction period, 10-year experimental phase, and a short-term decommissioning phase). Impacts associated with the project would be minor and would only occur within the S1 watershed and immediate vicinity. For these reasons, no cumulative impacts to the MEF or surrounding area have been identified.

5. SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Table 5.1 provides a comparative summary of the potential environmental consequences that could result from implementing the proposed action or alternatives.

Table 5.1. Summary of impacts by resource

Resource area	Proposed action	No action
Land use/visual resources	SPRUCE project is acceptable land use for MEF. Increased visibility of structures from roads adjacent to site. No impact on recreational users of Cutaway Lake.	No change from existing conditions.
Air quality	Negligible and temporary increase in engine exhaust and fugitive dust emissions during construction. Negligible localized emissions during experiment. No air quality thresholds exceeded and no adverse impacts to local or regional air quality.	Not applicable.
Noise	Temporary and short-term increase to the ambient sound environment. No adverse noise impact.	Not applicable.
Geological resources	No adverse impact on site geology. Erosion prevention and sedimentation controls would be implemented.	No change from existing conditions.
Water resources	No adverse impacts to nearby surface waters. Impacts on wetland hydrology would be localized and temporary.	No change from existing conditions.
Biological resources	Project would have minor localized effects on plants and animals. The loss of available habitat would be relatively small compared to the remaining habitat in the S1 bog.	No change from existing conditions.
Cultural resources	No traditional or historical resources would be impacted.	Not applicable.
Socioeconomics	Negligible positive impact on employment and income. No impact on population. No high and adverse impacts to minority or low-income populations.	No change from existing conditions.

Table 5.1. Summary of impacts by resource (continued)

Resource area	Proposed action	No action
Infrastructure	Electricity would be extended to the site. Propane and CO_2 would be transported and stored at site. No adverse impacts would occur. Short-term increase in traffic volume is considered to be within the existing transportation infrastructure's capacity and no adverse impacts would occur.	No change from existing conditions.
Hazardous materials and solid wastes	Small amount of solid waste generated during construction and operation. Generation of hazardous waste possible but unlikely. All waste would be handled, stored, transported, and disposed of according to all applicable MEF regulations and procedures.	No change from existing conditions.
Safety	Construction workers would be subject to typical hazards and occupational exposures. No unique health and safety hazards are expected during experiment to workers or public.	Not applicable.
Intentional Destructive Acts	Unlikely and insignificant impact.	Not applicable.
Cumulative impacts	None identified.	Not applicable.

MEF = Marcell Experimental Forest.
SPRUCE = Spruce and Peatlands Responses Under Climatic and Environmental Change Experiment.

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APPENDIX A

WETLAND ASSESSMENT

Wetland Assessment

Spruce and Peatland Responses under Climatic and Environmental Change Experiment (SPRUCE)

Marcell Experimental Forest, Itasca County, Minnesota

Date Issued—November 2010

U.S. Department of Energy
Oak Ridge Office
Oak Ridge, Tennessee

10-058(E)/110810

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

Wetland Assessment

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ABBREVIATIONS AND ACRONYMS

bgs	below ground surface
CFR	*Code of Federal Regulations*
cm	centimeter
CO_2	carbon dioxide
DOE	U.S. Department of Energy
EO	Executive Order
ESRI	Environmental Systems Research Institute
GPS	Global Positioning System
ha	hectare
km	kilometer
m	meter
mm	millimeter
MEF	Marcell Experimental Forest
MNDNR	Minnesota Department of Natural Resources
NF	National Forest
O&M	operation and maintenance
ORNL	Oak Ridge National Laboratory
SPRUCE	Spruce and Peatland Responses under Climatic and Environmental Change Experiment
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service

1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE) defines wetlands as "those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (Environmental Laboratory 1987; USACE 2009). Wetlands usually include swamps, marshes, bogs, and similar areas. In identifying a wetland, three characteristics must be present. First is the dominance of hydrophytic vegetation (plants that have morphological or physiological adaptations to grow, compete, or persist in anaerobic soil conditions). Second, hydric soils are present and possess characteristics that are associated with reducing (anaerobic or low oxygen) soil conditions. Third, wetland hydrology must be present (i.e., the site must be flooded or saturated for sufficient duration during the growing season to create anaerobic conditions at the site (Environmental Laboratory 1987; USACE 2009).

This wetland assessment has been prepared in accordance with the *Code of Federal Regulations* (*CFR*) Title 10 Part 1022, for the purpose of fulfilling the U.S. Department of Energy's (DOE's) responsibilities under Executive Order (EO) 11990, *Protection of Wetlands*. The order encourages federal agencies to implement measures to preserve and enhance the natural and beneficial functions of wetlands. The order also requires federal agencies to take action to minimize or mitigate the destruction, loss, and degradation of wetlands. The sequence of mitigation measures should emphasize the following:

- avoiding actions in wetlands, including new construction or work, unless there is no practicable alternative to that action; and

- minimizing harm should the only practicable alternative require that any particular action take place in a wetland.

Finally, EO 11990 seeks to provide early and adequate opportunities for public review of plans and proposals involving new construction or similar projects in wetlands.

This wetland assessment serves to inform the public of proposed scientific research activities by Oak Ridge National Laboratory (ORNL) and U.S. Forest Service (USFS) that are to be funded wholly or in part by the DOE and that have the potential to affect a wetland on USFS property at the Marcell Experimental Forest (MEF) in Itasca County, Minnesota. This wetland assessment also serves to present measures or alternatives to the proposed action that will reduce or mitigate adverse effects to the wetland. Information is presented on the following topics: project description, site description, effects on wetland, alternatives, and mitigation.

2. PROJECT DESCRIPTION

2.1 PROPOSED ACTION

The proposed Spruce and Peatlands Responses Under Climatic and Environmental Change Experiment (SPRUCE) project is a collaborative research effort between ORNL and the USFS to study the effects of climate change and increased atmospheric carbon dioxide (CO_2) on a black spruce-*Sphagnum* ecosystem located in the MEF on the Chippewa National Forest (NF) in Itasca County, Minnesota (Fig. 1). The black spruce-*Sphagnum* ecosystem is at the southern extent of the spatially expansive boreal

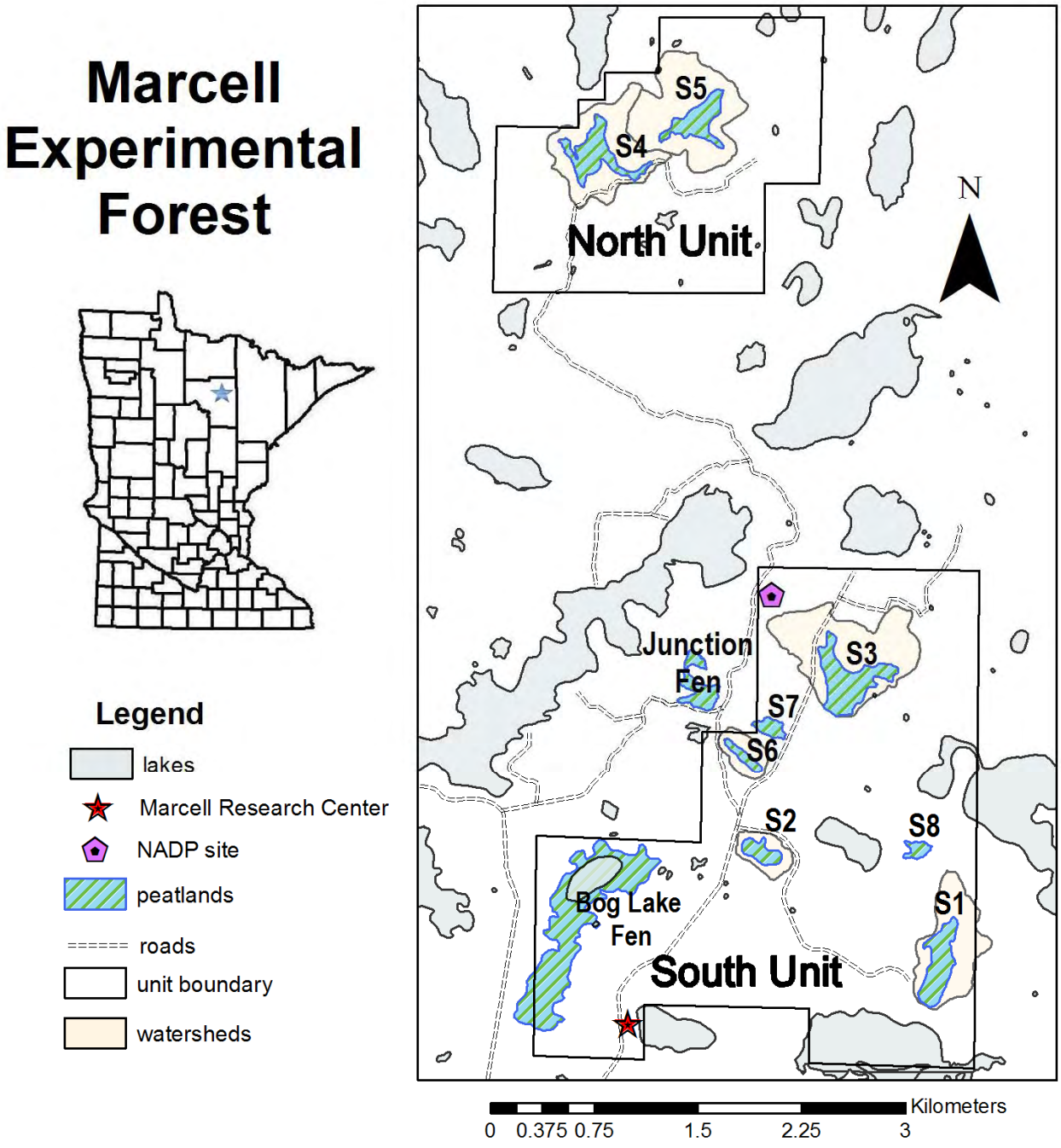

Fig. 1. Vicinity map for SPRUCE project.

peatland forests and is considered to be especially vulnerable to climate changes (Hanson et al. 2009). The purpose of the proposed research is to obtain information on how this ecosystem would respond to the higher temperature and increased atmospheric CO_2 projected to occur in the future. Because this ecosystem plays an important role in carbon storage, its responses to these changes are likely to have important feedbacks on the atmosphere and climate through the global carbon cycle.

ORNL and the USFS propose to study the effects of altered atmospheric and climate conditions to obtain information on the response to elevated temperature and elevated atmospheric CO_2 of a black spruce-*Sphagnum* ecosystem. Research would involve climate change manipulation activities, focusing on the response of multiple levels of warming combined with elevated CO_2 levels, the collection of field data, and the evaluation of the response of existing biological communities (plants and animals) to a range of warming levels.

Activities at the site would include (1) constructing and using temporary infrastructure for multi-year use to modify local temperatures and atmospheric CO_2 concentrations consistent with a range of climate change projections; (2) collecting field data regarding plant and animal growth and survival; (3) measuring changes in natural biogeochemical cycles of carbon, water, and other essential plant elements; and (4) evaluating air and soil temperatures, soil/peat water contents, and atmospheric humidity sufficient to characterize the nature of the imposed experimental treatments (Hanson et al. 2009). Other activities needed for research would include (1) extending utilities to the experiment site, (2) installing multiple boardwalks above the bog surface, (3) removing secondary growth trees in the bog area to facilitate the installation of infrastructure, and (4) installing experimental chambers. Experimental plots within the overall experiment site would be warmed and exposed to elevated CO_2 throughout a 10-year project duration period.

Electricity would be extended to the site from the south over a new 5-km (3-mile) distribution line corridor (Fig. 2). The new line would be installed primarily along existing roads on USFS land. The route would begin at the junction of Itasca County Road 50 and Forest Road 3495. It would be installed immediately adjacent to Forest Road 3495 and run parallel to it in a northeasterly direction for a distance of about 2.4 km (1.5 miles). The line would then depart Forest Road 3495 in a northerly direction crossing the Plantation/Cutaway Lake drainage to junction with Forest Road 3851, a distance of about 1.6 km (1 mile). The line would then parallel Forest Road 3851 in an easterly direction to the S1 bog, a distance of about 1 km (0.6 miles).

The new line would be installed (buried) by trenching to a depth of between 107 and 122 cm (42 and 48 in.). For the segment that does not follow the existing roads, a 6-m (20-ft)-wide strip would be cleared for the operation of the trenching machinery. The stumps would be left in place and there would be no grubbing or other disturbance of the ground or subsurface other than the trenching itself. The lowland/wetland area that is part of the Plantation/Cutaway Lake drainage would be crossed using unidirectional boring to go horizontally beneath this area. The depth of the boring would be about 1.5 m (5 ft) below the surface. For the borings, the electrical cable would be installed inside 5-cm (2-in.)-diameter PVC (polyvinyl chloride) conduit.

Once the line reaches the S1 bog, it would be buried or placed inside protected conduit at the ground surface and would be extended to each of the boardwalks and to other infrastructure, as needed. The boardwalks would serve as the utility corridor to the enclosures by attaching the utility lines to the undersides of the walkways.

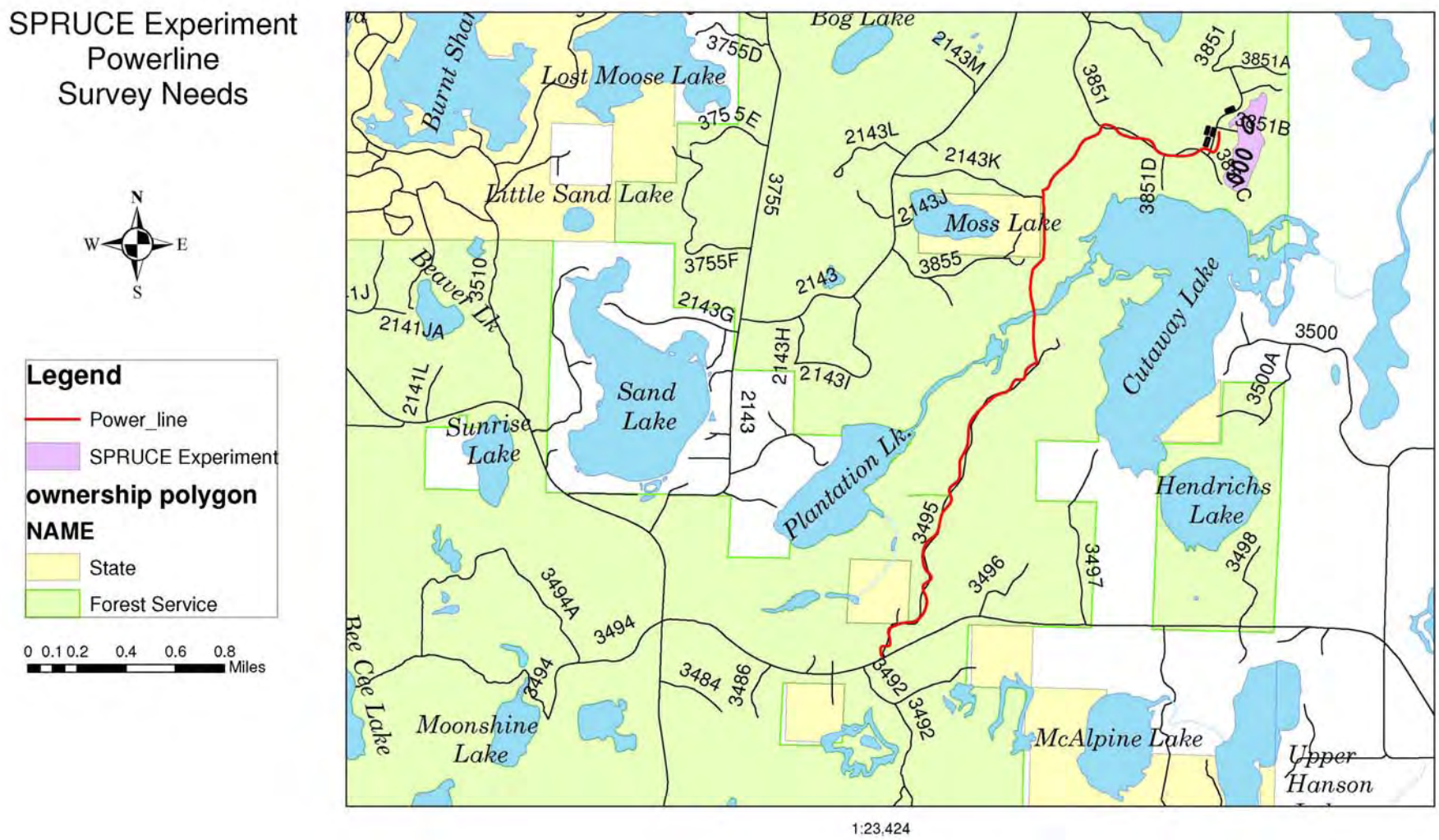

Fig. 2. New electrical distribution line for SPRUCE project.

2.2 PROJECT LOCATION

The planned experiment site is a bog within the 1141-hectare (ha) [2819.5-acre] MEF, which is located approximately 40 kilometers (km) [25 miles] north of Grand Rapids, Minnesota (Fig. 1). The MEF is within the Laurentian Mixed Forest Province, which is a transitional zone between boreal and broadleaf deciduous forests. The landscape is a typical moraine landscape of the Upper Great Lakes Region and includes uplands, peatlands, and lakes. The proposed experiment would be conducted in an ombrotrophic bog (a raised dome peat bog in which water and nutrient inputs originate from atmospheric sources). The study site (designated S1) is a 10.0-ha (24.69 acres) *Picea mariana – Sphagnum* spp. (black spruce-peat moss) forest community (Fig. 3).

2.3 S1 BOG WETLAND

A wetland delineation of the S1 bog wetland was conducted July 9–10, 2010. The wetland determination was performed according to USACE standards (USACE 2009), which require documentation of hydrophytic vegetation (U.S. Fish and Wildlife Service 1996), hydric soils, and wetland hydrology. The wetland boundary was mapped with a Trimble GeoXH Global Positioning System (GPS) and Environmental Systems Research Institute (ESRI) ArcGIS 9.3 mapping software. GPS data were differentially corrected to submeter accuracy. The USACE Routine Wetland Determination forms are included in Attachment 1.

The S1 bog is the only wetland that would be affected by the SPRUCE project. This wetland is a mosaic of emergent, scrub-shrub, and forested wetland habitat that covers 10.0 ha (24.69 acres) [Fig. 3]. The S1 bog is located within the South Unit of MEF in the S1 watershed. The wetland exhibits field indicators of all three criteria of a jurisdictional wetland: hydrophytic vegetation, wetland hydrology, and hydric soils (USACE 2009). Dominant vegetation consists of black spruce and tamarack in the tree layer; black spruce, tamarack, speckled alder, Labrador tea, and leatherleaf in the shrub layer; blue-joint reedgrass and three-leaf false Solomon's seal in the herbaceous layer; and peat moss and other mosses in the bryophyte layer.

Wetland hydrology in the bog is dominated by saturated conditions and a high water table with occasional shallow inundation in the hollows between hummocks. The primary water source is direct precipitation into the bog. Water in the bog flows laterally from the central part of the bog to the lagg (the transition zone between the bog and the adjacent upland). The average elevation in the center of the bog is on about 20 centimeters (cm) [8 in.] higher than the lagg, and this elevation change provides enough hydraulic gradient to prevent any runoff from the surrounding watershed from reaching beyond the lagg. Water in the lagg flows southward along the bog's margins to a natural, sand berm that separates the S1 bog from an adjacent downgradient bog on the north side of Cutaway Lake. Water flows into the adjacent peatland and eventually into Cutaway Lake through a small, stream channel through the berm and groundwater seepage through the berm.

Soils are moderately deep, organic soils derived from peat and other plant materials. Soil depths in most areas vary between 2 to 3 meters (m) [7 to 10 ft] with deeper (11+ m [36-ft]) pockets in the northern and southern ends of the bog. The peat layer thins out quickly toward the upland edges of the lagg where the peat overlies loamy deposits of calcareous glacial till. Soils in the bog are mapped as the Greenwood series; soils in the adjacent upland are mapped as the Warba series (Natural Resources Conservation Service 2010).

Fig. 3. S1 Bog wetland.

3. WETLAND EFFECTS

3.1 POTENTIAL WETLAND EFFECTS

The proposed SPRUCE project would have minor effects on vegetation, hydrology, and soils in part of the S1 bog. Some of these effects would occur during construction of the experimental apparatus; some would occur from operation and maintenance (O&M) of the proposed experiment. None of the effects are expected to be of sufficient magnitude to cause impacts that affect the long-term survival, quality, natural, and beneficial values of the wetland. The consequences of wetland alteration from the SPRUCE project are expected to be sufficiently minor such that the wetland could recover in a few years (short-term effects) once the experiment is concluded and experimental structures are removed. All infrastructures are designed for a 10-year experiment and would be removed after the completion of the study. The USFS may choose to retain the boardwalks for continued experimental access to the bog for future research on the MEF.

Although there would be some minor, adverse impacts from the SPRUCE project, there is no practical alternative to the proposed action. In order to study the effects of climate change on peat-dominated wetlands, the experiment must be conducted in that same type of habitat. With almost 50 years of hydrologic, meteorological, and other scientific background data available for the bog and surrounding area (Kolka et al. 2010), the S1 bog is the optimum location to conduct the SPRUCE project.

3.1.1 Construction Effects

Construction of the boardwalks, enclosures, and associated infrastructure and utilities would have minor adverse impacts to wetland vegetation, hydrology, and soils. None of these potential impacts would diminish the functional capacity of the wetland or result in the loss or conversion of wetland habitat to non-wetland. Disturbance would be minimized to the extent possible by constructing most of the walkways and associated infrastructure during the winter months when snow and ice would protect the sensitive vegetation and organic soils of the bog. Construction of the enclosures, boardwalks, and access spurs would affect a total area of about 1.5 ha (3.7 acres) of the S1 bog.

Construction of a new electrical distribution line to bring power to the SPRUCE project site would require crossing the Plantation/Cutaway Lake drainage channel and wetlands surrounding that drainage. The wetlands associated with the Plantation/Cutaway Lake drainage would be crossed using unidirectional boring to go horizontally beneath this area and would not affect either the wetland or other aquatic habitat.

Wetland vegetation

Construction of the boardwalks and enclosures would require cutting wetland vegetation in order to place the structures in the optimum locations (Hanson et al. 2009). Vegetation disturbance would be limited to the minimum necessary, but some cutting of trees and shrubs would be unavoidable. To the extent possible, vegetation cut or damaged during construction and installation would be collected and used to develop site-specific allometric relationships to estimate aboveground and coarse root biomass of trees and ericaceous shrubs in the enclosures. The boardwalk would be suspended 30 to 60 cm (12 to 24 in.) above the bog surface and not directly impact the bog surface. The decking material would allow a moderate amount of sunlight to reach the plants' bog surface thus allowing sufficient sunlight to reach plants beneath the walkways.

Wetland hydrology

Construction of hydrologic barriers around the enclosures would have minor effects on wetland hydrology and soils. The barriers would be constructed from sheet piling and extend from the bog surface into the mineral soil beneath the peat (Hanson et al. 2009). Alternatively the sheet piling would extend from 0.3 m (1 ft) below ground surface (bgs) into the underlying mineral soil. A small amount of soil would be disturbed around each enclosure as piling is driven through the peat and into the underlying mineral soils. The sheet piling would restrict subsurface flow in or out of the enclosures, thus limiting the water within the enclosures to that coming from atmospheric sources (precipitation). The net hydrologic effect would be somewhat drier conditions inside enclosures, especially those with higher treatment temperatures, and somewhat wetter conditions outside the hydrologic barriers. Any changes in hydrology would be most apparent within the affected enclosures.

Wetland soils

A small amount of soil disturbance would occur during construction of the enclosures and the boardwalk. This disturbance from construction of enclosures and walkways would be minimized by using helical piles to support the boardwalk and the framework for the enclosures (Hanson et al. 2009). These piles are steel shafts that are drilled or screwed into the mineral soil beneath the peat. Each helical pier would disturb a small area of the peat about 15 to 30 cm (6 to 12 in.) in diameter. A small amount of soil disturbance would occur during installation of circumferential vertical heaters. Heating elements are small ~30 millimeters (mm) [1.25 in.] pipes that contain low-wattage heaters for deep soil warming. Heating elements would be inserted into the bog to a depth of about 2 m (6.6 ft) bgs.

3.1.2 Operation and Maintenance Effects

The O&M of the SPRUCE project is expected to have both positive and negative effects on vegetation and predominantly negative effects on hydrology and soils of the S1 bog (Hanson et al. 2009). Most of these potential effects would occur as a result of warmer soil and air temperatures in the enclosures with or without increased CO_2 levels. Increased temperature will increase transpiration in higher plants and evaporation from the upper aerobic layer of peat. Without concurrent increases in precipitation, available surface water and the perched water table will decline earlier in the growing season and to a greater depth.

Wetland vegetation

In general, the combination of higher temperatures, elevated CO_2 levels, and increased nutrient availability from organic matter decomposition could influence large-scale reorganization of the plant community (Hanson et al. 2009). Drier soils and increased nutrient status could create conditions that favor the growth and regeneration and abundance of woody plants, thus increasing shading in the understory and limiting herbs, bryophytes, and graminoids. Conditions may change enough to allow non-bog species, such as red maple, to colonize hummocks in the bog. Increased nutrient availability may also directly threaten survival and regeneration of locally adapted bog species such as round-leaved sundew, purple pitcher-plant, and *Sphagnum* species. Although moderate warming may actually increase growth and survival of black spruce and other woody plants, the highest levels of warming, alone or in combination with elevated CO_2, could cause needle stress and increased foliar loss in black spruce and possibly increased mortality in spruce.

Wetland hydrology

As mentioned previously, increased temperature will increase evapotranspiration in heated enclosures (Hanson et al. 2009). This will likely draw down the local water table earlier in the growing season and to a greater depth. The primary effect associated with a drop in water table would influence growing conditions for plants and the physical, chemical, and biological properties of soils.

Wetland soils

As organic soils of the bog warm and dry out, they would be more susceptible to oxidation and accelerated decomposition (Hanson et al. 2009). Changes in soils temperatures could also result in changes of the structure of microbial communities. Increases in soil microbial activity could enhance the mineralization of the organic matter, thus increasing the availability of nitrogen, phosphorus, and other nutrients and altering the carbon cycle in treatment enclosures. These changes in nutrient and microbial status could, in turn, influence growth and survival of vegetation.

3.1.3 Indirect Effects

Indirect impacts could result from activities in areas adjacent to the wetland that could interfere with how the wetland functions. Examples of indirect adverse impacts include siltation from soil erosion at areas cleared for installation of support facilities, spills or leaks of oil or other chemicals from construction equipment, overuse of pesticides or herbicides, and allowing invasive, exotic plant pest species to invade and colonize the wetlands, thereby diminishing the diversity and quality of wetland habitat.

Land clearing and construction of support facilities (gravel access paths, parking areas, temporary office/storage buildings, and pads for the CO_2 and propane tanks) would affect about 0.118 ha (0.3 acre) of the upland forest on the west side of the bog (Hanson et al. 2009). Any soil disturbance can provide opportunities for invasive plants to get established and spread. Invasive species have the potential to negatively affect the productivity of wildlife habitat, native plant populations, and may negatively affect sensitive ecosystems like peatlands. Use of best management practices and standard erosion and spill control measures would ensure that sediment, other potential contaminants, and invasive species are controlled at the site and are not introduced into the S1 bog.

4. ALTERNATIVES

The only alternative examined was the No Action Alternative.

4.1 THE NO ACTION ALTERNATIVE

Under the No Action Alternative, the SPRUCE project would not take place at the S1 bog. The bog and adjacent upland would continue to be used for hydrologic research by USFS (its current use). No additional impacts to the wetland at the S1 bog would occur, and it is expected that the wetland would continue to exist and function as it presently does.

5. REGULATORY ISSUES

5.1 REGULATORY PERMITS

In June 2010, the USACE determined that the S1 bog is not within their regulatory jurisdiction (Baer 2010). USACE determined that the proposed SPRUCE project would not occur in a navigable water of the United States, nor would there be any discharge of dredged or fill material into any water of the United States, including wetlands.

Directionally boring under wetlands or other aquatic habitat for the new electrical distribution line would not cause a discharge of fill into Waters of the United States. Therefore, it is not a regulated activity under Sect. 404 of the Clean Water Act of 1972 and would not require a 404 permit (Baer 2010).

Although no federal permits would be required, there may be other state, local, or other authorizations, such as those of the Minnesota Department of Natural Resources (MNDNR), for permits involving waters of the State of Minnesota. It would be the responsibility of ORNL and/or USFS to secure all applicable permits prior to initiating work in the bog. Permit conditions would stipulate which activities could occur in, or around, the wetland. Regulatory permits would also specify all required mitigative measures, including compensation.

5.2 MITIGATION

The sequencing for regulatory review by the USACE requires applicants to take all efforts to avoid adverse impacts to wetlands if possible, minimize adverse impacts, and compensate for adverse impacts after making all practicable effort to avoid and minimize them. Compensatory requirements depend on the quality of the affected wetlands, the type and degree of impact, and the region of the state where the impact would occur. Compensation mitigation usually includes restoring, enhancing, or preserving wetlands. Compensatory requirements generally must be negotiated with USACE and/or state regulatory agencies on a case-by-case basis. Since no federal permit is required for the SPRUCE project and no long-term adverse effects are expected to occur to the S1 bog, no compensatory mitigation would be required.

6. SUMMARY AND CONCLUSIONS

The proposed SPRUCE project is a collaborative research effort between ORNL and the USFS to study the effects of climate change and increased atmospheric CO_2 on a black spruce-*Sphagnum* ecosystem located in the MEF on the Chippewa NF in Itasca County, Minnesota. The planned experiment site is the S1 bog, a 10.0-ha (24.69 acres) black spruce-peat moss bog located at the forest.

ORNL and USFS propose to study the effects of altered atmospheric and climate conditions to obtain information on the response to elevated temperature and elevated atmospheric CO_2 of a black spruce-*Sphagnum* ecosystem. Research would involve climate change manipulation activities, focusing on the response of multiple levels of warming combined with elevated CO_2 levels, the collection of field data, and the evaluation of the response of existing biological communities (plants and animals) to a range of warming levels.

The proposed SPRUCE project would have minor effects on vegetation, hydrology, and soils in part of the S1 bog. Some of these effects would occur during construction of the proposed experimental apparatus; some would occur from O&M of the proposed experiment. None of the effects is expected to be of sufficient magnitude to cause impacts that affect the long-term survival, quality, or natural and beneficial values of the wetland. Effects on wetlands may result from activities occurring directly in wetlands or effects may result indirectly from activities that occur in areas adjacent to wetlands.

Construction of a new electrical distribution line to bring power to the SPRUCE project site would require crossing the Plantation/Cutaway Lake drainage channel and wetlands surrounding that drainage. The wetlands associated with the Plantation/Cutaway Lake drainage would be crossed using unidirectional boring to go horizontally beneath this area and would not affect either the wetlands or other aquatic habitat.

The consequences of wetland alteration from the SPRUCE project are expected to be sufficiently minor such that the wetland could recover in a few years (short-term effects) once the experiment is concluded and experimental structures are removed. All infrastructures are designed for a 10-year experiment and would be removed after the completion of the study. The USFS may choose to retain the boardwalks for continued experimental access to the bog for future research on the MEF.

Although there would be some minor, adverse impacts from the SPRUCE project, there is no practical alternative to the proposed action. In order to study the effects of climate change on peat-dominated wetlands, the experiment must be conducted in that same type of habitat. With almost 50 years of hydrologic, meteorological, and other scientific background data available for the bog and surrounding area (Kolka et al. 2010), the S1 bog at Marcell Forest is the optimum location to conduct the SPRUCE project.

In June 2010, the USACE determined that the S1 bog is not within their regulatory jurisdiction (Baer 2010). Although no federal permits would be required, there may be other state, local, or other authorizations, such as those of the MNDNR, for permits involving waters of the State of Minnesota. It would be the responsibility of ORNL and/or USFS to secure all applicable permits prior to initiating work in the bog. Permit conditions would stipulate which activities could occur in, or around, the wetland. Regulatory permits would also specify all required mitigative measures, including compensation. Since no federal permit is required for the SPRUCE project and no long-term adverse effects are expected to occur to the S1 bog, no compensatory mitigation would be required.

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Attachment 1

USACE Wetland Determination Forms

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: S1 Bog Marcell Exp. Forest City/County: Itasca Sampling Date: 07/09/2010

Applicant/Owner: ORNL / USFS State: MN Sampling Point: W01-WET

Investigator(s): J. Groton, L. Pounds Section, Township, Range: E 1/2, Sect. 13, T58N, R25W

Landform (hillslope, terrace, etc.): Bog Local relief (concave, convex, none): _____

Slope (%): <1 Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: Greenwood NWI classification: PEM1E/PSS1E/PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	If yes, optional Wetland Site ID: W01-WET

Remarks: (Explain alternative procedures here or in a separate report.)

Plot center near bog/lagg interface, ~50% bog & 50% lagg

4 Photos: N, E, S, W from plot center Near center of west side of bog

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): <1
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Small pockets of standing water between hummocks <1 in deep

Plots WOI-WET & WOI-UPL
Sketch Map

VEGETATION – Use scientific names of plants. Sampling Point: W01-WET

Tree Stratum (Plot size: 10m radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	10		FACW
2. Larix laricina	10		FACW
3. Betula papyrifera	10		FACU
4.			
5.			
6.			
7.			
15/6	30 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rugosa	50	Y	OBL
2. Ledum groenlandica	30	Y	OBL
3. Betula papyrifera	15		FACU
4. Picea mariana	10		FACW
5. Acer rubrum	10		FAC
6. Larix laricina	5		FACW
7.			
60/24	120 = Total Cover		

Herb Stratum (Plot size: 2m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Calamagrostis canadensis	70	Y	OBL
2. Smilacina trifolia	25	Y	OBL
3. Trientalis borealis	10		FAC
4. Eriophorum vaginatum	<5		OBL
5. Carex trisperma	<5		OBL
6. Carex pauperacula	<5		OBL
7.			
8.			
9.			
10.			
11.			
12.			
60/24	120 = Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 175 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ✓ Rapid Test for Hydrophytic Vegetation
- ✓ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

Sphagnum & other mosses cover ~ 85%

SOIL

Sampling Point: W01-WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR4/4	90					~~pe~~ mucky peat	fibric
6-10	10YR2/2	90					mucky peat	hemic
10-20	7.5YR3/2	90					mucky peat	hemic

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- X Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR R, MLRA 149B)**
- ___ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- ___ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- ___ Loamy Mucky Mineral (F1) **(LRR K, L)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- ___ Coast Prairie Redox (A16) **(LRR K, L, R)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- ___ Dark Surface (S7) **(LRR K, L)**
- ___ Polyvalue Below Surface (S8) **(LRR K, L)**
- ___ Thin Dark Surface (S9) **(LRR K, L)**
- ___ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- ___ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

Mapped as Greenwood peat
Soil saturated to surface
Soil profile description derived from USDA description
Disturbance to soil minimized to avoid unnecessary disturbance to soil profile. Conditions confirmed w/ 1in. diameter push probe
Small pockets standing water between hummocks

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: S1 Bog Marcell Exp. Forest City/County: Itasca Sampling Date: ~~07/09/2010~~ 07/10/2010

Applicant/Owner: ORNL/USFS State: MN Sampling Point: W02-WET

Investigator(s): J. Groton, L. Pounds Section, Township, Range: E½, Sect 13, T58N, R25W

Landform (hillslope, terrace, etc.): Bog Local relief (concave, convex, none): ____

Slope (%): <1 Lat: ____ Long: ____ Datum: ____

Soil Map Unit Name: Greenwood NWI classification: PEM1C/PSS1E/PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____
Hydric Soil Present?	Yes X	No ____
Wetland Hydrology Present?	Yes X	No ____

Is the Sampled Area within a Wetland? Yes X No ____

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

Pit entirely in lagg

Near ~~southeastern~~

4 photos: N, E, S, W from pit center

Near southwestern corner of bog

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 0-4
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

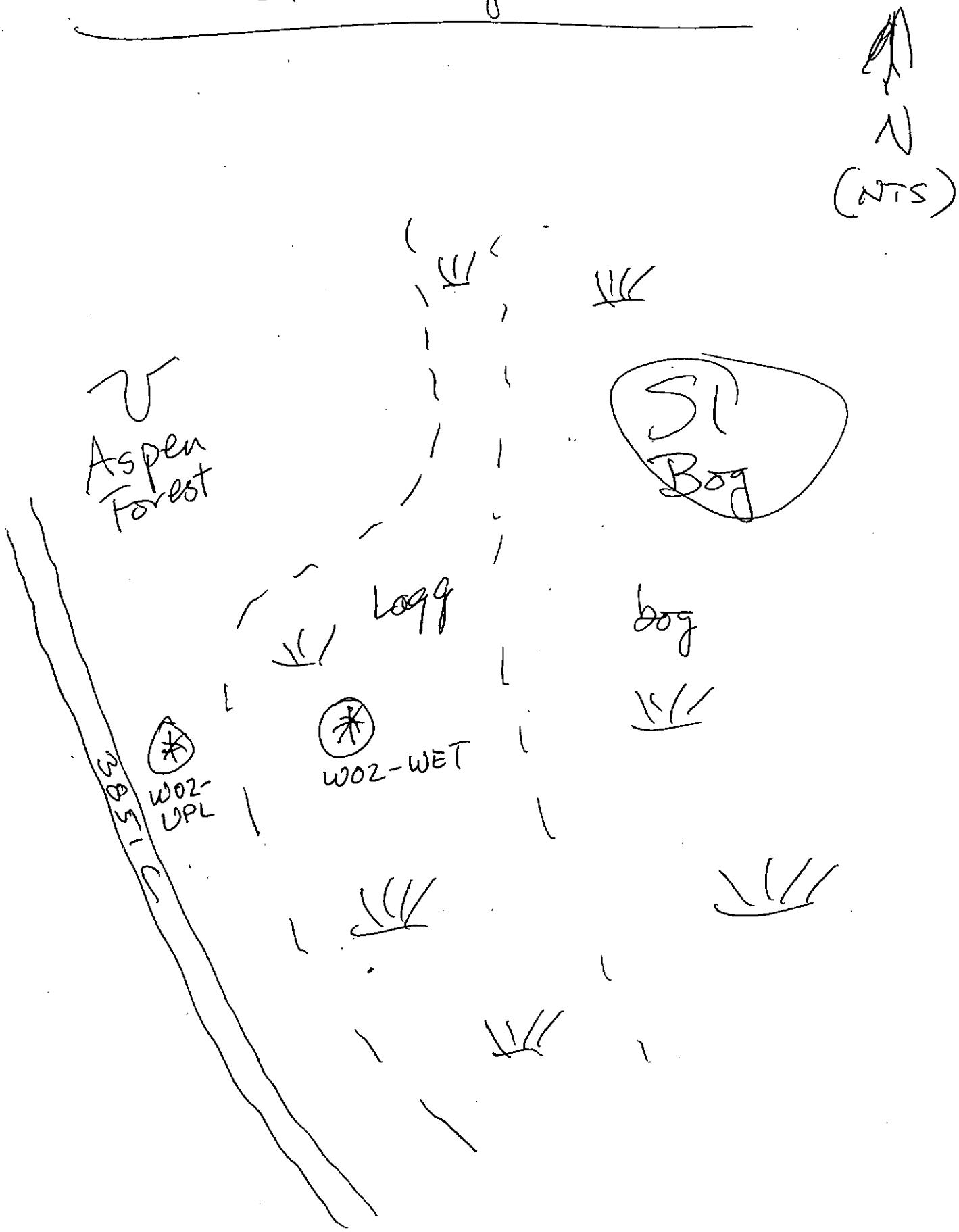
Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Pockets of standing water up to 4 in. deep between hummocks

Plots W02-WET & W02-UPL
Sketch Map



VEGETATION – Use scientific names of plants. Sampling Point: 002-WET

Tree Stratum (Plot size: 10-m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	5	Y	FACW
2. Larix laricina	5	Y	FACW
3.			
4.			
5.			
6.			
7.			
50/4	10 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5 m)			
1. Betula papyrifera	35	Y	FACW
2. Picea mariana	20	Y	FACW
3. Pinus strobus	5		FACU
4. Ledum groenlandicum	30	Y	OBL
5.			
6.			
7.			
45/18	90 = Total Cover		

Herb Stratum (Plot size: 2 m)			
1. Calamagrostis canadensis	85	Y	OBL
2. Smilacina trifolia	25	Y	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
55/22	110 = Total Cover		

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 160 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- X Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Sphagnum/moss cover 100%

SOIL

Sampling Point: WD2-WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR4/4	90					mucky peat	fibric
6-10	10YR2/2	90					mucky peat	hemic
10-20	7.5YR3/2	90					mucky peat	hemic

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- X Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Dark Surface (S7) **(LRR R, MLRA 149B)**
- __ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- __ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- __ Loamy Mucky Mineral (F1) **(LRR K, L)**
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- __ Coast Prairie Redox (A16) **(LRR K, L, R)**
- __ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- __ Dark Surface (S7) **(LRR K, L)**
- __ Polyvalue Below Surface (S8) **(LRR K, L)**
- __ Thin Dark Surface (S9) **(LRR K, L)**
- __ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- __ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- __ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- __ Red Parent Material (TF2)
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks:

Mapped as Greenwood peat
Soil saturated to surface
Soil profile description derived from USDA description.
Soil surface minimized to avoid unnecessary disturbance. Conditions confirmed w/ 1-in. diameter push probe
Small pockets standing water between hummocks

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: S1 Bog Marcell Exp. Forest City/County: Itasca Sampling Date: 07/10/2010

Applicant/Owner: ORNL/USFS State: MN Sampling Point: ~~W03~~-WET

Investigator(s): J. Groton, L. Pounds Section, Township, Range: E½, Sect 13, T58N, R25W

Landform (hillslope, terrace, etc.): Bog Local relief (concave, convex, none): ( )

Slope (%): <1 Lat: Long: Datum: ~~E½, Sect 13, T58N, R~~

Soil Map Unit Name: Greenwood NWI classification: PEM1E/PSS1G/PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____
Hydric Soil Present?	Yes X	No ____
Wetland Hydrology Present?	Yes X	No ____

Is the Sampled Area within a Wetland? Yes X No ____

If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

Plot center near logg/bog boundary ~50% logg, 50% bog
4 Photos: N, E, S, W from plot center
Near northwestern corner of wetland - raised boardwalk to well

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

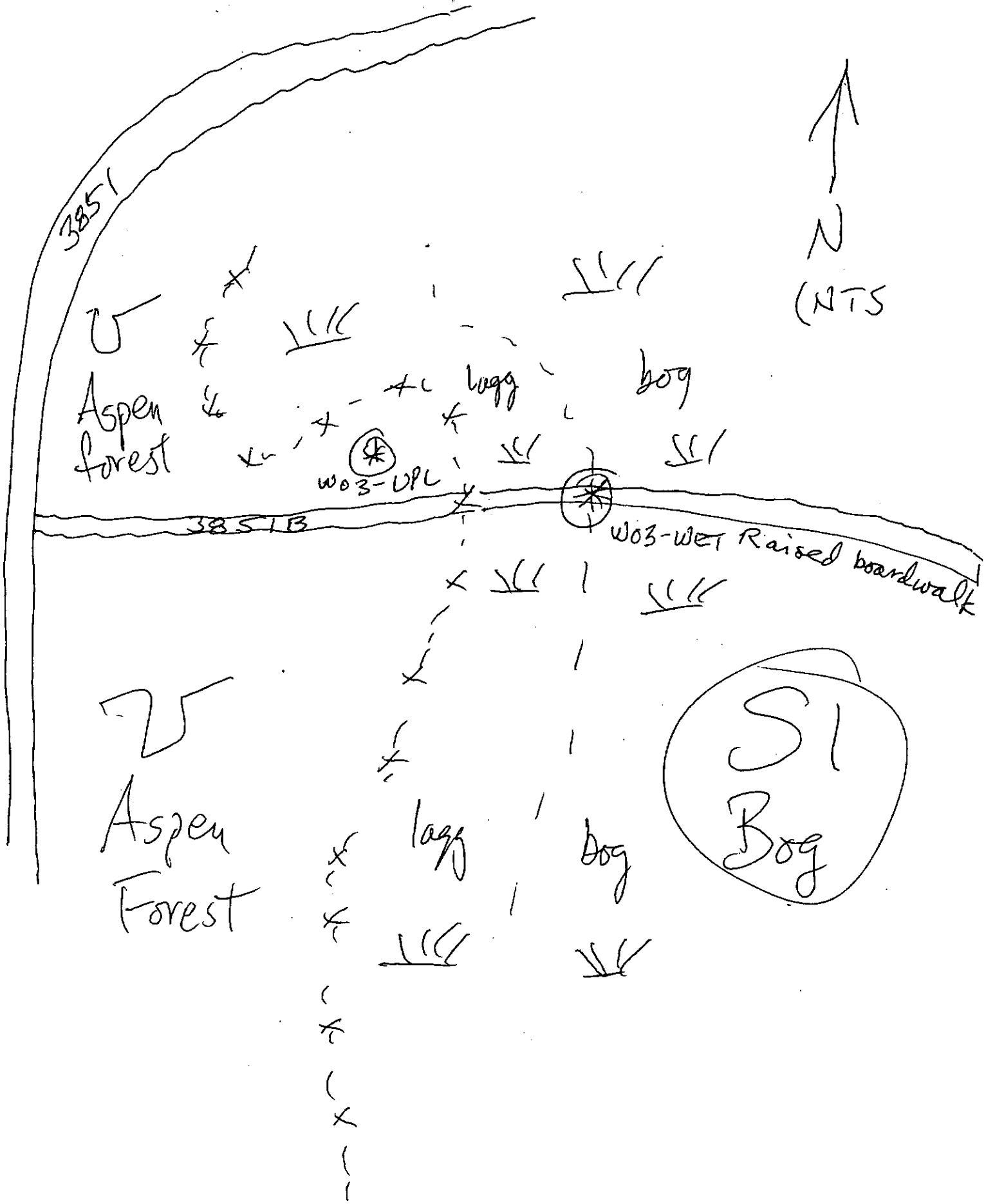
Surface Water Present?	Yes X	No ____	Depth (inches): 0
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

A little water visible between hummocks (<1 in. deep



Plots W03-WET & W03-UPL Sketch map

VEGETATION – Use scientific names of plants. Sampling Point: W03-WET

Tree Stratum (Plot size: 10-m R)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	30	Y	FACW
2. Larix laricina	5		FACW
3.			
4.			
5.			
6.			
7.			
17.5/7	35 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5-m)			
1. Ledum groenlandicum	30	Y	OBL
2. Chamaedaphne calyculata	15	Y	OBL
3. Betula papyrifera	5		FACU
4. Alnus rugosa	<5		OBL
5. Populus tremuloides	<5		NI
6.			
7.			
30/12	60 = Total Cover		

Herb Stratum (Plot size: 2-m)			
1. Calamagrostis canadensis	35	Y	OBL
2. Sanguisorba trifolia	15	Y	OBL
3. Carex paupercula	<5		OBL
4. Carex trisperma	<5		OBL
5. Vaccinium oxycoccus	<5		OBL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
32.5/13	65 = Total Cover		

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 125 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- X Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Sphagnum present throughout (~100%)

SOIL Sampling Point: W03-WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR4/4	90					mucky peat	fibric
6-10	10YR2/2	90					mucky peat	hemic
10-20	7.5YR3/2	90					mucky peat	hemic

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- X Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Dark Surface (S7) (**LRR R, MLRA 149B**)
- __ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- __ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- __ Loamy Mucky Mineral (F1) (**LRR K, L**)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- __ Coast Prairie Redox (A16) (**LRR K, L, R**)
- __ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- __ Dark Surface (S7) (**LRR K, L**)
- __ Polyvalue Below Surface (S8) (**LRR K, L**)
- __ Thin Dark Surface (S9) (**LRR K, L**)
- __ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- __ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- __ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- __ Red Parent Material (TF2)
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

Mapped as Greenwood peat
Soil saturated to surface - film of water visible between hummocks
Soil profile description derived from USDA description
Disturbance to soil profile minimized to prevent unnecessary to bog. Conditions confirmed w/ 1-in. diameter push probe.

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: S1 Bog Marcell Exp. Forest City/County: Itasca Sampling Date: 07/10/2010

Applicant/Owner: ORNL/USFS State: MN Sampling Point: W04-WET

Investigator(s): J. Groton, L. Pounds Section, Township, Range: E 1/2, Sect 13, T58N, R25W

Landform (hillslope, terrace, etc.): Bog Local relief (concave, convex, none): _____

Slope (%): <1 Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: Greenwood NWI classification: PEM1E/PSS1B/PFO1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____
Hydric Soil Present?	Yes X	No _____
Wetland Hydrology Present?	Yes X	No _____

Is the Sampled Area within a Wetland? Yes X No _____

If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)
Plot midway down east side more or less opposite W01-WET almost entirely in bog (< 25% in logg)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

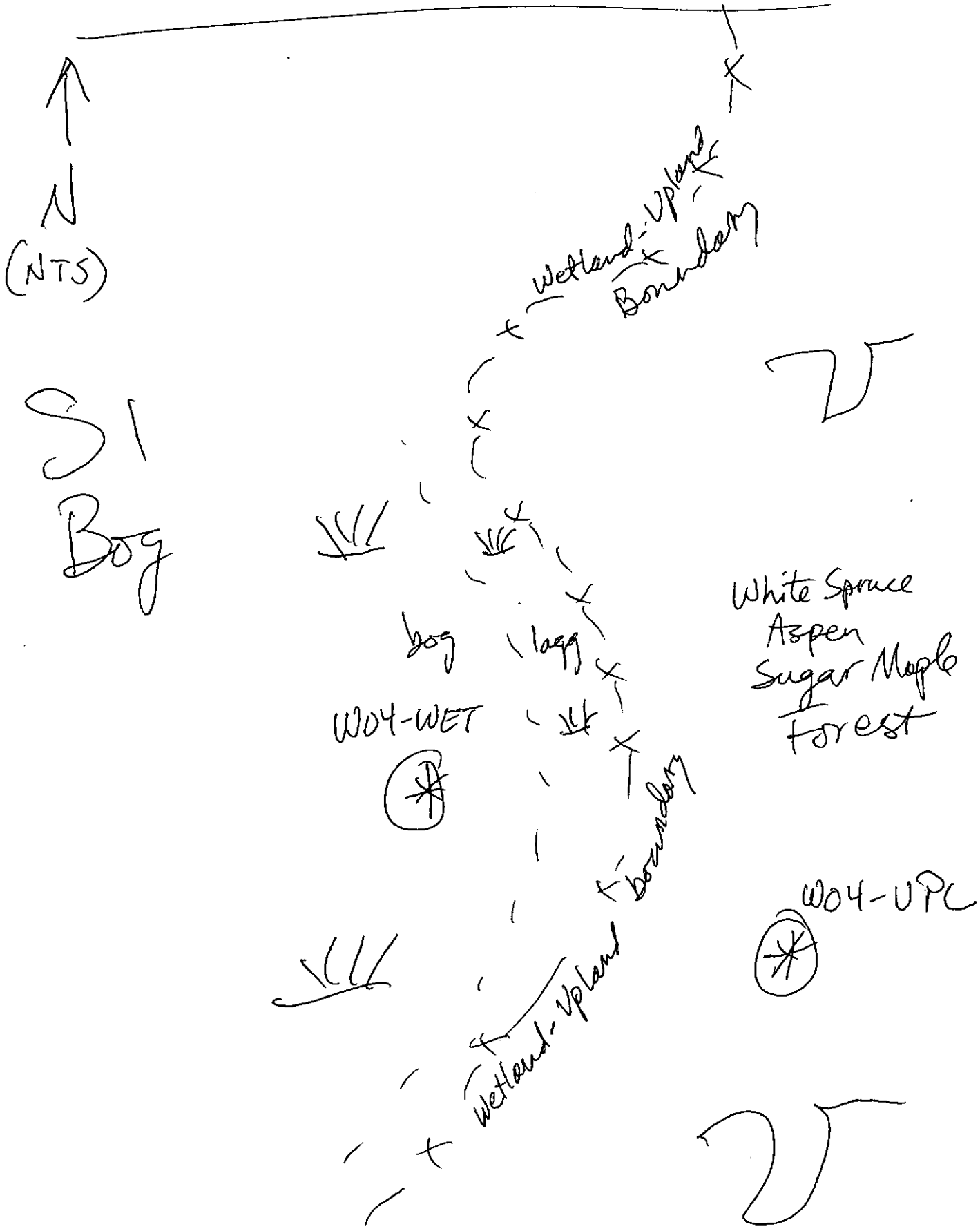
Surface Water Present?	Yes —	No —	Depth (inches): _____
Water Table Present?	Yes X	No 0	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes X	No 0	Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Water in footprints

Plots: W04-WET & W04-UPL
Sketch Map



VEGETATION – Use scientific names of plants. Sampling Point: W04-WET

Tree Stratum (Plot size: 10-m R)	Absolute % Cover	Dominant Species?	Indicator Status
1. Picea mariana	20	Y	FACW
2. Larix laricina	10		
3.			
4.			
5.			
6.			
7.			
15/6	30 = Total Cover		

Sapling/Shrub Stratum (Plot size: 5-m R)			
1. Ledum groenlandicum	70	Y	OBL
2. Chamaedaphne calyculata	20		OBL
3. Picea mariana	20		FACW
4. Vaccinium angustifolium	15		FACU
5. Betula papyrifera	10		FACU
6. Larix laricina	<5		FACW
7. Kalmia polifolia	<5		OBL
72.5/29	145 = Total Cover		

Herb Stratum (Plot size: 2-m R)			
1. Smilacina trifolia	20	Y	OBL
2. Calamagrostis canadensis	15	Y	OBL
3. Eriophorum vaginatum	<5		OBL
4. Vaccinium oxycoccus	<5		OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
22.5/9	45 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 125 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- X Rapid Test for Hydrophytic Vegetation
- X Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

Sphagnum cover 100%

SOIL

Sampling Point: W04-WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR 4/4	90					mucky peat	fibric
6-10	10YR 2/2	90					mucky peat	hemic
10-20	7.5YR 3/2	90					mucky peat	hemic

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol (A1)
- X Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Dark Surface (S7) **(LRR R, MLRA 149B)**
- __ Polyvalue Below Surface (S8) **(LRR R, MLRA 149B)**
- __ Thin Dark Surface (S9) **(LRR R, MLRA 149B)**
- __ Loamy Mucky Mineral (F1) **(LRR K, L)**
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10) **(LRR K, L, MLRA 149B)**
- __ Coast Prairie Redox (A16) **(LRR K, L, R)**
- __ 5 cm Mucky Peat or Peat (S3) **(LRR K, L, R)**
- __ Dark Surface (S7) **(LRR K, L)**
- __ Polyvalue Below Surface (S8) **(LRR K, L)**
- __ Thin Dark Surface (S9) **(LRR K, L)**
- __ Iron-Manganese Masses (F12) **(LRR K, L, R)**
- __ Piedmont Floodplain Soils (F19) **(MLRA 149B)**
- __ Mesic Spodic (TA6) **(MLRA 144A, 145, 149B)**
- __ Red Parent Material (TF2)
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ____

Remarks:

Mapped as Greenwood peat
Soil description derived from USDA description
Soil saturated to surface
Disturbance to soil profile minimized to prevent unnecessary soil profile disturbance in bog. Conditions confirmed w/ 1-in. diameter push probe

APPENDIX B

REGIONAL FORESTER SENSITIVE SPECIES

Table RFSS_01. Regional Forester Sensitive Species (RFSS)

Scientific name	Common name	Federal status	State status
Birds			
Accipiter gentilis	Northern goshawk	None	None
Ammodramus leconteii	LeConte's sparrow	None	None
Ammodramus nelsoni	Nelson's sharp-tailed sparrow	None	S
Buteo lineatus	Red-shouldered hawk	None	S
Childonis niger	Black tern	None	None
Contopus cooperi	Olive-sided flycatcher	None	None
Coturnicops noveboracensis	Yellow rail	None	S
Cygnus buccinator	Trumpeter swan	None	T
Dendroica caerulescens	Black-throated blue warbler	None	None
Dendroica castenea	Bay-breasted warbler	None	None
Falcipennis canadensis	Spruce grouse	None	None
Haliaeetus leucocephalus	Bald eagle	None	S
Oporornis agilis	Connecticut warbler	None	None
Phalaropus tricolor	Wilson's phalarope	None	T
Picoides arcticus	Black-backed woodpecker	None	None
Sterna caspia	Caspian tern	None	None
Sterna hirundo	Common tern	None	T
Strix nebulosa	Great gray owl	None	None
Tympanuchus phasinellus	Sharp-tailed grouse	None	None
Amphibians			
Hemidactylium scutatum	Four-toed salamander	None	S
Mammals			
Synaptomys borealis	Northern bog lemming	None	S
Reptiles			
Emydoidea blandingii	Blanding's turtle	None	T
Fish			
Moxostoma valenciennesi	Greater redhorse	None	None
Notropis anogenus	Pugnose shiner	None	S
Etheostoma microperca	Least darter	None	S
Mollusks			
Lasmigona compressa	Creek heelsplitter	None	S
Lasmigona costata	Fluted-shell mussel	None	S
Ligumia recta	Black sandshell	None	S
Insects			
Caraclea vertreesi	Vertree's caddisfly	None	S
Plants			
Botrychium lanceolatum var. angustisegmentum	Lanceleaf grapefern	None	T
Botrychium mormo	Goblin fern	None	S
Botrychium oneidense	Blunt-lobed grapefern	None	E
Botrychium pallidum	Pale moonwort	None	E
Botrychium rugulosum	Ternate grapefern	None	T
Botrychium simplex	Least moonwort	None	S
Calypso bulbosa	Fairy slipper	None	None
Cypripedium arietnum	Ram's-head lady's slipper	None	T

Table RFSS_01. Regional Forester Sensitive Species (RFSS) – continued

Scientific name	Common name	Federal status	State status
Dryopteris goldiana	Goldie's wood-fern	None	S
Eleocharis olivacea	Olivaceous spikerush	None	T
Eleocharis quinqueflora	Few-flowered spikerush	None	S
Erythronium albidum	White trout-lily	None	None
Gymnocarpium robertianum	Limestone oak fern	None	None
Malaxis brachypoda	White adder's mouth	None	S
Orobanche uniflora	One-flowered broomrape	None	S
Platanthera clavellata	Club-spur orchid	None	S
Sparganium glomeratum	Northern bur-reed	None	S
Subularia aquatica	Awlwort	None	T
Taxus canadensis	Canada yew	None	None

Source: Chippewa National Forest 2010.
Note: E = Endangered, S = Special Concern, T = Threatened, none = No status.

APPENDIX C

CORRESPONDENCE

Andrea LeVasseur/R9/USDAFS
05/17/2010 10:51 AM

To Barb Knight/R9/USDAFS@FSNOTES
cc
bcc
Subject Re: SPRUCE EA

History: This message has been forwarded.

Our surveyed layer shows this area was examined and documented by report R4-382. Stand 4 is inaccessible for walkover. No traditional resource gathering shows on the TR layer, and this location is outside of the reservation boundary. This action does not appear to meet the definition of an undertaking requiring Section 106 consultation as there do not appear to be any potential historic properties to be affected. No further work is warranted.

Andrea LeVasseur
Heritage Program Manager/ Forest Archeologist
Chippewa National Forest
200 Ash Ave.
Cass Lake MN 56633
218-335-8671 FAX 218-335-8637

Barb Knight/R9/USDAFS

Barb Knight/R9/USDAFS
05/10/2010 12:45 PM

To Andrea LeVasseur/R9/USDAFS@FSNOTES
cc Barb Knight/R9/USDAFS@FSNOTES
Subject SPRUCE EA

Andrea,
We talked this morning about this research experiment and EA. It is being done by a contractor, but our Northern Research contact is Randy Kolka. I will attach a couple maps I created and the powerpoint with their experimental layout for you to decide what more you need. As I mentioned this morning I did not know they were going this route until last Friday, before that I though it would be covered in our Central project EA.

Thanks,
Barb

[attachment "SPRUCE_photo.pdf" deleted by Andrea LeVasseur/R9/USDAFS] [attachment "SPRUCE_map2.pdf" deleted by Andrea LeVasseur/R9/USDAFS] [attachment "SPRUCE Exp Facilities.ppt" deleted by Andrea LeVasseur/R9/USDAFS]

Barbara Knight
Land Management Planner
Deer River District
Chippewa National Forest
1037 Division Street
Deer River, MN 56636
218-246-2362
Fax:218-246-9743
bknight@fs.fed.us
Front Desk 218-246-2123

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
180 FIFTH STREET EAST, SUITE 700
ST. PAUL MINNESOTA 55101-1678

June 21, 2010

REPLY TO
ATTENTION OF
Operations
Regulatory (2010-01910-WAB)

Mr. Greg Zimmerman
Oak Ridge National Laboratory
Building 1505, MS-6036
Oak Ridge, Tennessee 37831

Dear Mr. Zimmerman:

We have reviewed information about your project to install boardwalks, circular test structures, and related appurtenances in an unnamed wetland for the purpose of researching the potential effects of increased carbon dioxide levels and elevated temperatures to a spruce bog. The project site is in E ½, Sec. 13, T58N, R25W, Itasca County, Minnesota.

The work proposed at the location stated is not within the regulatory jurisdiction of the Corps of Engineers. No work will be done in a navigable water of the United States, and no dredged or fill material, including that associated with mechanical land clearing, will be discharged in any water of the United States, including wetlands. Therefore, a Department of the Army permit is not required to do this work.

This letter is valid only for the project referenced above. If any change in design, location, or purpose is contemplated, contact this office to avoid doing work that may be in violation of Federal law. PLEASE NOTE THAT THIS CONFIRMATION LETTER DOES NOT ELIMINATE THE NEED FOR STATE, LOCAL, OR OTHER AUTHORIZATIONS, SUCH AS THOSE OF THE DEPARTMENT OF NATURAL RESOURCES OR COUNTY.

The decision regarding this action is based on information found in the administrative record which documents the District's decision-making process, the basis for the decision, and the final decision.

If you have any questions, contact Bill Baer in our Bemidji Regulatory field office at (218) 444-6381. In any correspondence or inquiries, please refer to the Regulatory number shown above.

Sincerely,

William Baer
for Tamara E. Cameron
Chief, Regulatory Branch

Printed on Recycled Paper

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Twin Cities Field Office
4101 American Blvd E.
Bloomington, Minnesota 55425-1665

August 9, 2010

Department of Energy
c/o Dr. James Elmore
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831

RE: FWS No. 32410-2010-TA-0049

Dear Dr. Elmore:

This responds to your July 12, 2010 letter requesting a species list for the proposed Spruce and Peatland Responses Under Climatic and Environmental Change Experiment (SPRUCE) at the Marcell Experimental Forest, Itasca County, Minnesota. The proposed research is a climate change manipulation study focusing on the combined response of multiple levels of warming combined with elevated CO_2 levels, the collection of field data, and the evaluation of the response of existing biological communities to a range of warming levels. The U.S. Forest Service would participate in the project as a research collaborator and land manager.

There are two federally-listed endangered species as described under the Endangered Species Act of 1973 (ESA), as amended, within Itasca County, Minnesota; Canada lynx (*Lynx canadensis*) and the Gray wolf (*Canis lupus*). In addition, Itasca County contains wolf critical habitat.

It is the responsibility of the Federal action agency, in this case, the U. S. Department of Energy, to make the determination of effects to federally-listed species pursuant to Section 7 of the ESA. In brief, a Federal agency is required to consult if an action *may affect* listed species or designated critical habitat, even if the effects are expected to be beneficial. Refer to http://www.fws.gov/midwest/endangered/section7/index.html for further technical assistance regarding the Section 7 consultation process.

Although the proposed project is not located within designated Canada lynx critical habitat, or what may be considered the species' core area in Minnesota, Canada lynx may be present in the project areas. The Gray wolf may also be present in the project areas. The biology and habitat requirements of the Canada lynx and Gray wolf are detailed on the U. S. Fish & Wildlife Service (Service) website http://www.fws.gov/midwest/endangered/section7/s7process/lifehistory.html. Risk factors for lynx are those affecting productivity (*e.g.* prey habitat availability), mortality

(*e.g.* increased road densities leading to road collisions and human access), and movement (*e.g.* highways disrupting connectivity of habitat). Important constituent elements of wolf critical habitat include human population, road and prey densities.

We appreciate the opportunity to provide comments on this proposed project. If you have questions, please contact Ms. Tamara Smith, Fish and Wildlife Biologist, at (612) 725-3548, ext. 2219, or via email at *tamara_smith@fws.gov*.

Sincerely,

Tony Sullins
Field Supervisor

United States Department of Agriculture
Forest Service
Chippewa National Forest
Supervisor's Office
200 Ash Avenue NW
Cass Lake, MN 56633-3089
Phone: 218-335-8600
Fax: 218-335-8637
TTY: 218-335-8632

File Code: 2360
Date: October 18, 2010

Britta Bloomberg
Deputy State Historic Preservation Officer
State Historic Preservation Office
Minnesota Historical Society
345 Kellogg Boulevard West
St. Paul, MN 55012

Re: Spruce and Peatland Responses under Climate and Environmental Change Experiment (SPRUCE), Chippewa National Forest, Itasca County, outside the Leech Lake Reservation
Sections 13, 23(W2), 24(NW), 26, T58N, R25W

SHPO Number: 2010-2925

Dear Ms. Bloomberg:

The Forest Service is considering a proposal to conduct the above experiment within the S1 Bog of the Marcell Experimental Forest, located in Section 13 (W2) T58N, R25W. Information regarding the project was submitted to you in previous correspondence. The purpose of this letter is to provide you with additional project information and information relative to review of this project under Section 106 of the National Historic Preservation Act.

Installation of the equipment and plot enclosures within S1 Bog would create limited disturbance to the organic soils of the bog. As a practical matter, the bog itself is inaccessible to archaeological testing using standard field techniques. Uplands immediately surrounding the bog have been subject to previous heritage survey with negative results (R4-382 completed in 1999).

Although the experiment would be conducted solely within the bog, a three-phase buried electrical service would need to be installed to provide the power to the enclosed study plots in the bog. The proposed electric service would extend from Itasca County Road 50 northward to S1 bog, a distance of about 3.1 miles with a cleared corridor width of 15-20 feet.

The route would begin at the junction of Itasca Co Rd 50 and Forest Road 3495. It would be installed immediately adjacent to Forest Road 3495 and run parallel to it in a northeasterly direction for a distance of about 1.5 miles. The line would then depart FR 3495 in a northerly direction crossing the Plantation/Cutaway Lake drainage to junction with FR 3851, a distance of about 1.0 miles. The line would then parallel FR 3851 in an easterly direction to S1 Bog, a distance of about 0.6 miles. The entire route and experiment site are located on National Forest System lands (refer to the enclosed maps).

The route is located within the Central Lakes Coniferous (Central) Archaeological Region (SHPO). Most of the route is within forested uplands but there are a small number of wetlands

including the Plantation/Cutaway Lake drainage that would be passed under using directional boring technology.

Clearing of the trees along the corridor would be necessary to provide access for the cable plows and other machinery needed to bury the line. While installation of the electrical cable by use of cable plow would create relatively little ground disturbance, mechanical harvest of the trees has the potential to create severe surface disturbance along the corridor which would have potential to affect cultural resources if any were present.

Most of the proposed route has been subject to previous heritage surveys. These surveys were conducted in review of potential future timber management projects and are considered adequate relative to the current review. The previous surveys along the route are listed below:

Survey Number	*Year*
R4-148	1984
R4-336	1994
R4-349	1995
R4-382	1999
R04-4003	2004

These surveys included walk-over surface inspection and shovel testing of various parts of the Cutaway Lake drainage. The results were entirely negative.

One 300 meter segment of the route, however, had not been subject to previous survey and appeared to have moderate potential for the presence of cultural resources. It is located on the north side of the Plantation/Cutaway lakes drainage as shown on the enclosed USGS Quad location map.

On September 21 and 30, 2010, I conducted a field survey of this segment that included a walkover of the route corridor and shovel testing of a south-facing point of land extending into the Plantation/Cutaway Lakes drainage also noted on the enclosed map.

Three shovel tests were excavated on the proposed corridor on a small upland knoll that forms a point extending into the wetlands below. The tests were about 35 cm. wide and excavated to a depth of about 40 cm. All excavated soils were passed through ¼ inch mesh hardware cloth (see attached shovel test form). These tests and the walkover survey were negative.

No traditional resource use within the project area was identified during interviews with Leech Lake Band members, which is the source of the Chippewa N.F. traditional use inventory database. The potential for traditional use should not be impaired by this project except within the relatively narrow electrical service corridor and experiment site itself.

Given the negative results of the present and previous heritage surveys, the Forest Service concludes that no historic properties would be affected by the proposed project.

Would you please review this undertaking per your authority under Section 106 of the National Historic Preservation Act and 36CFR800? If you have any questions or require further information regarding the project or current and previous surveys, please contact Bill Yourd at the above address, by telephone at 218-335-8672 or email wyourd@fs.fed.us. Thank you for considering this project.

Sincerely,

/s/ William Yourd
WILLIAM YOURD
Forest Archaeologist

cc: Gina Lemon, Tribal Historic Preservation Officer, Leech Lake Band of Ojibwe

Minnesota
Historical Society

STATE HISTORIC PRESERVATION OFFICE

November 15, 2010

Bill Yourd
Forest Archaeologist
Chippewa National Forest
Supervisor's Office
200 Ash Avenue NW
Cass Lake, MN 56633-3089

RE: File Code:1950-1
Spruce and Peatland Responses Under Climatic and Environmental Change Experiment (SPRUCE), Deer River Ranger District, Chippewa National Forest
Koochiching County
SHPO Number: 2010-2925

Dear Mr. Yourd:

Thank you for the opportunity to review and comment on the above project. It has been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800).

Based on available information, we conclude that **no properties** listed in or eligible for listing in the National Register of Historic Places will be affected by this project.

Please contact our Compliance Section at (651) 259-3455 if you have any questions regarding our review of this project.

Sincerely,

Britta L. Bloomberg
Deputy State Historic Preservation Officer

DOE/EA-1764

DRAFT