University of New Hampshire
University of New Hampshire Scholars' Repository

Master's Theses and Capstones Student Scholarship

Fall 2006

Abiotic retention of nitrogen and dissolved organic matter by forest mineral soils

Naoko Watanabe
University of New Hampshire, Durham

Follow this and additional works at: https://scholars.unh.edu/thesis

Recommended Citation
Watanabe, Naoko, "Abiotic retention of nitrogen and dissolved organic matter by forest mineral soils" (2006). *Master's Theses and Capstones*. 213.
https://scholars.unh.edu/thesis/213

This Thesis is brought to you for free and open access by the Student Scholarship at University of New Hampshire Scholars' Repository. It has been accepted for inclusion in Master's Theses and Capstones by an authorized administrator of University of New Hampshire Scholars' Repository. For more information, please contact Scholarly.Communication@unh.edu.

ABIOTIC RETENTION OF NITROGEN AND DISSOLVED ORGANIC MATTER BY FOREST MINERAL SOILS

BY

NAOKO WATANABE
B.S.A., West Virginia University, 2003

THESIS

Submitted to the University of New Hampshire
in Partial Fulfillment of
the Requirements for the Degree of

Master of Science

in

Natural Resources

September, 2006

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UMI Number: 1437646

Copyright 2006 by
Watanabe, Naoko

All rights reserved.

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

UMI®

UMI Microform 1437646
Copyright 2006 by ProQuest Information and Learning Company.
All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.

ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

This thesis has been examined and approved.

Thesis Director, Dr. William McDowell,
Director, Water Resources Research Center and Professor of Water Resources Management

John Aber

Dr. John Aber,
Vice President for Research and Public Service and Professor of Natural Resources and
Earth, Oceans, and Space

JA Aitkenhead-Peterson

Dr. Jacqueline Aitkenhead-Peterson,
Research Assistant Professor of Natural Resources

Serita Frey

Dr. Serita Frey,
Associate Professor of Soil Microbial Ecology

8-11-06

Date

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

ACKNOWLEDGEMENTS

I was able to complete my thesis because of the generous support and assistance of many people. I would like to thank Jeff Merriam, Michelle Daley, Jody Potter, and the people at the Water Resources Research Center for help and support in my laboratory work. Without them, I would have been lost. I would also like to thank my committee members: Dr. Bill McDowell, Dr. John Aber, Dr. Jacqui Aitkenhead-Peterson, and Dr. Serita Frey for their guidance and suggestions. This project was funded by the Connecticut River Airshed-Watershed Consortium, to whom I am very grateful. My thanks also go to all of my friends and family, who have supported me without fail.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

TABLE OF CONTENTS

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

LIST OF TABLES

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

LIST OF FIGURES

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

ABSTRACT

ABIOTIC RETENTION OF NITROGEN AND DISSOLVED ORGANIC MATTER BY FOREST MINERAL SOILS

by

Naoko Watanabe
University of New Hampshire, September 2006

The effect of NO_3^- deposition on NH_4^+, DON, and DOC retention as well as abiotic NO_3^- retention via the hypothesized "ferrous wheel" mechanism was examined in oxic and anoxic tropical and oxic temperate soils using sorption isotherm experiments. Adsorption of NH_4^+, DON, and DOC by mineral soils was examined in forest floor extracts with DOC levels of 0-50 mg/L. Experimental treatments included no added NO_3^-, 4 mg/L of added NO_3^-, or 4 mg/L of NO_3^- and 2 mg/L of Fe^{3+}. Ferric iron was added since it would likely increase DOC retention in the context of podzolization, and it might also influence N retention. Retention of NH_4^+ and DOC did not change upon NO_3^- addition in any of the soils. Retention of DON increased upon NO_3^- addition in the temperate soil while no adsorption of DON could be demonstrated in the tropical soils. With added Fe^{3+}, NH_4^+ retention decreased in the anoxic tropical soil but remained unchanged in the temperate and oxic tropical soils. Neither DOC nor DON retention in any of the soils was affected by Fe^{3+} addition. The change in retention upon NO_3^- as well as Fe^{3+} addition seems to be related to the mineralogy of the soil and pH of the input solution. As DON and DOC response to NO_3^- was different, N and C cycles may not be fully connected in the soil.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

For abiotic NO_3^- retention, DOC, Fe^{3+}, and hydroquinone are likely to be involved according to the ferrous wheel hypothesis. To examine abiotic NO_3^- retention, different levels of NO_3^- (0-10 mg/L) with no DOC, 50 mg/L of DOC, 50 mg/L of DOC and 2 mg/L of Fe^{3+}, 10 mg/L of hydroquinone, or 10 mg/L of hydroquinone and 2 mg/L of Fe^{3+} was added to the soil and changes in NO_3^- retention were compared. No strong retention was observed in any of the soils despite the treatments. Although there are some experimental conditions that could be changed, the results indicate that the ferrous wheel hypothesis does not explain the NO_3^- retention by mineral soils that has been observed in the field.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

INTRODUCTION

Human activities have increased atmospheric nitrogen (N) deposition to temperate forests in the Northeastern U.S. as well as in other forest ecosystems in the world and have subsequently altered the nutrient cycling in these forests, particularly N. Anthropogenic atmospheric N deposition originates mainly from fossil fuel combustion and N fertilizer application. Fossil fuel combustion, which is a main source of nitrate (NO_3^-) deposition, has increased due to the rise of automobiles and power plants. As NO_x is released into the atmosphere from combustion, it reacts with water and produces nitric acid (HNO_3), which subsequently dissociates into hydrogen ions (H^+) and NO_3^- (Aber and Melillo, 2001). The amount of NO_x emitted from the combustion sources was 6.9 Tg, 6.5 Tg, and 3.3 Tg in the U.S., Asia, and in Europe, respectively, within 21 Tg of the total global NO_x emission in 1998 (Howarth et al., 2002).

The use of N fertilizer, in the form of ammonium (NH_4^+), has increased due to greater demand for food production caused by the human population growth (Galloway and Cowling, 2002). Ammonia that is volatilized from the fertilizers applied on the ground surface is washed off by rain and deposited as NH_4^+ to the earth's surface (Porter et al., 2000). The use of N fertilizer in the U.S. in 1999 was 11.2 Tg yr^{-1}, which largely increased from 3.1 Tg yr^{-1} in 1961. Global use of N fertilizer in 1999 was 86 Tg, and the N from fertilizer makes the largest source of anthropogenic N (Howarth et al., 2002).

The tendency of increasing N deposition has continued not only in the U.S. but also worldwide. In the U.S., NO_3^- and NH_4^+ deposition has spread to larger areas (NADP, 2004). The amount of N emission from developed countries may not increase

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

much in the future; however, if maximum projected human population (~ 8.9 billion people) and the average N emission rate in North America in 1995 (~ 100 kg N person^{-1} yr^{-1}) were achieved worldwide, N emission is expected to increase significantly especially in South America, Asia and in Africa in the future (Galloway and Cowling, 2002).

Considering the expectation that the future atmospheric N deposition will increase even more, how ecosystems will respond to a greater amount of N input is an issue to consider. Water quality is one of the most significant impacts related to increased atmospheric N deposition. Once N is deposited on the ground surface as rain, it percolates into the soil horizons. As N goes down the soil solum, it is taken up by plants and microbes or adsorbed to soil surfaces. Ammonium can be taken up by plants and microbes and tends to be retained by cation exchange sites. Nitrate, however, tends to leach out since its negative charge is not attracted to the negative charge of soil humus and clays. Leached NO_3^-, which increases as the input increases (Magill et al., 2004), percolates to groundwater or to streams and impacts water quality. Ammonium can also leach out if the input is large (Magill et.al., 2004).

Leached N has large effects on aquatic ecosystems and humans. Stream water with high N concentration causes eutrophication and subsequently hypoxia/anoxia in lakes and ponds as well as in estuaries and coastal waters (EPA, 2002). Eutrophication also decreases biodiversity in the sea floor community, such as seaweeds, seagrasses, and corals, as well as planktonic organisms (Vitousek et al., 1997). High N in estuaries and coastal waters may promote toxic algal blooms, which kill fish and shellfish and make the water unsafe to swim (Vitousek et al., 1997; EPA, 2002). High concentrations of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

NO_3^- in groundwater and streams can contaminate the drinking water, which may result in methemoglobinemia, or Blue Baby Syndrome, in human infants. High N concentration in streams also acidifies water, which mobilizes mercury (Hg) and aluminum (Al). Mercury tends to accumulate as the trophic level increases and humans can be indirectly affected by eating Hg-contaminated fish. Aluminum is directly toxic to fish due to its impacts on gill functions and osmoregulation, and results in a decrease in biodiversity (EPA, 2002; Driscoll et al., 2003).

Due to the adverse effects that atmospheric N deposition could have on ecosystems and our everyday lives, researchers have investigated how ecosystems react to increased inputs of N. Aber et al. (1998) examined the effects of long-term N deposition on temperate forests in the Northeastern U.S. In the context of N saturation theory, which suggests that the availability of NH_4^+ and NO_3^- exceeds the demand by plants and microbes and can be detected by increased NH_4^+ and NO_3^- leaching from below rooting zone (Aber et al., 1989), they first hypothesized that high N deposition in the long term would eventually cause more N mineralization followed by nitrification and subsequent dissolved inorganic N (DIN – NH_4^+, NO_3^-) leaching (Aber et al., 1989). However, the result after 6 years of N amendment showed that N mineralization generally declined, and DIN leaching was small relative to the input (Aber et al., 1998). This suggested that forest soils have an ability to retain N inputs and could be an excellent buffer that prevents N from leaching into aquatic ecosystems, such as streams, lakes, and estuaries. After 9 more years of N amendment, they found that most N retention appeared to occur in mineral soils rather than in forest floors (McDowell et al., 2004).

At this point, mechanisms of N retention are not fully understood. Nitrogen

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

uptake by vegetation does occur, but the amount of uptake does not seem sufficient to account for a large fraction of inputs despite the increased amount of atmospheric CO_2. Using a collection of ^{15}N tracer studies, Nadelhoffer et al. (1999) reported that only 20% of N deposition was recovered in plant biomass while 70% of N was recovered in soil (another 10% was lost as leachate and gas). Microbial immobilization is another possible mechanism of N retention; however, Micks et al. (2004) reported that microbial respiration did not increase as N was added. But at the same time, a large amount of N that was applied to the plots disappeared in the soils. They referred to this discrepancy as an abiotic N immobilization rather than microbial immobilization (Micks et al., 2004).

Abiotic immobilization of N, especially NO_3^-, is a topic that is getting increasing attention recently. Studying NO_3^- immobilization in zero and high N (15 g N m^{-2}) input plots at the Harvard Forest, Berntson and Aber (2000) reported that fast abiotic NO_3^- immobilization seemed to be a major pathway to retain NO_3^- in soils in pine plots regardless of the amount of N input as well as in the high N input hardwood plots. These plots seemed to lose the slow microbial N immobilization pathway. Dail et al. (2001) documented that a large amount of $^{15}N\text{-}NO_3^-$ added to soils disappeared within 15 minutes and was recovered in dissolved organic nitrogen (DON). Davidson et al., (2003) suggested a "ferrous wheel hypothesis", which is a hypothesized mechanism of abiotic NO_3^- immobilization to dissolved organic matter (DOM) in the forest floor that is mediated by iron (Fe).

If such a mechanism occurs widely in soils, then N retention by mineral soils, which often contain large amounts of Fe, receive large DOM inputs from the overlying forest floor, and show net N retention in long-term experiments (McDowell et al., 2004)

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

might be an important pathway for N conservation in forest ecosystems. The forest floor is the main source of DOC, NO_3^-, and NH_4^+ in forest soils (Solinger et al., 2001) and they are all transferred to mineral soils and typically lost from solution by a wide variety of biotic and abiotic pathways before reaching deeper groundwater or surface runoff (Qualls and Haines, 1992; Solinger et al., 2001). Considering these reports, I chose to examine the retention of NO_3^-, NH_4^+, and organic matter (DOC and DON) in several forest soils. Mechanisms of abiotic retention are not well studied in mineral soils, although tropical soils are known to be most likely to retain NO_3^- abiotically (Cahn et al., 1992; Rasiah et al., 2003). Ammonium can be fixed by 2:1 clays (Sparks, 2003). There is a report that the retention of NH_4^+ in mineral soil is related to base saturation and cation exchange capacity (CEC) (Matschonat and Matzner, 1996), but, in general, studies on abiotic NH_4^+ in mineral soils are scarce.

In addition to its importance in potential regulations of N flux, examining the dynamics of DOC in mineral soils will provide perspective in terms of C sequestration. Soils, especially mineral soil horizons, are considered to be large C sink (McDowell and Likens, 1988). Carbon can be sequestered in the soil as DOC is adsorbed; for example, McDowell and Wood (1984) reported an adsorption of DOC to the B horizon soils in temperate forest in the Northeastern U.S. They suggested that DOC would quickly precipitate with Fe on the B horizon soil in the podzolization process, which is a soil forming process in which Fe and Al are leached from the E horizon and are deposited in the B horizon. Tropical soil, which tends to contain a high amount of Fe and Al oxides, is reported to retain DOC as well (McDowell, 1998; Schwendenmann and Veldkamp, 2005). This ability of C sequestration in soils, however, may change in the situation of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

high N deposition due to competition and interaction between DOC and NO_3^-, which are both negatively charged. Since N deposition is speculated to increase, its effect on DOC retention is worth examining.

The presence of Fe does seem to play an important role in DOC retention in soils. For example, in their podzolization experiment, McDowell and Wood (1984) reported that more DOC was adsorbed to the B horizon when ferric iron (Fe^{3+}) was added to the soil solution. Dissolve organic carbon retention may be changed by N deposition; however, addition of Fe to soil solution, which would simulate the leaching of Fe from the upper soil horizon, would further alter DOC adsorption in an enhanced N condition. Adding Fe may affect DON and DIN dynamics as well.

Addition of Fe may indirectly influence N retention, especially NO_3^-, in mineral soils, too. As DOC percolates through the soil horizons, it is possible that DOC gets involved not only in the retention but also in some interactions with other chemical components. In the studies by Davidson et al. (2003) and McDowell and Wood (1984), DOC (DOM) and Fe seem to be common factors.

In the ferrous wheel hypothesis, Davidson et al. (2003) suggested that reduced C in the soil, such as hydroquinone, phenol, DOC, and humic substances can reduce Fe^{3+} in soil minerals. Subsequently reduced Fe^{3+} becomes Fe^{2+} and Fe^{2+} reduces NO_3^- to NO_2^-. Nitrite is highly reactive and is known to react with phenolic compounds to produce nitrophenols. Phenolic compounds are components of DOM and they hypothesized that NO_2^- reacts with DOM (DOC) to produce DON, although they only suggested possible fates (e.g. microbial uptake, adsorption, leaching) of DON. In the podzolization process, DOC precipitates with Fe in the B horizon (McDowell and Wood, 1984). Combining

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

these 2 studies, it may be possible that NO_3^- would react with DOC and the NO_3^--DOC component precipitates onto the mineral soils in the presence of Fe, which is abundant in the mineral soils. Hydroquinone could be used to examine if the combination of the ferrous wheel hypothesis and the podzolization process would increase NO_3^- adsorption. Hydroquinone is contained in the hydrophobic portion of DOC and is abundant in the soil (Cory and McKnight, 2005). Hydroquinone is a reduced form and as it is oxidized, it can reduce Fe^{3+} to ferrous iron (Fe^{2+}), which may further drive the ferrous wheel hypothesis and increase NO_3^- adsorption.

For this study, I conducted a series of adsorption experiments to examine retentions of NO_3^-, NH_4^+, DOC, and DON by mineral soils. I added forest floor extract with and without added NO_3^- to the mineral soils and compared the sorption of NH_4^+, DON, and DOC in the presence of high and low NO_3^- concentrations. I also examined NO_3^- sorption with and without added DOC, DOC and Fe^{3+}, hydroquinone, or hydroquinone and Fe^{3+}, as these are all potentially important in NO_3^- retention according to the ferrous wheel hypothesis. Adding Fe^{3+} would increase reducing power to drive NO_3^- retention as well as DOC adsorption.

Three contrasting soils were chosen for this study. One soil is from the Northeastern U.S., where large-scale N retention has been repeatedly observed, and 2 soils are from Puerto Rico. Soil properties, such as Al, Fe and organic matter (total CN) contents, soil texture, and pH were measured. Using tropical soils is important since studies on N retention and dynamics in tropical soils are scarce even though the tropical regions are expected to have increased atmospheric N emission (Galloway and Cowling, 2002) and possibly deposition in the future. Also, tropical soils tend to contain high Fe,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

and some are known to adsorb NO_3^-. Iron is a part of the ferrous wheel hypothesis, and as it is reduced, reduced Fe will further reduce NO_3^- to drive the mechanism. For this reason, NO_3^- retention via the ferrous wheel hypothesis could be easily observed in tropical soils. Due to the different soil properties, C and N retention and susceptibility to NO_3^- deposition may be different in these 3 soils. Examining the difference would be useful to predict each ecosystem's response to increased atmospheric N deposition as well as provide a wide range of conditions under which N and DOM retention can be examined.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER I

OBJECTIVES OF STUDY

Objective 1. Determine the form of N that is best retained in mineral soil and the sensitivity of retention to NO_3^- concentration as well as to Fe^{3+} input.

H1 The order of N retention in mineral soil will be NH_4^+>DON>NO_3^-, and is unaffected by NO_3^- levels.

H2 Adding Fe^{3+} and NO_3^- will change NH_4^+ and DON retention in soils.

Objective 2. Determine effects of NO_3^- and Fe^{3+} on DOC retention.

H1 Adding NO_3^- will not change DOC adsorption in soils.

H2 Adding Fe^{3+} and NO_3^- will increase DOC adsorption in soils.

Objective 3. Test the applicability of the ferrous wheel hypothesis to mineral soils.

H1 Adding DOC will increase NO_3^- adsorption in soils.

H2 Adding DOC and Fe^{3+} will increase NO_3^- adsorption in soils.

H3 Adding hydroquinone will increase NO_3^- adsorption in soils.

H4 Adding hydroquinone and Fe^{3+} will increase NO_3^- adsorption in soils.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER II

MATERIALS AND METHODS

Study sites

Among 3 soils that I used for my experiments, 2 soils were sampled from the Luquillo Experimental Forest in Puerto Rico. The Luquillo Experimental Forest has been used for tropical ecosystem study for about 100 years (Long Term Ecological Research Network, 2004). Within the experimental forest, soils were sampled from the Sonadora and the Icacos watersheds. In the Sonadora watershed, the dominant soil is Los Guineos clay (Ultisols) and the bedrock is andesite, mudstone origin. Main vegetation types are palms (*Prestoea montana*), and tabunuco (*Dacryodes excelsa*). In the Icacos watershed, the dominant soil is Utuado clay (Inceptisols) and the bedrock is quartz diorite. Vegetation types are dominated by colorado (*Cyrilla racemiflora*) and palms (*Prestoea montana*) (McDowell et al., 1992; McDowell and Asbury, 1994). In the Sonadora watershed, the soil was oxic and bright orange in color. In the Icacos watershed, a riparian soil was sampled, which was highly anoxic and pale grayish in color.

Another soil was sampled from a temperate region in the northeastern United States. College Woods is a study facility that is a part of the University of New Hampshire campus in Durham, NH. The site is located in the Oyster River watershed in the seacoast region of NH. The soil series of the sampling site is the Hollis-Charlton complex (Spodosols). The bedrock type of the Hollis series is quartzite, but the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Charlton series contains calcareous schist materials (Soil Survey, 1973); therefore, the soil is expected to have weathered materials from these 2 components. The dominant vegetation at the sampling site is eastern hemlock (*Tsuga canadensis*). The soil was oxic and the color was yellowish brown.

Soil sampling, processing, and DOC preparation

Sonadora and Icacos soils were collected by William H. McDowell in December 2005. The E horizon soils were chosen since Fe is abundant due to laterization, which is a soil forming process that silicon (Si) is leached from the E horizon and Fe and Al are left in the E horizon (Aber and Melillo, 2001).

College Woods soil was collected by the author and Jacqueline A. Aitkenhead-Peterson in March 2006. Forest floor was removed and the ground was dug using a shovel to the depth of 40 to 60 cm and the soil from the Bs horizon was collected using a scoop. The Bs horizon was chosen for its high iron and low organic matter contents.

All the soils were taken back to the soil laboratory at the University of New Hampshire for processing. For drying, the soil was spread on a clean aluminum tray and left with a paper towel cover on at room temperature in the laboratory until it dried (1 to 2 weeks). Upon drying, large clumps were cut or broken into small pieces as necessary to make the subsequent processing easier. Dried soil was sieved at 2 mm and pieces of organic matter were removed from the soil during the processing. A mortar and a pestle were used to break hard clumps and make them go through the sieve. Even though I was measuring abiotic processes, the soils were not sterilized since sterilization methods (e.g. UV radiation, autoclave, $HgCl_2$) can change soil properties (Dail et al.,

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

2001; Barrett et al., 2002). The sieved soil was stored in a plastic bag at room temperature until the time of the experiment.

The forest floor solution that was used in the experiment was extracted from the corresponding forest floor collected in College Woods and the Luquillo Mountains. College Woods forest floor was collected in July 2005, and the tropical forest floor was collected in 2004 from the Icacos watershed. To extract the solution, 20 g of forest floor material and 1 L of deionized distilled water (DDW) were placed in a plastic bottle and shaken for 24 hours. The solution was first filtered with a Whatman GF/C (1.2 μm) and then with a GF/F (0.7 μm) glass-fiber filters under vacuum. Twenty grams of the filtrate was transferred into a 60 mL HDPE bottle and diluted with 40 g of DDW to be used for DOC analysis (measured as the non-purgeable organic carbon with a Shimadzu TOC-V total carbon analyzer). The concentration of the original (stock) solution was back-calculated from the concentration of the diluted sample using the following equation.

$$[\text{stock solution}] = [\text{diluted sample}] \times (\text{mass}_{\text{sample}} + \text{mass}_{\text{DDW}}) / (\text{mass}_{\text{sample}})$$

The rest of the filtrate was stored in 500 mL plastic bottles and kept frozen until the time of experiment.

Experimental procedures

To examine changes in retention of NH_4^+, DON, and DOC in the soil upon NO_3^- addition, I conducted sorption isotherm experiments (Nodvin et al., 1986) using various dilutions of forest floor extract with and without added NO_3^- (4 mg/L). Input solutions in each treatment were made in 100 mL flasks. For the treatment with no NO_3^- added, 0, 10, 20, 30, 40, and 50 mg/L of DOC solutions and associated concentrations of NH_4^+ and

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

DON (0-1.25 and 0-1.57 mg/L, respectively) were prepared. Concentration of NO_3^- in the solution was negligible. A mass of forest floor stock solution was calculated to achieve a desired concentration of DOC in each flask by using the equation, required mass of stock solution = ([DOC desired] × V of flask) / [stock solution], and was diluted with DDW. For the treatment with added NO_3^-, a mass to achieve 4 mg/L of NO_3^- was added to each flask.

To examine the Fe effect on DOC, DON, and NH_4^+ adsorption, I conducted sorption isotherm experiments that contained 0-50 mg/L of DOC in forest floor extract, 4 mg/L of added NO_3^-, and 2 mg/L of added Fe^{3+}. Dissolved organic carbon and NO_3^- were calculated and prepared as described earlier and a required mass to achieve 2 mg/L of Fe^{3+} was added to each flask.

To test the ferrous wheel hypothesis, I conducted NO_3^- sorption isotherm (0-10 mg/L NO_3^-) on a stock NO_3^- solution with and without DOC added at 50 mg/L. I also examined the effects of added Fe^{3+} as well as hydroquinone on NO_3^- sorption by conducting experiments with 1) 50 mg/L DOC and 2 mg/L Fe^{3+}, 2) 10 mg/L hydroquinone, and 3) 10 mg/L hydroquinone and 2 mg/L Fe^{3+}.

Each treatment had 2 replicates and the weight of NO_3^-, $FeCl_3$, and DOC added to each flask was recorded to calculate exact concentrations. The stock solutions of NO_3^-, $FeCl_3$, and hydroquinone were made from $NaNO_3$, anhydrous $FeCl_3$, and granulated hydroquinone (HOC_6H_4OH), respectively. For the soil, 3.5 g was weighed in a 50 mL plastic centrifuge tube. Exact weight of the soil was also recorded.

All the treatments were done with each of the 3 different soils. Thirty five grams of the input solution was added to the soil and the exact weight was recorded.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

After solutions were added to all the tubes, they were placed in a refrigerator to suppress microbial activities. To ensure a good contact between the soil and the solution, the mixture was gently inverted 5 times every 15 minutes for 2 hours. About 30 minutes before the end of the 2 hours, a centrifuge was run for 20 minutes to refrigerate the inside of the machine to 5 °C. After 2 hours, tubes were centrifuged at 46,000G for 20 minutes. Supernatant liquid was taken carefully not to disturb the soil at the bottom using a plastic syringe. The liquid was first transferred to a glass vial for pH measurement. After that, the liquid was filtered through a Whatman GF/F (0.7 μm) glass-fiber filter and 20 g of the liquid was transferred into a 60 mL HDPE bottle. The sample was diluted with 40 g of DDW. Both the liquid and DDW weight were recorded. The input solution was also transferred into the same type of bottle in the same manner but without filtering. The diluted samples as well as the input solution were kept frozen until the time of analyses.

Soil property analyses

Soil CN, exchangeable and organically bound Al and Fe, exchangeable magnesium (Mg) and manganese (Mn), soil pH, and soil texture were measured on each soil. For the soil CN, the soil was first ground to a flour-like texture and analyzed by combustion using a Perkin Elmer 2400 Series II CHNS/O Analyzer. Exchangeable and organically bound Al and Fe and exchangeable Mg and Mn in the soil were extracted using KCl and sodium pyrophosphate extraction methods, respectively, and the samples were sent to the Department of Plant and Soil Science at the University of Vermont for the analysis. For soil pH, 10 g of soil and 20 g of DDW were placed in a glass beaker and stirred manually for 15 minutes. After the soil settled down, pH was measured.

Soil texture was measured using the hydrometer method. Thirty grams of soil

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

was weighed in a plastic jar and 100 mL of 5 % sodium hexametaphosphate solution was added. The lid of the jar was tightly closed and the mixture was agitated on a shaker for 24 hours. After 24 hours, the mixture was transferred into a 1000 mL cylinder and DDW was added to fill the cylinder to 1000 mL. A control was also prepared by putting 100 mL of 5 % sodium hexametaphosphate solution and DDW in another 1000 mL cylinder. The cylinders were inverted several times to homogenize the mixture. Temperature and hydrometer readings were taken about 20 seconds after they were put into the mixture. After the first reading, the cylinders were covered and left for 2 hours until the second reading. Percent sand and clay were calculated based on the first and second readings, respectively, and % silt was obtained by subtracting % sand and clay from 100%. All the soil properties are described in Table 1.

Chemical analyses and data presentation

Nitrate, NH_4^+, DOC, TDN, and soil CN analyses were done at the Water Resources Research Center at the University of New Hampshire. Nitrate and NH_4^+ were analyzed colorimetrically, using the USEPA 353.3 method (reduction by Cd-Cu) and the USEPA 350.1 method (reaction with phenol and then hypochlorite), respectively, with a WestCo SmartChem Discrete Wet Chemistry Analyzer. Dissolved organic carbon and TDN were analyzed by high temperature Pt-catalyzed combustion using a Shimadzu TOC-V Total Carbon Analyzer. Since all the samples were diluted, the concentrations obtained by the analyses were back-calculated in the same manner as stated for the DOC stock solution above. Dissolved organic nitrogen concentration was calculated by the equation, $[DON] = [TDN] - [NO_3^-] - [NH_4^+]$.

The retention of NO_3^-, NH_4^+, DON, and DOC were analyzed using the initial

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

mass isotherm approach (Nodvin et al., 1986). In the initial mass isotherms, the mass of a component in the input solution (Xi) and the mass of component retained or released (RE) are plotted on the x-axis and the y-axis, respectively, and both are presented as mass per unit soil mass (μg/g). The mass retained by or released from the soil is obtained by subtracting the mass of a component in the output solution from the input solution. The Xi and RE values were based on the average of 2 replicates. The relationship between Xi and RE is explained by the equation, RE = mXi – b. The partition coefficient (slope, or m) represents the fraction of the Xi retained in the soil. The larger the value, the greater the affinity of the component for the soil. The release term (b) represents the amount of component that is released when Xi = 0.

Throughout this study, I used the m and b values as well as the equilibrium, which is the x intercept, to describe the isotherm regression. The equilibrium is the point where no release or retention of a component occurs in the soil-solution system and the value was obtained by calculating for Xi when RE is zero. The m value ranges between 0 and 1 when sorption has occurred (Nodvin et al., 1986), and when an m value is negative, it indicates that no retention of a chemical component has occurred. The b value is supposed to be negative (Nodvin et al., 1986) and the equilibrium should be positive. When values of those parameters were not in the appropriate range, they were not reported on the tables.

Statistical analyses

When the regression describing the sorption experiment was not statistically significant, it was not used in the statistical analyses. Treatment effect on the retention of chemical components was analyzed using Analysis of Covariance to test the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

homogeneity of slopes. Throughout the statistical analyses, a result was considered as significant when $p<0.05$.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER III

RESULTS

N retention in systems that did not receive NO_3^- addition

The order of N retention was different in each soil, which did not agree with my original hypothesis. In the College Woods soil, NH_4^+ and DON retention were not significantly different (Figure 1a, Table 2). In the Sonadora soil, NH_4^+ showed higher retention than that of DON (Figure 1b, Table 2). In the Icacos soil, since the regression of DON retention was not significant, the difference between NH_4^+ and DON retention was not analyzed (Figure 1c, Table 2). The pH of the input solution decreased as DOC concentration increased for all the soils (Table 3).

The concentration of NO_3^- that was originally present in the forest floor extract was small, and the concentration of NO_3^- in the input solution for the temperate and tropical soils was 0-90 μg/L. At this concentration level, it was difficult to be confident about the analyzed values for the input solution as well as the output solution, and thus I have not reported NO_3^- sorption with no added NO_3^-.

Effect of NO_3^- on DON and NH_4^+ retention and their changes by Fe^{3+} addition

Upon NO_3^- addition, DON retention significantly increased in the College Woods soil (Figure 2a, Table 4). For the Sonadora and Icacos soils, the difference in DON retention was not analyzed due to the lack of significance in the regression of one of the treatments (Figure 2b, 2c, Table 4). Dissolved organic N retention did not significantly change compared to NO_3^- addition alone when both NO_3^- and Fe^{3+} were

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

added to College Woods (Figure 2a, Table 4). In the Sonadora and Icacos soils, the effect of Fe^{3+} on DON retention was not analyzed because of the lack of significance in one or both of the treatment isotherms (Figure 2b, 2c, Table 4).

Ammonium retention did not change significantly upon NO_3^- addition in any of the soils (Figure 3, Table 5). Ammonium retention was lower in the Icacos soil compared to the College Woods and Sonadora soils. As Fe^{3+} was added, the retention still did not change significantly in the College Woods and Sonadora soils (Figure 3a, 3b, Table 5). In the Icacos soil, NH_4^+ retention significantly decreased with Fe^{3+} addition (Figure 3c, Table 5).

The pH of the input solution increased upon NO_3^- addition in the College Woods and Icacos soils, while it decreased in the Sonadora soil (Table 6). Upon Fe^{3+} addition, pH of the input solution largely decreased in all the soils (Table 7).

Effect of NO_3^- on DOC retention and its change by Fe^{3+} addition

The addition of NO_3^- did not affect DOC retention in any of the soils (Figure 4, Table 8). Addition of Fe^{3+} and NO_3^- also had no effect on DOC retention in any of the soils (Figure 4, Table 8).

NO_3^- adsorption and the ferrous wheel hypothesis

In the College Woods soil, the regression for NO_3^- retention was not significant in most of the treatments; therefore, the effect of the treatments could not be analyzed, as adsorption did not occur (Figure 5, Table 9). In the Sonadora soil, NO_3^- sorption only occurred in 3 of the treatments, and there was no difference in NO_3^- sorption among those treatments (Figure 5, Table 9). Although the treatment effect was not significant, some NO_3^- retention does seem to occur in this soil. For the Icacos soil, the regression of

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

NO_3^- retention was not significant in any of the treatments. There is no “m” when the regression is not statistically significant.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

CHAPTER IV

DISCUSSION

N retention in systems that did not receive NO_3^- addition

The order of retention in N species was different in each soil, and thus I am forced to reject my original hypothesis. In the College Woods soil, retention of NH_4^+ and DON was not different. As quartzite and schist weather, quartz sandstone, feldspar, and mica (biotite and/or muscovite) would be produced (Fichter, 2000). The point of zero charge (pzc) is the point at which surface charge is zero and the surface gives negative charge when pH is higher than the pzc. The pzc is low in quartz and feldspars (2.0-2.4) (Sparks, 2003). Ammonium retention would be attributed to the presence of these minerals since pH of the input solution was higher than the pzc of quartz and feldspar. Iron is present in the soil; however, since the clay fraction is small in the College Woods soil, Fe would be present as Fe coatings on the minerals, not as Fe oxides. In the study by McCracken et al. (2002), which they studied interactions between DOC and several minerals soils from New Hampshire, they suggested that coatings on the soil partially consist of organic carbon and Fe. For DON adsorption, Kaiser and Zech (2000) reported a linear relationship between DON adsorption and Fe and Al oxides content in the soil. As I stated above, the clay fraction is low in the soil, so Al and Fe oxides are less likely to be related to DON adsorption. It may be the Fe coatings that contribute to DON adsorption.

In the Sonadora soil, NH_4^+ showed higher retention than DON. Ammonium

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

could have been fixed by clays, which accounts for a large portion in the soil texture. The bedrock of the Sonadora soil is andesite, which could be weathered into allophane $[(Al_2O_3)(SiO_2)_{1.3}\cdot 2.5(H_2O)]$, which has high CEC as well as high specific surface area (Sparks, 2003). Although tropical soils tend to contain high kaolinite, which has low CEC and low expandability, allophane content would have enhanced NH_4^+ retention in the Sonadora soil. There is another report that Puerto Rican Ultisols also contains smectite up to 19% (Appel et al., 2003). Smectite has relatively high CEC as well as high expandability (Sparks, 2003). This may also have contributed to NH_4^+ retention.

Dissolved organic N retention was the second most readily adsorbed form of N in the Sonadora soil. Although the soil has high clay content, clay is not as effective as Fe and Al oxides in DON retention (Kaiser and Zech, 2000). Since Al and Fe content, especially organically bound Fe, is low in the Sonadora soil, the soil may not contain high Al and Fe oxides, which could be related to the lower DON retention than that of NH_4^+. However, allophane could possibly be responsible for DON retention. Lilienfein et al. (2004) suggested an importance of allophane in DOC and DON retention.

In the Icacos soil, the regression of DON retention was not significant, and therefore it was not included in the analysis. Ammonium adsorption was low in the Icacos soil. This result seems to correspond to the finding by McDowell et al. (1992), who found that NH_4^+ is the dominant N form in groundwater in the Icacos watershed. As the retention of NH_4^+ is low and the equilibrium amount of NH_4^+ for this soil is quite high, NH_4^+ would leach out to groundwater. The low retention of NH_4^+ could be related to the composition of clay minerals in the soil. The bedrock of the Icacos soil is quartz diorite. Turner et al. (2003) reported that the weathering of the granitic rock into

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

kaolinite, quartz, biotite, and Fe^{3+} oxides in the Icacos watershed. Cation exchange capacity as well as specific surface area of kaolinite and biotite is small (Sparks, 2003), and this can be related to the low retention of NH_4^+.

Effect of NO_3^- on DON and NH_4^+ retention and their changes by Fe^{3+} addition

Effect of NO_3^- on DON and NH_4^+ retention was different among the soils, and therefore my hypotheses were rejected. In the College Woods soil, DON retention significantly increased upon NO_3^- addition. Change in NH_4^+ retention was not significant. The difference that would be related to NO_3^- addition in the input solution would be pH. Comparing the pH of the input solution of the 2 treatments, pH was slightly higher with NO_3^- addition. Since pH upon NO_3^- addition was still above the pzc of quartz and feldspar, NH_4^+ retention was probably not affected. For DON retention, functional groups in DON could have been affected by the pH change, which may be related to the change in the retention, although the change in pH seems to be too small.

Addition of Fe^{3+} did not change DON and NH_4^+ retention compared to the treatment that NO_3^- was added. As pH largely decreased upon Fe^{3+} addition, some changes in charges in DON as well as in the soil would have occurred, but the retention did not reflect it. One possibility is a reaction between Fe^{3+} and DON. Dissolved organic N is reported to have a pattern of adsorption to Fe oxides as similar as DOC (Kaiser and Zech, 2000). Also, DOC is known to precipitate with Fe^{3+} (Nierop et al., 2002). Although conditions that are related to DON adsorption or desorption are still not clear (Kalbitz et al., 2000), it is possible that DON may also precipitate with Fe^{3+}. Precipitation of DOC with Fe^{3+} seemed to happen in my experiment since DOC concentration of the input solution was lower than that of I aimed at whenever I added

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Fe^{3+}. Dissolved organic N concentration is much lower than that of DOC and it makes it difficult to tell if the precipitation of DON and Fe^{3+} actually occurred. If this really happened, DON retention would be higher than the reported value. No change in NH_4^+ retention could be because the pzc of quartz and feldspars is still lower than the pH of the input solution.

In the Sonadora soil, a change in DON retention upon NO_3^- as well as NO_3^- and Fe^{3+} addition was not analyzed due to a lack of significance in the regression describing the sorption isotherm. Ammonium retention did not change upon NO_3^- as well as Fe^{3+} addition. The pH of the input solution decreased upon NO_3^- addition and decreased even more as Fe^{3+} was added. No change in NH_4^+ retention in the both treatments could be attributed to the presence of smectite, which has minor variable charges.

For the Icacos soil, a change in DON retention upon NO_3^- as well as Fe^{3+} addition was not analyzed because the regression describing the sorption isotherm was not significant. Ammonium retention did not change upon NO_3^- addition but decreased upon Fe^{3+} addition. The pH of the input solution increased a bit when NO_3^- was added, but decreased as Fe^{3+} was added. Cation exchange capacity of the soil could be low in the first place since kaolinite and biotite would be the dominant minerals in the soil. The pzc of kaolinite is about 4.6 to 4.8 (Sparks, 2003). Since the pH in the input solution upon NO_3^- addition was still above the pzc of kaolinite, it would not affect CEC. But as pH decreased upon Fe^{3+} addition, CEC could have decreased as pH got in the range of the pzc of kaolinite.

Effect of NO_3^- on DOC retention and its change by Fe^{3+} addition

With and without addition of NO_3^-, DOC retention in the College Woods soil

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

was high. The soil has a substantial fraction of sand; however, Al and Fe contents are high. As I mentioned earlier, the clay fraction is small, and Al and Fe oxides could not have contributed much to DOC retention. Iron in the soil might exist as Fe coatings (McCracken et al., 2002) rather than as Fe oxides. Dissolved organic C would be adsorbed to the Fe coatings and it could result in high DOC retention.

Dissolved organic C retention was not changed by NO_3^- addition in the College Woods soil. Nitrate addition to the input solution did not seem to affect DOC retention at all, which is a little different from DON retention. Kaiser and Zech (2000) reported a similar pattern of retention of DOC and DON to mineral soils, but they did not examine how the retention of DOC and DON would be altered by adding NO_3^-. A change in the retention could be related to different functional groups that are expected to be present in DOC and DON, which would respond differently to a change in pH that might be related to the addition of a chemical component. Or, in the case of my experiment, in which the change in pH was not large, NO_3^- might have an influence on DON but not the DOC retention mechanism. In the Harvard Forest chronic N amendment study, no change in DOC flux and a large increase in DON flux have been reported (McDowell et al., 2004). This could also suggest that DOC and DON behave differently and their cycles may not be fully connected. As NO_3^- was added at only one concentration in my experiment, a range of NO_3^- concentration additions may be useful to obtain a more detailed view of DOC and DON dynamics and their differences.

With only DOC addition, DOC retention was high in the Sonadora soil, and it is probably due to its high clay content. Although the Sonadora soil has low Fe content, clay is reported to compensate for low Fe in retaining DOC (Fiedler and Kalbitz, 2003).

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Also, allophane could contribute to DOC retention. Lilienfein et al. (2004) observed that DOC and DON retention are linearly related to allophane concentration.

Dissolved organic C retention isotherms also did not change upon NO_3^- addition in the Sonadora soil. The pH of the input solution decreased upon NO_3^- addition; however, it did not seem to affect DOC retention. Functional groups on DOC might not have been affected by the pH, which may be related to the insignificant change in DOC retention.

Dissolved organic C retention in the Icacos soil was lower than other 2 soils when only DOC was added and it could be because of high sand content although the soil has high Fe content. High Fe content despite the anoxic condition is puzzling as mentioned earlier. But another contradictory thing is the low DOC retention although Fe oxides have been reported to retain DOC (Jardine et al., 1989; McDowell and Wood, 1984). One possible explanation is that Fe might exist as surface coating of minerals and not necessarily as weathered minerals, which I also suggested for the College Woods soil. If most of the Fe exists as a surface coating, then it would be mostly on the sand fraction. The surface area of the sand fraction is small compared to that of clay minerals. Dissolved organic C would be retained to the Fe coatings, but the amount would be small.

However, this idea may not make sense since the College Woods soil also has a substantial sand fraction and showed much higher DOC retention. Another explanation could attribute to the nature of the bedrock. As I mentioned, the bedrock of the Icacos watershed is quartz diorite and it is reported that the weathering of the granitic rock into kaolinite, quartz, biotite, and Fe^{3+} oxides (Turner et al., 2003). Although Fe^{3+} oxides would be left after weathering, biotite [$KMg_{2.5}Fe^{2+}_{0.5}AlSi_3O_{10}(OH)_{1.75}F_{0.25}$] could have

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

contributed a lot to the Fe content. Iron analysis could not differentiate Fe^{3+} and Fe^{2+}. If biotite dominated the Fe content, it might not have contributed a lot to DOC retention. Nierop et al. (2002) observed a weak precipitation between Fe^{2+} and DOC. The soil pH, which is higher than other soils, would decrease positive charge in the soil as well. As the soil pH is larger than the pzc of the mineral components in this soil, such as kaolinite and quartz, the minerals would exert negative charge (Sparks, 2003). As DOC exerts negative charge in general, DOC retention would have been small in this soil.

As NO_3^- was added, DOC retention in the Icacos soil did not change. There was a small change in pH in the input solution upon NO_3^- addition, but it does not seem to affect the retention of DOC. Since the change in pH was small, functional groups of DOC might not have been affected.

When Fe^{3+} was added in the presence of NO_3^-, DOC retention did not change in the College Woods and Sonadora soils, and the Icacos soils. However, the result from my experiment on DOC retention with Fe^{3+} addition could be misleading since Fe^{3+} could have precipitated out with DOC in the input solution. To measure the retention of N species and DOC, I analyzed for their concentrations in the input and output solutions and subtracted the output concentration from that of the input. During the analyses, I noticed that the DOC concentration in the input solution was lower than the target concentration when I added Fe^{3+} to the input solution. Nierop et al. (2002) observed a strong quick precipitation when they added Fe^{3+} to DOM at molar metal/carbon was more than 0.014. It was not related to pH. Considering the fact that the concentration of Fe^{3+} that I added to the input solution was high, and some flocculates were observed in the input solution, it is possible that the precipitation of DOC with Fe^{3+} occurred in my

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

experiment.

Since I could not confirm the exact DOC concentration before precipitation occurred, I used the concentration that was measured in the input solution. Therefore, if the amount of the precipitated DOC in the input solution is considered, DOC retention would be much higher in all the soils in the presence of Fe^{3+}. As Jansen et al. (2004) suggested that organic matter mostly adsorbed to freshly created Fe in the lower B horizon in addition to the precipitation as organo-Fe complexes, it would have been closer to the real podzolization situation if I have added Fe^{3+} to the soil, not to the input solution. Another thing to consider regarding the legitimacy of the experiment is the experimental condition for the Icacos soil. The Icacos soil is originally an anoxic soil and it might not have been appropriate to dry it. Moreover, the experiment was done under oxic conditions. If Fe^{3+} was added to an anoxic environment, it would be reduced to Fe^{2+}, subsequently dissolved, and leached out. In that case, even if Fe^{3+} comes into an anoxic environment, it is less likely to contribute to DOC retention. In that sense, my experiment was not simulating the field conditions. In the field, however, a reduction in DOC concentration in the course of riparian zone to the stream has been observed in the Icacos watershed (Chestnut and McDowell, 2000). As Fe would not be accounted for much of DOC retention, there could be other factors that are related to the removal of DOC in a course of riparian zone. There was a small DOC retention when only DOC was added in my experiment. As Fe that would contribute to DOC retention would be small in the first place in the soil, this DOC retention would be corresponding to the decrease in DOC concentration in the course of riparian zone to the stream in the field.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

NO_3^- adsorption and the ferrous wheel hypothesis

When only NO_3^- was added, NO_3^- retention was much lower than that of DON, NH_4^+, and DOC. Retention was observed in the College Woods and Sonadora soils, but not in the Icacos soil. Sonadora soil showed generally higher retention than the College Woods soil, and this could be because of the presence of allophane. Ryan et al. (2001) reported that Al-rich allophane, which is less weathered, adsorbed more NO_3^- compared to Si-rich allophane, which is highly weathered. Aluminum content is actually low in the Sonadora soil, which may indicate the soil contains less Al-rich allophane; however, retention of NO_3^- would be related to the presence of allophane.

The treatment did not have an influence on NO_3^- retention in any of the soils. Mostly, the regression of NO_3^- retention was not significant or NO_3^- retention did not occur. Even if the regression was significant, the treatment did not have any effect on NO_3^- retention. Among the soils, however, the Sonadora soil seems to show a small amount of NO_3^- retention, although it is not related to the treatment. There are some factors that should have been scrutinized before the experiment. The possible precipitation of DOC with Fe^{3+} in the input solution, which is mentioned earlier, is one of them. Although I added Fe^{3+} to increase the opportunity for Fe^{2+} production through reduction by DOC, Fe^{3+} did not behave as I expected. Adding Fe^{2+} might give a different result as it would not precipitate with DOC.

Another thing to consider is the quality of DOC. Since I did not further analyze the components of DOC, I do not know it contained constituents that have reducing power. It is possible that those components were not high enough to reduce Fe^{3+}. It would have been useful to analyze DOC for Fe^{3+}, Fe^{2+}, and reductants before the

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

experiment. Also, if I wanted to simulate the situation in the B horizon as closely as possible, I should have used soil solution from the upper B horizon, not forest floor extract, since the composition and component that has reducing power in DOC would be different. Ussiri and Johnson (2004) actually reported that characteristics of DOM that was extracted from the O horizon and Bh horizon was different; high alkyl-C and carboxyl C in the Bh horizon and high O-alkyl C in the O horizon.

Use of hydroquinone, with strong reducing power, did not result in enhanced NO_3^- retention. The reason why I used hydroquinone is to increase reducing power in the input solution to enhance the "ferrous wheel" reaction. Nitrate retention did not increase when only hydroquinone was added as well as when it was added with Fe^{3+}. Davidson et al. (2003) suggested that NO_3^- can be reduced to NO_2^- in anaerobic microsites. Since I dried and sieved the soil at 2 mm, anaerobic microsites could have been decreased. For the Icacos soil, I should have done the experiment under anaerobic conditions. It would have been better if I used field moist, unseived soil.

Conclusion

The results of my experiments would indicate immediate responses in N and DOC retention upon NO_3^- deposition. Nitrogen and C dynamics can be affected by NO_3^- addition although the magnitude and tendency of the change would be different in each soil, which could be related to soil properties as well as pH. More detailed analyses on soils properties, such as clay mineralogy, would be useful to examine further retention mechanisms. Although not all the changes were significant, DON retention seems to be more influenced by NO_3^- addition than NH_4^+ retention. Effects of NO_3^- addition on DOC retention were generally smaller than on N species retention and a

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

decrease in retention was not observed in any of the soils. This may suggest that DOC dynamics are less susceptible to a change caused by NO_3^- deposition. As DON responses to NO_3^- addition were different from that of DOC, C and N cycles could be different in the soil.

For NO_3^- retention, strong retention was not observed in any of the soils, which supports previous studies (Nodvin et al., 1986; Kaiser and Zech, 1996). Adding Fe^{3+} or hydroquinone did not influence NO_3^- retention, either. Although there are some experimental conditions that can be changed, my results suggest that the ferrous wheel hypothesis does not explain the net retention of N by mineral soils that has been inferred from the results of field manipulations.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

REFERENCES

Aber, J.D., K.J. Nadelhoffer, P. Steudler, and J.M. Melillo. 1989. Nitrogen saturation in northern forest ecosystems. Bioscience **39**: 378-386.

Aber, J., W. McDowell, K. Nadelhoffer, A. Magill, G. Berntson, M. Kamakea, S. McNulty, W. Currie, L. Rustad, and I. Fernandez. 1998. Nitrogen saturation in temperate forest ecosystems: Hypotheses revisited. Bioscience **48**: 921-934.

Aber, J.D., and J.M. Melillo. 2001. Terrestrial Ecosystems. Second edition. Academic Press, San Diego, CA, USA.

Appel, C., L.Q. Ma, R.D. Rhue, and W. Reve. 2003. Selectivities of potassium-calcium and potassium-lead exchange in two tropical soils. Soil Science Society of America Journal **67**:1707-1714.

Barrett, J.E., D.W. Johnson, and I.C. Burke. 2002. Abiotic nitrogen uptake in semiarid grassland soils of the U.S. great plains. Soil Science Society of America Journal **66**: 979-987.

Berntson, G.M., and J.D. Aber. 2000. Fast nitrate immobilization in N saturated temperate forest soils. Soil Biology and Biochemistry **32**: 151-156.

Cahn, M.D., D.R. Bouldin, and M.S. Cravo. 1992. Nitrate sorption in the profile of an acid soil. Plant and Soil **143**: 179-183.

Chestnut, T.J., and W.H. McDowell. 2000. C and N dynamics in the riparian and hyporheic zones of a tropical stream, Luquillo Mountains, Puerto Rico. Journal of the North American Benthological Society **19**: 199-214.

Cory, R.M., and D.M. McKnight. 2005. Fluorescence spectroscopy reveals ubiquitous presence of oxidized and reduced quinines in dissolved organic matter. Environmental Science and Technology **39**: 8142-8149.

Dail, D.B., E.A. Davidson, and J. Chorover. 2001. Rapid abiotic transformation of nitrate in an acid forest soil. Biogeochemistry **54**: 131-146.

Davidson, E.A., J. Chorover, and D.B. Dail. 2003. A mechanism of abiotic immobilization of nitrate in forest ecosystems: the ferrous wheel hypothesis. Global Change Biology **9**: 228-236.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Driscoll, C.T., K.M. Driscoll, M.J. Mitchell, and D.J. Raynal. 2003. Effects of acidic deposition on forest and aquatic ecosystems in New York State. Environmental Pollution **123**: 327-336.

EPA. 2002. Nitrogen: Multiple and regional impacts. EPA-430-R-01-006. Clean Air Market Programs, United States Environmental Protection Agency. http://www.epa.gov/airmarkets/articles/nitrogen.pdf

Fichter, L.S. 2000. Schist. Metamorphic Rocks. http://csmres.jmu.edu/geollab/Fichter/MetaRx/Rocks/schist1.html. Cited 13 July 2006.

Fiedler, S., and K. Kalbitz. 2003. Concentrations and properties of dissolved organic matter in forest soils as affected by the redox regime. Soil Science **168**: 793-801.

Galloway J.N., and E.B. Cowling. 2002. Reactive nitrogen and the world: 200 years of change. Ambio **31**: 64-71.

Howarth, R.W., E.W. Boyer, W.J. Pabich, and J.N. Galloway. 2002. Nitrogen use in the United States from 1961-2000 and potential future trends. Ambio **31**: 88-96.

Jansen, B., K.G.J. Nierop, and J.M. Verstraten. 2005. Mechanisms controlling the mobility of dissolved organic matter, aluminium and iron in podzol B horizons. European Journal of Soil Science **56**: 537-550.

Jardine, P.M., N.L. Weber, and J.F. McCarthy. 1989. Mechanisms of dissolved organic carbon adsorption on soil. Soil Science Society of America Journal **53**: 1378-1385.

Kaiser, K., and W. Zech. 1996. Nitrate, sulfate, and biphosphate retention in acid forest soils affected by natural dissolved organic carbon. Journal of Environmental Quality **25**: 1325-1331.

Kaiser, K., and W. Zech. 2000. Sorption of dissolved organic nitrogen by acid subsoil horizons and individual mineral phases. European Journal of Soil Science **51**: 403-411.

Kalbitz, K., S. Solinger, J.H. Park, B. Michalzik, and E. Matzner. 2000. Controls on the dynamics of dissolved organic matter in soils: a review. Soil Science **165**: 277-304.

Lilienfein, J., R.G. Qualls, S.M. Uselman, and S.D. Bridgham. 2004. Adsorption of dissolved organic carbon and nitrogen in soils of a weathering chronosequence. Soil Science Society of America Journal **68**: 292-305.

Long Term Ecological Research Network. 2004. Luquillo LTER. http://www.lternet.edu/sites/luq/. Cited 20 July 2006.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Magill, A.H., J.D. Aber, W.S. Currie, K.J. Nadelhoffer, M.E. Martin, W.H. McDowell, J.M. Melillo, and P. Steudler. 2004. Ecosystem response to 15 years of chronic nitrogen additions at the Harvard Forest LTER, Massachusetts, USA. Forest Ecology and Management **196**: 7-28.

Matschonat, G., and E. Matzner. 1996. Soil chemical properties affecting NH_4^+ sorption in forest soils. Zeitschrift fur Pflanzenernährung und Bodenkunde **159**: 505-511.

McCracken, K.L., W.H. McDowell, R.D. Harter, and C.V. Evans. 2002. Dissolved organic carbon retention in soils: comparison of solution and soil measurements. Soil Science Society of America Journal **66**: 563-568.

McDowell, W.H., and T. Wood. 1984. Podzolization: Soil processes control dissolved organic carbon concentrations in stream water. Soil Science **137**: 23-32.

McDowell, W.H., and G.E. Likens. 1988. Origin, composition, and flux of dissolved organic carbon in the Hubbard Brook valley. Ecological Monographs **58**: 177-195.

McDowell, W.H., W.B. Bowden, and C.E. Asbury. 1992. Riparian nitrogen dynamics in two geomorphologically distinct tropical rain forest watersheds: subsurface solute patterns. Biogeochemistry **18**: 53-75.

McDowell, W.H., and C.E. Asbury. 1994. Export of carbon, nitrogen, and major ions from three tropical montane watersheds. Limnology and Oceanography **39**: 111-125.

McDowell, W.H. 1998. Internal nutrient fluxes in a Puerto Rican rain forest. Journal of Tropical Ecology **14**: 521-536.

McDowell, W.H., A.H. Magill, J.A. Aitkenhead-Peterson, J.D. Aber, J.L. Merriam, and S.S. Kaushal. 2004. Effects of chronic nitrogen amendment on dissolved organic matter and inorganic nitrogen in soil solution. Forest Ecology and Management **196**: 29-41.

Micks, P., J.D. Aber, R.D. Boone, and E.A. Davidson. 2004. Short-term soil respiration and nitrogen immobilization response to nitrogen applications in control and nitrogen-enriched temperate forests. Forest Ecology and Management **196**: 57-70.

Nadelhoffer, K.F., B.A. Emmett, P. Gundersen, O.J. Kjønaas, C.J. Koopmans, P. Schleppi, A. Tietema, and R.F. Wright. 1999. Nitrogen deposition makes a minor contribution to carbon sequestration in temperate forests. Nature **398**: 145-148.

NADP. 2004. N deposition isopleth map; 1994 and 2003. National Atmospheric Deposition Program (NRSP-3). NADP Program Office, Illinois State Water Survey. http://nadp.sws.uiuc.edu/isopleths/annualmaps.asp

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Nierop, K.G.J., B. Jansen, and J.M. Verstraten. 2002. Dissolved organic matter, aluminium and iron interactions: precipitation induced by metal/carbon ratio, pH and competition. The Science of Total Environment **300**: 201-211.

Nodvin, S.C., C.T. Driscoll, and G.E. Likens. 1986. Simple partitioning of anions and dissolved organic carbon in a forest soil. Soil Science **142**: 27-35.

Porter, E., K. Tonnessen, J. Sherwell, and R. Grant. 2000. Nitrogen in the nation's rain. NADP Brochure 2000-01b. National Atmospheric Deposition Program. http://nadp.sws.uiuc.edu/lib/brochures/nitrogen.pdf

Qualls, R.G., and B.L. Haines. 1992. Biodegradability of dissolved organic matter in forest throughfall, soil solution, and stream water. Soil Science Society of America Journal **56**: 578-586.

Rasiah, V., J.D. Armour, N.W. Menzies, D.H. Heiner, M.J. Donn, and S. Mahendrarajah. Nitrate retention under sugarcane in wet tropical Queensland deep soil profiles. Australian Journal of Soil Research **41**: 1145-1161.

Ryan, M.C., G.R. Graham, and D.L. Rudolph. 2001. Contrasting nitrate adsorption in Andisols of two coffee plantations in Costa Rica. Journal of Environmental Quality **30**: 1848-1852.

Schwendenmann, L., and E. Veldkamp. 2005. The role of dissolved organic carbon, dissolved organic nitrogen, and dissolved inorganic nitrogen in a tropical wet forest ecosystem. Ecosystems **8**: 339-351.

Soil Survey of Strafford County, New Hampshire. 1973. Soil Conservation Service, United States Department of Agriculture.

Solinger, S., K. Kalbitz, and E. Matzner. 2001. Controls on the dynamics of dissolved organic carbon and nitrogen in a central European deciduous forest. Biogeochemistry **55**: 327-349.

Sparks, D.L. 2003. Environmental Soil Chemistry. Academic Press, San Diego, CA, USA.

Turner, B.F., R.F. Stallard, and S.L. Brantley. 2003. Investigation of in situ weathering of quartz diorite bedrock in the Rio Icacos basin, Luquillo Experimental Forest, Puerto Rico. Chemical Geology **202**: 313-341.

Ussiri D.A.N., and C.E. Johnson. 2004. Sorption of organic carbon fractions by Spodosol mineral horizons. Soil Science Society of America Journal **68**: 253-262.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Vitousek, P.M., J. Aber, R.W. Howarth, G.E. Likens, P.A. Matson, D.W. Schindler, W.H. Schlesinger, and G.D. Tilman. 1997. Human alteration of the global nitrogen cycle: Causes and consequences. Issues in Ecology **1**: 2-16.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 1. Chemical and physical properties of the soils

Soil	pH	C (%)	N (%)	Mg$_{ex}$[†] (μg/g)	Al$_{ex}$ (μg/g)	Al$_{org}$[#] (μg/g)	Fe$_{ex}$ (μg/g)	Fe$_{org}$ (μg/g)	Mn$_{ex}$ (μg/g)	Texture (% sand/silt/clay)
College Woods	5.07	0.86	0.03	0.61	42.03	2880.41	1.51	798.32	0.00	70.0/23.3/6.7
Sonadara	4.80	1.11	0.06	129.61	246.89	1142.82	4.51	33.85	7.75	38.3/13.3/48.3
Icacos	5.16	0.75	0.03	24.73	90.62	1980.76	18.17	2845.27	5.29	76.7/8.3/15.0

[†] Exchangeable
[#] Organically bound

Table 2. Partition coefficient (m), release term (b), equilibrium amount, and r^2 value of a regression line describing NH_4^+ and DON adsorption when 0-50 mg/L of DOC , 0-1.25 mg/L of NH_4^+, and 0-1.57 mg/L of DON were added to the soil. Small case letter beside the m value represents the significance of differences in slope between NH_4^+ and DON for a given soil.

Soil	N species	m	b (μg/g)	Equilibrium (μg/g)	r^2
College Woods	NH_4^+	0.342 [a]	- [†]	- [‡]	0.906
	DON	0.613 [a]	-1.448	2.362	0.978
Sonadora	NH_4^+	0.791 [a]	-0.885	1.119	0.996
	DON	0.907 [b]	-2.662	2.935	0.931
Icacos	NH_4^+	0.387 [a]	-4.390	11.343	0.968
	DON	0.274 [b]	-0.693	2.531	N.S

[†] The value was more than zero.
[‡] The value was negative.
N.S = not significant

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 3. pH of the input and output solution when a target concentration of 0-50 mg/L of DOC was added to the soil.

	College Woods		Sonadora		Icacos	
Target DOC concentration	pH_i	pH_f	pH_i	pH_f	pH_i	pH_f
0	5.85	5.17	6.98	6.14	6.55	6.14
10	5.41	5.30	6.28	5.94	6.00	6.16
20	5.29	5.37	6.11	5.97	5.88	6.10
30	5.24	5.40	5.94	5.91	5.81	6.08
40	5.23	5.45	5.85	5.86	5.75	6.07
50	5.18	5.49	5.81	5.82	5.70	6.06

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 4. Effects of added NO_3^- and Fe^{3+} on DON retention. Partition coefficient (m), release term (b), equilibrium amount, and r^2 value refer to regression lines describing DON retention, using the initial mass isotherm approach. Small case letter beside the m value represents the significance of differences in slope between treatments for a given soil.

Soil	Treatment	m	b (μg/g)	Equilibrium (μg/g)	r^2
College Woods	Control	0.613 [a]	-1.448	2.362	0.978
	With NO_3^-	0.768 [b]	-0.082	0.107	0.989
	With NO_3^- + Fe^{3+}	0.912 [b]	-0.384	0.428	0.995
Sonadora	Control	0.908 †	-2.662	2.935	0.931
	With NO_3^-	0.733 †	-3.667	5.012	N.S
	With NO_3^- + Fe^{3+}	0.122 †	-4.450	36.389	N.S
Icacos	Control	0.274 †	-0.693	2.531	N.S
	With NO_3^-	0.465 †	-5.246	11.275	0.841
	With NO_3^- + Fe^{3+}	- † ‡	-1.397	1.012	N.S

† Statistical analysis was not performed due to insignificance of the regression.
‡ The value was more than 1.
N.S = not significant

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 5. Effects of added NO_3^- and Fe^{3+} on NH_4^+ retention. Partition coefficient (m), release term (b), equilibrium amount, and r^2 value refer to regression lines describing NH_4^+ retention, using the initial mass isotherm approach. Small case letter beside the m value represents the significance of differences in slope between treatments for a given soil.

Soil	Treatment	m	b (μg/g)	Equilibrium (μg/g)	r^2
College Woods	Control	0.342 [a]	- [†]	- [‡]	0.906
	With NO_3^-	0.290 [a]	-0.078	0.279	0.900
	With NO_3^- + Fe^{3+}	0.290 [a]	-0.112	0.386	0.972
Sonadora	Control	0.791 [a]	-0.885	1.119	0.996
	With NO_3^-	0.720 [a]	-0.986	1.372	0.998
	With NO_3^- + Fe^{3+}	0.720 [a]	-1.190	1.653	0.988
Icacos	Control	0.387 [a]	-4.390	11.343	0.968
	With NO_3^-	0.420 [a]	-4.640	11.050	0.969
	With NO_3^- + Fe^{3+}	0.262 [b]	-5.533	21.126	0.907

[†] The value was more than zero.
[‡] The value was negative.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 6. pH of the input and output solution when a target concentration of 0-50 mg/L of DOC and 4 mg/L of NO_3^- were added to the soil.

	College Woods		Sonadora		Icacos	
Target DOC concentration	pH_i	pH_f	pH_i	pH_f	pH_i	pH_f
0	6.19	5.22	5.68	5.25	6.25	6.01
10	5.52	5.41	5.71	5.20	6.09	6.01
20	5.36	5.43	5.60	5.15	5.99	5.90
30	5.28	5.48	5.58	5.12	5.89	5.93
40	5.26	5.52	5.54	5.11	5.92	5.91
50	5.21	5.54	5.52	5.12	5.85	5.96

Table 7. pH of the input and output solution when a target concentration of 0-50 mg/L of DOC, 4 mg/L of NO_3^-, and 2mg/L of Fe^{3+} were added to the soil.

	College Woods		Sonadora		Icacos	
Target DOC concentration	pH_i	pH_f	pH_i	pH_f	pH_i	pH_f
0	4.02	4.78	4.18	5.32	4.20	5.74
1	4.41	4.98	4.42	5.40	4.41	5.71
2	4.60	5.08	4.56	5.35	4.57	5.71
3	4.71	5.18	4.62	5.32	4.63	5.67
4	4.76	5.26	4.68	5.35	4.70	5.63
5	4.80	5.29	4.73	5.35	4.75	5.61

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Table 8. Effects of added NO_3^- and Fe^{3+} on DOC retention. Partition coefficient (m), release term (b), equilibrium amount, and r^2 value refer to regression lines describing DOC retention, using the initial mass isotherm approach. Small case letter beside the m value represents the significance of differences in slope between treatments for a given soil.

Soil	Treatment	m	b (μg/g)	Equilibrium (μg/g)	r^2
College Woods	Control	0.633 [a]	-25.043	39.550	0.991
	With NO_3^-	0.634 [a]	-22.076	34.804	0.996
	With NO_3^- + Fe^{3+}	0.626 [a]	-31.157	49.764	0.999
Sonadora	Control	0.770 [a]	-62.419	81.064	0.999
	With NO_3^-	0.822 [ab]	-57.731	70.207	0.998
	With NO_3^- + Fe^{3+}	0.752 [b]	-47.307	62.933	0.998
Icacos	Control	0.353 [a]	-62.260	176.424	0.993
	With NO_3^-	0.396 [a]	-54.366	137.392	0.980
	With NO_3^- + Fe^{3+}	0.456 [a]	-41.118	90.230	0.961

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

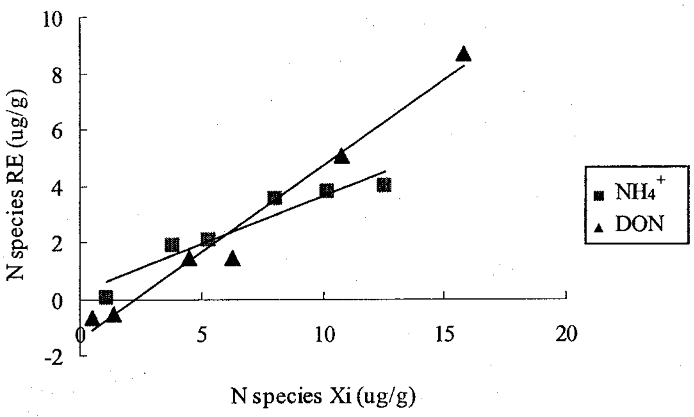
Table 9. Effects of added DOC, Fe^{3+}, and hydroquinone (HQ) on NO_3^- retention. Partition coefficient (m), release term (b), equilibrium amount, and r^2 value refer to regression lines describing NO_3^- retention, using the initial mass isotherm approach. Small case letters beside the values represents significance of differences between treatments for a given soil.

Soil	Treatment	m	b (µg/g)	Equilibrium (µg/g)	r^2
College Woods	NO_3^- alone	0.036	-0.484	13.444	0.742
	DOC + NO_3^-	0.024 [†]	-0.538	- [‡]	N.S
	DOC + NO_3^- + Fe^{3+}	0.070[†]	-1.009	1.449	N.S
	HQ + NO_3^-	0.031 [†]	-0.155	0.478	N.S
	HQ + NO_3^- +Fe^{3+}	0.043 [†]	- [*]	- [‡]	N.S
Sonadora	NO_3^- alone	0.103 [a]	-0.931	0.897	0.838
	DOC + NO_3^-	0.042 [†]	-2.163	5.116	N.S
	DOC + NO_3^- + Fe^{3+}	0.080 [a]	-1.610	1.996	0.848
	HQ + NO_3^-	0.106 [†]	-2.692	2.518	N.S
	HQ + NO_3^- +Fe^{3+}	0.065 [a]	-2.469	3.802	0.820
Icacos	NO_3^- alone	- [‡]	- [*]	6.333	N.S
	DOC + NO_3^-	- [‡]	- [*]	0.485	N.S
	DOC + NO_3^- + Fe^{3+}	0.023	-0.165	- [‡]	N.S
	HQ + NO_3^-	- [‡]	-0.596	- [‡]	N.S
	HQ + NO_3^- +Fe^{3+}	- [‡]	- [*]	9.225	N.S

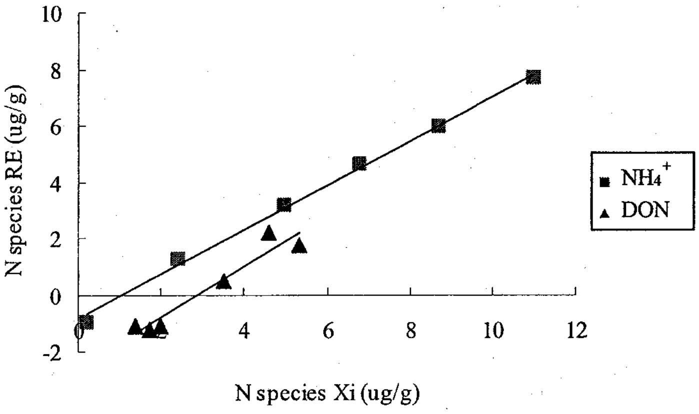
[†] Statistical analysis was not performed due to insignificance of the regression.
[‡] Value was negative.
[*] Value was more than zero.
N.S = not significant

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

a) College Woods



b) Sonadora



c) Icacos

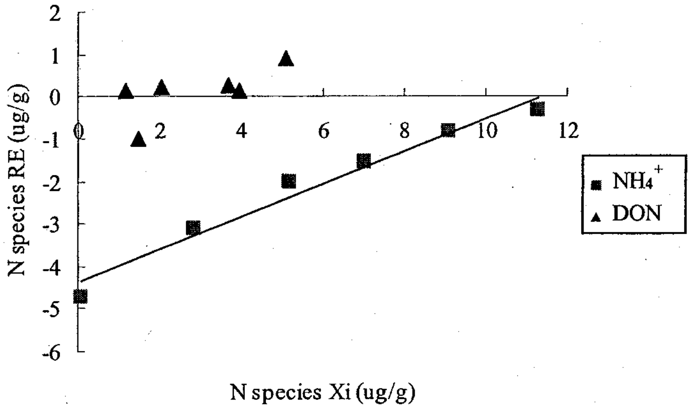
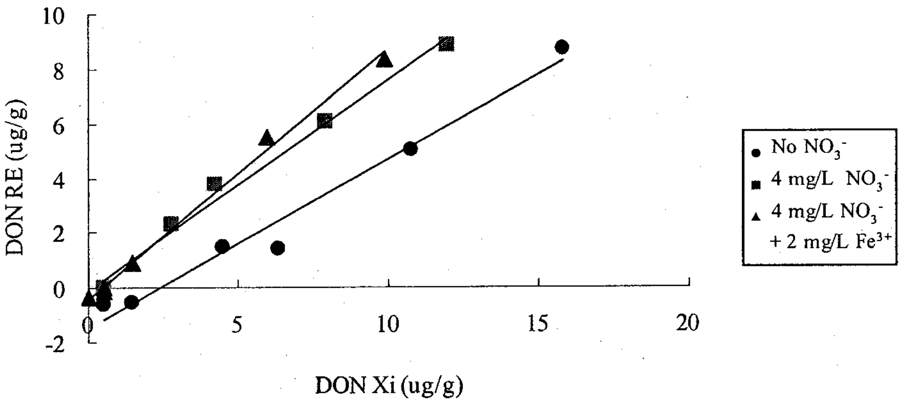


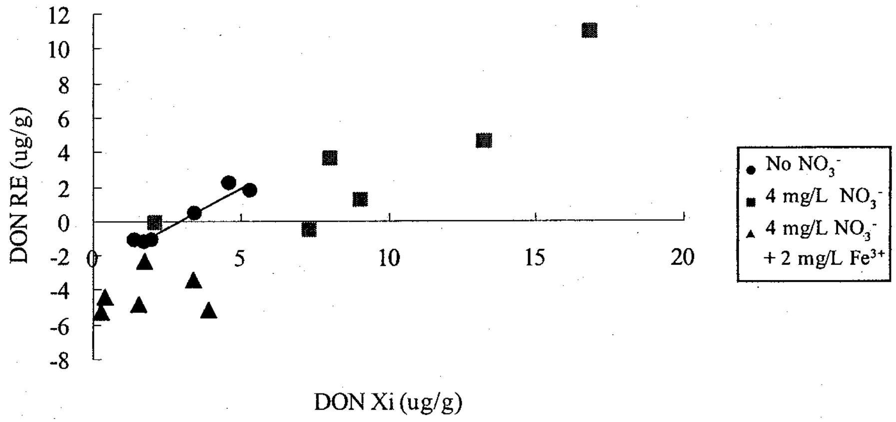
Figure1. Retention of N species in the soil, which are naturally occurring in 0-50 mg/L of DOC. The line indicates that the regression is significant. Scale of the y-axis changes in different soils.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

a) College Woods



b) Sonadora



c) Icacos

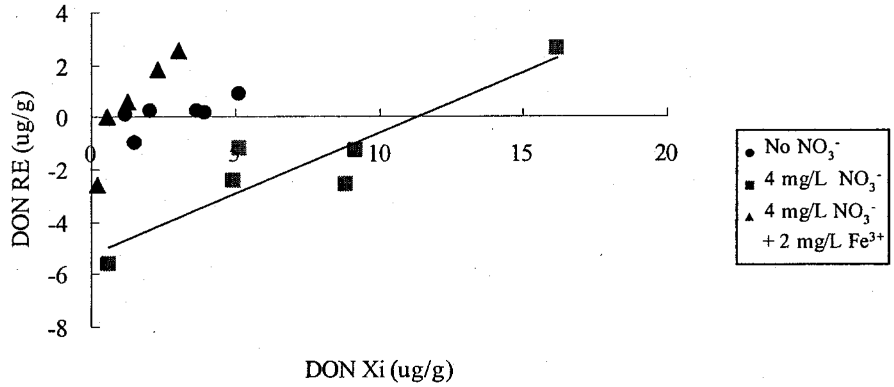
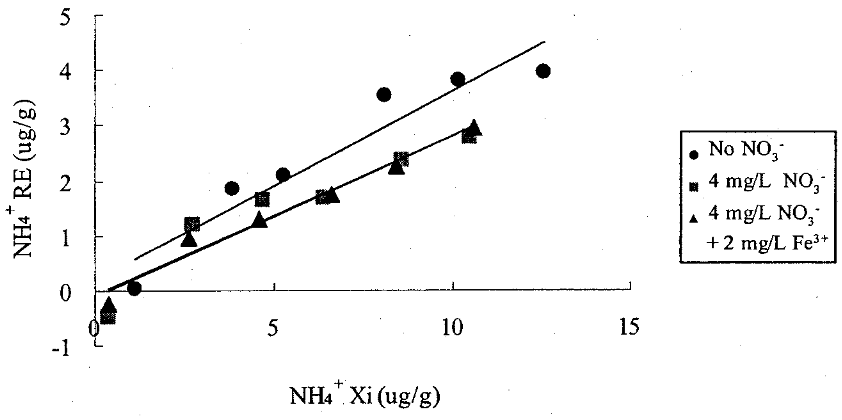


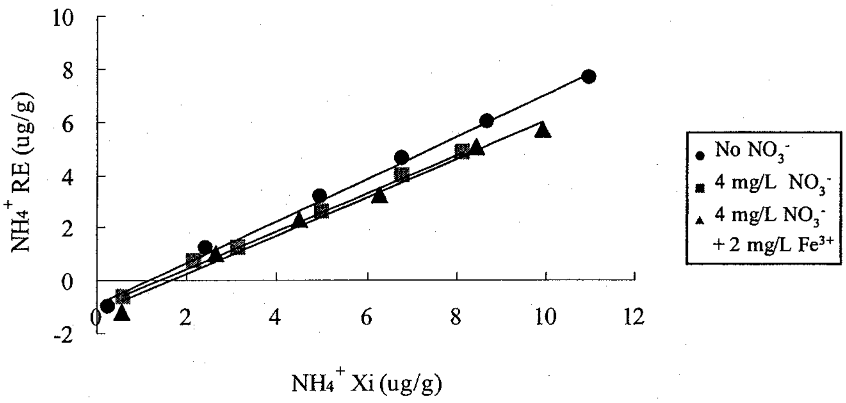
Figure 2. Effects of NO$_3^-$ (4 mg/L), and NO$_3^-$ and Fe^{3+} (2 mg/L) on adsorption of DON from a forest floor extract by mineral soils. The line indicates that the regression is significant.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

a) College Woods



b) Sonadora



c) Icacos

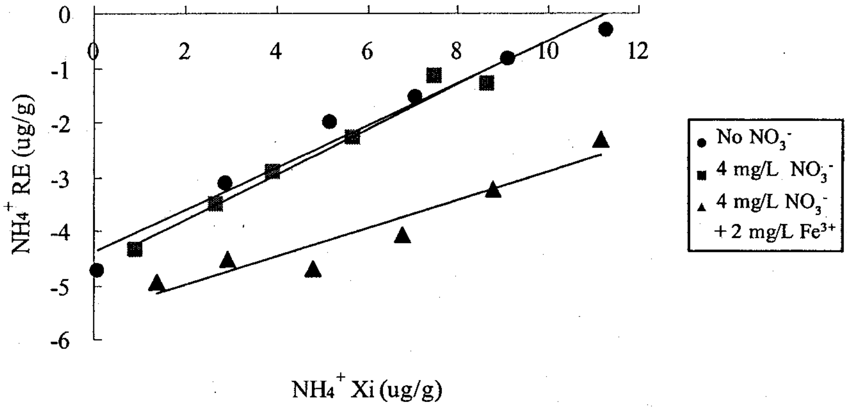
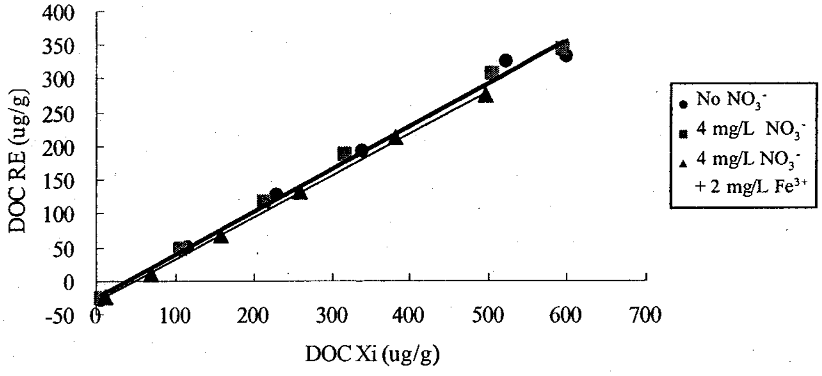


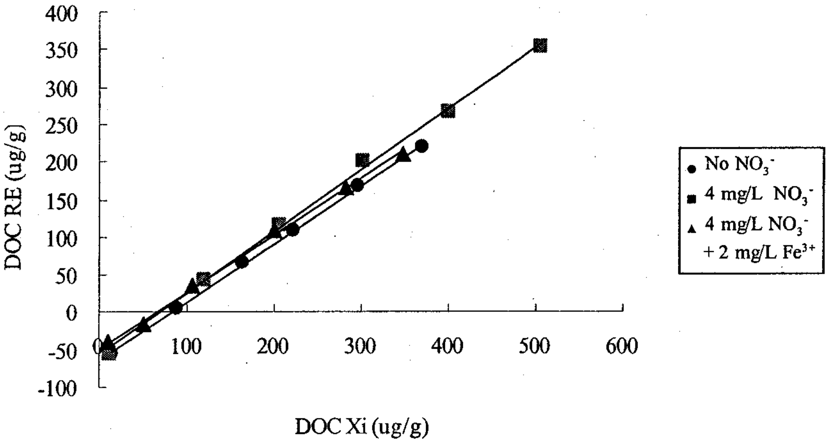
Figure 3. Effects of NO_3^- (4 mg/L), and NO_3^- and Fe^{3+} (2 mg/L) on adsorption of NH_4^+ from a forest floor extract by mineral soils. The line indicates that the regression is significant. Scale of the y-axis changes in different soils.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

a) College Woods



b) Sonadora



c) Icacos

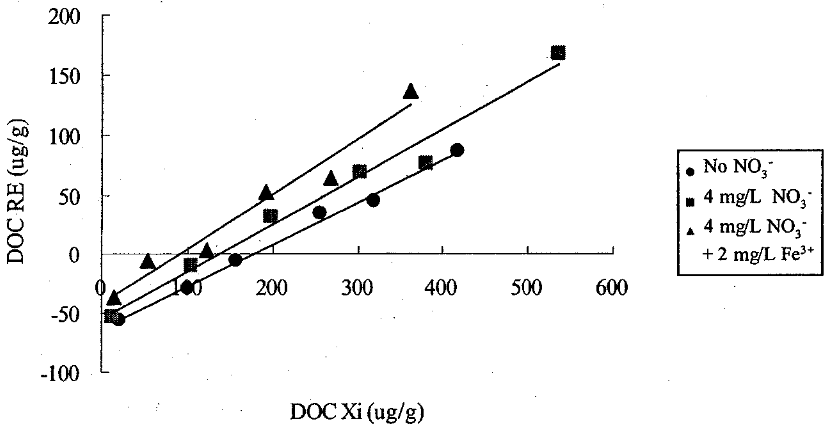
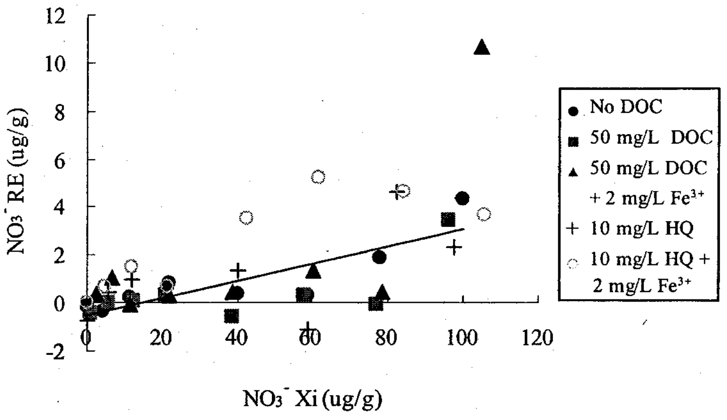


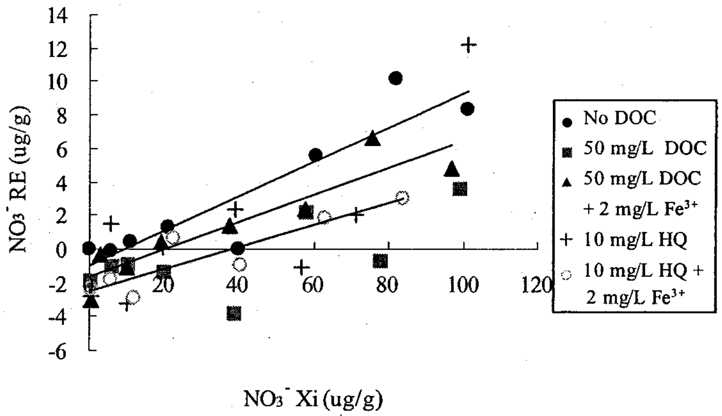
Figure 4. Effects of NO_3^- (4 mg/L), and NO_3^- and Fe^{3+} (2 mg/L) on adsorption of DOC from a forest floor extract by mineral soils. The line indicates that the regression is significant.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

a) College Woods



b) Sonadora



c) Icacos

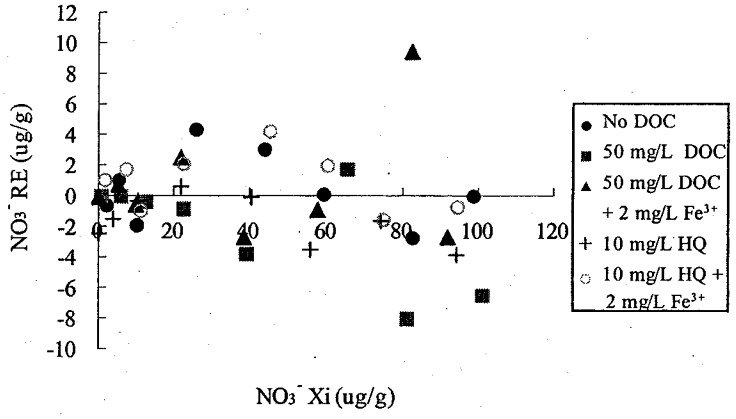


Figure 5. Effects of DOC (50 mg/L), DOC and Fe^{3+} (2 mg/L), hydroquinone (10 mg/L), and hydroquinone and Fe^{3+} on adsorption of NO_3^- in mineral soils. The line indicates that the regression is significant.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

APPENDIX: ADSORPTION EXPERIMENT RAW DATA

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	DOC (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
59512	CW	0	0	1	3.50	35.21	10.1	0	5.85	5.10	0.05	0.03	0.02	0.47	0.28	0.19	0.11	0.15	-0.04
59513	CW	0	0	2	3.50	35.16	10.0	0	5.85	5.23	0.05	0.01	0.04	0.47	0.10	0.38	0.11	0.07	0.04
59514	CW	10	0	1	3.52	35.22	10.0	0	5.41	5.30	0.05	0.04	0.01	0.45	0.39	0.06	0.38	0.17	0.21
59515	CW	10	0	2	3.52	35.15	10.0	0	5.41	5.29	0.05	0.03	0.02	0.45	0.28	0.17	0.38	0.22	0.17
59516	CW	20	0	1	3.50	35.37	10.1	0	5.29	5.37	0.05	0.03	0.03	0.55	0.29	0.26	0.52	0.30	0.22
59517	CW	20	0	2	3.50	35.66	10.2	0	5.29	5.37	0.05	0.06	-0.01	0.55	0.62	-0.07	0.52	0.33	0.19
59518	CW	30	0	1	3.51	35.23	10.0	0	5.24	5.42	0.09	0.04	0.04	0.85	0.43	0.42	0.81	0.42	0.39
59519	CW	30	0	2	3.51	35.02	10.0	0	5.24	5.38	0.09	0.03	0.06	0.85	0.27	0.58	0.81	0.49	0.32
59520	CW	40	0	1	3.51	35.85	10.2	0	5.23	5.43	0.05	0.07	-0.01	0.54	0.68	-0.14	1.00	0.61	0.39
59521	CW	40	0	2	3.51	35.25	10.0	0	5.23	5.47	0.05	0.05	0.00	0.53	0.51	0.02	1.00	0.65	0.36
59522	CW	50	0	1	3.51	35.38	10.1	0	5.18	5.48	0.04	0.05	-0.01	0.42	0.49	-0.06	1.25	0.82	0.42
59523	CW	50	0	2	3.51	35.25	10.0	0	5.18	5.49	0.04	0.06	-0.02	0.42	0.61	-0.19	1.25	0.89	0.36
58681	CW	0	0	1	3.52	35.09	10.0	0	7.45	5.38	0.00	0.03	-0.03	0.00	0.35	-0.35	0.00	0.07	-0.07
58682	CW	0	0	2	3.51	35.26	10.0	0	7.45	5.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	-0.02
58683	CW	0	0.5	1	3.51	35.19	10.0	0	7.51	5.25	0.42	0.40	0.02	4.25	4.01	0.24	0.01	0.03	-0.02
58684	CW	0	0.5	2	3.51	35.22	10.0	0	7.51	5.27	0.42	0.51	-0.09	4.25	5.14	-0.90	0.01	0.02	-0.01
58685	CW	0	1	1	3.51	35.17	10.0	0	6.41	5.26	1.14	1.09	0.06	11.47	10.92	0.55	0.02	0.03	-0.01
58686	CW	0	1	2	3.52	35.53	10.1	0	6.41	5.28	1.14	1.16	-0.01	11.54	11.68	-0.13	0.02	0.07	-0.05
58687	CW	0	2	1	3.50	35.11	10.0	0	7.18	5.31	2.17	2.07	0.10	21.70	20.72	0.99	0.02	0.02	0.00
58688	CW	0	2	2	3.52	35.58	10.1	0	7.18	5.27	2.17	2.10	0.07	21.91	21.23	0.69	0.02	0.04	-0.02
58689	CW	0	4	1	3.50	35.33	10.1	0	6.40	5.25	4.01	3.94	0.07	40.43	39.76	0.67	0.02	0.05	-0.03
58690	CW	0	4	2	3.51	35.28	10.1	0	6.40	5.22	4.01	4.00	0.01	40.34	40.27	0.07	0.02	0.02	0.00
58691	CW	0	6	1	3.50	35.02	10.0	0	6.36	5.22	5.90	5.73	0.16	58.95	57.30	1.64	0.02	0.03	0.00
58692	CW	0	6	2	3.51	35.05	10.0	0	6.36	5.25	5.90	6.00	-0.10	58.84	59.84	-1.01	0.02	0.02	0.00
58693	CW	0	8	1	3.51	35.22	10.0	0	6.31	5.21	7.74	7.37	0.37	77.77	74.01	3.75	0.02	0.03	-0.01
58694	CW	0	8	2	3.50	35.22	10.0	0	6.31	5.24	7.74	7.75	-0.01	77.80	77.88	-0.08	0.02	0.03	-0.01
58695	CW	0	10	1	3.51	35.00	10.0	0	6.13	5.23	9.99	9.58	0.41	99.66	95.55	4.11	0.01	0.04	-0.03
58696	CW	0	10	2	3.52	35.33	10.0	0	6.13	5.19	9.99	9.55	0.45	100.20	95.73	4.47	0.01	0.04	-0.03

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	NH_4^+ Xi	NH_4^+ Xf	RE	DOC Ci	DOC Cf	RE	DOC Xi	DOC Xf	RE	DON Ci	DON Cf	RE	DON Xi	DON Xf	RE
code		ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g
59512	CW	1.10	1.47	-0.37	0.73	3.91	-3.18	7.38	39.30	-31.92	0.05	0.07	-0.02	0.50	0.72	-0.22
59513	CW	1.10	0.70	0.40	0.73	3.29	-2.56	7.37	33.07	-25.70	0.05	0.16	-0.11	0.50	1.56	-1.06
59514	CW	3.81	1.74	2.07	11.54	6.08	5.46	115.45	60.79	54.66	0.14	0.21	-0.07	1.44	2.10	-0.67
59515	CW	3.80	2.16	1.65	11.54	7.34	4.20	115.21	73.30	41.91	0.14	0.18	-0.04	1.44	1.82	-0.38
59516	CW	5.26	3.01	2.25	22.72	9.96	12.76	229.35	100.50	128.86	0.44	0.30	0.15	4.46	2.99	1.47
59517	CW	5.30	3.38	1.92	22.72	10.31	12.41	231.38	105.02	126.36	0.44	0.30	0.14	4.50	3.05	1.44
59518	CW	8.09	4.20	3.89	33.92	14.38	19.55	340.00	144.09	195.91	0.63	0.50	0.13	6.32	4.97	1.35
59519	CW	8.06	4.89	3.17	33.92	14.91	19.01	338.44	148.80	189.64	0.63	0.48	0.15	6.29	4.78	1.51
59520	CW	10.24	6.22	4.02	51.48	19.71	31.77	525.82	201.32	324.50	1.06	0.57	0.49	10.86	5.84	5.02
59521	CW	10.07	6.48	3.59	51.48	19.11	32.37	517.20	191.95	325.25	1.06	0.56	0.50	10.68	5.65	5.02
59522	CW	12.57	8.31	4.26	59.64	26.48	33.16	601.45	267.05	334.40	1.57	0.75	0.82	15.83	7.52	8.31
59523	CW	12.52	8.90	3.62	59.64	26.50	33.14	599.04	266.19	332.84	1.57	0.67	0.90	15.77	6.76	9.01
58681	CW	0.01	0.73	-0.72	0.48	2.27	-1.79	4.79	22.64	-17.84	0.05	0.10	-0.05	0.50	1.03	-0.53
58682	CW	0.01	0.20	-0.19	0.48	2.58	-2.10	4.82	25.92	-21.10	0.05	0.12	-0.07	0.50	1.18	-0.68
58683	CW	0.08	0.27	-0.19	0.52	1.95	-1.43	5.19	19.53	-14.34	0.05	0.18	-0.13	0.50	1.82	-1.32
58684	CW	0.08	0.16	-0.08	0.52	2.59	-2.08	5.19	26.01	-20.82	0.05	0.16	-0.11	0.50	1.58	-1.08
58685	CW	0.22	0.31	-0.09	0.41	2.52	-2.12	4.10	25.31	-21.21	0.09	0.34	-0.25	0.90	3.46	-2.55
58686	CW	0.22	0.68	-0.45	0.41	2.69	-2.28	4.13	27.13	-23.00	0.09	0.11	-0.02	0.91	1.09	-0.18
58687	CW	0.22	0.20	0.02	0.74	2.58	-1.84	7.39	25.83	-18.44	0.44	0.16	0.28	4.45	1.62	2.83
58688	CW	0.22	0.40	-0.18	0.74	2.55	-1.81	7.46	25.82	-18.36	0.44	0.05	0.39	4.49	0.55	3.94
58689	CW	0.22	0.50	-0.27	1.27	2.18	-0.91	12.84	22.01	-9.17	1.07	0.05	1.02	10.75	0.50	10.25
58690	CW	0.22	0.23	-0.01	1.27	2.34	-1.07	12.81	23.58	-10.77	1.07	0.07	1.00	10.73	0.70	10.02
58691	CW	0.23	0.28	-0.04	0.64	2.73	-2.08	6.41	27.24	-20.83	1.20	1.37	-0.17	12.00	13.73	-1.73
58692	CW	0.23	0.23	0.00	0.64	3.51	-2.87	6.40	35.02	-28.62	1.20	1.33	-0.13	11.97	13.23	-1.26
58693	CW	0.21	0.33	-0.12	1.22	2.17	-0.95	12.21	21.80	-9.59	1.48	1.64	-0.15	14.90	16.44	-1.54
58694	CW	0.21	0.31	-0.10	1.22	3.17	-1.96	12.22	31.88	-19.66	1.48	1.95	-0.47	14.91	19.63	-4.72
58695	CW	0.14	0.42	-0.28	0.82	2.31	-1.49	8.15	23.02	-14.87	1.38	0.73	0.66	13.80	7.25	6.54
58696	CW	0.15	0.44	-0.30	0.82	2.98	-2.16	8.19	29.89	-21.70	1.38	2.60	-1.22	13.87	26.07	-12.20

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	DOC (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
59026	CW	50	0	1	3.51	35.34	10.1	0	5.12	5.35	0.07	0.14	-0.06	0.72	1.37	-0.64	0.99	0.69	0.30
59027	CW	50	0	2	3.51	35.60	10.1	0	5.12	5.37	0.07	0.09	-0.02	0.73	0.96	-0.23	0.99	0.74	0.24
59028	CW	50	0.5	1	3.53	35.23	10.0	0	5.10	5.38	0.58	0.53	0.05	5.75	5.27	0.48	1.00	0.76	0.24
59029	CW	50	0.5	2	3.53	35.38	10.0	0	5.10	5.31	0.58	0.62	-0.04	5.77	6.17	-0.39	1.00	0.74	0.26
59030	CW	50	1	1	3.51	35.98	10.3	0	5.08	5.34	1.21	1.15	0.05	12.38	11.83	0.55	1.02	0.77	0.25
59031	CW	50	1	2	3.51	35.88	10.2	0	5.08	5.37	1.21	1.24	-0.03	12.33	12.69	-0.36	1.02	0.82	0.20
59032	CW	50	2	1	3.53	35.33	10.0	0	5.09	5.32	2.10	1.94	0.16	20.99	19.41	1.58	1.04	0.75	0.29
59033	CW	50	2	2	3.51	35.55	10.1	0	5.09	5.35	2.10	2.19	-0.10	21.23	22.23	-1.00	1.04	0.76	0.28
59034	CW	50	4	1	3.52	35.00	9.9	0	5.07	5.36	3.87	3.82	0.05	38.40	37.95	0.45	1.04	0.75	0.29
59035	CW	50	4	2	3.50	35.07	10.0	0	5.07	5.36	3.87	4.02	-0.16	38.70	40.27	-1.57	1.04	0.78	0.26
59036	CW	50	6	1	3.51	35.11	10.0	0	5.09	5.37	5.77	5.53	0.24	57.82	55.42	2.40	1.01	0.78	0.24
59037	CW	50	6	2	3.52	35.50	10.1	0	5.09	5.40	5.77	5.95	-0.17	58.26	59.99	-1.73	1.01	0.78	0.24
59038	CW	50	8	1	3.50	35.27	10.1	0	5.08	5.36	7.69	7.67	0.02	77.42	77.25	0.17	1.04	0.82	0.23
59039	CW	50	8	2	3.52	35.19	10.0	0	5.08	5.37	7.69	7.72	-0.04	76.92	77.29	-0.37	1.04	0.80	0.24
59040	CW	50	10	1	3.51	35.03	10.0	0	5.07	5.35	9.52	9.18	0.34	95.09	91.65	3.44	1.05	0.79	0.27
59041	CW	50	10	2	3.51	35.82	10.2	0	5.07	5.37	9.52	9.18	0.34	97.26	93.83	3.43	1.05	0.78	0.27
59074	CW	0	4	1	3.50	35.64	10.2	0	6.19	5.21	4.17	3.70	0.46	42.38	37.67	4.71	0.04	0.10	-0.06
59075	CW	0	4	2	3.51	35.58	10.1	0	6.19	5.23	4.17	3.81	0.35	42.23	38.68	3.56	0.04	0.08	-0.04
59076	CW	10	4	1	3.51	35.17	10.0	0	5.52	5.42	4.23	4.25	-0.02	42.38	42.59	-0.20	0.27	0.14	0.13
59077	CW	10	4	2	3.52	35.11	10.0	0	5.52	5.39	4.23	4.18	0.05	42.16	41.65	0.51	0.27	0.16	0.11
59078	CW	20	4	1	3.53	36.02	10.2	0	5.36	5.43	4.06	4.13	-0.06	41.45	42.11	-0.66	0.46	0.30	0.16
59079	CW	20	4	2	3.50	35.55	10.2	0	5.36	5.43	4.06	4.15	-0.09	41.22	42.15	-0.93	0.46	0.30	0.16
59080	CW	30	4	1	3.52	35.03	9.9	0	5.28	5.49	4.16	4.28	-0.11	41.43	42.56	-1.13	0.63	0.47	0.16
59081	CW	30	4	2	3.51	35.50	10.1	0	5.28	5.46	4.16	4.27	-0.10	42.11	43.17	-1.06	0.63	0.46	0.17
59082	CW	40	4	1	3.51	36.23	10.3	0	5.26	5.51	4.32	4.05	0.27	44.62	41.84	2.79	0.83	0.59	0.24
59083	CW	40	4	2	3.52	36.01	10.2	0	5.26	5.52	4.32	4.17	0.15	44.24	42.72	1.51	0.83	0.61	0.22
59084	CW	50	4	1	3.51	35.15	10.0	0	5.21	5.53	4.24	4.10	0.14	42.45	41.06	1.39	1.04	0.77	0.28
59085	CW	50	4	2	3.51	35.35	10.1	0	5.21	5.55	4.24	3.94	0.30	42.69	39.67	3.02	1.04	0.76	0.28

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	NH_4^+ Xi ug/g	NH_4^+ Xf ug/g	RE ug/g	DOC Ci mg/L	DOC Cf mg/L	RE mg/L	DOC Xi ug/g	DOC Xf ug/g	RE ug/g	DON Ci mg/L	DON Cf mg/L	RE mg/L	DON Xi ug/g	DON Xf ug/g	RE ug/g
59026	CW	9.94	6.95	2.99	53.88	25.35	28.53	542.98	255.48	287.50	1.83	1.02	0.82	18.48	10.24	8.24
59027	CW	10.00	7.55	2.45	53.88	27.34	26.54	546.22	277.19	269.03	1.83	1.07	0.76	18.59	10.84	7.75
59028	CW	9.97	7.54	2.44	60.87	27.44	33.43	607.31	273.77	333.55	1.72	1.08	0.64	17.14	10.75	6.39
59029	CW	10.01	7.39	2.63	60.87	25.75	35.12	609.79	257.95	351.84	1.72	0.72	1.00	17.21	7.24	9.97
59030	CW	10.43	7.86	2.57	62.54	27.20	35.34	641.46	279.00	362.46	1.80	0.93	0.88	18.49	9.50	8.99
59031	CW	10.39	8.34	2.05	62.54	24.37	38.17	638.82	248.92	389.90	1.80	0.54	1.26	18.42	5.52	12.89
59032	CW	10.45	7.53	2.93	57.47	26.44	31.04	575.53	264.73	310.80	1.86	0.94	0.92	18.65	9.46	9.19
59033	CW	10.57	7.70	2.87	57.47	28.78	28.70	582.17	291.49	290.68	1.86	0.80	1.06	18.87	8.12	10.75
59034	CW	10.32	7.44	2.88	58.28	25.50	32.78	578.94	253.29	325.65	1.71	0.49	1.22	17.01	4.91	12.10
59035	CW	10.40	7.84	2.56	58.28	27.31	30.97	583.45	273.43	310.02	1.71	0.98	0.73	17.15	9.85	7.30
59036	CW	10.16	7.78	2.37	61.13	28.50	32.64	612.22	285.38	326.83	1.83	1.21	0.62	18.34	12.09	6.25
59037	CW	10.23	7.86	2.38	61.13	26.97	34.17	616.89	272.13	344.76	1.83	0.78	1.05	18.48	7.89	10.60
59038	CW	10.52	8.23	2.29	59.73	28.35	31.38	601.53	285.51	316.02	1.67	0.82	0.85	16.82	8.24	8.58
59039	CW	10.45	8.05	2.40	59.73	27.84	31.89	597.66	278.56	319.10	1.67	0.77	0.90	16.71	7.69	9.02
59040	CW	10.52	7.87	2.65	59.66	26.62	33.04	595.91	265.89	330.01	2.03	0.98	1.04	20.23	9.82	10.41
59041	CW	10.76	7.96	2.80	59.66	26.46	33.20	609.51	270.33	339.18	2.03	1.42	0.61	20.69	14.50	6.19
59074	CW	0.38	0.98	-0.59	0.58	3.17	-2.59	5.87	32.25	-26.38	0.05	0.05	0.00	0.51	0.51	0.00
59075	CW	0.38	0.76	-0.38	0.58	3.26	-2.68	5.85	33.07	-27.22	0.05	0.05	0.00	0.51	0.51	0.00
59076	CW	2.71	1.44	1.27	10.59	5.42	5.17	106.21	54.37	51.85	0.05	0.05	0.00	0.50	0.50	0.00
59077	CW	2.70	1.61	1.09	10.59	6.34	4.25	105.66	63.25	42.40	0.05	0.05	0.00	0.50	0.50	0.00
59078	CW	4.71	3.07	1.64	21.02	8.98	12.04	214.49	91.63	122.86	0.27	0.05	0.22	2.77	0.51	2.26
59079	CW	4.68	3.07	1.61	21.02	10.12	10.90	213.32	102.72	110.60	0.27	0.04	0.23	2.75	0.41	2.34
59080	CW	6.31	4.69	1.62	31.63	13.24	18.38	314.65	131.76	182.89	0.42	0.05	0.37	4.19	0.50	3.69
59081	CW	6.42	4.68	1.74	31.63	12.90	18.73	319.81	130.44	189.36	0.42	0.05	0.37	4.26	0.51	3.76
59082	CW	8.61	6.14	2.47	48.87	18.71	30.16	505.10	193.37	311.74	0.77	0.20	0.57	7.94	2.07	5.87
59083	CW	8.54	6.29	2.25	48.87	19.52	29.35	500.70	199.97	300.74	0.77	0.16	0.61	7.87	1.65	6.22
59084	CW	10.46	7.70	2.76	59.31	23.88	35.44	594.41	239.26	355.14	1.19	0.04	1.15	11.93	0.42	11.51
59085	CW	10.52	7.71	2.81	59.31	26.46	32.85	597.82	266.71	331.11	1.19	0.58	0.61	12.00	5.84	6.15

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	DOC (target) mg/L	NO_3^- (target) mg/L	Rep No.	Soil g	Solution g	S:S ratio	$FeCl_3$ mg/L	pHi	pHf	NO_3^- Ci mg/L	NO_3^- Cf mg/L	RE mg/L	NO_3^- Xi ug/g	NO_3^- Xf ug/g	RE ug/g	NH_4^+ Ci mg/L	NH_4^+ Cf mg/L	RE mg/L
59050	CW	50	0	1	3.51	35.17	10.0	2.35	4.93	5.38	0.24	0.18	0.06	2.42	1.80	0.62	0.98	0.69	0.29
59051	CW	50	0	2	3.50	35.29	10.1	2.35	4.93	5.35	0.24	0.23	0.02	2.44	2.27	0.17	0.98	0.73	0.26
59052	CW	50	0.5	1	3.50	35.24	10.1	2.36	4.89	5.37	0.67	0.57	0.11	6.78	5.70	1.08	0.99	0.77	0.22
59053	CW	50	0.5	2	3.51	35.59	10.1	2.36	4.89	5.38	0.67	0.58	0.10	6.83	5.85	0.98	0.99	0.71	0.28
59054	CW	50	1	1	3.51	35.72	10.2	2.36	4.89	5.35	1.16	1.13	0.03	11.81	11.49	0.32	0.96	0.75	0.21
59055	CW	50	1	2	3.50	35.05	10.0	2.36	4.89	5.36	1.16	1.21	-0.05	11.62	12.10	-0.49	0.96	0.73	0.22
59056	CW	50	2	1	3.51	35.08	10.0	2.36	4.88	5.35	2.20	1.98	0.22	22.05	19.85	2.20	1.00	0.71	0.29
59057	CW	50	2	2	3.50	35.08	10.0	2.36	4.88	5.38	2.20	2.37	-0.16	22.07	23.71	-1.64	1.00	0.73	0.28
59058	CW	50	4	1	3.51	35.27	10.0	2.36	4.87	5.37	3.86	3.75	0.11	38.82	37.68	1.13	0.97	0.75	0.23
59059	CW	50	4	2	3.52	35.51	10.1	2.36	4.87	5.38	3.86	3.89	-0.02	38.94	39.18	-0.25	0.97	0.75	0.23
59060	CW	50	6	1	3.51	35.26	10.1	2.35	4.86	5.39	6.00	5.45	0.56	60.38	54.79	5.59	0.99	0.76	0.23
59061	CW	50	6	2	3.54	35.35	10.0	2.35	4.86	5.34	6.00	6.28	-0.28	59.99	62.81	-2.81	0.99	0.74	0.25
59062	CW	50	8	1	3.50	35.06	10.0	2.37	4.86	5.38	7.77	7.66	0.11	77.79	76.68	1.11	0.97	0.75	0.22
59063	CW	50	8	2	3.51	35.54	10.1	2.37	4.86	5.35	7.77	7.79	-0.02	78.77	78.95	-0.18	0.97	0.76	0.22
59064	CW	50	10	1	3.54	35.57	10.1	2.37	4.89	5.33	10.46	9.32	1.14	105.21	93.79	11.42	0.98	0.76	0.22
59065	CW	50	10	2	3.50	35.04	10.0	2.37	4.89	5.39	10.46	9.47	0.99	104.66	94.72	9.93	0.98	0.77	0.21
59092	CW	0	4	1	3.50	35.86	10.2	2.37	4.02	4.81	4.23	3.57	0.66	43.25	36.51	6.74	0.04	0.08	-0.04
59093	CW	0	4	2	3.53	35.72	10.1	2.37	4.02	4.75	4.23	3.88	0.34	42.80	39.34	3.46	0.04	0.05	-0.01
59094	CW	10	4	1	3.51	35.38	10.1	2.36	4.41	4.97	4.16	4.08	0.09	41.95	41.07	0.88	0.26	0.13	0.13
59095	CW	10	4	2	3.51	35.08	10.0	2.36	4.41	4.99	4.16	3.89	0.28	41.61	38.84	2.77	0.26	0.20	0.06
59096	CW	20	4	1	3.50	35.32	10.1	2.36	4.60	5.08	4.09	4.02	0.06	41.18	40.53	0.65	0.45	0.30	0.16
59097	CW	20	4	2	3.50	35.62	10.2	2.36	4.60	5.08	4.09	3.96	0.12	41.56	40.32	1.24	0.45	0.35	0.10
59098	CW	30	4	1	3.50	36.33	10.4	2.36	4.71	5.17	4.22	4.02	0.20	43.77	41.66	2.11	0.65	0.47	0.17
59099	CW	30	4	2	3.52	35.01	9.9	2.36	4.71	5.19	4.22	4.07	0.15	41.93	40.42	1.52	0.65	0.48	0.17
59100	CW	40	4	1	3.50	35.02	10.0	2.37	4.76	5.23	4.12	4.04	0.08	41.23	40.44	0.79	0.84	0.59	0.25
59101	CW	40	4	2	3.51	35.45	10.1	2.37	4.76	5.29	4.12	4.09	0.03	41.65	41.33	0.32	0.84	0.64	0.20
59102	CW	50	4	1	3.52	35.72	10.2	2.36	4.80	5.29	4.09	4.21	-0.12	41.56	42.76	-1.20	1.05	0.72	0.33
59103	CW	50	4	2	3.51	35.15	10.0	2.36	4.80	5.28	4.09	4.11	-0.02	40.93	41.15	-0.22	1.05	0.80	0.25

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	NH_4^+ Xi	NH_4^+ Xf	RE	DOC Ci	DOC Cf	RE	DOC Xi	DOC Xf	RE	DON Ci	DON Cf	RE	DON Xi	DON Xf	RE
code		ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g
59050	CW	9.87	6.92	2.95	49.15	22.34	26.81	492.51	223.86	268.65	1.35	0.71	0.64	13.56	7.16	6.40
59051	CW	9.92	7.32	2.60	49.15	24.82	24.33	495.16	250.06	245.10	1.35	0.78	0.58	13.63	7.83	5.81
59052	CW	9.98	7.78	2.20	50.99	23.07	27.92	513.30	232.27	281.03	1.41	0.57	0.85	14.21	5.69	8.51
59053	CW	10.05	7.21	2.84	50.99	23.81	27.18	517.09	241.44	275.64	1.41	0.64	0.77	14.31	6.52	7.79
59054	CW	9.75	7.61	2.14	52.34	24.04	28.30	532.59	244.65	287.93	1.55	0.75	0.80	15.75	7.66	8.10
59055	CW	9.59	7.34	2.25	52.34	23.11	29.23	523.99	231.39	292.60	1.55	0.60	0.95	15.50	6.03	9.47
59056	CW	10.03	7.15	2.88	52.83	22.92	29.91	528.65	229.34	299.31	1.22	0.63	0.59	12.19	6.31	5.88
59057	CW	10.04	7.27	2.77	52.83	24.06	28.77	529.06	240.92	288.14	1.22	0.48	0.74	12.20	4.77	7.43
59058	CW	9.79	7.49	2.30	49.34	23.91	25.43	495.65	240.21	255.44	1.28	0.42	0.87	12.90	4.19	8.71
59059	CW	9.82	7.53	2.29	49.34	22.15	27.19	497.16	223.15	274.01	1.28	0.48	0.80	12.94	4.88	8.06
59060	CW	9.95	7.67	2.28	50.43	23.47	26.96	507.36	236.12	271.23	0.83	0.53	0.30	8.36	5.34	3.02
59061	CW	9.89	7.36	2.53	50.43	23.28	27.15	504.12	232.72	271.41	0.83	0.05	0.78	8.31	0.50	7.81
59062	CW	9.76	7.51	2.25	52.89	22.57	30.32	529.56	225.99	303.57	1.37	0.62	0.75	13.72	6.25	7.46
59063	CW	9.88	7.70	2.18	52.89	22.29	30.60	536.27	226.04	310.23	1.37	0.60	0.77	13.89	6.07	7.82
59064	CW	9.88	7.63	2.25	50.77	22.86	27.91	510.62	229.88	280.74	0.35	0.76	-0.41	3.53	7.64	-4.12
59065	CW	9.82	7.74	2.08	50.77	22.25	28.52	507.94	222.64	285.30	0.35	0.70	-0.35	3.51	6.97	-3.46
59092	CW	0.40	0.79	-0.39	1.04	2.98	-1.94	10.66	30.51	-19.85	0.05	0.05	0.00	0.51	0.51	0.00
59093	CW	0.40	0.50	-0.11	1.04	3.57	-2.52	10.55	36.12	-25.57	0.05	0.07	-0.02	0.51	0.70	-0.19
59094	CW	2.60	1.29	1.31	6.98	5.86	1.12	70.34	59.07	11.26	0.05	0.05	0.00	0.50	0.50	0.00
59095	CW	2.58	2.00	0.58	6.98	6.33	0.65	69.77	63.28	6.49	0.05	0.05	0.00	0.50	0.53	-0.03
59096	CW	4.56	2.98	1.58	15.61	8.43	7.18	157.36	84.97	72.40	0.00	0.05	-0.05	0.00	0.50	-0.50
59097	CW	4.61	3.59	1.02	15.61	9.31	6.30	158.82	94.68	64.14	0.00	0.01	-0.02	0.00	0.14	-0.14
59098	CW	6.71	4.90	1.81	25.57	11.52	14.05	265.25	119.50	145.75	0.14	0.05	0.09	1.48	0.52	0.96
59099	CW	6.43	4.77	1.66	25.57	13.72	11.85	254.12	136.38	117.74	0.14	0.05	0.09	1.42	0.50	0.92
59100	CW	8.37	5.88	2.49	37.85	15.98	21.87	378.56	159.80	218.77	0.59	0.04	0.55	5.90	0.39	5.52
59101	CW	8.46	6.43	2.03	37.85	17.60	20.25	382.44	177.87	204.57	0.59	0.05	0.54	5.96	0.48	5.48
59102	CW	10.69	7.32	3.37	49.14	20.81	28.32	498.98	211.36	287.62	0.98	0.15	0.82	9.92	1.55	8.36
59103	CW	10.52	7.99	2.54	49.14	22.79	26.35	491.45	227.94	263.50	0.98	0.15	0.83	9.77	1.49	8.28

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	HQ (target) mg/L	NO_3^- (target) mg/L	Rep No.	Soil g	Solution g	S:S ratio	$FeCl_3$ mg/L	pHi	pHf	NO_3^- Ci mg/L	NO_3^- Cf mg/L	RE mg/L	NO_3^- Xi ug/g	NO_3^- Xf ug/g	RE ug/g	NH_4^+ Ci mg/L	NH_4^+ Cf mg/L	RE mg/L
58633	CW	10	0	1	3.51	35.45	10.1	0	6.19	5.37	0.01	0.11	-0.10	0.14	1.14	-1.01	0.13	0.18	-0.05
58634	CW	10	0	2	3.52	35.05	10.0	0	6.19	5.34	0.01	0.06	-0.05	0.13	0.63	-0.49	0.13	0.26	-0.13
58635	CW	10	0.5	1	3.54	35.14	9.9	0	6.24	5.31	0.55	0.47	0.09	5.49	4.63	0.86	0.14	0.17	-0.03
58636	CW	10	0.5	2	3.52	35.22	10.0	0	6.24	5.40	0.55	0.54	0.01	5.53	5.44	0.09	0.14	0.16	-0.01
58637	CW	10	1	1	3.51	35.51	10.1	0	6.22	5.38	1.20	1.11	0.10	12.19	11.20	0.99	0.14	0.14	0.00
58638	CW	10	1	2	3.52	35.05	10.0	0	6.22	5.40	1.20	1.11	0.09	12.01	11.10	0.90	0.14	0.16	-0.02
58639	CW	10	2	1	3.54	35.11	9.9	0	6.56	5.29	2.13	1.96	0.16	21.13	19.50	1.63	0.14	0.14	0.00
58640	CW	10	2	2	3.50	35.15	10.0	0	6.56	5.38	2.13	2.17	-0.04	21.34	21.74	-0.41	0.14	0.14	0.00
58641	CW	10	4	1	3.51	35.11	10.0	0	6.05	5.24	3.97	3.74	0.24	39.80	37.43	2.36	0.10	0.15	-0.05
58642	CW	10	4	2	3.51	35.51	10.1	0	6.05	5.36	3.97	3.93	0.04	40.24	39.85	0.39	0.10	0.15	-0.05
58643	CW	10	6	1	3.51	35.26	10.1	0	6.16	5.31	5.82	5.65	0.17	58.50	56.82	1.68	0.14	0.15	0.00
58644	CW	10	6	2	3.51	35.38	10.1	0	6.16	5.31	5.82	6.20	-0.38	58.72	62.57	-3.84	0.14	0.15	0.00
58645	CW	10	8	1	3.52	35.72	10.2	0	5.97	5.33	8.16	7.33	0.82	82.82	74.46	8.36	0.14	0.17	-0.03
58646	CW	10	8	2	3.51	35.18	10.0	0	5.97	5.32	8.16	8.06	0.09	81.86	80.92	0.94	0.14	0.15	-0.01
58647	CW	10	10	1	3.51	35.22	10.0	0	6.36	5.33	9.71	9.15	0.56	97.47	91.81	5.67	0.12	0.16	-0.04
58648	CW	10	10	2	3.50	35.09	10.0	0	6.36	5.34	9.71	9.81	-0.10	97.31	98.35	-1.04	0.12	0.16	-0.04

UNH	Site	NH_4^+ Xi	NH_4^+ Xf	RE	DOC Ci	DOC Cf	RE	DOC Xi	DOC Xf	RE	DON Ci	DON Cf	RE	DON Xi	DON Xf	RE
code		ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g
58633	CW	1.31	1.80	-0.49	11.95	9.38	2.58	120.63	94.63	26.00	0.05	0.05	0.00	0.50	0.50	0.00
58634	CW	1.29	2.57	-1.28	11.95	13.58	-1.63	119.18	135.39	-16.21	0.05	0.05	0.00	0.50	0.50	0.00
58635	CW	1.41	1.70	-0.29	10.43	11.96	-1.53	103.65	118.83	-15.19	0.05	0.05	0.00	0.50	0.50	0.00
58636	CW	1.42	1.56	-0.14	10.43	13.27	-2.84	104.37	132.76	-28.39	0.05	0.05	0.00	0.50	0.50	0.00
58637	CW	1.41	1.43	-0.02	12.94	13.75	-0.81	131.01	139.24	-8.23	0.05	0.05	0.00	0.51	0.51	0.00
58638	CW	1.39	1.55	-0.16	12.94	11.31	1.63	128.99	112.76	16.23	0.05	0.05	0.00	0.50	0.50	0.00
58639	CW	1.38	1.36	0.02	12.37	9.96	2.41	122.83	98.89	23.94	0.05	0.05	0.00	0.50	0.50	0.00
58640	CW	1.40	1.36	0.03	12.37	13.77	-1.40	124.04	138.08	-14.04	0.05	0.12	-0.07	0.50	1.18	-0.68
58641	CW	0.99	1.50	-0.50	12.36	12.86	-0.50	123.78	128.81	-5.02	0.60	0.05	0.55	6.01	0.50	5.51
58642	CW	1.00	1.49	-0.48	12.36	14.74	-2.38	125.17	149.27	-24.10	0.60	0.76	-0.16	6.08	7.73	-1.65
58643	CW	1.44	1.47	-0.04	12.04	13.91	-1.88	121.07	139.92	-18.86	0.05	0.54	-0.49	0.50	5.46	-4.96
58644	CW	1.44	1.48	-0.03	12.04	12.04	0.00	121.52	121.57	-0.04	0.05	0.05	0.00	0.50	0.50	0.00
58645	CW	1.43	1.76	-0.33	10.90	11.69	-0.79	110.68	118.66	-7.98	0.05	0.47	-0.42	0.51	4.77	-4.26
58646	CW	1.42	1.55	-0.13	10.90	11.99	-1.09	109.40	120.31	-10.92	0.05	0.05	0.00	0.50	0.50	0.00
58647	CW	1.17	1.62	-0.45	13.60	11.28	2.32	136.50	113.22	23.27	3.07	0.05	3.02	30.85	0.50	30.35
58648	CW	1.17	1.62	-0.44	13.60	11.86	1.74	136.27	118.86	17.41	3.07	0.05	3.02	30.80	0.50	30.29

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	HQ (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
58657	CW	10	0	1	3.50	35.78	10.2	2.37	4.72	5.21	0.00	0.00	0.00	0.00	0.05	-0.05	0.09	0.11	-0.02
58658	CW	10	0	2	3.51	35.27	10.0	2.37	4.72	5.23	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	-0.01
58659	CW	10	0.5	1	3.50	35.26	10.1	2.36	4.74	5.22	0.48	0.37	0.11	4.80	3.70	1.10	0.08	0.09	-0.01
58660	CW	10	0.5	2	3.51	35.32	10.1	2.36	4.74	5.23	0.48	0.45	0.02	4.80	4.55	0.25	0.08	0.08	0.00
58661	CW	10	1	1	3.51	35.23	10.0	2.35	4.81	5.22	1.18	0.93	0.26	11.87	9.30	2.57	0.08	0.08	0.00
58662	CW	10	1	2	3.50	35.25	10.1	2.35	4.81	5.23	1.18	1.15	0.04	11.91	11.55	0.36	0.08	0.08	0.00
58663	CW	10	2	1	3.51	35.14	10.0	2.36	4.74	5.16	2.13	2.02	0.11	21.33	20.24	1.08	0.11	0.11	0.00
58664	CW	10	2	2	3.50	35.01	10.0	2.36	4.74	5.20	2.13	2.10	0.03	21.30	20.97	0.33	0.11	0.09	0.02
58665	CW	10	4	1	3.50	35.05	10.0	2.35	4.83	5.27	4.26	3.69	0.57	42.56	36.89	5.67	0.07	0.10	-0.03
58666	CW	10	4	2	3.52	35.57	10.1	2.35	4.83	5.25	4.26	4.12	0.14	43.01	41.61	1.39	0.07	0.11	-0.05
58667	CW	10	6	1	3.50	35.01	10.0	2.37	4.75	5.23	6.20	5.40	0.80	61.95	53.92	8.03	0.10	0.09	0.01
58668	CW	10	6	2	3.52	35.10	10.0	2.37	4.75	5.25	6.20	5.96	0.24	61.80	59.41	2.39	0.10	0.08	0.02
58669	CW	10	8	1	3.51	35.02	10.0	2.36	4.75	5.24	8.40	7.72	0.68	83.93	77.10	6.84	0.10	0.10	-0.01
58670	CW	10	8	2	3.52	35.23	10.0	2.36	4.75	5.23	8.40	8.16	0.24	84.13	81.68	2.45	0.10	0.09	0.00
58671	CW	10	10	1	3.50	35.12	10.0	2.36	4.77	5.20	10.52	10.19	0.33	105.51	102.25	3.26	0.09	0.11	-0.01
58672	CW	10	10	2	3.51	35.40	10.1	2.36	4.77	5.17	10.52	10.12	0.40	106.12	102.08	4.04	0.09	0.09	0.00

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	NH_4^+ Xi	NH_4^+ Xf	RE	DOC Ci	DOC Cf	RE	DOC Xi	DOC Xf	RE	DON Ci	DON Cf	RE	DON Xi	DON Xf	RE
code		ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g
58657	CW	0.88	1.11	-0.24	10.11	10.87	-0.76	103.23	110.99	-7.77	0.05	0.06	-0.06	0.51	0.59	-0.08
58658	CW	0.86	0.95	-0.09	10.11	12.00	-1.89	101.44	120.42	-18.98	0.05	0.08	-0.08	0.50	0.85	-0.35
58659	CW	0.77	0.90	-0.13	9.48	12.05	-2.57	95.38	121.29	-25.91	0.05	0.00	0.05	0.50	0.04	0.46
58660	CW	0.77	0.79	-0.02	9.48	11.76	-2.28	95.43	118.40	-22.97	0.05	0.05	0.05	0.50	0.50	0.00
58661	CW	0.77	0.77	0.00	9.53	11.95	-2.41	95.57	119.78	-24.21	0.05	0.05	0.00	0.50	0.50	0.00
58662	CW	0.78	0.78	0.00	9.53	11.23	-1.70	95.86	112.92	-17.06	0.05	0.02	-0.02	0.50	0.18	0.32
58663	CW	1.11	1.11	0.00	9.86	10.88	-1.02	98.67	108.90	-10.23	0.05	0.05	0.00	0.50	0.50	0.00
58664	CW	1.11	0.86	0.24	9.86	11.04	-1.18	98.54	110.34	-11.80	0.05	0.05	0.00	0.50	0.50	0.00
58665	CW	0.67	0.98	-0.30	9.79	10.80	-1.01	97.91	108.00	-10.09	0.05	0.05	0.00	0.50	0.50	0.00
58666	CW	0.68	1.14	-0.46	9.79	11.33	-1.54	98.93	114.47	-15.54	0.05	0.05	0.00	0.51	0.51	0.00
58667	CW	1.01	0.95	0.06	9.26	11.41	-2.15	92.50	114.00	-21.50	0.05	0.53	-0.53	0.50	5.31	-4.81
58668	CW	1.00	0.84	0.17	9.26	10.80	-1.54	92.28	107.67	-15.40	0.05	0.05	0.00	0.50	0.50	0.00
58669	CW	0.95	1.04	-0.09	10.50	11.73	-1.23	104.85	117.12	-12.27	0.05	0.83	-0.83	0.50	8.33	-7.83
58670	CW	0.96	0.93	0.03	10.50	12.52	-2.02	105.10	125.33	-20.24	0.05	0.12	-0.12	0.50	1.20	-0.70
58671	CW	0.91	1.05	-0.15	10.06	10.71	-0.65	100.88	107.41	-6.52	1.00	0.05	1.00	10.03	0.50	9.52
58672	CW	0.91	0.95	-0.04	10.06	11.19	-1.13	101.47	112.86	-11.39	1.00	0.05	1.00	10.08	0.50	9.58

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	DOC (target) mg/L	NO_3^- (target) mg/L	Rep No.	Soil g	Solution g	S:S ratio	$FeCl_3$ mg/L	pHi	pHf	NO_3^- Ci mg/L	NO_3^- Cf mg/L	RE mg/L	NO_3^- Xi ug/g	NO_3^- Xf ug/g	RE ug/g	NH_4^+ Ci mg/L	NH_4^+ Cf mg/L	RE mg/L
59476	SD	0	0	1	3.50	35.53	10.1	0	6.98	6.07	0.00	0.19	-0.19	0.00	1.89	-1.89	0.02	0.16	-0.13
59477	SD	0	0	2	3.51	35.24	10.0	0	6.98	6.20	0.00	0.16	-0.16	0.00	1.60	-1.60	0.02	0.08	-0.06
59478	SD	10	0	1	3.50	35.21	10.1	0	6.28	5.95	0.00	0.14	-0.14	0.00	1.42	-1.42	0.24	0.11	0.13
59479	SD	10	0	2	3.51	35.68	10.2	0	6.28	5.93	0.00	0.19	-0.19	0.00	1.97	-1.97	0.24	0.12	0.12
59480	SD	20	0	1	3.53	35.03	9.9	0	6.11	5.99	0.08	0.12	-0.04	0.77	1.16	-0.39	0.50	0.18	0.32
59481	SD	20	0	2	3.51	35.53	10.1	0	6.11	5.95	0.08	0.18	-0.10	0.78	1.83	-1.05	0.50	0.18	0.31
59482	SD	30	0	1	3.51	35.33	10.1	0	5.94	5.91	0.00	0.17	-0.17	0.00	1.68	-1.68	0.68	0.20	0.47
59483	SD	30	0	2	3.52	35.45	10.1	0	5.94	5.91	0.00	0.22	-0.22	0.00	2.18	-2.18	0.68	0.23	0.45
59484	SD	40	0	1	3.51	35.47	10.1	0	5.85	5.86	0.00	0.23	-0.23	0.00	2.36	-2.36	0.86	0.27	0.59
59485	SD	40	0	2	3.51	35.05	10.0	0	5.85	5.85	0.00	0.27	-0.27	0.00	2.74	-2.74	0.86	0.27	0.60
59486	SD	50	0	1	3.50	35.86	10.2	0	5.81	5.82	0.00	0.14	-0.14	0.00	1.39	-1.39	1.08	0.32	0.76
59487	SD	50	0	2	3.51	35.40	10.1	0	5.81	5.82	0.00	0.13	-0.13	0.00	1.33	-1.33	1.08	0.33	0.75
57648	SD	0	0	1	3.51	35.01	10.0	0	6.38	5.72	0.00	-0.11	0.11	0.00	-1.10	1.10	0.04	0.11	-0.07
57649	SD	0	0	2	3.53	35.18	10.0	0	6.38	5.88	0.00	0.12	-0.12	0.00	1.23	-1.23	0.04	0.08	-0.05
57650	SD	0	0.5	1	3.52	35.05	10.0	0	6.40	5.84	0.58	0.58	0.00	5.83	5.81	0.02	0.00	0.04	-0.04
57651	SD	0	0.5	2	3.51	35.13	10.0	0	6.40	5.81	0.58	0.60	-0.02	5.85	6.03	-0.18	0.00	0.07	-0.07
57652	SD	0	1	1	3.51	35.41	10.1	0	6.45	5.81	1.10	1.03	0.07	11.06	10.40	0.66	0.02	0.13	-0.11
57653	SD	0	1	2	3.51	35.18	10.0	0	6.45	5.81	1.10	1.08	0.01	10.99	10.85	0.14	0.02	0.08	-0.06
57654	SD	0	2	1	3.52	35.10	10.0	0	6.60	5.75	2.12	1.87	0.26	21.16	18.61	2.55	0.01	0.10	-0.09
57655	SD	0	2	2	3.52	35.06	10.0	0	6.60	5.77	2.12	2.12	0.00	21.14	21.11	0.02	0.01	0.06	-0.05
57656	SD	0	4	1	3.51	35.59	10.1	0	6.42	5.66	3.96	3.82	0.13	40.09	38.74	1.34	0.01	0.06	-0.05
57657	SD	0	4	2	3.51	35.55	10.1	0	6.42	5.79	3.96	4.10	-0.14	40.04	41.49	-1.45	0.01	0.13	-0.12
57658	SD	0	6	1	3.51	35.08	10.0	0	6.41	5.57	6.04	5.53	0.51	60.39	55.32	5.07	0.08	0.08	0.01
57659	SD	0	6	2	3.51	35.38	10.1	0	6.41	5.60	6.04	5.44	0.60	60.98	54.94	6.04	0.08	0.07	0.01
57660	SD	0	8	1	3.51	35.52	10.1	0	6.31	5.57	8.04	7.04	1.00	81.49	71.36	10.13	0.01	0.09	-0.07
57661	SD	0	8	2	3.51	35.91	10.2	0	6.31	5.52	8.04	7.04	1.00	82.19	71.96	10.23	0.01	0.10	-0.08
57662	SD	0	10	1	3.50	35.26	10.1	0	6.32	5.55	10.06	8.86	1.20	101.28	89.16	12.13	0.04	0.09	-0.05
57663	SD	0	10	2	3.51	35.25	10.1	0	6.32	5.48	10.06	9.62	0.45	101.14	96.64	4.50	0.04	-0.51	0.55

57663 not used as data for NH_4^+ and DON

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	NH_4^+ Xi ug/g	NH_4^+ Xf ug/g	RE ug/g	DOC Ci mg/L	DOC Cf mg/L	RE mg/L	DOC Xi ug/g	DOC Xf ug/g	RE ug/g	DON Ci mg/L	DON Cf mg/L	RE mg/L	DON Xi ug/g	DON Xf ug/g	RE ug/g
59476	SD	0.24	1.61	-1.37	1.33	6.79	-5.46	13.49	68.86	-55.37	0.14	0.19	-0.05	1.41	1.95	-0.55
59477	SD	0.24	0.85	-0.61	1.33	6.88	-5.55	13.35	69.13	-55.78	0.14	0.31	-0.17	1.39	3.09	-1.70
59478	SD	2.41	1.08	1.32	8.63	7.96	0.66	86.72	80.06	6.66	0.17	0.34	-0.16	1.74	3.39	-1.65
59479	SD	2.43	1.25	1.19	8.63	8.19	0.44	87.59	83.15	4.44	0.17	0.25	-0.08	1.76	2.55	-0.80
59480	SD	4.93	1.76	3.16	16.40	9.49	6.90	162.81	94.27	68.53	0.20	0.33	-0.13	1.99	3.28	-1.28
59481	SD	5.03	1.85	3.18	16.40	9.85	6.54	166.19	99.85	66.34	0.20	0.30	-0.09	2.03	2.99	-0.96
59482	SD	6.80	2.06	4.74	22.06	10.96	11.11	222.20	110.33	111.87	0.35	0.34	0.01	3.50	3.38	0.12
59483	SD	6.79	2.29	4.50	22.06	11.30	10.76	221.96	113.71	108.25	0.35	0.27	0.08	3.49	2.68	0.81
59484	SD	8.74	2.77	5.97	29.44	12.73	16.71	297.48	128.59	168.89	0.46	0.25	0.21	4.64	2.54	2.10
59485	SD	8.65	2.69	5.95	29.44	12.90	16.54	294.43	128.98	165.46	0.46	0.23	0.23	4.59	2.34	2.25
59486	SD	11.06	3.30	7.76	36.42	15.00	21.43	372.77	153.48	219.29	0.53	0.36	0.16	5.38	3.72	1.66
59487	SD	10.91	3.37	7.54	36.42	14.77	21.65	367.67	149.15	218.53	0.53	0.35	0.18	5.31	3.51	1.80
57648	SD	0.38	1.07	-0.69	1.74	6.51	-4.77	17.38	64.97	-47.59	0.28	1.18	-0.89	2.84	11.74	-8.90
57649	SD	0.38	0.85	-0.47	1.74	7.20	-5.46	17.38	71.86	-54.48	0.28	0.76	-0.47	2.84	7.57	-4.73
57650	SD	0.00	0.43	-0.43	1.15	6.27	-5.12	11.49	62.52	-51.03	0.05	0.63	-0.58	0.50	6.30	-5.80
57651	SD	0.00	0.73	-0.73	1.15	5.97	-4.82	11.52	59.67	-48.15	0.05	0.53	-0.48	0.50	5.32	-4.82
57652	SD	0.22	1.36	-1.15	1.08	6.63	-5.55	10.89	66.98	-56.09	0.24	0.66	-0.42	2.42	6.62	-4.20
57653	SD	0.22	0.82	-0.60	1.08	5.77	-4.69	10.82	57.88	-47.05	0.24	0.66	-0.42	2.41	6.63	-4.23
57654	SD	0.09	0.97	-0.88	1.20	6.54	-5.34	11.97	65.26	-53.29	0.15	0.56	-0.41	1.48	5.56	-4.08
57655	SD	0.09	0.64	-0.55	1.20	6.35	-5.15	11.95	63.26	-51.30	0.15	0.73	-0.58	1.48	7.23	-5.74
57656	SD	0.07	0.61	-0.54	0.49	6.64	-6.16	4.92	67.31	-62.39	0.34	0.87	-0.53	3.48	8.84	-5.36
57657	SD	0.07	1.30	-1.24	0.49	6.40	-5.91	4.92	64.76	-59.84	0.34	0.48	-0.14	3.48	4.88	-1.41
57658	SD	0.83	0.76	0.07	0.53	5.55	-5.02	5.32	55.48	-50.16	0.05	0.35	-0.30	0.50	3.52	-3.02
57659	SD	0.84	0.70	0.14	0.53	5.76	-5.23	5.37	58.17	-52.80	0.05	1.23	-1.18	0.50	12.39	-11.88
57660	SD	0.12	0.86	-0.74	0.99	6.40	-5.42	9.99	64.88	-54.89	0.05	5.30	-5.25	0.51	53.72	-53.21
57661	SD	0.12	0.98	-0.86	0.99	6.42	-5.43	10.08	65.61	-55.53	0.05	3.44	-3.39	0.51	35.11	-34.60
57662	SD	0.39	0.88	-0.49	0.65	5.66	-5.01	6.59	56.98	-50.39	0.05	4.15	-4.10	0.50	41.72	-41.22
57663	SD	0.39	-5.15	5.53	0.65	6.15	-5.49	6.58	61.81	-55.22	0.05	2.26	-2.21	0.50	22.72	-22.22

57663 not used as data for NH_4^+ and DON

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	DOC (target) mg/L	NO_3^- (target) mg/L	Rep No.	Soil g	Solution g	S:S ratio	$FeCl_3$ mg/L	pHi	pHf	NO_3^- Ci mg/L	NO_3^- Cf mg/L	RE mg/L	NO_3^- Xi ug/g	NO_3^- Xf ug/g	RE ug/g	NH_4^+ Ci mg/L	NH_4^+ Cf mg/L	RE mg/L
57141	SD	50	0	1	3.52	35.45	10.1	0	5.66	5.43	0.03	0.22	-0.19	0.34	2.26	-1.92	0.79	0.30	0.49
57142	SD	50	0	2	3.50	35.27	10.1	0	5.66	5.43	0.03	0.22	-0.19	0.34	2.24	-1.91	0.79	0.28	0.51
57143	SD	50	0.5	1	3.51	35.05	10.0	0	5.65	5.41	0.61	0.71	-0.09	6.12	7.06	-0.94	0.81	0.25	0.56
57144	SD	50	0.5	2	3.50	35.45	10.1	0	5.65	5.39	0.61	0.73	-0.12	6.19	7.37	-1.19	0.81	0.28	0.53
57145	SD	50	1	1	3.55	35.33	10.0	0	5.65	5.35	1.07	1.10	-0.04	10.63	10.98	-0.35	0.80	0.31	0.49
57146	SD	50	1	2	3.50	35.20	10.1	0	5.65	5.34	1.07	1.23	-0.16	10.73	12.38	-1.66	0.80	0.28	0.52
57147	SD	50	2	1	3.51	35.09	10.0	0	5.64	5.40	2.00	2.13	-0.12	20.03	21.24	-1.21	0.79	0.30	0.50
57148	SD	50	2	2	3.52	35.21	10.0	0	5.64	5.30	2.00	2.15	-0.15	20.08	21.57	-1.49	0.79	0.37	0.42
57149	SD	50	4	1	3.51	35.31	10.1	0	5.64	5.32	3.91	4.10	-0.20	39.33	41.30	-1.97	0.82	0.29	0.52
57150	SD	50	4	2	3.51	35.15	10.0	0	5.64	5.43	3.91	4.48	-0.57	39.17	44.91	-5.74	0.82	0.32	0.50
57151	SD	50	6	1	3.51	35.12	10.0	0	5.64	5.32	5.78	5.39	0.40	57.91	53.94	3.96	0.79	0.31	0.48
57152	SD	50	6	2	3.50	35.42	10.1	0	5.64	5.27	5.78	5.74	0.04	58.47	58.09	0.38	0.79	0.33	0.46
57153	SD	50	8	1	3.51	35.58	10.1	0	5.62	5.27	7.75	7.83	-0.08	78.61	79.45	-0.84	0.76	0.31	0.46
57154	SD	50	8	2	3.51	35.11	10.0	0	5.62	5.29	7.75	7.81	-0.06	77.52	78.11	-0.59	0.76	0.32	0.45
57155	SD	50	10	1	3.51	35.11	10.0	0	5.62	5.26	9.89	9.52	0.36	98.96	95.31	3.65	0.80	0.36	0.44
57156	SD	50	10	2	3.50	35.35	10.1	0	5.62	5.28	9.89	9.54	0.34	99.76	96.32	3.45	0.80	0.33	0.47
56823	SD	0	4	1	3.50	35.47	10.1	0	5.68	5.19	3.96	3.76	0.20	40.08	38.09	1.99	0.06	0.13	-0.07
56824	SD	0	4	2	3.52	35.41	10.1	0	5.68	5.31	3.96	3.93	0.03	39.86	39.59	0.26	0.06	0.12	-0.06
56825	SD	10	4	1	3.52	35.18	10.0	0	5.71	5.22	3.92	4.06	-0.14	39.18	40.61	-1.43	0.21	0.15	0.07
56826	SD	10	4	2	3.50	35.26	10.1	0	5.71	5.17	3.92	3.70	0.23	39.47	37.20	2.27	0.21	0.14	0.07
56827	SD	20	4	1	3.50	35.14	10.0	0	5.60	5.14	3.60	4.01	-0.41	36.11	40.23	-4.12	0.31	7.27	-6.96
56828	SD	20	4	2	3.51	35.51	10.1	0	5.60	5.16	3.60	4.05	-0.46	36.43	41.03	-4.61	0.31	0.19	0.12
56829	SD	30	4	1	3.51	35.75	10.2	0	5.58	5.12	4.14	0.00	4.14	42.13	0.00	42.13	0.50	0.00	0.50
56830	SD	30	4	2	3.50	35.04	10.0	0	5.58	5.12	4.14	4.00	0.14	41.45	40.01	1.43	0.50	0.23	0.26
56831	SD	40	4	1	3.52	35.48	10.1	0	5.54	5.10	3.95	4.06	-0.11	39.76	40.92	-1.16	0.67	1.38	-0.71
56832	SD	40	4	2	3.50	35.36	10.1	0	5.54	5.11	3.95	4.08	-0.13	39.84	41.20	-1.36	0.67	0.28	0.39
56833	SD	50	4	1	3.52	35.26	10.0	0	5.52	5.11	3.97	4.02	-0.05	39.83	40.31	-0.49	0.81	0.32	0.48
56834	SD	50	4	2	3.51	35.48	10.1	0	5.52	5.12	3.97	4.22	-0.25	40.19	42.71	-2.52	0.81	0.34	0.47

56829 : output sample missing

56827, 56831 : not used as data for NH_4^+ and DON

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	NH$_4^+$ Xi	NH$_4^+$ Xf	RE	DOC Ci	DOC Cf	RE	DOC Xi	DOC Xf	RE	DON Ci	DON Cf	RE	DON Xi	DON Xf	RE
code		ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g
57141	SD	7.94	3.01	4.93	51.12	19.93	31.19	514.84	200.74	314.09	1.62	1.37	0.25	16.27	13.79	2.48
57142	SD	7.94	2.83	5.10	51.12	21.19	29.93	514.82	213.36	301.46	1.62	0.97	0.64	16.27	9.81	6.47
57143	SD	8.07	2.48	5.59	49.58	17.36	32.22	495.71	173.56	322.15	1.42	0.63	0.79	14.19	6.34	7.85
57144	SD	8.16	2.84	5.32	49.58	18.82	30.77	501.59	190.35	311.24	1.42	0.62	0.80	14.35	6.25	8.11
57145	SD	7.96	3.06	4.90	50.87	21.43	29.43	506.83	213.57	293.26	1.45	0.72	0.74	14.47	7.14	7.33
57146	SD	8.04	2.81	5.23	50.87	17.99	32.87	511.46	180.91	330.54	1.45	0.50	0.95	14.61	5.05	9.56
57147	SD	7.93	2.98	4.95	50.18	17.85	32.33	501.39	178.37	323.01	1.28	0.58	0.71	12.83	5.76	7.08
57148	SD	7.95	3.75	4.20	50.18	16.73	33.45	502.61	167.55	335.06	1.28	0.41	0.88	12.86	4.08	8.79
57149	SD	8.21	2.92	5.28	51.37	17.01	34.36	517.12	171.26	345.86	1.30	0.24	1.06	13.13	2.43	10.70
57150	SD	8.17	3.21	4.96	51.37	16.83	34.54	514.99	168.72	346.27	1.30	0.25	1.06	13.07	2.48	10.59
57151	SD	7.92	3.10	4.82	49.16	16.89	32.28	492.42	169.16	323.26	1.09	0.75	0.33	10.90	7.55	3.35
57152	SD	7.99	3.33	4.66	49.16	16.55	32.61	497.20	167.42	329.78	1.09	0.61	0.48	11.01	6.15	4.85
57153	SD	7.73	3.10	4.63	50.14	17.55	32.59	508.50	177.98	330.52	1.21	1.15	0.06	12.26	11.65	0.62
57154	SD	7.63	3.16	4.47	50.14	16.10	34.04	501.46	161.04	340.42	1.21	0.46	0.75	12.10	4.62	7.48
57155	SD	8.02	3.63	4.40	50.93	16.35	34.58	509.85	163.67	346.18	1.48	0.28	1.20	14.86	2.84	12.03
57156	SD	8.09	3.31	4.78	50.93	17.07	33.86	513.99	172.28	341.71	1.48	1.38	0.10	14.98	13.97	1.01
56823	SD	0.60	1.33	-0.73	1.28	6.05	-4.77	12.98	61.26	-48.28	0.21	0.07	0.14	2.15	0.70	1.46
56824	SD	0.60	1.16	-0.57	1.28	7.34	-6.05	12.91	73.87	-60.96	0.21	0.39	-0.18	2.14	3.92	-1.77
56825	SD	2.15	1.45	0.69	11.95	8.01	3.94	119.42	80.00	39.42	0.73	0.61	0.12	7.30	6.07	1.23
56826	SD	2.16	1.43	0.73	11.95	7.44	4.51	120.30	74.92	45.38	0.73	0.96	-0.23	7.35	9.66	-2.32
56827	SD	3.11	72.94	-69.83	20.42	8.51	11.90	204.95	85.47	119.48	0.90	-6.75	7.65	9.04	-67.77	76.82
56828	SD	3.14	1.94	1.20	20.42	9.14	11.28	206.75	92.56	114.19	0.90	0.79	0.11	9.12	7.96	1.16
56829	SD	5.04	0.00	5.04	30.01	0.00	30.01	305.33	0.00	305.33	0.80	0.00	0.80	8.10	0.00	8.10
56830	SD	4.96	2.33	2.63	30.01	10.14	19.88	300.36	101.44	198.92	0.80	0.44	0.36	7.96	4.37	3.60
56831	SD	6.79	13.93	-7.13	39.56	12.90	26.67	398.69	129.95	268.75	1.31	-0.49	1.80	13.24	-4.90	18.14
56832	SD	6.81	2.86	3.95	39.56	13.60	25.96	399.49	137.37	262.13	1.31	0.86	0.45	13.26	8.68	4.59
56833	SD	8.09	3.23	4.86	50.24	14.57	35.68	503.72	146.04	357.68	1.67	0.62	1.05	16.77	6.20	10.57
56834	SD	8.16	3.42	4.74	50.24	15.63	34.61	508.30	158.14	350.17	1.67	0.57	1.11	16.93	5.73	11.20

56829 : output sample missing

56827, 56831 : not used as data for NH$_4^+$ and DON

UNH	Site	DOC (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
57624	SD	50	0	1	3.50	35.04	10.0	2.34	4.68	5.34	0.03	0.49	-0.46	0.27	4.91	-4.64	0.97	0.43	0.54
57625	SD	50	0	2	3.51	35.40	10.1	2.34	4.68	5.37	0.03	0.16	-0.13	0.28	1.60	-1.32	0.97	0.45	0.52
57626	SD	50	0.5	1	3.53	35.27	10.0	2.34	4.65	5.38	0.27	0.13	0.14	2.68	1.28	1.40	0.94	0.41	0.53
57627	SD	50	0.5	2	3.50	35.14	10.0	2.34	4.65	5.32	0.27	0.48	-0.22	2.69	4.85	-2.16	0.94	0.41	0.54
57628	SD	50	1	1	3.50	35.51	10.1	2.37	4.69	5.35	1.00	1.02	-0.03	10.11	10.37	-0.26	0.98	0.43	0.55
57629	SD	50	1	2	3.51	35.48	10.1	2.37	4.69	5.40	1.00	1.18	-0.18	10.07	11.94	-1.87	0.98	0.43	0.55
57630	SD	50	2	1	3.53	35.58	10.1	2.33	4.66	5.31	1.94	1.75	0.19	19.56	17.62	1.94	0.95	0.45	0.50
57631	SD	50	2	2	3.50	35.16	10.0	2.33	4.66	5.30	1.94	2.04	-0.10	19.47	20.48	-1.02	0.95	0.43	0.51
57632	SD	50	4	1	3.52	35.35	10.1	2.36	4.66	5.41	3.71	3.28	0.43	37.35	32.98	4.36	0.97	0.42	0.56
57633	SD	50	4	2	3.51	35.36	10.1	2.36	4.66	5.30	3.71	3.87	-0.15	37.37	38.89	-1.52	0.97	0.40	0.57
57634	SD	50	6	1	3.51	35.45	10.1	2.32	4.68	5.32	5.73	5.36	0.37	57.85	54.11	3.74	1.09	0.43	0.66
57635	SD	50	6	2	3.51	35.16	10.0	2.32	4.68	5.34	5.73	5.63	0.09	57.43	56.48	0.95	1.09	0.39	0.69
57636	SD	50	8	1	3.53	35.15	10.0	2.34	4.66	5.29	7.50	6.57	0.92	74.71	65.50	9.21	1.01	0.42	0.59
57637	SD	50	8	2	3.50	35.62	10.2	2.34	4.66	5.30	7.50	7.10	0.40	76.26	72.23	4.03	1.01	0.68	0.32
57638	SD	50	10	1	3.51	35.46	10.1	2.32	4.68	5.29	9.62	8.99	0.63	97.17	90.85	6.32	0.97	0.43	0.53
57639	SD	50	10	2	3.53	35.48	10.1	2.32	4.68	5.27	9.62	9.30	0.32	96.80	93.61	3.19	0.97	0.41	0.56
57402	SD	0	4	1	3.52	35.35	10.0	2.37	4.18	5.31	4.02	3.51	0.52	40.36	35.18	5.18	0.05	0.19	-0.14
57403	SD	0	4	2	3.50	35.40	10.1	2.37	4.18	5.33	4.02	3.96	0.06	40.68	40.05	0.63	0.05	0.15	-0.10
57404	SD	10	4	1	3.51	35.27	10.0	2.36	4.42	5.43	4.11	4.13	-0.02	41.27	41.49	-0.22	0.26	0.15	0.11
57405	SD	10	4	2	3.50	35.12	10.0	2.36	4.42	5.36	4.11	3.99	0.12	41.22	40.03	1.19	0.26	0.17	0.09
57406	SD	20	4	1	3.51	35.03	10.0	2.37	4.56	5.34	4.10	3.84	0.27	40.96	38.27	2.69	0.45	0.22	0.23
57407	SD	20	4	2	3.51	35.27	10.0	2.37	4.56	5.35	4.10	4.06	0.04	41.20	40.76	0.44	0.45	0.23	0.22
57408	SD	30	4	1	3.51	35.18	10.0	2.37	4.62	5.33	4.30	4.17	0.13	43.14	41.80	1.34	0.62	0.29	0.34
57409	SD	30	4	2	3.51	35.29	10.1	2.37	4.62	5.30	4.30	4.14	0.16	43.30	41.71	1.59	0.62	0.31	0.31
57410	SD	40	4	1	3.51	35.39	10.1	2.36	4.68	5.35	4.21	4.18	0.03	42.47	42.17	0.30	0.84	0.34	0.50
57411	SD	40	4	2	3.53	35.46	10.1	2.36	4.68	5.35	4.21	4.12	0.09	42.38	41.44	0.94	0.84	0.34	0.50
57412	SD	50	4	1	3.53	35.14	9.9	2.36	4.73	5.35	4.05	4.13	-0.08	40.33	41.12	-0.79	0.99	0.44	0.55
57413	SD	50	4	2	3.51	35.36	10.1	2.36	4.73	5.34	4.05	4.10	-0.04	40.89	41.30	-0.41	0.99	0.40	0.59

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	NH_4^+ Xi ug/g	NH_4^+ Xf ug/g	RE ug/g	DOC Ci mg/L	DOC Cf mg/L	RE mg/L	DOC Xi ug/g	DOC Xf ug/g	RE ug/g	DON Ci mg/L	DON Cf mg/L	RE mg/L	DON Xi ug/g	DON Xf ug/g	RE ug/g
57624	SD	9.68	4.31	5.36	47.34	15.76	31.58	473.42	157.62	315.81	1.28	0.29	0.99	12.82	2.93	9.89
57625	SD	9.76	4.56	5.20	47.34	14.69	32.65	477.30	148.10	329.20	1.28	0.67	0.61	12.92	6.77	6.15
57626	SD	9.43	4.10	5.33	49.53	13.79	35.74	495.02	137.86	357.17	2.11	1.12	0.99	21.12	11.22	9.90
57627	SD	9.47	4.10	5.37	49.53	14.54	34.98	496.96	145.93	351.03	2.11	0.52	1.60	21.21	5.19	16.02
57628	SD	9.96	4.37	5.60	40.87	13.17	27.70	414.55	133.56	280.99	1.07	0.83	0.25	10.90	8.42	2.49
57629	SD	9.93	4.40	5.53	40.87	14.28	26.59	413.23	144.39	268.83	1.07	0.62	0.46	10.87	6.23	4.64
57630	SD	9.55	4.51	5.05	45.02	14.09	30.93	454.29	142.17	312.12	1.46	1.10	0.36	14.68	11.06	3.62
57631	SD	9.51	4.36	5.15	45.02	14.98	30.04	452.01	150.38	301.63	1.46	0.91	0.55	14.61	9.12	5.49
57632	SD	9.80	4.20	5.60	46.07	13.79	32.28	463.16	138.61	324.55	1.71	1.17	0.54	17.24	11.78	5.46
57633	SD	9.81	4.06	5.75	46.07	15.65	30.42	463.50	157.46	306.04	1.71	1.72	0.00	17.25	17.27	-0.01
57634	SD	10.96	4.31	6.65	49.24	14.65	34.58	497.34	148.00	349.34	1.62	2.02	-0.40	16.37	20.38	-4.00
57635	SD	10.88	3.93	6.96	49.24	12.91	36.32	493.76	129.51	364.25	1.62	1.70	-0.08	16.26	17.04	-0.78
57636	SD	10.03	4.14	5.89	47.79	11.77	36.02	476.40	117.34	359.05	1.88	3.03	-1.15	18.76	30.25	-11.50
57637	SD	10.24	6.95	3.29	47.79	13.05	34.75	486.28	132.75	353.54	1.88	3.20	-1.32	19.14	32.58	-13.44
57638	SD	9.75	4.39	5.36	44.52	10.72	33.81	449.69	108.24	341.44	1.81	0.72	1.09	18.30	7.24	11.06
57639	SD	9.72	4.11	5.61	44.52	11.30	33.22	447.98	113.68	334.30	1.81	1.42	0.39	18.23	14.28	3.95
57402	SD	0.53	1.89	-1.36	0.91	5.50	-4.59	9.11	55.11	-46.01	0.03	0.61	-0.59	0.26	6.14	-5.88
57403	SD	0.53	1.54	-1.00	0.91	4.27	-3.36	9.18	43.16	-33.98	0.03	0.49	-0.46	0.26	4.94	-4.68
57404	SD	2.64	1.51	1.13	5.07	6.03	-0.95	50.93	60.47	-9.54	0.04	0.39	-0.35	0.38	3.89	-3.51
57405	SD	2.64	1.71	0.93	5.07	7.26	-2.18	50.87	72.74	-21.87	0.04	0.56	-0.53	0.38	5.65	-5.27
57406	SD	4.48	2.15	2.33	10.63	7.96	2.66	106.03	79.48	26.55	0.18	0.36	-0.18	1.76	3.60	-1.84
57407	SD	4.51	2.26	2.24	10.63	5.99	4.64	106.65	60.11	46.54	0.18	0.46	-0.29	1.77	4.67	-2.90
57408	SD	6.27	2.90	3.36	19.94	9.01	10.93	199.93	90.32	109.61	0.34	0.79	-0.45	3.38	7.94	-4.55
57409	SD	6.29	3.16	3.13	19.94	9.23	10.70	200.68	92.94	107.74	0.34	0.55	-0.21	3.40	5.55	-2.16
57410	SD	8.43	3.41	5.02	27.95	12.08	15.87	281.68	121.73	159.95	0.16	0.73	-0.58	1.56	7.38	-5.82
57411	SD	8.41	3.41	5.00	27.95	10.95	17.00	281.05	110.08	170.97	0.16	0.53	-0.37	1.56	5.32	-3.76
57412	SD	9.85	4.33	5.51	34.68	12.78	21.90	345.00	127.18	217.82	0.39	0.39	0.00	3.87	3.86	0.00
57413	SD	9.98	4.06	5.92	34.68	14.75	19.93	349.73	148.75	200.99	0.39	1.41	-1.02	3.92	14.21	-10.29

UNH	Site	HQ (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
57226	SD	10	0	1	3.50	35.19	10.0	0	6.13	5.80	0.04	0.35	-0.31	0.43	3.52	-3.09	0.12	0.14	-0.02
57227	SD	10	0	2	3.50	35.06	10.0	0	6.13	5.70	0.04	0.28	-0.24	0.43	2.83	-2.40	0.12	0.18	-0.06
57228	SD	10	0.5	1	3.50	35.08	10.0	0	6.12	5.66	0.56	0.70	-0.14	5.65	7.05	-1.41	0.07	0.13	-0.06
57229	SD	10	0.5	2	3.52	35.20	10.0	0	6.12	5.66	0.56	0.14	0.43	5.64	1.36	4.27	0.07	0.16	-0.09
57230	SD	10	1	1	3.50	35.43	10.1	0	6.01	5.67	0.99	1.17	-0.19	9.98	11.87	-1.89	0.11	0.14	-0.03
57231	SD	10	1	2	3.51	35.27	10.0	0	6.01	5.62	0.99	1.44	-0.46	9.92	14.49	-4.57	0.11	0.17	-0.06
57232	SD	10	2	1	3.52	35.49	10.1	0	6.18	5.63	1.95	1.88	0.07	19.71	18.97	0.75	0.10	0.14	-0.04
57233	SD	10	2	2	3.53	35.22	10.0	0	6.18	5.49	1.95	2.02	-0.07	19.50	20.17	-0.66	0.10	0.16	-0.06
57234	SD	10	4	1	3.50	35.43	10.1	0	6.13	5.54	3.90	3.39	0.51	39.39	34.27	5.12	0.10	0.16	-0.06
57235	SD	10	4	2	3.50	35.18	10.0	0	6.13	5.62	3.90	3.95	-0.05	39.14	39.67	-0.53	0.10	0.15	-0.05
57236	SD	10	6	1	3.50	35.08	10.0	0	6.05	5.67	5.66	5.37	0.29	56.63	53.73	2.90	0.07	0.16	-0.09
57237	SD	10	6	2	3.51	35.43	10.1	0	6.05	5.50	5.66	6.17	-0.51	57.16	62.32	-5.16	0.07	0.15	-0.08
57238	SD	10	8	1	3.51	35.35	10.1	0	6.00	5.59	7.13	6.48	0.65	71.84	65.31	6.53	0.11	0.19	-0.08
57239	SD	10	8	2	3.51	35.06	10.0	0	6.00	5.54	7.13	7.38	-0.25	71.28	73.79	-2.52	0.11	0.17	-0.06
57240	SD	10	10	1	3.51	35.05	10.0	0	6.16	5.50	10.07	8.65	1.42	100.57	86.39	14.19	0.09	0.17	-0.08
57241	SD	10	10	2	3.50	35.25	10.1	0	6.16	5.54	10.07	9.07	1.01	101.39	91.23	10.15	0.09	0.15	-0.06

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	NH_4^+ Xi	NH_4^+ Xf	RE	DOC Ci	DOC Cf	RE	DOC Xi	DOC Xf	RE	DON Ci	DON Cf	RE	DON Xi	DON Xf	RE
code		ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g
57226	SD	1.21	1.44	-0.23	13.49	15.13	-1.63	135.54	151.95	-16.41	0.80	0.32	0.48	8.01	3.17	4.84
57227	SD	1.21	1.76	-0.56	13.49	14.96	-1.47	134.98	149.64	-14.66	0.80	0.33	0.47	7.98	3.33	4.65
57228	SD	0.70	1.27	-0.56	12.74	16.96	-4.23	127.63	170.00	-42.37	0.26	0.31	-0.05	2.64	3.14	-0.49
57229	SD	0.70	1.59	-0.88	12.74	15.94	-3.21	127.39	159.47	-32.09	0.26	0.84	-0.58	2.64	8.40	-5.76
57230	SD	1.15	1.44	-0.29	11.78	17.09	-5.31	119.12	172.77	-53.65	0.33	0.38	-0.05	3.38	3.86	-0.48
57231	SD	1.14	1.70	-0.56	11.78	16.78	-4.99	118.38	168.53	-50.16	0.33	0.15	0.19	3.36	1.46	1.90
57232	SD	1.00	1.37	-0.37	11.10	18.06	-6.96	112.04	182.29	-70.25	0.04	0.54	-0.50	0.41	5.41	-5.00
57233	SD	0.99	1.61	-0.62	11.10	16.48	-5.38	110.85	164.53	-53.68	0.04	0.41	-0.37	0.40	4.07	-3.66
57234	SD	1.03	1.65	-0.62	11.93	18.97	-7.04	120.54	191.70	-71.16	0.00	0.49	-0.49	0.00	4.90	-4.90
57235	SD	1.03	1.49	-0.46	11.93	16.09	-4.16	119.79	161.58	-41.79	0.00	0.22	-0.22	0.00	2.24	-2.24
57236	SD	0.74	1.60	-0.85	10.85	17.24	-6.39	108.62	172.58	-63.96	0.01	0.40	-0.38	0.14	3.98	-3.84
57237	SD	0.75	1.54	-0.79	10.85	13.35	-2.50	109.63	134.85	-25.22	0.01	0.11	-0.10	0.14	1.13	-0.99
57238	SD	1.07	1.90	-0.84	12.80	17.39	-4.60	128.95	175.25	-46.30	0.74	1.19	-0.46	7.44	12.04	-4.60
57239	SD	1.06	1.67	-0.62	12.80	17.63	-4.84	127.94	176.28	-48.34	0.74	0.67	0.07	7.38	6.70	0.69
57240	SD	0.89	1.70	-0.82	12.45	20.54	-8.09	124.28	205.02	-80.75	0.05	1.47	-1.42	0.50	14.66	-14.16
57241	SD	0.89	1.47	-0.58	12.45	20.66	-8.21	125.28	207.89	-82.60	0.05	1.54	-1.49	0.50	15.51	-15.01

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	HQ (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
57461	SD	10	0	1	3.50	35.46	10.1	2.36	4.46	5.22	0.05	0.20	-0.15	0.52	2.00	-1.48	0.10	0.15	-0.05
57462	SD	10	0	2	3.50	35.07	10.0	2.36	4.46	5.28	0.05	0.37	-0.31	0.51	3.66	-3.15	0.10	0.16	-0.06
57463	SD	10	0.5	1	3.51	35.67	10.2	2.33	4.50	5.39	0.59	0.69	-0.10	6.05	7.05	-1.00	0.12	0.13	-0.02
57464	SD	10	0.5	2	3.51	35.13	10.0	2.33	4.50	5.27	0.59	0.86	-0.26	5.96	8.60	-2.64	0.12	0.15	-0.04
57465	SD	10	1	1	3.51	35.05	10.0	2.36	4.56	5.20	1.21	1.35	-0.14	12.12	13.54	-1.42	0.10	0.16	-0.06
57466	SD	10	1	2	3.51	35.44	10.1	2.36	4.56	5.19	1.21	1.65	-0.44	12.24	16.65	-4.41	0.10	0.17	-0.07
57467	SD	10	2	1	3.51	35.05	10.0	2.34	4.56	5.18	2.25	2.07	0.17	22.43	20.70	1.72	0.10	0.16	-0.06
57468	SD	10	2	2	3.52	35.28	10.0	2.34	4.56	5.27	2.25	2.30	-0.05	22.53	23.04	-0.51	0.10	0.14	-0.04
57469	SD	10	4	1	3.50	36.05	10.3	2.36	4.56	5.31	3.98	3.83	0.14	40.90	39.43	1.48	0.08	0.15	-0.07
57470	SD	10	4	2	3.51	35.04	10.0	2.36	4.56	5.33	3.98	4.31	-0.33	39.72	43.03	-3.32	0.08	0.16	-0.08
57471	SD	10	6	1	3.50	35.25	10.1	2.36	4.58	5.24	6.28	6.11	0.17	63.19	61.49	1.70	0.10	0.14	-0.04
57472	SD	10	6	2	3.51	35.15	10.0	2.36	4.58	5.14	6.28	6.08	0.20	62.85	60.88	1.97	0.10	0.15	-0.05
57473	SD	10	8	1	3.51	35.50	10.1	2.35	4.56	5.24	8.36	7.91	0.45	84.55	80.00	4.55	0.09	0.17	-0.08
57474	SD	10	8	2	3.51	35.05	10.0	2.35	4.56	5.23	8.36	8.21	0.15	83.55	82.04	1.51	0.09	0.18	-0.08
57475	SD	10	10	1	3.50	35.35	10.1	2.36	4.62	5.25	8.09	9.79	-1.70	81.61	98.78	-17.17	0.18	0.17	0.01
57476	SD	10	10	2	3.52	35.65	10.1	2.36	4.62	5.24	8.09	10.01	-1.92	81.95	101.39	-19.44	0.18	0.13	0.05

57475, 57476 : not used as data for NO_3^-

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	NH_4^+ Xi	NH_4^+ Xf	RE	DOC Ci	DOC Cf	RE	DOC Xi	DOC Xf	RE	DON Ci	DON Cf	RE	DON Xi	DON Xf	RE
code		ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L	ug/g	ug/g	ug/g
57461	SD	0.99	1.54	-0.55	10.89	14.24	-3.35	110.23	144.16	-33.93	0.05	0.09	-0.04	0.51	0.90	-0.39
57462	SD	0.97	1.57	-0.59	10.89	12.67	-1.79	108.97	126.85	-17.88	0.05	0.05	0.00	0.50	0.50	0.00
57463	SD	1.18	1.35	-0.17	10.01	15.34	-5.33	101.80	156.07	-54.27	0.05	0.05	0.00	0.51	0.51	0.00
57464	SD	1.16	1.55	-0.39	10.01	15.42	-5.41	100.25	154.46	-54.21	0.05	0.05	0.00	0.50	0.50	0.00
57465	SD	0.99	1.59	-0.60	8.60	13.03	-4.43	85.95	130.27	-44.32	0.05	0.05	0.00	0.50	0.50	0.00
57466	SD	1.00	1.67	-0.67	8.60	14.08	-5.48	86.81	142.16	-55.36	0.05	0.05	0.00	0.50	0.50	0.00
57467	SD	1.02	1.63	-0.61	9.13	12.20	-3.07	91.22	121.84	-30.62	0.05	0.05	0.00	0.50	0.50	0.00
57468	SD	1.03	1.40	-0.38	9.13	12.84	-3.71	91.64	128.89	-37.25	0.05	0.05	0.00	0.50	0.50	0.00
57469	SD	0.81	1.53	-0.72	10.76	13.12	-2.36	110.66	134.93	-24.27	0.35	0.05	0.30	3.65	0.51	3.14
57470	SD	0.79	1.60	-0.81	10.76	15.62	-4.86	107.45	155.99	-48.54	0.35	0.05	0.30	3.54	0.50	3.04
57471	SD	1.04	1.42	-0.39	9.77	13.89	-4.12	98.37	139.85	-41.49	0.02	0.05	-0.03	0.15	0.50	-0.35
57472	SD	1.03	1.52	-0.49	9.77	12.25	-2.48	97.83	122.68	-24.85	0.02	0.05	-0.03	0.15	0.50	-0.35
57473	SD	0.92	1.71	-0.79	8.94	16.67	-7.73	90.42	168.53	-78.10	0.05	1.48	-1.43	0.51	14.95	-14.44
57474	SD	0.91	1.76	-0.85	8.94	16.09	-7.15	89.35	160.74	-71.39	0.05	0.84	-0.79	0.50	8.40	-7.90
57475	SD	1.81	1.68	0.14	8.76	16.02	-7.26	88.36	161.55	-73.19	1.25	1.55	-0.31	12.58	15.66	-3.08
57476	SD	1.82	1.34	0.48	8.76	13.61	-4.85	88.73	137.80	-49.08	1.25	0.32	0.92	12.64	3.28	9.35

57475, 57476 : not used as data for NO_3^-

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	DOC (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
59494	IC	0	0	1	3.51	35.15	10.0	0	6.55	6.09	0.03	0.07	-0.04	0.28	0.66	-0.38	0.01	0.46	-0.46
59495	IC	0	0	2	3.51	35.64	10.1	0	6.55	6.18	0.03	0.07	-0.04	0.28	0.69	-0.41	0.01	0.49	-0.48
59496	IC	10	0	1	3.52	35.47	10.1	0	6.00	6.16	0.02	0.05	-0.03	0.20	0.53	-0.34	0.28	0.58	-0.30
59497	IC	10	0	2	3.50	35.68	10.2	0	6.00	6.15	0.02	0.05	-0.03	0.20	0.49	-0.29	0.28	0.60	-0.32
59498	IC	20	0	1	3.53	35.24	10.0	0	5.88	6.10	0.04	0.02	0.03	0.42	0.17	0.25	0.52	0.72	-0.20
59499	IC	20	0	2	3.50	35.18	10.0	0	5.88	6.10	0.04	0.06	-0.01	0.42	0.56	-0.14	0.52	0.71	-0.20
59500	IC	30	0	1	3.53	35.15	10.0	0	5.81	6.07	0.00	0.06	-0.06	0.00	0.63	-0.63	0.70	0.85	-0.15
59501	IC	30	0	2	3.50	35.61	10.2	0	5.81	6.08	0.00	0.03	-0.03	0.00	0.29	-0.29	0.70	0.86	-0.16
59502	IC	40	0	1	3.51	35.35	10.1	0	5.75	6.07	0.06	0.06	-0.01	0.57	0.63	-0.06	0.91	0.98	-0.07
59503	IC	40	0	2	3.51	35.06	10.0	0	5.75	6.07	0.06	0.06	0.00	0.57	0.58	-0.01	0.91	1.01	-0.10
59504	IC	50	0	1	3.51	35.16	10.0	0	5.70	6.07	0.09	0.05	0.04	0.88	0.51	0.37	1.13	1.14	-0.02
59505	IC	50	0	2	3.51	35.35	10.1	0	5.70	6.05	0.09	0.10	-0.02	0.89	1.04	-0.15	1.13	1.18	-0.05
57761	IC	0	0	1	3.51	35.27	10.1	0	7.96	6.35	0.25	0.21	0.04	2.50	2.15	0.35	0.07	0.41	-0.34
57762	IC	0	0	2	3.51	35.52	10.1	0	7.96	6.38	0.25	0.43	-0.19	2.52	4.40	-1.88	0.07	0.47	-0.40
57763	IC	0	0.5	1	3.50	35.09	10.0	0	7.29	6.47	0.57	0.49	0.08	5.70	4.87	0.83	0.03	0.40	-0.37
57764	IC	0	0.5	2	3.51	35.51	10.1	0	7.29	6.34	0.57	0.46	0.11	5.75	4.62	1.13	0.03	0.46	-0.43
57765	IC	0	1	1	3.50	35.32	10.1	0	7.62	6.42	1.05	1.22	-0.17	10.54	12.26	-1.72	0.07	0.43	-0.36
57766	IC	0	1	2	3.51	35.29	10.0	0	7.62	6.30	1.05	1.27	-0.22	10.51	12.73	-2.22	0.07	0.44	-0.37
57767	IC	0	2	1	3.50	35.36	10.1	0	7.12	6.31	2.60	2.05	0.54	26.19	20.71	5.48	0.08	0.45	-0.37
57768	IC	0	2	2	3.50	35.06	10.0	0	7.12	6.31	2.60	2.29	0.31	25.96	22.87	3.09	0.08	0.48	-0.39
57769	IC	0	4	1	3.52	35.24	10.0	0	7.25	6.24	4.40	3.82	0.58	44.11	38.27	5.84	0.07	0.48	-0.41
57770	IC	0	4	2	3.51	35.56	10.1	0	7.25	6.22	4.40	4.40	0.00	44.58	44.54	0.05	0.07	0.48	-0.41
57771	IC	0	6	1	3.51	35.94	10.2	0	6.37	6.23	5.86	5.74	0.12	60.04	58.86	1.18	0.06	0.53	-0.47
57772	IC	0	6	2	3.51	35.44	10.1	0	6.37	6.31	5.86	5.98	-0.12	59.21	60.40	-1.19	0.06	0.52	-0.46
57773	IC	0	8	1	3.51	35.61	10.2	0	6.48	6.24	8.23	8.31	-0.08	83.60	84.41	-0.81	0.12	0.56	-0.43
57774	IC	0	8	2	3.51	35.11	10.0	0	6.48	6.26	8.23	8.71	-0.48	82.26	87.07	-4.81	0.12	0.54	-0.42
57775	IC	0	10	1	3.51	35.63	10.1	0	6.92	6.33	9.79	9.99	-0.20	99.35	101.35	-2.00	0.06	0.60	-0.55
57776	IC	0	10	2	3.50	35.35	10.1	0	6.92	6.25	9.79	9.63	0.17	98.81	97.14	1.67	0.06	0.64	-0.58

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	NH$_4^+$ Xi ug/g	NH$_4^+$ Xf ug/g	RE ug/g	DOC Ci mg/L	DOC Cf mg/L	RE mg/L	DOC Xi ug/g	DOC Xf ug/g	RE ug/g	DON Ci mg/L	DON Cf mg/L	RE mg/L	DON Xi ug/g	DON Xf ug/g	RE ug/g
59494	IC	0.08	4.65	-4.57	2.05	7.36	-5.31	20.55	73.72	-53.18	0.12	0.12	0.00	1.19	1.24	-0.05
59495	IC	0.08	4.97	-4.89	2.05	7.65	-5.60	20.80	77.55	-56.75	0.12	0.09	0.03	1.20	0.92	0.29
59496	IC	2.86	5.85	-2.99	9.84	12.37	-2.53	99.12	124.59	-25.46	0.20	0.18	0.02	2.05	1.81	0.24
59497	IC	2.89	6.15	-3.26	9.84	13.04	-3.20	100.23	132.80	-32.57	0.20	0.18	0.02	2.08	1.88	0.20
59498	IC	5.16	7.19	-2.02	15.81	15.96	-0.15	157.82	159.28	-1.46	0.15	0.23	-0.08	1.50	2.25	-0.75
59499	IC	5.20	7.18	-1.98	15.81	16.80	-0.99	158.85	168.82	-9.97	0.15	0.28	-0.13	1.51	2.77	-1.26
59500	IC	6.99	8.48	-1.49	25.44	21.81	3.63	253.58	217.40	36.17	0.37	0.34	0.03	3.65	3.40	0.26
59501	IC	7.12	8.71	-1.59	25.44	22.16	3.28	258.51	225.20	33.31	0.37	0.34	0.03	3.73	3.46	0.27
59502	IC	9.15	9.84	-0.68	31.95	27.43	4.52	321.52	276.01	45.51	0.39	0.37	0.03	3.97	3.68	0.29
59503	IC	9.07	10.04	-0.97	31.95	27.66	4.29	318.75	275.92	42.83	0.39	0.39	0.00	3.93	3.91	0.02
59504	IC	11.27	11.42	-0.15	41.61	34.73	6.88	416.65	347.72	68.92	0.51	0.46	0.05	5.11	4.65	0.46
59505	IC	11.33	11.84	-0.50	41.61	31.32	10.30	418.77	315.15	103.62	0.51	0.38	0.13	5.13	3.81	1.32
57761	IC	0.71	4.16	-3.45	0.07	7.83	-7.77	0.66	78.74	-78.08	0.05	0.19	-0.14	0.50	1.92	-1.42
57762	IC	0.72	4.71	-4.00	0.07	7.67	-7.61	0.66	77.66	-77.00	0.05	0.05	0.00	0.51	0.51	0.00
57763	IC	0.33	4.00	-3.67	0.15	7.64	-7.49	1.50	76.55	-75.05	0.05	0.23	-0.18	0.50	2.35	-1.85
57764	IC	0.34	4.69	-4.35	0.15	7.09	-6.94	1.51	71.63	-70.12	0.05	0.44	-0.39	0.51	4.41	-3.90
57765	IC	0.67	4.31	-3.65	0.00	6.98	-6.98	0.00	70.44	-70.44	0.14	0.15	-0.01	1.41	1.47	-0.06
57766	IC	0.66	4.41	-3.74	0.00	6.72	-6.72	0.00	67.56	-67.56	0.14	0.19	-0.05	1.40	1.88	-0.48
57767	IC	0.84	4.56	-3.72	0.16	6.94	-6.78	1.64	70.03	-68.40	0.05	0.19	-0.14	0.50	1.92	-1.42
57768	IC	0.83	4.76	-3.92	0.16	5.72	-5.56	1.62	57.20	-55.57	0.05	0.14	-0.09	0.50	1.44	-0.94
57769	IC	0.70	4.77	-4.07	0.00	6.50	-6.50	0.00	65.11	-65.11	0.08	0.25	-0.17	0.77	2.46	-1.68
57770	IC	0.71	4.84	-4.13	0.00	6.14	-6.14	0.00	62.11	-62.11	0.08	0.05	0.03	0.78	0.51	0.28
57771	IC	0.59	5.42	-4.83	0.00	5.99	-5.99	0.00	61.37	-61.37	0.10	0.13	-0.03	1.04	1.32	-0.28
57772	IC	0.58	5.26	-4.68	0.00	5.92	-5.92	0.00	59.85	-59.85	0.10	0.71	-0.61	1.03	7.21	-6.18
57773	IC	1.27	5.65	-4.39	0.00	5.83	-5.83	0.00	59.20	-59.20	0.41	0.05	0.36	4.12	0.51	3.61
57774	IC	1.25	5.41	-4.16	0.00	5.91	-5.91	0.00	59.05	-59.05	0.41	0.05	0.36	4.05	0.50	3.55
57775	IC	0.56	6.12	-5.56	0.12	5.68	-5.56	1.18	57.58	-56.40	0.05	0.29	-0.24	0.51	2.96	-2.46
57776	IC	0.56	6.41	-5.86	0.12	5.39	-5.27	1.18	54.35	-53.17	0.05	0.96	-0.91	0.50	9.65	-9.15

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	DOC (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
58554	IC	50	0	1	3.51	35.52	10.1	0	5.39	5.67	0.10	0.12	-0.02	0.97	1.19	-0.22	1.04	1.00	0.05
58555	IC	50	0	2	3.52	35.31	10.0	0	5.39	5.75	0.10	0.11	-0.01	0.96	1.07	-0.11	1.04	1.04	0.00
58556	IC	50	0.5	1	3.50	35.73	10.2	0	5.43	5.77	0.63	0.60	0.02	6.37	6.13	0.25	1.05	1.06	-0.01
58557	IC	50	0.5	2	3.51	35.49	10.1	0	5.43	5.76	0.63	0.67	-0.04	6.32	6.74	-0.42	1.05	1.06	0.00
58558	IC	50	1	1	3.52	35.62	10.1	0	5.44	5.75	1.26	1.22	0.03	12.75	12.41	0.34	1.06	1.10	-0.04
58559	IC	50	1	2	3.50	35.26	10.1	0	5.44	5.78	1.26	1.39	-0.13	12.66	13.98	-1.32	1.06	1.16	-0.10
58560	IC	50	2	1	3.52	35.02	10.0	0	5.42	5.74	2.30	2.31	-0.01	22.95	23.04	-0.09	1.06	1.12	-0.07
58561	IC	50	2	2	3.53	35.30	10.0	0	5.42	5.76	2.30	2.48	-0.18	23.05	24.85	-1.79	1.06	1.11	-0.05
58562	IC	50	4	1	3.55	35.18	9.9	0	5.45	5.75	3.93	4.22	-0.28	38.98	41.79	-2.81	1.06	1.16	-0.10
58563	IC	50	4	2	3.51	35.23	10.0	0	5.45	5.73	3.93	4.43	-0.50	39.46	44.46	-5.00	1.06	1.16	-0.10
58564	IC	50	6	1	3.52	35.42	10.1	0	5.41	5.73	6.56	6.45	0.11	66.04	64.91	1.13	1.07	1.21	-0.14
58565	IC	50	6	2	3.53	35.54	10.1	0	5.41	5.75	6.56	6.34	0.21	66.06	63.89	2.16	1.07	1.21	-0.13
58566	IC	50	8	1	3.52	35.63	10.1	0	5.47	5.72	8.07	8.76	-0.68	81.79	88.73	-6.93	1.06	1.24	-0.18
58567	IC	50	8	2	3.52	35.25	10.0	0	5.47	5.71	8.07	9.00	-0.93	80.93	90.27	-9.33	1.06	1.20	-0.14
58568	IC	50	10	1	3.51	35.47	10.1	0	5.42	5.74	10.08	10.98	-0.89	101.80	110.82	-9.01	1.03	1.26	-0.23
58569	IC	50	10	2	3.51	35.32	10.1	0	5.42	5.69	10.08	10.49	-0.40	101.48	105.54	-4.06	1.03	1.24	-0.21
57165	IC	0	4	1	3.51	35.40	10.1	0	6.25	6.00	3.97	3.62	0.36	40.14	36.51	3.63	0.09	0.55	-0.46
57166	IC	0	4	2	3.54	35.04	9.9	0	6.25	6.02	3.97	4.01	-0.04	39.37	39.74	-0.36	0.09	0.50	-0.41
57167	IC	10	4	1	3.52	35.19	10.0	0	6.09	6.04	3.94	3.92	0.02	39.41	39.20	0.20	0.27	0.58	-0.32
57168	IC	10	4	2	3.51	35.13	10.0	0	6.09	5.98	3.94	3.98	-0.04	39.38	39.82	-0.44	0.27	0.65	-0.38
57169	IC	20	4	1	3.51	35.01	10.0	0	5.99	5.87	4.00	4.02	-0.02	39.96	40.12	-0.16	0.39	0.66	-0.27
57170	IC	20	4	2	3.51	35.21	10.0	0	5.99	5.92	4.00	4.07	-0.06	40.09	40.74	-0.65	0.39	0.71	-0.31
57171	IC	30	4	1	3.52	35.33	10.0	0	5.89	5.91	3.96	4.00	-0.03	39.74	40.09	-0.35	0.57	0.78	-0.22
57172	IC	30	4	2	3.51	35.30	10.1	0	5.89	5.94	3.96	4.15	-0.18	39.84	41.69	-1.85	0.57	0.81	-0.24
57173	IC	40	4	1	3.51	36.11	10.3	0	5.92	5.91	3.89	4.12	-0.23	39.99	42.38	-2.39	0.74	0.82	-0.09
57174	IC	40	4	2	3.53	35.23	10.0	0	5.92	5.90	3.89	4.06	-0.17	38.85	40.54	-1.69	0.74	0.88	-0.14
57175	IC	50	4	1	3.52	35.34	10.0	0	5.85	5.97	4.21	3.99	0.22	42.30	40.06	2.24	0.86	0.89	-0.04
57176	IC	50	4	2	3.51	35.76	10.2	0	5.85	5.95	4.21	4.09	0.12	42.96	41.73	1.23	0.86	1.08	-0.22

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	NH_4^+ Xi ug/g	NH_4^+ Xf ug/g	RE ug/g	DOC Ci mg/L	DOC Cf mg/L	RE mg/L	DOC Xi ug/g	DOC Xf ug/g	RE ug/g	DON Ci mg/L	DON Cf mg/L	RE mg/L	DON Xi ug/g	DON Xf ug/g	RE ug/g
58554	IC	10.58	10.09	0.49	45.10	32.65	12.45	456.83	330.71	126.13	0.89	0.74	0.15	8.97	7.49	1.48
58555	IC	10.48	10.43	0.04	45.10	34.76	10.35	452.49	348.69	103.80	0.89	0.69	0.19	8.88	6.96	1.92
58556	IC	10.73	10.84	-0.11	46.50	32.80	13.70	474.10	334.40	139.69	0.83	0.38	0.45	8.47	3.87	4.61
58557	IC	10.64	10.67	-0.04	46.50	34.08	12.42	470.17	344.56	125.60	0.83	0.52	0.31	8.40	5.30	3.10
58558	IC	10.71	11.15	-0.44	49.71	34.00	15.71	503.58	344.44	159.14	1.03	0.41	0.62	10.42	4.11	6.31
58559	IC	10.64	11.63	-0.99	49.71	34.37	15.34	500.37	345.96	154.41	1.03	0.52	0.51	10.35	5.23	5.13
58560	IC	10.52	11.19	-0.67	49.52	32.37	17.15	493.30	322.43	170.88	1.11	0.22	0.89	11.06	2.19	8.86
58561	IC	10.57	11.07	-0.50	49.52	33.09	16.43	495.53	331.10	164.43	1.11	0.32	0.79	11.11	3.17	7.93
58562	IC	10.50	11.51	-1.01	47.62	32.82	14.80	472.19	325.43	146.76	1.38	0.40	0.98	13.69	4.00	9.69
58563	IC	10.62	11.60	-0.97	47.62	33.82	13.80	477.93	339.43	138.51	1.38	0.40	0.98	13.86	4.01	9.85
58564	IC	10.81	12.18	-1.37	47.86	33.14	14.71	481.84	333.72	148.12	1.19	0.18	1.00	11.93	1.83	10.11
58565	IC	10.82	12.14	-1.33	47.86	31.28	16.58	481.95	315.01	166.93	1.19	0.25	0.94	11.94	2.47	9.46
58566	IC	10.73	12.59	-1.86	45.07	25.87	19.21	456.75	262.11	194.63	1.25	0.05	1.20	12.70	0.51	12.19
58567	IC	10.61	12.06	-1.44	45.07	26.14	18.93	451.93	262.09	189.84	1.25	0.05	1.20	12.57	0.50	12.07
58568	IC	10.41	12.74	-2.33	42.38	32.56	9.82	427.77	328.69	99.09	1.29	0.05	1.24	13.01	0.50	12.51
58569	IC	10.37	12.53	-2.15	42.38	32.86	9.52	426.40	330.63	95.77	1.29	0.83	0.46	12.97	8.39	4.58
57165	IC	0.92	5.53	-4.61	1.23	7.07	-5.84	12.42	71.42	-59.00	0.06	0.85	-0.79	0.62	8.63	-8.02
57166	IC	0.90	5.00	-4.09	1.23	5.80	-4.57	12.19	57.42	-45.23	0.06	0.39	-0.33	0.61	3.87	-3.27
57167	IC	2.68	5.85	-3.17	10.47	10.66	-0.19	104.83	106.72	-1.90	0.49	0.77	-0.27	4.93	7.68	-2.75
57168	IC	2.67	6.51	-3.84	10.47	12.11	-1.64	104.76	121.20	-16.44	0.49	0.71	-0.21	4.92	7.07	-2.15
57169	IC	3.93	6.59	-2.65	19.93	15.91	4.01	198.94	158.88	40.06	0.52	0.44	0.07	5.15	4.42	0.73
57170	IC	3.95	7.10	-3.15	19.93	17.73	2.20	199.60	177.57	22.03	0.52	0.84	-0.32	5.17	8.37	-3.20
57171	IC	5.69	7.87	-2.17	30.18	22.81	7.37	302.78	228.82	73.96	0.91	1.11	-0.19	9.15	11.11	-1.96
57172	IC	5.71	8.12	-2.41	30.18	23.84	6.34	303.56	239.79	63.77	0.91	0.97	-0.06	9.18	9.77	-0.59
57173	IC	7.57	8.46	-0.89	37.58	29.14	8.45	386.55	299.68	86.86	0.87	1.16	-0.29	8.96	11.93	-2.96
57174	IC	7.36	8.76	-1.41	37.58	31.12	6.46	375.57	310.98	64.59	0.87	1.10	-0.23	8.71	10.96	-2.25
57175	IC	8.59	8.94	-0.35	53.01	35.06	17.95	532.39	352.09	180.30	1.60	1.42	0.18	16.03	14.25	1.78
57176	IC	8.72	11.00	-2.28	53.01	37.81	15.20	540.69	385.67	155.03	1.60	1.26	0.34	16.28	12.86	3.42

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	DOC (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
58578	IC	50	0	1	3.50	35.46	10.1	2.35	4.74	5.64	0.00	0.00	0.00	0.00	0.04	-0.04	1.05	1.12	-0.07
58579	IC	50	0	2	3.51	35.21	10.0	2.35	4.74	5.65	0.00	0.01	-0.01	0.00	0.11	-0.11	1.05	1.18	-0.13
58580	IC	50	0.5	1	3.51	35.40	10.1	2.34	4.75	5.63	0.53	0.41	0.12	5.39	4.16	1.23	1.05	1.21	-0.16
58581	IC	50	0.5	2	3.51	35.30	10.1	2.34	4.75	5.64	0.53	0.52	0.02	5.38	5.21	0.17	1.05	1.24	-0.19
58582	IC	50	1	1	3.52	35.57	10.1	2.34	4.75	5.62	1.01	0.99	0.01	10.16	10.04	0.12	1.04	1.22	-0.17
58583	IC	50	1	2	3.51	35.19	10.0	2.34	4.75	5.63	1.01	1.13	-0.12	10.09	11.31	-1.21	1.04	1.24	-0.20
58584	IC	50	2	1	3.50	35.39	10.1	2.34	4.75	5.65	2.16	1.81	0.35	21.78	18.24	3.54	1.06	1.27	-0.21
58585	IC	50	2	2	3.52	35.14	10.0	2.34	4.75	5.65	2.16	2.01	0.15	21.56	20.05	1.51	1.06	1.23	-0.17
58586	IC	50	4	1	3.50	36.76	10.5	2.34	4.73	5.63	3.74	3.82	-0.08	39.23	40.07	-0.84	1.06	1.23	-0.18
58587	IC	50	4	2	3.50	35.35	10.1	2.34	4.73	5.67	3.74	4.19	-0.45	37.74	42.31	-4.58	1.06	1.27	-0.21
58588	IC	50	6	1	3.51	35.67	10.2	2.34	4.72	5.61	5.74	5.73	0.01	58.32	58.19	0.13	1.08	1.29	-0.20
58589	IC	50	6	2	3.51	35.26	10.0	2.34	4.72	5.61	5.74	5.94	-0.19	57.69	59.63	-1.94	1.08	1.30	-0.21
58590	IC	50	8	1	3.52	35.30	10.0	2.35	4.74	5.60	8.23	7.19	1.04	82.62	72.21	10.42	1.11	1.32	-0.22
58591	IC	50	8	2	3.50	35.00	10.0	2.35	4.74	5.60	8.23	7.39	0.84	82.19	73.80	8.39	1.11	1.36	-0.25
58592	IC	50	10	1	3.51	35.17	10.0	2.35	4.70	5.58	9.18	9.29	-0.11	91.84	92.93	-1.10	1.20	1.34	-0.14
58593	IC	50	10	2	3.51	35.36	10.1	2.35	4.70	5.61	9.18	9.61	-0.44	92.41	96.83	-4.42	1.20	1.33	-0.13
58602	IC	0	4	1	3.51	35.11	10.0	2.34	4.20	5.73	4.33	3.92	0.41	43.32	39.19	4.13	0.14	0.62	-0.48
58603	IC	0	4	2	3.51	35.25	10.0	2.34	4.20	5.74	4.33	4.40	-0.06	43.53	44.16	-0.62	0.14	0.64	-0.51
58604	IC	10	4	1	3.50	35.35	10.1	2.30	4.41	5.69	4.00	4.16	-0.16	40.36	41.97	-1.61	0.29	0.71	-0.42
58605	IC	10	4	2	3.51	35.56	10.1	2.30	4.41	5.73	4.00	4.33	-0.33	40.52	43.84	-3.31	0.29	0.76	-0.47
58606	IC	20	4	1	3.52	35.14	10.0	2.31	4.57	5.66	4.40	4.29	0.11	43.92	42.82	1.10	0.48	0.91	-0.43
58607	IC	20	4	2	3.51	35.14	10.0	2.31	4.57	5.76	4.40	4.26	0.14	44.03	42.62	1.41	0.48	0.99	-0.51
58608	IC	30	4	1	3.54	35.20	10.0	2.33	4.63	5.67	4.10	4.28	-0.19	40.78	42.65	-1.87	0.68	1.11	-0.43
58609	IC	30	4	2	3.50	35.23	10.1	2.33	4.63	5.66	4.10	4.01	0.08	41.21	40.38	0.83	0.68	1.06	-0.38
58610	IC	40	4	1	3.51	35.38	10.1	2.32	4.70	5.62	4.50	3.90	0.60	45.39	39.30	6.09	0.87	1.19	-0.32
58611	IC	40	4	2	3.50	35.20	10.0	2.32	4.70	5.64	4.50	3.93	0.57	45.19	39.44	5.76	0.87	1.20	-0.33
58612	IC	50	4	1	3.51	35.56	10.1	2.33	4.75	5.60	4.39	4.36	0.03	44.49	44.15	0.34	1.11	1.32	-0.21
58613	IC	50	4	2	3.51	35.35	10.1	2.33	4.75	5.62	4.39	4.02	0.37	44.27	40.56	3.71	1.11	1.35	-0.25

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	NH_4^+ Xi ug/g	NH_4^+ Xf ug/g	RE ug/g	DOC Ci mg/L	DOC Cf mg/L	RE mg/L	DOC Xi ug/g	DOC Xf ug/g	RE ug/g	DON Ci mg/L	DON Cf mg/L	RE mg/L	DON Xi ug/g	DON Xf ug/g	RE ug/g
58578	IC	10.62	11.33	-0.71	24.25	20.29	3.96	245.46	205.35	40.11	0.37	0.29	0.08	3.79	2.93	0.86
58579	IC	10.54	11.81	-1.28	24.25	21.73	2.52	243.45	218.13	25.32	0.37	0.26	0.11	3.76	2.61	1.15
58580	IC	10.59	12.18	-1.59	28.46	26.76	1.70	286.76	269.61	17.16	0.20	0.49	-0.30	1.97	4.96	-2.99
58581	IC	10.57	12.46	-1.89	28.46	27.30	1.16	286.21	274.57	11.65	0.20	0.45	-0.25	1.96	4.48	-2.52
58582	IC	10.54	12.28	-1.74	30.20	25.30	4.90	305.10	255.63	49.47	0.54	0.44	0.10	5.42	4.42	1.00
58583	IC	10.47	12.46	-1.99	30.20	25.40	4.80	302.99	254.80	48.19	0.54	0.32	0.22	5.38	3.17	2.21
58584	IC	10.73	12.84	-2.11	31.77	26.62	5.15	320.90	268.87	52.02	0.35	0.26	0.10	3.57	2.59	0.99
58585	IC	10.62	12.29	-1.67	31.77	24.25	7.52	317.63	242.44	75.19	0.35	0.45	-0.09	3.54	4.45	-0.91
58586	IC	11.07	12.93	-1.86	32.15	25.36	6.80	337.27	265.97	71.30	0.38	0.13	0.25	4.03	1.40	2.63
58587	IC	10.65	12.77	-2.12	32.15	21.04	11.12	324.41	212.27	112.14	0.38	0.05	0.33	3.88	0.50	3.38
58588	IC	11.00	13.05	-2.05	32.76	17.99	14.77	332.69	182.68	150.01	0.30	0.05	0.25	3.04	0.51	2.53
58589	IC	10.88	13.02	-2.14	32.76	21.72	11.03	329.11	218.25	110.86	0.30	0.05	0.25	3.00	0.50	2.50
58590	IC	11.11	13.30	-2.19	33.95	18.91	15.04	340.94	189.92	151.02	0.21	0.05	0.16	2.07	0.50	1.56
58591	IC	11.05	13.59	-2.54	33.95	17.55	16.40	339.16	175.32	163.84	0.21	0.05	0.16	2.05	0.50	1.56
58592	IC	12.01	13.43	-1.42	35.06	20.37	14.68	350.85	203.90	146.95	1.01	0.05	0.96	10.16	0.50	9.66
58593	IC	12.09	13.40	-1.31	35.06	23.97	11.08	353.03	241.43	111.60	1.01	0.14	0.88	10.22	1.40	8.82
58602	IC	1.37	6.18	-4.81	1.34	4.37	-3.03	13.39	43.67	-30.28	0.05	0.05	0.00	0.50	0.50	0.00
58603	IC	1.38	6.46	-5.08	1.34	5.49	-4.15	13.45	55.16	-41.71	0.05	0.05	0.00	0.50	0.50	0.00
58604	IC	2.92	7.18	-4.26	5.32	6.29	-0.97	53.65	63.44	-9.79	0.23	0.05	0.18	2.31	0.50	1.81
58605	IC	2.93	7.74	-4.81	5.32	5.27	0.04	53.86	53.44	0.42	0.23	0.05	0.18	2.32	0.51	1.82
58606	IC	4.80	9.11	-4.31	12.29	12.08	0.21	122.76	120.66	2.10	0.05	0.05	0.00	0.50	0.50	0.00
58607	IC	4.81	9.93	-5.12	12.29	11.73	0.57	123.07	117.38	5.69	0.05	0.05	0.00	0.50	0.50	0.00
58608	IC	6.72	11.00	-4.28	19.17	12.87	6.30	190.81	128.15	62.67	0.13	0.05	0.08	1.26	0.50	0.76
58609	IC	6.79	10.65	-3.86	19.17	15.08	4.09	192.82	151.73	41.09	0.13	0.08	0.05	1.27	0.77	0.50
58610	IC	8.80	11.99	-3.18	26.62	20.78	5.83	268.48	209.66	58.82	0.02	0.35	-0.33	0.21	3.49	-3.29
58611	IC	8.77	12.05	-3.28	26.62	19.81	6.81	267.31	198.94	68.37	0.02	0.20	-0.18	0.21	2.03	-1.82
58612	IC	11.20	13.35	-2.15	35.95	21.81	14.14	364.33	221.02	143.31	0.30	0.05	0.25	3.03	0.51	2.53
58613	IC	11.15	13.65	-2.50	35.95	23.12	12.83	362.58	233.16	129.42	0.30	0.05	0.25	3.02	0.50	2.51

UNH code	Site	HQ (target) mg/L	NO_3^- (target) mg/L	Rep No.	Soil g	Solution g	S:S ratio	$FeCl_3$ mg/L	pHi	pHf	NO_3^- Ci mg/L	NO_3^- Cf mg/L	RE mg/L	NO_3^- Xi ug/g	NO_3^- Xf ug/g	RE ug/g	NH_4^+ Ci mg/L	NH_4^+ Cf mg/L	RE mg/L
57577	IC	10	0	1	3.51	35.55	10.1	0	5.81	5.69	-0.04	0.41	-0.45	-0.40	4.18	-4.58	0.12	0.47	-0.35
57578	IC	10	0	2	3.50	35.44	10.1	0	5.81	5.86	-0.04	0.01	-0.05	-0.40	0.07	-0.47	0.12	0.45	-0.34
57579	IC	10	0.5	1	3.51	35.33	10.1	0	6.03	5.80	0.36	0.49	-0.13	3.63	4.94	-1.31	0.11	0.46	-0.34
57580	IC	10	0.5	2	3.52	35.21	10.0	0	6.03	5.86	0.36	0.52	-0.16	3.60	5.25	-1.65	0.11	0.48	-0.37
57581	IC	10	1	1	3.51	35.29	10.1	0	5.96	5.73	1.02	0.93	0.09	10.30	9.36	0.93	0.12	0.50	-0.38
57582	IC	10	1	2	3.51	35.64	10.1	0	5.96	5.85	1.02	1.18	-0.16	10.39	11.98	-1.59	0.12	0.50	-0.38
57583	IC	10	2	1	3.50	35.27	10.1	0	6.06	5.81	2.16	1.93	0.23	21.76	19.45	2.31	0.11	0.52	-0.40
57584	IC	10	2	2	3.50	35.71	10.2	0	6.06	5.78	2.16	2.26	-0.10	22.03	23.08	-1.05	0.11	0.51	-0.40
57585	IC	10	4	1	3.50	35.37	10.1	0	5.81	5.86	4.02	3.85	0.17	40.57	38.87	1.69	0.11	0.53	-0.43
57586	IC	10	4	2	3.51	35.32	10.1	0	5.81	5.83	4.02	4.21	-0.19	40.43	42.38	-1.95	0.11	0.56	-0.45
57587	IC	10	6	1	3.51	35.41	10.1	0	5.74	5.71	5.52	5.76	-0.24	55.71	58.16	-2.45	0.11	0.59	-0.48
57588	IC	10	6	2	3.50	35.58	10.2	0	5.74	5.81	5.52	5.98	-0.46	56.05	60.70	-4.66	0.11	0.58	-0.47
57589	IC	10	8	1	3.50	35.58	10.2	0	5.87	5.75	7.35	7.32	0.02	74.60	74.37	0.23	0.13	0.59	-0.45
57590	IC	10	8	2	3.50	35.44	10.1	0	5.87	5.75	7.35	7.70	-0.36	74.27	77.89	-3.62	0.13	0.59	-0.45
57591	IC	10	10	1	3.51	35.88	10.2	0	5.77	5.74	9.36	10.02	-0.66	95.70	102.41	-6.71	0.10	0.63	-0.54
57592	IC	10	10	2	3.51	35.01	10.0	0	5.77	5.70	9.36	9.47	-0.11	93.42	94.55	-1.13	0.10	0.61	-0.51

57256 : not used as data for NO_3^- and DON   57252, 57260: not used as data for NH_4^+ and DON

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	NH_4^+ Xi ug/g	NH_4^+ Xf ug/g	RE ug/g	DOC Ci mg/L	DOC Cf mg/L	RE mg/L	DOC Xi ug/g	DOC Xf ug/g	RE ug/g	DON Ci mg/L	DON Cf mg/L	RE mg/L	DON Xi ug/g	DON Xf ug/g	RE ug/g
57577	IC	1.19	4.71	-3.52	9.60	15.19	-5.60	97.16	153.86	-56.70	0.04	0.05	-0.01	0.36	0.51	-0.15
57578	IC	1.19	4.60	-3.41	9.60	16.13	-6.53	97.07	163.15	-66.08	0.04	0.05	-0.01	0.36	0.51	-0.15
57579	IC	1.14	4.61	-3.47	9.57	16.05	-6.48	96.39	161.69	-65.30	0.05	0.05	0.00	0.47	0.50	-0.03
57580	IC	1.13	4.84	-3.71	9.57	15.83	-6.26	95.68	158.22	-62.55	0.05	0.05	0.00	0.47	0.50	-0.03
57581	IC	1.19	5.03	-3.84	9.57	12.17	-2.60	96.21	122.30	-26.09	0.06	0.05	0.01	0.59	0.50	0.09
57582	IC	1.20	5.03	-3.83	9.57	14.77	-5.20	97.04	149.74	-52.70	0.06	0.05	0.01	0.59	0.51	0.09
57583	IC	1.14	5.21	-4.06	8.57	14.84	-6.27	86.25	149.34	-63.09	0.05	0.05	0.00	0.50	0.50	0.00
57584	IC	1.16	5.22	-4.06	8.57	13.21	-4.65	87.34	134.70	-47.36	0.05	0.05	0.00	0.51	0.51	0.00
57585	IC	1.10	5.40	-4.30	9.74	13.23	-3.48	98.45	133.65	-35.20	0.02	0.05	-0.03	0.24	0.51	-0.27
57586	IC	1.10	5.65	-4.56	9.74	15.07	-5.32	98.13	151.72	-53.59	0.02	0.06	-0.03	0.24	0.59	-0.35
57587	IC	1.10	5.91	-4.81	8.66	13.17	-4.50	87.46	132.93	-45.47	0.89	0.05	0.84	8.95	0.50	8.45
57588	IC	1.11	5.88	-4.77	8.66	12.45	-3.78	87.99	126.39	-38.40	0.89	0.08	0.80	9.01	0.85	8.16
57589	IC	1.34	5.96	-4.62	8.37	13.56	-5.19	84.98	137.70	-52.72	0.74	0.05	0.69	7.56	0.51	7.06
57590	IC	1.34	5.93	-4.60	8.37	15.02	-6.65	84.61	151.84	-67.23	0.74	2.05	-1.30	7.53	20.71	-13.18
57591	IC	0.99	6.48	-5.49	8.32	13.85	-5.52	85.10	141.58	-56.48	1.53	0.05	1.48	15.65	0.51	15.14
57592	IC	0.97	6.10	-5.13	8.32	11.28	-2.96	83.07	112.57	-29.50	1.53	0.05	1.48	15.28	0.50	14.78

57256 : not used as data for NO_3^- and DON

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH	Site	HQ (target)	NO_3^- (target)	Rep	Soil	Solution	S:S ratio	$FeCl_3$	pHi	pHf	NO_3^- Ci	NO_3^- Cf	RE	NO_3^- Xi	NO_3^- Xf	RE	NH_4^+ Ci	NH_4^+ Cf	RE
code		mg/L	mg/L	No.	g	g		mg/L			mg/L	mg/L	mg/L	ug/g	ug/g	ug/g	mg/L	mg/L	mg/L
57485	IC	10	0	1	3.51	35.28	10.04	2.36	4.49	5.40	0.19	0.08	0.11	1.87	0.78	1.09	0.11	0.56	-0.45
57486	IC	10	0	2	3.52	35.12	9.98	2.36	4.49	5.72	0.19	0.10	0.08	1.86	1.04	0.82	0.11	0.54	-0.44
57487	IC	10	0.5	1	3.52	35.21	10.00	2.37	4.49	5.44	0.74	0.49	0.26	7.41	4.86	2.55	0.11	0.57	-0.46
57488	IC	10	0.5	2	3.52	35.47	10.07	2.37	4.49	5.62	0.74	0.66	0.09	7.47	6.61	0.86	0.11	0.59	-0.48
57489	IC	10	1	1	3.51	35.12	10.00	2.38	4.49	5.71	1.13	1.17	-0.04	11.30	11.71	-0.41	0.12	5.23	-5.11
57490	IC	10	1	2	3.51	35.20	10.03	2.38	4.49	5.66	1.13	1.30	-0.17	11.34	13.01	-1.67	0.12	0.58	-0.46
57491	IC	10	2	1	3.51	35.25	10.04	2.36	4.53	5.58	2.26	1.94	0.32	22.66	19.48	3.19	0.10	0.60	-0.50
57492	IC	10	2	2	3.50	35.01	10.00	2.36	4.53	5.72	2.26	2.18	0.08	22.58	21.77	0.81	0.10	0.65	-0.55
57493	IC	10	4	1	3.51	35.22	10.04	2.36	4.48	5.59	4.46	3.89	0.57	44.81	39.05	5.76	0.09	0.64	-0.55
57494	IC	10	4	2	3.52	36.38	10.35	2.36	4.48	5.74	4.46	4.22	0.24	46.18	43.71	2.47	0.09	0.63	-0.54
57495	IC	10	6	1	3.51	35.20	10.04	2.35	4.54	5.47	6.04	5.95	0.09	60.64	59.76	0.87	0.11	0.67	-0.55
57496	IC	10	6	2	3.50	35.15	10.03	2.35	4.54	5.50	6.04	5.75	0.29	60.58	57.67	2.91	0.11	0.67	-0.56
57497	IC	10	8	1	3.51	35.17	10.03	2.36	4.48	5.47	7.54	7.50	0.04	75.67	75.26	0.42	0.10	0.66	-0.56
57498	IC	10	8	2	3.52	35.01	9.96	2.36	4.48	5.44	7.54	7.91	-0.37	75.12	78.79	-3.67	0.10	0.67	-0.57
57499	IC	10	10	1	3.51	35.14	10.01	2.36	4.49	5.68	9.43	9.32	0.12	94.41	93.25	1.16	0.10	0.69	-0.59
57500	IC	10	10	2	3.51	35.34	10.07	2.36	4.49	5.55	9.43	9.71	-0.28	95.00	97.81	-2.81	0.10	0.68	-0.58

57489 : not used as data for NH_4^+

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

UNH code	Site	NH_4^+ Xi ug/g	NH_4^+ Xf ug/g	RE ug/g	DOC Ci mg/L	DOC Cf mg/L	RE mg/L	DOC Xi ug/g	DOC Xf ug/g	RE ug/g	DON Ci mg/L	DON Cf mg/L	RE mg/L	DON Xi ug/g	DON Xf ug/g	RE ug/g
57485	IC	1.07	5.63	-4.56	11.11	13.48	-2.37	111.53	135.33	-23.80	0.05	0.49	-0.44	0.50	4.88	-4.38
57486	IC	1.06	5.43	-4.37	11.11	13.37	-2.25	110.92	133.43	-22.51	0.05	0.03	0.02	0.50	0.25	0.25
57487	IC	1.09	5.71	-4.62	9.84	13.75	-3.91	98.35	137.46	-39.11	0.05	0.05	0.00	0.50	0.50	0.00
57488	IC	1.10	5.96	-4.86	9.84	13.76	-3.92	99.11	138.62	-39.51	0.05	0.05	0.00	0.50	0.50	0.00
57489	IC	1.16	52.30	-51.14	10.67	12.01	-1.34	106.68	120.07	-13.39	0.05	0.05	0.00	0.50	0.50	0.00
57490	IC	1.16	5.82	-4.66	10.67	14.22	-3.55	107.03	142.63	-35.60	0.05	0.05	0.00	0.50	0.50	0.00
57491	IC	1.02	6.04	-5.02	10.58	13.14	-2.56	106.20	131.91	-25.71	0.05	0.17	-0.12	0.50	1.74	-1.23
57492	IC	1.01	6.54	-5.52	10.58	14.67	-4.09	105.83	146.71	-40.88	0.05	0.14	-0.09	0.50	1.41	-0.91
57493	IC	0.90	6.38	-5.48	10.09	15.17	-5.08	101.38	152.37	-50.99	0.54	0.03	0.51	5.38	0.29	5.09
57494	IC	0.93	6.52	-5.59	10.09	14.67	-4.57	104.48	151.78	-47.31	0.54	0.31	0.23	5.54	3.20	2.34
57495	IC	1.12	6.68	-5.56	10.67	13.74	-3.07	107.15	137.97	-30.82	1.53	0.80	0.74	15.38	8.00	7.38
57496	IC	1.12	6.74	-5.62	10.67	14.49	-3.82	107.05	145.34	-38.29	1.53	1.06	0.47	15.37	10.65	4.72
57497	IC	1.02	6.59	-5.58	10.33	14.53	-4.20	103.65	145.82	-42.16	1.69	2.27	-0.57	17.01	22.74	-5.73
57498	IC	1.01	6.68	-5.67	10.33	14.23	-3.90	102.90	141.73	-38.83	1.69	1.04	0.66	16.88	10.35	6.53
57499	IC	1.02	6.91	-5.89	10.29	14.81	-4.52	103.00	148.21	-45.21	2.66	2.23	0.43	26.63	22.30	4.33
57500	IC	1.03	6.89	-5.86	10.29	14.33	-4.04	103.64	144.29	-40.64	2.66	2.24	0.42	26.80	22.55	4.24

57489 : not used as data for NH_4^+

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.