Chemical Results of Laboratory Dry/Rewet Experiments Conducted on Wetland Soils from Two Sites in the Everglades, Florida

By William H. Orem

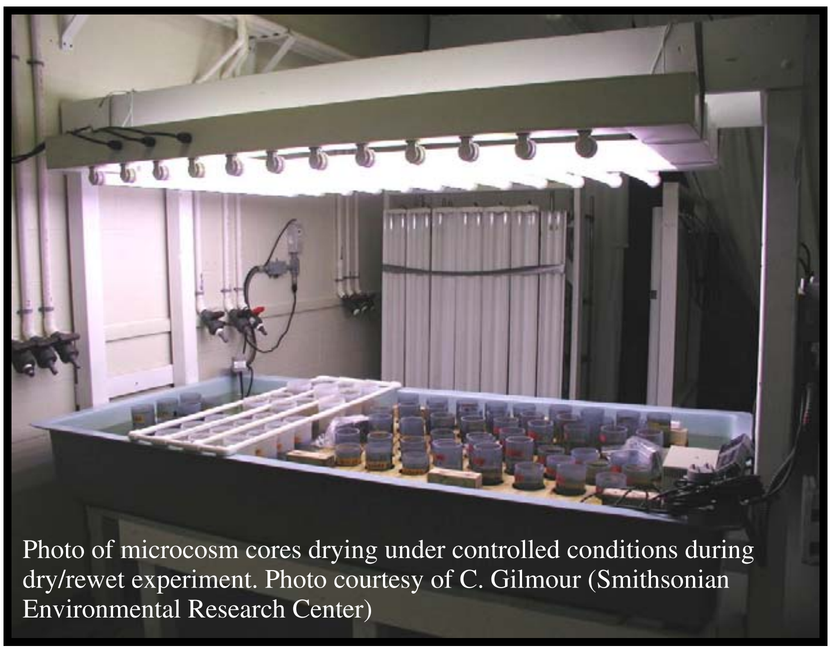

Photo of microcosm cores drying under controlled conditions during dry/rewet experiment. Photo courtesy of C. Gilmour (Smithsonian Environmental Research Center)

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If required, the raw data supporting the numerical data reported in the tables in this report is available by contacting the author (William H. Orem, *borem@usgs.gov*)

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Background

Drought and fire are natural environmental factors that have historically impacted and shaped the Everglades ecosystem (Gunderson and Snyder, 1994; Lodge 2004). For example, drought and fire help to maintain the existing ecosystem biotic assemblage by periodically eradicating invading flora not adapted to living with this normal aspect of Everglades' ecology (Shortemeyer, 1980). Flora native to the Everglades are adapted to withstand normal drought cycles and all but the most intense fire conditions that burn into the peat substrate (Egler, 1952; Robertson, 1953; Loveless, 1959; Beckage and Platt, 2003). Remobilization of nutrients and other elements from wetland soil following drought/fire and rewetting may actually stimulate plant re-growth, assisting in the recovery of the ecosystem from these events, and play a role in maintaining the geochemical balance of the ecosystem (Urban and others, 1993; Newman and others, 1996).

Although drought/fire cycles occur naturally in the Everglades ecosystem, the frequency, intensity, and duration of these events have been altered by anthropogenic activities (Lockwood and others, 2003). The hydrology of the ecosystem has been changed by the construction of water management structures starting around 1900 and continuing through the 1970s. These structures include canals, levees, and pumping stations around Lake Okeechobee and within the Everglades (Lockwood and others, 2003). In addition, water management practices have preferentially moved water toward agricultural and urban areas and away from the Everglades during periods of low rainfall (Lockwood and others, 2003). One result of these practices has been more severe drought and fire cycles within the ecosystem compared to pre-development activity (Yegang and others, 1996). A major goal of restoration efforts in the Everglades is to restore a more natural flow of water into the ecosystem to alleviate some of the extreme drought and fire conditions witnessed during the past several decades.

Despite the importance of drought and fire cycles in shaping the Everglades' landscape, the full impacts of these forces on the ecosystem have not been evaluated. In particular, the impact of drought and fire on the recycling of chemical species and biogeochemical processes operating within the ecosystem has not been investigated in detail. Following an extended drought in the Everglades in 1998–1999 and extensive fires in spring 1999 in northern Water Conservation Area (WCA) 3A, the U.S. Geological Survey (USGS) set out to examine the impacts of these events on chemical cycling and biogeochemical processes. Extensive field sampling was conducted at both drought- and fire-impacted sites in northern WCA 3A (north of Alligator Alley) and portions of WCA 2A (NE portion near the Hillsboro Canal) in June and July 1999 following the rewetting of these areas immediately after the drought and fire. Sampling included the collection of soil cores, surface water, and porewater samples, and the analysis of these samples for nutrients, anions, cations, sulfur species, mercury species, organic carbon, and general chemical parameters. Periodic sampling of the affected areas continued into the fall of 1999, and a follow-up survey of the biogeochemistry of the affected areas was conducted 14 months after the initial rewetting of the areas. Significant remobilization of some chemical species, most notably sulfate, was observed following drought/fire and rewet. Soil and water studies indicated that sulfur species stored in the soils were oxidized to sulfate by the effects of drought and fire and remobilized into the surface water following rewetting (Gilmour, Krabbenhoft, and others, 2007). Remobilization of mercury from the soil and increases in dissolved mercury in surface water were also observed, as were increases in methylmercury concentrations in surface water following drought/fire and rewet (Gilmour and others, 2004; Gilmour, Krabbenhoft, and others, 2007).

These results led to the formulation of a hypothesis linking remobilization of sulfur and mercury from soil following drought/fire and rewetting to stimulation of microbial sulfate reduction and mercury methylation in the soil (Gilmour, Krabbenhoft, and others, 2007; Gilmour, Orem, and others, 2007). In this hypothesis, drought/fire oxidizes reduced sulfur species in soil to sulfate and also remobilizes mercury bound in the soil. The sulfate and mercury are remobilized into surface water and soil porewater following rewetting of the drought/fire-impacted area. Rewetting also slowly reestablishes anoxic conditions in the wetland soil. The anoxic conditions and remobilized sulfate and mercury stimulate microbial sulfate reduction and mercury methylation (mercury is methylated by sulfate reducing bacteria) (Gilmour and others, 1992). For some time after rewetting, sulfide levels in soil porewater remain low, below levels inhibitory to mercury methylation, and mercury methylation can proceed unimpeded to produce high levels of methylmercury (Gilmour and others, 1998; Gilmour, Krabbenhoft, and others, 2007). High levels of methylmercury may persist for some time following drought/fire and rewet but eventually (usually several months later) return to levels characteristic of normal conditions at that site. The return to normal conditions occurs as microbial sulfate reduction depletes sulfate made available by the drought/fire and rewet, and/or sulfide concentrations (inhibitory to methylmercury production) gradually build up in porewater (Gilmour and others, 1998). The methylmercury produced during the drought/fire and rewet events is likely bioaccumulated, as indicated by preliminary evaluation of methylmercury levels in fish (Gilmour and others, 2004; Gilmour, Krabbenhoft, and others, 2007).

Field studies provided much insight into how drought/fire and rewet events influence biogeochemical processes, especially sulfate remobilization and stimulation of methylmercury production and bioaccumulation (Gilmour, Krabbenhoft, and others, 2007). Many details of the process, however, need additional study. To further address the effects of drought and rewet on biogeochemical processes in the Everglades, the USGS in collaboration with scientists currently with the Smithsonian Environmental Research Center, Edgewater, Md. (Gilmour and others), conducted a controlled laboratory experiment using microcosm soil cores collected from two sites within the Everglades. The chemical results for sulfur species, anions, and nutrients in water and for the organic elemental composition of soils are presented in this report. Mercury and other chemical data will be compiled and published by Smithsonian scientists. A full discussion and evaluation of results from this experiment will be prepared for publication in peer-reviewed journals.

Dry/Rewet Experiment Design

The experiment was designed to examine the effects of drying and subsequent rewetting with ambient surface water on Everglades' soils, including: (1) remobilization of chemical substances into the water and (2) the effects of these remobilized substances on methylmercury production. The overall study is thus referred to as a dry/rewet experiment. The basic dry/rewet experiment design involved collecting cores from two study sites, drying these cores in the laboratory for a selected period of time under controlled lighting conditions that approximated in situ light conditions and temperatures of 28°C, and then rewetting the cores with water collected from the sites (simulating natural rewetting conditions). The drying periods of 40 and 299 days were selected on the basis of field observations of drying times resulting in remobilization of chemical species from the 1999–2000 drought. After rewetting, surface water, sediment porewater, and sediment from the cores were analyzed for various chemical substances of interest, especially sulfur and mercury species to determine the impact of dry/rewet cycles on the remobilization of chemical species and methylmercury production.

Two contrasting sites were selected as a source of soil for the dry/rewet experiment: a site in the center of Water Conservation Area 3A (site 3A–15) and a site in Stormwater Treatment Area 2 (STA–2) cell 1. The 3A–15 site is a typical oligotrophic, peat-forming environment in the ridge and slough region of the central Everglades, representative of large portions of the ecosystem. This site has not routinely dried out in recent decades but may experience drydown during extended drought. The STA–2 site is a recently constructed buffer wetland area designed to help remove excess phosphorus from canal water destined for discharge into the Everglades. STA–2 has three treatment cells that are operated concurrently and independently by water managers for the South Florida Water Management District. Prior to conversion to an STA, cell 3 (the westernmost treatment cell) was a sod farm, cell 2 (the middle cell) was about one-third sod farm and two-thirds undeveloped wildlife preserve, and cell 1 (the easternmost cell) was entirely undeveloped wildlife preserve. Cores for this study were collected from cell 1 in STA–2. Cell 1 has a higher average elevation than cells 2 and 3 and therefore dries out more frequently and for longer periods of time. This cell has experienced some anomalously high methylmercury concentrations in surface water and indicator fish, by reflooding after periods of dryout (Gilmour and others, 2004; Gilmour, Krabbenhoft, and others, 2007). The high methylmercury levels in surface water and fish in STA–2 cell 1 could reflect (1) remobilization of sulfate and mercury from soil and (2) stimulation of microbial sulfate reduction and mercury methylation following rewet, as described above.

For the dry/rewet experiment, approximately 40 cores were collected in 10 cm teflon and 7 cm PVC core barrels at each of the two sites: on February 6, 2002, at WCA 3A–15 and on February 7, 2002, at STA–2 cell 1. Teflon core barrels were used to collect cores from which surface water was to be sampled after drying and rewetting; PVC core barrels were used for collecting cores for dry/rewet and subsequent soil chemical analyses. The cores were collected to a depth of about 10 cm, which filled the core barrels about halfway. The cores were topped off with site water and capped to prevent disturbance of the soil during shipment to laboratory facilities. Cores were tightly packed in an upright position in coolers to further protect against disturbance. The cores were transported in a USGS van on February 8 and 9, 2002, from Florida to southern Maryland (co-investigator Gilmour's labs were located at that time at the Academy of Natural Sciences (Philadelphia) Estuarine Research Center in St. Leonard, Md.) where the dry/rewet experiment was conducted. The cores were incubated in a 28°C water bath under artificial sunlight using a 12-hour day/night cycle. A photograph of the core drying and incubation setup is shown on the cover of this report.

The drying experiment was begun on February 14, 2002. One set of cores was dried for a period of 40 days before rewet, while another smaller set of cores was dried for 299 days before rewet. The timeline for the study is presented in table 1. Following the 40-day and 299-day drydown, cores from sites 3A–15 and STA–2 were rewet with site water. The initial rewet after the 40-day drydown was on March 27, 2002; and for the 299-day drydown, the initial rewet was on December 11, 2002. After the initial rewet, samples were collected from the rewet cores according to the scheme shown in table 2 for surface water and table 3 for soil sampling. In all tables, surface (overlying water) water is abbreviated SW, soil porewater is abbreviated PW, and soil is abbreviated SED.

Surface water, porewater, and soil samples were collected for the determination of background (ambient) conditions at each site (STA–2 cell 1 and WCA 3A–15). Surface water samples were carefully collected to minimize resuspension of soil particulate matter or interstitial waters into the sample. Porewater was collected at each site using a micropiezometer approach, with a sipper constructed from Teflon and properly cleaned and stored for ultra-trace mercury and sulfur species analysis. The porewater samples represented a depth-integrated sample with an average depth of approximately 5 cm. Soil cores from each site for background biogeochemistry were collected (in duplicate) in 0–4 cm depth increments at the same site and time as water samples, using 5 cm i.d. polycarbonate tubing with plastic caps. Soil cores were collected in a manner to preserve the undisturbed physical, chemical, and microbiological community structure of the soil to the maximum extent practicable.

Analytical Methods

Water chemistry presented in this report is limited to anions, sulfur species (sulfate, sulfite, and thiosulfate), and nutrients. However, water samples from the dry/rewet experiment were analyzed for the following parameters overall: mercury species (total and MeHg), anions (chloride, fluoride, bromide), nutrients (nitrate, ammonium, and phosphate), sulfur species (sulfate, sulfide, sulfite, and thiosulfate), dissolved organic carbon, pH, major cations (Ca, Mg, Na, K, Fe, Mn), conductivity, dissolved oxygen, salinity, total dissolved solids, and redox state. The complete range of parameters will be reported in subsequent publications. The soil cores did not fully rewet after drying, possibly due to a loss of pore space. As a result, porewater recovery from the rewet samples was minimal, and few porewater measurements were made.

Anions, sulfate, and nitrate concentrations were determined by ion chromatography (IC) using standard suppressed IC methods, and detection by in-line conductivity (all ions) and variable wavelength uv/vis spectrometry (nitrate only). Standard error for anion analysis by IC was about 1 percent (relative standard deviation). Sulfite and thiosulfate were determined by high-performance liquid chromatography using a diode array detection system. Results of recovery experiments indicate that the thiosulfate-derivative complex is fully recovered and stable with a maximum error of 15 percent at the lowest concentrations. The sulfite-derivative complex is fully recovered; however, it is unstable, with sulfite-derivative peak areas increasing with time. In order to quantify sulfite, a peak enhancement correction factor must be applied, which increases the error to 20 percent. Ammonium and phosphate were determined using standard colorimetric methods with fiber optic uv/vis spectrophotometric detection. Standard error (% relative standard deviation) was about 2 percent for both phosphate and ammonium. The data for each of these methods were reviewed routinely to ensure that quality control criteria were met.

Soils were analyzed for the following parameters: total C, organic C, total N, total S, sulfur speciation (acid-volatile sulfides, chromium-reducible sulfides, organic sulfur, and sulfates), mercury species (total and MeHg), sulfate reduction rates, and mercury methylation rates. Only total C, organic C, total N, and total S are presented in this report. The other soil parameters measured will be detailed in future reports by the collaborators who generated those data. Frozen soil samples were thawed under refrigeration, stirred until homogeneous, and a sub-sample dried overnight at 60°C. The dry soil was ground to a powder and then analyzed for total C, organic C, total N, and total S by high temperature combustion using a Leco 932 CNS analyzer (Leco Corporation, St. Joseph, MI, USA). Total C, total N, and total S are analyzed directly. Organic C was determined after removal of inorganic carbon (mostly carbonates) using an acid vapor method

(Hedges and Stern, 1984; Yamamuro and Kayanne, 1995). Analytical precision (percentage relative standard deviation) was about 2 percent for total C, 4 percent for organic C and total S, and 3 percent for total N. Data entry was done electronically in Excel spreadsheets. Data entries were quality controlled at three levels: (1) checked against hardcopy of the data report by a technician, (2) checked for accuracy in reporting and analytical quality by the laboratory chief, and (3) checked for analytical accuracy and geochemical fit by the Quality Assurance Officer (project chief/principal investigator).

Results

Water chemistry data from the dry/rewet experiments at sites WCA 3A–15, and STA–2 cell 1 are reported in tables 4 and 5, respectively. Chemical data reported in these tables include anions (F^-, Cl^-, Br^-), sulfate (SO_4^{2-}), sulfite (SO_3^-), thiosulfate ($S_2O_3^-$), and nutrients (phosphate, ammonium, and nitrate). Results are reported as mg/L or µg/L, depending on the chemical species. Only a cursory interpretation of data from this experiment is presented in this report; detailed interpretations will be presented in future journal publications from this study.

Chloride data in overlying water from experimental cores provide information on the relative ionic strength of waters at both sites, with STA–2 about ten times “saltier” than 3A–15. The concentration of conservative ions like chloride also provides information on the amount of evaporation occurring in each treatment throughout the experiment. All cores were open to the air starting February 14, 2002, and were held at the same controlled temperature. Cores were refilled with fresh site water as needed to maintain a constant volume of overlying water (except core that were drying). The chloride concentration of dry/rewet cores (after rewetting) and the chloride in cores that remained wet are not too dissimilar, showing roughly equal rates of evaporation.

Average concentrations for nutrients (nitrate, phosphate, and ammonium) in overlying water from experimental dry/rewet cores indicated that these dried soils released nitrate immediately after rewetting and ammonium in the first few weeks after rewetting, as soils become anoxic again. Nitrate and phosphate increases observed in water overlying cores that remained wet may have been evaporation or de novo production and efflux from soils. Dried STA–2 soils released nitrate and ammonium immediately after rewetting, releasing more nitrate and less ammonium than 3A–15 dry/rewet soils. Phosphate results from STA–2 cores were exceptionally variable, because one core of the triplicate dry/rewet cores released large amounts of phosphate. Dried 3A–15 soils released large concentrations of sulfate immediately after rewetting. Concentrations generated in these enclosed systems in the week following rewetting were roughly 100X ambient wet period concentrations. The concentration of sulfate in the 3A–15 surface water used to refill these cores was only about 0.5 mg/L. Therefore, almost all the sulfate generated was derived from oxidation of the reduced sulfur in sediments during soil drying. Most of the sulfate generated by drying the cores was used up again within about 3 weeks after rewetting the cores. The concentration of sulfate in soil pore waters also rose after rewetting but was lower than sulfate in water over the cores, reflecting active sulfate reduction. Dried STA–2 soils released sulfate upon rewetting, but the high sulfate canal water used to refill these cores also contributed much of the sulfate in this experiment. The sulfate concentration in the STA–2 inflow canal was about 50 mg/L. Sulfate concentrations in rewet cores were comparable to water-only controls but higher than wet cores. Sulfate in water can increase owing to evaporation or be lost through sulfate reduction in soils. Information on refill volumes is available, and evaporation can be calculated from existing data. This information can be used to estimate the relative contribution of sulfate from oxidized STA–2 soils and from canal refill water. Sulfate concentrations in the canal water and especially in cores after rewetting are exceptionally high for freshwater systems. Sulfate in the rewet cores was depleted back to levels found in the wet control cores over the course of about 4 weeks. Patterns for sulfite and thiosulfate in rewet cores tended to parallel those for sulfate but with concentrations of μg/L compared to mg/L for sulfate.

Soil data from the dry/rewet experiment from sites WCA 3A–15 and STA–2 cell 1 are reported in table 6 for total carbon, organic carbon, total hydrogen, total nitrogen, and total sulfur. All data in this table are reported as % on a dry weight basis. In general, site 3A–15 had higher total and organic C contents compared to STA–2, whereas STA–2 had generally higher soil total S contents. Dry and rewet appeared to have minimal impacts on the C, H, N, and S content of soils.

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Table 1. Timeline for dry/rewet experiment

Date	Activity
6-Feb-02	Soil cores for dry/rewet experiment collected at site WCA 3A-15; ambient surface water, porewater, and soil samples also collected
7-Feb-02	Soil cores for dry/rewet experiment collected at site STA-2 cell 1; ambient surface water, porewater, and soil samples also collected
8-Feb-02	Transport soil cores to Maryland
9-Feb-02	Complete transport of soil cores; sealed cores placed in 28°C water bath at ANSERC1
13-Feb-02	Begin drying subset of cores (cover removed from all cores); cores exposed to 12 h light/dark cycle
14-Feb-02	Sample soil, surface water, and porewater in wet control cores (baseline conditions); begin 40 day and 299 day drydown experiment
14-Feb-02	Begin 40 day drydown experiment
to	40 day drydown experiment; refill wet cores and water controls weekly to maintain water levels
27-Mar-02	End 40 day drydown
27-Mar-02	Rewet cores from 40 day drydown experiment using site water
to	Sample soil, surface water and porewater through time in rewet cores and controls from 40 day drydown experiment
13-May-02	End sampling from 40 day dry/rewet
14-Feb-02	Begin 299 day drydown experiment
to	299 day drydown experiment; refill wet cores and water controls weekly to maintain water levels
11-Dec-02	End 299 day drydown
11-Dec-02	Rewet cores from 299 day drydown experiment using site water
to	Sample soil, surface water and porewater through time in rewet cores and controls from 40 day drydown experiment
31-Jan-03	End sampling from 299 day dry/rewet

[1]ANSERC, Academy of Natural Sciences (Philadelphia) Estuarine Research Center

Table 2. Anion, sulfate, sulfite/thiosulfate, and nutrient samples collected from surface water for dry/rewet experiment

[x, sample for that analysis was collected; blank space, no sample collected due to limited volume.]

Date	Site	Treatment	Medium	Anions	Sulfate	Sulfite/Thiosulfate	Nutrients
2/14/02	3A15	Wet Control A	SW	x	x	x	x
2/14/02	3A15	Wet Control B	SW	x	x	x	x
2/14/02	3A15	Wet Control C	SW	x	x	x	x
3/27/02	3A15	Refill water	SW	x	x	x	x
3/27/02	3A15	Water Control	SW	x	x	x	x
3/27/02	3A15	Wet Control A	SW	x	x	x	x
3/27/02	3A15	Wet Control B	SW	x	x	x	x
3/27/02	3A15	Wet Control C	SW	x	x	x	x
3/29/02	3A15	Rewet A	SW	x	x		x
3/29/02	3A15	Rewet B	SW	x	x		x
3/29/02	3A15	Rewet C	SW	x	x		x
4/1/02	3A15	Rewet A	SW	x	x		x
4/1/02	3A15	Rewet B	SW	x	x		x
4/1/02	3A15	Rewet C	SW	x	x		x
4/04/02	3A15	Rewet A	SW	x	x	x	x
4/04/02	3A15	Rewet B	SW	x	x	x	x
4/04/02	3A15	Rewet C	SW	x	x	x	x
4/08/02	3A15	Rewet A	SW	x	x	x	x
4/08/02	3A15	Rewet B	SW	x	x	x	x
4/08/02	3A15	Rewet C	SW	x	x	x	x
4/15/02	3A15	Rewet A	SW	x	x		x
4/15/02	3A15	Rewet B	SW	x	x		x
4/15/02	3A15	Rewet C	SW	x	x		x
4/22/02	3A15	Rewet A	SW	x	x	x	x
4/22/02	3A15	Rewet B	SW	x	x	x	x
4/22/02	3A15	Rewet C	SW	x	x	x	x
4/22/02	3A15	Water Control	SW	x	x	x	x
4/22/02	3A15	Wet Control A	SW	x	x	x	x
4/22/02	3A15	Wet Control B	SW	x	x	x	x
4/22/02	3A15	Wet Control C	SW	x	x	x	x
4/29/02	3A15	Rewet A	SW	x	x	x	x
4/29/02	3A15	Rewet B	SW	x	x	x	x
4/29/02	3A15	Rewet C	SW	x	x	x	x
5/6/02	3A15	Rewet A	SW	x	x		x
5/6/02	3A15	Rewet B	SW	x	x		x
5/6/02	3A15	Rewet C	SW	x	x		x
5/13/02	3A15	Rewet A	SW	x	x	x	x
5/13/02	3A15	Rewet B	SW	x	x	x	x
5/13/02	3A15	Rewet C	SW	x	x	x	x
5/13/02	3A15	Water Control	SW	x	x	x	x

Table 2. Anion, sulfate, sulfite/thiosulfate, and nutrient samples collected from surface water for dry/rewet experiment—Continued

Date	Site	Treatment	Medium	Anions	Sulfate	Sulfite/Thiosulfate	Nutrients
5/13/02	3A15	Wet Control A	SW	x	x	x	x
5/13/02	3A15	Wet Control B	SW	x	x	x	x
5/13/02	3A15	Wet Control C	SW	x	x	x	x
3/27/02	STA2	Refill water	SW	x	x	x	x
3/27/02	STA2	Rewet A	SW	x	x		x
4/04/02	STA2	Rewet A	SW	x	x	x	x
4/08/02	STA2	Rewet A	SW	x	x	x	x
4/15/02	STA2	Rewet A	SW	x	x		x
4/22/02	STA2	Rewet A	SW	x	x	x	x
4/29/02	STA2	Rewet A	SW	x	x	x	x
5/6/02	STA2	Rewet A	SW	x	x		x
5/13/02	STA2	Rewet A	SW	x	x	x	x
3/27/02	STA2	Rewet B	SW	x	x		x
4/04/02	STA2	Rewet B	SW	x	x	x	x
4/08/02	STA2	Rewet B	SW	x	x	x	x
4/15/02	STA2	Rewet B	SW	x	x		x
4/22/02	STA2	Rewet B	SW	x	x	x	x
4/29/02	STA2	Rewet B	SW	x	x	x	x
5/6/02	STA2	Rewet B	SW	x	x		x
5/13/02	STA2	Rewet B	SW	x	x	x	x
3/27/02	STA2	Rewet C	SW	x	x		x
4/04/02	STA2	Rewet C	SW	x	x	x	x
4/08/02	STA2	Rewet C	SW	x	x	x	x
4/15/02	STA2	Rewet C	SW	x	x		x
4/22/02	STA2	Rewet C	SW	x	x	x	x
4/29/02	STA2	Rewet C	SW	x	x	x	x
5/6/02	STA2	Rewet C	SW	x	x		x
5/13/02	STA2	Rewet C	SW	x	x	x	x
3/27/02	STA2	Water Control	SW	x	x	x	x
4/22/02	STA2	Water Control	SW	x	x	x	x
5/13/02	STA2	Water Control	SW	x	x	x	x
2/14/02	STA2	Wet Control A	SW	x	x	x	x
3/27/02	STA2	Wet Control A	SW	x	x	x	x
4/22/02	STA2	Wet Control A	SW	x	x	x	x
5/13/02	STA2	Wet Control A	SW	x	x	x	x
2/14/02	STA2	Wet Control B	SW	x	x	x	x
3/27/02	STA2	Wet Control B	SW	x	x	x	x
4/22/02	STA2	Wet Control B	SW	x	x	x	x
5/13/02	STA2	Wet Control B	SW	x	x	x	x
2/14/02	STA2	Wet Control C	SW	x	x	x	x
3/27/02	STA2	Wet Control C	SW	x	x	x	x
4/22/02	STA2	Wet Control C	SW	x	x	x	x
5/13/02	STA2	Wet Control C	SW	x	x	x	x

Table 3. Geochemical data collected on soil samples from dry/rewet experiment

Date	Site	Treatment	Medium	Total C	Organic C	Total N	Total S
2/14/02	3A15	Wet Control A	SED	x	x	x	x
2/14/02	3A15	Wet Control B	SED	x	x	x	x
2/14/02	3A15	Wet Control C	SED	x	x	x	x
4/04/02	3A15	Rewet A	SED	x	x	x	x
4/04/02	3A15	Rewet B	SED	x	x	x	x
4/04/02	3A15	Rewet C	SED	x	x	x	x
4/29/02	3A15	Rewet A	SED	x	x	x	x
4/29/02	3A15	Rewet B	SED	x	x	x	x
4/29/02	3A15	Rewet C	SED	x	x	x	x
5/13/02	3A15	Rewet A	SED	x	x	x	x
5/13/02	3A15	Rewet B	SED	x	x	x	x
5/13/02	3A15	Rewet C	SED	x	x	x	x
2/14/02	STA2	Wet Control A	SED	x	x	x	x
2/14/02	STA2	Wet Control B	SED	x	x	x	x
2/14/02	STA2	Wet Control C	SED	x	x	x	x
4/04/02	STA2	Rewet A	SED	x	x	x	x
4/04/02	STA2	Rewet B	SED	x	x	x	x
4/04/02	STA2	Rewet C	SED	x	x	x	x
4/29/02	STA2	Rewet A	SED	x	x	x	x
4/29/02	STA2	Rewet B	SED	x	x	x	x
4/29/02	STA2	Rewet C	SED	x	x	x	x
5/13/02	STA2	Rewet A	SED	x	x	x	x
5/13/02	STA2	Rewet B	SED	x	x	x	x
5/13/02	STA2	Rewet C	SED	x	x	x	x

Table 4. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on WCA 3A-15 soil

[nd, no data available.]

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
14-Feb-02	SW	Control A	FL02 727, 734, 741	0.26	26.26	0.05	0.21	1.11	<1	904	5.25	54.05
14-Feb-02	SW	Control B	FL02 728, 735, 742	0.24	24.52	0.06	0.20	0.76	8.26	1011	4.00	31.03
14-Feb-02	SW	Control C	FL02 729, 736, 743	0.21	27.84	0.56	0.21	1.00	17.7	1043	2.77	15.76
14-Feb-02		Filter Blk	FL02 733, 740, 747	0.12	0.62	<0.01	0.40	0.25	nd	nd	2.76	12.15
14-Feb-02	PW	Control A	FL02 777	0.24	27.80	<0.01	0.56	0.61	nd	nd	nd	nd
14-Feb-02	PW	Control B	FL02 778	0.12	25.42	<0.01	0.20	0.64	nd	nd	nd	nd
14-Feb-02	PW	Control C	FL02 779	0.21	25.99	0.13	0.25	0.59	nd	nd	nd	nd
14-Feb-02	PW	Combined Control A, B, C	FL02 773, 775	nd	nd	nd	nd	nd	97.6	340	nd	nd
14-Feb-02	PW	Filter Blk	FL02 783	nd	nd	nd	nd	nd	<1	1.84	nd	nd
14-Feb-02		DI Blk not thru filter	FL02 785, 786, 787	nd	nd	nd	nd	nd	<1	13.1	3.54	15.77
27-Mar-02		Blk DI	FL02 844, 855, 833	0.12	6.71	<0.01	<0.01	<0.01	<1	8.32	17.6	7.53
27-Mar-02	SW	Control A	FL02 834, 845, 856	0.15	60.01	<0.01	<0.01	5.12	13.9	3649	50.4	8.38
27-Mar-02	SW	Control B	FL02 835, 846, 857	0.19	64.51	<0.01	<0.01	5.37	2.33	4652	77.5	15.16
27-Mar-02	SW	Control C	FL02 836, 847, 858	0.16	59.14	<0.01	1.107	3.64	33.6	1075	31.0	8.85
27-Mar-02	SW	Site H2O Ctrl	FL02 837, 848, 859	0.22	91.78	<0.01	<0.01	<0.01	3.49	26.0	26.3	8.43
27-Mar-02	SW	Refill H2O	FL02 838, 849, 860	0.09	23.95	<0.01	0.483	<0.01	2.33	104	29.7	15.70
29-Mar-02		DI Blk	FL02 912, 919	0.05	3.55	<0.01	0.65	1.95	23.2	<1	nd	nd
29-Mar-02	SW	Control A	FL02 913, 920	0.17	54.14	<0.01	25.70	64.47	13.9	565	nd	nd

Table 4. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on WCA 3A-15 soil—Continued

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
29-Mar-02	SW	Control B	FL02 914, 921	0.17	66.29	<0.01	3.43	35.25	<1	581	nd	nd
29-Mar-02	SW	Control C	FL02 915, 922	0.14	49.81	<0.01	27.52	50.63	24.4	514	nd	nd
1-Apr-02	SW	Control A	FL02 954, 961	0.19	56.90	<0.01	2.04	59.46	24.4	698	nd	nd
1-Apr-02	SW	Control B	FL02 955, 962	0.19	64.87	<0.01	0.52	42.26	2.33	1124	nd	nd
1-Apr-02	SW	Control C	FL02 956, 963	0.17	50.41	<0.01	4.02	47.69	24.4	762	nd	nd
1-Apr-02		DI Blk	FL02 953, 960	0.10	0.58	<0.01	<0.01	0.38	12.8	<1	nd	nd
4-Apr-02		Blk DI	FL02 995, 1002,1009	0.13	0.46	<0.01	<0.01	0.38	<1	3.05	6.27	3.48
4-Apr-02	SW	Rewet Contr A	FL02 996,1003, 1010	0.20	66.20	0.08	0.36	51.23	27.8	1600	17.7	5.85
4-Apr-02	SW	Rewet Contr B	FL02 997, 1004,1011	0.21	74.40	0.01	0.13	31.83	3.49	1687	49.9	9.06
4-Apr-02	SW	Rewet Contr C	FL02 998, 1005, 1012	0.20	65.59	0.18	0.12	42.93	3.49	1418	62.2	12.15
4-Apr-02	PW	Rewet PVC A,B,C	FL02 1058	0.31	91.20	0.36	<0.01	10.05	nd	nd	nd	nd
8-Apr-02		Blk DI	FL02 1111, 1118, 1125	0.11	0.77	<0.01	<0.01	0.36	<1	6.40	9.28	3.55
8-Apr-02	SW	Rewet Contr A	FL02 1112, 1119, 1126	0.24	55.82	<0.01	<0.01	25.47	25.5	2213	11.2	4.48
8-Apr-02	SW	Rewet Contr B	FL02 1113, 1120, 1127	0.27	58.31	0.09	<0.01	12.07	27.8	2195	35.1	5.66
8-Apr-02	SW	Rewet Contr C	FL02 1114, 1121, 1128	0.24	58.13	0.07	<0.01	25.71	27.8	2268	53.4	7.31
15-Apr-02		Blk DI	FL02 1159, 1166	<0.01	4.51	<0.01	<0.01	0.40	<1	3.28	nd	nd
15-Apr-02	SW	Rewet Contr A	FL02 1160, 1167	0.25	46.10	0.115	0.17	8.60	3.07	2175	nd	nd
15-Apr-02	SW	Rewet Contr B	FL02 1161, 1168	0.25	42.64	0.125	<0.01	4.14	13.9	2731	nd	nd
15-Apr-02	SW	Rewet Contr C	FL02 1162, 1169	0.25	43.54	0.172	<0.01	8.52	23.7	2731	nd	nd

Table 4. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on WCA 3A-15 soil—Continued

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
22-Apr-02		Blk DI	FL02 1215, 1230, 1245	<0.01	1.46	<0.01	<0.01	<0.01	<1	2.01	0.58	0.95
22-Apr-02	SW	Wet Control A	FL02 1216, 1231, 1246	0.22	55.28	0.469	<0.01	4.71	12.9	2443	5.01	1.19
22-Apr-02	SW	Wet Control B	FL02 1247	0.33	65.03	0.371	<0.01	2.26	nd	nd	nd	nd
22-Apr-02	SW	Wet Control C	FL02 1218, 1233, 1248	0.30	60.34	0.160	<0.01	1.26	23.7	1985	2.49	0.87
22-Apr-02	SW	Site H20	FL02 1219, 1234, 1249	0.23	86.24	<0.01	<0.01	3.64	<1	11.7	2.59	0.80
22-Apr-02	SW	Rewet Control A	FL02 1220, 1235, 1250	0.16	37.98	<0.01	<0.01	4.70	<1	2429	3.05	0.78
22-Apr-02	SW	Rewet Control B	FL02 1221, 1236, 1251	0.16	38.43	<0.01	<0.01	3.12	23.7	3246	3.19	1.02
22-Apr-02	SW	Rewet Control C	FL02 1222, 1237, 1252	0.17	36.35	<0.01	<0.01	5.23	34.6	2562	3.47	1.15
29-Apr-02		Blk DI	FL02 1357, 1364, 1371	<0.01	0.20	<0.01	<0.01	0.37	nd	nd	1.02	0.39
29-Apr-02	SW	Rewet Control A	FL02 1358, 1365, 1372	0.17	35.71	<0.01	0.56	3.34	nd	nd	4.17	0.78
29-Apr-02	SW	Rewet Control B	FL02 1359, 1366, 1373	0.17	33.76	<0.01	<0.01	2.33	nd	nd	3.07	0.41
29-Apr-02	SW	Rewet Control C	FL02 1360, 1367, 1374	0.17	31.75	<0.01	0.43	3.76	nd	nd	3.34	0.52
29-Apr-02		Filter Blk	FL02 1421, 1428, 1435	nd	nd	nd	nd	nd	nd	nd	nd	nd
29-Apr-02	PW	Rewet PVC A	FL02 1422, 1429, 1436	nd	111.56	nd	0.73	26.62	28.7	1264	1.56	0.35
29-Apr-02	PW	Rewet PVC B	FL02 1423, 1430, 1437	0.24	81.66	nd	0.79	4.31	20.0	1196	9.72	4.15
29-Apr-02	PW	Rewet PVC C	FL02 1424, 1431, 1438	0.23	89.13	0.310	0.38	2.48	93.4	4191	9.71	4.12
6-May-02		Blk DI	FL02 1481, 1488	<0.01	0.50	<0.01	<0.01	<0.01	<1	4.42	nd	nd
6-May-02	SW	Rewet Control A	FL02 1482, 1489	0.13	36.07	<0.01	7.74	4.10	12.3	439	nd	nd

Table 4. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on WCA 3A-15 soil—Continued

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
6-May-02	SW	Rewet Control B	FL02 1483, 1490	0.19	31.90	<0.01	0.03	2.06	11.2	2592	nd	nd
6-May-02	SW	Rewet Control C	FL02 1484, 1491	0.12	32.39	<0.01	1.70	3.75	3.51	1191	nd	nd
13-May-02		Blk DI	FL02 1547, 1554, 1561	nd	3.78	<0.01	<0.01	<0.01	3.51	2.92	nd	nd
13-May-02	SW	Rewet Control A	FL02 1548, 1555, 1562	0.16	34.80	<0.01	6.39	4.30	12.3	32.2	nd	nd
13-May-02	SW	Rewet Control B	FL02 1549, 1556, 1563	nd	31.46	<0.01	0.12	2.28	12.3	2430	nd	nd
13-May-02	SW	Rewet Control C	FL02 1550, 1557, 1564	nd	32.53	<0.01	5.90	4.27	20.0	70.5	nd	nd
13-May-02		Filter Blk	FL02 1605, 1612, 1619	<0.01	57.48	<0.01	0.89	0.64	3.51	20.4	nd	nd
13-May-02	PW	Rewet PVC A	FL02 1606, 1613, 1620	nd	158.69	0.360	<0.01	1.14	29.8	1566	nd	nd
13-May-02	PW	Rewet PVC B	FL02 1607, 1614, 1621	nd	263.83	<0.01	2.26	18.66	39.7	193	nd	nd
13-May-02	PW	Rewet PVC C	FL02 1608, 1615, 1622	nd	236.20	<0.01	2.04	8.45	46.3	1506	nd	nd
13-May-02	SW	Wet Control A	FL02 1673, 1681, 1689	nd	44.33	<0.01	<0.01	3.84	21.1	3791	nd	nd
13-May-02	SW	Wet Control B	FL02 1674, 1682, 1690	0.21	44.67	0.354	0.03	3.54	12.3	3154	nd	nd
13-May-02	SW	Wet Control C	FL02 1675, 1683, 1691	0.23	49.86	0.165	0.01	2.44	12.3	279	nd	nd
13-May-02	SW	Site H20 Cont	FL02 1676, 1684, 1692	0.22	57.61	0.202	<0.01	2.32	3.51	5.33	nd	nd
11-Dec-02		DI Blk	FL02 1745, 1747, 1781, 1788	nd	nd	nd	nd	nd	<1	<1	nd	nd
11-Dec-02		Site Water Ctr	FL02 1746, 1748	0.33	48.45	0.21	5.81	0.85	22.9	1.84	nd	nd
11-Dec-02	SW	Rewet Teflon Jar A	FL02 1782, 1789	0.16	81.19	<0.01	51.63	90.27	611.0	2.84	nd	nd

Table 4. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on WCA 3A-15 soil—Continued

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
11-Dec-02	SW	Rewet Teflon Jar B	FL02 1783, 1790	0.19	102.06	0.16	38.30	77.18	356.9	2.94	nd	nd
11-Dec-02	SW	Rewet Teflon Jar C	FL02 1784, 1791	0.15	96.00	<0.01	171.55	112.09	61.0	8.48	nd	nd
18-Dec-02		DI Blk	FL02 1843, 1850	nd	nd	nd	nd	nd	<1	<1	nd	nd
18-Dec-02	SW	Rewet Teflon Jar A	FL02 1844, 1851	0.22	82.01	<0.01	0.06	46.53	1033.5	13.0	nd	nd
18-Dec-02	SW	Rewet Teflon Jar B	FL02 1845, 1852	0.27	111.34	<0.01	1.44	58.63	818.7	14.0	nd	nd
18-Dec-02	SW	Rewet Teflon Jar C	FL02 1846, 1853	0.13	134.50	<0.01	1.63	281.16	383.1	14.3	nd	nd
31-Jan-03		DI Blk	FL03 1936, 1943	nd	nd	nd	nd	nd	<1	<1	nd	nd
31-Jan-03	SW	Rewet Teflon Jar A	FL03 1937, 1944	0.15	76.16	0.45	0.01	7.28	53.9	<1	nd	nd
31-Jan-03	SW	Rewet Teflon Jar B	FL03 1938, 1945	0.33	88.89	0.46	0.01	7.26	37.2	<1	nd	nd
31-Jan-03	SW	Rewet Teflon Jar C	FL03 1939, 1946	0.43	nd	<0.01	2.12	6.16	161.2	13.7	nd	nd

Table 5. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on STA-2 cell 1 soil

[nd, no data available.]

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
14-Feb-02	SW	Control A	FL02 730, 737, 744	0.82	265.22	0.34	0.83	10.27	45.9	1675	3.74	38.6
14-Feb-02	SW	Control B	FL02 731, 738, 745	0.84	303.14	39.97	11.35	15.11	55.3	2547	3.37	44.8
14-Feb-02	SW	Control C	FL02 732, 739, 746	0.89	280.93	0.31	0.20	11.90	65.8	1316	3.22	33.5
14-Feb-02	PW	Control A	FL02 780	0.84	246.43	<0.01	<0.01	1.70	nd	nd	nd	nd
14-Feb-02	PW	Control B	FL02 781	0.80	239.64	<0.01	<0.01	2.11	nd	nd	nd	nd
14-Feb-02	PW	Control C	FL02 782	0.71	235.11	<0.01	<0.01	2.30	nd	nd	nd	nd
14-Feb-02	PW	Combined Control A, B, C	FL02 774,776	nd	nd	nd	nd	nd	263	1530	83.6	76.6
27-Mar-02	SW	Control A	FL02 839, 850, 861	1.73	547.63	nd	3.30	51.88	70.7	114	41.4	8.97
27-Mar-02	SW	Control B	FL02 840, 851, 862	1.44	522.57	nd	0.57	41.62	110	987	51.5	10.0
27-Mar-02	SW	Control C	FL02 841, 852, 863	1.77	630.29	nd	<0.01	75.79	239	82.9	37.5	6.94
27-Mar-02	SW	Site H2O Ctrl	FL02 842, 853, 864	2.47	928.42	nd	1.88	183.80	35.9	16.9	86.0	13.5
27-Mar-02	SW	Refill H2O	FL02 843, 854, 865	0.71	227.92	nd	1.82	50.93	13.9	11.0	28.7	9.30
29-Mar-02	SW	Control A	FL02 916, 923	0.98	494.74	<0.01	75.39	189.16	47.5	348	nd	nd
29-Mar-02	SW	Control B	FL02 917, 924	1.13	567.29	1.137	38.38	261.22	1590	3070	nd	nd
29-Mar-02	SW	Control C	FL02 918, 925	0.85	447.36	1.258	45.29	202.93	96.2	47.5	nd	nd
1-Apr-02	SW	Control A	FL02 957, 964	1.16	477.52	1.77	27.52	179.14	25.5	11.2	nd	nd
1-Apr-02	SW	Control B	FL02 958, 965	1.49	563.79	2.66	24.91	225.07	37.1	25.9	nd	nd

Table 5. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on STA-2 cell 1 soil—Continued

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
1-Apr-02	SW	Control C	FL02 959, 966	1.20	438.99	1.68	12.45	199.68	1767	1534	nd	nd
4-Apr-02	SW	Rewet Contr A	FL02 999, 1006,1013	0.99	476.65	1.63	2.57	179.13	3.49	13.9	27.4	10.9
4-Apr-02	SW	Rewet Contr B	FL02 1000, 1007, 1014	1.29	579.34	0.94	3.56	218.93	1660	33.2	17.0	6.23
4-Apr-02	SW	Rewet Contr C	FL02 1001, 1008, 1015	0.11	420.49	1.57	1.63	181.91	27.8	16.9	28.4	8.29
4-Apr-02	PW	Rewet PVC A,B,C	FL02 1061	0.38	688.77	1.63	0.63	204.65	nd	nd	nd	nd
8-Apr-02	SW	Rewet Contr A	FL02 1115, 1122, 1129	1.14	670.43	0.44	0.66	157.95	40.6	29.4	36.5	2.76
8-Apr-02	SW	Rewet Contr B	FL02 1116, 1123, 1130	0.95	816.02	1.34	0.21	187.75	1456	15.0	24.1	5.19
8-Apr-02	SW	Rewet Contr C	FL02 117, 1124, 1131	0.93	442.69	1.99	1.26	178.17	16.2	12.9	42.7	6.88
15-Apr-02	SW	Rewet Contr A	FL02 1163, 1170	nd	447.37	<0.01	<0.01	128.59	48.8	24.4	nd	nd
15-Apr-02	SW	Rewet Contr B	FL02 1164, 1171	nd	435.64	<0.01	<0.01	132.76	1126	14.6	nd	nd
15-Apr-02	SW	Rewet Contr C	FL02 1165, 1172	nd	354.98	<0.01	<0.01	119.98	22.7	12.3	nd	nd
22-Apr-02	SW	Wet Control A	FL02 1223, 1238, 1253	nd	513.41	nd	nd	76.12	111	84.5	7.35	1.33
22-Apr-02	SW	Wet Control B	FL02 1224, 1239, 1254	nd	507.00	nd	nd	74.97	330	72.3	nd	nd
22-Apr-02	SW	Wet Control C	FL02 1225, 1240, 1255	nd	527.45	nd	nd	87.04	46.6	14.6	5.73	0.95
22-Apr-02	SW	Site H20	FL02 1226, 1241, 1256	nd	805.38	nd	nd	180.77	47.7	9.77	12.9	1.19
22-Apr-02	SW	Rewet Control A	FL02 1227, 1242, 1257	nd	383.53	nd	nd	121.69	13.9	16.2	2.38	0.74
22-Apr-02	SW	Rewet Control B	FL02 1228, 1243, 1258	nd	362.58	nd	nd	116.25	1200	10.9	5.82	0.71
22-Apr-02	SW	Rewet Control C	FL02 1229, 1244, 1259	nd	384.06	1.315	0.46	122.05	12.9	14.6	4.13	0.48

Table 5. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on STA-2 cell 1 soil—Continued

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
29-Apr-02	SW	Rewet Control A	FL02 1361, 1368, 1375	nd	331.34	0.824	0.25	102.42	nd	nd	6.86	1.64
29-Apr-02	SW	Rewet Control B	FL02 1362, 1369, 1376	nd	297.93	1.178	3.08	94.29	nd	nd	19.1	3.47
29-Apr-02	SW	Rewet Control C	FL02 1363, 1370, 1377	nd	300.21	1.047	0.33	90.79	nd	nd	10.6	1.42
29-Apr-02	PW	Rewet PVC A	FL02 1425, 1432, 1439	nd	663.22	nd	nd	190.71	308	714	8.50	5.48
29-Apr-02	PW	Rewet PVC B	FL02 1426, 1433, 1440	nd	881.23	nd	nd	62.48	2142	1754	4.90	4.07
29-Apr-02	PW	Rewet PVC C	FL02 1427, 1434, 1441	nd	743.69	nd	nd	175.19	1370	1012	7.23	4.80
6-May-02	SW	Rewet Control A	FL02 1485, 1492	nd	372.93	nd	nd	111.54	11.2	12.9	nd	nd
6-May-02	SW	Rewet Control B	FL02 1486, 1493	nd	353.65	nd	nd	93.60	873	8.95	nd	nd
6-May-02	SW	Rewet Control C	FL02 1487, 1494	nd	364.80	nd	nd	98.64	3.51	29.5	nd	nd
13-May-02	SW	Rewet Control A	FL02 1551, 1558, 1565	nd	334.98	<0.01	<0.01	106.75	3.51	21.6	nd	nd
13-May-02	SW	Rewet Control B	FL02 1552, 1559, 1566	nd	286.24	<0.01	2.57	92.73	518	20.4	nd	nd
13-May-02	SW	Rewet Control C	FL02 1553, 1560, 1567	nd	288.63	<0.01	1.12	82.02	3.51	54.8	nd	nd
13-May-02	PW	Rewet PVC A	FL02 1609, 1616, 1623	nd	1099.04	nd	nd	34.49	2422	1037	nd	nd
13-May-02	PW	Rewet PVC B	FL02 1610, 1617, 1624	nd	1287.22	nd	nd	233.46	nd	nd	nd	nd
13-May-02	PW	Rewet PVC C	FL02 1611, 1618, 1625	nd	946.70	nd	nd	130.32	720	371	nd	nd
13-May-02	SW	Wet Control A	FL02 1677, 1685, 1693	nd	448.05	nd	2.08	63.42	215	42.4	nd	nd
13-May-02	SW	Wet Control B	FL02 1678, 1686, 1694	nd	440.03	nd	nd	63.29	81.4	43.9	nd	nd
13-May-02	SW	Wet Control C	FL02 1679, 1687, 1695	nd	447.37	nd	1.11	69.77	101	168	nd	nd

Table 5. Concentrations of anions, sulfur species, and nutrients in water from dry/rewet experiment conducted on STA-2 cell 1 soil—Continued

Date	Matrix	Description	FL #	F^- (mg/L)	Cl^- (mg/L)	Br^- (mg/L)	NO_3^- (mg/L)	SO_4^{2-} (mg/L)	PO_4^{3-} (µg/L)	NH_4^+ (µg/L)	SO_3^{2-} (µg/L)	$S_2O_3^{2-}$ (µg/L)
13-May-02	SW	Site H20 Cont	FL02 1680, 1688, 1696	nd	629.46	nd	<0.01	157.93	30.9	<1	nd	nd
11-Dec-02	SW	Rewet Teflon Jar A	FL02 1785, 1792	nd	393.86	<0.01	170.59	185.85	1167	3.94	nd	nd
11-Dec-02	SW	Rewet Teflon Jar B	FL02 1786, 1793	0.58	272.36	<0.01	172.39	260.54	607	3.96	nd	nd
11-Dec-02	SW	Rewet Teflon Jar C	FL02 1787, 1794	nd	393.82	<0.01	183.01	226.01	576	2.67	nd	nd
18-Dec-02	SW	Rewet Teflon Jar A	FL02 1847, 1854	nd	343.44	<0.01	0.22	71.68	2735	13.2	nd	nd
18-Dec-02	SW	Rewet Teflon Jar B	FL02 1848, 1855	1.72	352.37	<0.01	3.61	180.69	2029	22.9	nd	nd
18-Dec-02	SW	Rewet Teflon Jar C	FL02 1849, 1856	nd	404.17	<0.01	0.25	137.54	2288	14.2	nd	nd
31-Jan-03	SW	Rewet Teflon Jar A	FL03 1940, 1947	1.37	nd	<0.01	3.24	5.44	3069	<1	nd	nd
31-Jan-03	SW	Rewet Teflon Jar B	FL03 1941, 1948	1.41	234.60	<0.01	4.22	4.71	1991	<1	nd	nd
31-Jan-03	SW	Rewet Teflon Jar C	FL03 1942, 1949	nd	265.49	<0.01	0.85	9.15	2267	<1	nd	nd

Table 6. Elemental C, H, N, and S composition of soil from dry/rewet experiment at sites WCA3A-15 and STA-2 cell 1

[nd, no data available.]

Date	Site	Matrix	Description	Depth (cm)	FL #	Total C (%)	Organic C (%)	Hydrogen (%)	Nitrogen (%)	Sulfur (%)
2/14/2002	3A15	soil	Control A	0-4	FL02 809	46.65	45.78	6.23	4.03	0.54
2/14/2002	3A15	soil	Control B	0-4	FL02 810	47.71	46.93	6.36	4.23	0.69
2/14/2002	3A15	soil	Control C	0-4	FL02 811	45.78	45.54	6.38	4.47	0.82
2/14/2002	STA 2	soil	Control A	0-4	FL02 812	44.65	42.84	5.03	3.32	0.63
2/14/2002	STA 2	soil	Control B	0-4	FL02 813	47.02	47.49	5.20	3.48	0.49
2/14/2002	STA 2	soil	Control C	0-4	FL02 814	42.22	40.97	4.90	3.24	0.56
4/4/2002	3A15	soil	Rewet PVC A	0-4	FL02 1098	52.06	48.12	6.73	4.03	0.59
4/4/2002	3A15	soil	Rewet PVC B	0-4	FL02 1099	48.39	47.85	6.40	3.96	0.56
4/4/2002	3A15	soil	Rewet PVC C	0-4	FL02 1100	49.88	48.29	6.71	4.23	0.59
4/4/2002	STA 2	soil	Rewet PVC A	0-4	FL02 1101	nd	nd	nd	nd	nd
4/4/2002	STA 2	soil	Rewet PVC B	0-4	FL02 1102	nd	nd	nd	nd	nd
4/4/2002	STA 2	soil	Rewet PVC C	0-4	FL02 1103	nd	nd	nd	nd	nd
4/29/2002	3A15	soil	Rewet PVC A	0-4	FL02 1475	50.57	47.23	6.55	4.52	0.70
4/29/2002	3A15	soil	Rewet PVC B	0-4	FL02 1476	51.12	48.31	7.02	4.34	0.69
4/29/2002	3A15	soil	Rewet PVC C	0-4	FL02 1477	50.95	47.57	5.54	4.02	0.64
4/29/2002	STA 2	soil	Rewet PVC A	0-4	FL02 1478	46.27	44.35	4.86	3.32	0.92
4/29/2002	STA 2	soil	Rewet PVC B	0-4	FL02 1479	46.57	43.04	5.28	3.25	0.78
4/29/2002	STA 2	soil	Rewet PVC C	0-4	FL02 1480	45.58	42.61	4.86	3.32	0.74
5/13/2002	3A15	soil	Rewet PVC A	0-4	FL02 1659	51.02	47.74	6.90	4.57	1.09
5/13/2002	3A15	soil	Rewet PVC B	0-4	FL02 1660	50.42	47.81	6.62	4.16	0.89
5/13/2002	3A15	soil	Rewet PVC C	0-4	FL02 1661	51.03	48.80	7.06	4.74	0.97
5/13/2002	STA 2	soil	Rewet PVC A	0-4	FL02 1662	40.85	36.50	4.61	2.83	1.06
5/13/2002	STA 2	soil	Rewet PVC B	0-4	FL02 1663	49.75	45.88	5.25	3.22	0.93
5/13/2002	STA 2	soil	Rewet PVC C	0-4	FL02 1664	44.50	42.04	4.85	3.40	1.11
12/11/2002	3A15	soil	Rewet PVC A	0-4	FL02 1756	48.39	47.02	nd	3.56	0.36
12/11/2002	3A15	soil	Rewet PVC B	0-4	FL02 1757	46.54	46.16	nd	3.45	0.64
12/11/2002	3A15	soil	Rewet PVC C	0-4	FL02 1758	48.67	46.88	nd	3.39	0.54
12/11/2002	STA 2	soil	Rewet PVC A	0-4	FL02 1759	50.12	49.54	nd	4.47	0.69

Table 6. Elemental C, H, N, and S composition of soil from dry/rewet experiment at sites WCA3A-15 and STA-2 cell 1—Continued

Date	Site	Matrix	Description	Depth (cm)	FL #	Total C (%)	Organic C (%)	Hydrogen (%)	Nitrogen (%)	Sulfur (%)
12/11/2002	STA 2	soil	Rewet PVC B	0-4	FL02 1760	48.31	47.41	nd	4.50	0.81
12/11/2002	STA 2	soil	Rewet PVC C	0-4	FL02 1761	50.62	50.37	nd	4.51	1.37
12/18/2002	3A15	soil	Rewet PVC A	0-4	FL02 1898	49.79	48.95	nd	4.70	1.06
12/18/2002	3A15	soil	Rewet PVC B	0-4	FL02 1899	50.03	49.97	nd	4.36	0.97
12/18/2002	3A15	soil	Rewet PVC C	0-4	FL02 1900	50.40	49.56	nd	4.53	0.94
12/18/2002	STA 2	soil	Rewet PVC A	0-4	FL02 1901	46.69	46.99	nd	3.29	0.85
12/18/2002	STA 2	soil	Rewet PVC B	0-4	FL02 1902	49.95	49.40	nd	3.63	1.15
12/18/2002	STA 2	soil	Rewet PVC C	0-4	FL02 1903	48.87	47.90	nd	3.46	1.29
1/31/2003	3A15	soil	Rewet Teflon Jar A	0-4	FL02 1991	49.36	50.39	nd	4.42	0.96
1/31/2003	3A15	soil	Rewet Teflon Jar B	0-4	FL02 1992	49.79	49.66	nd	4.50	0.85
1/31/2003	3A15	soil	Rewet Teflon Jar C	0-4	FL02 1993	48.88	49.39	nd	4.67	0.75
1/31/2003	STA 2	soil	Rewet Teflon Jar A	0-4	FL02 1994	48.32	47.70	nd	3.68	1.46
1/31/2003	STA 2	soil	Rewet Teflon Jar B	0-4	FL02 1995	46.64	44.88	nd	3.18	1.14
1/31/2003	STA 2	soil	Rewet Teflon Jar C	0-4	FL02 1996	39.02	36.00	nd	2.76	0.81

[1]All elemental C, H, N, and S data reported on a % dry weight basis.