Soil and Water Resources Working Paper
Cave Hill, Dennison Hollow, Stone Face and Simpson Barrens Vegetation Management

Hidden Springs Ranger District
Shawnee National Forest

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Introduction

This assessment analyzes the potential effects of the proposed vegetation management project on soil and associated watershed resources occurring within the boundaries of the Shawnee National Forest. The primary purpose of this assessment is to determine whether the likely effects would result in a degradation of watershed resources in the project area.

Formal objectives of this assessment include:

1) identify watershed resources that would be affected by the proposed project,

2) ensure that Forest Service actions do not result in degradation of soil quality, water quality or air quality,

3) provide a process and standard that ensures that watershed resources receive full consideration,

4) make certain that best management practices, as per the Shawnee National Forest Amended Land and Resource Management Plan (USDA 2006) and the Region 9 Soil Quality Standards, are followed,

5) maintain a case file on actions regulated under environmental policy and procedures.

Current Management Direction

Current policy as stated in the Forest Service, Region 9 Soil Quality Standards includes the following (USDA Forest Service 2005). However, changes to the existing condition on the in the project areas as a result of activities associated with the project need to be addressed. Detrimental soil disturbance will be minimized to the extent possible. Adherence to soil quality standards identified in land management plan direction (USDA Forest Service 2005) will be employed.

The management direction specified by the Shawnee National Forest Land and Resource Management Plan (Forest Plan; USDA 2006) is to conserve soil and water resources and ensure the protection of streams, stream banks, lakes, wetlands, and other bodies of water in accordance with applicable laws and regulations. Activities will be guided by the best

management practices defined by the Illinois Department of Natural Resources et al. and may include stream bank restoration and/or stabilization and management of large, woody debris.

Management interpretations of the soil mapping units for the project areas are provided by the USDA Natural Resources Conservation. Criteria for those interpretations are given in the appendix and are those given in the National Forestry Manual (NRCS 1998).

Scope of the Analysis

The spatial boundary used to evaluate **direct** consequences would be the project areas where actions are proposed within the project area. Project areas are where harvesting, herbicide treatment, and wildlife opening creation are proposed. This spatial boundary was chosen because it can be used to determine threshold effects to soil quality from proposed actions associated with this project**. Indirect** consequences are bound within the project area because effects are not expected to move outside of the sub-watersheds within the project area. Please refer to the Alternative Maps (Chapter 2) for the locations of the proposed activities.

The spatial boundary used to address **cumulative** impacts was the Pine Creek watershed (11 digit Watershed No. 05090103020) . This allows us to assess past and future effects within this boundary and determine threshold impacts to soil quality when added to the proposed actions.

Short term effects to soils are related to a recovery period of one to three years. These effects are apparent until the affected area develops a vegetative cover and responds to site treatments to minimize soil movement and compaction. Long term effects to soils result from soil displacement and would last for more than 100 years. These effects result from the removal of the upper portion of the soil profile. This part of the soil profile contains a large amount of the soil's organic matter and available plant nutrients and therefore, its productivity or quality. The replacement of this part of the soil takes a long time (200-400 years) and depends on local climate and ecological conditions.

Methodology

The effects of activities can be positive and negative and may include soil disturbance but also buildup of the soil organic layer. The effects of these activities on soil resources in the activity area can be described in terms of short and long term effects on the **productivity or quality** of the soils. **Short term effects** are those effects lasting three years or less, and are associated with the period in which disturbed soils become reestablished with vegetative cover and as ash from prescribed burning incorporates base cations in the soil . Short term effects imply that the existing soil profile has very little to no long-term impact from proposed activities. In contrast, **long term effects** , both positive and negative, are associated with activities which displace any portions of the soil profile (topsoil) but also add to the soil organic layer. Many years are needed for the soil to recover its original productivity when the surface layers are removed. Soil formation typically occurs at a rate of one inch per 200-400 years, and depends on many

local environmental factors. Soil formation rates are most rapid on the surface of the soil when organic matter is allowed to be incorporated into the soil.

Important factors considered in evaluating effects to soil resources from this project are: the extent of the activity area and the extent of the activity area where long term soil productivity has been reduced. Effects to the soils from this project are considered not significant when 85 percent of the activity area retains its potential long term **soil productivity** (Forest Service Handbook, 2509.18.2.2, Soil Quality Standards). Acres of soil impacted by soil disturbing activities were estimated using the best available information and compared to the total acres of the activity areas (harvest units and road corridors).

Description of the Proposed Project

Management of natural areas is one of the highest resource needs on the forest. Until recently, none of the natural areas had been managed for several years. Prescribed fire is the preferred silvicultural tool to maintain the ecological characteristics of the natural areas. The Cave Hill/Dennison Hollow/Stoneface and Simpson Barrens vegetation management is a proposed prescribed burn project with an expectation to be categorically excluded. There is a total of 3,602 acres on this project over four natural areas and adjacent forested lands on four watersheds.

Alternative 1 -

Direct and Indirect Effects

No new management activities would take place, nor any activities associated with the proposed action. Therefore, no management related changes in productivity of the land would occur. Soils would be impacted by planned and ongoing natural resource management activities such as road use and maintenance. In the absence of wildfire, current runoff and erosion patterns would be maintained. An upland erosion rate of less than one ton per acre per year is predicted by Forest Service Water Erosion Prediction Project (FSWEPP) for stands on steep slopes in the absence of fire. Natural processes and functions would continue to occur as dead material decomposes. Dead and dying trees would decay, with carbon released to the atmosphere. Actual soil organic matter may increase with an accompanying increase in microorganisms and fungi. Since there is no burning, no carbon would be removed from the forest from project activities.

Natural functions could also include pathogens and insects contributing to oak decline leading to dead and down trees. Dead and down trees would increase fuel levels leading to increased wildfire danger. In the absence of wildfire, dead and down trees would decompose over time, leading to increased macro and microorganism populations carrying out the decomposition process. As decomposition proceeds, dead and down

material would eventually be incorporated into the organic horizon and surface horizons leading to increased soil nutrient capital.

Forest soil formation happens in three locations: formation at the bottom of a profile where the parent material is broken down by chemical and geologic processes, at the soil surface as the litter layer and organic layers are broken down by geologic and biologic process and re-formation within the soil profile. The most rapid soil formation rates occur at the soil surface next to the litter and organic matter layers above. (Troeh et al. 1991)

There is evidence that some fire took place during the pre-European settlement period both by lightning and by the Native Americans. Native Americans sometimes intentionally set fire to improve game habitat, facilitate travel, reduce insect pests, remove cover for enemies, enhance conditions for berries, and drive game. (Davis 2004)

Under this alternative, biomass (fuels) will not be removed by prescribed burning. The probability of high intensity wildfires would increase. Wildfires that could occur under conditions of increased fuel loading could burn at a higher intensity and over a larger area than would have occurred before the proposal. The stands where wildfire does not occur would maintain current runoff and erosion patterns. An upland erosion rate of less than one ton/acre/year would be expected for stands on steeper slopes and near water if fire were excluded. Fire ignitions would increase relative to historic wildfire frequency because project area fuels are more exposed to sun and wind and may be in a readily combustible state more often. Future wildfires could be more intense and much larger due to the changed fuel conditions. Each occurrence would increase the short-term (3-5 years) erosion from the area affected by the wildfire; however, these fires will likely be separated by space and time. Further information on frequency and size of historic wild-land fires and predicted intensity of future wildfire is covered in the Fire and Fuels Working Paper.

No ecological restoration or vegetation management will occur under this alternative. There would be no direct or indirect effects to soil or water from prescribed burning. Soil quality and productivity would be increased in the long-term as organic matter decomposes and converts to the A horizon, leading to increased soil nutrient capital. Water quality would be maintained at current levels considering anticipated future actions and assuming the inputs from private land remain stable. Some geologic erosion could be expected to continue in the project area and in the cumulative effects analysis area and some of this sediment could be expected to enter the streams. This alternative would likely result in less soil erosion, compaction, sediment load, and percentage of bare ground than the proposed action. There would be no sedimentation resulting from the no action alternative and there would be no cumulative effect. Implementation of this alternative is not anticipated to result in any changes to water quality.

Cumulative Effects Area

Cumulative effects analyses takes in to account all known past actions, the proposed action, present actions, and reasonably foreseeable future actions which could or will impact the analyses areas.

Spatial Boundary - The Cumulative Effects Area (CEA) for watershed resources (soil and water) for this project includes all of the four watersheds in which the proposed vegetation management project occurs. These watersheds are: Black Branch/Eagle Creek, Horseshoe Creek/South Fork Saline River, Spring Valley Creek/South Fork Saline River, and Cedar Creek (85,700 acres total with 19, 214 acres in Forest Service jurisdiction).

The cumulative effects area for air is IEPA Airsheds No. 72 (Paducah and Cairo Interstate encompassing six counties) & 74 (Southeast Illinois Intrastate encompassing 21 counties). Air quality data is given in Tables 13 in the Appendix. No monitoring station data was available for Airshed 72 and all water quality monitoring data was from locations in Airshed 74. Ozone, particulate matter (2.5 and 10), and sulfur dioxide were the pollutants for which data was available. No state standards were exceeded for 2006.

Temporal Boundary

The time frame considered is fifteen years for the following reasons:

1. Fifteen-year time frames provide a significant basis for measuring change in soil disturbance due to soil erosion and soil compaction.
2. Increases in soil erosion from project and associated activities usually return to pre-project levels within three to five years.

Soil compaction effects are variable and there is little information as to the time length for compacted soil to return to pre-project conditions in southern Ohio. Some information from the southeast U.S. indicates 10 - 15 years is the average time for restoration of compacted areas through natural processes. The source of this information is from a technical bulletin on the effect of heavy equipment on the physical properties of soils and long-term productivity done under the auspices of the National Council for Air and Stream Improvement (NCASI, Miller, Colbert, & Morris 2004).

No restoration activity involving vegetation manipulation would result in less long-term woody recruitment and loss of opportunities for increasing the soil organic matter and increasing then buffering capacity of the soil. Acidic deposition will continue as during the last decade or so. Agricultural activity (see Appendix) will likely continue as in the past. Carbon sequestration and loss continue as in the past.

Table 5, 6, & 7 give the ownership patterns in the CEA, occurrence of wilderness, national natural landmarks, and natural areas, and prescribed burning history back to 2003.

Forest Service Activity
Prescribed burning - Prescribed burning activity in the CEA is outlined in Table 7. The majority of burning has occurred in the Black Branch/Eagle Creek and Horseshoe Creek/South Fork Saline River watersheds and this activity is likely to continue. The purpose of future prescribed burning in the CEA in the wilderness and natural areas is to aid in sustaining their wilderness character.

Watershed assessment – Forest watershed assessments will begin in FY '08 and continue for several years after. Black Branch/Eagle Creek are scheduled for assessments in FY '09. The assessments will include recommendations for projects. These projects will likely be located in the 1,728 acres of wilderness which includes 726 acres of natural areas.

Non-Forest Service Activity
Sources unknown, channelization, stream bank modification / destabilization, surface mining have degraded water quality in the South Fork Saline River. Surface mining have influenced water quality in Eagle Creek and Cedar Creek has degraded water quality due to unknown sources. (Illinois EPA 2006). These influences can be expected to remain at current levels or to increase in the next five years.

Agricultural activity has not been identified as a cause of degraded water quality in the major streams associated with the project areas (except for Cedar Creek, – Assessment Unit I.D. IL_AJF-02) by the IEPA. Agricultural activity for crops and livestock (2001 and on) for Johnson and Saline County is given in Tables 9a thru 9j in the appendix. These tables do not give an indication of private activity adjacent to the project areas but give an indication of activity on a portion of the 66,480+ acres not under Forest Service jurisdiction. (USDA – National Agricultural Statistics Service 2007) These activities are likely to have a far greater effect on watershed resources in the CEA than activities the Forest Service would undertake in the long run.

Existing Environment

The four project areas are each located within one of four Huc 6 watersheds. All watersheds discussed are those classified by the U.S. Geological Survey as Hydrologic Unit Code 6 watersheds.

Soil

The acreage in the Cave Hill project area is located on approximately 18 soil mapping units. The project areas for Dennison Hollow and Stoneface are located on 9 soil mapping units and the project area for Simpson Barrens is located on 14 soil mapping units. Soil mapping units on which this project are located are presented in Table 1 – 3. Potential damage to soil from fire and soil erosion potential is included in these tables. Potential damage to soil from fire is based on several factors including surface layer, soil

texture and rock fragments, slope, and organic matter. Project areas located on relatively gentle slopes are rated as having a slight erosion potential, areas located on moderate slopes are rated as having a moderate potential on roads and trails (slight potential off roads and trails) and those located on steeper slopes are rated as having a severe erosion potential on roads and trails (moderate potential off roads and trails).

Water

The Illinois Environmental Protection Agency (IEPA) 2008 Water Quality Report was consulted to assess the water quality of major streams in and adjacent to the project area. Beneficial use support (full support, non support, not assessed), causes for less than full support, and sources of the cause are given for thirteen streams in Table 8 in the Appendix . The major source for less than full support of beneficial uses was surface mining. Forest activities were not specifically mentioned in this report as a source of concern.

Air

The IEPA 2008 Air Quality Report (reporting on air quality in 2007) was consulted to assess the air quality of the project area and surrounding areas. The closest air quality station is in Carbondale, IL. In 2008, the report listed only particulate matter of at least 10 micrometers (PM10) monitoring values from the Carbondale station. The primary standard for this pollutant is 50 micrograms per cubic meter (50 ug/m3) for the annual arithmetic mean and 150 ug/m3 as the 24 hour averaging time. No samples exceeded 150 ug/m3 as samples ranged from 37 - 65 in 2007 and the annual arithmetic mean was 22 ug/m3. Short term trends taken from 2002 to 2007 ranged from 19 – 22 ug/m3 (primary annual standard was 50 ug/m3). Table 13 in the appendix lists estimated county stationary source emissions (tons per year for five pollutants for Johnson and Saline County along with the statewide county high for reference. These two counties have relatively low emissions compared to some other counties in the state.

National Atmospheric Deposition Program was queried to gain additional information about air and water quality. Two monitoring sites are located in the cumulative effects analysis area. One is in Carbondale, IL (IL 35) at Southern Illinois University which was in operation from 1979 to 1994 and the other is located at Dixon Springs Agricultural Center (IL 63). Trend plots were used to see changes over time for a number of factors. pH increased (became less acidic) at both sites although the increase was greater at the Dixon Springs site. Cations (calcium, magnesium, potassium, sodium, etc.) decreased slightly at both sites. Anions (sulfate, nitrate, chlorine) decreased slightly.

The pH values for atmospheric deposition in southern Illinois are corroborated by two other publications (Weaver et al. 1978, Weaver et al. 1981.) These pH levels are considered extremely acid to very strongly acid. (Sparks 2003)

Design Criteria for the Proposed Action

Soil and Water Resources	Trees will be felled away from streams and ponds where practicable and slash would be removed by hand far enough to prevent slash from accumulating in stream channels and ponds.	This will minimize soil impacts and disturbance and is in accordance with Forest Plan (page 41).
	Operators will not operate heavy equipment in a manner that causes excessive soil displacement, rutting or compaction.	
	Bare-soil exposure is limited to ten percent within riparian corridor filter strips.	
	Erosion control measures will be applied to constructed fire trails (hand or machine) upon completion of project activities and/or prior to winter rainy season,	This will minimize runoff and sedimentation into adjacent streams.

Effects of the Proposed Action

Alternative 2

Direct Effects

Soil and water resources can be affected. Sources of sediment on forest lands in the project area are likely. The location in the project area associated with transportation systems, mainly roads and trails can be sources of erosion and sediment under conditions outlined below.

Lopping and scattering of up to two acres of trees and shrubs per year would result in higher initial ground cover on the scattered areas thereby reducing erosion. Over a period of years, this biomass would break down and be converted into an O horizon and later incorporated into the soil. The additional biomass would also provide additional fuel for prescribed burning resulting in a burn of slightly higher intensity. The effect of this would be minimal and short-term.

Low intensity prescribed fire can expose bare soil which can lead to accelerated erosion. The effects of prescribed burning on soil erosion and nutrient loss are related to the severity of the burn. These effects are complex and depend on a host of factors but certain generalizations seem relatively consistent. Burning has its most pronounced effect on the forest floor where carbon (C), nitrogen (N), and sulfur (S) are volatilized and calcium (Ca), magnesium (Mg), potassium (K), and phosphorus (P), and other elements are left as ash. The ash is leached by rains into the mineral soil which increases its base saturation and pH. (Alban 1977) Increased nutrient availability at higher pH's may result in positive plant responses following fire. (Van Lear and Kapeluck (1989) These coincide with results from a variety of more recent reviews and studies. (DeBano 1998) (Liechty, Luckow, & Guldin 2004) (Neary, Ryan, & DeBano 2005) Erosion can increase as a result of prescribed fire, but WEPP model runs indicate that the erosion levels are much lower than erosion and sedimentation levels after a high severity stand replacement fire.

Erosion levels have been modeled using the aforementioned WEPP model runs and these are in Tables 10 – 12. Erosion control measures such as water bars would reduce these levels.

Many of fire lines may occur on areas with fragipans in the soil profile. The stands with areas of fragipans in the profile have been covered above. Ground disturbing activities, particularly in wet soil conditions would have the potential to degrade soil structure, especially in those locations on soils with fragipans. The hazard to these soils would result from machine based fireline construction. Fireline location employing roads as fire breaks and hand fireline construction in sensitive areas would reduce soil disturbance to these soils to minimal levels.

Areas with a steeper gradient have a greater erosion potential than areas with a lower gradient and steep trails have higher potential for erosion. Some steep gradients do exist in the project area. (USDA 2006) (Appendix B) Trail conditions in these areas will require monitoring and to ensure that they do not degrade to the point where they impact watershed resources due to erosion, sedimentation, compaction or other disturbance.

Some of the project area will have areas of ephemeral, intermittent and perennial streams and fires trails will cross these streams. These crossings are direct points of sediment delivery. Localized disturbance to banks and channel substrate can occur. Fire trail crossings at larger stream channels can cut the banks causing them to become unstable and erode. Some of the fire trails are located on soil mapping units identified as riparian soils and located at or adjacent to these trail crossings. (USDA 2006) (Tables 1 - 3)

Air quality can be influenced by prescribed fire in the short term. Prescribed fire is carried out in strict adherence to the burn plan and a permit from IEPA. Short term changes in air quality can be expected to be minor based on past experience. (Peterson, personal communication)

"When fire moves through the landscape, it burns where it's dry, and where it's moist, it doesn't," said Ruffner, an associate professor of forestry at Southern Illinois University Carbondale and a specialist in fire ecology…..There's never 100 percent coverage with fire. There will be islands of untouched vegetation and some spots that are intensely burned mixed in with areas that have burned moderately. This creates a mosaic of habitat with greater biodiversity… Fire is just decomposition speeded up. It's the opposite of photosynthesis — with fire, carbohydrates are broken down into their constituents." (Jaehnig 2007) This mosaic of habitat also creates future recruitment for soil organic matter to aid in buffering the soil.

Fire Lines –

Fire Lines – Fireline construction are part of this alternative. Fire line construction would be associated with the prescribed burning activities of this alternative. Erosion levels will vary depending on climatic conditions, slope, soil texture, and other factors. Erosion control measures

such as water bars would reduce these to minimal levels. Erosion rates (modeled by WEPP) are given in a table in the appendix.

Lopping / Scattering of Trees / Shrubs

Manual – Manual treatments are not expected to result in any ground disturbance. As with other actions, there are opportunities for increasing recruitment for long-term soil organic matter and those opportunities should be capitalized on.

Indirect Effects

Carbon sequestration – The effect of prescribed burning on the release of carbon dioxide and green house gases into the atmosphere has been mentioned as a concern. An increase of green house gases has been observed during the past few decades and many (including many scientists) recognize this. There is some debate on the role of trees in relation to this increase. Gerould Wilhem of the Conservation Research Institute out of Elmhurst, IL, in his article (The Realities of Carbon Dioxide: Seeing Through the Smog of Rhetoric and Politics and found on-line at: http://www.cdfinc.com/images/download/Realities_of_CO2_revised.pdf.) states in his summary: **"Planting trees** or setting forests aside cannot offset the oxidation of fossil fuels because fossil carbon represents stored carbon from another era. Such organic carbon is converted to CO_2 in surplus amounts. Trees and vegetation of this era already are cycling carbon into the atmosphere at a rate and concentration to which contemporary life forms are adapted. Relatively sudden changes in atmospheric chemistry, such as we are seeing today, impose global system constraints at a rate to which most life forms have difficulty adjusting during their life spans and physiologic development; most cannot adjust at all. These rapid macrohabitat system changes are not in synchrony with other systems such as day length, genetics,physiology, and chemistry. " (Wilhelm 2008)

Johnson's 1992 review and an updated one Johnson and Curtis (2001) are often cited to shed some light on the effects of burning on soil carbon. The 1992 review concluded carbon losses from mineral soil, as a result of low-intensity prescribed were minor to non-existent. Sometimes, soil carbon increased as result of nitrogen fixing species. Wildfires often resulted in significant carbon losses from the mineral soil but this did not happen in all cases. The effects on carbon were often linked to fire intensity. The review in 2001 looked at additional fire studies, no significant fire response on the surface or whole fire was found. When the studies were separated into classes for analysis (years since the fire), significantly higher carbon levels were noted in the 10+ after fire group. When only the 0 – ten year post-fire categories were analyzed, soil carbon was higher relative to unburned areas following wildfire and lower after a prescribed fire. (Johnson 1992, Johnson and Curtis 2001, Hoover 2003)

Hurteau, Koch, and Hungate (2008) made three points relative to carbon protection, fire risk reduction, and accounting of forest carbon offsets. The points are as follows:

> ***In current carbon accounting, forest management impacts on potentially catastrophic disturbances are typically ignored.**

***In forests where fire suppression has caused fuel accumulation, forest fuel reduction treatments can diminish the risk of stand replacement wildfire, thereby promoting carbon storage.**

***Carbon accounting should recognize the value of management actions that reduce the risk of carbon loss through stand replacing fire.**

Ecosystem Services- The agency position for ecosystem services is as follows and found on-line at http://www.fs.fed.us/ecosystemservices/ : "Healthy forest ecosystems are ecological life-support systems. Forests provide a full suite of goods and services that are vital to human health and livelihood – natural assets we call **ecosystem services. "**

"Many of these goods and services are traditionally viewed as free benefits to society, or "public goods" - wildlife habitat and diversity, watershed services, carbon storage, and scenic landscapes, for example. Lacking a formal market, these natural assets are traditionally absent from society's balance sheet; their critical contributions are often overlooked in public, corporate, and individual decision-making. "

"When our forests are undervalued they are increasingly susceptible to development pressures and conversion. Recognizing forest ecosystems as natural assets with economic and social value can help promote conservation and more responsible decision-making."

"The Forest Service is exploring national opportunities to advance markets and payments for ecosystem services. With help from our partners and others, we will encourage broader thinking and collaboration that stimulates market-based conservation and stewardship."

Conservation denotes wise use and stewardship denotes caring for the land. Prescribed fire does not degrade or eliminate these services and the services continue after a prescribed fire as before. Native Americans used fire for their own ecosystem services: i.e. improved game habitat, facilitated travel, reduced insect pests, remove cover for enemies, enhanced conditions for berries, and drive game. Present day services such as air cleaning services, watershed protection, habitat, scenic beauty, carbon storage, oxygen production and recreation continue as ecosystem services after a burn just as ecosystem services continued after a burn for Native Americans. There is no evidence that ecosystem services are degraded or eliminated after a burn.

Natural and anthropogenic processes occurred in pre-settlement conditions. Further information on this issue can be found on pages 218,218, 224 – 226 of Appendix I, FEIS for the LRMP of the Shawnee National Forest.

A prescribed fire would have the result of speeding up decomposition the volatilization of carbon, nitrogen, and resulting elements returning to the ground as ash. This is also covered above sections of the Working Paper.

Watershed quality following prescribed burns is covered in the Forest Plan (Chapter 4, pages 23, 24 and Chapter5, pages 41, 47, 48) and in the FEIS (page 72 - 75) for the LMRP, Shawnee National Forest.

Soil Productivity

Accelerated soil erosion can remove the productive topsoil more quickly than it develops. This can reduce the soil productivity of the site. Site productivity of the project area would be maintained by controlling erosion and compaction using BMP guidelines and Forest Plan standards and guidelines. This alternative would maintain site productivity, but would likely result in more of the project area temporarily (less than 5 years) in a detrimental state (i.e. eroded, compacted, displaced), as defined in the Soil Quality Handbook, than Alternative 1. Trees left on the site would be available for decomposition and later addition to soil nutrient capital.

Microbial populations

Soil biological properties involve a wide range of organisms which the soil as well as the properties they regulate**.** These components are made up of both living and dead biomass and both can be affected by the project activities including harvest and prescribed fire. Living organisms are classified in several ways. Soil flora includes algae, some bacteria, mycorrhizae and plant roots. Soil fauna includes protozoa, earthworms, and insects. This is further divided into micro, meso, and macro fauna. These participate in processes such as nitrogen cycling processes (nitrogen fixation and denitrification), decomposition, and mineralization. Management activities, including prescribed burning, will influence these processes. (Neary et al. 2005) (De Bano et al. 1998)

Fire affects living organisms in direct and indirect ways. Because organic matter and organisms are located at or near the surface, they can be exposed to flaming fuels and smoldering forest floor fuels. In the period after fire, a stable recovery of microbial populations to pre-fire levels can be expected. The moisture content of the litter, organic matter, and soil influences the effect on organisms. Water absorbs a lot of heat and this will reduce the temperatures and amount of substrate consumed. Because most soil micro-organisms are heterotrophic and require pre-formed organic material in the litter and soil for their source of energy. (Neary et al. 2005) (De Bano et al. 1998)

Low severity prescribed fire has a minimal effect on soil organisms. Temperatures can be non-lethal except in the upper litter layer and the consumption of forest floor substrate is limited. A single entry burn could be considered to have a minimal effect but repeated entries over time may reduce microbial population size and activity. (Neary et al. 2005) (De Bano et al. 1998)

In the past, soil organisms were not seriously considered in natural resource management as many were invisible to the naked eye, there was no economical field test available, and research studies did not always give matching results of the response of organisms to management activities. Some generalizations can be made from past experience and studies.

*Micro-organisms do re-colonize disturbed forests due to a great physiological and genetic diversity.
*Fire effects are greatest in the forest floor and decrease with depth in the mineral soil. Recovery of microbial populations increases with the increasing moisture content of the litter layer and soil profile.
*Repeated prescribed fire can reduce organic matter content and increase the loss of soil organisms through erosion.
*Avoiding drastic changes in soil temperature, moisture, and substrate availability will have a higher probability of ensuring maintenance of soil biological populations.
*Knowledge gaps exist such as the effect of repeated prescribed burns on organisms. (Neary et al. 2005) (De Bano et al. 1998)

Based on the above, some recommendations can be made:

*Minimize loss of the forest floor (litter and duff) as micro-organisms are vulnerable to heat damage and substrate changes. Burning when the upper layer of the forest floor is dry enough to carry a fire and the lower layers are moist enough to avoid consumption. Extending the recovery time between repeated fires may be needed to meet these conditions.
*If anticipated fire severity is high, burning may need to be avoided as mortality of organisms may be higher in moist soil at high temperatures. If the anticipated severity is high, rescheduling the burn can also be done.
*Burning with varying consumption occurring in mosaic patterns can provide substrate and habitat for microbial re-colonization following a fire.
*Supplement burning with other silvicultural practices. (Neary et al. 2005) (De Bano et al. 1998)

Disclosures

Prime Farmland, Rangeland and Forestland

Site productivity would be maintained in the project area in all alternatives, therefore, also on the prime farmland and forestland in the project area (see Indirect Effects).

Floodplains

Site productivity and riparian function would be maintained in the project area in all alternatives, therefore, also on the floodplains in the project area (see Indirect Effects).

Wetlands

None of the alternatives will have an adverse effect on the site productivity or function of the sites in the cumulative effects analysis areas near the project areas identified as having one or more wetland characteristics. Alternative 2 would result in a slight, temporary, minor increase in sediment in the streams.

Adverse Consequences Which Cannot be Avoided

- Slight, temporary accelerated rates of soil erosion could occur in Alternative 2 even though IDNR forestry BMPs guidelines, Forest Plan Standards and Guidelines, and soil suitability and limitation identified by the NRCS would be used to guide activities.

- Temporary, minor increases in turbidity in adjacent streams after storm events resulting in runoff.

- Temporary minor increases in smoke as a result of prescribed burning of Alternative 2.

Irreversible or Irretrievable Commitment on Resources

Neither of the alternatives in this project would have an irreversible or irretrievable commitment on this resource in the proposed project area or adjacent analysis area if mitigation measures are strictly adhered to.

Irreversible Effects

There are no known irreversible effects on soil and water resources from either alternative.

Irretrievable Effects
Soil erosion above natural rates is an irretrievable effect. Alternative 2 would result in a temporary, slight increase in erosion rates above natural geologic rates.

Summary
With proper maintenance, periodic monitoring, and strict adherence to the burn plan, the IEPA permit, and Forest LRMP, the activities associated with the proposed Categorical Exclusion are expected to add minimal amounts to the current erosion and sediment levels in the CEA. If prescribed burning is undertaken at past levels, then there would be a minimal increase in the combined erosion and sediment delivery within the watersheds. The cumulative effect of all of the sediment generated in these watersheds relative to Forest activity is minimal (immeasurable) when added to the natural watershed processes. Smoke from prescribed fire may have a minor, short term effect and an immeasurable long term effect.

Determination
As a result of this evaluation, it is my professional determination that issuance of this categorical exclusion for this vegetation management project is not likely to impact watershed resources.

Management Recommendations
No recommendations were identified for this project for watershed resources.

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Appendix A

Table 1 . Soil Mapping Unit and Acres / Management Interpretations for Cave Hill / acreages are approximate

Soil Mapping Unit	Acres	Riparian Soil	Soil Erosion Potential	Potential of damage to soil from fire
Hosmer silt loam (4 – 7 %), eroded	4.94	No	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Hosmer silt loam (7 – 12 %), eroded	7.65	No	Moderate off roads and trails and severe on roads and trails	Moderate due to texture and rock fragments
Hosmer silt loam (7 – 12 %), severely eroded	9.2	No	Moderate off roads and trails and severe on roads and trails	High due to texture, surface depth and rock fragments
Grantsburg silt loam (2 – 4 %)	18.99	No	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Grantsburg silt loam (4 – 7 %), eroded	171.77	No	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Sharon silt loam (0 – 3 %)	12.71	Yes	Slight	Moderate due to texture and

occasionally flooded				rock fragments
Belknap silt loam (0 – 2%) frequently flooded	14.33	Yes (hydric)	Slight	Low due to texture and rock fragments
Wellston silt loam (7 – 12 %), eroded	319.6	No	Moderate off roads and trails and severe on roads and trails	Low
Wellston silt loam (18 – 45%)	5	No	Severe	Low
Zaneville silt loam (12 – 18 %), eroded	43.75	No	Moderate off roads and trails and severe on roads and trails	Moderate
Burnside silt loam (1 – 4 %), occasionally flooded	24.9	Yes	Slight	Low
Markland silt loam (7 – 15 %), severely eroded	10.73	No	Moderate off roads and trails and severe on roads and trails	Low
Colp silt loam, rarely flooded (1 – 4 %)	13.71	Yes	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Colp silt loam (4 – 10%) , severely eroded, rarely flooded	13.51	Yes	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Muskingum channery silt loam – Berks channery loam (35 – 70%)	1.03	No	Severe to very severe	Moderate
Wellston silt loam – Berks channery loam (15 – 30 %)	783.05	No	Moderate off roads and trails and severe on roads and trails	Low to moderate
Berks channery loam - Wellston silt loam (30 –	0.78	No	Severe	Berks – high Wellson - low

60%)				
Total	1,455.83			

Table 2. Soil Mapping Unit and Acres / Management Interpretations for Dennison Hollow / Stoneface/ acreages are approximate

Soil Mapping Unit	Acres	Riparian Soil	Soil Erosion Potential	Potential of damage to soil from fire
Grantsburg silt loam (2 – 4 %)	28.02	No	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Grantsburg silt loam (4 – 7 %), eroded	343.58	No	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Sharon silt loam (0 – 3 %) occasionally flooded	3.7	Yes	Slight	Moderate due to texture and rock fragments
Wellston silt loam (7 – 12 %), eroded	464.73	No	Moderate off roads and trails and severe on roads and trails	Low
Zaneville silt loam (7 – 12 %), eroded	0.01	No	Moderate off roads and trails and severe on roads and trails	Moderate
Burnside silt loam (1 – 4 %), occasionally flooded	55.22	Yes	Slight	Low
Muskingum channery silt loam – Berks channery loam (35 – 70%)	28.16	No	Severe to very severe	Moderate
Wellston silt loam – Berks channery loam (15 – 30 %)	666.75	No	Moderate off roads and trails and severe on roads and trails	Low to moderate

Berks channery loam - Wellston silt loam (30 – 60%)	0.01	No	Severe	Berks – high Wellson - low
Total	1,590.18			

Table 3. Soil Mapping Unit and Acres / Management Interpretations for Simpson Barrens

Soil Mapping Unit	Acres	Riparian Soil	Soil Erosion Potential	Potential of damage to soil from fire
Grantsburg silt loam (2 – 5 %)	5.61	No	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Grantsburg silt loam (5 – 10 %) eroded	19.7	No	Slight off roads and trails; moderate on roads and trails	Moderate due to texture and rock fragments
Grantsburg silt loam (10 – 18 %) eroded	12.74	No	Moderate off roads and trails and severe on roads and trails	High
Zanesville silt loam (5 – 10 %) eroded	0.32	No	Slight off roads and trails; moderate on roads and trails	High
Zanesville silt loam (5 – 10 %) severely eroded	15.96	No	Slight off roads and trails; moderate on roads and trails	High
Zanesville silt loam (10 – 18%) , eroded	0.65	No	Moderate off roads and trails and severe on roads and trails	High
Zanesville silt loam (10 – 18%) , severely eroded	32.06	No	Moderate off roads and trails and severe on roads and trails	High
Berks channery loam – Muskingum &Weikert channery silt	3.08	No	Severe to very severe	Moderate

loam (35 – 70 %)				
Sharon silt loam (0 – 3 %) occasionally flooded	8.01	Yes	Slight	Moderate due to texture and rock fragments
Belknap silt loam (0 – 2%) frequently flooded	4.57	Yes (hydric)	Slight	Low due to texture and rock fragments
Burnside silt loam (1 – 4 %), occasionally flooded	12.98	Yes	Slight	Low
Wellston silt loam – Berks channery loam (10 – 18 %) eroded	108.06	No	Slight to moderate off skid roads and trails; moderate to severe on skid roads and trails	Low to moderate
Wellston silt loam – Berks channery loam (10 – 18 %) severely eroded	1.71	No	Slight to moderate off skid roads and trails; moderate to severe on skid roads and trails	Moderate to high
Wellston silt loam – Berks channery loam (18 - 35 %)	268.8	No	Moderate to severe off skid roads and trails; severe on skid roads and trails	Low to moderate
Total	494.25			

* acreages are approximate

Table 4. Acres of Natural Area CE burns by Watershed.

	Black Branch/Eagle Creek	Horseshoe Creek/South Fork Saline River	Spring Valley Creek/South Fork Saline River	Cedar Creek
Cave Hill	377.86	1,077.2	0.77	
Dennison Hollow/Stoneface	1,340.63		249.55	

Simpson Barrens				494.25
Total	1,718.72	1,077.2	250.32	494.25

Table 5. Ownership of the CEA (Cumulative Effects Analysis Area)				
	Acres (total)	Acres (Forest Service)	Acres (other ownership)	% acreage in Forest Service jurisdiction
Black Branch/Eagle Creek	22,162	6,485	15,677	29.26
Horseshoe Creek/South Fork Saline River	17,045	1,525	15,520	8.95
Spring Valley Creek/South Fork Saline River	21,076	4,518	16,558	21.44
Cedar Creek	25,417	6,686	18,731	26.31
Total	85,700	19,214	66,486	22.42

Table 6. Wilderness, National Natural Landmarks, and Natural Area acreage in the CEA			
	Wilderness (Acres)	Trails EIS	Natural Areas (Acres)
Black Branch/Eagle Creek	1,728	Yes	726
Horseshoe Creek/South Fork Saline River			829
Spring Valley Creek/South Fork Saline River			158
Cedar Creek			472
Total	1,728		2,185

Table 7: Prescribed fire activity in the CEA							
	2003	2004	2005	2006	2007	2008	Total
Black Branch/Eagle Creek	0.00	0.00	0.00	0.00	1,186.90	1,829.2	3,016.1
Horseshoe Creek/South Fork Saline River	0.00	0.00	0.00	0.00	1,211	829	2,040
Spring Valley Creek/South Fork Saline River	0.00	0.00	0.00	0.00	71.80	287.5	359.3
Cedar Creek	0.00	1.40	0.00	0.00	83.2	576.1	660.7
Total	0.00	1.40	0.00	0.00	2,552.9	3,521.8	6,076.1

Table 8. Major streams in or adjacent to the project area – from IEPA 2008 Stream Assessments.			
Stream Name	Beneficial Uses	Cause for less than fully supporting rating	Source
South Fork Saline River	Aquatic Life not supporting All other uses not assessed	Alteration in stream – side or littoral vegetative cover, manganese, pH	Channelization, streambank modification/destabilization, surface mining
South Fork Saline River - Assessment Unit I.D. IL_ATH	Not assessed	N.A.	N.A.
Black Branch	Not assessed	N.A.	N.A.
Cedar Creek – Assessment Unit I.D. IL_AJF-02	Aquatic Life not supporting All other uses not assessed	Manganese, dissolved oxygen, sedimentation / siltation, changes in stream depth and velocity patterns, loss of in-stream cover	Channelization, Source unknown, crop production, natural sources
Cedar Creek – Assessment Unit I.D. IL_AJF-16	Fully supporting for aquatic life. All other uses not assessed	N.A.	N.A.
Eagle Creek - Assessment Unit I.D. – IL_AE – 01	All uses not assessed	N.A.	N.A.
Eagle Creek - Assessment Unit I.D. – IL_AE – 02	Non supporting aquatic life, all other uses not assessed	Dissolved oxygen, cause unknown	Impact from abandoned mine lands, sources unknown
Eagle Creek - Assessment Unit I.D. – IL_AE – 03	Non supporting aquatic life, all other uses not assessed	Manganese, dissolved oxygen, sulfates	Surface mining , sources unknown
Eagle Creek - Assessment Unit I.D. – IL_AE – 04	Non supporting aquatic life, all other uses not assessed	Manganese, dissolved oxygen, sulfates, pH	Surface mining , sources unknown
Eagle Creek - Assessment Unit I.D. – IL_AE – 05	Non supporting aquatic life, all other uses not assessed	Manganese, dissolved oxygen, sulfates	Surface mining , sources unknown
Eagle Creek - Assessment	All uses not assessed	N.A.	N.A.

Unit I.D. – IL_AE – 06			
Horseshoe Creek	Not assessed	N.A.	N.A.
Spring Valley Creek	Not assessed	N.A.	N.A.

Table 9. Agricultural Activity in Johnson and Saline County
9a.

Commodity	Practice	Year	County	Planted All Purposes	Harvested	Yield	Production
Corn For Grain	Total For Crop	1993	Johnson	11,000 acres	10,500 acres	84 bushel	882,000 bushel
Corn For Grain	Total For Crop	1993	Saline	48,000 acres	46,900 acres	117 bushel	5,487,300 bushel
Corn For Grain	Total For Crop	1994	Johnson	14,000 acres	13,400 acres	109 bushel	1,460,600 bushel
Corn For Grain	Total For Crop	1994	Saline	48,000 acres	47,200 acres	111 bushel	5,239,200 bushel
Corn For Grain	Total For Crop	1995	Johnson	11,000 acres	10,300 acres	69 bushel	710,700 bushel
Corn For Grain	Total For Crop	1995	Saline	42,000 acres	41,300 acres	76 bushel	3,138,800 bushel
Corn For Grain	Total For Crop	1996	Johnson	15,000 acres	14,000 acres	94 bushel	1,316,000 bushel
Corn For Grain	Total For Crop	1996	Saline	46,000 acres	45,300 acres	117 bushel	5,300,100 bushel
Corn For Grain	Total For Crop	1997	Johnson	11,000 acres	10,800 acres	81 bushel	874,800 bushel
Corn For Grain	Total For Crop	1997	Saline	43,000 acres	42,500 acres	88 bushel	3,740,000 bushel
Corn For	Total	1998	Johnson	12,000	11,700	96	1,123,200

Grain	For Crop			acres	acres	bushel	bushel
Corn For Grain	Total For Crop	1998	Saline	35,000 acres	34,000 acres	91 bushel	3,094,000 bushel
Corn For Grain	Total For Crop	1999	Johnson	8,000 acres	7,700 acres	101 bushel	777,700 bushel
Corn For Grain	Total For Crop	1999	Saline	38,000 acres	37,600 acres	98 bushel	3,684,800 bushel
Corn For Grain	Total For Crop	2000	Johnson	10,000 acres	9,900 acres	122 bushel	1,207,800 bushel
Corn For Grain	Total For Crop	2000	Saline	48,000 acres	47,600 acres	125 bushel	5,950,000 bushel
Corn For Grain	Total For Crop	2001	Johnson	9,000 acres	8,900 acres	136 bushel	1,210,400 bushel
Corn For Grain	Total For Crop	2001	Saline	46,000 acres	45,500 acres	139 bushel	6,324,500 bushel
Corn For Grain	Total For Crop	2002	Johnson	6,000 acres	5,900 acres	80 bushel	472,000 bushel
Corn For Grain	Total For Crop	2002	Saline	46,000 acres	45,500 acres	60 bushel	2,730,000 bushel
Corn For Grain	Total For Crop	2003	Johnson	6,000 acres	5,700 acres	111 bushel	632,700 bushel
Corn For Grain	Total For Crop	2003	Saline	38,000 acres	37,600 acres	112 bushel	4,211,200 bushel
Corn For Grain	Total For Crop	2004	Johnson	8,000 acres	7,700 acres	155 bushel	1,193,500 bushel
Corn For Grain	Total For Crop	2004	Saline	46,000 acres	45,700 acres	157 bushel	7,174,900 bushel
Corn For Grain	Total For Crop	2005	Johnson	8,000 acres	7,800 acres	129 bushel	1,006,200 bushel
Corn For	Total	2005	Saline	46,000	45,800	139	6,366,200

Grain	For Crop			acres	acres	bushel	bushel
Corn For Grain	Total For Crop	2006	Johnson	6,000 acres	5,900 acres	131 bushel	772,900 bushel
Corn For Grain	Total For Crop	2006	Saline	40,000 acres	39,600 acres	150 bushel	5,940,000 bushel
Corn For Grain	Total For Crop	2007	Johnson	8,000 acres	7,900 acres	117 bushel	924,300 bushel
Corn For Grain	Total For Crop	2007	Saline	54,000 acres	53,200 acres	126 bushel	6,703,200 bushel
Corn For Grain	Total For Crop	2008	Johnson	7,400 acres	7,100 acres	153 bushel	1,086,300 bushel
Corn For Grain	Total For Crop	2008	Saline	40,000 acres	39,600 acres	153 bushel	6,058,800 bushel

9b.

Commodity	Practice	Year	County	Harvested	Yield	Production
Hay Alfalfa (Dry)	Total For Crop	1993	Johnson	1,000 acres	3.4 tons	3,400 tons
Hay Alfalfa (Dry)	Total For Crop	1993	Saline	1,700 acres	3.1 tons	5,270 tons
Hay Alfalfa (Dry)	Total For Crop	1994	Johnson	1,300 acres	2.8 tons	3,640 tons
Hay Alfalfa (Dry)	Total For Crop	1994	Saline	1,400 acres	2.4 tons	3,360 tons
Hay Alfalfa (Dry)	Total For Crop	1995	Johnson	1,200 acres	3.1 tons	3,720 tons
Hay Alfalfa (Dry)	Total For Crop	1995	Saline	1,200 acres	2.9 tons	3,480 tons
Hay Alfalfa (Dry)	Total For Crop	1996	Johnson	1,000 acres	2.6 tons	2,600 tons
Hay Alfalfa (Dry)	Total For Crop	1996	Saline	1,400 acres	2.8 tons	3,920 tons
Hay Alfalfa (Dry)	Total For Crop	1997	Johnson	2,200 acres	2.8 tons	6,160 tons
Hay Alfalfa	Total For	1997	Saline	1,500	2.2	3,300 tons

(Dry)	Crop			acres	tons	
Hay Alfalfa (Dry)	Total For Crop	1998	Johnson	2,900 acres	2.4 tons	6,960 tons
Hay Alfalfa (Dry)	Total For Crop	1998	Saline	2,300 acres	3.5 tons	8,050 tons
Hay Alfalfa (Dry)	Total For Crop	1999	Johnson	1,800 acres	2.9 tons	5,220 tons
Hay Alfalfa (Dry)	Total For Crop	1999	Saline	1,200 acres	3.9 tons	4,680 tons
Hay Alfalfa (Dry)	Total For Crop	2000	Johnson	1,100 acres	2.9 tons	3,190 tons
Hay Alfalfa (Dry)	Total For Crop	2001	Johnson	1,900 acres	2.3 tons	4,370 tons
Hay Alfalfa (Dry)	Total For Crop	2001	Saline	1,100 acres	3.3 tons	3,630 tons
Hay Alfalfa (Dry)	Total For Crop	2002	Johnson	2,200 acres	3.3 tons	7,260 tons
Hay Alfalfa (Dry)	Total For Crop	2003	Johnson	2,500 acres	4.2 tons	10,500 tons
Hay Alfalfa (Dry)	Total For Crop	2004	Johnson	1,800 acres	3.5 tons	6,300 tons
Hay Alfalfa (Dry)	Total For Crop	2004	Saline	1,100 acres	3.3 tons	3,630 tons
Hay Alfalfa (Dry)	Total For Crop	2005	Johnson	1,500 acres	2.4 tons	3,600 tons
Hay Alfalfa (Dry)	Total For Crop	2005	Saline	1,300 acres	3.4 tons	4,420 tons
Hay Alfalfa (Dry)	Total For Crop	2006	Johnson	1,500 acres	3.5 tons	5,250 tons
Hay Alfalfa (Dry)	Total For Crop	2006	Saline	1,300 acres	4.4 tons	5,720 tons
Hay Alfalfa (Dry)	Total For Crop	2007	Johnson	1,500 acres	1.7 tons	2,550 tons
Hay Alfalfa (Dry)	Total For Crop	2007	Saline	1,100 acres	2.4 tons	2,640 tons

9c.

Commodity	Practice	Year	County	Harvested	Yield	Production
Hay All (Dry)	Total For Crop	1993	Johnson	18,100 acres	2.08 tons	37,600 tons

Hay All (Dry)	Total For Crop	1993	Saline	8,900 acres	2.21 tons	19,670 tons
Hay All (Dry)	Total For Crop	1994	Johnson	18,600 acres	1.78 tons	33,050 tons
Hay All (Dry)	Total For Crop	1994	Saline	8,800 acres	1.81 tons	15,940 tons
Hay All (Dry)	Total For Crop	1995	Johnson	17,300 acres	2.63 tons	45,580 tons
Hay All (Dry)	Total For Crop	1995	Saline	10,700 acres	2.54 tons	27,230 tons
Hay All (Dry)	Total For Crop	1996	Johnson	15,900 acres	1.85 tons	29,420 tons
Hay All (Dry)	Total For Crop	1996	Saline	9,600 acres	1.78 tons	17,040 tons
Hay All (Dry)	Total For Crop	1997	Johnson	16,700 acres	2.19 tons	36,610 tons
Hay All (Dry)	Total For Crop	1997	Saline	10,000 acres	2.03 tons	20,300 tons
Hay All (Dry)	Total For Crop	1998	Johnson	16,500 acres	2.15 tons	35,520 tons
Hay All (Dry)	Total For Crop	1998	Saline	10,400 acres	2.95 tons	30,730 tons
Hay All (Dry)	Total For Crop	1999	Johnson	16,600 acres	1.92 tons	31,860 tons
Hay All (Dry)	Total For Crop	1999	Saline	6,300 acres	2.52 tons	15,900 tons
Hay All (Dry)	Total For Crop	2000	Johnson	15,600 acres	2.06 tons	32,190 tons
Hay All (Dry)	Total For Crop	2001	Johnson	16,400 acres	2.03 tons	33,370 tons
Hay All (Dry)	Total For Crop	2001	Saline	6,800 acres	2.46 tons	16,740 tons
Hay All (Dry)	Total For Crop	2002	Johnson	21,700 acres	1.86 tons	40,410 tons
Hay All (Dry)	Total For Crop	2003	Johnson	27,000 acres	3.02 tons	81,550 tons
Hay All (Dry)	Total For Crop	2004	Johnson	25,900 acres	2.57 tons	66,550 tons
Hay All (Dry)	Total For Crop	2004	Saline	9,600 acres	2.41 tons	23,180 tons
Hay All (Dry)	Total For Crop	2005	Johnson	21,400 acres	2.4 tons	51,360 tons
Hay All (Dry)	Total For Crop	2005	Saline	10,900 acres	2.17 tons	23,620 tons

Hay All (Dry)	Total For Crop	2006	Johnson	18,500 acres	2.4 tons	44,350 tons
Hay All (Dry)	Total For Crop	2006	Saline	9,900 acres	2.49 tons	24,640 tons
Hay All (Dry)	Total For Crop	2007	Johnson	18,100 acres	1.15 tons	20,810 tons
Hay All (Dry)	Total For Crop	2007	Saline	8,700 acres	1.35 tons	11,760 tons

9d.

Commodity	Practice	Year	County	Harvested	Yield	Production
Hay Other (Dry)	Total For Crop	1993	Johnson	17,100 acres	2 tons	34,200 tons
Hay Other (Dry)	Total For Crop	1993	Saline	7,200 acres	2 tons	14,400 tons
Hay Other (Dry)	Total For Crop	1994	Johnson	17,300 acres	1.7 tons	29,410 tons
Hay Other (Dry)	Total For Crop	1994	Saline	7,400 acres	1.7 tons	12,580 tons
Hay Other (Dry)	Total For Crop	1995	Johnson	16,100 acres	2.6 tons	41,860 tons
Hay Other (Dry)	Total For Crop	1995	Saline	9,500 acres	2.5 tons	23,750 tons
Hay Other (Dry)	Total For Crop	1996	Johnson	14,900 acres	1.8 tons	26,820 tons
Hay Other (Dry)	Total For Crop	1996	Saline	8,200 acres	1.6 tons	13,120 tons
Hay Other (Dry)	Total For Crop	1997	Johnson	14,500 acres	2.1 tons	30,450 tons
Hay Other (Dry)	Total For Crop	1997	Saline	8,500 acres	2 tons	17,000 tons
Hay Other (Dry)	Total For Crop	1998	Johnson	13,600 acres	2.1 tons	28,560 tons
Hay Other (Dry)	Total For Crop	1998	Saline	8,100 acres	2.8 tons	22,680 tons
Hay Other (Dry)	Total For Crop	1999	Johnson	14,800 acres	1.8 tons	26,640 tons
Hay Other (Dry)	Total For Crop	1999	Saline	5,100 acres	2.2 tons	11,220 tons
Hay Other (Dry)	Total For Crop	2000	Johnson	14,500 acres	2 tons	29,000 tons

Hay Other (Dry)	Total For Crop	2000	Saline	8,400 acres	2.2 tons	18,480 tons
Hay Other (Dry)	Total For Crop	2001	Johnson	14,500 acres	2 tons	29,000 tons
Hay Other (Dry)	Total For Crop	2001	Saline	5,700 acres	2.3 tons	13,110 tons
Hay Other (Dry)	Total For Crop	2002	Johnson	19,500 acres	1.7 tons	33,150 tons
Hay Other (Dry)	Total For Crop	2002	Saline	4,600 acres	1.8 tons	8,280 tons
Hay Other (Dry)	Total For Crop	2003	Johnson	24,500 acres	2.9 tons	71,050 tons
Hay Other (Dry)	Total For Crop	2003	Saline	6,600 acres	2.8 tons	18,480 tons
Hay Other (Dry)	Total For Crop	2004	Johnson	24,100 acres	2.5 tons	60,250 tons
Hay Other (Dry)	Total For Crop	2004	Saline	8,500 acres	2.3 tons	19,550 tons
Hay Other (Dry)	Total For Crop	2005	Johnson	19,900 acres	2.4 tons	47,760 tons
Hay Other (Dry)	Total For Crop	2005	Saline	9,600 acres	2 tons	19,200 tons
Hay Other (Dry)	Total For Crop	2006	Johnson	17,000 acres	2.3 tons	39,100 tons
Hay Other (Dry)	Total For Crop	2006	Saline	8,600 acres	2.2 tons	18,920 tons
Hay Other (Dry)	Total For Crop	2007	Johnson	16,600 acres	1.1 tons	18,260 tons
Hay Other (Dry)	Total For Crop	2007	Saline	7,600 acres	1.2 tons	9,120 tons

9e.

Commodity	Practice	Year	County	Planted All Purposes	Harvested	Yield	Production
Sorghum For Grain	Total For Crop	1993	Johnson	3,300 acres	3,100 acres	71 bushel	220,100 bushel
Sorghum For Grain	Total For Crop	1993	Saline	1,500 acres	1,300 acres	92 bushel	119,600 bushel
Sorghum For Grain	Total For Crop	1994	Johnson	1,300 acres	1,200 acres	74 bushel	88,800 bushel
Sorghum For	Total For	1995	Saline	1,500 acres	1,400	43	60,200

Grain	Crop				acres	bushel	bushel
Sorghum For Grain	Total For Crop	1996	Saline	1,100 acres	1,000 acres	70 bushel	70,000 bushel
Sorghum For Grain	Total For Crop	2003	Saline	2,500 acres	2,400 acres	100 bushel	240,000 bushel
Sorghum For Grain	Total For Crop	2004	Saline	1,000 acres	1,000 acres	92 bushel	92,000 bushel

9f.

Commodity	Practice	Year	County	Planted All Purposes	Harvested	Yield	Production
Soybeans	Total For Crop	1993	Johnson	10,000 acres	9,500 acres	31 bushel	294,500 bushel
Soybeans	Total For Crop	1993	Saline	45,000 acres	44,800 acres	34 bushel	1,523,200 bushel
Soybeans	Total For Crop	1994	Johnson	10,000 acres	9,700 acres	34.5 bushel	334,650 bushel
Soybeans	Total For Crop	1994	Saline	45,000 acres	44,600 acres	34 bushel	1,516,400 bushel
Soybeans	Total For Crop	1995	Johnson	10,000 acres	9,900 acres	29 bushel	287,100 bushel
Soybeans	Total For Crop	1995	Saline	43,000 acres	42,700 acres	27 bushel	1,152,900 bushel
Soybeans	Total For Crop	1996	Johnson	15,000 acres	14,900 acres	30.5 bushel	454,450 bushel
Soybeans	Total For Crop	1996	Saline	54,000 acres	53,900 acres	36.5 bushel	1,967,350 bushel
Soybeans	Total For Crop	1997	Johnson	15,000 acres	14,900 acres	34.5 bushel	514,050 bushel
Soybeans	Total For Crop	1997	Saline	47,000 acres	46,000 acres	36 bushel	1,656,000 bushel
Soybeans	Total	1998	Johnson	14,000	13,900	33.5	465,650

	For Crop			acres	acres	bushel	bushel
Soybeans	Total For Crop	1998	Saline	46,000 acres	45,900 acres	31.5 bushel	1,445,850 bushel
Soybeans	Total For Crop	1999	Johnson	14,000 acres	13,900 acres	30 bushel	417,000 bushel
Soybeans	Total For Crop	1999	Saline	44,000 acres	43,800 acres	28 bushel	1,226,400 bushel
Soybeans	Total For Crop	2000	Johnson	15,000 acres	14,900 acres	36 bushel	536,400 bushel
Soybeans	Total For Crop	2000	Saline	50,000 acres	49,600 acres	40 bushel	1,984,000 bushel
Soybeans	Total For Crop	2001	Johnson	18,000 acres	17,900 acres	41 bushel	733,900 bushel
Soybeans	Total For Crop	2001	Saline	58,000 acres	57,600 acres	45 bushel	2,592,000 bushel
Soybeans	Total For Crop	2002	Johnson	18,000 acres	17,800 acres	27 bushel	480,600 bushel
Soybeans	Total For Crop	2002	Saline	56,000 acres	55,500 acres	24 bushel	1,332,000 bushel
Soybeans	Total For Crop	2003	Johnson	14,000 acres	13,900 acres	43 bushel	597,700 bushel
Soybeans	Total For Crop	2003	Saline	53,000 acres	52,900 acres	38 bushel	2,010,200 bushel
Soybeans	Total For Crop	2004	Johnson	16,000 acres	15,900 acres	44 bushel	699,600 bushel
Soybeans	Total For Crop	2004	Saline	53,000 acres	52,800 acres	43 bushel	2,270,400 bushel
Soybeans	Total For Crop	2005	Johnson	15,000 acres	14,900 acres	38 bushel	566,200 bushel
Soybeans	Total	2005	Saline	54,000	53,800	46	2,474,800

	For Crop			acres	acres	bushel	bushel
Soybeans	Total For Crop	2006	Johnson	16,000 acres	15,900 acres	42 bushel	667,800 bushel
Soybeans	Total For Crop	2006	Saline	60,000 acres	59,700 acres	45 bushel	2,686,500 bushel
Soybeans	Total For Crop	2007	Johnson	11,000 acres	10,900 acres	33 bushel	359,700 bushel
Soybeans	Total For Crop	2007	Saline	49,000 acres	48,300 acres	27 bushel	1,304,100 bushel
Soybeans	Total For Crop	2008	Johnson	16,000 acres	15,900 acres	39 bushel	620,100 bushel
Soybeans	Total For Crop	2008	Saline	60,000 acres	59,800 acres	40 bushel	2,392,000 bushel

9g.

Commodity	Practice	Year	County	Planted All Purposes	Harvested	Yield	Production
Wheat All	Total For Crop	1993	Johnson	2,600 acres	2,500 acres	41 bushel	102,500 bushel
Wheat All	Total For Crop	1993	Saline	10,500 acres	10,000 acres	42 bushel	420,000 bushel
Wheat All	Total For Crop	1994	Johnson	1,200 acres	1,100 acres	48 bushel	52,800 bushel
Wheat All	Total For Crop	1994	Saline	6,800 acres	5,700 acres	54 bushel	307,800 bushel
Wheat All	Total For Crop	1995	Johnson	2,100 acres	2,000 acres	48 bushel	96,000 bushel
Wheat All	Total For	1995	Saline	9,300 acres	8,900 acres	53 bushel	471,700 bushel

	Crop						
Wheat All	Total For Crop	1996	Johnson	3,100 acres	2,300 acres	35 bushel	80,500 bushel
Wheat All	Total For Crop	1996	Saline	13,800 acres	11,400 acres	42 bushel	478,800 bushel
Wheat All	Total For Crop	1997	Johnson	2,500 acres	2,200 acres	57 bushel	125,400 bushel
Wheat All	Total For Crop	1997	Saline	10,500 acres	10,000 acres	52 bushel	520,000 bushel
Wheat All	Total For Crop	1998	Johnson	1,600 acres	1,500 acres	50 bushel	75,000 bushel
Wheat All	Total For Crop	1998	Saline	10,300 acres	10,000 acres	48 bushel	480,000 bushel
Wheat All	Total For Crop	1999	Johnson	1,500 acres	1,300 acres	51 bushel	66,300 bushel
Wheat All	Total For Crop	1999	Saline	5,700 acres	4,800 acres	57 bushel	273,600 bushel
Wheat All	Total For Crop	2000	Johnson	1,600 acres	1,500 acres	47 bushel	70,500 bushel
Wheat All	Total For Crop	2000	Saline	4,800 acres	4,500 acres	60 bushel	270,000 bushel
Wheat All	Total For Crop	2001	Johnson	1,600 acres	1,200 acres	61 bushel	73,200 bushel
Wheat All	Total For Crop	2001	Saline	3,500 acres	3,400 acres	56 bushel	190,400 bushel
Wheat All	Total For Crop	2002	Johnson	1,900 acres	1,000 acres	49 bushel	49,000 bushel
Wheat All	Total For Crop	2002	Saline	1,800 acres	1,700 acres	50 bushel	85,000 bushel
Wheat All	Total For	2003	Johnson	2,000 acres	1,200 acres	62 bushel	74,400 bushel

	Crop						
Wheat All	Total For Crop	2003	Saline	5,300 acres	4,100 acres	66 bushel	270,600 bushel
Wheat All	Total For Crop	2004	Johnson	1,900 acres	1,300 acres	60 bushel	78,000 bushel
Wheat All	Total For Crop	2004	Saline	6,900 acres	6,800 acres	63 bushel	428,400 bushel
Wheat All	Total For Crop	2006	Saline	3,300 acres	3,200 acres	64 bushel	204,800 bushel
Wheat All	Total For Crop	2007	Saline	3,200 acres	2,900 acres	50 bushel	145,000 bushel
Wheat All	Total For Crop	2008	Saline	6,600 acres	6,500 acres	64 bushel	416,000 bushel

9h.

Commodity	Year	County	Cattle All	Beef Cows	Cattle and Calves Marketings
Cattle & Calves	1993	Johnson	14,900 head	6,700 head	4,700 head
Cattle & Calves	1993	Saline	7,300 head	4,300 head	2,900 head
Cattle & Calves	1994	Johnson	12,800 head	7,000 head	6,600 head
Cattle & Calves	1994	Saline	7,300 head	4,100 head	2,700 head
Cattle & Calves	1995	Johnson	13,500 head	7,400 head	6,000 head
Cattle & Calves	1995	Saline	7,200 head	3,700 head	2,500 head
Cattle & Calves	1996	Johnson	13,900 head	6,500 head	6,100 head
Cattle & Calves	1996	Saline	7,400 head	3,300 head	2,500 head
Cattle & Calves	1997	Johnson	14,600 head	6,800 head	5,200 head
Cattle &	1997	Saline	6,500	3,200	1,900 head

Calves			head	head	
Cattle & Calves	1998	Johnson	14,500 head	7,200 head	5,000 head
Cattle & Calves	1998	Saline	5,700 head	3,100 head	1,800 head
Cattle & Calves	1999	Johnson	14,200 head	8,200 head	4,700 head
Cattle & Calves	1999	Saline	5,500 head	2,900 head	2,200 head
Cattle & Calves	2000	Johnson	13,400 head	8,000 head	4,700 head
Cattle & Calves	2000	Saline	6,100 head	3,300 head	2,000 head
Cattle & Calves	2001	Johnson	12,100 head	8,400 head	5,700 head
Cattle & Calves	2001	Saline	5,600 head	3,100 head	2,200 head
Cattle & Calves	2002	Johnson	13,400 head	10,200 head	5,800 head
Cattle & Calves	2002	Saline	6,300 head	3,600 head	2,400 head
Cattle & Calves	2003	Johnson	13,100 head	8,600 head	4,400 head
Cattle & Calves	2003	Saline	6,000 head	3,500 head	2,100 head
Cattle & Calves	2004	Johnson	13,600 head	8,700 head	3,500 head
Cattle & Calves	2004	Saline	7,400 head	5,000 head	2,400 head
Cattle & Calves	2005	Johnson	12,900 head	10,100 head	4,500 head
Cattle & Calves	2005	Saline	8,200 head	5,100 head	2,800 head
Cattle & Calves	2006	Johnson	14,800 head	12,200 head	5,600 head
Cattle & Calves	2006	Saline	8,200 head	4,800 head	2,400 head
Cattle & Calves	2007	Johnson	12,900 head	9,700 head	4,900 head
Cattle & Calves	2007	Saline	6,700 head	3,200 head	3,300 head
Cattle & Calves	2008	Johnson	10,800 head	8,600 head	
Cattle &	2008	Saline	7,700	3,800	

Calves			head	head	

9i

Commodity	Year	County	Hogs All	Hogs Marketed
Hogs & Pigs	1993	Johnson	16,000 head	26,000 head
Hogs & Pigs	1993	Saline	10,500 head	18,000 head
Hogs & Pigs	1994	Johnson	12,900 head	20,000 head
Hogs & Pigs	1994	Saline	11,700 head	20,000 head
Hogs & Pigs	1995	Johnson	10,800 head	17,000 head
Hogs & Pigs	1995	Saline	10,300 head	19,000 head
Hogs & Pigs	1996	Johnson	7,300 head	15,000 head
Hogs & Pigs	1996	Saline	14,000 head	22,000 head
Hogs & Pigs	1997	Johnson	7,700 head	12,000 head
Hogs & Pigs	1997	Saline	31,600 head	92,000 head
Hogs & Pigs	1998	Johnson	13,000 head	22,000 head
Hogs & Pigs	1998	Saline	27,600 head	82,000 head
Hogs & Pigs	1999	Johnson	4,800 head	10,000 head
Hogs & Pigs	1999	Saline	22,600 head	82,000 head
Hogs & Pigs	2000	Johnson	6,600 head	12,000 head
Hogs & Pigs	2000	Saline	36,100 head	111,000 head
Hogs & Pigs	2001	Johnson	5,000 head	9,000 head
Hogs & Pigs	2001	Saline	27,500 head	86,000 head
Hogs & Pigs	2002	Johnson	7,900 head	14,000 head
Hogs & Pigs	2002	Saline	19,400 head	49,000 head
Hogs & Pigs	2003	Johnson	7,900 head	17,000 head
Hogs & Pigs	2003	Saline	23,000 head	50,000 head
Hogs & Pigs	2004	Johnson	6,100 head	13,000 head
Hogs & Pigs	2004	Saline	24,900 head	51,000 head
Hogs & Pigs	2005	Johnson	4,200 head	9,000 head
Hogs & Pigs	2005	Saline	22,400 head	45,000 head
Hogs & Pigs	2006	Johnson	4,700 head	9,000 head
Hogs & Pigs	2006	Saline	23,900 head	44,000 head
Hogs & Pigs	2007	Johnson	5,000 head	10,000 head
Hogs & Pigs				

9j

Commodity	Year	County	Annual Pig Crop	Annual Sows Farrowed	Annual Pigs Per Litter
Hogs - Farrowings	1993	Johnson	27,000 head	3,600 head	
Hogs - Farrowings	1993	Saline	17,380 head	2,200 head	
Hogs - Farrowings	1994	Johnson	27,380 head	3,700 head	7.4 head
Hogs - Farrowings	1994	Saline	15,960 head	2,100 head	7.6 head
Hogs - Farrowings	1995	Johnson	27,200 head	3,400 head	8 head
Hogs - Farrowings	1995	Saline	16,000 head	2,000 head	8 head
Hogs - Farrowings	1996	Johnson	16,180 head	1,900 head	8.5 head
Hogs - Farrowings	1996	Saline	22,120 head	2,800 head	7.9 head
Hogs - Farrowings	1997	Johnson	17,160 head	2,200 head	7.8 head
Hogs - Farrowings	1997	Saline	22,800 head	3,000 head	7.6 head
Hogs - Farrowings	1998	Johnson	17,480 head	2,300 head	7.6 head
Hogs - Farrowings	1998	Saline	59,640 head	7,100 head	8.4 head
Hogs - Farrowings	1999	Johnson	7,300 head	1,000 head	7.3 head
Hogs - Farrowings	1999	Saline	46,440 head	5,400 head	8.6 head
Hogs - Farrowings	2000	Johnson	8,880 head	1,200 head	7.4 head
Hogs - Farrowings	2000	Saline	36,720 head	5,400 head	6.8 head
Hogs - Farrowings	2001	Johnson	3,540 head	600 head	5.9 head
Hogs - Farrowings	2001	Saline	46,550 head	4,900 head	9.5 head
Hogs - Farrowings	2002	Johnson	4,350 head	500 head	8.7 head
Hogs - Farrowings	2002	Saline	33,060 head	3,800 head	8.7 head
Hogs -	2003	Johnson	6,160 head	700 head	8.8 head

Farrowings					
Hogs - Farrowings	2003	Saline	28,000 head	3,500 head	8 head
Hogs - Farrowings	2004	Johnson	5,110 head	700 head	7.3 head
Hogs - Farrowings	2004	Saline	17,040 head	2,400 head	7.1 head
Hogs - Farrowings	2005	Johnson	4,400 head	500 head	8.8 head
Hogs - Farrowings	2005	Saline	16,200 head	2,000 head	8.1 head
Hogs - Farrowings	2006	Johnson	4,900 head	500 head	9.8 head
Hogs - Farrowings	2006	Saline	19,800 head	2,000 head	9.9 head
Hogs - Farrowings	2007	Johnson	5,880 head	600 head	9.8 head
Hogs - Farrowings	2007	Saline	17,220 head	2,100 head	8.2 head

Table 10. WEPP simulated runs (Approximate erosion projections for prescribed burning and fire trails by soil mapping unit) - Cave Hill

Soil mapping unit	Soil T value (t/a/y)	Prescribed burning (average) (t/ac/yr)	Fire trail (average) (t/a/y)	2 years after treatment (t/a/y)
Hosmer silt loam (4 – 7 %), eroded	4	½ - 1	0 – 3	0 – ½
Hosmer silt loam (7 – 12 %), eroded	4	1	0 – 5.5	0 – 2 ½
Hosmer silt loam (7 – 12 %), severely eroded	3	1	0 – 5.5	0 – 2 ½
Grantsburg silt loam (2 – 4 %)	4	0 – ½	0 – 1 ½	0 – ½
Grantsburg silt loam (4 – 7 %), eroded	4	½ - 1	0 - 3	0 – ½

Sharon silt loam (0 – 3 %) occasionally flooded	5	0 – ½	0 - 1	0 – ½
Belknap silt loam (0 – 2%) frequently flooded	5	0 – ½	0 - 1	0 – ½
Wellston silt loam (7 – 12 %), eroded	4	1	0 – 5.5	0 – 2 ½
Wellston silt loam (18 – 45%)	4	½ - 6	1 ½ - 22	½ - 6
Zaneville silt loam (12 – 18 %), eroded	3	½ - 3 ½	0 – 8 ½	½ - 3
Burnside silt loam (1 – 4 %), occasionally flooded	3	0 – ½	0 – 1 ½	0 – ½
Markland silt loam (7 – 15 %), severely eroded	2	½ - 2 ½	0 - 6	0 – 2 ½
Colp silt loam, rarely flooded (1 – 4 %)	4	0 – ½	0 – 1 ½	0 – ½
Colp silt loam (4 – 10%) , severely eroded, rarely flooded	4	0 – 1 ½	0 – 3 ½	0 – 1 ½
Muskingum channery silt loam – Berks channery loam (35 – 70%)	3	1 – 8 ½	16 - 63	½ - 8 ½
Wellston silt loam – Berks channery	Wellston – 4 Berks - 3	½ - 4 ½	0 - 13	0 – 4 ½

loam (15 – 30 %)				
Berks channery loam - Wellston silt loam (30 – 60%)	Wellston – 4 Berks - 3	1 – 8 ½	10 - 51	½ - 8
Total				

Table 11. Soil Mapping Unit and Acres / WEPP Erosion Projections for Dennison Hollow / Stoneface

Soil Mapping Unit	T values (t/a/y)	Prescribed burning (t/a/y)	Fire trail (t/a/y)	2 years after treatment (t/a/y)
Grantsburg silt loam (2 – 4 %)	4	0 – ½	0 – 1 ½	0 – ½
Grantsburg silt loam (4 – 7 %), eroded	4	½ - 1	0 - 3	0 – ½
Sharon silt loam (0 – 3 %) occasionally flooded	5	0 – ½	0 - 1	0 – ½
Wellston silt loam (7 – 12 %), eroded	4	1	0 – 5.5	0 – 2 ½
Zaneville silt loam (7 – 12 %), eroded	3	1	0 – 5.5	0 – 2 ½
Burnside silt loam (1 – 4 %), occasionally flooded	3	0 – ½	0 – 1 ½	0 – ½
Muskingum channery silt loam – Berks channery loam (35 – 70%)	3	½ - 4 ½	16 - 63	½ - 8 ½
Wellston silt loam – Berks channery loam (15 – 30 %)	Wellston – 4 Berks	½ - 4 ½	0 - 13	0 – 4 ½
Berks channery loam - Wellston	Wellston – 4 Berks - 3	1 – 8 ½	10 - 51	½ - 8

silt loam (30 – 60%)				
Total				

Table 12. Soil Mapping Unit and Acres / Approximate WEPP erosion projections for Simpson Barrens

Soil Mapping Unit	T values (t/a/y)	Prescribed fire (t/a/y)	Fire trails (t/a/y)	2 years after treatment (t/a/y)
Grantsburg silt loam (2 – 5 %)	4	0 – ½	0 – 1 ½	0 – ½
Grantsburg silt loam (5 – 10 %) eroded	4	0 – 1 ½	0 - 4	0 – 1 ½
Grantsburg silt loam (10 – 18 %) eroded	4	0 - 3	0 - 8	0 - 3
Zanesville silt loam (5 – 10 %) eroded	3	0 – 1 ½	0 - 4	0 – 1 ½
Zanesville silt loam (5 – 10 %) severely eroded	2	0 – 1 ½	0 - 4	0 – 1 ½
Zanesville silt loam (10 – 18%) , eroded	3	0 - 3	0 - 8	0 - 3
Zanesville silt loam (10 – 18%) , severely eroded	2	0 - 3	0 - 8	0 - 3
Berks channery loam – Muskingum &Weikert channery silt loam (35 – 70 %)	3	1 - 9	16 - 64	0 - 9
Sharon silt loam (0 – 3 %) occasionally flooded	5	0 – ½	0 - 1	0 – ½
Belknap silt loam (0 – 2%)	5	0 – ½	0 - 1	0 – ½

frequently flooded				
Burnside silt loam (1 – 4 %), occasionally flooded	3	0 – ½	0 – 1 ½	0 – ½
Wellston silt loam – Berks channery loam (10 – 18 %) eroded	Wellston – 4 Berks - 3	0 - 3	0 - 8	0 - 3
Wellston silt loam – Berks channery loam (10 – 18 %) severely eroded	Wellston – 3 Berks - 2	0 - 3	0 - 8	0 - 3
Wellston silt loam – Berks channery loam (18 - 35 %)	Wellston – 4 Berks - 3	½ - 5	0 - 18	½ - 5
Total				

Lower values in erosion ranges are for 1 year events and higher values for 10 year events. Model is set up for 200 foot runs, Harrisburg climate data, and a 10 year return interval.

The Forest Service Internet-based interface to the Water Erosion Prediction Model (FSWEPP; Elloit et al 2000) was used as part of this analysis. Climate was simulated for ten years at the Harrisburg, IL to obtain a range of wet and dry conditions. Erosion and sedimentation predictions must be evaluated with a full understanding of the uncertainties.

"At best, any predicted runoff or erosion value, by any model, will be within only plus or minus 50 percent of the true value. Erosion rates are highly variable, and most models can only predict a single value. Replicated research has shown that observed values vary widely for identical plots, or the same plot from year to year (Elliot et al 1994; Elliot et al 1995) Also, spatial variability and variability of soil properties add to the complexity of erosion prediction. " (Elliot et al 2000) (excerpted from Disturbed WEPP(Draft02/2000)WEPP Interface for Disturbed Forest and Range Runoff, Erosion and Sediment Delivery (William J. Elliot, David E. Hall, Dayna L. Scheele. U.S.D.A. Forest Service Rocky Mountain Research Station and San Dimas Technology and Development Center, February 2002) online from http://forest.moscowfsl.wsu.edu/fswepp/docs/distweppdoc.html.

FSWEPP provides relative versus absolute results to estimate and compare the magnitude of effects of alternatives. The analysis allows a comparison of alternatives but does not predict the effects for a specific stand. The outputs are given in tons per acre. One ton of

soil loss is approximately equal in weight to a uniform depth of 0.007 inches of soil over one acre. (Troeh et al. 1991) Models were run for silvicultural treatments with the following assumptions: 30 year climate events (climate station: Salem), silt loam soils, skeletal conditions (> 35 percent rock by volume), 200 foot slope length.

Tables 13 - Air quality data from IEPA 2007 data

Table. 13a. Estimated County Stationary Point Sources Emissions (Tons per Year) (IEPA 2008)

County	Carbon monoxide	Nitrogen oxides	Particulate matter	Sulfur dioxide	Volatile organic matter
Johnson	32.8	24.4	43.8	369.5	6.4
Saline	9.6	3.5	21.2	1.0	11.6
Statewide high	18,131.7(Madison County)	28,343.5(Tazewell County)	4,653.1 (Cook County)	75,357.9 (Will County)	10,512.2 (Cook) county)
Statewide low	0.0 (Menard and Pope counties)	0.0 (Pope and six other counties)	0.0 (Pope county)	0.0 (Pope and nine other counties)	0.0 (Pope and one other county)

Table 13b. 2007 samples for ozone

Monitoring site	Airshed Number	Pollutant	1 hour samples (ppm)				8 hour samples (ppm)			
Effinham, Route 45	74	Ozone	0.088	0.088	0.082	0.081	0.079	0.078	0.078	0.078
Knights Prairie Twp., Route 14	74	Ozone	0.089	0.085	0.084	0.083	0.084	0.080	0.079	0.076

Primary 8 hour standard for ozone– 0.08 ppm

Table 13c

Monitoring site	Airshed Number	Pollutant	98th % value (micro-grams per cubic meter)	Highest values (micro-grams per cubic meter)				Arithmetic mean (micro-grams per cubic meter)
Knights Prairie	74	PM 2.5	33.4	43.7	33.4	30.7	28.6	13.4

Twp., Route 14								

Primary 24-Hour Standard 35 ug/m3; Primary Annual Standard 15.0 ug/m3

Table 13d

Monitoring site	Airshed Number	Pollutant	Highest values (micro-grams per cubic meter)				Arithmetic mean (micro-grams per cubic meter)
Carbondale	74	PM 10	65	41	38	37	22

Primary 24-Hour Standard 150 ug/m3

Table 13e PM 10 – Short term trends for PM 10

Monitoring site	Airshed Number	Pollutant	2002 (micro-grams per cubic meter)	2003	2004	2005	2006	2007
Carbondale	74	PM 10	19	19	20	24	21	22

Table 13 Sulfur dioxide

Monitoring site	Airshed Number	Pollutant	Highest samples – 3 hour average (ppm)		Highest samples – 24 hour average (ppm)		Annual arithmetic mean (ppm)
Mount Carmel	74	Sulfur dioxide	0.115	0.090	0.031	0.023	0.005
Rural Wabash County	74	Sulfur dioxide	0.054	0.042	0.018	0.017	0.005

Primary Annual Standard 0.03 ppm

Table 13g Short term trends for sulfur dioxide

Monitoring site	Airshed Number	Pollutant	2002 (ppm)	2003	2004	2005	2006	2007
Mount Carmel	74	Sulfur dioxide	0.004	0.004	0.004	0.006	0.005	0.005
Rural Wabash County	74	Sulfur dioxide	0.003	0.003	0.003	0.004	0.004	0.005

Appendix B
From National Forestry Manual - NRCS

Potential Erosion Hazard (Road/Trail)

Description:

The hazard or risk of soil loss from un-surfaced roads.

Considerations:

Ratings assess:

*The force that natural precipitation events have to dislodge and move soil materials on roads, trails, and fire breaks.

*Activities on roads and trails that result in bare ground, compaction, and reshaping of the soil surface.

*Use by trucks, skidders, off-road vehicles, and other similar equipment.

*The impact on compacted, bare ground, trail surface using the representative value for slope gradient of the soil component.

Ratings assume:

*Roads and trails are generally linear, continuous, and narrow ranging up to 7.5 meters in width.

Ratings do not assess:

*Frozen or snow covered soil.

Ratings:

Slight – Little or no erosion is likely.

Moderate- Some erosion is likely; occasional maintenance may be needed; simple erosion control measures needed.
Severe – Significant erosion can be expected; roads require frequent maintenance; costly erosion control measures needed.

Soil rating criteria found on Exhibit 537-2 in the National Forestry Manual – NRCS. (found on-line at ftp://ftp-fc.sc.egov.usda.gov/NSSC/National_Forestry_Manual/2002_nfm_complete.pdf)

Potential Erosion Hazard (Off-road/Off-Trail)

Description: Ratings indicate the hazard or risk of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface.

Considerations:

Ratings assess:

*Sheet or rill erosion from exposed soil surfaces caused by various silvicultural practices, grazing, mining, fire, firebreaks, etc.
*Activities that disturb the site resulting in 50 – 75 percent bare ground in the affected area.
*The use of any equipment type or size and uncontrolled grazing by livestock.

Ratings assume:

*50 – 75% roughened mineral surface layer.

Ratings do not assess:

*Clean tillage or similar activities that disturb up to nearly 100 percent of the area and change the character of the soil.
*Histosols
*Individual precipitation or storm events.
*The impact of gully erosion.
*Sediment production/delivery ratio or stream bank or stream bed erosion for water courses on the site.
*Ground disturbing activities on the amount of surface or subsurface water runoff.

Ratings:
Slight – Erosion is unlikely under normal, climatic conditions.
Moderate – Some erosion is likely; control measures may be needed.
Severe – Erosion is very likely; control measures for vegetation re-establishment on bare areas and structural measures are advised.
Very severe – significant erosion is expected; loss of soil productivity and off-site damages is likely; control measures are costly and generally impractical.

Soil rating criteria found on Exhibit 537-3 in the National Forestry Manual – NRCS. (found on-line at ftp://ftp-fc.sc.egov.usda.gov/NSSC/National_Forestry_Manual/2002_nfm_complete.pdf)

Potential damage to soil from fire –

Description: The potential hazard of damage to soil nutrient, physical, and biotic characteristics from fire.

Considerations:

Ratings assess:

The impact fires (prescribed or wildfire) of moderate fireline intensity (116 – 520 btu's/sec/ft that provide the necessary heat to remove the duff layer and consume soil organic matter in the surface layer.

Ratings assume:

*Soils with shallow surface layer lack the capacity to safely absorb the effects of fire.

*Steep slopes are more likely to erode if the protective duff layer is removed.

*Soil texture and rock fragment content relate to soil erodability, vegetative recovery rate, and vegetative productivity.

*Medium textured soils, with their greater inherent water holding capacity, are more likely to be cooler and provide higher productivity potential.

*Soils with large volumes of rock fragments transmit heat to a greater depth in a shorter period of time.

*Soils with less than two percent organic matter are more resistant to sheet or rill erosion and have a greater water holding capacity.

Ratings do not assess:

*The time of year in which the fire occur (winter versus summer)

*Fuel moisture content or volume

*Weather conditions

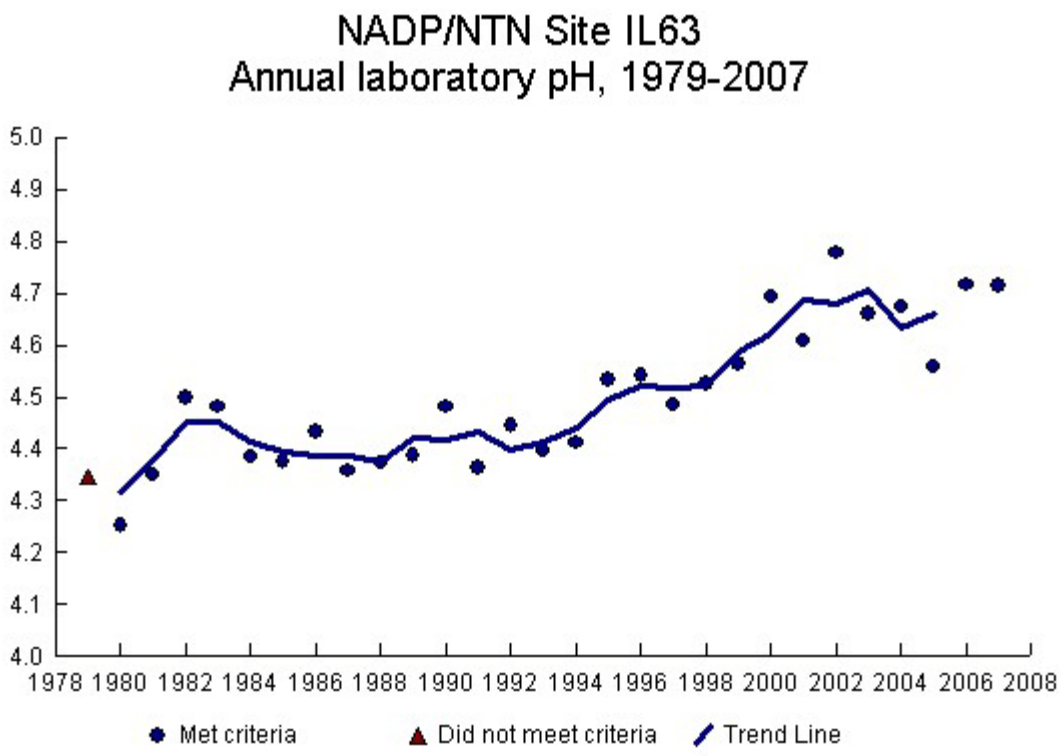
Ratings:

*Low – Little or not negative impacts to the soils characteristics are expected.

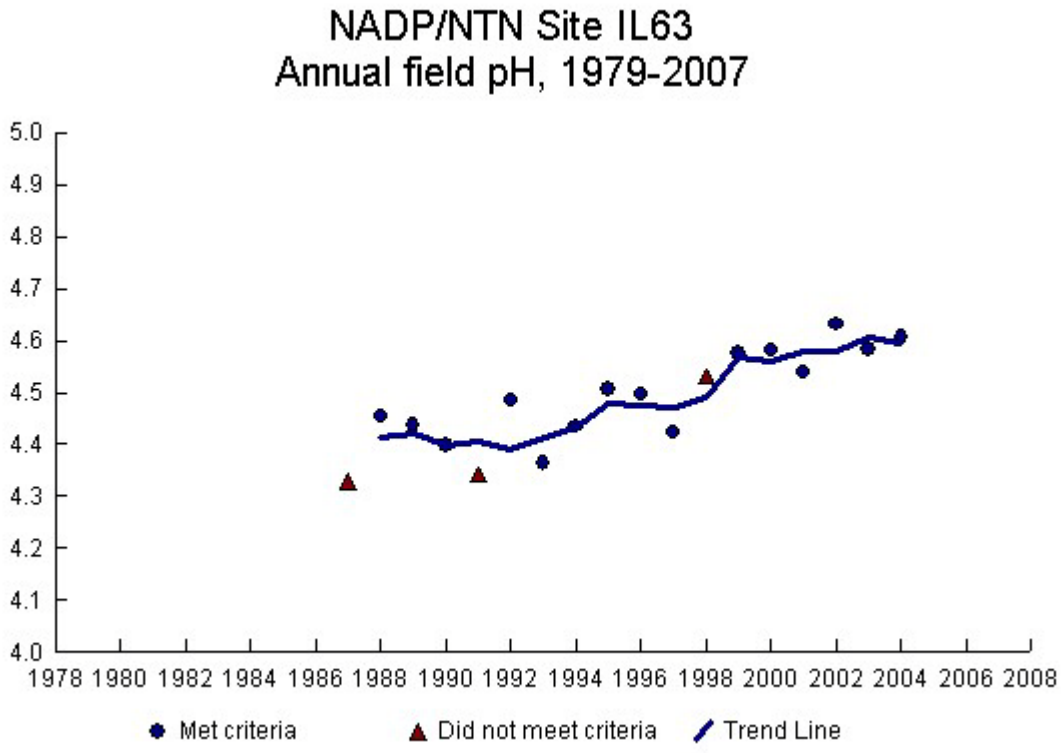
*Moderate – Negative impacts to the soil characteristics may occur.

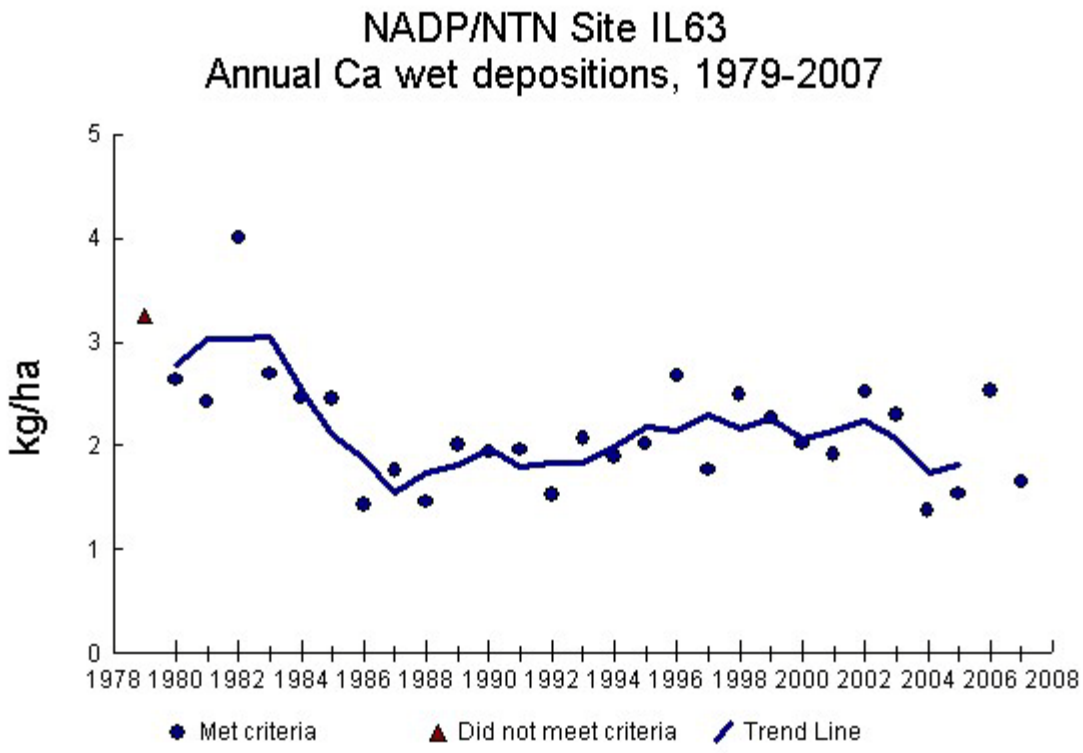
*High - Negative impacts to the soil characteristics are expected.

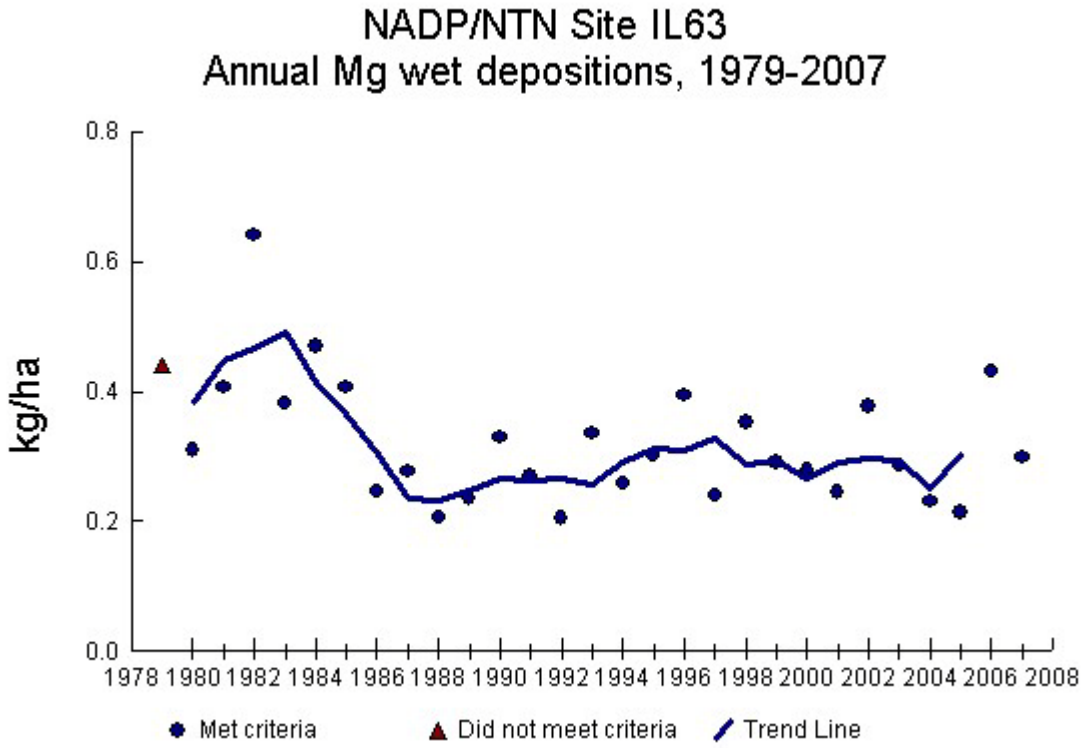
Soil rating criteria found on Exhibit 537-13 in the National Forestry Manual – NRCS. (found on-line at ftp://ftp-fc.sc.egov.usda.gov/NSSC/National_Forestry_Manual/2002_nfm_complete.pdf)

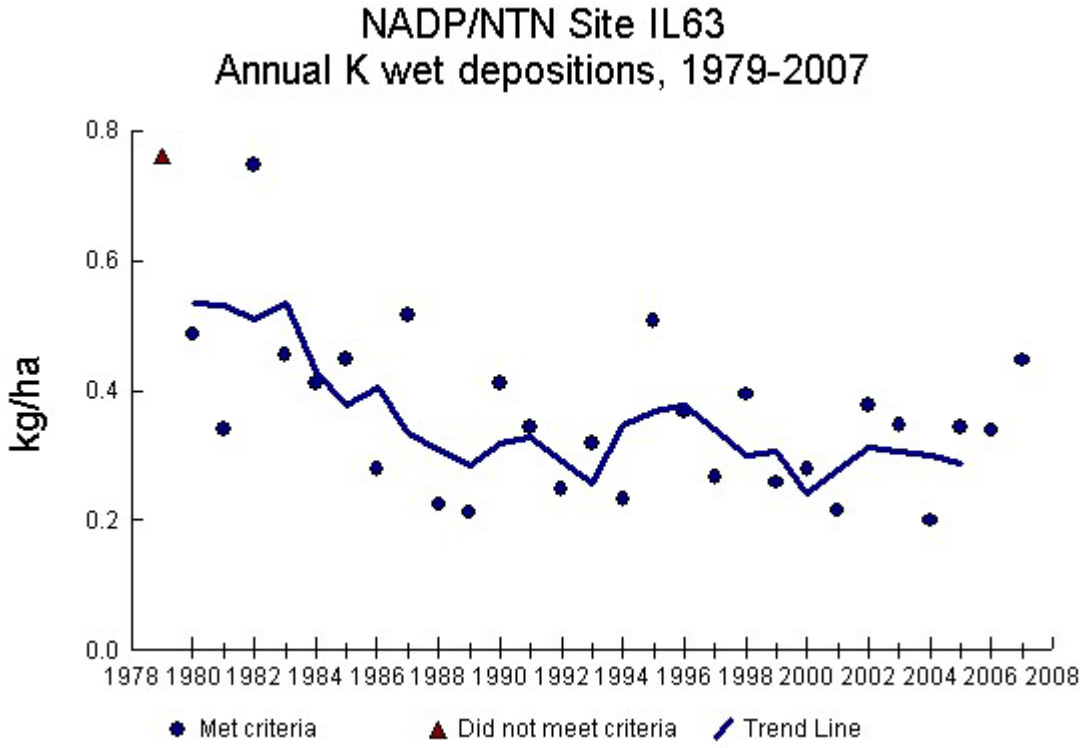


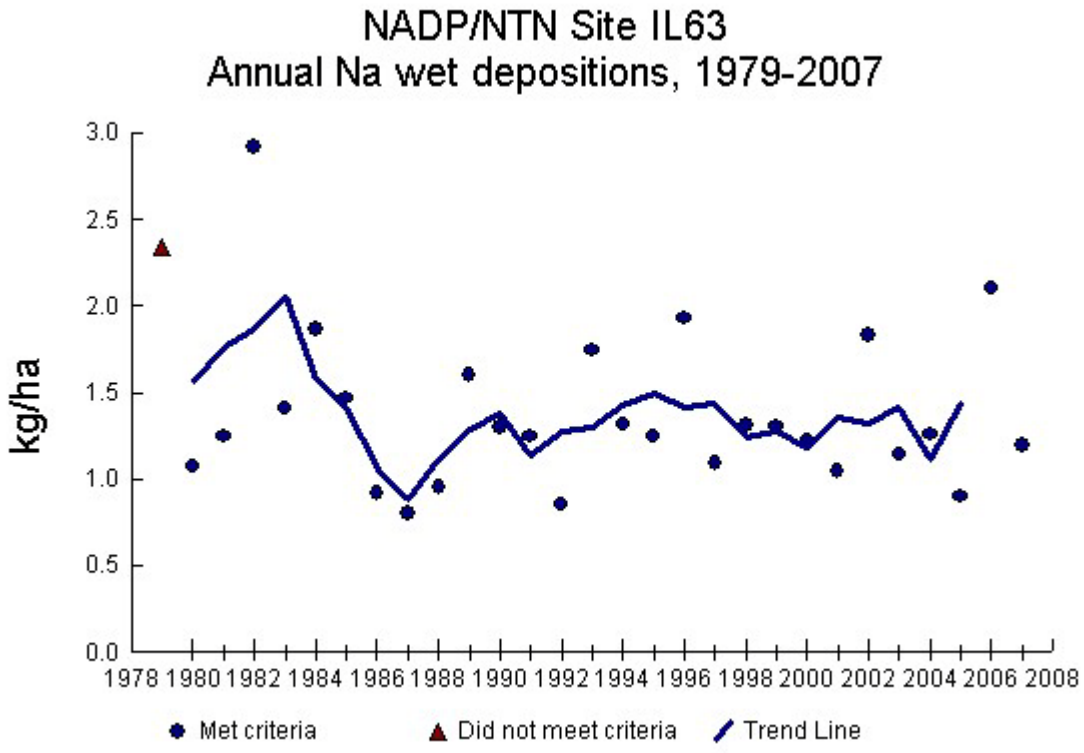
Site IL63 is located at the Dixon Springs Agricultural Center, Pope County, IL

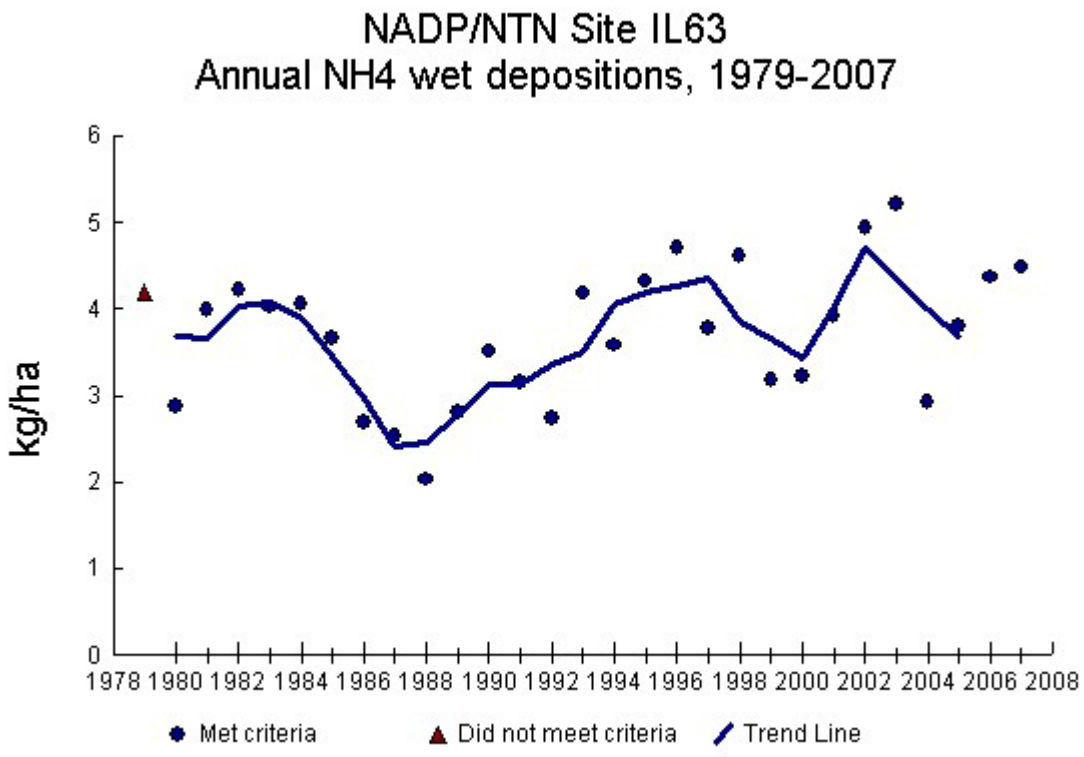

NADP/NTN Site IL63
Annual field pH, 1979-2007
5.0
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4.0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

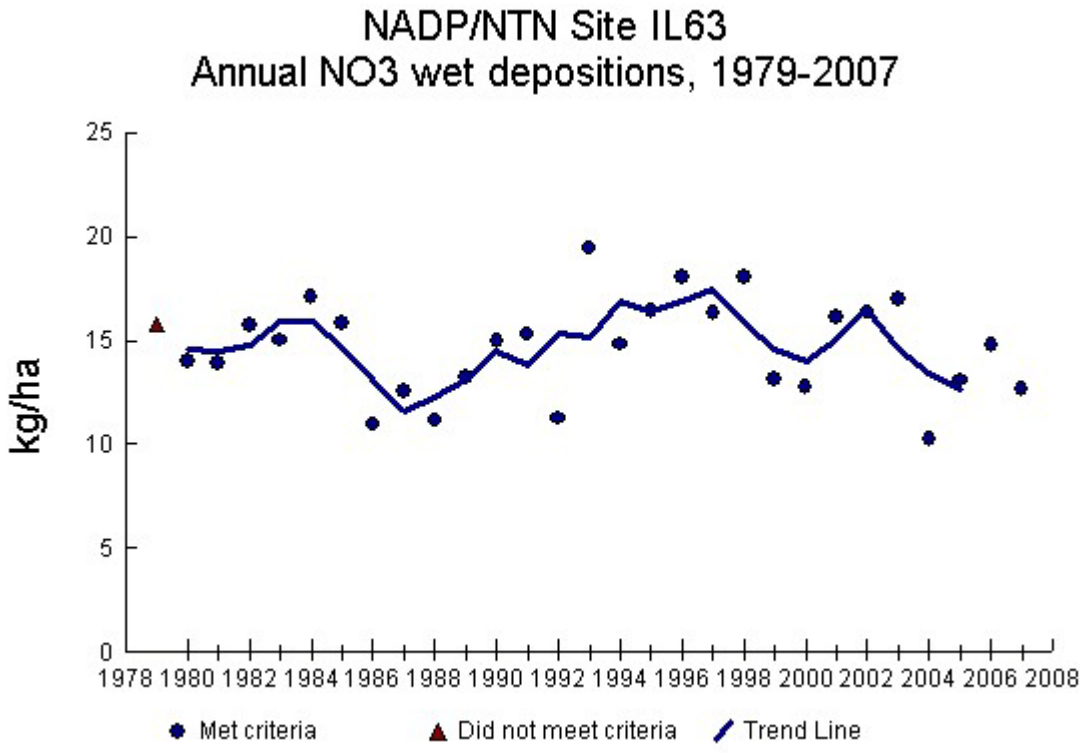

NADP/NTN Site IL63
Annual Ca wet depositions, 1979-2007
kg/ha
5
4
3
2
1
0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

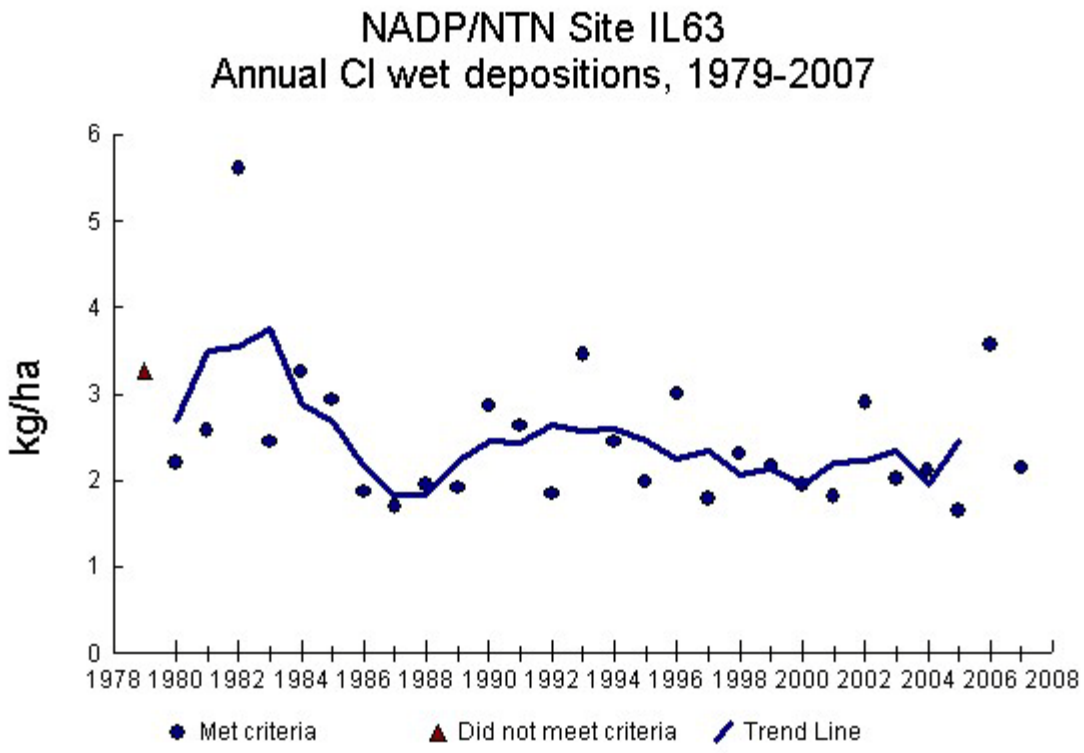

NADP/NTN Site IL63
Annual Mg wet depositions, 1979-2007
kg/ha
0.8
0.6
0.4
0.2
0.0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

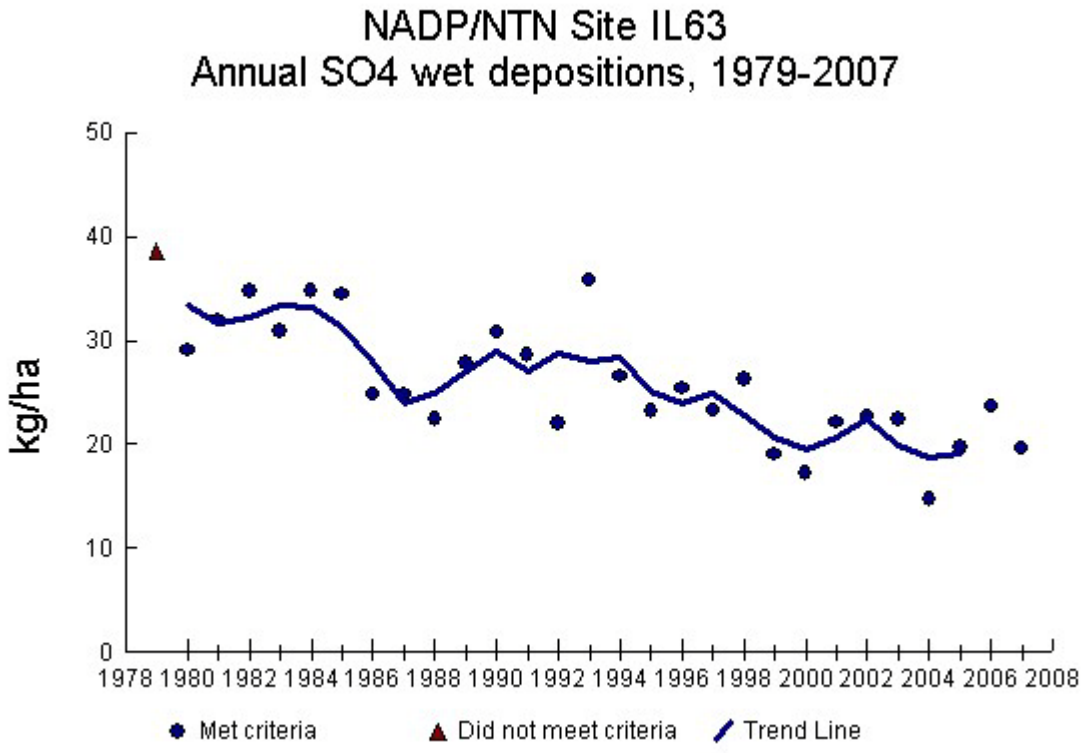

NADP/NTN Site IL63
Annual K wet depositions, 1979-2007
kg/ha
0.8
0.6
0.4
0.2
0.0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

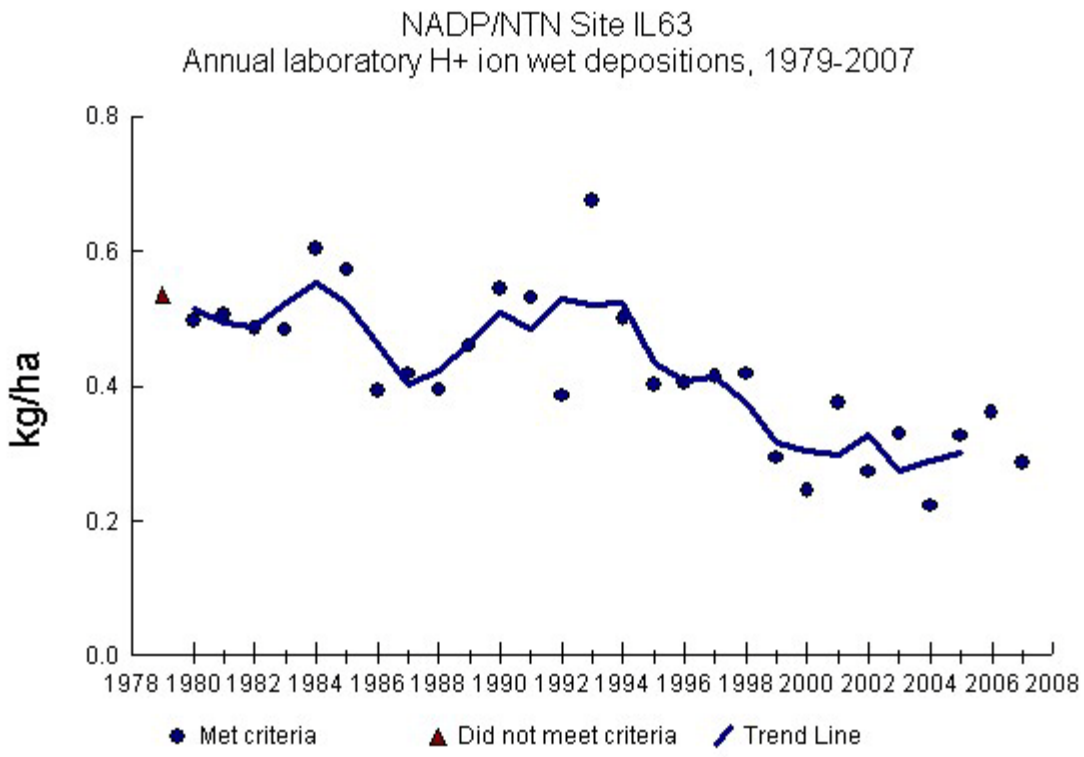

NADP/NTN Site IL63
Annual Na wet depositions, 1979-2007
kg/ha
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

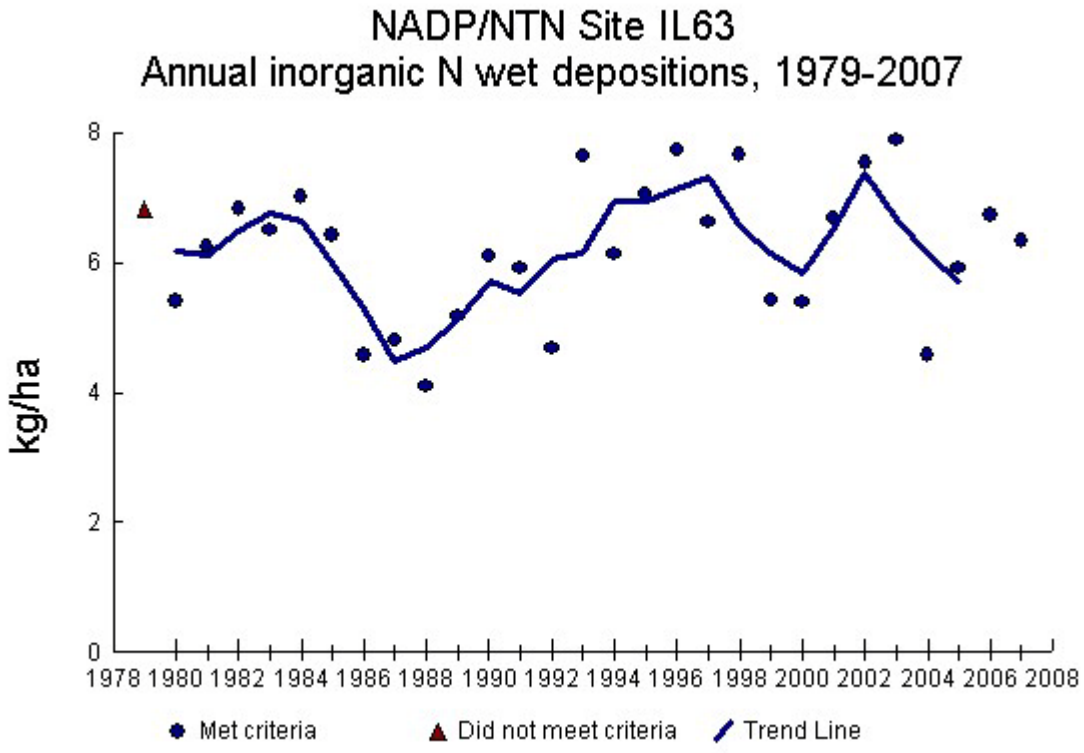

NADP/NTN Site IL63
Annual NH4 wet depositions, 1979-2007
kg/ha
6
5
4
3
2
1
0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

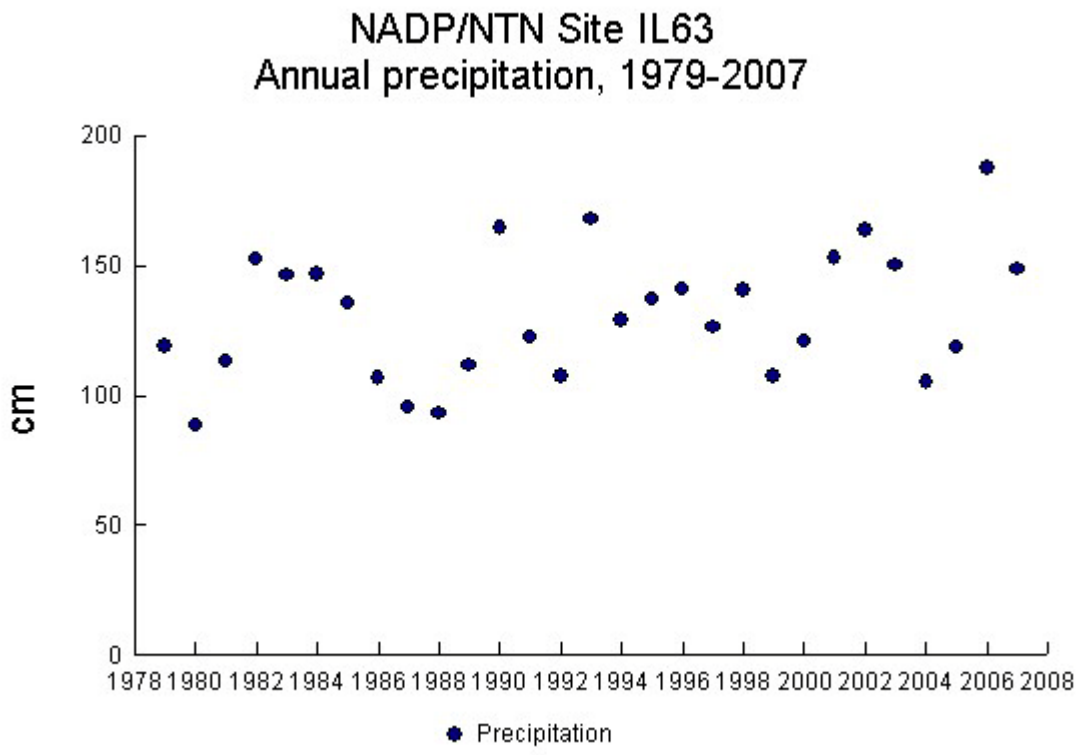

NADP/NTN Site IL63
Annual NO3 wet depositions, 1979-2007
kg/ha
25
20
15
10
5
0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

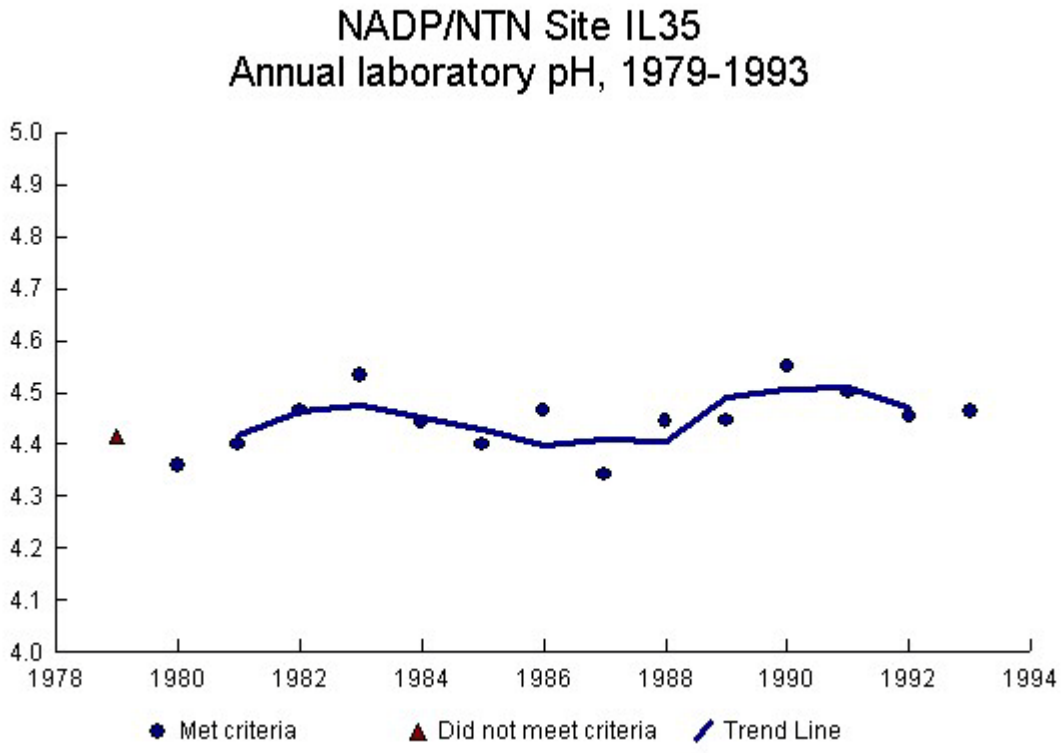

NADP/NTN Site IL63
Annual Cl wet depositions, 1979-2007
kg/ha
6
5
4
3
2
1
0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line


NADP/NTN Site IL63
Annual SO4 wet depositions, 1979-2007
kg/ha
50
40
30
20
10
0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

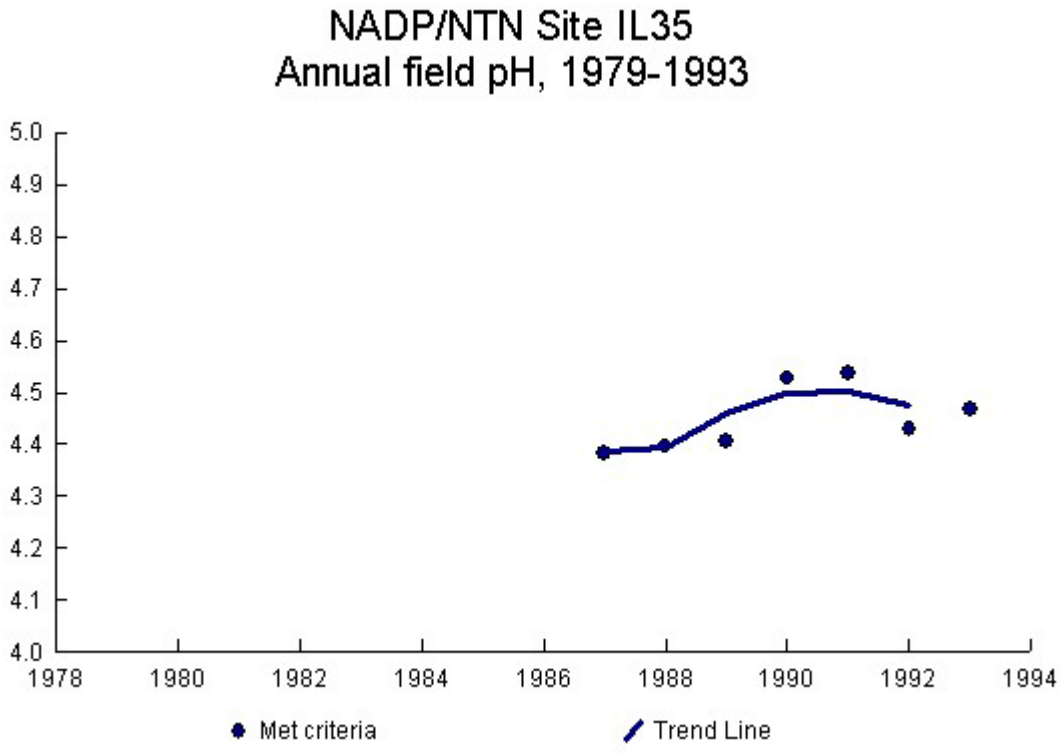

NADP/NTN Site IL63
Annual laboratory H+ ion wet depositions, 1979-2007
kg/ha
0.8
0.6
0.4
0.2
0.0
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

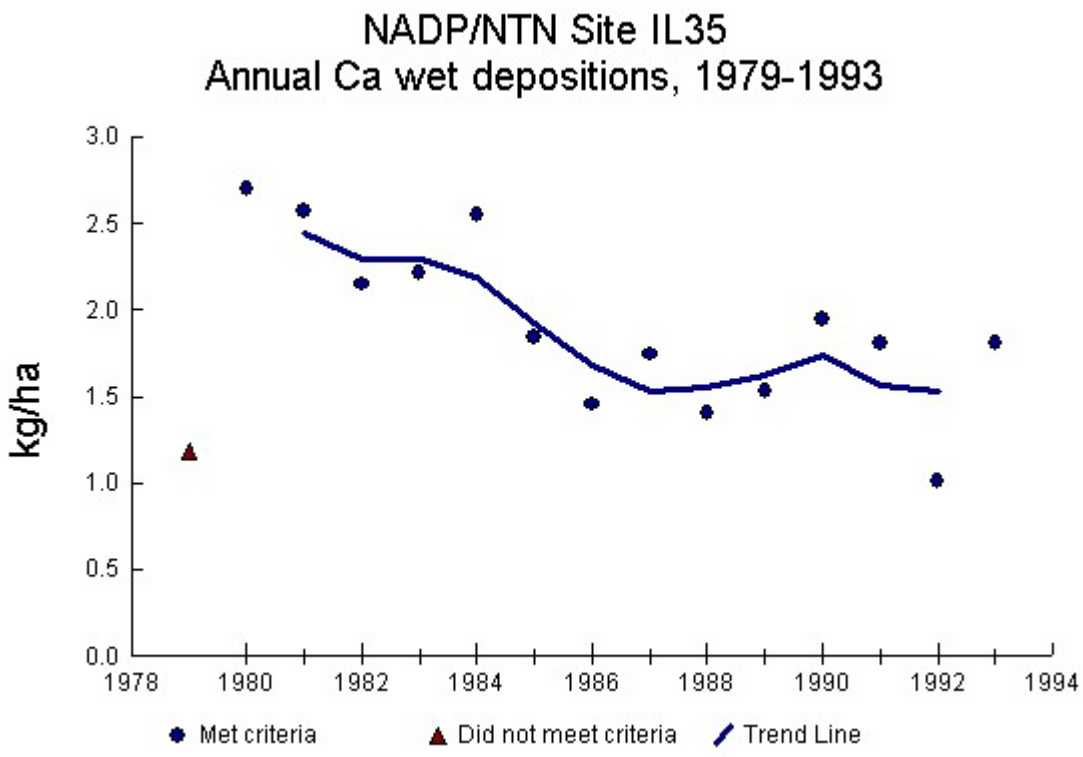

NADP/NTN Site IL63
Annual inorganic N wet depositions, 1979-2007
kg/ha
0
2
4
6
8
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Met criteria
Did not meet criteria
Trend Line

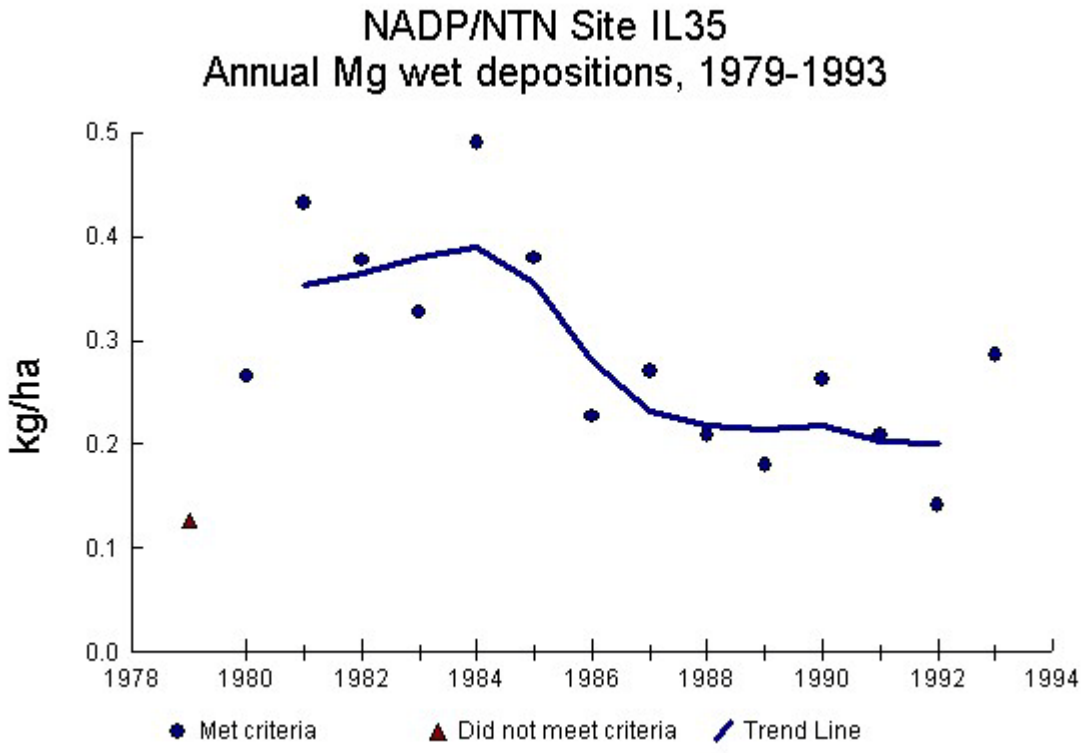

NADP/NTN Site IL63
Annual precipitation, 1979-2007
cm
0
50
100
150
200
1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008
Precipitation

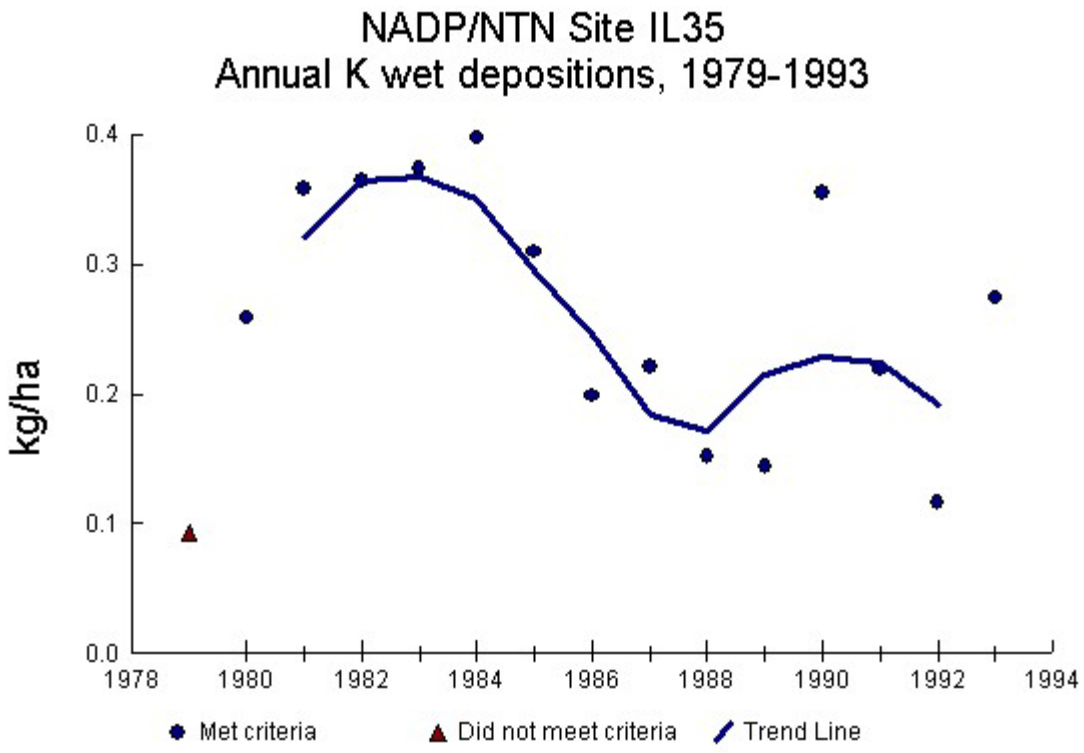


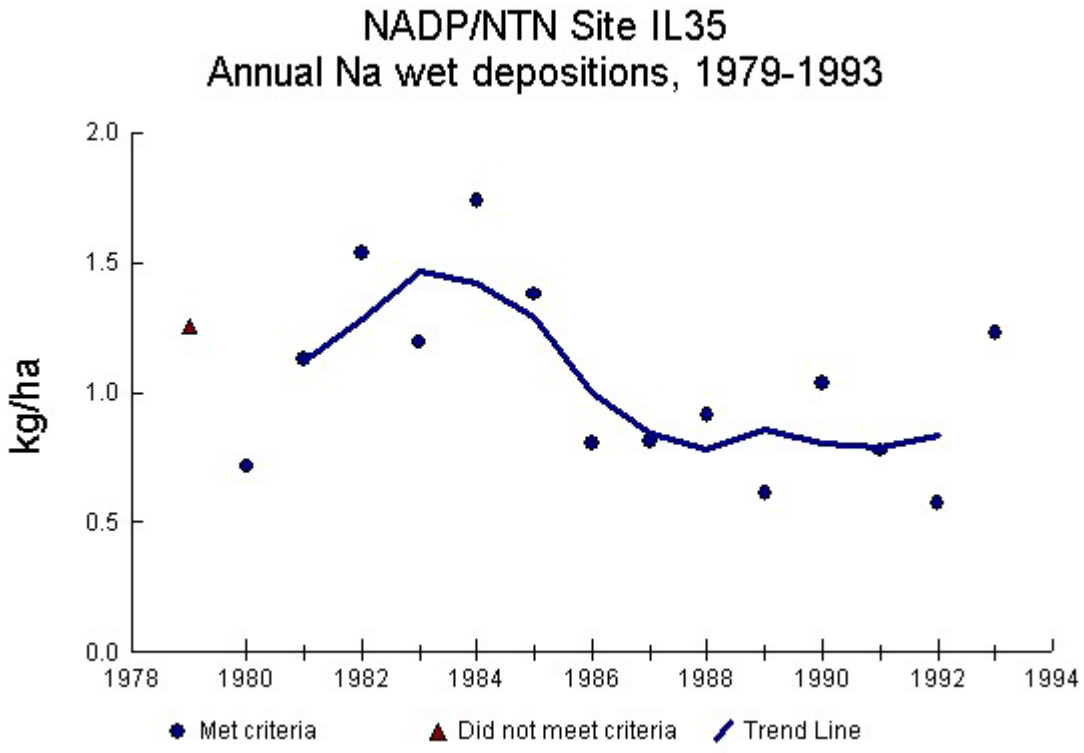
Site IL35 is located at Southern Illinois University at Carbondale, IL has data from 1979 through 1994.

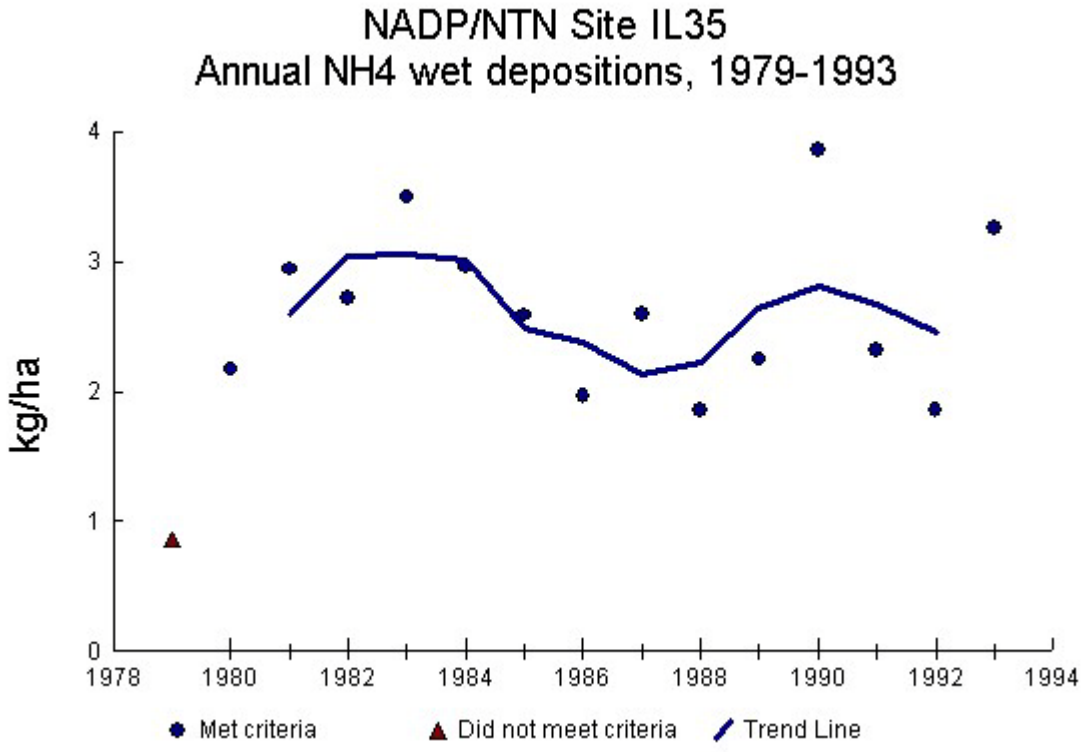

NADP/NTN Site IL35
Annual field pH, 1979-1993
5.0
4.9
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4.0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Trend Line

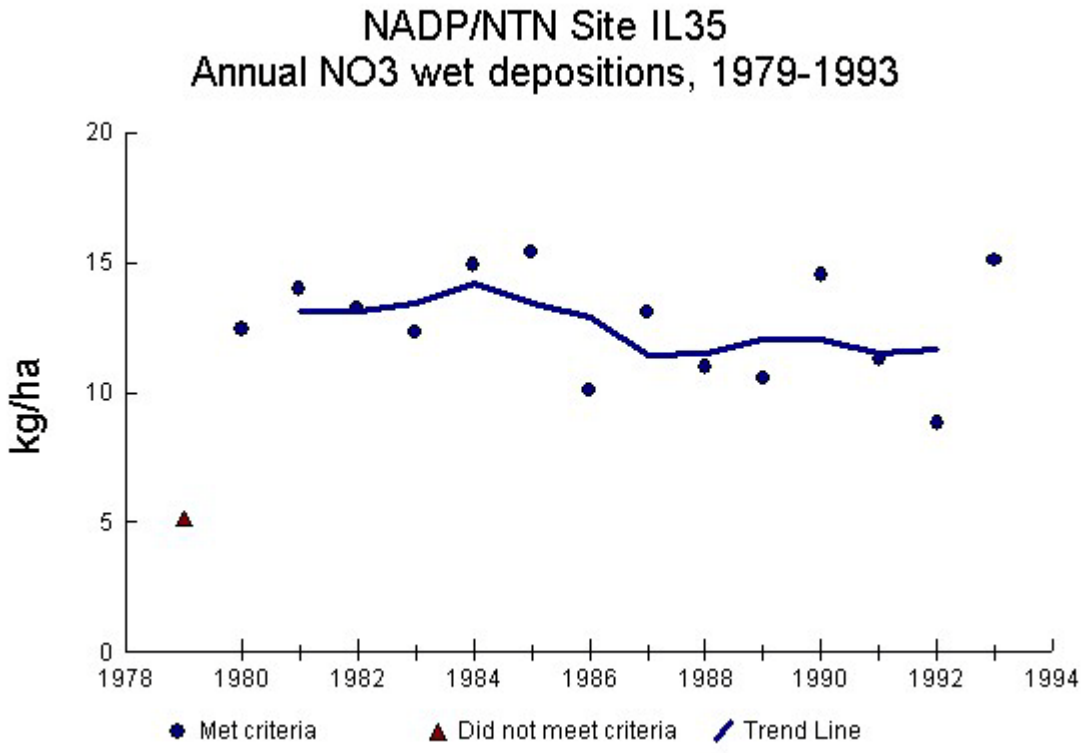

NADP/NTN Site IL35
Annual Ca wet depositions, 1979-1993
kg/ha
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line

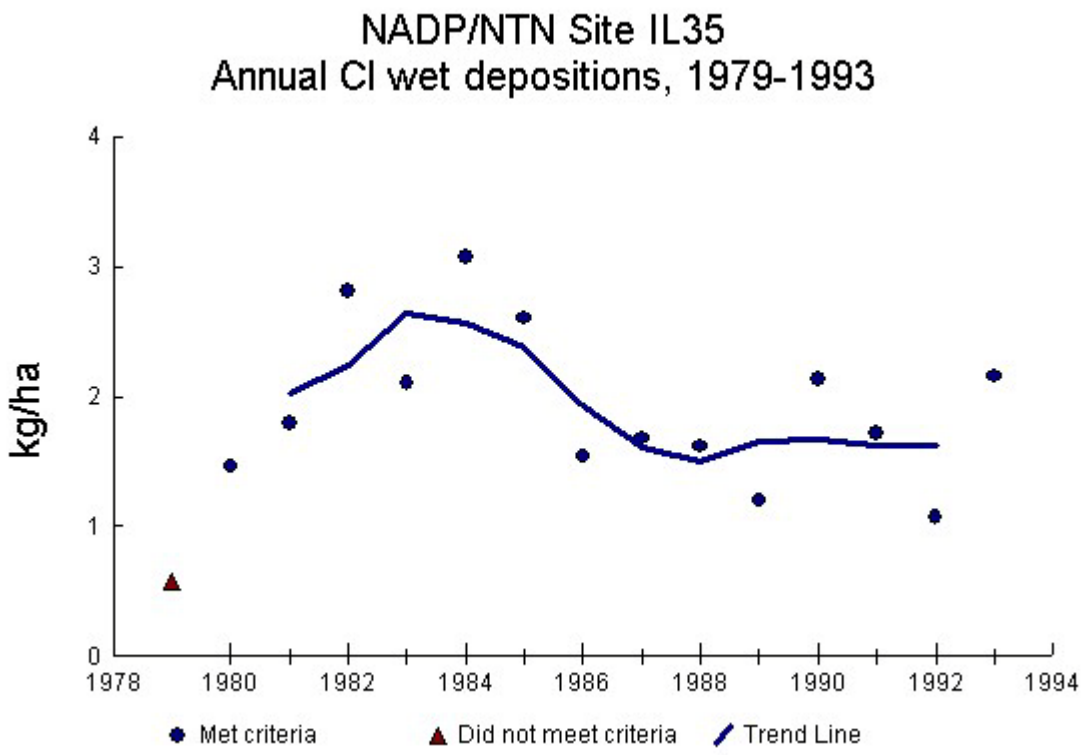

NADP/NTN Site IL35
Annual Mg wet depositions, 1979-1993
kg/ha
0.5
0.4
0.3
0.2
0.1
0.0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line

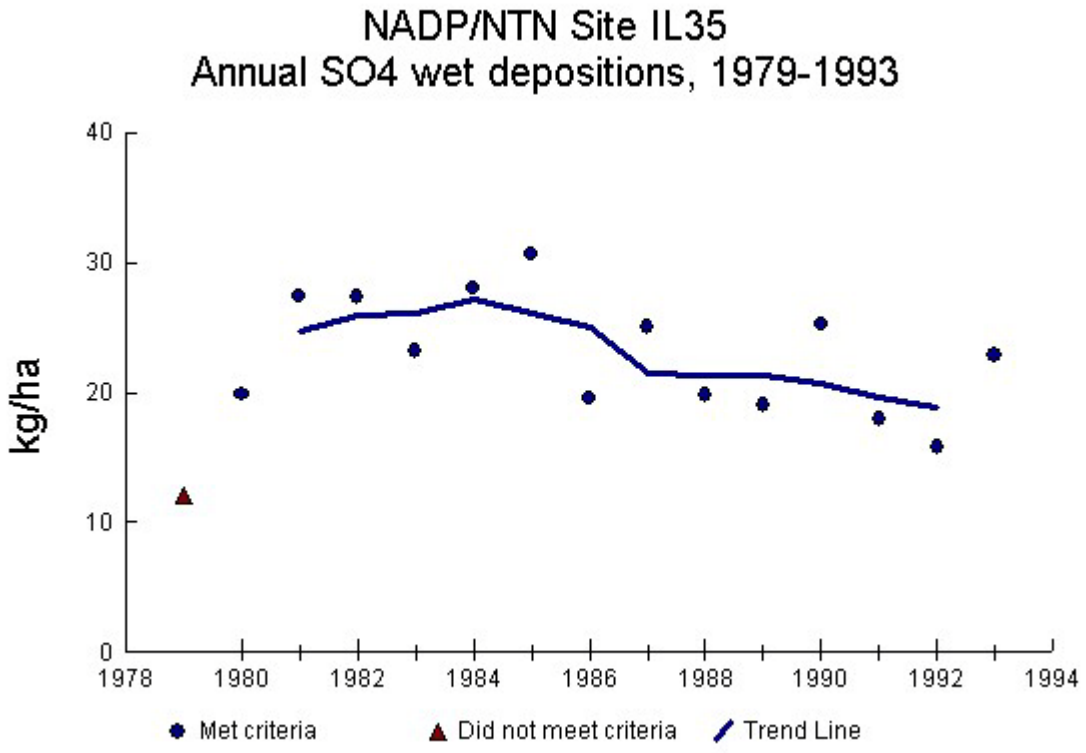

NADP/NTN Site IL35
Annual K wet depositions, 1979-1993
kg/ha
0.4
0.3
0.2
0.1
0.0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line

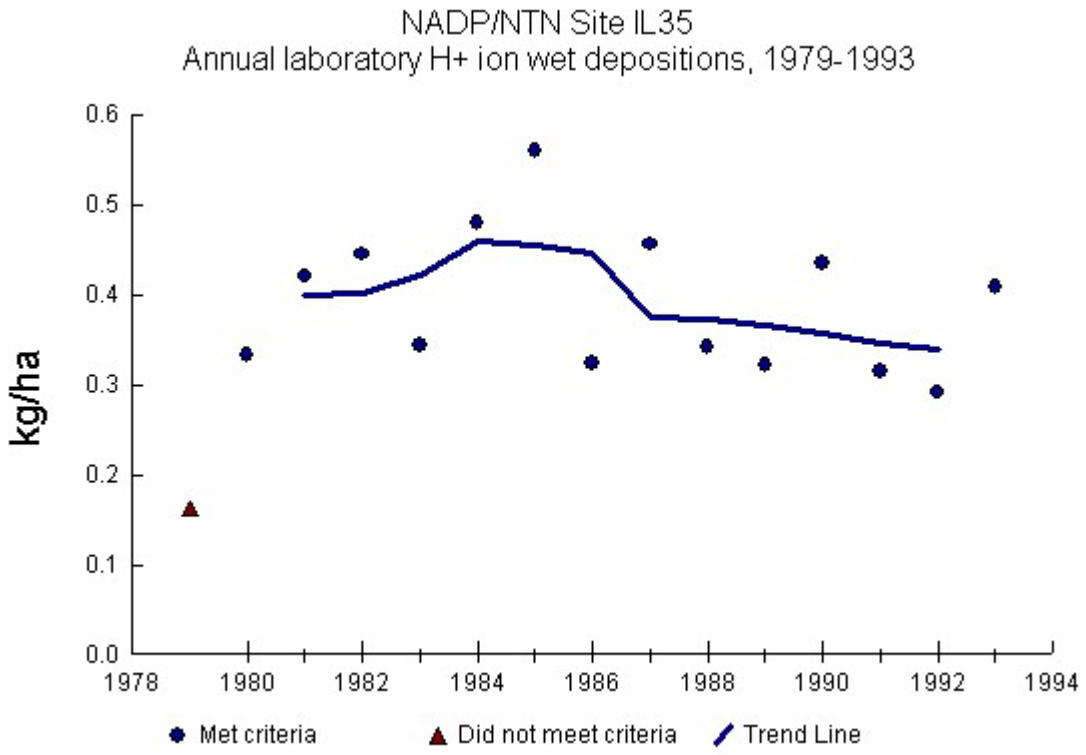

NADP/NTN Site IL35
Annual Na wet depositions, 1979-1993
kg/ha
2.0
1.5
1.0
0.5
0.0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line

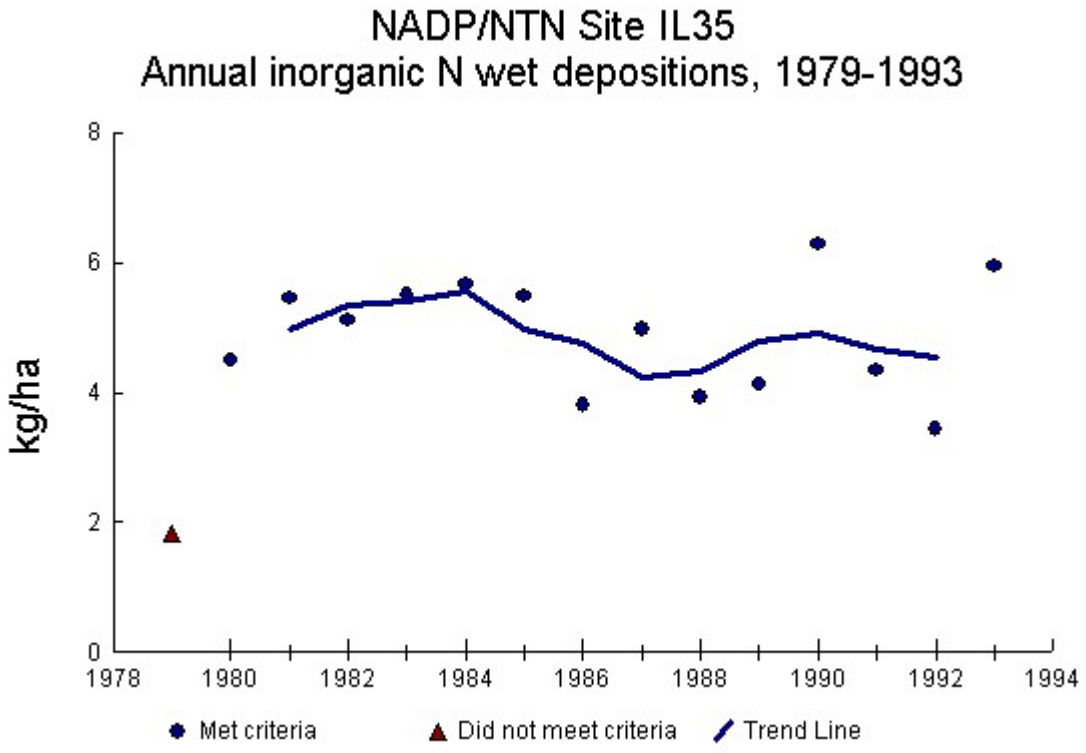

NADP/NTN Site IL35
Annual NH4 wet depositions, 1979-1993
kg/ha
4
3
2
1
0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line

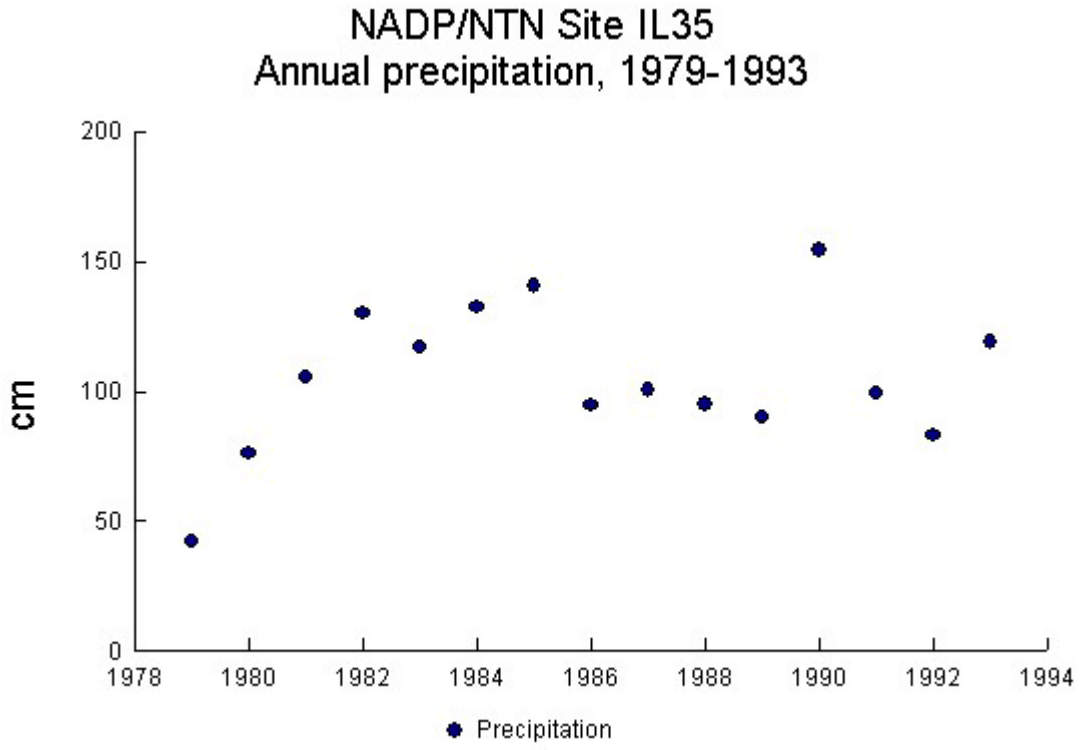

NADP/NTN Site IL35
Annual NO3 wet depositions, 1979-1993
kg/ha
20
15
10
5
0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line


NADP/NTN Site IL35
Annual Cl wet depositions, 1979-1993
kg/ha
4
3
2
1
0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line


NADP/NTN Site IL35
Annual SO4 wet depositions, 1979-1993
kg/ha
40
30
20
10
0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line


NADP/NTN Site IL35
Annual laboratory H+ ion wet depositions, 1979-1993
kg/ha
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line


NADP/NTN Site IL35
Annual inorganic N wet depositions, 1979-1993
kg/ha
0
2
4
6
8
1978
1980
1982
1984
1986
1988
1990
1992
1994
Met criteria
Did not meet criteria
Trend Line


NADP/NTN Site IL35
Annual precipitation, 1979-1993
cm
0
50
100
150
200
1978
1980
1982
1984
1986
1988
1990
1992
1994
Precipitation