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Evapotranspirative Controls in a Low Arctic Tundra Environment, Daring Lake, NWT, Canada

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EVAPOTRANSPIRATIVE CONTROLS IN A LOW ARCTIC TUNDRA ENVIRONMENT, DARING LAKE, NWT, CANADA.

by

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ABSTRACT

Determining the extent to which changes in vegetation assemblages influence evapotranspiration in the Arctic could potentially contribute to a more realistic estimation of evaporation in a warming climate.

This project aims to determine whether variations in PET and AET rates measured at six tundra vegetation communities can be attributed to the differing vegetation. This will provide a more realistic estimate of change in the water and energy cycles, as well as evaporative processes for a warmer future, caused by enhanced global warming. Predictions of temperature and precipitation regarding future climates in Canada's Western low Arctic vary greatly. The majority of existing Global Climate Models, regardless of predicted precipitation increases, indicate that the moisture deficit in the Canadian Arctic will grow, due to an increase in evaporation.

Weighted mean AET was estimated for the year 2040 using four scenarios detailing differing changes in mean summer air temperature and soil moisture. Given a new distribution of plant communities, it was found that any differences in mean temperature produced negligible effects on forecast ET, whereas an increasing soil moisture deficit lead to lower ET.

Evapotranspiration was estimated using field data obtained at Daring Lake, NWT, between June 21 and August 18, 2006. Potential evapotranspiration (PET) was quantified using the Priestly-Taylor method. Results ranged varied between 2.2 and 5.6 mm/day.

and varied between sites. Actual evapotranspiration (AET) was quantified using a series of lysimeters in five different vegetation communities. Lysimeter results ranged between 1.3 and 3.2 mm/day. Using an ICONOS imaging map of the Daring Lake region **(Figure 3.6)**, coverage was estimated each sampled vegetation community and a weighted mean AET for the Daring Lake Study Site was calculated: 2.2 mm/day.

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"Glory consists not in never falling, but in rising every time we fall."

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CHAPTER 1 - INTRODUCTION

1.1 – INTRODUCTION:

Evapotranspiration plays a crucial role in the water cycle and an important role in energy balances, climate, and the ecosystem. However, within the context of the hydrological cycle, evapotranspiration can be difficult to quantify, despite the existence of multiple methods to do so.

The study of evapotranspiration in Arctic ecosystems is especially important, because an increase in evapotranspiration is expected to coincide with the gradual warming of the climate in this region. Version 3.6 of the Canadian Regional Climate Model predicts a new mean annual air temperature between -6°C and 0°C, average annual precipitation rate of 1.0-2.0 mm/day, and evaporation rate of 1.0-2.0 mm/day for the Daring Lake region by 2040. Before forecasting future conditions it is necessary to quantify the present rate at which water is lost to the atmosphere via evapotranspirative processes in Low Arctic environments where long-term hydrological and climatological records do not exist. The expectation that many vegetation species will shift northward, changing vegetation assemblages is also key to the process of evapotranspiration in such a sensitive environment. Determining the extent to which changes in vegetation assemblages will influence evapotranspiration in the Arctic could potentially contribute to a more realistic estimation of evaporation in a warming climate.

One of many commonly "expected" results of climate change is a northward surge of the boreal forest eco-zone. However, if this change does take place, it will not be immediate. Given the time lags (generally >50 years) required for the establishment and growth of tree seedlings in areas north of the arctic tree line (Chapin et al., 1999; Chapin and Starfield, 1997), the expected change should be gradual. However, often neglected is the topic of vegetation changes within established communities in the Arctic. For example, an increase in vegetation density within existing vegetation communities could produce changes in surface forcing sufficient enough to affect the regional climate of northern land areas during summer (Chapin et al., 1999).

In the low Arctic, evapotranspiration occurs during the brief snow-free period, when vegetation is available to interact with the atmosphere, free of limiting factors such as temperature, snow cover, or available sunlight. In summer the energy supply to the arctic climate system is controlled by absorbed solar radiation (Chapin et al., 1999), the main control on the water cycle and hence on evapotranspirative processes.

Since this is a region where evapotranspiration is poorly quantified under present climatic conditions, there exists a need for further emphasis on the quantification of evapotranspiration in the Arctic tundra in order to predict the potential impacts of climate change on the region's water resources. Additional incentives for this research are the expanding demand for material resources which occur naturally in these regions, and the associated need to quantify these anthropogenic impacts on the hydrological cycle, such that anthropogenic and climatic stresses will still yield water resources sufficient in quantity and quality to meet the societal and economic needs of this region.

For example, mining has been, and remains, an important and expanding sustainable development issue in northern Canada (Gibson et al., 1998). Three diamond mines have recently opened within the Northwest Territories, and exploration for further mining continues throughout the Arctic. Tailings ponds are a common approach to the storage and treatment of waste water from mining operations, prior to its release into nature. Once the extraction of resources ceases, tailings ponds are commonly abandoned and then allowed to resume a natural hydrological balance (Gibson et al., 1998). Ideal construction of a tailings pond will ensure that all surface or subsurface inflows are equaled, or exceeded, by evaporation losses (Gibson et al., 1998). Ideally, this prevents surface outflow of contaminated water. Proper mine-site water management can prevent uncontrolled releases of potentially contaminated waters and can help minimize acid-rock drainage potential (Reid, 2004).

With the opening of several diamond mines in the region this past decade, the issues of sustainable operation and environmentally sound decommissioning are extremely important. Climate data, including air temperature, precipitation and evaporation are necessary for assisting in the designing of water management facilities at mine sites, assessing the operations of mine tailings containment areas, and determining the long-term stability of tailings areas for mine site restoration and abandonment (Reid, 2004).

Therefore, in order to ensure the proper operation and abandonment of mines in an environment as fragile and remote as the tundra of the Northwest Territories, an understanding of the local hydrology, climate, and vegetation is essential. Unfortunately, due to the remoteness of these areas, long-term climate and hydrological records are extremely scarce spatially and temporally, due to the remoteness and expense of obtaining and maintaining consistent and reliable records.

Records detailing hydrological processes such as evapotranspiration are even less common. Quantifying evapotranspirative water loss requires the measurement of multiple environmental and meteorological variables and parameters. This data is then used to calculate evapotranspiration using one of many universally utilized and accepted empirical formulas.

The purpose of this project is to determine the extent to which differing vegetation communities influence evapotranspiration temporally and spatially in a low Arctic tundra environment. This will provide a more realistic estimate of change in the water and energy cycles, as well as evaporative processes for a warmer future, caused by enhanced global warming. Predictions of temperature and precipitation regarding future climates in Canada's Western low Arctic vary greatly. The low Arctic is generalized as the zone immediately poleward of the tree-line, which is composed of relatively lush tundra vegetation (Rouse, 1990). However, the majority of existing Global Climate

Models, regardless of predicted precipitation increases, indicate that the moisture deficit in the Canadian Arctic will grow, due to an increase in evapotranspiration.

As vegetation assemblages shift poleward due to enhanced global warming, transpiration rates will change. The degree of control exerted by vegetation communities on spatial and temporal variability in evapotranspiration will be determined through the observation and examination of differences in evapotranspiration throughout various vascular and non-vascular vegetation assemblages.

1.2 - HYPOTHESIS:

It is hypothesized that vegetation communities are the primary influence on spatial and temporal variations in evapotranspiration. The main objective of this thesis is to address the degree to which different vegetation communities influence evapotranspiration. This will be accomplished by comparing evapotranspiration values calculated using lysimeters and the Priestly-Taylor model of evapotranspiration. Values and parameters being measured for use in these empirical models are outlined below. In this study, the term "vegetation community" is defined on a local scale, approximately 100 to 500 m^2, as an area dominated by two or three specific species.

CHAPTER 2 – LITERATURE REVIEW:

2.1 – ARCTIC ENERGY BALANCE AND EVAPOTRANSPIRATION:

2.1.1 - Water Balance:

The water balance equation is the most basic mathematical description of how the water cycle functions. Precipitation is described as the sum of runoff, evaporation, interception, transpiration, and storage. Given **Equation 2.1**, precipitation represents the main input, and all other terms represent outputs or losses of water for a given point on the Earth's surface. It is assumed that the water cycle is a closed system. Thus, precipitation (P) reaches the Earth's surface and is divided between runoff (R), evaporation (E), interception (I), transpiration (T), and storage (ΔS):

$$\mathbf{P = R + E + I + T \pm \Delta S} \qquad \mathbf{(2.1)}$$

In general, evaporation is the change in state from liquid to gas, and its release into the atmosphere as water vapour. Water may also change from solid to gas and move into the atmosphere by the process of sublimation. This is especially noteworthy, since there are snow and ice present at the Daring Lake study site for most of the year. For the purpose of this study, sublimation will be included within the term evaporation. For evaporation to occur requires an energy input, vapour pressure gradient, and exchange mechanism, such as advection or convection. Evapotranspiration (ET) is the term used to describe the combined losses to the atmosphere through interception, evaporation, and transpiration (Black, 1991). It is described as:

$$ET = E + I + T \tag{2.2}$$

Interception is the process by which the downward movement of water is interrupted and redistributed by some obstructing surface. The most common obstacle is the presence of vegetation. Precipitation becomes trapped by a vegetation layer, and eventually evaporated directly back into the atmosphere, disconnecting or decreasing the atmosphere-soil connection for incoming water. This is why the term interception also applies to the amount of water lost through the evaporative process following precipitation (Black, 1991).

Transpiration describes water movement through the stomata and tissue of vascular plants, into the atmosphere. Water moves from the soil and roots via the plant's internal moisture supply system, then through the stomata to the atmosphere. Vascular plants consist of leaves, roots, and a vascular system consisting of two conducting systems and tissues; phloem, the food conducting system and xylem, the water conducting system. The term stomata refers to the minute openings in leaves, mostly on their undersides, that allow the passage of oxygen, carbon dioxide, water vapour, and other gases (Black, 1991). The majority of water vapour is lost through the stomata, via stomatal respiration, with the leaves being normally the principal transpiring organs (Hufford, 1978). Transpiration can also occur through the cuticles. This is known as cuticular transpiration. Even though the cuticle is composed of a waxy substance, water vapour and other gases will still move through it (Hufford, 1978). Transpiration is governed by the same environmental processes and influenced by the same factors that dictate evaporation. Often, transpiration is modified by the nature of the evaporating surface and characteristics of the vegetation through which transpired water moves and is stored (Black, 1991). Plants can control transpiration by closing stomata, which inhibit vapour transfer from the leaves to the ambient air (Ventura et al., 1999). When the stomatal closure resulting from a water stress occurs, the transpiration rate reduces, and foliage temperature rises due to a decrease in energy dissipation (Lhomme and Monteny, 2000). The opposition to the release of water vapour through the stomata is defined as stomatal resistance. Non-vascular plants, such as lichens, lack leaves and a vascular system.

Water transpired from plants in an Arctic tundra environment originates from the seasonally frozen active layer. After water uptake through the roots of a plant, it is transported to the leaves through the xylem. The water is then transpired through the stomata of the leaves and evaporates into the atmosphere. Due to the expected large ratio of evaporation flux over water in leaves, it is generally assumed that leaf water is always near isotopic steady state with respect the ambient environmental conditions (Wang and Yakir, 2000).

All of these processes describe the actual evapotranspiration (AET) from a surface, which is the actual amount of moisture that can be evapotranspired, given measured constraints on soil moisture. Thus, AET is a representative of unsaturated conditions. Potential evapotranspiration (PET) is described as the maximum rate of evapotranspiration from a vegetated surface under the condition of unlimited moisture supply, and without heat advection or storage effects (Petrone et al., 2006; Jacobs et al., 2002; Thomas, 2000). Thus, given meteorological conditions, PET represents the maximum possible amount of water that can be evapotranspired from a unit of surface, consisting of soil and vegetation.

2.1.2 - Radiation Balance:

Water molecules involved in the process of evapotranspiration can originate from recent precipitation events, from vegetation, or from storage sources, such as lakes and ground water. Evaporation requires the presence of available water as previously listed, and an energy source to initiate the process (heat source or incoming short-wave radiation). The solar and long-wave radiation absorbed at the surface can be partitioned into three energy fluxes: sensible, latent, and ground heat.

As radiation moves through the atmosphere travelling toward the Earth's surface, it can be reflected back into space by obstacles such as clouds. When radiation reaches the surface, it can either be reflected or absorbed, depending on the albedo of the ground surface. The Earth's surface is a source of long wave radiation, as it emits energy previously absorbed from the sun, back into the atmosphere. Of what is emitted by the Earth's surface, some will continue off into space, whereas some will remain in the atmosphere, due to the absorption by greenhouse gasses. This balance of radiative and thermal energy at the surface can be represented by the surface energy balance, which is mathematically expressed as follows using **Equation 2.3**:

$$Q^* = Q_H + Q_E + Q_G \quad [W/m^2] \qquad (2.3)$$

where Q^* represents the total net radiation (energy available), Q_H represents energy allocated to sensible heating (manifested by temperature changes), Q_E represents energy allocated to latent heat (manifested by phase changes), including energy released during the freezing process, and Q_G represents heat exchange with the subsurface. The partitioning of energy at the surface into Q_H and Q_E is affected by many surface properties, including albedo, roughness, soil moisture or surface wetness, leaf area index, and canopy conductance (Bartlett et al., 2003). The portion of Q^* consumed by Q_G depends upon the presence or absence of permafrost (Rouse, et al., 1998), and is a function of air temperature, surface wetness, and thermal conductivity of the subsurface, as expressed in **Equation 2.4**:

$$Q_G = -k \, \Delta T / \Delta Z \quad [W/m^2] \qquad (2.4)$$

where k is the thermal conductivity of the substrate [W/m °K], which is a function of moisture content, ΔT is the change in substrate temperature [°K] over a depth of ΔZ thickness [m]. Thermal conductivity will vary depending on soil water content, and soil type. Given the higher thermal conductivity of water, ground heat flux is higher under saturated conditions. Oke (1987) lists a thermal conductivity value of 0.30 W/m °K for dry sandy soil with a porosity of approximately 40%. That value jumps to 2.20 W/m °K when saturated. Likewise, the thermal conductivity of clay soil with a porosity of approximately 40% is 0.25 W/m °K when dry, and 1.58 W/m °K when saturated. Peat soil, with an approximate porosity of 80%, is assigned a thermal conductivity of 0.06 W/m °K when dry, and 0.50 W/m °K when saturated.

By day when $\Delta T/\Delta Z$ is negative, the surface is warmer than the deeper soil, and the equation gives a positive value of Q_G (Oke, 1987), which indicates the ground is absorbing radiation, rather than losing it to the atmosphere. Because tundra is typically underlain by permafrost, the ground heat flux is usually large relative to non-permafrost terrain (Rouse et al., 1998). This is especially more noticeable in ice-rich soils, due to steep temperature gradients between the ground surface and frost table (Rouse et al., 1998).

Thus, the ground heat flux is an important factor in the hydrological regime, since it acts as the main energy source for melting the permafrost active layer (Rouse, 1990). However it is not the only energy source, as rainfall also contributes energy which leads to melting permafrost in the active layer. The proposed study site here is in the zone of continuous permafrost, so the presence of permafrost is assumed in all instances except for unfrozen taliks occurring beneath larger, deeper lakes. Permafrost soils can complicate the ground heat flux during melt and freeze back periods due to the large contribution of the latent heat of fusion (Petrone et al., 2000). Q_G can be subdivided into the storage of sensible heat, and the storage of the latent heat of fusion in the ground ice (Rouse, 1990). The ground heat flux can be large in ice-rich permafrost and in early summer competes with evaporation for the available energy. This competition decreases as the summer progresses (Rouse, 2000). However, the Daring Lake study site contains permafrost that is not considered ice-rich.

In general, the exchanges of energy and water between a surface and the atmosphere are strongly influenced by surface characteristics (Bartlett et al., 2003). The most important surface condition is albedo. The higher the albedo, the more incoming short-wave radiation is reflected away from the surface. Since available energy is a function of radiation, the surface energy balance can also be expressed using albedo, short and long wave radiation:

$$\mathbf{K9\,(1-\alpha)+L^{*} = Q_H + Q_E + Q_G \quad [W/m^2]} \qquad \mathbf{(2.5)}$$

The partitioning of the available energy (Q^*-Q_G) into Q_E and Q_H depends on soil moisture supply, atmospheric demand, and the surface and aerodynamic resistances to evapotranspiration (Rouse et al., 1998). Naturally, the availability of water for evapotranspiration governs the relative importance of sensible versus latent heat, with the ratio of these two fluxes referred to as Bowen's ratio (Turcotte, 2002). If the Bowen Ratio is greater than one, Q_H is larger than Q_E as a channel for dissipating heat (Oke, 1987). Since Q_H represents the majority of the heat convected into the atmosphere, it can be assumed that climate is likely relatively warm and surface water is of limited quantity. If a surface is wet, Q_E prevail over sensible heat, due to evaporation. In this instance, Q_E represents the evaporation rate which would occur if the surface was brought to saturation and the atmospheric parameters and the energy supply to the surface were held constant (Granger, 1989a). If a surface is dry, little or no Q_E occurs, due to the presence of little if any evaporation. Ergo, sensible heat prevails, meaning Q_E is larger than Q_H. This will not directly contribute to warming of the lower atmosphere, but may increase its humidity (Oke 1987). A negative Bowen Ratio indicates fluxes occurring in opposing directions. This is normally the case at night, when Q_H is downward, but evaporation may continue into the atmosphere at very low rates.

All significant energy fluxes in tundra environments occur during a brief period of four months, lasting from early-June to early-October (Rouse et al., 1998). The one exception to this statement is the heat release by freezing soils during the early winter period (Rouse et al., 1998). The energy balance of the dry snow period is dominated by net radiation as a main source and the sensible heat flux as a main sink (Ohmura, 1984). During winter, Q* is reduced by a high snow albedo, reflecting about 80% of K9, and by a net loss of long-wave radiation (L*) to the cold atmosphere (Woo, 1983). Since the dry snow period lasts for approximately eight months of the year, snow plays a dominant role in Arctic hydrology, with surface energy providing the driving force to generate snowmelt, evaporation, and the annual thawing of the active layer (Woo, 1983). Typically, Snowmelt begins in late May or June, and the melt within a basin is complicated by the uneven thickness of the pack (Woo, 1983). The melting water draining through the snow cover transports heat efficiently to the surface of the soil, causing a sudden increase in soil temperature (Ohmura, 1984). When the shallower snow disappears, the frozen ground in the snow-free areas begins to thaw and to lose water through evaporation (Woo, 1983). During the short melt, the albedo of the surface decreases from approximately 78% to 10% (Ohmura, 1984), and the heat of fusion is the largest energy sink, consuming 31%, followed by Q_H (28 %), Q_E (24 %), and Q_G (14 %), as discovered by Ohmura (1984) on Axel Heiberg Island. Q* is negative through the long winter, and it seldom becomes positive until late May, long after daylight has returned to the Arctic (Woo, 1983), and snowmelt is occurring. Since Arctic tundra covers such a large area, melt times will vary, and are dependent on latitude and local climate conditions. Generally, Q_E and Q_H will decrease with increasing latitude, as a response to decreasing Q* (Rouse, 1990). Observations at more southerly tundra sites in the Hudson Bay Lowlands, near Churchill, Manitoba, as documented by Rouse (2000) indicate that during May, the ground began to take on heat (positive Q_G) in spite of subfreezing temperatures, once Q* became positive.

After the final departure of the snow in spring, there is an increase in net radiation, evaporation and ground heat flux (Rouse, 2000). The summer is when regional climates within the Arctic become distinctive, and latent heat of vapourization becomes the most dominant energy sink (Ohmura, 1984). The heat balance of this period contains important information for understanding the causes of this regional climatic differentiation of the Arctic in summer (Ohmura, 1984). Since snowcover is gone, soil water is available for evaporation into the atmosphere. The resulting increase in Q*, high $K\uparrow$, and sharp decrease in K9 create ideal conditions for evapotranspiration to occur. During summer in the Hudson Bay Lowlands, positive Q_G is large and accounts for 20% of the energy of Q*. Much of this heat energy is used in melting the ground ice of the wetland (Rouse, 2000). Farther north on Cornwallis Island, Marsh et al. (1981) observed that a maximum of 60% of Q* was used in evaporation, and this fell below 5% on frequent occasions at the different sites (Marsh et al., 1981). Total evaporation during the snow-free period accounts for the major part of the annual total evaporation of the tundra (Ohmura, 1982).

2.2 – APPROACHES TO MEASURING EVAPOTRANSPIRATION:

2.2.1 - Lysimeters:

A lysimeter is a true water balance device, which hydrologically isolates a volume of soil and its plant cover (Oke, 1987). It represents an artificially enclosed volume of soil that can be placed in the field with representative soil and/or vegetation (Brutsaert, 1988). When using weighing lysimeters, small areas of ground are soil and vegetation are hydrologically isolated from the surrounding soil and weighed continuously to determine the loss of water from the isolated body (Boast and Robertson, 1982). Any changes in the lysimeters mass (storage) must be related to the mass flux of water to or from the atmosphere (Oke, 1987). Because precipitation, representing the mass flux of water from the atmosphere into the lysimeter, is measured, and net runoff and lateral groundwater flow are negated, any changes in its mass are attributed to evapotranspiration.

There is a distinction between the amount of water that actually transpires and evaporates (AET) and that which would transpire and evaporate if it were available (PET) (Granger, 1989a; Thornthwaite, 1948). When water supply increases, ET rises to a maximum that depends only on the climate (Granger, 1989a; Thornthwaite, 1948). Actual evapotranspiration (AET) values can be measures by weighing the contents of each lysimeter, and comparing the weights to those of the previous day, while accounting for precipitation and drainage. Potential evapotranspiration (PET) values can be measured by weighing the lysimeter contents each day, before saturating its contents, and allowing it to drain to field capacity. Theoretically, the lysimeter mass field capacity should be the same over time, as it simulates the evaporation rate which would occur if the surface was brought to saturation (Granger, 1989a).

One of the drawbacks regarding use of lysimeters is the fact that it can disturb study sites, due to the removal of soil and plant material. In order to maintain the same mechanical properties of the soil, contents should be placed inside the lysimeter as a monolith, or undisturbed block. Mirroring the natural conditions observed outside the lysimeters is quite difficult, due to disturbance of the soil and conduction of heat by the lateral walls (Boast and Robertson, 1982). To overcome this challenge, more frequent measurements are required of not only the weight of the lysimeter, but also the volume of percolated water and water input (i.e. precipitation) into the system (Petrone et al., 2006). The validity of lysimetric methods hinges on whether the evaporation from the isolated body of soil is essentially the same as from a comparable non-isolated body (Boast and Robertson, 1982).

2.2.2 - Priestly-Taylor:

The Priestly-Taylor model is classified as a radiation-based approach to estimating evapotranspiration (Petrone et al., 2006), since net radiation and air temperature are used to determine the amount of moisture being evapotranspired. Priestly and Taylor (1972) state that the partitioning of energy between sensible and latent heat fluxes will be governed by the dryness of the surface and the surface temperature (Granger, 1989a).

It is calculated by following **Equation 2.6**:

$$E = \alpha \; [\Delta / (\Delta + \gamma)] \; (Q^* - Q_G) \; [mm] \qquad (2.6)$$

Several terms in **Equation 2.6** are used for the purposes of simplification. The α-term represents the ratio of actual evapotranspiration (AET) versus potential evapotranspiration (PET). It has been normal practice, when a PET parameter was adopted or defined, to establish an empirical relationship between it and the AET rate for the given conditions (Granger, 1989a). When AET and PET are equal, $\alpha = 1$. The constant $\alpha = 1.26$ is used for subarctic regions (Gibson et al., 1996), as a universal generalization, although 1.26 is the value that Priestly and Taylor (1972) consider to represent PET (Stewart and Rouse, 1976). It is also hypothesized that if there are no soil moisture restrictions, α should remain relatively constant (Stewart and Rouse, 1976). The sensitivity of PET from different terrain units to changes in net radiation and temperature varies substantially (Rouse, 2000). The concept of PET was first developed as a climatic index (Granger, 1989a), is calculated from atmospheric variables (Granger and Gray, 1989).

Δ represents the slope of the temperature-saturated vapour pressure curve. It is an expression relating the daily average temperature, and the saturation vapour pressure at that temperature. It is calculated using **Equation 2.7**, and is expressed in units of pascals per degree Kelvin (Pa/°K).

$$\mathbf{\Delta = 4098\ e_s / (237.2 + T)^2 \quad [Pa/^oK]} \qquad \mathbf{(2.7)}$$

A non-saturated surface is characterized by the fact that water pressure at the surface is less than the saturation vapour pressure at the surface (Granger and Gray, 1989). As a surface dries, the decrease in AET is accompanied by an equal, but opposite, change in PET (Granger, 1989b), due to the decrease in Q_G, resulting from the fact that the thermal conductivity of a dry surface is much less than that of a saturated surface. The term e_s represents saturation vapour pressure in pascals, and can be calculated using **Equation 2.8**. T represents air temperature in degrees Celsius.

$$\mathbf{e_s = [0.6108 * e\ (17.27T / T + 237.3)]\ * (1000\ Pa/kPa) \quad [Pa]} \qquad \mathbf{(2.8)}$$

The psychrometric constant, γ, represents the ratio of the heat capacity of air (12000 J/m^{3}K), to the latent heat of vapourization calculated for the mean daily air temperature, and is expressed in units of kg/m^3 °K. It is calculated using **Equation 2.9**:

$$\mathbf{\gamma = c_p\ \rho_a / (0.622\ L_v) \quad [kg/m^3\ ^oK]} \qquad \mathbf{(2.9)}$$

The mean density and specific heat of air are represented by, ρ_a (1.22 kg/m^3) and c_p (1.005 kJ/kg ^{o}K) respectively. L_v represents the latent heat of vaporization at temperature T (^{o}C), as calculated using **Equation 2.10.** In this study, T represents the mean daily air temperature (^{o}C).

$$L_v = 2.501 \times 10^6 - 2370T \text{ [J/kg]} \qquad (2.10)$$

The Priestly-Taylor formula, **(Equation 2.6)** can also be expressed as a function of latent heat equivalents, as seen in **Equation 2.11**, and the latent heat equivalent (W/m^2) can be calculated using **Equation 2.12**:

$$E \text{ [mm/d]} = Q_{Eeq} \text{ [W/m}^2\text{]} * (1/L_v) \text{ [J/kg]} * (1/\rho_w) \text{ [m}^3\text{/kg]} * 8.64 \times 10^4 \text{ [s/d]} * 1000 \text{ [mm/m]} \qquad (2.11)$$

$$Q_{Eeq} = (\Delta / \Delta + \gamma) * (Q^* - Q_G) \quad \text{[W/m}^2\text{]} \qquad (2.12)$$

where L_v is the latent heat of vapourization, ρ_w is the density of water, and Q_{Eeq} is the latent heat equivalent.

2.2.3 – Other Methods:

Thornthwaite's approach is widely employed, and estimates potential evapotranspiration over a one-year period using mean monthly and annual temperature value. Annual and monthly budgeting can be useful due to minimizing the influence of the change of storage in soil moisture (Black, 1991). However, the influence of vegetation is not considered, nor are several other factors pertinent to the occurrence of evaporation and evapotranspiration. Other factors not considered include advection, vapour pressure gradient, and soil moisture.

The Penman-Monteith model is perhaps the most widely recognized and used mathematical model for predicting potential evapotranspiration. It is based on the big-leaf concept, and can be used successfully estimate evapotranspiration of relatively homogenous dense canopy, which is mostly represented by the transpiration term (Novak, 1998). Aside from the assumption of constant monthly conditions, estimation of canopy resistance is a weak point. Overall, this approach gives results close to real values, but it is applicable mostly to dense and homogenous canopies (Novak, 1998).

The partitioning of evapotranspiration into its respective fluxes, evaporation and transpiration, can be achieved through the examination of stable isotopes of hydrogen and oxygen in evapotranspired water vapour. Specifically, the ratios of ^{2}H : ^{1}H and ^{18}O : ^{16}O are pertinent in determining evaporation. Fractionation of water in the hydrological cycle arises because of differences in the behaviour of water molecules containing various combinations of the naturally occurring stable isotopes of hydrogen and oxygen (Edwards et al., 2004). During evaporation, the lighter isotopes (^{1}H and ^{16}O) are preferentially evaporated, leaving the source water comparatively enriched in the heavier isotopes (^{2}H and ^{18}O). This process is known as kinetic fractionation. Kinetic fractionation is unidirectional, and is humidity dependant. Equilibrium fractionation occurs at the boundary layer, where the air is saturated. It is temperature dependant, and involves isotopic exchange reactions between liquid water and water vapour at a rate where equilibrium is maintained. The liquid water will be enriched in the heavier isotopes, ^2H and ^{18}O, since it represents the lower state of energy. The evaporative process involves both types of fractionation, whereas precipitation undergoes equilibrium fractionation only.

2.3 – CLIMATE CHANGE IMPLICATIONS:

General circulation models project that increased concentrations of CO_2 and other greenhouse gases in the atmosphere could lead to a rise in the global mean air temperature of between 0.9 and 3.5°C by the year 2100, with the largest temperature rise occurring in the Arctic (Houghton et al., 1996). As mentioned in Chapter 1, predictions for the Daring Lake region include an increase in mean annual air temperature from the present value of approximately -8.9°C to a new value, between -6°C and 0°C by 2040. Average annual precipitation reported by surrounding stations is presently between 250 and 300mm. As a result of warming, an increase in the contribution of rain to that mean is likely. Rainfall will be difficult to estimate spatially, due to an expected increase in localized convective storms, associated with a warmer, more active atmosphere.

Warmer summer temperatures will likely result in higher evapotranspiration (Eaton and Rouse, 2001). The forecast rate of 1.0-2.0 mm/day, 365-700mm/year is a significant increase regardless of location within that range. The evapotranspiration rate is expected to increase to 1.0-2.0 mm/day by 2040. Since evapotranspiration consumes the largest portion of the available summertime energy, and is the largest component of the summertime water, changes to evapotranspiration resulting from climatic warming are likely to have substantial effects on ecosystem function (Eaton and Rouse, 2001). Therefore it is important to identify the controls on evapotranspiration in order to improve our understanding of and to better project climate changes associated with global warming (Eaton and Rouse, 2001).

Changes brought on by global warming are said to include an increase in extreme events, including synoptic scale events such as severe droughts, warm spells, and storms. Evidence suggests that wetland tundra is more sensitive to synoptic scale variability than wetland subarctic forests, since their lack of a canopy means they are more exposed to the atmosphere. If the climate were to become warmer and drier, there would be a greater increase in evapotranspiration from tundra than from forest (Rouse, 2000; Lafleur & Rouse 1995). The Arctic, including Daring Lake, contains wetlands and peatlands whose roles and significance are not fully understood. High-latitude wetlands favour organic soil development and are thus normally peatlands (Rouse, 2000). Climate is a controlling factor in the development of peat-dominated wetlands, since the formation of peat occurs more rapidly in warmer climates where the snow-free season is longer. The organic soils, in turn, export important controls on the surface vegetation and climate through their high porosity and large water (ice) contents (Rouse, 2000). Summertime energy and water balances of high-latitude wetlands can vary dramatically among years in response to changing hydroclimatological conditions (Eaton and Rouse, 2001).

CHAPTER 3 - STUDY SITE

3.1 - GENERAL:

The Daring Lake study site lies within the Coppermine River basin, which extends approximately 520 kilometres from the headwaters of Lac de Gras (Turcotte, 2002), and flows north-northwesterly, emptying into the Arctic Ocean at the Coronation Gulf, near Kugluktuk, Nunavut.

The Tundra Ecosystem Research Station (TERS) is located at 64°52'N, 111°35'W, at an altitude of 420 metres a.s.l., on the north shore of Daring Lake, 50 km west of Broken Hill Proprietary (BHP) Billiton's Ekati Diamond Mine (Matthews and Clark, 2004). It lies on a small peninsula between the lake, and a large sand and gravel esker that runs continuously in an east-west direction for approximately 100 kilometres (Turcotte, 2002; Matthews and Clark, 1996). TERS was established in 1994, with the purpose of providing a base of study and research of the southern low Arctic ecozone (Bean and Henry, 2001; GNWT, 1994), and to facilitate biological research, monitoring and mitigation studies associated with mineral exploration, mine development and associated infrastructure projects in the Lac de Gras area (Matthews and Clark, 2004). It is approximately 350 kilometres northeast of Yellowknife, and approximately 75 kilometres northeast of the treeline. An automatic meteorological station established by the Department of Indian and Northern Affairs Canada (Reid, personal communication, 2006), located 1.4 kilometres east of TERS has been recording data since 1996.

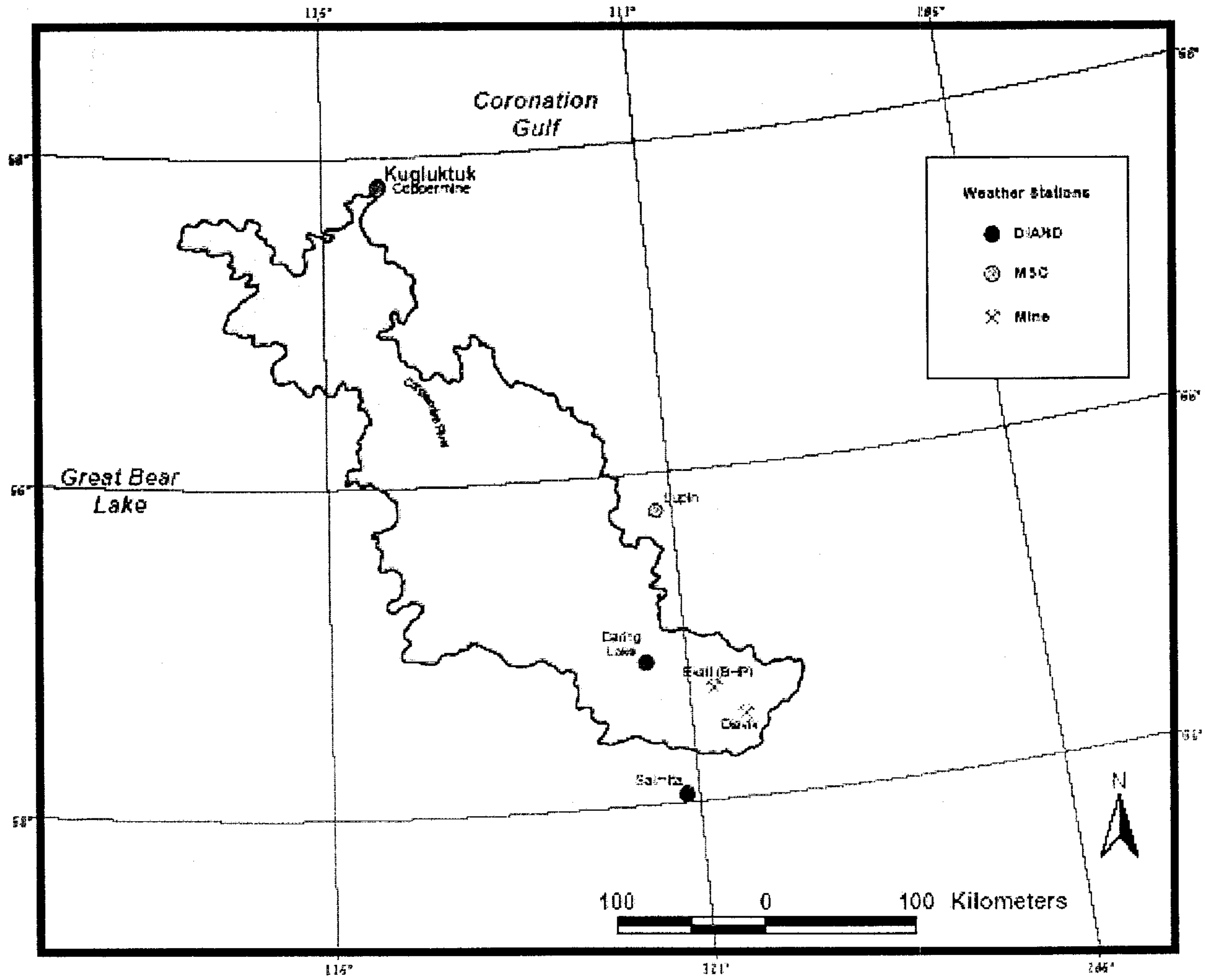


Figure 3.1 –Map of the Coppermine Drainage Basin, Northwest Territories, Canada

(Source: Bicknell and Reid, 2001)

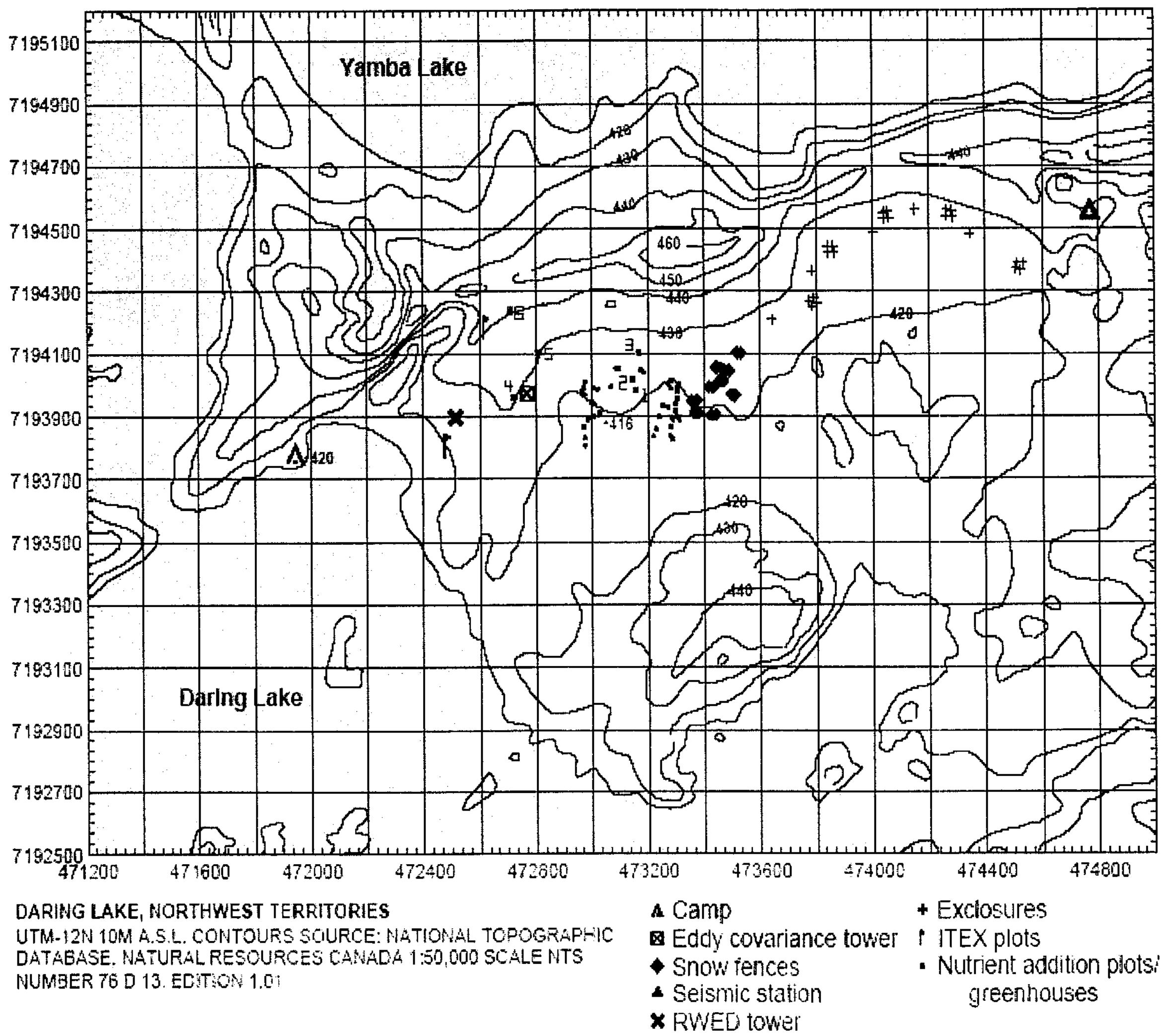


Figure 3.2 – Topographic Map of Daring Lake Showing Study Sites, Northwest Territories, Canada

(Trent Geography Department, 2006)

3.2 - GEOLOGY:

The Coppermine Basin encompasses two geological provinces: the southern Slave Geological Province and the northern Bear Geological Province with a gross drainage area of 50800 km^2 (Turcotte, 2002; Wedel et al, 1988). It is situated between 64°50' and 67°50' north latitude, and 109°30' and 118°20' west longitude, is approximately 520 kilometres in length, and about 100 kilometres wide (Wedel et al., 1998).

The Daring Lake field site is located within the Slave Geological Province. This area of the shield formed 1.8 - 2.8 billion years ago during the Kenoran and Hudsonian orogenies (Harrison, 1994). Most of the Slave Province is underlain by granitic rocks consisting of migmatide, mixed gneiss, banded gneiss, and granitic gneiss (Harrison, 1994). The Slave Geological Province is also home to several kimberlite pipes, which explains why there is great interest in diamond mining within the region. The kimberlite pipes, magmatic intrusions into pre-existing parent rock, formed approximately 50 – 100 million years ago, long after the formation of the Canadian Shield (Harrison, 1994).

The Slave Geological Province was glaciated from the onset on the Wisconsinian Glaciation some 100000 years ago, until approximately 10000 years ago. While de-glaciation was occurring, the resulting sediment-laden meltwater streams formed a whole series of landforms such as eskers, drumlins, and drift deposits (Harrison, 1994). Glacial deposits and rock outcrops are very prevalent in this region, as are numerous lakes. Approximately 28% of the land surface of this region of the low Arctic is covered by freshwater bodies. Till is the most prominent surficial sediment type in the Slave geological province (Dredge et al., 1999). **Figures 3.3 and 3.4** depict the surface geology of the Coppermine Basin. The Daring Lake study site is at the southwest tip of Yamba Lake.

The topography surrounding the Daring Lake field site features generally gently undulating to moderately rugged relief on the order of 10-20 metres (Turcotte, 2002; Dredge et al., 1999). Some eskers in the area are more than 45 metres high and rugged, rocky areas around Yamba Lake have about 50 metres local relief (Turcotte, 2002; Dredge et al., 1999). According to **Figure 3.2,** there exists an extensive esker, between 30 and 40 metres in height, running in an east-west direction along the south shore of Yamba Lake.

3.3 - CLIMATE:

Unfortunately, there are no meteorological stations within 100 kilometres of Daring Lake that have a proper 30-year climatological record.

The station at Lupin, located approximately 100 kilometres north of Daring Lake has a record that dates back to January 1982. Lupin reports a mean annual air temperature of -11.1°C, with January and July being the coldest and warmest months at -30.4°C and 11.5°C respectively (Environment Canada, 2006). Lupin reports a mean annual precipitation of 299.2 mm, 161.1mm or which falls as rain. August is the wettest month with an average of 60.1mm, 56.9mm or which falls as rain. Ekati, which is approximately 50 kilometres east of Daring Lake, has records dating back to February of 1998, lasting

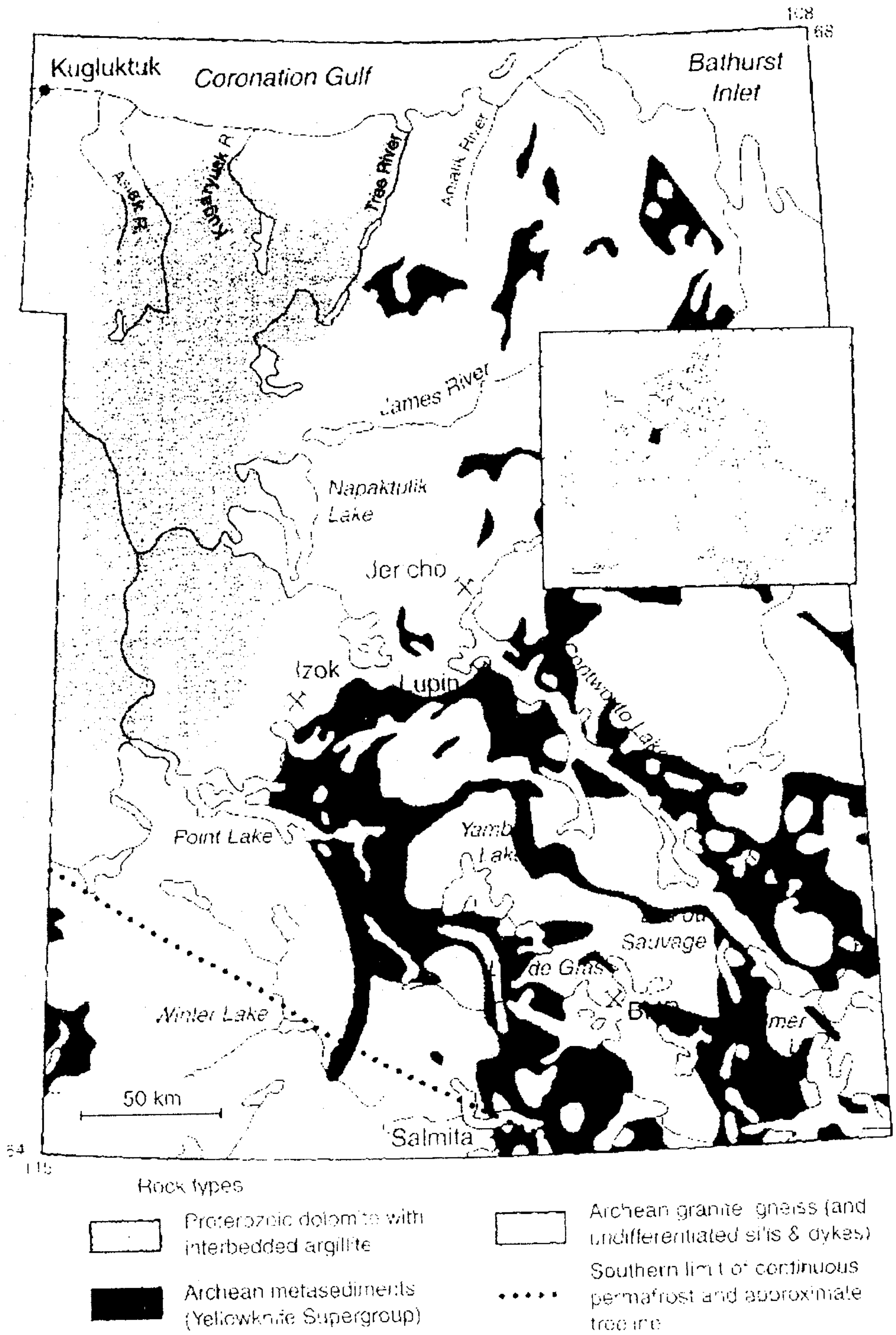


Figure 3.3 - Bedrock distribution in the Coppermine Basin, Northwest Territories, Canada

(Source: Dredge et al., 1999)

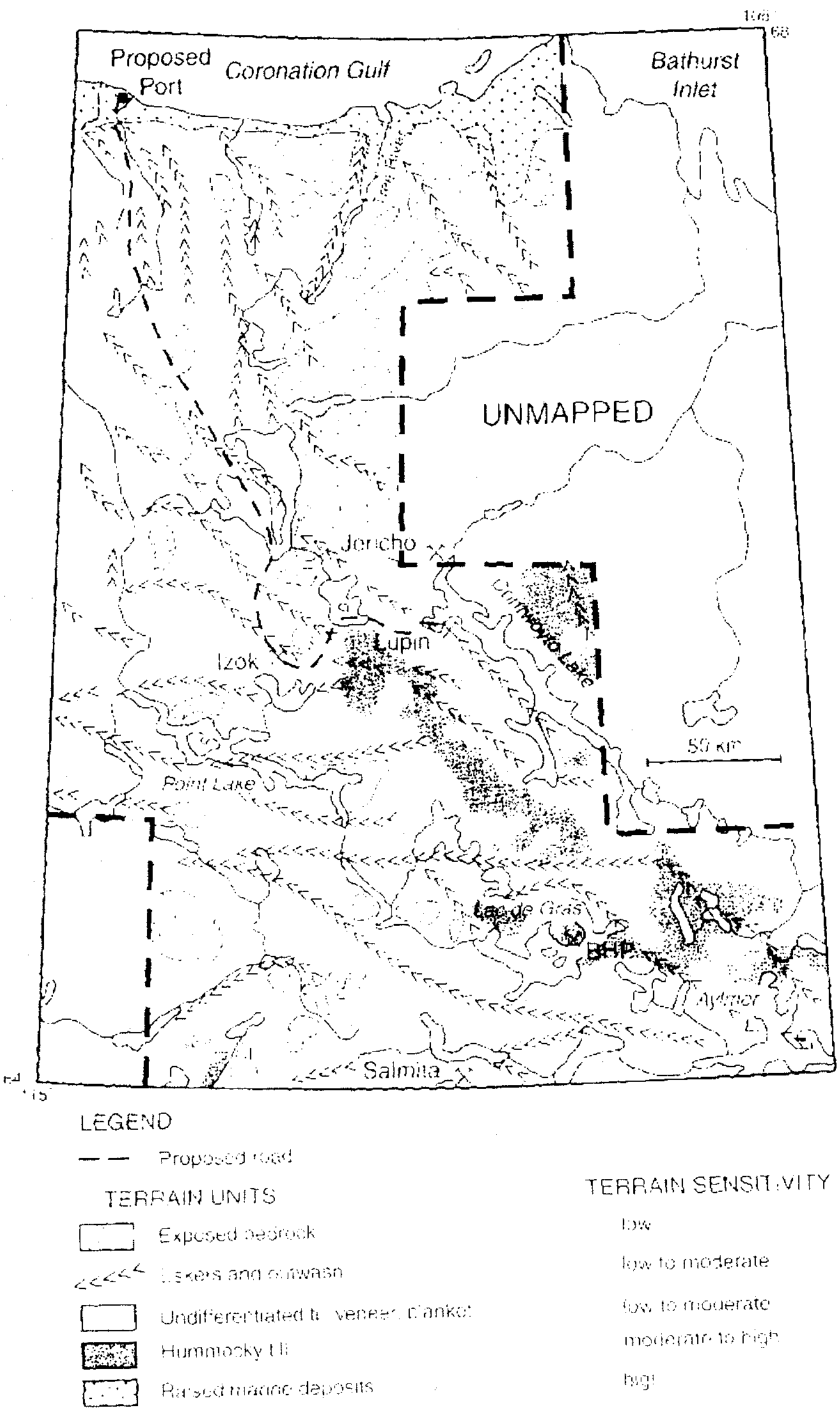


Figure 3.4 - Surficial sediments and ground ice distribution in the Coppermine Basin, Northwest Territories, Canada

(Source: Dredge et al., 1999)

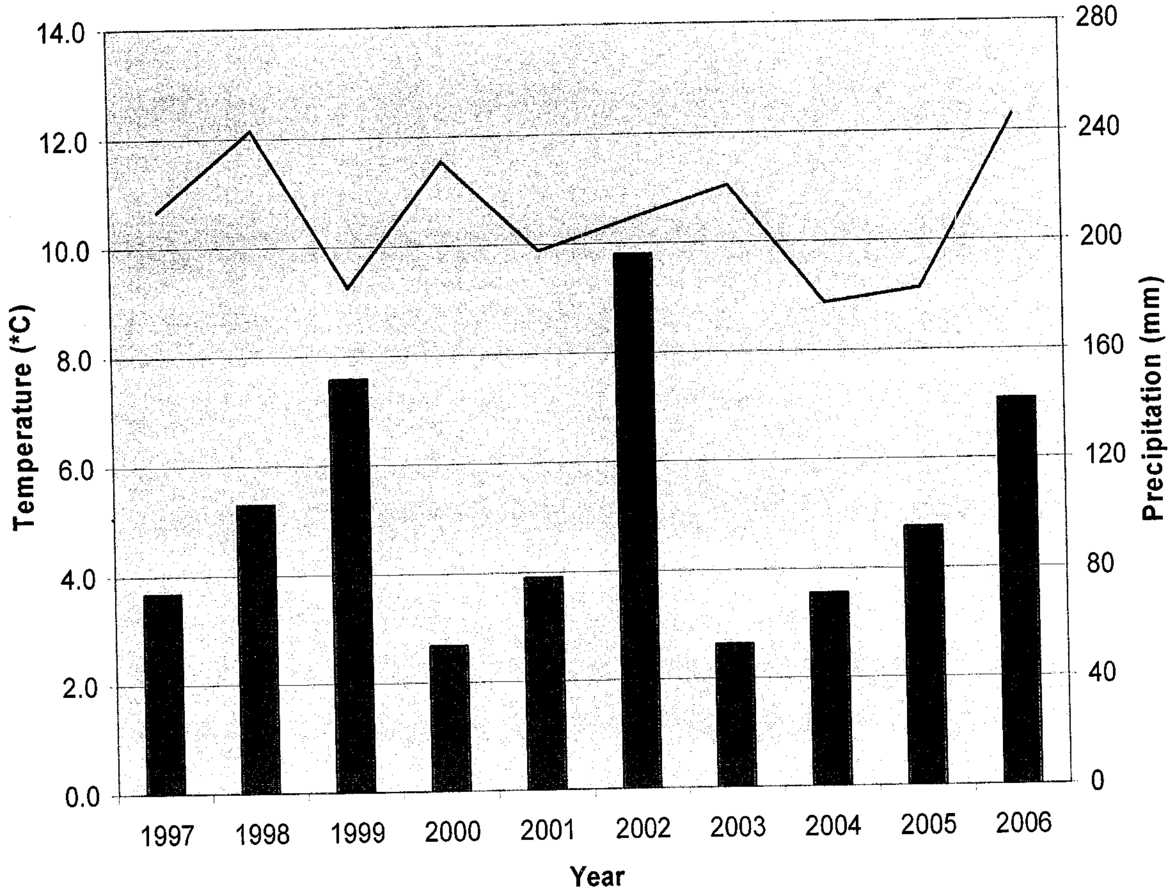


Figure 3.5 – Average summer air temperature and precipitation at Daring Lake, Northwest Territories, Canada

until May 2006. According to this data, obtained from Environment Canada, the mean annual air temperature is -8.9°C, and the mean annual precipitation is 274.6mm, 167.5mm of which falls as rain. January and July are the coldest and warmest months, with mean temperatures of -28.0°C and 13.7°C respectively. April and August are the driest and wettest months, with mean precipitation values of 6.3mm and 64.9mm respectively.

Figure 3.5 shows average summer air temperature and precipitation at Daring Lake. This data was recorded by the tower operated by the Department of Indian and Northern Affairs Canada. The daily average summer air temperature is 10.5°C, and average precipitation is 105.0 mm (Reid, Personal Communication). The mean annual air temperature at Daring Lake is approximately -8.9°C (Reid, Personal Communication).

3.4 - VEGETATION:

Vegetation in the Arctic is far from homogeneous, and is a function of temperature and moisture conditions, both of which are interrelated (Petrone et al., 2004; Eissenstant and Van Rees, 1994). Diversity and plant community composition vary with the summer temperatures, the nature of soils, and availability of moisture. Maximum diversity of vascular species in the Canadian Arctic occurs in the warmest regions close to the treeline (Edlund, 1991). The treeline can be roughly correlated with the 10°C isotherm for the warmest month of the year (Young, 1989). Vegetation is known to significantly influence the thermal regime and chemistry of soils, while soils affect the physiognomy, composition, and productivity of plant communities (Klinger, 1996).

The term "Low Arctic", which includes the Daring Lake study site, refers to tundra environments with closed, often meadow-like vegetation, and often includes shrubbery growth, even dwarf woodland (Young, 1989). Tundra, the treeless terrain with a continuous cover of vegetation, occupies ~31% of the Canadian Arctic (Quinton et al., 2000; Bliss and Matveyeva, 1992).

According to Milburn (2002), the Daring Lake watershed lies within the "Southern Arctic Ecozone", as seen in **Figure 3.6.** The Southern Arctic Ecozone's physiography can be described as rolling tundra, rock outcrops and boulder fields, with continuous permafrost (Milburn, 2002). This ecozone, commonly called "the barren lands", extends along northern mainland Canada from the Yukon's Richardson mountains to Ungava Bay in northern Quebec (Milburn, 2002). Typical flora include dwarf birch (*betula glandulosa*), willows, sedges, mosses, herbs, and various species of lichen. Ergo, it has the most extensive vegetative cover and highest diversity of species of the three Arctic ecozones (Milburn, 2002).

A common feature of tundra environments is the presence of extensive peat bogs. Peat can be defined as any unconsolidated soil material consisting largely of undecomposed, or slightly decomposed, organic matter accumulated under conditions of

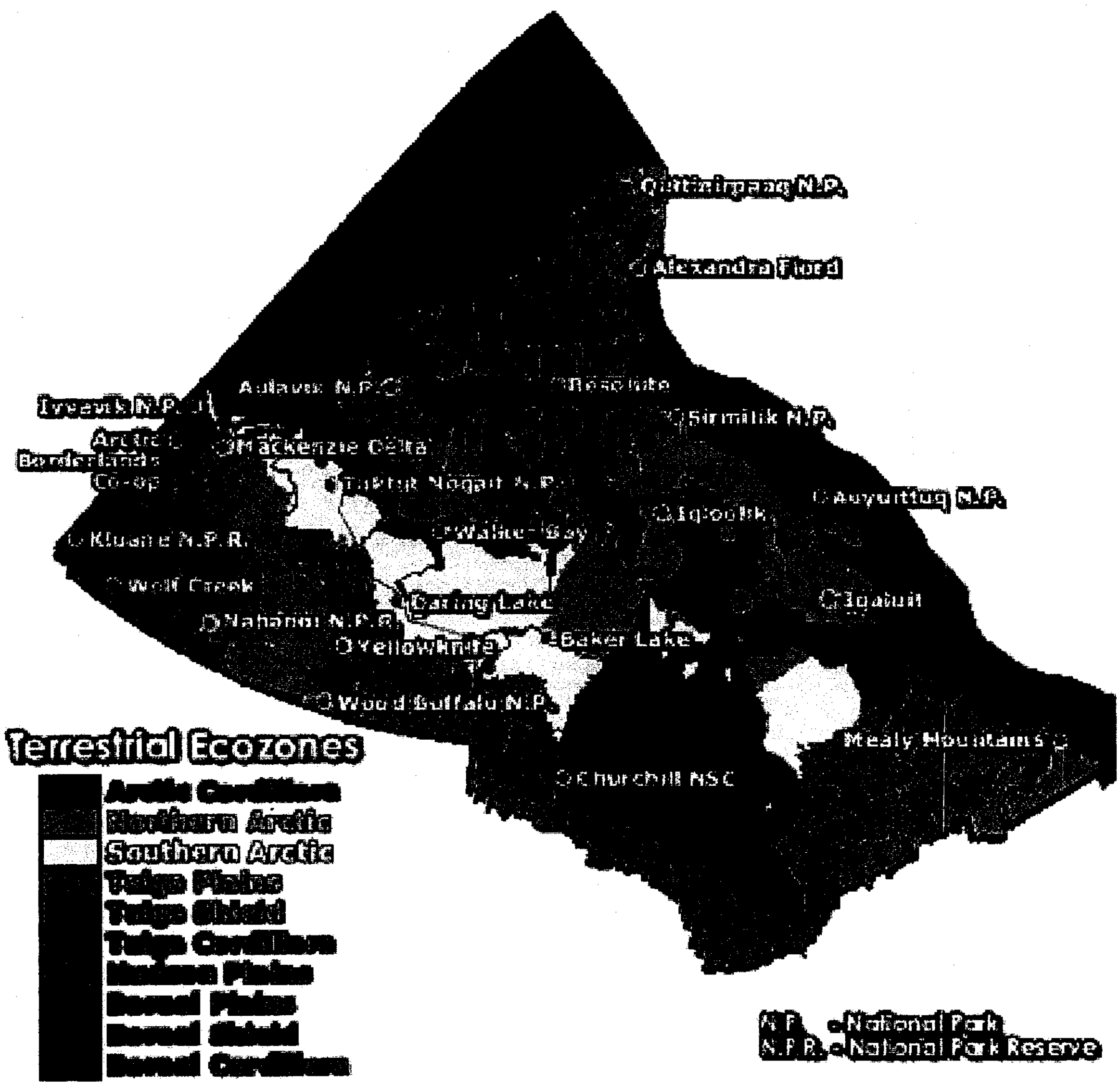


Figure 3.6 – Terrestrial Ecozones of the Canadian Arctic

(Source: http://www.emannorth.ca/images/sites.gif)

excessive moisture (Brady and Weil, 2002). Peat is formed by various species of moss, notably sphagnum. Mosses appear to occupy a keystone role in soil development and function of peatlands, controlling or modifying processes of acidification and podzolization as well as spatial patterns of ecosystem processes, such as gas efflux (Walker, 1996).

The mechanism by which bryophytes, such as sphagnum, may enhance podzolization and placic horizon formation is through acidification of soils, causing increased solubility of fluvic acids (Klinger, 1996; Rieger, 1983). Podzolization leads to formation of placic horizons. which eventually become impermeable, thus increasing surface soil moisture and favouring bryophyte establishment and growth (Klinger, 1996). Sphagnum mosses are notorious for their ability to acidify water (Klinger, 1996; Clymo and Hayward, 1982).

Soils in the Southern Arctic ecozone are generally thin, acidic, and feature frequent and numerous glacial deposits of sand and gravel. Although the tundra receives little precipitation on an annual basis, the summer is generally moist (Enger and Smith, 2000), due in large part to melting of the winter snowpack. Permafrost restricts water from sinking into the soil, resulting in waterlogged soils, and many shallow pools and ponds (Enger and Smith, 2000).

Figure 3.7 shows an ICONOS Imaging map of vegetation at Daring Lake. **Figure 3.8** is a close-up on the six study sites. **Figure 3.9** is a close-up of the legend located in the upper-right corner of **Figure 3.7**.

Figure 3.7 – ICONOS imaging vegetation map of Daring Lake Study Area, Northwest Territories, Canada, 2004

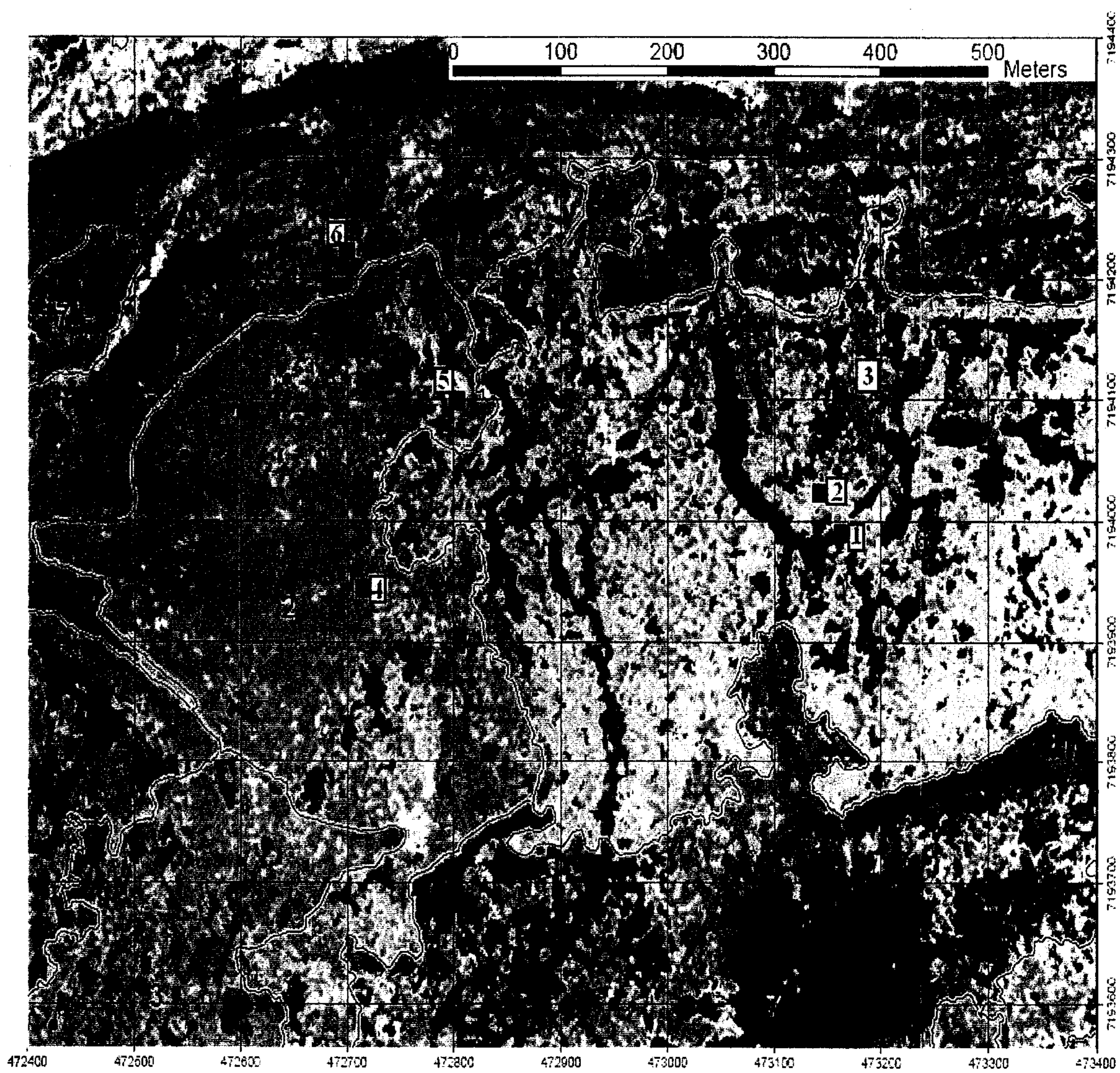


Figure 3.8 - ICONOS imaging vegetation map of study sites, within Daring Lake study area, Northwest Territories, Canada, 2004

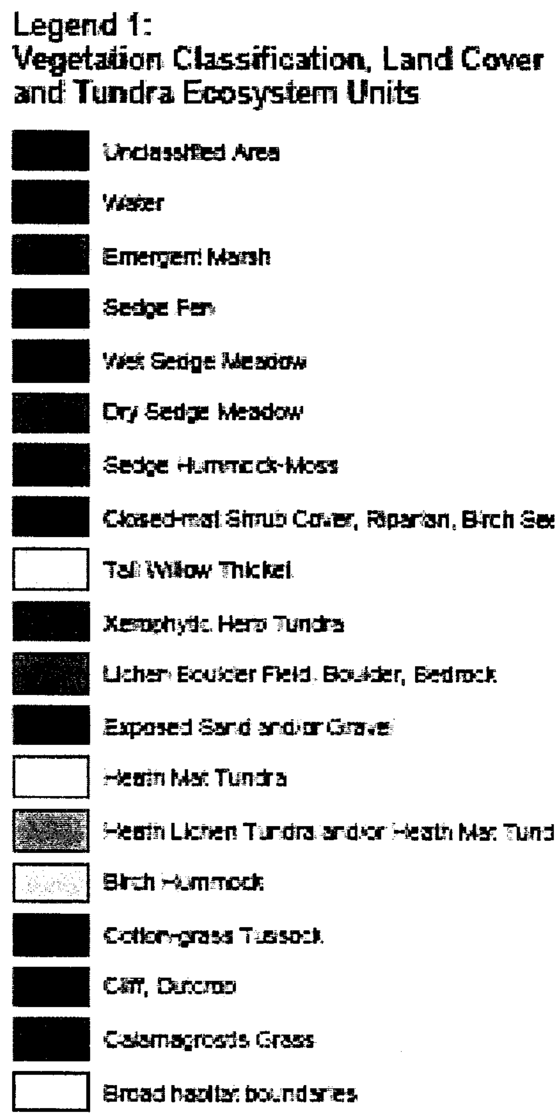


Figure 3.9 – ICONONS imaging vegetation map legend of land cover and tundra ecosystem units

According to **Figures 3.7** and **3.8**, the flooded sedge and hummock communities (Sites 1 and 3) are designated as wet sedge meadows. However, the flooded sedge community consists of a small pond underlain by peat, surrounded by wet sedge meadows and hummocks, which is more consistent with the marsh and pond designations **(Figure 3.7)**. The dry lowland heath community (Site 2) is designated as a 'birch hummock' area, which is consistent with vegetation observed in **Table 3.2**.

Table 3.7 shows the percent coverage of each site's representative vegetation community. The 640 000 m^2 covered by communities that were not sampled were excluded from **Table 3.7.** The study is based on the remaining 4.16 km^2, which consisted communities that were sampled.

3.5 – SITE SELECTION:

The hummocky fen to the east of Daring Lake **(Figure 3.2)** is host to two meteorological towers. A tower run by DIAND is located approximately 1.0 kilometres east of camp, and 400 metres east of the lake's shore. The carbon flux tower is located approximately 1.5 kilometres east of camp, and 500 metres east of the DIAND tower. The spatial coverage or "footprint" of a meteorological tower can be approximated as a circular area of uniform radius, with the tower at the centre. The distance to the footprint's edge can be roughly defined as 100 times the sensor height. However, the outermost coverage areas vary depending on wind direction and velocity. Thus, the assumption that a tower's footprint is circular, with a radius of 100 times the tower height is often incorrect. To be safe, a footprint size of 50 times the tower heights was employed.

Six sites were selected based on how representative they are of differing vegetation communities, which were selected based on predominant vegetation types, and relative homogeneity. Each site was classified based on the spatial extent of several existing species. A community is defined as a group of plant species that is typically found in a specific type of habitat (MacDonald, 2003).

3.6 – STUDY SITES:

3.6.1 – Flooded Sedge (Site 1):

Site 1 is located at 0473157 Easting, 7193987 Northing, at 426 metres altitude **(Figures 3.2, 3.8)**. It is characterized predominantly by tundra grasses and standing water within a circular depression whose diameter is approximately 13 metres.

Table 3.1 displays each species present, and its areal extent. Percent coverage denotes the extent to which a site was covered by a species or landform.
Total percent coverage exceeds 100%, because several species can inhabit the same approximate area. For instance, grasses, such as bog rush *(Juncus arcticus)* and water sedge *(Carex aquatius)*, can co-exist with Labrador tea *(ledum groenlandicum)* in an area of sphagnum moss. If the extent of a species or landform was less than 5%, it was regarded as insignificant.

Species	Common Name	Percent Coverage
Juncus arcticus, *Carex aquatili*	Grasses (Bog rush, Water Sedge)	90%
	Sphagnum Moss	60-65%
	Green Moss	25%
	White Lichen	5-10%
Betula glandulosa	Dwarf Birch	5%
Ledum groenlandicum	Labrador Tea	5%
	Standing Water	Variable *60% as of August 12, 2006

Table 3.1 – Coverage of dominant species at the Flooded Sedge Site (Site 1), Daring Lake Northwest Territories, Canada

Instrumentation at Site 1 featured two Type K thermocouple cables located at 2cm and 13cm depths and two water level sensors (Tru Trak, New Zealand). Both water level sensors were located where standing water was constantly present.

Soil cores (11 cm deep) were extracted from two locations at Site 1, containing 100% peat and sphagnum moss. Analysis of these soil cores determined that porosity was 0.942, bulk density was 0.070 +/- 0.047 g/cm^3, and field capacity was reached when volumetric soil moisture equals 82.2%. Due to the absence of soil particles in the samples, soil texture analysis was not necessary. Due to the relative uniform nature of the site it was assumed that these cores were representative.

3.6.2 – Dry Lowland Heath (Site 2):

Site 2 is located adjacent to the Flooded Sedge site, at 0473147 Easting, 7194033 Northing, at 427 metres altitude. It is characterized predominantly by a very heterogeneous dry heath featuring multiple species, and small mineral earth hummocks. A creek flows through the westernmost portion of the site, where both transects are located. **Table 3.2** shows the list of each species and their coverage.

Soil cores were taken at two locations (to approximate depths of 16 centimetres), and like Site 1, none of these cores yielded any mineral soil. Average porosity for Site 2 was 0.952, which is consistent with that of peat. Bulk density was calculated as 0.051 +/- 0.028 g/cm^3, and field capacity was reached when volumetric soil moisture equals 77.2%. No soil texture analysis at this site was required.

Species	Common Name	Percent Coverage
Ledum groenlandicum	Labrador Tea	55-60%
Juncus arcticus, *Carex aquatili*	Grasses (Bog rush, Water Sedge)	35%
Betula glandulosa	Dwarf Birch	30-35%
Cetraria cuclatia, *Mashonhalea Richardsonia,* *Alectoria*	Generic White Lichen, Tumbleweed lichen	20-25%
	Green Moss	20-25%
	Sphagnum Moss	20-25%
Vaccinium vitis-idaea	Cranberry	10%
Arctostaphylos uva-ursi, *Arctostaphylos rubra*	Bearberry	10%
Empetrum nigrum	Crowberry	5%
Eriophorum angustifolium	Cotton Grass (Sedge)	5%
	Standing Water	Variable *5% as of August 12, 2006

Table 3.2 – Coverage of dominant species at the Dry Lowland Heath Site (Site 2), Daring Lake Northwest Territories, Canada

3.6.3 – Lowland Hummocks (Site 3):

Site 3 is located just north of Sites 1 and 2, in an area of mineral earth hummocks flanked by troughs usually featuring standing water, at an altitude of 430 metres. The Easting and Northing values for Site 3 are 0473160 and 7194105, respectively. All species present at Site 3 and their coverage are indicated in **Table 3.3**.

Soil cores were taken at two locations to an approximate depth of 11 centimetres. Since all of the cores were composed entirely of vegetation and peat, no texture analysis was required. Porosity at Site 3 was 0.976, bulk density was 0.028 +/- 0.018 g/cm^3, and field capacity was reached at 86.5% volumetric soil moisture.

3.6.4 – Upland Heath (Site 4):

Site 4 is located at 0472712 Easting and 7193943 Northing, at 430 metres altitude. It is characterized by heath, specifically a predominant presence of several species of white lichen, as well as several other herbs and plants. The site is located approximately 50 metres south west of the carbon flux tower, and was surrounded by glacial erratics of various sizes. **Table 3.4** lists all species present at this site.

Soil cores were taken to a depth of 11 centimetres at two locations. Porosity is 0.630, bulk density was 0.484 +/- 0.331 g/cm^3, and field capacity was reached at a volumetric soil moisture of 51.7%. Soil texture analysis determined that approximately

Species	Common Name	Percent Coverage
	Sphagnum Moss	70%
Juncus arcticus, *Carex aquatili*	Grasses (Bog rush, Water Sedge)	70%
	White Lichen	25%
	Green Moss	10%
Betula glandulosa	Dwarf Birch	10%
Arctostaphylos uva-ursi, *Arctostaphylos rubra*	Bearberry	10%
Ledum groenlandicum	Labrador Tea	10%
Vaccinium uligonosum	Bog Blueberry	10%
	Standing Water	Variable *35% as of August 12, 2006

Table 3.3 – Coverage of dominant species at the Lowland Hummock Site (Site 3), Daring Lake Northwest Territories, Canada

Species	Common Name	Percent Coverage
Cetraria cuclatia	Generic White Lichen	80%
Empetrum nigrum	Crowberry	35%
Juncus arcticus *Carex aquatili*	Grasses (Bog rush, Water Sedge)	25%
	Green Moss	25%
Ledum groenlandicum	Labrador Tea	25%
Vaccinium vitis-idaea	Cranberry	10%
Arctostaphylos uva-ursi, *Arctostaphylos rubra*	Bearberry	5%
Betula glandulosa	Dwarf Birch	5%
	Erratics	15%

Table 3.4 – Coverage of dominant species at the Upland Heath Site (Site 4), Daring Lake Northwest Territories, Canada

31.4% of the samples consisted of organic material, where grain size exceeds 1.0 mm. Soil at this site consists of a mixture very coarse sands (31.41%), fine (27.62%) and very fine-grained sands (12.85%), and silts and clays (12.00%). A full description of soil texture analysis at this site is included in **Appendix A**.

3.6.5 – Upland Sedge (Site 5):

Site 5 is slightly sloped, located at the base of an esker, at an altitude of 433 metres, just uphill from Site 4. The Easting and Northing values for Site 3 are 0472804 and 7194100 respectively. It can be described as an upland sedge site, containing multiple types of vegetation, with grass and lichen being more predominant. Despite being an upland heath site, it is a poorly drained site. There was no standing water prior to June 29-30, whereas stagnant puddles were omnipresent following the rainfall on June 29-30. This is perhaps owing to the fact that of all sites involved in this study, its soil had the lowest porosity and highest bulk density. **Table 3.5** lists all species present at this site.

Soil cores were taken at two locations, to an approximate depth of 11 centimetres. Porosity was 0.595, bulk density was 0.631 +/- 0.527 g/cm^3, and field capacity was reached at a volumetric soil moisture of 51.6%. Soil texture analysis determined that approximately 19.2% of the samples consisted of grain sizes exceeding 1.0 mm. Soil at this site largely of fine (24.62%) and very fine sands (10.13%), as well as silts and clays (26.38). A full description of soil texture analysis, consult **Appendix A**.

Species	Common Name	Percent Coverage
	Green Moss	50%
Juncus arcticus, *Carex aquatili*	Grasses (Bog rush, Water Sedge)	45-50%
Cetraria cuclatia,	White Lichen	40-45%
Ledum groenlandicum	Labrador Tea	30-35%
Empetrum nigrum	Crowberry	15-20%
Arctostaphylos uva-ursi, *Arctostaphylos rubra*	Bearberry	15%
Rubus chamaemorus	Cloudberry	10%
Betula glandulosa	Dwarf Birch	10%
Vaccinium vitis-idaea	Cranberry	5%
	Standing Water	Variable *10% as of August 11

Table 3.5 – Coverage of dominant species at the Upland Sedge Site (Site 5), Daring Lake Northwest Territories, Canada

3.6.6 – Dwarf Birch (Site 6):

Site 6 is located at 444 metres altitude on a lower plateau on the south side of the esker which runs east-west along the south shore of Yamba Lake, at 0472700 Easting and 7194223 Northing. The site is sloped 2^{o} southward, and features several large patches of dwarf birch (*Betula glandulosa*) and crowberry (*Empetrum nigrum*), interspersed with open areas of dry heath and lichen. The soil at this site is generally sandy, with a high content of gravel and small rocks, as is typical of glacial deposits along an esker. **Table 3.6** lists all species and forms present at this site.

Soil cores were taken at two locations, to approximate depths of 16 centimetres. Porosity was 0.600, bulk density was 0.623 +/- 0.419 g/cm^3, and field capacity was reached at a volumetric soil moisture of 53.5%. Soil texture analysis determined that approximately 14.7% of the samples grain sizes exceeding 1.0 mm. Soil at this site is composed primarily of fine sands (39.69%) and coarse-grained materials typical of glacial till and eskers. Only 11.26% of the soil particles at this site had diameters less than 64μm. A full description of soil texture analysis, consult **Appendix A**.

Species	**Common Name**	**Percent Coverage**
Betula glandulosa	Dwarf Birch	70%
Cetraria cuclatia, cladina rangerferina	Generic White Lichen, Carbion Lichen	60%
Empetrum nigrum	Crowberry	50-55%
Arctostaphylos uva-ursi Arctostaphylos rubra	Bearberry	25-30%
Ledum groenlandicum	Labrador Tea	25%
Vaccinium vitis-idaea	Cranberry	15-20%
Rubus chamaemorus	Cloudberry	15%
	Brown Lichen	5%
	Mushrooms	5%

Table 3.6 – Coverage of dominant species at the Dwarf Birch Site (Site 6), Daring Lake Northwest Territories, Canada

Site	Vegetation Communities Present	Percent Coverage (%)	Arial Coverage (m^2)
Flooded Sedge (Site 1)	Marsh / Pond	1.5	60 000
Dry Lowland Heath (Site 2)	Birch Hummocks	16.8	700 000
Lowland Hummocks (Site 3)	Wet Sedge Meadow	9.6	400 000
Upland Heath (Site 4)	Heath Lichen and Heath Mat Tundra, Cotton Grass Tussocks	19.7	820 000
Upland Sedge (Site 5)	Heath Lichen and Heath Mat Tundra, Riparian Birch	26.8	1115 000
Dwarf Birch (Site 6)	Heath Lichen and Heath Mat Tundra, Dry Sedge Meadows	25.6	1065 000
Sampled Total		100.0%	4160 000
Not Sampled	Other	N/A	640 000
Total Area		N/A	4800 000

Table 3.7 – Coverage of sampled vegetation communities within a 4.16km^2 portion of the Daring Lake Study Site, Northwest Territories, Canada

CHAPTER 4 - METHODOLOGY

4.1 - INTRODUCTION:

All data for this study were obtained in the field, at the sites specified in **Chapter 3**. The six study sites were selected based on how representative they were of differing vegetation communities common throughout the low Arctic tundra. The specific locations of equipment at each site were chosen based on representation of the vegetation community being sampled. The location of all field equipment is found in **Appendix G**.

4.2 – EQUILIBRIUM EVAPOTRANSPIRATION:

4.2.1. – Priestly-Taylor Method:

The Priestly-Taylor formula is listed in its simplest form as **Equation 2.6**. An alpha value of 1.00 represents equilibrium evapotranspiration. Since atmospheric processes act to maintain air temperatures and relative humidities such that α remains near 1.26 over saturated surfaces, $\alpha = 1.26$, rather than $\alpha = 1.0$, should be considered the equilibrium wet surface ET value (Eichinger et al., 1996). The value of $\alpha = 1.0$ over a saturated surface requires that the air also be saturated, a condition that is rarely found in nature.

The daily mean air temperature is required to calculate the slope of the saturation vapour pressure curve, and the latent heat of vapourization (**Equation 2.10**). The latent heat of vapourization value obtained from **Equation 2.10** is then used, in conjunction with constants representing the mean density and specific heat of air to calculate the psychrometric constant, using **Equation 2.9**.

Air temperature was measured using several different pieces of equipment in this study. The carbon flux tower adjacent the upland heath site (Site 4) recorded air temperature at half-hour intervals throughout the sampling season, using a Vaisala HMP35CF sensor (error +/- 0.4°C), at a height of 1.5 metres. Those readings were recorded every 30 minutes were used to determine mean temperature for each day of the season **(Appendix B)** at the upland heath and upland sedge communities (Sites 4 and 5) **(Figures 3.2, 3.8)**. Two additional small scale towers were erected at the lowland heath and dwarf birth sites (Sites 2 and 6) with the purpose of acquiring air temperature and humidity measurements. Each tower featured two sensors: one closer to the surface of the ground, and one near the top. At Site 2, the sensors were at heights of 20 centimetres, and 125 centimetres. Due to their proximity to Site 2 **(Figures 3.2, 3.8)**, air temperature and relative humidity readings from the sensors at Site 2 are extrapolated to the flooded sedge and hummock communities (Sites 1 and 3).

At the dwarf birch site (Site 6), the sensors were placed at 18 and 106 centimetres above the ground. At this site the lowermost sensor was placed below the dwarf birch canopy, in order to obtain temperature and humidity readings below the canopy. The sensors used, were HOBO H8 Pro Series Loggers (Onset Computer Corporation, 2002). The HOBO sensors are capable of reporting temperatures ranging from -30°C to 50°C, with an error range of +/- 0.2°C at 21°C (Onset Computer Corporation, 2002). It can also measure relative humidity accurate to +/-3%; +/- 4% in condensing environments (Onset Computer Corporation, 2002).

Net radiation is required to quantify the available energy portion of the Priestly-Taylor formula **(Equation 2.6)**. Net radiation is the result of subtracting all outgoing short-wave and long-wave radiation, from all incoming short-wave and long-wave radiation generated by the sun. Net radiation can also be expressed as the sum of all sensible, latent, and ground heat fluxes **(Equation 2.3)**.

Net radiation was logged at half-hour intervals by a net radiometer on the carbon flux tower adjacent to Site 4. As with air temperature, the 48 daily readings were condensed into a table of daily average net radiation readings **(see Appendix B)**. The net radiometer measures net radiation to the nearest 0.01 W/m^2.

Short wave radiation fluxes were recorded using pyranometers. Two pyranometers were located at the Site 2 small scale tower; one facing upward, measuring incoming radiation, one facing downward, measuring outgoing radiation. The pyranometer on the small scale tower at Site 6 was located below the dwarf birch canopy, facing upwards. Its purpose was to obtain a record of short wave radiation penetrating the canopy. A pyranometer was also included with the portable albedometer, which permitted in-situ short-wave radiation measurements. As the albedometer was easy to invert, it was capable of measuring both incoming and outgoing short-wave radiation.

A portable net radiometer located on a portable albedometer was also used weekly to quantify net radiation at each site. This piece of equipment, the Funk Net Radiometer (Swissteco Pty. Ltd., Melbourne, Australia), was composed of two evenly transparent hemispheres, and a detachable handle rod, which was attached to the wooden plank of the albedometer. Like the pyranometers, output is expressed as an electrical potential.

Ground heat flux can be calculated using **Equation 2.4**. The measurement of ground heat flux requires the measurement of a temperature gradient over a measurable distance within the soil. This was accomplished by positioning temperature sensors at each site. Both automated and manual sensors were used in this study. Soil temperature was measured at Sites 2, 3, 5, and 6, using automated recorders (Stowaway TidBit Temperature Data Loggers, Onset Computer Corporation, Bourne, MA, USA). Stowaways are capable of reporting soil temperature between -20°C to +50°C. Values recorded are precise to 0.01 °C, with an error range of +/- 0.5 °C (Onset Computer Corporation, 2002). The Stowaways were programmed to record soil temperature hourly, which were then condensed into daily average values for each depth, at the aforementioned sites **(Appendix B)**. At site 4, soil temperature was automatically logged beneath the carbon flux tower using 107B Fenwal Thermistors (error +/0.2°C) at depths of 5, 10, 20, and 60 centimetres. Thermocouples were used at the Flooded Sedge Site. Daily readings were taken using a portable analog temperature recorder during. The recorder enabled the thermocouple cables to report temperatures precise to 0.1°C, with an error range of +/- 1.0°C.

4.3 – ACTUAL EVAPOTRANSPIRATION:

Actual evapotranspiration was assessed using two different methods: the Priestly-Taylor formula and lysimeters.

4.3.1 – Priestly-Taylor Method:

The value of alpha was assessed at each of the six study sites. Potential evapotranspiration estimates from the Priestly-Taylor formula were compared with actual average daily evapotranspiration rates from the lysimeters.

For this study, Priestly-Taylor derived evapotranspiration rates are calculated using soil temperature values obtained from automatic sensors at all sites except Site 1, where thermocouples are used **(Appendix C)**. Also used are air temperature values recorded by the carbon flux tower and HOBO sensors, and net radiation reported by the carbon flux tower **(Appendix B)**.

4.3.2 – Actual Evapotranspiration Lysimeters:

With the AET lysimeters, any water input is attributed to precipitation on the exposed surface of the lysimeter. Water loss can be attributed to evapotranspiration or throughflow. Throughflow only occurs if the volumetric soil moisture of the monolith inside the lysimeter boxes is equal to, or exceeds, field capacity. It is possible to satisfy both cases in the same day, especially if the site experiences a brief period of heavy rainfall.

Three lysimeters were located in five of the six vegetation communities. No lysimeters were installed at the Flooded Sedge site (Site 1), due to the presence of standing water through much of the season. Each lysimeter is composed of inner and outer Rubbermaid bins of equal size. The inner bin containing the monolith of soil and vegetation, sits inside the outer bin. To allow for drainage, nine holes are drilled in the base of the inner bin. The clearance between the inner and outer bins is 3.7 centimetres. The lysimeter bins are not perfect cubes. At the top opening, the inside length and width are 33.8 and 33.5 centimetres respectively. Thus, the surface area of the soil and vegetation inside the inner bin is the product of the length and width: 1132.3 cm^2. At the base, the inner length and width of the lysimeter are 32.6 and 30.9 centimetres respectively. The depth of each bin is uniformly 14.7 centimetres. However, the centre of the inner bin of a full lysimeter is likely to be deeper due to the weight of its contents.

Calculating the volume of the lysimeter involved dividing it into five sections; one cube and four triangular wedges **(Figure 4.2).** The central cube has dimensions of 32.6 cm x 30.9 cm x 14.7 cm; two of the surrounding triangular slivers have dimensions 33.8 cm x 1.3 cm x 14.7 cm; the other two triangular slivers have dimensions of 30.9 cm x 0.6 cm x 14.7 cm. The volume of each lysimeter bin, equal to the sum of each of the five previous sections, is 16135.2 cm^3.

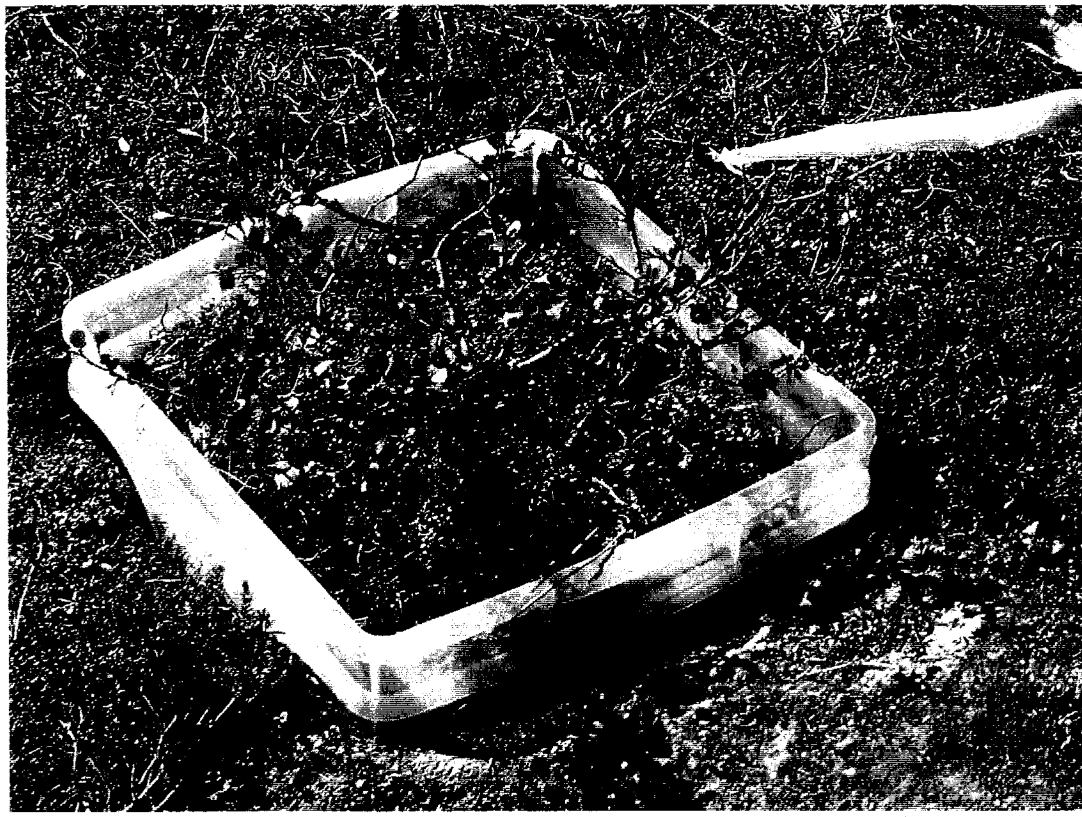


Figure 4.1 – Photo of a lysimeter at Site 6, Daring Lake, Northwest Territories, Canada, August 19, 2006

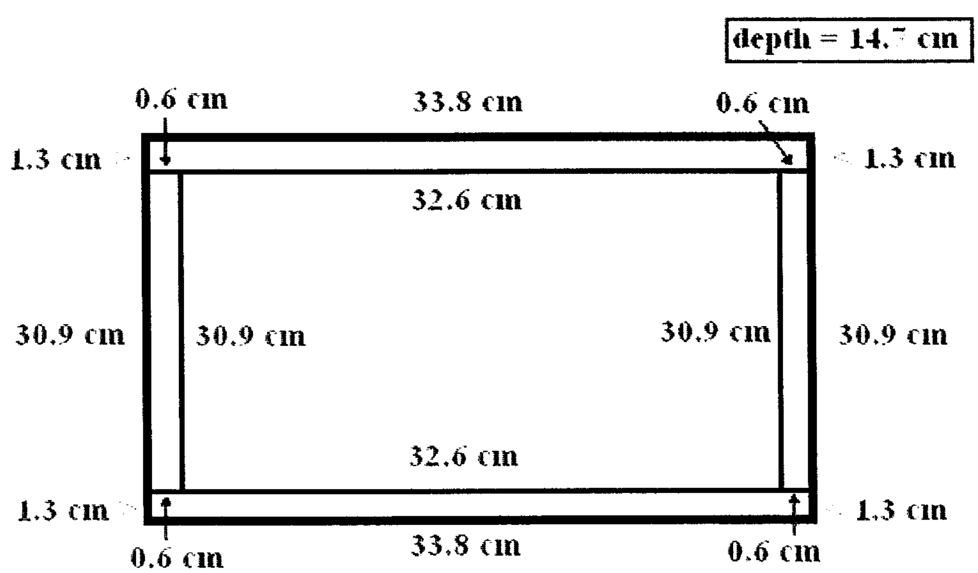


Figure 4.2 – Dimensions of a lysimeter's volume

An appropriately sized portion of soil and vegetation, representative of the surrounding predominant plant community, was excavated from the ground, and placed into the lysimeter. The lysimeter was then placed into the hole from which its contents were removed, isolating the area inside the containers, and eliminating complications due to lateral movement of water within the soil.

Each lysimeter is weighed daily, using the same equipment as was used for the potential evapotranspiration lysimeters. Daily weight fluctuations were converted to an equivalent water depth in millimetres by multiplying it by the lysimeter surface area (1132.3 cm^2), density of water (1.0 g/ cm^3), and the relevant unit conversions. Knowing the equivalent daily water fluctuations, one can calculate throughflow, and ultimately daily evapotranspiration from the lysimeter.

Throughflow is only possible if the volumetric water content of the lysimeter contents is at or exceeding field capacity. If the volumetric water content is below field capacity, then throughflow is theoretically impossible. Thus, throughflow is zero. **Table 4.1** explains the process for determining how much throughflow has occurred. Cases 2 and 3 from **Table 4.1** are applicable when lysimeter contents are at or exceeding field capacity. According to the model, throughflow (T_o) only occurs when a field capacity has been reached, precipitation (P_o) exceeds equivalent water gain (ΔW), and if equivalent water gain is positive. If the equivalent amount of throughflow exceeds the 37mm clearance between the two lysimeter bins, the clearance has filled, and the

Case 1: VSM <= Field Capacity	
	True: $T_o = 0$
	False: Advance to Case 2
Case 2: $\Delta W > P_o$	
	True: $T_o = 0$
	False: Advance to Case 3
Case 3: $\Delta W < 0$	
	True: $T_o = 0$
	False: $T_o = P_o - \Delta W$
***Case 4: T > 37.0 mm**	
	True: $T_o = 37.0$, *Next day:* $T_1 = (P_o - \Delta W) - 37.0 - P_1$
	False: $T_o = P_o - \Delta W$

Table 4.1: Model for calculating lysimeter throughflow

lysimeter begins to saturate. When this occurs throughflow for the following day (T_1) equals the amount used to saturate the lysimeter, plus any precipitation that falls on that day (P_1) **(Table 4.1)**. During daily visits, any water that flowed into the lysimeter's lower bin was emptied in order to prevent re-wetting of the lysimeter bottoms during non-extreme events.

Once throughflow can be quantified, daily evapotranspirative loss (E) can be determined. The flow chart in **Table 4.2** explains the steps to determining how much water was evapotranspired into the atmosphere under varying conditions. As with the evaporation pan and PET lysimeters, daily evapotranspiration values were obtained by multiplying the calculated evapotranspiration value between observations by the reciprocal of the number of days between observations. In instances where no precipitation was recorded, yet a lysimeter gained weight, it is assumed that no evapotranspiration has occurred since the last record was taken. Additionally, if precipitation was recorded, and the amount of precipitation exceeded the weight gain, and throughflow did occur, then it is assumed that no evapotranspiration has occurred since the last visit.

Case 1: $P_o = 0$	
	True: Advance to Case 2
	False: Advance to Case 3
Case 2: $\Delta W > 0$	
	True: $E = 0$
	False: $E = -\Delta W$
Case 3: $\Delta W < 0$	
	True: $E = P_o - \Delta W$
	False: Advance to Case 4
Case 4: $\Delta W > P_o$	
	True: $E = 0$
	False: Advance to Case 5
Case 5: $T_o = 0$	
	True: $E = P_o - \Delta W$
	False: $E = 0$

Table 4.2: Model for calculating actual evapotranspiration using a lysimeter

4.4 – SOIL PHYSICAL PROPERTIES:

Soil samples were taken at each of the six sites to determine physical soil properties, including porosity and bulk density, using metal cores with a radius of 2.5cm, and depth of 5.5 cm. These cores were driven into the ground at representative locations at each study site in order to isolate and remove the contents from their surroundings. This was done by digging a small pit, inserting while slowly turning the core into the ground beside the pit, sharpened end first, and cutting around the outside of the core with a soil knife.

4.4.1 – Porosity:

Porosity is the amount of pore space within a unit of soil. Soil pores can further be grouped by size, as macropores and micropores. What cannot be quantified as pore space is then considered to be occupied by soil particles.

Determining porosity involves measuring both the saturated weight and dry weight of a soil sample. Other important figures include the weight and volume of the metal core, which is subtracted from any weight taken, provided the contents are still within.

Soil samples were saturated by immersion in a bath for a period of approximately 24 hours, so that the samples can absorb water via capillarity. Because the samples are absorbing water from the bottom upward, water can not drain back into the bath. It is important that the tops of each sample not be submerged, since flooding will compromise the physical integrity of the sample and skew values, due to the presence of unwanted puddles atop the sample. The dry weight was obtained by putting the cores in an oven at 80°C for 24 to 48 hours. Once the saturated (W_{sat}) and dry weights (W_{dry}) were measured, porosity (n) was calculated using,

$$n = 1 - (W_{dry} / W_{sat}) \qquad (4.4)$$

For example, a porosity of 0.40, denotes that 40% of the space within the soil sample is occupied by pores, with the remaining 60% occupied by soil.

4.4.2 – Volumetric Soil Moisture:

Pore space can be occupied by either air or water. Volumetric soil moisture is a measure of how much of a unit soil is occupied by water. By definition, volumetric soil moisture can not exceed porosity. If volumetric soil moisture is equal to porosity, the soil is said to be completely saturated.

Soil moisture is the key defining variable that integrates all components of the surface energy balance, and as such is of major importance to climate models and their surface schemes (Petrone et al., 2004; Rodriguez-Iturbe and Rinaldo, 1997). For instance, ground heat flux varies with soil moisture, since thermal conductivity values can increase by a magnitude of 7 to 8 when a soil is saturated.

The spatial patterns and temporal variability of soil moisture will be a consequence, and some extent a controlling factor, of the area's vegetation and physiography (Rodriguez-Iturbe, 2000). Because some species can tolerate certain ranges of soil moisture, they can flourish in areas where conditions are optimal, yet never survive metres away if conditions are beyond their range of tolerance. This can lead to feedback effects, such as a community of taller shrubs trapping drifting snow, leading to better insulation from extreme winter cold, and higher soil moisture once the snowcover melts. Within an ecosystem, the spatial variability of soil moisture can be influenced by larger scale watershed features such as slope and aspect, or smaller scale variations in microtopography (Petrone et al., 2004).

Volumetric soil moisture was measured manually, using Time Domain Reflectometry (TDR) probes. The TDR probes, whose rods are 20 cm in length, were buried at the beginning of the season at all sites except the Flooded Sedge site **(Appendix F)**. Most TDR instruments operate by launching a fast rise voltage step along the probe in the soil. The TDR step pulse travels to the end of the probe and is reflected back to the instrument where it is detected. The velocity of propagation of the pulse is related to the dielectric permittivity and thus to water content (Topp, 2003). The dialectric constant (K_a) is calculated by recording the start and end times, measured in feet, and substituting the total travel time (l) **Equation 4.5**, along with the physical length of the probe (L), expressed in millimetres. The probes used for this project were 20cm in length.

$$\mathbf{K_a = 1.01\ (l/L)^2} \qquad \mathbf{(4.5)}$$

The dialectric constant (K_a) calculated using **Equation 4.5** is then substituted into **Equation 4.6**, yielding soil moisture (Θ):

$$\Theta = -530 + 292(K_a) - 5.5(K_a)^2 + 0.043(K_a)^3 \ / \ 10000 \qquad (4.6)$$

Equation 4.6 was derived from TDR experiments performed by Topp et al., (1980), which can predict volumetric soil moisture with a standard error of +/- 0.013 Θ. Soil moisture was also measured using a portable Hydrosense Water Content measurement system (Campbell Scientific Ltd., Utah). The Hydrosense rods are 12 centimetres in length, and therefore measure soil moisture over a depth of 12 centimetres at each indicated sampling point. Readings are taken at predetermined sites throughout each transect, indicated by numbered flags every two days. It is accurate to +/- 3.0% volumetric water content with electrical conductivity <2 dS m^{-1} *(Source: http://www.decagon.com/hydrosense/specs.html)*.

4.4.3 – Bulk Density:

Bulk density is defined as the mass of dry soil per unit volume, including pore space (Brady and Weil, 2002). One of the main reasons for measuring soil bulk density is to calculate pore space (Brady and Weil, 2002), because bulk density values help us predict total porosity (Brady and Weil, 2002). Generally, the a higher bulk density is indicative of a lower porosity. Thus, the bulk density of soil core contents can be quantified by dividing the dry weight of the contents (W_{dry}) by the volume (V) of the core **(Equation 4.7)**.

$$D_b\ [kg/m^3] = W_{dry}\ [kg]\ /\ V\ [m^3] \tag{4.7}$$

Knowing the average bulk density of samples at a study site, the dry weight of a lysimeter ($W_{lys\text{-}dry}$) can be calculated by multiplying it by the lysimeter volume (V_{lys}):

$$W_{lys\text{-}dry}\ [kg] = D_b\ [kg/m^3]\ x\ V_{lys}\ [m^3] \tag{4.8}$$

4.4.4 – Soil Texture Analysis:

Once porosity and bulk density were calculated, the remaining soil core contents were used for soil texture analysis. Organic material was removed by sieveing and filtering out any grains larger than 1.0 mm (0 Φ) in diameter. The remainder of the sample was sorted using the following sieves: 710μm (0.5 Φ), 500μm (1.0 Φ), 250 μm (2 Φ), 125 μm (3 Φ), 90 μm (3.5 Φ), and 64 μm (4 Φ). Any grains with diameters under 64 μm were considered to be fine-grained. Results of the soil texture analysis are available in **Appendix A**, including the grain size grade scale.

CHAPTER 5 – DATA ANALYSIS AND RESULTS

5.1 - EQUILIBRIUM EVAPOTRANSPIRATION:

The average daily equilibrium evapotranspiration (EET) rate at all sites is calculated as a function of latent heat equivalents **(Equation 2.11)**, which is a derivation of the Priestly-Taylor method **(Equation 2.6)**. All EET estimates were deemed significantly different at a 95% level of confidence **(Appendix G)**.

The air temperatures used to calculate the slope of the saturation curve **(Equation 2.7)**, saturation vapour pressure **(Equation 2.8)**, and latent heat of vaporization **(Equation 2.10)**, were recorded as specified in **Section 4.2.1.** Daily high, low, and mean values of temperature and relative humidity are reported in **Appendix B**, and **Figure 5.1**.

Net radiation was measured at each site using a portable net radiometer. This data was extrapolated using net radiation values reported by the carbon flux tower, since it was recorded on a weekly basis. This method was used at all sites except Site 4, due to the presence of the carbon flux tower which constantly logged net radiation values. Since Q* was measured only once weekly, those values were extrapolated using the tower data to obtain data for days where Q* was not directly measured at those sites. Average Q* measured using the portable net radiometer, was divided by average Q* reported by the carbon flux tower for days where the portable net radiometer was used, giving a correction factor for the site.

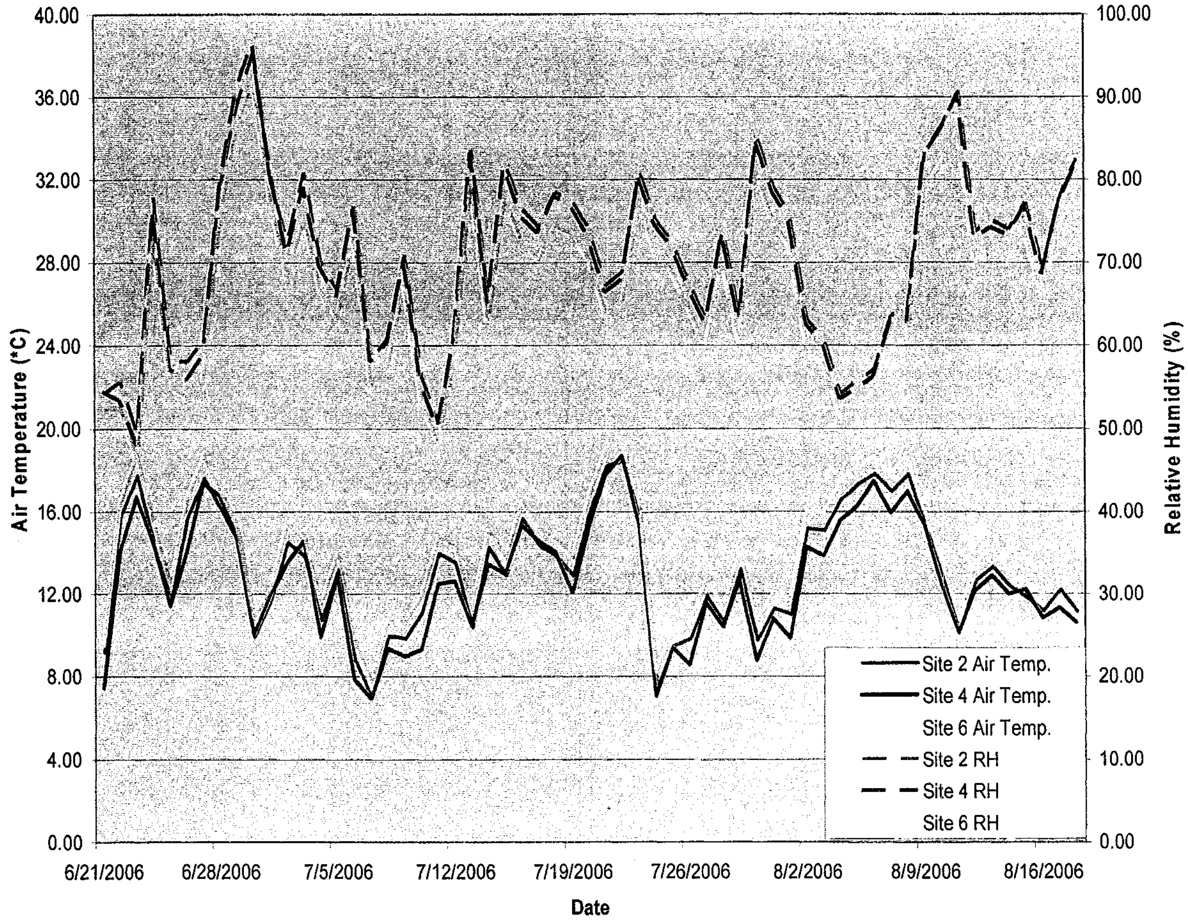


Figure 5.1 – Daily average air temperature and relative humidity recorded by the carbon flux tower at Site 4 (z = 1.50 m) and HOBO Sensors at Sites 2 (z = 1.25m) and Site 6 (z = 1.06 m), Daring Lake, Northwest Territories, Canada

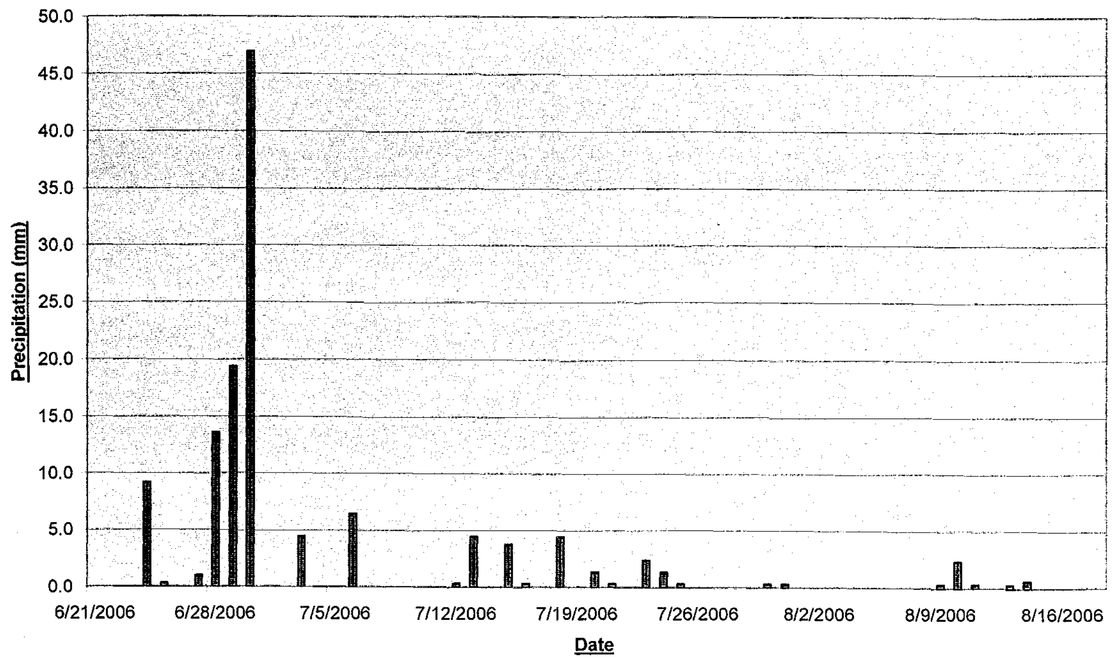


Figure 5.2 – Daily precipitation recorded by the carbon flux tower, Daring Lake, Northwest Territories, Canada

Statistic	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
N	57	59	59	59	59	59
Mean (mm/d)	5.7	3.3	4.5	2.2	3.7	3.6
Median (mm/d)	5.7	3.3	4.5	2.2	3.7	3.5
Standard Error of Mean (mm/d)	0.3	0.2	0.2	0.1	0.2	0.2
Standard Deviation (mm/d)	2.1	1.3	1.6	1.1	1.4	1.4
Sum (mm)	322.5	191.6	263.7	131.1	215.4	212.6
Skewness	-0.372	-0.359	-0.417	-0.241	-0.370	-0.326

Table 5.1 - Descriptive statistics of Priestly-Taylor EET estimates for all sites, Daring Lake, Northwest Territories, Canada

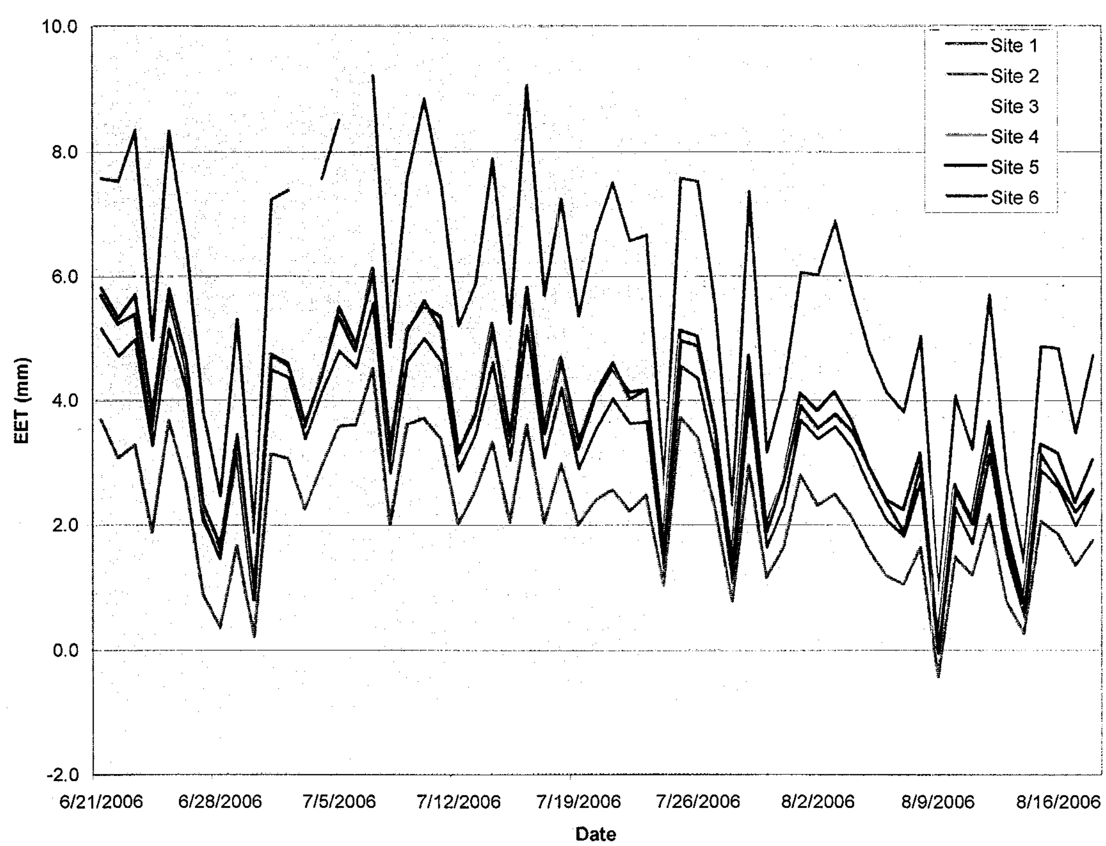


Figure 5.3 – Daily Priestly-Taylor derived EET estimates for all sites, Daring Lake, Northwest Territories, Canada

Thermal conductivity values for each site were taken from Oke (1987) and used to calculate ground heat flux for use in the Priestly-Taylor method. Saturated values are used, since potential evapotranspiration assumes an unlimited source of water for evaporation into the atmosphere.

5.1.1 – Flooded Sedge (Site 1):

Because much of Site 1 was under water, the thermal conductivity value for water (0.57 W/m °K) was used to calculate ground heat flux **(Appendix C)**. The average daily PET value at Site 1, calculated using **Equation 2.6**, were 5.7 +/- 0.3 mm/day **(Table 5.1)**. Daily values ranged from a high of 9.2 mm on July 7, to a minimum of 0.8 mm on August 9. Total seasonal evapotranspiration for the period June 21 through August 18 was 322.5 mm. Daily and cumulative EET values are depicted using **Figures 5.3 and 5.4** respectively. Tables containing data for daily calculated EET using Priestly-Taylor at each site is included in **Appendix D**. This site featured 57 days of data, since readings from the thermocouples were omitted on two occasions (July 3 and 6), due to missing data.

5.1.2 – Lowland Heath (Site 2):

The average daily EET rate at Site 2 was 3.3 +/- 0.2 mm/day **(Table 5.1)**. Daily values ranged from a high of 5.6 mm on July 7, to a low of -0.03 mm on August 9 **(Figure 5.3)**. A negative evaporation amount is possible, as it suggests zero evapotranspiration, and the occurrence of condensation. The cumulative EET is 191.6 mm **(Figure 5.4).**

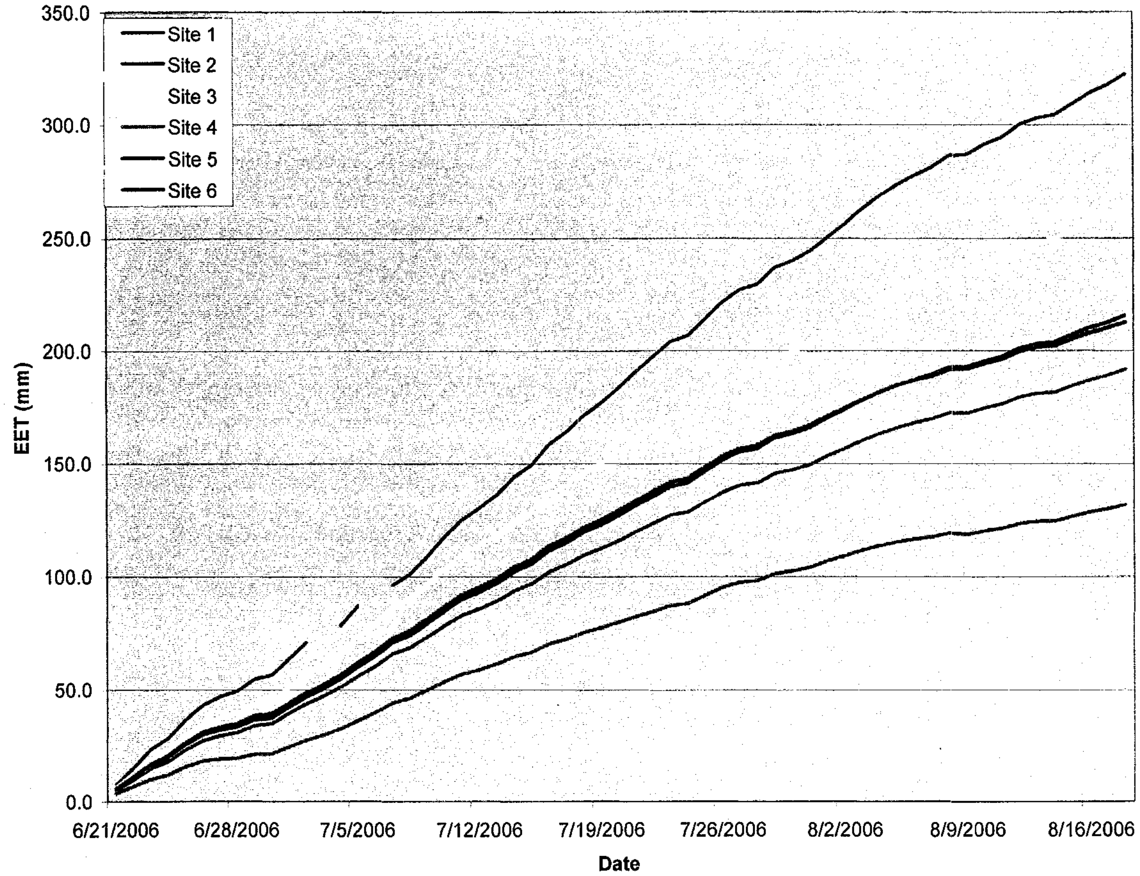


Figure 5.4 – Cumulative Priestly-Taylor derived EET estimates for all sites, Daring Lake, Northwest Territories, Canada

5.1.3 – Lowland Peat Hummocks (Site 3):

The daily average EET value at Site 3 was 4.5 +/- 0.2 mm/day **(Table 5.1)**, with a season high of 7.3 mm on July 7 and a low of 0.5 mm on August 9 **(Figure 5.3)**. Cumulative EET for the season was 263.7 mm **(Figures 5.4)**.

5.1.4 – Upland Heath (Site 4):

Daily average EET is 2.2 +/- 0.1 mm/day **(Table 5.1)**. Maximum EET of 4.5 mm occurred on July 7, while a minimum estimate of -0.4 mm was observed on August 9 **(Figure 5.3)**. The cumulative estimate for EET at Site 4 was 131.6 mm **(Figure 5.4)**.

5.1.5 – Upland Sedge (Site 5):

The daily average EET at Site 5 was 3.7 +/- 0.2 mm/day with a high of 6.1 mm on July 7 and a low of 0.2 mm on August 9 **(Table 5.1; Figure 5.3)**. The cumulative EET estimate is 215.4 mm **(Figure 5.4).**

5.1.6 – Dwarf Birch (Site 6):

Temperature data from the Hobo sensor located at Site 6 **(Appendix B, Figure 5.1)** was used to calculate EET. The daily average EET values were 3.6 +/- 0.2 mm/day. A seasonal high value of 6.1 mm occurred on July 7, whereas the low value (-0.05 mm) occurred on August 9 **(Table 5.1; Figure 3.5)**. Cumulative EET was 212.6 mm **(Figure 5.4)**.

5.2 – ACTUAL EVAPOTRANSPIRATION:

5.2.1 – AET Lysimeters:

June 21 through August 18 was chosen as the sampling period for which to compare all results using all methods, due to reasons previously outlined. Daily data from the AET lysimeters is included in **Appendix D**. Since there were no lysimeters at Site 1, AET for that site was not calculated by these means.

A number of changes can cause lysimeters to deviate from reality: changes in the hydrological boundary conditions, for example, imposition of a plane of zero flow or a water table at the bottom of a lysimeter (Boast and Robertson, 1982). To determine if lysimeters at any site are underestimating AET and by how much, estimates of lysimeter soil moisture were compared to soil moisture measurements from the surrounding undisturbed vegetation community, obtained using a hydrosense TDR probe (Campbell Scientific Ltd., Utah). Soil moisture of the actual lysimeter contents was never directly measured with the intent of protecting their integrity. However, soil moisture of lysimeter contents could be estimated using the analysis of soil cores and lysimeter dimensions,

$$\Theta_L = ((W_{OBS} [g] - W_{DRY} [g]) / V_{SAT} [cm^3] \times 1 [g/cm^3]) \times 100 \% \qquad (5.1)$$

where W_{OBS} is the observed lysimeter weight, W_{DRY} is the lysimeter oven-dry weight, and V_{SAT} is the saturated water volume of the lysimeter. The later two terms are calculated using the bulk density obtained from soils cores at that site. At the beginning of the season, it can be assumed that soil moisture inside the lysimeters equals that of the surrounding undisturbed vegetation community. For that reason, the volumetric soil moisture of the surrounding community on the first day of Hydrosense sampling (June 20) replaces the previous estimate of lysimeter volumetric soil moisture on that date.

At Site 2, that value is 47.1%, taken on June 20. From there, the previously calculated differences between daily lysimeter VSM estimates are applied to the hydrosense VSM value reported on the previous day. For example, the VSM of the lysimeters at Site 2 decreased 0.2% between June 20 and June 21. That 0.2% decrease is applied to the original hydrosense value from June 20 (47.1%), yielding a lysimeter VSM of 46.9% on June 21. These calculations were done until the end of the field season on August 18. This newly created extrapolated VSM series for the lysimeter is then compared with the observed VSM data series for the undisturbed vegetation community **(Figure 5.8).** This is also explained in **Appendix E.**

Daily differences between soil moisture inside and outside the lysimeter on the last day of the season are converted to an equivalent weight difference in kilograms **(Equation 5.2)**, and an equivalent water depth in millimetres **(Equation 5.3)**,

$$\Delta W_L\ [kg] = V_{SAT}\ [m^3] \times (-\Delta\Theta_L / 100) \times 1000\ [kg/m^3] \tag{5.2}$$

$$\Delta W_m\ [mm] = (1000\ [g/kg] \times 1\ [cm^3/g] \times \Delta W_L\ [kg]) \times 10\ [mm/cm] / (33.8\ [cm] \times 33.5\ [cm]) \tag{5.3}$$

where ΔW_L is the cumulative lysimeter weight difference in kilograms, and ΔW_m is the difference in millimetres. The numbers on the denominator represent the surface area of the lysimeter in cm^2. The cumulative ΔW_m values throughout the season represent the amount of throughflow water denied to the lysimeter due to the presence of its walls, and thus the amount by which evapotranspiration was potentially underestimated. That cumulative difference was divided by the number of days (58), yielding a daily correction factor for that site. Corrections were not required at Site 6, since negligible lateral flow was thought to occur in the sandy esker soil. **Appendix E** shows corrected daily VSM values, observed VSM in the undisturbed surrounding community, and the daily cumulative weight difference as a depth of water.

There is approximately 4.8 km^2 of tundra within the Daring Lake study area **(Figure 3.7)**. As tundra is far from homogeneous, that area is divided into several vegetative community classifications based on ICONOS classifications **(Table 3.7)**. Approximately 640 000 m^2 of tundra, 13.3% of the Daring Lake study area **(Figure 3.7)** features vegetation communities that were not sampled at any site. This area was not included in any of the weighted AET calculations or in the approximate coverage of the land cover classifications associated with the six study sites **(Table 3.7)**. Because the 'heath lichen and heath mat tundra was found at several sites **(Table 3.7)**, spatial coverage of this community was spread evenly among the upland heath, upland sedge, and dwarf birch communities (Sites 4, 5, and 6). The upland heath community is also partially covered by 'cotton grass tussocks', the upland sedge community by 'riparian birch', and the dwarf birch community by 'dry sedge meadows' **(Figures 3.6, 3.7)**.

Statistic	Site 2	Site 3	Site 4	Site 5	Site 6
N	58	58	58	58	58
Mean (mm/d)	1.8	3.2	1.7	3.0	1.3
Median (mm/d)	1.7	3.1	1.8	2.9	1.3
Standard Error of Mean (mm/d)	0.1	0.2	0.1	0.1	0.1
Standard Deviation (mm/d)	0.9	1.2	1.0	1.0	0.9
Sum (mm)	102.4	183.0	99.5	172.0	77.5
Skewness	0.373	0.305	0.403	0.735	0.636

Table 5.2 - Descriptive statistics of corrected lysimeter AET for the 2006 study period (June 21 – August 18, 2006), Daring Lake, Northwest Territories, Canada

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
α	**1.26***	**0.55**	**0.71**	**0.77**	**0.81**	**0.36**

Table 5.3 – Calculated Priestly-Taylor α-values at each site, Daring Lake, Northwest Territories, Canada

Mean AET rates **(Table 5.2; Appendix G)** among vegetation communities were deemed statistically different for all but two cases. The two cases where differences in AET were not statistically significant were between the lowland and upland heath sites (Sites 2 and 4), and between the hummock and upland sedge sites (Sites 3 and 5).

5.2.1.1 – Lowland Heath (Site 2):

Since this site consisted largely of peat, it is expected that the changes observed here **(Figure 5.5)** are thought to be underestimates. That is, the solid walls of the lysimeter structure prevent the throughflow of soil water, rendering the lysimeter contents drier than the surrounding vegetation community. It is estimated that the lysimeters at Site 2 underestimated cumulative evapotranspiration over the season by 2.0 kg, or 17.9 mm **(Appendix D)**. The difference between lysimeter and hydrosense volumetric soil moisture can be seen in **Figure 5.8**. When this correction factor is applied **(Section 5.2.1)**, total evapotranspirative losses for were 102.4 mm, with a daily average of 1.8 +/- 0.1 mm/day.

5.2.1.2 – Lowland Peat Hummocks (Site 3):

Because Site 3 was a wet, lowland site containing a series of sphagnum/peat hummocks and hollows, observed evapotranspiration rates reported by lysimeters were thought to be grossly underestimated for reasons previously discussed at Site 2. Daily VSM differences between the lysimeters and surrounding vegetation community **(Figure 5.8)**

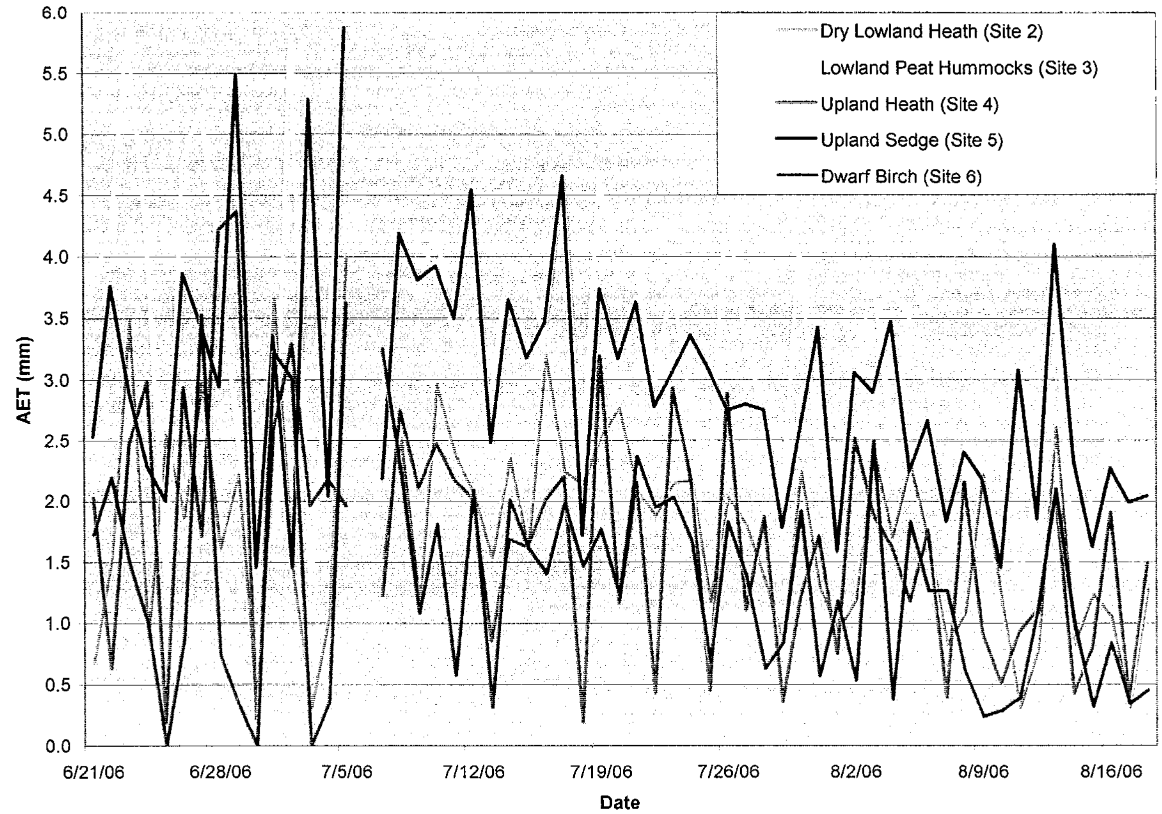


Figure 5.5 – Daily lysimeter AET rates at Sites 2 - 6, June 21 – August 18, 2006, Daring Lake, Northwest Territories, Canada

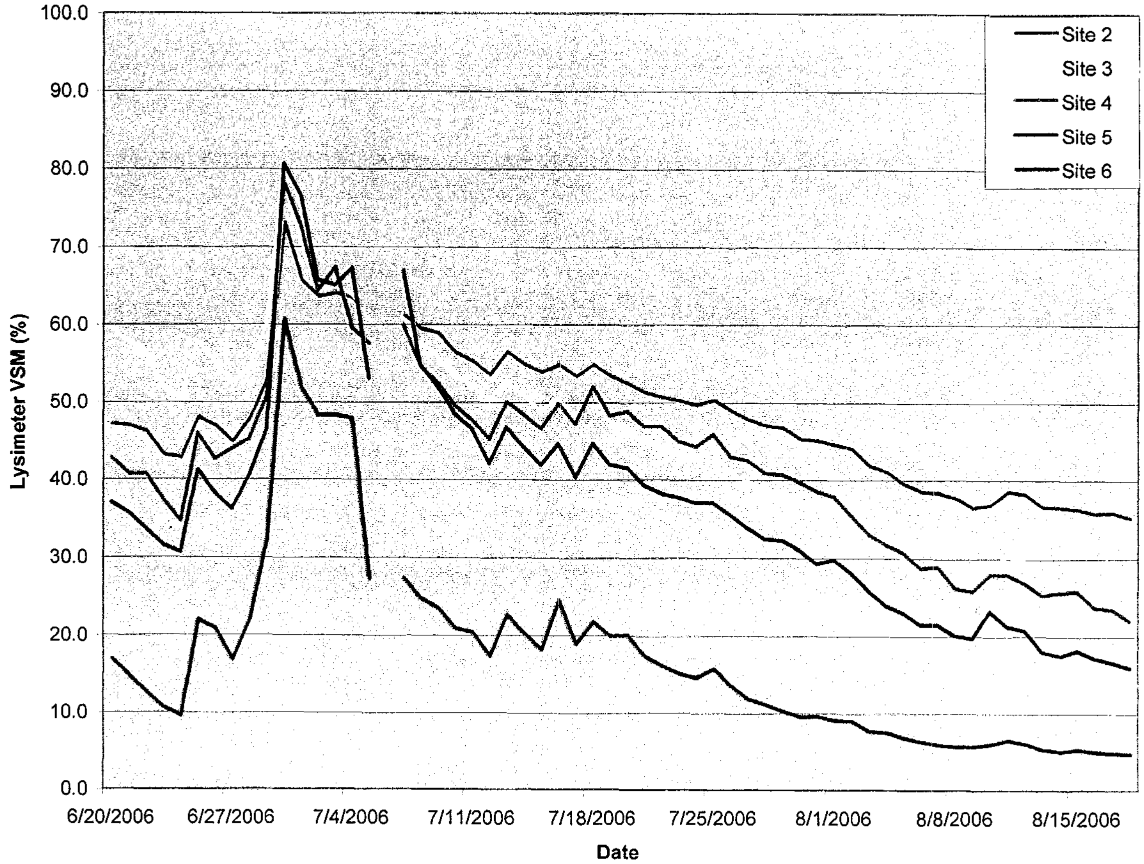


Figure 5.6 – Lysimeter VSM at Sites 2 - 6, June 20 – August 18, 2006, Daring Lake, Northwest Territories, Canada

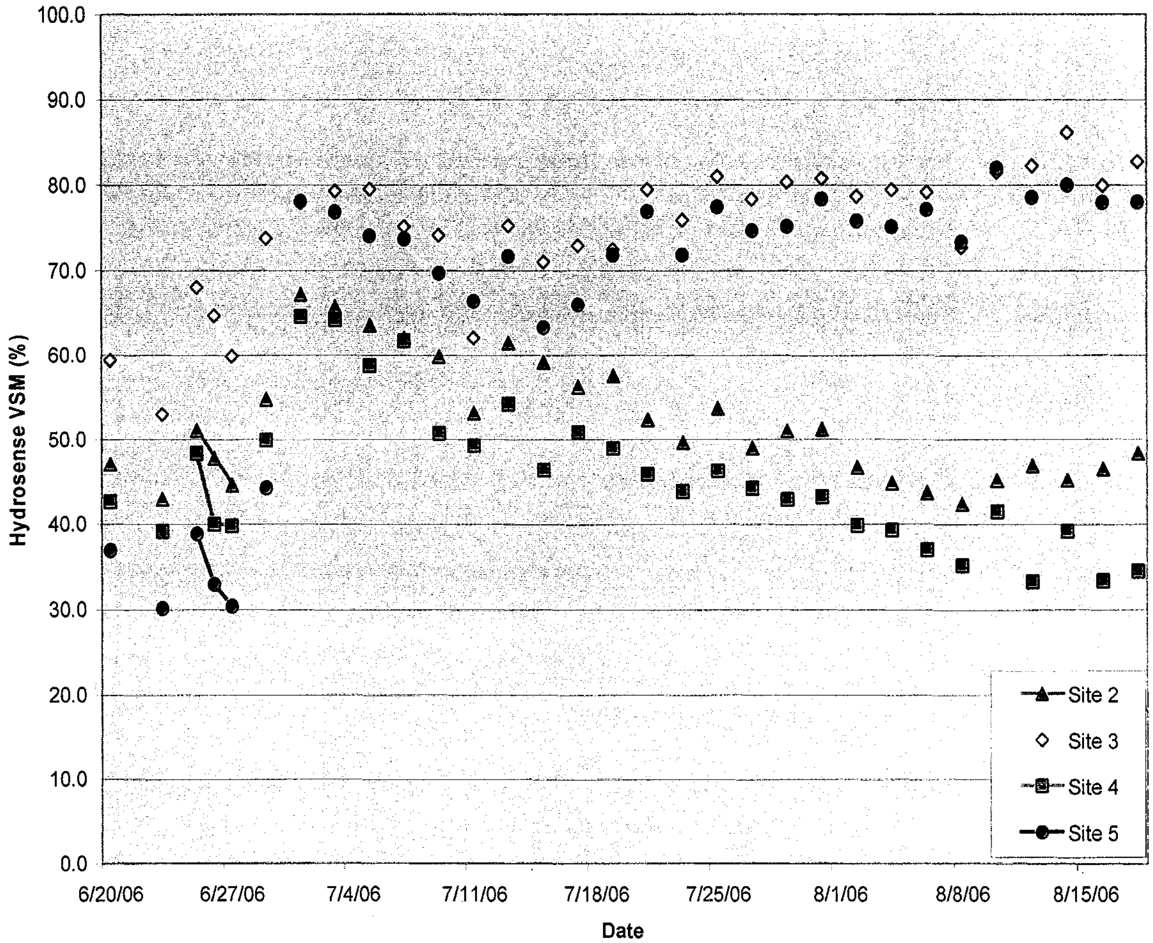


Figure 5.7 – Hydrosense VSM at Sites 2 - 5, June 20 – August 18, 2006, Daring Lake, Northwest Territories, Canada

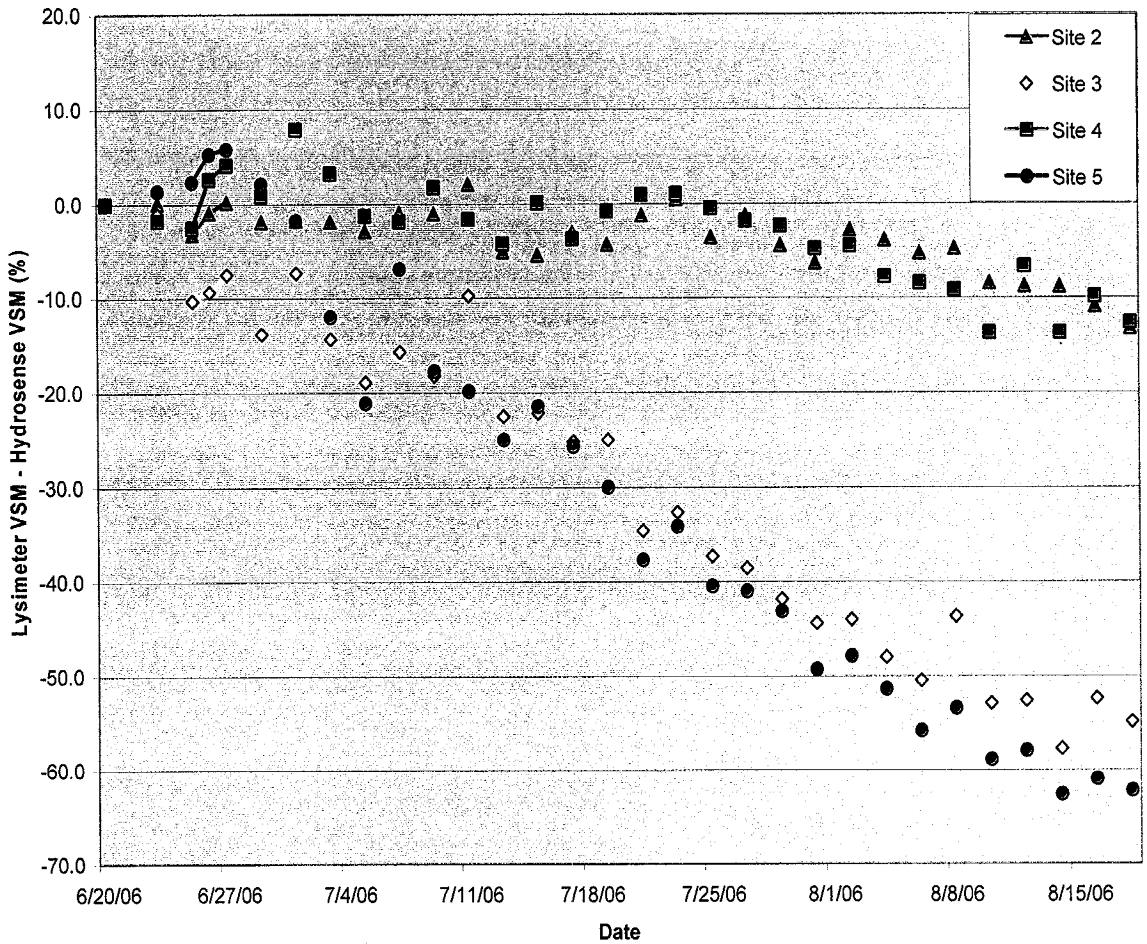


Figure 5.8 – Difference between lysimeter and hydrosense VSM at sites 2 - 5, June 20 – August 18, 2006, Daring Lake, Northwest Territories, Canada

indicate the lysimeters at Site 3 underestimate the season's total evapotranspiration by 76.2 mm, **(Figures 5.6 and 5.7, Appendix E)** equating to a daily offset of 1.3 mm. When this correction is applied to the observed data, the season total evapotranspiration at Site 3 becomes 183.0 mm, and the daily average AET rate becomes 3.2 +/- 0.2 mm/day.

5.2.1.3 – Upland Heath (Site 4):

Site 4 appeared relatively dry on the surface, except for the week following an extreme rainfall on June 30. The soil at this site is a mixture of silt, fine-grained sands, and clay. The same correction techniques used at Sites 2 and 3 were applied to data at this site to determine whether or not lysimeter AET is significantly underestimated **(Figures 5.6 and 5.7)**. According to **Appendix E,** lysimeters at Site 4 underestimate the season's total AET by only 11.3 mm, or 0.2 mm/day. After correcting, AET becomes 99.5 mm, and the daily average AET rate 1.7 +/- 0.1 mm/day.

5.2.1.4 – Upland Sedge (Site 5):

While Site 5 appeared relatively dry at the season's onset, several areas of standing water appeared following an extreme rainfall event on June 30, and remained until season's end, despite the lack of any subsequent heavy rainfalls. This site is on a small plateau on the southward incline between the esker and carbon flux tower. The soil at this site consisted largely of silt and clay, hence an ability to retain water. For this reason, it is suspected that AET was underestimated by the lysimeters at this site. AET is underestimated by 84.4 mm over the season (an equivalent of 9.6 kg of water), or 1.5 mm/day **(Figures 5.6, 5.7, Appendix E)**. When this correction is factored into the original observations, the new season total AET at Site 5 becomes 172.0 mm, and the daily AET is 3.0 +/- 0.1 mm/day.

5.2.1.5 – Dwarf Birch (Site 6):

Because this site was relatively dry and dominated by dwarf birch, featured coarse-grained soil, and the location on the esker, it is assumed that the presence of the lysimeters did not significantly affect the lateral flow of soil water. Thus the corrections applied at Sites 2 through 5 were deemed unnecessary. Evapotranspirative losses at Site 6 totaled 77.5 mm, with a daily average of 1.3 +/- 0.1 mm/day **(Figure 5.5)**.

5.2.2 – Regional Scale Evapotranspiration:

To determine regional scale evapotranspiration, the percent coverage **(Tables 3.8, 5.4)** of each site was multiplied by the daily mean AET values for all communities except for the flooded sedge **(Table 5.2)** and the daily mean EET value for the flooded sedge **(Table 5.1)**, giving a weighted mean AET value of 2.2 mm/day for the Daring Lake study area **(Table 5.6)**.

Table 5.4 indicates contributions from each sampled vegetation community to the weighted mean AET for the Daring Lake region. The upland sedge site had the largest contribution **(Table 5.4)**, since it covered a larger area (26.8%) than any other community, and it featured a high daily AET rate of 3.0 mm/day **(Table 5.2)**. The flooded sedge site had the lowest contribution due to low arial coverage (1.5%), despite yielding extremely high EET and AET values **(Table 5.1)**. The other four sites gave similar contributions to the weighted mean. However, these four sites were all quite different. The dwarf birch community featured the lowest AET **(Table 5.2)** at 1.3 mm/day, but covered an extensive area **(Tables 3.7, 5.4)**, whereas the hummock site featured the highest AET of all sites with lysimeters **(Table 5.2)**, but covered a much smaller area.

Figure 5.9 indicates daily weighted AET for the Daring Lake study area for the 2006 summer season. AET seems to be consistently high, between 2.5 and 3.0 mm/day until the last week of July, when it begins to decline, eventually reaching the 1.0 to 1.5 mm/day range by the end of the season.

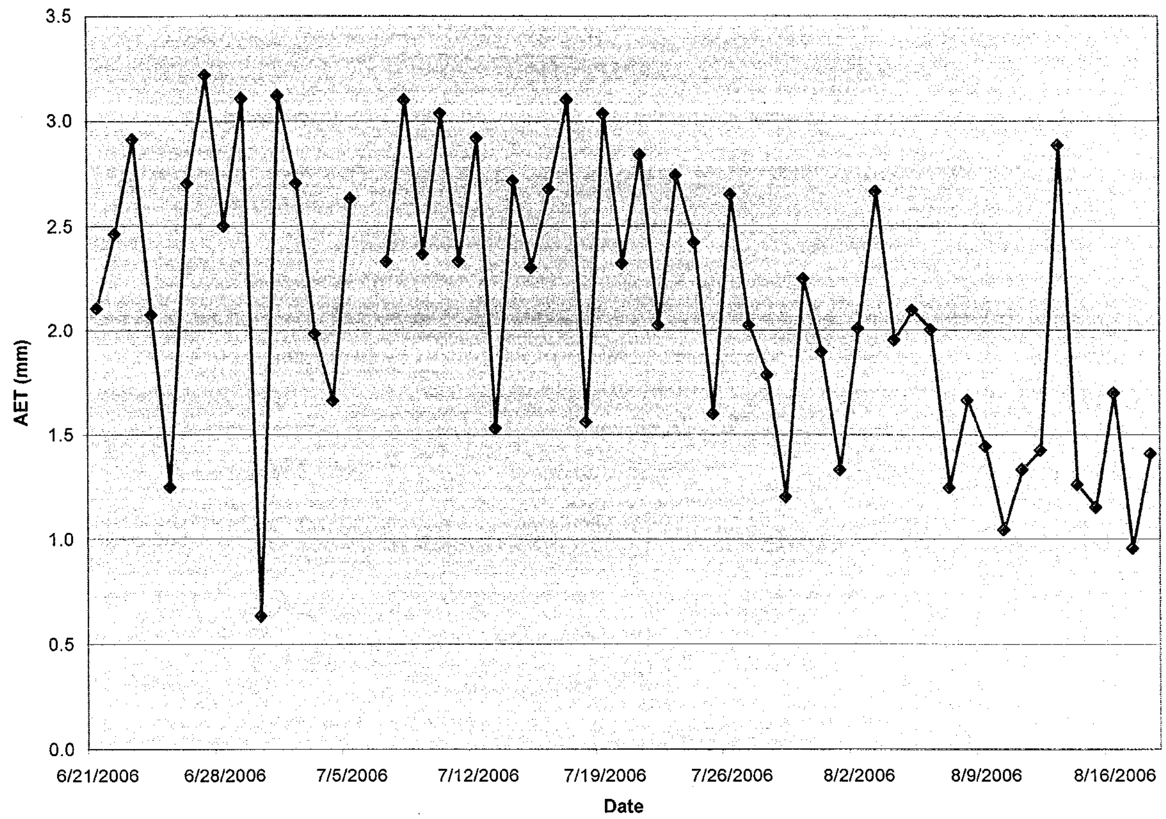


Figure 5.9 – Daily weighted AET for the Daring Lake study area, Northwest Territories, Canada, June 21 – August 18, 2006

Site	Vegetation Communities Present	Percent Coverage (%)	Arial Coverage (m^2)	Contribution to Weighted Mean (mm)
Flooded Sedge (Site 1)	Marsh / Pond	1.5	60 000	0.1
Dry Lowland Heath (Site 2)	Birch Hummocks	16.8	700 000	0.3
Lowland Hummocks (Site 3)	Wet Sedge Meadow	9.6	400 000	0.3
Upland Heath (Site 4)	Heath Lichen and Heath Mat Tundra, Cotton Grass Tussocks	19.7	820 000	0.35
Upland Sedge (Site 5)	Heath Lichen and Heath Mat Tundra, Riparian Birch	26.8	1115 000	0.8
Dwarf Birch (Site 6)	Heath Lichen and Heath Mat Tundra, Dry Sedge Meadows	25.6	1065 000	0.35
Sampled Total		100.0%	4160 000	2.2
Not Sampled	Other	N/A	640 000	N/A
Total Area		N/A	4800 000	N/A

Table 5.4 – Coverage of sampled vegetation communities within a 4.16km^2 portion of the Daring Lake study site, Northwest Territories, Canada

CHAPTER 6 – DISCUSSION

6.1 – EQUILIBRIUM EVAPOTRANSPIRATION:

The sensitivity of potential and equilibrium evaporation from different vegetation communities to changes in net radiation and temperature varies substantially (Rouse, 2000). EET was highest at the flooded sedge (Site 1) and lowland hummock (Site 3) sites, which were located approximately 100 metres apart, within the same fen **(Figure 3.8)**. The high porosity of peat, presence of standing water and low ground heat flux (Q_G) are prime reasons why EET is higher at these sites. Although the lowland sedge site (Site 2) is located within the same fen, EET estimates were much lower. The reason why EET at Sites 1 and 3 exceed EET estimates at Site 2 is likely due to soil moisture **(Appendix E)**. Rouse (2000) had similar results in tundra near Churchill, Manitoba, noting that the fen exhibited mostly larger EET than the other wetland terrains. At Daring Lake, the two wet fen sites noted above also had EET exceeding the wet upland sedge site (Site 5) **(Table 5.1)**.

Although each of these three sites features similar porosities that are consistent with accepted values for peat, there is a great difference in both soil moisture and vegetation distribution. Sites 1 and 3 are classified as wet sedge meadow sites according to ICONOS imagery **(Figure 3.7)**, and are situated in depressions, where the drainage of water from surrounding areas is more likely. Site 2 is classified by ICONOS as birch hummocks **(Figures 3.7, 3.8)**. **Table 3.2** indicates that approximately one third of the site features dwarf birch, compared to coverage of 10% or less at Sites 1 and 3 **(Tables 3.1,**

3.3). EET estimates at the flooded sedge community (Site 1) were significantly higher than those at the hummock community (Site 3) due to the presence of standing water. Standing water was occasionally present over a small portion of the hummock community, notably in low lying areas between hummocks. However, the flooded sedge community was constantly saturated due to the presence of a standing pond of water which varied in size and depth. A similar study by Rouse (2000) near Churchill, Manitoba, noted that EET for a lake was 52% greater than the averaged EET of surrounding wetland sites and more than two times greater than lichen heath. While the Flooded Sedge community (Site 1) was a small pond EET was 27% greater than the hummock site, and more than double that of the upland heath community (Site 4) whose lichen coverage was approximately 80% **(Table 3.4)**.

The presence of standing water and a thick layer of peat made the flooded sedge and hummock communities (Sites 1 and 3) unique compared to all other sites, and explain why EET was highest here. This was due to high moisture availability and low surface resistance to evaporation (Eaton et al., 2001). PET exhibits different sensitivity to the forcing parameters of Q* and temperature for the different vegetation communities (Rouse, 2000).

Calculated daily EET rates differed among all three upland sites (Sites 4, 5, and 6), due to differences in soil texture and soil moisture, which are two prime determinants of whether or not certain species of vegetation can survive in a particular location. The upland sedge site (Site 5) had the highest daily EET rates of the three upland sites, due to the presence of small areas of standing water, which remained following the extreme rainfall event of June 30 until the end of the study period. The persistence of this standing water was likely due to the high clay content of the soil. While the upland heath and upland sedge (Sites 4 and 5) featured similar dominant species, the clay content at the upland heath site was lower, contained more silt and smaller grains of sand **(Appendix A)**. The distribution of dominant species was also quite different **(Tables 3.4, 3.5)**. For instance, the coverage of lichen (i.e. *Cetraria cuclatia*) was approximately 80% for the upland heath community **(Table 3.4)**, and only 40-45% for the upland sedge site **(Table 3.5)**. Grasses such as bog rush (*Juncus arcticus*) and water sedge (*Carex aquatilis*) covered approximately 50% of the upland sedge site **(Table 3.5)**, but only 25% of the upland heath site **(Table 3.4)**.

The upland heath site (Site 4) had the lowest daily EET rates of all sites. The soil at Site 4 was more fine-grained than Site 6 (dwarf birch community). The upland heath site also had the deepest active layer and highest Q_G **(Appendix C)**. According to ICONOS **(Figures 3.7, 3.8)**, the upland heath community (Site 4) borders heath lichen/heath mat tundra and cotton grass tussocks. The upland sedge community (Site 5) borders heath lichen/heath mat tundra and closed mat shrub cover/riparian birch seep. Site 6 is classified is dry sedge meadow/heath tundra.

6.2 – ACTUAL EVAPOTRANSPIRATION:

In low-lying peatlands, the vegetation tends to form hummocks which retain surface water immediately after melt and intense rainfall (Ohmura, 1982b). Soil moisture data for the hummock site (Site 3) **(Appendix E)** indicates that soil moisture jumped following a large storm on June 30, and continued to rise throughout the season, although rainfall decreased substantially during the last month of sampling. The retention of water by the hummocks means that water is available for evaporation into the atmosphere. However, water retained within hummocks is not as easily evaporated as surface water or water within the uppermost centimetres of inter-hummock soils (Ohmura, 1982b).

Evaporation from moist bryophytes and lichens enhances tundra and subarctic woodland water loss (McFadden & Chapin 1998). When saturated, mosses can store from 300% to 500% of their dry weight in water depending on the species and their rates of drying vary with the morphology of the species (Rouse, 2000; Bayfield 1973). According to soil moisture data **(Figure 5.7, Appendix E)**, the peat at the flooded sedge and hummock communities (Sites 1 and 3) were wetter than at the lowland heath community (Site 2). Peatlands have the distinguishing physical features of extremely large water content when wet, and equally large air content when dry (Rouse, 2000). Despite the lowland heath and hummock sites (Sites 2 and 3) being located less than 100 metres apart within the same peat bog **(Figure 3.8)**, conditions were very different.

Summertime energy and water balances of high latitude wetlands can vary dramatically among years in response to changing hydroclimatological conditions (Eaton and Rouse, 2001). Of those hydroclimatological conditions, temperature is said to govern AET in wetlands (Eaton and Rouse, 2001). On Cornwallis Island, Nunavut, Young and Woo (2003) noted that the warmer summer (1998) caused much larger evaporation loss than the cooler, wetter season (1997). This is because warmer air has a higher saturation mixing ratio, meaning the maximum amount of water vapour contained in the air increases with temperature. According to Young and Woo (2003), between JD 180 and 220, the total wetland evaporation was 67mm for 1997 (assuming no condensation) and 104mm for 1998 (Young and Woo, 2003). The summer of 2006 was considered warm **(Figure 3.5)** for Daring Lake, and approximately half of the season's precipitation fell within a 24 hour period.

The lowland heath community (Site 2), classified by ICONOS as 'birch hummocks' **(Figures 3.7, 3.8)**, was dominated by *Ledum groenlandicum* (Labrador tea), *Betula glandulosa* (dwarf birch), and various grasses *(Juncus arcticus, Carex aquatili)* **(Table 3.2)**. The hummock site, classified as 'wet sedge meadow' according to ICONOS **(Figure 3.7)**, was dominated by sphagnum moss, and the same grasses and bog rush as the lowland heath site *(Juncus arcticus, Carex aquatili)* although coverage of these grasses increased from approximately 35% to 70% **(Table 3.3)**.

Despite the upland sedge community (Site 5) being higher in elevation, it featured more clay and finer grains than the upland heath site (Site 4). Site 5 was largely populated by various grasses and feather mosses, as was Site 4, but in smaller proportions. Grasses and mosses covered approximately 25% of Site 4, compared to approximately 50% of Site 5. Site 4 also had a greater cover of heath species including *Empetrum nigrum* (crowberry), *Ledum groenlandicum* (Labrador tea), *Vaccinium vitis-idaea* (Cranberry), and various species of white lichen (i.e. *Cetraria cuclatia*).

The Dwarf Birch community (Site 6) was different from all other sites due to its location. Soil was coarse-grained, surface water was not readily available, and plants with deep roots such as dwarf birch were able to flourish. Given its location on the south face of an esker **(Figures 3.2, 3.8),** the soil largely consisted of sand and pebbles, and suffered a lack of available moisture. This is why Site 6 had the lowest rates of AET (1.3 mm/day), and α-values.

Because tundra is far from homogeneous α varies with time, thus assigning one value to an entire biome is inaccurate. The diversity of values in **Table 5.3** indicates that no one value can be representative of the whole tundra biome. During previous studies, the α-value for the wetland was set to 1.26 by considering the water supply to be unlimited (Young and Woo, 2003). At Daring Lake, measured α-values were nowhere near 1.26. The highest α recorded at any site was 0.81 **(Table 5.3)**. At the flooded sedge community (Site 1), α was not directly measured, due to the absence of AET measurements. The assertion that $\alpha = 1.26$ was used due to the presence of standing water, which constitutes an essentially limitless water supply. Given that α-values increase with soil moisture, it is expected that the hummock and upland sedge communities (Sites 3 and 5) would have the highest values, whereas the dwarf birch community (Site 6) would have the lowest.

Results for a high Arctic site on Cornwallis Island, near Resolute showed that for gravel and loamy surfaces underlain by permafrost, the co-efficient α could be expressed as the following function of soil moisture (Marsh et al., 1981), where Θ represents average soil moisture over the season:

$$\alpha = 1.26 \ / \ [\ \exp(5.24 - 21.56(\Theta)\ ) + 1\ ] \qquad \textbf{(6.1)}$$

According to this formula, evaporation is large for soil moisture volumes greater than 30%, and proceeds near the potential rate (Marsh et al., 1981). When volumetric soil moisture is between 20% and 30%, there is a very rapid decrease in evaporation, and below 20% it is very small (Marsh et al., 1981). Average volumetric soil moisture for the 2006 summer season at Daring Lake **(Appendix E)**, were 45.2% for the upland heath community (Site 4), 67.4% for the upland sedge community (Site 5), and 19.5% at the dwarf birch site (Site 6). If **Equation 6.1** was used to calculate α, values would be 1.25, 1.26, and 0.33 for Sites 4, 5, and 6 respectively. These results all diverge from observed results **(Table 5.3)**. However, the soils at these sites differ from the gravel and loamy soils at the study site in Marsh et al. (1981) **(Appendix A)**. During the 1977 field season on Cornwallis Island (Marsh et al, 1981), the lysimeter locations varied from dry with an average Θ of 0.13 and an average α of 0.12, to very wet with Θ of 0.35 and an evaporation near the potential rate, with an average α of 1.14 (Marsh et al., 1981). At Daring Lake, Θ of 0.35 would be considered dry at several sites, notably peatland sites where porosity exceeded 90%.

Results of statistical comparisons of AET between the dry lowland and upland heath communities (Sites 2 and 4), and between the lowland peat hummock and upland sedge communities (Sites 3 and 5) indicate that differences between the compared data sets are statistically insignificant at the 95% level of confidence **(Appendix G)**, and therefore constitute similar data sets. The dry lowland and upland heath communities also featured data from PET lysimeters which upon comparison were also deemed statistically insignificant at a 95% level of confidence, but significantly different at a 90% level of confidence **(Appendix G)**.

Mean AET at Sites 3 and 5 **(Sections 5.2.1.2 and 5.2.1.4; Table 5.2)** differed by 0.2 mm/day, the season total AET differed by 2.9 mm **(Table 5.2),** and Q_{eEQ} daily average differed by 0.5 W/m^2. The three most dominant species at the hummock site (Site 3) were sphagnum and various species of grasses and lichen **(Table 3.3)**. At the upland sedge community (Site 5), the three most predominant species were various species of green moss, lichen, and grass **(Table 3.5)**. The main similarity is that both sites featured small areas of standing water throughout the season and similar volumetric soil moisture content throughout the season **(Figure 5.7)**, which explains why daily AET rates were higher at these sites. Volumetric soil moisture also rose sharply following a rainfall event on June 30, and remained high throughout the season at both sites.

Mean AET **(Sections 5.2.1.1 and 5.2.1.3; Table 5.2)** of the lowland and upland heath sites (Sites 2 and 4) were only 0.1 mm/day apart, total season AET differed by 11.0 mm **(Table 5.2)**. Volumetric soil moisture followed similar trends at both sites **(Figure**

5.7). The dry lowland sedge (Site 2) featured dry heath atop a layer of sphagnum moss in a peat bog. The three most predominant species at this site were Labrador tea, Dwarf Birch, and various grasses **(Table 3.2)**. The upland sedge (Site 4) was a heath site underlain by a silty-clay soil, and characterized by several species of lichen, grasses, and crowberry **(Table 3.4)**.

6.3 – IMPLICATIONS OF LAND USE AND CLIMATIC CHANGE:

General circulation models project that increased concentrations of CO_2 and other greenhouse gases in the atmosphere could lead to a rise in the global mean air temperature of between 0.9°C and 3.5°C by the year 2100, with the largest temperature rise occurring in the Arctic (Houghton et al., 1996). An increase in temperature will lead to an expected increase in PET, according to the Priestly-Taylor formula **(Equation 2.6)**, because the energy and water-holding capacity of air are increased. Additionally, warmer summer temperatures will likely result in higher AET (Eaton and Rouse, 2001). Changes in other meteorological controls may exaggerate or offset the rise in temperature, and it is possible that increased water vapour content and lower net radiation could lead to lower evaporative demands (IPCC, 2001).

6.3.1 – Climate Model Predictions:

In almost all cases, predicted climates are well beyond the range of variability of the current climate (IPCC, 2001). However, these estimates cover a very large range of precipitation and temperatures, so future climate remains uncertain except that it will be wetter and warmer (IPCC, 2001). Most models predict that land areas in the Arctic will receive substantially increased snowfall in winter and that the climate will be markedly warmer (IPCC, 2001).

Shorter, less severe winters will be a result of climate change in the Arctic. Warming will shrink the cryosphere temporally and spatially, particularly in the Arctic, causing additional heating of the surface, which in turn will further reduce ice and snow cover (IPCC, 2001). Snow plays a dominant role in Arctic hydrology, with surface energy providing the driving force to generate snowmelt, evaporation, and the annual thawing of the active layer (Woo, 1983). Over three-quarters of annual discharge is released during the melt period, but occasional high-flow events are also produced by summer rainstorms (Woo, 1983). Higher temperatures and deeper snow packs promote increased microbial activity, which in turn increases the availability of nutrients (Tape et al., 2006). The shrubs are able to utilize these more efficiently than other tundra plants. This temperature-nutrient boost works in both summer and winter (Tape et al., 2006). According to the synthesis of models used by the IPCC, snowfall is expected to increase. The forecast increase in temperature will lead to an earlier snowmelt, despite the increase in snowfall. An early melt would result in a deeper active layer and lower summer soil moisture.

The climate scenario proposed by the International Panel on Climate Change represents a synthesis of climate model outputs. It indicates that Arctic land will see a summer temperature increase of 4.0-7.5°C, and precipitation increase of 10-20% (IPCC, 2001). Version 3.6 of the Canadian Regional Climate Model (CRCM) (Environment Canada, 2007) predictions of summer conditions for 2040 include: an average air temperature of 12°C-18°C, a precipitation rate of 2.0-4.0 mm/day, an evaporation rate of 2.0-4.0 mm/day, and a 10% decrease in soil moisture for the Daring Lake region. So the consensus is that summers at the Daring Lake region will be warmer and wetter, with a decrease in soil moisture.

6.3.2 – Successional Changes in Vegetation:

Vegetation plays an important role in evapotranspiration. Changes in vegetation structure and distribution, such as a change in canopy height and/or cover will create changes in available soil moisture. Evidence indicates that changes will be at the level of individual species rather than groups of species (Chapin et al., 1997). The response of reproductive and vegetative structures to warming will vary, depending on abiotic constraints (Wookey et al., 1994; Arft et al., 1999), such as soil texture. Climate change is likely to result in alterations to major biomes in the Arctic. Ecosystem models suggest that the tundra will decrease by as much as two-thirds of its present size (IPCC, 2001; Everett and Fitzharris, 1998). However, the northward movement of forest may lag changes in temperature by decades to centuries (Starfield and Chapin, 1996; Chapin and Starfield, 1997).

One consequence of a warmer Arctic is the alteration of established vegetation patterns. Plant controls on water and energy exchanges are numerous (Rouse, 2000). Wetlands and peatlands will be especially susceptible to changes in soil moisture and evapotranspiration related to a warming climate. Peatlands generally feature the highest water content and porosity, as well as a shallower active layer. Climate is a controlling factor in the development of peat-dominated wetlands, but the organic soils, in turn, exert important controls on the surface vegetation and climate because of their high porosity and large water (ice) contents (Rouse, 2000). Non-vasculars, such as mosses and lichen, act as a mulch layer, decoupling the moist subsurface from the atmosphere (Rouse, 2000). Evidence suggests that wetland tundra is more sensitive to synoptic scale variability than wetland subarctic forest (Rouse, 2000; Lafleur & Rouse 1995). This is because wetland tundra is more exposed, since it lacks the canopy present in the subarctic forest. If the climate were to become warmer and drier, there would be a greater increase in evaporation from tundra than from forest (Rouse, 2000; Lafleur & Rouse 1995).

The drying of peatlands could lead to more hospitable environments for species such as Labrador tea (*Ledum groenlandicum*), crowberry (*Empetrum nigrum hermaphroditum*) and dwarf birch (*Betula glandulosa*), which prefer drier areas. Note that the driest of the three peatland sites at Daring Lake (Site 2, the lowland heath site) had a higher coverage of the aforementioned vascular species, compared to the two wetter peatland sites (Sites 1 and 3) **(Tables 3.1, 3.2, 3.3)**. Under the projected conditions, there will be more ponding of water in some areas, but peatlands may dry out because of increased evaporation and transpiration from plants (IPCC, 2001). Thus decomposition of peat will likely occur. So it is proposed that under a warmer climate, small ponds and flooded sedge areas (Site 1) will remain but become drier and shallower, resulting in the drying of boundary areas. Hummocky communities (Site 3) will transition to drier peatland sites, dominated by Labrador tea, crowberry, and dwarf birch (Site 2).

Another expected response to climate warming in the Arctic is an increase in the abundance and extent of shrubs in tundra areas (Tape et al, 2006). Observations from Northern Alaska note that the occurrence of smaller willow and birch shrubs have been increasing, therefore, indicating future expansion of all major shrubs (Tape et al, 2006). Sedge-dominated wet meadows are one of the most distinctive community types in the Arctic (Bliss & Matveyeva 1992), and in the Tundra Biome as a whole (Henry, 1998). At the Daring Lake study site, sedge was present at all six sites, three of which (Sites 1, 3, 5) can be referred to as 'sedge dominated wet meadows'. Soil characteristics will determine to some extent the responses of vegetation to climate change (Callaghan, 2004), through controls on soil moisture. Areas of riparian birch may succeed into willow communities due to increasing soil moisture, whereas this transition is less likely for drier dwarf birch communities (Site 6), since the type of soil is very likely to constrain potential rates of colonization by southern species (Callaghan, 2004). The local effects of climate change on soil moisture are expected to vary with the degree of warming associated with climate change, and with soil characteristics (IPCC, 2001). The water-holding capacity of soil will affect possible changes in soil moisture deficits; the lower the capacity, the greater the sensitivity to climate change (IPCC, 2001).

An experiment in the tundra near Toolik Lake, Alaska by Chapin et al. (1995) determined the effect of warming on several tundra communities by using greenhouses. Increased temperature alone caused significant growth increases in deciduous and evergreen shrubs, while growth in non-vascular plants declined (Henry and Molau, 1997). The major effect of elevated temperature was to speed plant response to changes in soil resources and, in the long term, to increase nutrient availability (Chapin et al, 1995). However, the effects of the greenhouse experiment and ongoing natural climatic warming were complicated by increases in soil temperature, thaw depth, and nutrient availability, and a decline in irradiance (Chapin et al, 1995; Maxwell 1992), and should not be considered the result of simple changes in air temperature (Chapin et al, 1995). Since increased nutrient availability is expected to coincide with warming of the tundra, its effects were also considered.

The basis for predictions of vegetation succession is the assumption that the climate of the region will be warmer in general, with summers being wetter, and soil moisture lower than present. With warming and increased nutrient availability, the 'cotton grass tussock' area covering part of Site 4 is expected to be dominated by deciduous shrubs such as dwarf birch (Site 6). The lichen which dominates much of the 'heath lichen tundra' community **(Figure 3.7)** is likely to become less abundant, in favour of species such as Labrador tea (*Ledum groenlandicum*), crowberry (*Empetrum nigrum*) and dwarf birch (*Betula glandulosa*). Proposed changes in vegetation distribution are included in **Table 6.1**. It is proposed that half of the present vegetation at Sites 4 and 5 will succeed to drier dwarf birch communities, similar to those presently occupying Site 6. Sites 4 and 5 will be reduced to half their present coverage, whereas the coverage of Site 6 will increase.

Description	**ICONOS Classification**	**Present Coverage (%)**	**Present Contribution to Regional AET Total (mm/d)**	**Future Scenario**	**Future ICONOS Classification**	**Future Coverage (%)**	**Future α**
Flooded Sedge	Marsh / Pond	1.5	0.1	Same distribution, but drier.	Marsh / Pond	1.5	1.26
Dry Lowland Heath	Birch Hummocks	16.8	0.3	Now includes Site 3.	Birch Hummocks	26.4	0.55
Lowland Hummocks	Wet Sedge Meadow	9.6	0.3	Becomes Site 2.	Birch Hummocks	0.0	0.55
Upland Heath	50% Heath Lichen and Heath Mat Tundra, 50% Cotton Grass Tussocks	19.7	0.35	Half remains, half becomes like Site 6.	50% Heath Lichen and Heath Mat Tundra, 50% Dry Sedge Meadows	9.9	0.57
Upland Sedge	50% Heath Lichen and Heath Mat Tundra, 50% Riparian Birch	26.8	0.8	Half remains, half becomes like Site 6. The riparian birch area will contain willows.	50% Heath Lichen and Heath Mat Tundra, 50% Riparian Birch	13.4	0.59
Dwarf Birch	50% Heath Lichen and Heath Mat Tundra, 50% Dry Sedge Meadows	25.6	0.35	Now includes half of Sites 4 and 5.	50% Heath Lichen and Heath Mat Tundra, 50% Dry Sedge Meadows	48.9	0.36

Table 6.1 – Proposed Changes in Vegetation Coverage at Daring Lake Study Sites, Assuming an Increase in Temperature and Decrease in Soil Moisture

6.3.3 – Effects on Evapotranspiration:

As evapotranspiration is controlled by vegetation, and the spatial distribution of vegetation communities is controlled by soil moisture. An increase in evapotranspiration associated with an increase in temperature could lead to a decrease in summer soil moisture. This will lead to certain areas becoming more hospitable or less hospitable for different types of vegetation. The water table generally resides at lower levels during a warm year, given a reduction of water supply.

Given climatic changes predicted for the Daring Lake study area, the result will be a slight decrease in evapotranspiration. When using the Priestly-Taylor formula **(Equation 2.6)**, the effect of temperature increase is minimal. An increase in temperature will lead to higher values for the Δ **(Equations 2.7, 2.8)** and γ **(Equations 2.9, 2.10)** components of the Priestly-Taylor formula **(Equation 2.6)**. Because both Δ occurs in both the numerator and denominator of **Equation 2.6**, and γ is a comparably miniscule number **(Appendix D)**, the resulting change in either will have a minimal effect on the resulting evapotranspiration value.

Predicted changes to soil moisture are related to predicted changes in snowfall, snow water equivalent, and the timing of the snow melt. The predicted increase in temperature and length of growing season, combined with the expected changes in vegetation distribution will mitigate and possibly nullify any increase in soil moisture coinciding with the predicted increase in precipitation. The effect of soil moisture is significant, as soil moisture dictates Q_G. Lower soil moisture means lower availability of soil water for evapotranspiration into the atmosphere. Lower soil also moisture means Q_G will be higher and occupy a greater percentage of Q^*, reducing the amount of energy allotted to Q_{eEQ}. According to **Equation 2.6**, as Q_G increases, ET will decrease, provided Q^* remains constant. So, a reduction in summer soil water, for example, could lead to a reduction in the rate of evapotranspiration from a catchment despite an increase in evaporative demands (IPCC, 2001).

The effect of vegetation communities also exerts a greater influence than air temperature. The role of vegetation communities in the Priestly-Taylor formula **(Equation 2.6)** is expressed using α. Because the occurrence of plant communities depends on soil water availability, α is also a function of soil moisture. As soil water availability becomes scarcer, AET becomes lower, as does α, which represents the ration of AET to PET. **Table 6.1** shows predicted α-values of the six study sites under the new vegetation regime proposed in **Section 6.3.2**, most of which are lower than the present day values from **Table 5.3**. According to **Equation 2.6**, a lower α will lead to lower AET.

Given predictions for warmer, wetter summers and lower soil moisture for the Daring Lake study site **(Section 6.3.1)**, and how the proposed climate and vegetation changes will effect evapotranspiration, it can be concluded that evapotranspiration should decrease.

CHAPTER 7 – CONCLUSIONS

Evapotranspiration estimates at sites representing six different vegetation communities indicate that vegetation assemblages exert a significant influence on spatial and temporal variations in evapotranspiration. The primary influence on where various vegetation assemblages can succeed is the availability of soil moisture, which is strongly dependent on soil texture. The highest EET and AET occur in locations of greater soil moisture availability, such as peatlands and areas where the occurrence of surface water is most likely. The lowest EET and AET estimates occurred at a dry site on an esker with the coarsest soil of all six sites and plentiful coverage of dwarf birch. Thus, a direct correlation between evapotranspiration and soil moisture availability exists.

Assuming warmer conditions and decreased soil moisture for the tundra in the Daring Lake region occurs, the spatial distribution of vegetation communities will change. Changes in vegetation are expected to include a drying of peatlands, the invasion of peatlands and other communities by vascular species such as dwarf birch, and a lower incidence of bryophytes.

Using the synthesis of climate models employed by the IPCC and the CRCM V3.6 climate model, a shift in vegetation communities was forecast to coincide with the warming of the local climate. It was determined that given the predicted shift in vegetation, the magnitude of warming had little effect on the predicted daily weighted AET for the Daring Lake region, whereas the decrease in soil moisture and vegetation shifts resulting from warming did affect daily weighted AET for the Daring Lake region.

Given the change in vegetation and a finite decrease in soil moisture, changes to regional scale evapotranspiration were negligible, whereas given the change in vegetation and a finite increase in air temperature, a decrease in evapotranspiration coincided with decreased soil moisture. Evapotranspiration is expected to decrease slightly from present day values, regardless of the magnitude of warming or decrease in soil moisture.

APPENDIX A – SOIL TEXTURE MEASUREMENTS

Due to the uniform nature of samples extracted at sites 1, 2, and 3, soil texture analysis was deemed unnecessary. Anything coarser than 1.0mm in diameter was deemed to be very coarse sand. All other ranges of particle sizes follow the USDA classification system, except for silts ad clays. Since there was no 50μm sieve available for use, anything finer than 64μm in diameter fell into the aforementioned category.

Soil Texture Analysis by Weight, Sites 4, 5 and 6

Sample	Total Input (g)	> 1.0 mm (g)	> 710 um (g)	> 500 um (g)	> 250 um (g)	> 125 um (g)	> 90 um (g)	> 64 um (g)	< 64 um (g)	Soil Lost (g)
4W	24.37	6.25	1.36	1.38	2.38	3.98	2.27	2.09	2.81	1.85
4X	67.49	23.7	3.58	3.35	5.06	10.11	8.70	8.00	4.45	0.54
4Y	16.91	10.16	0.84	0.87	1.52	1.76	0.95	0.69	0.36	-0.24
4Z	86.87	2.77	0.51	0.80	2.97	14.85	18.36	22.37	22.91	1.33
5W	2.94	0.13	0.09	0.15	0.40	0.67	0.38	0.43	1.30	-0.61
5X	108.73	25.38	5.32	6.00	12.06	17.14	9.99	9.82	22.25	0.77
5Y	38.87	14.65	2.73	2.64	4.77	5.41	2.67	2.60	3.70	-0.30
5Z	122.13	14.8	3.28	3.72	8.81	15.76	12.17	15.28	46.88	1.43
6A	20.88	6.51	1.51	1.61	3.41	4.20	2.19	1.43	0.74	-0.72
6B	113.66	1.46	0.63	0.96	6.01	30.43	29.01	26.88	17.88	0.40
6C	109.25	0.58	0.41	1.07	5.76	26.11	27.81	26.28	19.28	1.95
6D	18.45	5.98	1.54	1.62	3.39	3.39	1.30	0.89	0.58	-0.24
6E	42.5	6.31	1.69	2.23	5.90	9.74	6.73	6.17	3.78	-0.05
6F	95.46	9.06	1.67	1.77	5.58	20.57	19.38	19.49	17.49	0.45

Soil Texture Analysis by Percentage, Sites 4, 5 and 6

Sample	Total Input (%)	> 1.0 mm (%)	> 710 um (%)	> 500 um (%)	> 250 um (%)	> 125 um (%)	> 90 um (%)	> 64 um (%)	< 64 um (%)	Soil Lost (%)
4W	100.00	27.75	6.04	6.13	10.57	17.67	10.08	9.28	12.48	7.59
4X	100.00	35.40	5.35	5.00	7.56	15.10	12.99	11.95	6.65	0.80
4Y	100.00	59.24	4.90	5.07	8.86	10.26	5.54	4.02	2.10	-1.42
4Z	100.00	3.24	0.60	0.94	3.47	17.36	21.46	26.15	26.78	1.53
5W	100.00	3.66	2.54	4.23	11.27	18.87	10.70	12.11	36.62	-20.75
5X	100.00	23.51	4.93	5.56	11.17	15.88	9.25	9.10	20.61	0.71
5Y	100.00	37.40	6.97	6.74	12.18	13.81	6.82	6.64	9.45	-0.77
5Z	100.00	12.26	2.72	3.08	7.30	13.06	10.08	12.66	38.84	1.17
6A	100.00	30.14	6.99	7.45	15.79	19.44	10.14	6.62	3.43	-3.45
6B	100.00	1.29	0.56	0.85	5.31	26.87	25.61	23.73	15.79	0.35
6C	100.00	0.54	0.38	1.00	5.37	24.33	25.92	24.49	17.97	1.78
6D	100.00	32.00	8.24	8.67	18.14	18.14	6.96	4.76	3.10	-1.30
6E	100.00	14.83	3.97	5.24	13.87	22.89	15.82	14.50	8.88	-0.12
6F	100.00	9.54	1.76	1.86	5.87	21.65	20.40	20.51	18.41	0.47

Soil Texture Analysis by Texture, Sites 4, 5 and 6

Study Site	V. Coarse Sand (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	V. Fine Sand (%)	Silts and Clays (%)
Site 4	31.41	8.51	7.62	27.62	12.85	12.00
Site 5	19.21	9.19	10.48	24.62	10.13	26.38
Site 6	14.72	7.83	10.72	39.69	15.77	11.26

Porosity and Bulk Density of Soil Cores at all Sites

Sample	Saturated Wt. (g)	Field Capacity Wt. (g)	Dry Wt. (g)	Porosity	Bulk Density (g/cm^3)
1A	113.0	106.0	4.5	0.961	0.045
1B	133.5	123.1	12.0	0.910	0.111
1D	100.1	75.3	1.7	0.983	0.016
1E	136.8	124.2	11.5	0.916	0.106
2A	121.8	102.5	8.4	0.931	0.078
2B	108.2	86.1	7.2	0.933	0.067
2C	126.4	110.8	1.5	0.988	0.014
2D	103.3	76.5	3.8	0.963	0.035
2E	122.1	96.0	8.6	0.929	0.080
2F	100.1	87.8	3.3	0.967	0.030
3A	118.7	99.2	3.8	0.968	0.035
3B	125.4	115.6	1.6	0.987	0.015
3D	130.8	120.4	5.4	0.958	0.050
3E	123.3	108.1	1.3	0.989	0.012
4W	117.9	101.8	26.1	0.779	0.242
4X	167.8	151.2	76.1	0.547	0.704
4Y	118.5	99.6	17.5	0.852	0.162
4Z	135.7	127.8	89.4	0.341	0.828
5W	110.4	95.3	2.9	0.974	0.027
5X	177.9	169.7	108.7	0.389	1.007
5Y	128.7	120.3	38.6	0.700	0.358
5Z	179.5	167.0	122.3	0.318	1.133
6A	110.5	103.3	20.6	0.813	0.191
6B	196.0	186.4	116.3	0.407	1.077
6C	171.0	162.4	110.0	0.357	1.018
6D	94.5	91.2	18.1	0.809	0.168
6E	185.1	167.1	42.6	0.770	0.394
6F	173.5	157.1	95.9	0.447	0.888

APPENDIX B – METEOROLOGICAL DATA

Air temperature and relative humidity recorded by the tower was used at Sites 4 and 5 due to their proximity to the tower. Data from the Hobos at Site 2 were used at Sites 1, 2, and 3, whereas data from the Hobos at Site 6 were used exclusively at Site 6.

Correction of the HOBO values was required, because each of the four sensors stopped recorded values during the middle of the season. Any data recorded by the HOBOS was left untouched. Temperature and relative humidity data recorded at 30-minute intervals by the HOBOs were regressed against temperature and relative humidity data recorded at 30-minute intervals by the carbon flux tower. Because the HOBOs tended to overestimate air temperature during the afternoon and overestimate relative humidity during the night and early morning, it was decided that creating one correction factor representing the entire day would be inaccurate. Hence, the day was divided into four sections, as indicated on the above table. Each six hour section of the day was assigned its own correction factor, which was multiplied by the tower data in order to derive air temperature and relative humidity values for the HOBOs after they stopped recording. The results of said regressions are displayed using the graphs below, and the Hobo correction table. From the time when data recording stopped and onward, relative humidity values recorded by the tower were multiplied by the above correction factors. Air temperature values were converted to degrees Kelvin, multiplied by the above correction factors, and converted back to values in degrees Celsius. In cases where the re-calculated relative humidity exceeded 100%, the corrected relative humidity values were set to 100%.

Daily Temperature, Relative Humidity, and Precipitation Recorded at the Carbon Flux Tower

Date	Julian Date	High Temp (°C)	Low Temp (°C)	Avg. Temp (°C)	High RH (%)	Low RH (%)	Avg. RH (%)	Precipitation (mm)
6/21/2006	172	15.07	-0.18	8.27	92.80	31.17	54.51	0.00
6/22/2006	173	22.23	5.95	15.46	86.70	30.52	53.43	0.00
6/23/2006	174	23.35	10.05	17.59	77.10	22.27	47.94	0.00
6/24/2006	175	19.60	9.30	14.27	97.30	47.93	76.31	9.18
6/25/2006	176	15.72	7.07	11.32	91.30	30.84	57.18	0.34
6/26/2006	177	20.55	7.57	15.50	88.50	37.43	55.89	0.00
6/27/2006	178	21.78	12.97	17.45	72.90	44.03	58.89	1.02
6/28/2006	179	20.88	12.63	15.91	100.00	58.30	78.85	13.61
6/29/2006	180	18.67	10.83	14.17	100.00	73.80	90.76	19.39
6/30/2006	181	11.13	8.89	9.78	99.70	92.30	96.61	46.95
7/1/2006	182	15.42	8.48	11.17	96.60	56.08	81.45	0.00
7/2/2006	183	20.15	6.90	14.39	99.00	41.02	70.98	0.00
7/3/2006	184	20.40	8.78	13.73	96.90	50.70	79.13	4.42
7/4/2006	185	14.66	5.10	10.42	96.80	46.73	69.47	0.00
7/5/2006	186	17.54	8.31	12.87	92.50	41.30	65.88	0.00
7/6/2006	187	11.30	4.36	8.51	96.90	52.40	76.50	6.46
7/7/2006	188	10.46	3.40	6.63	71.50	44.62	58.09	0.00
7/8/2006	189	12.83	5.85	9.64	83.40	44.18	60.31	0.00
7/9/2006	190	13.21	4.72	9.53	100.00	45.51	70.14	0.00
7/10/2006	191	15.60	2.98	10.80	93.90	34.42	55.50	0.00
7/11/2006	192	18.36	6.64	13.66	87.40	31.23	50.05	0.00
7/12/2006	193	17.04	8.19	13.22	88.30	41.83	61.10	0.34
7/13/2006	194	13.11	7.80	10.09	93.90	68.84	83.24	4.42
7/14/2006	195	19.44	7.48	13.94	91.80	40.20	65.08	0.00
7/15/2006	196	17.73	8.21	12.62	99.40	58.97	81.65	3.74
7/16/2006	197	20.90	9.79	15.33	100.00	42.14	75.55	0.34
7/17/2006	198	16.54	12.55	14.05	90.50	58.18	73.58	0.00
7/18/2006	199	16.76	11.32	13.55	92.80	56.07	78.05	4.42
7/19/2006	200	16.65	7.47	12.61	99.30	56.10	76.72	0.00
7/20/2006	201	21.46	9.12	15.69	100.00	42.20	73.06	1.36
7/21/2006	202	24.72	10.81	17.86	94.90	39.33	66.40	0.34
7/22/2006	203	24.43	12.94	18.11	92.20	33.92	67.93	0.00
7/23/2006	204	21.55	9.13	15.37	100.00	47.50	80.24	2.38
7/24/2006	205	8.77	5.33	7.11	91.10	59.90	74.50	1.36
7/25/2006	206	12.64	6.09	9.15	95.30	46.79	71.90	0.34
7/26/2006	207	14.63	2.47	9.50	98.70	40.37	66.87	0.00
7/27/2006	208	16.14	6.99	11.57	92.80	42.29	62.64	0.00
7/28/2006	209	11.97	8.78	10.29	81.50	59.55	73.53	0.00
7/29/2006	210	17.61	7.75	12.90	82.60	36.62	62.77	0.00
7/30/2006	211	13.35	4.18	9.44	100.00	62.24	84.65	0.34
7/31/2006	212	13.56	8.00	10.99	96.80	64.93	78.50	0.34
8/1/2006	213	15.88	3.79	10.71	100.00	49.76	74.96	0.00
8/2/2006	214	19.97	8.59	14.87	87.80	35.58	62.58	0.00
8/3/2006	215	20.25	7.45	14.78	92.10	35.82	60.06	0.00
8/4/2006	216	23.11	7.99	16.26	84.00	28.67	53.56	0.00
8/5/2006	217	23.33	9.17	17.00	88.10	28.54	54.82	0.00
8/6/2006	218	23.99	10.92	17.50	84.90	27.61	56.31	0.00
8/7/2006	219	23.22	8.65	16.68	95.90	31.90	62.79	0.00
8/8/2006	220	24.12	9.83	17.49	100.00	33.20	62.91	0.00
8/9/2006	221	17.94	12.68	14.97	97.40	63.26	82.93	0.34
8/10/2006	222	15.63	9.23	12.56	94.90	72.00	86.01	2.38
8/11/2006	223	12.08	8.15	9.83	98.80	79.50	90.38	0.34
8/12/2006	224	17.38	6.92	12.36	100.00	42.87	72.89	0.00
8/13/2006	225	17.97	7.79	13.03	98.60	49.67	74.24	0.34
8/14/2006	226	16.51	7.49	12.08	89.70	48.69	73.31	0.68
8/15/2006	227	14.67	9.75	11.53	91.80	59.48	76.79	0.00
8/16/2006	228	15.66	5.99	10.88	97.30	36.62	68.57	0.00
8/17/2006	229	16.02	6.61	11.91	94.50	59.22	77.18	0.00
8/18/2006	230	14.54	6.65	10.84	100.00	61.25	81.81	0.00

Daily Temperature, Radiation and Wind Data Taken at the Carbon Flux Tower

Date	Julian Date	Total Net Radiation (W/m^2)	Avg. Net Radiation (W/m^2)	Avg. Wind Speed (m/s)	Peak Wind Speed (m/s)
6/21/2006	172	7490.75	156.06	1.52	3.46
6/22/2006	173	7264.11	151.34	2.30	3.76
6/23/2006	174	7619.95	158.75	1.84	4.39
6/24/2006	175	5401.47	112.53	2.98	6.10
6/25/2006	176	7506.69	156.39	3.41	4.94
6/26/2006	177	6541.61	136.28	2.04	4.91
6/27/2006	178	3788.55	78.93	5.64	7.94
6/28/2006	179	3158.18	65.80	3.16	5.87
6/29/2006	180	5119.78	106.66	2.47	5.57
6/30/2006	181	1922.74	40.06	6.91	9.63
7/1/2006	182	6576.88	137.02	3.92	6.11
7/2/2006	183	6473.07	134.86	2.33	4.46
7/3/2006	184	5332.38	111.09	2.66	4.85
7/4/2006	185	6177.15	128.69	1.60	3.54
7/5/2006	186	7240.12	150.84	3.21	5.97
7/6/2006	187	6270.97	130.65	4.07	5.84
7/7/2006	188	7753.78	161.54	2.29	4.11
7/8/2006	189	4288.37	89.34	1.22	3.63
7/9/2006	190	6625.76	138.04	2.19	3.65
7/10/2006	191	7305.30	152.19	1.31	2.60
7/11/2006	192	6686.50	139.30	1.60	3.63
7/12/2006	193	4379.37	91.24	2.90	4.69
7/13/2006	194	4986.45	103.88	3.89	5.72
7/14/2006	195	6898.50	143.72	2.82	4.17
7/15/2006	196	4681.03	97.52	2.27	3.71
7/16/2006	197	7853.06	163.61	1.91	4.23
7/17/2006	198	4900.30	102.09	4.82	7.61
7/18/2006	199	6339.34	132.07	3.04	4.89
7/19/2006	200	4515.48	94.07	1.35	3.19
7/20/2006	201	5624.57	117.18	2.10	4.17
7/21/2006	202	6387.38	133.07	2.06	4.41
7/22/2006	203	5993.08	124.86	1.97	4.38
7/23/2006	204	5783.22	120.48	2.97	6.65
7/24/2006	205	2252.32	46.92	2.82	5.74
7/25/2006	206	6336.45	132.01	3.19	4.55
7/26/2006	207	6413.11	133.61	1.64	3.47
7/27/2006	208	4816.72	100.35	2.84	5.32
7/28/2006	209	1992.56	41.51	4.97	6.14
7/29/2006	210	6215.36	129.49	3.34	4.98
7/30/2006	211	2774.10	57.79	3.14	5.79
7/31/2006	212	3591.72	74.83	5.13	6.94
8/1/2006	213	5313.41	110.70	2.11	3.55
8/2/2006	214	5280.06	110.00	2.09	3.13
8/3/2006	215	5633.14	117.36	1.90	3.20
8/4/2006	216	5204.67	108.43	0.88	2.40
8/5/2006	217	4420.20	92.09	1.15	2.18
8/6/2006	218	3781.52	78.78	1.19	3.02
8/7/2006	219	3457.68	72.04	1.49	3.39
8/8/2006	220	4529.59	94.37	1.50	3.07
8/9/2006	221	903.61	18.83	3.45	5.23
8/10/2006	222	3667.45	76.41	3.64	6.01
8/11/2006	223	2777.07	57.86	4.08	5.94
8/12/2006	224	4974.90	103.64	1.63	2.70
8/13/2006	225	2656.22	55.34	1.82	3.78
8/14/2006	226	1288.11	26.84	3.04	5.40
8/15/2006	227	4309.91	89.79	3.66	4.97
8/16/2006	228	4173.77	86.95	1.92	4.12
8/17/2006	229	3192.70	66.51	3.67	6.50
8/18/2006	230	4088.87	85.18	2.05	4.71

Daily Temperature and Relative Humidity Data From HOBO #1 (Site 2, z = 125 cm)

Date	Julian Date	High Temp (°C)	Low Temp (°C)	Avg. Temp (°C)	High RH (%)	Low Rh (%)	Avg. RH (%)
6/21/2006	172	17.14	-1.51	9.17	96.70	28.00	62.35
6/22/2006	173	24.01	4.57	15.75	95.60	27.10	61.35
6/23/2006	174	24.79	7.43	17.75	89.60	20.40	55.00
6/24/2006	175	20.95	8.63	14.43	98.80	43.80	71.30
6/25/2006	176	16.76	7.03	11.58	92.10	29.90	61.00
6/26/2006	177	22.86	4.15	15.70	99.20	31.30	65.25
6/27/2006	178	22.86	13.32	17.59	78.30	43.30	60.80
6/28/2006	179	21.33	12.93	16.17	98.50	57.20	77.85
6/29/2006	180	21.71	10.21	14.59	99.80	62.40	81.10
6/30/2006	181	10.99	9.03	9.91	98.10	92.10	95.10
7/1/2006	182	16.76	8.63	11.71	95.60	54.10	74.85
7/2/2006	183	22.09	5.40	14.50	99.80	40.20	70.00
7/3/2006	184	22.48	7.83	13.82	98.80	45.80	72.30
7/4/2006	185	15.86	4.15	10.72	100.00	44.29	72.14
7/5/2006	186	18.75	7.35	13.18	99.19	39.14	69.17
7/6/2006	187	12.19	4.35	8.80	100.00	49.66	74.83
7/7/2006	188	11.44	2.46	6.93	68.12	46.39	57.25
7/8/2006	189	14.03	5.27	9.94	86.70	41.87	64.29
7/9/2006	190	14.41	3.77	9.83	100.00	43.13	71.57
7/10/2006	191	16.63	2.04	11.11	100.00	32.62	66.31
7/11/2006	192	19.58	5.68	13.97	93.72	29.60	61.66
7/12/2006	193	18.25	7.23	13.53	91.79	39.65	65.72
7/13/2006	194	14.31	6.84	10.39	100.00	65.65	82.83
7/14/2006	195	20.66	6.52	14.25	98.44	38.10	68.27
7/15/2006	196	18.03	7.25	12.92	100.00	61.30	80.65
7/16/2006	197	22.13	8.82	15.64	100.00	39.94	69.97
7/17/2006	198	17.75	11.60	14.35	96.61	55.14	75.88
7/18/2006	199	17.97	10.59	13.85	94.36	53.14	73.75
7/19/2006	200	16.75	6.51	12.91	100.00	55.13	77.57
7/20/2006	201	22.69	8.16	16.01	100.00	40.00	70.00
7/21/2006	202	25.96	9.84	18.17	100.00	39.42	69.71
7/22/2006	203	25.67	11.96	18.42	98.87	32.15	65.51
7/23/2006	204	22.78	9.12	15.68	100.00	45.02	72.51
7/24/2006	205	9.85	4.38	7.40	95.76	57.17	76.46
7/25/2006	206	13.83	5.14	9.45	100.00	46.27	73.14
7/26/2006	207	15.06	1.53	9.81	100.00	41.97	70.98
7/27/2006	208	17.35	6.04	11.87	99.51	40.75	70.13
7/28/2006	209	13.16	7.82	10.59	84.73	56.74	70.73
7/29/2006	210	18.82	7.74	13.21	88.57	34.71	61.64
7/30/2006	211	14.55	3.24	9.75	100.00	58.99	79.50
7/31/2006	212	14.76	7.04	11.29	100.00	61.54	80.77
8/1/2006	213	17.06	2.85	11.01	100.00	47.25	73.62
8/2/2006	214	21.19	7.63	15.18	94.15	33.72	63.94
8/3/2006	215	21.48	6.49	15.10	98.76	33.95	66.35
8/4/2006	216	23.37	7.03	16.57	90.07	28.77	59.42
8/5/2006	217	24.44	8.21	17.32	94.47	27.69	61.08
8/6/2006	218	25.23	9.95	17.82	91.04	26.17	58.60
8/7/2006	219	24.46	7.69	16.99	100.00	30.23	65.12
8/8/2006	220	25.36	8.86	17.81	100.00	31.47	65.73
8/9/2006	221	18.94	11.70	15.28	100.00	60.27	80.14
8/10/2006	222	16.84	8.27	12.86	100.00	68.24	84.12
8/11/2006	223	13.05	7.19	10.13	100.00	75.54	87.77
8/12/2006	224	18.59	5.96	12.67	100.00	40.63	70.32
8/13/2006	225	19.19	7.29	13.34	100.00	47.08	73.54
8/14/2006	226	17.72	6.53	12.39	95.86	46.15	71.01
8/15/2006	227	15.87	9.05	11.83	97.26	56.37	76.82
8/16/2006	228	16.65	5.13	11.18	100.00	34.90	67.45
8/17/2006	229	17.19	5.65	12.21	100.00	56.13	78.06
8/18/2006	230	15.74	5.69	11.15	100.00	58.48	79.24

Daily Temperature and Relative Humidity Data From HOBO #2 (Site 2, z = 20 cm)

Date	Julian Date	High Temp (°C)	Low Temp (°C)	Avg. Temp (°C)	High RH (%)	Low Rh (%)
6/21/2006	172	20.57	-2.44	10.84	99.60	27.40
6/22/2006	173	26.34	2.89	16.07	99.30	27.00
6/23/2006	174	26.73	4.15	17.72	99.60	21.10
6/24/2006	175	22.48	7.43	14.45	99.60	43.60
6/25/2006	176	19.42	5.40	12.99	95.70	32.20
6/26/2006	177	24.32	2.03	16.26	100.00	33.96
6/27/2006	178	25.56	10.34	18.53	86.81	39.95
6/28/2006	179	24.65	10.68	16.98	100.00	52.90
6/29/2006	180	21.68	8.22	15.24	100.00	66.97
6/30/2006	181	13.49	7.51	10.82	100.00	87.02
7/1/2006	182	19.12	5.89	12.22	100.00	51.89
7/2/2006	183	23.73	4.33	15.47	100.00	42.24
7/3/2006	184	24.17	6.42	14.81	100.00	46.01
7/4/2006	185	18.35	2.54	11.48	100.00	42.40
7/5/2006	186	21.27	5.73	13.94	100.00	37.48
7/6/2006	187	13.60	5.08	9.54	100.00	47.55
7/7/2006	188	13.90	0.86	7.67	74.38	44.87
7/8/2006	189	16.50	3.65	10.69	93.36	40.09
7/9/2006	190	16.88	2.17	10.59	100.00	41.30
7/10/2006	191	19.12	0.45	11.87	100.00	31.23
7/11/2006	192	22.10	4.07	14.74	100.00	28.34
7/12/2006	193	20.76	5.61	14.29	100.00	37.96
7/13/2006	194	16.78	5.22	11.14	100.00	62.86
7/14/2006	195	23.19	4.90	15.02	100.00	36.48
7/15/2006	196	20.54	5.63	13.68	100.00	59.53
7/16/2006	197	24.67	7.19	16.41	100.00	38.24
7/17/2006	198	20.26	9.96	15.11	100.00	52.79
7/18/2006	199	20.48	8.95	14.61	100.00	50.88
7/19/2006	200	19.24	4.89	13.67	100.00	52.78
7/20/2006	201	25.24	6.53	16.78	100.00	38.29
7/21/2006	202	28.54	8.20	18.96	100.00	37.74
7/22/2006	203	28.25	10.31	19.20	100.00	30.78
7/23/2006	204	25.33	7.62	16.45	100.00	43.10
7/24/2006	205	12.28	2.78	8.13	100.00	54.73
7/25/2006	206	16.31	3.53	10.19	100.00	44.30
7/26/2006	207	17.54	-0.06	10.56	100.00	41.47
7/27/2006	208	19.85	4.42	12.63	100.00	39.01
7/28/2006	209	15.63	6.19	11.34	92.52	55.88
7/29/2006	210	21.34	6.99	13.97	98.36	33.23
7/30/2006	211	17.02	1.64	10.50	100.00	56.48
7/31/2006	212	17.24	5.42	12.05	100.00	58.92
8/1/2006	213	19.56	1.25	11.78	100.00	45.23
8/2/2006	214	23.73	6.00	15.95	100.00	32.29
8/3/2006	215	24.01	4.87	15.87	100.00	32.50
8/4/2006	216	25.93	5.41	17.35	100.00	27.54
8/5/2006	217	27.00	6.58	18.10	100.00	26.51
8/6/2006	218	27.80	8.31	18.60	100.00	25.05
8/7/2006	219	27.02	6.06	17.77	100.00	28.95
8/8/2006	220	27.93	7.23	18.59	100.00	30.13
8/9/2006	221	20.39	10.05	16.04	100.00	59.37
8/10/2006	222	19.33	6.64	13.62	100.00	65.33
8/11/2006	223	15.52	5.57	10.88	100.00	72.32
8/12/2006	224	21.11	4.35	13.43	100.00	38.90
8/13/2006	225	21.70	5.67	14.10	100.00	45.07
8/14/2006	226	20.23	4.91	13.15	100.00	44.18
8/15/2006	227	18.36	7.42	12.58	100.00	53.97
8/16/2006	228	19.14	3.52	11.94	100.00	33.41
8/17/2006	229	19.69	4.04	12.97	100.00	53.74
8/18/2006	230	18.23	4.08	11.90	100.00	55.99

Daily Temperature and Relative Humidity Data From HOBO #3 (Site 6, z = 18 cm)

Date	Julian Date	High Temp (°C)	Low Temp (°C)	Avg. Temp (°C)	High RH (%)	Low Rh (%)
6/21/2006	172	23.24	-1.97	10.96	97.00	22.50
6/22/2006	173	27.12	3.74	16.48	98.10	24.30
6/23/2006	174	28.70	5.40	18.51	97.70	20.30
6/24/2006	175	23.63	8.23	14.22	100.00	40.20
6/25/2006	176	17.52	6.22	11.62	97.70	32.30
6/26/2006	177	27.91	3.31	16.04	99.40	28.40
6/27/2006	178	26.73	11.77	16.80	94.40	37.70
6/28/2006	179	21.71	12.16	15.60	100.00	72.90
6/29/2006	180	22.86	9.82	14.44	100.00	79.70
6/30/2006	181	10.60	8.63	9.41	100.00	98.10
7/1/2006	182	17.90	7.03	11.91	99.10	55.10
7/2/2006	183	23.24	3.74	14.21	100.00	40.70
7/3/2006	184	24.01	5.40	13.26	100.00	47.30
7/4/2006	185	21.33	4.15	11.85	100.00	43.70
7/5/2006	186	21.33	6.22	13.21	99.80	37.20
7/6/2006	187	12.16	3.74	8.29	100.00	52.00
7/7/2006	188	16.38	2.89	8.77	84.30	42.20
7/8/2006	189	19.04	3.31	10.25	93.20	40.70
7/9/2006	190	20.19	1.60	10.90	100.00	38.70
7/10/2006	191	23.63	2.89	12.58	100.00	27.50
7/11/2006	192	27.91	0.73	14.21	100.00	22.10
7/12/2006	193	22.86	6.62	14.29	98.10	38.20
7/13/2006	194	16.38	7.03	10.50	100.00	66.40
7/14/2006	195	22.86	4.99	14.91	100.00	38.70
7/15/2006	196	22.86	6.22	13.34	100.00	50.40
7/16/2006	197	24.40	7.03	15.56	100.00	40.70
7/17/2006	198	18.66	11.38	14.16	98.10	58.20
7/18/2006	199	19.77	10.99	14.01	99.10	53.78
7/19/2006	200	18.96	5.78	13.41	100.00	55.56
7/20/2006	201	24.95	7.42	16.51	100.00	40.31
7/21/2006	202	28.25	9.10	18.69	100.00	39.73
7/22/2006	203	27.96	11.22	18.93	100.00	32.40
7/23/2006	204	25.04	8.51	16.18	100.00	45.37
7/24/2006	205	12.01	3.66	7.88	99.70	57.62
7/25/2006	206	16.03	4.41	9.94	100.00	46.63
7/26/2006	207	17.26	0.81	10.30	100.00	43.65
7/27/2006	208	19.57	5.31	12.37	100.00	41.06
7/28/2006	209	15.35	7.08	11.08	88.96	64.08
7/29/2006	210	21.06	7.89	13.70	92.22	34.98
7/30/2006	211	16.75	2.51	10.24	100.00	59.45
7/31/2006	212	16.96	6.31	11.78	100.00	62.02
8/1/2006	213	19.28	2.13	11.51	100.00	47.62
8/2/2006	214	23.45	6.89	15.68	98.02	33.99
8/3/2006	215	23.73	5.76	15.60	100.00	34.22
8/4/2006	216	25.64	6.30	17.08	93.78	28.99
8/5/2006	217	26.71	7.47	17.83	98.36	27.91
8/6/2006	218	27.51	9.21	18.33	94.79	26.37
8/7/2006	219	26.73	6.95	17.50	100.00	30.47
8/8/2006	220	27.64	8.13	18.32	100.00	31.71
8/9/2006	221	19.82	10.96	15.77	100.00	68.07
8/10/2006	222	19.05	7.53	13.36	100.00	68.77
8/11/2006	223	15.24	6.46	10.62	100.00	76.13
8/12/2006	224	20.82	5.23	13.17	100.00	40.95
8/13/2006	225	21.42	6.56	13.83	100.00	47.44
8/14/2006	226	19.94	5.80	12.88	99.81	46.51
8/15/2006	227	18.08	8.31	12.32	100.00	56.82
8/16/2006	228	18.86	4.40	11.67	100.00	35.17
8/17/2006	229	19.41	4.92	12.71	100.00	56.57
8/18/2006	230	17.95	4.96	11.64	100.00	58.94

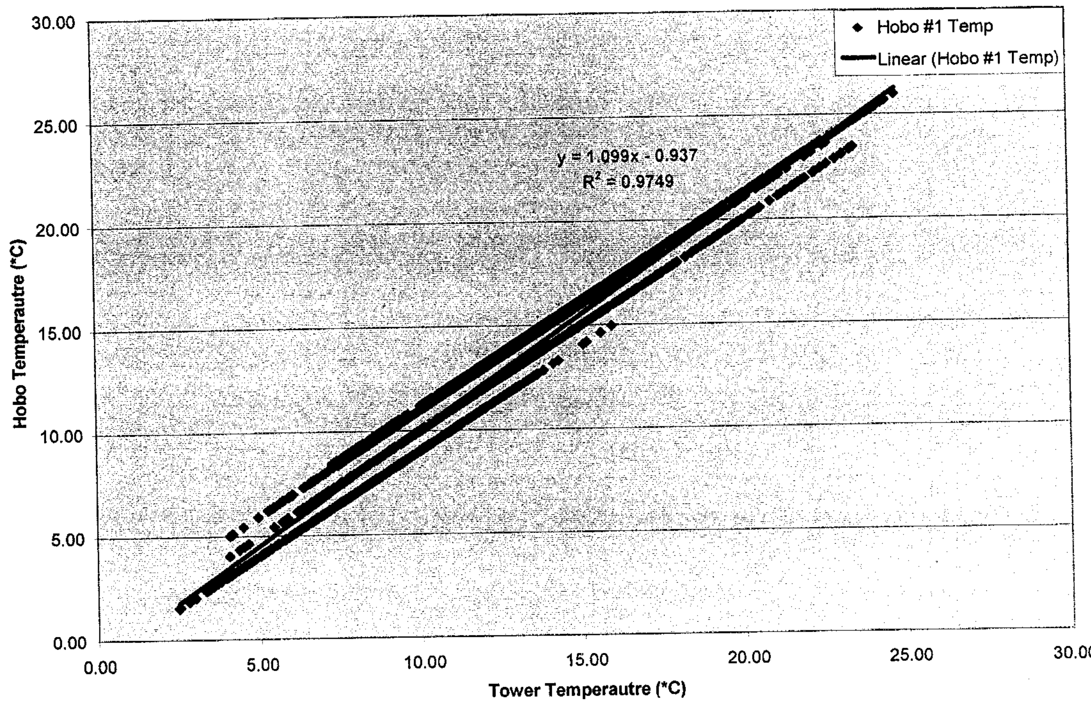
Daily Temperature and Relative Humidity Data From HOBO #4 (Site 6, z = 106 cm)

Date	Julian Date	High Temp (°C)	Low Temp (°C)	Avg. Temp (°C)	High RH (%)	Low Rh (%)	Avg. RH (%)
6/21/2006	172	16.76	-0.16	9.49	92.00	28.40	60.20
6/22/2006	173	23.85	5.40	16.48	89.50	26.87	58.18
6/23/2006	174	24.98	9.90	18.75	78.01	19.61	48.81
6/24/2006	175	21.21	10.10	15.41	92.69	42.20	67.44
6/25/2006	176	17.26	6.96	12.44	92.38	27.15	59.76
6/26/2006	177	22.16	7.43	16.64	89.54	32.95	61.25
6/27/2006	178	23.40	12.82	18.59	73.76	38.76	56.26
6/28/2006	179	22.49	13.16	17.05	95.26	51.32	73.29
6/29/2006	180	20.25	10.68	15.30	100.00	64.97	82.49
6/30/2006	181	12.64	9.96	10.89	100.00	84.43	92.21
7/1/2006	182	17.00	8.33	12.29	97.74	50.35	74.04
7/2/2006	183	21.71	6.76	15.53	100.00	39.07	69.54
7/3/2006	184	22.01	8.86	14.87	93.08	44.63	68.86
7/4/2006	185	16.24	4.95	11.54	97.94	41.14	69.54
7/5/2006	186	19.14	8.16	14.00	93.59	36.36	64.97
7/6/2006	187	12.75	5.83	9.62	94.91	46.13	70.52
7/7/2006	188	11.97	3.26	7.74	68.13	42.50	55.32
7/8/2006	189	14.40	6.08	10.76	79.44	38.89	59 17
7/9/2006	190	14.78	4.57	10.65	100.00	40.06	70.03
7/10/2006	191	17.14	2.84	11.93	95.01	30.30	62.65
7/11/2006	192	19.96	6.49	14.80	88.43	27.49	57.96
7/12/2006	193	18.63	8.04	14.35	86.10	36.83	61.46
7/13/2006	194	14.68	7.66	11.21	95.01	60.98	77.99
7/14/2006	195	21.05	7.34	15.08	92.88	35.39	64.14
7/15/2006	196	19.28	8.06	13.74	94.69	56.17	75.43
7/16/2006	197	22.51	9.64	16.47	100.00	37.10	68.55
7/17/2006	198	18.13	12.43	15.18	91.16	51.22	71.19
7/18/2006	199	18.35	11.41	14.67	89.04	49.36	69.20
7/19/2006	200	18.19	7.33	13.74	100.00	51.21	75.61
7/20/2006	201	23.08	8.97	16.84	100.00	37.15	68.58
7/21/2006	202	26.36	10.66	19.01	96.02	36.61	66.32
7/22/2006	203	26.06	12.79	19.26	93.29	29.86	61.57
7/23/2006	204	23.17	10.07	16.51	100.00	41.82	70.91
7/24/2006	205	10.27	5.19	8.21	90.35	53.10	71.73
7/25/2006	206	14.21	5.95	10.26	96.42	42.98	69.70
7/26/2006	207	16.16	2.33	10.62	99.86	38.46	69.16
7/27/2006	208	17.73	6.85	12.69	93.89	37.85	65.87
7/28/2006	209	13.54	8.63	11.41	78.62	56.74	67.68
7/29/2006	210	19.21	9.25	14.03	83.57	32.24	57.91
7/30/2006	211	14.92	4.04	10.56	100.00	54.79	77.40
7/31/2006	212	15.13	7.85	12.11	97.64	57.16	77.40
8/1/2006	213	17.44	3.65	11.83	100.00	43.89	71.94
8/2/2006	214	21.58	8.44	16.01	88.84	31.32	60.08
8/3/2006	215	21.86	7.31	15.93	93.19	31.53	62.36
8/4/2006	216	24.69	7.84	17.40	84.99	26.72	55.85
8/5/2006	217	24.91	9.02	18.15	89.14	25.72	57.43
8/6/2006	218	25.62	10.77	18.65	85.90	24.31	55.10
8/7/2006	219	24.85	8.50	17.83	97.03	28.08	62.56
8/8/2006	220	25.75	9.68	18.64	100.00	29.23	64.61
8/9/2006	221	19.52	12.53	16.11	92.78	60.28	76.53
8/10/2006	222	17.22	9.08	13.69	96.02	63.39	79.70
8/11/2006	223	13.60	8.00	10.95	99.26	70.16	84.71
8/12/2006	224	18.98	6.78	13.49	100.00	37.74	68.87
8/13/2006	225	19.57	8.10	14.16	99.76	43.73	71.74
8/14/2006	226	18.10	7.35	13.21	90.45	42.86	66.66
8/15/2006	227	16.25	9.87	12.65	91.77	52.36	72.07
8/16/2006	228	17.20	5.94	12.00	97.84	32.41	65.13
8/17/2006	229	17.59	6.46	13.03	95.61	52.13	73.87
8/18/2006	230	16.12	6.50	11.96	100.00	54.32	77.16

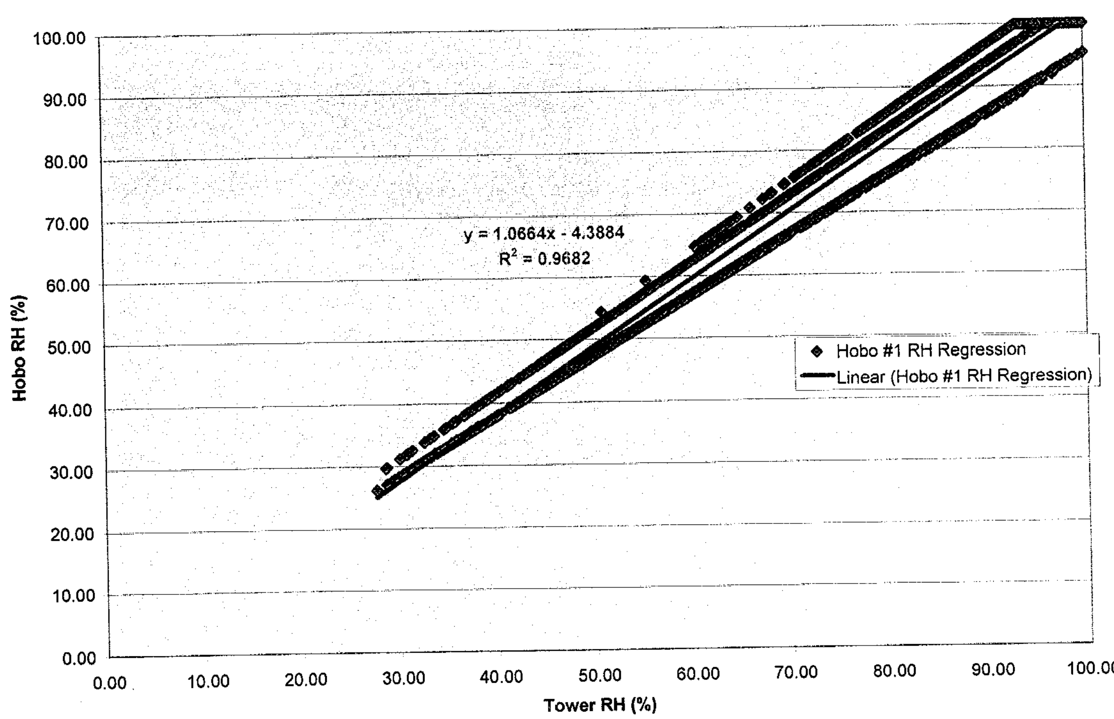
HOBO Temperature and Relative Humidity Correction Factors

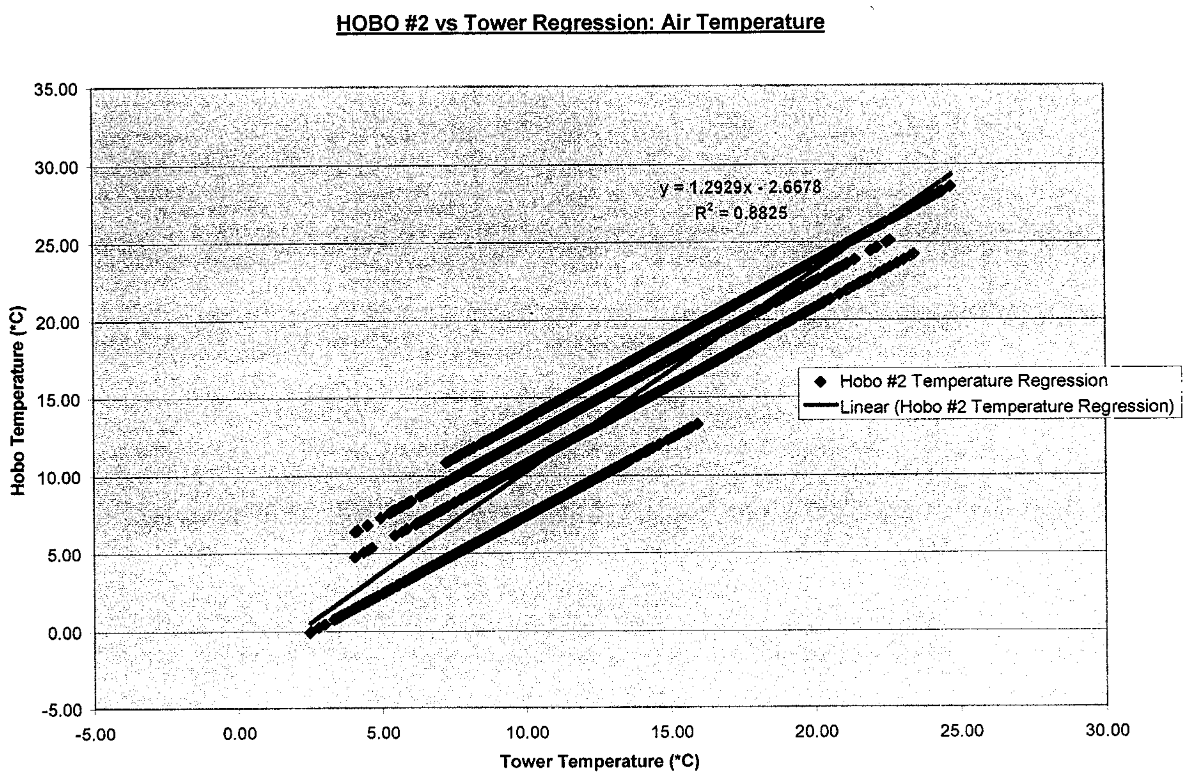
Time	HOBO 1		HOBO 2		HOBO 3		HOBO 4	
	Temp	RH	Temp	RH	Temp	RH	Temp	RH
0:01 – 6:00	0.997	1.072	0.991	1.191	0.994	1.116	0.999	1.012
6:01 – 12:00	1.003	0.953	1.008	0.938	1.004	1.076	1.005	0.953
12:01 – 18:00	1.004	0.948	1.013	0.907	1.012	0.955	1.005	0.880
18:01 – 0:00	1.000	1.040	1.003	1.077	1.001	1.092	1.005	0.953

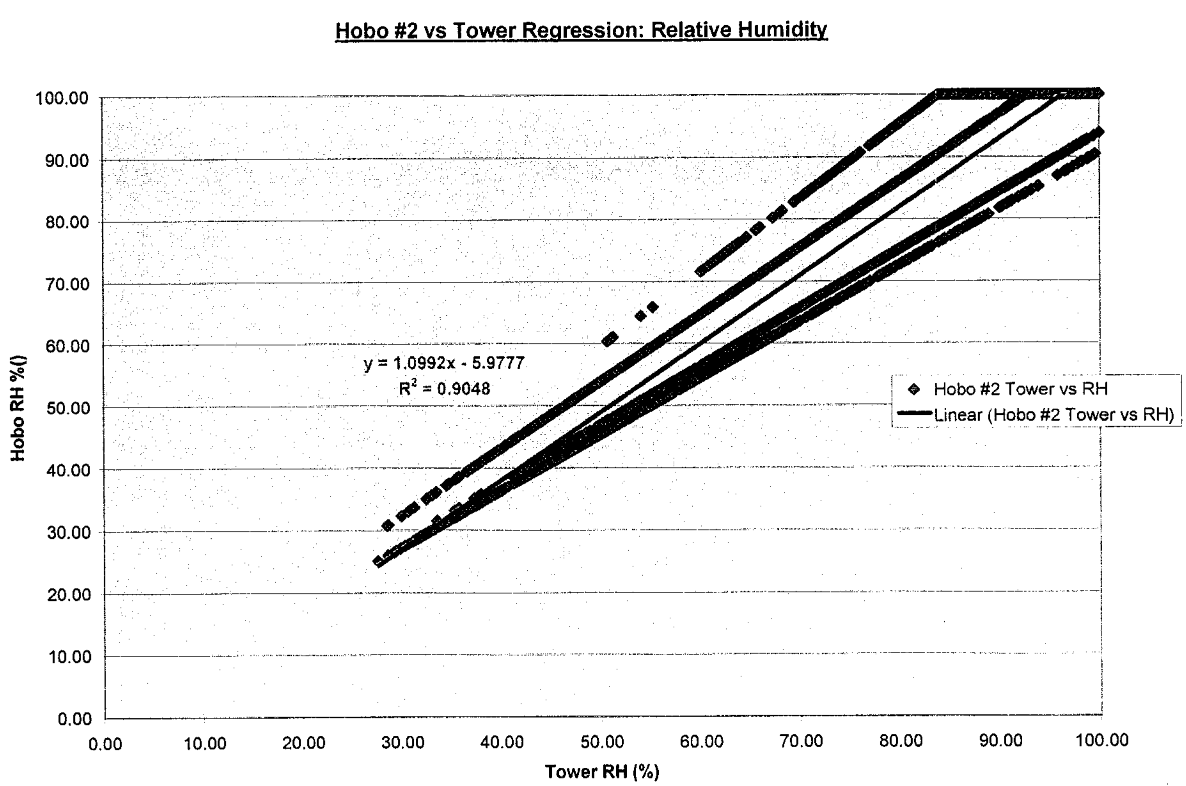
HOBO #1 vs Tower Regression: Air Temperature

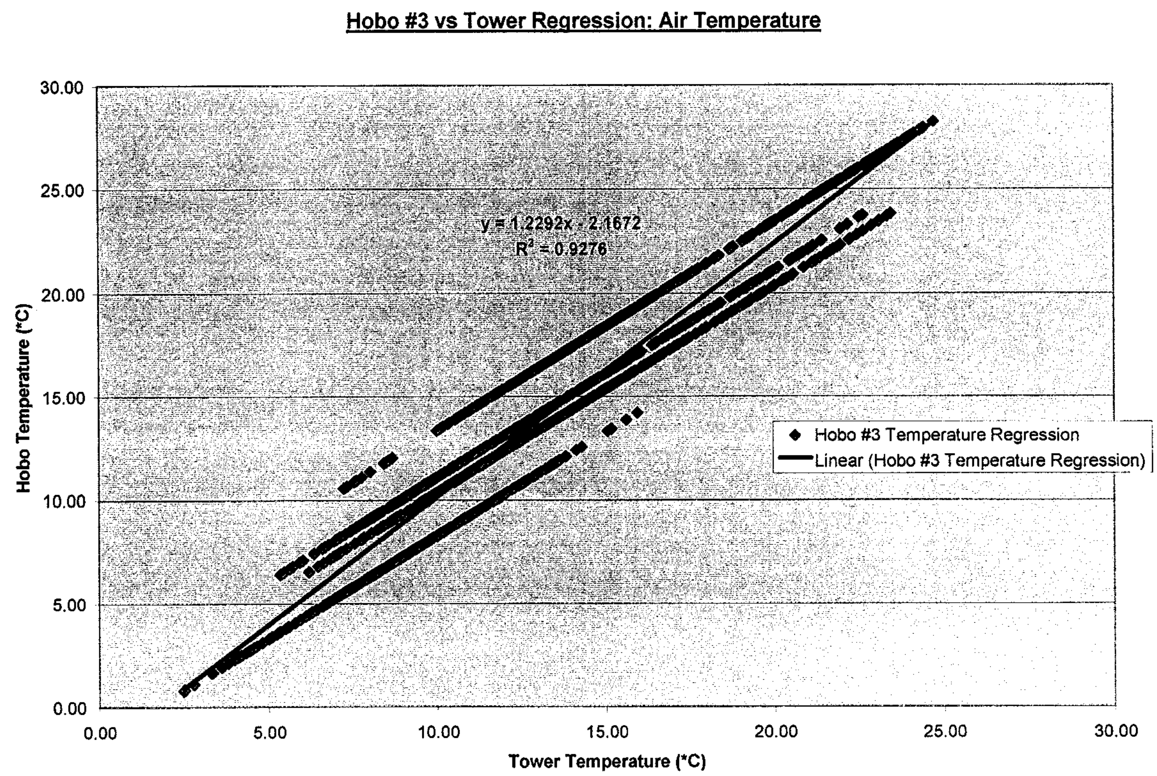


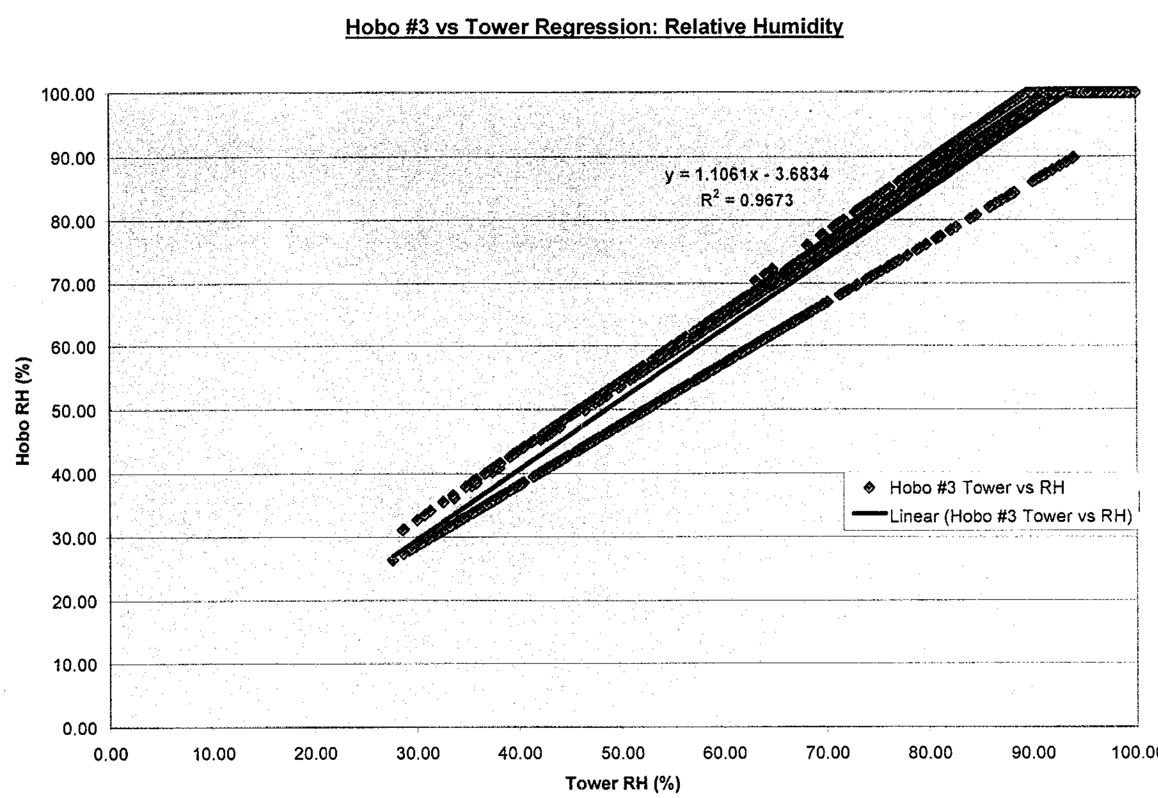
Hobo #1vs Tower Regression: Relative Humidity



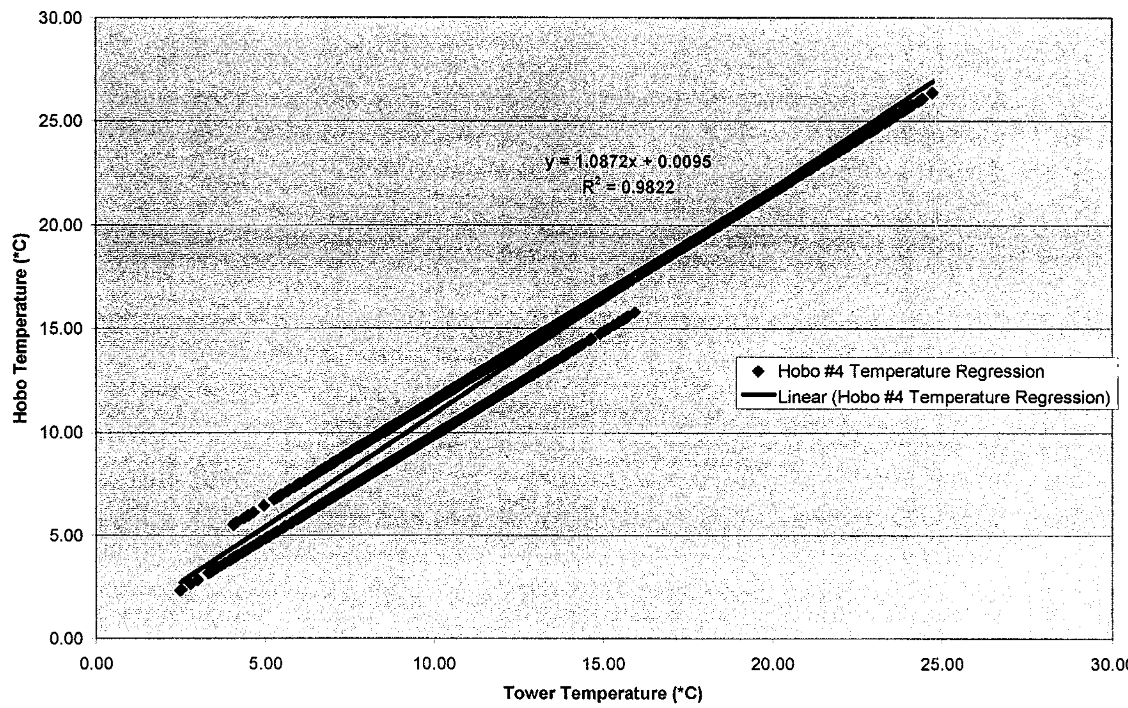

HOBO #2 vs Tower Regression: Air Temperature
y = 1.2929x - 2.6678
R² = 0.8825
Hobo #2 Temperature Regression
Linear (Hobo #2 Temperature Regression)
Hobo Temperature (°C)
Tower Temperature (°C)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
-5.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00


Hobo #2 vs Tower Regression: Relative Humidity
y = 1.0992x - 5.9777
R² = 0.9048
Hobo #2 Tower vs RH
Linear (Hobo #2 Tower vs RH)
Hobo RH %()
Tower RH (%)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00

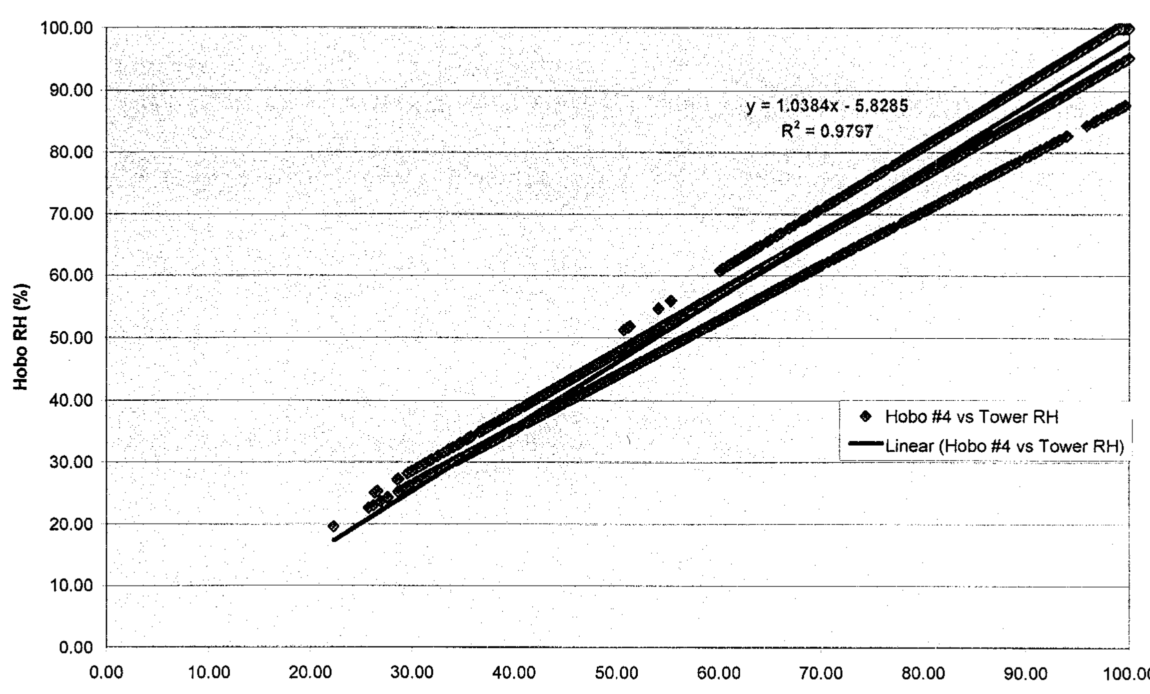

Hobo #3 vs Tower Regression: Air Temperature
y = 1.2292x - 2.1672
R² = 0.9276
Hobo #3 Temperature Regression
Linear (Hobo #3 Temperature Regression)
Hobo Temperature (°C)
Tower Temperature (°C)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00


Hobo #3 vs Tower Regression: Relative Humidity
y = 1.1061x - 3.6834
R² = 0.9673
Hobo #3 Tower vs RH
Linear (Hobo #3 Tower vs RH)
Hobo RH (%)
Tower RH (%)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00

Hobo #4 vs Tower Regression: Air Temperature



Hobo #4 vs Tower Regression: Relative Humidity



Below are tables which include soil temperature measured using electronic sensors (Stowaways) at Sites 2 through 6, and the resulting ground heat fluxes. The thermal conductivity for saturated peat (0.50 W/m °C) was used at Sites 2 and 3. Thermal conductivity values for saturated clay (1.58 W/m °C) were used for Sites 4 and 5, whereas the value representing saturated sand (2.20 W/m °C) was used at Site 6.

Thermocouples also recorded soil temperatures at each site. However, these values were only used at Site 1, where there were no Stowaways logging soil temperature at regular intervals. Ground heat flux was calculated by equating the time between samplings to a number of days. The ground heat flux calculated between sample times was then multiplied by the reciprocal of this number, giving a 24-hour ground heat flux estimate. Due to its location in a bog which containing standing water, the thermal conductivity for saturated peat (0.50 W/m °C) was used at Site 1. A table for thermocouple values and ground heat flux at Site 1 is included in this appendix, but is separate from the other sites, due to its unique situation.

Date	Julian Date	Site 2 (°C)	Site 2 (°C)	Site 3 (°C)	Site 3 (°C)	Site 5 (°C)	Site 5 (°C)	Site 6 (°C)	Site 6 (°C)
		z = 2 cm	z = 15 cm	z = 2 cm	z = 17 cm	z = 3 cm	z = 34 cm	z = 3 cm	z = 37 cm
6/21/2006	172	9.5	1.4	10.7	1.4	6.9	0.9	9.0	4.0
6/22/2006	173	12.2	2.1	13.3	1.9	8.9	1.3	10.5	4.1
6/23/2006	174	13.3	2.8	14.0	2.4	10.4	1.7	10.8	4.6
6/24/2006	175	12.8	3.5	13.5	2.4	9.9	2.1	10.5	5.0
6/25/2006	176	11.3	3.1	12.5	2.3	8.5	2.2	10.4	5.3
6/26/2006	177	13.0	3.2	14.5	2.6	10.2	2.2	11.5	5.2
6/27/2006	178	12.3	3.9	13.6	3.4	9.9	2.6	10.8	5.5
6/28/2006	179	12.6	4.5	14.3	3.8	10.6	2.7	11.1	5.5
6/29/2006	180	14.0	5.3	15.3	4.4	11.5	3.1	11.8	5.9
6/30/2006	181	10.0	5.4	10.5	5.2	9.1	3.8	9.5	6.0
7/1/2006	182	11.1	3.7	11.9	4.9	10.6	3.8	10.2	4.1
7/2/2006	183	11.7	3.9	12.8	5.7	11.7	4.5	9.5	3.1
7/3/2006	184	12.4	4.3	13.3	6.8	12.3	5.1	9.2	3.4
7/4/2006	185	11.9	4.3	13.2	7.1	11.9	5.3	9.8	3.9
7/5/2006	186	14.0	4.6	13.8	7.3	12.5	5.7	10.0	4.6
7/6/2006	187	9.5	4.3	10.5	7.1	10.6	5.8	9.0	5.0
7/7/2006	188	9.9	3.4	11.2	5.9	10.1	5.3	9.9	5.0
7/8/2006	189	9.0	3.5	10.1	5.7	10.2	5.4	8.5	5.2
7/9/2006	190	10.1	3.5	11.1	6.0	10.3	5.4	9.6	5.0
7/10/2006	191	12.1	4.0	13.4	6.3	11.8	5.8	10.4	5.2
7/11/2006	192	11.6	4.3	12.8	6.9	10.3	6.3	10.4	5.6
7/12/2006	193	10.4	4.4	11.2	7.2	11.3	6.6	9.8	5.8
7/13/2006	194	9.3	4.1	10.5	7.1	10.7	6.4	9.4	5.8
7/14/2006	195	12.8	4.2	14.0	7.3	12.1	6.4	11.3	5.8
7/15/2006	196	11.3	4.8	12.3	7.8	12.0	6.9	10.3	6.2
7/16/2006	197	15.5	5.4	17.1	8.6	14.6	7.2	12.9	6.4
7/17/2006	198	13.4	5.8	14.2	9.3	13.3	8.0	11.8	7.0
7/18/2006	199	13.6	5.4	14.9	9.0	13.7	7.8	12.5	7.0
7/19/2006	200	11.8	5.3	13.4	8.9	12.9	7.9	10.9	7.1
7/20/2006	201	13.9	5.1	15.1	9.0	13.9	7.9	11.9	7.0
7/21/2006	202	15.9	6.0	16.8	9.7	15.6	8.3	13.3	7.3
7/22/2006	203	17.3	6.8	19.0	10.7	16.4	9.0	14.9	7.9
7/23/2006	204	15.7	6.8	16.9	11.1	15.4	9.3	13.7	8.3
7/24/2006	205	9.9	5.7	11.0	10.1	11.1	8.9	10.6	8.1
7/25/2006	206	9.8	4.3	10.7	8.1	11.0	7.7	11.4	7.4
7/26/2006	207	11.8	4.3	13.0	7.5	11.7	7.4	11.9	7.1
7/27/2006	208	11.5	4.6	13.1	7.8	11.6	7.5	11.4	7.1
7/28/2006	209	8.7	4.4	9.7	7.6	9.4	7.2	9.3	6.9
7/29/2006	210	12.9	4.4	14.1	7.5	11.9	6.8	12.4	6.6
7/30/2006	211	9.6	4.6	10.9	7.7	10.1	7.2	9.8	6.8
7/31/2006	212	9.4	4.3	10.0	7.4	10.0	6.7	9.3	6.4
8/1/2006	213	9.8	4.1	10.9	7.2	10.4	6.5	10.7	6.2
8/2/2006	214	12.4	4.6	14.3	7.8	12.3	6.9	12.5	6.4
8/3/2006	215	13.9	5.4	15.9	8.6	13.0	7.6	13.3	6.9
8/4/2006	216	14.2	5.8	16.6	9.2	14.0	8.0	13.2	7.2
8/5/2006	217	14.3	6.1	16.5	9.7	14.7	8.5	12.8	7.4
8/6/2006	218	14.4	6.3	17.0	10.3	14.7	8.9	12.6	7.5
8/7/2006	219	14.3	6.3	17.0	10.4	14.1	9.1	13.5	7.6
8/8/2006	220	14.6	6.3	16.5	10.5	14.6	9.2	13.3	7.7
8/9/2006	221	12.3	6.5	13.7	10.4	13.0	9.3	11.7	7.7
8/10/2006	222	11.8	5.9	13.3	9.7	12.7	8.8	11.2	7.5
8/11/2006	223	9.9	5.4	11.1	9.2	10.8	8.5	9.7	7.2
8/12/2006	224	12.7	5.1	14.7	8.7	12.7	7.9	12.1	6.9
8/13/2006	225	10.8	5.6	12.0	8.9	11.2	8.4	10.3	7.2
8/14/2006	226	9.1	5.1	10.2	8.4	10.1	8.1	9.4	6.9
8/15/2006	227	10.4	5.0	11.0	7.9	11.1	7.7	10.5	6.6
8/16/2006	228	11.6	5.0	13.0	7.7	11.2	7.6	12.0	6.7
8/17/2006	229	9.9	4.9	11.0	7.6	10.8	7.7	10.1	6.7
8/18/2006	230	11.4	5.0	12.8	7.7	11.4	7.6	12.0	6.6

Date	Julian Date	Site 4 (°C)	Site 4 (°C)	Site 4 (°C)	Site 4 (°C)
		z = 5 cm	z = 10 cm	z = 20 cm	z = 60 cm
6/21/2006	172	7.75	4.95	2.97	0.02
6/22/2006	173	9.54	5.90	3.45	0.10
6/23/2006	174	10.38	6.77	4.14	0.26
6/24/2006	175	10.33	7.26	4.72	0.55
6/25/2006	176	9.40	6.72	4.53	0.73
6/26/2006	177	10.14	6.78	4.39	0.80
6/27/2006	178	10.08	7.35	4.98	1.06
6/28/2006	179	10.39	7.50	5.10	1.28
6/29/2006	180	11.22	8.17	5.61	1.56
6/30/2006	181	9.31	8.20	6.07	1.89
7/1/2006	182	10.42	8.39	5.90	1.93
7/2/2006	183	11.31	9.42	6.79	2.22
7/3/2006	184	11.93	10.03	7.46	2.67
7/4/2006	185	11.69	9.79	7.43	2.92
7/5/2006	186	12.56	10.42	7.94	3.23
7/6/2006	187	10.08	9.15	7.48	3.42
7/7/2006	188	9.63	8.20	6.59	3.17
7/8/2006	189	9.71	8.29	6.68	3.18
7/9/2006	190	9.60	7.92	6.31	3.18
7/10/2006	191	10.62	8.17	6.26	3.13
7/11/2006	192	10.62	8.40	6.51	3.25
7/12/2006	193	9.85	8.30	6.64	3.41
7/13/2006	194	9.28	7.77	6.33	3.45
7/14/2006	195	10.85	8.12	6.20	3.33
7/15/2006	196	10.32	8.35	6.59	3.48
7/16/2006	197	12.83	9.45	7.05	3.70
7/17/2006	198	11.93	9.74	7.72	4.11
7/18/2006	199	12.11	9.64	7.63	4.28
7/19/2006	200	11.19	9.41	7.69	4.38
7/20/2006	201	12.30	9.59	7.63	4.39
7/21/2006	202	13.82	10.44	8.07	4.52
7/22/2006	203	14.67	11.36	8.79	4.88
7/23/2006	204	13.85	11.28	9.09	5.23
7/24/2006	205	10.14	9.67	8.51	5.24
7/25/2006	206	9.85	8.63	7.44	4.88
7/26/2006	207	10.61	8.64	7.15	4.50
7/27/2006	208	10.54	8.65	7.17	4.42
7/28/2006	209	8.71	7.88	6.87	4.36
7/29/2006	210	10.97	8.38	6.65	4.17
7/30/2006	211	9.06	7.83	6.72	4.19
7/31/2006	212	9.04	7.52	6.36	4.09
8/1/2006	213	9.02	7.38	6.09	3.91
8/2/2006	214	10.70	8.28	6.49	3.92
8/3/2006	215	11.46	8.94	7.04	4.17
8/4/2006	216	12.00	9.33	7.39	4.43
8/5/2006	217	12.23	9.70	7.78	4.68
8/6/2006	218	12.29	9.88	8.01	4.89
8/7/2006	219	12.09	9.86	8.10	5.04
8/8/2006	220	12.67	9.97	8.14	5.16
8/9/2006	221	11.29	9.83	8.33	5.29
8/10/2006	222	11.23	9.50	8.02	5.28
8/11/2006	223	9.89	8.77	7.66	5.15
8/12/2006	224	11.22	8.81	7.26	4.89
8/13/2006	225	10.67	8.94	7.51	4.84
8/14/2006	226	8.94	8.06	7.11	4.80
8/15/2006	227	9.86	8.25	6.91	4.64
8/16/2006	228	10.07	8.20	6.83	4.57
8/17/2006	229	9.44	7.98	6.79	4.49
8/18/2006	230	10.11	8.20	6.77	4.45

Date	Julian Date	Site 2 (W/m^2)	Site 3 (W/m^2)	Site 4 (W/m^2)	Site 5 (W/m^2)	Site 6 (W/m^2)
6/21/2006	172	30.910	31.264	50.341	30.632	32.482
6/22/2006	173	39.035	37.981	64.088	39.105	41.075
6/23/2006	174	40.163	38.692	65.653	44.193	40.104
6/24/2006	175	35.771	36.674	59.014	39.778	35.494
6/25/2006	176	31.804	34.053	51.209	32.186	33.510
6/26/2006	177	37.755	39.721	60.573	40.821	41.096
6/27/2006	178	32.138	34.099	53.685	36.926	34.246
6/28/2006	179	31.268	35.097	55.685	40.214	36.378
6/29/2006	180	33.494	36.456	59.154	42.479	37.845
6/30/2006	181	17.601	17.553	34.080	27.019	22.857
7/1/2006	182	28.506	23.593	47.640	34.637	39.357
7/2/2006	183	29.971	23.563	47.676	36.501	41.695
7/3/2006	184	31.151	21.665	47.027	36.593	37.737
7/4/2006	185	29.088	20.396	44.924	33.530	37.972
7/5/2006	186	35.933	21.635	48.712	34.796	35.044
7/6/2006	187	19.905	11.197	27.321	24.715	25.758
7/7/2006	188	24.982	17.428	31.977	24.666	31.668
7/8/2006	189	21.425	14.671	31.963	24.382	21.420
7/9/2006	190	25.381	17.096	34.624	24.688	29.603
7/10/2006	191	31.138	23.622	45.964	30.901	33.620
7/11/2006	192	27.947	19.792	43.330	20.382	31.452
7/12/2006	193	22.803	13.204	33.813	23.948	25.874
7/13/2006	194	20.104	11.172	31.062	21.916	23.464
7/14/2006	195	32.931	22.326	49.062	29.026	35.928
7/15/2006	196	25.091	14.825	39.291	26.412	26.888
7/16/2006	197	39.011	28.392	60.971	37.595	42.404
7/17/2006	198	29.216	16.108	44.330	26.913	31.479
7/18/2006	199	31.548	19.672	47.249	30.234	35.637
7/19/2006	200	25.024	14.694	36.954	25.441	24.596
7/20/2006	201	33.848	20.285	49.107	30.642	31.965
7/21/2006	202	38.159	23.710	60.523	37.228	38.683
7/22/2006	203	40.229	27.733	61.945	37.661	44.973
7/23/2006	204	34.095	19.238	50.207	31.150	34.596
7/24/2006	205	16.159	3.101	17.163	11.436	16.203
7/25/2006	206	21.024	8.561	25.458	17.110	26.001
7/26/2006	207	28.543	18.265	36.494	21.876	30.754
7/27/2006	208	26.514	17.839	35.464	20.999	27.438
7/28/2006	209	16.596	6.840	19.332	10.952	15.729
7/29/2006	210	32.468	22.053	45.515	26.040	37.786
7/30/2006	211	19.032	10.583	24.599	15.222	19.552
7/31/2006	212	19.681	8.781	28.239	16.754	18.449
8/1/2006	213	21.723	12.464	30.854	19.826	29.131
8/2/2006	214	29.928	21.560	44.278	27.463	39.196
8/3/2006	215	32.607	24.072	46.605	27.814	41.830
8/4/2006	216	32.518	24.807	48.502	30.559	38.888
8/5/2006	217	31.777	22.503	46.865	31.337	34.971
8/6/2006	218	31.258	22.374	45.015	29.750	33.520
8/7/2006	219	30.678	21.776	42.065	25.830	38.212
8/8/2006	220	31.744	20.033	47.694	27.996	36.251
8/9/2006	221	22.357	11.096	31.262	19.242	25.408
8/10/2006	222	22.614	11.878	33.801	19.616	24.327
8/11/2006	223	17.397	6.349	23.500	12.139	15.810
8/12/2006	224	29.455	19.774	41.738	24.363	33.838
8/13/2006	225	19.909	10.360	33.329	13.885	19.879
8/14/2006	226	15.330	6.087	19.217	10.081	15.939
8/15/2006	227	20.835	10.397	31.045	17.578	25.114
8/16/2006	228	25.394	17.582	34.133	18.338	34.310
8/17/2006	229	19.247	11.315	27.887	15.447	21.736
8/18/2006	230	24.641	17.008	35.175	19.166	35.235

Date	Julian Date	Site 2 (°C)	Site 2 (°C)	Site 3 (°C)	Site 3 (°C)	Site 4 (°C)	Site 4 (°C)	Site 5 (°C)	Site 5 (°C)	Site 6 (°C)	Site 6 (°C)
		z = 2 cm	z = 14 cm	z = 2 cm	z = 18 cm	z = 2 cm	z = 39 cm	z = 2 cm	z = 40 cm	z = 2 cm	z = 35 cm
6/21/2006	172	13.5	2.2	17.2	2.4	14.1	4.5	15.2	2.8	15.2	5.8
6/22/2006	173	9.6	2.1	10.2	2.5	8.5	4.2	13.6	2.6	11.0	5.5
6/23/2006	174	14.1	4.8	19.8	4.0	16.5	6.1	16.1	3.8	15.6	6.2
6/24/2006	175	12.5	3.9	16.1	3.9	14.3	6.2	14.9	3.8	13.2	6.4
6/25/2006	176	12.4	4.0	15.2	3.6	11.5	6.0	14.3	3.8	13.0	6.4
6/26/2006	177	18.1	4.3	19.0	3.9	17.0	6.9	18.1	4.2	18.5	7.2
6/27/2006	178	12.2	5.8	14.5	4.2	13.6	7.2	12.1	4.2	12.5	7.2
6/28/2006	179	14.0	5.8	16.0	6.0	14.6	7.4	14.1	4.5	16.0	7.7
6/29/2006	180	13.6	4.6	17.0	7.0	15.7	7.7	14.8	5.2	16.0	8.0
6/30/2006	181	9.8	6.1	12.0	9.0	10.2	7.0	9.9	4.8	12.0	7.8
7/1/2006	182	15.2	6.0	17.2	11.0	12.4	7.0	11.6	5.5	15.0	6.9
7/2/2006	183	14.8	6.3	18.0	10.3	15.9	7.7	13.8	5.8	14.6	6.0
7/3/2006	184	12.0	7.0	16.0	10.8	14.4	8.0	13.3	6.0	14.3	5.8
7/4/2006	185	16.1	6.0	19.9	7.8	16.7	7.9	16.1	6.3	17.9	6.1
7/5/2006	186	13.1	7.6	16.3	8.9	16.1	8.1	15.9	6.4	14.5	6.4
7/6/2006	187	M	M	M	M	M	M	M	M	M	M
7/7/2006	188	13.9	6.0	18.4	6.2	14.8	7.8	16.0	6.2	17.9	7.0
7/8/2006	189	11.6	5.9	13.7	6.6	13.7	7.6	13.2	6.2	12.5	6.8
7/9/2006	190	14.0	5.8	17.7	6.0	14.7	7.5	15.7	6.5	16.5	6.9
7/10/2006	191	9.9	7.2	15.0	8.0	14.4	8.1	14.1	7.0	14.0	7.7
7/11/2006	192	13.8	6.3	18.0	7.0	16.3	8.2	17.9	7.9	16.5	7.8
7/12/2006	193	9.0	6.2	11.6	8.0	12.1	8.3	12.1	7.4	11.9	7.7
7/13/2006	194	9.6	5.9	12.0	8.0	12.0	8.0	12.1	7.4	13.7	7.8
7/14/2006	195	14.9	7.8	20.0	7.9	16.6	8.1	18.0	7.9	19.0	8.0
7/15/2006	196	13.9	7.3	17.9	8.0	15.9	8.8	16.0	8.0	17.0	8.5
7/16/2006	197	18.0	9.0	23.5	9.8	18.9	9.2	20.8	8.4	19.2	8.6
7/17/2006	198	13.2	7.9	16.2	9.8	15.0	9.9	16.0	8.5	15.6	8.8
7/18/2006	199	16.3	8.5	20.0	10.0	16.2	10.0	19.0	9.8	19.0	9.2
7/19/2006	200	12.0	8.4	15.0	9.8	13.8	9.9	14.3	9.5	14.1	9.8
7/20/2006	201	12.1	8.2	15.8	9.2	15.9	10.0	15.9	8.2	15.0	9.0
7/21/2006	202	15.0	9.8	17.8	9.8	17.7	10.2	16.0	9.8	16.0	9.9
7/22/2006	203	19.6	9.5	24.3	10.3	19.9	10.4	22.2	10.0	20.4	10.0
7/23/2006	204	17.5	9.3	22.3	10.5	18.5	10.5	19.9	10.0	19.8	10.1
7/24/2006	205	10.4	6.6	12.6	8.0	11.9	9.7	13.0	9.5	14.0	9.0
7/25/2006	206	11.2	6.0	15.0	8.0	14.4	9.1	16.0	8.0	18.0	9.2
7/26/2006	207	14.2	7.7	19.9	7.9	16.2	8.4	18.0	8.0	19.9	9.5
7/27/2006	208	12.7	7.1	17.0	8.0	14.5	9.8	16.0	8.0	17.4	9.0
7/28/2006	209	8.9	6.0	10.5	7.9	10.4	8.4	11.9	8.0	12.2	8.5
7/29/2006	210	12.9	6.0	14.5	8.0	14.8	9.6	17.0	9.2	15.3	9.5
7/30/2006	211	10.4	5.7	12.0	8.0	9.6	8.2	12.0	8.0	11.2	8.5
7/31/2006	212	9.5	5.9	10.2	7.7	11.0	8.0	12.0	8.0	12.4	8.3
8/1/2006	213	12.2	6.2	16.0	7.7	13.7	7.9	15.0	7.7	17.2	8.1
8/2/2006	214	13.4	6.2	16.0	8.0	14.4	8.1	17.0	8.0	13.0	8.0
8/3/2006	215	10.6	8.3	18.0	9.8	15.6	9.5	16.4	8.9	17.0	9.3
8/4/2006	216	16.4	8.1	23.0	10.0	19.0	9.6	22.0	9.0	20.7	9.5
8/5/2006	217	16.2	8.5	23.0	10.0	18.0	9.8	21.3	9.8	19.4	9.7
8/6/2006	218	17.0	8.7	22.0	10.0	17.7	10.0	17.9	10.0	17.8	9.4
8/7/2006	219	15.5	7.6	17.2	9.9	14.5	10.1	18.0	10.0	14.9	9.6
8/8/2006	220	16.5	8.3	23.0	10.0	17.9	10.0	19.8	10.0	18.8	9.7
8/9/2006	221	11.5	7.9	14.5	11.3	13.9	10.0	15.3	10.1	14.0	9.7
8/10/2006	222	15.2	7.8	17.3	13.2	14.5	9.7	16.0	10.0	14.8	9.5
8/11/2006	223	10.3	7.2	13.0	11.4	11.9	9.4	13.1	9.7	12.7	9.0
8/12/2006	224	15.2	8.1	20.0	13.0	17.0	9.5	20.0	10.0	19.0	9.2
8/13/2006	225	13.3	7.8	17.9	12.1	15.5	9.3	16.6	9.6	15.2	8.8
8/14/2006	226	9.0	6.0	12.0	10.0	11.9	9.0	12.9	9.3	12.5	8.5
8/15/2006	227	10.5	7.5	16.7	11.7	13.6	8.4	16.0	9.5	17.5	8.7
8/16/2006	228	12.2	7.0	21.0	11.0	16.0	9.0	18.0	9.0	19.2	8.8
8/17/2006	229	10.2	6.4	15.6	10.1	12.2	8.4	14.0	9.0	13.3	8.5
8/18/2006	230	9.6	5.8	13.0	9.0	13.6	8.3	16.0	8.8	13.9	8.2

Date	Julian Date	Soil Temperature (°C)	Soil Temperature (°C	Ground Heat Flux (W/m²)
		z = 2 cm	z = 13 cm	
6/21/2006	172	12.0	4.1	45.874
6/22/2006	173	10.5	4.2	40.525
6/23/2006	174	15.5	8.1	30.206
6/24/2006	175	15.0	7.5	47.751
6/25/2006	176	12.0	6.8	25.360
6/26/2006	177	15.0	6.8	43.457
6/27/2006	178	13.6	8.2	24.539
6/28/2006	179	15.3	8.2	40.974
6/29/2006	180	15.7	9.8	28.275
6/30/2006	181	10.6	7.9	13.866
7/1/2006	182	16.1	11.8	23.998
7/2/2006	183	17.0	13.5	16.688
7/3/2006	184	M	M	M
7/4/2006	185	14.3	14.3	0.000
7/5/2006	186	14.3	11.8	11.238
7/6/2006	187	M	M	M
7/7/2006	188	11.8	9.1	7.292
7/8/2006	189	11.3	9.1	11.114
7/9/2006	190	11.5	8.8	15.286
7/10/2006	191	12.0	11.2	3.315
7/11/2006	192	13.3	10.2	21.618
7/12/2006	193	11.6	10.3	5.171
7/13/2006	194	10.5	9.6	6.662
7/14/2006	195	15.0	11.5	17.125
7/15/2006	196	13.9	11.0	14.312
7/16/2006	197	16.3	13.2	17.392
7/17/2006	198	14.0	12.0	9.457
7/18/2006	199	15.1	12.4	15.914
7/19/2006	200	14.3	13.0	5.333
7/20/2006	201	14.2	12.9	6.653
7/21/2006	202	16.4	14.4	10.861
7/22/2006	203	17.7	14.3	23.733
7/23/2006	204	17.0	14.2	13.453
7/24/2006	205	11.8	10.8	5.700
7/25/2006	206	10.7	9.7	5.281
7/26/2006	207	12.6	10.6	9.560
7/27/2006	208	12.5	10.3	11.183
7/28/2006	209	9.8	9.1	3.766
7/29/2006	210	10.7	9.4	7.899
7/30/2006	211	9.8	8.5	7.060
7/31/2006	212	10.2	9.0	6.083
8/1/2006	213	12.3	9.4	13.059
8/2/2006	214	11.7	9.4	13.752
8/3/2006	215	12.3	11.9	1.507
8/4/2006	216	14.4	11.7	18.466
8/5/2006	217	15.8	12.1	19.106
8/6/2006	218	15.9	12.9	15.417
8/7/2006	219	13.9	11.8	13.015
8/8/2006	220	16.0	12.4	15.857
8/9/2006	221	13.8	12.2	8.408
8/10/2006	222	14.1	11.8	12.356
8/11/2006	223	12.2	11.0	5.593
8/12/2006	224	14.0	11.8	11.751
8/13/2006	225	13.6	11.3	12.760
8/14/2006	226	11.0	10.0	4.981
8/15/2006	227	13.0	10.7	11.910
8/16/2006	228	11.6	10.0	8.177
8/17/2006	229	11.5	9.3	12.855
8/18/2006	230	9.9	8.4	8.260

The tables below indicate the resulting daily EET rates, as well as the components used to calculate them. The Priestly-Taylor method was used to calculate EET. Priestly-Taylor results employed thermocouple data for Site 1, and Stowaway data for all other sites. Missing data is denoted by an "M". Blank spaces in the precipitation columns indicate that no precipitation fell that day. A negative number denotes weight or water was lost from the lysimeter.

Date	Julian Date	Site 1 (mm)	Site 2 (mm)	Site 3 (mm)	Site 4 (mm)	Site 5 (mm)	Site 6 (mm)
6/21/2006	172	7.56	5.15	6.52	3.68	5.69	5.80
6/22/2006	173	7.51	4.70	6.09	3.06	5.23	5.32
6/23/2006	174	8.33	4.97	6.44	3.27	5.38	5.70

6/24/2006	175	4.96	3.26	4.23	1.87	3.51	3.77
6/25/2006	176	8.31	5.14	6.45	3.67	5.67	5.78
6/26/2006	177	6.52	4.14	5.29	2.65	4.51	4.64
6/27/2006	178	3.81	2.04	2.68	0.89	2.15	2.32
6/28/2006	179	2.45	1.54	2.00	0.35	1.46	1.66
6/29/2006	180	5.30	3.10	3.95	1.66	3.16	3.43
6/30/2006	181	1.87	0.98	1.34	0.21	0.80	0.98
7/1/2006	182	7.22	4.48	5.87	3.12	4.74	4.72
7/2/2006	183	7.37	4.35	5.78	3.05	4.60	4.55
7/3/2006	184	M	3.36	4.68	2.24	3.56	3.63
7/4/2006	185	7.56	4.12	5.57	2.92	4.41	4.40
7/5/2006	186	8.49	4.78	6.63	3.57	5.34	5.49
7/6/2006	187	M	4.51	5.98	3.60	4.80	4.89
7/7/2006	188	9.20	5.56	7.25	4.51	6.13	6.06
7/8/2006	189	4.86	2.82	3.85	2.00	3.02	3.22
7/9/2006	190	7.57	4.62	6.14	3.61	5.12	5.10
7/10/2006	191	8.83	4.99	6.61	3.71	5.53	5.60
7/11/2006	192	7.45	4.60	6.13	3.36	5.35	5.11
7/12/2006	193	5.19	2.86	4.00	2.01	3.13	3.16
7/13/2006	194	5.87	3.45	4.68	2.54	3.74	3.80
7/14/2006	195	7.87	4.61	6.26	3.31	5.24	5.15
7/15/2006	196	5.24	3.02	4.25	2.04	3.32	3.40
7/16/2006	197	9.05	5.20	7.03	3.60	5.82	5.82
7/17/2006	198	5.69	3.07	4.44	2.02	3.50	3.45
7/18/2006	199	7.23	4.19	5.78	2.97	4.69	4.64
7/19/2006	200	5.35	2.89	4.09	2.00	3.20	3.33
7/20/2006	201	6.69	3.52	5.04	2.39	4.04	4.11
7/21/2006	202	7.49	4.01	5.71	2.55	4.51	4.60
7/22/2006	203	6.56	3.61	5.17	2.21	4.13	4.01
7/23/2006	204	6.64	3.64	5.24	2.46	4.16	4.17
7/24/2006	205	2.55	1.31	2.18	1.04	1.63	1.52
7/25/2006	206	7.56	4.53	6.14	3.71	5.13	4.95
7/26/2006	207	7.51	4.34	5.88	3.39	5.03	4.86
7/27/2006	208	5.51	3.09	4.28	2.27	3.63	3.51
7/28/2006	209	2.31	1.08	1.79	0.77	1.42	1.30
7/29/2006	210	7.35	4.05	5.57	2.94	4.72	4.45
7/30/2006	211	3.15	1.64	2.45	1.16	1.98	1.88
7/31/2006	212	4.19	2.30	3.35	1.63	2.66	2.68
8/1/2006	213	6.05	3.66	4.97	2.79	4.11	3.90
8/2/2006	214	6.01	3.36	4.64	2.30	3.83	3.54
8/3/2006	215	6.87	3.56	4.91	2.48	4.14	3.77
8/4/2006	216	5.76	3.21	4.45	2.10	3.66	3.48
8/5/2006	217	4.77	2.58	3.73	1.59	2.92	2.89
8/6/2006	218	4.12	2.07	3.09	1.19	2.40	2.35
8/7/2006	219	3.80	1.82	2.77	1.05	2.24	1.88
8/8/2006	220	5.03	2.68	3.94	1.64	3.14	2.95
8/9/2006	221	0.82	-0.03	0.53	-0.44	0.15	-0.05
8/10/2006	222	4.07	2.27	3.32	1.49	2.64	2.55
8/11/2006	223	3.20	1.70	2.60	1.20	2.09	2.02
8/12/2006	224	5.69	3.12	4.38	2.16	3.65	3.43
8/13/2006	225	2.81	1.52	2.35	0.77	1.92	1.77
8/14/2006	226	1.41	0.54	1.10	0.27	0.81	0.64
8/15/2006	227	4.87	2.86	4.03	2.05	3.29	3.12
8/16/2006	228	4.83	2.59	3.63	1.84	3.14	2.67
8/17/2006	229	3.46	1.99	2.86	1.35	2.35	2.20
8/18/2006	230	4.72	2.54	3.57	1.75	3.03	2.56

Date	Julian Date	Daily Avg. Temperature (°C)	Δ (Pa/°C)	γ (kg/m³°C)	Net Radiation (W/m²)	Ground Heat Flux (W/m²)	EET (mm)
6/21/2006	172	9.17	78.3926713	0.004840128	262.76	45.874	7.56

6/22/2006	173	15.75	114.5954315	0.004870767	254.81	40.525	7.51
6/23/2006	174	17.75	128.0681401	0.004880148	267.29	30.206	8.33
6/24/2006	175	14.43	106.3562753	0.004864577	189.47	47.751	4.96
6/25/2006	176	11.58	90.33427966	0.004851323	263.31	25.360	8.31
6/26/2006	177	15.70	114.3171671	0.004870563	229.46	43.457	6.52
6/27/2006	178	17.59	126.9742808	0.004879417	132.89	24.539	3.81
6/28/2006	179	16.17	117.3264908	0.004872738	110.78	40.974	2.45
6/29/2006	180	14.59	107.3569979	0.004865349	179.59	28.275	5.30
6/30/2006	181	9.91	81.89856236	0.004843552	67.44	13.866	1.87
7/1/2006	182	11.71	91.02674381	0.004851934	230.70	23.998	7.22
7/2/2006	183	14.50	106.8285119	0.004864942	227.06	16.688	7.37
7/3/2006	184	13.82	102.7738831	0.004861763	187.05	M	M
7/4/2006	185	10.72	85.92242582	0.004847337	216.68	0.000	7.56
7/5/2006	186	13.18	99.06154812	0.004858761	253.96	11.238	8.49
7/6/2006	187	8.80	76.72253344	0.004838452	219.97	M	M
7/7/2006	188	6.93	68.54678748	0.004829787	271.98	7.292	9.20
7/8/2006	189	9.94	82.0607622	0.004843707	150.42	11.114	4.86
7/9/2006	190	9.83	81.54678959	0.004843214	232.41	15.286	7.57
7/10/2006	191	11.11	87.87047899	0.004849117	256.25	3.315	8.83
7/11/2006	192	13.97	103.6322304	0.004862444	234.54	21.618	7.45
7/12/2006	193	13.53	101.064566	0.004860392	153.62	5.171	5.19
7/13/2006	194	10.39	84.25198846	0.004845784	174.91	6.662	5.87
7/14/2006	195	14.25	105.3149816	0.004863767	241.98	17.125	7.87
7/15/2006	196	12.92	97.60186819	0.004857555	164.20	14.312	5.24
7/16/2006	197	15.64	113.9008115	0.004870259	275.46	17.392	9.05
7/17/2006	198	14.35	105.9160357	0.004864235	171.89	9.457	5.69
7/18/2006	199	13.85	102.9227158	0.004861881	222.37	15.914	7.23
7/19/2006	200	12.91	97.56100991	0.004857521	158.39	5.333	5.35
7/20/2006	201	16.01	116.2622241	0.004871974	197.29	6.653	6.69
7/21/2006	202	18.17	131.1279416	0.004882166	224.05	10.861	7.49
7/22/2006	203	18.42	132.9380276	0.004883342	210.22	23.733	6.56
7/23/2006	204	15.68	114.1438794	0.004870437	202.86	13.453	6.64
7/24/2006	205	7.40	70.52274538	0.004831956	79.01	5.700	2.55
7/25/2006	206	9.45	79.69510717	0.004841414	222.27	5.281	7.56
7/26/2006	207	9.81	81.41005226	0.004843082	224.95	9.560	7.51
7/27/2006	208	11.87	91.86837899	0.004852672	168.96	11.183	5.51
7/28/2006	209	10.59	85.25908096	0.004846723	69.89	3.766	2.31
7/29/2006	210	13.21	99.21628896	0.004858888	218.02	7.899	7.35
7/30/2006	211	9.75	81.1276384	0.004842809	97.31	7.060	3.15
7/31/2006	212	11.29	88.82564757	0.004849978	125.99	6.083	4.19
8/1/2006	213	11.01	87.39654167	0.004848687	186.38	13.059	6.05
8/2/2006	214	15.18	110.9951229	0.004868108	185.21	13.752	6.01
8/3/2006	215	15.10	110.4683229	0.004867713	197.60	1.507	6.87
8/4/2006	216	16.57	119.9762557	0.004874616	182.57	18.466	5.76
8/5/2006	217	17.32	125.0744203	0.004878135	155.05	19.106	4.77
8/6/2006	218	17.82	128.5640013	0.004880478	132.65	15.417	4.12
8/7/2006	219	16.99	122.8373807	0.004876606	121.29	13.015	3.80
8/8/2006	220	17.81	128.488455	0.004880427	158.89	15.857	5.03
8/9/2006	221	15.28	111.5988951	0.004868559	31.70	8.408	0.82
8/10/2006	222	12.86	97.28775045	0.004857294	128.64	12.356	4.07
8/11/2006	223	10.13	82.98003424	0.004844584	97.41	5.593	3.20
8/12/2006	224	12.67	96.20476455	0.004856387	174.51	11.751	5.69
8/13/2006	225	13.34	99.95083414	0.004859488	93.17	12.760	2.81
8/14/2006	226	12.39	94.63881241	0.004855062	45.18	4.981	1.41
8/15/2006	227	11.83	91.62525519	0.00485246	151.18	11.910	4.87
8/16/2006	228	11.18	88.24069066	0.004849452	146.40	8.177	4.83
8/17/2006	229	12.21	93.68918646	0.004854249	111.99	12.855	3.46
8/18/2006	230	11.15	88.06735426	0.004849295	143.43	8.260	4.72

Date	Julian Date	Daily Avg. Temperature (°C)	Δ (Pa/°C)	γ (kg/m^{3o}C)	Net Radiation (W/m^2)	Ground Heat Flux (W/m^2)	EET (mm)
6/21/2006	172	9.17	78.3926713	0.004840128	178.56	30.910	5.15

6/22/2006	173	15.75	114.5954315	0.004870767	173.15	39.035	4.70
6/23/2006	174	17.75	128.0681401	0.004880148	181.64	40.163	4.97
6/24/2006	175	14.43	106.3562753	0.004864577	128.75	35.771	3.26
6/25/2006	176	11.58	90.33427966	0.004851323	178.94	31.804	5.14
6/26/2006	177	15.70	114.3171671	0.004870563	155.93	37.755	4.14
6/27/2006	178	17.59	126.9742808	0.004879417	90.31	32.138	2.04
6/28/2006	179	16.17	117.3264908	0.004872738	75.28	31.268	1.54
6/29/2006	180	14.59	107.3569979	0.004865349	122.04	33.494	3.10
6/30/2006	181	9.91	81.89856236	0.004843552	45.83	17.601	0.98
7/1/2006	182	11.71	91.02674381	0.004851934	156.77	28.506	4.48
7/2/2006	183	14.50	106.8285119	0.004864942	154.30	29.971	4.35
7/3/2006	184	13.82	102.7738831	0.004861763	127.11	31.151	3.36
7/4/2006	185	10.72	85.92242582	0.004847337	147.24	29.088	4.12
7/5/2006	186	13.18	99.06154812	0.004858761	172.58	35.933	4.78
7/6/2006	187	8.80	76.72253344	0.004838452	149.48	19.905	4.51
7/7/2006	188	6.93	68.54678748	0.004829787	184.83	24.982	5.56
7/8/2006	189	9.94	82.0607622	0.004843707	102.22	21.425	2.82
7/9/2006	190	9.83	81.54678959	0.004843214	157.94	25.381	4.62
7/10/2006	191	11.11	87.87047899	0.004849117	174.14	31.138	4.99
7/11/2006	192	13.97	103.6322304	0.004862444	159.39	27.947	4.60
7/12/2006	193	13.53	101.064566	0.004860392	104.39	22.803	2.86
7/13/2006	194	10.39	84.25198846	0.004845784	118.86	20.104	3.45
7/14/2006	195	14.25	105.3149816	0.004863767	164.44	32.931	4.61
7/15/2006	196	12.92	97.60186819	0.004857555	111.58	25.091	3.02
7/16/2006	197	15.64	113.9008115	0.004870259	187.19	39.011	5.20
7/17/2006	198	14.35	105.9160357	0.004864235	116.81	29.216	3.07
7/18/2006	199	13.85	102.9227158	0.004861881	151.11	31.548	4.19
7/19/2006	200	12.91	97.56100991	0.004857521	107.64	25.024	2.89
7/20/2006	201	16.01	116.2622241	0.004871974	134.07	33.848	3.52
7/21/2006	202	18.17	131.1279416	0.004882166	152.26	38.159	4.01
7/22/2006	203	18.42	132.9380276	0.004883342	142.86	40.229	3.61
7/23/2006	204	15.68	114.1438794	0.004870437	137.85	34.095	3.64
7/24/2006	205	7.40	70.52274538	0.004831956	53.69	16.159	1.31
7/25/2006	206	9.45	79.69510717	0.004841414	151.04	21.024	4.53
7/26/2006	207	9.81	81.41005226	0.004843082	152.87	28.543	4.34
7/27/2006	208	11.87	91.86837899	0.004852672	114.82	26.514	3.09
7/28/2006	209	10.59	85.25908096	0.004846723	47.50	16.596	1.08
7/29/2006	210	13.21	99.21628896	0.004858888	148.16	32.468	4.05
7/30/2006	211	9.75	81.1276384	0.004842809	66.13	19.032	1.64
7/31/2006	212	11.29	88.82564757	0.004849978	85.62	19.681	2.30
8/1/2006	213	11.01	87.39654167	0.004848687	126.66	21.723	3.66
8/2/2006	214	15.18	110.9951229	0.004868108	125.86	29.928	3.36
8/3/2006	215	15.10	110.4683229	0.004867713	134.28	32.607	3.56
8/4/2006	216	16.57	119.9762557	0.004874616	124.06	32.518	3.21
8/5/2006	217	17.32	125.0744203	0.004878135	105.36	31.777	2.58
8/6/2006	218	17.82	128.5640013	0.004880478	90.14	31.258	2.07
8/7/2006	219	16.99	122.8373807	0.004876606	82.42	30.678	1.82
8/8/2006	220	17.81	128.488455	0.004880427	107.97	31.744	2.68
8/9/2006	221	15.28	111.5988951	0.004868559	21.54	22.357	-0.03
8/10/2006	222	12.86	97.28775045	0.004857294	87.42	22.614	2.27
8/11/2006	223	10.13	82.98003424	0.004844584	66.20	17.397	1.70
8/12/2006	224	12.67	96.20476455	0.004856387	118.59	29.455	3.12
8/13/2006	225	13.34	99.95083414	0.004859488	63.32	19.909	1.52
8/14/2006	226	12.39	94.63881241	0.004855062	30.70	15.330	0.54
8/15/2006	227	11.83	91.62525519	0.00485246	102.74	20.835	2.86
8/16/2006	228	11.18	88.24069066	0.004849452	99.49	25.394	2.59
8/17/2006	229	12.21	93.68918646	0.004854249	76.10	19.247	1.99
8/18/2006	230	11.15	88.06735426	0.004849295	97.47	24.641	2.54

Date	**Julian Date**	**Daily Avg. Temperature (°C)**	**Δ (Pa/°C)**	**γ (kg/m³°C)**	**Net Radiation (W/m²)**	**Ground Heat Flux (W/m²)**	**EET (mm)**
6/21/2006	172	9.17	78.3926713	0.004840128	218.33	31.264	6.52

6/22/2006	173	15.75	114.5954315	0.004870767	211.73	37.981	6.09
6/23/2006	174	17.75	128.0681401	0.004880148	222.10	38.692	6.44
6/24/2006	175	14.43	106.3562753	0.004864577	157.44	36.674	4.23
6/25/2006	176	11.58	90.33427966	0.004851323	218.80	34.053	6.45
6/26/2006	177	15.70	114.3171671	0.004870563	190.67	39.721	5.29
6/27/2006	178	17.59	126.9742808	0.004879417	110.42	34.099	2.68
6/28/2006	179	16.17	117.3264908	0.004872738	92.05	35.097	2.00
6/29/2006	180	14.59	107.3569979	0.004865349	149.23	36.456	3.95
6/30/2006	181	9.91	81.89856236	0.004843552	56.04	17.553	1.34
7/1/2006	182	11.71	91.02674381	0.004851934	191.69	23.593	5.87
7/2/2006	183	14.50	106.8285119	0.004864942	188.67	23.563	5.78
7/3/2006	184	13.82	102.7738831	0.004861763	155.42	21.665	4.68
7/4/2006	185	10.72	85.92242582	0.004847337	180.04	20.396	5.57
7/5/2006	186	13.18	99.06154812	0.004858761	211.03	21.635	6.63
7/6/2006	187	8.80	76.72253344	0.004838452	182.78	11.197	5.98
7/7/2006	188	6.93	68.54678748	0.004829787	226.00	17.428	7.25
7/8/2006	189	9.94	82.0607622	0.004843707	124.99	14.671	3.85
7/9/2006	190	9.83	81.54678959	0.004843214	193.12	17.096	6.14
7/10/2006	191	11.11	87.87047899	0.004849117	212.93	23.622	6.61
7/11/2006	192	13.97	103.6322304	0.004862444	194.89	19.792	6.13
7/12/2006	193	13.53	101.064566	0.004860392	127.64	13.204	4.00
7/13/2006	194	10.39	84.25198846	0.004845784	145.34	11.172	4.68
7/14/2006	195	14.25	105.3149816	0.004863767	201.07	22.326	6.26
7/15/2006	196	12.92	97.60186819	0.004857555	136.44	14.825	4.25
7/16/2006	197	15.64	113.9008115	0.004870259	228.89	28.392	7.03
7/17/2006	198	14.35	105.9160357	0.004864235	142.83	16.108	4.44
7/18/2006	199	13.85	102.9227158	0.004861881	184.77	19.672	5.78
7/19/2006	200	12.91	97.56100991	0.004857521	131.61	14.694	4.09
7/20/2006	201	16.01	116.2622241	0.004871974	163.94	20.285	5.04
7/21/2006	202	18.17	131.1279416	0.004882166	186.17	23.710	5.71
7/22/2006	203	18.42	132.9380276	0.004883342	174.68	27.733	5.17
7/23/2006	204	15.68	114.1438794	0.004870437	168.56	19.238	5.24
7/24/2006	205	7.40	70.52274538	0.004831956	65.65	3.101	2.18
7/25/2006	206	9.45	79.69510717	0.004841414	184.69	8.561	6.14
7/26/2006	207	9.81	81.41005226	0.004843082	186.92	18.265	5.88
7/27/2006	208	11.87	91.86837899	0.004852672	140.39	17.839	4.28
7/28/2006	209	10.59	85.25908096	0.004846723	58.08	6.840	1.79
7/29/2006	210	13.21	99.21628896	0.004858888	181.16	22.053	5.57
7/30/2006	211	9.75	81.1276384	0.004842809	80.86	10.583	2.45
7/31/2006	212	11.29	88.82564757	0.004849978	104.69	8.781	3.35
8/1/2006	213	11.01	87.39654167	0.004848687	154.87	12.464	4.97
8/2/2006	214	15.18	110.9951229	0.004868108	153.90	21.560	4.64
8/3/2006	215	15.10	110.4683229	0.004867713	164.19	24.072	4.91
8/4/2006	216	16.57	119.9762557	0.004874616	151.70	24.807	4.45
8/5/2006	217	17.32	125.0744203	0.004878135	128.83	22.503	3.73
8/6/2006	218	17.82	128.5640013	0.004880478	110.22	22.374	3.09
8/7/2006	219	16.99	122.8373807	0.004876606	100.78	21.776	2.77
8/8/2006	220	17.81	128.488455	0.004880427	132.02	20.033	3.94
8/9/2006	221	15.28	111.5988951	0.004868559	26.34	11.096	0.53
8/10/2006	222	12.86	97.28775045	0.004857294	106.89	11.878	3.32
8/11/2006	223	10.13	82.98003424	0.004844584	80.94	6.349	2.60
8/12/2006	224	12.67	96.20476455	0.004856387	145.00	19.774	4.38
8/13/2006	225	13.34	99.95083414	0.004859488	77.42	10.360	2.35
8/14/2006	226	12.39	94.63881241	0.004855062	37.54	6.087	1.10
8/15/2006	227	11.83	91.62525519	0.00485246	125.62	10.397	4.03
8/16/2006	228	11.18	88.24069066	0.004849452	121.65	17.582	3.63
8/17/2006	229	12.21	93.68918646	0.004854249	93.06	11.315	2.86
8/18/2006	230	11.15	88.06735426	0.004849295	119.18	17.008	3.57

Date	**Julian Date**	**Daily Avg. Temperature (°C)**	**Δ (Pa/°C)**	**γ (kg/m^3°C)**	**Net Radiation (W/m^2)**	**Ground Heat Flux (W/m^2)**	**EET (mm)**
6/21/2006	172	8.27	74.32881571	0.004835997	156.06	50.341	3.68

6/22/2006	173	15.46	112.7338035	0.0048694	151.34	64.088	3.06
6/23/2006	174	17.59	126.9991195	0.004879434	158.75	65.653	3.27
6/24/2006	175	14.27	105.4533066	0.004863875	112.53	59.014	1.87
6/25/2006	176	11.32	88.95633231	0.004850096	156.39	51.209	3.67
6/26/2006	177	15.50	113.0085274	0.004869603	136.28	60.573	2.65
6/27/2006	178	17.45	125.978305	0.004878747	78.93	53.685	0.89
6/28/2006	179	15.91	115.6481	0.004871531	65.80	55.685	0.35
6/29/2006	180	14.17	104.8284663	0.004863386	106.66	59.154	1.66
6/30/2006	181	9.78	81.2957923	0.004842972	40.06	34.080	0.21
7/1/2006	182	11.17	88.18404992	0.004849401	137.02	47.640	3.12
7/2/2006	183	14.39	106.1519401	0.004864418	134.86	47.676	3.05
7/3/2006	184	13.73	102.2595461	0.004861352	111.09	47.027	2.24
7/4/2006	185	10.42	84.41471285	0.004845936	128.69	44.924	2.92
7/5/2006	186	12.87	97.34147306	0.004857339	150.84	48.712	3.57
7/6/2006	187	8.51	75.38804514	0.004837091	130.65	27.321	3.60
7/7/2006	188	6.63	67.32833222	0.004828424	161.54	31.977	4.51
7/8/2006	189	9.64	80.61796149	0.004842315	89.34	31.963	2.00
7/9/2006	190	9.53	80.10565117	0.004841816	138.04	34.624	3.61
7/10/2006	191	10.80	86.32102	0.004847704	152.19	45.964	3.71
7/11/2006	192	13.66	101.8259839	0.004861005	139.30	43.330	3.36
7/12/2006	193	13.22	99.3048442	0.00485896	91.24	33.813	2.01
7/13/2006	194	10.09	82.78600235	0.0048444	103.88	31.062	2.54
7/14/2006	195	13.94	103.477661	0.004862322	143.72	49.062	3.31
7/15/2006	196	12.62	95.90740707	0.004856137	97.52	39.291	2.04
7/16/2006	197	15.33	111.9303602	0.004868805	163.61	60.971	3.60
7/17/2006	198	14.05	104.1104617	0.004862822	102.09	44.330	2.02
7/18/2006	199	13.55	101.160804	0.004860469	132.07	47.249	2.97
7/19/2006	200	12.61	95.86942775	0.004856105	94.07	36.954	2.00
7/20/2006	201	15.69	114.24769	0.004870513	117.18	49.107	2.39
7/21/2006	202	17.86	128.876752	0.004880685	133.07	60.523	2.55
7/22/2006	203	18.11	130.6745362	0.004881869	124.86	61.945	2.21
7/23/2006	204	15.37	112.1747473	0.004868987	120.48	50.207	2.46
7/24/2006	205	7.11	69.28611811	0.004830605	46.92	17.163	1.04
7/25/2006	206	9.15	78.29570306	0.004840031	132.01	25.458	3.71
7/26/2006	207	9.50	79.96713939	0.004841681	133.61	36.494	3.39
7/27/2006	208	11.57	90.26484338	0.004851262	100.35	35.464	2.27
7/28/2006	209	10.29	83.78211363	0.004845342	41.51	19.332	0.77
7/29/2006	210	12.90	97.49895087	0.00485747	129.49	45.515	2.94
7/30/2006	211	9.44	79.68856676	0.004841408	57.79	24.599	1.16
7/31/2006	212	10.99	87.27824545	0.004848579	74.83	28.239	1.63
8/1/2006	213	10.71	85.85027778	0.00484727	110.70	30.854	2.79
8/2/2006	214	14.87	109.0738993	0.00486666	110.00	44.278	2.30
8/3/2006	215	14.78	108.5433514	0.004866257	117.36	46.605	2.48
8/4/2006	216	16.26	117.9042481	0.00487315	108.43	48.502	2.10
8/5/2006	217	17.00	122.9134335	0.004876658	92.09	46.865	1.59
8/6/2006	218	17.50	126.3517427	0.004878999	78.78	45.015	1.19
8/7/2006	219	16.68	120.7145747	0.004875133	72.04	42.065	1.05
8/8/2006	220	17.49	126.271745	0.004878945	94.37	47.694	1.64
8/9/2006	221	14.97	109.700818	0.004867135	18.83	31.262	-0.44
8/10/2006	222	12.56	95.61311907	0.004855889	76.41	33.801	1.49
8/11/2006	223	9.83	81.54005257	0.004843207	57.86	23.500	1.20
8/12/2006	224	12.36	94.52103812	0.004854961	103.64	41.738	2.16
8/13/2006	225	13.03	98.20617902	0.004858056	55.34	33.329	0.77
8/14/2006	226	12.08	92.98549445	0.004853643	26.84	19.217	0.27
8/15/2006	227	11.53	90.04371705	0.004851066	89.79	31.045	2.05
8/16/2006	228	10.88	86.69389482	0.004848046	86.95	34.133	1.84
8/17/2006	229	11.91	92.04857319	0.004852829	66.51	27.887	1.35
8/18/2006	230	10.84	86.53538478	0.004847901	85.18	35.175	1.75

Date	**Julian Date**	**Daily Avg. Temperature (°C)**	**Δ (Pa/°C)**	**γ (kg/m³°C)**	**Net Radiation (W/m²)**	**Ground Heat Flux (W/m²)**	**EET (mm)**
6/21/2006	172	8.27	74.32881571	0.004835997	194.12	30.632	5.69

6/22/2006	173	15.46	112.7338035	0.0048694	188.24	39.105	5.23
6/23/2006	174	17.59	126.9991195	0.004879434	197.46	44.193	5.38
6/24/2006	175	14.27	105.4533066	0.004863875	139.97	39.778	3.51
6/25/2006	176	11.32	88.95633231	0.004850096	194.53	32.186	5.67
6/26/2006	177	15.50	113.0085274	0.004869603	169.52	40.821	4.51
6/27/2006	178	17.45	125.978305	0.004878747	98.18	36.926	2.15
6/28/2006	179	15.91	115.6481	0.004871531	81.84	40.214	1.46
6/29/2006	180	14.17	104.8284663	0.004863386	132.67	42.479	3.16
6/30/2006	181	9.78	81.2957923	0.004842972	49.83	27.019	0.80
7/1/2006	182	11.17	88.18404992	0.004849401	170.43	34.637	4.74
7/2/2006	183	14.39	106.1519401	0.004864418	167.74	36.501	4.60
7/3/2006	184	13.73	102.2595461	0.004861352	138.18	36.593	3.56
7/4/2006	185	10.42	84.41471285	0.004845936	160.07	33.530	4.41
7/5/2006	186	12.87	97.34147306	0.004857339	187.62	34.796	5.34
7/6/2006	187	8.51	75.38804514	0.004837091	162.51	24.715	4.80
7/7/2006	188	6.63	67.32833222	0.004828424	200.93	24.666	6.13
7/8/2006	189	9.64	80.61796149	0.004842315	111.13	24.382	3.02
7/9/2006	190	9.53	80.10565117	0.004841816	171.70	24.688	5.12
7/10/2006	191	10.80	86.32102	0.004847704	189.31	30.901	5.53
7/11/2006	192	13.66	101.8259839	0.004861005	173.27	20.382	5.35
7/12/2006	193	13.22	99.3048442	0.00485896	113.49	23.948	3.13
7/13/2006	194	10.09	82.78600235	0.0048444	129.22	21.916	3.74
7/14/2006	195	13.94	103.477661	0.004862322	178.77	29.026	5.24
7/15/2006	196	12.62	95.90740707	0.004856137	121.30	26.412	3.32
7/16/2006	197	15.33	111.9303602	0.004868805	203.50	37.595	5.82
7/17/2006	198	14.05	104.1104617	0.004862822	126.99	26.913	3.50
7/18/2006	199	13.55	101.160804	0.004860469	164.28	30.234	4.69
7/19/2006	200	12.61	95.86942775	0.004856105	117.01	25.441	3.20
7/20/2006	201	15.69	114.24769	0.004870513	145.76	30.642	4.04
7/21/2006	202	17.86	128.876752	0.004880685	165.52	37.228	4.51
7/22/2006	203	18.11	130.6745362	0.004881869	155.30	37.661	4.13
7/23/2006	204	15.37	112.1747473	0.004868987	149.87	31.150	4.16
7/24/2006	205	7.11	69.28611811	0.004830605	58.37	11.436	1.63
7/25/2006	206	9.15	78.29570306	0.004840031	164.20	17.110	5.13
7/26/2006	207	9.50	79.96713939	0.004841681	166.19	21.876	5.03
7/27/2006	208	11.57	90.26484338	0.004851262	124.82	20.999	3.63
7/28/2006	209	10.29	83.78211363	0.004845342	51.64	10.952	1.42
7/29/2006	210	12.90	97.49895087	0.00485747	161.06	26.040	4.72
7/30/2006	211	9.44	79.68856676	0.004841408	71.89	15.222	1.98
7/31/2006	212	10.99	87.27824545	0.004848579	93.08	16.754	2.66
8/1/2006	213	10.71	85.85027778	0.00484727	137.69	19.826	4.11
8/2/2006	214	14.87	109.0738993	0.00486666	136.83	27.463	3.83
8/3/2006	215	14.78	108.5433514	0.004866257	145.98	27.814	4.14
8/4/2006	216	16.26	117.9042481	0.00487315	134.87	30.559	3.66
8/5/2006	217	17.00	122.9134335	0.004876658	114.55	31.337	2.92
8/6/2006	218	17.50	126.3517427	0.004878999	97.99	29.750	2.40
8/7/2006	219	16.68	120.7145747	0.004875133	89.60	25.830	2.24
8/8/2006	220	17.49	126.271745	0.004878945	117.38	27.996	3.14
8/9/2006	221	14.97	109.700818	0.004867135	23.42	19.242	0.15
8/10/2006	222	12.56	95.61311907	0.004855889	95.04	19.616	2.64
8/11/2006	223	9.83	81.54005257	0.004843207	71.97	12.139	2.09
8/12/2006	224	12.36	94.52103812	0.004854961	128.92	24.363	3.65
8/13/2006	225	13.03	98.20617902	0.004858056	68.83	13.885	1.92
8/14/2006	226	12.08	92.98549445	0.004853643	33.38	10.081	0.81
8/15/2006	227	11.53	90.04371705	0.004851066	111.69	17.578	3.29
8/16/2006	228	10.88	86.69389482	0.004848046	108.16	18.338	3.14
8/17/2006	229	11.91	92.04857319	0.004852829	82.74	15.447	2.35
8/18/2006	230	10.84	86.53538478	0.004847901	105.96	19.166	3.03

Date	**Julian Date**	**Daily Avg. Temperature (°C)**	**Δ (Pa/°C)**	**γ (kg/m³°C)**	**Net Radiation (W/m²)**	**Ground Heat Flux (W/m²)**	**EET (mm)**
6/21/2006	172	10.96	87.10100871	0.004848418	198.66	32.482	5.80

6/22/2006	173	16.48	119.3592159	0.004874182	192.65	41.075	5.32
6/23/2006	174	18.51	133.5466904	0.004883734	202.09	40.104	5.70
6/24/2006	175	14.22	105.1243117	0.004863618	143.25	35.494	3.77
6/25/2006	176	11.62	90.54121715	0.004851506	199.08	33.510	5.78
6/26/2006	177	16.04	116.5078158	0.004872151	173.49	41.096	4.64
6/27/2006	178	16.80	121.558256	0.004875721	100.48	34.246	2.32
6/28/2006	179	15.60	113.6519386	0.004870076	83.76	36.378	1.66
6/29/2006	180	14.44	106.4593859	0.004864657	135.78	37.845	3.43
6/30/2006	181	9.41	79.50524141	0.004841228	50.99	22.857	0.98
7/1/2006	182	11.91	92.08670454	0.004852862	174.42	39.357	4.72
7/2/2006	183	14.21	105.0459306	0.004863557	171.67	41.695	4.55
7/3/2006	184	13.26	99.54459867	0.004859157	141.42	37.737	3.63
7/4/2006	185	11.85	91.76362699	0.004852581	163.82	37.972	4.40
7/5/2006	186	13.21	99.24083479	0.004858908	192.01	35.044	5.49
7/6/2006	187	8.29	74.40831489	0.00483608	166.31	25.758	4.89
7/7/2006	188	8.77	76.56286159	0.00483829	205.64	31.668	6.06
7/8/2006	189	10.25	83.55771563	0.004845131	113.73	21.420	3.22
7/9/2006	190	10.90	86.83837319	0.004848178	175.72	29.603	5.10
7/10/2006	191	12.58	95.72913287	0.004855987	193.74	33.620	5.60
7/11/2006	192	14.21	105.085737	0.004863588	177.33	31.452	5.11
7/12/2006	193	14.29	105.535692	0.004863939	116.14	25.874	3.16
7/13/2006	194	10.50	84.80605047	0.004846302	132.24	23.464	3.80
7/14/2006	195	14.91	109.333565	0.004866857	182.95	35.928	5.15
7/15/2006	196	13.34	99.96714283	0.004859501	124.14	26.888	3.40
7/16/2006	197	15.56	113.4180946	0.004869905	208.27	42.404	5.82
7/17/2006	198	14.16	104.7527543	0.004863327	129.96	31.479	3.45
7/18/2006	199	14.01	103.8600103	0.004862624	168.12	35.637	4.64
7/19/2006	200	13.41	100.3795107	0.004859837	119.75	24.596	3.33
7/20/2006	201	16.51	119.6060074	0.004874355	149.17	31.965	4.11
7/21/2006	202	18.69	134.8675101	0.004884581	169.40	38.683	4.60
7/22/2006	203	18.93	136.7029278	0.004885746	158.94	44.973	4.01
7/23/2006	204	16.18	117.4024048	0.004872792	153.38	34.596	4.17
7/24/2006	205	7.88	72.59672295	0.00483418	59.73	16.203	1.52
7/25/2006	206	9.94	82.03551503	0.004843683	168.05	26.001	4.95
7/26/2006	207	10.30	83.8143173	0.004845372	170.08	30.754	4.86
7/27/2006	208	12.37	94.54587823	0.004854983	127.74	27.438	3.51
7/28/2006	209	11.08	87.72686611	0.004848987	52.84	15.729	1.30
7/29/2006	210	13.70	102.0863984	0.004861214	164.84	37.786	4.45
7/30/2006	211	10.24	83.51309659	0.004845088	73.57	19.552	1.88
7/31/2006	212	11.78	91.40529036	0.004852267	95.26	18.449	2.68
8/1/2006	213	11.51	89.9724863	0.004851002	140.92	29.131	3.90
8/2/2006	214	15.68	114.1905408	0.004870471	140.03	39.196	3.54
8/3/2006	215	15.60	113.6647968	0.004870086	149.40	41.830	3.77
8/4/2006	216	17.08	123.4210626	0.004877007	138.03	38.888	3.48
8/5/2006	217	17.83	128.6592332	0.004880541	117.23	34.971	2.89
8/6/2006	218	18.33	132.231149	0.004882884	100.29	33.520	2.35
8/7/2006	219	17.50	126.3490757	0.004878997	91.70	38.212	1.88
8/8/2006	220	18.32	132.1673496	0.004882843	120.13	36.251	2.95
8/9/2006	221	15.77	114.7478612	0.004870878	23.96	25.408	-0.05
8/10/2006	222	13.36	100.0753892	0.00485959	97.26	24.327	2.55
8/11/2006	223	10.62	85.39090029	0.004846845	73.65	15.810	2.02
8/12/2006	224	13.17	99.00873665	0.004858717	131.94	33.838	3.43
8/13/2006	225	13.83	102.8460279	0.00486182	70.45	19.879	1.77
8/14/2006	226	12.88	97.38576362	0.004857375	34.16	15.939	0.64
8/15/2006	227	12.32	94.27068261	0.004854748	114.30	25.114	3.12
8/16/2006	228	11.67	90.82251247	0.004851755	110.69	34.310	2.67
8/17/2006	229	12.71	96.41091535	0.004856561	84.67	21.736	2.20
8/18/2006	230	11.64	90.63296403	0.004851587	108.44	35.235	2.56

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This appendix contains tables of observed and corrected daily AET rates derived from lysimeters, and soil moisture data used to correct lysimeter data to account for the severance of lateral ground water flow. Also included at the end of this appendix are tables of data which were used to calculate daily lysimeter AET rates. Any "M" values in the tables indicate missing data.

The lysimeters at Sites 2, 3, 4, and 5 were corrected by comparing calculated volumetric soil moisture inside the lysimeters to measured volumetric soil moisture from the surrounding plant communities. A positive difference between the two volumetric soil moistures indicates that the lysimeter is drier than the surrounding community. That difference was equated to a depth in millimetres using the surface area of the lysimeter, the density of water. The cumulative difference at the end of the season, attributed to cutting off lateral flow of soil water, was added to the observed total AET, giving a corrected total season AET value. That cumulative difference was also divided by the number of days (58), yielding a daily correction factor for that site. Corrections were not required at Site 6, since negligible lateral flow was thought to occur in the sandy esker soil.

Date	Julian Date	Site 2 (mm)	Site 3 (mm)	Site 4 (mm)	Site 5 (mm)	Site 6 (mm)
6/21/2006	172	0.37	1.98	1.83	1.08	1.73

6/22/2006	173	1.22	2.74	0.43	2.30	2.20
6/23/2006	174	3.16	3.65	2.28	1.45	1.48
6/24/2006	175	0.57	2.66	2.80	0.83	1.00
6/25/2006	176	2.24	0.00	0.00	0.55	0.00
6/26/2006	177	1.56	2.94	2.74	2.41	0.87
6/27/2006	178	2.66	3.40	1.52	1.98	3.53
6/28/2006	179	1.31	2.49	4.02	1.49	0.74
6/29/2006	180	1.91	1.39	4.17	4.04	0.34
6/30/2006	181	0.00	0.00	0.00	0.00	0.00
7/1/2006	182	3.35	0.43	2.40	1.89	3.22
7/2/2006	183	1.10	4.46	3.09	0.00	3.00
7/3/2006	184	0.00	0.00	1.77	3.83	0.00
7/4/2006	185	0.74	1.91	1.99	0.59	0.35
7/5/2006	186	3.68	4.15	1.77	4.42	3.62
7/6/2006	187	M	M	M	M	M
7/7/2006	188	1.22	1.59	3.18	0.74	3.25
7/8/2006	189	2.22	2.50	2.56	2.73	2.25
7/9/2006	190	0.83	2.36	1.91	2.36	1.08
7/10/2006	191	2.65	2.65	2.28	2.47	1.81
7/11/2006	192	2.06	1.78	1.98	2.04	0.57
7/12/2006	193	1.76	2.03	1.82	3.09	2.09
7/13/2006	194	1.22	1.44	0.66	1.03	0.31
7/14/2006	195	2.04	2.29	1.49	2.19	2.01
7/15/2006	196	1.30	2.10	1.43	1.72	1.63
7/16/2006	197	2.89	2.03	1.82	2.01	1.41
7/17/2006	198	1.94	3.02	2.01	3.20	1.99
7/18/2006	199	1.83	1.49	0.00	0.27	1.47
7/19/2006	200	2.23	3.33	3.00	2.29	1.77
7/20/2006	201	2.46	2.22	0.96	1.71	1.23
7/21/2006	202	1.76	2.31	1.96	2.17	2.37
7/22/2006	203	1.57	1.35	0.23	1.33	1.95
7/23/2006	204	1.84	2.29	2.74	1.61	2.03
7/24/2006	205	1.86	1.36	1.97	1.90	1.68
7/25/2006	206	0.87	0.83	0.25	1.63	0.68
7/26/2006	207	1.72	3.06	2.69	1.30	1.83
7/27/2006	208	1.49	1.73	0.91	1.34	1.39
7/28/2006	209	1.04	1.15	1.67	1.30	0.63
7/29/2006	210	0.53	0.26	0.16	0.33	0.84
7/30/2006	211	1.94	2.78	1.03	1.16	1.92
7/31/2006	212	0.99	0.67	1.52	1.97	0.57
8/1/2006	213	0.63	0.96	0.55	0.13	1.18
8/2/2006	214	0.88	1.53	2.32	1.60	0.53
8/3/2006	215	2.10	2.41	1.70	1.44	2.50
8/4/2006	216	1.40	0.87	1.43	2.02	0.38
8/5/2006	217	1.99	1.98	0.99	0.79	1.83
8/6/2006	218	1.36	1.75	1.56	1.21	1.27
8/7/2006	219	0.52	0.53	0.19	0.38	1.27
8/8/2006	220	0.77	0.94	1.97	0.95	0.61
8/9/2006	221	1.91	0.57	0.72	0.73	0.24
8/10/2006	222	0.89	1.52	0.31	0.00	0.29
8/11/2006	223	0.00	0.00	0.74	1.62	0.40
8/12/2006	224	0.47	1.14	0.91	0.40	1.11
8/13/2006	225	2.31	2.13	1.91	2.64	2.10
8/14/2006	226	0.52	0.16	0.23	0.87	1.00
8/15/2006	227	0.93	1.12	0.61	0.17	0.32
8/16/2006	228	0.75	0.87	1.71	0.82	0.84
8/17/2006	229	0.00	0.50	0.18	0.53	0.35
8/18/2006	230	0.97	0.70	1.29	0.59	0.45

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Date	Julian Date	Site 2	Site 3	Site 4	Site 5

		Lysimeters	Site	Lysimeters	Site	Lysimeters	Site	Lysimeters	Site
6/20/2006	171	67.15	47.13	82.75	59.42	115.03	42.75	34.84	36.96
6/21/2006	172	66.94		81.17		112.93		33.52	
6/22/2006	173	66.18		79.49		112.93		31.43	
6/23/2006	174	63.14	43.00	75.34	53.04	109.65	39.13	29.35	30.13
6/24/2006	175	62.81		73.67		106.86		28.48	
6/25/2006	176	68.02	51.17	81.17	68.08	118.18	48.42	39.07	38.88
6/26/2006	177	66.94	47.79	78.73	64.71	114.90	40.00	36.12	33.00
6/27/2006	178	64.88	44.63	75.77	59.88	116.21	39.83	34.04	30.42
6/28/2006	179	67.81		77.67		117.53		38.38	
6/29/2006	180	73.01	54.83	83.37	73.83	123.07	49.92	44.27	44.29
6/30/2006	181	93.09		102.98		150.66		78.46	
7/1/2006	182	85.60	67.25	94.06	78.00	144.76	64.63	74.29	78.17
7/2/2006	183	83.54		87.69		136.56		63.54	
7/3/2006	184	83.97	65.75	88.37	79.33	139.64	64.17	62.84	76.92
7/4/2006	185	83.43		86.99		131.80		65.10	
7/5/2006	186	80.72	63.54	84.00	79.54	129.83	58.79	50.87	74.08
7/6/2006	187	M		M		M		M	
7/7/2006	188	81.15	62.04	82.86	75.21	132.13	61.68	64.75	73.75
7/8/2006	189	79.42		81.06		126.88		52.60	
7/9/2006	190	78.87	59.83	79.37	74.22	124.74	50.72	49.83	69.69
7/10/2006	191	76.38		76.72		121.79		46.36	
7/11/2006	192	75.29	53.16	75.66	62.05	119.99	49.29	44.45	66.37
7/12/2006	193	73.56		73.54		117.53		39.94	
7/13/2006	194	76.49	61.49	76.19	75.30	122.28	54.21	44.62	71.68
7/14/2006	195	74.86		74.18		120.64		42.02	
7/15/2006	196	73.88	59.22	72.27	71.02	118.84	46.41	39.76	63.32
7/16/2006	197	74.86		73.86		122.12		42.54	
7/17/2006	198	73.34	56.30	71.21	72.99	119.49	50.89	38.20	65.98
7/18/2006	199	74.86		75.02		124.25		42.54	
7/19/2006	200	73.34	57.57	70.90	72.52	120.48	48.96	39.76	71.85
7/20/2006	201	72.47		70.05		121.13		39.42	
7/21/2006	202	71.28	52.40	68.25	79.51	119.17	45.92	37.16	76.96
7/22/2006	203	70.63		67.61		119.17		36.12	
7/23/2006	204	70.19	49.65	66.66	75.97	117.20	43.89	35.60	71.89
7/24/2006	205	69.65		66.45		116.54		34.90	
7/25/2006	206	70.30	53.78	67.08	81.05	118.18	46.36	34.90	77.49
7/26/2006	207	68.89		64.65		115.23		33.34	
7/27/2006	208	67.81	48.99	63.17	78.40	114.74	44.25	31.61	74.73
7/28/2006	209	67.05		62.21		113.10		30.22	
7/29/2006	210	66.72	51.05	61.90	80.38	112.93	42.95	30.05	75.26
7/30/2006	211	65.31		59.99		111.95		28.83	
7/31/2006	212	65.09	51.27	59.78	80.80	110.80	43.26	27.10	78.47
8/1/2006	213	64.55		59.04		110.14		27.62	
8/2/2006	214	64.01	46.72	58.08	78.73	107.68	39.87	25.88	75.84
8/3/2006	215	61.84		55.54		105.22		23.63	
8/4/2006	216	61.08	44.86	54.91	79.50	103.91	39.31	21.72	75.17
8/5/2006	217	59.56		53.32		102.92		20.85	
8/6/2006	218	58.58	43.76	52.15	79.24	100.96	37.06	19.29	77.21
8/7/2006	219	58.37		52.26		101.12		19.29	
8/8/2006	220	57.72	42.41	52.47	72.76	98.33	35.18	17.90	73.38
8/9/2006	221	56.52		51.94		98.00		17.55	
8/10/2006	222	56.85	45.18	52.05	81.53	100.14	41.50	21.02	82.00
8/11/2006	223	58.58		53.74		100.14		19.11	
8/12/2006	224	58.26	46.91	53.11	82.29	98.99	33.29	18.59	78.62
8/13/2006	225	56.63		51.52		97.51		15.82	
8/14/2006	226	56.52	45.24	51.84	86.18	97.84	39.21	15.30	80.00
8/15/2006	227	56.30		51.94		98.00		15.99	
8/16/2006	228	55.76	46.56	50.99	79.97	95.87	33.41	14.95	78.03
8/17/2006	229	55.87		51.10		95.71		14.43	
8/18/2006	230	55.22	48.38	51.31	82.76	94.23	34.53	13.73	78.06

Volumetric Water Content Difference Between Lysimeters and Surrounding Environment

Date	Julian Date	Site 2		Site 3		Site 4		Site 5	
		VSM	Water	VSM	Water	VSM	Water	VSM	Water

		Diff. (%)	Diff. (mm)	Diff. (%)	Diff. (mm)	Diff. (%)	Diff. (mm)	Diff. (%)	Diff. (mm)
6/20/2006	171	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
6/21/2006	172								
6/22/2006	173								
6/23/2006	174	-0.1	0.15	1.0	-1.44	1.8	-1.58	-1.3	1.83
6/24/2006	175								
6/25/2006	176	3.2	-4.31	10.3	-14.26	2.5	-2.26	-2.3	3.14
6/26/2006	177	0.9	-1.20	9.3	-12.95	-2.6	2.35	-5.2	7.11
6/27/2006	178	-0.2	0.30	7.4	-10.35	-4.1	3.68	-5.7	7.79
6/28/2006	179								
6/29/2006	180	1.8	-2.51	13.8	-19.19	-0.9	0.78	-2.1	2.86
6/30/2006	181								
7/1/2006	182	1.7	-2.28	7.3	-10.11	-7.9	7.04	1.7	-2.37
7/2/2006	183								
7/3/2006	184	1.8	-2.45	14.3	-19.89	-3.2	2.86	12.0	-16.21
7/4/2006	185								
7/5/2006	186	2.9	-3.87	18.9	-26.24	1.2	-1.12	21.1	-28.61
7/6/2006	187								
7/7/2006	188	0.9	-1.25	15.7	-21.81	1.8	-1.65	6.9	-9.32
7/8/2006	189								
7/9/2006	190	1.0	-1.34	18.2	-25.30	-1.7	1.57	17.7	-24.06
7/10/2006	191								
7/11/2006	192	-2.1	2.85	9.7	-13.53	1.6	-1.42	19.8	-26.85
7/12/2006	193								
7/13/2006	194	5.0	-6.83	22.4	-31.21	4.2	-3.77	24.9	-33.82
7/14/2006	195								
7/15/2006	196	5.4	-7.28	22.1	-30.71	-0.1	0.13	21.4	-29.08
7/16/2006	197								
7/17/2006	198	3.0	-4.06	25.1	-34.91	3.7	-3.30	25.7	-34.81
7/18/2006	199								
7/19/2006	200	4.3	-5.78	25.0	-34.70	0.8	-0.68	30.0	-40.65
7/20/2006	201								
7/21/2006	202	1.1	-1.56	34.6	-48.10	-1.0	0.87	37.7	-51.12
7/22/2006	203								
7/23/2006	204	-0.5	0.70	32.6	-45.39	-1.0	0.92	34.2	-46.35
7/24/2006	205								
7/25/2006	206	3.5	-4.76	37.3	-51.86	0.5	-0.42	40.5	-54.90
7/26/2006	207								
7/27/2006	208	1.2	-1.65	38.6	-53.62	1.8	-1.61	41.0	-55.63
7/28/2006	209								
7/29/2006	210	4.4	-5.91	41.8	-58.14	2.3	-2.06	43.1	-58.45
7/30/2006	211								
7/31/2006	212	6.2	-8.42	44.4	-61.67	4.7	-4.25	49.3	-66.82
8/1/2006	213								
8/2/2006	214	2.7	-3.72	44.0	-61.15	4.5	-4.01	47.8	-64.90
8/3/2006	215								
8/4/2006	216	3.8	-5.17	47.9	-66.63	7.7	-6.89	51.3	-69.63
8/5/2006	217								
8/6/2006	218	5.2	-7.07	50.4	-70.09	8.4	-7.52	55.8	-75.69
8/7/2006	219								
8/8/2006	220	4.7	-6.41	43.6	-60.65	9.1	-8.19	53.4	-72.39
8/9/2006	221								
8/10/2006	222	8.4	-11.34	52.8	-73.43	13.6	-12.24	58.9	-79.84
8/11/2006	223								
8/12/2006	224	8.7	-11.78	52.5	-73.02	6.6	-5.91	57.9	-78.55
8/13/2006	225								
8/14/2006	226	8.7	-11.86	57.7	-80.18	13.6	-12.25	62.6	-84.90
8/15/2006	227								
8/16/2006	228	10.8	-14.69	52.3	-72.73	9.8	-8.81	61.0	-82.70
8/17/2006	229								
8/18/2006	230	13.2	-17.90	54.8	-76.17	12.6	-11.29	62.2	-84.38

Date + Time	Julian Date	Observed Wt.	Wt.	Equivalent	Calculated	Calculated

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/06 18:29	171	15.45	N/A	N/A	N/A	N/A
6/21/06 13:42	172	15.45	0.00	0.00	0.00	0.00
6/22/06 9:59	173	15.35	-0.10	-0.88	0.00	0.88
6/23/06 17:15	174	14.90	-0.45	-3.97	0.00	3.97
6/24/06 11:53	175	14.80	-0.10	-0.88	0.00	0.88
6/25/06 14:17	176	15.65	0.85	7.51	0.00	2.02
6/26/06 13:00	177	15.45	-0.20	-1.77	0.00	1.77
6/27/06 17:17	178	15.05	-0.40	-3.53	0.00	3.87
6/28/06 14:01	179	15.60	0.55	4.86	0.00	0.25
6/29/06 16:41	180	16.10	0.50	4.42	0.00	4.77
6/30/06 16:02	181	18.25	2.15	18.99	46.67	0.00
7/1/06 15:09	182	16.80	-1.45	-12.81	9.67	3.81
7/2/06 16:37	183	16.55	-0.25	-2.21	0.00	2.21
7/3/06 19:57	184	16.60	0.05	0.44	3.98	0.00
7/4/06 14:21	185	16.55	-0.05	-0.44	0.00	0.44
7/5/06 18:51	186	16.00	-0.55	-4.86	0.00	4.86
M	187	M	M	M	M	M
7/7/06 16:00	188	16.20	0.20	1.77	4.70	0.00
7/8/06 17:29	189	15.90	-0.30	-2.65	0.00	2.65
7/9/06 14:44	190	15.85	-0.05	-0.44	0.00	0.44
7/10/06 21:26	191	15.45	-0.40	-3.53	0.00	3.53
7/11/06 14:33	192	15.30	-0.15	-1.32	0.00	1.32
7/12/06 22:39	193	15.10	-0.20	-1.77	0.00	1.77
7/13/06 14:45	194	15.55	0.45	3.97	0.00	0.79
7/14/06 16:42	195	15.35	-0.20	-1.77	0.00	1.77
7/15/06 17:15	196	15.20	-0.15	-1.32	0.00	1.32
7/16/06 16:08	197	15.40	0.20	1.77	0.00	2.32
7/17/06 17:40	198	15.20	-0.20	-1.77	0.00	1.77
7/18/06 15:45	199	15.45	0.25	2.21	0.00	1.53
7/19/06 21:18	200	15.20	-0.25	-2.21	0.00	2.89
7/20/06 22:04	201	15.10	-0.10	-0.88	0.00	2.24
7/21/06 20:05	202	14.95	-0.15	-1.32	0.00	1.32
7/22/06 14:46	203	14.95	0.00	0.00	0.00	0.34
7/23/06 16:12	204	14.85	-0.10	-0.88	0.00	2.24
7/24/06 14:48	205	14.75	-0.10	-0.88	0.00	1.90
7/25/06 13:27	206	14.85	0.10	0.88	0.00	0.82
7/26/06 16:08	207	14.70	-0.15	-1.32	0.00	1.32
7/27/06 15:50	208	14.55	-0.15	-1.32	0.00	1.32
7/28/06 15:38	209	14.50	-0.05	-0.44	0.00	0.44
7/29/06 11:36	210	14.40	-0.10	-0.88	0.00	0.88
7/30/06 11:15	211	14.25	-0.15	-1.32	0.00	1.32
7/31/06 10:58	212	14.20	-0.05	-0.44	0.00	1.12
8/1/06 15:11	213	14.15	-0.05	-0.44	0.00	0.44
8/2/06 11:17	214	14.15	0.00	0.00	0.00	0.00
8/3/06 20:57	215	13.90	-0.25	-2.21	0.00	2.21
8/4/06 14:40	216	13.75	-0.15	-1.32	0.00	1.32
8/5/06 15:29	217	13.60	-0.15	-1.32	0.00	1.32
8/6/06 14:56	218	13.50	-0.10	-0.88	0.00	0.88
8/7/06 11:28	219	13.45	-0.05	-0.44	0.00	0.44
8/8/06 14:56	220	13.40	-0.05	-0.44	0.00	0.44
8/9/06 15:35	221	13.20	-0.20	-1.77	0.00	2.11
8/10/06 13:53	222	13.40	0.20	1.77	0.00	0.00
8/11/06 17:25	223	13.65	0.25	2.21	0.00	0.00
8/12/06 16:00	224	13.60	-0.05	-0.44	0.00	0.44
8/13/06 14:59	225	13.30	-0.30	-2.65	0.00	2.65
8/14/06 14:55	226	13.35	0.05	0.44	0.00	0.00
8/15/06 16:07	227	13.40	0.05	0.44	0.00	0.24
8/16/06 15:45	228	13.30	-0.10	-0.88	0.00	0.88
8/17/06 13:44	229	13.30	0.00	0.00	0.00	0.00
8/18/06 11:40	230	13.25	-0.05	-0.44	0.00	0.44

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/06 18:29	171	8.70	N/A	N/A	N/A	N/A
6/21/06 13:42	172	8.65	-0.05	-0.44	0.00	0.44
6/22/06 9:59	173	8.55	-0.10	-0.88	0.00	0.88
6/23/06 17:15	174	8.05	-0.50	-4.42	0.00	4.42
6/24/06 11:53	175	8.00	-0.05	-0.44	0.00	0.44
6/25/06 14:17	176	8.80	0.80	7.07	0.00	2.46
6/26/06 13:00	177	8.70	-0.10	-0.88	0.00	0.88
6/27/06 17:17	178	8.40	-0.30	-2.65	0.00	2.99
6/28/06 14:01	179	8.80	0.40	3.53	0.00	1.57
6/29/06 16:41	180	9.80	1.00	8.83	0.00	0.35
6/30/06 16:02	181	13.20	3.40	30.03	35.63	0.00
7/1/06 15:09	182	12.95	-0.25	-2.21	0.00	2.89
7/2/06 16:37	183	11.85	-1.10	-9.71	0.00	9.71
7/3/06 19:57	184	11.95	0.10	0.88	3.54	0.00
7/4/06 14:21	185	11.80	-0.15	-1.32	0.00	1.32
7/5/06 18:51	186	11.40	-0.40	-3.53	0.00	3.53
M	187	M	M	M	M	M
7/7/06 16:00	188	11.45	0.05	0.44	6.02	0.00
7/8/06 17:29	189	11.20	-0.25	-2.21	0.00	2.21
7/9/06 14:44	190	11.05	-0.15	-1.32	0.00	1.32
7/10/06 21:26	191	10.75	-0.30	-2.65	0.00	2.65
7/11/06 14:33	192	10.50	-0.25	-2.21	0.00	2.21
7/12/06 22:39	193	10.25	-0.25	-2.21	0.00	2.21
7/13/06 14:45	194	10.60	0.35	3.09	0.00	1.67
7/14/06 16:42	195	10.40	-0.20	-1.77	0.00	1.77
7/15/06 17:15	196	10.25	-0.15	-1.32	0.00	1.32
7/16/06 16:08	197	10.35	0.10	0.88	0.00	3.20
7/17/06 17:40	198	10.10	-0.25	-2.21	0.00	2.21
7/18/06 15:45	199	10.40	0.30	2.65	0.00	1.09
7/19/06 21:18	200	10.10	-0.30	-2.65	0.00	3.33
7/20/06 22:04	201	9.95	-0.15	-1.32	0.00	2.69
7/21/06 20:05	202	9.75	-0.20	-1.77	0.00	1.77
7/22/06 14:46	203	9.55	-0.20	-1.77	0.00	2.11
7/23/06 16:12	204	9.55	0.00	0.00	0.00	1.36
7/24/06 14:48	205	9.45	-0.10	-0.88	0.00	1.90
7/25/06 13:27	206	9.55	0.10	0.88	0.00	0.82
7/26/06 16:08	207	9.25	-0.30	-2.65	0.00	2.65
7/27/06 15:50	208	9.10	-0.15	-1.32	0.00	1.32
7/28/06 15:38	209	8.95	-0.15	-1.32	0.00	1.32
7/29/06 11:36	210	8.95	0.00	0.00	0.00	0.00
7/30/06 11:15	211	8.70	-0.25	-2.21	0.00	2.21
7/31/06 10:58	212	8.65	-0.05	-0.44	0.00	1.12
8/1/06 15:11	213	8.55	-0.10	-0.88	0.00	0.88
8/2/06 11:17	214	8.45	-0.10	-0.88	0.00	0.88
8/3/06 20:57	215	8.05	-0.40	-3.53	0.00	3.53
8/4/06 14:40	216	7.90	-0.15	-1.32	0.00	1.32
8/5/06 15:29	217	7.60	-0.30	-2.65	0.00	2.65
8/6/06 14:56	218	7.45	-0.15	-1.32	0.00	1.32
8/7/06 11:28	219	7.35	-0.10	-0.88	0.00	0.88
8/8/06 14:56	220	7.30	-0.05	-0.44	0.00	0.44
8/9/06 15:35	221	7.10	-0.20	-1.77	0.00	2.11
8/10/06 13:53	222	7.10	0.00	0.00	0.00	1.02
8/11/06 17:25	223	7.35	0.25	2.21	0.00	0.00
8/12/06 16:00	224	7.30	-0.05	-0.44	0.00	0.44
8/13/06 14:59	225	7.05	-0.25	-2.21	0.00	2.21
8/14/06 14:55	226	7.00	-0.05	-0.44	0.00	0.78
8/15/06 16:07	227	6.90	-0.10	-0.88	0.00	1.56
8/16/06 15:45	228	6.85	-0.05	-0.44	0.00	0.44
8/17/06 13:44	229	6.85	0.00	0.00	0.00	0.00
8/18/06 11:40	230	6.75	-0.10	-0.88	0.00	0.88

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/06 18:29	171	9.25	N/A	N/A	N/A	N/A
6/21/06 13:42	172	9.20	-0.05	-0.44	0.00	0.44
6/22/06 9:59	173	9.05	-0.15	-1.32	0.00	1.32
6/23/06 17:15	174	8.60	-0.45	-3.97	0.00	3.97
6/24/06 11:53	175	8.60	0.00	0.00	0.00	0.00
6/25/06 14:17	176	9.35	0.75	6.62	0.00	2.90
6/26/06 13:00	177	9.15	-0.20	-1.77	0.00	1.77
6/27/06 17:17	178	8.90	-0.25	-2.21	0.00	2.55
6/28/06 14:01	179	9.30	0.40	3.53	0.00	1.57
6/29/06 16:41	180	10.20	0.90	7.95	0.00	1.24
6/30/06 16:02	181	13.90	3.70	32.68	32.98	0.00
7/1/06 15:09	182	12.15	-1.75	-15.46	0.00	16.14
7/2/06 16:37	183	12.55	0.40	3.53	0.00	0.00
7/3/06 19:57	184	12.60	0.05	0.44	3.98	0.00
7/4/06 14:21	185	12.55	-0.05	-0.44	0.00	0.44
7/5/06 18:51	186	12.25	-0.30	-2.65	0.00	2.65
M	187	M	M	M	M	M
7/7/06 16:00	188	12.20	-0.05	-0.44	0.00	6.90
7/8/06 17:29	189	11.95	-0.25	-2.21	0.00	2.21
7/9/06 14:44	190	11.90	-0.05	-0.44	0.00	0.44
7/10/06 21:26	191	11.45	-0.45	-3.97	0.00	3.97
7/11/06 14:33	192	11.35	-0.10	-0.88	0.00	0.88
7/12/06 22:39	193	11.00	-0.35	-3.09	0.00	3.09
7/13/06 14:45	194	11.55	0.55	4.86	0.00	0.00
7/14/06 16:42	195	11.20	-0.35	-3.09	0.00	3.09
7/15/06 17:15	196	11.05	-0.15	-1.32	0.00	1.32
7/16/06 16:08	197	11.20	0.15	1.32	0.00	2.76
7/17/06 17:40	198	10.95	-0.25	-2.21	0.00	2.21
7/18/06 15:45	199	11.10	0.15	1.32	0.00	2.42
7/19/06 21:18	200	10.95	-0.15	-1.32	0.00	2.00
7/20/06 22:04	201	10.80	-0.15	-1.32	0.00	2.69
7/21/06 20:05	202	10.60	-0.20	-1.77	0.00	1.77
7/22/06 14:46	203	10.50	-0.10	-0.88	0.00	1.22
7/23/06 16:12	204	10.40	-0.10	-0.88	0.00	2.24
7/24/06 14:48	205	10.35	-0.05	-0.44	0.00	1.46
7/25/06 13:27	206	10.45	0.10	0.88	0.00	0.82
7/26/06 16:08	207	10.25	-0.20	-1.77	0.00	1.77
7/27/06 15:50	208	10.05	-0.20	-1.77	0.00	1.77
7/28/06 15:38	209	9.90	-0.15	-1.32	0.00	1.32
7/29/06 11:36	210	9.85	-0.05	-0.44	0.00	0.44
7/30/06 11:15	211	9.60	-0.25	-2.21	0.00	2.21
7/31/06 10:58	212	9.60	0.00	0.00	0.00	0.68
8/1/06 15:11	213	9.50	-0.10	-0.88	0.00	0.88
8/2/06 11:17	214	9.35	-0.15	-1.32	0.00	1.32
8/3/06 20:57	215	9.00	-0.35	-3.09	0.00	3.09
8/4/06 14:40	216	8.95	-0.05	-0.44	0.00	0.44
8/5/06 15:29	217	8.70	-0.25	-2.21	0.00	2.21
8/6/06 14:56	218	8.50	-0.20	-1.77	0.00	1.77
8/7/06 11:28	219	8.55	0.05	0.44	0.00	0.00
8/8/06 14:56	220	8.35	-0.20	-1.77	0.00	1.77
8/9/06 15:35	221	8.20	-0.15	-1.32	0.00	1.66
8/10/06 13:53	222	8.15	-0.05	-0.44	0.00	1.46
8/11/06 17:25	223	8.45	0.30	2.65	0.00	0.00
8/12/06 16:00	224	8.40	-0.05	-0.44	0.00	0.44
8/13/06 14:59	225	8.20	-0.20	-1.77	0.00	1.77
8/14/06 14:55	226	8.15	-0.05	-0.44	0.00	0.78
8/15/06 16:07	227	8.10	-0.05	-0.44	0.00	1.12
8/16/06 15:45	228	8.00	-0.10	-0.88	0.00	0.88
8/17/06 13:44	229	8.05	0.05	0.44	0.00	0.00
8/18/06 11:40	230	7.90	-0.15	-1.32	0.00	1.32

			(kg)	Water Change (mm)	Throughflow (mm)	AET (mm)
6/20/2006 17:45	171	12.60	N/A	N/A	N/A	N/A
6/21/2006 15:10	172	12.35	-0.25	-2.21	0.00	2.21
6/22/2006 10:30	173	12.10	-0.25	-2.21	0.00	2.21
6/23/2006 16:58	174	11.50	-0.60	-5.30	0.00	5.30
6/24/2006 12:30	175	11.26	-0.24	-2.12	0.00	2.12
6/25/2006 14:00	176	12.55	1.29	11.39	0.00	0.00
6/26/2006 13:28	177	12.15	-0.40	-3.53	0.00	3.53
6/27/2006 16:50	178	11.65	-0.50	-4.42	0.00	4.76
6/28/2006 14:23	179	12.00	0.35	3.09	0.00	2.01
6/29/2006 16:20	180	13.05	1.05	9.27	0.00	0.00
6/30/2006 16:33	181	16.00	2.95	26.05	39.95	0.00
7/1/2006 14:50	182	14.40	-1.60	-14.13	2.95	11.52
7/2/2006 16:55	183	13.80	-0.60	-5.30	0.00	5.30
7/3/2006 19:33	184	14.05	0.25	2.21	2.22	0.00
7/4/2006 14:52	185	13.80	-0.25	-2.21	0.00	2.21
7/5/2006 18:32	186	13.30	-0.50	-4.42	0.00	4.42
7/6/2006 0:00	187	M	M	M	M	M
7/7/2006 16:35	188	13.20	-0.10	-0.88	6.46	0.88
7/8/2006 17:12	189	12.85	-0.35	-3.09	0.00	3.09
7/9/2006 15:10	190	12.60	-0.25	-2.21	0.00	2.21
7/10/2006 21:11	191	12.25	-0.35	-3.09	0.00	3.09
7/11/2006 15:01	192	12.05	-0.20	-1.77	0.00	1.77
7/12/2006 22:17	193	11.80	-0.25	-2.21	0.00	2.21
7/13/2006 15:05	194	12.25	0.45	3.97	0.00	0.79
7/14/2006 16:30	195	11.95	-0.30	-2.65	0.00	2.65
7/15/2006 17:42	196	11.75	-0.20	-1.77	0.00	1.77
7/16/2006 15:52	197	11.95	0.20	1.77	0.00	2.32
7/17/2006 18:10	198	11.55	-0.40	-3.53	0.00	3.53
7/18/2006 15:16	199	11.90	0.35	3.09	0.00	0.65
7/19/2006 21:35	200	11.55	-0.35	-3.09	0.00	3.77
7/20/2006 21:53	201	11.50	-0.05	-0.44	0.00	1.80
7/21/2006 20:47	202	11.30	-0.20	-1.77	0.00	1.77
7/22/2006 14:36	203	11.25	-0.05	-0.44	0.00	0.78
7/23/2006 16:29	204	11.15	-0.10	-0.88	0.00	2.24
7/24/2006 14:18	205	11.10	-0.05	-0.44	0.00	1.46
7/25/2006 13:51	206	11.25	0.15	1.32	0.00	0.38
7/26/2006 15:52	207	10.80	-0.45	-3.97	0.00	3.97
7/27/2006 16:20	208	10.70	-0.10	-0.88	0.00	0.88
7/28/2006 15:27	209	10.55	-0.15	-1.32	0.00	1.32
7/29/2006 11:55	210	10.60	0.05	0.44	0.00	0.00
7/30/2006 10:49	211	10.30	-0.30	-2.65	0.00	2.65
7/31/2006 11:21	212	10.35	0.05	0.44	0.00	0.24
8/1/2006 14:58	213	10.20	-0.15	-1.32	0.00	1.32
8/2/2006 11:46	214	10.10	-0.10	-0.88	0.00	0.88
8/3/2006 20:47	215	9.75	-0.35	-3.09	0.00	3.09
8/4/2006 14:58	216	9.70	-0.05	-0.44	0.00	0.44
8/5/2006 15:03	217	9.50	-0.20	-1.77	0.00	1.77
8/6/2006 15:15	218	9.30	-0.20	-1.77	0.00	1.77
8/7/2006 11:19	219	9.25	-0.05	-0.44	0.00	0.44
8/8/2006 15:33	220	9.20	-0.05	-0.44	0.00	0.44
8/9/2006 15:13	221	9.20	0.00	0.00	0.00	0.34
8/10/2006 14:22	222	9.15	-0.05	-0.44	0.00	1.46
8/11/2006 17:03	223	9.35	0.20	1.77	0.00	0.00
8/12/2006 16:20	224	9.25	-0.10	-0.88	0.00	0.88
8/13/2006 14:45	225	9.05	-0.20	-1.77	0.00	1.77
8/14/2006 15:43	226	9.10	0.05	0.44	0.00	0.00
8/15/2006 15:44	227	9.00	-0.10	-0.88	0.00	1.56
8/16/2006 16:04	228	8.90	-0.10	-0.88	0.00	0.88
8/17/2006 13:21	229	8.90	0.00	0.00	0.00	0.00
8/18/2006 11:56	230	8.75	-0.15	-1.32	0.00	1.32

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change	Equivalent	Calculated	Calculated

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/2006 17:45	171	12.20	N/A	N/A	N/A	N/A
6/21/2006 15:10	172	12.05	-0.15	-1.32	0.00	1.32
6/22/2006 10:30	173	11.80	-0.25	-2.21	0.00	2.21
6/23/2006 16:58	174	11.35	-0.45	-3.97	0.00	3.97
6/24/2006 12:30	175	11.10	-0.25	-2.21	0.00	2.21
6/25/2006 14:00	176	12.25	1.15	10.16	0.00	0.00
6/26/2006 13:28	177	12.00	-0.25	-2.21	0.00	2.21
6/27/2006 16:50	178	11.70	-0.30	-2.65	0.00	2.99
6/28/2006 14:23	179	12.00	0.30	2.65	0.00	2.45
6/29/2006 16:20	180	12.70	0.70	6.18	0.00	3.00
6/30/2006 16:33	181	16.00	3.30	29.14	36.86	0.00
7/1/2006 14:50	182	13.40	-2.60	-22.96	0.00	23.30
7/2/2006 16:55	183	12.99	-0.41	-3.62	0.00	3.62
7/3/2006 19:33	184	13.05	0.06	0.53	3.89	0.00
7/4/2006 14:52	185	12.90	-0.15	-1.32	0.00	1.32
7/5/2006 18:32	186	12.49	-0.41	-3.62	0.00	3.62
7/6/2006 0:00	187	M	M	M	M	M
7/7/2006 16:35	188	12.40	-0.09	-0.79	6.46	0.79
7/8/2006 17:12	189	12.20	-0.20	-1.77	0.00	1.77
7/9/2006 15:10	190	11.95	-0.25	-2.21	0.00	2.21
7/10/2006 21:11	191	11.55	-0.40	-3.53	0.00	3.53
7/11/2006 15:01	192	11.45	-0.10	-0.88	0.00	0.88
7/12/2006 22:17	193	11.10	-0.35	-3.09	0.00	3.09
7/13/2006 15:05	194	11.50	0.40	3.53	0.00	1.23
7/14/2006 16:30	195	11.25	-0.25	-2.21	0.00	2.21
7/15/2006 17:42	196	10.95	-0.30	-2.65	0.00	2.65
7/16/2006 15:52	197	11.25	0.30	2.65	0.00	1.43
7/17/2006 18:10	198	10.90	-0.35	-3.09	0.00	3.09
7/18/2006 15:16	199	11.10	0.20	1.77	0.00	1.98
7/19/2006 21:35	200	10.85	-0.25	-2.21	0.00	2.89
7/20/2006 21:53	201	10.70	-0.15	-1.32	0.00	2.69
7/21/2006 20:47	202	10.40	-0.30	-2.65	0.00	2.65
7/22/2006 14:36	203	10.30	-0.10	-0.88	0.00	1.22
7/23/2006 16:29	204	10.15	-0.15	-1.32	0.00	2.69
7/24/2006 14:18	205	10.15	0.00	0.00	0.00	1.02
7/25/2006 13:51	206	10.20	0.05	0.44	0.00	1.26
7/26/2006 15:52	207	9.90	-0.30	-2.65	0.00	2.65
7/27/2006 16:20	208	9.60	-0.30	-2.65	0.00	2.65
7/28/2006 15:27	209	9.50	-0.10	-0.88	0.00	0.88
7/29/2006 11:55	210	9.45	-0.05	-0.44	0.00	0.44
7/30/2006 10:49	211	9.15	-0.30	-2.65	0.00	2.65
7/31/2006 11:21	212	9.10	-0.05	-0.44	0.00	1.12
8/1/2006 14:58	213	9.00	-0.10	-0.88	0.00	0.88
8/2/2006 11:46	214	8.80	-0.20	-1.77	0.00	1.77
8/3/2006 20:47	215	8.40	-0.40	-3.53	0.00	3.53
8/4/2006 14:58	216	8.30	-0.10	-0.88	0.00	0.88
8/5/2006 15:03	217	8.05	-0.25	-2.21	0.00	2.21
8/6/2006 15:15	218	7.85	-0.20	-1.77	0.00	1.77
8/7/2006 11:19	219	7.80	-0.05	-0.44	0.00	0.44
8/8/2006 15:33	220	7.60	-0.20	-1.77	0.00	1.77
8/9/2006 15:13	221	7.55	-0.05	-0.44	0.00	0.78
8/10/2006 14:22	222	7.50	-0.05	-0.44	0.00	1.46
8/11/2006 17:03	223	7.75	0.25	2.21	0.00	0.00
8/12/2006 16:20	224	7.60	-0.15	-1.32	0.00	1.32
8/13/2006 14:45	225	7.35	-0.25	-2.21	0.00	2.21
8/14/2006 15:43	226	7.35	0.00	0.00	0.00	0.34
8/15/2006 15:44	227	7.35	0.00	0.00	0.00	0.68
8/16/2006 16:04	228	7.25	-0.10	-0.88	0.00	0.88
8/17/2006 13:21	229	7.15	-0.10	-0.88	0.00	0.88
8/18/2006 11:56	230	7.15	0.00	0.00	0.00	0.00

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/2006 17:45	171	15.65	N/A	N/A	N/A	N/A
6/21/2006 15:10	172	15.30	-0.35	-3.09	0.00	3.09
6/22/2006 10:30	173	15.01	-0.29	-2.56	0.00	2.56
6/23/2006 16:58	174	14.10	-0.91	-8.04	0.00	8.04
6/24/2006 12:30	175	13.80	-0.30	-2.65	0.00	2.65
6/25/2006 14:00	176	14.90	1.10	9.71	0.00	0.00
6/26/2006 13:28	177	14.40	-0.50	-4.42	0.00	4.42
6/27/2006 16:50	178	13.80	-0.60	-5.30	0.00	5.64
6/28/2006 14:23	179	14.05	0.25	2.21	0.00	2.90
6/29/2006 16:20	180	14.99	0.94	8.30	0.00	0.88
6/30/2006 16:33	181	18.00	3.01	26.58	39.42	0.00
7/1/2006 14:50	182	17.99	-0.01	-0.09	0.00	0.43
7/2/2006 16:55	183	15.99	-2.00	-17.66	2.42	15.25
7/3/2006 19:33	184	16.00	0.01	0.09	4.33	0.00
7/4/2006 14:52	185	15.75	-0.25	-2.21	0.00	2.21
7/5/2006 18:32	186	15.25	-0.50	-4.42	0.00	4.42
7/6/2006 0:00	187	M	M	M	M	M
7/7/2006 16:35	188	14.90	-0.35	-3.09	6.46	3.09
7/8/2006 17:12	189	14.60	-0.30	-2.65	0.00	2.65
7/9/2006 15:10	190	14.30	-0.30	-2.65	0.00	2.65
7/10/2006 21:11	191	13.80	-0.50	-4.42	0.00	4.42
7/11/2006 15:01	192	13.60	-0.20	-1.77	0.00	1.77
7/12/2006 22:17	193	13.20	-0.40	-3.53	0.00	3.53
7/13/2006 15:05	194	13.60	0.40	3.53	0.00	1.23
7/14/2006 16:30	195	13.20	-0.40	-3.53	0.00	3.53
7/15/2006 17:42	196	12.80	-0.40	-3.53	0.00	3.53
7/16/2006 15:52	197	13.05	0.25	2.21	0.00	1.87
7/17/2006 18:10	198	12.55	-0.50	-4.42	0.00	4.42
7/18/2006 15:16	199	13.80	1.25	11.04	0.00	0.00
7/19/2006 21:35	200	12.45	-1.35	-11.92	0.00	12.60
7/20/2006 21:53	201	12.25	-0.20	-1.77	0.00	3.13
7/21/2006 20:47	202	11.90	-0.35	-3.09	0.00	3.09
7/22/2006 14:36	203	11.75	-0.15	-1.32	0.00	1.66
7/23/2006 16:29	204	11.55	-0.20	-1.77	0.00	3.13
7/24/2006 14:18	205	11.50	-0.05	-0.44	0.00	1.46
7/25/2006 13:51	206	11.60	0.10	0.88	0.00	0.82
7/26/2006 15:52	207	11.20	-0.40	-3.53	0.00	3.53
7/27/2006 16:20	208	10.90	-0.30	-2.65	0.00	2.65
7/28/2006 15:27	209	10.70	-0.20	-1.77	0.00	1.77
7/29/2006 11:55	210	10.55	-0.15	-1.32	0.00	1.32
7/30/2006 10:49	211	10.25	-0.30	-2.65	0.00	2.65
7/31/2006 11:21	212	10.15	-0.10	-0.88	0.00	1.56
8/1/2006 14:58	213	10.05	-0.10	-0.88	0.00	0.88
8/2/2006 11:46	214	9.90	-0.15	-1.32	0.00	1.32
8/3/2006 20:47	215	9.45	-0.45	-3.97	0.00	3.97
8/4/2006 14:58	216	9.30	-0.15	-1.32	0.00	1.32
8/5/2006 15:03	217	9.00	-0.30	-2.65	0.00	2.65
8/6/2006 15:15	218	8.85	-0.15	-1.32	0.00	1.32
8/7/2006 11:19	219	9.00	0.15	1.32	0.00	0.00
8/8/2006 15:33	220	9.35	0.35	3.09	0.00	0.00
8/9/2006 15:13	221	9.15	-0.20	-1.77	0.00	2.11
8/10/2006 14:22	222	9.30	0.15	1.32	0.00	0.00
8/11/2006 17:03	223	9.65	0.35	3.09	0.00	0.00
8/12/2006 16:20	224	9.60	-0.05	-0.44	0.00	0.44
8/13/2006 14:45	225	9.30	-0.30	-2.65	0.00	2.65
8/14/2006 15:43	226	9.40	0.10	0.88	0.00	0.00
8/15/2006 15:44	227	9.55	0.15	1.32	0.00	0.00
8/16/2006 16:04	228	9.30	-0.25	-2.21	0.00	2.21
8/17/2006 13:21	229	9.45	0.15	1.32	0.00	0.00
8/18/2006 11:56	230	9.70	0.25	2.21	0.00	0.00

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/06 16:25	171	19.01	N/A	N/A	N/A	N/A
6/21/06 17:08	172	18.80	-0.21	-1.85	0.00	1.85
6/22/06 9:30	173	18.85	0.05	0.44	0.00	0.00
6/23/06 16:30	174	18.65	-0.20	-1.77	0.00	1.77
6/24/06 13:59	175	18.20	-0.45	-3.97	0.00	3.97
6/25/06 13:00	176	19.35	1.15	10.16	0.00	0.00
6/26/06 14:45	177	19.00	-0.35	-3.09	0.00	3.09
6/27/06 15:18	178	19.85	0.85	7.51	0.00	0.00
6/28/06 15:08	179	19.25	-0.60	-5.30	0.00	10.40
6/29/06 15:22	180	19.75	0.50	4.42	0.00	4.77
6/30/06 17:42	181	22.90	3.15	27.82	38.52	0.00
7/1/06 13:37	182	23.30	0.40	3.53	0.00	0.00
7/2/06 17:47	183	22.05	-1.25	-11.04	1.52	9.52
7/3/06 18:12	184	22.99	0.94	8.30	0.00	0.00
7/4/06 15:47	185	21.05	-1.94	-17.13	4.42	12.71
7/5/06 17:15	186	21.00	-0.05	-0.44	0.00	0.44
M	187	M	M	M	M	M
7/7/06 18:13	188	22.05	1.05	9.27	0.00	0.00
7/8/06 16:10	189	20.80	-1.25	-11.04	6.46	4.58
7/9/06 16:26	190	20.50	-0.30	-2.65	0.00	2.65
7/10/06 20:21	191	20.05	-0.45	-3.97	0.00	3.97
7/11/06 16:01	192	19.85	-0.20	-1.77	0.00	1.77
7/12/06 21:04	193	19.55	-0.30	-2.65	0.00	2.65
7/13/06 16:04	194	20.00	0.45	3.97	0.00	0.79
7/14/06 15:46	195	19.80	-0.20	-1.77	0.00	1.77
7/15/06 18:57	196	19.60	-0.20	-1.77	0.00	1.77
7/16/06 14:53	197	19.55	-0.05	-0.44	0.00	4.52
7/17/06 19:00	198	19.55	0.00	0.00	0.00	0.00
7/18/06 13:53	199	20.10	0.55	4.86	0.00	0.00
7/19/06 22:25	200	19.60	-0.50	-4.42	0.00	5.10
7/20/06 21:00	201	19.60	0.00	0.00	0.00	1.36
7/21/06 22:48	202	19.50	-0.10	-0.88	0.00	1.22
7/22/06 13:57	203	19.50	0.00	0.00	0.00	0.00
7/23/06 17:22	204	19.20	-0.30	-2.65	0.00	4.01
7/24/06 12:58	205	19.20	0.00	0.00	0.00	1.02
7/25/06 14:56	206	19.30	0.10	0.88	0.00	0.82
7/26/06 14:34	207	19.10	-0.20	-1.77	0.00	1.77
7/27/06 17:40	208	18.95	-0.15	-1.32	0.00	1.32
7/28/06 14:47	209	18.70	-0.25	-2.21	0.00	2.21
7/29/06 12:46	210	18.70	0.00	0.00	0.00	0.00
7/30/06 9:26	211	18.60	-0.10	-0.88	0.00	0.88
7/31/06 12:30	212	18.55	-0.05	-0.44	0.00	1.12
8/1/06 14:08	213	18.45	-0.10	-0.88	0.00	0.88
8/2/06 12:56	214	18.15	-0.30	-2.65	0.00	2.65
8/3/06 20:09	215	17.90	-0.25	-2.21	0.00	2.21
8/4/06 15:56	216	17.75	-0.15	-1.32	0.00	1.32
8/5/06 13:26	217	17.65	-0.10	-0.88	0.00	0.88
8/6/06 16:33	218	17.35	-0.30	-2.65	0.00	2.65
8/7/06 10:42	219	17.45	0.10	0.88	0.00	0.00
8/8/06 17:15	220	17.15	-0.30	-2.65	0.00	2.65
8/9/06 14:19	221	17.15	0.00	0.00	0.00	0.34
8/10/06 15:49	222	17.30	0.15	1.32	0.00	0.72
8/11/06 14:01	223	17.35	0.05	0.44	0.00	0.24
8/12/06 17:05	224	17.15	-0.20	-1.77	0.00	1.77
8/13/06 14:03	225	16.95	-0.20	-1.77	0.00	2.11
8/14/06 17:08	226	17.00	0.05	0.44	0.00	0.00
8/15/06 14:05	227	17.05	0.05	0.44	0.00	0.24
8/16/06 16:54	228	16.80	-0.25	-2.21	0.00	2.21
8/17/06 12:05	229	16.80	0.00	0.00	0.00	0.00
8/18/06 12:45	230	16.70	-0.10	-0.88	0.00	0.88

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/06 16:25	171	18.40	N/A	N/A	N/A	N/A
6/21/06 17:08	172	18.25	-0.15	-1.32	0.00	1.32
6/22/06 9:30	173	18.15	-0.10	-0.88	0.00	0.88
6/23/06 16:30	174	17.80	-0.35	-3.09	0.00	3.09
6/24/06 13:59	175	17.55	-0.25	-2.21	0.00	2.21
6/25/06 13:00	176	18.70	1.15	10.16	0.00	0.00
6/26/06 14:45	177	18.35	-0.35	-3.09	0.00	3.09
6/27/06 15:18	178	18.20	-0.15	-1.32	0.00	1.66
6/28/06 15:08	179	18.60	0.40	3.53	0.00	1.57
6/29/06 15:22	180	19.20	0.60	5.30	0.00	3.89
6/30/06 17:42	181	21.45	2.25	19.87	46.47	0.00
7/1/06 13:37	182	20.05	-1.40	-12.36	9.47	2.89
7/2/06 17:47	183	19.70	-0.35	-3.09	0.00	3.09
7/3/06 18:12	184	19.80	0.10	0.88	3.54	0.00
7/4/06 15:47	185	19.55	-0.25	-2.21	0.00	2.21
7/5/06 17:15	186	19.30	-0.25	-2.21	0.00	2.21
M	187	M	M	M	M	M
7/7/06 18:13	188	19.25	-0.05	-0.44	6.46	0.44
7/8/06 16:10	189	19.00	-0.25	-2.21	0.00	2.21
7/9/06 16:26	190	18.90	-0.10	-0.88	0.00	0.88
7/10/06 20:21	191	18.60	-0.30	-2.65	0.00	2.65
7/11/06 16:01	192	18.40	-0.20	-1.77	0.00	1.77
7/12/06 21:04	193	18.20	-0.20	-1.77	0.00	1.77
7/13/06 16:04	194	18.75	0.55	4.86	0.00	0.00
7/14/06 15:46	195	18.50	-0.25	-2.21	0.00	2.21
7/15/06 18:57	196	18.40	-0.10	-0.88	0.00	0.88
7/16/06 14:53	197	18.90	0.50	4.42	0.00	0.00
7/17/06 19:00	198	18.45	-0.45	-3.97	0.00	3.97
7/18/06 13:53	199	18.90	0.45	3.97	0.00	0.00
7/19/06 22:25	200	18.65	-0.25	-2.21	0.00	2.89
7/20/06 21:00	201	18.65	0.00	0.00	0.00	1.36
7/21/06 22:48	202	18.50	-0.15	-1.32	0.00	1.66
7/22/06 13:57	203	18.45	-0.05	-0.44	0.00	0.44
7/23/06 17:22	204	18.35	-0.10	-0.88	0.00	2.24
7/24/06 12:58	205	18.20	-0.15	-1.32	0.00	2.34
7/25/06 14:56	206	18.40	0.20	1.77	0.00	0.00
7/26/06 14:34	207	18.30	-0.10	-0.88	0.00	0.88
7/27/06 17:40	208	18.10	-0.20	-1.77	0.00	1.77
7/28/06 14:47	209	18.00	-0.10	-0.88	0.00	0.88
7/29/06 12:46	210	17.95	-0.05	-0.44	0.00	0.44
7/30/06 9:26	211	17.85	-0.10	-0.88	0.00	0.88
7/31/06 12:30	212	17.75	-0.10	-0.88	0.00	1.56
8/1/06 14:08	213	17.65	-0.10	-0.88	0.00	0.88
8/2/06 12:56	214	17.40	-0.25	-2.21	0.00	2.21
8/3/06 20:09	215	17.20	-0.20	-1.77	0.00	1.77
8/4/06 15:56	216	17.05	-0.15	-1.32	0.00	1.32
8/5/06 13:26	217	17.00	-0.05	-0.44	0.00	0.44
8/6/06 16:33	218	16.85	-0.15	-1.32	0.00	1.32
8/7/06 10:42	219	16.85	0.00	0.00	0.00	0.00
8/8/06 17:15	220	16.60	-0.25	-2.21	0.00	2.21
8/9/06 14:19	221	16.60	0.00	0.00	0.00	0.34
8/10/06 15:49	222	16.90	0.30	2.65	0.00	0.00
8/11/06 14:01	223	16.80	-0.10	-0.88	0.00	1.56
8/12/06 17:05	224	16.75	-0.05	-0.44	0.00	0.44
8/13/06 14:03	225	16.60	-0.15	-1.32	0.00	1.66
8/14/06 17:08	226	16.55	-0.05	-0.44	0.00	0.78
8/15/06 14:05	227	16.60	0.05	0.44	0.00	0.24
8/16/06 16:54	228	16.45	-0.15	-1.32	0.00	1.32
8/17/06 12:05	229	16.45	0.00	0.00	0.00	0.00
8/18/06 12:45	230	16.25	-0.20	-1.77	0.00	1.77

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/06 16:25	171	21.08	N/A	N/A	N/A	N/A
6/21/06 17:08	172	20.80	-0.28	-2.47	0.00	2.47
6/22/06 9:30	173	20.85	0.05	0.44	0.00	0.00
6/23/06 16:30	174	20.40	-0.45	-3.97	0.00	3.97
6/24/06 13:59	175	20.25	-0.15	-1.32	0.00	1.32
6/25/06 13:00	176	21.40	1.15	10.16	0.00	0.00
6/26/06 14:45	177	21.10	-0.30	-2.65	0.00	2.65
6/27/06 15:18	178	20.80	-0.30	-2.65	0.00	2.99
6/28/06 15:08	179	21.40	0.60	5.30	0.00	0.00
6/29/06 15:22	180	21.99	0.59	5.21	0.00	3.98
6/30/06 17:42	181	25.00	3.01	26.58	39.76	0.00
7/1/06 13:37	182	24.20	-0.80	-7.07	2.76	4.31
7/2/06 17:47	183	23.30	-0.90	-7.95	0.00	7.95
7/3/06 18:12	184	23.20	-0.10	-0.88	0.00	5.31
7/4/06 15:47	185	23.00	-0.20	-1.77	0.00	1.77
7/5/06 17:15	186	22.70	-0.30	-2.65	0.00	2.65
M	187	M	M	M	M	M
7/7/06 18:13	188	22.40	-0.30	-2.65	6.46	2.65
7/8/06 16:10	189	22.30	-0.10	-0.88	0.00	0.88
7/9/06 16:26	190	22.05	-0.25	-2.21	0.00	2.21
7/10/06 20:21	191	21.90	-0.15	-1.32	0.00	1.32
7/11/06 16:01	192	21.75	-0.15	-1.32	0.00	1.32
7/12/06 21:04	193	21.50	-0.25	-2.21	0.00	2.21
7/13/06 16:04	194	21.95	0.45	3.97	0.00	0.79
7/14/06 15:46	195	21.90	-0.05	-0.44	0.00	0.44
7/15/06 18:57	196	21.65	-0.25	-2.21	0.00	2.21
7/16/06 14:53	197	22.20	0.55	4.86	0.00	0.00
7/17/06 19:00	198	21.85	-0.35	-3.09	0.00	3.09
7/18/06 13:53	199	22.30	0.45	3.97	0.00	0.00
7/19/06 22:25	200	21.90	-0.40	-3.53	0.00	4.21
7/20/06 21:00	201	22.10	0.20	1.77	0.00	0.00
7/21/06 22:48	202	21.75	-0.35	-3.09	0.00	3.43
7/22/06 13:57	203	21.80	0.05	0.44	0.00	0.00
7/23/06 17:22	204	21.60	-0.20	-1.77	0.00	3.13
7/24/06 12:58	205	21.55	-0.05	-0.44	0.00	1.46
7/25/06 14:56	206	21.75	0.20	1.77	0.00	0.00
7/26/06 14:34	207	21.15	-0.60	-5.30	0.00	5.30
7/27/06 17:40	208	21.35	0.20	1.77	0.00	0.00
7/28/06 14:47	209	21.20	-0.15	-1.32	0.00	1.32
7/29/06 12:46	210	21.20	0.00	0.00	0.00	0.00
7/30/06 9:26	211	21.10	-0.10	-0.88	0.00	0.88
7/31/06 12:30	212	20.90	-0.20	-1.77	0.00	2.45
8/1/06 14:08	213	20.90	0.00	0.00	0.00	0.00
8/2/06 12:56	214	20.70	-0.20	-1.77	0.00	1.77
8/3/06 20:09	215	20.40	-0.30	-2.65	0.00	2.65
8/4/06 15:56	216	20.30	-0.10	-0.88	0.00	0.88
8/5/06 13:26	217	20.15	-0.15	-1.32	0.00	1.32
8/6/06 16:33	218	20.00	-0.15	-1.32	0.00	1.32
8/7/06 10:42	219	19.95	-0.05	-0.44	0.00	0.44
8/8/06 17:15	220	19.65	-0.30	-2.65	0.00	2.65
8/9/06 14:19	221	19.55	-0.10	-0.88	0.00	1.22
8/10/06 15:49	222	19.75	0.20	1.77	0.00	0.27
8/11/06 14:01	223	19.80	0.05	0.44	0.00	0.24
8/12/06 17:05	224	19.70	-0.10	-0.88	0.00	0.88
8/13/06 14:03	225	19.60	-0.10	-0.88	0.00	1.22
8/14/06 17:08	226	19.70	0.10	0.88	0.00	0.00
8/15/06 14:05	227	19.65	-0.05	-0.44	0.00	1.12
8/16/06 16:54	228	19.40	-0.25	-2.21	0.00	2.21
8/17/06 12:05	229	19.35	-0.05	-0.44	0.00	0.44
8/18/06 12:45	230	19.20	-0.15	-1.32	0.00	1.32

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/2006 15:37	171	9.23	N/A	N/A	N/A	N/A
6/21/2006 16:30	172	9.10	-0.13	-1.15	0.00	1.15
6/22/2006 10:54	173	8.95	-0.15	-1.32	0.00	1.32
6/23/2006 16:10	174	8.80	-0.15	-1.32	0.00	1.32
6/24/2006 13:29	175	8.70	-0.10	-0.88	0.00	0.88
6/25/2006 13:22	176	9.70	1.00	8.83	0.00	0.69
6/26/2006 14:20	177	9.45	-0.25	-2.21	0.00	2.21
6/27/2006 15:53	178	9.30	-0.15	-1.32	0.00	1.66
6/28/2006 14:50	179	9.70	0.40	3.53	0.00	1.57
6/29/2006 15:42	180	10.25	0.55	4.86	0.00	4.33
6/30/2006 17:19	181	13.35	3.10	27.38	38.62	0.00
7/1/2006 14:02	182	13.70	0.35	3.09	1.62	0.00
7/2/2006 17:31	183	11.65	-2.05	-18.10	4.71	13.39
7/3/2006 18:37	184	11.50	-0.15	-1.32	0.00	5.75
7/4/2006 15:33	185	11.30	-0.20	-1.77	0.00	1.77
7/5/2006 17:37	186	10.80	-0.50	-4.42	0.00	4.42
M	187	M	M	M	M	M
7/7/2006 17:42	188	10.55	-0.25	-2.21	6.46	2.21
7/8/2006 16:32	189	10.45	-0.10	-0.88	0.00	0.88
7/9/2006 16:03	190	10.20	-0.25	-2.21	0.00	2.21
7/10/2006 20:41	191	10.00	-0.20	-1.77	0.00	1.77
7/11/2006 15:44	192	9.85	-0.15	-1.32	0.00	1.32
7/12/2006 21:28	193	9.50	-0.35	-3.09	0.00	3.09
7/13/2006 15:48	194	10.00	0.50	4.42	0.00	0.34
7/14/2006 15:57	195	9.80	-0.20	-1.77	0.00	1.77
7/15/2006 18:35	196	9.60	-0.20	-1.77	0.00	1.77
7/16/2006 15:13	197	9.85	0.25	2.21	0.00	1.87
7/17/2006 18:47	198	9.40	-0.45	-3.97	0.00	3.97
7/18/2006 14:19	199	9.85	0.45	3.97	0.00	0.00
7/19/2006 22:11	200	9.60	-0.25	-2.21	0.00	2.89
7/20/2006 21:22	201	9.55	-0.05	-0.44	0.00	1.80
7/21/2006 22:14	202	9.30	-0.25	-2.21	0.00	2.55
7/22/2006 14:11	203	9.20	-0.10	-0.88	0.00	0.88
7/23/2006 17:06	204	9.20	0.00	0.00	0.00	1.36
7/24/2006 13:24	205	9.05	-0.15	-1.32	0.00	2.34
7/25/2006 14:31	206	9.10	0.05	0.44	0.00	1.26
7/26/2006 15:00	207	8.90	-0.20	-1.77	0.00	1.77
7/27/2006 17:16	208	8.70	-0.20	-1.77	0.00	1.77
7/28/2006 15:00	209	8.55	-0.15	-1.32	0.00	1.32
7/29/2006 12:31	210	8.50	-0.05	-0.44	0.00	0.44
7/30/2006 9:54	211	8.35	-0.15	-1.32	0.00	1.32
7/31/2006 12:09	212	8.15	-0.20	-1.77	0.00	2.45
8/1/2006 14:25	213	8.25	0.10	0.88	0.00	0.00
8/2/2006 12:28	214	8.10	-0.15	-1.32	0.00	1.32
8/3/2006 20:21	215	7.85	-0.25	-2.21	0.00	2.21
8/4/2006 15:38	216	7.65	-0.20	-1.77	0.00	1.77
8/5/2006 14:00	217	7.55	-0.10	-0.88	0.00	0.88
8/6/2006 16:17	218	7.35	-0.20	-1.77	0.00	1.77
8/7/2006 10:55	219	7.30	-0.05	-0.44	0.00	0.44
8/8/2006 16:47	220	7.10	-0.20	-1.77	0.00	1.77
8/9/2006 14:46	221	7.10	0.00	0.00	0.00	0.34
8/10/2006 15:23	222	7.45	0.35	3.09	0.00	0.00
8/11/2006 14:39	223	7.20	-0.25	-2.21	1.70	2.21
8/12/2006 16:53	224	7.10	-0.10	-0.88	0.00	0.88
8/13/2006 14:16	225	6.85	-0.25	-2.21	0.00	2.21
8/14/2006 16:42	226	6.75	-0.10	-0.88	0.00	1.22
8/15/2006 14:44	227	6.80	0.05	0.44	0.00	0.24
8/16/2006 16:39	228	6.70	-0.10	-0.88	0.00	0.88
8/17/2006 12:28	229	6.65	-0.05	-0.44	0.00	0.44
8/18/2006 12:29	230	6.55	-0.10	-0.88	0.00	0.88

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/2006 15:37	171	14.50	N/A	N/A	N/A	N/A
6/21/2006 16:30	172	14.30	-0.20	-1.77	0.00	1.77
6/22/2006 10:54	173	14.20	-0.10	-0.88	0.00	0.88
6/23/2006 16:10	174	13.80	-0.40	-3.53	0.00	3.53
6/24/2006 13:29	175	13.75	-0.05	-0.44	0.00	0.44
6/25/2006 13:22	176	14.80	1.05	9.27	0.00	0.25
6/26/2006 14:20	177	14.50	-0.30	-2.65	0.00	2.65
6/27/2006 15:53	178	14.30	-0.20	-1.77	0.00	2.11
6/28/2006 14:50	179	14.70	0.40	3.53	0.00	1.57
6/29/2006 15:42	180	15.30	0.60	5.30	0.00	3.89
6/30/2006 17:19	181	19.00	3.70	32.68	33.32	0.00
7/1/2006 14:02	182	18.25	-0.75	-6.62	0.00	6.96
7/2/2006 17:31	183	18.60	0.35	3.09	0.00	0.00
7/3/2006 18:37	184	18.70	0.10	0.88	3.54	0.00
7/4/2006 15:33	185	19.10	0.40	3.53	0.00	0.00
7/5/2006 17:37	186	16.60	-2.50	-22.08	0.00	22.08
M	187	M	M	M	M	M
7/7/2006 17:42	188	17.75	1.15	10.16	0.00	0.00
7/8/2006 16:32	189	16.50	-1.25	-11.04	6.46	4.58
7/9/2006 16:03	190	16.35	-0.15	-1.32	0.00	1.32
7/10/2006 20:41	191	16.10	-0.25	-2.21	0.00	2.21
7/11/2006 15:44	192	15.90	-0.20	-1.77	0.00	1.77
7/12/2006 21:28	193	15.35	-0.55	-4.86	0.00	4.86
7/13/2006 15:48	194	15.80	0.45	3.97	0.00	0.79
7/14/2006 15:57	195	15.45	-0.35	-3.09	0.00	3.09
7/15/2006 18:35	196	15.25	-0.20	-1.77	0.00	1.77
7/16/2006 15:13	197	15.50	0.25	2.21	0.00	1.87
7/17/2006 18:47	198	15.05	-0.45	-3.97	0.00	3.97
7/18/2006 14:19	199	15.40	0.35	3.09	0.00	0.65
7/19/2006 22:11	200	15.10	-0.30	-2.65	0.00	3.33
7/20/2006 21:22	201	15.10	0.00	0.00	0.00	1.36
7/21/2006 22:14	202	14.90	-0.20	-1.77	0.00	2.11
7/22/2006 14:11	203	14.75	-0.15	-1.32	0.00	1.32
7/23/2006 17:06	204	14.60	-0.15	-1.32	0.00	2.69
7/24/2006 13:24	205	14.60	0.00	0.00	0.00	1.02
7/25/2006 14:31	206	14.60	0.00	0.00	0.00	1.70
7/26/2006 15:00	207	14.45	-0.15	-1.32	0.00	1.32
7/27/2006 17:16	208	14.30	-0.15	-1.32	0.00	1.32
7/28/2006 15:00	209	14.15	-0.15	-1.32	0.00	1.32
7/29/2006 12:31	210	14.10	-0.05	-0.44	0.00	0.44
7/30/2006 9:54	211	14.00	-0.10	-0.88	0.00	0.88
7/31/2006 12:09	212	13.85	-0.15	-1.32	0.00	2.00
8/1/2006 14:25	213	13.80	-0.05	-0.44	0.00	0.44
8/2/2006 12:28	214	13.70	-0.10	-0.88	0.00	0.88
8/3/2006 20:21	215	13.50	-0.20	-1.77	0.00	1.77
8/4/2006 15:38	216	13.25	-0.25	-2.21	0.00	2.21
8/5/2006 14:00	217	13.15	-0.10	-0.88	0.00	0.88
8/6/2006 16:17	218	13.05	-0.10	-0.88	0.00	0.88
8/7/2006 10:55	219	13.00	-0.05	-0.44	0.00	0.44
8/8/2006 16:47	220	12.95	-0.05	-0.44	0.00	0.44
8/9/2006 14:46	221	12.80	-0.15	-1.32	0.00	1.66
8/10/2006 15:23	222	13.15	0.35	3.09	0.00	0.00
8/11/2006 14:39	223	12.95	-0.20	-1.77	1.70	1.77
8/12/2006 16:53	224	12.90	-0.05	-0.44	0.00	0.44
8/13/2006 14:16	225	12.70	-0.20	-1.77	0.00	1.77
8/14/2006 16:42	226	12.55	-0.15	-1.32	0.00	1.66
8/15/2006 14:44	227	12.65	0.10	0.88	0.00	0.00
8/16/2006 16:39	228	12.60	-0.05	-0.44	0.00	0.44
8/17/2006 12:28	229	12.55	-0.05	-0.44	0.00	0.44
8/18/2006 12:29	230	12.50	-0.05	-0.44	0.00	0.44

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/2006 15:37	171	16.85	N/A	N/A	N/A	N/A
6/21/2006 16:30	172	16.80	-0.05	-0.44	0.00	0.44
6/22/2006 10:54	173	16.45	-0.35	-3.09	0.00	3.09
6/23/2006 16:10	174	16.40	-0.05	-0.44	0.00	0.44
6/24/2006 13:29	175	16.30	-0.10	-0.88	0.00	0.88
6/25/2006 13:22	176	17.30	1.00	8.83	0.00	0.69
6/26/2006 14:20	177	17.00	-0.30	-2.65	0.00	2.65
6/27/2006 15:53	178	16.75	-0.25	-2.21	0.00	2.55
6/28/2006 14:50	179	17.20	0.45	3.97	0.00	1.13
6/29/2006 15:42	180	17.75	0.55	4.86	0.00	4.33
6/30/2006 17:19	181	20.80	3.05	26.94	39.06	0.00
7/1/2006 14:02	182	20.00	-0.80	-7.07	2.06	5.34
7/2/2006 17:31	183	18.60	-1.40	-12.36	0.00	12.36
7/3/2006 18:37	184	18.45	-0.15	-1.32	0.00	5.75
7/4/2006 15:33	185	18.90	0.45	3.97	0.00	0.00
7/5/2006 17:37	186	17.80	-1.10	-9.71	0.00	9.71
M	187	M	M	M	M	M
7/7/2006 17:42	188	20.90	3.10	27.38	0.00	0.00
7/8/2006 16:32	189	18.75	-2.15	-18.99	6.46	12.52
7/9/2006 16:03	190	18.35	-0.40	-3.53	0.00	3.53
7/10/2006 20:41	191	17.80	-0.55	-4.86	0.00	4.86
7/11/2006 15:44	192	17.60	-0.20	-1.77	0.00	1.77
7/12/2006 21:28	193	17.20	-0.40	-3.53	0.00	3.53
7/13/2006 15:48	194	17.60	0.40	3.53	0.00	1.23
7/14/2006 15:57	195	17.40	-0.20	-1.77	0.00	1.77
7/15/2006 18:35	196	17.15	-0.25	-2.21	0.00	2.21
7/16/2006 15:13	197	17.45	0.30	2.65	0.00	1.43
7/17/2006 18:47	198	17.10	-0.35	-3.09	0.00	3.09
7/18/2006 14:19	199	17.55	0.45	3.97	0.00	0.00
7/19/2006 22:11	200	17.30	-0.25	-2.21	0.00	2.89
7/20/2006 21:22	201	17.25	-0.05	-0.44	0.00	1.80
7/21/2006 22:14	202	17.05	-0.20	-1.77	0.00	2.11
7/22/2006 14:11	203	17.00	-0.05	-0.44	0.00	0.44
7/23/2006 17:06	204	17.00	0.00	0.00	0.00	1.36
7/24/2006 13:24	205	16.95	-0.05	-0.44	0.00	1.46
7/25/2006 14:31	206	16.90	-0.05	-0.44	0.00	2.14
7/26/2006 15:00	207	16.80	-0.10	-0.88	0.00	0.88
7/27/2006 17:16	208	16.65	-0.15	-1.32	0.00	1.32
7/28/2006 15:00	209	16.55	-0.10	-0.88	0.00	0.88
7/29/2006 12:31	210	16.60	0.05	0.44	0.00	0.00
7/30/2006 9:54	211	16.50	-0.10	-0.88	0.00	0.88
7/31/2006 12:09	212	16.35	-0.15	-1.32	0.00	2.00
8/1/2006 14:25	213	16.45	0.10	0.88	0.00	0.00
8/2/2006 12:28	214	16.20	-0.25	-2.21	0.00	2.21
8/3/2006 20:21	215	16.00	-0.20	-1.77	0.00	1.77
8/4/2006 15:38	216	15.90	-0.10	-0.88	0.00	0.88
8/5/2006 14:00	217	15.85	-0.05	-0.44	0.00	0.44
8/6/2006 16:17	218	15.70	-0.15	-1.32	0.00	1.32
8/7/2006 10:55	219	15.80	0.10	0.88	0.00	0.00
8/8/2006 16:47	220	15.65	-0.15	-1.32	0.00	1.32
8/9/2006 14:46	221	15.70	0.05	0.44	0.00	0.00
8/10/2006 15:23	222	16.00	0.30	2.65	0.00	0.00
8/11/2006 14:39	223	15.90	-0.10	-0.88	1.70	0.88
8/12/2006 16:53	224	15.90	0.00	0.00	0.00	0.00
8/13/2006 14:16	225	15.55	-0.35	-3.09	0.00	3.09
8/14/2006 16:42	226	15.65	0.10	0.88	0.00	0.00
8/15/2006 14:44	227	15.70	0.05	0.44	0.00	0.24
8/16/2006 16:39	228	15.55	-0.15	-1.32	0.00	1.32
8/17/2006 12:28	229	15.50	-0.05	-0.44	0.00	0.44
8/18/2006 12:29	230	15.45	-0.05	-0.44	0.00	0.44

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/2006 14:11	171	15.51	N/A	N/A	N/A	N/A
6/21/2006 15:57	172	15.30	-0.21	-1.85	0.00	1.85
6/22/2006 11:15	173	15.10	-0.20	-1.77	0.00	1.77
6/23/2006 15:52	174	14.90	-0.20	-1.77	0.00	1.77
6/24/2006 13:04	175	14.80	-0.10	-0.88	0.00	0.88
6/25/2006 13:37	176	16.00	1.20	10.60	0.00	0.00
6/26/2006 13:58	177	15.90	-0.10	-0.88	0.00	0.88
6/27/2006 16:20	178	15.50	-0.40	-3.53	0.00	3.87
6/28/2006 14:40	179	16.00	0.50	4.42	0.00	0.69
6/29/2006 15:58	180	17.00	1.00	8.83	0.00	0.35
6/30/2006 17:02	181	19.75	2.75	24.29	41.71	0.00
7/1/2006 14:23	182	18.89	-0.86	-7.60	4.71	3.22
7/2/2006 17:14	183	18.55	-0.34	-3.00	0.00	3.00
7/3/2006 19:03	184	18.55	0.00	0.00	4.42	0.00
7/4/2006 15:14	185	18.51	-0.04	-0.35	0.00	0.35
7/5/2006 17:55	186	18.10	-0.41	-3.62	0.00	3.62
M	187	M	M	M	M	M
7/7/2006 17:11	188	17.95	-0.15	-1.32	0.00	7.79
7/8/2006 16:47	189	17.75	-0.20	-1.77	0.00	1.77
7/9/2006 15:39	190	17.65	-0.10	-0.88	0.00	0.88
7/10/2006 20:55	191	17.35	-0.30	-2.65	0.00	2.65
7/11/2006 15:26	192	17.35	0.00	0.00	0.00	0.00
7/12/2006 21:51	193	17.00	-0.35	-3.09	0.00	3.09
7/13/2006 15:29	194	17.55	0.55	4.86	0.00	0.00
7/14/2006 16:07	195	17.25	-0.30	-2.65	0.00	2.65
7/15/2006 18:12	196	17.00	-0.25	-2.21	0.00	2.21
7/16/2006 15:31	197	17.30	0.30	2.65	0.00	1.43
7/17/2006 18:30	198	17.15	-0.15	-1.32	0.00	1.32
7/18/2006 14:46	199	17.50	0.35	3.09	0.00	0.65
7/19/2006 21:57	200	17.20	-0.30	-2.65	0.00	3.33
7/20/2006 21:39	201	17.20	0.00	0.00	0.00	1.36
7/21/2006 21:30	202	16.95	-0.25	-2.21	0.00	2.21
7/22/2006 14:22	203	16.85	-0.10	-0.88	0.00	1.22
7/23/2006 16:51	204	16.70	-0.15	-1.32	0.00	2.69
7/24/2006 13:46	205	16.70	0.00	0.00	0.00	1.02
7/25/2006 14:14	206	16.75	0.05	0.44	0.00	1.26
7/26/2006 15:20	207	16.55	-0.20	-1.77	0.00	1.77
7/27/2006 16:50	208	16.40	-0.15	-1.32	0.00	1.32
7/28/2006 15:14	209	16.25	-0.15	-1.32	0.00	1.32
7/29/2006 12:14	210	16.20	-0.05	-0.44	0.00	0.44
7/30/2006 10:19	211	15.95	-0.25	-2.21	0.00	2.21
7/31/2006 11:45	212	16.00	0.05	0.44	0.00	0.24
8/1/2006 14:40	213	15.75	-0.25	-2.21	0.00	2.21
8/2/2006 10:36	214	15.75	0.00	0.00	0.00	0.00
8/3/2006 20:34	215	15.30	-0.45	-3.97	0.00	3.97
8/4/2006 15:20	216	15.30	0.00	0.00	0.00	0.00
8/5/2006 14:28	217	15.10	-0.20	-1.77	0.00	1.77
8/6/2006 15:33	218	14.90	-0.20	-1.77	0.00	1.77
8/7/2006 11:05	219	14.75	-0.15	-1.32	0.00	1.32
8/8/2006 16:14	220	14.70	-0.05	-0.44	0.00	0.44
8/9/2006 15:00	221	14.70	0.00	0.00	0.00	0.34
8/10/2006 14:55	222	14.80	0.10	0.88	0.00	0.14
8/11/2006 15:05	223	15.00	0.20	1.77	0.00	0.00
8/12/2006 16:35	224	14.90	-0.10	-0.88	0.00	0.88
8/13/2006 14:28	225	14.70	-0.20	-1.77	0.00	1.77
8/14/2006 16:14	226	14.50	-0.20	-1.77	0.00	2.11
8/15/2006 15:14	227	14.70	0.20	1.77	0.00	0.00
8/16/2006 16:23	228	14.55	-0.15	-1.32	0.00	1.32
8/17/2006 12:50	229	14.45	-0.10	-0.88	0.00	0.88
8/18/2006 12:15	230	14.50	0.05	0.44	0.00	0.00

Date + Time	Julian Date	Observed Wt. (kg)	Wt. Change (kg)	Equivalent Water Change (mm)	Calculated Throughflow (mm)	Calculated AET (mm)
6/20/2006 14:11	171	N/A	N/A	N/A	N/A	N/A
6/21/2006 15:57	172	N/A	N/A	N/A	N/A	N/A
6/22/2006 11:15	173	N/A	N/A	N/A	N/A	N/A
6/23/2006 15:52	174	N/A	N/A	N/A	N/A	N/A
6/24/2006 13:04	175	N/A	N/A	N/A	N/A	N/A
6/25/2006 13:37	176	N/A	N/A	N/A	N/A	N/A
6/26/2006 13:58	177	N/A	N/A	N/A	N/A	N/A
6/27/2006 16:20	178	N/A	N/A	N/A	N/A	N/A
6/28/2006 14:40	179	N/A	N/A	N/A	N/A	N/A
6/29/2006 15:58	180	N/A	N/A	N/A	N/A	N/A
6/30/2006 17:02	181	N/A	N/A	N/A	N/A	N/A
7/1/2006 14:23	182	N/A	N/A	N/A	N/A	N/A
7/2/2006 17:14	183	N/A	N/A	N/A	N/A	N/A
7/3/2006 19:03	184	N/A	N/A	N/A	N/A	N/A
7/4/2006 15:14	185	N/A	N/A	N/A	N/A	N/A
7/5/2006 17:55	186	17.30	N/A	N/A	N/A	N/A
M	187	M	M	M	M	M
7/7/2006 17:11	188	17.20	-0.10	-0.88	0.00	7.35
7/8/2006 16:47	189	16.90	-0.30	-2.65	0.00	2.65
7/9/2006 15:39	190	16.70	-0.20	-1.77	0.00	1.77
7/10/2006 20:55	191	16.35	-0.35	-3.09	0.00	3.09
7/11/2006 15:26	192	16.20	-0.15	-1.32	0.00	1.32
7/12/2006 21:51	193	15.85	-0.35	-3.09	0.00	3.09
7/13/2006 15:29	194	16.35	0.50	4.42	0.00	0.34
7/14/2006 16:07	195	16.15	-0.20	-1.77	0.00	1.77
7/15/2006 18:12	196	15.85	-0.30	-2.65	0.00	2.65
7/16/2006 15:31	197	16.05	0.20	1.77	0.00	2.32
7/17/2006 18:30	198	15.75	-0.30	-2.65	0.00	2.65
7/18/2006 14:46	199	16.00	0.25	2.21	0.00	1.53
7/19/2006 21:57	200	15.75	-0.25	-2.21	0.00	2.89
7/20/2006 21:39	201	15.75	0.00	0.00	0.00	1.36
7/21/2006 21:30	202	15.45	-0.30	-2.65	0.00	2.65
7/22/2006 14:22	203	15.30	-0.15	-1.32	0.00	1.66
7/23/2006 16:51	204	15.15	-0.15	-1.32	0.00	2.69
7/24/2006 13:46	205	15.00	-0.15	-1.32	0.00	2.34
7/25/2006 14:14	206	15.10	0.10	0.88	0.00	0.82
7/26/2006 15:20	207	14.90	-0.20	-1.77	0.00	1.77
7/27/2006 16:50	208	14.60	-0.30	-2.65	0.00	2.65
7/28/2006 15:14	209	14.60	0.00	0.00	0.00	0.00
7/29/2006 12:14	210	14.40	-0.20	-1.77	0.00	1.77
7/30/2006 10:19	211	14.20	-0.20	-1.77	0.00	1.77
7/31/2006 11:45	212	14.10	-0.10	-0.88	0.00	1.56
8/1/2006 14:40	213	14.05	-0.05	-0.44	0.00	0.44
8/2/2006 10:36	214	13.90	-0.15	-1.32	0.00	1.32
8/3/2006 20:34	215	13.45	-0.45	-3.97	0.00	3.97
8/4/2006 15:20	216	13.35	-0.10	-0.88	0.00	0.88
8/5/2006 14:28	217	13.10	-0.25	-2.21	0.00	2.21
8/6/2006 15:33	218	12.85	-0.25	-2.21	0.00	2.21
8/7/2006 11:05	219	12.75	-0.10	-0.88	0.00	0.88
8/8/2006 16:14	220	12.55	-0.20	-1.77	0.00	1.77
8/9/2006 15:00	221	12.55	0.00	0.00	0.00	0.34
8/10/2006 14:55	222	12.60	0.05	0.44	0.00	0.58
8/11/2006 15:05	223	12.70	0.10	0.88	0.00	0.82
8/12/2006 16:35	224	12.50	-0.20	-1.77	0.00	1.77
8/13/2006 14:28	225	12.20	-0.30	-2.65	0.00	2.65
8/14/2006 16:14	226	12.15	-0.05	-0.44	0.00	0.78
8/15/2006 15:14	227	12.20	0.05	0.44	0.00	0.24
8/16/2006 16:23	228	12.05	-0.15	-1.32	0.00	1.32
8/17/2006 12:50	229	12.05	0.00	0.00	0.00	0.00
8/18/2006 12:15	230	11.90	-0.15	-1.32	0.00	1.32

			(kg)	Water Change (mm)	Throughflow (mm)	AET (mm)
6/20/2006 14:11	171	N/A	N/A	N/A	N/A	N/A
6/21/2006 15:57	172	N/A	N/A	N/A	N/A	N/A
6/22/2006 11:15	173	N/A	N/A	N/A	N/A	N/A
6/23/2006 15:52	174	N/A	N/A	N/A	N/A	N/A
6/24/2006 13:04	175	N/A	N/A	N/A	N/A	N/A
6/25/2006 13:37	176	N/A	N/A	N/A	N/A	N/A
6/26/2006 13:58	177	N/A	N/A	N/A	N/A	N/A
6/27/2006 16:20	178	N/A	N/A	N/A	N/A	N/A
6/28/2006 14:40	179	N/A	N/A	N/A	N/A	N/A
6/29/2006 15:58	180	N/A	N/A	N/A	N/A	N/A
6/30/2006 17:02	181	N/A	N/A	N/A	N/A	N/A
7/1/2006 14:23	182	N/A	N/A	N/A	N/A	N/A
7/2/2006 17:14	183	N/A	N/A	N/A	N/A	N/A
7/3/2006 19:03	184	N/A	N/A	N/A	N/A	N/A
7/4/2006 15:14	185	N/A	N/A	N/A	N/A	N/A
7/5/2006 17:55	186	14.13	N/A	N/A	N/A	N/A
M	187	M	M	M	M	M
7/7/2006 17:11	188	14.40	0.27	2.38	0.00	4.08
7/8/2006 16:47	189	14.15	-0.25	-2.21	0.00	2.21
7/9/2006 15:39	190	14.10	-0.05	-0.44	0.00	0.44
7/10/2006 20:55	191	14.00	-0.10	-0.88	0.00	0.88
7/11/2006 15:26	192	14.00	0.00	0.00	0.00	0.00
7/12/2006 21:51	193	13.80	-0.20	-1.77	0.00	1.77
7/13/2006 15:29	194	14.30	0.50	4.42	0.00	0.34
7/14/2006 16:07	195	14.10	-0.20	-1.77	0.00	1.77
7/15/2006 18:12	196	14.05	-0.05	-0.44	0.00	0.44
7/16/2006 15:31	197	15.40	1.35	11.92	0.00	0.00
7/17/2006 18:30	198	14.20	-1.20	-10.60	0.00	10.60
7/18/2006 14:46	199	14.45	0.25	2.21	0.00	1.53
7/19/2006 21:57	200	14.45	0.00	0.00	0.00	0.68
7/20/2006 21:39	201	14.50	0.05	0.44	0.00	0.92
7/21/2006 21:30	202	14.25	-0.25	-2.21	0.00	2.21
7/22/2006 14:22	203	14.15	-0.10	-0.88	0.00	1.22
7/23/2006 16:51	204	14.15	0.00	0.00	0.00	1.36
7/24/2006 13:46	205	14.15	0.00	0.00	0.00	1.02
7/25/2006 14:14	206	14.35	0.20	1.77	0.00	0.00
7/26/2006 15:20	207	14.10	-0.25	-2.21	0.00	2.21
7/27/2006 16:50	208	14.05	-0.05	-0.44	0.00	0.44
7/28/2006 15:14	209	14.00	-0.05	-0.44	0.00	0.44
7/29/2006 12:14	210	14.00	0.00	0.00	0.00	0.00
7/30/2006 10:19	211	13.85	-0.15	-1.32	0.00	1.32
7/31/2006 11:45	212	13.95	0.10	0.88	0.00	0.00
8/1/2006 14:40	213	13.80	-0.15	-1.32	0.00	1.32
8/2/2006 10:36	214	13.85	0.05	0.44	0.00	0.00
8/3/2006 20:34	215	13.55	-0.30	-2.65	0.00	2.65
8/4/2006 15:20	216	13.55	0.00	0.00	0.00	0.00
8/5/2006 14:28	217	13.40	-0.15	-1.32	0.00	1.32
8/6/2006 15:33	218	13.40	0.00	0.00	0.00	0.00
8/7/2006 11:05	219	13.30	-0.10	-0.88	0.00	0.88
8/8/2006 16:14	220	13.35	0.05	0.44	0.00	0.00
8/9/2006 15:00	221	13.40	0.05	0.44	0.00	0.00
8/10/2006 14:55	222	13.50	0.10	0.88	0.00	0.14
8/11/2006 15:05	223	13.65	0.15	1.32	0.00	0.38
8/12/2006 16:35	224	13.55	-0.10	-0.88	0.00	0.88
8/13/2006 14:28	225	13.40	-0.15	-1.32	0.00	1.32
8/14/2006 16:14	226	13.40	0.00	0.00	0.00	0.34
8/15/2006 15:14	227	13.40	0.00	0.00	0.00	0.68
8/16/2006 16:23	228	13.40	0.00	0.00	0.00	0.00
8/17/2006 12:50	229	13.40	0.00	0.00	0.00	0.00
8/18/2006 12:15	230	13.40	0.00	0.00	0.00	0.00

[redacted]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carbon Flux Tower				1		
HOBO (Air Temp/RH Sensor)		2 (20 cm, 125cm)				2 (18 cm, 106 cm)
TDR Probes		2 (4cm, 15cm)	4 (5cm, 6cm, 16cm, 18cm)	3 (7cm, 23cm, 23cm)	4 (8cm, 13cm, 23cm, 23cm)	3 (7cm, 10cm, 23cm)
Thermocouples	2 (2cm, 13cm)	3 (2cm, 2cm, 14cm)	2 (2cm, 18cm)	2 (2cm, 39cm)	2 (2cm, 40cm)	2 (2cm, 35 cm)
Stowaways		2 (2 cm, 15 cm)	2 (2 cm, 17 cm)		2 (3 cm, 34 cm)	2 (3cm, 37 cm)
TruTraks	2					
Pyranometers		2 (both at 125 cm)				2 (18cm, 106cm)
Lysimeters		3	3	3	3	3

[illegible]

Since sample sizes are relatively small (n ~ 57 to 60), any statistical testing used to compare sites will employ the student t-test, providing the data are normally distributed. If the data are not normal, Mann-Whitney U test will be used. A data set is deemed to be skewed if the absolute skewness statistic is greater than one.

[redacted]

Daily EET estimates for all sites are located in [redacted] Descriptive statistics regarding the data sets are located in [redacted] The data show that all median daily estimates for EET are within one standard error of the mean regardless of location or equipment used. The skewness values and corresponding visual representation [redacted] indicates a slight negative skewing, meaning there are more days where evapotranspiration is less than the mean compared to exceeding the mean. Each of the data sets are approximated as normally distributed due to median values being within one standard error or their respective mean values, as well as relatively low absolute skewness values.

At Site 1, 68.4% of days during the season feature EET rates of 4.0 to 8.0 mm. [redacted] shows two distinct peaks within that range; 11 days (19.3% of the season) where 5.0 to 6.0 mm occur, and 13 days (22.8% of the season) with 7.0 to 8.0 mm. EET never exceeds 7.0 mm after July 29. Most days where EET exceeds 7.0 mm correspond to high incoming short-wave radiation and windier conditions. 21.1% (12 days) of the season feature PET rates below 4.0 mm.

Site 2 features 74.6% of the data (44 days) where EET rates are between 2.0 and 5.0 mm, and EET never exceeds 6.0 mm. There are 11 instances where daily PET rates are less than 2.0 mm. Site 2 is represented by the blue columns on [illegible]

Frequency distribution at Site 2 is approximately normally distributed, since [illegible]hows that median and mean values are quite close, and absolute skewness is significantly less than 1.00.

Site 3 features daily EET rates between 2.0 and 6.0 mm for 71.2% of the season (42 days). At this site, there are also no incidences where EET is 0.00 mm or less. Site 3 is represented by the green columns on [illegible] Frequency distribution is approximately normal, as [illegible]hows close median and mean values, and absolute skewness values which are significantly under 1.00.

86.4 % of the season (51 days) at Site 4 featured daily EET rates between 1.0 and 4.0 mm. Soil temperature at the tower was recorded at depths of 5cm, 10cm, 20cm, and 60cm. To calculate ground heat flux, data from the sensors buried at 5cm and 20cm were used. EET is above 4.0 mm/day on one occasion, and is less than 1.0 mm on seven occasions using the tower.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
N	57	59	59	59	59	59
Mean	5.7	3.3	4.5	2.2	3.7	3.6
Median	5.7	3.2	4.4	2.2	3.6	3.5

Standard Error of Mean	0.3	0.2	0.2	0.1	0.2	0.2
Standard Deviation	2.2	1.3	1.6	1.1	1.4	1.4
Sum	321.3	191.7	263.2	131.1	214.6	211.8
Skewness	-0.372	-0.359	-0.417	-0.241	-0.370	-0.326

[redacted]

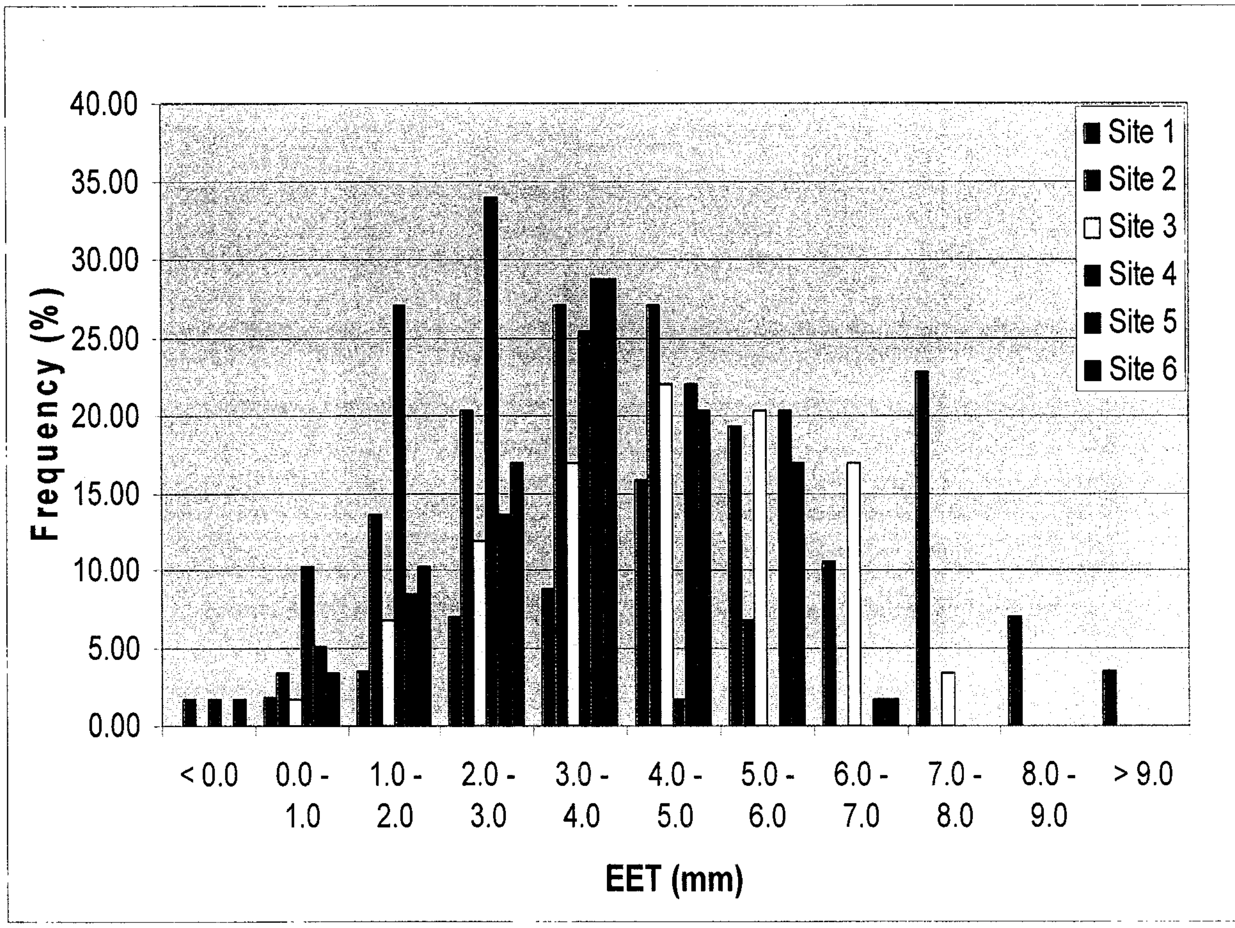

Figure G1 – Frequency Distribution of Priestly-Taylor EET at all sites

At Site 5, 71.2% (42 days) of the season consists of rates between 3.0 and 6.0 mm/day; 64.4% of the season (38 days) features daily EET rates between 2.0 and 5.0 mm. 13 days feature more than 5.0 mm/day, and EET is below 2.0 mm on eight occasions.

Site 6, situated on a lower branch of an esker, features 39 days (76.3% of the season) with EET between 1.0 and 5.0 mm. Seven days have EET less than 1.0 mm, compared to 11 days where EET exceeds 5.0 mm. The hypothesis being tested regarding daily Priestly-Taylor EET is:

H_O: There exists no difference in daily mean EET between sites and their corresponding vegetation communities.

H_A: Daily mean EET rates are different, and constitute different populations.

To determine whether or not data from each site are independent, student t-tests are employed, the results of which appear in **Table G2**. All Priestly-Taylor EET estimates, regardless of location, were significant at a 95% level of confidence. This means all data sets are independent from all others. Therefore, the null hypothesis was rejected in favour of the alternative hypothesis which states that daily mean EET rates are different between sites, and constitute different populations.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Site 1	X	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Site 2	< 0.0001	X	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Site 3	< 0.0001	< 0.0001	X	< 0.0001	< 0.0001	< 0.0001
Site 4	< 0.0001	< 0.0001	< 0.0001	X	< 0.0001	< 0.0001
Site 5	< 0.0001	< 0.0001	< 0.0001	< 0.0001	X	0.0467
Site 6	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0467	X

Table G2 – T-test Results, Priestly-Taylor derived EET

ACTUAL EVAPOTRANSPIRATION:

Daily observed lysimeter evapotranspiration and corrected AET vales can be found in **Appendix D**. Observed daily average evapotranspiration using lysimeters is 1.5 +/- 0.1 mm at Site 2, 1.8 +/- 0.2 mm at Site 3, 1.6 +/- 0.1 mm at Site 4, 1.5 +/- 0.1 mm at Site 5, and 1.3 +/- 0.1 mm at Site 6. No estimate is given for Site 1, as no lysimeters were used there. These values represent output from the model in **Table 4.2**. Descriptive statistics regarding observed lysimeter data are located in **Table G3.** Sites 2 and 3 are grouped together for reasons mentioned previously. **Figure G2** is a representation of frequency distribution at Sites 2 and 3.

Although the mean and median at both sites are within one standard error of the mean, these data sets was considered not normally distributed, as indicated by the skewness statistics in **Table G3**. 75.9% (44 days) of the season at Site 2, and 53.4% (31 days) of the season at Site 3 features observed daily lysimeter AET rates between 0.0 and 2.0 mm. Both sites feature four days where no evapotranspiration is observed. At Site 2, observed evapotranspiration exceeds 3.0 mm on three occasions, compared to eight at Site 3. Data for the three upland sites are also positively skewed. At Site 4, 75.9% of the season (44 days) featured daily observed evapotranspiration between 0.0 and 2.0 mm, compared to 70.7% (41 days) at Site 5, and 77.6% (45 days) at Site 6. Observed evapotranspiration is zero on three occasions at each of these sites. Despite differing soil textures, porosity was much lower at Sites 4 through 6. As explained in **Section 5.2.1**, it is suspected that the lysimeters are underestimating evapotranspiration at all sites except the dwarf birch site (Site 6) **(Appendix E)**.

Statistic	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 6**
N	58	58	58	58	58
Mean	1.5	1.8	1.5	1.5	1.3
Median	1.4	1.8	1.6	1.4	1.3
Standard Error of Mean	0.1	0.2	0.1	0.1	0.1
Standard Deviation	0.9	1.2	1.0	1.0	0.9
Sum	84.5	106.8	88.2	87.6	77.5
Skewness	0.373	0.305	0.403	0.735	0.636

Table G3 - Descriptive Statistics of Lysimeter Observed AET

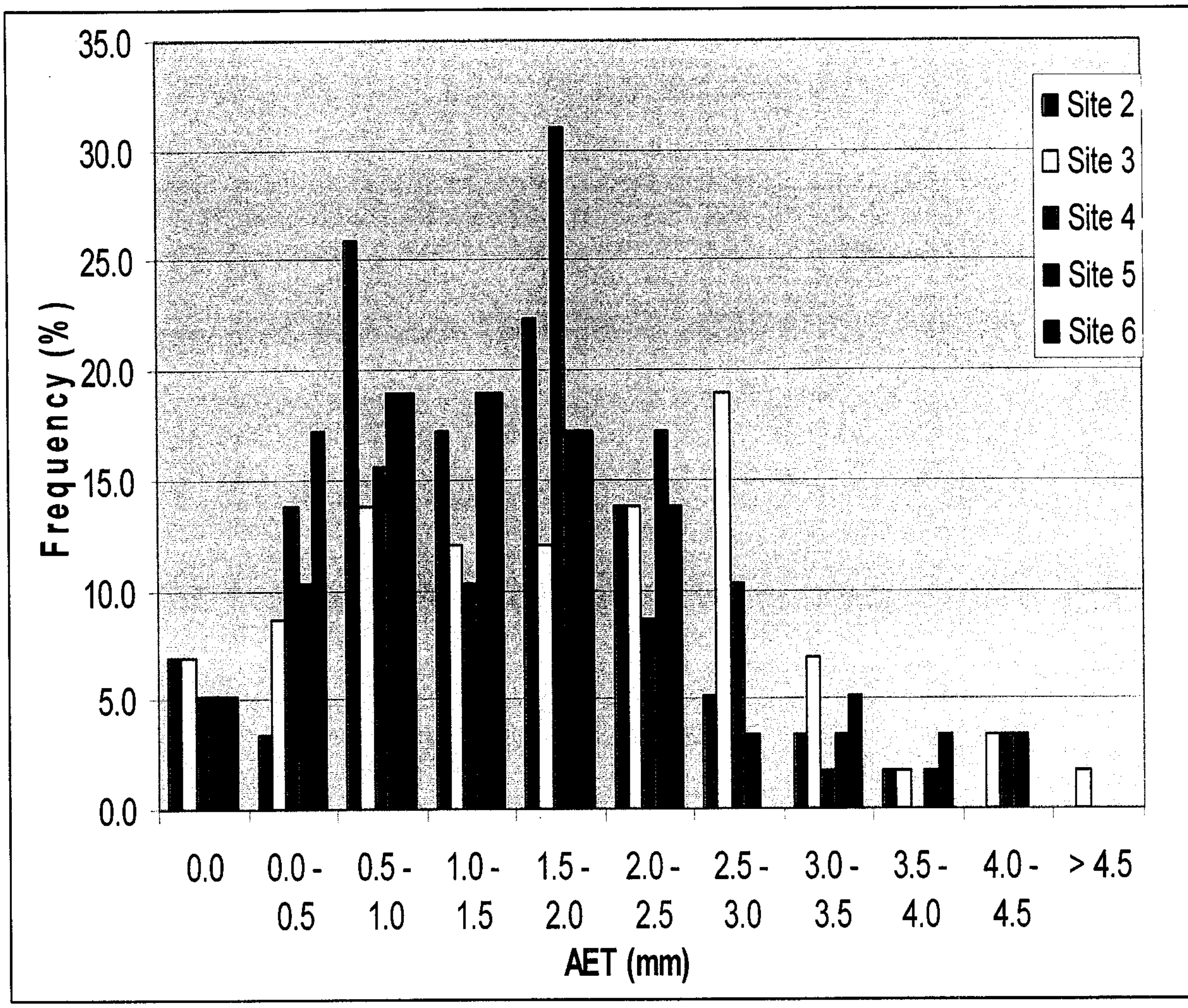

Figure G2 – Frequency distribution of lysimeter observed AET for all sites with lysimters

Calculated underestimates of observed evapotranspiration over the season and corrected mean values are included in **Table G4**. Since the underestimate was spread evenly over the season, all statistics remain the same, except the mean and median. **Figure G3** shows the distribution of corrected daily evapotranspiration. The hypothesis being tested regarding daily AET rates obtained from lysimeters is:

H_O: There exists no difference in daily mean AET between sites and their corresponding vegetation communities.

H_A: Daily mean AET rates are different, and constitute different populations.

Table G5 shows the results of comparisons of corrected mean daily evapotranspiration, using the t-test, and shows that all but two comparisons are significant at a 95% level of confidence.

	Site 2	**Site 3**	**Site 4**	**Site 5**
Season Underestimate (mm)	17.90	76.17	11.29	84.38
Daily Underestimate (mm/day)	0.31	1.31	0.19	1.45
Corrected Mean (mm)	1.8	3.2	1.7	3.0
Corrected Sum (mm)	102.4	183.0	99.5	172.0

Table G4 – Corrected AET Lysimeter Statistics

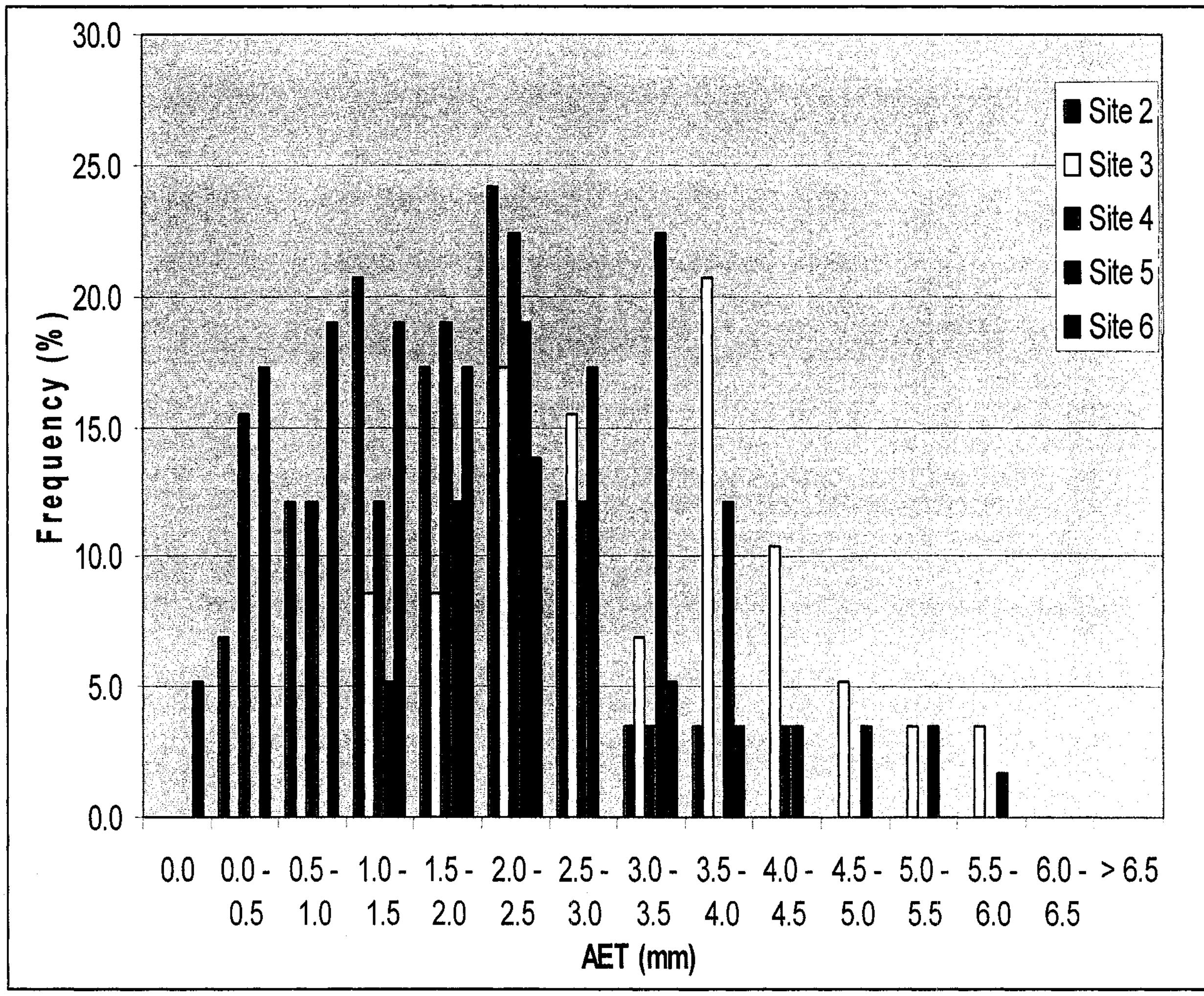

Figure G3 – Frequency distribution of corrected lysimeter AET Estimates for all sites with lysimeters

	Site 2	Site 3	Site 4	Site 5	Site 6
Site 2	X	< 0.0001	**0.7250**	< 0.0001	0.0002
Site 3	< 0.0001	X	< 0.0001	**0.2487**	< 0.0001
Site 4	**0.7250**	< 0.0001	X	< 0.0001	0.0178
Site 5	< 0.0001	**0.2487**	< 0.0001	X	< 0.0001
Site 6	0.0002	< 0.0001	0.0178	< 0.0001	X

Table G5 – T-Test, Corrected AET Lysimeter Data

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