UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

NOV 7 1991

MEMORANDUM

SUBJECT: Environmental Fate and Transport Assessment for Cu(II) Salts (023104)

FROM: R. David Jones, Ph.D., Agronomist R David Jones
Surface Water Section
EFGWB/EFED

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TO: Doug Urban, Acting Branch Chief
Ecological Effects Branch
Environmental Fate and Effects Division (H7507C)

Daniel D. Rieder, Section Chief
Section 3
EEB/EFED

Please find attached a copy of the EFGWB environmental fate and transport assessment for Cu(II) salt pesticides. This report contains an integrated literature survey on the environmental chemistry of cupric copper, Cu(II), and estimated environmental concentrations (EEC) for Cu^{2+} ion using model simulated standard field-pond runoff scenarios on sites in Aiken County, South Carolina and Kossuth County, Iowa.

CONCURRENCES								
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SURNAME								
DATE								

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WASHINGTON, D.C. 20460

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OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

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Please find attached a copy of the EFGWB environmental fate and transport assessment for Cu(II) salt pesticides. This report contains an integrated literature survey on the environmental chemistry of cupric copper, Cu(II), and estimated environmental concentrations (EEC) for Cu^{2+} ion using model simulated standard field-pond runoff scenarios on sites in Aiken County, South Carolina and Kossuth County, Iowa.

The EEC predictions for Cu were determined using a standard field-pond runoff scenario: a 10 ha field amended with 13.75 kg Cu^{2+} ha^{-1} and drains into a 1 ha pond (20000 m^3 H_20). Runoff simulations were done using GLEAMS. The GLEAMS runoff data was then used in EXAMS for predicting Cu EEC in the pond water column. *It is important to note that both GLEAMS and EXAMS were not designed to simulate runoff of inorganic compounds. Therefore, some of the input parameters (including aerobic soil half-life, partition coefficient (K_{oc}), and pesticide solubility (K_{sp})) were manipulated to allow for reasonable model simulations.*

Since introduced Cu^{2+} is indistinguishable from native Cu^{2+}, it is reasonable to assume that both will behave similarly in the environment. The model simulations indicate that introduced Cu, in addition to native Cu, will runoff from the site of application. Because Cu^{2+} has a high binding affinity for soil, it predominately moves on entrained sediments during soil erosion. As expected, the quantity of introduced copper in runoff was influenced by the management system (*i.e.* crop and fallow); 8.25% of the total copper was removed from the field by runoff from the fallow field as compared to 1.51% of the copper applied when peanuts were present, an increase a factor of 5.5. In a probabilistic sense, 3% of the rain events (14 out 592 rain events) produced runoff, or erosion of introduced Cu, from the site of application.

Both the predicted cumulative EEC of introduced Cu in pond water over 15 years of model simulation and the predicted maximum EEC of introduced Cu during a single rainfall event exceed 10 $\mu g\ L^{-1}$. This concentration represents an upper limit of copper concentration in natural non-polluted waters. Although these EECs may exceed ambient Cu concentrations in natural water, the elevated Cu concentrations should rapidly equilibrate back to the ambient Cu concentrations. Why?

The linear partition model (K_{oc}) used in the simulation models does not account for Cu(II) mineral precipitation. Therefore, depending on the environmental conditions, the dissolved Cu^{2+} concentration could be high enough to cause precipitation of Cu(II) minerals. Based on mineral equilibria with cupric ferrite, the least soluble Cu(II) mineral, the dissolved Cu^{2+} concentration will exceed 10 $\mu g\ L^{-1}$ in acidic environments (pH < 6); otherwise, the dissolved Cu concentration would expected to be < 10 $\mu g\ L^{-1}$, or equivalent to ambient Cu concentrations. *It is important to note that the dissolved Cu^{2+} concentration in aquatic environments can exceed 10 $\mu g\ L^{-1}$ under acidic conditions (pH < 6).* This situation can occur in natural water whether the sediments contain native and/or introduced Cu. Therefore, it is possible to exceed the acute and chronic Cu LD_{50}'s for aquatic organisms in limited aquatic environments (*e.g.* shallow, well-mixed ponds in acidic environments).

cc: Amy Rispin, Ph.D. SACB/EFED
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ENVIRONMENTAL FATE AND TRANSPORT ASSESSMENT FOR COPPER

INTRODUCTION

This report is an environmental fate and transport assessment for copper (Cu) in terrestrial and aquatic ecosystems. It is divided into two sections: qualitative and quantitative aspects of copper cycling. The qualitative fate assessment is an overview and integration of literature on the cycling of copper. The quantitative fate assessment provides estimated environmental concentration (EEC) of copper in runoff waters from treated agricultural fields and the receiving watersheds. The EEC's were generated using two computer models, GLEAMS, for simulation of the agricultural field, and EXAMS for simulations of the watersheds.

QUALITATIVE ASPECTS

Copper (Cu) in the environment can be traced to geologic minerals including among others, chalcopyrite ($CuFeS_2$), cuprite (Cu_2O), and malachite ($Cu_2(OH)_2CO_3$) (Greenwood and Earnshaw, 1984). Copper minerals can be interbedded in different rock types: sedimentary rocks, (*e.g.* shale and carbonates) may contain from 4 to 50 μg-Cu g^{-1} ; and igneous rocks (*e.g.* mafic and felsic rocks) may contain 20 to 100 μg-Cu g^{-1} (Krauskopf, 1979). The total Cu concentration in mineral soil (2 to 100 $\mu g\ g^{-1}$) is similar to that found in rocks and minerals (Lindsay, 1978).

The dissolved Cu concentration in most non-polluted, natural waters range between 1 and 10 $\mu g\ L^{-1}$ (EPA Water Quality Criteria, 1984; Boyle, 1979). Similarly, copper concentration in soil water[1] in native soil typically range from 10 to 60 $\mu g\ L^{-1}$ (Baker and Amacher, 1982; Sanders, 1982). It is important to note that the dissolved Cu concentration in soil and natural waters is dependent on pH; the lowest theoretical Cu concentrations (assuming a fixed ionic strength of 0.03 M) may approach 7.77 $\mu g\ L^{-1}$ at pH 5, 1.52 ng L^{-1} at pH 7, and 0.749 ng L^{-1} at pH 9 (Lindsay, 1978). The ambient Cu concentrations in unpolluted, natural waters are low ($< 10\ \mu g\ L^{-1}$) and hence near or below the analytical detection limit of current analytical methods (1 $\mu g\ L^{-1}$ by flame absorption spectrometry) (Baker and Suhr, 1982; Sanders, 1982; Boyle, 1979). Such an analytical problem may prevent an establishment of "true" ambient Cu concentrations in natural waters, but it does provide an *estimate* of the upper limit of Cu concentration.

Additionally, anthropogenic processes including tailings from mineral extraction operations, smelting of metals, combustion of fossil fuels, amendment of land with sewage sludge, fertilization with copper salts, and application of copper salts as pesticides can increase

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[1] Soil water is the water in soil and/or sediment that can be extracted mechanically and that which is chemically bound directly to the soil.

environmental copper concentrations (Greenland and Hayes, 1981). Based on a copper salt pesticide application rate of 13.75 kg Cu ha^{-1}, the soil-Cu concentration can be increased from 6 to 92 μg g $soil^{-1}$, which represent an average increase of 42 μg Cu g $soil^{-1}$. These data suggest that short-term use of copper salt pesticides may not significantly increase the total soil-Cu concentration above reported ambient soil concentrations (< 100 $\mu g\ g^{-1}$).

Copper Cycling in the Environment

In nature, copper can exist in two oxidation states: cuprous (Cu(I) or Cu^{+}) and cupric (Cu(II) or Cu^{2+}) ions. The equilibrium condition between the cuprous and cupric ions is controlled by oxidation-reduction (redox) chemistry; the chemical activities of Cu^{+} and Cu^{2+} are equal at an $E_h = 156$ mV (pe=2.65)[2] (Lindsay, 1978). Cupric ions will be the predominant Cu species in suboxic and oxic environments, pe > 2.65 (Sposito, 1989). Thus an important aspect of copper redox chemistry is that it can control the stability of Cu(II) minerals; under anoxic conditions, Cu(II) minerals will dissolved and reprecipitate as Cu(I) minerals and subsequently lower the concentration of soluble Cu^{2+}. Therefore, it is important that environmental redox conditions are considered when estimating environmental concentrations of copper because cupric concentrations are directly dependent on environmental redox conditions.

The cycling of copper in soil is dependent on soil retention mechanisms and plant uptake. In general, the bioavailability of Cu^{2+} in soil is controlled by soil retention mechanisms (Chapman, 1974). Although the soil retention mechanisms for Cu are not fully understood, they may be dependent on mineral precipitation, cation exchange on secondary clay minerals, adsorption on hydrous oxide surfaces, and chelation into organic matter (Greenland and Hayes, 1981).

Copper retention in soil has been traditionally described using adsorption isotherms and ion exchange equations (Kinniburgh, 1986). These batch equilibrium techniques cannot be used to delineate specific Cu retention mechanisms in soil; however, they can provide quantitative data on Cu retention in different soils. Metal adsorption studies indicate that Cu (including all soluble species) equilibrate rapidly (<0.3 hours) and has a high binding affinity to soil (K_d = 386 to $\approx \infty$) (Elliott, et al. 1986; King, 1988; Sidle and Kardos, 1977). Similarly, the loading rate of copper in mineral soils, based on average soil cation exchange capacities, can range from 1.58 (Vertisol) to 11.75 mg-Cu^{2+} g^{-1} soil (Oxisol). The large K_d's and predicted loading rate of copper on mineral soil/sediment indicates that Cu has an extremely large binding affinity for soil (including both mineral and organic fractions). In other words, the soil/sediment may act as a near-infinite sink for binding copper and, hence, only a small percentage of the copper is dissolved and bioavailable. However, the linear partition models

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[2] Redox potential is the tendency of soil to deplete molecular oxygen from the system to form other oxygen-containing compounds. Redox can be measured as an electrical potential in millivolts (mV). It also controls the chemical forms of other compounds in the soil/sediment.

(K_d, K_{oc}) are limited in usefulness for descriptions of environmental copper chemistry because they cannot account for pH effects, CEC or mineral precipitation.

Another approach for describing soil copper retention is using chemical thermodynamics for modelling Cu(II) mineral stability. Although chemical equilibrium is a useful diagnostic tool, has universal applications and is scientifically rigorous, it requires a complete characterization of the soluble organic and inorganic Cu(II) complexes. The stability constants[3] for soluble inorganic complexes and hydrolysis species of Cu^{2+} (including $CuOH^+$, $Cu(OH)_2^\circ$, $Cu(OH)_3^-$, $Cu(OH)_4^{2-}$, $Cu_2(OH)_2^{2+}$, $CuCl^+$, $CuCl_2^\circ$, $CuCl_3^-$, $CuHCO_3^+$, etc.)[4] and synthetic organic ligands (DTPA, EDTA, HEDTA, etc.) have been determined (Lindsay 1978; Norvell, 1972). However, the stability constants for natural organic ligands are mostly unknown (Schnoor *et al.*, 1987). Also, by its very nature, thermodynamics can say nothing about the rates of processes in soil. However, as mentioned above, copper appears to equilibrate rapidly with soil and thus thermodynamic calculations are valid in most cases. The distribution and importance of the soluble Cu complexes is dependent on the pH (McBride and Bouldin, 1984; Lindsay, 1979). Because the stability constants for soluble Cu^{2+} species are not completely described, it is nearly impossible to get a reliable estimate of the Cu^{2+} activity[5] (effective concentration) in natural, aqueous environments. It is important to note that Cu^{2+} activities may be directly measured using an ion specific electrode. Although an ion specific electrode provides a direct measurement of Cu^{2+} activity, the accuracy of activity measurements is highly dependent upon the environmental matrices (Sanders, 1982). Therefore, the Cu^{2+} activity in natural aqueous environments (soil water, runoff waters, pond and river waters) can only be **approximated** using chemical speciation or ion electrode measurements. The consequence of this is that it is not yet possible to accurately predict Cu^{2+} activities in soil solutions based on a detailed knowledge of soil chemistry.

Equilibrium studies indicate Cu^{2+} activities in soil water are undersaturated to **all known** Cu(II) minerals (Lindsay, 1978; Cavallaro and McBride, 1980). These results suggest either copper equilibria in soil is controlled by an unknown Cu(II) mineral, or Cu^{2+} retention is controlled by an adsorption process. Therefore, the least soluble Cu(II) mineral, cupric ferrite, may be a good index for predicting the maximum concentration of dissolved Cu^{2+};

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[3] A stability constant is an equilibrium constant. Equilibrium constants are mathematical expressions of LeChatelier's Principal which states that when a stress in applied to a system, the system reacts to relieve the stress.. In this case, adding copper to the system is the stress, the system reacts by forming copper complexes to relive the stress.

[4] Cu^{2+} is shorthand for $Cu[H_2O]_6^{2+}$, the hexaquocopper(II) ion. Other copper complexes replace the bound water with the listed ligand. Hence $CuCl_2^\circ$ is actually $[Cu[H_2O]_4Cl_2]^\circ$.

[5] Total measured copper in solution is a chemical summation of various forms of copper present. Because of the varying availability of these forms, the reactivity of the copper present will be less than this measurement would predict. "Activity" is a measure of this empirical reactivity. A description of any ion in solution needs to be in terms of activity in order for the description to be accurate.

the copper concentration in equilibrium with cupric ferrite, α-$CuFe_2O_4$, (assuming equilibrium with soil-Fe and ionic strength = 0.03 mol L^{-1}) is 685 $\mu g\ L^{-1}$ at pH 5, 0.129 $\mu g\ L^{-1}$ at pH 7, and 0.0638 $\mu g\ L^{-1}$ at pH 9 (Lindsay, 1978). These predicted copper concentrations would, in theory, be the physical ceiling for Cu^{2+} concentrations because any greater Cu concentration would promote cupric ferrite precipitation and subsequent return to the ceiling concentration.

For purposes of the fate assessment and EEC calculations, it is necessary to predict the bioavailable copper in the environment. Agronomists have traditionally used direct measurements of plant mineral uptake or soil extraction procedures to estimate bioavailable soil copper. The use of copper toxicity symptoms in plants is not a very reliable indicator of copper bioavailability because they are dependent on both the biological species and ambient environment conditions (Chapman, 1974). Conversely, soil Cu extraction procedures have been developed to provide an index of bioavailability. The soil extracts utilized two chemical techniques: acid solubilization and chelation (Baker and Amacher, 1982). These extractant have been developed to selectively remove pools of Cu^{2+} in exchangeable, mineral, or organic fractions; and then empirical bioavailability of copper in each fraction is implied by correlation analysis between extractable soil and plant Cu concentrations. In short, the bioavailability of soil/sediment bound Cu is a measurement dependent on both the chemical environment and biological species and subject to the inherent variability in both.

Because Cu has a high adsorption affinity to sediments/soil, it is natural to question the bioavailability of the sediment/soil bound Cu. As previously mentioned, copper is predominately associated with soil/sediment, and only a small quantity of the total Cu is dissolved or water soluble. The dissolved Cu is comprised of the hexaquo- cation (Cu^{2+}) as well as soluble complexes (*including* hydrolysis species, ion pairs, and organic complexes). These soluble Cu^{2+} species are bioavailable because they are chemically reactive and mobile. In contrast, sediment/soil-bound copper is composed of exchangeable, mineral, and organically-complexed fractions. These fractions are increasingly less bioavailable unless the bound copper is released from the soil solid phase by some dramatic change in the environmental condition. Likewise there is little or no evidence as yet that sediment bound copper is bioavailable to benthic organisms until it is released.

Several processes may enhance the release of bound copper including ion exchange, biological mineralization of the organically complexed fraction, or dissolution of copper minerals. The bound bioavailable fraction is that fraction in *constant and rapid* equilibrium with the dissolved copper (Barber, 1984). Measurement made of neutral-salt-extractable Cu is expected to be in rapid equilibrium with the dissolved Cu because it is for the most part, the ion exchangeable pool of copper. Miller and McFee (1983) found that approximately 2% of the total soil copper was in the "bioavailable" fractions, with < 0.8% (of total) as dissolved Cu^{2+} and 1.2% (of total) as neutral salt (KCl) extractable Cu. The remaining soil Cu (≈90%) was evenly distributed in the $Na_4P_2O_7$-extracted (organically-bound Cu), EDTA-extracted (carbonate and amorphous-Fe oxide-bound Cu), and residual bound Cu. Similar soil Cu distributions were reported for mineral soils amended with 48 mg Cu kg^{-1} soil as $CuSO_4$ (Miller, et al. 1987). These data indicate that a small percentage of the bound Cu is bioavailable.

ESTIMATION OF COPPER EXPOSURE

Methods

To estimate the exposure of aquatic organisms to Cu^{+2} applied to agricultural fields, two questions must be answered: "How much copper is transported from the field to the body of water?"; and "What happens to the copper once it has entered the body of water?". GLEAMS (Griggs *et al.* 1990), a model which simulates chemical fate and transport on an agricultural field, was used to estimate the amount of copper that was moved off the field into the bodies of water. The output from GLEAMS was fed into EXAMS (Burns, 1991), a model that simulates processes that occur in a stream or pond.

It is very important to recognize that both GLEAMS and EXAMS were designed to simulate non-naturally occurring organic chemicals and that the chemistry of copper is very different from this class of compounds. Hence, it is necessary to make several major approximations and adjustments to both models in order to make them usable with copper.

Copper is applied to a variety of crops including soybeans, peanuts, potatoes, sugar beets, citrus orchards, other fruit and nut trees, and directly to surface water for aquatic plant (algae) control. Copper can be applied as a number of different salts, including copper ammonium carbonate $Cu(NH_4)CO_3$, copper oxychloride ($CuCl_2{\bullet}3CuO{\bullet}4H_2O$), copper oxychloride sulfate (?), copper hydroxide ($Cu(OH)_2$), and copper sulfate ($CuSO_4{\bullet}xH_20$, x = 0, 1, or 5). It was requested that EEC's be calculated for both a pond and pond stream scenario using every combination of Cu salt, crop, and typical site condition. Generating data for all these combinations would require at least 70 separate simulations. Consequently, some approximations were required so that the number of environmental fate simulations could be reduced to a manageable level.

Fortunately, the number of simulations can be reduced without jeopardizing output quality. Because all the copper salts listed dissociate in water to their constituent ions (Cu^{2+} and a counter-ion) to a much greater extent than the native soil copper minerals and (as will be discussed below) only the K_{oc} is being used to partition copper between soil and water, it is feasible to do the simulation using one salt to represent all the copper salts, therefore copper hydroxide was chosen at random to represent the chemistry of the whole class of compounds. Secondly, an extreme range of soil types and crops was chosen so as to find conditions where transport of Cu^{2+} was at a maximum.

Two sites were chosen to show the range of conditions. The first site, located in Aiken County, South Carolina, had a Lakeland sand soil (Typic Quartzipsamment). The second site, located in Kossuth County, Iowa, had a Nicollet silty clay loam soil (Aquic Hapludoll). The Aiken County site was chosen because of the fairly high annual precipitation rate. Although the sandy soil at this site tends to have runoff only under high intensity rainfall events, large amounts of soil erosion can occur when there is runoff because of the small particle to particle adhesion in sandy soil (Baver *et al.* 1972). The Kossuth County site was chosen because the fine texture of the soil would be likely to cause runoff during storms of low and moderate intensity due to the slower infiltration rate of water into the soil. For purposes of the runoff simulations, a 1 hectare (ha) pond was placed in the center of a 10 ha field at each site. Because data were not available, ambient levels of copper in the soil were ignored. The site parameters used in GLEAMS are shown in Table 1.

Table 1. Location parameters for GLEAMS.

Location	Aiken County, SC	Kossuth County, IA.
Soil	Lakeland sand	Nicollet silty clay loam
Site Size (DAREA) (DAOVR)	10 hectares	10 hectares
Slope (CHS)	3%	1%
Timeframe	1970-1984	1970-1984
Surface Water Flow Type (FLGSEQ)	overland	overland
Field Length to Width Ratio (WLW)	10	10
Number of Point in Overland Profile Slope (NPTSO)	1	1
Distance from Upper End of Overland Profile Slope to Point Where Slope Is Given (XOV)	100 m	100 m
Modified USLE Soil Erodability Factor (KSOIL)	0.352	0.299
Modified USLE Crop Factor (CFACT)	0.2	0.2
Modified USLE Practice Factor (PFACT)	1.0	1.0
Manning's n for Overland Flow (NFACT)	0.023	0.018

To simulate an extreme in runoff conditions, four different runoff scenarios were used under varying environmental conditions:

1. Peanuts growing on a Lakeland sand in Aiken County, South Carolina with runoff flowing to a pond with outlet.
2. Soybeans growing on a Nicollet silty clay loam in Kossuth County, Iowa with runoff flowing to a pond with outlet.
3. Same as scenario 1 except with a fallow field instead of peanuts.
4. Same as scenario 1 except with pond-stream combination.

Scenarios 1, 3 and 4 were chosen to determine the amount of copper runoff using a range of crop and soil parameters. Scenario 3 was constructed to determine copper loss from the pond by advection under a constant stream flow. Each scenario was run for a period of 15 years, 1970-1984, with application of 13.75 kg-Cu ha^{-1} each year 60 days after planting of the crop. Additionally, scenario 1 was run for a period of 6 years 1970-1975 in order to generate storm by storm runoff data. The runoff scenarios 1 and 4 are model simulations using PRE-AP ver 1.2 (Griggs *et al.* 1991), a program that aids in assembling input files for GLEAMS. The crop growth curves for these GLEAMS runs are shown in Table 2. The soil parameters for GLEAMS are shown in Table 3. Environmental conditions (including temperature, precipitation, and solar irradiation data) for both sites are listed in Appendices A, B, and C.

Table 2. Crop growth curves for GLEAMS simulations.

Peanuts		Soybeans	
Julian Day	Leaf Area Index	Julian Day	Leaf Area Index
115	0.00	132	0.00
130	0.20	147	0.15
146	0.55	162	0.40
159	2.00	177	1.90
174	2.95	192	2.60
189	3.00	207	3.00
204	3.00	222	2.96
219	3.00	237	2.92
233	3.00	252	2.30
248	2.85	267	1.15
263	2.60	282	0.50
366	0.00	366	0.00

Table 3. Soil parameters for GLEAMS simulations.					
Series	Lakeland sand		Nicollet silty clay loam		
Classification	thermic, coated Typic Quartzipsamment		fine-loamy, mixed, mesic Aquic Hapludoll		
Percent Sand SOLSND)	92%		41%		
Percent Silt (SOLSLT)	2%		29%		
Percent Clay (SOLCLY)	5%		31%		
Clay Particle Surface Area (SSCLAY)	20 m^2 g^{-1}		100 m^2 g^{-1}		
Organic Matter Surface Area (SSORG)	1000 m^2 g^{-1}		1000 m^2 g^{-1}		
Effective Saturated Conductivity (RC)	1.03 cm hr^{-1}		0.57 cm hr^{-1}		
SCS curve number (CN2)	65		75		
Soil Evaporation Parameter (CONA)	3.3		4.0		
Initial Plant Available Water (BST)	0.8		0.8		
Rooting Depth (RD)	152 cm		152 cm		
Number of Layers in Root Zone (NOSOHZ)	2		3		
	Layer		Layer		
	1	2	1	2	3
Depth to Bottom of Layers (BOTHOR)	109.2 cm	152 cm	43.18 cm	91.44 cm	152 cm
Porosity of Layers (POR)[1]	0.315	0.216	0.533	0.433	0.384
Field Capacity of Layers (FC)[2]	0.181	0.140	0.321	0.295	0.288
Wilting Point of Layers (BR15)[2]	0.043	0.027	0.183	0.181	0.180
Organic Matter Content of Layers (OM)	1.00%	0.125%	6.00%	0.750%	0.094%

[1] Units are cm^3-pores cm^{-3}-soil. [2] Units are cm^3-H_2O cm^{-3}-soil.

The pesticide input parameters for GLEAMS are listed in Table 4. The values used for some of the pesticide parameters require some explanation. GLEAMS uses the water solubility of the pesticide for two purposes. First, if the solubility is less than 1 mg L^{-1} (1000 $\mu g\ L^{-1}$), the vertical transport model (*i.e.*, leaching) component of GLEAMS is automatically shut off. Secondly, the pesticide concentration in solution is limited by the pesticide's water solubility (Knisel, 1980). As previously discussed (See Qualitative Aspects Section), Cu^{2+} in most natural water is < 10 $\mu g\ L^{-1}$. Copper concentrations in this range would cause the vertical transport to shut down, and thus none of the copper would be moved into the profile. This results in errors in runoff-infiltration partition of precipitation. It also will cause all the Cu to remain on the soil surface. The net result would cause erroneously high values for the amount of copper carried in the runoff. To avoid this pathological behaviour of the model, the solubility was set to a value high above 1000 $\mu g\ L^{-1}$. At solubility values this large and larger, the simulation is basically unaffected by the solubility parameter and the solution concentration is controlled solely by the partition coefficient (K_{oc}). The pesticide's water solubility was calculated assuming that the crystalline copper phase was $Cu(OH)_2$ in a solution at pH 5 and ionic strength of 0.03 mol L^{-1}. It is also assumed that $Cu(OH)_2$ dissolution was in equilibrium with the soil water. Soil and foliar half-lives were set at an arbitrarily large value since copper, being an element, does not degrade. The $Cu(OH)_2$ application rate was 13.75 kg ha^{-1} and was applied annually, and is the highest single annual application rate for the Cu salts.

Pertinent chemical parameters used in EXAMS are listed in Table 5. As with GLEAMS, the behavior of the solubility parameter in EXAMS is inappropriate for simulating copper behavior in the environment. For example, EXAMS discards computed pesticide solution concentrations greater than one-half the pesticide's solubility and, hence, artificially reduces the solution pesticide concentrations. Therefore, as with GLEAMS, the solubility parameter was set at a value large enough to avoid this behavior. Loading rates of Cu^{2+} for EXAMS simulations were taken from the GLEAMS simulation outputs.

Table 4. Pesticide input parameters into GLEAMS for copper.

Water Solubility (H2OSOL)	5896 mg L^{-1} *
Soil Half-life (SOLLIF)	100000 days
Foliar Half-life (HAFLIF)	100000 days
Foliar Residue (FOLRES)	0
Foliar Washoff Fraction (WSHFRC)	0.50
Coefficient of Transformation (COFTRAN)	0
Coefficient of Plant Uptake (COFUP)	0.1
K_{oc} (KOC)	10000, 90000
Number of Yearly Applications	1
Application Rate (APRATE)	13.75 kg ha^{-1}
Application Date (PDATE)	julian day 155 (June 4)
Application Method (METH)	Broadcast, Unincorporated

* Solubility of $Cu(OH)_2$ in solution with pH = 5, pSO_4 = 4, $P(CO_2)$ = 6.0×10^{-4} atm, and ionic strength = 0.03 mol L^{-1}.

Table 5. Chemical input parameters for EXAMS.	
Molecular weight of copper (MWT)	63.546 g mol^{-1}
K_d (KPS)	400, 3600
Solubility* (SOL)	5896 mg L^{-1}

* Solubility of $Cu(OH)_2$ in solution with pH = 5, pSO_4 = 4, $P(CO_2)$ = 6.0×10^{-4} atm, and ionic strength = 0.03 mol L^{-1}.

EXAMS parameters describing the geometry of the sediment entrapment pond and the pond-stream are listed in Table 6. The stream in the pond-stream scenario (Scenario 3) was divided into two consecutive segments. The dispersive transport parameters are shown in Table 7. Advective transport in the pond was from the benthic layer to the limnic layer. The advective transport for the Scenario 3 was from the pond through segment 1 to segment 2. Sediment parameter values are summarized in Table 8.

Table 6. Pond Geometry for EXAMS

	Pond		Stream 1		Stream 2	
	Littoral	Benthic	Littoral	Benthic	Littoral	Benthic
Area (AREA)	10000 m^2	10000 m^2	300 m^2	300 m^2	1200 m^2	1200 m^2
Depth (DEPTH)	2 m	0.02, 0.05 m	0.5 m	0.05 m	0.5 m	0.05 m
Volume (VOL)	20000 m^3	200, 500 m^3	150 m^3	15 m^3	600 m^3	60 m^3
Length (LENG)	100 m	100 m	100 m	100 m	400 m	400 m
Width (WIDTH)	100 m	100 m	3.0 m	3.0 m	3.0 m	3.0 m

Table 7. Dispersive transport parameters for EXAMS between benthic and littoral layers in each segment.

	Pond*	Stream 1**	Stream 2***
Turbulent Cross-section (XSTUR)	10000 m^2	300 m^2	1200 m^2
Characteristic Length (CHARL)	1.01, 1.025 m	0.275 m	0.275 m
Dispersion Coefficient for Eddy Diffusivity (DSP)	3.0×10^{-5}	3.0×10^{-5}	3.0×10^{-5}

* JTURB = 1, ITURB = 2; ** JTURB = 3, ITURB = 4; *** JTURB = 5, ITURB = 6

Table 8. Sediment properties for EXAMS.

	Littoral	Benthic
Suspended Sediment (SUSED)	30 mg L^{-1}	
Bulk Density (BULKD)		1.85 g cm^{-3}
Per cent Water in Benthic Sediments (PCTWA)		137%
Fraction of Organic Matter (FROC)	0.04	0.04

Table 9. Miscellaneous environmental parameters for EXAMS.	
Precipitation (RAIN)	90 mm month^{-1}
Atmospheric Turbulence (ATURB)	2.00 km
Evaporation Rate (EVAP)	90 mm month^{-1}
Air Mass Type (AMASS)	Rural (R)

Results

As mentioned above, the strategy for estimating EEC's for Cu^{2+} was to first run GLEAMS for each scenario and determine the Cu loading rates for the EXAMS simulations. Then EXAMS simulations were run to generate Cu concentrations in the pond and stream.

Scenario 1 simulations. Copper runoff predicted by GLEAMS for Scenario 1 is shown in Figure 1. For a K_{oc} of 10000[6], the mean concentration of copper in the transported sediment was 546 mg kg-soil$^{-1.}$ This compares with an average ambient concentration of copper in soils of 30 mg kg-soil^{-1}, indicating that the use of copper pesticides increases the copper in sediment by somewhat more than an order of magnitude. At these levels, the introduced copper would be expected to behave in an identical manner to the copper already present in the system. The salient parameters in determining copper transport are those affecting it's retention in the surface soil. Cu^{2+}, being a cation, can be retained in the soil by two mechanisms: retention on cation exchange complex, and precipitation of copper salts. While neither of these processes is linear, a partition coefficient type model can give accurate results for pesticide transport when the value of the partition coefficient is large (*i.e.*, the vast majority of the chemical is retained on the soil) as is the case with copper. Values for K_{oc} at both ends of the range reported in the literature (K_{oc} = 10000, 90000) were simulated with GLEAMS. The amount of copper dissolved in the runoff was similar for both values, but considerably more copper was moved with eroded soil when K_{oc} was equal to 90000. More importantly, the amount of copper transported increased in time. This is because the Cu tends to accumulate in the top layer of soil over time and, hence, increases that which is available to transport with eroded soil. Consequently, more copper is moved with sediment in the last years of the simulation than at the start. The true value of K_{oc} for the Lakeland sand is probably closer to the 10000 value because sands generally have a low cation exchange capacity.

While the linear partition coefficient model appears to predict reasonable values for copper runoff, this is not the case for predicting dissolved Cu^{2+} in the pond and stream. The linear partition coefficient method predicts that as copper accumulates in the benthic sediments, there would be proportional increase in the dissolved Cu^{2+} in the water column. In reality, Cu^{2+} would increase in the water column over the 15 year period of simulation only until

[6] For comparison purposes, the K_{oc} of atrazine is 52 (average of EFGWB one-liner values), of chlorpyrifos is 6070 (SCS-ARS database), and paraquat is 100000 (SCS-ARS database).

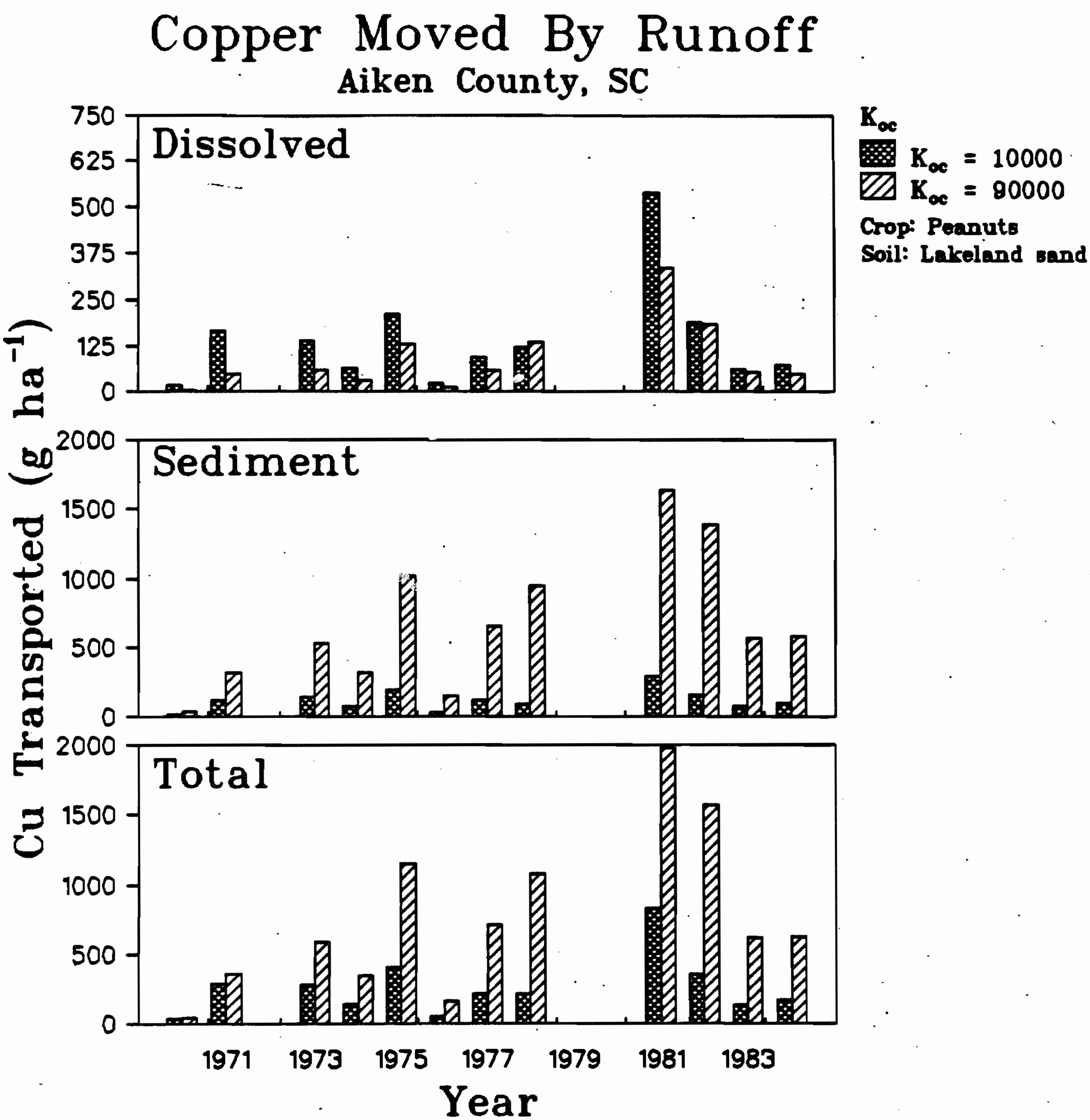

Figure 1. Simulated copper moved with runoff from an peanut field with a Lakeland sand soil in Aiken County, South Carolina (Scenario 1) as simulated by GLEAMS.

the solubility product constant for a copper mineral is exceeded; at this point Cu^{2+} would begin precipitating out from solution. (Copper concentration may exceed the mineral solubility for brief periods following runoff events but would be expected to return to the equilibrium value as precipitation and other removal processes occurred. As mentioned in the Qualitative Aspects section, the kinetics of copper precipitation have not been measured, but appear to be relatively rapid.) Unfortunately, EXAMS has only a linear model available for partitioning of copper between the solution and sediment and cannot simulate mineral precipitation if it occurs. A strategy used to work around this limitation is to run EXAMS normally using the GLEAMS output for loading values to the pond and then compare EXAMS output values with the Cu concentrations predicted by copper mineral equilibria. While the thermochemistry of Cu in soil is not completely understood, it is possible to bound the observed environmental concentrations of copper with some known Cu phases (Figure 2); observed environmental concentrations of copper are normally undersaturated to known copper minerals and are seldom below that of soil-Cu, an empirical pH dependent isotherm (Lindsay, 1979). Because copper added as a pesticide would be expected to behave in an identical manner to copper already present in the environment, the solubility of the least soluble Cu(II) mineral, cupric ferrite, can be used as an index to the maximum concentration of Cu^{2+} in the pond when the water column and the sediments are in equilibrium.

Since the PRE-AP version of GLEAMS is only capable of generating yearly summary data, and because the only process occurring in the pond was partitioning of copper between the sediments and water column, it was decided to add all the copper transported to the pond in a year as a single loading and then allow the pond to come to equilibrium. Storm by storm simulations were generated for 1970-1975 using the standard version GLEAMS is discussed in a following section.

Dissolved Cu concentrations in the pond for Scenario 1 are shown in Figure 3. Based only on a linear partition model, considerably more Cu^{2+} is in the water column for K_{oc} equal to 10000 than for K_{oc} = 90000 in each of the 15 years. However, if as discussed above equilibrium with cupric ferrite is used to index the maximum Cu in solution, for a pH of 6, the dissolved Cu would be expected to peak at 6.7 $\mu g\ L^{-1}$ after 1 year when the K_{oc} is 10000 and 6 years when the K_{oc} was 90000. In unbuffered water in equilibrium with atmospheric CO_2 (pH $\approx$ 5.5), the dissolved copper would be expected to reach a maximum concentration of 66 $\mu g\ L^{-1}$ after 6 years and 27 years when the K_{oc} is at 10000 and 90000, respectively. In waters with pH's greater than 6, this method would predict that the dissolved Cu^{2+} would not increase over the ambient concentration.

In general, changing the K_{oc} from 10000 to 90000 reduced the Cu^{2+} water column concentrations after 15 years by a third (Table 10). If the depth of benthic sediment actively in contact with the water column is actually only 2 cm rather than 5 cm, the Cu^{2+} in the water column goes up by a factor of 2.5. Again, these values may be greater than those that would likely occur in the pond because EXAMS cannot simulate all Cu processes which occur (*i.e.*, precipitation).

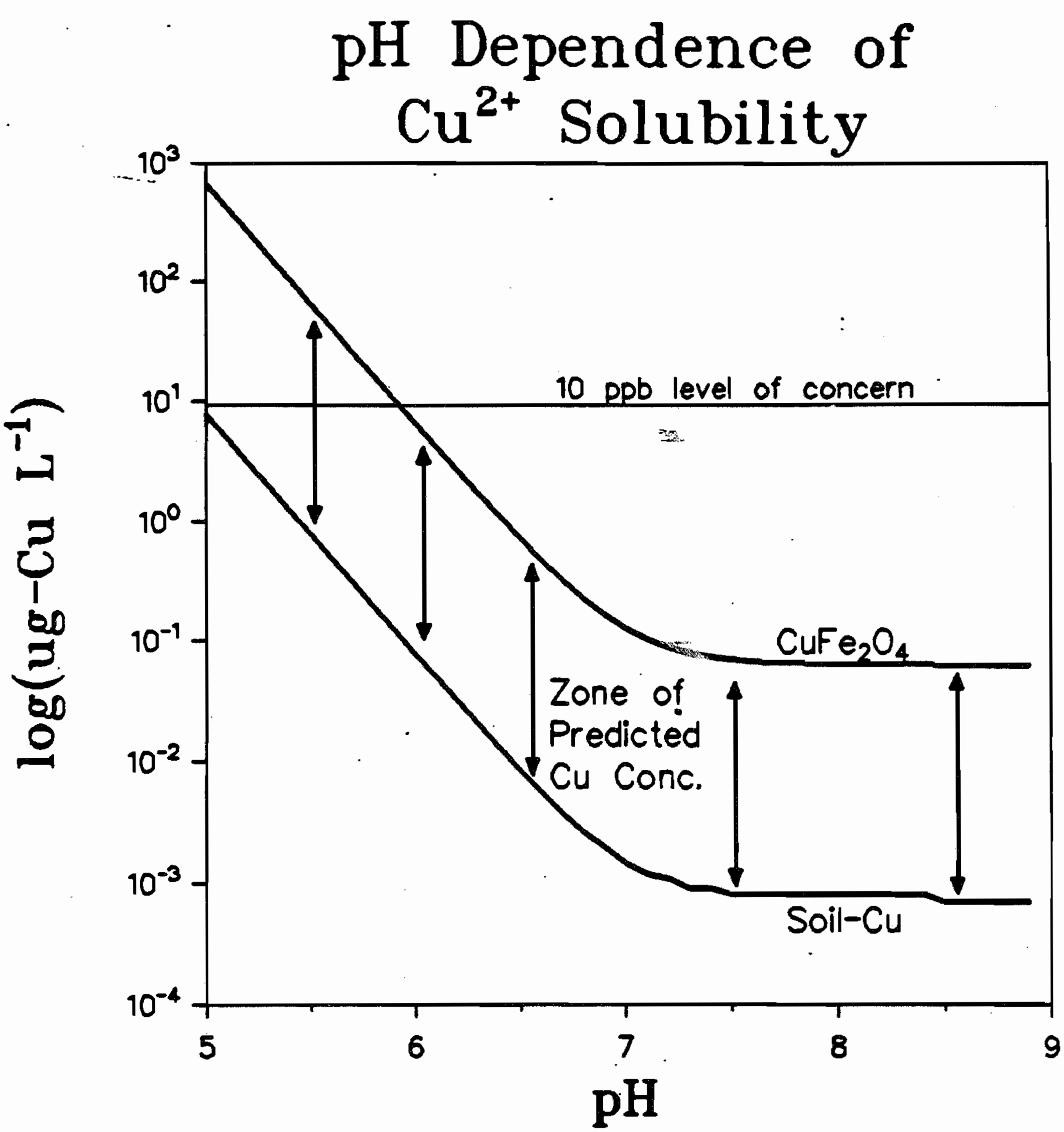

Figure 2. pH dependence of Cu^{2+} solubility as predicted by thermodynamics. The soil-Cu isotherm is used as an index to the minimum Cu^{2+} concentration in the soil and the solubility of cupric ferrite can be used as an index to the maximum Cu^{2+} concentration, so it can reasonably be expected that the Cu^{2+} concentration to be between these two lines. The lines were calculated assuming an ionic strength of 1.0×10^{-1} mol L^{-1}, a SO_4^{2-} activity of 1.0×10^{-4} mol L^{-1}, and an ambient CO_2 partial pressure of 5.62×10^{-4} atmospheres. Since data was not available Cu - organic complexes were ignored for the purposes of this calculation. These complexes would be expected to increase the total Cu in solution, particularly at neutral and alkaline pH's.

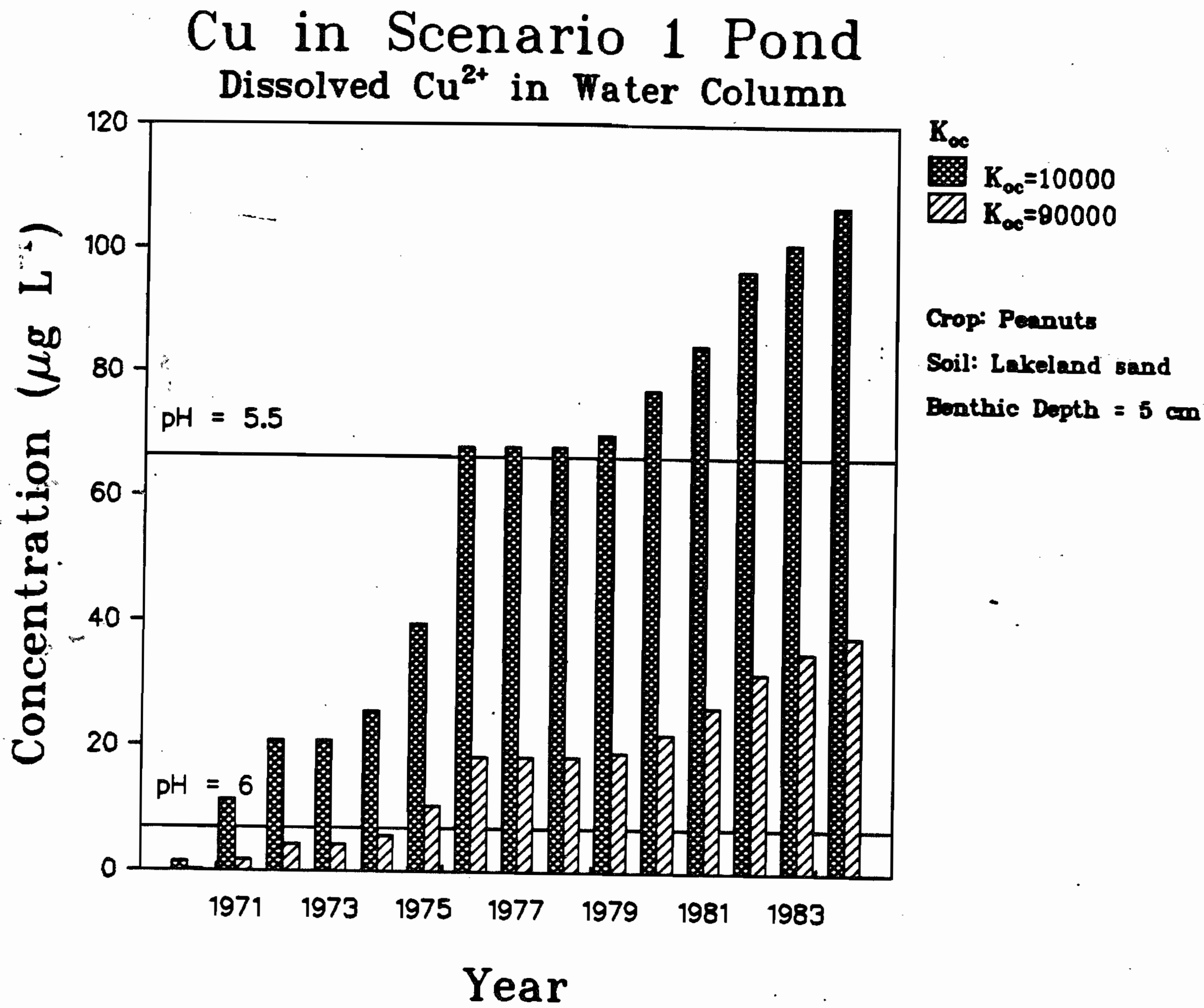

Figure 3. Simulated dissolved Cu^{2+} in the water column of a pond without an outlet (Scenario 1) as simulated by EXAMS. The pond received runoff and sediment from a peanut field with a Lakeland sand soil in Aiken County, South Carolina as simulated by GLEAMS. The depth of benthic sediments in active contact with the water column was assumed to be 5 cm. The lines for maximum dissolved Cu^{2+} concentrations at pH's of 5.5 and 6 were calculated using the same assumptions as for those used in Figure 2.

Table 10. Baseline concentrations in water column assuming a linear partition model 1 ha pond in 10 ha watershed

Crop	K_{oc}			
	10000		90000	
	Benthic Depth = 2 cm	Benthic Depth = 5 cm	Benthic Depth = 2 cm	Benthic Depth = 5 cm
Peanuts	268.0	107.2	94.05	37.62
Fallow	1465.8	586.3	708.2	283.3

Scenario 2 simulation. GLEAMS simulations for the Kossuth County, Iowa site showed that only a small amount of copper ran off the field over the 15 year period of simulation: 0.777 kg-Cu ha^{-1} when the K_{oc} was 90000, a typical value for a clay soil. Because this amount was so small compared to that for the South Carolina site, it was decided not to do EXAMS simulations for the Iowa site and to concentrate further efforts on the Lakeland sand.

Scenario 3 simulation. In order to determine the maximum amount of copper that could be eroded from the site in South Carolina, GLEAMS was run using a fallow field amended with copper (Figure 4). For sediments with a K_{oc} = 10000, 8.25% of total applied copper was removed from the field by runoff from the fallow field as compared to 1.51% of the copper applied when peanuts were present, an increase by a factor of 5.5. It should be remembered that this is not a realistic situation because a farmer will not apply a fungicide to a fallow field for 15 consecutive years. As one would expect, the fallow values for Cu^{2+} in the pond (Table 10) are considerably higher than those when peanuts were simulated.

Scenario 4 simulation. A comparison of the pond (Scenario 1) and pond-stream (Scenario 3) is shown in Figure 5. When the stream was present, the Cu^{2+} concentration stabilized between 10 and 20 $\mu g\ L^{-1}$ due to advective transport of copper out of the scenario from the water column. In fact, only 19.6% of the copper which was loaded into the simulation was still in the pond and stream at the end of 15 years. This would indicate that advective transport of copper could be an important mechanism in removing copper from the pond. However, it is likely that EXAMS overestimates the removal by this mechanism because it overestimates the concentration of Cu^{2+} in the water column.

Storm by storm simulations. As mentioned above, a six year period from 1970-1975 was simulated to generate storm by storm runoff values from GLEAMS for Scenario 1. The K_{oc} value of 10000 was used because this value was more appropriate for the Lakeland sand soil in the scenario. During this time period, 592 rain events occurred and only 14, or slightly less than 3%, produced runoff. These values have been arranged into a cumulative probability distribution (Figure 6). Two different method were used to estimate the copper concentration in pond after each storm. The first method ignores any background that was present when the storm occurred and hence, is just the increase in copper due to the storm. The second method includes this background Cu^{2+} concentration that EXAMS calculated was present when the storm occurred. The maximum increase due to a single storm was 87.4 $\mu g\ L^{-1}$.

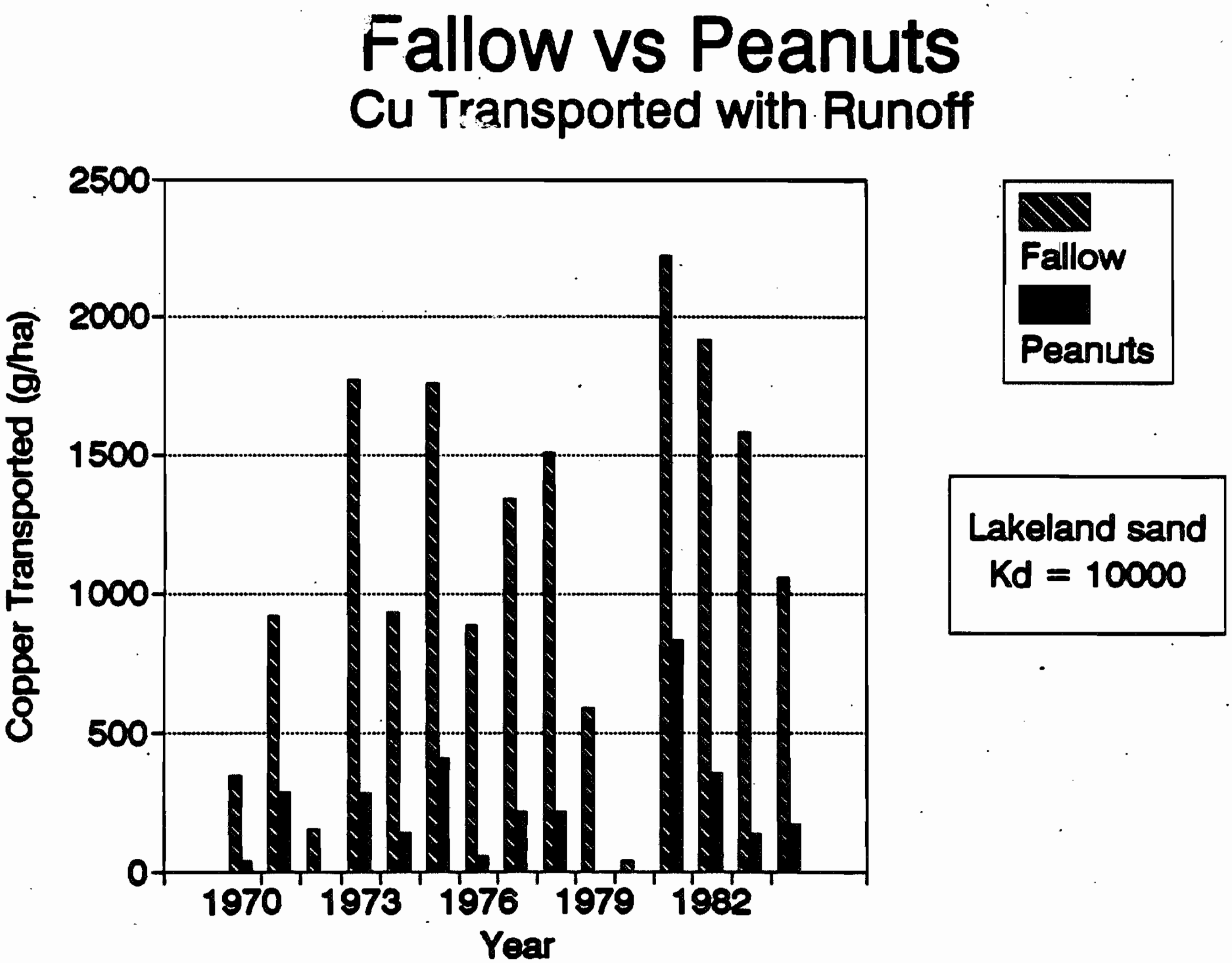

Figure 4. Comparison of simulated copper runoff from a fallow field (Scenario 2) and a peanut field (Scenario 1) in Aiken County, South Carolina with a Lakeland soil as simulated by GLEAMS.

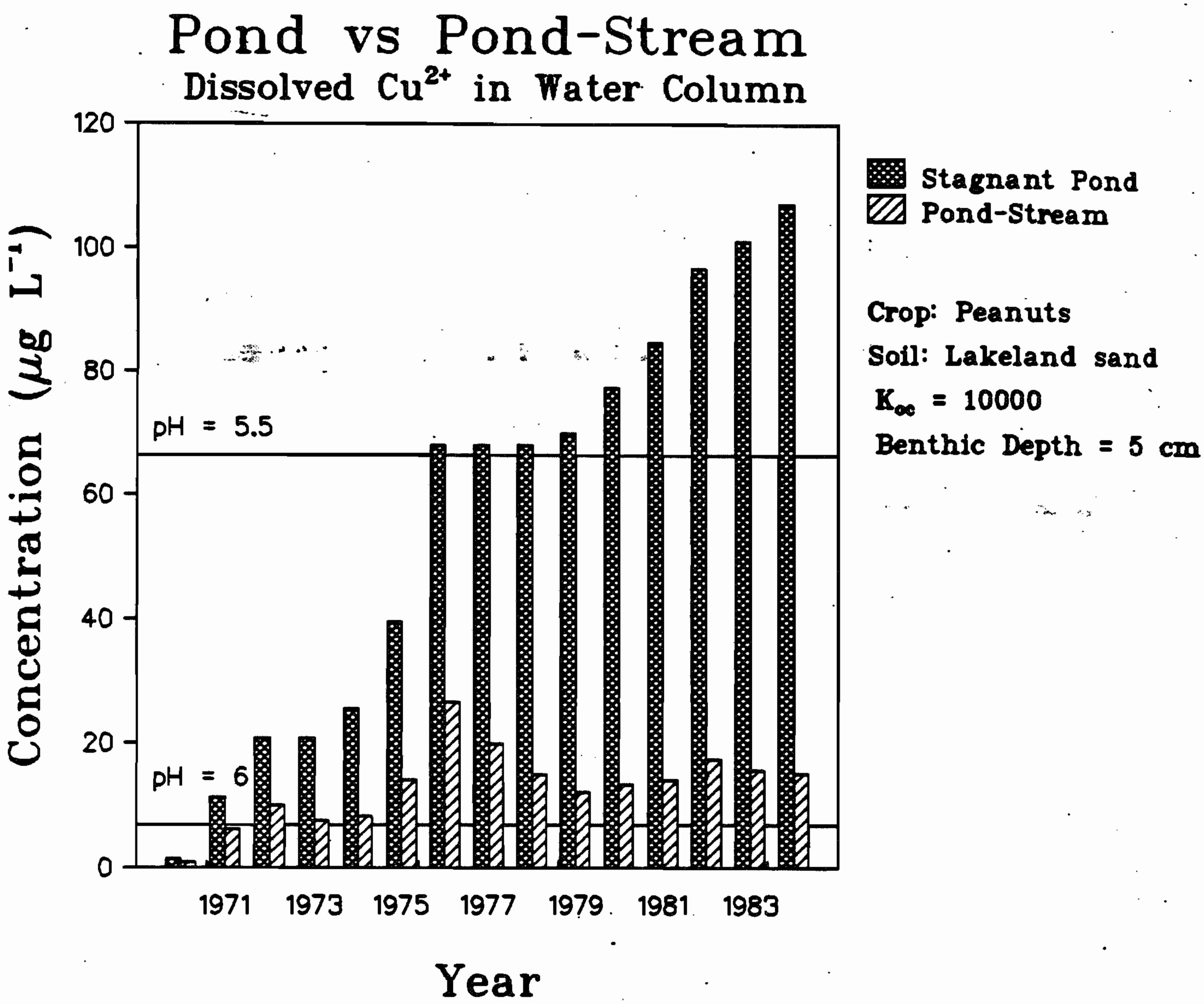

Figure 5. Comparison of simulated dissolved Cu^{2+} concentrations for pond without an outlet (Scenario 1) and pond-stream combination (Scenario 4) as simulated by EXAMS. The pond received runoff and sediment from a peanut field with a Lakeland sand soil in Aiken County, South Carolina as simulated by GLEAMS. The depth of benthic sediments in active contact with the water column was assumed to be 5 cm. The lines for maximum dissolved Cu^{2+} concentrations at pH's of 5.5 and 6 were calculated using the same assumptions as for those used in Figure 2.

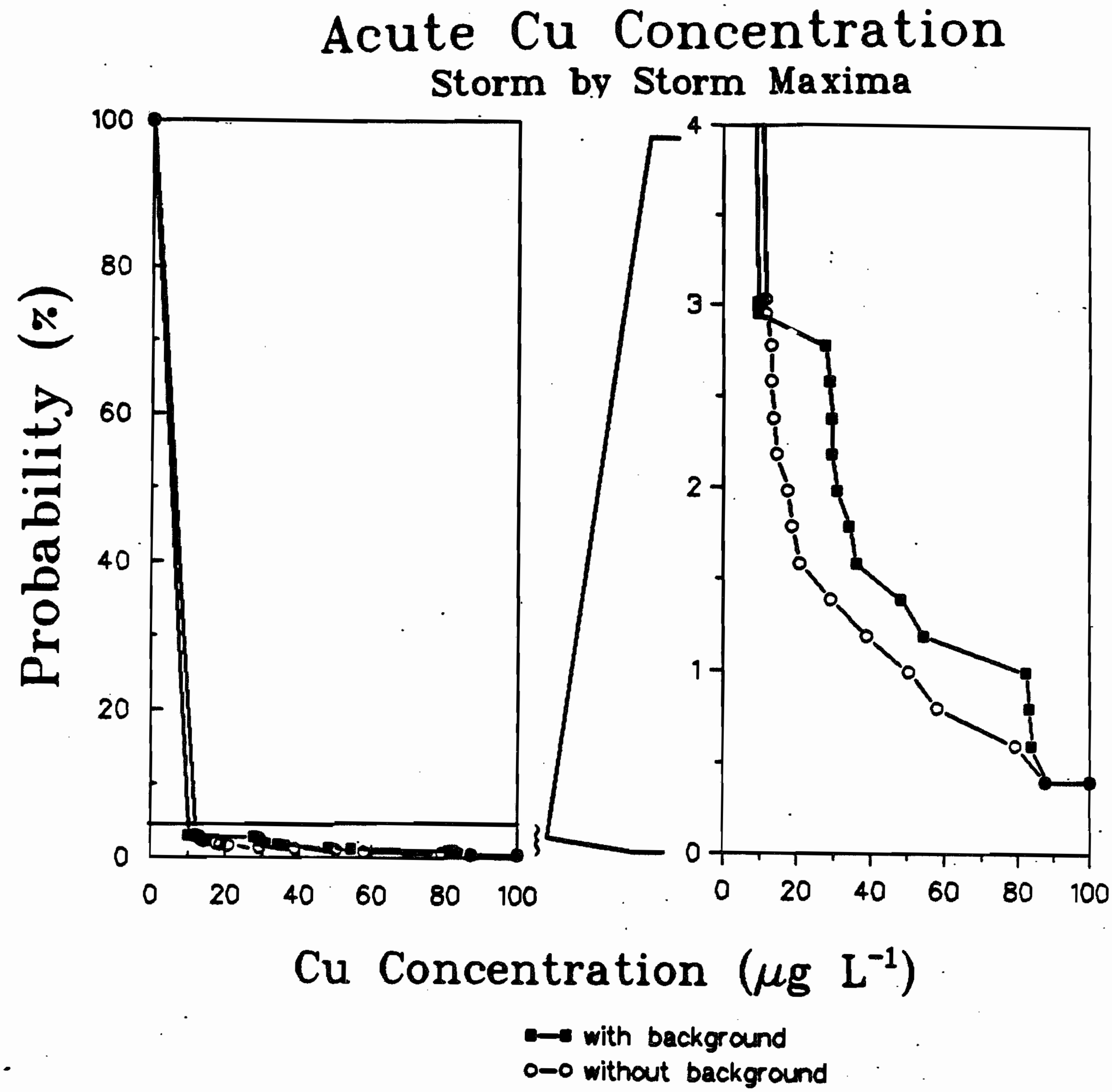

Figure 6. Cumulative probability distribution for maximum simulated Cu^{2+} concentrations in a pond without an outlet receiving sediment from a peanut field on a Lakeland sand soil in Aiken County, South Carolina (Scenario 1) as simulated by EXAMS for the period 1970 to 1975. *The probability values represent the probability that a storm would produce a maximum concentration of copper in the pond of the corresponding value on the X-axis or greater.* The figure on the right represents a y-axis scale expansion of the figure on the left in order to show curve in more detail for cases where copper runoff to the pond does occur.

After each storm, the copper dissolved in the water column returned to equilibrium with the sediments. EXAMS models this process as a first order decay. For a K_{oc} of 10000, copper concentration decreased from the maximum to ambient with a rate constant of 8.122×10^{-3} hr^{-1}, or a half-life of 85.3 hours. At this rate, copper can remain above the background level for several days, if a large amount of copper was loaded to the pond. However, it is likely that the rate of clearance of copper from the water column would faster than in this simulation when pH of water was greater than 6 because of precipitation directly from the water column, a process which is not modeled by EXAMS. A table of maximum values, 96-hr and 48 hr acute copper concentrations based on this half-life have been included as an an addendum to this report.

SUMMARY

In summary, EFGWB concludes that the environmental fate and transport of Cu is as follows:

▪ Copper salt pesticides dissociate in water to Cu^{2+} and a companion anion. Because introduced Cu^{2+} is indistinguishable from native Cu^{2+}, it is reasonable to assume that both will behave similarly in the environment.

▪ Because Cu^{2+} has an extremely high binding affinity for soil, it moves on entrained sediments during erosional events. Both native and introduced Cu are expected to move in a similar manner.

▪ The dissolved Cu concentration in aquatic environments can exceed 10 $\mu g\ L^{-1}$ under acidic environmental conditions (pH < 6). This prediction is based on mineral equilibria with cupric ferrite ($CuFe_2O_4$), the least soluble Cu mineral, controlling the dissolved Cu^{2+} concentration.

▪ Based on a simulation of storm events in Aiken County, South Carolina over a 6 year period, 3% of the rainfall events caused movement of introduced Cu^{2+} from the site of application. The maximum dissolved Cu concentration due to a single rainfall event in the pond water column was 84 $\mu g\ L^{-1}$. The actual fate of the dissolved Cu is dependent on environmental conditions: under strongly acidic conditions (pH < 6), the dissolved Cu^{2+} concentration should be greater than 10 $\mu g\ L^{-1}$; and under near-neutral to alkaline conditions (pH > 6), the dissolved Cu^{2+} concentration should be less than 10 $\mu g\ L^{-1}$. This EEC prediction, based on mineral equilibria and sediment adsorption models, should pertain to all situations regardless of the environmental conditions.

▪ It is important to note that the dissolved Cu^{2+} concentration in aquatic environments can exceed 10 $\mu g\ L^{-1}$ under acidic conditions (pH<6). This situation can occur in natural water whether the sediments contain native and/or introduced Cu. Therefore, it is possible to exceed the acute and chronic Cu LD_{50}'s for aquatic organisms in limited aquatic environments (*e.g.* shallow, well-mixed ponds in acidic environments)

■ The results of this report are supported by previously reviewed aquatic field dissipation studies (MRIDs 00099539, 00062074, 411890-01).

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Appendix A.
Temperature input values for GLEAMS.

Table A1. Maximum (TEMPX) monthly temperature for Aiken County, South Carolina, 1970-1984.

Year	Maximum Monthly Temperature (°C)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	14.98	19.20	17.50	23.73	29.80	31.01	32.86	31.62	29.15	24.87	19.64	14.84
1971	16.62	16.41	18.63	24.66	28.58	31.86	32.40	30.88	29.83	26.51	19.55	11.15
1972	16.90	16.25	18.28	24.20	31.66	33.60	31.93	33.90	27.97	24.13	19.24	14.55
1973	13.81	16.10	23.78	27.60	29.56	31.44	33.45	33.01	31.36	24.00	18.32	13.94
1974	15.84	16.54	21.85	25.41	30.87	31.14	32.79	30.73	29.91	26.41	19.37	15.90
1975	15.78	16.67	19.79	23.94	28.00	33.31	32.39	33.85	29.83	25.58	18.37	14.03
1976	15.33	15.41	19.67	27.35	29.83	34.77	33.69	33.23	30.87	23.74	19.47	16.28
1977	13.70	14.90	19.48	24.22	28.31	32.51	34.51	32.02	31.33	23.13	19.48	15.65
1978	18.19	16.64	21.09	25.94	29.03	29.19	33.40	31.80	30.25	23.01	18.40	15.69
1979	15.84	11.68	18.96	25.09	30.63	32.02	34.33	33.21	30.49	25.73	19.80	12.29
1980	12.81	14.40	21.54	25.83	26.86	31.85	32.67	31.95	29.80	24.47	18.22	17.16
1981	15.32	15.99	21.90	24.47	30.28	31.77	32.83	34.43	31.22	25.41	20.54	16.19
1982	15.44	19.87	19.80	25.19	27.68	31.93	30.78	32.10	30.21	24.19	20.29	12.17
1983	14.53	16.03	21.29	24.88	30.41	33.34	32.86	33.27	29.36	23.10	18.08	16.52
1984	13.93	18.42	22.72	25.91	28.66	30.33	31.75	32.40	30.48	22.65	18.51	14.71

Table A2. Minimum monthly temperature (TEMPN) for Aiken, South Carolina, 1970-1984.

Year	Minimum Monthly Temperature (°C)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970	4.11	5.94	6.85	9.69	15.54	17.71	20.97	21.72	19.15	11.65	9.40	4.52
1971	6.32	3.44	5.82	10.01	14.19	20.61	20.97	20.39	18.34	15.21	7.44	-0.15
1972	3.90	3.98	5.21	11.33	17.56	19.73	20.54	23.15	17.76	10.62	5.23	3.54
1973	1.30	3.96	11.16	11.23	17.85	19.36	21.17	21.00	19.56	12.35	5.77	2.39
1974	2.63	5.17	8.39	11.31	17.17	18.89	20.90	19.98	20.26	12.58	7.55	5.21
1975	4.02	2.25	6.44	10.06	15.41	20.57	21.37	20.70	17.66	12.90	8.47	2.66
1976	5.52	4.31	6.43	11.89	14.77	20.76	20.98	21.28	18.99	12.43	6.85	5.71
1977	2.67	2.17	5.09	10.14	14.98	20.80	21.59	21.39	18.94	11.99	9.54	6.86
1978	4.78	4.49	8.75	12.24	15.19	17.31	21.08	20.80	17.75	11.36	5.65	4.21
1979	2.28	-0.38	6.31	11.17	17.05	18.25	21.51	20.40	18.96	12.63	9.28	1.49
1980	2.26	1.82	6.97	11.50	14.64	18.33	20.97	19.87	18.86	13.25	6.69	6.44
1981	3.32	4.19	7.91	9.99	16.12	18.25	20.98	24.57	19.99	14.89	10.75	4.29
1982	4.52	8.28	6.67	11.89	16.95	19.55	19.42	21.37	19.86	12.60	6.79	0.29
1983	3.02	3.10	7.38	11.95	16.15	21.50	20.73	22.22	18.15	11.91	5.16	5.99
1984	3.50	6.44	9.63	11.96	16.28	19.32	20.13	21.13	18.79	11.63	3.48	2.63

Table A3. Monthly maximum temperature (TEMPX) for Kossuth County, Iowa, 1970-1984.

Year	Maximum Monthly Temperature											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	°C											
1970	0.57	6.78	5.13	15.48	23.69	27.07	30.82	29.83	25.63	19.84	11.03	3.02
1971	2.94	3.11	6.21	15.54	22.03	27.54	31.43	28.01	26.62	21.55	10.18	-0.92
1972	3.03	2.87	5.38	15.89	27.29	30.18	31.12	33.19	24.30	19.37	9.66	2.87
1973	-0.24	2.48	13.50	20.59	24.65	27.32	32.51	30.83	26.75	19.27	7.47	1.92
1974	2.37	3.97	11.13	17.26	26.18	26.97	31.72	28.26	26.15	21.67	9.66	3.89
1975	2.54	3.27	7.57	14.98	22.45	29.87	30.94	32.29	25.61	20.91	9.07	2.22
1976	1.25	2.14	7.50	20.07	24.26	30.80	32.08	31.01	27.08	18.58	9.69	4.65
1977	-0.85	1.16	6.57	15.99	21.69	28.95	33.55	29.81	27.48	18.27	10.41	3.89
1978	4.69	4.06	10.19	18.56	23.45	25.05	32.44	29.99	26.60	18.19	8.75	4.06
1979	1.65	-3.18	6.85	18.17	25.94	27.27	33.36	31.42	27.19	20.78	10.62	0.11
1980	-1.28	0.70	9.89	18.59	19.98	28.01	31.07	29.48	26.41	19.71	8.46	5.62
1981	1.23	2.52	11.09	15.60	24.95	27.93	31.28	33.50	27.87	20.68	11.81	4.60
1982	1.39	7.73	7.58	18.40	22.52	27.62	29.27	29.55	26.69	19.13	10.91	0.26
1983	0.23	3.08	9.98	17.55	24.69	29.43	31.80	32.29	25.40	17.95	7.88	4.99
1984	-0.09	6.14	12.32	18.04	23.50	26.52	29.93	29.87	27.07	18.07	7.88	2.72

Table A4. Monthly minimum temperature (TEMPN) for Kossuth County, Iowa, 1970-1984.

Year	Minimum Monthly Temperature											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	°C											
1970	-12.90	-8.78	-5.29	0.68	8.40	12.24	16.84	16.32	11.42	3.00	-0.50	-8.97
1971	-9.92	-12.30	-6.83	1.03	6.64	15.02	16.84	15.02	10.37	8.32	-2.97	-14.30
1972	-13.20	-11.80	-7.75	2.50	11.05	14.18	15.99	17.71	9.61	1.47	-5.78	-10.20
1973	-16.60	-11.60	1.09	2.40	11.44	13.82	16.94	15.61	11.95	4.04	-5.09	-11.40
1974	-14.90	-9.77	-2.98	2.48	10.54	13.37	16.53	14.63	12.86	4.39	-2.77	-8.32
1975	-12.90	-14.00	-5.90	1.10	8.23	14.99	17.25	15.33	9.48	4.88	-1.69	-11.00
1976	-11.10	-11.10	-5.91	3.13	7.40	15.16	16.65	15.90	11.21	4.17	-3.73	-7.72
1977	-14.80	-14.10	-7.92	1.18	7.65	15.21	17.60	16.00	11.15	3.52	-0.32	-6.42
1978	-12.00	-10.80	-2.43	3.52	7.95	11.86	16.80	15.43	9.60	2.57	-5.25	-9.40
1979	-15.30	-17.80	-6.09	2.32	10.39	12.76	17.47	15.03	11.18	4.46	-0.64	-12.40
1980	-15.30	-14.60	-5.11	2.70	7.23	12.83	16.64	14.52	11.04	5.40	-3.93	-6.90
1981	-14.00	-11.30	-3.69	1.01	9.16	12.76	16.66	19.09	12.52	7.85	1.26	-9.32
1982	-12.40	-5.45	-5.55	3.14	10.26	14.01	14.27	15.98	12.34	4.43	-3.80	-13.80
1983	-14.30	-12.80	-4.48	3.19	9.20	15.88	16.28	16.81	10.12	3.39	-5.86	-7.40
1984	-13.70	-8.06	-1.20	3.21	9.38	13.79	15.35	15.74	10.95	2.97	-7.99	-11.20

Appendix B.
Daily Rainfall Values for GLEAMS.

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.

Year	Daily Rainfall Values									
	cm									
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
1970	0.11	0.00	0.99	0.30	0.48	0.00	0.27	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.84	0.00	1.96	0.00	0.00	0.00
1970	1.09	0.00	2.35	0.00	0.00	0.00	0.03	0.09	1.86	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00
1970	0.77	0.05	0.00	0.00	0.00	0.00	0.00	0.00	2.20	0.26
1970	0.56	1.79	0.50	1.31	0.63	1.08	0.00	0.58	0.00	0.00
1970	0.00	0.00	0.55	0.33	0.33	0.00	0.00	0.65	0.00	0.00
1970	0.38	0.83	0.00	0.00	0.27	0.32	1.62	1.02	0.00	0.00
1970	0.00	0.00	0.45	1.14	0.00	2.29	0.00	0.00	1.51	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.65	0.57	0.00	0.54	0.72	1.91	1.35	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.04	1.56	0.00
1970	0.00	0.00	0.00	0.04	0.04	0.00	0.00	1.67	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.19	0.00	1.11	0.07	1.65	0.07	0.32
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72
1970	0.00	0.00	0.00	0.00	0.00	0.14	0.00	1.71	0.00	0.00
1970	0.07	0.00	2.06	0.64	0.00	0.11	0.00	0.00	0.28	0.00
1970	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00
1970	1.55	0.00	0.00	0.00	0.00	3.93	0.62	0.00	0.00	0.00
1970	0.00	0.13	0.62	0.75	0.00	0.00	0.00	0.73	0.17	0.06
1970	0.04	0.00	0.00	0.00	0.00	0.00	1.47	0.00	0.00	0.00
1970	1.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.12	0.00
1970	0.00	1.48	0.00	1.83	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.15	1.53	0.00	0.00	0.00	0.00	0.00
1970	0.00	1.30	5.56	0.40	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.11	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.80	1.18	0.45	0.38	0.00	0.00	1.66
1970	0.00	4.87	0.00	1.21	0.00	0.00	3.27	0.67	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	1.09	5.89	0.00	0.00	0.00
1970	0.00	0.00	0.00	4.00	0.00	0.27	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.27	0.00	0.29	0.28	0.38	0.00	2.01
1970	2.56	0.00	0.00	0.65	0.00	0.00	0.00	0.28	0.00	0.00
1970	0.91	3.44	0.81	0.42	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.74	0.00	0.00	0.00	0.27	2.14	0.00	1.28	0.00	1.24
1971	3.62	0.12	0.69	0.00	0.00	0.00	0.00	0.00	0.03	0.07
1971	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.04	0.11	0.26
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00
1971	0.00	0.21	1.90	0.00	0.00	0.00	0.78	0.02	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	1.50	1.51	0.62	0.00	0.00
1971	0.00	0.39	0.36	2.54	1.06	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.27	0.00	0.00	1.19	0.40	1.91	0.00	0.00	0.89
1971	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.40	0.00	0.00
1971	0.00	0.00	0.20	2.38	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	5.80	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.38	0.08	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.93
1971	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.12	0.91	0.07	1.93	0.07	0.00	0.00	0.00	0.00

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.

Year	Daily Rainfall Values									
	cm									
1971	0.00	0.00	1.98	0.00	0.00	0.00	0.00	[illegible]	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.17	0.96	0.00	0.21	1.34	0.00
1971	0.00	0.00	0.00	2.24	0.00	0.00	0.07	0.00	0.00	0.00
1971	0.00	2.22	0.00	0.00	0.00	0.00	2.06	0.31	0.00	1.51
1971	0.00	0.00	0.92	0.11	0.00	[illegible]	0.00	0.93	0.00	0.00
1971	1.90	0.81	2.61	1.27	1.50	[illegible]	0.00	0.00	0.16	1.40
1971	0.00	0.00	0.00	0.00	0.00	[illegible]	2.11	0.00	0.00	0.00
1971	0.00	0.00	0.42	0.79	0.00	[illegible]	0.00	0.00	0.00	0.00
1971	0.00	0.56	3.97	0.00	0.85	0.63	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00
1971	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	3.83	0.00	0.00	0.69
1971	4.94	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.25	2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.46	0.38	0.38	0.39	0.00	0.00	0.45	0.00	0.00	0.00
1971	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.37	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	1.04	2.42	1.04	0.37	0.00	0.00	1.71	0.27	0.00	0.00
1971	0.31	0.00	1.01	0.00	0.00	0.00	[illegible]	0.00	1.13	0.27
1971	0.75	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.27
1972	2.34	0.00	0.01	0.00	0.59	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.52	0.00	2.44	0.74	0.00	0.00	0.00
1972	0.40	0.00	0.00	0.00	0.00	1.84	1.99	0.60	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.04	0.04	0.00	2.41	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.00	0.00	1.44
1972	0.00	0.25	0.00	0.00	0.28	0.28	0.00	0.32	0.00	0.00
1972	1.43	0.29	0.78	0.00	3.11	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.64	3.71	1.75	0.14	0.00	0.21	0.18
1972	0.27	0.59	0.13	0.00	0.00	2.06	0.00	0.00	0.46	0.00
1972	0.00	0.00	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	1.24	0.00	3.87	0.00	0.00	0.00
1972	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.55	1.03
1972	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.45	0.00	0.00	2.14	0.00	0.47	0.07	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.00
1972	0.00	0.00	0.00	0.07	0.28	2.99	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	1.01	3.76	0.05	0.77	0.00	0.00	0.00
1972	1.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60
1972	0.98	0.00	0.15	0.00	0.83	0.00	0.00	0.00	0.00	0.00
1972	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.93	0.00	0.00
1972	0.00	0.01	0.00	2.23	0.26	0.75	0.00	2.11	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.55
1972	0.00	0.92	4.84	0.62	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69
1972	0.00	1.14	1.33	0.48	1.39	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	1.63	0.42	0.00	0.00	0.38	0.00	0.00	0.00
1972	0.38	1.26	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.

Year	Daily Rainfall Values								
	cm								
1972	0.00	0.00	0.00	0.00	0.00	0.00	4.68	0.52	0.00	0.00
1972	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.40	0.00	0.00	1.22	0.00	0.00	0.00	0.00	0.00
1973	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.13
1973	0.55	0.18	0.30	3.01	0.00	0.00	0.00	0.00	6.30	0.40
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56
1973	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.45	3.30	7.43
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00
1973	0.00	0.00	0.00	0.00	1.21	0.00	0.00	0.00	1.36	0.00
1973	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.15	0.91	0.46	0.00	0.90	0.00	0.00	0.38
1973	0.00	0.00	0.00	0.04	1.17	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	1.79	0.00	0.00	0.00	0.51
1973	0.08	0.00	0.00	1.69	0.00	0.00	0.07	2.34	4.29	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	5.61	0.19	0.00	0.00	0.00	0.00	0.22	0.00	0.07
1973	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	2.57	0.00
1973	0.00	2.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.08	1.24	2.14	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.23	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	5.03	6.04	1.22	0.00	0.00
1973	0.00	0.00	0.39	0.87	0.20	1.45	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.87	3.71	0.00	0.00	0.00	0.00
1973	0.00	1.23	3.67	0.00	0.00	0.00	0.68	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.38	0.00	0.00	0.00	2.21	5.36	0.00
1973	0.00	0.61	0.00	1.01	0.00	0.05	0.00	0.00	0.00	0.00
1973	0.00	1.47	0.00	1.06	2.12	0.43	0.00	0.00	0.00	0.00
1973	0.00	0.00	1.96	0.00	0.00	0.00	0.71	0.66	0.00	0.00
1973	0.00	2.26	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	1.06	0.30	0.00	0.00	0.00	2.23	0.00	0.00	0.00	0.61
1974	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.09	2.01	0.72	0.00	0.00	0.00
1974	0.00	0.00	0.00	1.07	0.85	0.00	4.21	0.00	0.00	0.00
1974	1.24	0.00	0.24	1.88	0.72	0.00	1.94	0.00	0.00	0.60
1974	1.26	0.71	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	1.74	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.76	2.36	1.39	0.90	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	3.25	4.54	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.98	0.00
1974	0.00	0.00	1.48	0.00	0.51	0.00	0.00	3.02	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.00
1974	0.19	0.12	0.21	0.00	0.00	0.00	0.00	0.00	0.00	1.57
1974	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.76	0.00	0.00

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.										
Year	Daily Rainfall Values									
	cm									
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
1974	0.07	0.00	0.00	1.69	0.00	0.00	0.00	0.00	1.07	0.00
1974	0.00	1.01	0.64	0.07	1.92	0.00	0.66	0.81	0.00	[illegible]
1974	0.40	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	[illegible]
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	[illegible]
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.00	[illegible]
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.43
1974	0.00	0.00	0.00	0.00	2.33	0.00	0.00	0.00	0.97	0.00
1974	0.00	0.03	0.57	0.46	0.00	0.00	0.00	0.00	2.73	0.31
1974	0.00	0.00	0.00	0.00	0.00	2.39	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	7.11	0.63	0.66	6.52	0.26	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	2.05	0.00	0.00	0.50	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	2.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.99	0.40
1974	0.00	0.00	0.00	0.00	0.00	1.67	0.00	0.00	0.00	0.00
1974	0.59	0.00	0.00	0.50	1.79	0.00	4.00	0.00	0.00	0.00
1974	0.00	0.00	0.57	0.41	0.00	0.00	0.00	1.43	0.00	0.00
1974	0.00	0.49	0.67	0.00	0.00	0.00	0.00	0.00	0.35	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00
1974	0.00	1.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.68	0.07	0.00	0.00	0.00	0.00	0.00	0.00
1975	2.57	0.00	0.23	0.25	0.05	1.40	0.00	0.00	0.00	0.02
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.03	0.62	1.50
1975	0.74	0.00	0.00	0.00	0.38	2.28	0.00	0.00	0.80	0.00
1975	0.00	0.00	0.08	0.04	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.40	0.34	0.00	0.00	0.00	0.00	0.00	1.51	0.00	0.00
1975	0.00	5.31	0.00	0.28	0.00	0.33	0.00	0.00	0.29	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41	0.00
1975	0.00	0.00	0.00	2.24	0.00	0.00	0.00	0.00	0.00	0.36
1975	0.22	0.00	0.00	0.00	0.00	0.00	2.34	0.00	0.00	0.00
1975	0.11	0.00	3.56	0.79	0.00	0.00	0.00	0.00	0.00	0.34
1975	0.06	0.58	0.54	0.00	0.18	0.00	0.00	0.00	1.86	0.00
1975	3.88	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	2.28	1.08	0.00	0.00	0.00	9.95	0.00	0.00	0.01	0.00
1975	0.76	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.00
1975	0.07	1.00	0.00	0.00	2.32	0.46	0.47	0.00	0.32	0.00
1975	0.00	1.27	0.87	0.00	0.00	0.00	0.00	0.15	0.00	0.00
1975	0.00	0.00	0.00	1.13	0.17	0.00	3.57	0.00	0.00	0.37
1975	0.27	0.00	1.14	0.00	0.00	0.28	3.97	8.64	0.06	0.00
1975	0.00	0.00	0.00	0.00	1.03	0.29	0.00	0.00	0.00	2.98
1975	0.00	0.00	0.09	0.22	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	4.22
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	1.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	1.55	0.00	0.00	0.00
1975	0.00	0.00	0.00	2.98	1.39	0.00	0.00	0.00	0.00	1.64
1975	0.00	0.00	0.50	0.00	0.00	0.00	0.00	1.63	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.70	1.13	0.00
1975	0.00	0.00	0.00	0.97	2.43	0.40	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	1.72	0.37	1.26	0.38	0.38	0.40

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.										
Year	Daily Rainfall Values									
	cm									
1975	0.38	0.00	0.00	0.38	2.54	0.00	0.00	0.00	3.51	0.28
1975	0.31	0.80	0.68	0.00	0.00	0.00	0.00	1.32	0.00	0.00
1975	0.00	0.00	0.00	0.34	0.34	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.32	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00
1976	0.52	0.00	0.00	0.00	0.00	1.83	1.36	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	1.78	0.00	0.00	0.90	0.00	0.00
1976	0.21	2.01	0.32	0.00	0.24	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.22	0.06	0.00	0.00	0.00	0.19	0.06	0.19	0.00
1976	0.00	0.00	1.17	0.91	0.00	0.36	2.10	0.02	0.00	0.00
1976	0.00	0.00	0.00	0.99	0.00	0.00	0.28	0.30	0.41	1.17
1976	4.39	0.27	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.08	0.00	1.72	0.00	0.00	0.00	0.95	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00
1976	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	1.11
1976	3.17	0.00	1.80	0.00	0.00	0.21	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00
1976	0.00	4.61	0.00	0.00	0.00	0.00	0.00	7.51	0.00	0.00
1976	1.22	2.19	0.00	0.00	0.00	5.08	0.00	0.51	0.57	0.00
1976	1.42	0.00	0.00	0.00	0.00	0.40	1.33	0.18	0.00	0.00
1976	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	1.18	0.70	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.06	0.00	0.00	0.41	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.29	0.00
1976	0.00	0.86	0.93	0.27	0.00	1.84	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.79	0.02	0.00	0.09	0.00
1976	0.00	1.06	0.00	1.63	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.31	0.51	1.34	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.85	0.27	0.00	0.00	0.00
1976	0.00	0.00	1.56	0.00	0.00	0.00	0.91	1.31	0.52	1.27
1976	1.25	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.49
1976	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.00	0.00
1977	1.05	0.51	1.52	0.00	0.00	0.00	0.00	0.00	0.68	0.40
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1.38
1977	4.13	0.00	0.00	0.62	0.00	1.46	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.02	0.58	3.02	5.48	0.80	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
1977	0.69	0.00	0.00	3.69	0.00	0.00	0.00	0.23	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	3.91	0.91	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.39	0.95	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	1.69	0.14	0.00	0.00	0.00
1977	0.23	0.00	0.00	0.00	1.68	0.00	0.00	0.00	0.11	2.43
1977	1.07	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00
1977	0.00	0.00	0.00	2.47	0.03	0.00	0.00	0.00	0.05	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.76	1.64

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.

Year	Daily Rainfall Values								
	cm								
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00
1977	0.00	0.00	0.00	3.57	5.39	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.37	0.00	0.52	0.92	0.29	1.59	0.00	0.07	2.44
1977	0.00	0.00	0.06	0.85	0.00	1.11	0.00	0.00	0.00	0.30
1977	1.89	0.00	0.00	3.20	0.00	0.00	0.00	3.41	1.15	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	6.23
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.60	5.66	0.00	0.05
1977	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78
1977	0.00	0.00	0.51	0.00	0.00	0.00	1.86	0.00	0.00	0.00
1977	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.00	2.31	0.00
1977	0.00	0.23	0.00	0.00	0.00	0.00	4.31	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00
1977	0.03	0.00	0.00	0.00	1.19	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00
1977	0.00	0.00	1.88	2.72	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.12	1.10	0.29	0.79	1.54	0.00	7.23	0.77	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.38	0.00
1977	0.38	0.95	0.37	0.00	0.00	0.00	1.01	0.00	0.44	0.44
1977	0.41	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	1.75	1.81
1977	0.00	0.00	3.73	0.36	1.65	2.24	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.43	0.85	0.69	0.00	0.27	0.00	0.29	2.32
1977	0.87	1.06	1.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	1.44	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.03	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	1.47	2.09	1.26	2.48	4.21	0.57	0.00	0.00	2.31
1978	0.00	0.00	0.00	0.00	3.45	0.10	0.00	0.00	0.00	0.19
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
1978	2.11	0.27	0.00	0.00	1.36	0.00	0.00	0.00	0.00	4.78
1978	0.00	0.00	0.00	0.00	9.66	0.87	0.80	0.92	0.00	4.27
1978	0.00	5.55	1.18	0.48	0.00	0.00	1.04	0.30	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.67
1978	1.88	0.41	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.25
1978	0.00	3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.43	0.04	0.00	0.00	0.05	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00
1978	0.00	0.03	0.00	0.00	0.00	0.00	1.32	1.15	0.00	0.19
1978	0.00	0.16	1.08	0.26	0.00	0.00	0.17	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	2.94	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.29	0.07	0.34	0.12	0.00	0.00
1978	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.32	0.00
1978	0.11	0.00	0.00	1.29	0.00	0.00	0.00	0.00	2.96	4.69
1978	0.00	1.08	0.00	0.00	1.35	0.13	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	1.86	0.00	0.38	0.51
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	1.46	0.82	0.00	2.75	0.06
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	1.85	0.80	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	1.90
1978	0.96	0.00	0.00	0.00	0.00	0.40	3.72	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	3.13
1978	0.63	0.31	0.00	0.00	0.00	0.00	0.00	0.43	2.55	2.12
1978	0.00	0.79	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.

Year	Daily Rainfall Values									
	cm									
1978	0.37	0.38	0.39	2.47	1.39	0.40	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.59	0.00
1978	0.00	0.00	0.82	0.00	0.32	0.49	0.00	0.00	0.00	0.00
1978	0.00	0.35	0.54	1.09	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	1.40	0.81	0.00	0.00	0.00	0.00	0.00	1.55	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.72	0.38	0.00	2.01	0.86	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.95	0.33	0.00	0.00	0.00	0.00	0.00	0.90	0.46
1979	0.42	0.77	0.59	2.06	0.42	0.00	0.25	0.00	0.00	0.00
1979	0.00	0.00	0.00	3.45	0.37	1.58	0.00	1.09	0.00	0.00
1979	0.00	1.30	0.99	0.00	0.00	0.00	0.03	0.00	0.53	0.00
1979	0.00	0.00	0.33	1.64	0.80	0.00	1.42	0.00	0.38	0.36
1979	2.13	1.18	0.13	0.00	1.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	1.75	0.00	0.63	0.77	0.46	0.49	0.00
1979	0.00	0.00	0.30	0.25	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.43	0.00	0.00
1979	0.03	0.07	0.00	0.00	0.00	0.00	0.00	0.08	0.16	0.00
1979	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.95
1979	0.00	0.41	0.00	0.00	0.00	0.00	0.06	0.00	0.24	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	1.73	0.08
1979	0.00	0.00	0.08	0.00	0.00	0.00	0.09	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	1.26	1.18	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.29	0.17	0.29	0.31	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	1.30	0.03	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	1.76	0.00	0.00	0.00	0.00	0.00
1979	1.16	6.21	0.00	0.64	0.46	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.08	1.18	0.28	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	1.83	0.00	0.00	1.31	5.28	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.49	0.40	1.04	0.45	1.13	0.00
1979	0.00	0.41	0.41	0.37	0.42	0.37	0.00	1.62	0.45	0.00
1979	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00
1979	0.00	0.00	0.00	0.77	0.38	0.00	0.00	0.27	0.00	0.00
1979	0.00	0.00	0.00	0.63	1.04	0.39	0.00	1.41	0.00	0.00
1979	0.00	0.00	1.30	0.43	0.73	0.00	0.00	0.00	0.00	0.00
1980	0.40	0.79	0.46	2.36	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.28	0.04	0.00	0.00	1.42	1.29	1.88	0.00	0.00	0.00
1980	0.00	0.00	1.00	0.03	0.13	0.00	0.00	0.64	0.57	0.00
1980	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.43	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.03	0.00	0.19	0.05	0.00	0.00
1980	0.00	0.87	2.45	0.00	0.00	0.00	1.11	0.00	0.00	0.00
1980	0.50	3.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.83	0.42	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.15	0.49	0.00	0.00	0.00	0.00	0.00
1980	1.92	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.27	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
1980	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.23	0.00

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.

Year	Daily Rainfall Values								
	cm								
1980	0.00	0.00	0.22	0.82	0.03	0.43	1.31	0.00	0.00	0.00
1980	0.17	0.00	0.00	0.00	0.04	0.00	0.00	0.43	0.00	0.06
1980	0.84	0.00	0.00	0.00	0.00	0.19	0.09	0.09	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.20	0.30	0.40	0.68	1.13	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	1.65	0.00	0.83	0.00	0.58
1980	0.00	0.00	0.00	0.00	0.60	0.27	0.00	0.00	0.00	0.00
1980	1.42	0.00	0.52	0.73	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89	0.23	0.00
1980	0.28	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00
1980	0.00	0.00	0.58	0.00	0.00	2.32	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	2.49	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.22	0.00	0.11	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.17	1.86	0.09	0.60	3.90	0.00
1980	0.00	2.63	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.86
1980	0.00	0.00	0.00	0.00	0.26	0.00	1.47	0.74	2.24	0.00
1980	3.61	0.00	0.00	1.97	0.00	0.00	0.00	0.00	0.43	0.00
1980	0.00	0.00	0.38	0.40	0.00	0.00	0.00	0.00	0.38	0.98
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.13	0.00	0.56
1980	0.00	0.28	0.00	0.00	1.27	0.00	0.00	2.29	3.49	0.00
1980	0.00	0.00	0.00	0.00	0.45	1.18	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.96	0.41	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.41	1.79	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.67	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.35	0.48
1981	0.12	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.40	0.00	0.00	0.00	0.00	1.62	0.45	1.86
1981	0.31	1.26	0.00	0.00	0.00	0.60	0.00	1.44	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	1.46
1981	0.00	0.00	0.00	1.34	0.93	0.82	0.50	0.00	0.00	0.31
1981	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.59	0.27
1981	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.43	2.09	0.00	0.00	0.00	0.00	0.00	1.10	1.21
1981	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00
1981	0.00	0.00	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.04	0.00	0.06	0.59	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.28	0.00
1981	2.81	0.00	0.35	0.00	2.70	0.00	0.00	0.44	0.00	0.00
1981	0.00	0.00	0.00	1.56	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.84	0.00	0.00	0.56	0.00	0.00	0.00	2.08	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.10	2.52	0.00	0.00	0.00	0.08	2.16	0.87	0.21	0.00
1981	0.00	0.00	0.00	1.55	0.00	0.00	0.00	0.00	1.65	5.36
1981	14.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28	1.27	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	1.13	0.03	0.00	1.48	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
1981	0.00	0.00	0.00	2.22	0.23	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.13	1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.

Year	Daily Rainfall Values (cm)									
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.62	0.00	0.00
1981	3.57	0.00	0.00	0.04	1.75	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.33	0.40	0.00	0.00	0.00	0.00	0.00
1981	0.00	1.69	0.28	0.00	1.33	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.00	0.00	2.47
1981	0.75	0.00	0.00	0.00	0.82	1.46	0.00	0.00	0.00	0.00
1982	5.13	0.00	5.10	0.00	0.00	0.00	0.00	0.00	[illegible]	0.17
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	[illegible]	0.00
1982	0.00	0.00	1.82	0.00	0.00	0.00	0.00	0.00	[illegible]	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.09	0.33	0.00	1.62	0.00
1982	0.10	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	2.10	5.61	3.97	0.00	0.00	0.00
1982	0.00	0.64	0.00	0.00	0.00	0.00	0.68	0.49	0.28	0.00
1982	0.00	0.00	0.00	0.56	0.00	0.28	0.95	0.54	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	1.44	4.58	0.00	0.00	9.01	0.00	0.00
1982	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27
1982	0.20	0.00	0.16	0.00	1.05	4.10	0.00	1.11	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.04	0.47	0.26	1.21	0.27	[illegible]
1982	0.04	0.51	0.00	0.00	0.00	0.00	1.24	0.93	0.00	0.00
1982	0.00	0.00	0.54	0.03	0.07	3.16	0.35	1.25	0.32	0.00
1982	0.00	0.00	2.47	0.00	0.00	0.74	0.32	0.00	0.13	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.14	0.00	2.67	0.00	0.33
1982	0.16	0.00	0.00	0.00	1.78	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.52	1.02	0.00	0.00	0.78	0.00	0.00
1982	0.00	0.00	2.56	0.00	0.23	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	1.79	0.00	0.44	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.46	0.20
1982	0.00	0.00	0.00	0.00	0.45	0.00	1.27	0.03	0.49	0.00
1982	0.00	0.00	0.00	0.00	1.05	0.00	0.00	0.00	0.00	0.30
1982	0.00	0.00	0.00	1.73	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	3.04	0.61	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.41	0.33
1982	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55
1982	0.58	0.00	0.00	0.00	0.00	0.00	3.41	0.00	0.00	0.00
1982	0.00	0.45	0.00	0.00	0.00	3.41	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
1982	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.00
1982	0.00	0.00	0.00	0.00	3.27	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.14	0.30
1982	0.00	0.77	0.36	0.59	2.32	1.46	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00
1983	0.13	0.10	0.00	0.00	0.00	0.20	0.00	0.00	0.92	3.57
1983	0.00	2.27	0.90	0.31	0.00	0.00	0.00	0.18	0.00	0.00
1983	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	2.75	4.51
1983	0.00	0.00	1.00	0.00	0.00	0.00	2.33	0.00	0.00	0.03
1983	0.00	0.00	0.00	0.00	0.82	0.69	0.00	0.00	1.38	0.00
1983	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.70	0.35	0.69
1983	0.00	0.00	0.00	0.00	0.00	0.00	3.85	0.00	0.00	0.00
1983	0.00	0.00	0.95	0.00	0.00	0.00	3.07	0.00	0.27	0.00
1983	1.33	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.44	3.25
1983	0.62	0.31	0.00	2.64	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.46	0.00	0.00	2.24	0.20	0.00	0.00	0.00

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.

Year	Daily Rainfall Values (cm)								
1983	0.00	0.00	0.05	0.41	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.61	0.00	0.00	0.29	0.04	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	1.31	0.00
1983	0.00	4.10	0.00	0.00	0.31	0.00	0.87	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.10	0.00
1983	0.12	0.00	0.00	0.00	0.00	0.00	1.28	0.00	0.00	0.00
1983	2.10	0.32	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00
1983	0.00	0.00	0.00	1.86	0.45	0.00	0.00	2.65	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	1.57	0.00	0.00	0.00	6.56	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.83	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	1.42	0.00	0.00	4.29
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.53
1983	0.83	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	1.08	0.96	0.18	0.00	0.00	0.00	2.62
1983	0.40	0.01	3.43	0.00	0.00	0.00	0.00	0.00	0.00	0.86
1983	0.00	1.45	4.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.39	0.00	1.42	6.69	0.00	0.69	0.72
1983	0.40	0.91	0.00	0.00	0.00	1.04	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.80	1.53	0.84	0.00
1983	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.85	0.00	1.46	0.00	0.00	0.00	0.00
1984	0.01	0.26	2.40	0.00	0.00	0.04	0.16	0.08	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00
1984	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.58	0.67	0.00	0.00	0.51	3.03	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.22
1984	0.00	0.00	0.00	0.00	0.00	0.10	0.04	0.00	0.00	0.00
1984	0.00	1.08	0.42	0.00	0.00	0.00	0.00	0.00	0.42	0.00
1984	3.67	0.00	0.86	0.00	0.00	0.00	0.53	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.27	0.38	2.41	1.10	0.00	0.00
1984	0.00	0.00	0.00	0.00	3.07	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	4.78	0.00	0.00	0.00	0.60	3.38
1984	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
1984	0.04	0.00	0.00	0.00	0.00	2.56	0.38	0.00	0.00	2.98
1984	0.04	0.00	0.00	0.59	3.39	0.00	0.84	0.04	0.10	0.00
1984	0.51	0.00	0.00	0.00	1.40	6.50	0.00	0.00	0.77	0.34
1984	1.37	0.00	0.00	0.07	1.06	0.00	0.00	0.00	0.00	0.00
1984	0.06	0.00	0.00	2.60	6.16	0.40	2.68	0.35	0.00	0.81
1984	0.00	0.00	2.70	0.00	0.00	4.64	0.00	4.30	0.00	0.00
1984	0.81	0.69	0.00	0.00	2.23	1.18	0.00	0.00	0.00	0.00
1984	0.76	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	1.76	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	3.34
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	2.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.32	0.00	2.15	0.00	0.00	0.00	0.00	0.00	0.71	1.31
1984	0.33	0.00	0.00	0.51	0.06	0.25	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.79	0.00	0.00

Table B1. Daily rainfall values for Aiken County, South Carolina, 1970-1984.										
Year	Daily Rainfall Values									
	cm									
1984	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00
1984	0.40	0.00	0.00	0.00	0.00	0.00	0.27	1.54	0.34	0.00
1984	0.00	0.73	0.00	0.00	0.00	0.00	1.22	0.68	3.25	0.00
1984	0.00	0.00	2.49	3.17	0.00	0.55	0.00	0.00	0.00	0.00
1984	0.78	0.27	0.00	0.00	0.00	1.46	0.00	0.00	0.00	0.00
1984	0.78	0.27	0.00	0.00	0.00	1.46	0.00	0.00	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.

Year	Daily Rainfall Values								
	cm								
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00
1970	0.03	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00
1970	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.24
1970	0.00	0.02	0.82	0.00	0.00	0.54	0.00	0.08	0.00	0.00
1970	0.00	0.00	0.40	0.04	0.01	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.09	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.72
1970	0.57	0.00	0.04	0.61	0.00	1.38	0.00	0.00	0.87	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.22	0.15	0.00	0.12	0.28	1.14	0.76	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	1.52	0.00
1970	0.00	0.00	0.00	1.60	0.01	0.00	0.00	1.10	0.00	0.00
1970	0.00	0.00	0.00	0.00	1.63	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.46	0.00	1.00	0.13	2.09	0.00	2.37
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.51
1970	0.00	0.00	0.00	0.00	0.00	0.71	0.00	1.07	0.00	0.00
1970	0.00	0.00	0.15	0.00	0.00	0.11	0.00	0.00	1.78	0.00
1970	0.00	0.00	0.00	0.03	3.90	0.00	0.88	0.00	0.37	1.00
1970	1.13	0.00	0.00	0.00	0.00	1.11	0.49	0.00	0.00	0.00
1970	0.34	0.31	0.00	0.00	0.00	0.00	0.00	1.69	0.00	0.02
1970	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42
1970	0.00	0.00	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	1.68	0.21	1.09	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.92	4.40	0.24	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.95	0.00	0.01
1970	0.00	0.00	0.00	0.00	0.00	0.00	1.38	0.00	0.00	0.00
1970	0.00	0.00	3.61	0.00	0.00	0.63	2.04	0.00	0.00	0.14
1970	0.00	0.52	0.00	3.56	0.00	0.00	2.48	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.69	0.00	0.94	0.01	0.00	0.00	0.16
1970	1.32	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00
1970	0.05	0.00	0.72	0.31	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.08	0.00	0.00	0.00	1.62	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.71	0.15	0.00	0.00	0.00	0.00	0.41	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.66	0.07	0.00	0.00	0.00
1971	0.00	0.00	1.23	0.38	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.47	0.00	0.00	0.00	0.89	0.27	0.00	0.00	0.40
1971	0.00	0.00	0.00	0.00	0.00	0.00	1.44	3.41	0.00	0.00
1971	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.74
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	1.89	0.00	0.00	0.00	1.93
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.18	1.29	0.27	1.70	0.29	0.00	0.00	0.00	0.00
1971	0.00	2.51	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	2.50	0.00	0.00	0.17	0.19	0.00	2.37	0.74	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.										
Year	Daily Rainfall Values									
	cm									
1971	0.00	0.00	1.75	1.18	0.00	0.00	0.34	0.00	0.00	0.00
1971	1.20	2.11	0.00	1.08	0.00	0.00	2.70	1.61	0.00	0.00
1971	0.00	0.00	1.80	0.00	0.00	0.00	0.00	1.28	0.00	0.00
1971	0.48	0.00	1.64	0.23	2.15	0.77	0.00	0.00	1.13	0.04
1971	0.00	0.00	0.00	0.00	0.00	0.91	3.34	0.00	0.00	0.00
1971	0.00	0.00	0.92	0.72	0.00	0.00	0.83	0.00	0.00	0.00
1971	0.00	1.05	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	3.40	0.00	0.00	0.00	0.00
1971	0.40	0.00	0.00	0.00	0.00	0.00	0.00	4.59	11.03	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	1.39
1971	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.30	1.33	0.31	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.21	0.27	0.00	0.00	0.00	0.07	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.00	0.00
1972	0.00	0.00	0.41	0.00	0.49	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.96	0.55	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.61	0.00	0.00	0.00	0.19	0.00	1.52	0.00	0.00
1972	0.07	1.83	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	1.24
1972	0.05	0.82	0.95	0.00	0.00	2.33	0.17	0.45	0.82	0.00
1972	0.00	0.06	0.26	0.00	1.56	0.28	0.00	0.00	0.00	0.00
1972	0.00	0.00	1.77	0.00	0.00	0.00	0.15	0.00	0.00	0.00
1972	0.00	2.83	0.00	0.00	1.09	0.00	0.00	0.00	3.21	0.19
1972	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.06	1.48
1972	0.00	0.00	0.00	0.00	1.98	0.00	1.42	0.56	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00
1972	0.00	0.00	0.00	1.28	0.00	1.42	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.07	0.09	0.00	2.94	0.00	0.00	0.00
1972	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00
1972	0.00	0.00	0.00	0.00	2.41	0.00	0.00	0.00	0.00	0.60
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16	0.00	0.00
1972	0.13	2.17	0.00	0.00	0.99	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	3.57	0.00	0.00	0.00	0.00	0.00	0.40	0.00
1972	0.00	0.00	0.41	0.77	0.00	0.00	0.00	0.00	0.93	0.00
1972	0.00	0.00	0.00	0.26	0.00	0.99	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	2.90	0.00	0.00	0.00	0.13	0.00	0.00	0.00
1972	0.00	0.45	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.

Year	Daily Rainfall Values								
	cm								
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	4.20	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	3.31	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00
1973	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.50	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
1973	0.73	0.37	0.00	0.00	0.00	0.00	0.00	0.72	0.00	0.00
1973	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	1.19	1.70	0.00	0.56	0.00	0.00	0.00
1973	0.00	0.00	0.00	1.67	0.00	0.00	2.26	0.00	0.00	0.00
1973	0.00	0.00	0.00	3.93	0.00	4.99	0.00	0.00	0.00	0.02
1973	0.06	0.00	0.00	0.00	0.00	0.25	0.18	0.20	0.22	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	1.19	0.20	0.00	0.30	0.00	0.00	0.18	0.00	1.04
1973	0.00	2.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.31	0.83	0.06
1973	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.11	1.24	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.85	0.00	0.00	0.00	4.70	5.82	0.84	0.20	0.55	0.00
1973	0.00	0.00	0.07	1.04	0.00	0.00	0.55	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	2.87	0.99	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	2.85	0.39	0.00	0.00	1.81
1973	3.92	0.00	0.29	0.78	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.32	1.12	0.00
1973	1.00	0.03	0.00	0.00	0.00	0.00	1.22	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.28	0.00	0.00
1973	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.69	0.10	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.27	0.00	0.17	0.00	1.62	0.35	0.00	0.00
1973	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.30	0.03	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
1974	0.00	0.00	0.51	0.00	0.06	0.00	0.78	0.00	0.00	0.59
1974	0.28	1.58	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	1.46	0.30	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00
1974	0.00	1.15	0.00	0.00	0.00	0.00	1.27	0.00	0.66	0.00
1974	0.00	0.00	0.00	0.00	1.26	0.00	0.00	0.81	0.00	0.75
1974	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00
1974	1.88	0.63	0.78	0.00	0.00	0.00	0.32	0.00	0.00	0.63
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00
1974	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87
1974	1.49	0.00	0.37	1.39	0.00	0.00	0.00	0.00	0.25	2.47

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.

Year	Daily Rainfall Values								
	cm								
1974	0.00	0.00	0.12	1.89	2.58	0.00	1.51	0.46	0.00	0.00
1974	1.13	0.83	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00
1974	2.80	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20	0.00
1974	0.00	0.00	0.00	0.00	0.00	4.82	0.73	0.00	0.00	0.76
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.50	0.00
1974	0.00	0.34	1.83	0.00	0.00	0.00	0.00	0.00	0.60	2.29
1974	0.00	0.00	0.00	0.00	2.14	0.01	0.00	0.00	1.74	0.00
1974	0.00	0.00	0.00	0.31	0.16	1.89	4.60	0.28	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.01	0.00	1.13	0.08	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.01
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1974	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.46	0.00	0.00
1974	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	2.17
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37
1975	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	1.75	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.28	0.00	0.25	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
1975	0.00	2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.55
1975	0.84	0.00	0.00	0.00	0.00	0.00	4.77	0.00	0.00	0.00
1975	0.00	0.00	0.62	0.04	0.00	0.00	0.13	0.00	0.00	0.75
1975	2.24	0.38	0.39	0.00	0.21	0.00	0.00	0.00	1.31	0.00
1975	0.98	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	1.20	0.00	0.00	0.00	0.33	0.00	0.00	3.07	0.00
1975	0.52	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.57	0.00	0.00
1975	0.36	0.71	0.00	0.00	3.88	7.23	0.45	0.00	0.08	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	0.64	0.00
1975	0.00	0.00	0.00	2.99	0.00	0.00	0.38	0.00	0.00	0.56
1975	0.09	0.00	0.57	0.00	0.12	3.54	0.00	0.00	1.67	0.00
1975	0.00	0.00	0.00	0.00	0.00	1.49	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	2.64	1.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	1.21	0.27	0.00	1.20
1975	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.47	0.00	1.05	0.00	0.00	0.00	0.83	2.69
1975	0.00	0.00	0.00	0.00	0.00	0.00	1.43	0.00	0.00	0.00
1975	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	2.10	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.11	0.01	0.53	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
1975	0.84	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.54	0.13
1975	0.00	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.

Year	Daily Rainfall Values									
	cm									
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.10	0.01	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.26	0.00	0.00	0.00	1.57	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.93	0.00	0.00	0.51	0.35	0.59	0.57
1976	1.79	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00
1976	0.00	0.00	0.00	0.00	2.77	0.00	0.00	0.00	0.00	0.00
1976	0.00	4.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96
1976	0.00	2.04	0.00	4.14	0.00	0.00	0.65	0.71	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	1.44	0.00	0.00	0.65	0.00
1976	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.00
1976	0.10	0.00	1.18	0.00	0.00	0.39	0.00	0.00	0.00	0.00
1976	0.00	1.69	0.00	0.00	0.00	0.00	0.00	0.00	1.26	0.00
1976	0.00	0.34	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00
1976	0.00	0.03	0.00	0.00	0.00	0.00	0.00	2.12	0.96	0.00
1976	1.02	0.00	0.00	0.00	0.00	0.39	0.00	1.77	1.03	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.08	1.08	0.00
1976	0.00	0.00	1.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.42	1.66	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	1.29	0.51	0.96	0.00	0.11	0.00	0.00	0.00	0.93
1976	0.90	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01
1976	0.27	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.06	0.96	0.22	0.00	0.00	0.00
1976	0.00	0.00	0.84	3.19	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	1.12	2.14	0.00	0.00	0.00
1976	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.08	1.40	0.00
1976	1.24	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
1977	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.38	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.48	2.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	2.95	0.03	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.33	0.00	0.68	0.07	0.00	0.00	0.00
1977	1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.75	0.00
1977	0.63	0.84	0.00	0.00	0.00	0.00	0.00	0.08	1.39	0.00
1977	0.00	0.00	0.00	0.00	2.80	0.00	0.00	2.95	1.21	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	4.94	0.73
1977	0.00	4.55	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00
1977	0.00	0.00	0.00	0.95	0.17	0.00	0.00	0.00	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.

Year	Daily Rainfall Values								
	cm								
1977	0.00	1.33	0.00	0.31	1.07	0.12	0.09	0.00	2.23	0.00
1977	0.00	0.00	1.54	0.00	0.00	2.56	0.00	0.00	0.00	0.75
1977	3.59	0.00	0.98	0.09	0.00	0.00	0.00	1.24	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	1.86
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.64
1977	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10
1977	0.32	0.00	0.81	1.48	5.72	0.00	0.00	0.00	0.80	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.89	0.00
1977	0.07	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
1977	0.00	0.00	1.24	1.29	0.00	2.81	0.00	0.00	0.00	0.00
1977	0.00	1.15	1.65	0.00	0.41	0.00	0.23	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	0.00
1977	0.18	0.33	0.33	0.00	0.00	0.00	0.56	0.00	0.00	0.00
1977	0.66	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.90	1.62
1977	0.00	0.00	0.00	0.82	1.30	0.00	0.00	0.00	0.00	0.00
1977	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.31	1.53
1977	3.05	0.10	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	1.54	2.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.26	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.44	0.53	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.17
1978	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.72	0.00	0.62
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.06
1978	0.00	0.07	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00
1978	0.00	1.20	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00	0.00	0.09
1978	2.62	3.67	0.00	0.00	0.00	0.00	1.15	1.37	0.29	0.00
1978	0.00	2.23	0.00	0.93	0.00	1.07	0.23	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.10	0.00	0.00	1.92	1.38	0.00	2.87	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.15	1.78
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00
1978	0.00	0.02	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00
1978	0.00	1.89	0.00	0.00	0.00	0.00	0.97	0.43	3.21	0.00
1978	0.00	0.25	0.00	0.00	0.00	0.00	2.76	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.66	0.00	0.34	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	2.83	2.31	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	2.01	0.00	0.00	0.00	0.00	1.14
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.01
1978	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.34	0.53	0.10
1978	0.00	0.63	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
1978	0.00	1.04	0.22	0.28	0.00	0.25	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.										
Year	Daily Rainfall Values									
	cm									
1978	0.00	0.00	0.13	0.00	0.03	0.71	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	1.09	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.08	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.08
1979	0.37	0.00	0.00	0.00	0.64	0.00	0.22	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.30	0.75	0.00	0.06	0.00	0.00
1979	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.00
1979	0.02	0.00	1.37	0.00	0.21	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.01	0.00	0.00	1.29	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.99	0.94	0.31	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.33	0.44	0.46	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41	0.00
1979	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	1.67	5.05	0.94	0.76	0.00	0.00	0.32	0.00	1.41	0.57
1979	0.00	0.00	0.00	0.00	0.00	0.00	1.06	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	1.82	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	1.33	0.00	4.95	0.00	0.00
1979	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.11	0.00
1979	0.00	0.00	0.00	0.00	0.00	1.29	0.24	0.00	1.41	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.08	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	1.67	0.09	0.41	0.00	0.00	0.00	0.00	0.36
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.17	0.59	0.00	0.00	0.94	0.00	0.00
1979	0.00	0.84	0.00	0.00	0.00	0.06	0.00	0.08	0.00	0.00
1979	0.00	1.24	0.00	0.00	0.00	0.54	0.45	0.88	0.24	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.17	0.88	0.00	0.29	0.00	0.00
1979	0.00	0.00	0.00	0.95	0.08	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.05	0.00	0.00	0.00	0.45	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.20	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
1980	1.12	0.00	0.00	0.00	0.00	1.62	0.94	0.00	0.72	0.00
1980	0.00	0.00	0.14	0.73	0.42	1.44	0.67	0.00	0.00	0.00
1980	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.										
Year	Daily Rainfall Values									
	cm									
1980	1.84	0.00	0.00	0.00	0.00	0.75	0.82	0.17	0.00	0.11
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	1.81	1.14	0.17	2.57	0.00	0.00	0.00
1980	0.00	0.86	0.00	0.00	0.00	[illegible]	0.00	2.28	0.00	0.33
1980	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.21	0.00	1.85	0.14	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.65	3.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	2.37	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00
1980	0.00	0.00	1.75	0.00	0.00	0.82	0.00	0.86	0.00	0.00
1980	0.00	0.00	2.60	0.00	0.00	0.00	0.00	0.00	0.00	4.13
1980	0.00	0.00	2.12	0.05	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.75	0.68	[illegible]	0.00	0.81	1.69
1980	2.63	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.51
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00
1980	0.00	0.36	0.00	0.00	0.04	0.00	0.00	0.44	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.45	0.30	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.12	0.07	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.19	0.24
1981	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.28	0.62	1.29	0.00	0.00	1.59
1981	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.53	0.09	0.87
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.72	0.05	0.00	0.00	0.00	0.00	0.00	0.52	0.00
1981	1.47	0.00	0.00	0.00	0.00	0.00	0.15	0.00	1.71	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.29	2.02	0.00	0.00	0.00	0.00	0.00
1981	0.00	1.07	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.07	4.54
1981	9.23	0.00	0.00	0.00	0.55	0.00	0.00	1.61	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.31	1.31	0.00
1981	0.00	0.00	0.00	0.00	1.16	0.00	0.00	0.00	0.07	0.00
1981	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.16	0.00	0.00	0.00	0.00	0.00	2.04	0.00	0.00
1981	0.00	0.00	0.24	0.12	0.00	0.00	0.00	0.00	1.83	0.93
1981	0.63	0.00	3.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	1.44	0.00	0.00	0.00
1981	0.00	0.00	0.00	1.01	0.00	0.50	1.83	0.00	0.31	0.00
1981	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.98	4.02
1981	3.99	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.										
Year	Daily Rainfall Values									
	cm									
1981	0.00	0.00	0.00	0.00	1.10	0.00	0.00	0.00	0.00	0.00
1981	0.00	2.19	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
1982	0.00	0.00	0.00	0.00	0.00	0.00	1.78	0.00	0.00	0.00
1982	0.00	0.00	5.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	1.48	0.19	0.00	0.00	0.00	0.00
1982	0.00	0.20	0.00	0.00	0.00	0.00	0.03	0.66	0.03	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.67	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.74	0.44	0.00	0.00	0.00	0.00	0.00
1982	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
1982	0.96	0.00	0.23	0.00	1.77	0.53	0.00	0.10	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	2.55	0.22	0.00	1.75
1982	0.66	1.10	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00
1982	0.00	0.00	2.32	0.00	0.39	0.00	0.00	1.73	0.00	0.00
1982	0.59	0.27	0.14	0.00	0.30	0.00	0.00	0.00	2.67	0.71
1982	0.00	0.00	0.00	0.00	0.00	1.01	0.00	1.76	0.00	0.46
1982	1.04	0.00	0.00	0.00	1.58	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.65	0.00	0.00
1982	0.00	0.00	0.02	0.00	0.00	0.00	0.00	1.68	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	2.49	0.71	0.00	0.00	2.72	0.00	0.42	0.13
1982	0.00	0.00	0.00	0.00	0.59	0.00	0.62	0.00	2.97	0.00
1982	0.00	0.00	0.00	0.00	0.48	0.00	2.97	0.00	0.95	0.00
1982	0.00	0.00	0.34	3.52	0.00	0.00	3.35	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.17	0.00	0.00
1982	0.00	0.00	0.00	0.00	2.25	0.00	0.00	0.00	0.05	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.43	0.00	0.00	0.00	2.71	0.00	0.00	0.00	1.60	0.42
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.75	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00
1982	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
1982	0.00	0.09	0.41	0.00	0.02	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00
1983	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.29
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00
1983	2.74	0.09	0.00	0.00	0.00	0.00	0.64	0.00	0.26	0.00
1983	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	1.48	0.34	0.98	0.00	0.00	0.00
1983	0.00	0.00	0.00	1.79	0.59	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	2.39	0.00	0.00	0.00	0.07	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.

Year	Daily Rainfall Values								
	cm								
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.61	0.00	0.00
1983	4.66	0.00	0.00	0.00	4.22	0.00	0.09	0.00	0.19	0.00
1983	0.00	0.10	0.00	0.00	1.60	0.00	3.58	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	5.53	0.00	0.00	0.00	1.11	0.00
1983	0.63	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.11	1.00
1983	0.00	0.00	0.00	0.23	0.00	2.55	0.00	0.45	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.99
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	0.00	0.00
1983	3.80	0.00	1.75	7.80	0.00	0.00	0.45	0.00	0.48	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.74
1983	0.92	0.39	0.00	1.25	0.00	0.00	0.00	0.00	0.44	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
1983	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00
1983	1.72	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.12
1983	0.00	0.32	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	1.74	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.10	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.02	0.00	0.00	0.00	0.00	0.85	1.92	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00
1984	1.70	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.23	0.76	3.51	0.00	0.34
1984	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
1984	1.03	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	1.85
1984	3.84	0.00	0.19	0.00	0.00	1.90	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.78
1984	2.43	0.00	0.00	0.00	0.00	3.84	3.60	0.00	0.00	0.00
1984	0.92	0.00	0.00	0.81	0.04	0.00	0.00	2.07	1.24	0.00
1984	0.02	0.00	0.00	0.00	0.10	0.00	0.00	0.00	1.21	1.41
1984	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00
1984	0.95	0.00	0.00	2.15	0.00	0.50	0.27	0.24	0.00	3.27
1984	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00
1984	2.47	0.19	0.44	0.00	0.00	2.01	0.76	1.33	0.38	0.00
1984	0.00	0.03	0.00	0.00	0.00	0.00	0.56	0.00	0.00	0.00
1984	0.00	0.10	0.00	0.26	0.00	0.00	0.00	0.00	1.70	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.04
1984	0.00	0.00	0.00	0.00	1.62	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.32	0.00	0.00	0.00	0.87	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	3.49	2.47	3.38	0.00	0.00	0.00	0.00	0.00	0.08	0.33
1984	0.00	0.00	0.23	0.00	0.00	0.57	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B2. Daily rainfall values for Kossuth County Iowa, 1970-1984.

Year	Daily Rainfall Values									
	cm									
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	[illegible]	0.93	0.00
1984	0.29	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.15	0.00
1984	0.00	0.45	0.00	0.00	0.11	0.00	1.93	0.00	0.00	0.00
1984	0.00	0.00	0.81	1.24	0.00	0.29	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix C.
Mean monthly solar radiation values for GLEAMS.

Table C1. Monthly mean solar radiation (RAD) for Aiken County, South Carolina, 1970-1984.

Year	Monthly Mean Solar Radiation											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	MJ cm^{-2}											
1970	238.94	303.10	301.21	449.65	567.32	588.33	523.56	430.31	409.25	354.07	235.48	207.42
1971	223.43	279.00	372.65	493.72	593.23	523.85	507.85	475.30	458.57	326.66	279.10	227.27
1972	264.18	296.39	395.24	459.67	593.92	590.71	534.45	468.54	429.87	353.50	274.71	231.87
1973	250.07	319.81	399.96	557.09	501.21	579.94	570.15	553.84	450.49	331.11	253.78	228.75
1974	268.15	282.89	374.16	492.93	569.41	563.04	544.28	461.89	389.35	384.88	259.48	234.06
1975	249.59	300.41	402.88	483.70	506.91	585.72	469.37	541.27	446.24	347.56	222.60	222.08
1976	239.92	261.01	407.72	549.56	588.98	656.57	574.35	501.48	420.76	329.01	279.11	229.13
1977	235.29	299.25	419.79	476.52	567.83	534.27	588.05	477.88	456.20	300.82	259.48	191.68
1978	273.48	284.78	352.80	499.23	542.49	568.27	554.33	484.60	454.33	305.87	262.30	239.52
1979	265.76	271.58	333.70	494.45	576.86	603.18	577.34	551.11	428.76	365.45	236.17	213.67
1980	221.48	307.41	419.08	500.81	496.25	594.35	556.82	507.03	442.85	311.64	238.04	229.24
1981	252.06	271.50	384.96	495.04	603.36	636.23	546.74	476.05	448.45	310.66	256.87	240.71
1982	247.54	286.82	393.05	465.01	447.93	562.46	531.26	458.96	398.54	339.98	296.49	235.55
1983	232.87	292.89	421.57	458.10	583.63	562.39	569.93	509.56	437.13	305.18	265.25	239.88
1984	244.96	311.05	373.50	505.33	500.81	491.19	504.16	475.38	444.37	321.68	284.44	232.64

Table C2. Monthly mean solar radiation (RAD) for Kossuth County, Iowa, 1970-1984.

Year	Monthly Mean Solar Radiation											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	MJ cm^{-2}											
1970	152.59	238.21	274.62	441.15	534.13	604.82	525.88	469.36	373.02	279.67	159.97	120.89
1971	144.44	224.50	333.46	455.65	598.91	527.76	566.45	473.54	424.36	259.96	189.35	135.11
1972	170.86	237.45	353.46	414.68	569.20	623.29	599.93	522.01	389.55	285.32	186.37	132.60
1973	171.06	252.97	360.28	521.09	511.43	586.06	616.86	554.14	375.72	267.68	156.83	132.74
1974	183.17	235.73	335.62	459.41	558.16	572.70	583.63	488.59	359.62	305.51	166.09	128.87
1975	172.59	239.30	358.50	453.93	532.63	618.64	504.12	548.43	386.45	283.82	149.11	130.92
1976	157.84	214.03	365.23	511.77	595.16	654.59	590.59	493.52	378.41	257.81	187.30	137.11
1977	153.00	246.70	375.82	452.28	580.83	562.10	623.45	486.38	404.09	243.01	174.94	112.00
1978	176.23	235.26	305.55	473.15	548.39	587.67	597.88	516.28	409.43	246.47	177.92	143.88
1979	170.86	223.35	299.72	471.71	576.66	578.83	616.47	547.39	400.35	286.78	146.43	122.17
1980	154.94	258.37	376.15	481.72	495.24	613.44	576.85	507.85	407.61	254.63	158.44	136.21
1981	166.37	218.46	344.97	455.66	619.18	659.56	574.10	493.02	406.65	254.24	170.19	143.39
1982	160.65	225.74	351.75	455.16	466.89	553.05	572.23	451.49	374.38	286.27	200.06	137.92
1983	152.99	245.28	373.69	440.84	550.93	570.71	618.71	510.54	381.17	246.10	177.68	141.21
1984	166.12	256.20	326.65	465.07	517.72	521.46	527.37	468.22	403.96	265.86	188.65	138.46

ADDENDUM

Storm by storm acute copper concentrations in simulated pond.
Aiken County, South Carolina, Lakeland sand soil

Probability	--- Without Background ---			---- With Background ---		
	Maximum	48 hr	96 hr	Maximum	48 hr	96 hr
%	ppb - Cu					
2.97	10.2	9.7	9.2	12.2	11.8	11.5
2.78	27.6	27.0	25.6	13.2	12.6	12.2
2.58	28.9	27.2	26.9	13.2	12.6	12.2
2.38	29.4	28.8	28.4	13.6	13.0	12.5
2.18	29.5	28.9	28.4	14.7	13.9	13.3
1.98	31.0	29.7	28.7	17.4	16.1	15.1
1.79	34.1	33.3	32.7	18.7	17.2	16.0
1.59	36.3	34.8	33.6	20.9	19.0	17.6
1.39	48.2	44.9	42.4	29.0	25.7	23.2
1.19	54.2	49.2	45.3	39.0	34.0	30.1
0.99	82.2	70.5	60.2	50.2	43.3	37.9
0.79	83.2	75.0	66.3	57.9	49.7	43.3
0.60	83.8	75.3	68.6	79.1	67.2	58.0
0.40	87.4	75.5	69.9	87.4	74.1	63.8

48 hr and 96 hr means calculated assuming a first order decay process
with an 85.3 hour half-life.