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An Analysis of Stable Isotopes from n-alkanes derived from Leaf Waxes in North America

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An Analysis of Stable Isotopes from *n*-alkanes derived from Leaf Waxes in North America

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Abstract

Leaf wax biomarkers are increasingly becoming a fundamental aspect of paleoclimate research. The strength of the relationship between their molecular and isotopic properties and environmental conditions is critical to their effectiveness in reconstructing past environments. To address the current lack of data pertaining to arid and semi-arid environments, soil and modern plant samples (grasses, trees, forbs, and shrubs) from sites in the western United States were analyzed to assess relationships between normal alkane molecular distribution, δD and $\delta^{13}C$ and seasonal/annual climatic conditions in semi-arid ecosystems. The data show a stronger relationship between δD of leaf waxes (δD_{wax}) in soils and δD of mean annual precipitation (δD_{MAP}) than the δD of plants. δD_{wax} of grasses and soils correlate with latitude, mean annual vapor pressure deficit (VPD), mean annual temperature (MAT), and annual relative humidity (RH). No relationships were observed between $\delta^{13}C_{wax}$ or the molecular distribution of the waxes and any of the climate variables tested. There is an offset between the δD and $\delta^{13}C$ of these waxes and the δD and $\delta^{13}C$ of the environment in which they were created. The apparent fractionation ($\varepsilon_{wax/atm}$) between δD_{wax} and δD_{MAP} for grasses and soils correlated with latitude as well as mean annual RH. There was no relationship found for the carbon discrimination between $\delta^{13}C_{wax}$ and $\delta^{13}C_{atm}$ ($\Delta leaf_{wax/atm}$) and the climatic variables tested.

To further investigate the dominant environmental drivers controlling the composition of leaf wax biomarkers, data from the Western United States was then combined with published data from studies throughout the United States. These combined data show distinct distributions of $\varepsilon_{wax/atm}$ from soils in different climates. The $\varepsilon_{wax/atm}$ of the plants display correlations to mean annual VPD. The data also show an increase in the Average Chain

Length (ACL) of the *n*-alkanes in soils with increased temperature and aridity. In contrast to previous studies, the offset between carbon isotope composition of bulk leaf tissue and leaf wax biomarkers varied in the soils. This suggests that the fractionation between the carbon isotope composition of bulk leaf tissue and leaf wax could be due to the differences in environmental or vegetation type. The data presented here suggest careful consideration of ecosystem type is critical to reconstructing past environmental conditions using leaf wax biomarkers.

1. Introduction

Over the last decade, there has been an increase in the use of molecular distribution and stable isotope composition of organic biomarkers, such as leaf waxes, as a proxy for hydrology, ecosystem, and other environmental conditions. Despite the widespread application of leaf waxes as proxies for paleoenvironmental reconstruction, many of the existing calibrations relating their molecular and isotopic properties to environmental parameters (e.g., temperature, precipitation) appear relatively weak. Furthermore, semi-arid climates and scrubland/grassland ecosystems are poorly represented in present global datasets. Thus, interpretation of environmental information recorded by leaf wax biomarker proxies is particularly problematic in these ecosystems. The primary questions underlying this thesis are:

(1) Does the magnitude of apparent fractionation between the hydrogen and carbon of the leaf waxes and the environment change as a function of temperature, precipitation, and other climate variables in a semi-arid environment?

(2) How does the hydrogen and carbon isotope composition and the apparent fractionation between the isotopic composition of the *n*-alkanes and environment manifest on a continental scale?

(3) How does the isotopic composition in individual plants translate to the isotopic composition of soils?

This study presents new molecular and isotopic data from modern plants and soils across the United States to address these issues. Furthermore, this study adds to the limited empirical leaf wax biomarker data currently available from semi-arid and arid ecosystems.

1.1 Lipid Biomarkers

The use of lipid biomarkers as a paleoclimate proxy has been shown to improve our understanding of ancient environments and ecosystems (Sachse et al., 2012). Lipid biomarkers, derived from the epicuticular wax layer of terrestrial plant leaves, are widely preserved in geologic record. These leaf waxes help shield the plant from ultraviolet radiation, protect the leaf against insect/fungal attacks, and prevent non-stomatal water loss (Eglinton; and Hamilton, 1967). The waxes are composed of lipids such as *n*-alkanes, *n*-alcohols, *n*-alkanoic acids, ketones, and triterpenoid compounds (Eglinton and Hamilton, 1967; and Volkman et al., 1998). Terrestrial plant-derived *n*-alkanes are dominated by odd numbered, straight-chained, saturated hydrocarbons and are synthesized from fatty acids (Zhou et al., 2010). These *n*-alkyl lipids are produced through the acetogenic pathway, which starts with the decarboxylation of pyruvate dehydrogenase and forms fatty acids (Elington and Hamilton, 1967; Kolattukudy, 1968, 1969, 1996; Kunst et al., 2006; and Jetter and Kunst, 2008). These fatty acids are then elongated to contain up to 40 carbons with the addition of two carbon units, which originate from malonyl-ACP. This pathway can produce either even or odd chained numbered *n*-fatty acids, *n*-acids, and *n*-aldehydes. However, this pathway favors even-numbered chains of *n*-fatty acids, which then undergo decarboxylation and produces odd-numbered *n*-alkanes (Kunst and Samuels, 2003; Kunst et al., 2006; Chikaraishi and Naraoka, 2007; and Jetter and Kunst, 2008). This process produces a higher abundance of odd chained *n*-alkanes over even chained *n*-alkanes.

1.2 Average Chain Lengths

Average chain length (ACL) is the weight-averaged number of carbon atoms in *n*-alkanes C_{C25} to C_{C33} extracted from higher plants. There are three main biological sources that are able to

produce *n*-alkanes with unique ACL ranges: terrestrial plants, aquatic plants, and algae (Cranwell et al., 1987; Meyers and Ishiwatari, 1993; Ficken et al., 2000; Nott et al., 2000; Pancost et al., 2002; and Mügler et al., 2008). Samples dominated by algae or aquatic plants contain more of the C_{17-23} *n*-alkanes, while samples dominated by higher terrestrial plants contain more C_{25-33} *n*-alkanes (Eglinton and Hamilton, 1967; and Ficken et al., 2000). This allows for ACL to be calculated for *n*-alkanes extracted from sediments in order to determine its source in the geologic record. The ACL of a sample is calculated using equation (1):

$$(1)\ ACL = \frac{A_{23}(23) + A_{24}(24) + A_{25}(25) + A_{27}(27) + A_{29}(29) + A_{31}(31) + A_{33}(33) + A_{34}(34) + A_{35}(35)}{A_{23} + A_{24} + A_{25} + A_{27} + A_{29} + A_{31} + A_{33} + A_{34} + A_{35}}$$

For equation (1), ‘A’ represents the area of the individual *n*-alkane peak calculated on a gas chromatograph. Previous studies have used ACL to determine differences between various vascular plant groups (e.g. woody plants, grasses) as a potential chemotaxonmic proxy (Cranwell, 1973; Wakeham, 1976; Cranwell, 1984; Kawamura and Ishiwatari, 1984; Meyers and Ishiwatari, 1993; Nott et al., 2000; and Meyers, 2003). However, Bush and McInerney (2013) found its use for paleoecological reconstruction was limited, only identifying *Spagnum* sp. mosses due to their higher productions of C_{23} *n*-alkanes.

Although ACL is limited as a chemotaxonomic proxy, it still has potential value as a paleoclimate proxy as recent studies show that plant and soil ACL have a strong inverse relationship with latitude, a positive relationship with mean annual temperature (MAT), and mean summer temperatures (Tipple and Pagani, 2013; and Bush and McInerney, 2015). Other studies have also shown variation in ACL values of *n*-alkanes between plants in the same ecosystem (Sachse et al., 2006; Tipple and Pagani, 2013; and Oakes and Hren, 2016). However, sediments and soils incorporate *n*-alkanes from various plant groups creating a weighted

ecosystem average, and providing a strong relationship between ACL and temperature (Bush and McInerney, 2015). Modern soil ACL studies suggest that larger values may be associated with hotter temperatures (Bush and McInerney, 2015). It has also been proposed that aridity produces longer ACL values (Dodd et al., 1998; and Andersson et al., 2011). In the arid environments from Vogts et al. (2009), plant species produced longer *n*-alkane chain lengths than the same species growing in rainforests. It is unclear whether temperature or aridity is the primary mechanism driving ACL variability in plants, and remains a contentious area of research (Bush and McInerney, 2015).

1.3 Isotope Terminology

The isotopic composition of different materials are reported as delta (δ) values, which compares the ratio of heavier isotopes to lighter isotopes in the sample to the ratio of isotopes in a known standard using a mass spectrometer (equations 2 and 3). When there are positive delta values, it means that the sample is enriched in heavy isotopes relative to the standard and vice versa. Since the ratio between the sample and standard are so small, the values are expressed as per mil (‰) which stands for parts per thousand. There are three different isotopic standards for hydrogen depending on the location of the sample: Vienna Mean Ocean Water (VSMOW), Standard Mean Ocean Water (SMOW), and Standard Light Antarctic Precipitation (SLAP). For carbon isotopic standards, the Pee Dee Belemnite (PDB) which is derived from a Cretaceous marine fossil, *Belemnitella Americana* is often used.

$$(2)\ \delta = \frac{R_{sample} - R_{standard}}{R_{standard}} * 1000$$

$$(3)\ R = \frac{heavy\ isotope}{light\ isotope}$$

Using δD_{wax}, $\delta^{13}C_{wax}$, and the ACL of leaf wax for paleoenvironmental reconstruction relies on the *n*-alkanes to be preserved and unaltered over geologic time. Although all organic hydrogen will eventually exchange with surrounding environmental waters, the exchange rate for covalently bonded carbon-bound hydrogen isotopes is on the magnitude of 10^4 to 10^8 years (Sessions et al., 2004; Pedentchouk et al., 2006; and Schimmelmann, 2006). Schimmelmann (2006) showed that temperatures above ~150^{o}C from burial/diagenesis causes the covalently bonded carbon-bound hydrogen to readily exchange with the surrounding waters and become more enriched over time.

In organic-rich sedimentary rocks, *n*-alkanes can be extracted and analyzed as a proxy for understanding paleoenvironments due to the δD and $\delta^{13}C$ values of *n*-alkanes are strongly related to hydrology and vegetation type (Collister et al., 1994; Sessions et al., 1999; Bi et al., 2005; Sachse et al., 2006; Hou et al., 2008; and Feakins et al., 2013). These leaf waxes have undergone minimal degradation at temperatures below 100°C to 150°C, making them ideal for long term paleoclimate studies in areas where diagenesis is not a significant issue (Eglinton and Hamilton, 1967; Schimmelmann et al., 1999; Sessions et al., 2004; and Eglinton and Eglinton, 2008).

1.4 Isotope Fractionation

In terrestrial settings, plants derive most of their metabolic water from the soil, which is often recharged via precipitation (Hou et al., 2008). The deuterium (D)-enrichment of soil and leaf water relative to the source water is dependent on environmental conditions such as relative humidity, temperature, and precipitation (Sauer et al., 2001; Sachse et al., 2006; Smith and Freeman, 2006; Hou et al., 2008; Mügler et al., 2008, Pedentchouk et al., 2008; Feakins and Sessions, 2010; Polissar and Freeman, 2010; and Yang et al., 2009). There are three environmental processes that drive D-enrichment between δD_{wax} and δD_{MAP}: the evaporation of

soil water, the transpiration of leaf water, and the biosynthesis of *n*-alkanes in leaves (Sachse et al., 2012) (explained in detail in section 3.2.3). The δD values of higher plant *n*-alkanes is interpreted to reflect the hydrogen isotopic composition of soil water, modified by various physiological and biological processes, which constitutes as a valuable record of past hydrology (Lockheart et al., 1998; Chikaraishi and Naraoka 2003; Chikaraishi et al., 2004; Pagani et al., 2006; Hou et al., 2008; Tipple and Pagani 2010; Tipple et al., 2011; Yang et al., 2011; and Sachse et al., 2012). However, studies have found that different plant groups (ferns, trees, and grasses) collected from the same ecosystem have highly variable δD values of up to 85‰ (Hou et al., 2007a; and Oakes and Hren, 2016). One reason for this variability is differences in plant physiology such as root length. Plants with deeper roots are not affected as much by soil evaporation that occurs near the soil surface (Dawson, 1993; and Dawson and Pate, 1996). For leaf water transpiration, differences in leaf structure and stomatal regulation affects the rate of transpiration within the leaf (Smith and Freeman, 2006; Tipple and Pagani, 2007; and Hou et al., 2008). These factors show how δD values become enriched during the process in which plants take up water from soil, transport it to the leaves, and then use it for *n*-alkane biosynthesis. (Figure 1).

1.5 Biosynthetic fractionation and apparent fractionation

During biosynthesis, kinetic fractionation occurs which causes the lighter isotope to be preferentially incorporated into plant leaf waxes. The magnitude of isotopic fractionation during biosynthesis varies for each plant group due to differences in photosynthetic pathways and the timing of leaf waxes synthesis (Chikaraishi and Naraoko, 2003; Sachse et al., 2010; and Tipple and Pagani, 2013). The apparent fractionation ($\varepsilon_{wax/MAP}$) is the observed isotopic fractionation

between the precipitation water and the *n*-alkanes, where δD_{wax} is the deuterium ratio of the *n*-alkane and δD_{MAP} is the deuterium ratio of the precipitation (equation 4).

$$(4)\ \varepsilon_{wax/MAP} = \frac{\delta D_{wax} + 1}{\delta D_{MAP} + 1} - 1$$

1.6 $\delta^{13}C$ of n-alkanes and Bulk Carbon

Plants produce their waxes during leaf wax synthesis by using carbon derived from photosynthates. Photosynthates are sugars produced during photosynthesis using the atmospheric carbon taken into the plant during carbon fixation. There are several carbon fractionation events that occur from the atmospheric $\delta^{13}C$ to the $\delta^{13}C$ in both bulk carbon and leaf waxes. For both bulk carbon and leaf waxes, carbon fractionation occurs during carbon fixation and photosynthesis. However, for $\delta^{13}C$ of leaf waxes there is an additional step of carbon fractionation that occurs during lipid biosynthesis (Figure 2) (Hayes, 2001; Currano et al., 2008; Currano et al., 2010; Tipple et al., 2010; Beerling and Royer, 2011; Diefendorf et al., 2011; Diefendorf et al., 2012; Schubert and Jahren, 2012; and Diefendorf et al., 2015). The apparent fractionation ($\varepsilon_{wax/bulk}$) is used to describe the fractionation between the $\delta^{13}C$ from the *n*-alkanes to the bulk $\delta^{13}C$ (equation 5).

$$(5)\ \varepsilon_{wax/bulk} = \frac{\delta^{13}C_{wax} + 1}{\delta^{13}C_{bulk} + 1} - 1$$

There are several factors that affect the fractionation of bulk $\delta^{13}C$ and $\delta^{13}C_{wax}$ including water availability, plant type, photosynthetic pathways, and CO_2 partial pressure (Farquhar et al., 1989; Collister et al., 1994; Diefendorf et al., 2010; Schubert and Jahren. 2012; and Graham et al., 2014). The next sections will describe the impact that these factors have on the bulk $\delta^{13}C$ and $\delta^{13}C_{wax}$.

1.7 Carbon discrimination and Water Use Efficacy

Plant carbon uptake is highly dependent on atmospheric CO_2 pressure which controls the diffusion of CO_2 to the plants through its leaf stomata as well as the photosynthetic pathway. Plant stomata plays an integral role in maintaining the balance between carbon uptake and water loss. Short term responses to water stress or changes in CO_2 include opening and closing of the stomata which prevents isotopic carbon discrimination during carbon uptake (Farquhar and Sharkey, 1982; and Tipple and Pagani, 2007). Water use efficacy (WUE), is the ratio between the rate of carbon uptake and the rate of water loss via transpiration (Farquhar et al., 1980; Farquhar et al., 1982; Farquhar and Richards, 1984; and Franks et al., 2014). Increases in WUE are interpreted as a time of high water stress. For this study, WUE was calculated using equation 6 (Farquhar and Sharkey, 1982 and von Caemmerer, 2000), equation 7 (Farquhar et al., 1982), and equation 8 (Farquhar and Richards, 1984), where c_i/c_a is the ratio of CO_2 within the plant leaf (c_i) and the atmosphere (c_a), a is a fixed value of 4.4‰ for carbon fractionation from the diffusion of CO_2 in the atmosphere (Farquhar et al., 1982), and b is a fixed value of 30‰ for the carbon fractionation from RuBP carbonxylase (Roeske and O'Leary, 1984). Carbon discrimination between the leaf wax and the atmosphere is presented by $\Delta leaf_{wax/atm.}$ In equation 7, $\Delta leaf_{wax/atm}$ was calculated using the carbon isotopic value from the *n*-alkanes.

$$(6)\ WUE = 400 * (1 - \frac{c_i}{c_a})$$

$$(7)\ \frac{c_i}{c_a} = \frac{\Delta leaf_{wax/atm} - a}{a - b}$$

$$(8)\ \Delta leaf_{wax/atm} = \frac{-8 - (\delta^{13}C_{wax})}{(1 + \delta^{13}C_{wax})/1000)}$$

Hou et al., 2007b found a strong negative correlation between $\delta^{13}C_{wax}$ and $\delta D_{wax,}$ which they suggested was due to WUE playing an important role. This study was focused only on trees and it is unclear if this trend is applicable to other plant groups. Diefendorf et al., 2010 investigated the climatic controls on $\Delta leaf_{bulk/atm}$, and found strong correlations with precipitation and elevation. However, it is unclear if $\Delta leaf_{wax/atm}$ responds in the same way to climate variables as $\Delta leaf_{bulk/atm}$.

1.8 Carbon ($\delta^{13}C$) and hydrogen (δD) of C_3 vs C_4 photosynthetic plants

Photosynthetic pathways play a large role in carbon fixation of C_3 and C_4 plants. The C_3 photosynthetic pathway is a primitive pathway also known as the Calvin-Benson Cycle and includes the majority of trees, shrubs, and cool-seasoned grasses. The C_3 pathway uses the enzyme ribulose bisphosphate carboxylase oxygenase (Rubisco) to produce photosynthates from CO_2. During this process, ^{12}C is preferentially incorporated, leading the average isotopic values of $\delta^{13}C_{wax}$ in C_3 plants to be -31‰ to -39‰ (Figure 3); (Farquhar et al., 1989; and Bi et al., 2005).

However, rubisco also interacts with $O_{2,}$ particularly at higher temperatures, preventing carbon fixation (Ehleringer, 2005). As a result of this phenomena, the C_4 pathway has evolved to be more efficient in carbon fixation and includes plants such as warm-seasoned grasses and sedges. This pathway allows for carbon storage by converting CO_2 into bicarbonate, fixing it with phosphoenolpyruvate-carboxylase (PEP-C) which produces a four-carbon acid called oxaloacetate, and storing it in the mesophyll cell. Afterwards, the C_4 acids are moved to the bundle sheath cells and decarboxylated, allowing the CO_2 to be used in the Calvin-Benson Cycle. During this process, the PEP-C preferentially fixes ^{13}C, which allows the $\delta^{13}C_{wax}$ of C_4 plants to

become more enriched, ranging from -18‰ to -25‰ (Farquhar 1989; Bi et al., 2005; and Tipple and Pagani, 2007).

1.9 Plant Groups

The four major groups of plants include grasses, trees, forbs, and shrubs. Studies have shown variations of isotopic composition in differing plant groups within the same sites (Hou et al., 2008; Diefendorf et al., 2011; Diefendorf et al., 2015B; and Oakes and Hren 2016). The most enriched to depleted δD_{wax} goes as follows: shrubs, trees, forbs, and grasses (Sachse et al., 2012). It is proposed that C_3 grasses are generally depleted compared to the other plant groups, which may be a result of their leaf structure. Grasses have long parallel veins in their leaves, whereas other plant groups have leaves with branching veins (Helliker and Ehlering, 2002a, 2002b). Helliker and Ehleringer (2000) proposed that in C_3 grasses, the vein structure influences the mixing of different sources of water within the leaf. The sources of water include stomatal water, leaf water, and vein water that can undergo different degrees of evaporation and impact the oxygen isotopic composition of each source. They proposed that the degree of mixing of these water sources is a function of vein distance which differs between C_3 and C_4 grasses. Smith and Freeman (2006) suggested that the mechanism affecting the oxygen isotopic composition could also affect the hydrogen isotopic composition of the leaf water and thus impacting the δD of leaf waxes. However, a recent study done by Zhou et al. (2016) looked at the differences in δD of leaf waxes from C_3 and C_4 plants and proposed that the differences were due to biochemical processes instead of leaf structure. Zhou et al., 2016 found that depending on the lipid-forming pathway used by C_3 and C_4 grasses, C_4 plants can be more depleted in deuterium than C_3.

Values for δD_{MAP} differ temporally and spatially, driven primarily by evaporation and condensation (Craig, 1961; and Gat, 1996). During evaporation, the isotopically lighter hydrogen

isotope is favored, leaving the heavier deuterium isotope behind in the water source (Gat, 1996). As the water-saturated air mass moves from its water source, condensation will cause the deuterium in the air mass to gradually rain out, leaving the air mass enriched in the lighter isotope. This pattern can be seen spatially in global isoscapes where air masses generally move poleward from the equator, imparting a signal on the precipitation (Yurtsever and Gat, 1981; Bowen and Revenaugh, 2003; and Bowen et al., 2005). The isotopic composition of precipitation varies over identifiable geographical scales, influenced by factors such as latitude, longitude, temperature, and elevation (Dansgaard, 1964; Bowen, 2008; and Bowen, 2010). One such example from Craig and Gordon (1965) showed that as more rain events occur, the lighter isotopes will travel further inland as the heavier isotopes get rained out, this is commonly known as the "continental effect." Temperature negatively correlates with δD_{MAP} due to its impact on isotopic fractionation, which decreases the enrichment of deuterium between water vapor and its source water (Dansgaard, 1964). Elevation in mountainous settings plays a major role in the fractionation of heavier isotopes causing saturated air mass to rise on the windward side of the mountain which, in turn, depletes δD_{MAP} (Smith, 1979; and Roe, 2005).

1.10 Previous Studies

Large spatial scale studies have shown a statistically robust offset between the δD_{wax} and δD_{MAP} (Sessions et al., 1999; Sachse et al., 2006; and Hou et al., 2008). These studies have found that the strength of the relationship between δD_{wax} and δD_{MAP} varies by dominant plant group and are likely due to differences in biochemical processes (Chikaraishi and Naraoka, 2003; Bi et al., 2005; Sachse et al., 2006; Smith and Freeman, 2006; Hou et al., 2007a; Pedentchouk et al., 2008; Sachse et al., 2009; Yang et al., 2010; Tipple and Pagani, 2013; and Oakes and Hren, 2016). The δD_{wax} extracted from soils and sediments are offset but also highly positively

correlated with δD_{MAP}, and are used to interpret changes in ecological environments (Feakins and Sessions, 2010; Tipple and Pagani, 2013; Oakes and Hren, 2016). While advances have been made using stable isotopes of lipid biomarkers for determining properties of source water and intracellular water in phototrophic organisms, factors related to environmental influence of isotopic integration into the plants and sediment are poorly understood (Sachse et al., 2012). A better understanding of the various mechanisms controlling the molecular distribution and isotopic composition of leaf waxes will assist quantitative reconstruction of paleoclimates.

Studies have also shown that the $\delta^{13}C$ of bulk plant tissue and the $\delta^{13}C$ of leaf waxes can be used to reconstruct the relative proportions of C_3 vs C_4 plants in a paleoecosystem, the isotopic composition of CO_2 in the atmosphere, and past aridity (Collister et al., 1994; Ehleringer et al., 1994; Bi et al., 2005; Diefendorf et al., 2010; Freeman et al., 2011; Cernusak et al., 2013; and Feakins et al., 2013). It has been suggested that the variation in bulk organic $\delta^{13}C$ are also reflected in leaf wax $\delta^{13}C$ (Castañeda and Schouten, 2011). The offset between atmospheric $\delta^{13}C$ and bulk plant $\delta^{13}C$ is known as the carbon discrimination ($\Delta leaf_{bulk/atm}$) (Farquhar et al., 1989). Studies have used the $\delta^{13}C$ of leaf waxes to reconstruct $\Delta leaf_{bulk/atm}$ even though there is an additional step of carbon fractionation between bulk $\delta^{13}C$ and $\delta^{13}C$ of leaf waxes by using a fixed value to account for this step (Smith et al., 2007; Diefendorf et al., 2010; and Diefendorf et al., 2015a). Diefendorf et al. (2010) found correlations between $\Delta leaf_{bulk/atm}$ and two variables, annual precipitation and elevation. However, Eley et al. (2016) has shown that an offset between $\delta^{13}C$ of *n*-alkanes and bulk $\delta^{13}C$ is not constant, rendering a fixed value for this fractionation inappropriate. If the offset between bulk $\delta^{13}C$ and $\delta^{13}C$ of *n*-alkanes varies, the climatic variables affecting $\Delta leaf_{bulk/atm}$ may not have the same relationship with $\Delta leaf_{wax/atm}$. Quantifying the

biological or environmental factors that influence the extent of $\Delta leaf_{wax/atm}$ could improve the quantitative information available from leaf wax biomarkers.

The majority of studies focusing on reconstructing $\Delta leaf_{bulk/atm}$ were in similar humid climates (Chikaraishi and Naraoka, 2003; Bi et al., 2005; Sachse et al., 2006; Smith and Freeman, 2006; Hou et al., 2007a; Pedentchouk et al., 2008; Sachse et al., 2009; Yang et al., 2010; Sachse et al., 2012; Tipple and Pagani, 2013; and Oakes and Hren, 2016), highlighting the need for studies in more diverse settings. This project seeks to develop a mechanistic understanding of the climatic conditions and environmental processes controlling the molecular and isotopic profiles of *n*-alkanes in a modern semi-arid/arid locations. Additionally, this study expands on previous studies to encompass the molecular and isotopic composition of *n*-alkanes across the conterminous U.S. to consider the influence of continental-scale spatial climate gradients.

2. Methods

2.1 Sampling locations

Samples were collected from 47 sites along a large sampling transect in the western United States during the summer of 2009 (Appendix A). The sampling transect spans from Colorado, Wyoming, Montana, Idaho, and Nevada circling around the Rocky Mountains. These mountain states are generally characterized with a semi-arid climate with some regions receiving more rainfall than others (Kottek et al., 2006). According to Koppen's climate classification, a semi-arid climate receives less rainfall than the amount evaporated on average annually.

At each site, multiple samples were collected from the surrounding grasses, trees, forbs, shrubs, and soils (Figure 4) (Appendix A). Site elevation ranged from 1171 to 3400 meters above

sea level. Mean annual relative humidity for the sampling locations ranged from 38% to 60%. Mean annual temperature ranged from 0 to 12 degrees Celsius and mean annual precipitation ranged from 176 to 825 mm/yr.

2.2 n-alkane extraction and analysis

The *n*-alkanes were extracted from the freeze-dried samples by soxhlet extraction using a 2:1 ratio of dichloromethane (DCM) to methanol. The *n*-alkanes were further separated by silica-gel column chromatography. Branched *n*-alkanes were separated from the straight-chained *n*-alkanes by urea adduction if needed. A Thermo Trace GC Ultra with flame ionization detector and a fused silica DB-1 phase column (60 m x 0.25 mm I.D., 0.25 μm film thickness) with helium as a carrier gas (1.5ml/min), was used in order to identify the *n*-alkanes chains and to determine its abundance present in the sample. Samples were injected into a split/splitless injector with initial temperatures of 260°C. Oven temperatures increased from 50°C to 250°C at a rate of 15°C/min, then from 250°C to 320°C at 6°C/min, and then held for 8 mins. The sample traces were then compared to known elution times using the *n*-alkane standard (Mix A5 prepared by A. Schimmelmann). Samples were then analyzed for isotopic composition on a GC Isolink coupled to a Thermo Scientific Thermo Delta V Plus gas isotope ratio mass spectrometer with a 30 m x 0.25 mm I.D., 0.25 μm film thickness BP-5 fused silica column with He as a carrier (1.5 ml/min). For bulk carbon analyses, freeze-dried soils were weighted out and measured on a Costech Elemental Analyzer coupled with a Thermo Scientific MAT 253 isotope ratio mass spectrometer.

2.3 Climate variables and δD_{MAP}

Geographic information software (ArcGIS) was used in order to map and extract the temperature, precipitation, relative humidity (RH), average vapor pressure deficit (VPD), and potential evapotranspiration (PET) values for the study sites. The data sets were obtained from Oregon Climate Group's PRISM (parameter-elevation regressions on Independent Slopes Model) and University of Montana's MODIS Global Evapotranspiration Project (MOD16). Annual mean temperature and annual mean precipitation were downloaded from PRISM group's 30 year normal 800 m rasters (1981-2010) and imported into ArcGIS. Minimum and maximum vapor pressure deficit rasters were downloaded from PRISM and averaged together for mean average VPD data. Relative humidity was calculated from equation 9 using the saturated vapor pressure (e_s) (equation 10) and actual vapor pressure (e) (equation 11). Saturated vapor pressure is calculated using the Tetens formula (Buck, 1981).

$$(9)\ RH = \left(\frac{e}{e_s}\right) * 100\%$$

$$(10)\ e_s = 6.11 * 10^{\left(\frac{17.269 * T_{mean}}{273.3 + T_{mean}}\right)}$$

$$(11)\ e = 6.11 * 10^{\left(\frac{17.269 * T_d}{273.3 + T_d}\right)}$$

Annual temperature is represented by T_{mean} and annual dew point temperature is presented by T_d, which were downloaded from PRISM. The δD of monthly and annual precipitation was calculated using the online isotope in precipitation calculator (OPIC). Growing season was defined at each site to occur between the end of the frost in the spring/summer and the first frost occurrence in the fall/winter. The δD of the growing season (δD_{MGP}) is a weighted average of monthly δD precipitation and monthly precipitation.

2.4 Data collection

In order to study how different environmental conditions within the United States affected the δD and $\delta^{13}C$ in biolipids across multiple climates, datasets were collected from Yang and Huang (2003), Sessions (2006), Smith and Freeman (2006), Hou et al. (2007), Pedentchouk et al. (2008), Tipple (2009), Diefendorf et al. (2010), Feakins and Sessions (2010), and Bush and McInerney (2015). All data, including the data collected during this study, were compiled into one dataset and are shown in Appendix B. Figure 5 shows the geographic sites for all compiled data. For this study, δD_{MAP} was calculated using Bowen's online precipitation isotope calculator (OPIC). Temperature, precipitation, RH, VPD, PET and isotopic water data were recalculated for each study site for consistency between the different studies (Appendix B), and then compared to the isotopic composition, hydrogen apparent fractionation, carbon discrimination, WUE, and ACL of the samples as simple linear regressions. For this study, the climate data for the semi-arid study is located in Appendix A and the climate data for the US analysis is located in Appendix B.

3. Results

3.1 δD of *n*-alkanes in a semi-arid environment

We measured 153 plant and soil *n*-alkanes with an isotopic composition of C_{25} to C_{33}. The δD values of these *n*-alkanes are presented in Appendix A. In this study, the compound abundance of C_{27} to C_{31} was used to calculate a δD weighted average for each individual sample, which is referred to as $\delta D_{C27\text{-}31}$.

δD_{C27-31} of all the plants and soils samples included in this study ranged from -293‰ to -134‰ with an average value of -208‰ and a standard error of ± 3.05‰. Sample size of δD_{C27-31} values varied for each plant group: forbs (n= 2), angiosperm shrubs (n= 42), C_3 grasses (n= 45), C_4 grasses (n= 3), angiosperm trees (n= 5), gymnosperm trees (n = 5), and soils (n= 46). Forbs and C_4 grasses were excluded from the semi-arid study due to their small sample size. Angiosperm trees and gymnosperm trees were included in this study in order to see the effects of how trees record hydrogen and carbon in their leaf waxes. The means of δD_{C27-31} from plant groups and soil samples also varied, with C_3 grasses averaging -246 ± 3.69‰, angiosperm shrubs averaging -178 ± 4.06‰, angiosperm trees averaging -173 ± 9.18‰, gymnosperm trees averaging -202 ± 3.47‰, and soils averaging -205± 3.39‰. The average of all vegetation combined was -210± 4.17‰. The distribution of δD_{C27-31} differed for each plant group and soils, with C_3 grasses being the most depleted in $\delta D_{C27-31,}$ angiosperm shrubs and angiosperm trees being enriched in $\delta D_{C27-31,}$ and soils along with gymnosperm trees fall within the average of the other plant groups (Appendix A).

This study found that δD_{C27-31} of grasses and soils show a correlation to δD_{MAP} (r^2 = 0.5034, p = 4.86E-08 and r^2 = 0.3189, p = 4.35E-05, respectively), while angiosperm shrubs, angiosperm trees, and gymnosperm trees did not (Figure 6). The δD_{C27-31} of C_3 grasses correlated with latitude (r^2 = 0.5401, p = 9.0E-09), annual VPD (r^2 = 0.4644, p = 2.56E-07), PET (r^2 = 0.4615, p = 2.88E-07), MAT (r^2 = 0.3997, p = 3.19E-06), and annual RH (r^2 = 0.4402, p = 6.79E-07). The δD_{C27-31} of soils also correlated with latitude (r^2 = 0.5639, p = 1.85E-09), annual VPD (r^2 = 0.3934, p = 3.09E-06), PET (r^2 = 0.3701, p = 7.28E-06), MAT (r^2 = 0.2456, p = 3.98E-04), and annual RH (r^2 = 0.5677, p = 1.52E-09) (Appendix A).

3.2 *$\delta^{13}C$ of n-alkanes and bulk carbon in a semi-arid environment*

The $\delta^{13}C_{C27\text{-}31}$ of all samples ranged from -38‰ to -25‰ with an average value of -32 and a standard error of ± 0.17‰. The means for soils and for each plant group varied, with C_3 grasses averaging -34 ± 0.27‰ (n = 43), angiosperm shrubs averaging -32 ± 0.27‰ (n = 42), angiosperm trees averaging -33 ± 0.65‰ (n = 5), gymnosperm trees averaging -31 ± 0.49‰ (n = 5), and soils averaging -32 ± 0.21‰ (n = 45). The bulk carbon of the soils averaged -25 ± 0.23‰ (n =41).

Plots of $\delta^{13}C_{C27\text{-}31}$ vs $\delta D_{C27\text{-}31}$ reveal distinct groupings, with C_3 grasses being most depleted in both carbon and hydrogen isotopic composition (Figure 7). The same distinct groupings are also observed in plots of $\Delta leaf_{C27\text{-}31/atm}$ and $\varepsilon_{C27\text{-}31/MAP}$ (Figure 7). For the carbon discrimination ($\Delta leaf_{C27\text{-}31/atm}$), no relationships with any of the climate variables tested (Figure 8). There is a weak relationship between $\delta^{13}C_{C27\text{-}31}$ of the soil *n*-alkanes and the bulk $\delta^{13}C$ (r^2 = 0.255) (Figure 9); however, the offset between soil $\delta^{13}C_{C27\text{-}31}$ and bulk $\delta^{13}C$ varies from site to site which may be masking a correlative relationship (Figure 10). There is large variability in the fractionation between the bulk carbon of the soils and the isotopic carbon of the *n*-alkanes from the soils (Figure 11).

3.3 *ε of n-alkanes in a semi-arid environment*

We calculated the apparent fractionations between the δD of the waxes and both the δD of the mean annual precipitation ($\varepsilon_{C27\text{-}31/MAP}$) and the δD of the mean growing season precipitation ($\varepsilon_{C27\text{-}31/MGP}$). For $\varepsilon_{C27\text{-}31/MAP}$ the range was -207‰ to -38‰ with an average of -116 ± 3.2‰ (n= 146). C_3 grasses had the most depleted $\varepsilon_{C27\text{-}31/MAP}$ mean of -158 ± 3.34‰ (n = 45), followed by soils with a mean of -112 ± 3.2‰ (n = 46). The $\varepsilon_{C27\text{-}31/MAP}$ mean was -97 ± 4.25‰

for gymnosperm trees (n = 5), -83 ± 4.13‰ for angiosperm shrubs (n = 42), and -81 ± 7.9‰ for angiosperm trees (n = 5). The distribution of the apparent fractionation was similar for angiosperm shrubs, angiosperm trees, and gymnosperm trees while the distribution for grasses and soils was more depleted (Figure 12).

The $\varepsilon_{C27\text{-}31/MGP}$ was found to be more depleted than $\varepsilon_{C27\text{-}31/MAP}$. The $\varepsilon_{C27\text{-}31\text{-}MGP}$ for plants and soils ranged from -222‰ to -55‰ with a mean of -135 and a standard error of ± 3.19‰. The calculated $\varepsilon_{C27\text{-}31\text{-}MGP}$ mean values from most depleted to least depleted are: C_3 grasses with -176 ± 3.59‰, soils with -131 ± 3.34‰, gymnosperm trees with -120 ± 3.56‰, angiosperm shrubs with -102 ± 4.15‰, and angiosperm trees with -99 ± 8.53‰ (Appendix A).

The results show that for angiosperm shrubs $\varepsilon_{C27\text{-}31/MAP}$, there was no relationship with the other climate variables in this study; however, a correlation with $\varepsilon_{C27\text{-}31/MAP}$ and latitude for C_3 grasses (r^2 = 0.096, p = 2.20E-06), angiosperm trees (r^2 = 0.7039, p = 0.7.56E-02), and soils (r^2 = 0.3873, p = 3.88E-06). The $\varepsilon_{C27\text{-}31/MAP}$ for C_3 grasses and soils had a relationship with annual RH (C_3 grasses r^2 = 0.3131, p = 6.45E-05, soils r^2 = 0.3858, p = 4.10E-06). The $\varepsilon_{C27\text{-}31/MAP}$ weakly correlated with mean annual VPD for C_3 grasses (r^2 = 0.2556, p = 3.96E-04); however, for $\varepsilon_{C27\text{-}31\text{-}MGP}$, latitude correlated for C_3 grasses (r^2 = 0.4425, p = 1.98E-07) and soils (r^2 = 0.4424, p = 7.81E-08) and mean growing RH for soils (r^2 = 0.381, p = 4.76E-06) (Figure 13).

3.4 ACL and WUE in a semi-arid environment

ACL of the samples ranged from 26 to 33 with an average of 29 ± 0.08. The mean ACL of each plant group were similar, with C_3 grasses = 30 ± 0.10 (n = 42), angiosperm shrubs = 29 ± 0.09 (n = 41), angiosperm trees = 29 ± 0.34 (n = 5), gymnosperm trees = 28 ± 0.55 (n = 5), and soils = 30 ± 0.09 (n = 45). For the samples collected from a semi-arid environment, no

relationships were identified between ACL and the climate/spatial variables that were tested. The water-use efficacy (WUE) of the samples were compared to the climate/spatial variables in this study, and showed no relationships.

3.5 US Data analysis

The δD and $\delta^{13}C$ values of the *n*-alkanes from previous studies are presented in in Table 10 of Appendix B. Since abundances of these *n*-alkanes were not reported in the other studies, the weighted averages of δD and $\delta^{13}C$ could not be calculated. For the remainder of the US analysis, δD_{C29} and $\delta^{13}C_{C29}$ will be used. Plant groups that were analyzed in this study were forbs, angiosperm shrubs, C_3 grasses, C_4 grasses, angiosperm trees, and gymnosperm trees.

3.5.1 δD and $\delta^{13}C$ of US Soils

Soils had an average δD_{C29} of -183 ± 3.13‰ (n = 83) and an average $\delta^{13}C_{C29}$ of -32 ± 0.17‰ (n = 93). Our results also show δD_{C29} is positively correlated to δD_{MAP} with soils having the strongest correlation (r^2 = 0.477, p = 5.02E-13). The δD_{C29} values did not correlate with δD_{MGP} as well as δD_{MAP} (Figure 14). Stronger relationships were found between δD_{C29} and latitude (r^2 = 0.5687, p = 1.99E-14) as well as temperature (r^2 = 0.5736, p = 1.07E-15) (Appendix B). No relationships were found for $\delta^{13}C_{C29}$ and any of the climatic variables tested.

3.5.2 $\varepsilon_{C27-31/MAP}$ of soils in US

Overall, soils in the United States had an average $\varepsilon_{C27-31/MAP}$ of -103 ± 2.50‰. The data show that the apparent fractionation of soils varied in different climates throughout the US. The three main climates and environments that these soils were sampled from are: semi-arid climate in scrubland/grassland, humid climate in temperate forests, and a Mediterranean climate in a scrubland/woodland environment (Sayre et al., 2009). The distribution for $\varepsilon_{C27-31/MAP}$ ranged

from -139‰ to -88‰ for a humid climate, -57‰ to -92‰ for a Mediterranean climate and -147‰ to -60‰ for a semi-arid climate. The distribution and range of $\varepsilon_{C27-31/MAP}$ for the soils in a semi-arid climate is larger than the other two climates (Figure 15). The means of $\varepsilon_{C27-31/MAP}$ for each climate is statistically different using a one way ANOVA test (p = 4.89E-13) (Table 1). Only mean annual VPD had a relationship between $\varepsilon_{C27-31/MAP}$ of the soils in the US (r^2 = 0.567, p = 1.02E-06) (Figure 16).

3.5.3 ACL Soils in the US

In the review of previously published literature, the number of chain lengths used to calculate ACL varied. Bush and McInerney (2015) used chain lengths 21 to 39 and Tipple and Pagani (2013) used chain length 23 to 35. In this study used chain lengths 23 to 35. However, the soil *n*-alkane concentration from dataset in Bush and McInerney (2015) was very low to non-detected for peaks 21 to 23 and 36 to 39. This suggests that even though the study used additional chain lengths, the overall contribution of these additional chain lengths was not enough to effect the overall ACL.

Soils within the United States had an average ACL of 30 ± 0.07 (n = 143). In this study, the ACL of soils has a positive relationship with latitude, PET, VPD, and MAT (Figure 17). The focus was on the results of soil ACL and its relationships with VPD and MAT. In order to determine what factors could be contributing to this relationship, data were separated by climate and vegetation type (Figure 18). Although a relationship was found between soil ACL and MAT, climate or vegetation type did not appear to influence the relationship. Similarly, no relationship was identified between soil ACL and growing season VPD or soil ACL and MGT. A relationship between temperature and VPD revealed three distinct trends dependent on the different climate (Figure 19).

3.5.4 δD of plant groups in the US

The range of δD_{C29} from all the plants was -298‰ to -102‰ with a mean of -186 ± 1.8‰ (n= 349). Out of all the other plant types and soil groups, C_3 grasses had the most depleted mean of -238 ± 3.05‰ (n = 70), followed by C_4 grasses with -203 ± 5.36‰ (n = 27), gymnosperm trees with -179 ± 3.13‰ (n = 40), forbs with -172 ± 8.27‰ (n = 14), angiosperm shrubs with -176 ± 3.11‰ (n = 81), and angiosperms trees with a mean of -160 ± 2.45‰ (n = 117). The average δD_{C29} value for all the vegetation is -186 ± 2.10‰ (n = 349). The δD_{C29} plotted against δD_{MAP} showed different strengths in the relationships for each plant type (Appendix B).

3.5.5 $\delta^{13}C$ of plant groups in the US

The $\delta^{13}C_{C29}$ of all samples ranged from -39‰ to -24‰ with an average value of -33 ± 2.18‰. C_3 grasses had an average of -34 ± 0.27‰ (n = 43), angiosperm shrubs had an average of -32 ± 0.22‰ (n = 63), angiosperm trees had an average of -34 ± 0.22‰ (n = 69), and gymnosperm trees had an average of -31 ± 0.20‰ (n = 45). The sample sizes for forbs (n = 2) and C_4 grasses (n = 3) were too small to be analyzed. No correlations were found in the collective $\delta^{13}C_{C29}$ values with any climatic variables tested. There was also no relationship identified between $\delta^{13}C_{C29}$ vs δD_{C29} of the collective samples (Figure 20). For, $\Delta leaf_{bulk/atm}$ was calculated from measured bulk carbon data and $\Delta leaf_{C29/atm}$ was calculated from measured *n*-alkane data. Contrary to other studies (Diefendorf et al., 2010), there was no relationship between $\Delta leaf_{bulk/atm}$, and precipitation or elevation (Figure 21). There was also no relationships found between $\Delta leaf_{C29/atm}$ with precipitation or elevation (Figure 21).

3.5.6 Apparent fractionation of different plant groups US Data analysis

The apparent fractionation of the samples was compared to the climatic variables in order to identify factors influencing variation of δD_{C29} in *n*-alkanes. A large range of $\varepsilon_{C29/MAP}$ was calculated between -216 to -26, with an average of -110 ± 1.77. The hydrogen apparent fractionation of different plant groups were very similar with the exception of the grasses, which were more depleted than the rest (Table 2). No large differences were identified in distribution of $\varepsilon_{C29/MAP}$ between the different plant types and soil groups (Figure 22). Furthermore, it was found that the average $\varepsilon_{C29/MAP}$ between all the vegetation is -112 ± 2.10‰ while for soils the average is -103 ± 2.50‰.

The $\varepsilon_{C29/MGP}$ was calculated for all samples across the United States, which were more depleted than $\varepsilon_{C29/MAP}$. The range of all the samples was -228 to -37 with an average of -126 ± 1.89. Again, the $\varepsilon_{C29/MGP}$ of the different plant types and soil groups were very close to each other with the exception of the grasses, where were more depleted (Appendix B).

The results of this study show that the $\varepsilon_{C29/MAP}$ in the majority of the plant groups did not have a correlation with any of the climate variables except mean annual VPD (Appendix B). For the $\varepsilon_{C29/MAP}$ and VPD, angiosperm trees showed a correlation (angiosperm trees $r^2 = 0.4615$, p = 3.79E-17). For $\varepsilon_{C29/MGP}$, no relationships with the climate variables, including VPD (Appendix B).

3.5.7 ACL of plant groups in US

ACL ranged from 24 to 34 with a mean of 30 ± 0.09 (n = 307) or all samples included in this study. The means of the different plant groups were very close to one another with C_3 grasses mean of 30 ± 0.10 (n = 42), angiosperm shrubs with 29 ± 0.14 (n = 41), angiosperm trees

with 30 ± 0.14 (n = 39), and gymnosperm trees with a mean of 30 ± 0.58 (n = 37). This study did not find any differences in the distribution of ACL between the different plant groups and soil groups (Appendix B).

Our results show that most of the plant types ACL had no relationship with the climate variables tested. For ACL vs latitude, only angiosperm trees had a weak relationship (r^2 = 0.2659, p = 7.8E-04). Angiosperm tree ACL had relationships with PET (r^2 = 0.341, p = 2.73E-04) and MAT (r^2 = 0.3333, p = 1.5E-04) (Appendix B).

3.5.8 Isoscapes of the United States

North American Molecular Iscoscapes were created in order to see the spatial distribution of δD, $\delta^{13}C$, ε and ACL from *n*-alkanes within the United States. Soils showed the most completed spatial trends compared to plants. For $\delta^{13}C_{C29}$, the east coast and west coast showed a general trend of depleting carbon with increasing latitude. However in the mid-western US, the opposite trend is seen with decreasing carbon value corresponding with decreasing latitude (Figure 23). For δD of the soils, they showed a positive relationship δD_{C29} of mean annual precipitation (Figure 24). General trends showed depleting δD values with increasing latitude and increasing distance from the coasts. As for $\varepsilon_{C29/MAP}$, it was observed generally invariant values for both the east and west coasts. In the mid-western US, enriched $\varepsilon_{C29/MAP}$ values are seen in lower latitudes and depleted $\varepsilon_{C29/MAP}$ values in higher latitudes (Figure 25).

4. Discussion

4.1 δD_{C27-31} and $\varepsilon_{C27-31/MAP}$ n-alkanes from semi-arid climates

Varying relationships are identified between the δD_{C27-31} of the plant groups or soils and the δD_{MAP}, in a semi-arid environment. Overall, the majority of the plant groups showed a weak relationship between δD_{C27-31} and δD_{MAP}, with the exception of C_3 grasses and soils which is similar to what Feakins and Sessions (2010) found in southern California. This relationship between δD_{C27-31} of C_3 grasses and δD_{MAP} could be explained by the shallow root depth of C_3 grasses. Due to the semi-arid climate, groundwater is often too deep for grass roots, causing grasses to heavily rely on precipitation as their water source (Boutoon et al., 1999; and Welker, 2000). The other plant groups (shrubs, forbs, angiosperm trees, and gymnosperm trees) could rely on both groundwater and precipitation as a result of having deeper root depths. This would affect the relationship between δD_{C27-31} of soils and δD_{MAP}, due to the integration of δD_{C27-31} from all the plant groups (Tipple and Pagani, 2013; Oakes and Hren, 2016). Other studies have found a stronger relationship between δD_{C27-31} of different plant groups /soils and δD_{MAP} in humid climates (Sache et al., 2012; and Tipple and Pagani, 2013). In addition, it has been noted that the OPIC δD_{MAP} values are more negative than measured δD_{MAP}, especially in arid conditions (Table 3) (Smith and Freeman, 2006; and Feakins and Sessions, 2010). This error in the OIPC within semi-arid to arid climates could explain the lack of correlation between δD_{C27-31} and δD_{MAP} for these plant groups. The average δD_{C27-31} of vegetation was -210‰ and for soils the average was -205‰. These values were very close together, suggesting that soils are able to reflect long term averaging of *n*-alkanes from the ecosystem and eliminate the noise from individual plant types. By doing so, this explains why there is a stronger relationship between δD_{C27-31} of the soils and δD_{MAP}, which allows us to use soils as a proxy for reconstructing past δD_{MAP} values.

The correlations between C_3 grasses and soil δD_{C27-31} and latitude, mean annual PET, mean annual VPD, and MAT in semi-arid climates were the strongest in this study. However, the three climate variables are related to one another and co-vary with latitude. Since fractionation of hydrogen isotopes is heavily impacted by temperature, this would explain the correlations to one another. In semi-arid environments, $\varepsilon_{C27-31/MAP}$ was generally higher at lower latitudes and gradually decreased into higher latitudes. Of the climate variables tested against $\varepsilon_{C27-31/MAP}$, $\varepsilon_{C27-31/MAP}$ of C_3 grasses and soils weakly correlated with mean annual RH and mean annual VPD. There is an overall decrease in mean annual RH and an increase in mean annual VPD, which causes an increase in positive values for $\varepsilon_{C27-31/MAP.}$ This could be due to an increase in evaporation of source water and/or increase in transpiration of leaf water for the plants, which results in more positive δD_{C27-31} values. C_3 grasses could be the most sensitive to this due to relying more on precipitation and shallow soil water which would see greater effects from evaporation. There is some debate on the impact of leaf water transpiration on the δD_{C27-31} values of plants. Kahmen et al. (2013) found leaf water D-enrichment from transpiration fully impacted dicot plants, while for moncot grasses, 18% to 68% of the leaf water D-enrichment effected the δD_{C27-31} values. In McInerney et al.'s 2011 study, they suggested that grasses are insensitive to leaf water D-enrichment and reflect soil water D-enrichment. However, the weak relationship between $\varepsilon_{C27-31/MAP}$ of C_3 grasses and soils with mean annual RH and mean annual VPD does not fully explain the variability seen in the $\varepsilon_{C27-31/MAP}$ values. Further studies are needed to understand the drivers behind $\varepsilon_{C27-31/MAP}$ values in a semi-arid environment.

4.2 $\delta^{13}C$ of plant and soil n-alkanes in a semi-arid environment

Bulk $\delta^{13}C$ and $\delta^{13}C_{C27-31}$ are weakly correlated and the apparent fractionation between the two values varied between different sites in a semi-arid environment. This highlights the

complexity of carbon fractionation from the bulk $\delta^{13}C$ and *n*-alkanes $\delta^{13}C$ in plants. This variation between the offset of bulk $\delta^{13}C$ and $\delta^{13}C_{C27-31}$ in soils has important implications for studies using the carbon isotopic composition of *n*-alkanes for paleoenvironment reconstructions. Some studies use a fixed value as the apparent fractionation to calculate bulk $\delta^{13}C$ from *n*-alkane $\delta^{13}C$ (Smith et al., 2007; Tipple and Pagani, 2007; Diefendorf et al., 2010; and Diefendorf et al., 2015a, b). Based on the results in this study, it may not be appropriate to use a fixed value due to the variation of offset between bulk $\delta^{13}C$ and $\delta^{13}C_{C27-31}$ in soils.

No relationship was found between $\Delta leaf_{C29/atm}$ and any climate variables tested in semi-arid for the majority of plant groups and soils. Diefendorf et al. (2010) found that globally $\Delta leaf_{bulk/atm}$ showed relationships to MAP and altitude. This study also did not find a relationship in our US analysis between $\Delta leaf_{bulk/atm}$ and any of the climate variables. A precipitation threshold could explain why Diefendorf et al. (2010) (Figure 26) found relationship between $\Delta leaf_{bulk/atm}$ and climate variables while this study did not. The sites for the US study ranged in precipitation from 167 mm/year to 2126 mm/yr with the majority of the sites receiving less than 1500 mm/yr. Diefendorf et al. (2010) had sites ranging in precipitation from 147 mm/yr to 3700 mm/yr. Looking at Figure 26, the relationship between $\Delta leaf_{bulk/atm}$ and MAP is much stronger at MAP values greater than 1500 mm/yr. Potentially, there may be a threshold for precipitation where the relationship for $\Delta leaf_{bulk/atm}$ and MAP weakens.

This study found significant variation in the fractionation ($\varepsilon_{C27-31/bulk}$) between *n*-alkane $\delta^{13}C$ and bulk $\delta^{13}C$ from plants. Eley et al. (2016) found variation in offset between bulk $\delta^{13}C$ and *n*-alkane $\delta^{13}C$ from plants in saltmarshes throughout the growing season. Previous studies have shown that environmental factors, biochemical processes, and biological differences among plant groups impact this carbon fractionation (Hayes, 2001; Tipple and Pagani, 2007; Tcherkez et al.,

2011; and Eley et al., 2016). These factors compounded with change in vegetation input could explain the variation in offset between the bulk $\delta^{13}C$ and $\delta^{13}C_{C27-31}$ in the soils.

4.3 n-alkanes of soils in the US

From the analysis of soils for all the datasets from the US, average values for δD_{C29}, $\delta^{13}C_{C29}$, and $\varepsilon_{C29/MAP}$ were very similar to the averages of the all the different plant groups. This suggests that soils can provide a reliable representation of the ecosystem. Soil δD_{C29} strongly correlated to latitude, temperature, and δD_{MAP}, which is consistent with covariance of δD_{MAP} with latitude and its temperature dependence.

For soil $\varepsilon_{C29/MAP}$, no relationships were found with any climate variable, except for a weak relationship with mean annual VPD, which is likely insignificant. The average value for a humid climate in temperate forests is -117 ± 3‰, Mediterranean climate in chaparral/woodland is -77 ± 3‰, and a semi-arid climate in scrubland/grassland is -108 ± 3‰. The distribution of soil $\varepsilon_{C29/MAP}$ between humid climate for temperate forests and Mediterranean climate for chaparral/woodland is distinct, while a larger range is observed in semi-arid climate and scrubland/grassland. This large range in scrubland/grassland may be due to the error in δD_{MAP} values associated with Bowen's model. The soil $\varepsilon_{C29/MAP}$ isoscape shows relatively low variance in a Mediterranean climate for chaparral/woodland and semi-arid climate for scrubland/grassland, and that soil $\varepsilon_{C29/MAP}$ changes as a function of latitude.

4.4 Climatic impacts on soil ACL

Other studies have also found that soil ACL has a stronger relationship with temperature and aridity than vegetation (Carr et al., 2014 and Bush and McInerney, 2015). This study found a relationship between soil ACL and mean annual VPD and MAT. Shepherd and Griffiths (2006)

found that increases in temperature and water stress causes the plant to increase its production of leaf waxes. It was suggested that this mechanism protects the plant from additional water loss and provides additional UV protection. Other studies have also found that increases in VPD causes increases in leaf wax production in order to minimize leaf water transpiration (Meinzer, 1982, Sáchez et al., 2001; and Mohammadian et al., 2007). Since the impacts of temperature and mean annual VPD on plant ACL are noted, it could be suggested that the soils are recording these impacts as well. A suggestion for the changes in soil ACL can be interpreted as either changes in temperature or water availability. Since it is still unclear whether temperature or water availability is the primary driver behind ACL, further investigation is needed on modern plants.

4.5 Implications for paleoclimate reconstruction

This study has found important relationships between $\varepsilon_{C29/MAP}$ values and ACL values of soils to climatic variables. These relationships can allow better interpretations of $\varepsilon_{C29/MAP}$ values and ACL values of sediments for paleoclimate reconstructions. However, more work needs to be done before using $\varepsilon_{C29/MAP}$ values and ACL values of sediments for paleoclimate reconstructions. Douglas et al. (2014) found waxes deposited in surface sediments were older than the surrounding modern bulk deposition, highlighting the importance of radiocarbon dating on the waxes to ensure temporally accurate reconstructions. The wax production in modern plants vary, which can bias the sediment record (Otto and Simpson, 2005; and Diefendorf et al., 2011). Differences in these concentrations influence the contribution of waxes from varying plants in a given ecosystem. Different plant groups also produce different isotopic composition in their plant leaf waxes which can impact the interpretation of plant community shifts or changes in climate. Further studies are needed in order to see the impacts of this. Sachse et al. (2012) also

emphasized the importance of studying how these waxes are deposited and transported in the soils.

4.6 δD of plant n-alkanes in the US

No strong relationships were identified between δD_{C29} of the vegetation and δD_{MAP} or δD_{MGP}. Although Sachse et al. (2012) found stronger relationships between climate and δD_{C29} of the plant groups, their analysis did not include semi-arid climates. In this study, δD of *n*-alkanes from vegetation in semi-arid climates had a much weaker relationship with δD_{MAP} than other vegetation in humid climates. This is supported by the results of the study done by Feakins and Sessions (2010) in southern California. The addition of the data from semi-arid climates can introduce more noise and weaken this overall relationship; however, data in this study suggest that soils are averaging the ecosystem and are able to record δD_{MAP} over time, resulting in a stronger relationship between soil *n*-alkanes and $\delta D_{MAP.}$ Due to the climate-dependent difference in the strength of the relationship between the δD soil *n*-alkanes and δD_{MAP}, further studies are needed to delineate how climates affect this relationship.

4.7 Growing season vs Mean annual values

Plants synthisize their waxes during the growing season although there is a debate on the timing of leaf wax synthesis. Studies have suggested that the waxes are produced during a two week period in the spring (called leaf flush), recording the isotopic composition of the enviornment during this time (Kahmen et al., 2011; Tipple et al., 2012; and Tipple and Pagani, 2013). However, Jenks et al. (2002) found increases in wax production in early spring, a decrease in wax coverage from spring to summer (due to erosion from rain and wind), and then an increase again from summer to autumn. Plants that experience wax abrasion from these

natural conditions are able to produce more waxes but maybe unable to reproduce at the same rate as waxes loss (Hall and Jones, 1961). Studies have also shown that the waxes being reproduced throughout the growing season are using leaf water (Gao et al., 2012; Gao and Huang, 2013; and Gao et al., 2015). Other studies have also found the distribution of *n*-alkane chain length reflects summer temperatures (Tipple and Pagani, 2013; and Bush and McInerney, 2015). Oakes and Hren, 2016 sampled four plants in a river catchment and found only one of the plants produced all its waxes during leaf flush, while the other three contiuned to produce leaf waxes throughout the growing season. They also found δD and $\varepsilon_{wax/MAP}$ values of the plants changed throughout the growing season while the fluvial sediments had a relatively constant $\varepsilon_{wax/MAP}$ during the sampling period. In our study, δD_{C29} generally had a much stronger relationship with δD_{MAP} rather than δD_{MGP} for the majority of the plant groups and soils. For apparent fractionation of hydrogen, using δD_{MAP} to calcualate $\varepsilon_{C29/MAP}$ produced stronger relationships to climate variables than using δD_{MGP}; however, the $\varepsilon_{C29/MAP}$ and $\varepsilon_{C29/MGP}$ for forbs produced similar relationships to the climate variables suggesting no difference between the two. As for chain length distribution, the mean annual climate variables produced stronger relationships to ACL than using mean growing season climate values. These results indicate that invidiual plants are influcenced by a number of factors which can impact the timing of leaf wax synthesis. Furthermore, using the mean annual values for δD and climatic variables produce stronger relationships to the isotopic composition and ACL of *n*-alkanes.

4.8 North American Molecular Isoscapes

The Isoscape for $\delta^{13}C_{C29}$ soils shows that there does not seem to be a spatial trend and more research should be done in the United States. For δD_{C29} soils, the spatial patterns of the samples followed the spatial patterns of δD_{precip} (Figure 29). For the plant isoscapes, no spatial

trends were found. Additional future studies and the resulting data will further improve these isoscapes and the ability to use them.

5. Conclusion

This study contributed a higher resolution dataset for *n*-alkanes in a semi-arid environment. The relationship between $\delta D_{C27\text{-}31}$ of modern plants and δD_{MAP} is relatively weaker in a semi-arid environment than compared to plants in other climates. However, in a semi-arid environment $\delta D_{C27\text{-}31}$ of soils have a much stronger relationship to δD_{MAP} than the plant groups. This relationship is weaker in semi-arid climates than in other types of climates (Tipple, 2009; Feakins and Sessions, 2010; and Tipple et al., 2013). The difference in this relationship maybe due to using the OIPC, which has been shown to have large errors in calculating δD_{MAP} in semi-arid climates (Feakins and Sessions, 2010). In our sampling tract, it was found that $\varepsilon_{C27\text{-}31/MAP}$ was more enriched in the southern latitudes and became more depleted at higher latitudes. No strong relationships were observed between $\varepsilon_{C27\text{-}31/MAP}$ of our samples and the climatic gradients, suggesting further investigation may be needed to identify other potential controls.

In the soils from the western US, the offset between the bulk $\delta^{13}C$ and *n*-alkane $\delta^{13}C$ varied. This highlights the uncertainty of carbon fractionation during wax biosynthesis and suggests that a constant value should not be used to account for this offset. Future research should measure bulk $\delta^{13}C$ when calculating $\Delta leaf_{bulk/atm}$. No relationships were found between $\Delta leaf_{C27\text{-}29/atm}$ and $\Delta leaf_{bulk/atm}$ and any climate variables throughout the US. Although previous work had identified globally strong relationships between $\Delta leaf_{bulk/atm}$ with precipitation and elevation. This difference between studies may be a result of a precipitation threshold.

Within the US, complex relationships were identified between the varying plant groups and the climatic variables tested. However, soils are able to integrate *n*-alkanes from the ecosystem overtime and are able to eliminate some of the noise produced by plants. The apparent fractionation of soils and δD_{MAP} varies by climate. More studies are needed in semi-arid climates to better constrain the controls of $\varepsilon_{C29/MAP}$. These soils are able to record δD_{MAP}, and if the appropriate apparent fractionation can be applied, this proxy can be used for better interpretations of paleoclimate records. The ACL of these soils can also potentially provide a paleoclimate proxy. Both temperature and water availability act as a driver in ACL due to its relationships with mean annual VPD and MAT. The isoscapes produced from this study give insight on how $\delta^{13}C$, δD, and $\varepsilon_{wax/MAP}$ can change spatially. Over time, with the addition of more data, iscosapes will be a valuable tool for interpreting trends of $\delta^{13}C$, δD, and $\varepsilon_{wax/MAP}$ from *n*-alkanes.

6. Figures

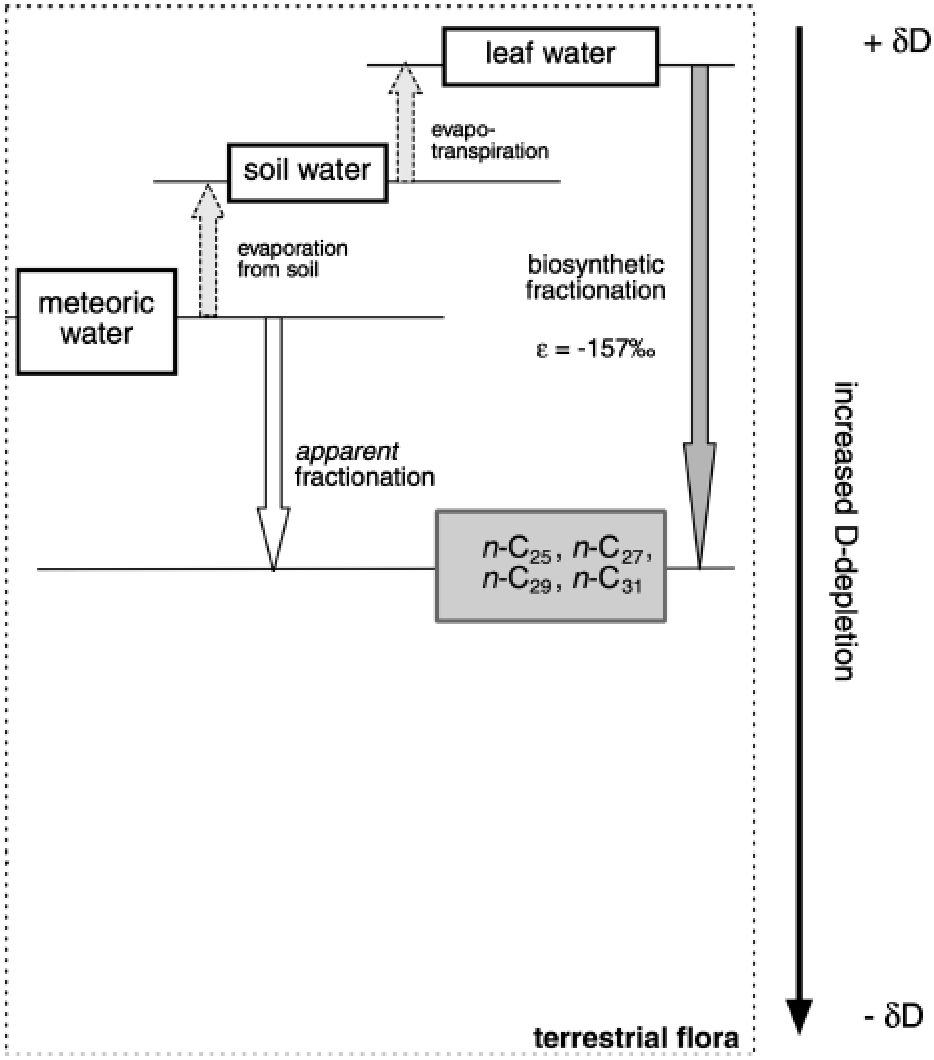

Figure 1. Flow diagram showing the different steps of potential fractionation as $\delta D_{precipitation}$ is taken up by in terrestrial plants and used for *n*-alkane production. Evaporation and transpiration of the soil/leaf water increases D-enrichment as the lighter hydrogen isotopes are preferred in these steps. Afterwards, the water within the leaf is used for lipid biosynthesis which prefers the lighter isotope, causing D-depletion. The apparent fractionation is the difference between $\delta D_{precipitation}$ and δD_{wax} (Adopted from Sachse et al., 2006).

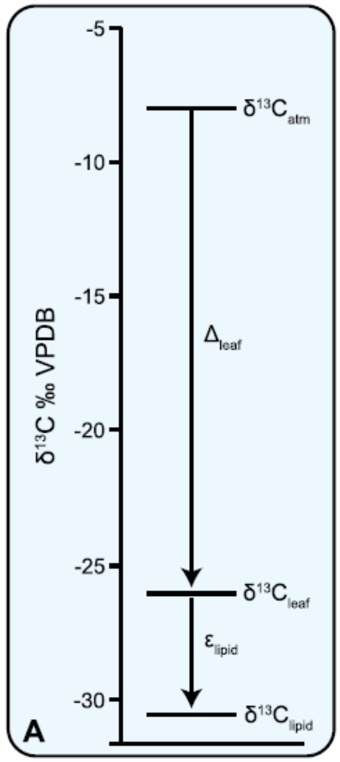

Figure 2. A schematic describing the fractionation of carbon as it gets taken in by the plant and used to produce *n*-alkanes. There are three key steps in controlling the magnitude of fractionation between the atmospheric carbon ($\delta^{13}C_{atm}$) and carbon of the leaf wax ($\delta^{13}C_{leaf}$). These sources of carbon fractionation occurs during: carbon diffusion through stomata pores, photosynthesis, and biosynthesis of leaf waxes. $\Delta leaf_{bulk/atm}$ represents the fractionation of carbon between the carbon isotopic composition of the bulk tissue and the atmosphere. $\Delta leaf_{lipid/atm}$ represents the fractionation of carbon between the carbon isotope of the leaf wax and the atmosphere. ε_{lipid} represents the fractionation of carbon between the bulk tissue and the leaf wax. (Modified from Diefendorf et al., 2015).

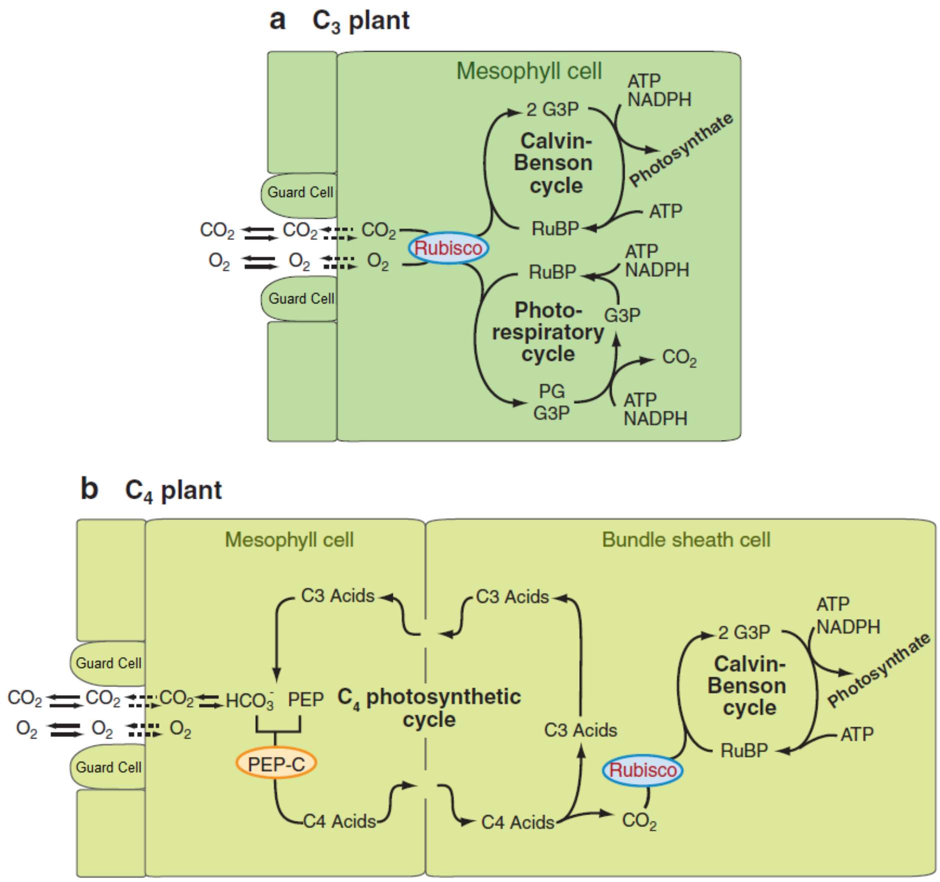

Figure 3. A diagram of the C_3 (a) and C_4 (b) photosynthetic pathways, both use the Calvin-Benson Cycle. However, the C_4 pathways fixes carbon to PEP-C in the mesophyll cell in order to prevent photorespiration from occurring. (Modified from Tipple and Pagani, 2007).

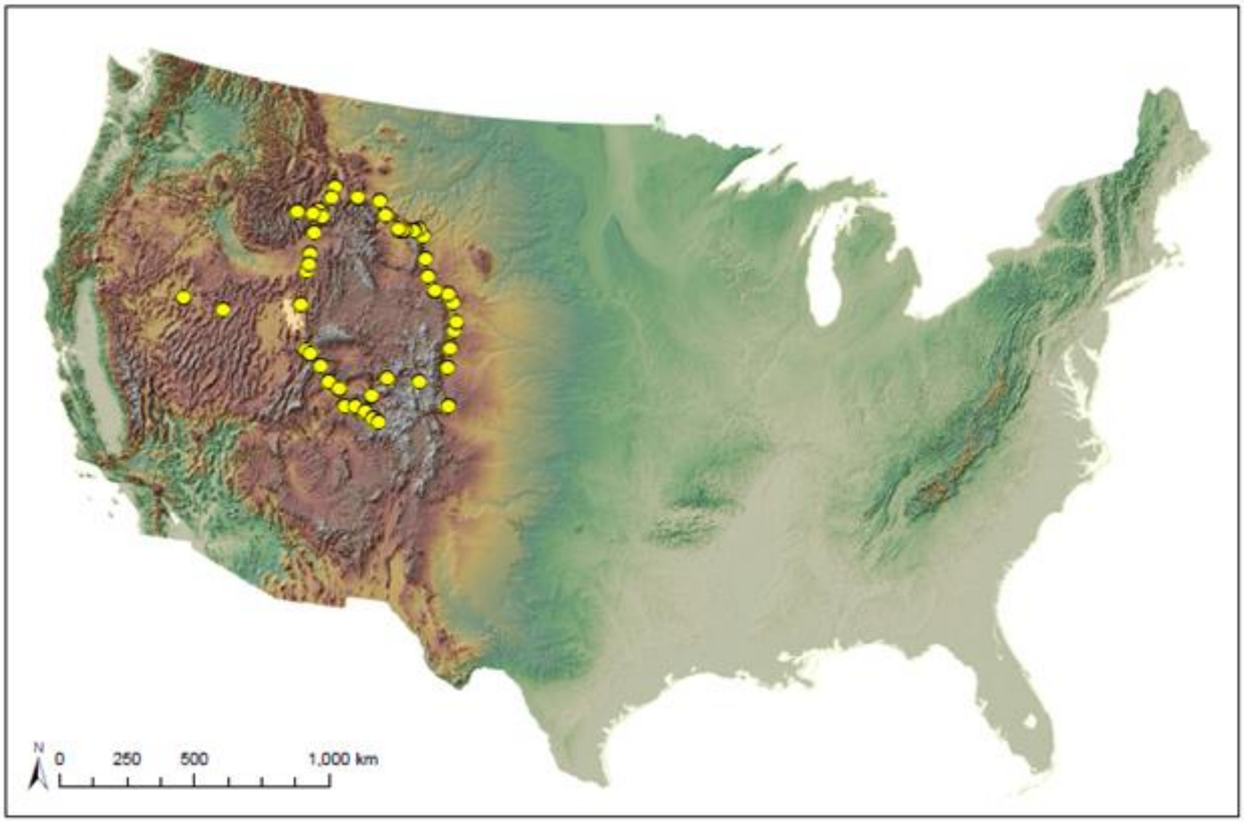

Figure 4. Map of sampling sites (yellow dots) for this study in a semi-arid environment.

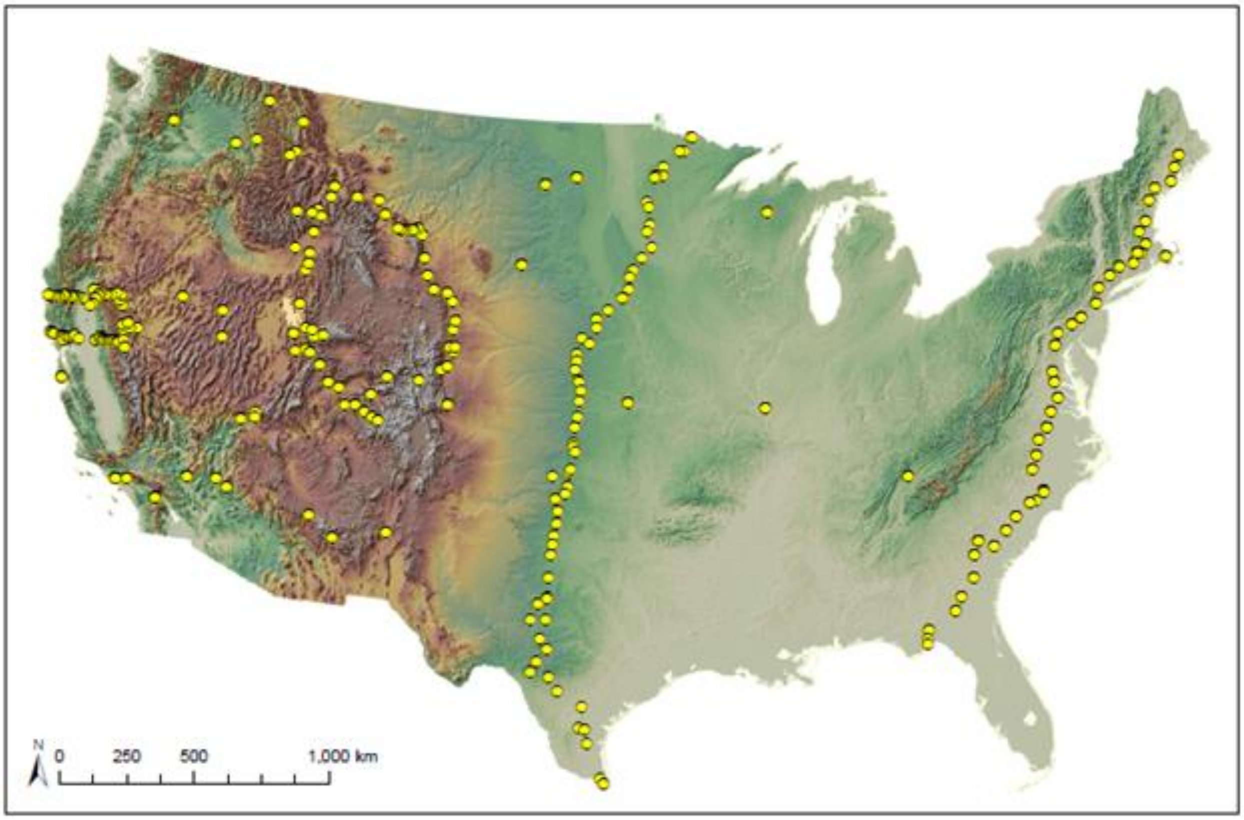

Figure 5. Sample sites (yellow dots) from both this study and published δD, $\delta^{13}C$, apparent fractionation, and *n*-alkane compound distribution data in the United States used for this analysis.

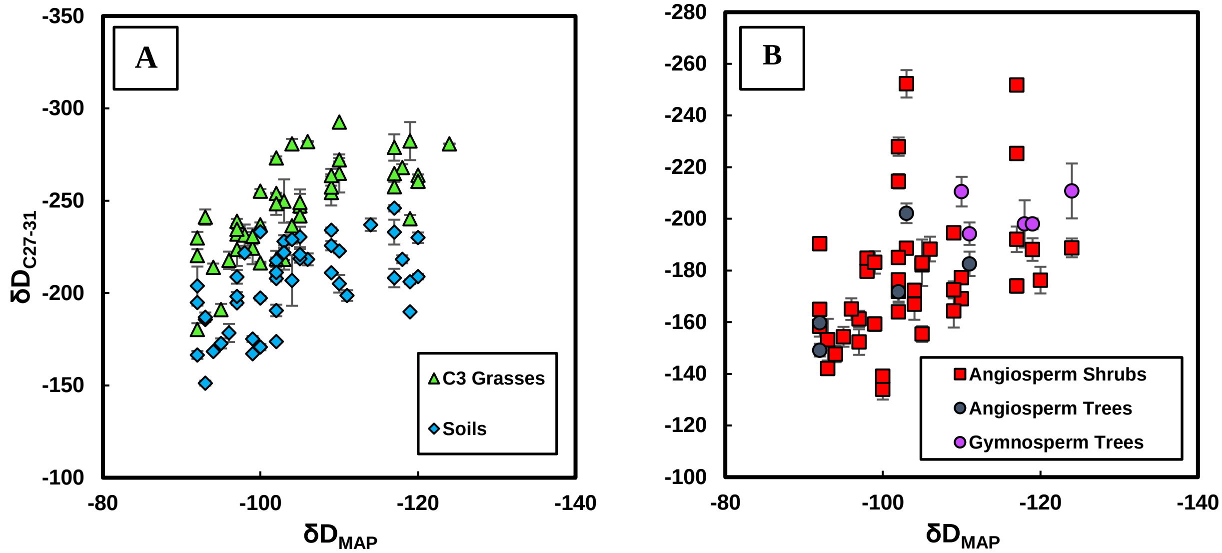

Figure 6. Relationship between hydrogen isotopes of the calculated mean annual precipitation and the weighted averages of the leaf waxes. (A) Grasses and soils show a correlation to δD_{MAP} ($r^2 = 0.50$, p = 4.86E-08 and $r^2 = 0.3189$, p = 4.35E-05, respectively). (B) The other plant groups (shrubs and trees) show no correlation to δD_{MAP}. The error bars represent the standard deviation of each sample.

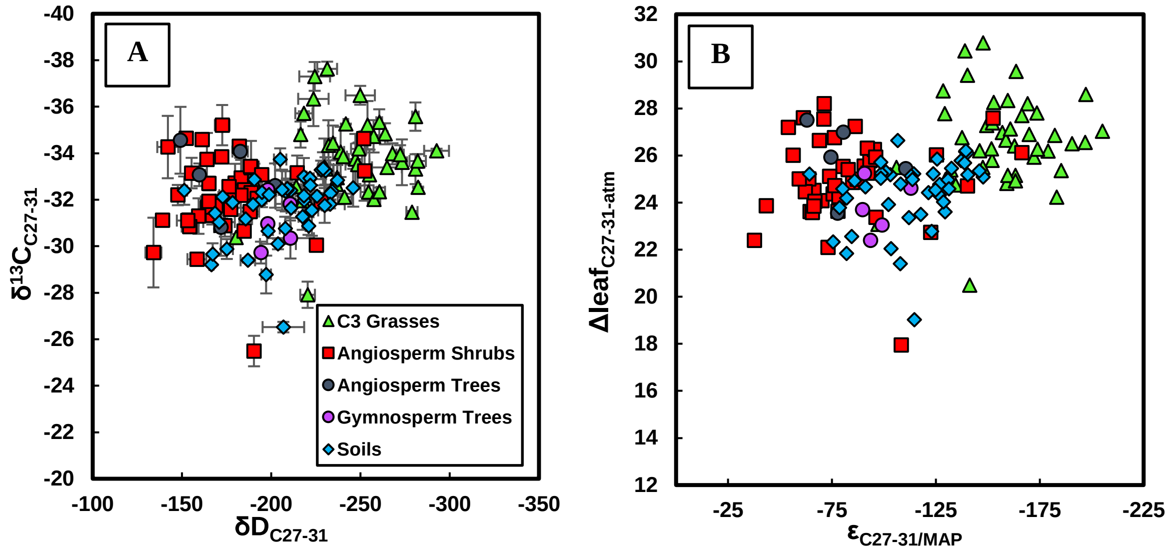

Figure 7. (A) The relationship between carbon and hydrogen values of the leaf waxes in different plant groups and soils in a semi-arid environment. The error bars represent the standard deviation of each sample's isotopic composition. (B) The relationship between $\Delta leaf_{C27\text{-}31/atm}$ and $\varepsilon_{C27\text{-}31/MAP}$ of all the plant groups in a semi-arid environment study. $\Delta leaf_{C27\text{-}31/atm}$ represents the apparent fractionation between the $\delta^{13}C_{27\text{-}31}$ of the leaf wax and $\delta^{13}C_{atm}$ of the atmosphere. $\varepsilon_{C27\text{-}31/MAP}$ represents the apparent fractionation between $\delta D_{27\text{-}31}$ of the leaf wax and δD_{MAP} of the atmosphere.

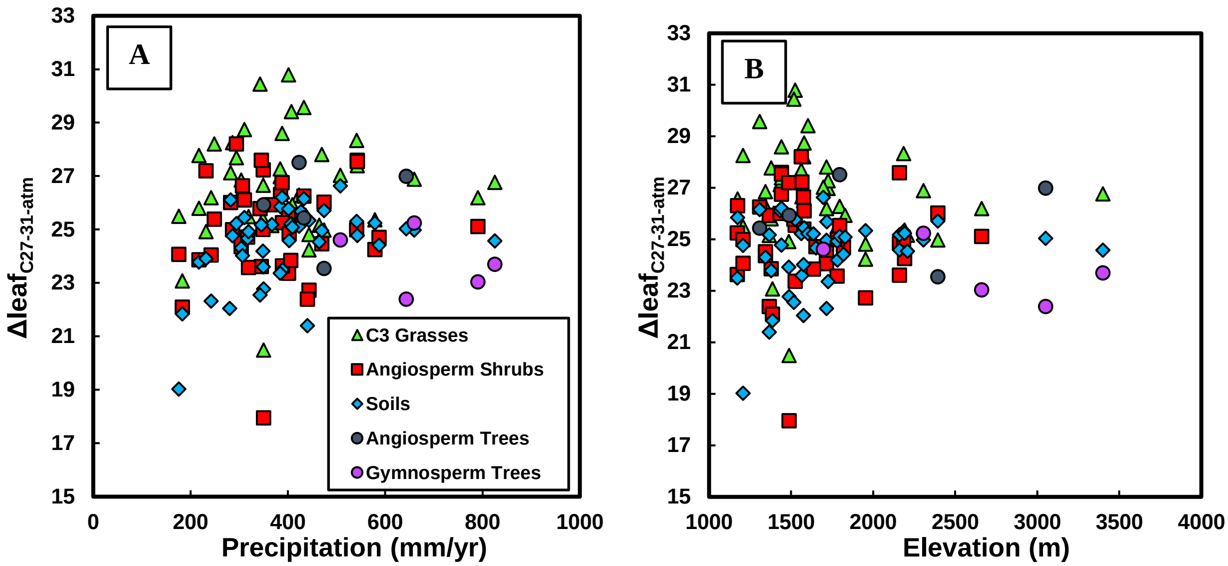

Figure 8. The plotted relationship between $\Delta leaf_{C27\text{-}31/atm}$ of all the plant groups in the semi-arid environment study and (A) annual precipitation or (B) elevation in meters. $\Delta leaf_{C27\text{-}31/atm}$ represents the apparent fractionation between the $\delta^{13}C_{27\text{-}31}$ of the leaf wax and $\delta^{13}C_{atm}$ of the atmosphere.

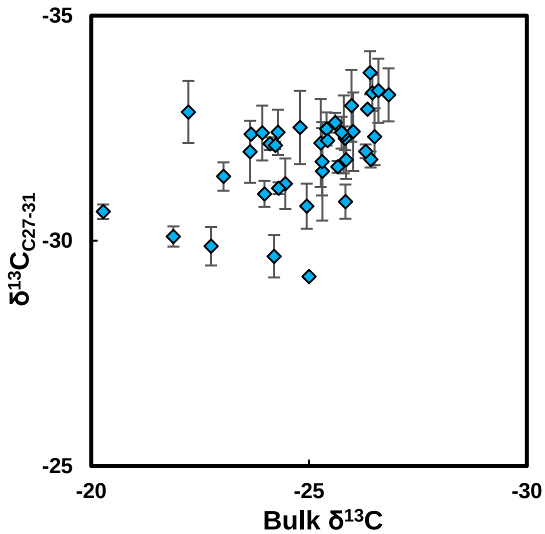

Figure 9. Soil bulk carbon isotopes plotted against leaf wax carbon isotopes in a semi-arid climate. The error bars represent the standard deviation of each sample's carbon isotopic composition.

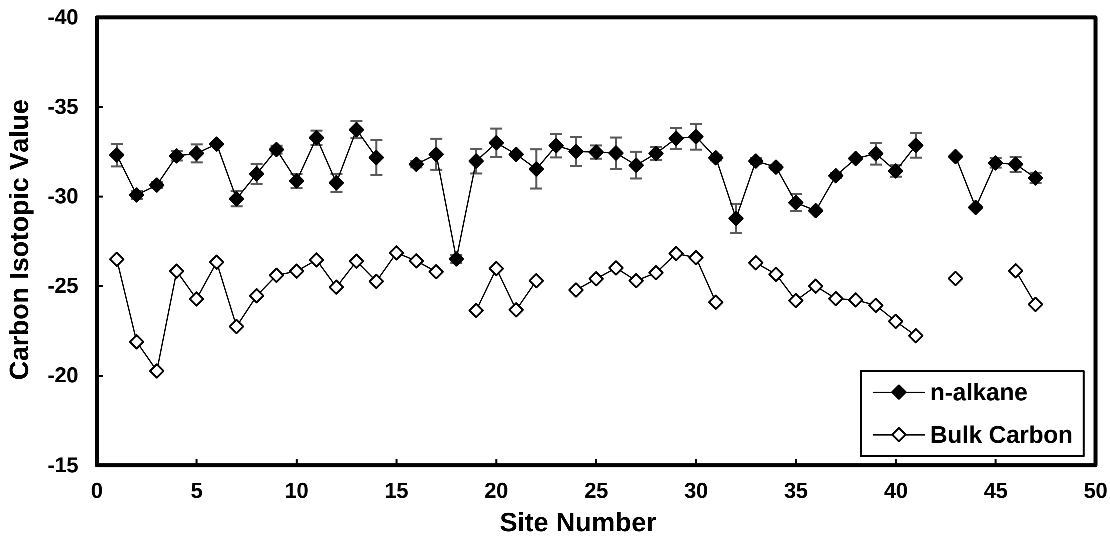

Figure 10. The carbon isotope value of the bulk and *n*-alkane from soils at different sample sites. There is an offset between the two values vary.

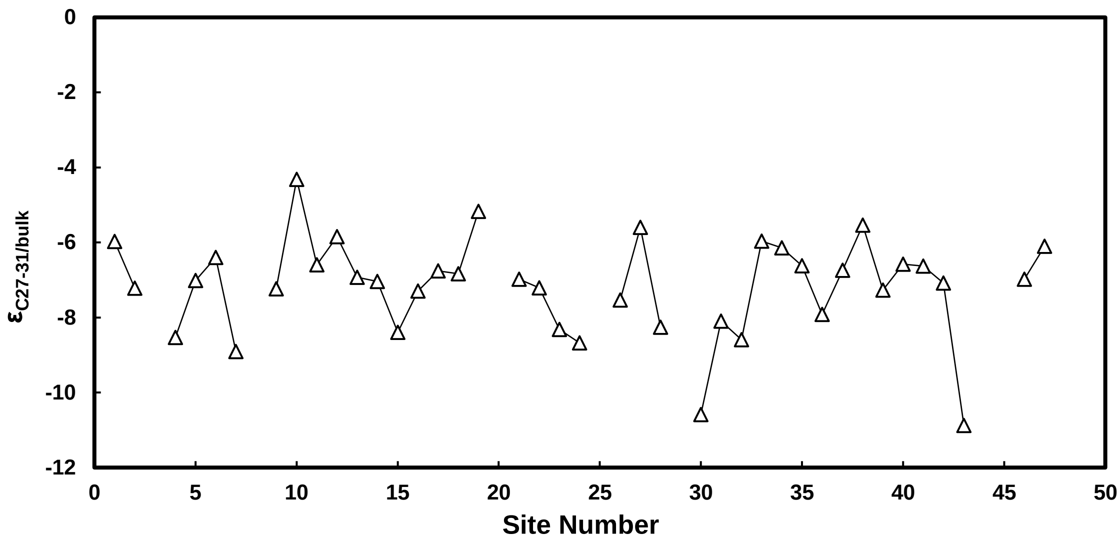

Figure 11. The calculated $\varepsilon_{C27\text{-}31/bulk}$ values describes the fractionation between the bulk carbon and the isotopic carbon value of the *n*-alkanes in the soils from the Western US.

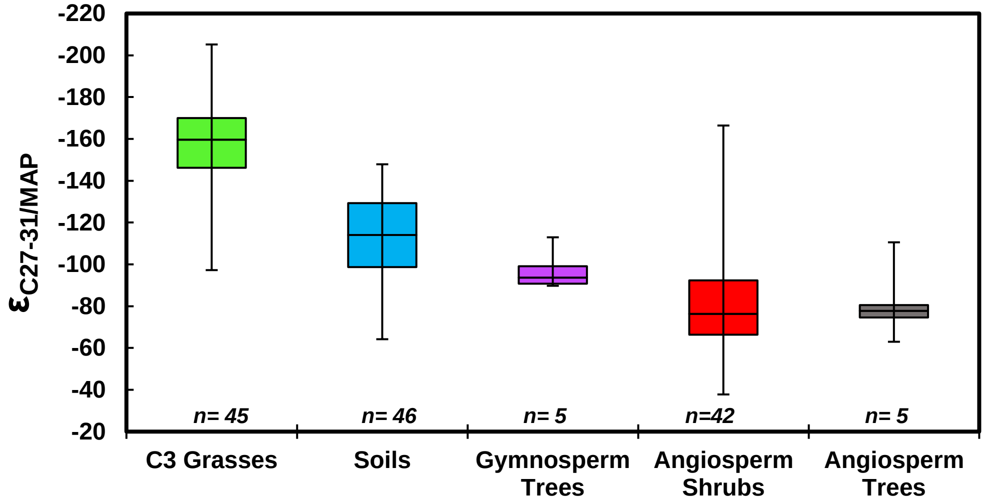

Figure 12: Box and whisker plot of the apparent fractionation ($\varepsilon_{C27-31/MAP}$) between δD_{C27-31} and calculated δD_{MAP} in different plant groups and soils from a semi-arid environment. The boxes represent the upper and lower quantile while the horizontal line represents the median. The error bar represent the maximum and minimum values in each growth habit.

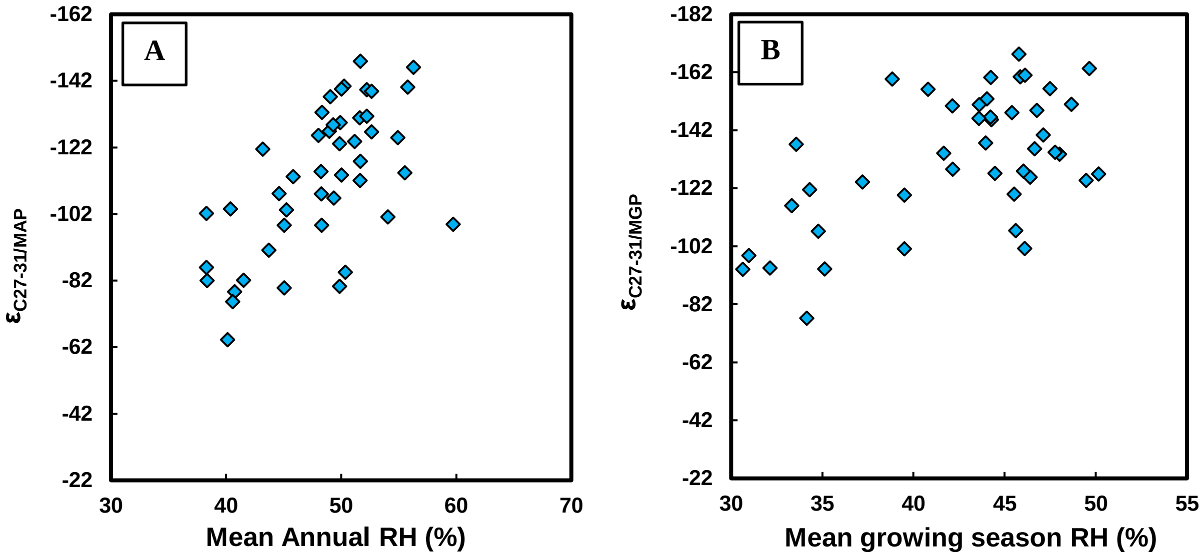

Figure 13: $\varepsilon_{C27\text{-}31/MAP}$ of soils in a semi-arid environment plotted against (A) mean annual relative humidity ($r^2 = 0.3858$, p = 4.1E-06) and (B) $\varepsilon_{C27\text{-}31/MGP}$ of soils mean growing season relative humidity ($r^2 = 0.3818$, p = 4.76E-06).

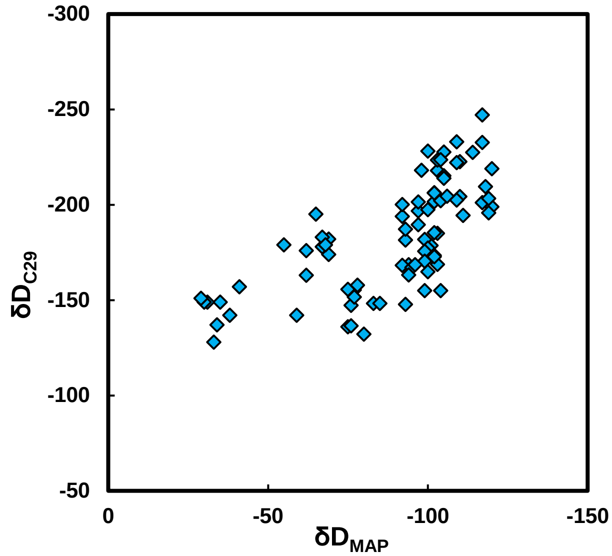

Figure 14: δD$_{C29}$ of soils within the United States compared to calculated δD$_{MAP}$ .There was no observable relationship between the plant groups and δD$_{MAP.}$ Soils did have a significant relationship δD$_{MAP}$ (r^2 = 0.477, p = 5.02E-13).

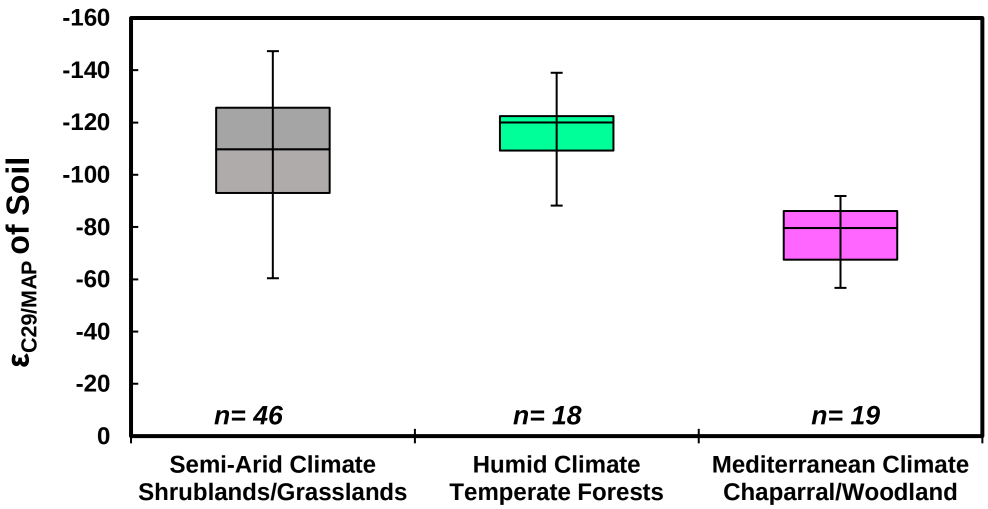

Figure 15. Box and whisker plot of the ε_{C29} from all the soils in the United States. The boxes represent the upper and lower quantile and the horizontal line presents the median. The error bars represent the range of values in each grouping.

Soil $\varepsilon_{C29/MAP}$	Count (*n*)	Mean	Standard Deviation	Standard Error
Semi-Arid Climate	46	-108	21	3
Humid Climate	18	-117	12	3
Mediterranean Climate	19	-77	11	3

Table 1. $\varepsilon_{C29/MAP}$ from all the soils in the United States categorized by different climates and vegetation.

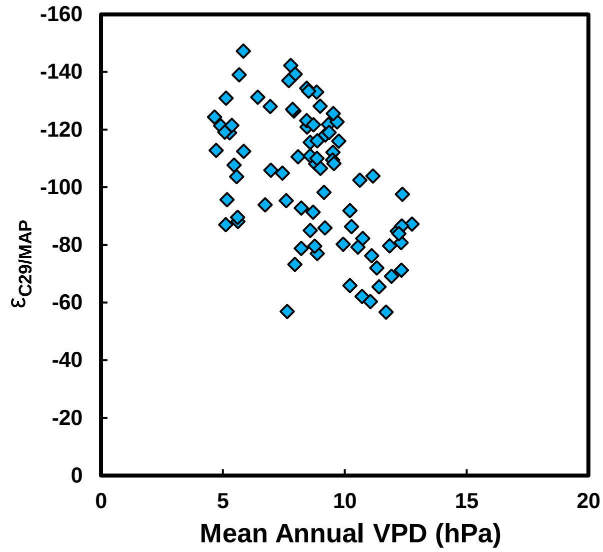

Figure 16. Apparent fractionation ($\varepsilon_{C29/MAP}$) of all the soils in the US plotted against VPD ($r^2 = 0.2567$, p = 1.02E-06)

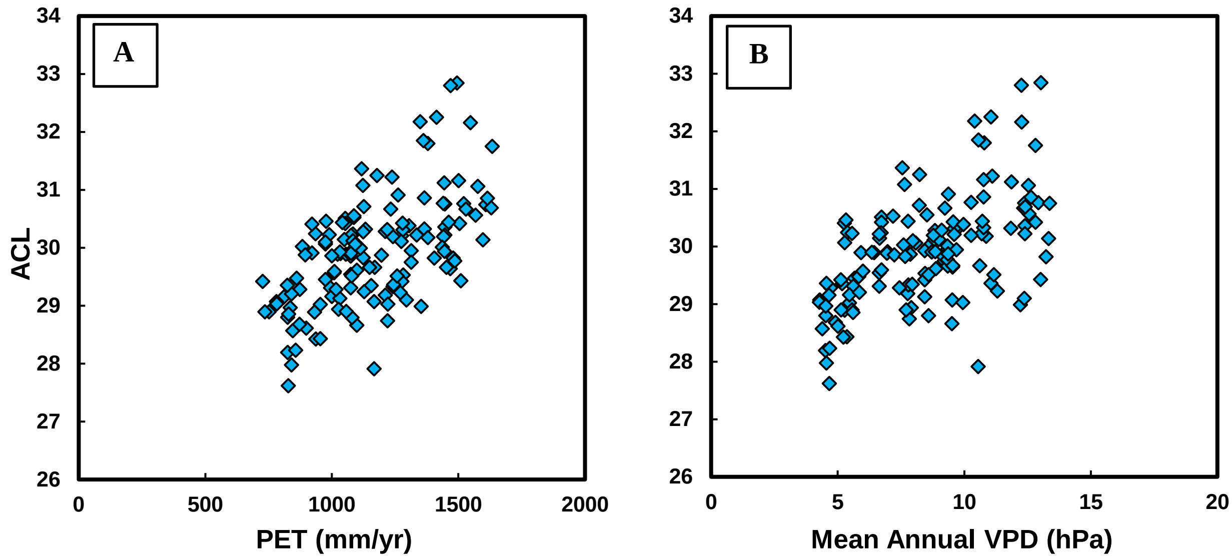

Figure 17. Average chain lengths (ACL) of soils sampled through the United States, plotted against (A) Potential Evaporation Transpiration (PET) (mm/yr) and (B) Mean annual vapor pressure deficient (VPD)(hPa). ACL shows a correlation to PET ($r^2 = 0.3582$, p = 2.93E-15) and mean annual VPD ($r^2 = 0.3179$, p = 2.35E-13).

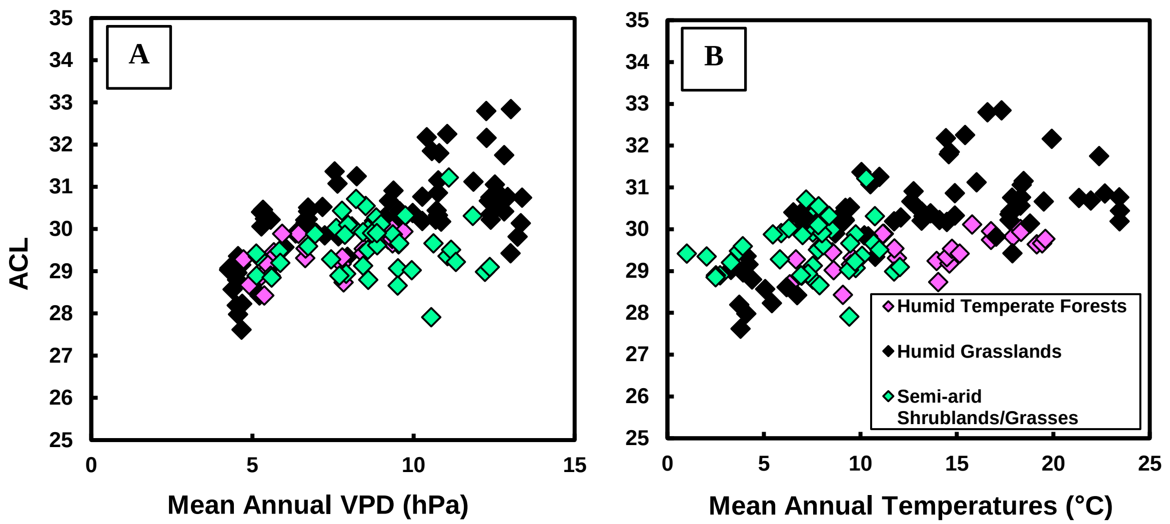

Figure 18. The average chain length (ACL) of soils within the US plotted against (A) the mean annual VPD and (B) mean annual temperature. Soil ACL has a correlation with VPD ($r^2 = 0.3179$, p = 2.25E-13) and MAT ($r^2 = 0.2964$, p = 2.08E-12). The soil ACL data used for this study was from three studies: Bush and McInerney, 2015; Tipple and Pagani, 2013; and this study on semi-arid environment. The climate and ecosystems from these three studies varied from: semi-arid/temperate grasslands central US (Bush and McInerney, 2015), temperate forests (Tipple and Pagani, 2013), and semi-arid scrublands/grasslands (this study). The soil ACL from these three locations are well distributed with its relationship with mean annual VPD.

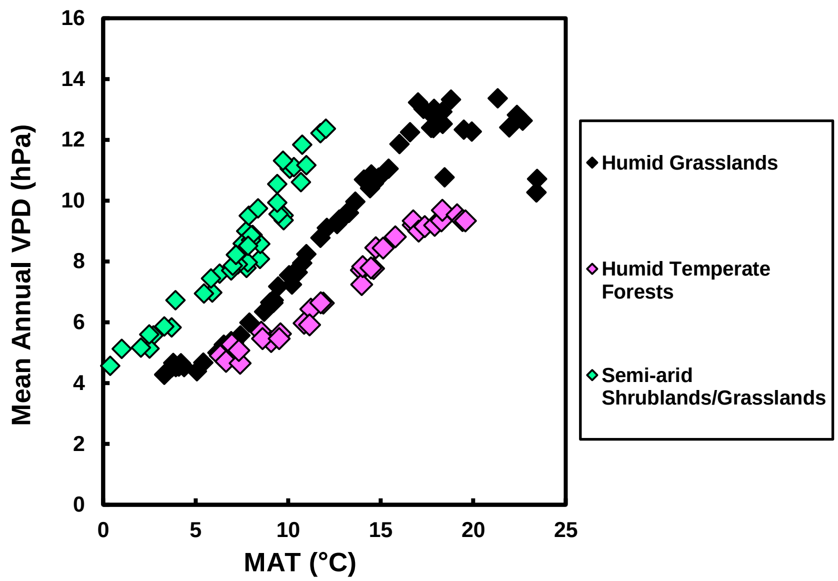

Figure 19. The relationship between the mean annual temperature (MAT) (°C) and mean annual vapor pressure deficient (hPa) of the ACL soil sites. There were three different climate and vegetation types within the US that the soils were sampled in: humid grasslands, humid temperate forests, and semi-arid shrublands/grasslands. All three sampling tracts experience similar temperatures changes but had different water availability, therefore VPD was affected differently.

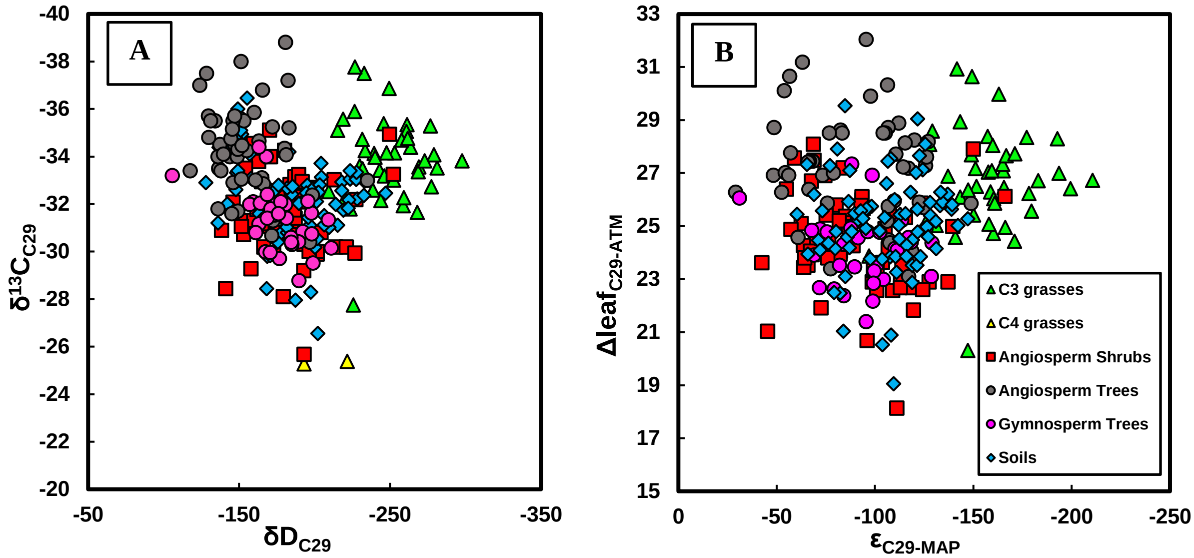

Figure 20. (A) Plotted carbon and hydrogen values of the leaf waxes from different plant groups and soils in the United States. (B) Plotted $\Delta leaf_{C27-31/atm}$ and $\varepsilon_{C27-31/MAP}$ of all the plant groups in the US. $\Delta leaf_{C27-31/atm}$ represents the apparent fractionation between the $\delta^{13}C_{27-31}$ of the leaf wax and $\delta^{13}C_{atm}$ of the atmosphere. $\varepsilon_{C27-31/MAP}$ represents the apparent fractionation between δD_{27-31} of the leaf wax and δD_{MAP} of the atmosphere.

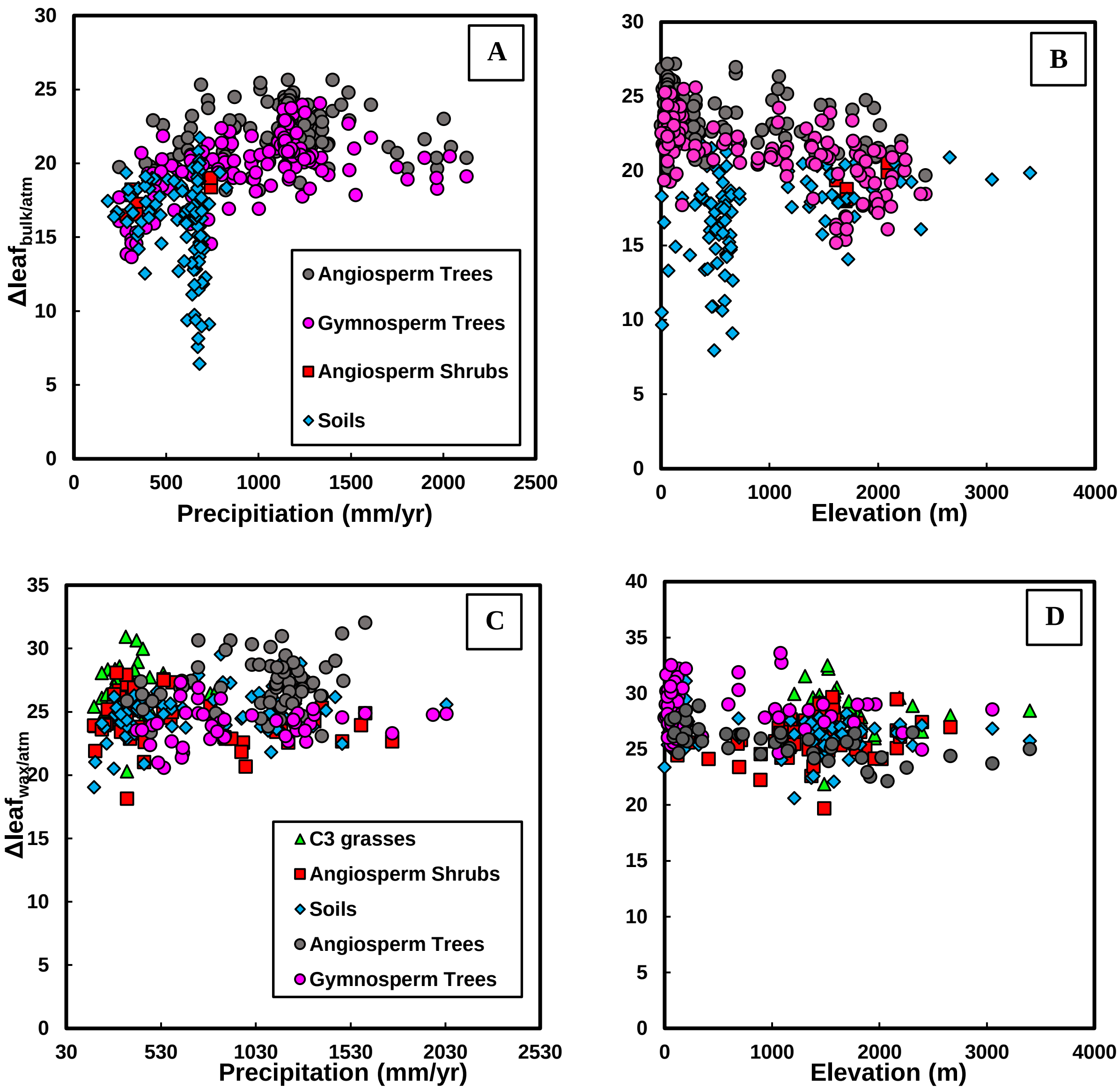

Figure 21. Precipitation and elevation plotted with carbon discrimiation between the bulk/*n*-alkanes and the atmosphere of each plant groups. $\Delta leaf_{bulk/atm}$ is represented in graphs A and B while $\Delta leaf_{C29/atm}$ is represented in graphs C and D.

$\varepsilon_{C29/MAP}$	Forbs	C_3 grasses	C_4 grasses	Shrubs	Soil	Angiosperm Trees	Gymnosperm Trees	All Samples
Count (*n*)	14	70	27	81	83	117	40	432
Mean	-108	-160	-139	-92	-103	-95	-101	-110
Standard deviation	39	24	27	29	23	32	23	37
Standard Error	11	3	5	3	3	3	4	2

Table 2: Summary of $\varepsilon_{C29/MAP}$ for all samples and the individual plant groups throughout the United States.

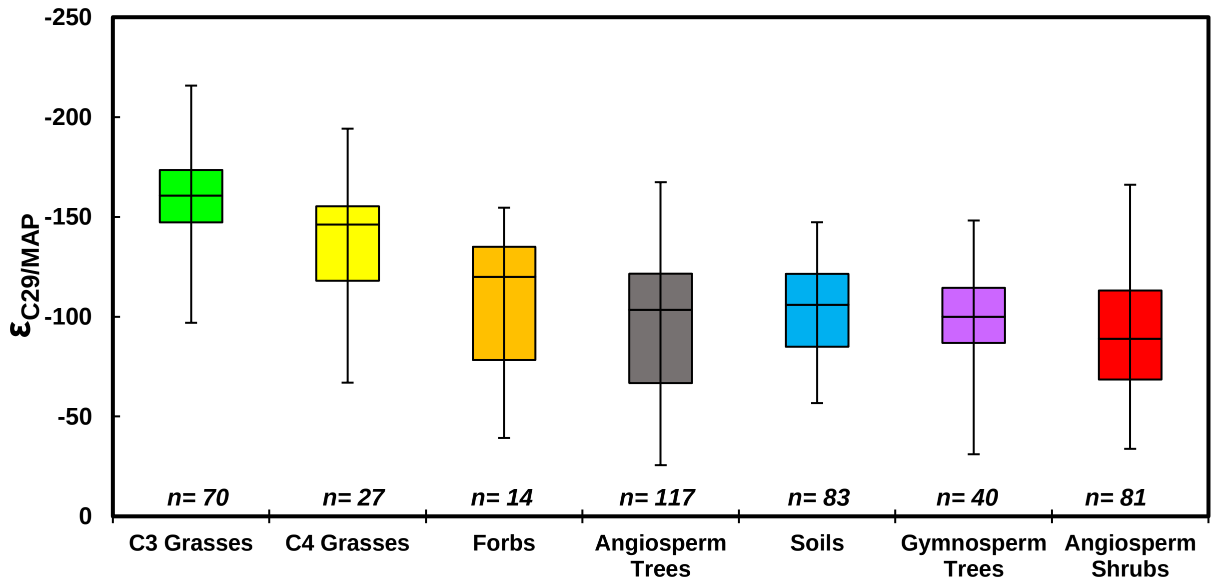

Figure 22. Apparent fractionation ($\varepsilon_{C29/MAP}$) between $\delta D_{C29}$and calculated δD_{MAP} in different plant groups and soil groups in the United States. The boxes represent the upper and lower quantile while the horizontal line represents the median. The error bar represent the range of values in each growth habit.

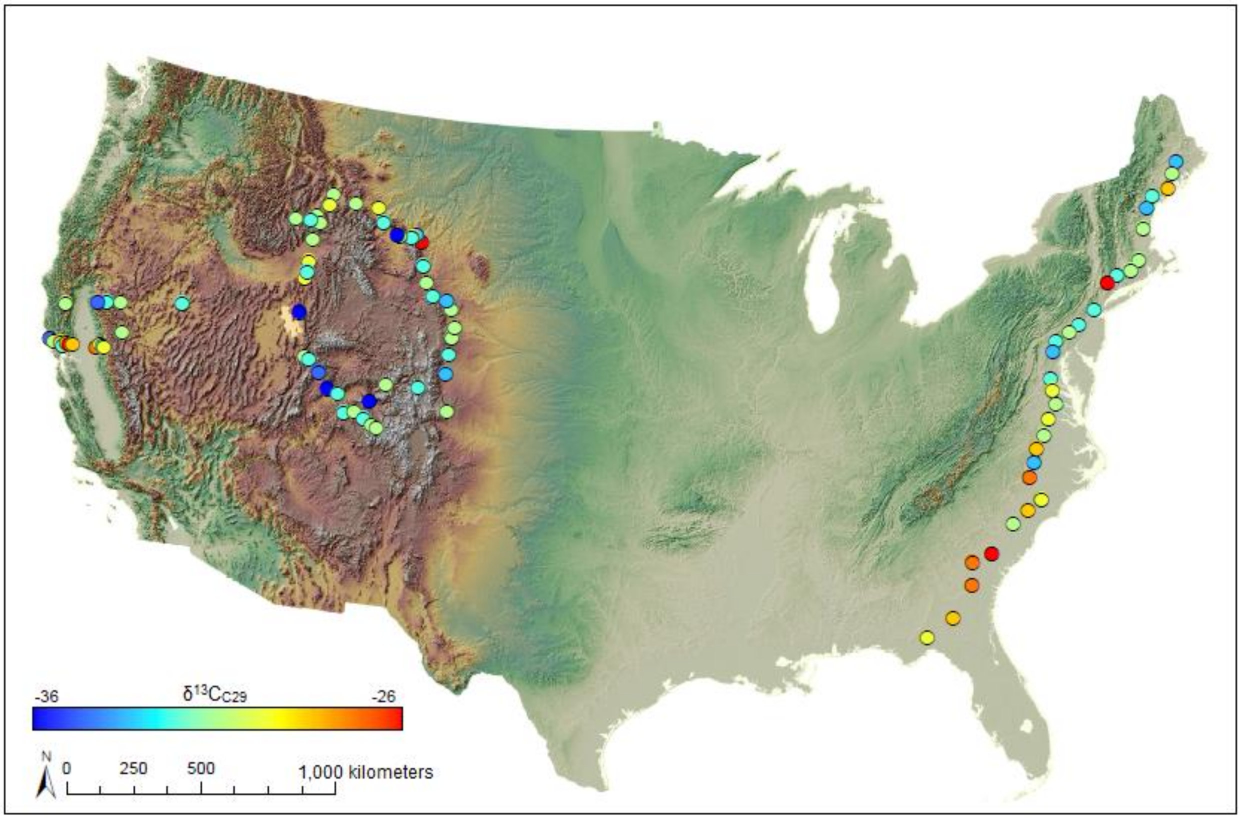

Figure 23. Isoscape of $\delta^{13}C$ values of published soils *n*-alkanes sampled within the United States.

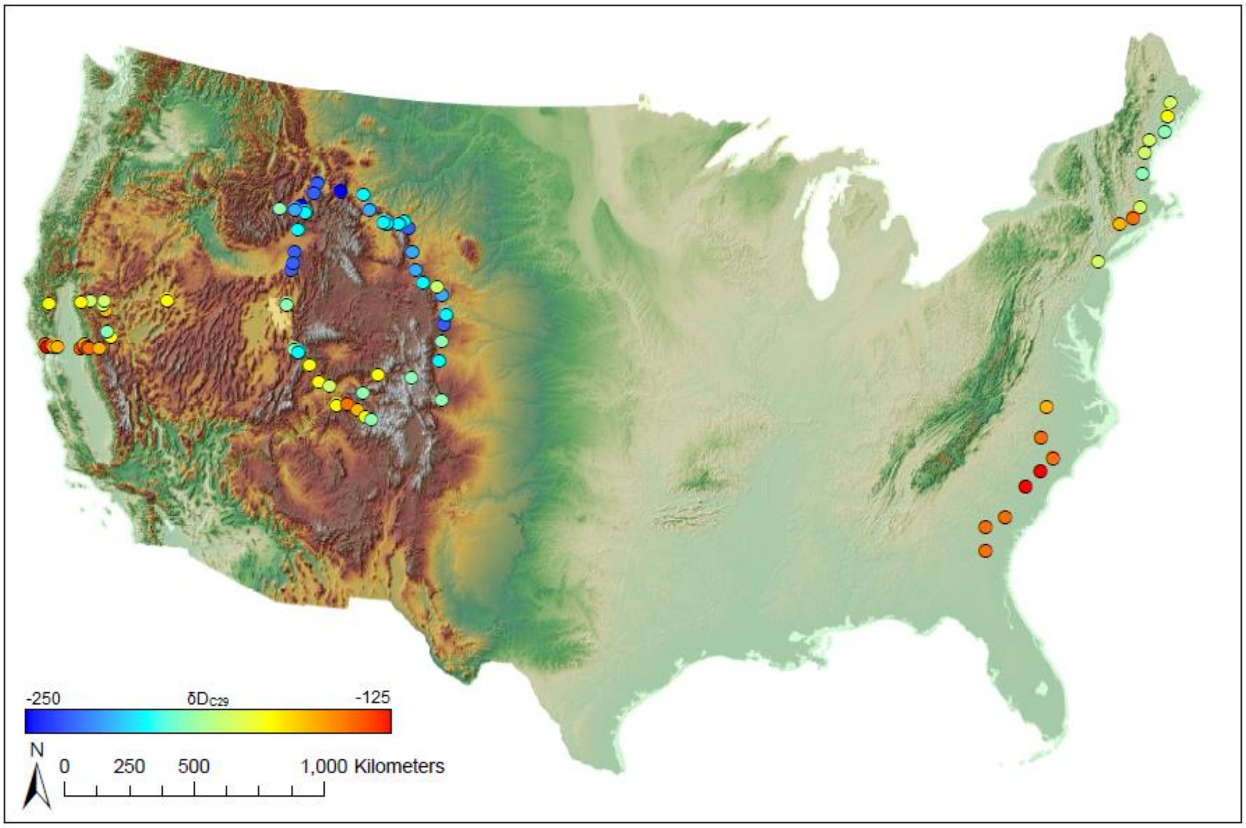

Figure 24. Isoscape of δD values of published soils from all over the US. Spatially, δD_{C29} follow the same trends as δD_{MAP} indicating that δD_{MAP} is the main contributor to δD_{C29}.

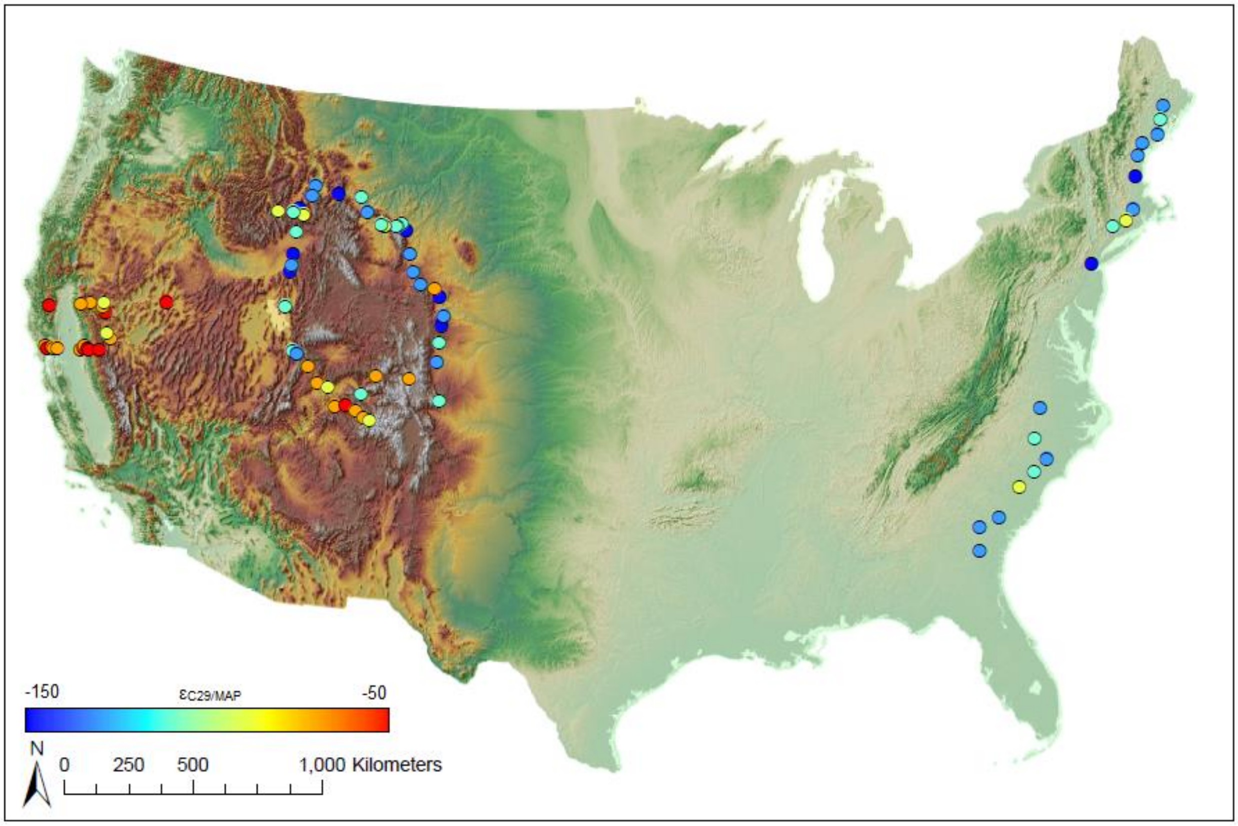

Figure 25. Isoscape of $\varepsilon_{C29/MAP}$ of published soils data within the United States. Spatially, there is differences in $\varepsilon_{C29/MAP}$ due to differences in climates. On the east coast, the $\varepsilon_{C29/MAP}$ are relatively negative suggesting smaller amount of evaporation transpiration took place. However, the west coast the $\varepsilon_{C29/MAP}$ values are less negative suggesting a large impact occurred from evaporation transpiration. For the western US sampling tract, changes in $\varepsilon_{C29/MAP}$ going more negative from south to north suggesting the impact of evaporation transpiration had changed.

Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Distance inland (km)	δD_{gw} (‰)	δD_p (measured) (‰)	δD_p (model) (‰)	95% (‰)	$\Delta\delta D_p$ (model-measured) (‰)
1. Mojave	35	-116	1500	240	-79.1	na	-66	4	na
2. Jacinto	34	-117	1620	90	-66.7	-46.7	-67	5	-20
3. Pasadena	34	-118	640	40	-44.5	-40	-54	3	-14
4. Topanga	34	-119	400	1	na	-37.3	-51	3	-14

Table 3. A table showing measured δD of groundwater (δD_{gw}), δD of precipitation (δD_p), and modeled δD_p in an arid climate (Modified from Feakins and Sessions, 2006). The difference between measured and modeled δD_p is represented by $\Delta\delta D_p$.

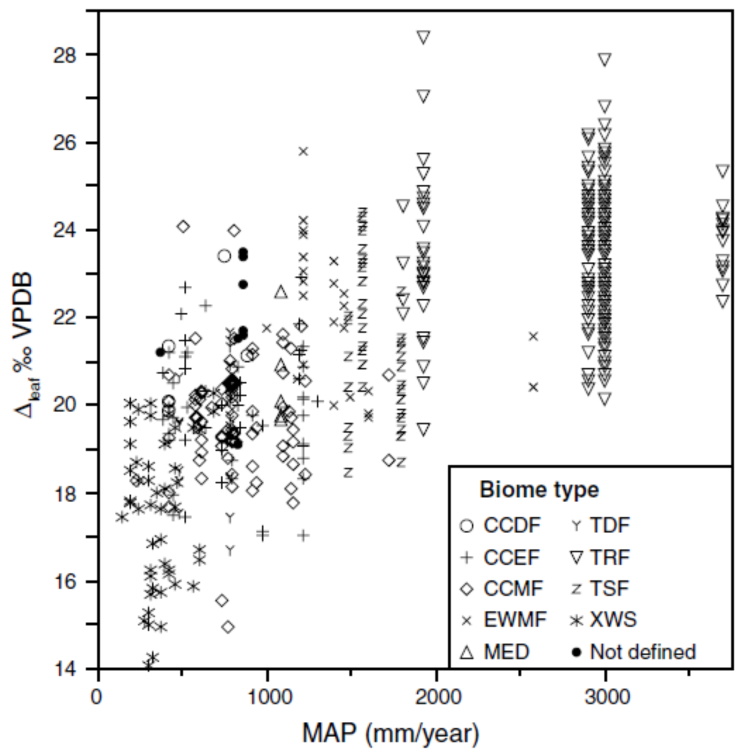

Figure 26. The relationship between Δleaf and mean annual precipitation for globally. In this linear regression model, it was found that MAP accounts for 55% of the variability in Δleaf. Different point symbols represent a different environmental biome: cool-cold deciduous forest (CCDF), cool-cold mixed forest (CCMF), cool-cold evergreen forest (CCEF), evergreen warm mixed forest (EWMF), tropical deciduous forest (TDF), tropical rain forest (TRF), tropical seasonal forest (TSF), tropical deciduous forest (TDF), and xeric woodland scrubland (XWS) (Diefendorf et al., 2010).

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8. Appendix

Appendix A: *n*-alkanes in semi-arid climate study

Table 1. Site Information

Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Growing Season	Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Growing Season
CO-09-01	39	-105	1795	May to August	MT-09-25	45	-113	2185	June to September
CO-09-02	40	-105	1487	May to September	MT-09-26	45	-112	2192	June to September
CO-09-03	41	-105	1725	May to September	MT-09-30	45	-113	2209	June to September
CO-09-04	41	-105	1828	May to September	MT-09-31	44	-112	1562	June to September
CO-09-05	42	-105	1602	May to September	MT-09-32	43	-112	1433	May to September
CO-09-06	42	-105	1524	May to September	MT-09-33	43	-112	1441	May to September
CO-09-07	43	-105	1516	May to September	MT-09-34	43	-112	1715	May to September
WY-09-08	43	-106	1575	May to September	MT-09-35	42	-112	1367	May to September
WY-09-09	43	-106	1580	May to September	MT-09-36	40	-112	1441	May to September
WY-09-10	44	-107	1566	May to September	MT-09-37	40	-111	1820	May to September
WY-09-11	45	-107	1308	May to September	MT-09-38	40	-111	1715	June to September
WY-09-12	45	-107	1171	May to September	UT-09-39	39	-110	1386	May to October
WY-09-13	45	-107	1696	May to September	UT-09-40	39	-110	1485	May to September
WY-09-14	45	-107	2307	May to September	UT-09-41	38	-109	1781	May to October
WY-09-15	45	-108	2661	May to September	CO-09-42	38	-109	1635	May to October
WY-09-16	45	-108	2160	May to September	CO-09-43	38	-108	1782	May to October
WY-09-17	45	-108	2160	May to September	CO-09-44	38	-108	2395	June to September
WY-09-18	45	-108	1206	May to September	CO-09-45	38	-108	3051	June to September
WY-09-19	45	-109	1207	May to September	CO-09-46	39	-108	1575	May to October
MT-09-20	46	-109	1173	May to September	CO-09-47	40	-108	1652	May to September
MT-09-21	46	-110	1366	June to September	CO-09-48	40	-106	3400	June to September
MT-09-22	46	-112	1343	June to September	Elko	41	-116	1578	June to September
MT-09-23	45	-112	1717	June to September	Win	41	-118	1379	June to September
MT-09-24	45	-112	1953	June to September					

Appendix A: *n*-alkanes in semi-arid climate study

Table 2. Calculated Monthly Precipitation, Mean Growing Season Precipitation (MGP), and Mean Annual Precipitation (MAP) δD

Site	δD Jan	δD Feb	δD Mar	δD Apr	δD May	δD Jun	δD Jul	δD Aug	δD Sep	δD Oct	δD Nov	δD Dec	δD_{MGP}	δD_{MAP}
CO-09-01	-141	-128	-108	-92	-87	-78	-73	-72	-85	-92	-113	-127	-77	-92
CO-09-02	-154	-138	-118	-96	-87	-79	-74	-74	-86	-96	-119	-136	-81	-92
CO-09-03	-162	-144	-123	-98	-88	-80	-75	-76	-88	-99	-122	-142	-82	-97
CO-09-04	-169	-152	-131	-102	-89	-82	-77	-78	-90	-103	-127	-148	-83	-100
CO-09-05	-141	-128	-108	-92	-87	-78	-73	-72	-85	-92	-113	-127	-80	-97
CO-09-06	-171	-155	-131	-100	-85	-80	-74	-78	-89	-101	-127	-150	-81	-98
CO-09-07	-173	-158	-133	-102	-85	-81	-75	-79	-90	-102	-129	-153	-82	-99
WY-09-08	-173	-158	-134	-103	-87	-82	-76	-80	-91	-103	-130	-153	-84	-102
WY-09-09	-175	-161	-137	-105	-87	-83	-77	-81	-92	-105	-132	-156	-84	-103
WY-09-10	-179	-166	-141	-107	-88	-85	-78	-83	-93	-107	-135	-160	-86	-105
WY-09-11	-179	-167	-141	-107	-85	-84	-77	-83	-93	-106	-136	-162	-85	-103
WY-09-12	-176	-165	-138	-105	-84	-83	-76	-82	-92	-104	-134	-160	-84	-102
WY-09-13	-186	-175	-151	-114	-92	-89	-83	-88	-98	-114	-142	-169	-91	-110
WY-09-14	-195	-186	-164	-123	-99	-95	-90	-94	-103	-123	-149	-178	-97	-118
WY-09-15	-198	-188	-169	-127	-103	-97	-93	-96	-105	-127	-152	-181	-100	-124
WY-09-16	-194	-184	-164	-123	-100	-95	-90	-94	-103	-123	-149	-177	-97	-117
WY-09-17	-185	-175	-152	-116	-93	-90	-84	-89	-98	-115	-142	-168	-91	-117
WY-09-18	-173	-162	-136	-105	-84	-83	-77	-83	-91	-103	-133	-157	-84	-104
WY-09-19	-172	-162	-136	-106	-85	-84	-77	-83	-91	-103	-133	-157	-84	-105
MT-09-20	-173	-163	-138	-107	-85	-85	-78	-85	-92	-104	-135	-159	-85	-106
MT-09-21	-173	-164	-141	-111	-89	-88	-82	-88	-94	-107	-136	-159	-88	-109
MT-09-22	-166	-158	-136	-109	-88	-87	-82	-88	-92	-104	-133	-154	-87	-110
MT-09-23	-171	-163	-144	-114	-94	-91	-86	-91	-95	-110	-137	-158	-91	-114
MT-09-24	-171	-165	-150	-118	-98	-94	-90	-93	-97	-115	-139	-159	-93	-117
MT-09-25	-166	-160	-149	-117	-99	-94	-90	-94	-96	-114	-137	-155	-94	-120
MT-09-26	-172	-164	-149	-117	-98	-93	-89	-93	-97	-114	-139	-159	-93	-119
MT-09-30	-169	-162	-149	-117	-98	-93	-90	-93	-97	-114	-138	-157	-93	-120
MT-09-31	-156	-147	-132	-106	-90	-85	-81	-85	-89	-101	-127	-143	-85	-109
MT-09-32	-148	-139	-124	-101	-87	-82	-77	-81	-86	-96	-122	-136	-84	-105
MT-09-33	-144	-134	-121	-99	-87	-80	-76	-80	-85	-93	-119	-131	-82	-104
MT-09-34	-145	-135	-121	-99	-87	-80	-76	-80	-85	-94	-120	-133	-82	-109
MT-09-35	-135	-126	-115	-97	-89	-79	-76	-78	-85	-90	-116	-125	-83	-100
MT-09-36	-129	-121	-109	-95	-91	-77	-75	-75	-85	-87	-113	-120	-83	-97
MT-09-37	-133	-125	-114	-98	-94	-80	-78	-78	-87	-92	-116	-124	-86	-102
MT-09-38	-132	-125	-113	-98	-95	-79	-78	-77	-87	-91	-116	-124	-81	-99
UT-09-39	-124	-117	-102	-91	-90	-74	-72	-72	-82	-84	-109	-117	-65	-92
UT-09-40	-93	-126	-119	-104	-92	-90	-75	-73	-72	-83	-85	-110	-78	-93
UT-09-41	-127	-122	-107	-94	-93	-77	-75	-73	-85	-88	-112	-121	-65	-95
CO-09-42	-126	-120	-104	-92	-91	-76	-73	-72	-83	-86	-110	-119	-72	-93

Appendix A: *n*-alkanes in semi-arid climate study

Table 2 continued. Calculated Monthly Precipitation, MGP, and MAP δD

Site	δD Jan	δD Feb	δD Mar	δD Apr	δD May	δD Jun	δD Jul	δD Aug	δD Sep	δD Oct	δD Nov	δD Dec	δD_{MGP}	δD_{MAP}
CO-09-43	-129	-123	-107	-94	-93	-77	-75	-73	-85	-89	-112	-122	-65	-94
CO-09-44	-134	-129	-115	-99	-97	-80	-79	-76	-88	-94	-116	-127	-81	-102
CO-09-45	-149	-145	-134	-112	-108	-89	-89	-84	-96	-109	-127	-141	-89	-111
CO-09-46	-130	-121	-104	-91	-89	-75	-72	-71	-83	-86	-111	-120	-65	-93
CO-09-47	-138	-126	-110	-94	-89	-77	-74	-73	-84	-90	-114	-126	-80	-96
CO-09-48	-169	-157	-147	-117	-108	-93	-91	-88	-100	-118	-136	-154	-92	-119
Elko	-122	-120	-117	-98	-92	-79	-78	-80	-87	-90	-111	-116	-81	-102
Win	-112	-112	-110	-93	-87	-76	-74	-78	-83	-84	-104	-107	-78	-100

Appendix A: *n*-alkanes in semi-arid climate study

Table 3. Monthly, Growing Season (Grow), and Annual Precipitation (An) (mm/yr)

Site	Jan PPT	Feb PPT	Mar PPT	Apr PPT	May PPT	Jun PPT	Jul PPT	Aug PPT	Sep PPT	Oct PPT	Nov PPT	Dec PPT	Grow PPT	An PPT
CO-09-01	10	9	30	36	57	54	65	87	33	17	14	11	264	423
CO-09-02	9	9	35	44	55	41	36	30	39	22	17	14	201	350
CO-09-03	6	8	28	45	67	59	42	49	36	26	11	8	253	384
CO-09-04	8	13	26	41	67	66	47	46	41	25	16	14	266	409
CO-09-05	10	14	27	46	70	60	44	42	34	29	17	16	179	407
CO-09-06	7	10	25	49	66	75	41	31	36	28	21	11	183	401
CO-09-07	9	13	25	39	57	48	35	25	31	30	17	12	196	343
WY-09-08	7	14	22	38	54	37	29	20	26	32	15	12	166	307
WY-09-09	8	12	21	33	58	44	34	21	25	29	14	12	182	311
WY-09-10	9	11	22	40	67	48	42	22	31	29	17	11	210	349
WY-09-11	16	16	31	48	71	64	35	23	46	42	23	17	240	433
WY-09-12	17	17	27	43	66	52	35	22	35	38	21	17	209	389
WY-09-13	20	22	45	58	87	64	41	24	47	51	27	23	262	508
WY-09-14	32	33	65	76	108	78	48	29	57	63	37	35	319	660
WY-09-15	63	56	78	84	97	83	49	28	63	67	59	63	320	790
WY-09-16	22	20	39	40	59	43	46	15	34	41	21	22	198	403
WY-09-17	13	13	29	34	58	45	34	14	37	37	15	15	188	345
WY-09-18	6	6	9	17	34	31	14	8	20	16	8	7	107	176
WY-09-19	10	10	18	33	54	45	23	16	25	27	13	11	164	287
MT-09-20	14	16	26	48	70	58	33	23	32	34	16	14	216	385
MT-09-21	11	12	21	43	66	61	35	26	30	32	16	13	153	367
MT-09-22	9	7	16	31	53	58	34	26	25	20	14	10	143	304
MT-09-23	13	13	28	46	71	77	37	37	33	37	19	15	184	427
MT-09-24	22	22	32	40	61	66	40	38	34	37	27	24	178	443
MT-09-25	42	37	48	61	68	58	28	27	34	41	51	46	147	541
MT-09-26	41	38	52	58	72	69	41	34	39	47	46	43	182	579
MT-09-30	31	30	38	43	64	58	36	33	32	35	29	37	159	464
MT-09-31	19	17	22	26	50	43	21	15	20	21	19	22	99	294
MT-09-32	22	20	25	28	39	29	14	14	19	23	25	24	115	282
MT-09-33	35	30	38	34	46	33	20	25	27	30	31	39	151	388
MT-09-34	41	39	45	41	54	38	27	29	33	34	40	48	182	469
MT-09-35	39	38	42	42	59	30	19	19	35	43	36	39	161	440
MT-09-36	47	54	57	59	56	32	18	20	38	56	54	53	163	542
MT-09-37	57	56	59	58	60	36	18	28	43	53	57	64	185	587
MT-09-38	18	17	21	15	14	17	19	28	29	31	13	20	93	242
UT-09-39	12	10	13	16	15	10	15	20	25	23	10	12	109	183
UT-09-40	17	15	22	19	19	10	15	25	29	30	15	14	98	232
UT-09-41	19	19	25	27	24	17	28	36	36	41	28	21	181	319
CO-09-42	28	33	30	33	30	19	40	42	47	45	31	28	286	406

Appendix A: *n*-alkanes in semi-arid climate study

Table 3 continued. Monthly, Growing Season (Grow), and Annual Precipitation (An) (mm/yr)

Site	Jan PPT	Feb PPT	Mar PPT	Apr PPT	May PPT	Jun PPT	Jul PPT	Aug PPT	Sep PPT	Oct PPT	Nov PPT	Dec PPT	Grow PPT	An PPT
CO-09-43	22	24	29	26	25	14	32	42	45	38	27	23	198	349
CO-09-44	28	31	40	39	37	24	59	59	52	39	36	30	194	474
CO-09-45	46	49	59	56	46	27	59	76	70	55	53	46	233	643
CO-09-46	16	17	25	27	26	17	21	27	32	32	24	17	155	280
CO-09-47	17	19	25	27	30	24	30	28	35	38	25	18	148	317
CO-09-48	60	62	84	92	69	43	60	85	52	61	82	75	241	825
Elko	29	21	24	25	26	18	9	9	12	20	28	29	48	249
Win	21	18	22	23	30	17	6	6	10	19	22	23	39	217

Appendix A: *n*-alkanes in semi-arid climate study

Table 4. Monthly Mean, Mean Growing Season (Grow), and Mean Annual VPD (An) (hPa)

Site	Jan VPD	Feb VPD	Mar VPD	Apr VPD	May VPD	Jun VPD	Jul VPD	Aug VPD	Sep VPD	Oct VPD	Nov VPD	Dec VPD	Grow VPD	An VPD
CO-09-01	5	5	6	8	11	15	18	15	13	9	6	6	15	10
CO-09-02	3	4	6	8	10	15	18	16	13	9	5	5	15	9
CO-09-03	3	4	5	7	9	12	16	14	11	8	5	5	13	8
CO-09-04	3	3	5	6	8	12	16	14	11	7	4	4	12	8
CO-09-05	3	4	5	7	9	13	18	16	12	8	5	5	15	9
CO-09-06	3	4	5	7	9	13	19	18	13	8	5	5	16	9
CO-09-07	3	3	5	6	9	13	19	18	13	8	5	5	14	9
WY-09-08	3	3	5	6	9	14	20	18	13	8	4	4	15	9
WY-09-09	3	3	5	7	9	14	20	19	13	8	4	4	15	9
WY-09-10	3	3	4	6	8	13	18	18	13	7	4	4	14	8
WY-09-11	3	3	4	6	8	12	18	18	12	7	4	4	14	8
WY-09-12	3	3	4	7	9	13	19	19	13	7	4	4	15	9
WY-09-13	3	3	4	5	7	10	15	15	11	6	4	4	11	7
WY-09-14	2	3	3	4	5	8	12	12	8	5	3	3	9	6
WY-09-15	2	2	3	3	4	6	10	10	7	4	2	2	8	5
WY-09-16	2	2	3	4	5	8	12	12	9	5	3	3	9	5
WY-09-17	3	3	4	6	7	10	17	17	12	7	4	4	13	8
WY-09-18	2	3	5	8	11	15	21	21	14	8	4	4	16	10
WY-09-19	3	3	5	7	9	13	19	18	13	8	4	4	15	9
MT-09-20	3	4	5	7	9	13	19	19	13	8	5	5	14	9
MT-09-21	3	3	4	6	8	11	17	17	12	7	4	4	14	8
MT-09-22	2	3	4	6	9	11	18	17	12	7	4	4	14	8
MT-09-23	2	3	4	5	7	10	15	15	11	6	3	3	13	7
MT-09-24	1	2	3	4	6	8	13	13	10	5	2	2	11	6
MT-09-25	2	2	3	4	6	8	13	13	9	5	2	2	11	6
MT-09-26	1	2	2	4	6	8	12	12	8	5	2	2	10	5
MT-09-30	1	2	3	4	6	9	14	14	10	5	2	2	11	6
MT-09-31	1	2	3	6	9	11	17	18	12	7	3	3	15	7
MT-09-32	1	1	3	6	9	12	18	18	13	7	3	3	14	8
MT-09-33	1	2	4	7	10	13	20	19	14	8	3	3	15	9
MT-09-34	2	2	3	6	8	12	19	19	13	7	3	3	14	8
MT-09-35	2	2	5	7	11	16	23	22	15	8	4	4	17	10
MT-09-36	2	3	5	8	12	18	24	22	16	9	4	4	19	11
MT-09-37	2	3	5	7	11	17	22	20	15	9	4	4	17	10
MT-09-38	2	3	5	9	12	19	23	21	15	9	5	5	20	11
UT-09-39	3	4	7	11	16	22	26	22	17	10	5	5	19	12
UT-09-40	3	4	7	10	16	23	27	23	17	11	5	5	21	12
UT-09-41	3	3	6	10	15	23	26	22	17	10	5	5	19	12
CO-09-42	3	4	7	10	15	21	24	19	16	10	6	6	15	11

Appendix A: *n*-alkanes in semi-arid climate study

Table 4 continued. Monthly Mean, Grow, and An VPD (hPa)

Site	Jan VPD	Feb VPD	Mar VPD	Apr VPD	May VPD	Jun VPD	Jul VPD	Aug VPD	Sep VPD	Oct VPD	Nov VPD	Dec VPD	Grow VPD	An VPD
CO-09-43	3	4	6	9	14	21	23	19	15	10	6	6	17	11
CO-09-44	3	3	5	7	10	15	16	13	11	8	5	5	14	8
CO-09-45	3	3	4	5	8	13	13	11	9	6	4	4	11	7
CO-09-46	3	4	7	10	14	21	24	20	15	10	5	5	17	11
CO-09-47	2	3	6	8	12	18	22	18	14	9	4	4	17	10
CO-09-48	2	2	3	4	6	9	10	8	7	5	3	3	9	5
Elko	2	3	5	7	11	16	23	22	16	9	4	4	19	10
Win	3	4	6	8	12	18	26	25	17	10	5	5	21	11

Appendix A: *n*-alkanes in semi-arid climate study

Table 5. Potential Evapotranspiration (mm/yr)

Site	PET	Site	PET
CO-09-01	1167	MT-09-25	829
CO-09-02	1196	MT-09-26	824
CO-09-03	1092	MT-09-30	841
CO-09-04	1042	MT-09-31	1016
CO-09-05	1113	MT-09-32	1057
CO-09-06	1124	MT-09-33	1087
CO-09-07	1078	MT-09-34	1000
WY-09-08	1098	MT-09-35	1149
WY-09-09	1083	MT-09-36	1169
WY-09-10	1031	MT-09-37	1133
WY-09-11	1044	MT-09-38	1167
WY-09-12	1080	UT-09-39	1353
WY-09-13	921	UT-09-40	1295
WY-09-14	752	UT-09-41	1218
WY-09-15	670	CO-09-42	1244
WY-09-16	735	CO-09-43	1238
WY-09-17	883	CO-09-44	1126
WY-09-18	1099	CO-09-45	1010
WY-09-19	1076	CO-09-46	1258
MT-09-20	1068	CO-09-47	1221
MT-09-21	975	CO-09-48	727
MT-09-22	1026	Elko	1195
MT-09-23	895	Win	1271
MT-09-24	861		

Appendix A: *n*-alkanes in semi-arid climate study

Table 6. Monthly Mean, Mean Growing Season (Grow), and Mean Annual Temperature (An) (°C)

Site	Jan T_m	Feb T_m	Mar T_m	Apr T_m	May T_m	Jun T_m	Jul T_m	Aug T_m	Sep T_m	Oct T_m	Nov T_m	Dec T_m	Grow T_m	An T_m
CO-09-01	-1	1	4	8	14	19	22	21	16	10	4	-1	19	10
CO-09-02	-2	0	4	9	14	19	23	22	17	10	3	-2	19	10
CO-09-03	-2	-1	3	7	12	17	21	20	15	9	2	-2	17	8
CO-09-04	-2	-2	2	6	11	16	20	20	15	8	2	-3	16	8
CO-09-05	-2	-1	3	7	12	17	21	21	15	9	2	-2	19	9
CO-09-06	-3	-2	2	7	12	17	22	21	15	8	2	-4	19	8
CO-09-07	-4	-2	2	6	12	17	22	21	15	8	1	-4	17	8
WY-09-08	-3	-2	2	7	12	17	22	21	15	8	2	-4	17	8
WY-09-09	-4	-2	2	6	12	17	22	21	15	8	1	-4	17	8
WY-09-10	-3	-2	2	6	11	16	21	20	14	8	1	-4	17	8
WY-09-11	-4	-3	2	6	11	16	21	20	14	8	1	-4	17	7
WY-09-12	-4	-3	2	7	12	17	21	21	15	8	1	-4	17	8
WY-09-13	-3	-3	0	4	9	14	18	18	12	6	0	-4	14	6
WY-09-14	-6	-6	-2	1	5	10	14	14	9	3	-3	-7	10	3
WY-09-15	-9	-8	-5	-1	3	8	13	12	7	1	-6	-10	9	0
WY-09-16	-7	-6	-2	1	5	10	15	14	9	3	-4	-7	11	3
WY-09-17	-3	-3	0	5	10	14	19	19	13	6	0	-4	15	6
WY-09-18	-6	-3	3	8	13	18	22	21	15	8	0	-6	18	8
WY-09-19	-4	-2	3	8	12	17	21	21	15	8	1	-4	17	8
MT-09-20	-3	-2	3	7	12	17	21	20	15	8	1	-4	17	8
MT-09-21	-2	-1	3	7	11	16	20	20	14	8	2	-3	17	8
MT-09-22	-4	-2	2	7	11	16	20	19	14	8	1	-5	17	7
MT-09-23	-4	-3	0	4	9	13	17	17	12	6	-1	-5	15	5
MT-09-24	-7	-5	-2	2	7	11	16	16	11	5	-3	-7	13	4
MT-09-25	-7	-6	-3	1	5	10	15	14	10	3	-4	-8	12	2
MT-09-26	-9	-8	-4	1	6	10	15	14	9	3	-4	-9	12	2
MT-09-30	-7	-6	-2	2	7	11	16	16	11	4	-3	-8	13	3
MT-09-31	-7	-5	0	6	11	15	20	19	14	7	-1	-7	17	6
MT-09-32	-6	-4	2	7	12	16	20	20	14	8	0	-6	16	7
MT-09-33	-4	-2	3	7	12	16	21	20	15	9	1	-4	17	8
MT-09-34	-5	-3	2	6	11	15	20	20	14	8	1	-5	16	7
MT-09-35	-4	-1	5	9	14	19	23	23	17	10	3	-3	19	9
MT-09-36	-2	1	6	10	15	20	24	23	18	11	4	-1	20	11
MT-09-37	-4	-2	3	8	12	17	21	21	16	9	2	-3	17	8
MT-09-38	-4	-1	4	9	14	19	23	22	17	10	3	-3	20	9
UT-09-39	-3	1	7	12	17	22	26	25	19	12	4	-2	20	12
UT-09-40	-2	2	7	11	17	22	26	25	20	12	5	-1	22	12
UT-09-41	-2	1	6	10	15	21	24	23	18	11	4	-2	19	11
CO-09-42	-2	1	5	9	14	20	23	22	17	11	3	-2	15	10

Table 6 continued. Monthly Mean, Grow, and An Temperatures (°C)

Site	Jan T_m	Feb T_m	Mar T_m	Apr T_m	May T_m	Jun T_m	Jul T_m	Aug T_m	Sep Tm	Oct T_m	Nov T_m	Dec T_m	Grow T_m	An T_m
CO-09-43	-2	1	5	9	14	20	23	22	17	11	4	-1	18	10
CO-09-44	-3	-1	2	6	11	16	19	18	14	8	2	-4	16	7
CO-09-45	-6	-5	-1	3	7	11	15	14	10	5	-1	-6	13	4
CO-09-46	-2	1	6	10	16	21	25	23	18	11	4	-2	19	11
CO-09-47	-4	0	5	9	14	19	23	22	17	10	3	-3	19	9
CO-09-48	-9	-8	-4	-1	4	9	12	11	8	2	-5	-9	10	1
Elko	-4	-2	3	7	11	16	21	20	15	8	1	-4	18	8
Win	-1	2	5	8	13	18	23	21	16	10	3	-1	20	10

Appendix A: *n*-alkanes in semi-arid climate study

Table 7. Monthly Mean and Mean Annual Dew Point Temperature (An) (°C)

Site	Jan T_{dew}	Feb T_{dew}	Mar T_{dew}	Apr T_{dew}	May T_{dew}	Jun T_{dew}	Jul T_{dew}	Aug T_{dew}	Sep T_{dew}	Oct T_{dew}	Nov T_{dew}	Dec T_{dew}	An T_{dew}
CO-09-01	-10	-9	-7	-3	2	6	9	10	4	-2	-7	-10	-1
CO-09-02	-9	-8	-5	-2	4	8	11	11	5	-1	-5	-9	0
CO-09-03	-10	-9	-6	-3	3	7	9	10	5	-1	-6	-10	-1
CO-09-04	-10	-9	-7	-4	2	6	9	9	4	-2	-6	-10	-2
CO-09-05	-9	-8	-6	-3	3	7	9	9	4	-2	-6	-9	-1
CO-09-06	-11	-10	-7	-3	2	6	8	8	3	-3	-7	-11	-2
CO-09-07	-11	-9	-6	-3	3	6	8	7	3	-2	-7	-11	-2
WY-09-08	-10	-9	-6	-3	2	6	7	7	2	-2	-7	-10	-2
WY-09-09	-11	-10	-6	-4	1	5	7	6	2	-2	-7	-11	-2
WY-09-10	-11	-10	-6	-3	2	6	8	6	2	-2	-7	-11	-2
WY-09-11	-11	-10	-6	-2	3	7	8	7	3	-2	-7	-11	-2
WY-09-12	-10	-10	-6	-3	2	7	8	7	3	-1	-7	-11	-2
WY-09-13	-13	-11	-8	-5	0	4	5	4	1	-3	-9	-12	-4
WY-09-14	-14	-14	-11	-8	-3	1	3	1	-2	-6	-11	-14	-7
WY-09-15	-16	-15	-12	-10	-5	-1	1	0	-4	-8	-13	-16	-8
WY-09-16	-14	-13	-10	-8	-3	1	3	2	-2	-6	-11	-14	-6
WY-09-17	-13	-12	-9	-6	-1	4	5	3	-1	-5	-10	-13	-5
WY-09-18	-12	-10	-6	-3	2	6	8	6	2	-2	-8	-11	-2
WY-09-19	-11	-10	-6	-3	2	6	8	6	3	-2	-7	-11	-2
MT-09-20	-11	-10	-6	-3	2	6	7	6	2	-2	-7	-11	-2
MT-09-21	-10	-9	-6	-3	2	6	7	6	2	-2	-7	-10	-2
MT-09-22	-10	-9	-6	-3	2	6	7	7	3	-2	-6	-10	-2
MT-09-23	-11	-10	-7	-4	0	3	5	4	1	-3	-8	-11	-3
MT-09-24	-10	-11	-8	-5	-1	2	4	3	-1	-4	-7	-11	-4
MT-09-25	-12	-12	-10	-6	-3	0	2	1	-2	-6	-9	-13	-6
MT-09-26	-12	-12	-9	-6	-2	2	4	3	-1	-4	-9	-12	-5
MT-09-30	-11	-11	-8	-6	-2	2	3	2	-2	-5	-8	-12	-5
MT-09-31	-11	-9	-6	-3	1	5	7	5	1	-2	-6	-10	-2
MT-09-32	-9	-7	-4	-2	1	5	7	5	2	-1	-4	-8	-1
MT-09-33	-8	-7	-4	-3	1	4	5	4	1	-2	-5	-8	-2
MT-09-34	-8	-7	-5	-3	0	4	5	3	0	-3	-5	-8	-2
MT-09-35	-8	-6	-3	-1	2	4	6	6	2	-1	-4	-7	-1
MT-09-36	-7	-6	-3	-1	1	3	6	6	3	-1	-4	-7	-1
MT-09-37	-9	-8	-6	-4	-2	0	3	4	0	-3	-6	-9	-3
MT-09-38	-10	-8	-6	-5	-2	0	4	4	1	-3	-7	-10	-3
UT-09-39	-10	-7	-5	-4	-1	2	6	8	3	-1	-6	-9	-2
UT-09-40	-8	-6	-5	-4	-1	1	6	8	3	-1	-5	-8	-2
UT-09-41	-8	-7	-6	-5	-2	-1	4	6	2	-2	-6	-9	-3
CO-09-42	-9	-8	-6	-5	-3	0	5	7	3	-2	-7	-9	-3

Table 7 continued. Monthly average and An Dew Point Temperature (°C)

Site	Jan T_{dew}	Feb T_{dew}	Mar T_{dew}	Apr T_{dew}	May T_{dew}	Jun T_{dew}	Jul T_{dew}	Aug T_{dew}	Sep T_{dew}	Oct T_{dew}	Nov T_{dew}	Dec T_{dew}	An T_{dew}
CO-09-43	-8	-7	-6	-4	-2	0	6	7	3	-2	-6	-8	-2
CO-09-44	-10	-9	-7	-6	-3	-1	4	6	1	-4	-7	-11	-4
CO-09-45	-13	-12	-10	-8	-4	-2	3	4	-1	-6	-10	-13	-6
CO-09-46	-8	-7	-5	-4	-1	1	6	7	3	-2	-6	-8	-2
CO-09-47	-9	-7	-6	-4	-1	1	6	7	2	-2	-6	-9	-2
CO-09-48	-15	-15	-13	-10	-6	-4	1	2	-3	-8	-13	-15	-8
Elko	-8	-7	-5	-3	-1	1	1	1	-2	-4	-6	-8	-3
Win	-6	-5	-4	-3	-1	1	1	0	-2	-4	-5	-7	-3

Appendix A: *n*-alkanes in semi-arid climate study

Table 8. Monthly Mean, Mean Growing Season (Grow), and Mean Annual Relative Humidity (An) (%)

Site	Jan RH	Feb RH	Mar RH	Apr RH	May RH	Jun RH	Jul RH	Aug RH	Sept RH	Oct RH	Nov RH	Dec RH	Grow RH	An RH
CO-09-01	48	48	45	43	46	44	44	50	45	43	46	50	46	46
CO-09-02	57	53	48	45	50	47	46	50	47	47	54	58	48	50
CO-09-03	55	55	51	49	53	50	47	51	50	50	55	57	50	52
CO-09-04	55	56	53	50	53	50	46	50	49	49	55	57	50	52
CO-09-05	56	57	53	50	53	49	45	48	47	48	55	59	47	51
CO-09-06	56	55	52	49	52	48	42	43	43	46	51	57	44	49
CO-09-07	58	58	55	50	54	48	42	42	44	49	54	60	46	50
WY-09-08	58	58	55	52	51	46	40	39	42	48	54	60	44	49
WY-09-09	58	58	54	49	49	45	38	37	41	48	54	60	42	48
WY-09-10	55	57	55	52	53	49	42	40	43	49	55	58	45	50
WY-09-11	61	60	56	53	55	53	44	41	45	50	57	62	47	52
WY-09-12	62	60	56	51	53	52	43	40	44	51	57	61	47	52
WY-09-13	49	54	54	52	53	52	42	41	45	52	52	53	46	49
WY-09-14	52	52	52	53	54	53	45	42	45	50	51	56	48	50
WY-09-15	56	56	54	53	55	55	46	43	47	54	56	61	49	52
WY-09-16	57	56	54	53	55	55	45	42	47	54	56	61	49	52
WY-09-17	48	50	49	47	49	48	38	35	39	45	47	52	42	45
WY-09-18	67	58	51	46	47	45	39	37	41	48	55	65	42	48
WY-09-19	57	55	52	48	49	48	41	39	44	50	55	60	44	49
MT-09-20	55	53	51	47	49	49	41	39	43	48	52	57	44	48
MT-09-21	56	55	53	52	52	54	43	42	44	49	53	58	46	50
MT-09-22	63	59	55	52	51	53	44	43	47	51	60	64	47	53
MT-09-23	62	59	56	53	53	52	44	43	46	51	59	62	46	53
MT-09-24	74	68	64	57	54	54	43	41	45	53	69	73	46	56
MT-09-25	67	62	60	57	55	52	42	40	43	52	65	67	44	54
MT-09-26	75	72	67	60	57	56	48	46	49	58	71	78	49	60
MT-09-30	74	67	64	57	54	53	41	39	42	52	68	73	44	55
MT-09-31	78	74	65	53	50	51	43	40	43	52	68	79	44	56
MT-09-32	83	77	66	53	50	49	42	38	42	52	70	82	44	56
MT-09-33	77	70	59	50	46	43	35	33	37	47	62	75	39	50
MT-09-34	76	71	61	51	48	46	37	34	38	48	64	75	41	52
MT-09-35	74	69	56	48	44	38	33	33	37	47	61	72	37	48
MT-09-36	68	63	52	45	39	33	30	32	36	43	56	68	34	45
MT-09-37	65	62	50	43	38	32	31	33	35	41	53	64	34	43
MT-09-38	62	60	47	38	34	28	28	32	34	40	50	61	31	41
UT-09-39	59	56	41	32	30	26	28	34	35	40	48	57	32	38
UT-09-40	61	56	42	33	29	24	28	34	34	38	49	59	30	38
UT-09-41	62	56	43	35	30	23	27	34	34	38	48	59	31	38
CO-09-42	59	54	43	36	31	26	31	38	38	41	47	58	35	40

Appendix A: *n*-alkanes in semi-arid climate study

Table 8 continued. Monthly Average, Grow, and An RH (%)

Site	Jan RH	Feb RH	Mar RH	Apr RH	May RH	Jun RH	Jul RH	Aug RH	Sept RH	Oct RH	Nov RH	Dec RH	Grow RH	An RH
CO-09-43	61	56	45	38	33	26	33	39	39	41	49	61	35	42
CO-09-44	58	56	51	43	38	32	39	46	42	42	51	59	40	45
CO-09-45	55	55	52	46	43	38	46	52	46	45	51	54	46	48
CO-09-46	64	55	43	37	32	26	30	36	36	40	50	62	33	40
CO-09-47	66	60	48	41	36	30	33	38	38	42	54	65	35	44
CO-09-48	60	57	52	49	47	39	45	51	48	45	53	61	46	50
Elko	72	68	56	48	43	35	28	27	32	42	59	69	31	45
Win	69	62	51	44	39	31	23	23	29	38	56	67	26	41

Appendix A: *n*-alkanes in semi-arid climate study

Table 9. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
CO-09-1A	*Alnus incana*	Angiosperm Dicot	Shrub	C_3	Grey Alder
CO-09-1B	*Populus deltoides*	Angiosperm Dicot	Tree	C_3	Plains cottonwood
CO-09-1C	*Artemisia ludoviciana*	Angiosperm Dicot	Forb	C_3	White Sagebrush
CO-09-1D		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-01S			Soil		
CO-09-2A		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-2C	*Artemisia arbuscula*	Angiosperm Dicot	Shrub	C_3	Little Sagebrush
CO-09-2D	*Populus deltoides*	Angiosperm Dicot	Tree	C_3	Plains Cottonwood
CO-09-02S			Soil		
CO-09-3B		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-3C	*Agropyron Repends*	Angiosperm Monocot	Graminoid	C_3	Quack grass
CO-09-03S			Soil		
CO-09-4A	*Bromus Inermis*	Angiosperm Monocot	Graminoid	C_3	Smooth Brome
CO-09-04S			Soil		
CO-09-5A		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-05S			Soil		
CO-09-6A		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-6B	*Artemisia arbuscula*	Angiosperm Dicot	Shrub	C_3	Little Sagebrush
CO-09-6C	*Juniperus scopulorum*	Gymnosperm	Shrub	C_3	Rocky Mountain Juniper
CO-09-6D	*Ribes aureum*	Angiosperm Dicot	Shrub	C_3	Golden Current
CO-09-06S			Soil		
CO-09-7A		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-7B	*Artemisia arbuscula*	Angiosperm Dicot	Shrub	C_3	Little Sagebrush
CO-09-07S			Soil		
WY-09-8A	Puccinellia Nuttalliana	Angiosperm Monocot	Graminoid	C_3	Puttall's Alkaligrass
CO-09-8B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-08S			Soil		
WY-09-9A	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-9B		Angiosperm Monocot	Graminoid	C_3	Grass
WY-09-09S			Soil		
WY-09-10A	*Koeleria Macranthra*	Angiosperm Monocot	Graminoid	C_3	Prairie Junegrass
WY-09-10B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-10S			Soil		
WY-09-11A		Angiosperm Monocot	Graminoid	C_3	Grass
WY-09-11B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-11C		Angiosperm Dicot	Tree	C_3	Cottonwood
WY-09-11S			Soil		
WY-09-12A		Angiosperm Monocot	Graminoid	C_3	Grass
WY-09-12C	*Artemisia cana*	Angiosperm Dicot	Shrub	C_3	Silver Sagebrush

Appendix A: *n*-alkanes in semi-arid climate study

Table 9 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
WY-09-12D	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-12S			Soil		
WY-09-13A		Angiosperm	Vine	C_3	Vine
WY-09-13B		Angiosperm Monocot	Graminoid	C_3	Grass
WY-09-13D	*Pseudotsuga menziesii*	Gymnosperm	Tree	C_3	Douglas Fir
WY-09-13S			Soil		
WY-09-14A		Angiosperm Monocot	Graminoid	C_3	Grass
WY-09-14D	*Pinus contorta*	Gymnosperm	Tree	C_3	Lodgepole Pine
WY-09-14S			Soil		
WY-09-15A	*Poa Secunda*	Angiosperm Monocot	Graminoid	C_3	Sandberg Bluegrass
WY-09-15B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-15C	*Picea engelmannii*	Gymnosperm	Tree	C_3	Engelmann Spruce
WY-09-15S			Soil		
WY-09-16A		Angiosperm Monocot	Graminoid	C_3	Grass
WY-09-16B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-16S			Soil		
WY-09-17A	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-17B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-17S			Soil		
WY-09-18A	*Oryzopsis Hymenoide*	Angiosperm Monocot	Graminoid	C_3	Indian Ricegrass
WY-09-18B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-18S			Soil		
WY-09-19A	*Agropyron Repens*	Angiosperm Monocot	Graminoid	C_3	Quackgrass
WY-09-19B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
WY-09-19S			Soil		
MT-09-20A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-20C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-20D	*Juniperus scopulorum*	Gymnosperm	Shrub	C_3	Rocky Mountain Juniper
MT-09-20S			Soil		
MT-09-21A	*Agropyron Spicatum*	Angiosperm Monocot	Graminoid	C_3	Bluebunch Wheatgrass
MT-09-21B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-21C	*Juniperus scopulorum*	Gymnosperm	Shrub	C_3	Rocky Mountain Juniper
MT-09-21S			Soil		
MT-09-22A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-22B		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-22C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-22D	*Juniperus scopulorum*	Gymnosperm	Shrub	C_3	Rocky Mountain Juniper
MT-09-22E	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-22S			Soil		

Appendix A: *n*-alkanes in semi-arid climate study

Table 9 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
MT-09-23S			Soil		
MT-09-24A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-24B		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-24C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-24S			Soil		
MT-09-25A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-25B		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-25C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-25S			Soil		
MT-09-26A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-26C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-26S			Soil		
MT-09-30A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-30S			Soil		
MT-09-31A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-31C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-31S			Soil		
MT-09-32A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-32C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-32S			Soil		
MT-09-33A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-33C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-33S			Soil		
MT-09-34A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-34C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-34S			Soil		
MT-09-35B		Angiosperm Dicot	Shrub	C_3	
MT-09-35S			Soil		
MT-09-36A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-36B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-36C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-36S			Soil		
MT-09-37A		Angiosperm Monocot	Graminoid	C_4	Grass
MT-09-37B	*Artemisia cana*	Angiosperm Dicot	Shrub	C_3	Silver Sagebrush
MT-09-37S			Soil		
MT-09-38A		Angiosperm Monocot	Graminoid	C_3	Grass
MT-09-38C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
MT-09-38S			Soil		
UT-09-39A		Angiosperm Monocot	Graminoid	C_3	Grass

Appendix A: *n*-alkanes in semi-arid climate study

Table 9 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
UT-09-39C		Angiosperm Dicot	Shrub	C_3	
UT-09-39S			Soil		
UT-09-40A		Angiosperm Monocot	Graminoid	C_3	Grass
UT-09-40B	*Artemisia pygmaea*	Angiosperm Dicot	Shrub	C_3	Pygmy Sagebrush
UT-09-40S			Soil		
UT-09-41A		Angiosperm Monocot	Graminoid	C_3	Grass
UT-09-41C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
UT-09-41S			Soil		
CO-09-42A		Angiosperm Monocot	Graminoid	C_4	Grass
CO-09-42C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
CO-09-42S			Soil		
CO-09-43A		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-43C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
CO-09-43S			Soil		
CO-09-44A		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-44B	*Populus augustifolia*	Angiosperm Dicot	Tree	C_3	Narrowleaf Cottonwood
CO-09-44D	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
CO-09-44S			Soil		
CO-09-44E			Soil		
CO-09-45B	*Populus augustifolia*	Angiosperm Dicot	Tree	C_3	Narrowleaf Cottonwood
CO-09-45D	*Picea engelmannii*	Gymnosperm	Tree	C_3	Engelmann Spruce
CO-09-45S			Soil		
CO-09-46A		Angiosperm Monocot	Graminoid	C_4	Grass
CO-09-46B	*Artemisia ludoviciana*	Angiosperm Dicot	Forb	C_3	White Sagebrush
CO-09-46S			Soil		
CO-09-47A		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-47B	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
CO-09-47S			Soil		
CO-09-48A		Angiosperm Monocot	Graminoid	C_3	Grass
CO-09-48B	*Picea engelmannii*	Gymnosperm	Tree	C_3	Engelmann Spruce
CO-09-48S			Soil		
Elko A		Angiosperm Dicot	Graminoid	C_3	Grass
Elko C	*Artemisia tridentata*	Angiosperm Dicot	Shrub	C_3	Common Sagebrush
Win A		Angiosperm Dicot	Graminoid	C_3	Grass
Win B		Angiosperm Dicot	Graminoid	C_3	Grass
Win C	*Artemisia arbuscula*	Angiosperm Dicot	Shrub	C_3	Little Sagebrush
Win S			Soil		

Appendix A: *n*-alkanes in semi-arid climate study

Table 10. Isotope Hydrogen Data

Sample Name	(n)	δD C_{25}	δD C_{25} SD	δD C_{27}	δD C_{27} SD	δD C_{29}	δD C_{29} SD	δD C_{31}	δD C_{31} SD	δD C_{33}	δD C_{33} SD	δD C_{27-31}	δD C_{27-31} SD
CO-09-1A	2	-156	3	-166	2	-165	2	-164	2			-165	2
CO-09-1B	2			-136	1	-152	2	-151	1			-149	2
CO-09-1C	2			-153		-159	6	-159	6			-159	6
CO-09-1D	2			-228		-230	3	-230	3			-230	3
CO-09-1S	2			-198	1	-194	0					-195	0
CO-09-2A	2			-215		-226	3	-213	4			-220	4
CO-09-2C	2			-178	7	-193	1	-199				-190	3
CO-09-2D	2			-151	1	-161	4	-171				-160	4
CO-09-2S	2	-203		-215		-200	11	-209	6	-211		-204	10
CO-09-3B	2			-235	1	-239	1	-239	3			-239	2
CO-09-3C	2	-227		-229	7	-233	3	-231	1	-227		-232	2
CO-09-3S	2	-195	1	-201	4	-197	2	-198	4	-211		-198	1
CO-09-4A	2					-243	1	-262	1			-255	0
CO-09-4S	2	-227	1	-238	0	-228	1	-236	1	-236	2	-233	1
CO-09-5A	2					-226	9	-220	7			-224	9
CO-09-5S	2	-215		-217	9	-201	4	-211	2	-215		-209	2
CO-09-6A	2					-233	6	-231	5			-231	6
CO-09-6B	2			-175	4	-181	1	-179	2			-180	2
CO-09-6C	2			-139		-159		-136	0			-138	3
CO-09-6D	2	-177	5	-175	6	-188	2	-199	6			-185	3
CO-09-6S	2	-229	3	-229	2	-218	3	-222	1	-222	3	-222	2
CO-09-7A	2	-231		-225		-227	9	-222	9			-224	9
CO-09-7B	2	-176		-180	1	-184	4	-185	1			-183	2
CO-09-7S	2	-166		-171	4	-176	2	-182		-209	4	-175	3
WY-09-8A	2					-281	1	-267	4			-273	3
CO-09-8B	2			-162	5	-163	2	-173	2			-164	3
WY-09-8S	2	-225		-227	3	-206	2	-224	2			-218	2
WY-09-9A	2					-252	5	-253	5			-252	1
WY-09-9B	2	-214		-205	4	-219	6	-229	4			-218	5
WY-09-9S	2	-214	13	-227	3	-218	4	-223	0	-235		-222	2
WY-09-10A	2	-242		-248		-253	9	-243	3			-247	4
WY-09-10B	2			-178	4	-180	2	-193	10			-182	2
WY-09-10S	2	-213	7	-230	0	-215	3	-218	3			-221	2
WY-09-11A	2	-258		-253	0	-249	12	-250	8			-250	8
WY-09-11B	2			-190	7	-187	2	-192	3			-189	1
WY-09-11C	2			-198	9	-198	4	-204	2			-202	3
WY-09-11S	2	-217	2	-234	1	-224	3	-229	1	-220		-228	2
WY-09-12A	2	-263	11	-253	0	-246	6	-252	12			-248	7
WY-09-12C	2	-173		-173		-170	4					-172	2

Appendix A: *n*-alkanes in semi-arid climate study

Table 10 continued. Isotope Hydrogen Data

Sample Name	(n)	δD C_{25}	δD C_{25} SD	δD C_{27}	δD C_{27} SD	δD C_{29}	δD C_{29} SD	δD C_{31}	δD C_{31} SD	δD C_{33}	δD C_{33} SD	δD C_{27-31}	δD C_{27-31} SD
WY-09-12D	2			-182	8	-178	2	-201	1			-185	3
WY-09-12S	2	-209	7	-206	1	-202	1	-221	0	-218		-208	3
WY-09-13A	2	-210		-216	0	-213	5					-214	3
WY-09-13B	2	-285		-273		-298		-291	10			-293	7
WY-09-13D	2	-221	1	-213	12	-209	6					-211	8
WY-09-13S	2	-208	5	-218	3	-204	5	-198	2	-197	2	-205	3
WY-09-14A	2	-249	11	-256	5	-263	2	-274	0			-268	0
WY-09-14D	2			-203	3	-195	9	-199				-198	6
WY-09-14S	2	-211		-228	1	-209	2	-220	1			-218	0
WY-09-15A	2	-260		-276		-269	0	-287	2	-279		-281	1
WY-09-15B	2	-178		-187	0	-190	4	-193	7			-189	2
WY-09-15C	2	-220	8	-213	15	-211	11	-207	16			-211	13
WY-09-15S													
WY-09-16A	1	-261		-268		-263		-266				-265	
WY-09-16B	2	-184	4	-191	5	-191	5	-203	5			-192	5
WY-09-16S	2	-231	8	-231	11	-233	7	-237	5	-237		-233	8
WY-09-17A	2			-273	5	-250	1	-238	1			-252	3
WY-09-17B	2			-172	2	-175	3					-174	1
WY-09-17S	2	-221	0	-214	3	-201	5	-213	7	-216	1	-208	5
WY-09-18A	2	-231	2	-243	0	-239	2	-234	2			-236	2
WY-09-18B	2	-156	1	-171	1	-165	6	-169	9			-167	6
WY-09-18S	2	-200	22	-213	16	-202	14	-206	5	-212		-207	12
WY-09-19A	2	-242	5	-238	1	-246	2	-239	1			-242	1
WY-09-19B	2			-176	9	-182	9	-193	2			-183	7
WY-09-19S	2	-228	1	-227	0	-214	2	-219	1	-213	5	-219	1
MT-09-20A	2			-272	17	-279	0	-285	10			-282	5
MT-09-20C	2			-177	3	-189	5	-198	6			-188	5
MT-09-20D	2							-155	8			-155	8
MT-09-20S	2			-234	1	-204	3	-223	2			-218	2
MT-09-21A	2	-248	2	-257	5	-252	4	-254	5			-255	4
MT-09-21B	2			-189		-192	2	-197	4			-195	3
MT-09-21C	2							-160	1			-160	1
MT-09-21S	2	-226		-250	3	-233	1	-229	0	-223		-234	1
MT-09-22A	2	-272		-263	8	-269	10	-259	5			-265	8
MT-09-22B	2			-256		-273	1	-272	2			-272	2
MT-09-22C	2			-176	2	-175	1	-187	2			-177	0
MT-09-22D	2			-174		-183	2	-162	3			-166	3
MT-09-22E	2	-159	1	-163	1	-172	2	-178	1			-169	1
MT-09-22S	2	-213	6	-224	8	-223	1	-222		-212		-223	4

Appendix A: *n*-alkanes in semi-arid climate study

Table 10 continued. Isotope Hydrogen Data

Sample Name	(n)	δD C_{25}	δD C_{25} SD	δD C_{27}	δD C_{27} SD	δD C_{29}	δD C_{29} SD	δD C_{31}	δD C_{31} SD	δD C_{33}	δD C_{33} SD	δD C_{27-31}	δD C_{27-31} SD
MT-09-23S	2			-256	2	-227	3	-231	3	-240		-237	2
MT-09-24A	2					-268	7	-282	1			-279	3
MT-09-24B	2			-259	9	-259	3	-243	1			-258	3
MT-09-24C	2			-220	3	-227	2	-231	2			-225	2
MT-09-24S	2			-252	3	-247	2	-233	1			-246	1
MT-09-25A	1					-253		-270				-264	
MT-09-25B	2	-274	6	-261	9	-261	1	-260	2			-260	2
MT-09-25C	2	-194		-174	5	-175	5	-189	6			-176	5
MT-09-25S	2	-222	5	-221	0	-199	1	-212	0			-209	1
MT-09-26A	2					-277	10	-285	7			-282	1
MT-09-26C	2	-192		-192	12	-186	4	-198	5			-188	5
MT-09-26S	2			-210	2	-203	1					-206	2
MT-09-30A	2	-272		-253		-259	4	-262	4			-261	3
MT-09-30S	2			-244	4	-219	3	-223	4			-230	2
MT-09-31A	2	-273		-261	4	-258	10	-256	4			-257	8
MT-09-31C	2	-182		-177	7	-170	3	-176	4			-173	4
MT-09-31S	2	-220	8	-226	0	-203	1	-211	0			-211	0
MT-09-32A	2			-252	3	-248	5	-250	7			-249	4
MT-09-32C	2	-142		-153	2	-154	3	-162	2			-155	3
MT-09-32S	2	-224	6	-233	3	-228	6	-233	4	-222	3	-230	4
MT-09-33A	2					-277	3	-284	2			-281	2
MT-09-33C	2			-173	5	-171	3	-183				-172	1
MT-09-33S	2	-227	6	-224	2	-224	2	-235	4	-220	3	-229	3
MT-09-34A	2					-262	1	-265	1	-258		-264	1
MT-09-34C	2	-150	6	-159	4	-166	6	-167	1			-164	5
MT-09-34S	2	-234	2	-228	1	-222	2	-228	1	-229	0	-226	1
MT-09-35B	2			-123	7	-141	4					-134	4
MT-09-35S	2	-192	6	-198	6	-197	1	-194	7	-209		-197	3
MT-09-36A	2	-222	0	-236	1	-232	2					-235	1
MT-09-36B	2			-156	3	-150	5	-155	2			-152	3
MT-09-36C	2			-162	4	-159	3	-166	1			-161	3
MT-09-36S	2	-198		-196	9	-190	1	-200	2			-195	2
MT-09-37A	2			-237		-222	10	-234	4	-241		-231	6
MT-09-37B	2			-233	2	-227	4	-228	3			-228	3
MT-09-37S	2	-196	14	-201	12	-206	1	-217	4	-210	2	-211	2
MT-09-38A	2			-238	3	-232	4	-227	4			-231	4
MT-09-38C	2	-163	6	-158	1	-160	3	-162	3			-159	1
MT-09-38S	1	-137		-142		-170		-196				-167	
UT-09-39A	2			-186	2	-180	3	-180	3			-180	3

Appendix A: *n*-alkanes in semi-arid climate study

Table 10 continued. Isotope Hydrogen Data

Sample Name	(n)	δD C_{25}	δD C_{25} SD	δD C_{27}	δD C_{27} SD	δD C_{29}	δD C_{29} SD	δD C_{31}	δD C_{31} SD	δD C_{33}	δD C_{33} SD	δD C_{27-31}	δD C_{27-31} SD
UT-09-39C	2	-156	3	-157	7	-158	4	-160	7			-158	5
UT-09-39S	2			-164		-168	2	-164		-155		-166	1
UT-09-40A	2			-237	0	-244	4	-237	6			-241	4
UT-09-40B	2	-137	1	-143	5			-135				-142	6
UT-09-40S	2	-204		-195	8	-182	1	-182	3			-186	4
UT-09-41A	2					-197	3	-185	3			-191	3
UT-09-41C	2			-157	7	-153	4	-156	5			-154	4
UT-09-41S	2	-174	7	-180	6	-167	3	-176	1	-183	6	-173	2
CO-09-42A	2			-182	3	-193	3	-191	2	-180		-190	3
CO-09-42C	2	-152	6	-150	5	-151	8	-162	2			-153	6
CO-09-42S	2	-170	5	-154	2	-148	1	-159	2			-151	2
CO-09-43A	2			-233	1	-209	2	-193	2			-214	4
CO-09-43C	2			-150	2	-146	3	-150	7			-148	4
CO-09-43S	2			-179	4	-163	0	-167	5			-168	0
CO-09-44A	2					-220	4	-217	3			-218	3
CO-09-44B	2			-175	3	-172	4	-165	1			-172	4
CO-09-44D	2			-221	6	-213	3	-216	2			-215	3
CO-09-44S	2	-199	1	-191	0	-185	3	-194	4	-196	0	-191	3
CO-09-44E	1			-180		-173		-173				-174	
CO-09-45B	2			-183	3	-181	5	-202	4			-183	4
CO-09-45D	2			-185		-199	4	-187	2			-194	2
CO-09-45S	2	-213	1	-200	4	-194	3	-203	2	-204	2	-199	1
CO-09-46A	2	-158		-145	2			-132	2			-141	0
CO-09-46B	2	-163	1	-167	1	-176	3	-169	2			-170	1
CO-09-46S	2	-198		-197	7	-187	3	-179	7	-180	3	-187	4
CO-09-47A	2	-230	8	-224	5	-223	5	-202	3	-216	5	-218	6
CO-09-47B	2			-163	5	-162	4	-175	4			-165	4
CO-09-47S	2			-188	6	-169	5	-189	2			-178	4
CO-09-48A	2			-231		-240	2	-241	2			-240	2
CO-09-48B	2	-215	5	-202	5	-198	2	-184				-198	1
CO-09-48S	1	-193		-181		-196		-188		-156		-190	
Elko A	2			-236	1	-261	0	-251	0			-254	0
Elko C	2			-180	1	-176	0	-172	1			-176	1
Win A	2					-229	1	-242	1			-237	1
Win B	2			-217	4	-215	1	-219	2			-216	1
Win C	2			-140	3	-138	2	-142	3			-139	3
Win S	2	-177		-162	19	-165	2	-176	2			-171	9

Appendix A: *n*-alkanes in semi-arid climate study

Table 11. Isotope Carbon Data

Sample Name	(n)	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{25} SD	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{27} SD	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{29} SD	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{31} SD	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{33} SD	$\delta^{13}C$ C_{27-31}	$\delta^{13}C$ C_{27-31} SD	Bulk Carbon
CO-09-1A	2	-32	1	-32	0	-33	1	-33	1			-33	0	
CO-09-1B	2			-35	2	-34	1	-33	0	-46		-35	1	
CO-09-1C	2					-33	1	-33	1	-33	1	-33	1	
CO-09-1D	2			-34	2	-34	1	-33	1	-34	0	-33	1	
CO-09-1S	2	-32	0	-33	0	-32	1	-32	0	-33	0	-32	1	-27
CO-09-2A	2			-27	0	-28	1	-29	1			-28	1	
CO-09-2C	2	-23		-25	1	-26	1	-24	2			-25	1	
CO-09-2D	2			-33	0	-33	1	-33				-33	0	
CO-09-2S	2	-28	0	-30	1	-30	0	-30	0	-32	2	-30	0	-22
CO-09-3B	2	-32		-33	1	-34	1	-34	1	-36		-34	1	
CO-09-3C	2	-33		-34	1	-34	1	-35	1	-35	1	-34	1	
CO-09-3S	2	-26	0	-28	0	-31	0	-31	0	-30	0	-31	0	-20
CO-09-4A	2	-31		-32	1	-33	1	-33	1	-34	1	-33	1	
CO-09-4S	2	-30	0	-32	0	-32	0	-32	0	-32	0	-32	0	-26
CO-09-5A	2	-34	1	-35	1	-36	1	-37	1	-37	1	-36	1	
CO-09-5S	2	-31	0	-32	0	-33	0	-32	1	-31	0	-32	1	-24
CO-09-6A	2	-35		-37	1	-37	1	-38	0	-38	0	-38	0	
CO-09-6B	2			-32	0	-32	1	-34	1	-32	1	-33	1	
CO-09-6C	2			-40		-32		-31	0	-30	1	-32	1	
CO-09-6D	2	-31	0	-31	1	-31	0	-30	1			-31	0	
CO-09-6S	2	-31	1	-32	0	-33	0	-33	0	-33	1	-33	0	-26
CO-09-7A	2					-38	1	-37	1			-37	1	
CO-09-7B	2			-33	1	-33	1	-33	1	-31		-33	1	
CO-09-7S	2	-28	0	-29	0	-30	0	-30	0	-30	1	-30	0	-23
WY-09-8A	2	-32	0	-33	1	-34	1	-34	1	-34	1	-34	1	
CO-09-8B	2			-34	1	-34	1	-33	1	-30	0	-34	1	
WY-09-8S	2	-30	0	-31	1	-32	1	-31	0	-31	0	-31	1	-24
WY-09-9A	2	-33		-33	1	-33	1	-33	1	-30	0	-33	1	
WY-09-9B	2	-35		-35	0	-36	0	-37	0	-32		-36	0	
WY-09-9S	2	-31	0	-32	0	-33	0	-33	0	-33	0	-33	0	-26
WY-09-10A	2			-34	1	-34	1	-33	1	-33	0	-34	1	
WY-09-10B	2			-34	0	-34	0	-34	1	-33		-34	0	
WY-09-10S	2	-29	1	-30	1	-31	0	-31	0	-30	1	-31	0	-26
WY-09-11A	2			-36	1	-37	1	-36	0	-36	1	-36	0	
WY-09-11B	2			-33	1	-33	1	-34	1	-32		-33	1	
WY-09-11C	2			-32	1	-32	1	-33	1	-32	0	-33	1	
WY-09-11S	2	-30	2	-32	1	-33	0	-34	0	-34	1	-33	0	-26
WY-09-12A	2	-31		-36		-33	0	-33	1			-34	1	
WY-09-12C	2	-30	2	-31	1	-31	1	-31	2			-31	1	

Appendix A: *n*-alkanes in semi-arid climate study

Table 11 continued. Isotope Carbon Data

Sample Name	(n)	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{25} SD	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{27} SD	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{29} SD	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{31} SD	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{33} SD	$\delta^{13}C$ C_{27-31}	$\delta^{13}C$ C_{27-31} SD	Bulk Carbon
WY-09-12D	2			-32	0	-33	0	-32	0	-30	0	-32	0	
WY-09-12S	2	-30	0	-30	0	-31	1	-32	0	-32	0	-31	1	-25
WY-09-13A	2	-35	0	-37	0	-36	0	-35	0			-36	0	
WY-09-13B	2	-33	0	-34	0	-34	0	-34	0	-36	2	-34	0	
WY-09-13D	2	-31	1	-32	1	-31	1	-35	1			-32	1	
WY-09-13S	2	-31	0	-33	1	-34	0	-34	0	-34	0	-34	0	-26
WY-09-14A	2	-33	1	-34	1	-34	1	-34	0	-35	0	-34	0	
WY-09-14D	2	-32		-33		-32		-32				-32		
WY-09-14S	2	-29	1	-31	1	-31	1	-31	0	-32	1	-32	1	-25
WY-09-15A	2			-33	0	-34	1	-33	1	-34	1	-33	1	
WY-09-15B	2	-33	1	-32	0	-33	0	-32	0	-29	0	-32	0	
WY-09-15C	2	-29	1	-30	1	-30	1	-31	1			-30	1	
WY-09-15S														-27
WY-09-16A	0													
WY-09-16B	2	-31		-32	0	-32	0	-33	0			-32	0	
WY-09-16S	2	-31	0	-31	0	-32	0	-32	0	-32	0	-32	0	-26
WY-09-17A	2			-34	1	-35	0	-35	0	-35	0	-35	0	
WY-09-17B	2			-32		-31	0	-31				-31	0	
WY-09-17S	2	-32	1	-32	1	-32	1	-33	1	-32	0	-32	1	-26
WY-09-18A	2			-32	1	-33	0	-33	0	-32	0	-33	0	
WY-09-18B	2			-32	1	-31	1	-32	0	-25		-31	0	
WY-09-18S	2	-24	0	-27	1	-27	0	-26	0	-28		-27	0	
WY-09-19A	2	-33		-34	0	-35	0	-35	0	-37	1	-35	0	
WY-09-19B	2			-33	1	-32	1	-31	0	-28	1	-32	1	
WY-09-19S	2	-30	1	-31	1	-32	1	-32	1	-32	0	-32	1	-24
MT-09-20A	2			-33	1	-34	0	-33	0	-34	0	-34	0	
MT-09-20C	2			-34	0	-33	0	-33	1	-30	1	-33	0	
MT-09-20D	2			-38		-31		-32	1	-31		-33	1	
MT-09-20S	2	-31	1	-32	1	-33	1	-33	1	-33	0	-33	1	-26
MT-09-21A	2	-31		-31	0	-33	0	-33	0	-30		-32	0	
MT-09-21B	2			-33	0	-33	0	-33	0	-31	1	-33	0	
MT-09-21C	2							-31	0	-29	0	-31	0	
MT-09-21S	2	-28	1	-31	0	-33	0	-33	0	-32	1	-32	0	-24
MT-09-22A	2			-33		-33		-34		-34		-33		
MT-09-22B	2	-33		-34	0	-34	0	-34	0	-35	0	-34	0	
MT-09-22C	2			-32	0	-32	0	-31	1			-32	0	
MT-09-22D	2					-31		-31	0	-30	0	-31	0	
MT-09-22E	2	-33		-32	0	-32	0	-31	1			-32	0	
MT-09-22S	2	-28	0	-30	1	-32	1	-32	1	-32	1	-32	1	-25

Appendix A: *n*-alkanes in semi-arid climate study

Table 11 continued. Isotope Carbon Data

Sample Name	(n)	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{25} SD	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{27} SD	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{29} SD	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{31} SD	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{33} SD	$\delta^{13}C$ C_{27-31}	$\delta^{13}C$ C_{27-31} SD	Bulk Carbon
MT-09-23S	2	-32		-33	0	-33	1	-32	1	-32	0	-33	1	
MT-09-24A	2			-31	0	-32	0	-31	0	-32	0	-31	0	
MT-09-24B	2			-32	0	-32	0	-32				-32	0	
MT-09-24C	2			-30	0	-30	0	-30	1			-30	0	
MT-09-24S	2	-30		-33	1	-32	1	-32	1	-33	1	-33	1	-25
MT-09-25A														
MT-09-25B	2	-34		-34	0	-35	0	-36	1	-37	1	-35	1	
MT-09-25C	2			-32	0	-32	0	-33	1			-32	0	
MT-09-25S	2	-32	0	-33	0	-33	1	-32	0	-29	4	-32	0	-25
MT-09-26A	2			-31	0	-33	0	-33	0	-33	0	-33	0	
MT-09-26C	2			-31	0	-32	0	-31	1	-25		-31	0	
MT-09-26S	2	-31	0	-32	0	-33	1	-32	1	-31	1	-32	1	-26
MT-09-30A	2	-32		-33	0	-32	0	-32	0	-34	0	-32	0	
MT-09-30S	2	-31	1	-32	1	-32	1	-31	1	-32	1	-32	1	-25
MT-09-31A	2			-35	1	-35	1	-35	1	-37	2	-35	1	
MT-09-31C	2	-34	1	-34	1	-35	1	-35	1	-36	0	-35	1	
MT-09-31S	2	-33		-32	0	-32	1	-32	0	-32	1	-32	0	-26
MT-09-32A	2	-34	1	-34	1	-34	0	-34	0	-34	0	-34	0	
MT-09-32C	2	-33		-33	1	-34	1	-32	0	-32		-33	1	
MT-09-32S	2	-30		-33	2	-33	0	-34	0	-33	1	-33	1	-27
MT-09-33A	2	-35	0	-35	1	-35	0	-36	1	-36		-36	1	
MT-09-33C	2			-34	0	-34	0	-33	0	-31		-34	0	
MT-09-33S	2	-31		-32	0	-33	0	-33	1	-35	0	-33	1	-27
MT-09-34A	2	-32		-33	0	-35	0	-35	1	-35	1	-35	0	
MT-09-34C	2	-32		-32	0	-32	0	-32	0	-29		-32	0	
MT-09-34S	2	-31		-32	0	-32	0	-32	0	-33	0	-32	0	-24
MT-09-35B	2	-29		-29	0	-28	1	-39		-39		-30	1	
MT-09-35S	2	-28	0	-29	0	-28	1	-30	1	-30	1	-29	1	
MT-09-36A	2	-33		-34	1	-35	1	-35	1			-34	1	
MT-09-36B	2			-34	0	-35	0	-35	1			-35	0	
MT-09-36C	2			-35	0	-35	0	-35	0			-35	0	
MT-09-36S	2	-31		-31	1	-32	0	-32	0	-28	4	-32	0	-26
MT-09-37A	2					-25	1	-26	1	-24	1	-26	1	
MT-09-37B	2	-32		-32	0	-32	1	-32	0			-32	0	
MT-09-37S	2	-28	2	-29	0	-31	0	-33	0	-32	1	-32	0	-26
MT-09-38A	1	-31		-32	0	-33	0	-33	0			-33	0	
MT-09-38C	2	-31	1	-31	1	-31	1	-31	0	-25		-31	1	
MT-09-38S	2	-29	0	-29	1	-30	0	-30	1	-29		-30	0	-24
UT-09-39A	2	-30		-31	0	-31	0	-30	0	-27	0	-30	0	

Appendix A: *n*-alkanes in semi-arid climate study

Table 11 continued. Isotope Carbon Data

Sample Name	(n)	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{25} SD	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{27} SD	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{29} SD	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{31} SD	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{33} SD	$\delta^{13}C$ C_{27-31}	$\delta^{13}C$ C_{27-31} SD	Bulk Carbon
UT-09-39C	2	-29	0	-29	0	-29	0	-30	0			-29	0	
UT-09-39S	2	-29	0	-29	1	-28	1	-30	1	-30	1	-29	0	-25
UT-09-40A	2			-32	0	-32	0	-32	0			-32	0	
UT-09-40B	2	-31	2	-35	1	-31	1	-39		-39		-34	1	
UT-09-40S		-32		-32		-31	0	-31				-31	0	-24
UT-09-41A	2	-31		-33	1	-33	1	-33	0	-33	1	-33	1	
UT-09-41C	2			-31	0	-31	0	-31	1	-30		-31	0	
UT-09-41S	2	-29		-31		-31	0	-33	0	-33		-32	0	-24
CO-09-42A	2			-26		-25	1	-25	1	-24	1	-25	1	
CO-09-42C	2			-31	1	-31	0	-31	0	-29		-31	0	
CO-09-42S	2	-31	2	-33	0	-33	1	-32	1	-31	0	-32	1	-24
CO-09-43A	2	-36		-33	0	-33	0	-32	0	-33	0	-33	0	
CO-09-43C	2			-33	1	-32	0	-32	0	-30	0	-32	0	
CO-09-43S	2	-29	1	-31	0	-32	0	-32	0	-30	0	-31	0	-23
CO-09-44A	2	-32	0	-33	0	-32	0	-32	0	-34	0	-32	0	
CO-09-44B	2			-32	0	-31	0	-31				-31	0	
CO-09-44D	2	-32	1	-33	1	-33	1	-33	1			-33	1	
CO-09-44S	2	-29		-31	0	-33	1	-33	1	-32	1	-33	1	-22
CO-09-44E	0													
CO-09-45B	2			-34	0	-34	0	-35	1	-32	1	-34	0	
CO-09-45D	2			-30	1	-30	0	-30	0			-30	0	
CO-09-45S	2	-30	0	-31	0	-32	0	-33	0	-32	0	-32	0	-25
CO-09-46A	2	-26	0	-27	0	-27	0	-28	0	-29	1	-27	0	
CO-09-46B	1	-23	0	-23	0	-24	0	-24	1			-23	0	
CO-09-46S	2	-27		-28		-28	1	-31	0	-33	0	-29	0	
CO-09-47A	2	-31	0	-32	1	-32	0	-32	1	-32	1	-32	1	
CO-09-47B	2			-32	1	-32	0	-33	0			-32	0	
CO-09-47S	2	-30	0	-32	0	-32	0	-32	0	-32		-32	0	
CO-09-48A	2					-34	1	-34	0	-33	0	-34	0	
CO-09-48B	2	-30	0	-31	0	-31	0	-31	0			-31	0	
CO-09-48S	2	-30	0	-30	0	-31	1	-32	0	-32	1	-32	0	-26
Elko A	2			-35	2	-35	1	-35	0			-35	1	
Elko C	2			-33	0	-32	1	-33	1	-30	0	-33	0	
Win A	2			-31		-33	0	-33	1			-33	1	
Win B	2			-33		-35	0	-35	1			-35	1	
Win C	2			-32	1	-31	0	-31	0			-31	0	
Win S	2	-30		-30	0	-31	0	-31	0	-28	0	-31	0	-24

Appendix A: *n*-alkanes in semi-arid climate study

Table 12. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	ε_{C25}/MAP	ε_{C27}/MAP	ε_{C29}/MAP	ε_{C31}/MAP	ε_{C33}/MAP	ε_{C35}/MAP	ε_{C27-31}/MAP	ε_{C25}/MGP	ε_{C27}/MGP	ε_{C29}/MGP	ε_{C31}/MGP	ε_{C33}/MGP	ε_{C35}/MGP	ε_{C27-31}/MGP	ACL
CO-09-1A	-71	-82	-80	-80			-80	-86	-97	-95	-95			-96	28
CO-09-1B		-48	-66	-65			-63		-64	-81	-81			-78	29
CO-09-1C		-67	-74	-74			-74		-82	-89	-89			-89	30
CO-09-1D		-150	-152	-152			-152		-164	-166	-166			-166	31
CO-09-1S		-117	-112				-113		-131	-127				-128	29
CO-09-2A		-135	-147	-134			-141		-146	-157	-144			-152	29
CO-09-2C		-94	-111	-118			-108		-105	-122	-129			-119	29
CO-09-2D		-65	-76	-87			-75		-77	-87	-98			-86	29
CO-09-2S	-122	-135	-119	-129	-131		-123	-133	-146	-130	-140	-142		-134	30
CO-09-3B		-153	-158	-158			-157		-167	-172	-172			-171	29
CO-09-3C	-144	-146	-151	-148	-144		-150	-158	-160	-165	-162	-159		-164	30
CO-09-3S	-109	-116	-111	-111	-126		-112	-123	-130	-125	-126	-141		-127	30
CO-09-4A			-159	-179			-172			-174	-194			-187	30
CO-09-4S	-141	-153	-142	-151	-151		-148	-156	-168	-158	-166	-166		-163	30
CO-09-5A			-143	-136			-140			-160	-153			-157	30
CO-09-5S	-130	-133	-116	-126	-131		-124	-147	-150	-132	-142	-147		-140	30
CO-09-6A			-149	-147			-148			-165	-162			-163	30
CO-09-6B		-86	-92	-90			-91		-102	-108	-106			-107	33
CO-09-6C		-45	-67	-42			-44		-63	-84	-59			-62	33
CO-09-6D	-88	-86	-99	-112			-96	-104	-102	-116	-128			-113	28
CO-09-6S	-145	-145	-133	-137	-137		-137	-161	-161	-149	-153	-153		-153	30
CO-09-7A	-146	-140	-142	-137			-139	-162	-155	-157	-153			-155	30
CO-09-7B	-85	-90	-94	-95			-93	-102	-106	-111	-112			-110	29
CO-09-7S	-74	-80	-85	-92	-122		-84	-91	-97	-102	-109	-138		-101	30
WY-09-8A			-199	-184			-191			-215	-200			-207	30
CO-09-8B		-66	-68	-79			-69		-85	-86	-97			-88	29
WY-09-8S	-137	-139	-116	-136			-129	-154	-157	-134	-153			-146	30
WY-09-9A			-166	-167			-166			-183	-184			-184	29
WY-09-9B	-124	-113	-129	-140			-129	-142	-132	-147	-158			-146	29
WY-09-9S	-124	-138	-128	-134	-147		-133	-142	-156	-146	-152	-164		-150	30
WY-09-10A	-153	-160	-165	-154			-159	-171	-178	-183	-172			-177	29
WY-09-10B		-82	-84	-98			-86		-101	-103	-117			-106	29
WY-09-10S	-120	-139	-123	-126			-129	-139	-158	-142	-145			-148	29
WY-09-11A	-173	-167	-163	-163			-164	-189	-183	-180	-180			-180	31
WY-09-11B		-97	-93	-99			-95		-114	-111	-117			-113	30
WY-09-11C		-106	-106	-113			-111		-124	-124	-130			-128	30
WY-09-11S	-127	-146	-134	-140	-131		-139	-144	-163	-151	-157	-148		-156	30
WY-09-12A	-180	-168	-160	-167			-163	-196	-185	-177	-183			-180	29
WY-09-12C	-79	-79	-76				-78	-98	-97	-95				-96	27

Table 12 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27\text{-}31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27\text{-}31/MGP}$	ACL
WY-09-12D		-89	-85	-110			-92		-107	-104	-128			-111	30
WY-09-12S	-119	-115	-111	-133	-130		-118	-137	-133	-129	-150	-147		-136	29
WY-09-13A	-113	-119	-115				-117	-132	-137	-134				-135	28
WY-09-13B	-197	-184	-211	-203			-205	-214	-201	-228	-220			-222	29
WY-09-13D	-124	-115	-111				-113	-143	-134	-130				-132	27
WY-09-13S	-110	-121	-106	-99	-98		-107	-129	-140	-125	-118	-118		-126	30
WY-09-14A	-149	-157	-165	-177			-170	-169	-176	-184	-196			-189	30
WY-09-14D		-96	-88	-92			-91		-117	-109	-113			-112	29
WY-09-14S	-105	-124	-104	-116			-114	-126	-145	-125	-136			-134	29
WY-09-15A	-155	-174	-166	-187	-177		-179	-178	-196	-188	-208	-199		-201	30
WY-09-15B	-62	-72	-75	-79			-74	-87	-97	-100	-104			-99	28
WY-09-15C	-109	-102	-99	-94			-99	-133	-126	-124	-119			-123	26
WY-09-15S															
WY-09-16A	-163	-171	-165	-169			-167	-182	-190	-184	-188			-186	
WY-09-16B	-75	-84	-84	-97			-85	-96	-105	-105	-117			-106	28
WY-09-16S	-129	-129	-131	-136	-136		-131	-148	-149	-151	-156	-155		-151	29
WY-09-17A		-177	-150	-137			-153		-200	-174	-161			-177	29
WY-09-17B		-62	-66				-65		-89	-92				-91	
WY-09-17S	-117	-109	-95	-109	-112		-103	-142	-135	-121	-134	-138		-129	30
WY-09-18A	-142	-156	-150	-145			-148	-161	-174	-169	-164			-166	30
WY-09-18B	-58	-75	-68	-73			-70	-78	-95	-88	-93			-91	29
WY-09-18S	-107	-122	-109	-114	-121		-115	-127	-141	-129	-133	-140		-134	29
WY-09-19A	-153	-149	-157	-149			-153	-172	-168	-176	-168			-172	30
WY-09-19B		-80	-87	-98			-87		-100	-107	-118			-108	29
WY-09-19S	-138	-136	-122	-127	-120		-127	-157	-156	-142	-147	-140		-147	30
MT-09-20A		-186	-194	-200			-197		-205	-212	-219			-215	30
MT-09-20C		-80	-93	-103			-92		-101	-114	-123			-113	30
MT-09-20D				-55			-55				-77			-77	33
MT-09-20S		-143	-110	-130			-126		-163	-131	-150			-146	30
MT-09-21A	-156	-166	-161	-162			-163	-176	-185	-180	-182			-183	28
MT-09-21B		-90	-93	-99			-96		-111	-114	-120			-117	29
MT-09-21C				-57			-57				-79			-79	33
MT-09-21S	-132	-158	-139	-134	-128		-140	-152	-178	-159	-154	-148		-160	30
MT-09-22A	-182	-172	-178	-168			-174	-203	-193	-199	-189			-195	29
MT-09-22B		-164	-183	-182			-182		-186	-204	-203			-203	30
MT-09-22C		-75	-73	-87			-76		-98	-97	-110			-99	29
MT-09-22D		-72	-82	-59			-63		-95	-105	-82			-87	30
MT-09-22E	-55	-59	-70	-77			-66	-79	-83	-93	-100			-90	27
MT-09-22S	-115	-128	-127	-126	-114		-127	-138	-150	-149	-148	-137		-149	29

Appendix A: *n*-alkanes in semi-arid climate study

Table 12 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	εC25/MAP	εC27/MAP	εC29/MAP	εC31/MAP	εC33/MAP	εC35/MAP	εC27-31/MAP	εC25/MGP	εC27/MGP	εC29/MGP	εC31/MGP	εC33/MGP	εC35/MGP	εC27-31/MGP	ACL
MT-09-23S		-160	-128	-132	-142		-139		-181	-150	-155	-164		-161	30
MT-09-24A			-171	-187			-183			-193	-208			-204	31
MT-09-24B		-160	-160	-143			-159		-182	-182	-165			-181	29
MT-09-24C		-117	-124	-129			-123		-140	-147	-152			-145	29
MT-09-24S		-153	-147	-131			-146		-175	-169	-154			-168	29
MT-09-25A			-151	-170			-163			-175	-194			-188	
MT-09-25B	-175	-160	-160	-159			-160	-199	-185	-184	-184			-184	30
MT-09-25C	-85	-61	-62	-78			-64	-111	-88	-90	-105			-91	29
MT-09-25S	-116	-115	-90	-104			-101	-142	-141	-116	-130			-127	29
MT-09-26A			-180	-189			-185			-203	-212			-209	30
MT-09-26C	-82	-83	-77	-90			-78	-109	-109	-103	-116			-105	28
MT-09-26S		-104	-96				-99		-129	-122				-125	29
MT-09-30A	-172	-151	-158	-162			-160	-197	-176	-183	-186			-185	30
MT-09-30S		-141	-112	-117			-125		-166	-139	-143			-151	29
MT-09-31A	-184	-170	-167	-165			-166	-205	-192	-189	-187			-188	30
MT-09-31C	-82	-76	-69	-75			-71	-106	-100	-93	-100			-96	29
MT-09-31S	-125	-131	-105	-115			-114	-148	-154	-128	-138			-138	29
MT-09-32A		-164	-159	-161			-161		-183	-179	-181			-180	29
MT-09-32C	-42	-54	-55	-63			-56	-64	-76	-77	-85			-78	29
MT-09-32S	-133	-143	-137	-143	-130		-140	-153	-163	-157	-163	-151		-160	29
MT-09-33A			-193	-201			-197			-212	-220			-216	
MT-09-33C		-77	-74	-89			-76		-99	-96	-110			-98	29
MT-09-33S	-137	-134	-133	-146	-130		-140	-157	-154	-154	-166	-150		-160	31
MT-09-34A			-171	-175	-167		-174			-195	-199	-191		-198	30
MT-09-34C	-46	-56	-64	-65			-62	-74	-84	-91	-92			-89	29
MT-09-34S	-140	-134	-127	-134	-134		-131	-165	-159	-152	-159	-159		-156	30
MT-09-35B		-26	-46				-38		-44	-63				-55	28
MT-09-35S	-102	-109	-108	-105	-121		-108	-118	-125	-124	-121	-137		-124	30
MT-09-36A	-138	-154	-149				-152	-151	-167	-162				-165	29
MT-09-36B		-65	-59	-64			-61		-79	-73	-78			-75	29
MT-09-36C		-72	-69	-77			-71		-86	-83	-91			-85	29
MT-09-36S	-111	-109	-102	-114			-108	-125	-123	-116	-127			-122	30
MT-09-37A		-150	-133	-147	-155		-143		-165	-149	-163	-170		-159	32
MT-09-37B		-146	-140	-140			-140		-161	-155	-156			-156	30
MT-09-37S	-104	-110	-116	-129	-120		-121	-120	-126	-132	-144	-136		-137	30
MT-09-38A		-155	-147	-142			-146		-172	-164	-159			-163	29
MT-09-38C	-71	-65	-67	-70			-67	-89	-84	-86	-88			-86	29
MT-09-38S	-43	-48	-79	-108			-76	-62	-67	-98	-125			-94	28
UT-09-39A		-103	-97	-97			-97		-115	-109	-109			-109	31

Appendix A: *n*-alkanes in semi-arid climate study

Table 12 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
UT-09-39C	-70	-72	-73	-75			-73	-83	-84	-85	-87			-86	29
UT-09-39S		-80	-84	-79	-69		-82		-92	-96	-92	-82		-94	29
UT-09-40A		-159	-166	-159			-163		-172	-179	-173			-177	29
UT-09-40B	-48	-55		-46			-54	-63	-70		-61			-69	30
UT-09-40S	-122	-112	-98	-98			-102	-136	-127	-112	-112			-116	29
UT-09-41A			-113	-99			-106			-126	-112			-119	29
UT-09-41C		-69	-64	-67			-66		-82	-77	-81			-79	29
UT-09-41S	-87	-94	-80	-90	-97		-86	-100	-107	-93	-102	-110		-99	30
CO-09-42A		-98	-110	-108	-96		-107		-111	-123	-120	-108		-120	32
CO-09-42C	-65	-63	-64	-76			-66	-78	-76	-77	-89			-79	29
CO-09-42S	-84	-67	-60	-73			-64	-97	-80	-73	-86			-77	29
CO-09-43A		-153	-127	-109			-132		-164	-139	-121			-144	28
CO-09-43C		-62	-57	-62			-59		-74	-70	-74			-72	30
CO-09-43S		-94	-76	-81			-82		-106	-88	-93			-94	31
CO-09-44A			-131	-128			-130			-151	-149			-150	29
CO-09-44B		-81	-78	-70			-78		-102	-99	-91			-99	29
CO-09-44D		-133	-123	-127			-125		-153	-144	-147			-146	29
CO-09-44S	-108	-99	-93	-103	-105		-99	-129	-120	-114	-124	-126		-120	31
CO-09-44E		-87	-79	-79			-80		-108	-100	-100			-101	
CO-09-45B		-81	-79	-102			-81		-102	-101	-124			-102	28
CO-09-45D		-83	-99	-85			-94		-105	-120	-107			-115	29
CO-09-45S	-115	-100	-94	-104	-104		-99	-136	-122	-115	-125	-125		-120	30
CO-09-46A	-72	-57		-43			-53	-85	-71		-56			-66	29
CO-09-46B	-77	-81	-92	-83			-85	-90	-94	-105	-96			-98	28
CO-09-46S	-116	-115	-104	-95	-96		-104	-128	-127	-116	-107	-109		-116	30
CO-09-47A	-149	-142	-141	-117	-133		-135	-164	-157	-156	-133	-148		-150	31
CO-09-47B		-74	-73	-87			-76		-91	-89	-103			-93	30
CO-09-47S		-102	-80	-103			-91		-118	-96	-118			-107	29
CO-09-48A		-127	-137	-138			-138		-152	-163	-164			-163	30
CO-09-48B	-109	-94	-90	-74			-90	-136	-121	-116	-101			-117	27
CO-09-48S	-84	-70	-87	-78	-42		-80	-111	-97	-114	-105	-70		-107	29
Elko A		-150	-177	-165			-169		-169	-196	-185			-188	30
Elko C		-87	-82	-78			-83		-108	-103	-99			-104	29
Win A			-143	-158			-152			-164	-178			-173	30
Win B		-130	-128	-132			-129		-151	-149	-153			-150	30
Win C		-44	-43	-46			-44		-67	-66	-69			-67	30
Win S	-86	-69	-72	-85			-79	-108	-91	-94	-107			-101	29

Appendix A: *n*-alkanes in semi-arid climate study

Table 13. Water use efficacy (WUE), Carbon discrimination ($\Delta leaf_{C29\text{-}31/atm}$ or $\Delta leaf_{bulk/atm}$), and Carbon Apparent fractionation

Sample Name	WUE	$\Delta leaf_{C29\text{-}31/atm}$	$\Delta leaf_{bulk/atm}$	$\varepsilon_{C27\text{-}31/bulk}$	Sample Name	WUE	$\Delta leaf_{C29\text{-}31/atm}$	$\Delta leaf_{bulk/atm}$	$\varepsilon_{C27\text{-}31/bulk}$
CO-09-1A	70	26			WY-09-12D	74	25		
CO-09-1B	39	28			WY-09-12S	102	23	17	-6
CO-09-1C	57	26			WY-09-13A	10	29		
CO-09-1D	58	26			WY-09-13B	46	27		
CO-09-1S	76	25	19	-6	WY-09-13D	84	25		
CO-09-2A	149	20			WY-09-13S	53	27	19	-8
CO-09-2C	188	18			WY-09-14A	49	27		
CO-09-2D	64	26			WY-09-14D	74	25		
CO-09-2S	113	23	14	-8	WY-09-14S	78	25	18	-7
CO-09-3B	47	27			WY-09-15A	60	26		
CO-09-3C	43	27			WY-09-15B	76	25		
CO-09-3S	104	23	13	-11	WY-09-15C	109	23		
CO-09-4A	64	26			WY-09-15S			19	
CO-09-4S	77	25	18	-7	WY-09-16A				
CO-09-5A	9	29			WY-09-16B	80	25		
CO-09-5S	75	25	17	-8	WY-09-16S	85	25	19	-6
CO-09-6A	-12	31			WY-09-17A	38	28		
CO-09-6B	70	26			WY-09-17B	100	24		
CO-09-6C	82	25			WY-09-17S	75	25	18	-7
CO-09-6D	104	23			WY-09-18A	70	25		
CO-09-6S	66	26	19	-7	WY-09-18B	93	24		
CO-09-7A	-7	30			WY-09-18S	171	19		
CO-09-7B	66	26			WY-09-19A	27	28		
CO-09-7S	116	23	15	-7	WY-09-19B	78	25		
WY-09-8A	55	27			WY-09-19S	82	25	16	-9
CO-09-8B	52	27			MT-09-20A	54	27		
WY-09-8S	93	24	17	-7	MT-09-20C	58	26		
WY-09-9A	61	26			MT-09-20D	71	25		
WY-09-9B	20	29			MT-09-20S	65	26	18	-7
WY-09-9S	71	25	18	-7	MT-09-21A	76	25		
WY-09-10A	52	27			MT-09-21B	64	26		
WY-09-10B	43	27			MT-09-21C	101	24		
WY-09-10S	100	24	18	-5	MT-09-21S	75	25	16	-9
WY-09-11A	7	30			MT-09-22A	58	26		
WY-09-11B	59	26			MT-09-22B	49	27		
WY-09-11C	71	25			MT-09-22C	88	24		
WY-09-11S	60	26	19	-7	MT-09-22D	91	24		
WY-09-12A	56	26			MT-09-22E	86	25		
WY-09-12C	99	24			MT-09-22S	89	24	18	-6

Table 13 continued. WUE, Carbon discrimination, ($\Delta leaf_{C29\text{-}31/atm}$ or $\Delta leaf_{bulk/atm}$), and Carbon Apparent fractionation

Sample Name	WUE	$\Delta leaf_{C29\text{-}31/atm}$	$\Delta leaf_{bulk/atm}$	$\varepsilon_{C27\text{-}31/bulk}$	Sample Name	WUE	$\Delta leaf_{C29\text{-}31/atm}$	$\Delta leaf_{bulk/atm}$	$\varepsilon_{C27\text{-}31/bulk}$
MT-09-23S	67	26			UT-09-39C	123	22		
MT-09-24A	90	24			UT-09-39S	127	22	17	-4
MT-09-24B	81	25			UT-09-40A	79	25		
MT-09-24C	114	23			UT-09-40B	44	27		
MT-09-24S	73	25	17	-8	UT-09-40S	95	24	17	-7
MT-09-25A					UT-09-41A	70	25		
MT-09-25B	26	28			UT-09-41C	100	24		
MT-09-25C	78	25			UT-09-41S	79	25	17	-8
MT-09-25S	73	25	18	-7	CO-09-42A	198	17		
MT-09-26A	72	25			CO-09-42C	96	24		
MT-09-26C	90	24			CO-09-42S	75	25	16	-9
MT-09-26S	74	25	18	-7	CO-09-43A	72	25		
MT-09-30A	76	25			CO-09-43C	78	25		
MT-09-30S	85	25	18	-7	CO-09-43S	91	24	15	-9
MT-09-31A	36	28			CO-09-44A	78	25		
MT-09-31C	28	28			CO-09-44B	101	24		
MT-09-31S	75	25	18	-7	CO-09-44D	62	26		
MT-09-32A	45	27			CO-09-44S	67	26	15	-11
MT-09-32C	62	26			CO-09-44E				
MT-09-32S	61	26	19	-7	CO-09-45B	47	27		
MT-09-33A	22	29			CO-09-45D	119	22		
MT-09-33C	51	27			CO-09-45S	78	25	18	-7
MT-09-33S	59	26	19	-7	CO-09-46A	158	20		
MT-09-34A	34	28			CO-09-46B	221	16		
MT-09-34C	86	24			CO-09-46S	124	22		
MT-09-34S	79	25	16	-8	CO-09-47A	82	25		
MT-09-35B	119	22			CO-09-47B	83	25		
MT-09-35S	134	21			CO-09-47S	83	25		
MT-09-36A	41	27			CO-09-48A	51	27		
MT-09-36B	38	28			CO-09-48B	98	24		
MT-09-36C	38	28			CO-09-48S	85	25	18	-6
MT-09-36S	82	25	19	-6	Elko A	28	28		
MT-09-37A	186	18			Elko C	72	25		
MT-09-37B	83	25			Win A	66	26		
MT-09-37S	87	24	18	-6	Win B	35	28		
MT-09-38A	59	26			Win C	96	24		
MT-09-38C	93	24			Win S	97	24	16	-7
MT-09-38S	120	22	17	-6					
UT-09-39A	108	23							

Appendix A: *n*-alkanes in semi-arid climate study

Table 14. Summary of plant groups and soils

C_3 grasses	ACL	$\delta^{13}C_{C27\text{-}31}$	Bulk Carbon	$\delta D_{C27\text{-}31}$	$\varepsilon_{C27\text{-}31/MAP}$	$\varepsilon_{C27\text{-}31/MGP}$	$\Delta leaf_{C29\text{-}31/atm}$	$\Delta leaf_{bulk/atm}$	WUE
(n)	42	43	0	45	45	45	43	0	43
Mean	30	-34		-246	-158	-176	27		53
Standard Deviation	1	2		25	22	24	2		30
Standard Error	0	0		4	3	4	0		5

Angiosperm Shrubs	ACL	$\delta^{13}C_{C27\text{-}31}$	Bulk Carbon	$\delta D_{C27\text{-}31}$	$\varepsilon_{C27\text{-}31/MAP}$	$\varepsilon_{C27\text{-}31/MGP}$	$\Delta leaf_{C29\text{-}31/atm}$	$\Delta leaf_{bulk/atm}$	WUE
(n)	41	42	0	42	42	42	42	0	42
Mean	29	-32		-178	-83	-102	25		78
Standard Deviation	1	2		26	27	27	2		29
Standard Error	0	0		4	4	4	0		4

Angiosperm Trees	ACL	$\delta^{13}C_{C27\text{-}31}$	Bulk Carbon	$\delta D_{C27\text{-}31}$	$\varepsilon_{C27\text{-}31/MAP}$	$\varepsilon_{C27\text{-}31/MGP}$	$\Delta leaf_{C29\text{-}31/atm}$	$\Delta leaf_{bulk/atm}$	WUE
(n)	5	5	0	5	5	5	5	0	5
Mean	29	-33		-173	-81	-99	26		64
Standard Deviation	1	1		21	18	19	2		24
Standard Error	0	1		9	8	9	1		11

* $\delta^{13}C_{C27\text{-}31}$, $\delta D_{C27\text{-}31}$, $\varepsilon_{C27\text{-}31/MAP}$, $\varepsilon_{C27\text{-}31/MGP}$, $\Delta leaf_{C29\text{-}31/atm}$, $\Delta leaf_{bulk/atm}$, Bulk carbon are reported as ‰ values

Appendix A: *n*-alkanes in semi-arid climate study

Table 14. Summary of plant groups and soils

Gymnosperm Trees	ACL	$\delta^{13}C_{C27-31}$	Bulk Carbon	δD_{C27-31}	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C27-31/MGP}$	$\Delta leaf_{C29-31/atm}$	$\Delta leaf_{bulk/atm}$	WUE
(n)	5	5	0	5	5	5	5	0	5
Mean	28	-31		-202	-97	-120	24		97
Standard Deviation	1	1		8	10	8	1		18
Standard Error	1	0		3	4	4	1		8

Soils	ACL	$\delta^{13}C_{C27-31}$	Bulk Carbon	δD_{C27-31}	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C27-31/MGP}$	$\Delta leaf_{C29-31/atm}$	$\Delta leaf_{bulk/atm}$	WUE
(n)	45	45	41	46	46	46	45	41	45
Mean	30	-32	-25	-205	-112	-131	24	17	87
Standard Deviation	1	1	1	23	22	23	1	2	23
Standard Error	0	0	0	3	3	3	0	0	3

* $\delta^{13}C_{C27-31}$, δD_{C27-31}, $\varepsilon_{C27-31/MAP}$, $\varepsilon_{C27-31/MGP}$, $\Delta leaf_{C29-31/atm}$, $\Delta leaf_{bulk/atm}$, Bulk carbon are reported as ‰ values

Appendix A: *n*-alkanes in semi-arid climate study

Table 15. Relationships between isotopic compositions, WUE, carbon discrimination, ACL of *n*-alkanes to climatic variables

y-axis	x-axis	C_3 Grasses		Angiosperm Shrubs		Angiosperm Trees		Gymnosperm Trees		Soils	
		r^2 value	p value	r^2 value	p value	r^2 value	p value	r^2 value	p value	r^2 value	p value
$\delta^{13}C$ C_{27-31}	Latitude	0.05		0.02		0.01		0.43	0.23	0.04	
$\delta^{13}C$ C_{27-31}	Longitude	0.00		0.00		0.30	0.34	0.08		0.00	
$\delta^{13}C$ C_{27-31}	Elevation	0.01		0.00		0.00		0.40	0.26	0.06	
$\delta^{13}C$ C_{27-31}	An PPT	0.00		0.01		0.03		0.14		0.17	
$\delta^{13}C$ C_{27-31}	An VPD	0.01		0.00		0.01		0.00		0.16	
$\delta^{13}C$ C_{27-31}	PET	0.01		0.02		0.00		0.06		0.13	
$\delta^{13}C$ C_{27-31}	MAT	0.01		0.00		0.00		0.08		0.12	
$\delta^{13}C$ C_{27-31}	An RH	0.02		0.00		0.01		0.00		0.10	
δD C_{27-31}	Latitude	0.54	0.00	0.13		0.40	0.25	0.56	0.15	0.56	0.00
δD C_{27-31}	Longitude	0.03		0.08		0.41	0.24	0.04		0.00	
δD C_{27-31}	Elevation	0.03		0.12		0.00		0.38	0.27	0.01	
δD C_{27-31}	An PPT	0.17		0.06		0.13		0.03		0.03	
δD C_{27-31}	An VPD	0.46	0.00	0.22		0.42	0.24	0.02		0.39	0.00
δD C_{27-31}	PET	0.46	0.00	0.22		0.68	0.08	0.08		0.37	0.00
δD C_{27-31}	MAT	0.40	0.00	0.20		0.39	0.26	0.00		0.25	0.00
δD C_{27-31}	An RH	0.44	0.00	0.09		0.42	0.24	0.40	0.25	0.57	0.00
$\varepsilon_{C27-31/MAP}$	Latitude	0.41	0.00	0.02		0.70	0.08	0.25	0.39	0.39	0.00
$\varepsilon_{C27-31/MAP}$	Longitude	0.01		0.14		0.17		0.08		0.01	
$\varepsilon_{C27-31/MAP}$	Elevation	0.00		0.04		0.09		0.62	0.11	0.08	
$\varepsilon_{C27-31/MAP}$	An PPT	0.07		0.02		0.00		0.47	0.20	0.00	
$\varepsilon_{C27-31/MAP}$	An VPD	0.26	0.00	0.05		0.14		0.24	0.40	0.15	
$\varepsilon_{C27-31/MAP}$	PET	0.24		0.04		0.40	0.26	0.11		0.12	
$\varepsilon_{C27-31/MAP}$	MAT	0.18		0.04		0.12		0.41	0.24	0.05	
$\varepsilon_{C27-31/MAP}$	An RH	0.31	0.00	0.01		0.60	0.12	0.00		0.39	0.00
$\varepsilon_{C27-31/MGP}$	Latitude	0.44	0.00	0.05		0.52	0.18	0.02		0.44	0.00
$\varepsilon_{C27-31/MGP}$	Longitude	0.04		0.09		0.35	0.29	0.01		0.00	
$\varepsilon_{C27-31/MGP}$	Elevation	0.00		0.07		0.01		0.39	0.26	0.04	
$\varepsilon_{C27-31/MGP}$	Growing PPT	0.03		0.08		0.00		0.00		0.02	
$\varepsilon_{C27-31/MGP}$	Growing VPD	0.22		0.14		0.13		0.07		0.17	
$\varepsilon_{C27-31/MGP}$	MGT	0.21		0.09		0.20		0.18		0.08	
$\varepsilon_{C27-31/MGP}$	Growing RH	0.19		0.12		0.00		0.01		0.38	0.00

*Highlighted red cells are for r^2 values greater than 0.25, the green cells are p-values less than 0.05

Appendix A: *n*-alkanes in semi-arid climate study

Table 15 continued. Relationships between isotopic compositions, WUE, carbon discrimination, ACL of *n*-alkanes to climatic variables

y-axis	x-axis	C_3 Grasses		Angiosperm Shrubs		Angiosperm Trees		Gymnosperm Trees		Soils	
		r^2 value	p value	r^2 value	p value	r^2 value	p value	r^2 value	p value	r^2 value	p value
WUE	Latitude	0.05		0.02		0.01		0.43	0.23	0.04	
WUE	Longitude	0.00		0.00		0.30	0.34	0.08		0.00	
WUE	Elevation	0.01		0.00		0.00		0.40	0.25	0.06	
WUE	An PPT	0.00		0.01		0.03		0.14		0.17	
WUE	An VPD	0.01		0.00		0.01		0.00		0.16	
WUE	PET	0.01		0.02		0.00		0.06		0.13	
WUE	MAT	0.01		0.00		0.00		0.08		0.12	
WUE	An RH	0.02		0.00		0.01		0.00		0.10	
$\Delta leaf_{C27-31/atm}$	Latitude	0.05		0.02		0.01		0.43	0.23	0.04	
$\Delta leaf_{C27-31/atm}$	Longitude	0.00		0.00		0.30	0.34	0.08		0.00	
$\Delta leaf_{C27-31/atm}$	Elevation	0.01		0.00		0.00		0.40	0.25	0.06	
$\Delta leaf_{C27-31/atm}$	An PPT	0.01		0.01		0.03		0.14		0.17	
$\Delta leaf_{C27-31/atm}$	An VPD	0.01		0.00		0.01		0.00		0.16	
$\Delta leaf_{C27-31/atm}$	PET	0.01		0.02		0.00		0.06		0.13	
$\Delta leaf_{C27-31/atm}$	MAT	0.01		0.00		0.00		0.08		0.12	
$\Delta leaf_{C27-31/atm}$	An RH	0.03		0.00		0.01		0.00		0.10	
ACL	Latitude	0.00		0.00		0.87	0.02	0.29	0.34	0.03	
ACL	Longitude	0.00		0.01		0.02		0.04		0.04	
ACL	Elevation	0.01		0.05		0.36	0.28	0.06		0.00	
ACL	An PPT	0.00		0.01		0.07		0.05		0.03	
ACL	An VPD	0.01		0.02		0.00		0.19		0.01	
ACL	PET	0.00		0.02		0.12		0.31	0.33	0.02	
ACL	MAT	0.02		0.02		0.00		0.08		0.03	
ACL	An RH	0.00		0.01		0.45	0.22	0.53	0.16	0.00	
$\delta D\ C_{27-31}$	δD_{MAP}	0.50	0.00	0.19		0.54	0.13	0.04		0.32	0.00
$\delta D\ C_{27-31}$	δD_{MGP}	0.41	0.00	0.19		0.56	0.15	0.15		0.29	0.00
$\delta D\ C_{27-31}$	$\delta D\ C_{27-31}$	0.02		0.01		0.09		0.03	0.79	0.15	
$\delta D\ C_{27-31}$	$\delta D\ C_{27-31}$	0.96	0.00	0.99	0.00	1.00	0.35	0.87	0.02	0.97	0.00
$\Delta leaf_{C27-31/atm}$	$\varepsilon_{C27-31/MAP}$	0.02		0.00		0.11		0.03		0.10	
$\delta^{13}C\ C_{27-31}$	$\delta^{13}C\ C_{29}$	0.98	0.00	0.91	0.00	1.00	0.02	0.99	0.00	0.93	0.00

*Highlighted red cells are for r^2 values greater than 0.25, the green cells are p-values less than 0.05

Appendix A: *n*-alkanes in semi-arid climate study

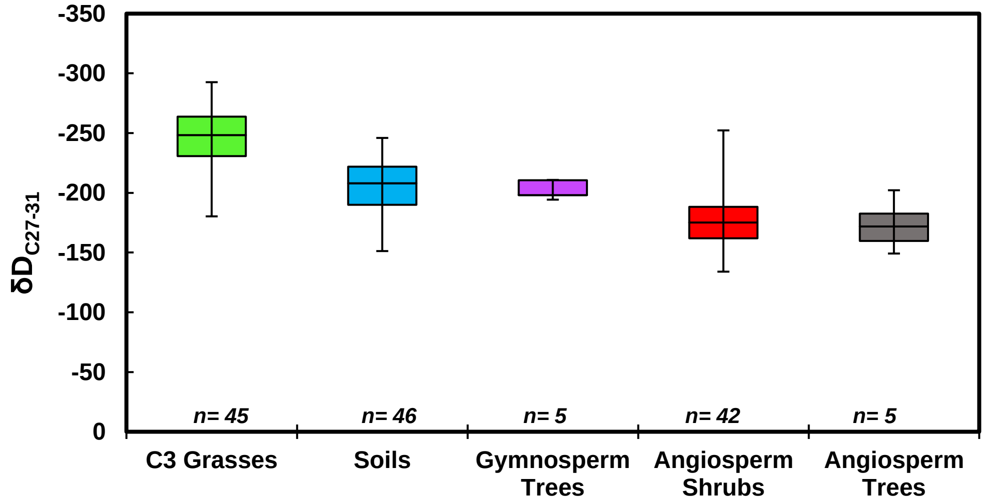

Figure 1. A box and whisker plot showing the distribution of δD_{C27-31} values for all plant and soils groups in a semi-arid environment. The boxes represent the first and third quartiles and the horizontal line represents the median values. The whiskers represent the maximum and minimum values for each group. C_3 grasses were the most depleted values while angiosperm trees and shrubs were more enriched.

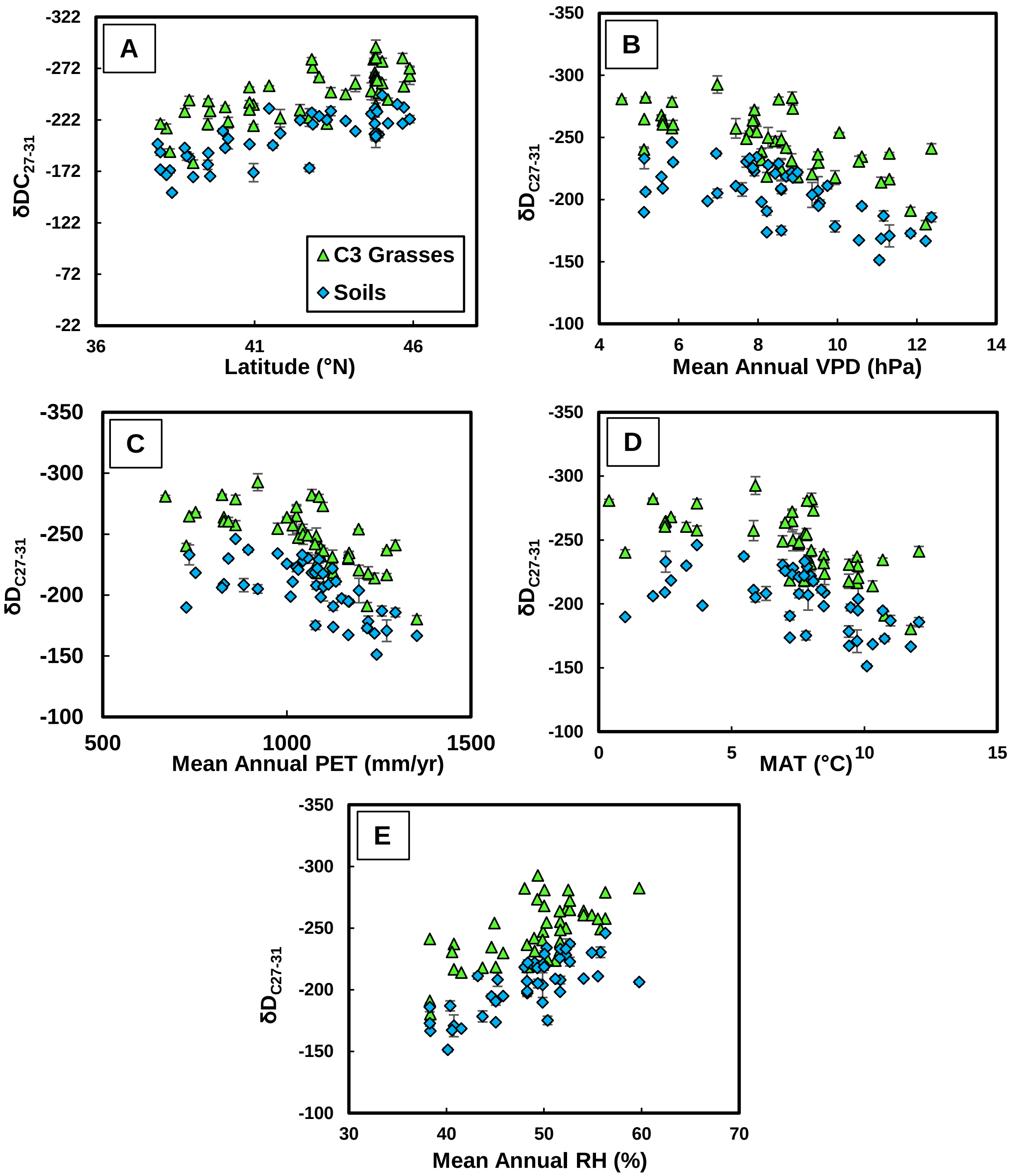

Figure 2. δD_{C27-31} of grasses and soils plotted against (A) latitude, (B), mean annual VPD, (C) mean annual PET, (D) mean annual temperature, (E) mean annual RH. Grasses and soils had the strongest relationship between δD_{C27-31} and the climate variables listed than the other plant groups tested.

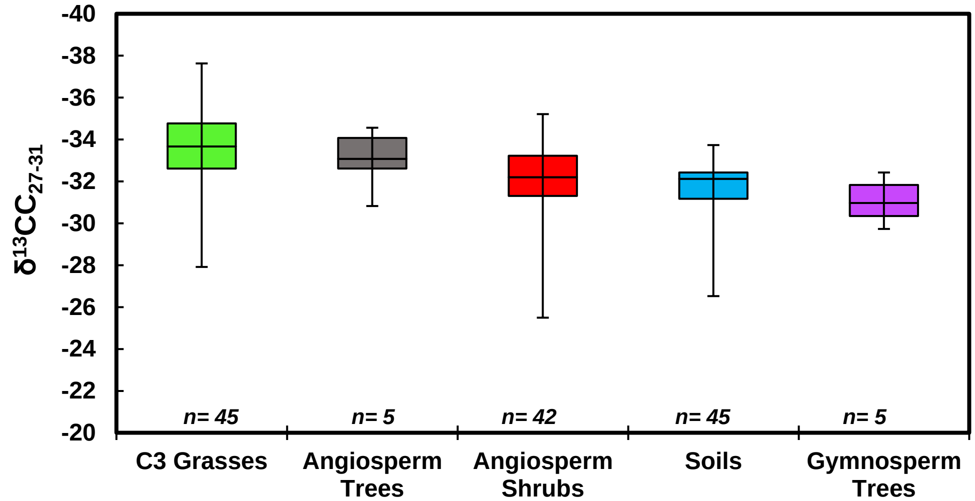

Figure 3. The distribution of $\delta^{13}C_{C27\text{-}31}$ values for all plant groups and soils groups in a semi-arid environment shown as a box and whisker plot. The boxes represent the first and third quartiles and the horizontal line represents the median values. The whiskers represent the range of values for each group.

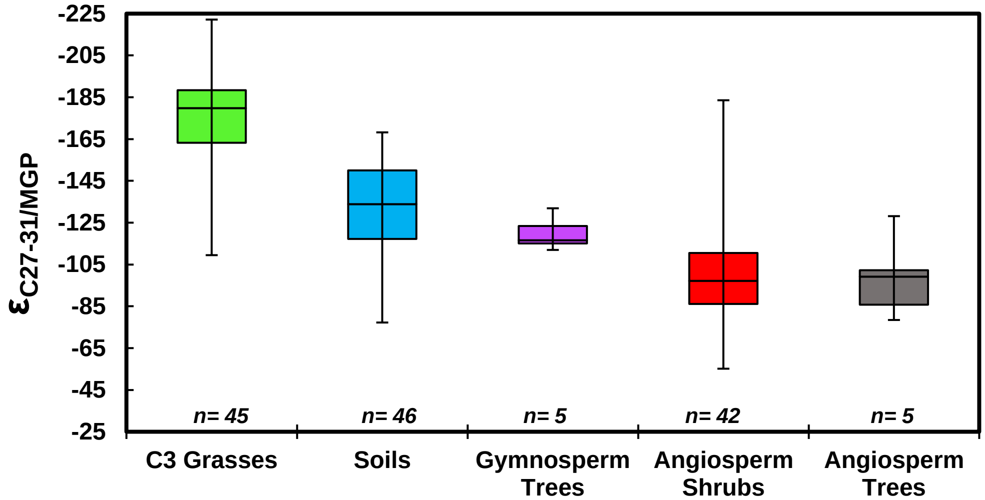

Figure 4. Box and whisker plot displaying the distribution of $\varepsilon_{C27\text{-}31/MGP}$ values for the plant and soils groupings in a semi-arid environment. The boxes represent the upper and lower quantiles of each grouping. The horizontal line represents the median and the whiskers represent the range of values of each group.

Appendix B. *n*-alkanes in US analysis

Table 1. Site Information

Master Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Published Source	Published Site Number	Growing Season dates
1	38	-123	13	Tipple Dissertation, 2009	1	All year
2	38	-123	17	Tipple Dissertation, 2009	2	All year
3	38	-123	130	Tipple Dissertation, 2009	3	All year
4	38	-123	130	Tipple Dissertation, 2009	4	March to October
5	38	-123	119	Tipple Dissertation, 2009	5	March to November
6	38	-122	11	Tipple Dissertation, 2009	6	March to November
7	38	-122	409	Tipple Dissertation, 2009	7	March to October
8	38	-122	106	Tipple Dissertation, 2009	8	May to September
9	38	-122	198	Tipple Dissertation, 2009	9	May to October
10	39	-122	57	Tipple Dissertation, 2009	10	May to October
11	39	-122	93	Tipple Dissertation, 2009	11	April to October
12	39	-122	17	Tipple Dissertation, 2009	12	February to November
13	39	-121	197	Tipple Dissertation, 2009	13	March to November
14	39	-121	348	Tipple Dissertation, 2009	14	March to November
15	39	-121	219	Tipple Dissertation, 2009	15	May to October
16	39	-121	693	Tipple Dissertation, 2009	16	March to November
17	39	-121	689	Tipple Dissertation, 2009	17	March to November
18	39	-121	1161	Tipple Dissertation, 2009	18	May to October
19	39	-120	1027	Tipple Dissertation, 2009	19	May to October
20	39	-120	1061	Tipple Dissertation, 2009	20	May to October
21	39	-120	2018	Tipple Dissertation, 2009	21	July to August
22	39	-120	1867	Tipple Dissertation, 2009	22	July to August
23	39	-120	1962	Tipple Dissertation, 2009	23	July to August
24	39	-120	2244	Tipple Dissertation, 2009	24	July to August
25	39	-120	2251	Tipple Dissertation, 2009	25	July to August
26	39	-120	2074	Tipple Dissertation, 2009	26	July to August
27	39	-120	1913	Tipple Dissertation, 2009	27	July to September
28	39	-120	1763	Tipple Dissertation, 2009	28	July to September
29	39	-120	1547	Tipple Dissertation, 2009	29	July to September
30	39	-120	1797	Tipple Dissertation, 2009	30	All year
31	39	-120	1888	Tipple Dissertation, 2009	31	June to September
32	39	-120	2438	Tipple Dissertation, 2009	32	June to September
33	39	-120	2569	Tipple Dissertation, 2009	33	June to September
34	39	-120	2706	Tipple Dissertation, 2009	34	June to September
35	39	-120	2392	Tipple Dissertation, 2009	35	All year
36	39	-120	2213	Tipple Dissertation, 2009	36	All year
37	39	-120	1585	Tipple Dissertation, 2009	37	July to August
38	39	-120	1834	Tipple Dissertation, 2009	38	July to August
39	40	-120	1419	Tipple Dissertation, 2009	39	June to August
40	40	-120	1804	Tipple Dissertation, 2009	40	June to August

Appendix B. *n*-alkanes in US analysis

Table 1 continued. Site Information

Master Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Published Site Number	Published Site Number	Growing Season dates
41	40	-120	1788	Tipple Dissertation, 2009	41	June to August
42	40	-121	1550	Tipple Dissertation, 2009	42	June to August
43	40	-121	1403	Tipple Dissertation, 2009	43	June to August
44	40	-121	1526	Tipple Dissertation, 2009	44	June to August
45	40	-121	1558	Tipple Dissertation, 2009	45	June to August
46	40	-121	1482	Tipple Dissertation, 2009	46	July to August
47	40	-121	1383	Tipple Dissertation, 2009	47	July to August
48	40	-121	1392	Tipple Dissertation, 2009	48	July to August
49	40	-122	1474	Tipple Dissertation, 2009	49	July to August
50	40	-122	1340	Tipple Dissertation, 2009	50	July to August
51	40	-122	891	Tipple Dissertation, 2009	51	July to August
52	40	-121	2305	Tipple Dissertation, 2009	52	July to August
53	40	-122	1087	Tipple Dissertation, 2009	53	July to August
54	40	-122	1080	Tipple Dissertation, 2009	54	July to August
55	40	-122	710	Tipple Dissertation, 2009	55	July to August
56	40	-122	133	Tipple Dissertation, 2009	56	April to September
57	40	-122	76	Tipple Dissertation, 2009	57	March to November
58	40	-122	172	Tipple Dissertation, 2009	58	March to November
59	40	-123	213	Tipple Dissertation, 2009	59	March to November
60	40	-123	277	Tipple Dissertation, 2009	60	March to November
61	40	-123	317	Tipple Dissertation, 2009	61	March to November
62	40	-123	573	Tipple Dissertation, 2009	62	March to November
63	40	-123	894	Tipple Dissertation, 2009	63	March to November
64	40	-123	1394	Tipple Dissertation, 2009	64	March to November
65	40	-123	1888	Tipple Dissertation, 2009	65	April to November
66	40	-123	1770	Tipple Dissertation, 2009	66	April to November
67	40	-123	1630	Tipple Dissertation, 2009	67	April to November
68	40	-123	1536	Tipple Dissertation, 2009	68	April to November
69	40	-123	1423	Tipple Dissertation, 2009	69	April to November
70	40	-123	1288	Tipple Dissertation, 2009	70	April to November
71	40	-123	1145	Tipple Dissertation, 2009	71	April to November
72	40	-123	933	Tipple Dissertation, 2009	72	April to November
73	40	-123	566	Tipple Dissertation, 2009	73	April to November
74	40	-123	594	Tipple Dissertation, 2009	74	April to November
75	40	-123	681	Tipple Dissertation, 2009	75	June to September
76	40	-123	728	Tipple Dissertation, 2009	76	June to September
77	40	-124	535	Tipple Dissertation, 2009	77	June to September
78	40	-124	496	Tipple Dissertation, 2009	78	April to November
79	40	-124	465	Tipple Dissertation, 2009	79	April to November

Appendix B. *n*-alkanes in US analysis

Table 1 continued. Site Information

Master Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Published Site Number	Published Site Number	Growing Season dates
81	40	-124	39	Tipple Dissertation, 2009	81	March to November
82	43	-71	95	Tipple and Pagani, 2013	1	June to August
83	44	-71	137	Tipple and Pagani, 2013	2	June to August
84	45	-69	56	Tipple and Pagani, 2013	3	June to August
85	45	-69	116	Tipple and Pagani, 2013	4	June to August
86	44	-69	65	Tipple and Pagani, 2013	5	June to September
87	44	-70	89	Tipple and Pagani, 2013	6	June to September
88	43	-72	129	Tipple and Pagani, 2013	7	June to August
89	42	-71	82	Tipple and Pagani, 2013	8	June to September
90	42	-72	209	Tipple and Pagani, 2013	9	June to September
91	42	-72	92	Tipple and Pagani, 2013	10	May to September
92	42	-73	318	Tipple and Pagani, 2013	11	June to September
93	42	-74	156	Tipple and Pagani, 2013	12	June to August
94	41	-74	142	Tipple and Pagani, 2013	13	May to October
95	41	-74	82	Tipple and Pagani, 2013	14	June to September
96	40	-75	166	Tipple and Pagani, 2013	15	May to September
97	40	-76	169	Tipple and Pagani, 2013	16	May to September
98	40	-77	104	Tipple and Pagani, 2013	17	May to September
99	40	-77	179	Tipple and Pagani, 2013	18	June to September
100	39	-77	30	Tipple and Pagani, 2013	19	May to September
101	38	-77	31	Tipple and Pagani, 2013	20	May to September
102	38	-77	33	Tipple and Pagani, 2013	21	May to September
103	37	-78	89	Tipple and Pagani, 2013	22	May to September
104	37	-78	109	Tipple and Pagani, 2013	23	May to September
105	36	-78	112	Tipple and Pagani, 2013	24	May to September
106	36	-79	61	Tipple and Pagani, 2013	25	May to September
107	35	-79	119	Tipple and Pagani, 2013	26	May to September
108	35	-79	31	Tipple and Pagani, 2013	27	April to November
109	35	-79	28	Tipple and Pagani, 2013	28	April to November
110	34	-79	27	Tipple and Pagani, 2013	29	May to September
111	34	-79	28	Tipple and Pagani, 2013	30	May to September
112	34	-80	60	Tipple and Pagani, 2013	31	May to September
113	34	-80	67	Tipple and Pagani, 2013	32	April to September
114	33	-81	37	Tipple and Pagani, 2013	33	April to September
115	33	-82	60	Tipple and Pagani, 2013	34	April to September
116	32	-82	60	Tipple and Pagani, 2013	35	April to September
117	32	-83	62	Tipple and Pagani, 2013	36	April to September
118	31	-83	70	Tipple and Pagani, 2013	37	April to September
119	31	-84	55	Tipple and Pagani, 2013	38	April to September

Appendix B. *n*-alkanes in US analysis

Table 1 continued. Site Information

Master Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Published Site Number	Published Site Number	Growing Season dates
120	30	-84	29	Tipple and Pagani, 2013	39	April to September
121	30	-84	4	Tipple and Pagani, 2013	40	April to September
122	47	-99	625	Smith and Freeman, 2006	1	June to August
123	47	-101	558	Smith and Freeman, 2006	2	June to August
124	44	-102	734	Smith and Freeman, 2006	3	June to August
125	41	-105	1581	Smith and Freeman, 2006	4	June to September
126	40	-105	165	Smith and Freeman, 2006	5	June to September
127	39	-97	330	Smith and Freeman, 2006	6	May to September
128	39	-90	607	Smith and Freeman, 2006	7	May to September
129	34	-107	1405	Smith and Freeman, 2006	8	May to September
130	34	-117	1620	Feakins and Sessions, 2010	2	February to November
131	35	-116	1500	Feakins and Sessions, 2010	1	April to October
132	34	-118	640	Feakins and Sessions, 2010	3	June to October
133	34	-119	400	Feakins and Sessions, 2010	4	April to October
134	42	-72	212	Hou et al., 2007		June to September
135	47	-120	502	Pedentchouk et al., 2008		June to August
136	42	-71	0	Sessions, 2006		June to September
137	47	-116	862	Yang and Huang, 2003		June to August
138	47	-117	787	Yang and Huang, 2003		June to August
139	39	-105	1795	Truong Thesis	CO-09-01	May to August
140	40	-105	1487	Truong Thesis	CO -09-02	May to September
141	41	-105	1725	Truong Thesis	CO -09-03	May to September
142	41	-105	1828	Truong Thesis	CO -09-04	May to September
143	42	-105	1602	Truong Thesis	CO-09-05	May to September
144	42	-105	1524	Truong Thesis	CO-09-06	May to September
145	43	-105	1516	Truong Thesis	CO-09-07	May to September
146	43	-106	1575	Truong Thesis	WY-09-08	May to September
147	43	-106	1580	Truong Thesis	WY-09-09	May to September
148	44	-107	1566	Truong Thesis	WY-09-10	May to September
149	45	-107	1308	Truong Thesis	WY-09-11	May to September
150	45	-107	1171	Truong Thesis	WY-09-12	May to September
151	45	-107	1696	Truong Thesis	WY-09-13	May to September
152	45	-107	2307	Truong Thesis	WY-09-14	May to September
153	45	-108	2661	Truong Thesis	WY-09-15	May to September
154	45	-108	2160	Truong Thesis	WY-09-16	May to September
155	45	-108	2160	Truong Thesis	WY-09-17	May to September
156	45	-108	1206	Truong Thesis	WY-09-18	May to September
157	45	-109	1207	Truong Thesis	WY-09-19	May to September
158	46	-109	1173	Truong Thesis	MT-09-20	May to September

Appendix B. *n*-alkanes in US analysis

Table 1 continued. Site Information

Master Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Published Site Number	Published Site Number	Growing Season dates
159	46	-110	1366	Truong Thesis	MT-09-21	June to September
160	46	-112	1343	Truong Thesis	MT-09-22	June to September
161	45	-112	1717	Truong Thesis	MT-09-23	June to September
162	45	-112	1953	Truong Thesis	MT-09-24	June to September
163	45	-113	2185	Truong Thesis	MT-09-25	June to September
164	45	-112	2192	Truong Thesis	MT-09-26	June to September
165	45	-113	2209	Truong Thesis	MT-09-30	June to September
166	44	-112	1562	Truong Thesis	MT-09-31	June to September
167	43	-112	1433	Truong Thesis	MT-09-32	May to September
168	43	-112	1441	Truong Thesis	MT-09-33	May to September
169	43	-112	1715	Truong Thesis	MT-09-34	May to September
170	42	-112	1367	Truong Thesis	MT-09-35	May to September
171	40	-112	1441	Truong Thesis	MT-09-36	May to September
172	40	-111	1820	Truong Thesis	MT-09-37	May to September
173	40	-111	1715	Truong Thesis	MT-09-38	June to September
174	39	-110	1386	Truong Thesis	UT-09-39	May to October
175	39	-110	1485	Truong Thesis	UT-09-40	May to September
176	38	-109	1781	Truong Thesis	UT-09-41	May to October
177	38	-109	1635	Truong Thesis	CO-09-42	May to October
178	38	-108	1782	Truong Thesis	CO-09-43	May to October
179	38	-108	2395	Truong Thesis	CO-09-44	June to September
180	38	-108	3051	Truong Thesis	CO-09-45	June to September
181	39	-108	1575	Truong Thesis	CO-09-46	May to October
182	40	-108	1652	Truong Thesis	CO-09-47	May to September
183	40	-106	3400	Truong Thesis	CO-09-48	June to September
184	41	-116	1578	Truong Thesis	Elko	June to September
185	41	-118	1379	Truong Thesis	Win	June to September
186	49	-93	352	Bush and McInerney, 2014	RTB001	June to September
187	49	-93	342	Bush and McInerney, 2014	RTB002	June to September
188	48	-94	378	Bush and McInerney, 2014	RTB003	June to September
189	48	-94	381	Bush and McInerney, 2014	RTB004	June to September
190	48	-95	422	Bush and McInerney, 2014	RTB005	June to September
191	47	-95	425	Bush and McInerney, 2014	RTB006	June to September
192	47	-95	466	Bush and McInerney, 2014	RTB007	June to September
193	47	-95	448	Bush and McInerney, 2014	RTB008	June to September
194	47	-95	487	Bush and McInerney, 2014	RTB009	June to September
195	46	-96	405	Bush and McInerney, 2014	RTB010	June to September
196	46	-96	479	Bush and McInerney, 2014	RTB011	May to September
197	46	-96	367	Bush and McInerney, 2014	RTB012	May to October

Appendix B. *n*-alkanes in US analysis

Table 1 continued. Site Information

Master Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Published Site Number	Published Site Number	Growing Season dates
198	45	-96	315	Bush and McInerney, 2014	RTB013	May to September
199	45	-95	268	Bush and McInerney, 2014	RTB014	May to September
200	44	-96	452	Bush and McInerney, 2014	RTB015	May to October
201	44	-96	493	Bush and McInerney, 2014	RTB016	May to September
202	44	-96	500	Bush and McInerney, 2014	RTB017	May to September
203	44	-97	451	Bush and McInerney, 2014	RTB018	May to September
204	43	-97	445	Bush and McInerney, 2014	RTB019	May to September
205	43	-97	406	Bush and McInerney, 2014	RTB020	May to September
206	43	-97	364	Bush and McInerney, 2014	RTB021	April to October
207	43	-98	548	Bush and McInerney, 2014	RTB022	April to September
208	42	-98	534	Bush and McInerney, 2014	RTB023	May to September
209	42	-98	534	Bush and McInerney, 2014	RTB024	May to September
210	42	-98	572	Bush and McInerney, 2014	RTB025	May to September
211	41	-99	640	Bush and McInerney, 2014	RTB026	May to September
212	41	-98	536	Bush and McInerney, 2014	RTB027	May to September
213	41	-99	644	Bush and McInerney, 2014	RTB028	May to September
214	41	-99	642	Bush and McInerney, 2014	RTB029	May to October
215	40	-99	662	Bush and McInerney, 2014	RTB030	May to October
216	40	-99	643	Bush and McInerney, 2014	RTB031	May to October
217	40	-99	601	Bush and McInerney, 2014	RTB032	May to October
218	40	-99	481	Bush and McInerney, 2014	RTB033	May to October
219	39	-99	590	Bush and McInerney, 2014	RTB034	May to October
220	39	-99	587	Bush and McInerney, 2014	RTB035	May to October
221	38	-99	604	Bush and McInerney, 2014	RTB036	May to October
222	38	-99	629	Bush and McInerney, 2014	RTB037	April to October
223	38	-99	630	Bush and McInerney, 2014	RTB038	April to October
224	38	-99	644	Bush and McInerney, 2014	RTB039	April to October
225	37	-99	564	Bush and McInerney, 2014	RTB040	April to October
226	37	-99	492	Bush and McInerney, 2014	RTB041	April to October
227	37	-99	508	Bush and McInerney, 2014	RTB042	April to October
228	37	-100	725	Bush and McInerney, 2014	RTB043	April to October
229	36	-99	591	Bush and McInerney, 2014	RTB044	April to October
230	36	-99	571	Bush and McInerney, 2014	RTB045	April to October
231	36	-100	652	Bush and McInerney, 2014	RTB046	April to October
232	36	-100	658	Bush and McInerney, 2014	RTB047	April to October
233	35	-100	565	Bush and McInerney, 2014	RTB048	April to October
234	35	-100	518	Bush and McInerney, 2014	RTB049	April to October
235	34	-100	460	Bush and McInerney, 2014	RTB050	April to October
236	34	-100	429	Bush and McInerney, 2014	RTB051	April to October

Appendix B. *n*-alkanes in US analysis

Table 1 continued. Site Information

Master Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Published Site Number	Published Site Number	Growing Season dates
237	34	-100	463	Bush and McInerney, 2014	RTB052	April to November
238	33	-100	470	Bush and McInerney, 2014	RTB053	April to November
239	32	-100	587	Bush and McInerney, 2014	RTB054	April to November
240	32	-100	604	Bush and McInerney, 2014	RTB055	April to November
241	32	-100	606	Bush and McInerney, 2014	RTB056	April to November
242	31	-101	595	Bush and McInerney, 2014	RTB057	April to November
243	31	-100	505	Bush and McInerney, 2014	RTB058	April to November
244	31	-100	648	Bush and McInerney, 2014	RTB059	April to November
245	30	-100	555	Bush and McInerney, 2014	RTB060	April to October
246	30	-100	722	Bush and McInerney, 2014	RTB061	March to November
247	30	-100	583	Bush and McInerney, 2014	RTB062	March to November
248	29	-100	379	Bush and McInerney, 2014	RTB063	April to November
249	29	-99	195	Bush and McInerney, 2014	RTB064	March to November
250	28	-98	67	Bush and McInerney, 2014	RTB065	March to November
251	28	-98	135	Bush and McInerney, 2014	RTB066	February to December
252	27	-98	30	Bush and McInerney, 2014	RTB067	February to December
253	26	-98	11	Bush and McInerney, 2014	RTB068	All year
254	26	-97	7	Bush and McInerney, 2014	RTB069	All year
255	26	-97	7	Bush and McInerney, 2014	RTB070	All year
256	47	-114	1158	Diefendorf et al., 2010		June to September
257	48	-114	1012	Diefendorf et al., 2010		June to September
258	48	-116	706	Diefendorf et al., 2010		June to September
259	47	-114	2130	Diefendorf et al., 2010		June to September
260	46	-90	482	Diefendorf et al., 2010		June to September
261	36	-84	300	Diefendorf et al., 2010		April to October
262	40	-116	1859	Diefendorf et al., 2010		June to September
263	34	-109	1980	Diefendorf et al., 2010		June to September
264	35	-114	2120	Diefendorf et al., 2010		February to December
265	34	-110	1970	Diefendorf et al., 2010		May to October
266	41	-112	1980	Diefendorf et al., 2010		May to October
267	37	-114	2000	Diefendorf et al., 2010		May to October
268	33	-82	60	Diefendorf et al., 2010		April to November
269	39	-119	1700	Diefendorf et al., 2010		May to October
270	39	-120	1615	Diefendorf et al., 2010		May to October
271	40	-120	1710	Diefendorf et al., 2010		June to September
272	39	-120	2088	Diefendorf et al., 2010		July to August
273	41	-112	1630	Diefendorf et al., 2010		May to October
274	40	-112	1775	Diefendorf et al., 2010		May to September
275	35	-114	534	Diefendorf et al., 2010		March to November

Appendix B. *n*-alkanes in US analysis

Table 1 continued. Site Information

Master Site	Latitude (°N)	Longitude (°W)	Elevation (m)	Published Site Number	Published Site Number	Growing Season dates
276	44	-113	1505	Diefendorf et al., 2010		May to September
277	41	-105	1650	Diefendorf et al., 2010		May to October
278	38	-113	1798	Diefendorf et al., 2010		June to September
279	37	-113	1340	Diefendorf et al., 2010		May to October
280	28	-98	80	Diefendorf et al., 2010		February to December
281	41	-111	2800	Diefendorf et al., 2010		June to September
282	41	-111	2400	Diefendorf et al., 2010		June to September
283	41	-111	1700	Diefendorf et al., 2010		June to September
284	37	-122	297	Diefendorf et al., 2010		March to November

Appendix B. *n*-alkanes in US analysis

Table 2. Key of sample name from semi-arid analysis to US analysis

Master Sample Name	Sample Name	Master Sample Name	Sample Name	Master Sample Name	Sample Name	Master Sample Name	Sample Name
139a	CO-09-1A	151a	WY-09-13A	162d	MT-09-24S	176b	UT-09-41C
139b	CO-09-1B	151b	WY-09-13B	163a	MT-09-25A	176c	UT-09-41S
139c	CO-09-1C	151c	WY-09-13D	163b	MT-09-25B	177a	CO-09-42A
139d	CO-09-1D	151d	WY-09-13S	163c	MT-09-25C	177b	CO-09-42C
139e	CO-09-1S	152a	WY-09-14A	163d	MT-09-25S	177c	CO-09-42S
140a	CO-09-2A	152b	WY-09-14D	164a	MT-09-26A	178a	CO-09-43A
140b	CO-09-2C	152c	WY-09-14S	164b	MT-09-26C	178b	CO-09-43C
140c	CO-09-2D	153a	WY-09-15A	164c	MT-09-26S	178c	CO-09-43S
140d	CO-09-2S	153b	WY-09-15B	165a	MT-09-30A	179a	CO-09-44A
141a	CO-09-3B	153c	WY-09-15C	165b	MT-09-30S	179b	CO-09-44B
141b	CO-09-3C	153S	WY-09-15S	166a	MT-09-31A	179c	CO-09-44D
141c	CO-09-3S	154a	WY-09-16A	166b	MT-09-31C	179d	CO-09-44E
142a	CO-09-4A	154b	WY-09-16B	166c	MT-09-31S	179e	CO-09-44S
142b	CO-09-4S	154c	WY-09-16S	167a	MT-09-32A	180a	CO-09-45B
143a	CO-09-5A	155a	WY-09-17A	167b	MT-09-32C	180b	CO-09-45D
143b	CO-09-5S	155b	WY-09-17B	167c	MT-09-32S	180c	CO-09-45S
144a	CO-09-6A	155c	WY-09-17S	168a	MT-09-33A	181a	CO-09-46A
144b	CO-09-6B	156a	WY-09-18A	168b	MT-09-33C	181b	CO-09-46B
144c	CO-09-6C	156b	WY-09-18B	168c	MT-09-33S	181c	CO-09-46S
144d	CO-09-6D	156c	WY-09-18S	169a	MT-09-34A	182a	CO-09-47A
144e	CO-09-6S	157a	WY-09-19A	169b	MT-09-34C	182b	CO-09-47B
145a	CO-09-7A	157b	WY-09-19B	169c	MT-09-34S	182c	CO-09-47S
145b	CO-09-7B	157c	WY-09-19S	170a	MT-09-35B	183a	CO-09-48A
145c	CO-09-7S	158a	MT-09-20A	170b	MT-09-35S	183b	CO-09-48B
146a	WY-09-8A	158b	MT-09-20C	171a	MT-09-36A	183c	CO-09-48S
146b	WY-09-8B	158c	MT-09-20D	171b	MT-09-36B	184a	Elko A
146c	WY-09-8 S	158d	MT-09-20S	171c	MT-09-36C	184b	Elko C
147a	WY-09-9A	159a	MT-09-21A	171d	MT-09-36S	185a	Win A
147b	WY-09-9B	159b	MT-09-21B	172a	MT-09-37A	185b	Win B
147c	WY-09-9S	159c	MT-09-21C	172b	MT-09-37B	185c	Win C
148a	WY-09-10A	159d	MT-09-21S	172c	MT-09-37S	185d	Win S
148b	WY-09-10B	160a	MT-09-22A	173a	MT-09-38A		
148c	WY-09-10S	160b	MT-09-22B	173b	MT-09-38C		
149a	WY-09-11A	160c	MT-09-22C	173c	MT-09-38S		
149b	WY-09-11B	160d	MT-09-22D	174a	UT-09-39A		
149c	WY-09-11C	160e	MT-09-22E	174b	UT-09-39C		
149d	WY-09-11S	160f	MT-09-22S	174c	UT-09-39S		
150a	WY-09-12A	161a	MT-09-23S	175a	UT-09-40A		
150b	WY-09-12C	162a	MT-09-24A	175b	UT-09-40B		
150c	WY-09-12D	162b	MT-09-24B	175c	UT-09-40S		
150d	WY-09-12S	162c	MT-09-24C	176a	UT-09-41A		

Appendix B. *n*-alkanes in US analysis

Table 3. Calculated Monthly Precipitation, Mean Growing Season Precipitation (MGP), and Mean Annual Precipitation (MAP) δD

Master Site	δD Jan	δD Feb	δD Mar	δD Apr	δD May	δD Jun	δD Jul	δD Aug	δD Sep	δD Oct	δD Nov	δD Dec	δD_{MGP}	δD_{MAP}
1	-75	-79	-76	-69	-71	-58	-54	-64	-75	-57	-77	-72	-74	-74
2	-75	-79	-76	-69	-71	-58	-54	-65	-75	-57	-77	-72	-74	-74
3	-76	-81	-78	-71	-73	-59	-55	-65	-76	-59	-79	-73	-76	-76
4	-77	-81	-78	-71	-73	-58	-55	-65	-76	-59	-79	-74	-72	-76
5	-76	-81	-77	-70	-72	-58	-55	-65	-76	-58	-78	-73	-73	-75
6	-74	-79	-75	-69	-71	-57	-54	-64	-75	-57	-77	-71	-72	-74
7	-81	-86	-84	-75	-76	-61	-58	-68	-78	-63	-82	-78	-76	-80
8	-76	-81	-77	-70	-72	-58	-55	-65	-75	-58	-79	-73	-70	-76
9	-78	-82	-79	-72	-74	-59	-56	-66	-76	-60	-80	-75	-67	-77
10	-76	-80	-76	-70	-72	-58	-54	-65	-75	-58	-78	-73	-65	-75
11	-77	-81	-78	-71	-73	-58	-55	-65	-75	-59	-79	-74	-67	-76
12	-76	-80	-76	-70	-72	-58	-54	-65	-75	-58	-78	-73	-75	-75
13	-80	-83	-80	-72	-74	-59	-56	-66	-77	-61	-81	-77	-76	-77
14	-82	-85	-83	-74	-75	-60	-57	-66	-77	-62	-83	-78	-78	-80
15	-80	-83	-80	-72	-73	-59	-56	-65	-76	-60	-81	-77	-66	-78
16	-87	-91	-90	-79	-79	-63	-61	-69	-80	-68	-87	-84	-83	-83
17	-87	-91	-90	-78	-79	-63	-61	-69	-80	-67	-87	-84	-82	-85
18	-94	-98	-99	-84	-84	-67	-65	-72	-83	-74	-92	-90	-78	-92
19	-92	-96	-96	-82	-82	-65	-63	-71	-82	-72	-90	-88	-76	-90
20	-92	-97	-97	-83	-82	-65	-64	-71	-82	-72	-90	-89	-76	-90
21	-107	-113	-117	-96	-93	-74	-73	-79	-90	-87	-102	-103	-75	-104
22	-104	-110	-113	-93	-91	-72	-72	-77	-88	-84	-100	-101	-74	-102
23	-106	-111	-115	-95	-92	-73	-73	-78	-89	-86	-101	-102	-75	-103
24	-110	-116	-122	-99	-96	-76	-76	-80	-92	-90	-105	-106	-78	-107
25	-112	-117	-123	-100	-96	-77	-76	-81	-92	-91	-106	-108	-79	-108
26	-109	-114	-119	-97	-94	-75	-75	-79	-90	-88	-104	-105	-77	-105
27	-106	-112	-115	-95	-92	-73	-73	-78	-88	-86	-102	-102	-82	-103
28	-104	-109	-112	-92	-90	-72	-71	-76	-87	-83	-100	-100	-81	-101
29	-100	-105	-107	-89	-88	-70	-69	-74	-85	-80	-97	-97	-78	-98
30	-106	-111	-114	-94	-91	-73	-73	-78	-87	-85	-101	-102	-102	-102
31	-107	-112	-116	-95	-92	-74	-74	-78	-88	-86	-102	-104	-81	-104
32	-116	-122	-128	-103	-99	-80	-80	-83	-93	-95	-109	-112	-86	-111
33	-118	-124	-131	-105	-100	-81	-81	-85	-94	-97	-111	-114	-87	-113
34	-120	-126	-134	-107	-102	-82	-82	-86	-95	-99	-113	-116	-88	-115
35	-115	-121	-127	-102	-98	-79	-79	-83	-93	-94	-108	-111	-112	-111
36	-112	-118	-123	-100	-96	-77	-77	-81	-91	-91	-106	-108	-109	-108
37	-103	-107	-109	-91	-88	-72	-70	-76	-85	-81	-98	-99	-73	-99
38	-107	-111	-115	-95	-91	-74	-73	-78	-87	-85	-102	-103	-75	-103
39	-103	-107	-109	-91	-87	-73	-71	-77	-83	-81	-99	-99	-73	-99
40	-109	-114	-117	-96	-91	-76	-75	-80	-86	-87	-103	-105	-77	-104

Appendix B. *n*-alkanes in US analysis

Table 3 continued. Calculated Monthly, MGP, and MAP δD

Master Site	δD Jan	δD Feb	δD Mar	δD Apr	δD May	δD Jun	δD Jul	δD Aug	δD Sep	δD Oct	δD Nov	δD Dec	δD_{MGP}	δD_{MAP}
41	-109	-113	-117	-96	-91	-76	-75	-80	-86	-87	-103	-105	-77	-104
42	-105	-110	-112	-93	-88	-75	-73	-78	-84	-83	-100	-101	-75	-101
43	-103	-108	-109	-91	-86	-74	-72	-77	-82	-81	-99	-100	-74	-99
44	-105	-110	-112	-93	-88	-75	-73	-78	-83	-83	-100	-101	-75	-101
45	-105	-110	-112	-93	-88	-75	-73	-78	-83	-83	-100	-101	-75	-101
46	-103	-108	-111	-92	-87	-74	-72	-78	-83	-82	-99	-100	-75	-100
47	-102	-106	-108	-91	-86	-73	-71	-77	-82	-80	-98	-98	-74	-99
48	-102	-107	-109	-91	-86	-73	-71	-77	-82	-81	-98	-98	-74	-99
49	-103	-108	-111	-93	-87	-75	-73	-78	-83	-82	-99	-100	-76	-100
50	-102	-107	-109	-91	-86	-74	-72	-78	-82	-81	-98	-98	-76	-98
51	-95	-99	-99	-85	-81	-70	-67	-74	-78	-74	-93	-91	-71	-92
52	-117	-123	-130	-105	-98	-83	-82	-86	-90	-96	-110	-113	-84	-112
53	-97	-101	-102	-87	-83	-71	-68	-75	-80	-76	-94	-93	-72	-94
54	-96	-101	-102	-87	-83	-70	-68	-75	-80	-76	-94	-93	-73	-94
55	-91	-95	-94	-82	-80	-68	-65	-72	-78	-71	-90	-88	-69	-88
56	-82	-85	-81	-74	-73	-62	-58	-67	-74	-62	-82	-79	-72	-79
57	-82	-85	-81	-74	-73	-63	-59	-68	-73	-62	-82	-79	-76	-79
58	-82	-86	-83	-75	-73	-63	-59	-68	-73	-63	-83	-79	-77	-80
59	-83	-87	-84	-75	-73	-63	-60	-68	-73	-63	-83	-80	-77	-81
60	-83	-87	-85	-76	-74	-63	-60	-68	-74	-64	-84	-80	-79	-82
61	-84	-88	-85	-76	-74	-64	-60	-69	-74	-64	-84	-81	-79	-82
62	-88	-92	-91	-80	-78	-66	-63	-71	-77	-68	-87	-85	-83	-86
63	-92	-97	-97	-84	-81	-69	-66	-73	-79	-73	-91	-89	-87	-90
64	-100	-106	-109	-91	-87	-73	-71	-78	-83	-81	-97	-97	-95	-97
65	-108	-114	-119	-98	-93	-78	-77	-82	-88	-88	-103	-104	-96	-104
66	-106	-112	-117	-96	-91	-77	-76	-81	-87	-87	-101	-102	-94	-103
67	-103	-110	-114	-94	-90	-76	-74	-80	-85	-84	-100	-100	-93	-101
68	-102	-108	-111	-93	-89	-75	-73	-79	-85	-83	-98	-98	-91	-99
69	-100	-106	-109	-91	-87	-74	-72	-78	-84	-81	-97	-97	-90	-98
70	-98	-104	-106	-89	-85	-72	-70	-77	-82	-79	-95	-95	-88	-96
71	-96	-101	-103	-87	-84	-71	-69	-75	-81	-77	-93	-92	-86	-94
72	-92	-98	-98	-84	-81	-69	-66	-74	-79	-73	-91	-89	-84	-91
73	-87	-92	-90	-79	-77	-66	-62	-70	-76	-68	-86	-84	-79	-85
74	-87	-92	-91	-80	-77	-66	-63	-71	-76	-68	-87	-84	-80	-86
75	-89	-94	-93	-81	-79	-67	-64	-72	-78	-70	-88	-86	-73	-87
76	-89	-94	-93	-81	-79	-67	-64	-72	-78	-70	-88	-86	-71	-87
77	-87	-92	-90	-80	-78	-66	-63	-71	-77	-68	-87	-84	-71	-84
78	-86	-91	-90	-79	-77	-66	-63	-71	-77	-67	-86	-83	-79	-84
79	-86	-91	-89	-79	-77	-66	-63	-71	-76	-67	-86	-83	-79	-84

Table 3 continued. Calculated Monthly, MGP, and MAP δD

Master Site	δD Jan	δD Feb	δD Mar	δD Apr	δD May	δD Jun	δD Jul	δD Aug	δD Sep	δD Oct	δD Nov	δD Dec	δD_{MGP}	δD_{MAP}
81	-79	-84	-80	-73	-72	-62	-58	-68	-73	-61	-81	-76	-70	-77
82	-107	-106	-77	-56	-46	-43	-39	-38	-51	-64	-69	-96	-40	-65
83	-110	-109	-81	-59	-49	-45	-41	-41	-53	-67	-72	-99	-42	-67
84	-108	-108	-83	-61	-51	-49	-44	-43	-54	-68	-74	-98	-45	-69
85	-108	-108	-83	-61	-51	-48	-44	-42	-54	-68	-73	-98	-45	-69
86	-107	-106	-81	-59	-49	-46	-42	-41	-52	-66	-71	-97	-46	-67
87	-109	-109	-82	-59	-49	-46	-42	-41	-53	-67	-72	-99	-46	-68
88	-106	-105	-76	-55	-46	-42	-38	-37	-50	-64	-68	-95	-39	-64
89	-102	-101	-73	-52	-43	-40	-36	-35	-48	-60	-65	-92	-40	-61
90	-104	-103	-74	-53	-44	-40	-36	-36	-49	-62	-66	-93	-40	-62
91	-101	-100	-70	-50	-42	-38	-34	-34	-47	-59	-64	-90	-39	-59
92	-105	-104	-75	-54	-45	-40	-37	-36	-49	-63	-67	-94	-41	-62
93	-102	-100	-70	-51	-42	-38	-34	-34	-47	-60	-64	-91	-35	-59
94	-101	-98	-68	-49	-41	-37	-33	-33	-46	-58	-63	-89	-41	-58
95	-97	-94	-64	-46	-39	-34	-31	-31	-44	-55	-60	-86	-35	-55
96	-97	-94	-63	-46	-39	-34	-31	-31	-44	-55	-60	-85	-36	-54
97	-97	-93	-62	-45	-38	-33	-31	-31	-44	-54	-60	-84	-35	-54
98	-95	-90	-59	-43	-37	-32	-30	-30	-43	-52	-58	-82	-35	-52
99	-94	-89	-59	-43	-37	-32	-30	-29	-43	-52	-58	-82	-34	-52
100	-87	-82	-51	-37	-33	-28	-26	-26	-39	-46	-53	-76	-31	-47
101	-85	-81	-49	-36	-32	-27	-25	-25	-38	-45	-52	-74	-29	-45
102	-83	-78	-47	-34	-31	-26	-24	-23	-37	-43	-50	-71	-28	-44
103	-81	-77	-47	-33	-30	-25	-24	-23	-36	-42	-50	-70	-28	-43
104	-79	-75	-45	-32	-30	-24	-23	-22	-35	-41	-48	-69	-27	-42
105	-77	-73	-43	-30	-29	-24	-22	-21	-34	-39	-47	-67	-26	-41
106	-74	-70	-40	-28	-27	-22	-20	-20	-33	-37	-45	-64	-24	-39
107	-73	-69	-39	-27	-27	-22	-20	-20	-32	-36	-44	-63	-24	-38
108	-67	-64	-35	-24	-25	-21	-18	-18	-31	-33	-41	-58	-25	-35
109	-67	-64	-35	-24	-25	-21	-18	-18	-31	-33	-41	-58	-25	-35
110	-65	-63	-34	-23	-25	-21	-18	-18	-30	-32	-41	-56	-22	-34
111	-65	-62	-33	-23	-24	-20	-17	-18	-30	-32	-40	-56	-21	-34
112	-63	-60	-32	-22	-24	-20	-17	-17	-29	-31	-39	-54	-21	-33
113	-61	-58	-30	-20	-23	-20	-16	-17	-28	-29	-38	-52	-20	-32
114	-57	-54	-27	-18	-22	-20	-15	-16	-27	-28	-37	-49	-19	-31
115	-56	-53	-27	-18	-22	-20	-14	-15	-27	-27	-36	-48	-19	-30
116	-50	-47	-24	-16	-23	-21	-15	-16	-27	-26	-35	-44	-19	-29
117	-46	-43	-22	-16	-23	-23	-15	-17	-27	-26	-34	-41	-20	-28
118	-43	-39	-21	-15	-24	-24	-16	-18	-27	-26	-34	-39	-20	-27
119	-39	-35	-19	-14	-25	-26	-16	-19	-27	-26	-34	-36	-21	-26

Appendix B. *n*-alkanes in US analysis

Table 3 continued. Calculated Monthly, MGP, and MAP δD

Master Site	δD Jan	δD Feb	δD Mar	δD Apr	δD May	δD Jun	δD Jul	δD Aug	δD Sep	δD Oct	δD Nov	δD Dec	δD_{MGP}	δD_{MAP}
120	-36	-32	-17	-14	-25	-26	-17	-19	-27	-25	-33	-35	-21	-25
121	-34	-31	-16	-13	-25	-27	-16	-19	-27	-25	-32	-33	-21	-25
122	-179	-169	-136	-94	-71	-73	-66	-73	-86	-100	-134	-165	-70	-90
123	-178	-168	-136	-96	-72	-74	-67	-75	-87	-100	-134	-164	-72	-91
124	-169	-156	-123	-89	-71	-71	-63	-69	-82	-92	-122	-150	-68	-85
125	-158	-140	-119	-95	-85	-78	-73	-74	-86	-96	-120	-138	-77	-94
126	-127	-109	-82	-73	-68	-64	-57	-60	-72	-71	-98	-110	-63	-73
127	-113	-97	-68	-51	-47	-45	-37	-40	-54	-58	-77	-96	-44	-55
128	-103	-93	-61	-43	-39	-33	-29	-31	-43	-49	-66	-86	-35	-52
129	-102	-109	-78	-76	-77	-67	-62	-60	-74	-72	-90	-102	-66	-74
130	-87	-95	-88	-75	-80	-58	-56	-61	-77	-66	-84	-86	-84	-83
131	-94	-100	-89	-78	-82	-61	-60	-62	-78	-69	-89	-92	-69	-83
132	-71	-79	-72	-64	-70	-50	-47	-56	-74	-53	-72	-69	-57	-70
133	-67	-74	-67	-61	-68	-48	-45	-55	-73	-50	-69	-65	-58	-66
134	-104	-103	-74	-53	-44	-40	-36	-36	-49	-62	-66	-93	-40	-62
135	-108	-109	-107	-91	-79	-82	-78	-83	-72	-83	-103	-105	-81	-98
136	-96	-95	-67	-48	-40	-37	-32	-32	-45	-56	-61	-86	-37	-58
137	-134	-130	-117	-97	-81	-82	-77	-83	-80	-91	-117	-129	-81	-106
138	-127	-124	-114	-95	-81	-82	-78	-83	-78	-89	-113	-122	-81	-104
186	-177	-161	-126	-81	-64	-64	-58	-63	-76	-95	-125	-158	-65	-86
187	-177	-161	-126	-81	-64	-64	-58	-63	-75	-95	-125	-158	-65	-86
188	-175	-160	-125	-80	-64	-63	-57	-63	-75	-94	-124	-156	-64	-84
189	-175	-161	-125	-81	-64	-63	-58	-63	-76	-94	-124	-157	-64	-84
190	-174	-160	-125	-81	-63	-63	-57	-63	-76	-92	-124	-156	-64	-83
191	-172	-158	-123	-80	-63	-62	-56	-62	-75	-91	-122	-153	-63	-81
192	-173	-160	-124	-81	-64	-63	-57	-63	-76	-92	-123	-155	-64	-82
193	-173	-159	-124	-81	-63	-63	-57	-63	-76	-92	-123	-155	-64	-82
194	-173	-160	-125	-82	-64	-64	-57	-63	-76	-92	-124	-155	-64	-82
195	-167	-154	-118	-77	-61	-61	-54	-60	-73	-87	-118	-149	-61	-78
196	-167	-154	-118	-77	-61	-60	-54	-60	-73	-88	-118	-148	-61	-78
197	-161	-148	-111	-73	-58	-57	-51	-56	-69	-83	-112	-142	-61	-74
198	-159	-145	-108	-71	-57	-56	-49	-55	-68	-81	-110	-139	-57	-73
199	-154	-140	-103	-68	-55	-53	-47	-52	-65	-77	-106	-134	-54	-70
200	-156	-141	-105	-70	-56	-55	-48	-54	-67	-79	-107	-135	-58	-71
201	-155	-140	-104	-70	-57	-55	-48	-54	-67	-78	-106	-133	-56	-71
202	-155	-140	-104	-70	-57	-55	-49	-54	-67	-78	-106	-134	-56	-71
203	-153	-138	-102	-69	-56	-54	-47	-53	-66	-77	-104	-131	-55	-69
204	-149	-134	-98	-67	-55	-53	-46	-51	-64	-74	-101	-128	-53	-68
205	-147	-131	-96	-65	-54	-52	-45	-50	-63	-73	-99	-125	-53	-66

Table 3 continued. Calculated Monthly, MGP, and MAP δD

Master Site	δD Jan	δD Feb	δD Mar	δD Apr	δD May	δD Jun	δD Jul	δD Aug	δD Sep	δD Oct	δD Nov	δD Dec	δD_{MGP}	δD_{MAP}
206	-147	-130	-95	-65	-53	-52	-45	-50	-63	-72	-99	-125	-56	-66
207	-148	-132	-98	-67	-56	-54	-47	-52	-65	-74	-100	-126	-56	-68
208	-147	-130	-96	-67	-56	-55	-47	-52	-65	-74	-100	-125	-55	-68
209	-147	-130	-96	-67	-56	-55	-47	-52	-65	-74	-100	-125	-55	-68
210	-145	-128	-95	-67	-56	-54	-47	-51	-65	-73	-98	-123	-54	-67
211	-145	-127	-96	-69	-58	-56	-49	-53	-66	-75	-99	-123	-56	-69
212	-141	-123	-91	-65	-56	-54	-46	-51	-64	-72	-96	-119	-54	-66
213	-141	-123	-92	-67	-58	-56	-48	-52	-66	-73	-97	-119	-56	-68
214	-139	-120	-90	-67	-58	-56	-48	-52	-66	-72	-95	-117	-57	-67
215	-136	-118	-89	-66	-59	-57	-48	-52	-66	-72	-94	-115	-57	-67
216	-132	-114	-85	-64	-57	-55	-47	-50	-64	-70	-92	-112	-56	-66
217	-131	-113	-84	-64	-57	-55	-47	-50	-64	-70	-91	-111	-56	-65
218	-125	-107	-79	-61	-55	-53	-45	-48	-62	-66	-87	-106	-53	-62
219	-123	-105	-79	-61	-56	-54	-46	-48	-63	-67	-87	-105	-54	-63
220	-117	-100	-75	-59	-55	-54	-45	-47	-62	-66	-84	-101	-53	-62
221	-114	-97	-73	-59	-56	-55	-45	-47	-62	-65	-83	-99	-54	-62
222	-106	-92	-69	-57	-55	-55	-44	-46	-62	-64	-80	-95	-54	-61
223	-107	-92	-70	-58	-55	-55	-44	-46	-62	-64	-80	-96	-54	-61
224	-107	-92	-70	-58	-56	-55	-45	-46	-62	-65	-80	-96	-54	-61
225	-103	-89	-66	-56	-54	-54	-43	-44	-61	-62	-78	-93	-53	-59
226	-93	-82	-60	-53	-52	-53	-41	-42	-59	-59	-73	-87	-51	-57
227	-95	-83	-62	-53	-52	-54	-42	-43	-60	-60	-74	-88	-52	-57
228	-97	-87	-66	-58	-57	-57	-46	-46	-63	-64	-77	-91	-55	-61
229	-90	-80	-60	-53	-52	-54	-42	-42	-60	-60	-72	-85	-52	-57
230	-87	-78	-58	-52	-51	-54	-41	-41	-59	-59	-70	-84	-51	-56
231	-87	-80	-59	-53	-53	-55	-43	-43	-61	-60	-71	-85	-53	-57
232	-87	-80	-60	-53	-53	-55	-43	-43	-61	-61	-72	-85	-53	-57
233	-81	-75	-55	-50	-50	-53	-40	-40	-58	-57	-67	-80	-50	-54
234	-76	-71	-51	-47	-48	-52	-38	-38	-57	-55	-64	-77	-48	-52
235	-72	-68	-48	-45	-46	-51	-36	-37	-56	-53	-61	-74	-47	-50
236	-69	-66	-45	-43	-45	-50	-35	-35	-55	-51	-59	-72	-45	-48
237	-66	-65	-44	-43	-44	-50	-34	-35	-54	-50	-57	-70	-46	-48
238	-62	-62	-41	-40	-42	-48	-32	-32	-52	-48	-54	-67	-44	-46
239	-60	-62	-41	-39	-41	-48	-32	-32	-52	-48	-52	-66	-44	-46
240	-60	-62	-41	-40	-41	-48	-32	-32	-52	-48	-52	-66	-44	-46
241	-60	-64	-41	-40	-42	-48	-33	-33	-52	-48	-53	-66	-44	-46
242	-59	-64	-38	-39	-41	-47	-32	-32	-51	-47	-51	-65	-43	-45
243	-55	-59	-36	-36	-38	-46	-29	-30	-50	-45	-48	-62	-41	-43
244	-56	-61	-36	-38	-40	-46	-31	-31	-50	-46	-49	-63	-42	-44

Appendix B. *n*-alkanes in US analysis

Table 3 continued. Calculated Monthly, MGP, and MAP δD

Master Site	δD Jan	δD Feb	δD Mar	δD Apr	δD May	δD Jun	δD Jul	δD Aug	δD Sep	δD Oct	δD Nov	δD Dec	δD_{MGP}	δD_{MAP}
245	-52	-57	-33	-35	-37	-45	-29	-28	-48	-43	-46	-59	-39	-41
246	-55	-62	-35	-37	-39	-46	-31	-31	-50	-45	-48	-62	-41	-44
247	-52	-61	-30	-35	-37	-44	-30	-30	-48	-42	-46	-59	-39	-41
248	-46	-53	-25	-30	-33	-41	-26	-26	-45	-38	-41	-54	-36	-37
249	-40	-46	-19	-25	-29	-38	-22	-23	-42	-33	-37	-48	-31	-33
250	-34	-39	-14	-21	-26	-36	-20	-20	-39	-30	-33	-43	-28	-30
251	-34	-39	-12	-21	-26	-36	-21	-21	-39	-30	-33	-42	-29	-30
252	-30	-34	-7	-18	-24	-35	-20	-20	-37	-27	-30	-38	-27	-28
253	-24	-26	-1	-15	-23	-35	-20	-21	-36	-26	-28	-32	-26	-26
254	-23	-25	0	-15	-22	-35	-21	-21	-36	-26	-28	-31	-26	-26
255	-23	-25	0	-15	-22	-35	-21	-21	-36	-26	-28	-31	-26	-26
256														
257														
258														
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283														
284														

Appendix B. *n*-alkanes in US analysis

Table 4. Monthly, Growing Season (Grow), and Annual Precipitation (An) (mm/yr)

Master Site	Jan PPT	Feb PPT	Mar PPT	Apr PPT	May PPT	Jun PPT	Jul PPT	Aug PPT	Sep PPT	Oct PPT	Nov PPT	Dec PPT	Grow PPT	An PPT
1	214	206	162	70	42	8	1	3	11	53	135	204	1110	1110
2	224	201	163	65	42	7	1	3	10	52	135	203	1107	1107
3	288	256	212	83	53	9	1	3	12	64	171	248	1400	1400
4	170	165	125	54	33	7	1	2	9	51	107	172	281	895
5	168	169	120	52	34	6	1	2	7	50	98	163	370	869
6	132	134	100	42	24	4	0	2	5	36	82	127	295	687
7	173	189	130	57	53	5	0	6	6	51	120	171	308	961
8	161	174	118	50	30	5	0	3	7	43	99	165	44	855
9	156	160	120	47	45	5	0	4	6	41	103	157	101	844
10	152	148	111	42	23	4	0	2	6	28	78	130	63	725
11	130	126	91	34	19	4	0	1	7	28	72	120	93	632
12	106	104	75	31	16	4	0	1	7	24	62	96	325	526
13	129	127	111	59	30	8	0	1	10	39	90	122	349	727
14	144	145	133	67	36	10	0	2	12	44	106	142	410	841
15	139	138	127	63	35	10	1	1	12	42	100	138	101	806
16	155	158	147	82	45	15	1	2	15	54	117	162	478	954
17	163	167	154	88	46	16	1	2	16	59	123	174	505	1009
18	224	199	181	110	72	18	2	2	18	66	146	207	179	1245
19	229	212	193	118	76	20	3	2	18	72	151	222	192	1317
20	245	208	207	123	74	20	3	2	22	72	165	237	193	1378
21	194	188	172	105	77	28	10	6	27	67	146	180	16	1200
22	189	185	167	100	65	26	9	8	27	65	142	179	17	1163
23	184	181	164	96	64	26	10	8	27	65	140	179	18	1143
24	167	181	149	82	46	28	9	13	26	66	127	170	22	1065
25	104	103	93	46	31	18	6	10	19	35	70	109	16	645
26	89	91	76	33	24	15	7	10	17	30	56	96	17	544
27	85	84	69	30	22	14	7	10	17	30	57	90	34	514
28	79	78	62	27	20	13	6	10	16	28	57	85	32	483
29	67	63	49	22	15	12	6	8	14	25	49	71	28	401
30	97	95	71	24	20	13	5	8	17	27	73	106	556	556
31	108	112	84	29	23	12	6	9	20	30	86	122	47	640
32	166	173	143	61	35	18	9	11	32	40	126	186	70	1001
33	228	225	200	92	51	23	10	11	35	55	165	239	80	1335
34	245	238	212	94	55	25	11	11	34	60	174	243	81	1402
35	138	142	122	56	35	16	6	9	25	35	94	161	839	839
36	134	137	119	53	35	16	6	10	25	34	92	157	818	818
37	82	89	69	31	22	14	6	5	14	44	53	99	11	529
38	86	117	73	34	23	19	9	7	17	40	59	101	16	586
39	58	59	47	22	24	16	4	5	10	19	49	54	24	365
40	102	114	46	22	25	16	4	9	12	17	44	67	29	477

Appendix B. *n*-alkanes in US analysis

Table 4 continued. Monthly, Grow, and An Precipitation (mm/yr)

Master Site	Jan PPT	Feb PPT	Mar PPT	Apr PPT	May PPT	Jun PPT	Jul PPT	Aug PPT	Sep PPT	Oct PPT	Nov PPT	Dec PPT	Grow PPT	An PPT
41	102	114	46	22	25	16	4	9	12	17	44	67	29	477
42	73	66	52	23	26	14	6	5	13	26	56	67	25	428
43	75	55	48	23	26	15	6	6	12	28	52	71	27	416
44	93	62	57	22	28	15	7	7	16	33	58	75	28	471
45	160	163	133	49	36	20	5	6	19	44	73	91	31	798
46	165	165	141	72	47	21	8	7	19	52	112	152	15	962
47	153	142	125	61	44	19	7	6	18	51	102	140	13	867
48	218	196	194	104	67	26	6	8	27	78	161	210	14	1295
49	238	215	229	123	87	35	7	12	36	84	191	235	19	1491
50	193	155	169	104	78	33	3	7	37	60	128	171	9	1137
51	165	146	135	87	59	25	3	5	27	55	110	158	8	976
52	456	372	363	212	137	76	18	25	56	172	381	508	43	2773
53	243	218	247	121	81	27	5	6	31	85	183	237	11	1485
54	254	246	294	122	83	27	2	7	37	75	197	262	9	1607
55	231	238	184	100	61	18	2	3	23	81	150	247	5	1339
56	151	147	111	59	36	11	1	3	14	44	92	151	124	821
57	122	98	81	36	26	11	1	3	11	29	75	95	198	589
58	113	101	83	39	27	11	1	3	10	28	66	97	202	579
59	103	100	81	41	31	12	2	3	11	26	65	96	207	572
60	116	106	92	39	38	12	3	2	9	26	67	107	221	617
61	119	109	95	39	42	12	3	2	8	26	65	113	227	633
62	129	122	115	46	60	15	5	2	10	29	73	146	281	751
63	160	136	124	55	54	16	7	3	10	37	89	171	307	864
64	170	147	131	59	49	17	6	3	10	39	103	165	315	900
65	390	360	283	138	93	22	9	15	25	108	270	412	411	2126
66	377	343	270	133	89	22	9	13	23	101	259	395	390	2035
67	361	323	258	130	88	24	7	11	25	101	254	384	385	1966
68	360	297	246	130	88	26	7	9	23	94	246	373	377	1899
69	353	272	226	113	83	25	6	10	25	90	244	359	352	1806
70	312	238	233	121	74	25	6	11	27	87	238	331	350	1703
71	317	243	239	127	77	26	7	11	27	90	246	339	365	1748
72	253	196	198	90	50	26	7	11	20	60	194	265	265	1371
73	186	143	150	82	38	18	5	9	16	53	152	192	219	1041
74	265	212	161	83	44	12	2	4	15	67	174	250	227	1288
75	328	246	182	95	51	13	3	5	18	75	206	363	260	1585
76	374	307	232	126	69	20	3	9	15	105	238	465	347	1964
77	377	302	226	123	69	19	3	9	18	98	231	424	340	1899
78	389	329	247	134	76	19	4	9	19	102	250	424	362	2002
79	385	346	264	142	83	18	5	8	22	104	263	403	381	2042

Appendix B. *n*-alkanes in US analysis

Table 4 continued. Monthly, Grow, and An Precipitation (mm/yr)

Master Site	Jan PPT	Feb PPT	Mar PPT	Apr PPT	May PPT	Jun PPT	Jul PPT	Aug PPT	Sep PPT	Oct PPT	Nov PPT	Dec PPT	Grow PPT	An PPT
81	223	199	175	92	51	19	3	7	15	72	169	245	433	1269
82	81	83	106	108	104	106	98	92	95	109	110	94	296	1185
83	86	89	114	120	106	110	104	93	100	125	123	105	307	1275
84	83	68	81	91	97	93	77	86	99	107	112	100	257	1095
85	82	72	91	101	98	100	85	85	100	111	118	100	269	1142
86	91	84	109	111	103	100	88	83	102	117	130	110	373	1229
87	82	81	104	113	97	106	91	84	98	115	118	102	378	1189
88	86	83	101	108	102	107	98	93	94	109	107	97	297	1186
89	97	89	115	109	98	105	98	97	96	111	112	111	395	1237
90	95	87	113	111	96	105	101	99	98	118	109	106	402	1237
91	91	84	107	114	98	108	101	103	105	121	114	104	515	1251
92	92	84	111	113	113	121	116	110	119	133	117	103	465	1332
93	88	78	98	107	110	111	127	120	106	116	107	95	359	1265
94	89	74	103	111	113	120	116	113	117	114	106	101	693	1276
95	93	72	105	110	111	115	124	107	116	111	104	103	462	1271
96	88	72	98	104	110	111	121	99	115	110	95	102	557	1227
97	81	69	90	94	99	104	112	95	109	100	97	92	519	1142
98	74	69	91	89	98	96	108	80	111	92	88	81	493	1076
99	85	75	101	94	114	89	110	90	116	102	96	91	405	1164
100	75	69	93	85	106	95	99	80	95	94	85	82	474	1056
101	77	68	95	81	95	94	101	91	93	87	82	83	474	1047
102	82	74	104	82	101	89	119	102	98	85	84	85	509	1104
103	89	76	106	86	100	86	110	110	109	84	90	88	516	1135
104	88	78	103	90	99	102	120	111	106	87	90	85	538	1158
105	87	75	106	85	93	97	118	106	96	85	84	85	512	1119
106	95	81	105	81	92	101	112	110	109	87	83	83	523	1138
107	90	85	101	80	93	110	131	117	100	83	77	77	551	1144
108	94	85	98	80	83	117	149	142	122	80	76	81	849	1206
109	94	85	98	80	82	117	149	143	123	80	76	81	849	1206
110	96	85	97	77	89	118	139	143	124	82	76	80	613	1206
111	93	82	96	76	84	117	138	141	113	82	76	79	593	1178
112	96	86	97	72	82	127	133	146	108	83	71	86	596	1188
113	97	87	99	69	81	130	131	145	102	84	66	81	657	1170
114	102	89	101	74	75	136	131	138	97	80	71	83	650	1177
115	101	100	97	75	70	123	133	113	88	81	72	88	602	1141
116	108	91	106	71	69	126	128	141	99	77	68	81	634	1167
117	110	102	127	80	62	126	128	139	106	84	68	90	641	1223
118	116	107	132	76	64	134	135	157	102	72	67	87	668	1247
119	123	117	145	83	87	172	169	170	121	78	88	95	802	1448

Appendix B. *n*-alkanes in US analysis

Table 4 continued. Monthly, Grow, and An Precipitation (mm/yr)

Master Site	Jan PPT	Feb PPT	Mar PPT	Apr PPT	May PPT	Jun PPT	Jul PPT	Aug PPT	Sep PPT	Oct PPT	Nov PPT	Dec PPT	Grow PPT	An PPT
120	117	111	141	88	84	171	197	197	149	88	89	92	886	1524
121	115	106	139	91	79	160	201	196	161	91	88	90	889	1517
122	11	10	18	25	72	90	94	60	52	39	15	12	244	497
123	10	11	17	28	66	84	78	55	39	33	16	10	217	448
124	10	14	30	44	73	76	58	37	34	35	16	10	171	436
125	6	8	23	38	51	52	47	36	29	25	13	7	164	335
126	16	16	48	60	69	57	42	45	40	34	27	20	184	475
127	16	26	60	77	124	132	108	100	83	64	41	25	547	857
128	59	60	82	99	126	101	101	84	84	86	98	75	496	1056
129	9	6	12	10	11	14	38	50	35	23	14	15	147	236
130	118	125	104	44	14	4	12	20	15	28	56	84	422	625
131	27	32	20	8	4	1	13	15	14	14	11	20	68	178
132	142	173	136	49	19	7	3	3	12	38	58	93	63	733
133	137	151	100	32	11	2	1	1	4	27	43	83	79	594
134	94	85	109	113	96	108	104	99	99	122	110	102	409	1241
135	34	18	20	18	20	16	7	7	9	15	32	39	30	235
136	104	91	132	116	92	98	89	100	101	109	116	116	388	1264
137	142	112	123	81	109	86	45	39	53	92	150	162	169	1192
138	80	63	69	63	64	51	24	24	31	52	94	76	99	692
186	24	18	25	42	78	108	93	86	78	58	39	26	364	674
187	24	18	26	42	78	108	94	86	80	60	40	26	368	681
188	21	15	27	44	80	107	96	86	81	63	37	23	370	681
189	21	15	26	43	78	107	99	86	80	63	37	22	372	678
190	17	13	25	42	75	103	98	84	78	61	30	18	363	643
191	17	14	29	46	78	104	101	81	78	68	32	19	364	667
192	18	14	30	45	78	111	100	82	80	70	33	20	372	681
193	18	14	30	45	78	111	100	82	80	70	33	20	372	681
194	18	14	30	45	78	111	101	81	79	70	32	20	372	680
195	17	13	31	50	81	109	93	79	75	64	27	15	356	654
196	17	13	32	53	79	113	91	84	75	66	28	16	442	666
197	16	15	35	58	75	105	93	87	79	64	29	16	502	670
198	18	16	37	61	74	104	95	89	78	60	30	17	439	677
199	18	16	42	64	76	106	80	80	74	51	35	20	416	662
200	18	15	42	72	85	102	88	80	87	49	37	18	491	692
201	15	15	40	72	82	107	87	82	80	54	35	19	437	688
202	14	15	39	71	82	105	88	81	80	54	35	19	435	681
203	16	16	42	74	83	107	85	81	77	55	37	21	433	693
204	13	14	42	74	84	104	85	77	70	57	35	19	420	674
205	13	15	45	77	93	107	86	76	74	57	36	19	436	699

Appendix B. *n*-alkanes in US analysis

Table 4 continued. Monthly, Grow, and An Precipitation (mm/yr)

Master Site	Jan PPT	Feb PPT	Mar PPT	Apr PPT	May PPT	Jun PPT	Jul PPT	Aug PPT	Sep PPT	Oct PPT	Nov PPT	Dec PPT	Grow PPT	An PPT
206	13	15	44	76	94	105	85	74	74	57	35	18	565	690
207	15	18	48	77	102	104	79	80	72	57	33	21	513	704
208	15	18	48	77	102	104	79	80	72	57	33	21	436	704
209	13	17	43	71	98	103	80	86	64	56	31	18	431	679
210	13	17	45	68	101	106	82	86	67	54	32	17	442	689
211	13	16	43	67	96	106	77	76	65	48	32	17	419	655
212	12	15	49	65	110	108	82	73	60	49	31	14	433	669
213	12	14	45	62	107	107	82	77	57	49	28	16	431	657
214	12	14	45	57	108	100	88	80	53	51	27	14	480	649
215	12	15	45	55	109	90	93	79	52	48	28	14	472	641
216	12	16	46	57	111	92	97	76	53	48	28	16	476	651
217	13	16	46	56	108	92	100	75	54	48	27	17	477	653
218	13	16	46	54	93	83	102	70	53	40	26	17	441	614
219	15	19	53	61	94	89	107	83	60	43	30	21	477	676
220	14	20	49	61	98	91	95	82	53	44	24	21	464	653
221	16	21	51	56	97	97	90	77	49	49	24	22	459	649
222	17	23	57	58	96	106	81	80	56	57	27	22	535	680
223	17	22	55	57	97	105	82	79	53	56	26	22	529	670
224	17	22	56	58	95	106	80	80	56	57	27	22	532	676
225	19	26	58	61	106	113	79	86	68	65	28	23	579	732
226	18	25	57	56	97	106	65	79	59	57	35	26	519	680
227	19	25	56	57	97	104	66	78	59	58	35	26	519	680
228	16	22	49	51	82	93	62	68	52	52	29	24	460	601
229	21	25	56	59	100	96	58	63	64	63	36	28	504	671
230	20	28	56	63	107	97	53	66	64	68	36	30	517	687
231	20	25	53	58	99	103	55	69	65	63	34	26	511	669
232	20	25	53	58	99	103	55	69	65	63	34	26	511	669
233	20	26	53	57	107	102	49	79	72	68	35	26	534	695
234	25	31	52	61	99	108	55	74	74	70	36	28	540	712
235	26	32	51	54	91	107	58	63	69	72	37	28	513	686
236	27	33	47	60	95	107	57	65	64	68	41	28	516	692
237	27	35	45	52	94	93	48	57	72	71	38	27	525	659
238	26	41	45	52	86	100	45	60	65	71	37	33	516	660
239	29	37	49	45	84	101	46	59	71	74	41	30	520	665
240	29	36	49	45	84	104	45	58	72	75	42	30	525	669
241	21	34	36	42	77	82	35	56	55	74	33	25	451	566
242	23	37	39	37	73	67	40	57	66	65	32	24	438	560
243	27	44	50	38	84	91	46	54	63	68	41	30	485	637
244	24	40	44	45	72	83	42	63	67	67	40	27	479	614

Appendix B. *n*-alkanes in US analysis

Table 4 continued. Monthly, Grow, and An Precipitation (mm/yr)

Master Site	Jan PPT	Feb PPT	Mar PPT	Apr PPT	May PPT	Jun PPT	Jul PPT	Aug PPT	Sep PPT	Oct PPT	Nov PPT	Dec PPT	Grow PPT	An PPT
245	25	36	50	48	74	86	40	51	61	60	40	33	420	604
246	24	31	46	47	73	81	49	60	69	82	45	31	552	637
247	26	31	43	44	74	72	53	61	74	69	40	22	530	608
248	37	39	59	52	89	92	69	54	73	85	49	34	563	731
249	34	39	48	48	73	79	52	50	74	88	44	28	557	658
250	35	36	45	54	68	77	71	46	84	61	41	34	548	653
251	29	36	39	37	71	70	60	51	79	61	34	29	568	597
252	25	43	27	32	75	64	68	52	92	73	34	25	584	610
253	31	35	29	36	66	67	56	56	133	91	39	34	673	673
254	33	32	29	38	63	61	55	58	143	99	47	32	691	691
255	33	32	29	38	63	61	55	58	144	99	47	32	691	691
256	30	26	33	38	58	65	28	32	34	27	34	34	158	438
257	79	59	60	49	66	73	36	37	60	66	94	102	206	781
258	74	53	59	49	59	65	33	27	38	59	96	88	162	698
259	108	91	95	82	90	83	40	41	56	65	116	116	220	984
260	28	23	42	64	85	99	101	89	102	80	52	35	391	800
261	125	121	119	114	117	104	129	89	105	77	109	135	735	1344
262	43	38	46	48	41	26	13	20	23	33	39	40	81	410
263	37	43	40	18	15	20	102	120	59	66	33	54	301	607
264	30	34	31	12	5	2	21	29	21	19	17	23	215	245
265	33	25	38	13	9	8	54	78	55	40	34	46	244	432
266	50	57	76	75	67	35	27	27	41	53	63	56	251	628
267	42	54	55	28	15	12	21	34	26	37	29	35	145	387
268	105	99	109	74	71	125	119	119	91	82	76	87	758	1158
269	46	40	37	17	16	14	5	7	12	18	31	41	73	285
270	52	53	32	15	13	13	5	6	11	19	39	54	66	312
271	53	51	38	19	20	15	7	8	14	21	40	53	43	338
272	119	117	98	48	34	17	14	17	24	48	85	119	32	741
273	87	77	88	92	83	46	23	25	52	74	85	89	304	822
274	37	44	45	41	47	33	26	27	32	46	36	38	165	451
275	25	27	23	7	4	1	12	17	12	13	12	15	100	167
276	15	14	16	23	30	24	15	9	15	14	17	18	92	208
277	7	11	28	41	57	53	41	39	31	21	11	8	241	346
278	50	70	61	35	19	15	28	45	33	45	36	42	120	478
279	37	45	45	24	12	9	20	30	23	30	26	31	125	333
280	31	39	37	36	76	72	54	52	96	71	37	30	601	631
281	104	99	97	100	85	57	43	52	67	76	96	106	220	982
282	50	46	50	46	48	33	28	35	44	46	53	46	140	525
283	56	47	58	55	52	34	26	31	41	55	57	53	132	566
284	247	235	181	79	28	6	1	1	9	55	142	241	502	1227

Appendix B. *n*-alkanes in US analysis

Table 5. Monthly Mean, Mean Growing Season (Grow), and Mean Annual VPD (An) (hPa)

Master Site	Jan VPD	Feb VPD	Mar VPD	Apr VPD	May VPD	Jun VPD	Jul VPD	Aug VPD	Sep VPD	Oct VPD	Nov VPD	Dec VPD	Grow VPD	An VPD
1	3	3	3	4	4	4	4	4	5	6	4	4	5	5
2	3	4	5	5	5	6	6	6	7	7	5	5	5	5
3	3	4	5	6	8	11	11	11	11	10	5	5	8	8
4	3	4	6	7	10	13	14	14	14	12	6	6	11	9
5	4	5	6	8	11	15	17	17	17	13	6	6	12	10
6	3	4	6	8	10	12	12	13	14	11	6	6	10	9
7	4	4	6	8	11	16	19	19	17	12	6	6	13	10
8	4	5	7	9	13	17	20	19	18	14	7	7	17	11
9	4	5	7	9	12	18	23	22	20	14	7	7	18	12
10	4	5	8	10	13	19	24	23	21	15	7	7	19	13
11	4	5	7	10	14	20	23	23	21	15	7	7	18	13
12	3	5	7	10	15	20	23	22	20	14	6	6	14	12
13	3	5	6	8	13	19	25	25	21	14	6	6	15	12
14	3	5	6	7	12	18	24	23	20	13	6	6	14	12
15	3	5	6	8	13	19	25	25	21	14	6	6	19	12
16	4	5	6	8	12	18	25	26	21	13	6	6	15	12
17	5	5	6	7	11	17	23	25	21	13	6	6	14	12
18	5	5	6	7	11	17	23	24	20	13	6	6	18	13
19	5	5	7	8	12	17	24	25	22	14	7	7	19	13
20	5	5	7	8	12	17	23	24	21	14	7	7	19	12
21	4	3	4	5	7	10	14	15	13	8	5	5	15	8
22	4	4	5	6	9	13	17	17	14	9	5	5	17	9
23	4	4	5	5	8	11	16	16	14	9	5	5	16	8
24	4	3	4	5	7	10	14	14	12	8	4	4	14	7
25	3	3	4	5	7	10	14	14	12	8	4	4	14	7
26	4	3	5	6	9	12	16	16	14	9	5	5	16	9
27	4	4	5	6	9	12	17	16	13	9	5	5	15	8
28	4	4	5	6	9	13	18	18	14	9	5	5	17	9
29	4	4	6	7	11	15	20	20	17	11	6	6	19	10
30	4	4	5	6	9	13	17	18	14	9	5	5	9	9
31	4	3	5	6	8	13	17	17	13	8	5	5	15	8
32	3	3	3	4	6	9	13	13	11	7	4	4	11	7
33	3	3	4	4	5	8	11	12	10	7	4	4	10	6
34	3	3	4	4	5	8	11	12	10	7	4	4	10	6
35	3	3	3	4	6	9	12	13	11	7	4	4	6	6
36	3	3	4	5	7	10	14	14	11	7	4	4	7	7
37	4	4	5	7	10	15	21	20	17	10	6	6	20	10
38	3	4	5	6	9	13	18	17	14	9	5	5	17	9
39	3	4	6	8	11	16	23	22	17	10	5	5	21	11
40	4	4	5	6	9	13	19	19	15	9	4	4	17	9

Table 5 continued. Monthly Mean, Grow, and An VPD (hPa)

Master Site	Jan VPD	Feb VPD	Mar VPD	Apr VPD	May VPD	Jun VPD	Jul VPD	Aug VPD	Sep VPD	Oct VPD	Nov VPD	Dec VPD	Grow VPD	An VPD
41	4	4	5	6	9	13	19	19	15	9	4	4	17	9
42	3	4	5	7	11	16	21	21	17	10	5	5	19	10
43	3	3	6	7	11	16	22	21	17	10	4	4	20	10
44	3	3	5	6	10	15	21	20	16	9	4	4	19	10
45	3	3	4	5	8	12	18	18	15	9	4	4	16	9
46	2	3	5	6	9	14	20	19	16	9	4	4	20	9
47	2	3	5	6	10	14	21	20	16	9	4	4	21	9
48	3	4	5	6	9	14	20	19	16	10	4	4	20	9
49	3	3	5	6	9	13	18	19	16	9	4	4	18	9
50	5	4	5	7	11	16	23	24	20	12	6	6	23	11
51	5	5	6	8	13	19	26	27	23	14	6	6	27	13
52	3	3	3	4	7	9	13	14	12	7	3	3	14	7
53	4	5	6	7	11	16	22	22	18	11	5	5	22	11
54	5	4	5	7	10	15	22	22	19	12	5	5	22	11
55	5	5	7	9	13	18	26	26	22	14	6	6	26	13
56	3	5	7	10	15	21	25	24	22	15	7	7	19	13
57	4	5	7	10	15	22	26	25	23	15	6	6	18	13
58	4	5	7	10	15	22	29	27	23	15	7	7	19	14
59	5	6	8	11	16	23	30	29	25	16	8	8	20	15
60	5	6	8	11	17	24	32	30	25	16	8	8	20	16
61	5	6	8	11	16	23	31	29	25	16	8	8	20	15
62	5	4	6	8	12	18	24	23	21	13	6	6	16	14
63	5	5	7	8	13	18	26	25	22	14	6	6	17	13
64	4	4	5	6	10	15	20	20	18	12	5	5	13	11
65	3	3	4	5	7	10	15	16	15	10	3	3	11	8
66	4	3	5	5	8	11	17	18	16	11	4	4	12	8
67	4	4	5	6	9	13	19	20	18	11	5	5	14	9
68	4	4	5	6	9	13	19	20	18	11	5	5	14	10
69	4	4	5	6	9	13	19	21	19	12	5	5	14	10
70	4	4	6	7	10	15	22	23	21	13	6	6	16	10
71	5	4	5	6	9	14	20	22	19	12	5	5	15	10
72	4	4	6	7	11	15	22	23	20	13	5	5	16	11
73	4	5	6	8	11	16	24	24	22	14	5	5	17	12
74	4	4	6	8	11	15	23	22	20	13	5	5	16	11
75	3	4	5	6	9	12	19	20	19	12	5	5	14	11
76	3	4	5	7	10	13	20	21	20	12	5	5	15	10
77	4	4	6	7	10	13	19	19	19	12	5	5	14	11
78	4	4	5	6	9	12	17	18	18	11	5	5	13	9
79	4	4	5	5	7	9	14	14	14	9	5	5	10	8

Table 5 continued. Monthly Mean, Grow, and An VPD (hPa)

Master Site	Jan VPD	Feb VPD	Mar VPD	Apr VPD	May VPD	Jun VPD	Jul VPD	Aug VPD	Sep VPD	Oct VPD	Nov VPD	Dec VPD	Grow VPD	An VPD
81	2	3	3	3	5	4	5	5	7	6	3	3	5	4
82	2	2	3	6	8	9	11	10	7	5	3	3	10	6
83	2	2	3	5	7	9	10	9	7	5	3	3	9	5
84	1	2	3	4	7	8	10	9	7	4	3	3	9	5
85	1	2	3	4	7	8	9	9	6	4	3	3	9	5
86	1	2	3	5	6	8	9	8	6	4	3	3	8	5
87	1	2	3	5	7	8	9	9	7	5	3	3	8	5
88	2	2	3	6	8	10	11	10	8	5	3	3	10	6
89	2	2	4	6	8	9	11	10	8	5	4	4	9	6
90	2	2	3	6	7	8	9	8	7	5	3	3	8	5
91	2	2	4	6	8	9	10	9	7	5	4	4	8	6
92	2	2	3	6	8	9	10	9	7	5	3	3	8	5
93	2	2	4	6	7	8	9	8	7	5	3	3	8	5
94	2	2	4	6	8	9	11	10	7	5	4	4	8	6
95	2	3	4	7	8	10	12	11	8	6	4	4	10	6
96	2	2	4	6	8	9	11	10	8	5	4	4	9	6
97	2	3	4	6	8	9	10	10	8	5	4	4	9	6
98	2	3	4	7	9	11	12	11	9	6	4	4	10	7
99	2	3	5	7	9	10	11	11	9	6	4	4	10	7
100	3	4	6	8	10	12	14	13	10	7	5	5	12	8
101	3	4	5	8	9	11	12	11	9	7	5	5	10	7
102	3	4	6	9	10	12	13	12	10	7	5	5	11	8
103	3	4	6	9	9	12	13	12	9	7	5	5	11	8
104	3	4	6	9	10	12	13	11	10	7	5	5	11	8
105	4	5	7	9	10	13	14	12	10	8	6	6	12	8
106	4	5	7	10	11	13	13	12	10	7	6	6	12	8
107	4	5	7	10	11	13	13	12	10	8	6	6	12	9
108	5	6	8	11	12	13	14	12	11	9	7	7	11	9
109	5	6	8	11	12	13	14	13	11	9	7	7	11	9
110	4	5	7	10	12	13	14	12	10	8	7	7	12	9
111	4	5	7	10	12	14	14	12	11	8	7	7	12	9
112	5	6	8	10	12	14	14	12	11	8	7	7	12	9
113	5	6	8	10	12	13	14	12	11	8	7	7	12	9
114	5	6	8	10	12	13	14	12	11	9	7	7	12	9
115	5	6	8	11	13	14	14	13	12	9	7	7	13	10
116	5	6	8	10	13	14	14	13	11	9	7	7	12	10
117	5	6	9	11	13	13	14	13	12	10	7	7	13	10
118	5	6	8	10	13	13	13	12	11	9	7	7	12	9
119	5	6	8	10	13	13	12	12	11	10	7	7	12	9

Appendix B. *n*-alkanes in US analysis

Table 5 continued. Monthly Mean, Grow, and An VPD (hPa)

Master Site	Jan VPD	Feb VPD	Mar VPD	Apr VPD	May VPD	Jun VPD	Jul VPD	Aug VPD	Sep VPD	Oct VPD	Nov VPD	Dec VPD	Grow VPD	An VPD
120	5	6	9	11	13	13	12	12	11	10	7	7	12	9
121	4	5	7	8	11	10	10	10	9	8	6	6	10	8
122	1	1	2	5	8	9	11	12	8	5	2	2	11	5
123	1	1	3	6	8	10	13	13	9	5	3	3	12	6
124	2	3	4	7	9	13	18	18	14	8	4	4	16	9
125	3	4	6	8	10	14	18	15	13	8	5	5	15	9
126	4	5	6	8	11	15	19	17	14	9	6	6	16	10
127	3	3	5	8	9	12	15	14	11	8	5	5	12	8
128	2	3	5	7	9	12	13	12	10	7	4	4	11	7
129	6	8	11	16	21	26	24	20	18	13	8	8	22	15
130	6	6	7	9	12	16	18	19	17	13	9	9	13	12
131	7	7	10	14	20	27	30	27	24	16	10	10	23	17
132	9	9	9	11	12	15	20	22	19	15	12	12	18	13
133	10	10	10	10	11	12	16	19	18	15	13	13	15	13
134	2	2	3	6	8	9	10	9	7	5	3	3	8	5
135	1	2	4	6	9	12	17	17	12	6	2	2	15	8
136	2	2	3	4	5	6	7	7	6	5	4	4	7	5
137	1	2	3	4	6	8	13	14	10	5	2	2	12	6
138	1	2	4	5	8	10	15	17	12	6	2	2	14	7
186	1	1	2	5	7	8	9	8	5	3	2	2	8	4
187	1	1	2	5	7	8	9	8	5	3	1	1	8	4
188	1	1	2	6	8	9	9	8	6	4	2	2	8	5
189	1	1	2	5	7	8	9	8	6	4	2	2	8	5
190	1	1	2	5	7	8	10	9	6	4	2	2	8	5
191	1	1	2	5	7	8	9	9	6	4	2	2	8	5
192	1	1	2	5	7	8	9	9	6	4	2	2	8	5
193	1	1	2	5	7	8	9	9	6	4	2	2	8	5
194	1	1	2	5	7	8	9	9	6	4	2	2	8	5
195	1	1	2	5	7	9	9	9	7	4	2	2	8	5
196	1	1	2	5	7	8	9	8	6	4	2	2	8	4
197	1	1	2	5	8	9	10	9	7	5	2	2	8	5
198	1	1	2	5	8	10	10	9	8	5	2	2	9	5
199	1	1	2	5	9	11	10	8	8	5	2	2	9	5
200	1	1	2	5	8	11	10	9	8	5	3	3	9	5
201	1	1	2	6	8	10	10	9	8	5	3	3	9	5
202	1	1	2	5	8	10	10	9	8	5	3	3	9	5
203	1	1	2	6	8	10	10	9	8	6	3	3	9	6
204	1	2	3	6	9	11	11	10	9	6	3	3	10	6
205	1	2	3	7	9	12	11	10	9	6	3	3	10	6

Table 5 continued. Monthly Mean, Grow, and An VPD (hPa)

Master Site	Jan VPD	Feb VPD	Mar VPD	Apr VPD	May VPD	Jun VPD	Jul VPD	Aug VPD	Sep VPD	Oct VPD	Nov VPD	Dec VPD	Grow VPD	An VPD
206	2	2	3	7	9	12	12	11	10	7	3	3	10	7
207	2	2	4	7	9	12	12	11	10	7	4	4	10	7
208	2	2	4	7	9	11	12	11	10	7	4	4	11	7
209	2	2	4	7	9	11	12	11	10	7	4	4	11	7
210	2	2	4	7	9	11	12	11	10	7	4	4	10	7
211	2	3	4	7	9	11	13	12	11	7	4	4	11	7
212	2	3	4	7	9	12	13	12	11	7	4	4	11	7
213	3	3	5	7	9	12	14	12	11	8	5	5	12	8
214	3	3	5	8	9	12	14	12	11	8	5	5	11	8
215	2	3	5	7	9	12	14	12	11	8	4	4	11	8
216	3	3	5	7	9	13	15	14	12	8	5	5	12	8
217	3	3	5	8	9	13	16	14	12	8	5	5	12	8
218	3	3	5	8	10	14	18	16	13	8	5	5	13	9
219	3	4	6	8	10	15	19	16	13	8	5	5	14	9
220	3	4	6	8	10	15	19	17	13	9	5	5	14	9
221	3	4	6	8	10	15	19	17	13	9	5	5	14	9
222	3	4	6	9	10	15	19	18	14	9	5	5	13	10
223	3	4	6	8	10	15	19	18	14	9	5	5	13	10
224	3	4	6	8	10	15	19	18	14	9	5	5	13	10
225	4	5	6	9	11	15	20	18	14	9	6	6	14	10
226	4	5	7	10	12	16	21	20	15	10	6	6	15	11
227	4	5	7	10	12	16	21	20	15	10	6	6	15	11
228	4	5	7	10	12	16	20	19	14	10	7	7	14	11
229	4	5	7	9	11	15	20	19	14	9	6	6	14	10
230	4	5	7	10	11	15	20	19	14	10	6	6	14	11
231	5	5	8	10	12	15	20	19	14	10	7	7	14	11
232	5	5	8	10	12	15	20	19	14	10	7	7	14	11
233	5	5	8	10	12	16	21	20	15	10	7	7	15	11
234	5	6	8	11	14	17	22	21	16	11	7	7	16	12
235	5	6	8	11	14	18	22	22	16	11	7	7	16	12
236	6	7	9	13	16	20	24	24	17	12	8	8	18	13
237	6	7	9	12	15	19	23	23	17	11	8	8	16	13
238	6	7	9	13	16	19	22	23	17	11	8	8	16	13
239	6	7	9	12	15	17	21	21	16	11	8	8	15	12
240	6	7	9	13	15	17	21	20	16	11	8	8	15	12
241	6	7	10	13	15	18	21	21	16	12	8	8	16	13
242	7	7	10	13	16	18	21	21	15	11	8	8	16	13
243	7	8	10	14	16	18	22	22	16	12	9	9	16	13
244	7	8	10	13	15	18	19	20	15	12	8	8	15	13

Appendix B. *n*-alkanes in US analysis

Table 5 continued. Monthly Mean, Grow, and An VPD (hPa)

Master Site	Jan VPD	Feb VPD	Mar VPD	Apr VPD	May VPD	Jun VPD	Jul VPD	Aug VPD	Sep VPD	Oct VPD	Nov VPD	Dec VPD	Grow VPD	An VPD
245	7	8	9	13	14	18	20	21	16	12	8	8	16	13
246	6	7	8	11	12	14	17	18	14	10	7	7	12	11
247	6	8	10	13	14	17	19	20	16	11	8	8	14	12
248	7	8	10	12	14	16	18	20	16	12	8	8	15	12
249	7	9	11	14	15	17	19	22	17	13	9	9	15	13
250	7	8	10	12	14	16	18	20	16	12	9	9	14	12
251	7	8	11	13	14	17	19	20	15	13	10	10	14	13
252	7	9	11	13	15	16	18	19	15	12	10	10	13	13
253	7	8	9	11	12	13	15	16	12	11	9	9	15	11
254	6	7	9	10	11	13	14	15	12	11	8	8	15	10
255	6	7	9	10	11	13	14	15	12	11	8	8	15	10
256	2	2	4	6	8	10	17	17	11	6	3	1	14	7
257	1	2	3	5	7	9	14	15	10	5	2	1	12	6
258	1	2	4	5	8	11	16	16	11	5	1	1	13	7
259	2	2	3	4	5	7	13	13	9	5	2	1	10	5
260	1	1	2	5	7	8	9	8	6	4	2	1	8	4
261	3	4	6	8	9	10	11	11	9	7	5	3	9	7
262	3	3	4	6	9	14	20	19	14	9	4	3	17	9
263	6	6	8	11	15	21	19	15	14	11	8	6	17	12
264	8	9	12	17	24	32	34	30	27	19	13	8	20	19
265	4	5	7	10	14	20	19	15	14	11	7	4	15	11
266	2	2	5	7	11	17	23	21	15	8	4	2	16	10
267	4	5	7	9	15	22	25	22	17	12	7	4	19	12
268	5	6	8	10	12	14	14	13	11	9	7	5	11	10
269	4	4	5	7	10	15	21	20	15	9	5	3	15	10
270	4	4	6	8	12	17	23	22	17	11	6	3	17	11
271	4	4	6	7	11	16	22	22	17	10	5	3	19	11
272	4	4	5	6	8	12	16	16	13	9	5	3	16	8
273	2	3	4	6	8	13	18	17	11	7	4	2	13	8
274	3	3	5	7	11	17	22	20	14	8	4	2	17	10
275	9	11	15	21	30	40	44	39	33	22	14	9	29	24
276	1	2	3	6	9	13	19	19	13	7	3	1	14	8
277	4	4	5	7	9	13	18	15	12	8	5	3	13	9
278	4	4	6	9	13	20	23	20	15	10	6	4	19	11
279	5	6	9	13	19	27	31	28	22	14	8	5	24	16
280	7	8	10	13	13	16	18	19	15	12	9	7	13	12
281	2	2	3	4	6	9	11	10	8	5	3	2	10	5
282	2	2	4	6	9	14	18	17	12	8	4	2	15	8
283	2	2	4	7	9	14	19	17	12	8	4	2	16	8
284	4	4	5	7	10	10	11	10	13	12	6	4	9	8

Appendix B. *n*-alkanes in US analysis

Table 6. Mean Annual Potential Evapotranspiration (mm/yr)

Master Site	PET	Master Site	PET	Master Site	PET	Master Site	PET	Master Site	PET	Master Site	PET
1	1056	41	1075	82	974	122	891	209	1083	249	1608
2	1129	42	1177	83	931	123	928	210	1076	250	1630
3	1194	43	1194	84	872	124	1118	211	1087	251	1634
4	1315	44	1157	85	873	125	1143	212	1074	252	1615
5	1341	45	1110	86	893	126	1159	213	1117	253	1461
6	1338	46	1130	87	889	127	1176	214	1124	254	1441
7	1301	47	1174	88	969	128	1122	215	1123	255	1440
8	1386	48	1133	89	986	129	1536	216	1155	256	983
9	1380	49	1079	90	954	130	1259	217	1178	257	921
10	1430	50	1120	91	995	131	1336	218	1241	258	984
11	1460	51	1260	92	954	132	1344	219	1211	259	849
12	1441	52	859	93	1000	133	1284	220	1232	260	845
13	1363	53	1194	94	1005	134	953	221	1261	261	1230
14	1360	54	1200	95	1055	135	998	222	1280	262	997
15	1378	55	1269	96	1039	136	878	223	1279	263	1396
16	1329	56	1376	97	1022	137	838	224	1276	264	1515
17	1340	57	1401	98	1075	138	951	225	1305	265	1311
18	1229	58	1409	99	1074	186	781	226	1379	266	1057
19	1255	59	1414	100	1127	187	782	227	1379	267	1238
20	1235	60	1411	101	1139	188	828	228	1335	268	1430
21	954	61	1404	102	1211	189	825	229	1349	269	1201
22	1008	62	1373	103	1220	190	812	230	1362	270	1273
23	982	63	1302	104	1242	191	825	231	1365	271	1168
24	926	64	1161	105	1282	192	841	232	1365	272	1054
25	906	65	942	106	1277	193	844	233	1413	273	993
26	1075	66	995	107	1274	194	835	234	1444	274	1065
27	1049	67	1050	108	1314	195	857	235	1469	275	1582
28	1168	68	1076	109	1313	196	845	236	1479	276	1059
29	1248	69	1081	110	1352	197	899	237	1494	277	1122
30	1160	70	1139	111	1379	198	921	238	1510	278	1208
31	1105	71	1152	112	1378	199	937	239	1446	279	1363
32	889	72	1234	113	1405	200	935	240	1446	280	1622
33	857	73	1329	114	1436	201	977	241	1504	281	712
34	825	74	1340	115	1445	202	975	242	1521	282	1012
35	911	75	1251	116	1468	203	990	243	1597	283	1044
36	955	76	1204	117	1474	204	1009	244	1568	284	1143
37	1170	77	1199	118	1453	205	1034	245	1576		
38	1044	78	1177	119	1486	206	1049	246	1501		
39	1196	79	1141	120	1484	207	1053	247	1530		
40	1075	81	1053	121	1475	208	1053	248	1548		

Appendix B. *n*-alkanes in US analysis

Table 7. Monthly Mean, Mean Growing Season (Grow), and Mean Annual Temperature (An) (°C)

Master Site	Jan T_m	Feb T_m	Mar T_m	Apr T_m	May T_m	Jun T_m	Jul T_m	Aug T_m	Sep T_m	Oct T_m	Nov T_m	Dec T_m	Grow T_m	An T_m
1	10	11	11	12	13	15	15	16	16	15	12	10	13	13
2	10	11	12	12	13	15	15	16	15	14	12	10	13	13
3	9	10	12	13	16	18	19	19	19	17	12	9	14	14
4	9	10	12	13	16	19	20	20	20	17	12	9	17	15
5	9	10	12	14	17	20	21	21	20	17	12	9	17	15
6	9	10	12	14	16	19	19	20	19	17	12	9	16	15
7	8	9	11	13	17	20	22	22	21	17	11	8	18	15
8	9	10	12	15	18	21	23	23	21	18	12	9	21	16
9	9	10	12	14	18	22	25	24	22	18	12	9	22	16
10	8	10	12	15	19	22	25	24	23	18	12	9	22	17
11	8	10	13	15	19	23	25	25	23	18	12	9	21	17
12	8	11	13	16	19	23	25	24	23	18	12	8	18	17
13	8	10	12	14	18	22	25	25	23	18	12	8	19	16
14	8	10	12	14	17	21	24	24	22	17	12	8	18	16
15	8	10	12	14	18	22	25	25	22	18	12	8	22	16
16	7	9	10	13	17	21	25	25	22	17	11	7	18	15
17	7	8	10	12	16	20	24	24	21	16	10	7	17	15
18	6	7	9	11	15	19	23	23	21	16	9	6	20	14
19	6	7	9	11	15	19	23	23	20	15	9	5	19	13
20	5	6	8	10	14	18	22	22	20	15	8	5	18	13
21	1	0	3	4	8	13	18	17	14	9	4	0	17	8
22	0	1	3	5	9	13	18	17	14	9	4	0	17	8
23	1	1	3	5	9	13	17	17	14	9	4	1	17	8
24	-1	-1	1	3	7	12	16	16	13	8	2	-1	16	6
25	-2	-1	1	3	7	11	15	15	12	7	2	-1	15	6
26	0	1	3	5	9	14	18	18	14	9	3	0	18	8
27	0	0	2	5	9	13	17	17	14	9	3	-1	16	7
28	0	1	4	6	10	14	18	18	14	9	4	0	17	8
29	1	2	5	7	12	16	20	19	16	11	5	1	18	10
30	0	1	3	5	10	14	18	18	14	9	3	0	8	8
31	0	0	3	5	10	14	19	18	15	9	3	0	17	8
32	-2	-2	0	2	7	11	16	15	12	7	1	-2	13	5
33	-2	-2	-1	1	6	10	15	14	11	6	0	-2	12	5
34	-2	-3	-1	1	5	10	14	14	10	6	0	-2	12	4
35	-2	-2	0	3	7	11	16	16	12	7	2	-2	6	6
36	-1	-1	1	3	8	12	16	15	13	8	2	-1	6	6
37	-1	1	4	7	11	15	19	19	15	10	4	0	19	9
38	-1	0	2	4	9	13	17	17	13	8	2	-1	17	7
39	0	2	5	8	12	16	20	20	16	10	4	0	19	9
40	0	1	3	5	9	14	19	19	15	10	3	0	17	8

Table 7 continued. Monthly Mean, Grow, and An Temperatures (°C)

Master Site	Jan T_m	Feb T_m	Mar T_m	Apr T_m	May T_m	Jun T_m	Jul T_m	Aug T_m	Sep T_m	Oct T_m	Nov T_m	Dec T_m	Grow T_m	An T_m
41	0	1	3	5	9	14	19	19	15	10	3	0	17	8
42	0	1	4	7	11	16	20	19	15	10	4	0	18	9
43	0	1	4	7	11	16	20	19	15	10	4	0	18	9
44	-1	1	4	6	11	15	19	19	15	9	3	-1	18	8
45	-1	0	3	5	9	14	18	17	14	9	3	-1	16	8
46	0	1	4	6	10	15	18	18	15	9	3	0	18	8
47	0	1	4	6	11	15	19	18	15	10	4	0	19	9
48	0	2	4	6	10	15	19	18	15	10	4	0	18	9
49	0	1	3	6	10	14	18	17	15	9	4	0	18	8
50	4	5	7	9	13	18	22	22	19	14	7	4	22	12
51	7	7	9	12	16	21	25	24	22	16	10	6	25	15
52	-2	-1	0	3	7	11	16	15	12	7	1	-2	16	6
53	3	5	6	9	13	17	21	21	18	12	6	3	21	11
54	5	5	7	9	13	18	22	22	19	14	7	4	22	12
55	7	9	10	12	17	21	25	24	22	17	10	7	25	15
56	8	10	12	15	19	23	26	25	23	18	12	8	22	17
57	8	10	12	15	19	24	26	25	23	18	12	8	20	17
58	8	10	12	15	19	24	27	26	24	18	12	8	21	17
59	8	10	12	15	19	24	27	26	24	18	12	8	21	17
60	8	10	12	14	19	23	27	26	24	18	12	8	20	17
61	8	9	12	14	18	23	27	26	23	18	11	8	20	16
62	7	8	10	12	17	21	25	24	22	16	10	6	18	15
63	6	7	9	11	16	21	25	24	22	16	9	6	18	14
64	6	6	8	10	14	19	24	23	21	15	8	5	17	13
65	2	1	3	5	9	14	19	19	16	10	4	2	13	9
66	2	2	3	5	9	14	19	19	16	11	4	2	13	9
67	4	3	5	7	11	16	21	21	18	12	6	4	15	11
68	4	4	5	7	12	16	21	21	19	13	7	4	16	11
69	4	4	5	7	12	16	21	21	19	13	7	4	16	11
70	4	4	5	8	12	16	21	21	19	13	7	4	16	11
71	4	5	6	8	12	17	21	21	19	13	7	4	16	11
72	5	6	7	9	14	18	23	23	21	15	8	5	18	13
73	6	7	9	11	14	18	22	22	19	14	8	5	17	13
74	7	8	9	11	14	18	23	22	20	15	9	6	18	14
75	7	8	9	11	14	18	22	21	19	15	9	7	17	13
76	7	7	8	10	14	18	22	22	21	15	9	7	18	13
77	7	8	9	11	15	18	22	22	20	15	9	7	18	14
78	7	8	9	10	14	17	21	21	19	15	9	7	17	13
79	7	8	9	10	13	16	19	19	18	14	10	7	16	13

Appendix B. *n*-alkanes in US analysis

Table 7 continued. Monthly Mean, Grow, and An Temperatures (°C)

Master Site	Jan T_m	Feb T_m	Mar T_m	Apr T_m	May T_m	Jun T_m	Jul T_m	Aug T_m	Sep T_m	Oct T_m	Nov T_m	Dec T_m	Grow T_m	An T_m
81	10	10	10	11	13	14	14	15	15	13	11	9	13	12
82	-5	-3	1	8	13	19	21	21	16	10	4	-2	20	9
83	-7	-6	-1	6	12	17	20	19	15	8	3	-4	19	7
84	-9	-7	-2	5	12	17	20	19	14	8	3	-4	19	6
85	-9	-7	-1	6	12	17	20	19	15	8	3	-4	19	7
86	-7	-5	0	6	12	17	20	20	15	9	4	-3	18	7
87	-7	-5	0	6	12	18	21	20	15	9	3	-3	18	7
88	-5	-3	2	8	14	19	22	21	17	10	4	-1	20	9
89	-4	-2	2	8	14	19	22	21	17	10	5	-1	20	9
90	-4	-2	2	8	14	19	22	21	17	10	5	-1	19	9
91	-3	-2	3	9	14	19	22	21	17	11	6	0	19	10
92	-5	-3	1	8	13	19	21	20	16	10	5	-2	19	9
93	-4	-2	3	9	14	19	22	21	17	11	5	-1	21	10
94	-3	-1	3	9	15	20	22	22	17	11	6	0	18	10
95	-2	0	4	10	16	21	24	23	19	12	7	1	21	11
96	-2	0	4	10	16	21	23	22	18	12	6	1	20	11
97	-1	0	4	10	16	21	23	22	18	12	7	1	20	11
98	-1	1	5	11	17	22	24	23	19	13	7	1	21	12
99	-1	1	5	11	16	21	24	23	19	13	7	2	22	12
100	2	3	8	13	18	23	26	25	21	15	9	4	23	14
101	2	4	8	13	18	23	26	25	21	15	9	4	23	14
102	3	5	9	14	19	24	26	25	21	15	10	5	23	15
103	3	4	8	14	18	23	25	24	21	14	9	4	22	14
104	3	5	9	14	19	23	26	25	21	15	10	5	23	14
105	3	5	9	14	19	24	26	25	21	15	10	5	23	15
106	4	6	10	15	19	24	26	25	21	15	10	6	23	15
107	5	7	10	16	20	25	26	26	22	16	11	6	24	16
108	6	8	12	16	21	25	27	26	23	17	12	8	21	17
109	6	8	12	16	21	25	27	26	23	17	12	8	21	17
110	7	8	12	17	21	25	27	26	23	17	12	8	24	17
111	7	9	12	17	21	25	27	26	23	17	13	8	25	17
112	7	9	13	17	21	26	27	27	23	18	13	8	25	17
113	8	10	14	17	22	26	28	27	24	18	13	9	24	18
114	8	11	14	18	22	26	28	27	24	19	14	9	24	18
115	8	10	14	18	22	26	28	27	24	19	14	9	24	18
116	10	12	15	19	23	27	28	27	25	20	15	11	25	19
117	10	12	15	19	23	27	28	27	25	20	15	11	25	19
118	10	12	16	19	23	26	28	27	25	20	15	11	25	19
119	10	12	16	19	23	26	28	27	25	21	16	12	25	20

Appendix B. *n*-alkanes in US analysis

Table 7 continued. Monthly Mean, Grow, and An Temperatures (°C)

Master Site	Jan T_m	Feb T_m	Mar T_m	Apr T_m	May T_m	Jun T_m	Jul T_m	Aug T_m	Sep T_m	Oct T_m	Nov T_m	Dec T_m	Grow T_m	An T_m
120	11	13	16	19	23	27	28	27	26	21	16	12	25	20
121	11	13	16	19	23	27	28	27	26	21	16	12	25	20
122	-12	-10	-3	5	12	17	21	20	14	6	-3	-10	19	5
123	-10	-8	-1	7	13	18	22	21	15	7	-1	-8	20	6
124	-5	-3	2	8	14	19	24	23	17	9	1	-5	22	9
125	-2	-1	4	8	13	18	22	21	16	9	2	-2	19	9
126	0	1	5	9	14	19	23	22	17	10	4	-1	20	10
127	-2	1	7	12	18	23	26	25	20	14	6	0	23	13
128	-1	2	7	13	19	24	26	25	21	14	8	1	23	13
129	3	6	10	14	19	23	25	24	21	14	8	3	23	14
130	5	5	6	9	13	17	21	21	18	13	8	5	13	12
131	6	7	10	14	19	24	27	26	23	16	10	6	21	16
132	11	11	12	13	17	20	25	25	23	18	14	11	22	17
133	14	14	15	17	18	20	23	24	24	21	17	14	21	19
134	-4	-3	2	8	14	19	21	21	16	10	5	-1	19	9
135	-2	1	5	8	13	17	20	20	16	9	3	-2	19	9
136	-1	0	3	8	13	19	22	22	18	12	8	2	20	11
137	-3	-2	1	5	9	12	17	17	12	6	0	-4	16	6
138	-1	1	4	7	11	15	18	19	14	9	3	-2	17	8
186	-15	-12	-5	4	11	16	19	18	12	5	-3	-12	16	3
187	-15	-12	-5	4	11	16	19	18	13	5	-3	-12	16	3
188	-15	-11	-4	5	12	17	19	18	13	6	-3	-11	17	4
189	-15	-11	-4	5	12	17	19	18	13	6	-3	-11	17	4
190	-14	-11	-4	5	12	17	20	19	13	6	-3	-11	17	4
191	-13	-11	-3	5	12	17	20	19	13	6	-2	-11	17	4
192	-14	-11	-4	5	12	17	20	19	13	6	-3	-11	17	4
193	-14	-11	-4	5	12	17	20	19	13	6	-3	-11	17	4
194	-14	-11	-4	5	12	17	20	19	13	6	-3	-11	17	4
195	-13	-10	-3	6	13	18	21	20	15	7	-2	-10	19	5
196	-13	-10	-3	6	13	18	21	20	14	7	-2	-10	17	5
197	-11	-9	-2	7	14	19	22	21	16	8	-1	-9	16	6
198	-11	-8	-1	7	14	20	22	21	16	8	0	-8	18	7
199	-11	-8	-1	7	15	20	22	21	16	8	0	-8	19	7
200	-10	-7	-1	7	14	20	22	21	16	9	0	-8	17	7
201	-9	-7	0	8	14	20	22	21	16	9	0	-8	18	7
202	-9	-7	0	7	14	20	22	21	16	9	0	-8	18	7
203	-9	-6	0	8	14	20	22	21	16	9	0	-7	19	7
204	-8	-6	1	8	15	20	23	21	17	10	1	-7	19	8
205	-7	-5	2	9	16	21	23	22	17	10	2	-6	20	9

Appendix B. *n*-alkanes in US analysis

Table 7 continued. Monthly Mean, Grow, and An Temperatures (°C)

Master Site	Jan T_m	Feb T_m	Mar T_m	Apr T_m	May T_m	Jun T_m	Jul T_m	Aug T_m	Sep T_m	Oct T_m	Nov T_m	Dec T_m	Grow T_m	An T_m
206	-7	-4	2	9	16	21	24	23	18	11	2	-5	17	9
207	-5	-3	3	9	15	21	23	23	18	10	2	-5	18	9
208	-5	-3	3	9	15	21	23	23	18	10	2	-5	20	9
209	-5	-3	3	9	15	21	23	22	17	10	2	-4	20	9
210	-5	-3	3	9	15	21	23	22	17	10	2	-4	20	9
211	-5	-2	3	9	15	21	23	22	17	10	2	-4	20	9
212	-4	-2	4	10	16	22	24	23	18	11	3	-3	21	10
213	-4	-2	4	10	16	21	24	23	18	11	3	-3	20	10
214	-3	-1	4	10	16	22	24	23	18	11	4	-3	19	10
215	-3	-1	4	10	16	22	24	23	18	11	4	-3	19	11
216	-3	-1	4	11	16	22	25	24	19	12	4	-2	20	11
217	-3	-1	5	11	16	22	25	24	19	12	4	-2	20	11
218	-2	0	6	11	17	23	26	25	20	12	5	-1	21	12
219	-2	1	6	11	17	23	26	25	20	13	5	-1	21	12
220	-1	1	7	12	18	23	26	25	21	13	6	0	21	13
221	0	2	7	12	18	23	26	25	21	14	6	0	21	13
222	0	3	7	13	18	23	26	26	21	14	7	1	20	13
223	0	2	7	13	18	23	26	26	21	14	7	1	20	13
224	0	2	7	12	18	23	26	26	21	14	7	1	20	13
225	1	3	8	13	19	24	27	26	21	14	7	1	21	14
226	2	4	9	14	19	25	28	27	22	15	8	2	21	15
227	2	4	9	14	19	25	28	27	22	15	8	2	21	14
228	2	4	8	14	19	24	27	26	22	15	8	2	21	14
229	2	4	9	14	19	24	27	27	22	15	8	2	21	14
230	2	4	9	14	19	24	27	27	22	15	8	3	21	15
231	3	5	9	14	20	24	27	27	22	16	9	3	21	15
232	3	5	9	14	20	24	27	27	22	16	9	3	21	15
233	3	5	10	15	20	25	28	27	23	16	9	4	22	15
234	4	6	11	16	21	25	28	28	23	17	10	4	23	16
235	4	7	11	16	22	26	29	28	24	17	11	5	23	17
236	5	7	12	17	22	27	29	29	24	18	11	5	24	17
237	6	8	12	17	22	27	29	29	24	18	11	6	22	17
238	6	8	13	18	23	27	29	29	24	19	12	7	23	18
239	7	9	13	18	23	26	28	28	24	19	12	7	22	18
240	7	9	13	18	23	26	28	28	24	19	12	7	22	18
241	7	9	13	18	23	26	28	28	24	19	12	7	22	18
242	8	10	14	19	23	27	28	28	24	19	13	8	23	18
243	8	10	14	19	24	27	28	29	25	20	13	8	23	19
244	8	10	14	19	23	26	28	28	24	19	13	8	22	18

Appendix B. *n*-alkanes in US analysis

Table 7 continued. Monthly Mean, Grow, and An Temperatures (°C)

Master Site	Jan T_m	Feb T_m	Mar T_m	Apr T_m	May T_m	Jun T_m	Jul T_m	Aug T_m	Sep T_m	Oct T_m	Nov T_m	Dec T_m	Grow T_m	An T_m
245	8	10	14	19	23	26	27	28	24	19	13	8	24	18
246	9	11	14	19	23	26	27	27	24	20	14	9	21	18
247	10	12	16	20	24	27	28	28	25	21	15	10	23	20
248	10	12	16	20	24	27	28	28	26	21	15	10	24	20
249	12	14	18	22	26	28	29	30	27	22	17	12	24	21
250	13	15	18	22	26	29	30	30	27	23	18	13	25	22
251	13	15	19	23	26	29	30	30	27	23	18	14	23	22
252	14	16	19	23	27	29	30	30	27	24	19	15	23	23
253	16	18	20	24	27	29	29	30	28	24	21	16	23	23
254	16	18	20	24	27	29	29	30	28	24	21	16	23	23
255	16	18	20	24	27	29	29	30	28	24	21	16	23	23
256	-4	-2	3	7	11	15	19	19	13	7	0	-5	16	7
257	-4	-3	1	6	10	14	18	17	12	6	0	-5	15	6
258	-3	-1	3	7	11	15	19	18	13	7	1	-4	16	7
259	-5	-4	-1	3	7	11	16	16	11	5	-2	-6	13	4
260	-11	-9	-4	4	11	16	19	18	13	6	-1	-9	17	5
261	3	5	9	14	19	23	25	24	21	15	9	4	20	14
262	-3	-2	1	4	9	15	20	19	14	8	1	-3	17	7
263	2	3	6	9	13	18	21	19	16	11	6	2	19	10
264	9	10	12	16	21	26	29	28	25	19	13	8	19	18
265	1	2	5	9	13	18	21	20	17	11	5	1	17	10
266	-2	0	4	8	13	19	24	23	18	11	3	-2	18	10
267	3	4	7	10	16	21	24	24	20	13	7	2	20	13
268	8	10	14	18	22	26	28	27	24	18	13	9	22	18
269	1	2	5	8	12	17	21	21	16	10	4	1	16	10
270	1	3	6	9	13	18	22	21	17	11	5	1	17	10
271	1	2	5	8	12	17	21	20	16	11	5	1	19	10
272	0	0	2	5	9	13	17	17	13	9	3	-1	17	7
273	-3	-1	3	6	11	16	20	20	15	8	2	-3	15	8
274	-2	-1	3	7	12	17	21	21	16	9	2	-3	17	9
275	11	13	16	19	25	30	33	32	28	22	15	10	24	21
276	-8	-5	1	6	11	16	20	19	14	7	-1	-7	16	6
277	-2	-1	3	7	12	18	22	21	16	9	2	-3	16	9
278	0	2	5	9	14	19	23	22	17	11	5	0	20	10
279	4	6	9	13	18	23	26	26	22	15	8	4	22	15
280	14	16	19	23	26	29	30	30	27	24	19	14	23	22
281	-7	-7	-4	0	4	9	14	13	8	3	-4	-8	11	2
282	-5	-3	1	5	10	15	19	18	13	7	0	-5	16	6
283	-5	-3	1	6	10	15	19	19	13	7	1	-4	17	7
284	9	10	12	14	16	18	19	19	19	17	12	9	16	15

Table 8. Monthly Mean and Mean Annual Dew Point Temperatures (An) (°C)

Master Site	Jan T_{dew}	Feb T_{dew}	Mar T_{dew}	Apr T_{dew}	May T_{dew}	Jun T_{dew}	Jul T_{dew}	Aug T_{dew}	Sep T_{dew}	Oct T_{dew}	Nov T_{dew}	Dec T_{dew}	An T_{dew}
1	6	6	7	7	9	10	11	11	10	8	7	6	8
2	6	6	6	6	8	9	11	11	9	8	7	5	8
3	6	6	6	6	8	9	11	11	9	8	7	5	8
4	5	6	6	6	8	10	11	11	10	7	7	4	8
5	4	5	5	6	8	9	10	10	9	7	6	4	7
6	5	6	6	7	9	10	11	11	10	8	6	4	8
7	3	4	4	5	7	8	10	10	8	6	4	2	6
8	4	4	5	6	8	10	11	11	9	7	6	3	7
9	3	3	5	6	9	10	11	11	8	6	5	3	7
10	3	4	5	6	8	10	11	10	8	6	5	3	7
11	4	5	6	7	8	10	12	11	9	7	6	3	7
12	5	6	7	7	9	10	12	11	10	8	6	4	8
13	4	5	6	7	9	10	11	10	8	7	6	4	7
14	4	5	6	6	8	9	10	9	8	6	5	3	7
15	4	5	6	7	8	10	11	9	8	6	5	3	7
16	2	3	4	6	7	9	9	8	7	5	4	2	6
17	1	2	3	4	7	8	9	8	6	4	3	1	5
18	-1	0	1	2	4	7	7	6	4	2	0	-2	3
19	-2	-1	0	1	4	6	7	5	3	2	0	-2	2
20	-3	-2	-1	1	3	5	6	5	3	1	-1	-3	1
21	-7	-6	-5	-4	-1	2	4	2	0	-2	-4	-7	-2
22	-7	-7	-5	-5	-3	0	3	1	-1	-4	-5	-7	-3
23	-7	-6	-6	-5	-2	1	2	1	-1	-3	-5	-7	-3
24	-8	-7	-7	-6	-3	0	2	1	-1	-4	-6	-8	-4
25	-9	-8	-7	-6	-3	0	2	0	-2	-5	-6	-8	-4
26	-8	-6	-6	-5	-2	0	2	1	-1	-4	-5	-7	-3
27	-7	-6	-6	-5	-2	0	2	1	-1	-4	-5	-7	-3
28	-7	-6	-5	-4	-2	1	2	1	-2	-3	-5	-7	-3
29	-7	-5	-5	-4	-1	1	3	1	-1	-4	-5	-7	-3
30	-7	-7	-5	-4	-1	1	2	1	-2	-4	-6	-7	-3
31	-7	-6	-5	-4	-1	1	3	2	-1	-3	-5	-7	-3
32	-8	-8	-7	-6	-2	0	1	-1	-3	-5	-6	-8	-4
33	-9	-9	-8	-7	-3	-1	0	-2	-4	-6	-8	-9	-5
34	-9	-9	-8	-7	-4	-1	0	-2	-4	-6	-8	-9	-6
35	-8	-7	-6	-5	-2	1	2	0	-2	-4	-6	-8	-4
36	-8	-7	-6	-5	-1	1	1	0	-2	-4	-6	-8	-4
37	-7	-6	-5	-4	-1	1	3	1	-2	-3	-5	-7	-3
38	-8	-7	-6	-5	-2	0	2	0	-2	-4	-6	-8	-4
39	-6	-5	-4	-3	-1	1	2	1	-2	-3	-4	-6	-2
40	-6	-6	-5	-3	-1	1	2	0	-3	-3	-4	-7	-3

Appendix B. *n*-alkanes in US analysis

Table 8 continued. Monthly Mean and An Dew Point Temperatures (°C)

Master Site	Jan T_{dew}	Feb T_{dew}	Mar T_{dew}	Apr T_{dew}	May T_{dew}	Jun T_{dew}	Jul T_{dew}	Aug T_{dew}	Sep T_{dew}	Oct T_{dew}	Nov T_{dew}	Dec T_{dew}	An T_{dew}
41	-6	-6	-5	-3	-1	1	2	0	-3	-3	-4	-7	-3
42	-6	-5	-4	-3	-1	1	2	0	-2	-3	-4	-6	-3
43	-6	-5	-4	-3	0	1	2	0	-2	-3	-4	-6	-2
44	-6	-5	-4	-2	0	2	2	1	-2	-3	-4	-6	-2
45	-5	-5	-4	-3	0	1	2	1	-2	-2	-3	-5	-2
46	-5	-4	-3	-2	0	2	2	1	-2	-2	-2	-4	-2
47	-4	-4	-3	-2	1	3	3	2	-1	-1	-2	-4	-1
48	-4	-4	-3	-2	1	2	3	2	0	-1	-2	-4	-1
49	-5	-4	-4	-2	0	2	3	1	-1	-2	-3	-5	-2
50	-3	-2	-1	1	3	5	6	4	2	1	-1	-3	1
51	0	1	2	3	5	7	8	7	4	3	2	0	4
52	-6	-6	-5	-3	-1	1	2	0	-2	-2	-4	-6	-3
53	-3	-2	-1	0	2	4	6	4	2	0	-1	-3	1
54	-3	-2	-1	1	3	5	6	4	2	1	0	-3	1
55	0	1	2	3	5	8	9	7	5	3	2	0	4
56	4	5	5	6	8	10	12	11	9	6	5	3	7
57	4	5	6	6	8	10	13	12	9	6	6	3	7
58	3	4	5	6	8	9	12	11	8	6	5	3	7
59	3	3	5	5	7	9	11	10	7	5	4	2	6
60	2	3	4	4	6	8	10	9	6	4	3	1	5
61	2	3	4	4	6	8	10	9	6	4	3	1	5
62	0	1	2	2	4	7	10	8	6	4	2	-1	4
63	-1	0	1	2	4	6	8	6	3	2	1	-2	3
64	-2	-1	0	1	3	5	7	5	2	1	0	-2	2
65	-4	-5	-4	-3	0	4	6	3	0	-2	-3	-5	-1
66	-4	-5	-4	-3	0	4	6	4	0	-2	-3	-6	-1
67	-3	-3	-2	-1	1	4	6	4	1	-1	-1	-4	0
68	-3	-3	-3	-1	1	4	6	4	1	-1	-1	-4	0
69	-3	-3	-2	-1	2	4	6	4	1	0	-1	-3	0
70	-3	-3	-3	-1	1	4	6	4	1	-1	-1	-4	0
71	-3	-2	-2	0	2	4	6	4	1	-1	-1	-4	0
72	-2	-1	0	1	3	5	7	5	2	1	1	-2	2
73	1	1	2	3	5	8	9	7	5	3	3	1	4
74	2	2	3	3	6	8	10	8	5	4	3	2	5
75	2	2	3	3	5	8	9	8	5	4	3	1	4
76	2	2	3	3	5	8	9	7	5	3	3	1	4
77	2	2	3	3	5	8	9	8	5	4	3	1	5
78	2	2	3	3	5	8	9	8	5	4	3	1	4
79	2	2	3	4	6	8	9	9	6	5	4	2	5

Table 8 continued. Monthly Mean and An Dew Point Temperatures (°C)

Master Site	Jan T_{dew}	Feb T_{dew}	Mar T_{dew}	Apr T_{dew}	May T_{dew}	Jun T_{dew}	Jul T_{dew}	Aug T_{dew}	Sep T_{dew}	Oct T_{dew}	Nov T_{dew}	Dec T_{dew}	An T_{dew}
81	7	7	7	8	9	10	11	11	9	9	8	6	8
82	-10	-9	-6	0	6	12	15	15	11	5	-1	-7	3
83	-12	-11	-7	-1	5	11	14	14	10	3	-2	-8	1
84	-13	-12	-8	-2	4	11	14	14	10	3	-2	-8	1
85	-13	-11	-7	-1	5	11	15	14	10	4	-2	-8	1
86	-11	-10	-6	-1	5	12	15	15	11	4	-1	-7	2
87	-12	-11	-7	-1	5	11	15	14	10	4	-2	-8	2
88	-9	-9	-5	0	6	13	16	15	12	5	-1	-6	3
89	-9	-8	-5	0	7	13	16	16	12	5	0	-6	3
90	-9	-8	-5	0	6	13	16	16	12	5	0	-6	3
91	-9	-8	-5	1	7	13	16	16	12	5	0	-5	4
92	-10	-9	-6	-1	6	13	15	15	11	5	-1	-7	3
93	-9	-8	-5	1	7	14	16	16	12	6	0	-6	4
94	-8	-7	-4	1	8	14	16	16	12	6	0	-5	4
95	-7	-6	-3	2	9	15	17	17	13	7	1	-4	5
96	-7	-6	-3	3	9	15	17	17	13	7	1	-4	5
97	-6	-6	-3	3	9	15	18	17	13	7	2	-4	6
98	-6	-5	-2	4	10	15	18	18	14	7	2	-3	6
99	-6	-5	-2	4	10	16	18	17	14	7	2	-4	6
100	-5	-4	-1	5	11	17	19	19	15	9	3	-2	7
101	-4	-3	0	5	11	17	19	19	15	9	3	-2	8
102	-3	-2	1	6	12	18	20	20	16	10	4	-1	8
103	-3	-2	1	6	12	18	20	19	16	9	4	-1	8
104	-2	-1	2	7	13	18	20	20	16	10	5	0	9
105	-3	-2	1	6	12	18	20	19	16	10	4	-1	8
106	-2	-1	2	7	13	18	20	20	16	10	5	0	9
107	-1	0	3	8	13	18	21	20	17	11	5	0	10
108	1	1	5	9	14	19	21	21	18	12	7	3	11
109	0	1	4	8	14	19	21	21	18	12	7	2	11
110	1	2	5	9	14	19	21	21	18	12	7	3	11
111	1	2	5	9	14	19	21	21	18	12	7	3	11
112	1	2	5	9	14	19	21	21	18	12	7	3	11
113	2	3	6	9	15	20	22	21	18	13	8	3	12
114	2	4	7	10	15	20	22	22	19	13	8	4	12
115	3	4	7	10	15	20	22	22	19	13	8	4	12
116	4	6	8	11	16	21	22	22	20	15	10	6	14
117	5	6	8	11	16	21	22	22	20	14	10	6	14
118	5	7	9	12	17	21	22	22	20	15	11	7	14
119	5	7	9	12	17	21	23	23	20	15	11	7	14

Table 8 continued. Monthly Mean and An Dew Point Temperatures (°C)

Master Site	Jan T_{dew}	Feb T_{dew}	Mar T_{dew}	Apr T_{dew}	May T_{dew}	Jun T_{dew}	Jul T_{dew}	Aug T_{dew}	Sep T_{dew}	Oct T_{dew}	Nov T_{dew}	Dec T_{dew}	An T_{dew}
120	5	7	9	12	17	21	23	23	21	15	11	7	14
121	7	8	10	14	18	22	23	23	22	17	12	8	15
122	-15	-13	-7	-2	4	10	14	12	7	0	-6	-13	-1
123	-14	-11	-6	-2	5	11	14	12	7	0	-6	-11	0
124	-11	-9	-5	-1	6	11	14	13	6	0	-5	-10	1
125	-10	-9	-6	-3	3	7	10	10	5	-1	-6	-9	-1
126	-10	-9	-6	-3	3	7	9	10	5	-1	-6	-10	-1
127	-7	-5	-1	5	11	17	19	18	13	6	0	-5	6
128	-5	-3	1	6	12	17	20	19	14	8	2	-3	7
129	-7	-7	-6	-5	-2	2	10	12	8	1	-4	-6	0
130	-7	-6	-4	-3	0	2	5	5	2	-2	-6	-8	-2
131	-7	-6	-5	-5	-3	-3	3	5	1	-3	-6	-8	-3
132	-1	0	2	3	7	9	10	10	8	6	1	-2	4
133	2	4	5	7	10	12	13	13	12	8	4	1	8
134	-9	-9	-5	0	6	13	16	15	12	5	-1	-6	3
135	-4	-3	-1	1	4	6	9	9	6	2	-1	-5	2
136	-6	-5	-3	2	8	14	17	17	13	7	2	-3	5
137	-5	-6	-4	-2	1	5	6	5	3	0	-3	-6	0
138	-3	-3	-1	1	4	7	8	6	4	2	0	-4	2
186	-17	-15	-10	-4	4	10	14	13	8	1	-6	-14	-1
187	-17	-15	-9	-3	4	10	14	13	9	1	-6	-14	-1
188	-17	-14	-9	-3	4	11	14	13	9	1	-6	-13	-1
189	-17	-14	-9	-3	4	11	14	13	9	1	-6	-13	-1
190	-16	-14	-8	-3	4	11	14	13	9	1	-6	-13	-1
191	-16	-14	-8	-3	5	11	15	14	9	2	-5	-13	0
192	-17	-14	-8	-3	4	11	14	14	9	1	-6	-13	-1
193	-16	-14	-8	-3	4	11	14	14	9	1	-6	-13	-1
194	-17	-14	-9	-3	4	11	14	14	9	1	-6	-13	-1
195	-15	-12	-6	-1	6	12	16	15	10	2	-5	-12	1
196	-15	-12	-7	-1	6	12	16	15	10	2	-4	-11	1
197	-14	-11	-5	0	6	12	16	15	10	3	-4	-11	1
198	-14	-11	-5	0	6	12	16	15	10	3	-4	-11	1
199	-13	-10	-5	0	6	12	16	16	10	3	-4	-10	2
200	-12	-10	-5	0	6	12	16	16	10	2	-4	-10	2
201	-12	-10	-4	0	7	13	16	16	10	3	-4	-10	2
202	-12	-9	-4	0	7	13	16	16	10	3	-4	-10	2
203	-12	-9	-4	1	7	13	17	16	10	3	-4	-10	2
204	-11	-9	-4	1	7	13	17	16	10	3	-3	-9	3
205	-11	-8	-4	1	8	14	17	17	11	3	-3	-9	3

Table 8 continued. Monthly Mean and An Dew Point Temperatures (°C)

Master Site	Jan T_{dew}	Feb T_{dew}	Mar T_{dew}	Apr T_{dew}	May T_{dew}	Jun T_{dew}	Jul T_{dew}	Aug T_{dew}	Sep T_{dew}	Oct T_{dew}	Nov T_{dew}	Dec T_{dew}	An T_{dew}
206	-10	-8	-3	2	8	14	18	17	11	3	-3	-9	3
207	-10	-8	-3	1	8	13	17	17	11	3	-3	-8	3
208	-10	-8	-3	1	8	13	17	17	11	3	-3	-8	3
209	-10	-8	-4	1	8	13	17	16	10	3	-3	-8	3
210	-9	-7	-3	1	8	13	17	16	10	3	-3	-8	3
211	-10	-8	-4	1	8	13	16	16	10	3	-4	-8	3
212	-9	-7	-3	2	9	14	17	17	11	4	-3	-7	4
213	-9	-7	-3	1	8	14	17	16	10	3	-3	-8	3
214	-9	-7	-3	2	8	14	17	17	10	3	-3	-8	3
215	-8	-6	-3	2	9	14	17	17	11	4	-2	-7	4
216	-9	-6	-3	2	9	14	17	17	11	4	-2	-7	4
217	-9	-6	-3	2	9	14	17	17	11	4	-2	-7	4
218	-8	-6	-2	3	10	15	17	17	11	4	-2	-7	4
219	-8	-6	-2	3	10	14	17	17	11	5	-2	-6	4
220	-7	-5	-1	4	10	15	17	17	12	5	-1	-6	5
221	-7	-5	-1	4	10	15	17	16	12	5	-1	-6	5
222	-6	-4	-1	4	11	15	17	16	12	6	0	-5	5
223	-6	-4	-1	4	11	15	17	16	12	6	0	-5	5
224	-6	-4	-1	4	11	15	17	16	12	6	0	-5	5
225	-6	-4	0	5	11	15	17	17	12	6	0	-5	6
226	-5	-3	1	5	12	16	17	17	13	7	1	-4	6
227	-6	-4	0	5	12	16	17	17	13	7	0	-5	6
228	-6	-4	0	4	11	15	16	16	12	6	0	-5	6
229	-5	-3	1	5	12	16	17	17	13	7	1	-4	6
230	-5	-3	1	5	12	16	17	17	13	7	1	-4	6
231	-5	-3	1	5	12	16	17	17	13	7	1	-4	6
232	-5	-3	1	5	12	16	17	17	13	7	1	-4	6
233	-5	-3	1	6	12	16	17	17	14	8	2	-3	7
234	-4	-2	2	6	13	17	17	17	14	8	2	-3	7
235	-4	-1	2	7	13	17	18	17	14	9	3	-2	8
236	-4	-1	3	7	13	17	18	17	14	9	3	-2	8
237	-3	-1	3	7	13	17	18	18	15	9	3	-2	8
238	-2	0	4	8	14	18	18	18	15	10	4	-1	9
239	-1	1	4	8	14	18	18	18	15	10	5	0	9
240	-1	1	4	7	14	17	18	17	15	10	4	-1	9
241	-2	0	4	7	13	17	17	17	15	10	4	-1	9
242	0	1	4	8	14	18	18	18	15	11	5	0	9
243	0	2	5	9	15	18	18	18	16	11	6	1	10
244	0	2	5	9	15	18	18	18	15	11	5	0	10

Table 8 continued. Monthly Mean and An Dew Point Temperatures (°C)

Master Site	Jan T_{dew}	Feb T_{dew}	Mar T_{dew}	Apr T_{dew}	May T_{dew}	Jun T_{dew}	Jul T_{dew}	Aug T_{dew}	Sep T_{dew}	Oct T_{dew}	Nov T_{dew}	Dec T_{dew}	An T_{dew}
245	1	2	6	9	15	18	18	18	16	11	6	1	10
246	2	4	6	10	15	18	18	18	16	12	7	2	11
247	2	4	7	10	16	19	19	18	17	13	8	3	11
248	3	4	8	11	17	20	20	19	17	13	8	3	12
249	4	6	9	12	18	20	20	20	18	14	10	5	13
250	6	8	11	15	19	21	22	21	20	16	11	7	15
251	7	9	11	15	20	21	22	21	20	16	12	8	15
252	8	10	12	16	20	22	22	22	21	17	13	9	16
253	11	12	14	17	21	23	23	23	22	19	15	11	18
254	11	12	14	18	21	23	23	23	22	19	15	12	18
255	11	12	14	18	21	23	23	23	22	19	15	12	18
256	-7	-7	-4	-1	2	6	7	6	3	-1	-5	-8	-1
257	-7	-7	-4	-2	2	6	7	6	3	0	-4	-7	-1
258	-4	-4	-3	0	3	7	8	7	5	2	-1	-5	1
259	-8	-8	-6	-4	0	3	5	4	1	-3	-6	-9	-3
260	-12	-12	-8	-3	4	11	14	13	9	2	-4	-10	0
261	-1	-1	2	7	13	18	20	20	16	10	4	0	9
262	-9	-9	-8	-7	-4	-3	-1	-1	-4	-6	-9	-10	-6
263	-8	-8	-8	-7	-5	-2	7	10	5	-2	-7	-9	-3
264	-5	-5	-4	-5	-3	-2	7	10	5	0	-5	-6	-1
265	-6	-6	-5	-5	-3	-1	7	11	6	-1	-5	-7	-1
266	-5	-5	-4	-3	1	2	4	5	2	0	-3	-6	-1
267	-7	-7	-6	-5	-4	-3	3	6	1	-3	-6	-8	-3
268	3	3	6	10	15	20	22	21	18	13	8	4	12
269	-5	-5	-4	-2	0	2	4	2	0	-2	-4	-6	-2
270	-5	-5	-5	-3	-1	1	3	2	0	-2	-4	-6	-2
271	-5	-5	-4	-3	0	1	3	2	-1	-2	-4	-6	-2
272	-7	-7	-7	-6	-3	-1	1	1	-2	-5	-6	-8	-4
273	-7	-7	-5	-4	0	3	4	3	2	-2	-5	-7	-2
274	-7	-7	-6	-4	-2	-1	3	3	0	-3	-6	-9	-3
275	-3	-3	-3	-3	-1	0	8	10	6	1	-3	-4	0
276	-9	-9	-5	-3	0	4	6	4	1	-3	-6	-11	-3
277	-9	-9	-6	-3	3	7	9	9	5	-1	-6	-10	-1
278	-7	-7	-6	-5	-4	-3	3	5	1	-3	-6	-8	-4
279	-5	-5	-5	-5	-3	-3	3	5	1	-2	-5	-7	-3
280	9	9	12	15	20	22	22	22	21	17	12	8	16
281	-13	-13	-11	-9	-5	-2	2	2	-2	-6	-11	-13	-7
282	-9	-9	-8	-6	-3	0	3	4	0	-4	-7	-10	-4
283	-9	-9	-7	-6	-3	0	3	3	-1	-4	-7	-10	-4
284	5	5	6	7	8	9	11	11	10	8	6	4	7

Appendix B. *n*-alkanes in US analysis

Table 9. Monthly Mean, Mean Growing Season (Grow), and Mean Annual Relative Humidity (An) (%)

Master Site	Jan RH	Feb RH	Mar RH	Apr RH	May RH	Jun RH	Jul RH	Aug RH	Sep RH	Oct RH	Nov RH	Dec RH	Grow RH	An RH
1	78	75	73	70	73	72	78	75	68	63	71	75	73	73
2	78	75	70	71	72	71	73	73	68	66	70	74	72	72
3	81	75	69	64	60	57	59	59	54	55	70	76	64	64
4	78	73	66	63	59	56	56	57	52	53	68	72	58	62
5	72	69	64	60	57	52	48	49	47	51	65	69	55	58
6	77	73	68	62	60	58	58	57	54	55	68	75	60	63
7	70	68	62	56	54	47	45	46	44	49	63	67	50	55
8	71	66	62	56	53	49	47	48	45	49	64	68	48	56
9	68	65	60	56	53	47	42	42	41	46	62	65	45	53
10	70	65	59	55	50	45	41	41	40	45	60	66	44	52
11	73	68	63	56	50	44	43	43	41	46	64	70	46	53
12	79	72	66	57	49	44	44	44	44	50	67	76	54	56
13	77	70	68	61	53	45	39	38	40	47	66	75	51	54
14	75	70	67	62	55	46	40	38	40	47	65	73	51	54
15	76	71	68	60	53	46	40	37	39	46	64	72	44	54
16	70	69	66	61	54	46	37	34	37	45	63	68	49	52
17	67	65	63	60	53	46	38	35	36	45	60	66	48	51
18	59	58	57	53	49	43	36	32	33	41	54	59	39	46
19	57	58	55	52	49	42	35	32	32	40	53	58	38	45
20	55	57	54	52	48	42	36	32	32	39	50	56	38	45
21	57	61	57	54	51	47	41	36	37	44	55	59	38	49
22	57	58	53	49	44	41	37	34	37	40	52	57	35	45
23	56	60	55	50	46	43	37	34	36	41	53	58	36	46
24	57	61	55	51	49	44	39	36	38	43	54	60	38	48
25	58	61	56	53	51	46	39	35	37	42	54	60	37	48
26	56	61	54	49	46	40	35	33	34	40	53	58	34	45
27	60	62	56	51	47	42	36	34	35	41	54	60	35	47
28	59	60	53	48	44	39	35	32	33	40	51	59	33	45
29	55	57	49	46	42	37	33	30	32	36	49	56	31	42
30	59	58	54	49	46	40	34	32	33	40	52	59	45	45
31	57	60	55	51	48	41	35	32	35	42	54	58	36	46
32	63	62	60	56	54	46	38	33	35	43	57	62	38	49
33	60	61	59	55	52	46	38	33	35	42	55	59	38	48
34	60	61	58	56	52	46	39	33	35	42	53	59	38	48
35	62	66	62	57	54	48	39	35	37	45	59	64	51	51
36	60	65	58	54	52	45	37	36	36	43	57	61	49	49
37	62	60	54	47	44	38	33	31	30	39	51	61	32	44
38	60	62	57	51	48	41	36	33	35	42	55	61	35	47
39	64	61	51	46	42	35	29	28	30	40	57	65	31	43
40	62	62	57	55	48	41	32	28	29	42	58	63	33	46

Appendix B. *n*-alkanes in US analysis

Table 9 continued. Monthly Mean, Grow, and An RH (%)

Master Site	Jan RH	Feb RH	Mar RH	Apr RH	May RH	Jun RH	Jul RH	Aug RH	Sep RH	Oct RH	Nov RH	Dec RH	Grow RH	An RH
41	62	62	57	55	48	41	32	28	29	42	58	63	33	46
42	66	62	52	48	43	36	31	29	31	41	58	66	32	44
43	67	63	53	49	44	37	30	28	31	41	59	68	32	45
44	69	65	56	53	47	40	32	30	32	43	61	69	34	47
45	71	69	61	58	52	43	34	32	33	46	64	72	37	50
46	72	69	60	56	50	41	34	32	33	45	66	73	33	50
47	73	69	61	57	51	43	36	33	34	46	68	74	34	51
48	72	67	60	56	51	43	36	33	35	46	64	71	34	50
49	68	66	60	57	50	43	36	33	34	45	64	69	34	50
50	59	60	58	55	49	41	34	31	32	41	57	60	32	46
51	63	63	60	55	49	41	35	32	32	41	60	62	33	47
52	72	70	66	62	55	48	40	35	37	52	69	71	37	54
53	63	60	57	54	48	42	36	33	34	44	60	64	35	48
54	58	59	58	56	50	42	34	32	32	41	58	59	33	47
55	62	60	57	53	47	42	35	32	33	41	58	61	34	47
56	75	69	63	53	47	43	42	41	39	45	65	72	44	53
57	75	70	64	56	48	42	42	42	39	46	66	73	47	53
58	72	68	62	55	47	40	38	38	37	44	63	70	45	51
59	69	64	60	53	45	38	35	35	34	40	59	65	43	48
60	67	61	59	51	44	37	34	33	32	38	56	64	41	46
61	67	62	59	52	44	38	34	33	32	39	58	63	41	46
62	62	61	56	51	44	39	37	36	35	43	59	61	43	47
63	60	61	57	54	45	39	33	31	30	38	56	59	41	45
64	60	62	59	56	47	40	35	32	30	38	57	58	42	46
65	64	61	61	59	54	51	42	36	33	41	60	58	45	50
66	63	63	59	59	54	51	42	36	33	41	60	57	45	50
67	61	62	59	59	51	46	38	34	31	40	58	57	43	48
68	59	61	58	56	49	44	37	33	30	38	58	57	41	47
69	60	61	58	57	50	45	38	33	31	40	58	58	42	47
70	59	60	57	55	49	43	36	32	29	37	56	56	40	46
71	58	60	58	56	49	44	36	32	29	37	56	56	41	46
72	61	64	60	57	49	42	35	31	29	38	59	60	40	46
73	70	68	63	59	55	51	42	39	38	48	68	71	48	54
74	71	68	65	60	55	51	43	40	37	47	67	72	47	54
75	69	65	62	59	53	51	45	43	40	48	66	70	48	55
76	70	70	67	61	54	52	43	39	35	44	66	68	47	54
77	69	68	64	59	53	50	44	42	38	47	66	68	48	54
78	69	68	64	61	56	54	47	44	39	49	66	66	50	56
79	69	68	66	65	61	60	53	51	46	54	67	69	56	60

Table 9 continued. Monthly Mean, Grow, and An RH (%)

Master Site	Jan RH	Feb RH	Mar RH	Apr RH	May RH	Jun RH	Jul RH	Aug RH	Sep RH	Oct RH	Nov RH	Dec RH	Grow RH	An RH
81	83	82	80	80	78	78	79	75	68	72	83	81	76	78
82	68	63	60	57	61	67	69	70	73	70	70	70	69	66
83	69	65	61	58	61	68	70	71	74	71	70	71	69	67
84	71	68	63	60	61	67	69	70	72	71	71	73	69	68
85	73	69	64	61	62	68	71	72	74	73	72	73	70	69
86	70	66	63	61	63	70	72	73	75	72	71	71	73	69
87	68	64	61	58	61	67	69	70	72	70	68	69	70	66
88	68	63	60	57	60	67	69	70	72	71	70	69	69	66
89	66	62	59	58	61	67	69	70	72	70	68	67	70	66
90	67	63	59	57	61	68	70	73	74	71	68	69	71	67
91	66	63	59	57	62	69	71	73	73	71	67	67	70	67
92	68	64	59	55	60	68	70	72	73	70	68	70	71	66
93	68	64	59	57	62	70	71	72	74	71	69	69	71	67
94	67	64	59	57	62	69	69	72	73	70	68	69	69	67
95	66	62	58	58	63	68	68	71	71	71	69	68	69	66
96	69	65	61	59	64	70	70	73	73	72	71	71	70	68
97	69	66	61	61	64	71	71	72	73	71	70	70	70	68
98	68	65	59	59	64	67	68	71	71	70	69	70	68	67
99	65	64	58	59	65	69	70	71	71	69	67	68	71	66
100	63	60	56	57	63	66	66	68	69	68	64	64	66	64
101	65	62	58	58	65	69	68	70	70	69	65	66	69	66
102	64	62	58	58	66	70	71	72	72	70	67	67	70	66
103	66	63	60	60	67	71	71	73	74	72	68	69	71	68
104	67	64	61	61	68	71	72	74	74	73	70	71	72	69
105	64	60	58	57	66	68	69	71	72	70	67	66	69	66
106	64	60	57	57	66	68	70	73	73	71	67	66	70	66
107	64	61	58	58	65	68	70	72	72	70	67	67	70	66
108	66	63	61	60	66	71	73	74	74	72	69	69	70	68
109	65	63	60	59	65	70	72	73	73	71	68	68	69	67
110	66	64	61	60	65	69	72	73	73	71	68	69	70	68
111	66	64	61	59	65	68	71	73	73	70	68	69	70	67
112	64	63	60	59	64	68	70	72	72	70	68	68	69	67
113	65	63	60	59	65	68	70	72	72	70	69	68	68	67
114	66	63	60	60	64	69	70	74	72	70	69	69	68	67
115	67	64	61	60	65	69	70	73	72	71	70	70	68	68
116	69	67	63	63	66	70	72	75	74	73	73	73	70	70
117	70	67	64	61	65	71	72	74	73	71	72	73	69	69
118	70	68	64	63	66	71	73	75	74	73	72	73	70	70
119	71	68	64	64	67	72	75	75	73	70	72	73	71	70

Table 9 continued. Monthly Mean, Grow, and An RH (%)

Master Site	Jan RH	Feb RH	Mar RH	Apr RH	May RH	Jun RH	Jul RH	Aug RH	Sep RH	Oct RH	Nov RH	Dec RH	Grow RH	An RH
120	70	67	64	64	67	72	74	75	74	70	71	72	71	70
121	74	72	70	70	71	75	76	78	78	75	76	76	75	74
122	80	79	73	58	57	64	64	62	63	65	77	83	63	68
123	76	76	70	55	56	62	61	59	59	61	72	79	61	65
124	65	64	61	54	57	59	53	51	49	53	60	67	54	57
125	56	54	49	47	51	49	46	50	48	49	55	59	48	51
126	47	48	44	45	48	46	42	47	44	44	47	49	45	46
127	66	64	60	59	65	67	65	65	64	61	66	69	65	64
128	74	71	66	62	67	67	69	70	68	65	69	76	68	68
129	46	40	32	25	25	25	38	45	43	40	44	50	35	37
130	43	46	46	43	41	37	36	34	33	33	36	39	38	38
131	39	38	33	27	22	17	21	25	24	26	31	36	23	27
132	44	48	51	50	52	48	40	38	37	44	42	41	41	44
133	44	49	52	52	57	59	53	48	47	45	41	41	52	49
134	67	63	60	57	61	68	70	72	73	71	68	69	71	66
135	83	73	63	57	54	51	47	48	52	62	77	85	48	61
136	68	67	66	66	70	73	75	75	75	71	69	68	75	70
137	86	74	69	62	60	58	49	45	53	64	83	86	51	64
138	84	78	69	64	60	60	51	45	50	62	82	85	52	64
186	83	77	68	57	60	68	72	74	76	74	80	86	73	72
187	84	79	69	57	59	68	72	74	76	74	81	86	73	72
188	82	78	68	55	58	67	71	74	75	72	82	86	72	71
189	82	78	69	56	59	68	72	74	76	73	83	86	72	72
190	81	79	71	57	59	68	71	71	74	72	80	85	71	71
191	81	78	71	58	59	68	71	73	75	72	80	85	72	72
192	80	77	71	57	59	68	71	72	75	72	80	85	71	71
193	80	78	71	58	59	68	71	72	75	72	80	85	71	71
194	79	75	69	57	59	68	71	73	76	72	79	83	72	71
195	82	82	76	60	60	67	71	72	71	70	80	87	70	72
196	85	83	78	61	62	69	73	74	73	72	82	89	70	74
197	82	82	77	60	59	65	70	72	70	68	78	85	67	71
198	79	80	76	60	58	63	70	72	69	67	75	83	66	70
199	81	81	77	61	58	62	70	74	70	68	77	84	67	71
200	80	79	74	61	59	62	70	73	68	65	74	83	66	70
201	81	80	74	61	60	64	71	74	69	66	76	84	68	71
202	81	81	74	61	61	65	71	74	69	67	76	85	68	71
203	79	78	73	60	60	64	70	72	67	65	75	83	67	70
204	78	77	70	59	59	62	70	72	67	63	74	82	66	69
205	77	75	68	59	59	63	70	72	66	62	72	80	66	68

Appendix B. *n*-alkanes in US analysis

Table 9 continued. Monthly Mean, Grow, and An RH (%)

Master Site	Jan RH	Feb RH	Mar RH	Apr RH	May RH	Jun RH	Jul RH	Aug RH	Sep RH	Oct RH	Nov RH	Dec RH	Grow RH	An RH
206	75	73	67	58	59	62	69	70	64	61	70	79	63	67
207	71	70	65	58	60	62	68	70	65	61	70	77	64	66
208	71	70	65	58	60	62	68	70	65	61	70	77	65	66
209	71	70	64	58	61	63	67	69	63	61	67	74	65	65
210	73	71	65	59	63	64	67	70	64	62	68	76	66	66
211	68	67	61	57	61	63	65	67	61	60	64	70	64	63
212	70	69	63	58	62	63	66	68	62	60	66	72	64	65
213	67	66	60	56	61	62	64	67	60	59	63	68	63	62
214	66	66	60	56	61	62	64	66	60	59	62	67	62	62
215	67	68	61	57	62	62	63	66	60	59	64	70	62	63
216	66	66	60	57	63	61	61	65	60	59	63	68	61	62
217	65	65	60	56	62	61	61	63	59	58	62	68	61	61
218	65	64	59	56	62	60	58	62	58	57	62	67	60	61
219	63	63	58	56	61	59	57	60	57	57	61	66	59	59
220	63	62	58	57	63	60	56	58	57	58	60	65	58	59
221	61	60	57	56	62	59	55	58	56	57	59	63	58	58
222	62	60	58	56	62	59	54	56	56	58	61	65	57	59
223	62	61	58	56	62	59	55	56	56	58	61	65	57	59
224	62	60	57	56	62	59	55	56	56	58	60	64	57	59
225	61	59	57	56	62	59	54	56	57	58	60	65	57	58
226	59	59	56	55	61	59	53	55	57	57	59	62	57	58
227	58	58	56	55	61	59	53	55	56	57	59	61	57	57
228	57	57	54	52	60	59	53	55	56	57	56	60	56	56
229	58	59	57	56	62	60	54	55	57	58	59	62	57	58
230	57	58	57	55	62	60	54	55	57	58	59	61	57	58
231	56	56	55	54	61	60	53	55	57	57	58	60	57	57
232	56	56	55	54	61	60	53	55	57	57	58	60	57	57
233	56	57	56	54	61	60	53	54	56	58	58	60	56	57
234	56	56	55	53	59	58	52	52	56	57	58	59	55	56
235	56	56	55	53	59	58	52	52	56	57	58	59	55	56
236	55	56	54	52	57	57	51	51	55	56	57	58	54	55
237	55	56	54	52	58	57	51	51	56	57	57	58	55	55
238	56	56	53	51	57	58	52	52	57	58	58	58	55	55
239	56	56	54	51	58	59	54	54	58	59	58	58	56	56
240	56	56	53	51	57	59	54	54	58	58	58	58	56	56
241	54	54	52	49	56	58	53	52	57	58	57	56	55	55
242	57	55	53	50	56	58	53	53	58	59	59	57	56	56
243	56	55	54	51	58	59	54	53	58	58	59	58	56	56
244	56	55	54	52	59	59	56	55	59	59	59	58	57	57

Appendix B. *n*-alkanes in US analysis

Table 9 continued. Monthly Mean, Grow, and An RH (%)

Master Site	Jan RH	Feb RH	Mar RH	Apr RH	May RH	Jun RH	Jul RH	Aug RH	Sep RH	Oct RH	Nov RH	Dec RH	Grow RH	An RH
245	58	57	56	53	60	60	56	55	59	60	61	59	58	58
246	60	60	58	57	64	64	60	59	63	64	65	63	61	61
247	59	57	55	54	60	61	57	55	60	62	62	60	59	58
248	59	59	57	57	63	63	59	57	60	62	62	61	60	60
249	59	58	56	56	61	62	59	56	60	61	61	61	59	59
250	65	66	62	63	67	64	62	60	64	65	65	66	64	64
251	66	65	61	61	66	64	62	60	65	65	65	66	64	64
252	68	67	63	64	67	66	65	64	67	68	67	67	66	66
253	72	70	67	68	72	69	68	67	71	71	71	72	70	70
254	73	71	68	69	72	70	69	67	72	72	72	73	71	71
255	73	71	68	69	72	70	69	67	72	72	71	73	71	71
256	79	69	61	56	56	56	46	44	50	59	70	77	49	60
257	81	73	65	59	58	59	50	48	55	64	75	80	53	64
258	91	79	67	62	55	58	52	50	57	71	88	88	54	68
259	76	70	67	62	59	59	48	45	50	60	72	78	51	62
260	95	80	71	59	61	69	72	74	77	74	80	87	73	75
261	78	68	62	62	70	73	75	75	74	72	71	75	71	71
262	63	58	49	43	39	29	25	26	29	36	48	57	27	42
263	49	44	38	31	29	26	41	54	48	42	41	45	42	41
264	37	34	31	24	19	16	24	31	27	27	29	34	27	28
265	60	53	46	37	33	28	40	55	47	44	48	55	41	45
266	80	70	55	46	42	33	29	31	35	46	61	73	36	50
267	51	47	39	33	25	19	25	31	29	32	39	45	27	34
268	73	64	60	60	64	68	70	72	72	71	69	70	68	68
269	64	60	53	49	45	38	31	30	33	42	53	60	36	46
270	65	56	48	43	39	33	29	28	31	39	51	60	33	43
271	66	59	51	47	42	35	30	29	31	39	53	61	31	45
272	60	58	52	46	43	38	34	33	34	39	51	57	33	45
273	73	65	56	49	46	41	33	33	42	49	61	73	41	52
274	69	61	52	44	39	31	29	31	34	42	55	63	33	46
275	37	33	28	22	18	15	21	26	24	25	29	36	23	26
276	87	73	63	51	48	46	39	36	41	49	66	76	42	56
277	58	54	50	49	52	48	45	49	48	49	55	58	49	51
278	61	54	45	37	30	22	27	33	32	36	46	53	28	40
279	52	45	37	29	23	17	22	26	25	30	38	46	24	32
280	75	66	63	63	68	66	64	62	67	67	67	67	65	66
281	63	59	55	51	49	45	45	48	48	50	59	65	47	53
282	69	61	53	45	41	37	35	37	39	43	57	66	37	49
283	70	63	52	43	41	37	34	35	38	44	56	66	36	48
284	75	70	69	62	58	58	60	61	53	55	67	70	60	63

Appendix B. *n*-alkanes in US analysis

Table 10. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
1a			Soils		
1b	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
2a	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
2b	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
3a			Soils		
3b	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
3c	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
4a			Soils		
4b	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
5a			Soils		
5b	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
5c	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
5d	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
5e	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
6a	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
7a	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
7b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
7c	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
8a			Soils		
8b	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
9a			Soils		
9b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
9c	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
10a			Soils		
10b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
10c	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
11a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
11b	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
11c	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
12a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
13a			Soils		
13b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
13c	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
13d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
14a			Soils		
14b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
14c	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
14d	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
15a			Soils		

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
15b	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
15c	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
15d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
16a			Soils		
16b	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
16c	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
16d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
17a			Soils		
17b	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
17c	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
17d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
18a	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
18b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
18c	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
18d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
19a	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
19b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
19c	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
19d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
20a	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
20b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
20c	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
20d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
21a			Soils		
21b	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
21c	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
21d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
22a	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
22b	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
23a	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
23b	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
24a	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
25a	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
26a	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
27a	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
28a	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
28b	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
29a	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
30a			Soils		

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
30b	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
31a	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
31b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
32a	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
32b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
35a	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
36a	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
36b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
37a	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
38a			Soils		
38b	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
38c	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
39a			Soils		
39b	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
39c	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
40a	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
41a	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
42a			Soils		
42b	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
42c	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
42d	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
43a			Soils		
43b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
44a	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
45a	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
46a			Soils		
46b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
47a	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
48a	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
49a	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
49b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
50a	*Quercus kelloggii*	Angiosperm Dicot	Shrub		Black Oak
50b	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
50c	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
51a	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
51b	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
51c	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
53a			Soils		
53b	*Quercus kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
53c	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
53d	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
54a	*Quercus Kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
54b	*Alnus Rubra*	Angiosperm Dicot	Tree	C_3	Red Alder
54c	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
55a	*Quercus Kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
55b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
56a	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
57a	*Quercus Kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
58a	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
59a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
59b	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
60a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
60b	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
61a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
61b	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
61c	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
62a	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
63a	*Quercus Kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
63b	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
63c	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
64a	*Quercus Kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
64b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
65a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
65b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
66a			Soils		
66b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
67a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
67b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
68a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
68b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
69a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
69b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
70a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
71a	*Quercus Kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
71b	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
71c	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
72a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
72b	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
73a	*Quercus Douglasii*	Angiosperm Dicot	Tree	C_3	Blue Oak
74a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
74b	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
74c	*Pinus Sabiniana*	Gymnosperm	Tree	C_3	Grey Pine
74d	*Pinus Ponderosa*	Gymnosperm	Tree	C_3	Ponderosa Pine
75a			Soils		
75b	*Quercus Kelloggii*	Angiosperm Dicot	Shrub	C_3	Black Oak
76a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
76b	*Pinus Jeffreyi*	Gymnosperm	Tree	C_3	Jeffrey Pine
78a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
79a	*Quercus lobata*	Angiosperm Dicot	Tree	C_3	White Oak
81a	*Acer Macrophyllum*	Angiosperm Dicot	Tree	C_3	Big Leaf Maple
82a			Soils		
82b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
82c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
83a			Soils		
83b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
83c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
84a			Soils		
84b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
84c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
85a			Soils		
85b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
85c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
86a			Soils		
86b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
86c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
87a			Soils		
87b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
87c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
88a	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
88b	*Platanus Occidentalis*	Angiosperm Dicot	Tree	C_3	Sycamore
88c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
88d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
89a	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
89b	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
89c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
89d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
90a			Soils		

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
90b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
90c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
90d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
91a			Soils		
91b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
91c	*Platanus Occidentalis*	Angiosperm Dicot	Tree	C_3	Sycamore
91d	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
92a			Soils		
92b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
92c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
92d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
93a			Soils		
93b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
93c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
93d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
94a	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
94b	*Platanus Occidentalis*	Angiosperm Dicot	Tree	C_3	Sycamore
94c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
95a			Soils		
95b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
95c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
95e	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
96a			Soils		
96b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
96c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
96d	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
97a			Soils		
97b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
97c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
97d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
98a			Soils		
98b	*Platanus Occidentalis*	Angiosperm Dicot	Tree	C_3	Sycamore
99a			Soils		
99b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
99c	*Pinus Strobus*	Gymnosperm	Tree	C_3	White Pine
99d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
100a			Soils		
100b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
100c	*Platanus Occidentalis*	Angiosperm Dicot	Tree	C_3	Sycamore

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
100d	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
101a			Soils		
101b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
101c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
101d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
102a			Soils		
102b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
102c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
102d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
103a			Soils		
103b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
103c	*Pinus Taeda*	Gymnosperm	Tree	C_3	Loblolly Pine
103d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
104a			Soils		
104b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
104c	*Platanus Occidentalis*	Angiosperm Dicot	Tree	C_3	Sycamore
104d	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
104e	*Pinus Taeda*	Gymnosperm	Tree	C_3	Loblolly Pine
104f	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
105a			Soils		
105b	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
105c	*Pinus Taeda*	Gymnosperm	Tree	C_3	Loblolly Pine
105d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
106a			Soils		
106b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
106c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
106d	*Pinus Taeda*	Gymnosperm	Tree	C_3	Loblolly Pine
106e	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
107a			Soils		
107b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
107c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
107d	*Pinus Taeda*	Gymnosperm	Tree	C_3	Loblolly Pine
108a			Soils		
108b	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple
108c	*Juniperus Virginiana*	Gymnosperm	Tree	C_3	Red Cedar
108d	*Quercus Alba*	Angiosperm Dicot	Tree	C_3	White Oak
109a			Soils		
109b	*Platanus Occidentalis*	Angiosperm Dicot	Tree	C_3	Sycamore
110a	*Acer Rubrum*	Angiosperm Dicot	Tree	C_3	Red Maple

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
122d	*Bromus inermis*	Angiosperm Monocot	Grass	C_3	Smooth brome
122e	*Andropogon gerardii*	Angiosperm Monocot	Grass	C_4	Big bluestem
122f	*Schizachyrium scoparium*	Angiosperm Monocot	Grass	C_4	Little bluestem
123a	*Stipa viridula*	Angiosperm Monocot	Grass	C_3	Green needlegrass
123b	*Stipa comata*	Angiosperm Monocot	Grass	C_3	Needleandthread
123c	*Schizachyrium scoparium*	Angiosperm Monocot	Grass	C_4	Little bluestem
123d	*Agropyron smithii*	Angiosperm Monocot	Grass	C_3	Western wheatgrass
123e	*Bouteloua gracilis*	Angiosperm Monocot	Grass	C_4	Blue Grama
123f	*Calamovilfa longifolia*	Angiosperm Monocot	Grass	C_4	Prairie sandreed
124a	*Bromus inermis*	Angiosperm Monocot	Grass	C_3	Smooth brome
124b	*Schizachyrium scoparium*	Angiosperm Monocot	Grass	C_4	Little bluestem
124c	*Agropyron smithii*	Angiosperm Monocot	Grass	C_3	Western wheatgrass
124d	*Koeleria pyramidata*	Angiosperm Monocot	Grass	C_3	Junegrass
124e	*Buchloe dactyloides*	Angiosperm Monocot	Grass	C_4	Buffalograss
124f	*Aristida longiseta*	Angiosperm Monocot	Grass	C_4	Redthreeawn
124g	*Bouteloua curtipendula*	Angiosperm Monocot	Grass	C_4	Sideoats grama
125a	*Stipa comata*	Angiosperm Monocot	Grass	C_3	Needleandthread
125b	*Agropyron smithii*	Angiosperm Monocot	Grass	C_3	Western wheatgrass
125c	*Bouteloua gracilis*	Angiosperm Monocot	Grass	C_4	Blue Grama
126a	*Bromus inermis*	Angiosperm Monocot	Grass	C_3	Smooth brome
126b	*Andropogon gerardii*	Angiosperm Monocot	Grass	C_4	Big bluestem
126c	*Schizachyrium scoparium*	Angiosperm Monocot	Grass	C_4	Little bluestem
127a	*Poa pratensis*	Angiosperm Monocot	Grass	C_3	Kentucky bluegrass
127b	*Andropogon gerardii*	Angiosperm Monocot	Grass	C_4	Big bluestem
127c	*Schizachyrium scoparium*	Angiosperm Monocot	Grass	C_4	Little bluestem
127d	*Elymus canadensis*	Angiosperm Monocot	Grass	C_3	Canada wildrye
127e	*Sorghastrum nutans*	Angiosperm Monocot	Grass	C_4	Indiangrass
128a	*Andropogon gerardii*	Angiosperm Monocot	Grass	C_4	Big bluestem
128b	*Agropyron smithii*	Angiosperm Monocot	Grass	C_3	Western wheatgrass
128c	*Sorghastrum nutans*	Angiosperm Monocot	Grass	C_4	Indiangrass
128d	*Panicum virgatum*	Angiosperm Monocot	Grass	C_4	Switchgrass
129a	*Stipa comata*	Angiosperm Monocot	Grass	C_3	Needleandthread
129b	*Bouteloua gracilis*	Angiosperm Monocot	Grass	C_4	Blue Grama
129c	*Oryzopsis hymenoides*	Angiosperm Monocot	Grass	C_3	Indian Ricegrass
129d	*Bouteloua Eripoda*	Angiosperm Monocot	Grass	C_4	Black Grama
130a	*Alnus glutinosa*	Angiosperm Dicot	Tree	C_3	European alder
130b	*Arctostaphylos pringlei*	Angiosperm Dicot	Tree	C_3	Pringle manzanita
130c	*Arctostaphylos pringlei*	Angiosperm Dicot	Tree	C_3	Pringle manzanita
130d	*Quercus chrysolepis*	Angiosperm Dicot	Tree	C_3	Canyon live oak

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
130e	*Quercus chrysolepis*	Angiosperm Dicot	Tree	C_3	Canyon live oak
130f	*Quercus chrysolepis*	Angiosperm Dicot	Tree	C_3	Canyon live oak
130g	*Quercus kelloggi*	Angiosperm Dicot	Tree	C_3	California black oak
130h	*Quercus kelloggi*	Angiosperm Dicot	Tree	C_3	California black oak
130i	*Quercus kelloggi*	Angiosperm Dicot	Tree	C_3	California black oak
130j	*Eriogonum wrightii*	Angiosperm Dicot	Forb	C_3	Bastardsage
130k	*Salix lasiolepis*	Angiosperm Dicot	Tree	C_3	Arroyo willow
130l	*Pinus lambertiana*	Gymnosperm	Tree	C_3	Sugar pine
131a	*Artemisia ludoviciana*	Angiosperm Dicot	Forb	C_3	White sagebrush
131b	*Ericameria cuneata*	Angiosperm Dicot	Shrub	C_3	Cliff goldenbush
131c	*Quercus chrysolepis*	Angiosperm Dicot	Tree	C_3	Canyon live oak
131d	*Epilobium canum ssp. latifoilium*	Angiosperm Dicot	Forb	C_3	Hummingbird trumpet
131e	*Rhamnus ilicifolia*	Angiosperm Dicot	Tree	C_3	Hollyleaf redberry
131f	*Coleogyne ramosissima*	Angiosperm Dicot	Shrub	C_3	Blackbrush
131g	*Purshia tridentata var. gladulosa*	Angiosperm Dicot	Shrub	C_3	Antelope bitterbrush
131h	*Salix exigua*	Angiosperm Dicot	Tree	C_3	Narrowleaf willow
131i	*Larrea tridentata*	Angiosperm Dicot	Shrub	C_3	Creosote bush
131j	*Yucca brevifolia*	Angiosperm Monocot	Shrub	C_3	Joshua tree
131k	*Ephedra nevadensis*	Gymnosperm	Shrub	C_3	Nevada jointfir
132a	*Quercus agrifolia*	Angiosperm Dicot	Tree	C_3	California live oak
132b	*Quercus agrifolia*	Angiosperm Dicot	Tree	C_3	California live oak
132c	*Quercus agrifolia*	Angiosperm Dicot	Tree	C_3	California live oak
132d	*Ceanothus leucodermis*	Angiosperm Dicot	Shrub	C_3	Chaparral whitethorn
133a	*Rhus laurina*	Angiosperm Dicot	Tree	C_3	Laurel sumac
133b	*Artemisia californica*	Angiosperm Dicot	Shrub	C_3	Coastal sagebrush
133c	*Sambucus mexicana*	Angiosperm Dicot	Tree	C_3	Elderberry
133d	*Arctostaphylos glandulosa*	Angiosperm Dicot	Shrub	C_3	Eastwood's manzanita
133e	*Quercus agrifolia*	Angiosperm Dicot	Tree	C_3	California live oak
133f	*Quercus agrifolia*	Angiosperm Dicot	Tree	C_3	California live oak
133g	*Quercus dumosa*	Angiosperm Dicot	Tree	C_3	Coastal sage scrub oak
133h	*Phacelia cicutaria*	Angiosperm Dicot	Forb	C_3	Caterpillar phacelia
133i	*Malacothamnus fasciculatus*	Angiosperm Dicot	Shrub	C_3	Mendocino bushmallow
133j	*Platanus racemosa*	Angiosperm Dicot	Tree	C_3	California sycamore
133k	*Ceanothus integerrimus*	Angiosperm Dicot	Shrub	C_3	Deerbrush
133l	*Ceanothus spinosus*	Angiosperm Dicot	Tree	C_3	Redheart
133m	*Ceanothus megacarpus*	Angiosperm Dicot	Shrub	C_3	Bigpod ceanothus
133n	*Ceanothus megacarpus*	Angiosperm Dicot	Shrub	C_3	Bigpod ceanothus
133o	*Adenostoma fasciculatum*	Angiosperm Dicot	Shrub	C_3	Chamise
133p	*Heteromeles arbutifolia*	Angiosperm Dicot	Tree	C_3	Toyon

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
133q	*Keckiella cordifolia*	Angiosperm Dicot	Shrub	C_3	Heartleaf keckiella
134a	*Acer rubrum L.*	Angiosperm Dicot	Tree	C_3	Maple
134aa	*Quercus rubra L.*	Angiosperm Dicot	Tree	C_3	Northern red oak
134ab	*Quercus velutina Lam.*	Angiosperm Dicot	Tree	C_3	Black oak
134ac	*Hamamelis virginiana*	Angiosperm Dicot	Shrub	C_3	Witch hazel
134ad	*Hamamelis virginiana*	Angiosperm Dicot	Shrub	C_3	Witch hazel
134ae	*Hamamelis virginiana*	Angiosperm Dicot	Shrub	C_3	Witch hazel
134af	*Carya sp. Nutt.*	Angiosperm Dicot	Tree	C_3	Hickory
134ag	*Carya sp. Nutt.*	Angiosperm Dicot	Tree	C_3	Hickory
134ah	*Carya sp. Nutt.*	Angiosperm Dicot	Tree	C_3	Hickory
134ai	*Carya sp. Nutt.*	Angiosperm Dicot	Tree	C_3	Hickory
134aj	*Lindera benzoin (L.)*	Angiosperm Dicot	Shrub	C_3	*Northern spicebush*
134ak	*Rhododendron sp. L.*	Angiosperm Dicot	Shrub	C_3	Rhododendron
134al	*Fraxinus americana L.*	Angiosperm Dicot	Tree	C_3	White ash
134am	*Fraxinus americana L.*	Angiosperm Dicot	Tree	C_3	White ash
134an	*Fraxinus americana L.*	Angiosperm Dicot	Tree	C_3	White ash
134ao	*Plantago major L.*	Angiosperm Dicot	Forb	C_3	Common plantain
134ap	*Prunus serotina Ehrh.*	Angiosperm Dicot	Tree	C_3	na
134aq	*Prunus serotina Ehrh.*	Angiosperm Dicot	Tree	C_3	na
134ar	*Rubus allegheniensis*	Angiosperm Dicot	Shrub	C_3	Blackberry
134as	*Mimulus ringens L.*	Angiosperm Dicot	Forb	C_3	Allegheny monkeyflower
134at	*Juncus tenuis Willd.*	Angiosperm Monocot	Grass	C_3	Slender rush
134au	*Agropyron sp.*	Angiosperm Monocot	Grass	C_3	Wheatgrass
134av	*Alopercurus sp L.*	Angiosperm Monocot	Grass	C_3	Foxtail
134aw	*Dactylis glomerata L.*	Angiosperm Monocot	Grass	C_3	Orchardgrass
134ax	*Phleum pratense L.*	Angiosperm Monocot	Grass	C_3	Timothy grass
134ay	*na*	Angiosperm Monocot	Grass	C_3	na
134az	*Dactylis glomerata L.*	Angiosperm Monocot	Grass	C_3	Orchardgrass
134b	*Acer rubrum L.*	Angiosperm Dicot	Tree	C_3	Maple
134ba	*Typha latifolia L.*	Angiosperm Monocot	Forb	C_3	Broadleaf cattail
134bb	*Onoclea sensibilis L.*	Pteridophyta		C_3	Sensitive fern
134bc	*Polystichum acrostichoides*	Pteridophyta		C_3	Christmas fern
134bd	*Osmunda cinnamomea L.*	Pteridophyta		C_3	Cinnamon fern
134be	*Pinus strobus L.*	Gymnosperm	Tree	C_3	Eastern white pine
134bf	*Pinus strobus L.*	Gymnosperm	Tree	C_3	Eastern white pine
134bg	*Pinus strobus L.*	Gymnosperm	Tree	C_3	Eastern white pine
134bh	*Tsuga canadensis L.*	Gymnosperm	Tree	C_3	Eastern Hemock
134bi	*Tsuga canadensis L.*	Gymnosperm	Tree	C_3	Eastern Hemock
134bj	*na*	na	Forb	C_3	

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
134c	*Acer rubrum L.*	Angiosperm Dicot	Tree	C_3	Maple
134d	*Acer rubrum L.*	Angiosperm Dicot	Tree	C_3	Maple
134e	*Daucus carota L.*	Angiosperm Dicot	Forb	C_3	Queen Anne's lace
134f	*Aster Divaricatus L.*	Angiosperm Dicot	Forb	C_3	White wood aster
134g	*Impatiens capensis*	Angiosperm Dicot	Forb	C_3	Jewelweed
134h	*Betula lenta L.*	Angiosperm Dicot	Tree	C_3	Sweet birch
134i	*Betula lenta L.*	Angiosperm Dicot	Tree	C_3	Sweet birch
134j	*Betula lenta L.*	Angiosperm Dicot	Tree	C_3	Sweet birch
134k	*Betula lenta L.*	Angiosperm Dicot	Tree	C_3	Sweet birch
134l	*Betula lenta L.*	Angiosperm Dicot	Tree	C_3	Sweet birch
134m	*Betula lenta L.*	Angiosperm Dicot	Tree	C_3	Sweet birch
134n	*Betula populifolia Marsh.*	Angiosperm Dicot	Tree	C_3	Gray birch
134o	*Betula populifolia Marsh.*	Angiosperm Dicot	Tree	C_3	Gray birch
134p	*Betula populifolia Marsh.*	Angiosperm Dicot	Tree	C_3	Gray birch
134q	*Betula populifolia Marsh.*	Angiosperm Dicot	Tree	C_3	Gray birch
134r	*Betula populifolia Marsh.*	Angiosperm Dicot	Tree	C_3	Gray birch
134s	*Lonicera tatarica L.*	Angiosperm Dicot	Shrub	C_3	Twinberry
134t	*Viburnum acerifolium L.*	Angiosperm Dicot	Shrub	C_3	Mapleleaf viburnum
134u	*Clethra alnifolia L.*	Angiosperm Dicot	Shrub	C_3	Coastal sweetpepperbush
134v	*Nyssa sylvatica Marsh.*	Angiosperm Dicot	Tree	C_3	Blackgum
134w	*Nyssa sylvatica Marsh.*	Angiosperm Dicot	Tree	C_3	Blackgum
134x	*Nyssa sylvatica Marsh.*	Angiosperm Dicot	Tree	C_3	Blackgum
134y	*Trifolium pratense L.*	Angiosperm Dicot	Forb	C_3	Red clover
134z	*Quercus rubra L.*	Angiosperm Dicot	Tree	C_3	Northern red oak
135a	*Betula pendula*	Angiosperm Dicot	Tree	C_3	Silver birch
135b	*Syringa vulgaris*	Angiosperm Dicot	Tree	C_3	Common liliac
135c	*Populus tremuloides*	Angiosperm Dicot	Tree	C_3	Quaking aspen
135d	*Picea pungens*	Gymnosperm	Tree	C_3	Blue spruce
135e	*Pinus sylvestris*	Gymnosperm	Tree	C_3	Scotch pine
136a	*Spartina alterniflora*	Angiosperm-Monocot	Grass	C_4	Smooth cordgrass
136b	*Spartina alterniflora*	Angiosperm-Monocot	Grass	C_4	Smooth cordgrass
136c	*Spartina alterniflora*	Angiosperm-Monocot	Grass	C_4	Smooth cordgrass
136d	*Spartina alterniflora*	Angiosperm-Monocot	Grass	C_4	Smooth cordgrass
136e	*Spartina alterniflora*	Angiosperm-Monocot	Grass	C_4	Smooth cordgrass
137a	*Salix amygdaloides*	Angiosperm-Dicot	Tree	C_3	Peachleaf willow
138a	*Platanus occidentalis*	Angiosperm-Dicot	Tree	C_3	American sycamore
138b	*Quercus garryana*	Angiosperm-Dicot	Tree	C_3	Oregon white oak
186a			Soils		
187a			Soils		

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
188a			Soils		
189a			Soils		
190a			Soils		
191a			Soils		
192a			Soils		
193a			Soils		
194a			Soils		
195a			Soils		
196a			Soils		
197a			Soils		
198a			Soils		
199a			Soils		
200a			Soils		
201a			Soils		
202a			Soils		
203a			Soils		
204a			Soils		
205a			Soils		
206a			Soils		
207a			Soils		
208a			Soils		
209a			Soils		
210a			Soils		
211a			Soils		
212a			Soils		
213a			Soils		
214a			Soils		
215a			Soils		
216a			Soils		
217a			Soils		
218a			Soils		
219a			Soils		
220a			Soils		
221a			Soils		
222a			Soils		
223a			Soils		
224a			Soils		
225a			Soils		
226a			Soils		

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
227a			Soils		
228a			Soils		
229a			Soils		
230a			Soils		
231a			Soils		
232a			Soils		
233a			Soils		
234a			Soils		
235a			Soils		
236a			Soils		
237a			Soils		
238a			Soils		
239a			Soils		
240a			Soils		
240b			Soils		
241a			Soils		
242a			Soils		
243a			Soils		
244a			Soils		
245a			Soils		
246a			Soils		
247a			Soils		
248a			Soils		
249a			Soils		
250a			Soils		
251a			Soils		
252a			Soils		
253a			Soils		
254a			Soils		
255a			Soils		
256a	*Larix occidentalis*	Gymnosperm	Tree		
256b	*Pseudotsuga menziesii*	Gymnosperm	Tree		
257a	*Larix occidentalis*	Gymnosperm	Tree		
257b	*Pseudotsuga menziesii*	Gymnosperm	Tree		
258a	*Larix occidentalis*	Gymnosperm	Tree		
258b	*Pinus contorta*	Gymnosperm	Tree		
259a	*Larix lyallii*	Gymnosperm	Tree		
259b	*Pinus albicaulis*	Gymnosperm	Tree		
260a	*Larix larcina*	Gymnosperm	Tree		

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
260b	*Picea mariana*	Gymnosperm	Tree		
261a	*Acer rubrum*	Angiosperm Dicot	Tree		
261b	*Liriodendron tulipifera*	Angiosperm Dicot	Tree		
261c	*Nyssa sylvatica*	Angiosperm Dicot	Tree		
261d	*Quercus sp.*	Angiosperm Dicot	Tree		
261e	*Pinus sp.*	Gymnosperm	Tree		
262a	*Juniperus osteosperma*	Gymnosperm	Tree		
262b	*Pinus edulis*	Gymnosperm	Tree		
262c	*Quercus gambelii*	Angiosperm Dicot	Tree		
263a	*Juniperus osteosperma*	Gymnosperm	Tree		
263b	*Pinus edulis*	Gymnosperm	Tree		
263c	*Quercus gambelii*	Angiosperm Dicot	Tree		
264a	*Juniperus osteosperma*	Gymnosperm	Tree		
264b	*Pinus edulis*	Gymnosperm	Tree		
264c	*Quercus gambelii*	Angiosperm Dicot	Tree		
265a	*Juniperus osteosperma*	Gymnosperm	Tree		
265b	*Pinus edulis*	Gymnosperm	Tree		
265c	*Quercus gambelii*	Angiosperm Dicot	Tree		
266a	*Juniperus osteosperma*	Gymnosperm	Tree		
266b	*Quercus gambelii*	Angiosperm Dicot	Tree		
267a	*Juniperus osteosperma*	Gymnosperm	Tree		
267b	*Pinus edulis*	Gymnosperm	Tree		
267c	*Quercus gambelii*	Angiosperm Dicot	Tree		
268a	*Acer rubrum*	Angiosperm Dicot	Tree		
268b	*Quercus laurifolia*	Angiosperm Dicot	Tree		
268c	*Carpinus caroliniana*	Angiosperm Dicot	Tree		
268d	*Ilex opaca*	Angiosperm Dicot	Tree		
268e	*Acer rubrum*	Angiosperm Dicot	Tree		
268f	*Quercus nigra*	Angiosperm Dicot	Tree		
268g	*Carpinus caroliniana*	Angiosperm Dicot	Tree		
268h	*Ilex opaca*	Angiosperm Dicot	Tree		
268i	*Liquidambar styraciflua*	Angiosperm Dicot	Tree		
268j	*Nyssa sylvatica*	Angiosperm Dicot	Tree		
268k	*Acer rubrum*	Angiosperm Dicot	Tree		
268l	*Taxodium distichum*	Gymnosperm	Tree		
269a	*Artemisia tridentata*	Angiosperm Dicot	Shrub		
269b	*Juniperus osteosperma*	Gymnosperm	Tree		
269c	*Pinus ponderosa*	Gymnosperm	Tree		
270a	*Amelanchier alnifolia*	Angiosperm Dicot	Shrub		

Appendix B. *n*-alkanes in US analysis

Table 10 continued. Sample Identification

Sample Name	Latin Name	Plant Group	Growth Habit	C_3 vs C_4	Common Name
270b	*Artemesia tridentata*	Angiosperm Dicot	Shrub		
270c	*Juniperus osteosperma*	Gymnosperm	Tree		
270d	*Pinus monophylla*	Gymnosperm	Tree		
270e	*Pinus ponderosa*	Gymnosperm	Tree		
271a	*Artemisia tridentata*	Angiosperm Dicot	Shrub		
271b	*Purshia tridentata*	Angiosperm Dicot	Shrub		
271c	*Pinus jeffreyi*	Gymnosperm	Tree		
271d	*Pinus ponderosa*	Gymnosperm	Tree		
272a	*Artemisia tridentata*	Angiosperm Dicot	Shrub		
272b	*Arctostaphylos patula*	Angiosperm Dicot	Shrub		
272c	*Pinus jeffreyi*	Gymnosperm	Tree		
273a	*Artemisia tridentata*	Angiosperm Dicot	Shrub		
273b	*Chrysothamnus nauseosus*	Angiosperm Dicot	Shrub		
273c	*Acer negundo*	Angiosperm Dicot	Tree		
273d	*Salix exigua*	Angiosperm Dicot	Shrub		
274a	*Chrysothamnus nauseosus*	Angiosperm Dicot	Shrub		
275a	*Acamptopappus sphaerocephalus*	Angiosperm Dicot	Shrub		
275b	*Ambrosia dumosa*	Angiosperm Dicot	Shrub		
275c	*Ambrosia eriocentra*	Angiosperm Dicot	Shrub		
275d	*Encelia farinosa*	Angiosperm Dicot	Shrub		
275e	*Hymenoclea monogyra*	Angiosperm Dicot	Shrub		
275f	*Encelia farinosa*	Angiosperm Dicot	Shrub		
276a	*Artemisia tridentata*	Angiosperm Dicot	Shrub		
277a	*Populus sargentii*	Angiosperm Dicot	Tree		
278a	*Quercus gambelii*	Angiosperm Dicot	Tree		
279a	*Quercus turbinella*	Angiosperm Dicot	Tree		
280a	*Condalia hookeri*	Angiosperm Dicot	Shrub		
280b	*Zanthoxylum fagara*	Angiosperm Dicot	Shrub		
281a	*Abies lasiocarpa*	Gymnosperm	Tree		
281b	*Pinus contorta*	Gymnosperm	Tree		
281c	*Picea engelmanii*	Gymnosperm	Tree		
282a	*Populus tremuloides*	Angiosperm Dicot	Tree		
283a	*Acer grandidentatum*	Angiosperm Dicot	Tree		
283b	*Acer negundo*	Angiosperm Dicot	Tree		
284a	*Arbutus menziesii*	Gymnosperm	Tree		
284b	*Quercus agrifolia*	Angiosperm Dicot	Tree		
284c	*Umbellularia californica*	Angiosperm Dicot	Tree		
284d	*Vaccinium ovatum*	Angiosperm Dicot	Shrub		
284e	*Corylus californica*	Angiosperm Dicot	Shrub		

Appendix B. *n*-alkanes in US analysis

Table 11. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
1a								
1b			-151					
2a			-123	-124				
2b			-135	-150				
3a								
3b			-144	-130				
3c			-144	-153				
4a				-147	-154			
4b			-140	-128				
5a				-136	-144			
5b			-163	-166				
5c			-130	-121				
5d			-147	-126				
5e			-155	-165				
6a			-137	-137				
7a			-163	-173				
7b								
7c								
8a				-137	-128			
8b								
9a				-155	-148			
9b								
9c			-115	-106				
10a				-156	-175			
10b			-150	-146				
10c								
11a								
11b			-155	-144				
11c								
12a			-146	-136				
13a				-152	-163			
13b								
13c			-169	-168				
13d								
14a				-132	-182			
14b			-131	-121				
14c			-151	-136				
14d			-183	-181				
15a				-158	-145			

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	$δD_{C27-31}$
15b			-154	-154				
15c			-130	-122				
15d								
16a				-148				
16b			-180	-193				
16c								
16d								
17a				-148	-143			
17b			-136	-130				
17c			-167	-182				
17d								
18a			-183	-186				
18b								
18c			-152	-136				
18d								
19a			-178	-187				
19b			-138	-113				
19c			-154	-139				
19d								
20a			-189	-195				
20b			-192	-197				
20c			-160	-138				
20d								
21a				-155				
21b			-191	-202				
21c			-190	-211				
21d								
22a			-192	-204				
22b								
23a			-203					
23b								
24a								
25a								
26a								
27a								
28a			-233	-235				
28b								
29a								
30a				-174	-162			

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
30b								
31a			-224					
31b			-191	-190				
32a			-213					
32b								
35a								
36a			-221					
36b								
37a								
38a				-185	-176			
38b								
38c			-174	-167				
39a				-155	-160			
39b				-214				
39c								
40a								
41a								
42a				-179	-171			
42b			-203	-198				
42c			-218					
42d			-195	-192				
43a				-182	-194			
43b								
44a			-179	-177				
45a			-174	-163				
46a				-177	-163			
46b								
47a			-200	-189				
48a			-177	-170				
49a			-192					
49b								
50a			-194	-189				
50b			-161	-149				
50c			-172	-174				
51a			-185	-179				
51b			-128	-140				
51c								
53a				-169				
53b			-199	-202				

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	$δD_{C27-31}$
53c			-159	-151				
53d			-168	-177				
54a				-189				
54b				-181				
54c			-157	-159				
55a			-176	-169				
55b			-163	-157				
56a			-150	-141				
57a								
58a			-166	-138				
59a								
59b			-172	-143				
60a								
60b			-173	-155				
61a								
61b			-163	-145				
61c			-174	-163				
62a			-180	-174				
63a			-186	-193				
63b			-189	-185				
63c			-193	-198				
64a			-193	-221				
64b								
65a								
65b								
66a				-169	-175			
66b			-162	-164				
67a								
67b								
68a								
68b								
69a								
69b								
70a								
71a			-184	-196				
71b								
71c			-160	-184				
72a								
72b			-133	-117				

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
73a			-167	-145				
74a								
74b			-142	-147				
74c			-167	-161				
74d								
75a					-125			
75b			-179	-162				
76a								
76b			-186	-181				
78a								
79a								
81a			-139	-130				
82a				-195	-182			-185
82b								
82c								
83a				-178	-159			-165
83b								
83c								
84a				-182	-159			-166
84b								
84c								
85a				-174	-187			-183
85b								
85c								
86a				-183	-182			-180
86b								
86c								
87a				-179	-180			-177
87b								
87c								
88a				-183	-181			
88b					-172			
88c				-185	-201			
88d								
89a				-173	-172			
89b						-144	-129	
89c				-171	-177			
89d								
90a				-176	-148			-173

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	$\delta D_{C27\text{-}31}$
90b				-165	-153			
90c				-169	-176			
90d								
91a				-142	-138			-138
91b				-172	-165			
91c					-176			
91d				-178	-187			
92a				-163	-159			-163
92b				-180	-180			
92c				-169	-169			
92d								
93a								
93b								
93c						-140		
93d								
94a								
94b								
94c						-146	-138	
95a				-179	-163			-165
95b								
95c						-133	-124	
95e								
96a								
96b				-160	-165			
96c						-137	-123	
96d				-176	-184			
97a								
97b								
97c								
97d								
98a								
98b								
99a								
99b								
99c								
99d								
100a								
100b				-149	-157			
100c				-166	-155			

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	$δD_{C27-31}$
100d						-134	-127	
101a								
101b				-147	-155			
101c						-133	-123	
101d								
102a								
102b				-146	-149			
102c						-137	-120	
102d								
103a								
103b				-155	-159			
103c		-171	-178					
103d								
104a								
104b				-163	-154			
104c				-145	-169			
104d						-124	-116	
104e		-164	-179					
104f								
105a				-157	-129			-142
105b						-97	-105	
105c		-178	-184					
105d								
106a								
106b				-149	-154			
106c						-139	-118	
106d		-178	-171					
106e								
107a				-142	-135			-135
107b				-145	-140			
107c						-116	-102	
107d		-151	-162					
108a				-149	-135			-141
108b								
108c						-107		
108d								
109a								
109b								
110a								

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
111a				-137	-134			-134
111b				-146	-148			
111c						-143		
111d								
112a				-128	-135			-131
112b				-131	-138			
112c				-152	-145			
112d						-137	-127	
112e								
113a								
113b				-134	-135			
113c		-166						
113d								
114a				-149	-153			-150
114b								
114c							-112	
114d								
115a				-149	-125			-135
115b				-131	-115			
115c								
115d						-129	-118	
115e		-155	-181					
115f								
116a				-151	-131			-143
116b								
116c								
117a								
117b								
117c								
118a								
118b								
118c								
119a								
119b								
120a						-128	-127	
121a						-123	-111	
122a				-232	-257	-249		
122b			-227	-247	-254	-244		
122c				-231	-238			

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
122d				-275	-280			
122e			-219	-225	-234	-221		
122f				-223	-224			
123a			-235	-239	-254	-235		
123b			-244	-222	-218	-219	-221	
123c	-232	-230	-230	-228	-230			
123d			-248	-251	-249	-253		
123e			-208	-220	-232	-222		
123f		-228	-230	-216	-213			
124a			-237	-238	-255			
124b	-229	-228	-224	-233	-236	-220		
124c				-244	-246			
124d			-262	-261	-263			
124e			-215	-219	-209			
124f				-196	-241	-233		
124g			-220	-231	-219			
125a			-221	-210	-219	-215		
125b				-214	-218			
125c	-161	-166	-171	-189	-211	-213		
126a				-273	-284			
126b	-234	-235	-234	-238	-235	-233		
126c			-235	-253	-266	-253		
127a			-220	-230	-227			
127b		-205	-211	-205	-204	-191		
127c		-187	-193	-196	-207	-199		
127d		-216	-234	-234	-230			
127e		-204	-199	-197	-192	-176		
128a		-207	-212	-213	-213			
128b				-211	-207			
128c		-191	-203	-196	-197			
128d			-205	-212	-205			
129a				-167	-174			
129b		-176	-180	-190	-210	-207		
129c			-193	-187	-189			
129d				-136	-155	-165		
130a			-165					
130b				-145	-163			
130c			-182	-191	-210			
130d			-159	-150	-146			

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
130e			-131	-134	-134			
130f			-143	-136	-129			
130g			-160	-162				
130h			-147	-172				
130i			-137	-158				
130j			-119	-119	-111			
130k			-145					
130l					-151			
131a				-127	-128			
131b			-149	-143				
131c			-147	-151	-153			
131d				-207	-221			
131e				-156				
131f				-192	-150			
131g			-191					
131h				-197				
131i				-114	-120			
131j					-184			
131k				-149	-157			
132a				-139				
132b				-127				
132c				-136				
132d				-156	-159			
133a				-147				
133b				-125	-127			
133c				-133				
133d					-159			
133e				-126				
133f				-120				
133g				-119				
133h				-118	-126			
133i				-102	-90			
133j			-131		-148			
133k				-126	-124			
133l				-128	-137			
133m				-136	-142			
133n				-130	-136			
133o				-121	-102			
133p				-132				

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
133q				-130	-121			
134a			-172	-194	-180			
134aa			-168	-173	-157			
134ab			-152	-167				
134ac			-166	-188				
134ad			-179	-170				
134ae			-171	-168	-161			
134af				-194	-172			
134ag				-188	-175			
134ah				-176	-185			
134ai			-190	-208	-203			
134aj			-189	-200	-182			
134ak			-190	-190	-168			
134al				-185	-162			
134am				-182	-177			
134an				-187	-172			
134ao				-204	-208			
134ap				-184	-166			
134aq			-201	-173				
134ar			-178	-187	-180			
134as				-173	-168			
134at			-216	-217	-198			
134au			-175	-231	-228			
134av			-171	-186	-188			
134aw			-202	-218	-221			
134ax			-232	-226	-217			
134ay			-206	-232	-238			
134az			-202	-218	-221			
134b			-157	-195	-198			
134ba			-195	-195	-189			
134bb			-156	-156				
134bc			-162	-170	-165			
134bd			-152	-159				
134be			-183	-192	-195			
134bf			-173	-201	-200			
134bg			-178	-200	-199			
134bh			-159	-160	-155			
134bi			-163	-165	-156			
134bj				-188	-190			

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
134c				-206	-213			
134d				-219	-210			
134e			-188	-170	-156			
134f				-176	-181			
134g			-193	-187				
134h			-182	-182				
134i				-197	-178			
134j			-181	-181				
134k			-188	-168				
134l			-193	-174				
134m			-204	-174				
134n			-191	-182	-177			
134o			-186	-176	-174			
134p			-198	-190	-182			
134q			-192	-178	-176			
134r			-192	-177	-180			
134s				-185	-179			
134t				-187				
134u				-197				
134v				-180				
134w				-187				
134x				-188				
134y			-196	-207	-190			
134z			-167	-165	-150			
135a			-170		-155			
135b			-175	-191	-209			
135c			-179					
135d			-207	-211	-193			
135e			-193	-207	-190			
136a			-157	-161	-136			
136b			-151	-161	-125			
136c			-178	-192	-133			
136d			-152	-160	-166			
136e			-156	-166				
137a			-246	-227				
138a			-195	-187	-181			
138b			-213	-203	-204			
186a								
187a								

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
188a								
189a								
190a								
191a								
192a								
193a								
194a								
195a								
196a								
197a								
198a								
199a								
200a								
201a								
202a								
203a								
204a								
205a								
206a								
207a								
208a								
209a								
210a								
211a								
212a								
213a								
214a								
215a								
216a								
217a								
218a								
219a								
220a								
221a								
222a								
223a								
224a								
225a								
226a								

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	$δD_{C27-31}$
227a								
228a								
229a								
230a								
231a								
232a								
233a								
234a								
235a								
236a								
237a								
238a								
239a								
240a								
240b								
241a								
242a								
243a								
244a								
245a								
246a								
247a								
248a								
249a								
250a								
251a								
252a								
253a								
254a								
255a								
256a								
256b								
257a								
257b								
258a								
258b								
259a								
259b								
260a								

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	δD_{C27-31}
260b								
261a								
261b								
261c								
261d								
261e								
262a								
262b								
262c								
263a								
263b								
263c								
264a								
264b								
264c								
265a								
265b								
265c								
266a								
266b								
267a								
267b								
267c								
268a								
268b								
268c								
268d								
268e								
268f								
268g								
268h								
268i								
268j								
268k								
268l								
269a								
269b								
269c								
270a								

Appendix B. *n*-alkanes in US analysis

Table 11 continued. Isotope Hydrogen Data

Sample Name	δD C_{23}	δD C_{25}	δD C_{27}	δD C_{29}	δD C_{31}	δD C_{33}	δD C_{35}	$δD_{C27-31}$
270b								
270c								
270d								
270e								
271a								
271b								
271c								
271d								
272a								
272b								
272c								
273a								
273b								
273c								
273d								
274a								
275a								
275b								
275c								
275d								
275e								
275f								
276a								
277a								
278a								
279a								
280a								
280b								
281a								
281b								
281c								
282a								
283a								
283b								
284a								
284b								
284c								
284d								
284e								

Appendix B. *n*-alkanes in US analysis

Table 12. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
1a			-29					
1b		-32	-33					-29
2a		-34	-37					-31
2b		-35	-36					-31
3a			-32					
3b								-33
3c		-35	-36					-31
4a			-34	-35				
4b		-34	-38					-30
5a			-31					
5b		-31	-30					
5c								-30
5d								-30
5e		-37	-37					-32
6a		-34	-35					-33
7a		-31	-30					
7b								-27
7c								-27
8a			-34					
8b								-29
9a			-36	-37				
9b		-34	-34					-30
9c		-33	-33					-30
10a			-34	-36				
10b		-35	-36					-32
10c		-33	-33					-28
11a								-28
11b		-34	-34					-30
11c		-33	-33					-28
12a		-32	-34					-28
13a			-35	-36				
13b		-36	-38					-31
13c		-33	-34					-29
13d		-30	-32					-24
14a								
14b								-29
14c			-32					-29
14d		-31	-31					-27
15a			-33	-34				

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
15b		-30	-31					
15c								-28
15d								-28
16a			-32					
16b		-30	-29					
16c								-30
16d								-28
17a			-33					
17b		-36	-36					-32
17c		-37	-37					-33
17d		-32	-32					-28
18a		-32	-31					
18b								-31
18c		-34	-34					-29
18d		-31	-31					-28
19a		-32	-31					
19b								-29
19c		-35	-34					-31
19d		-32	-31					-27
20a		-33	-33					
20b		-31	-30					-29
20c		-32	-33					-27
20d								-27
21a								
21b		-30	-30					
21c								-29
21d		-29	-30					-27
22a		-31	-31					
22b								-26
23a		-33	-35					-30
23b								-27
24a								-26
25a		-30	-29					-27
26a		-29	-28					-24
27a		-29	-28					-26
28a		-33	-33					-30
28b		-32	-31					-29
29a		-31	-31					-27
30a								

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
30b								-27
31a		-34	-35					-31
31b		-30	-29					-25
32a		-31						-26
32b								-25
35a								-25
36a		-31	-32					-28
36b								-28
37a								-27
38a			-32	-33				
38b								-26
38c		-30	-30					-27
39a								
39b		-31	-30					
39c								-28
40a								-26
41a								-28
42a								
42b		-33	-33					
42c		-33	-34					-30
42d		-31	-31					-27
43a			-33	-32				
43b								-24
44a		-30	-30					-27
45a		-31	-31					-30
46a			-32	-32				
46b								-29
47a		-31	-30					-28
48a		-30	-30					-28
49a		-34	-35					-30
49b								-27
50a		-32	-31					
50b		-33	-34					-28
50c		-31	-32					-29
51a		-29	-28					
51b								-28
51c								-26
53a			-30					
53b		-31	-30					

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
53c		-36	-38					-32
53d		-30	-32					-30
54a			-32					
54b		-36	-39					-31
54c		-32	-32					-29
55a		-32	-32					
55b		-32	-32					-28
56a		-31						-26
57a			-34					
58a								-28
59a								-29
59b		-32						-28
60a								-28
60b		-33						-29
61a								-28
61b		-32						-27
61c		-33	-34					-28
62a		-33	-32					-28
63a			-30					
63b		-30	-30					-27
63c		-31	-32					-27
64a		-31	-30					
64b								-27
65a								-28
65b								-27
66a			-33	-34				
66b		-31	-32					-28
67a								-27
67b								-26
68a								-29
68b								-28
69a								-27
69b								-26
70a								-29
71a			-30					
71b								-28
71c		-31	-31					-27
72a								-29
72b		-32	-33					-29

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
73a								-29
74a								-29
74b		-34	-35					-30
74c		-31	-31					
74d								-28
75a								
75b			-31					
76a								-28
76b		-32	-32					-27
78a								-30
79a								-29
81a		-34	-35					-30
82a			-33	-34				
82b			-36	-37				-32
82c								-31
83a			-31	-31				
83b			-32	-32				-29
83c								-28
84a			-31	-31				
84b			-31					-28
84c								-28
85a			-33	-35				
85b								-30
85c								-27
86a			-34	-35				
86b								-30
86c								-28
87a			-32	-34				
87b			-35					-30
87c								-29
88a			-35	-35				-30
88b				-33				-28
88c			-30	-30				-28
88d								-29
89a			-31	-31				-29
89b					-30	-29		-25
89c			-32	-33				-31
89d								-29
90a			-33	-33				

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
90b			-33	-32				-29
90c			-31	-32				-31
90d								-31
91a			-32	-33				
91b			-35	-35				-31
91c				-32				-28
91d			-32	-33				-31
92a			-31	-33				
92b			-34	-35				-30
92c			-32	-33				-31
92d								-31
93a			-36	-36				
93b			-34	-33				-31
93c					-33	-32		-28
93d								-30
94a			-34	-34				-30
94b								-28
94c					-30	-30		-26
95a			-31	-32				
95b			-34	-34				-29
95c					-33	-33		-28
95e								-29
96a			-32	-33				
96b			-36	-36				-30
96c					-35	-34		-28
96d			-32	-32				-28
97a			-32	-33				
97b			-32	-31				-28
97c								-30
97d								-29
98a			-32	-33				
98b								-29
99a			-31	-33				
99b			-33	-33				-29
99c								-30
99d								-30
100a			-31	-32				
100b			-32	-32				-28
100c			-33	-34				-28

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
100d					-34	-33		-28
101a			-34	-34				
101b			-36	-36				-31
101c					-32	-32		-27
101d								-29
102a			-32	-33				
102b			-33	-32				-29
102c					-34	-33		-29
102d								-30
103a			-33	-34				
103b			-34	-34				-30
103c	-33	-33						-31
103d								-30
104a			-32	-33				
104b			-35	-35				-31
104c			-32	-32				-28
104d					-34	-35		-30
104e	-32	-33						-29
104f								-30
105a			-34	-35				
105b					-33	-32		-29
105c	-32	-33						-29
105d								-29
106a			-31	-33				
106b			-34	-34				-30
106c					-34	-33		-29
106d	-32	-32						-29
106e								-32
107a			-35	-35				
107b			-35	-35				-30
107c					-33	-32		-29
107d	-1622	-33						-29
108a			-33	-34				
108b			-34	-34				-31
108c					-33	-33		-29
108d								-30
109a			-34	-37				
109b								-28
110a			-34	-34				-30

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
111a			-35	-35				
111b			-35	-35				-30
111c					-33	-32		-28
111d								-30
112a			-33	-32				
112b				-36				-32
112c			-33	-36				-30
112d					-33	-33		-28
112e								-30
113a								
113b			-36	-36				-32
113c	-30	-31						-28
113d								-31
114a			-36	-36				
114b								-28
114c					-33	-32		-28
114d								-31
115a			-35					
115b			-36	-35				-30
115c								-32
115d					-32	-31		-28
115e	-33	-33						-30
115f								-31
116a			-35					
116b			-38	-38				-32
116c								-27
117a			-33	-34				-28
117b								-26
117c								-29
118a			-34	-35				
118b				-34				-30
118c								-28
119a			-33	-34				
119b			-36	-35				-31
120a					-29	-29		-25
121a					-33	-32		-28
122a								
122b								
122c								

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
122d								
122e								
122f								
123a								
123b								
123c								
123d								
123e								
123f								
124a								
124b								
124c								
124d								
124e								
124f								
124g								
125a								
125b								
125c								
126a								
126b								
126c								
127a								
127b								
127c								
127d								
127e								
128a								
128b								
128c								
128d								
129a								
129b								
129c								
129d								
130a								
130b								
130c								
130d								

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
130e								
130f								
130g								
130h								
130i								
130j								
130k								
130l								
131a								
131b								
131c								
131d								
131e								
131f								
131g								
131h								
131i								
131j								
131k								
132a								
132b								
132c								
132d								
133a								
133b								
133c								
133d								
133e								
133f								
133g								
133h								
133i								
133j								
133k								
133l								
133m								
133n								
133o								
133p								

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
133q								
134a								
134aa								
134ab								
134ac								
134ad								
134ae								
134af								
134ag								
134ah								
134ai								
134aj								
134ak								
134al								
134am								
134an								
134ao								
134ap								
134aq								
134ar								
134as								
134at								
134au								
134av								
134aw								
134ax								
134ay								
134az								
134b								
134ba								
134bb								
134bc								
134bd								
134be								
134bf								
134bg								
134bh								
134bi								
134bj								

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
134c								
134d								
134e								
134f								
134g								
134h								
134i								
134j								
134k								
134l								
134m								
134n								
134o								
134p								
134q								
134r								
134s								
134t								
134u								
134v								
134w								
134x								
134y								
134z								
135a								
135b								
135c								
135d								
135e								
136a								
136b								
136c								
136d								
136e								
137a								
138a								
138b								
186a								-28
187a								-29

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
188a								-27
189a								-28
190a								-27
191a								-26
192a								-27
193a								-27
194a								-26
195a								-24
196a								-27
197a								-24
198a								-24
199a								-21
200a								-22
201a								-23
202a								-23
203a								-24
204a								-22
205a								-20
206a								-24
207a								-23
208a								-22
209a								-22
210a								-25
211a								-22
212a								-26
213a								-24
214a								-25
215a								-19
216a								-21
217a								-21
218a								-17
219a								-19
220a								-18
221a								-21
222a								-21
223a								-21
224a								-21
225a								-17
226a								-14

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
227a								-22
228a								-24
229a								-23
230a								-22
231a								-23
232a								-15
233a								-24
234a								-20
235a								-23
236a								-20
237a								-24
238a								-17
239a								-24
240a								-26
240b								-27
241a								-20
242a								-24
243a								-21
244a								-24
245a								-24
246a								-25
247a								-24
248a								-25
249a								-24
250a								-20
251a								-21
252a								-23
253a								-16
254a								-24
255a								-17
256a								-26
256b								-26
257a								-27
257b								-27
258a								-27
258b								-28
259a								-27
259b								-26
260a								-29

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
260b								-27
261a								-29
261b								-30
261c								-30
261d								-29
261e								-27
262a								-24
262b								-24
262c								-27
263a								-24
263b								-24
263c								-27
264a								-25
264b								-24
264c								-27
265a								-25
265b								-24
265c								-27
266a								-24
266b								-27
267a								-24
267b								-23
267c								-27
268a								-30
268b								-30
268c								-31
268d								-30
268e								-31
268f								-30
268g								-31
268h								-30
268i								-31
268j								-33
268k								-31
268l								-28
269a								-24
269b								-23
269c								-22
270a								-26

Appendix B. *n*-alkanes in US analysis

Table 12 continued. Isotope Carbon Data

Sample Name	$\delta^{13}C$ C_{25}	$\delta^{13}C$ C_{27}	$\delta^{13}C$ C_{29}	$\delta^{13}C$ C_{31}	$\delta^{13}C$ C_{33}	$\delta^{13}C$ C_{35}	$\delta^{13}C_{C27-31}$	Bulk $\delta^{13}C$
270b								-25
270c								-23
270d								-21
270e								-22
271a								-25
271b								-24
271c								-23
271d								-22
272a								-26
272b								-27
272c								-22
273a								
273b								
273c								
273d								
274a								
275a								
275b								
275c								
275d								
275e								
275f								
276a								
277a								
278a								
279a								
280a								
280b								
281a								
281b								
281c								
282a								
283a								
283b								
284a								
284b								
284c								
284d								
284e								

Appendix B. *n*-alkanes in US analysis

Table 13. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
1a															
1b		-83							-83						
2a		-53	-54						-52	-54					
2b		-65	-83						-65	-83					
3a															
3b		-74	-58						-74	-58					
3c		-74	-83						-74	-84					
4a			-77	-84						-81	-88				
4b		-70	-57						-74	-61					
5a			-66	-75						-68	-77				
5b		-95	-99						-97	-101					
5c		-60	-49						-62	-52					
5d		-77	-55						-79	-57					
5e		-87	-98						-89	-100					
6a		-68	-68						-70	-71					
7a		-90	-101						-94	-105					
7b															
7c															
8a			-66	-57						-71	-62				
8b															
9a			-85	-77						-94	-87				
9b															
9c		-41	-31						-51	-41					
10a			-87	-108						-97	-118				
10b		-81	-77						-91	-87					
10c															
11a															
11b		-86	-73						-94	-82					
11c															
12a		-77	-66						-77	-66					
13a			-81	-93						-82	-94				
13b															
13c		-100	-99						-101	-100					
13d															
14a			-57	-110						-59	-113				
14b		-55	-45						-57	-47					
14c		-78	-61						-80	-63					
14d		-112	-110						-114	-112					
15a			-87	-73						-98	-84				

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	εC25/ MAP	εC27/ MAP	εC29/ MAP	εC31/ MAP	εC33/ MAP	εC35/ MAP	εC27-31/MAP	εC25/ MGP	εC27/ MGP	εC29/ MGP	εC31/ MGP	εC33/ MGP	εC35/ MGP	εC27-31/MGP	ACL
15b		-82	-82						-94	-94					
15c		-56	-48						-68	-60					
15d															
16a			-71							-72					
16b		-105	-120						-106	-120					
16c															
16d															
17a			-69	-64						-72	-67				
17b		-56	-49						-59	-52					
17c		-89	-106						-92	-109					
17d															
18a		-100	-104						-114	-117					
18b															
18c		-66	-48						-81	-63					
18d															
19a		-97	-107						-111	-120					
19b		-53	-26						-67	-40					
19c		-70	-54						-84	-69					
19d															
20a		-109	-116						-122	-129					
20b		-112	-117						-125	-131					
20c		-77	-53						-91	-67					
20d															
21a			-57							-86					
21b		-98	-109						-126	-137					
21c		-96	-120						-124	-147					
21d															
22a		-100	-114						-127	-140					
22b															
23a		-112							-138						
23b															
24a															
25a															
26a															
27a															
28a		-146	-149						-165	-168					
28b															
29a															
30a			-80	-67						-79	-66				

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	ε_{C25}/ MAP	ε_{C27}/ MAP	ε_{C29}/ MAP	ε_{C31}/ MAP	ε_{C33}/ MAP	ε_{C35}/ MAP	ε_{C27-} 31/MAP	ε_{C25}/ MGP	ε_{C27}/ MGP	ε_{C29}/ MGP	ε_{C31}/ MGP	ε_{C33}/ MGP	ε_{C35}/ MGP	ε_{C27-} 31/MGP	ACL
30b															
31a		-134							-156						
31b		-97	-95						-120	-118					
32a		-114							-138						
32b															
35a															
36a		-127							-126						
36b															
37a															
38a			-91	-82						-119	-109				
38b															
38c		-79	-72						-107	-100					
39a			-62	-68						-88	-94				
39b			-128							-152					
39c															
40a															
41a															
42a			-86	-78						-112	-104				
42b		-114	-107						-138	-132					
42c		-130							-154						
42d		-104	-101						-129	-126					
43a			-92	-105						-116	-129				
43b															
44a		-86	-84						-112	-110					
45a		-82	-69						-107	-95					
46a			-86	-70						-111	-95				
46b															
47a		-112	-100						-136	-125					
48a		-87	-79						-111	-104					
49a		-102							-125						
49b															
50a		-106	-101						-127	-122					
50b		-70	-56						-92	-78					
50c		-82	-84						-103	-105					
51a		-103	-96						-123	-116					
51b		-40	-53						-61	-74					
51c															
53a			-82							-104					
53b		-116	-119						-137	-140					

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
53c		-71	-63						-93	-85					
53d		-82	-92						-103	-113					
54a			-105							-125					
54b			-96							-116					
54c		-70	-72						-91	-93					
55a		-97	-89						-115	-107					
55b		-82	-76						-101	-94					
56a		-77	-68						-84	-74					
57a															
58a		-94	-63						-97	-66					
59a															
59b		-99	-68						-102	-71					
60a															
60b		-99	-79						-103	-82					
61a															
61b		-88	-69						-91	-72					
61c		-100	-88						-104	-92					
62a		-103	-96						-106	-100					
63a		-105	-113						-108	-116					
63b		-109	-104						-112	-107					
63c		-113	-118						-116	-121					
64a		-106	-137						-108	-139					
64b															
65a															
65b															
66a			-73	-80						-82	-89				
66b		-66	-68						-75	-77					
67a															
67b															
68a															
68b															
69a															
69b															
70a															
71a		-99	-113						-107	-121					
71b															
71c		-73	-100						-81	-107					
72a															
72b		-46	-29						-54	-37					

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
73a		-90	-66						-96	-72					
74a															
74b		-61	-67						-67	-73					
74c		-89	-82						-95	-88					
74d															
75a				-41							-56				
75b		-101	-82						-115	-97					
76a															
76b		-108	-103						-123	-118					
78a															
79a															
81a		-68	-57						-75	-64					
82a			-139	-125			-128			-161	-148			-151	29
82b															28
82c															
83a			-119	-99			-105			-142	-122			-128	29
83b															30
83c															
84a			-121	-97			-104			-143	-119			-126	29
84b															27
84c															
85a			-113	-127			-122			-135	-149			-145	29
85b															
85c															
86a			-124	-123			-121			-144	-143			-141	
86b															
86c															
87a			-119	-120			-117			-140	-141			-138	
87b															
87c															
88a			-127	-125						-150	-148				30
88b				-115							-138				28
88c			-129	-146						-151	-168				27
88d															
89a			-119	-118						-138	-137				29
89b					-88	-72						-109	-93		33
89c			-117	-124						-137	-143				28
89d															
90a			-122	-92			-118			-141	-112			-138	28

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	εC25/MAP	εC27/MAP	εC29/MAP	εC31/MAP	εC33/MAP	εC35/MAP	εC27-31/MAP	εC25/MGP	εC27/MGP	εC29/MGP	εC31/MGP	εC33/MGP	εC35/MGP	εC27-31/MGP	ACL
90b			-110	-97						-130	-118				29
90c			-114	-121						-134	-141				28
90d															
91a			-88	-84			-84			-107	-103			-103	29
91b			-120	-113						-138	-131				30
91c				-124							-143				
91d			-126	-136						-144	-154				28
92a			-108	-103			-108			-128	-123			-128	29
92b			-126	-126						-145	-145				30
92c			-114	-114						-133	-134				28
92d															
93a															29
93b															30
93c					-86							-109			33
93d															
94a															30
94b															
94c					-93	-85						-109	-101		33
95a			-131	-114			-116			-149	-133			-135	30
95b															29
95c					-83	-73						-102	-92		33
95e															
96a															
96b			-112	-117						-129	-134				30
96c					-88	-73						-105	-90		33
96d			-129	-137						-145	-154				28
97a															30
97b															29
97c															
97d															
98a															29
98b															
99a															30
99b															30
99c															
99d															
100a															29
100b			-107	-115						-122	-130				29
100c			-125	-113						-140	-128				28

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27\text{-}31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27\text{-}31/MGP}$	ACL
100d					-91	-84						-107	-99		33
101a															
101b			-107	-115						-121	-129				30
101c					-92	-82						-107	-96		33
101d															
102a															29
102b			-107	-110						-121	-124				30
102c					-97	-79						-112	-95		33
102d															
103a															29
103b			-117	-121						-131	-135				30
103c	-133	-141						-147	-154						25
103d															
104a															29
104b			-126	-117						-140	-131				30
104c			-108	-132						-122	-146				29
104d					-85	-77						-100	-92		33
104e	-127	-142						-141	-156						25
104f															
105a			-121	-92			-105			-135	-106			-119	30
105b					-58	-67						-73	-81		33
105c	-143	-149						-156	-162						26
105d															
106a															29
106b			-114	-120						-128	-133				30
106c					-104	-82						-118	-96		33
106d	-145	-137						-158	-150						27
106e															
107a			-108	-101			-101			-121	-114			-114	30
107b			-111	-106						-124	-119				30
107c					-81	-67						-94	-80		33
107d	-117	-129						-130	-142						25
108a			-118	-104			-110			-127	-113			-119	30
108b															30
108c					-75							-84			33
108d															
109a															30
109b															
110a															30

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	εC25/ MAP	εC27/ MAP	εC29/ MAP	εC31/ MAP	εC33/ MAP	εC35/ MAP	εC27-31/MAP	εC25/ MGP	εC27/ MGP	εC29/ MGP	εC31/ MGP	εC33/ MGP	εC35/ MGP	εC27-31/MGP	ACL
111a			-107	-104			-104			-118	-115			-115	
111b			-115	-117						-127	-129				30
111c					-113							-124			33
111d															
112a			-98	-105			-101			-109	-117			-113	
112b			-101	-109						-113	-120				31
112c			-123	-116						-133	-127				30
112d					-108	-97						-119	-108		33
112e															
113a															30
113b			-105	-106						-116	-117				30
113c	-138							-149							24
113d															
114a			-122	-126			-123			-132	-136			-133	30
114b															
114c						-84							-95		33
114d															
115a			-123	-98			-108			-133	-108			-118	30
115b			-104	-88						-114	-98				30
115c															32
115d					-102	-90						-112	-101		34
115e	-128	-156						-138	-165						24
115f															
116a			-126	-105			-117			-134	-114			-126	30
116b															
116c															
117a															
117b															
117c															
118a															30
118b															30
118c															
119a															30
119b															31
120a					-106	-105						-109	-108		34
121a					-101	-88						-104	-92		33
122a			-156	-184	-175					-174	-201	-192			
122b		-151	-173	-180	-169				-169	-190	-198	-187			
122c			-155	-163						-173	-180				

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	ε_{C25}/MAP	ε_{C27}/MAP	ε_{C29}/MAP	ε_{C31}/MAP	ε_{C33}/MAP	ε_{C35}/MAP	ε_{C27-31}/MAP	ε_{C25}/MGP	ε_{C27}/MGP	ε_{C29}/MGP	ε_{C31}/MGP	ε_{C33}/MGP	ε_{C35}/MGP	ε_{C27-31}/MGP	ACL
122d			-203	-209						-220	-226				
122e		-142	-148	-158	-144				-160	-166	-176	-162			
122f			-146	-147						-164	-165				
123a		-158	-163	-179	-158				-176	-180	-196	-176			
123b		-168	-144	-140	-141	-143			-186	-162	-158	-159	-161		
123c	-153	-153	-151	-153				-170	-170	-168	-170				
123d		-173	-176	-174	-178				-190	-193	-191	-195			
123e		-129	-142	-155	-144				-147	-160	-173	-162			
123f	-151	-153	-138	-134				-168	-170	-155	-152				
124a		-166	-167	-186					-181	-183	-201				
124b	-156	-152	-162	-165	-148			-172	-168	-177	-180	-163			
124c			-174	-176						-189	-191				
124d		-193	-192	-195					-208	-207	-209				
124e		-142	-146	-136					-158	-162	-151				
124f			-121	-170	-162					-137	-186	-177			
124g		-148	-160	-146					-163	-175	-162				
125a		-140	-128	-138	-134				-156	-144	-154	-149			
125b			-132	-137						-148	-153				
125c	-79	-85	-105	-129	-131			-96	-102	-121	-145	-147			
126a			-216	-228						-224	-236				
126b	-175	-174	-178	-175	-173			-183	-182	-187	-183	-181			
126c		-175	-194	-208	-194				-183	-203	-216	-203			
127a		-175	-185	-182					-184	-194	-191				
127b	-159	-165	-159	-158	-144			-168	-174	-168	-167	-153			
127c	-140	-146	-149	-161	-152			-149	-156	-159	-170	-162			
127d	-170	-189	-189	-185				-180	-198	-198	-194				
127e	-158	-152	-150	-145	-128			-167	-162	-160	-155	-138			
128a	-164	-169	-170	-170				-178	-183	-184	-184				
128b			-168	-164						-182	-178				
128c	-147	-159	-152	-153				-162	-174	-167	-168				
128d		-161	-169	-161					-176	-183	-176				
129a			-100	-108						-108	-116				
129b	-110	-114	-125	-147	-144			-118	-122	-133	-154	-151			
129c		-129	-122	-124					-136	-130	-132				
129d			-67	-87	-98					-75	-96	-106			
130a		-89							-89						
130b			-68	-87						-67	-87				
130c		-108	-118	-138					-107	-117	-138				
130d		-83	-73	-69					-82	-73	-68				

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
130e		-52	-56	-56					-52	-55	-55				
130f		-65	-58	-50					-65	-57	-50				
130g		-84	-86						-83	-86					
130h		-70	-97						-69	-97					
130i		-59	-82						-58	-81					
130j		-39	-39	-31					-39	-39	-30				
130k		-68							-67						
130l				-74							-74				
131a			-48	-49						-62	-63				
131b		-72	-65						-86	-79					
131c		-70	-74	-76					-84	-88	-90				
131d			-135	-150						-148	-163				
131e			-80							-93					
131f			-119	-73						-132	-87				
131g		-118							-131						
131h			-124							-137					
131i			-34	-40						-48	-55				
131j				-110							-123				
131k			-72	-81						-86	-94				
132a			-74							-87					
132b			-61							-75					
132c			-71							-84					
132d			-92	-96						-105	-109				
133a			-87							-94					
133b			-63	-65						-71	-73				
133c			-72							-79					
133d				-100							-107				
133e			-64							-72					
133f			-58							-66					
133g			-57							-64					
133h			-56	-64						-63	-72				
133i			-39	-26						-46	-34				
133j		-70		-88					-77		-95				
133k			-64	-62						-72	-70				
133l			-66	-76						-74	-84				
133m			-75	-81						-82	-89				
133n			-69	-75						-76	-82				
133o			-59	-39						-67	-46				
133p			-71							-78					

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
133q			-69	-59						-76	-67				
134a		-117	-141	-126					-137	-160	-146				
134aa		-113	-118	-101					-133	-138	-122				
134ab		-96	-112						-116	-132					
134ac		-111	-134						-131	-154					
134ad		-125	-115						-145	-135					
134ae		-116	-113	-106					-136	-133	-126				
134af			-141	-117						-160	-137				
134ag			-134	-120						-154	-140				
134ah			-122	-131						-141	-151				
134ai		-136	-156	-150					-156	-175	-170				
134aj		-135	-147	-128					-155	-167	-148				
134ak		-136	-136	-113					-156	-156	-133				
134al			-131	-107						-151	-127				
134am			-128	-123						-148	-143				
134an			-133	-117						-153	-137				
134ao			-151	-156						-171	-175				
134ap			-130	-111						-150	-131				
134aq		-148	-118						-168	-138					
134ar		-124	-133	-126					-144	-153	-146				
134as			-118	-113						-138	-133				
134at		-164	-165	-145					-183	-184	-164				
134au		-120	-180	-177					-140	-199	-196				
134av		-116	-132	-134					-136	-152	-154				
134aw		-149	-166	-170					-169	-185	-188				
134ax		-181	-175	-165					-200	-194	-184				
134ay		-154	-181	-188					-173	-200	-206				
134az		-149	-166	-170					-169	-185	-188				
134b		-101	-142	-145					-122	-161	-164				
134ba		-142	-142	-135					-161	-161	-155				
134bb		-100	-100						-121	-121					
134bc		-107	-115	-110					-127	-135	-130				
134bd		-96	-103						-116	-124					
134be		-129	-139	-142					-149	-158	-161				
134bf		-118	-148	-147					-138	-168	-167				
134bg		-124	-147	-146					-144	-167	-165				
134bh		-103	-104	-99					-124	-125	-120				
134bi		-108	-110	-100					-128	-130	-121				
134bj			-134	-136						-154	-156				

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	εC25/ MAP	εC27/ MAP	εC29/ MAP	εC31/ MAP	εC33/ MAP	εC35/ MAP	εC27-31/MAP	εC25/ MGP	εC27/ MGP	εC29/ MGP	εC31/ MGP	εC33/ MGP	εC35/ MGP	εC27-31/MGP	ACL
134c			-154	-161						-173	-180				
134d			-167	-158						-186	-177				
134e		-134	-115	-100					-154	-135	-121				
134f			-122	-127						-141	-147				
134g		-140	-133						-159	-153					
134h		-128	-128						-148	-148					
134i			-144	-124						-163	-144				
134j		-127	-127						-147	-147					
134k		-134	-113						-154	-133					
134l		-140	-119						-159	-139					
134m		-151	-119						-171	-139					
134n		-138	-128	-123					-157	-148	-143				
134o		-132	-122	-119					-152	-141	-139				
134p		-145	-136	-128					-164	-156	-148				
134q		-139	-124	-122					-158	-144	-141				
134r		-139	-123	-126					-158	-143	-146				
134s			-131	-125						-151	-145				
134t			-133							-153					
134u			-144							-163					
134v			-126							-146					
134w			-133							-153					
134x			-134							-154					
134y		-143	-155	-136					-162	-174	-156				
134z		-112	-110	-94					-132	-130	-114				
135a		-79		-64					-96		-81				
135b		-86	-103	-123					-102	-120	-139				
135c		-90							-106						
135d		-121	-125	-106					-137	-141	-122				
135e		-105	-121	-102					-122	-137	-118				
136a		-105	-109	-83					-125	-129	-103				
136b		-99	-109	-71					-119	-129	-92				
136c		-127	-142	-80					-147	-161	-100				
136d		-100	-108	-115					-120	-128	-134				
136e		-104	-115						-124	-134					
137a		-157	-135						-180	-159					
138a		-102	-93	-86					-124	-115	-109				
138b		-122	-110	-112					-143	-132	-134				
186a															29
187a															29

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
188a															28
189a															28
190a															29
191a															29
192a															28
193a															29
194a															29
195a															28
196a															29
197a															29
198a															30
199a															28
200a															30
201a															30
202a															30
203a															30
204a															30
205a															30
206a															30
207a															31
208a															30
209a															30
210a															30
211a															31
212a															30
213a															31
214a															30
215a															31
216a															29
217a															31
218a															30
219a															30
220a															31
221a															31
222a															30
223a															30
224a															30
225a															30
226a															32

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
227a															30
228a															30
229a															32
230a															32
231a															31
232a															30
233a															32
234a															31
235a															33
236a															30
237a															33
238a															29
239a															31
240a															30
240b															30
241a															30
242a															31
243a															30
244a															31
245a															31
246a															31
247a															31
248a															32
249a															31
250a															31
251a															32
252a															31
253a															30
254a															30
255a															31
256a															
256b															
257a															
257b															
258a															
258b															
259a															
259b															
260a															

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
260b															
261a															
261b															
261c															
261d															
261e															
262a															
262b															
262c															
263a															
263b															
263c															
264a															
264b															
264c															
265a															
265b															
265c															
266a															
266b															
267a															
267b															
267c															
268a															
268b															
268c															
268d															
268e															
268f															
268g															
268h															
268i															
268j															
268k															
268l															
269a															
269b															
269c															
270a															

Appendix B. *n*-alkanes in US analysis

Table 13 continued. Hydrogen Apparent Fractionation and *n*-alkane compound data

Sample Name	$\varepsilon_{C25/MAP}$	$\varepsilon_{C27/MAP}$	$\varepsilon_{C29/MAP}$	$\varepsilon_{C31/MAP}$	$\varepsilon_{C33/MAP}$	$\varepsilon_{C35/MAP}$	$\varepsilon_{C27-31/MAP}$	$\varepsilon_{C25/MGP}$	$\varepsilon_{C27/MGP}$	$\varepsilon_{C29/MGP}$	$\varepsilon_{C31/MGP}$	$\varepsilon_{C33/MGP}$	$\varepsilon_{C35/MGP}$	$\varepsilon_{C27-31/MGP}$	ACL
270b															
270c															
270d															
270e															
271a															
271b															
271c															
271d															
272a															
272b															
272c															
273a															
273b															
273c															
273d															
274a															
275a															
275b															
275c															
275d															
275e															
275f															
276a															
277a															
278a															
279a															
280a															
280b															
281a															
281b															
281c															
282a															
283a															
283b															
284a															
284b															
284c															
284d															
284e															

Appendix B. *n*-alkanes in US analysis

Table 14. Water use efficacy (WUE), Carbon discrimination between lipid/bulk and atmosphere ($\Delta leaf_{C29/atm}$ or $\Delta leaf_{bulk/atm}$)

Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$
1a	128	22		15b	93	24		30b			20
1b	58	26	22	15c			21	31a	40	27	23
2a	-2	30		15d			20	31b	134	21	18
2b	22	29	24	16a	86	24		32a			18
3a	76	25		16b	128	22		32b			17
3b			26	16c			22	35a			17
3c	23	29	24	16d			20	36a	80	25	20
4a	42	27		17a	59	26		36b			20
4b	-10	31	23	17b	20	29	25	37a			20
5a	95	24		17c	-5	30	25	38a	74	25	
5b	111	23		17d	82	25	21	38b			18
5c			22	18a	100	24		38c	114	23	19
5d			22	18b			24	39a			
5e	2	30	24	18c	48	27	22	39b	111	23	
6a	40	27	25	18d	101	24	20	39c			21
7a	116	23		19a	91	24		40a			18
7b			19	19b			22	41a			20
7c			20	19c	47	27	23	42a			
8a	42	27		19d	93	24	20	42b	70	26	
8b			21	20a	73	25		42c	57	26	23
9a	7	30		20b	108	23	21	42d	101	24	19
9b	48	27	23	20c	58	26	20	43a	70	26	
9c	61	26	22	20d			19	43b			17
10a	45	27		21a				44a	119	22	19
10b	23	29	24	21b	116	23		45a	95	24	22
10c	61	26	20	21c			22	46a	85	25	
11a			20	21d	114	23	20	46b			22
11b	48	27	22	22a	101	24		47a	108	23	20
11c	58	26	20	22b			19	48a	115	23	20
12a	57	26	20	23a	40	27	23	49a	40	27	23
13a	33	28		23b			20	49b			20
13b	-10	31	24	24a			18	50a	103	23	
13c	48	27	21	25a	128	22	19	50b	48	27	21
13d	80	25	16	26a	147	21	17	50c	89	24	21
14a				27a	141	21	18	51a	146	21	
14b			22	28a	65	26	23	51b			20
14c	85	25	21	28b	95	24	22	51c			19
14d	91	24	20	29a	101	24	19	53a	118	22	
15a	64	26		30a				53b	114	23	

Table 14 continued. WUE, Δ$leaf_{C29/atm}$, and Δ$leaf_{bulk/atm}$

Sample Name	WUE	Δleaf C29/atm	Δleaf bulk/atm	Sample Name	WUE	Δleaf C29/atm	Δleaf bulk/atm	Sample Name	WUE	Δleaf C29/atm	Δleaf bulk/atm
53c	-19	31	25	73a			21	90b	63	26	22
53d	85	25	23	74a			21	90c	91	24	24
54a	80	25		74b	40	27	22	90d			23
54b	-32	32	24	74c	101	24		91a	81	25	
54c	80	25	22	74d			21	91b	27	28	24
55a	90	24		75a				91c			21
55b	82	25	20	75b	95	24		91d	80	25	23
56a			18	76a			20	92a	96	24	
57a	42	27		76b	82	25	19	92b	42	27	23
58a			21	78a			23	92c	75	25	24
59a			21	79a			21	92d			23
59b			21	81a	35	28	23	93a	18	29	
60a			21	82a	68	26		93b	50	27	24
60b			22	82b	8	29	25	93c			20
61a			21	82c			23	93d			23
61b			19	83a	101	24		94a	50	27	23
61c	42	27	20	83b	83	25	21	94b			20
62a	81	25	20	83c			20	94c			18
63a	109	23		84a	101	24		95a	91	24	
63b	109	23	19	84b	96	24	21	95b	53	27	22
63c	88	24	19	84c			21	95c			20
64a	111	23		85a	71	25		95e			21
64b			19	85b			22	96a	86	24	
65a			20	85c			20	96b	17	29	23
65b			19	86a	45	27		96c			21
66a	69	26		86b			23	96d	88	24	21
66b	81	25	20	86c			20	97a	76	25	
67a			20	87a	86	24		97b	88	24	21
67b			18	87b	25	28	23	97c			22
68a			22	87c			21	97d			21
68b			20	88a	28	28	22	98a	85	25	
69a			20	88b			21	98b			22
69b			19	88c	108	23	20	99a	103	23	
70a			21	88d			22	99b	71	25	22
71a	114	23		89a	93	24	21	99c			23
71b			21	89b			18	99d			23
71c	105	23	20	89c	85	25	24	100a	96	24	
72a			21	89d			22	100b	86	24	20
72b	58	26	21	90a	68	26		100c	67	26	20

Appendix B. *n*-alkanes in US analysis

Table 14 continued. WUE, Δleaf$_{C29/atm}$, and Δleaf$_{bulk/atm}$

Sample Name	WUE	Δleaf C29/atm	Δleaf bulk/atm	Sample Name	WUE	Δleaf C29/atm	Δleaf bulk/atm	Sample Name	WUE	Δleaf C29/atm	Δleaf bulk/atm
100d			21	111a	40	27		122d			
101a	55	26		111b	29	28	23	122e			
101b	20	29	24	111c			21	122f			
101c			20	111d			23	123a			
101d			22	112a	66	26		123b			
102a	80	25		112b			25	123c			
102b	66	26	22	112c	64	26	22	123d			
102c			21	112d			21	123e			
102d			22	112e			22	123f			
103a	65	26		113a				124a			
103b	44	27	23	113b	23	29	25	124b			
103c			24	113c			21	124c			
103d			22	113d			24	124d			
104a	75	25		114a	15	29		124e			
104b	37	28	23	114b			21	124f			
104c	88	24	21	114c			21	124g			
104d			23	114d			24	125a			
104e			22	115a	37	28		125b			
104f			23	115b	23	29	23	125c			
105a	47	27		115c			24	126a			
105b			21	115d			21	126b			
105c			22	115e			23	126c			
105d			22	115f			24	127a			
106a	100	24		116a	30	28		127b			
106b	43	27	22	116b	-15	31	24	127c			
106c			22	116c			19	127d			
106d			21	117a	68	26	21	127e			
106e			24	117b			19	128a			
107a	38	28		117c			22	128b			
107b	36	28	22	118a	42	27		128c			
107c			21	118b			23	128d			
107d			22	118c			20	129a			
108a	58	26		119a	60	26		129b			
108b	42	27	24	119b	15	29	24	129c			
108c			22	120a			18	129d			
108d			22	121a			21	130a			
109a	52	27		122a				130b			
109b			21	122b				130c			
110a	53	27	23	122c				130d			

Appendix B. *n*-alkanes in US analysis

Table 14 continued. WUE, $\Delta leaf_{C29/atm}$, and $\Delta leaf_{bulk/atm}$

Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$
130e				133q				134c			
130f				134a				134d			
130g				134aa				134e			
130h				134ab				134f			
130i				134ac				134g			
130j				134ad				134h			
130k				134ae				134i			
130l				134af				134j			
131a				134ag				134k			
131b				134ah				134l			
131c				134ai				134m			
131d				134aj				134n			
131e				134ak				134o			
131f				134al				134p			
131g				134am				134q			
131h				134an				134r			
131i				134ao				134s			
131j				134ap				134t			
131k				134aq				134u			
132a				134ar				134v			
132b				134as				134w			
132c				134at				134x			
132d				134au				134y			
133a				134av				134z			
133b				134aw				135a			
133c				134ax				135b			
133d				134ay				135c			
133e				134az				135d			
133f				134b				135e			
133g				134ba				136a			
133h				134bb				136b			
133i				134bc				136c			
133j				134bd				136d			
133k				134be				136e			
133l				134bf				137a			
133m				134bg				138a			
133n				134bh				138b			
133o				134bi				139a	66	26	
133p				134bj				139b	40	27	

Appendix B. *n*-alkanes in US analysis

Table 14 continued. WUE, $\Delta leaf_{C29/atm}$, and $\Delta leaf_{Bulk/atm}$

Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$
139c	57	26		151a	12	29		162b	82	25	
139d	55	26		151b	51	27		162c	115	23	
139e	78	25	19	151c	92	24		162d	74	25	17
140a	151	20		151d	53	27	19	163a			
140b	185	18		152a	42	27		163b	31	28	
140c	65	26		152b	79	25		163c	77	25	
140d	111	23	14	152c	98	24	18	163d	71	25	18
141a	46	27		153a	55	26		164a	69	26	
141b	44	27		153b	72	25		164b	85	25	
141c	96	24	13	153c	112	23		164c	68	26	18
142a	58	26		153s			19	165a	77	25	
142b	78	25	18	154a				165b	86	25	18
143a	17	29		154b	76	25		166a	37	28	
143b	71	25	17	154c	75	25	19	166b	30	28	
144a	-10	31		155a	33	28		166c	73	25	18
144b	75	25		155b	101	24		167a	46	27	
144c	78	25		155c	80	25	18	167b	56	26	
144d	104	23		156a	71	25		167c	59	26	19
144e	66	26	19	156b	95	24		168a	27	28	
145a	-15	31		156c	171	19		168b	48	27	
145b	68	26		157a	25	28		168c	58	26	19
145c	108	23	15	157b	79	25		169a	36	28	
146a	56	26		157c	82	25	16	169b	89	24	
146b	52	27		158a	47	27		169c	84	25	16
146c	89	24	17	158b	61	26		170a	140	21	
147a	61	26		158c	104	23		170b	142	21	
147b	22	29		158d	63	26	18	171a	36	28	
147c	72	25	18	159a	65	26		171b	38	28	
148a	46	27		159b	66	26		171c	39	27	
148b	44	27		159c				171d	81	25	19
148c	96	24	18	159d	65	26	16	172a	190	18	
149a	0	30		160a	59	26		172b	78	25	
149b	62	26		160b	51	27		172c	96	24	18
149c	75	25		160c	87	24		173a	57	26	
149d	64	26	19	160d	93	24		173b	93	24	
150a	62	26		160e	88	24		173c	117	22	17
150b	97	24		160f	79	25	18	174a	96	24	
150c	72	25		161a	64	26		174b	126	22	
150d	105	23	17	162a	87	24		174c	140	21	17

Appendix B. *n*-alkanes in US analysis

Table 14 continued. WUE, $\Delta leaf_{C29/atm}$, and $\Delta leaf_{Bulk/atm}$

Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$
175a	79	25		190a			20	229a			15
175b	94	24		191a			19	230a			14
175c	97	24	17	192a			20	231a			16
176a	71	25		193a			19	232a			8
176b	103	23		194a			19	233a			17
176c	91	24	17	195a			17	234a			12
177a	192	18		196a			19	235a			15
177b	97	24		197a			17	236a			12
177c	71	25	16	198a			16	237a			16
178a	73	25		199a			13	238a			9
178b	80	25		200a			14	239a			16
178c	88	24	15	201a			15	240a			19
179a	78	25		202a			16	240b			20
179b	103	23		203a			16	241a			13
179c	64	26		204a			14	242a			16
179d	69	26	15	205a			12	243a			13
179e				206a			17	244a			17
180a	47	27		207a			15	245a			16
180b	122	22		208a			14	246a			17
180c	74	25	18	209a			15	247a			16
181a	161	20		210a			18	248a			17
181b	219	16		211a			14	249a			17
181c	148	21		212a			18	250a			12
182a	85	25		213a			17	251a			13
182b	85	25		214a			17	252a			15
182c	81	25		215a			11	253a			8
183a	49	27		216a			13	254a			17
183b	102	23		217a			13	255a			9
183c	91	24	18	218a			9	256a			19
184a	26	28		219a			11	256b			18
184b	75	25		220a			10	257a			20
185a	61	26		221a			13	257b			19
185b	30	28		222a			14	258a			20
185c	100	24		223a			13	258b			21
185d	92	24	16	224a			13	259a			19
186a			21	225a			9	259b			18
187a			22	226a			6	260a			21
188a			19	227a			15	260b			19
189a			20	228a			17	261a			21

Appendix B. *n*-alkanes in US analysis

Table 14 continued. WUE, $\Delta leaf_{C29/atm}$, and $\Delta leaf_{Bulk/atm}$

Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$	Sample Name	WUE	$\Delta leaf_{C29/atm}$	$\Delta leaf_{bulk/atm}$
261b			22	270d			14
261c			23	270e			15
261d			21	271a			17
261e			19	271b			17
262a			16	271c			15
262b			16	271d			15
262c			20	272a			18
263a			16	272b			19
263b			17	272c			15
263c			19	273a			
264a			18	273b			
264b			16	273c			
264c			20	273d			
265a			18	274a			
265b			16	275a			
265c			19	275b			
266a			16	275c			
266b			19	275d			
267a			16	275e			
267b			16	275f			
267c			20	276a			
268a			23	277a			
268b			23	278a			
268c			24	279a			
268d			22	280a			
268e			24	280b			
268f			23	281a			
268g			23	281b			
268h			23	281c			
268i			24	282a			
268j			26	283a			
268k			24	283b			
268l			21	284a			
269a			16	284b			
269b			15	284c			
269c			14	284d			
270a			18	284e			
270b			18				
270c			15				

Appendix B. *n*-alkanes in US analysis

Table 15. Relationships between isotopic compositions, ACL, WUE of *n*-alkanes to climatic variables

y-axis	x-axis	Forbs		Angiosperm Shrubs		Angiosperm Trees		Gymnosperm Trees	
		r^2 value	p value	r^2 value	p value	r^2 value	p value	r^2 value	p value
δD C_{29}	Latitude	0.47	0.01	0.26	0.00	0.36	0.00	0.27	0.00
δD C_{29}	Longitude	0.42	0.01	0.03		0.21		0.01	
δD C_{29}	Elevation	0.16		0.10		0.02		0.12	
δD C_{29}	An PPT	0.21		0.05		0.04		0.11	
δD C_{29}	An VPD	0.25		0.19		0.30	0.00	0.14	
δD C_{29}	PET	0.33	0.03	0.22		0.51	0.00	0.24	
δD C_{29}	MAT	0.32	0.03	0.28	0.00	0.59	0.00	0.28	0.00
δD C_{29}	An RH	0.22		0.04		0.06		0.00	
δ^{13}C C_{29}	Latitude			0.11		0.04		0.00	
δ^{13}C C_{29}	Longitude			0.10		0.04		0.00	
δ^{13}C C_{29}	Elevation			0.04		0.03		0.41	0.00
δ^{13}C C_{29}	An PPT			0.07		0.04		0.04	
δ^{13}C C_{29}	An VPD			0.08		0.02		0.17	
δ^{13}C C_{29}	PET			0.08		0.08		0.20	
δ^{13}C C_{29}	MAT			0.09		0.08		0.36	0.00
δ^{13}C C_{29}	An RH			0.01		0.00		0.08	
δ^{13}C Bulk Carbon	Latitude			0.64	0.03	0.04		0.00	
δ^{13}C Bulk Carbon	Longitude			0.03		0.04		0.23	
δ^{13}C Bulk Carbon	Elevation			0.36	0.16	0.13		0.40	0.00
δ^{13}C Bulk Carbon	An PPT			0.53	0.06	0.02		0.27	0.98
δ^{13}C Bulk Carbon	An VPD			0.25		0.04		0.09	
δ^{13}C Bulk Carbon	PET			0.14		0.02		0.00	
δ^{13}C Bulk Carbon	MAT			0.04		0.39	0.77	0.06	
δ^{13}C Bulk Carbon	An RH			0.16		0.14		0.33	0.00
$\varepsilon_{C29/MAP}$	Latitude	0.61	0.00	0.03		0.19		0.22	
$\varepsilon_{C29/MAP}$	Longitude	0.63	0.00	0.16		0.64	0.00	0.43	0.00
$\varepsilon_{C29/MAP}$	Elevation	0.42	0.01	0.04		0.07		0.15	
$\varepsilon_{C29/MAP}$	An PPT	0.44	0.01	0.25		0.14		0.00	
$\varepsilon_{C29/MAP}$	An VPD	0.41	0.01	0.11		0.46	0.00	0.24	
$\varepsilon_{C29/MAP}$	PET	0.54	0.00	0.07		0.45	0.00	0.13	
$\varepsilon_{C29/MAP}$	MAT	0.36	0.02	0.02		0.32	0.00	0.02	
$\varepsilon_{C29/MAP}$	An RH	0.44	0.01	0.15		0.30	0.00	0.43	0.00
$\varepsilon_{C29/MGP}$	Latitude	0.66	0.00	0.10		0.26	0.00	0.28	0.00
$\varepsilon_{C29/MGP}$	Longitude	0.64	0.00	0.21		0.66	0.00	0.50	0.00
$\varepsilon_{C29/MGP}$	Elevation	0.41	0.01	0.00		0.05		0.06	
$\varepsilon_{C29/MGP}$	Growing PPT	0.22		0.13		0.09		0.43	0.00
$\varepsilon_{C29/MGP}$	Growing VPD	0.27	0.06	0.08		0.26	0.00	0.34	0.00
$\varepsilon_{C29/MGP}$	MGT	0.10		0.02		0.05		0.00	
$\varepsilon_{C29/MGP}$	Growing RH	0.40	0.02	0.12		0.34	0.00	0.39	0.00

* Highlighted red cells are for r^2 values greater than 0.25, the green cells are p-values less than 0.05

Appendix B. *n*-alkanes in US analysis

Table 15 continued. Relationships between isotopic compositions, ACL, WUE of *n*-alkanes to climatic variables

y-axis	x-axis	Forbs		Angiosperm Shrubs		Angiosperm Trees		Gymnosperm Trees	
		r^2 value	p value	r^2 value	p value	r^2 value	p value	r^2 value	p value
WUE	Latitude			0.11		0.04		0.00	
WUE	Longitude			0.10		0.04		0.00	
WUE	Elevation			0.04		0.03		0.41	0.00
WUE	An PPT			0.07		0.04		0.04	
WUE	An VPD			0.08		0.02		0.17	
WUE	PET			0.08		0.08		0.20	
WUE	MAT			0.09		0.08		0.36	0.00
WUE	An RH			0.01		0.00		0.08	
WUE	Growing PPT			0.10		0.00		0.01	
WUE	Growing VPD			0.04		0.01		0.01	
WUE	MGT			0.05		0.00		0.14	
WUE	Growing RH			0.01		0.00		0.10	
$\Delta leaf_{bulk\text{-}atm}$	Latitude			0.64	0.03	0.04		0.00	
$\Delta leaf_{bulk\text{-}atm}$	Longitude			0.03		0.04		0.23	
$\Delta leaf_{bulk\text{-}atm}$	Elevation			0.36	0.16	0.13		0.40	0.00
$\Delta leaf_{bulk\text{-}atm}$	An PPT			0.53	0.06	0.02		0.27	0.00
$\Delta leaf_{bulk\text{-}atm}$	An VPD			0.25		0.04		0.09	
$\Delta leaf_{bulk\text{-}atm}$	PET			0.15		0.02		0.00	
$\Delta leaf_{bulk\text{-}atm}$	MAT			0.39	0.13	0.04		0.06	
$\Delta leaf_{bulk\text{-}atm}$	An RH			0.16		0.14		0.33	0.00
$\Delta leaf_{bulk\text{-}atm}$	Growing PPT			0.19		0.10		0.12	
$\Delta leaf_{bulk\text{-}atm}$	Growing VPD			0.16		0.07		0.10	
$\Delta leaf_{bulk\text{-}atm}$	MGT			0.10		0.04		0.14	
$\Delta leaf_{bulk\text{-}atm}$	Growing RH			0.01		0.12		0.33	0.00
$\Delta leaf_{C29\text{-}atm}$	Latitude			0.11		0.04		0.00	
$\Delta leaf_{C29\text{-}atm}$	Longitude			0.10		0.04		0.00	
$\Delta leaf_{C29\text{-}atm}$	Elevation			0.04		0.03		0.41	0.00
$\Delta leaf_{C29\text{-}atm}$	An PPT			0.07		0.04		0.04	
$\Delta leaf_{C29\text{-}atm}$	An VPD			0.08		0.02		0.17	
$\Delta leaf_{C29\text{-}atm}$	PET			0.08		0.08		0.20	
$\Delta leaf_{C29\text{-}atm}$	MAT			0.09		0.08		0.36	0.00
$\Delta leaf_{C29\text{-}atm}$	An RH			0.01		0.00		0.08	
$\Delta leaf_{C29\text{-}atm}$	Growing PPT			0.10		0.00		0.01	
$\Delta leaf_{C29\text{-}atm}$	Growing VPD			0.04		0.01		0.01	
$\Delta leaf_{C29\text{-}atm}$	MGT			0.05		0.00		0.14	
$\Delta leaf_{C29\text{-}atm}$	Growing RH			0.01		0.00		0.10	

* Highlighted red cells are for r^2 values greater than 0.25, the green cells are p-values less than 0.05

Appendix B. *n*-alkanes in US analysis

Table 15 continued. Relationships between isotopic compositions, ACL, WUE of *n*-alkanes to climatic variables

y-axis	x-axis	Forbs		Angiosperm Shrubs		Angiosperm Trees		Gymnosperm Trees	
		r^2 value	p value	r^2 value	p value	r^2 value	p value	r^2 value	p value
ACL	Latitude			0.03		0.27	0.00	0.05	
ACL	Longitude			0.00		0.00		0.04	
ACL	Elevation			0.01		0.09		0.07	
ACL	An PPT			0.01		0.08		0.09	
ACL	An VPD			0.06		0.18		0.02	
ACL	PET			0.07		0.30	0.00	0.05	
ACL	MAT			0.04		0.33	0.00	0.08	
ACL	An RH			0.05		0.11		0.07	
ACL	Growing PPT			0.03		0.33	0.00	0.11	
ACL	Growing VPD			0.08		0.02		0.01	
ACL	MGT			0.06		0.21		0.07	
ACL	Growing RH			0.06		0.08		0.07	
$\delta^{13}C$ C_{29}	δD C_{29}			0.00		0.04		0.23	
δD C_{29}	δD_{MAP}	0.13		0.14		0.01		0.11	
δD C_{29}	δD_{MGP}	0.35	0.03	0.08		0.03		0.05	
$\Delta leaf_{C29\text{-}atm}$	$\varepsilon_{C29/MAP}$			0.02		0.02		0.01	

* Highlighted red cells are for r^2 values greater than 0.25, the green cells are p-values less than 0.05

Appendix B. *n*-alkanes in US analysis

Table 15 continued. Relationships between isotopic compositions, ACL, WUE of *n*-alkanes to climatic variables

y-axis	x-axis	C_3 Grasses		C_4 Grasses		Soils	
		r^2 value	p value	r^2 value	p value	r^2 value	p value
δD C_{29}	Latitude	0.40	0.00	0.19		0.51	0.00
δD C_{29}	Longitude	0.11		0.29	0.00	0.01	
δD C_{29}	Elevation	0.05		0.00		0.32	0.00
δD C_{29}	An PPT	0.02		0.19		0.34	0.00
δD C_{29}	An VPD	0.17		0.00		0.20	
δD C_{29}	PET	0.30	0.00	0.01		0.43	0.00
δD C_{29}	MAT	0.37	0.00	0.22		0.55	0.00
δD C_{29}	An RH	0.02		0.01		0.06	
$\delta^{13}C$ C_{29}	Latitude	0.05				0.09	
$\delta^{13}C$ C_{29}	Longitude	0.00				0.02	
$\delta^{13}C$ C_{29}	Elevation	0.01				0.09	
$\delta^{13}C$ C_{29}	An PPT	0.01				0.10	
$\delta^{13}C$ C_{29}	An VPD	0.01				0.00	
$\delta^{13}C$ C_{29}	PET	0.01				0.06	
$\delta^{13}C$ C_{29}	MAT	0.01				0.12	
$\delta^{13}C$ C_{29}	An RH	0.02				0.12	
$\delta^{13}C$ Bulk Carbon	Latitude					0.14	
$\delta^{13}C$ Bulk Carbon	Longitude					0.01	
$\delta^{13}C$ Bulk Carbon	Elevation					0.06	
$\delta^{13}C$ Bulk Carbon	An PPT					0.00	
$\delta^{13}C$ Bulk Carbon	An VPD					0.14	
$\delta^{13}C$ Bulk Carbon	PET					0.19	
$\delta^{13}C$ Bulk Carbon	MAT					0.18	
$\delta^{13}C$ Bulk Carbon	An RH					0.00	
$\varepsilon_{C29/MAP}$	Latitude	0.23		0.05		0.14	
$\varepsilon_{C29/MAP}$	Longitude	0.03		0.04		0.24	
$\varepsilon_{C29/MAP}$	Elevation	0.10		0.10		0.01	
$\varepsilon_{C29/MAP}$	An PPT	0.07		0.00		0.01	
$\varepsilon_{C29/MAP}$	An VPD	0.20		0.02		0.26	0.00
$\varepsilon_{C29/MAP}$	PET	0.16		0.01		0.14	
$\varepsilon_{C29/MAP}$	MAT	0.06		0.01		0.06	
$\varepsilon_{C29/MAP}$	An RH	0.21		0.03		0.15	
$\varepsilon_{C29/MGP}$	Latitude	0.30	0.00	0.10		0.20	
$\varepsilon_{C29/MGP}$	Longitude	0.02		0.02		0.22	
$\varepsilon_{C29/MGP}$	Elevation	0.06		0.12		0.01	
$\varepsilon_{C29/MGP}$	Growing PPT	0.06		0.03		0.12	
$\varepsilon_{C29/MGP}$	Growing VPD	0.19		0.01		0.09	
$\varepsilon_{C29/MGP}$	MGT	0.04		0.02		0.00	
$\varepsilon_{C29/MGP}$	Growing RH	0.14		0.03		0.06	

* Highlighted red cells are for r^2 values greater than 0.25, the green cells are p-values less than 0.05

Appendix B. *n*-alkanes in US analysis

Table 15 continued. Relationships between isotopic compositions, ACL, WUE of *n*-alkanes to climatic variables

y-axis	x-axis	C_3 Grasses		C_4 Grasses		Soils	
		r^2 value	p value	r^2 value	p value	r^2 value	p value
WUE	Latitude	0.05				0.09	
WUE	Longitude	0.00				0.02	
WUE	Elevation	0.02				0.09	
WUE	An PPT	0.01				0.10	
WUE	An VPD	0.01				0.00	
WUE	PET	0.01				0.07	
WUE	MAT	0.01				0.12	
WUE	An RH	0.02				0.13	
WUE	Growing PPT	0.00				0.02	
WUE	Growing VPD	0.00				0.03	
WUE	MGT	0.00				0.06	
WUE	Growing RH	0.01				0.10	
$\Delta leaf_{bulk-atm}$	Latitude					0.22	
$\Delta leaf_{bulk-atm}$	Longitude					0.07	
$\Delta leaf_{bulk-atm}$	Elevation					0.13	
$\Delta leaf_{bulk-atm}$	An PPT					0.06	
$\Delta leaf_{bulk-atm}$	An VPD					0.15	
$\Delta leaf_{bulk-atm}$	PET					0.24	
$\Delta leaf_{bulk-atm}$	MAT					0.27	0.00
$\Delta leaf_{bulk-atm}$	An RH					0.01	
$\Delta leaf_{bulk-atm}$	Growing PPT					0.24	
$\Delta leaf_{bulk-atm}$	Growing VPD					0.06	
$\Delta leaf_{bulk-atm}$	MGT					0.26	0.00
$\Delta leaf_{bulk-atm}$	Growing RH					0.03	
$\Delta leaf_{C29-atm}$	Latitude	0.05				0.09	
$\Delta leaf_{C29-atm}$	Longitude	0.00				0.02	
$\Delta leaf_{C29-atm}$	Elevation	0.02				0.09	
$\Delta leaf_{C29-atm}$	An PPT	0.00				0.10	
$\Delta leaf_{C29-atm}$	An VPD	0.01				0.00	
$\Delta leaf_{C29-atm}$	PET	0.01				0.07	
$\Delta leaf_{C29-atm}$	MAT	0.01				0.12	
$\Delta leaf_{C29-atm}$	An RH	0.02				0.13	
$\Delta leaf_{C29-atm}$	Growing PPT	0.00				0.02	
$\Delta leaf_{C29-atm}$	Growing VPD	0.00				0.03	
$\Delta leaf_{C29-atm}$	MGT	0.00				0.06	
$\Delta leaf_{C29-atm}$	Growing RH	0.01				0.10	

* Highlighted red cells are for r^2 values greater than 0.25, the green cells are p-values less than 0.05

Appendix B. *n*-alkanes in US analysis

Table 15 continued. Relationships between isotopic compositions, ACL, WUE of *n*-alkanes to climatic variables

y-axis	x-axis	C_3 Grasses		C_4 Grasses		Soils	
		r^2 value	p value	r^2 value	p value	r^2 value	p value
ACL	Latitude	0.00				0.31	0.00
ACL	Longitude	0.00				0.02	
ACL	Elevation	0.01				0.02	
ACL	An PPT	0.00				0.00	
ACL	An VPD	0.01				0.32	0.00
ACL	PET	0.00				0.36	0.00
ACL	MAT	0.02				0.30	0.00
ACL	An RH	0.00				0.02	
ACL	Growing PPT	0.00				0.14	
ACL	Growing VPD	0.01				0.13	
ACL	MGT	0.02				0.17	
ACL	Growing RH	0.00				0.00	
$\delta^{13}C$ C_{29}	δD C_{29}	0.02				0.06	
δD C_{29}	δD_{MAP}	0.30	0.00	0.18		0.42	0.00
δD C_{29}	δD_{MGP}	0.29	0.86	0.21		0.30	0.00
$\Delta leaf_{C29\text{-}atm}$	$\varepsilon_{C29/MAP}$	0.02				0.00	

* Highlighted red cells are for r^2 values greater than 0.25, the green cells are p-values less than 0.05

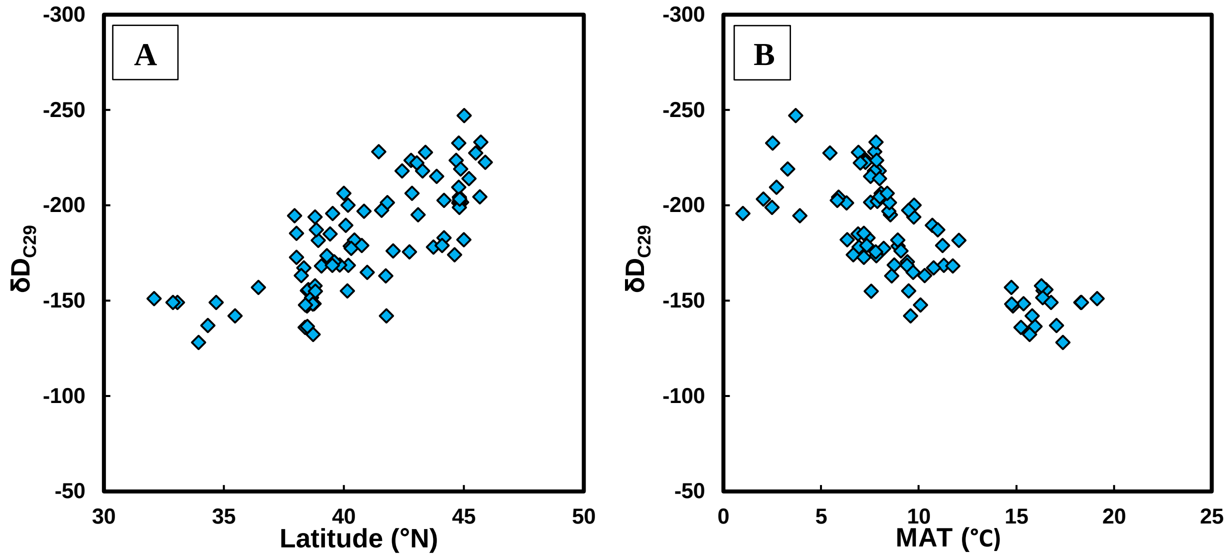

Figure 1. δD_{C29} of soils in the US is strongly correlated to both (A) latitude and (B) mean annual temperature.

Appendix B. *n*-alkanes in US analysis

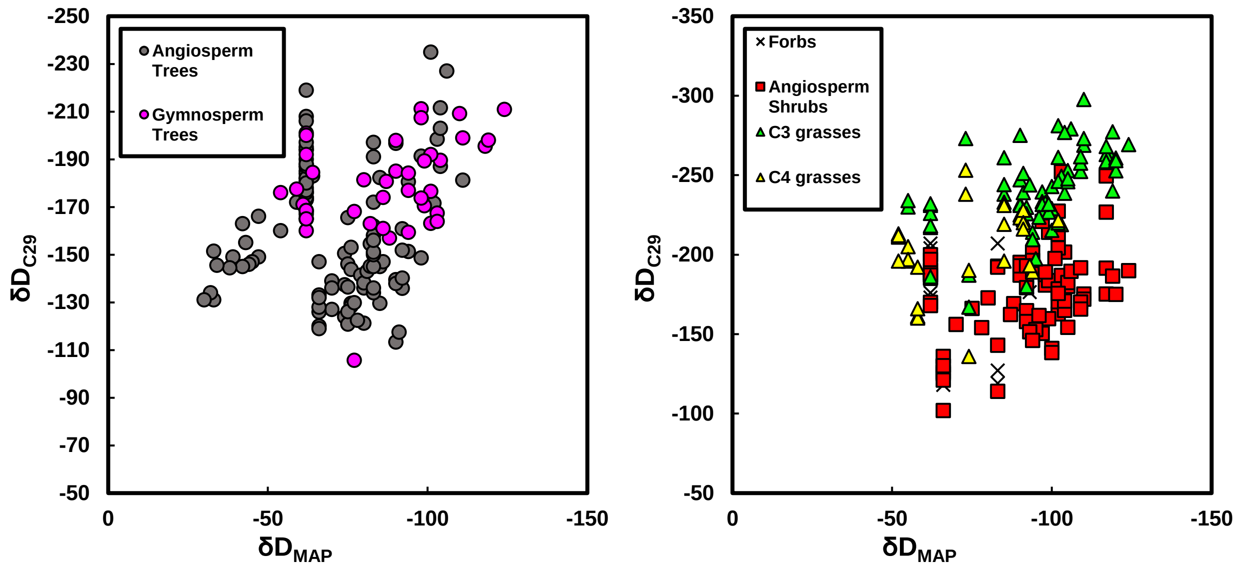

Figure 2. δD_{C29} of different growth habits (A) angiosperm and gymnosperm trees , (B) forbs, angiosperm shrubs, C_3 grasses, and C_4 grasses plotted against δD_{MAP}. We found that the relationships of δD_{C29} from the growth habits and δD_{MAP} was much weaker than other studies. This may be due to the wide range of climates and environments that the data was collected from.

Appendix B. *n*-alkanes in US analysis

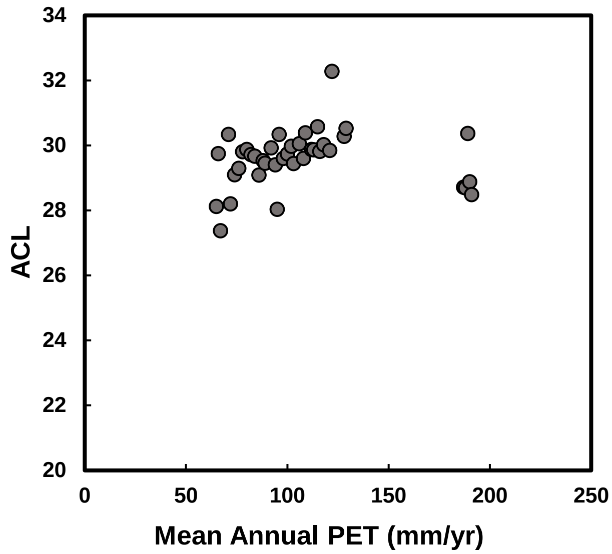

Figure 3. ACL of angiosperm trees correlated with mean annual potential evaporation transpiration and mean annual temperature.

Appendix B. *n*-alkanes in US analysis

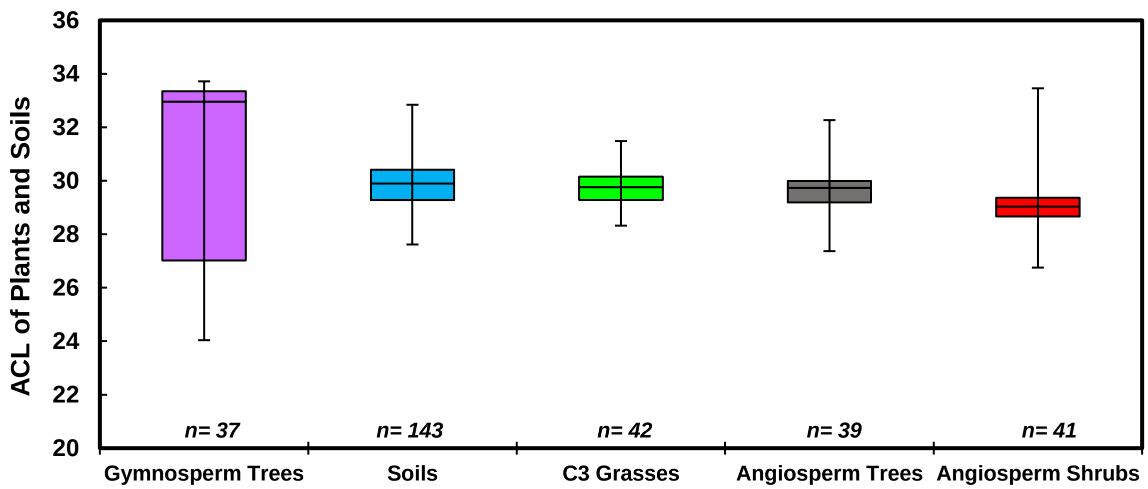

Figure 4. Box and whisker plot displaying the distribution of average chain lengths of the different growth haibts in the US. The boxes represent the first and third quartiles while the horizontal line represent the median of each group. The whiskers represent the range of values found in each group. We see that gymnosperm trees have the widest range of ACL values while all the other groupings have a much smaller range.

Appendix C: Climate Maps and Plant Isoscapes

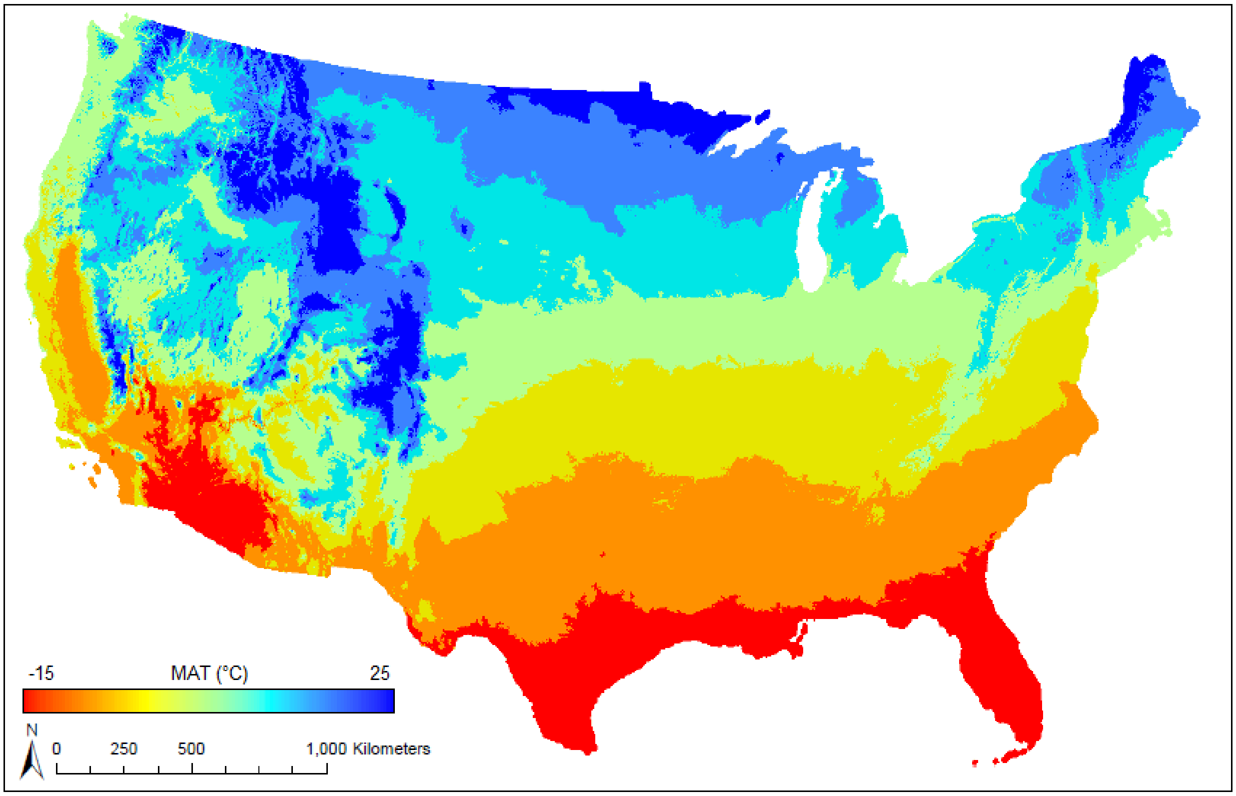

Figure 1. Modeled mean annual temperature (°C) from 30 year normal dataset (1981 to 2010) in the United States.

Appendix C: Climate Maps and Plant Isoscapes

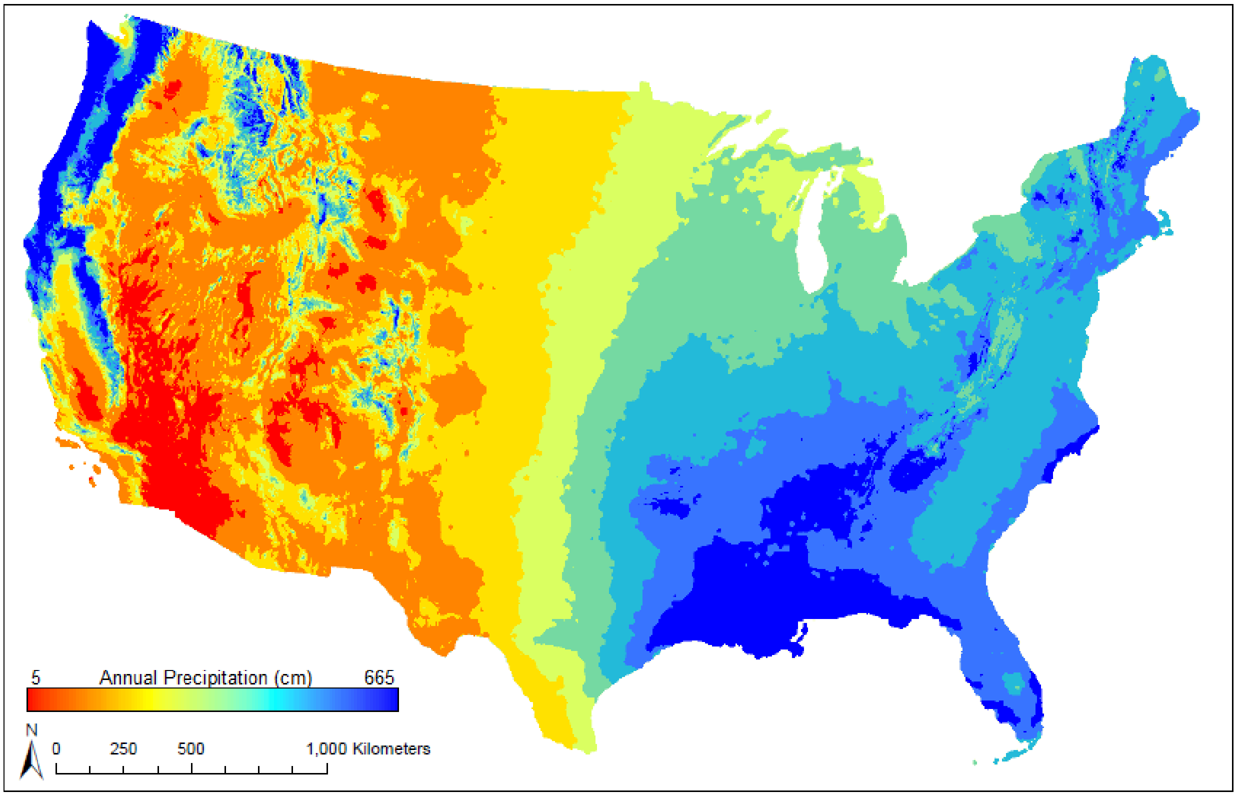

Figure 2. Modeled mean annual precipitation (cm) from 30 year normal dataset (1981 to 2010) in the United States.

Appendix C: Climate Maps and Plant Isoscapes

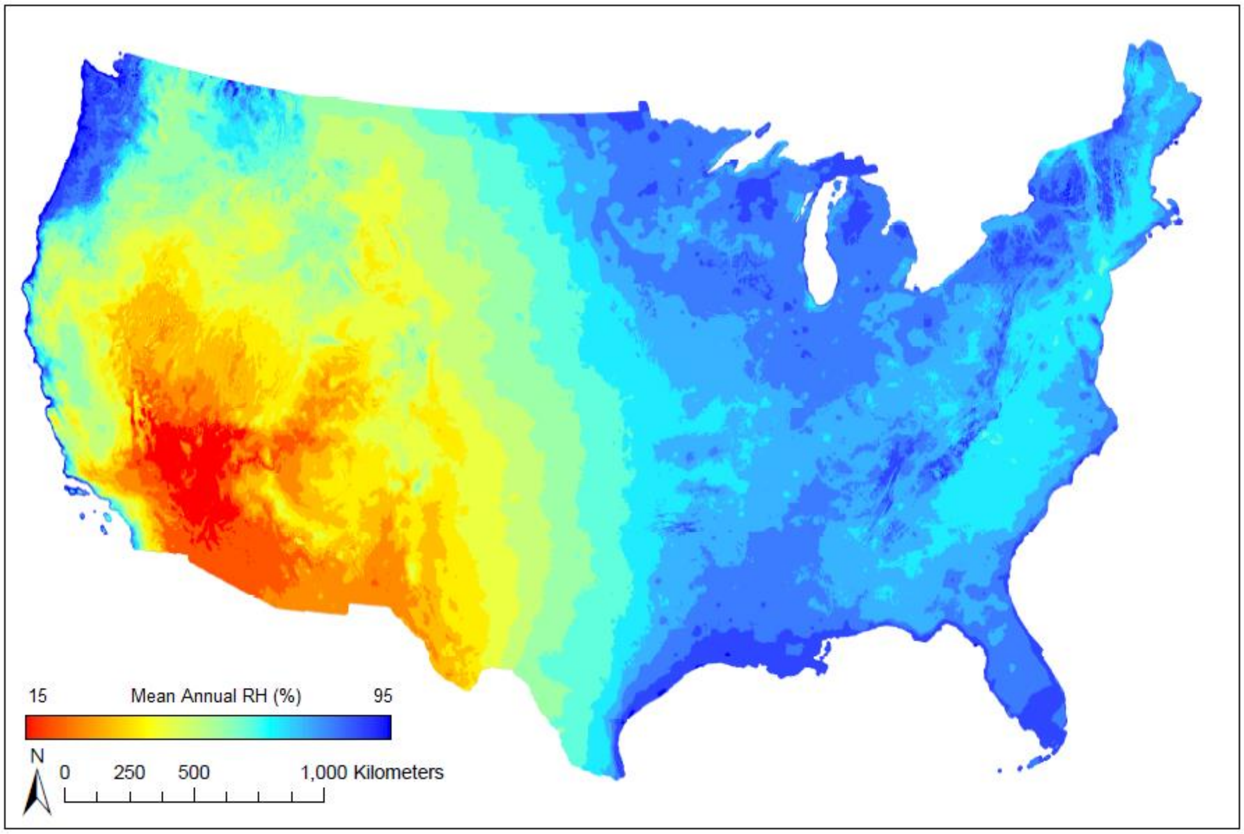

Figure 3. Modeled mean annual relative humidity (%) from 30 year normal dataset (1981 to 2010) in the United States.

Appendix C: Climate Maps and Plant Isoscapes

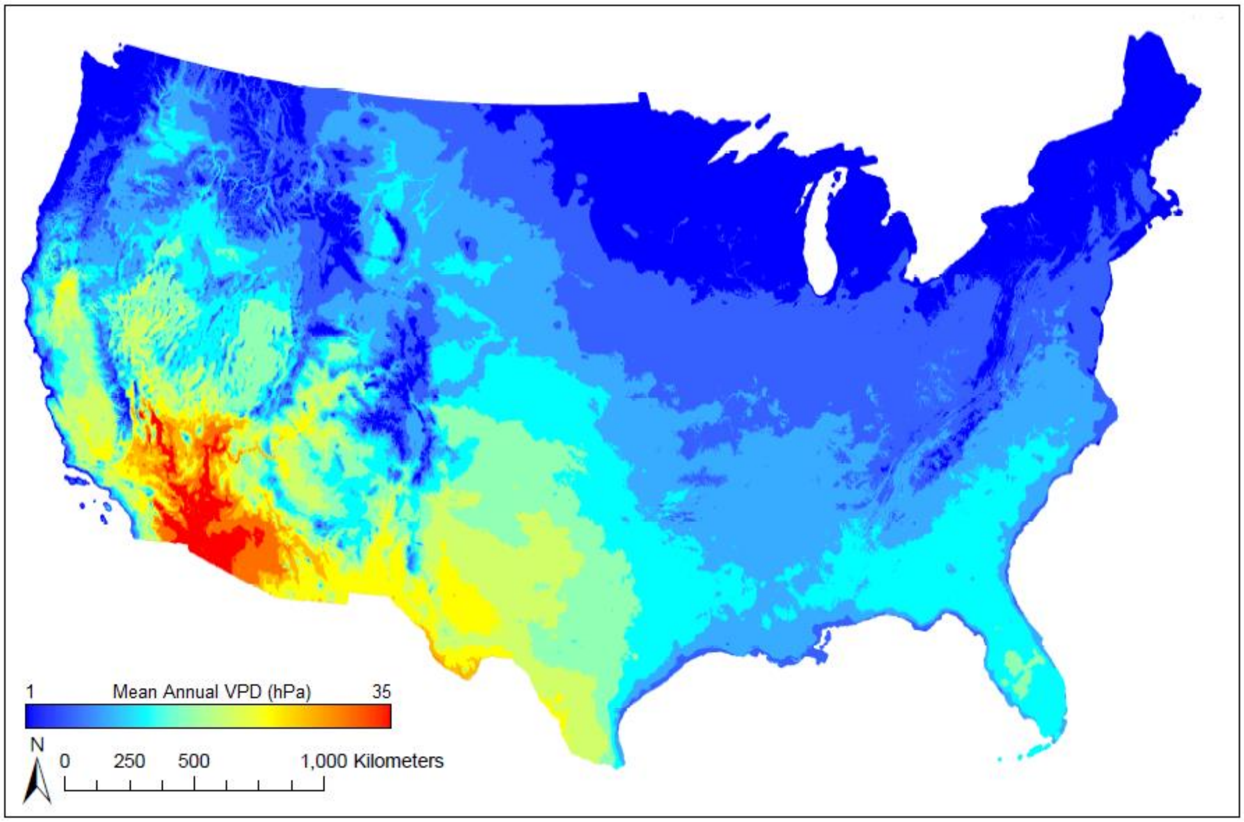

Figure 4. Modeled mean annual vapor pressure deficit (hPa) from 30 year normal dataset (1981 to 2010) in the United States.

Appendix C: Climate Maps and Plant Isoscapes

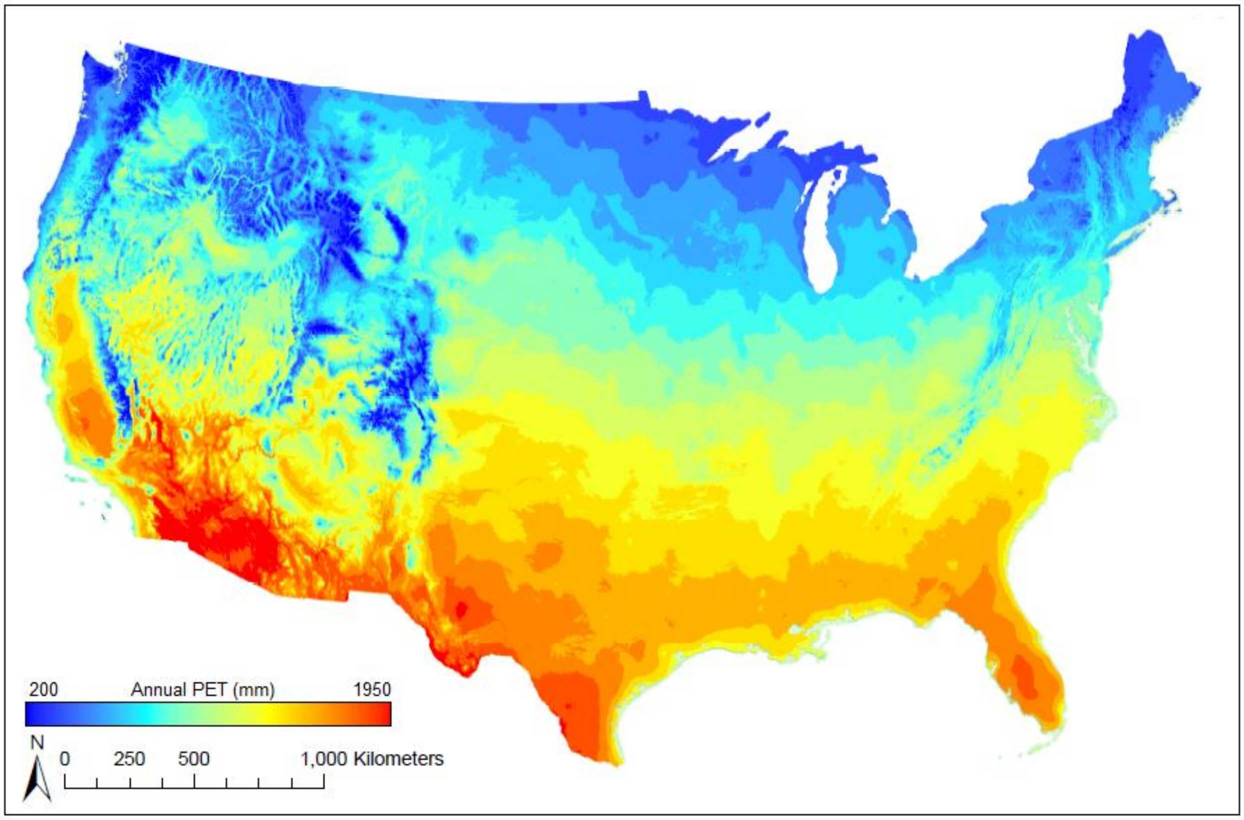

Figure 5. Potential Evapotranspiration from satellite data in the United States.

Appendix C: Climate Maps and Plant Isoscapes

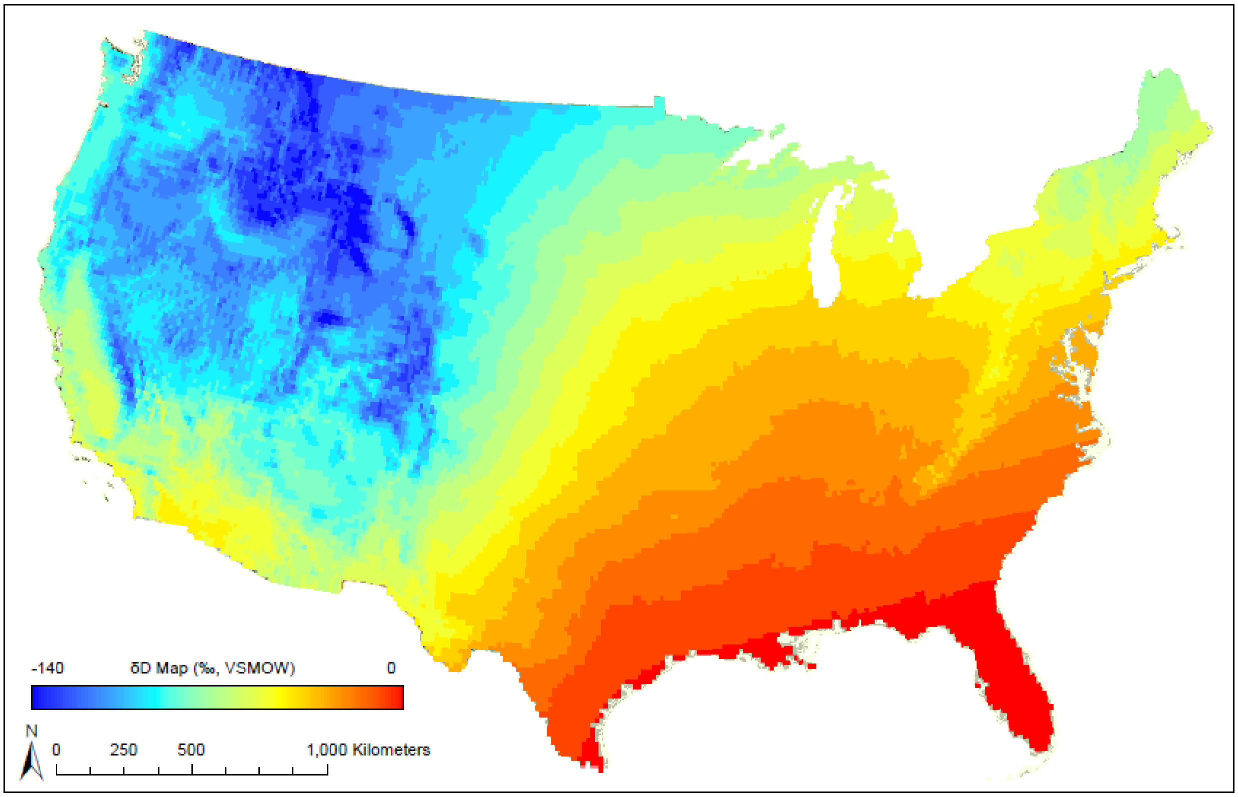

Figure 6. Modeled mean annual δD data from the OPIC in the United States.

Appendix C: Climate Maps and Plant Isoscapes

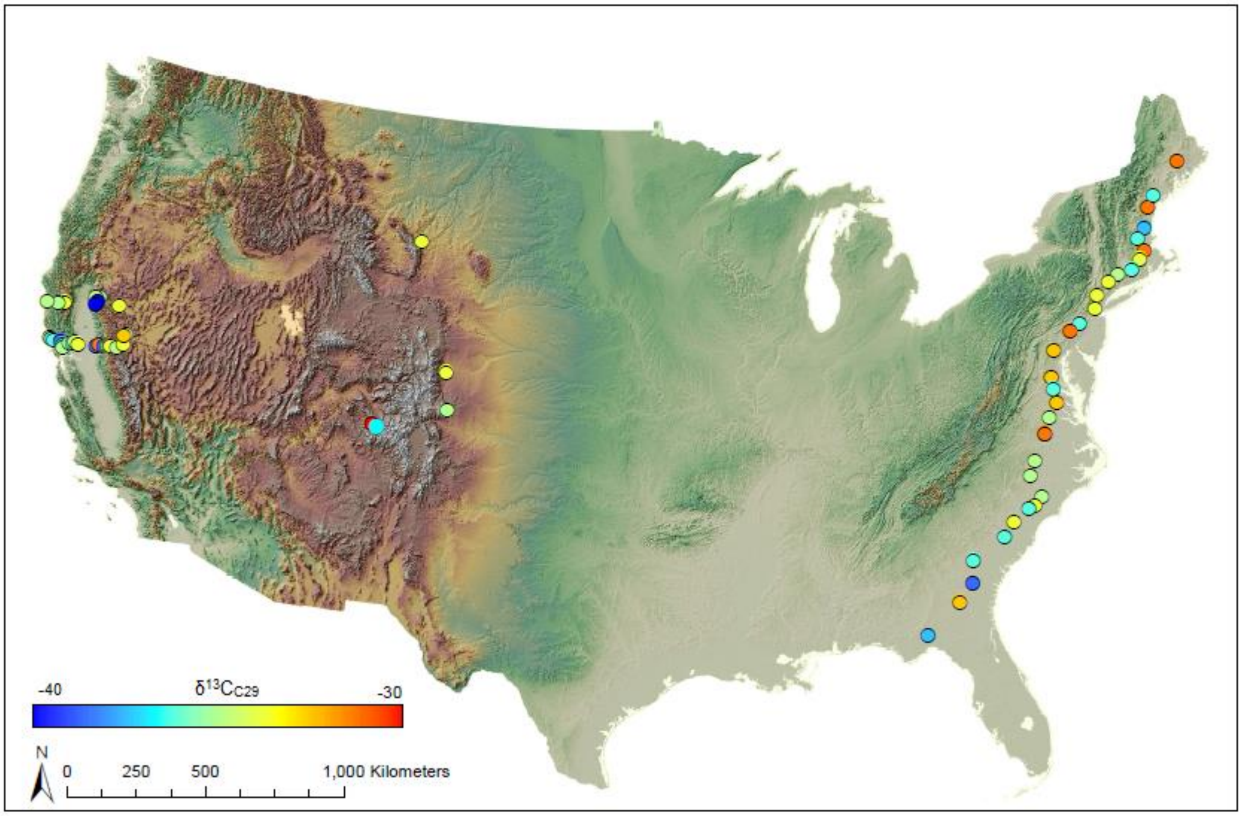

Figure 7. Isoscape of $\delta^{13}C$ values of published *n*-alkanes from angiosperm trees sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

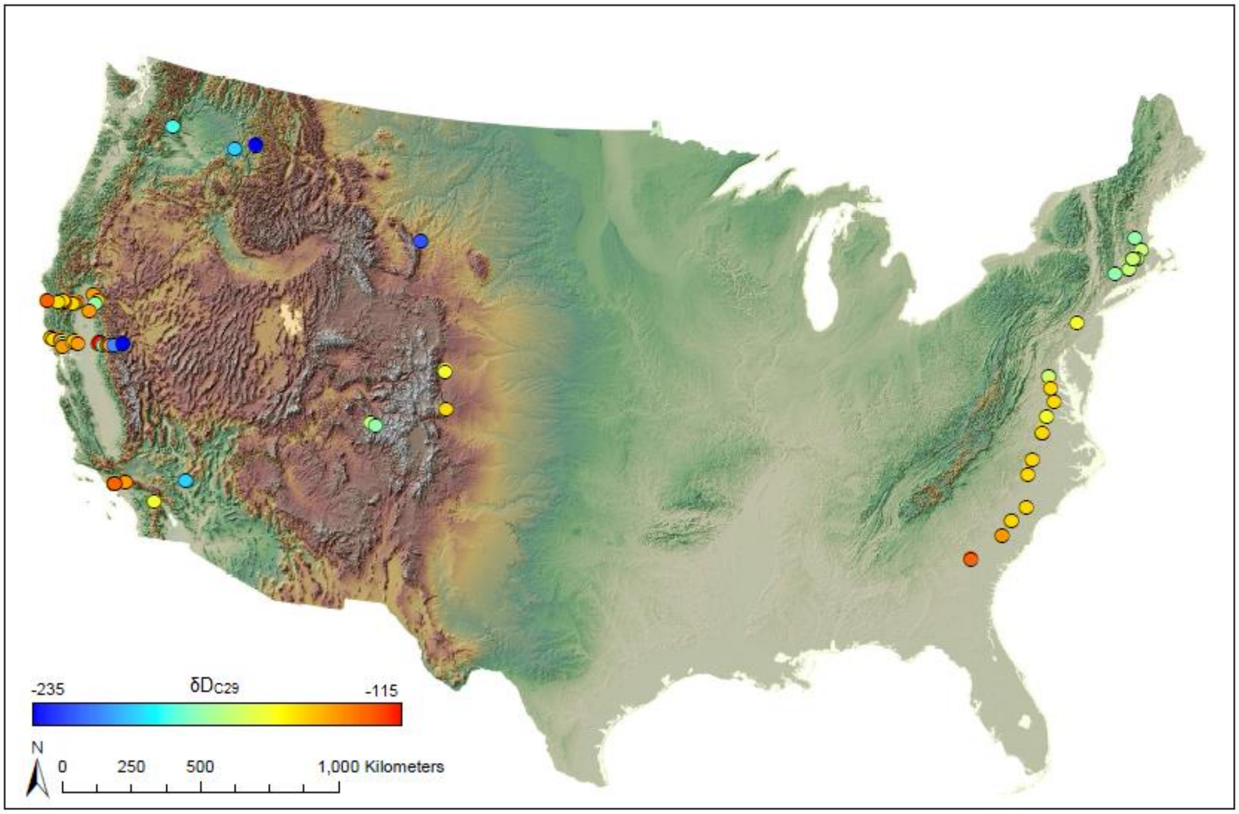

Figure 8. Isoscape of δD values of published *n*-alkanes from angiosperm trees sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

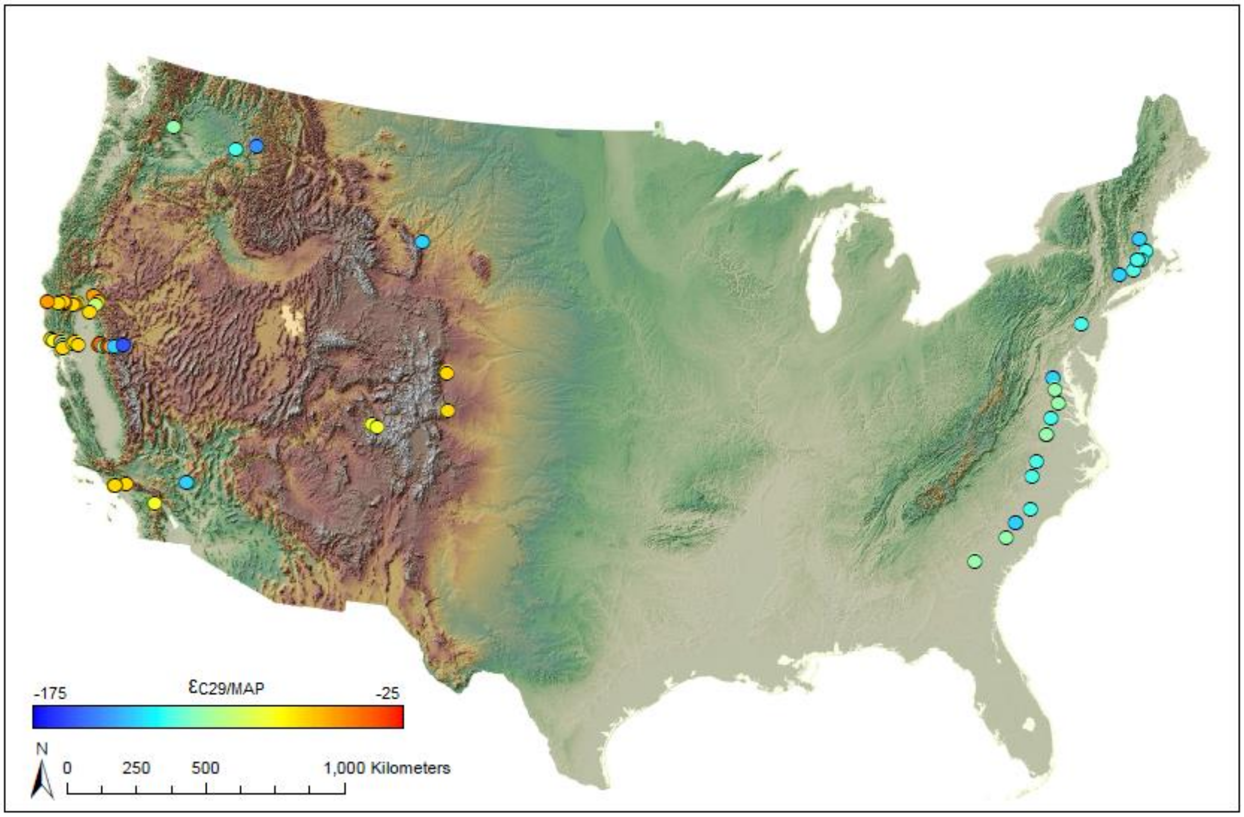

Figure 9. Isoscape of $\varepsilon_{C29/MAP}$ values of published *n*-alkanes from angiosperm trees sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

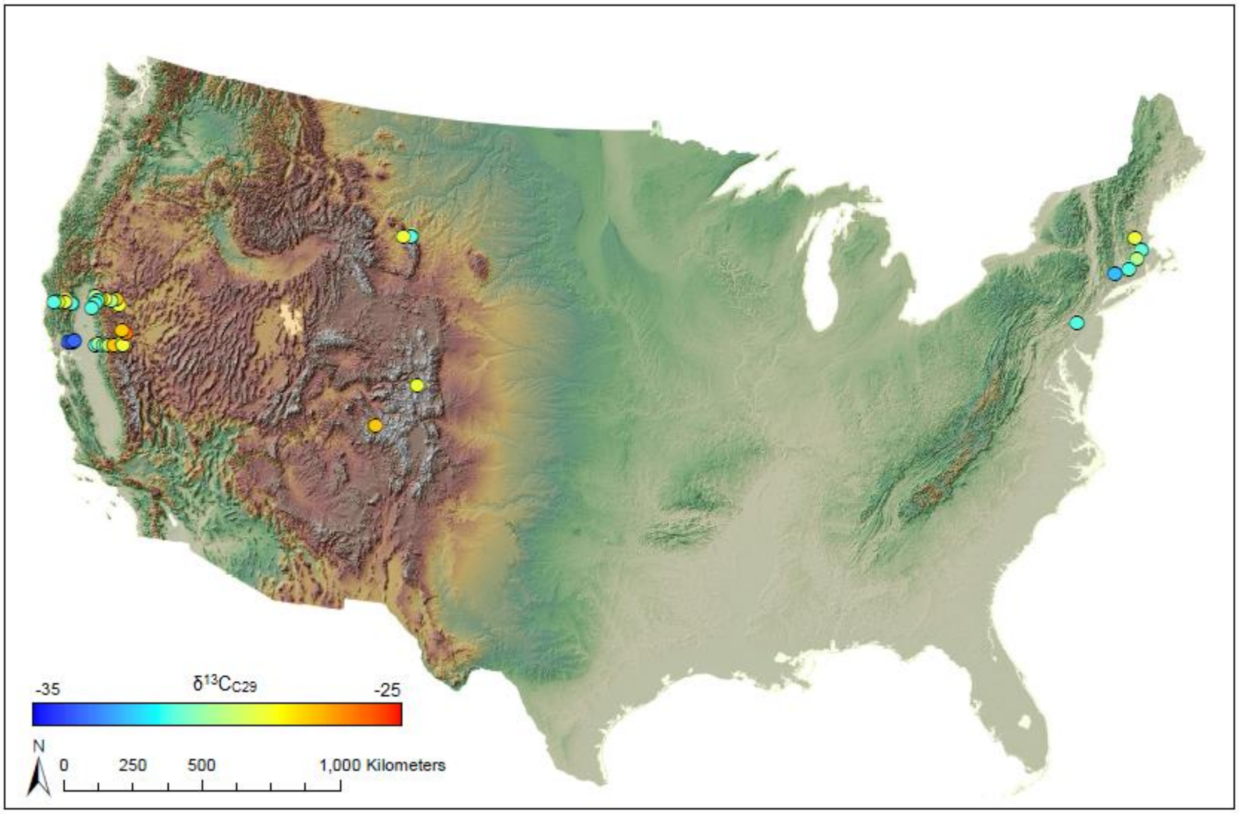

Figure 10. Isoscape of $\delta^{13}C$ values of published *n*-alkanes from gymnosperm trees sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

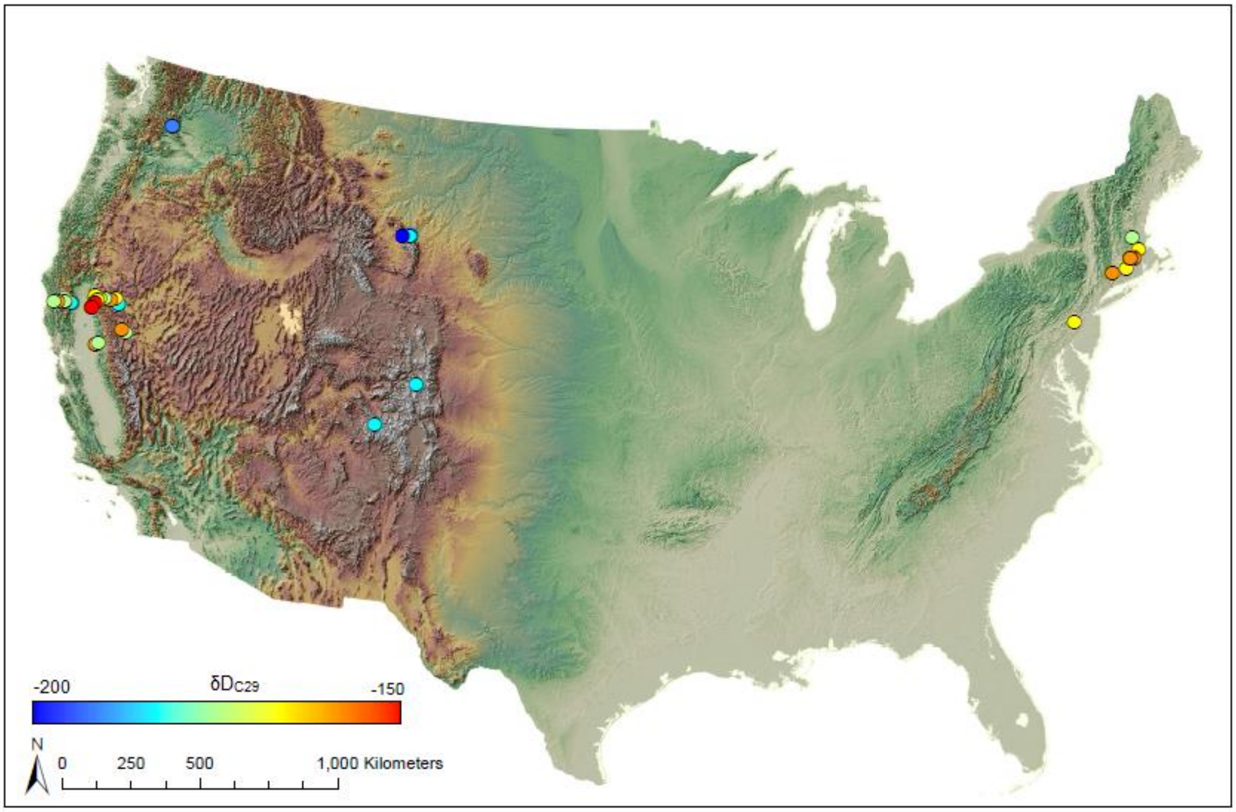

Figure 11. Isoscape of δD values of published *n*-alkanes from gymnosperm trees sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

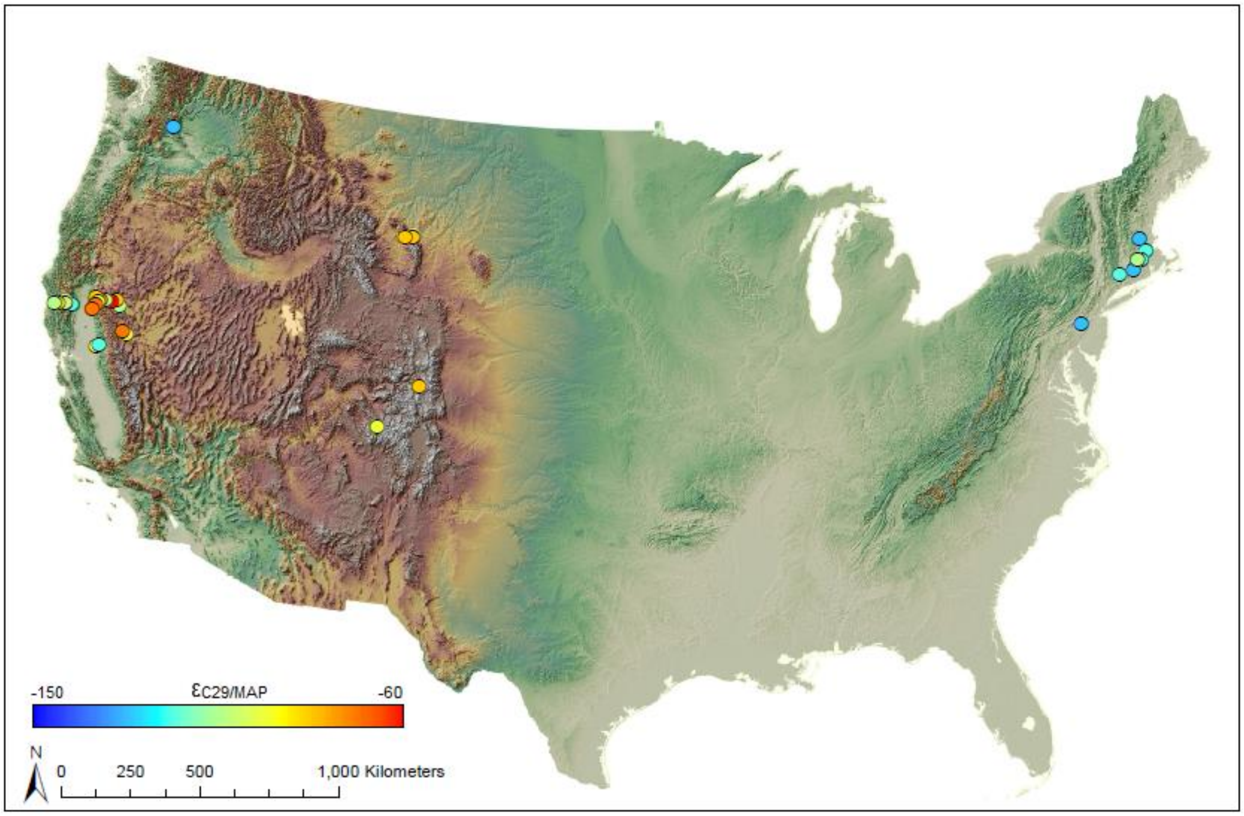

Figure 12. Isoscape of $\varepsilon_{C29/MAP}$ values of published *n*-alkanes from gymnosperm trees sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

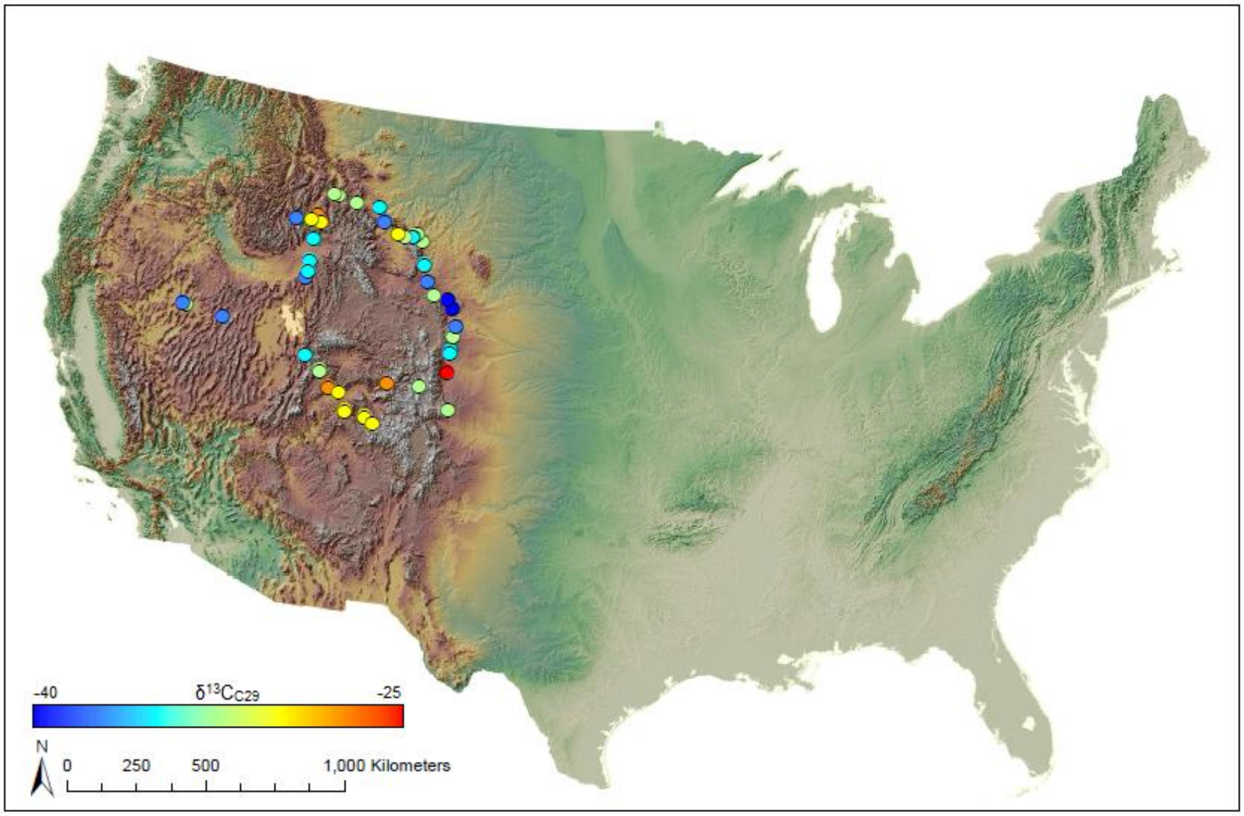

Figure 13. Isoscape of $\delta^{13}C$ values of published *n*-alkanes from C_3 grasses sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

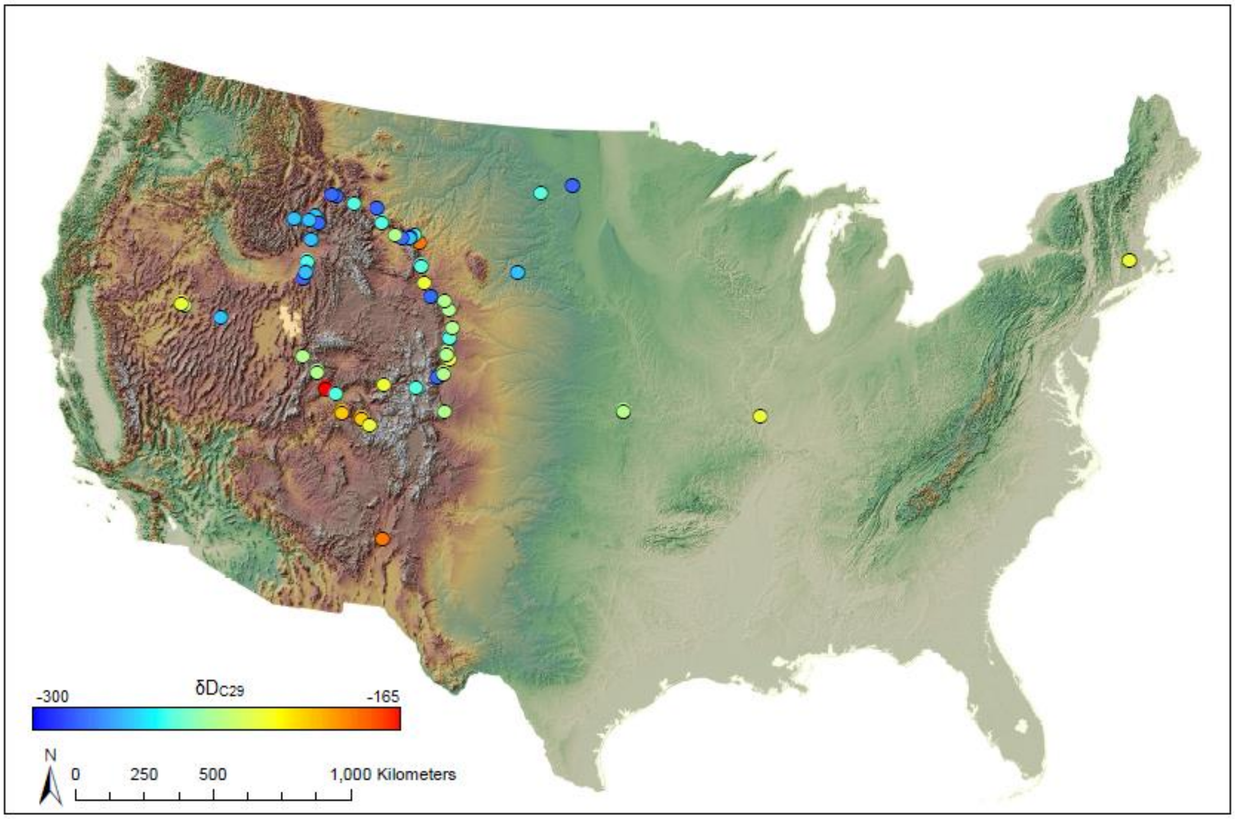

Figure 14. Isoscape of δD values of published *n*-alkanes from C_3 grasses sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

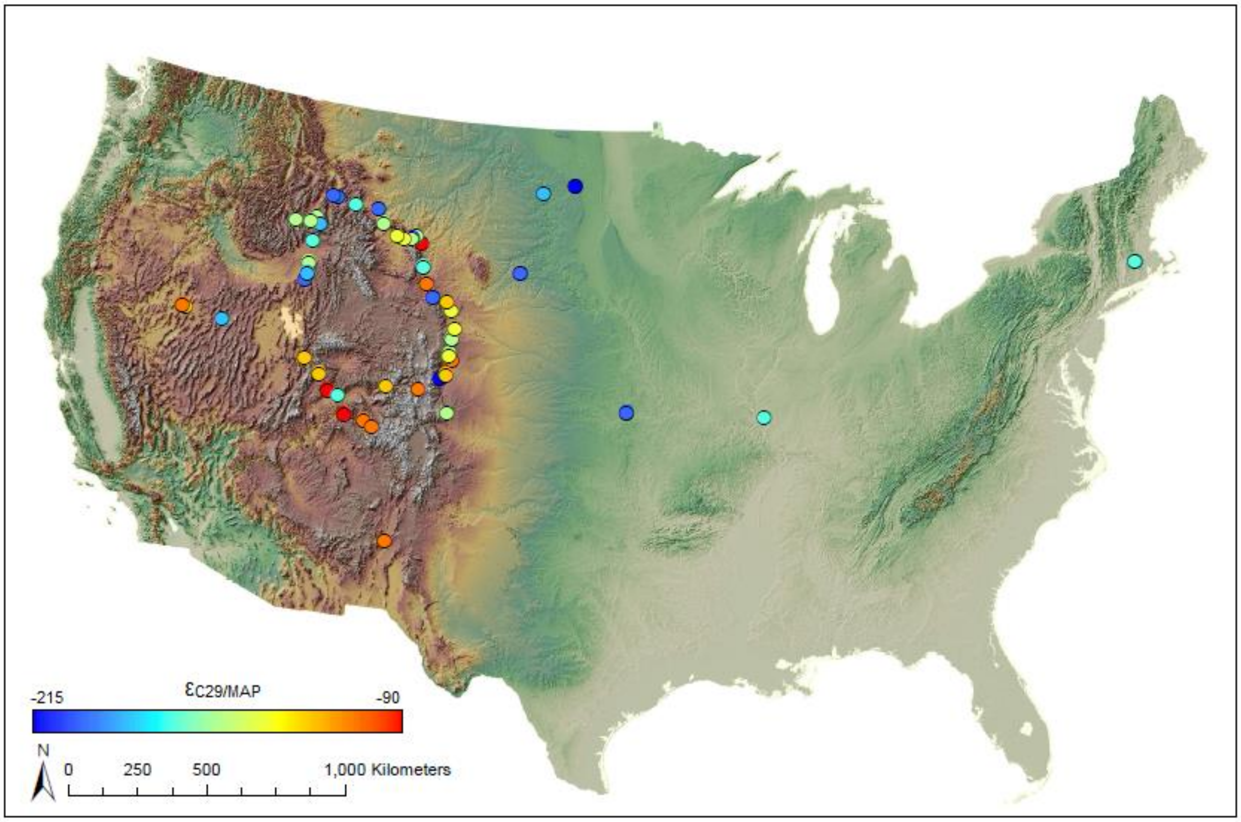

Figure 15. Isoscape of $\varepsilon_{C29/MAP}$ values of published *n*-alkanes from C_3 grasses sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

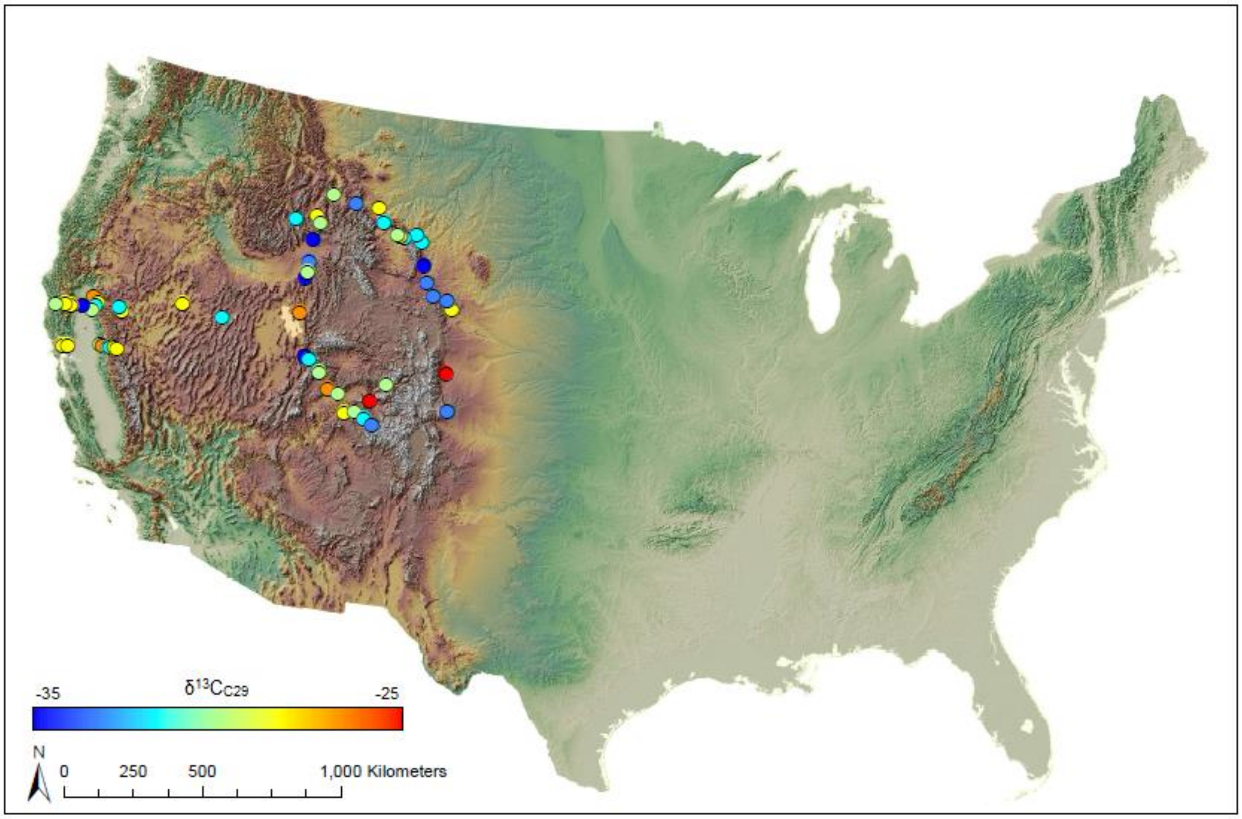

Figure 16. Isoscape of $\delta^{13}C$ values of published *n*-alkanes from angiosperm shrubs sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

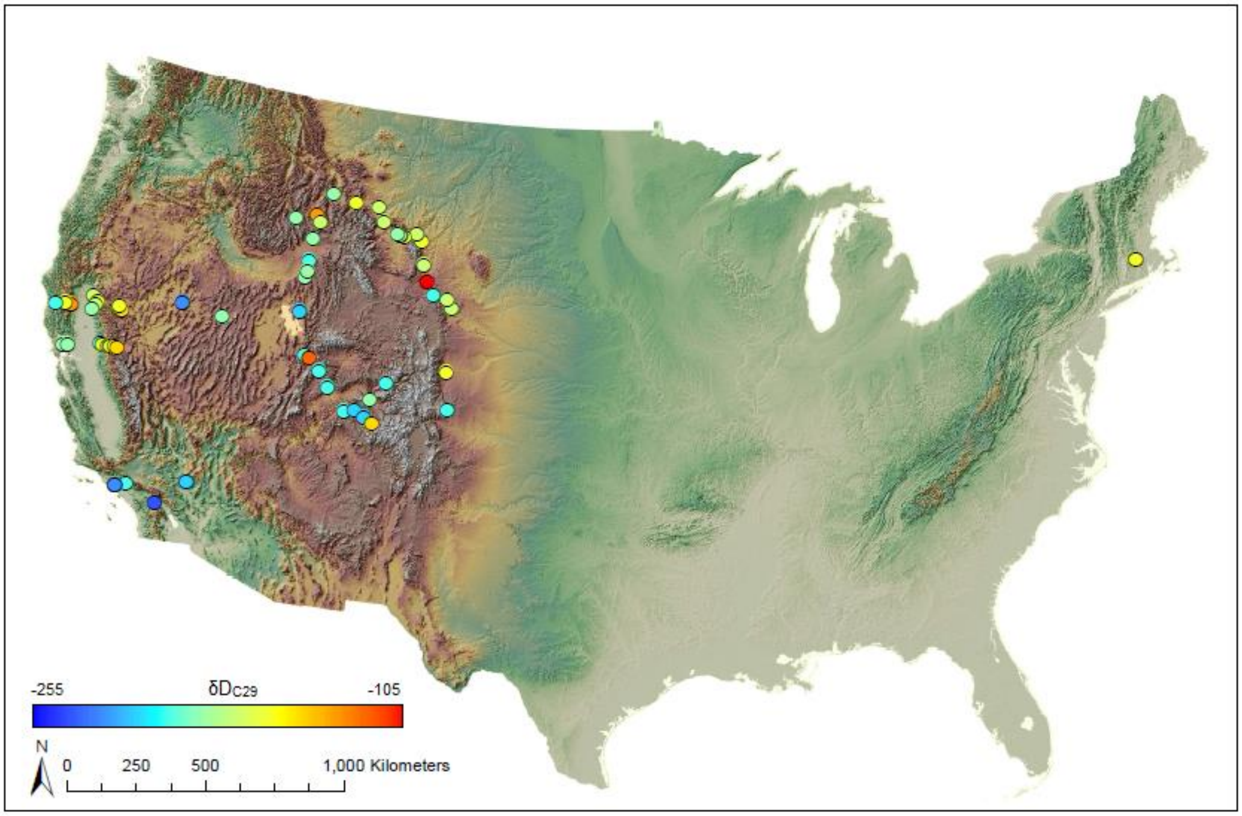

Figure 17. Isoscape of δD values of published *n*-alkanes from angiosperm shrubs sampled within the United States.

Appendix C: Climate Maps and Plant Isoscapes

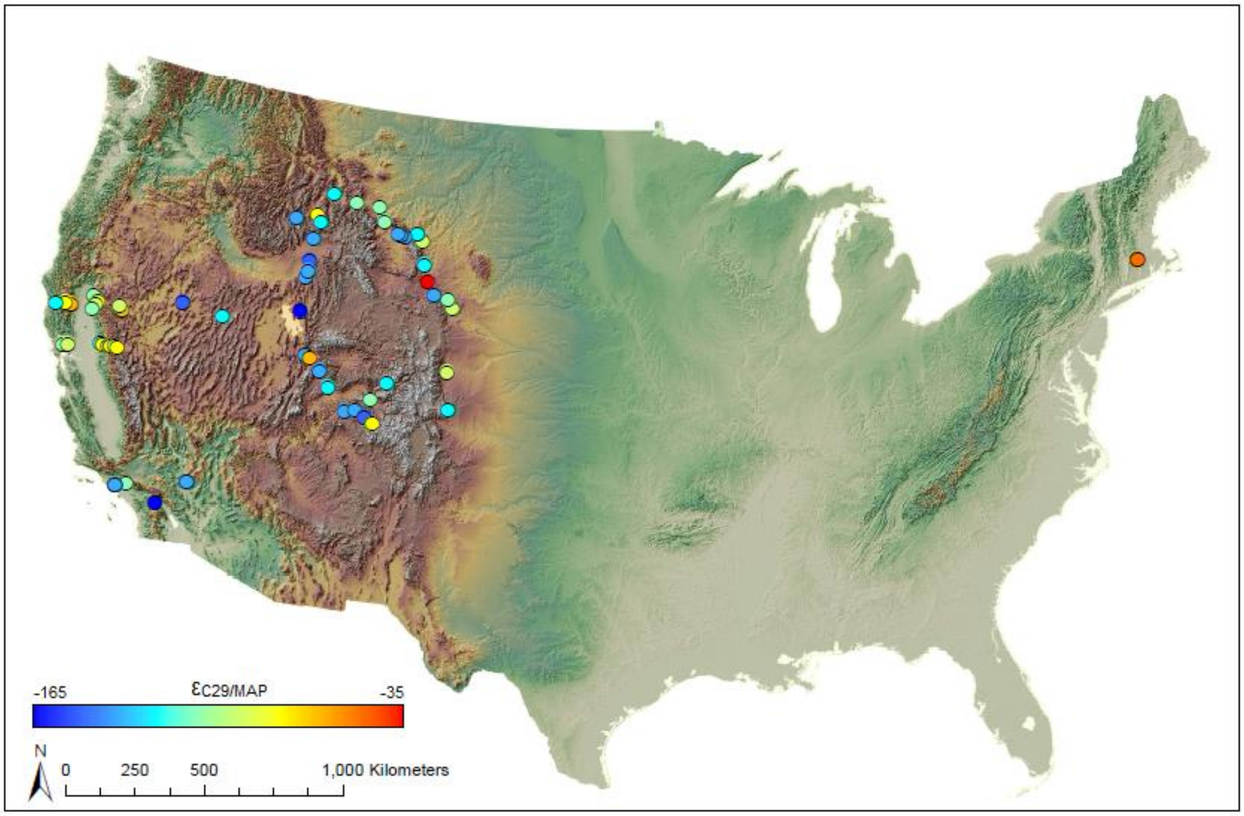

Figure 18. Isoscape of $\varepsilon_{C29/MAP}$ values of published *n*-alkanes from angiosperm shrubs sampled within the United States.