DELINEATION OF AGROCLIMATE ZONES IN IDAHO

A Thesis

Presented in Partial Fulfillment of the Requirements for the

Degree of Master of Science

with a

Major in Environmental Science

in the

College of Graduate Studies

University of Idaho

by

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December 1999

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ABSTRACT

Multivariate statistical analysis and geographic information systems were used to delineate Idaho into homogeneous agroclimate zones for the purpose of applying successful dryland agricultural research practices and management decisions throughout these areas of relative climatic uniformity. Data used to produce the classification are from the Parameter-elevation Regressions on Independent Slopes Model (PRISM), developed at Oregon State University. PRISM has produced gridded estimates of mean monthly and annual climatic parameters from point data and a digital elevation model (DEM). Principal components analysis was performed on 55 variables including various temperature and precipitation parameters, the number of growing degree days, the annual number of freeze-free days, the annual day of freeze in the fall, and the annual day of freeze in the spring. Cluster analysis identified 16 agroclimate zones in the state each having similar climatic conditions regardless of it's spatial location. As a result, successful dryland agricultural practices and management decisions that are based on new technologies and developed for one part of the state may potentially be applied to other parts of the state that fall within the same agroclimate zone.

ACKNOWLEDGEMENTS

I would like to express my gratitude to the Environmental Science Program, the Department of Biological and Agricultural Engineering, the College of Forestry, Wildlife, and Range Sciences, and the Remote Sensing / Geographic Information Systems laboratory. Additionally, I wish to thank all the faculty and staff members in each department who have assisted me during my graduate studies.

Special gratitude is extended to my Major Professor, Dr. Myron P. Molnau for his guidance, suggestions, help, and encouragement throughout this thesis project. I wish to acknowledge my sincere appreciation to each of my committee members, Liza Fox, Robert L. Mahler, and Hengchun Ye. Furthermore, I would like to thank Dr. Chris Williams for his statistical advice and recommendations.

Finally, I wish to take this opportunity to thank my family and friends (no need for names -- they know who they are) for their support.

DEDICATION

Dedicated to my mother and Arnold.

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CHAPTER I: INTRODUCTION

Air -- one of the basic elements of the environment that influences all life. Weather is the condition of the air at a given moment and location. Climate, however is the total occurrence of weather at a given location over some extended period of time. Weather can be easily observed, measured, and stated. Climate cannot be evaluated exactly because it "...represents a complex and abstract idea which has no concrete existence at a given instant." (Blair, 1942). Climate exerts an undeniable influence on the surface of the earth. Climatic gradients influence the spatial distribution of all life forms including humans, animals, vegetation, and microorganisms. Within the human spatial distribution, occupation, architecture, economy, health, and the general manner of living are all influenced to a certain degree by the climate. Additionally, the foraging and mating habits of animals, the growth rate and density of vegetation cover, and the abundance of microorganisms in a given location are affected by the climate. This phenomena that influences where we live, what we do, how we do it, and what we do it with, beckons a detailed understanding so that we may increase production and output in a number of industries and insure healthy and stable ecological and biological productivity.

A classification is a framework for organizing knowledge about things. Within this framework, things that are similar are grouped together and things that are dissimilar are separated. Classifications may form hierarchical organizations by including divisions and levels or may simply be non-hierarchical. A well-designed classification brings order to large data sets and permits expeditious analysis of complex situations.

A climate classification is an attempt to divide a predefined area into regions (or zones) wherein each will have an approximately homogeneous set of climatic conditions. A climate classification should do four things: (1) collate the vast amount of data into a manageable form, (2) be easy to apply (3) be based of meteorological variables and (4) have certain limited and well-defined objectives. An agroclimate classification attempts to delineate climate zones such that each zone is defined using variables of specific importance to agricultural. A zone is an area in which one type of climate dominates and where the major climatic elements are much the same. It is not an area of complete climatic uniformity. The boundaries between climatic regions should not be thought of as distinct lines but rather transition zones (i.e., belts in which the climate changes gradually from one type to the next). There is substantial room for difference of opinion and practice as to where a transition zones may occur. Ultimately, there is no exact number of climate zones that any given area is required to have. Strahler (1951) notes that success is only partially achieved when "...the scientist attempts to devise schemes of classification that will include all variations in climate, yet permit them to be placed in several clearly defined and easily distinguished groups."

OBJECTIVES

The objectives of this research are:

1. to demonstrate that a combination of geographic information systems (GIS) and multivariate statistical procedures can be used to map climate using data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) and to

2. delineate agroclimate zones for the purpose of applying successful dryland agricultural research management practices throughout areas of relative climatic uniformity.

CHAPTER II: BACKGROUND AND LITERATURE REVIEW

This chapter discusses the general climate, natural vegetation, and agriculture patterns in Idaho. Idaho has a rugged, highly diverse surface which varies between steep mountain ranges and rolling prairie land. This complex landscape, coupled with the maritime influence of the Pacific Ocean some 640 kilometers to the west, create a complex climatic environment for the state's 22,000 farms and ranches (Idaho Agricultural Statistics Service, 1998). Additionally, a review of literature relevant to this thesis is discussed.

CLIMATE OF IDAHO

Since this thesis attempts to divide Idaho into a relatively small number of agroclimate zones, a background into the general climate of the state is necessary. This section provides generalities about the climates of Idaho.

The wide range of elevation and complex topography of Idaho combine to influence it's climate and produces a varied climate (Table 1 & Table 2). Numerous steep, jagged peaks and ridges that project from the main mountain ranges eventually give way to rolling prairie land, high mountain valleys, deep canyons, and high deserts. This varied landscape takes place on 32,253 square kilometers between 225 meters, the confluence of the Clearwater and Snake Rivers near Lewiston, and 3860 meters, Borah Peak. A considerable amount of area lies between 760 and 1830 meters above sea level (USDA, 1941). The Snake River Plain in southern Idaho is the largest expanse of relatively flat topography.

Table 1. NWS station temperature and precipitation extremes for the period of record.

Climate variable	Measurement	Date	Location
Maximum daily temperature	48°C	7/28/1934	Orofino
Minimum daily temperature	–51°C	1/18/1943	Island Park
Maximum daily precipitation	122 mm	3/12/1939	Pierce RS
Maximum monthly precipitation	717 mm	12/1933	Roland W Portal

Source: Abramovich et al., 1998.

It increases in elevation from 556 meters at Weiser, at the extreme western edge, to 1524 meters in the extreme east, near Yellowstone Park (USDA, 1941).

The climate is milder than its latitude would indicate due to the influence of the Pacific Ocean. Prevailing westerly winds originating in the Pacific Ocean some 640 kilometers to the west influence both the summer and winter temperatures with a stronger maritime effect on the latter. This influence is felt more in central and north Idaho than in the south. Eastern Idaho's climate (the central mountains and areas near Yellowstone National Park) is more continental in character than western and northern Idaho's resulting in a greater range between winter and summer temperatures. In winter the strong winds, particularly in the northern part of the state, result in a maritime influence that helps to produce relatively mild conditions. However, on some occasions dry arctic air from Canada spills west of the continental divide producing clear skies and a distinct drop in temperatures. One such arctic outbreak in December 1968 resulted in record cold temperatures over much of the state with the minimum temperature reaching –42°C at Moscow (Abramovich et al., 1998). The lower Snake and Salmon river valleys near Lewiston and Riggins have the warmest mean minimum nighttime winter temperatures whereas the high mountain valleys around areas such as Stanley have the lowest.

Table 2. NWS station temperature and precipitation extremes for 1961-1990.

Climate variable	Measurement	Location
Normal annual maximum	19.3°C	Bruneau & Grand View 2 W
Normal annual minimum	–7.7°C	Stanley
Coldest normal January	–18.7°C	Stanley
Warmest normal July	35.7°C	Swan Falls Power House
Highest normal annual precipitation	1054 mm	Pierce
Lowest normal annual precipitation	181 mm	Grand View 2 W

Source: Abramovich et al., 1998

In summer, rainfall, cloud cover, and relative humidity are at their annual minimum due to a weakening of the westerly winds which allows continental climatic conditions to prevail (Abramovich et al., 1998). The coolest mean summer temperatures occur in the high mountain valleys near Stanley while the warmest summer temperatures occur in the Snake River Plain southwest of Boise.

The maritime air from the prevailing westerly winds is Idaho's major moisture source. This maritime influence is strongest in northern Idaho. Weather systems heading east off the Pacific coast encounter north-south mountain ranges and lower, relatively flat areas from the coast of Washington to northern Idaho. These mountain ranges force much of the precipitation carried by the eastward-moving winds to be expunged before reaching Idaho. The Olympic Mountains in western Washington see much greater precipitation amounts than those in the Puget Sound area; the leeward side of the mountain range. The Cascade Mountains of Washington produce a precipitation rise again, with decreasing amounts recorded in the Columbia Basin. The Bitter Root Mountains of Idaho raise the annual average once again with lesser amounts seen to the east in Montana. These successive mountain ranges illustrate the influence topography has on precipitation. In general, for

Idaho, altitude is a more important factor of control than latitude as far as temperature and precipitation are concerned.

Annual average precipitation in Idaho ranges from about 175 mm near the cities of Grand View and Bruneau in Owhyee county to over 2000 mm along the Idaho-Montana border in Bonner, Clearwater, and Shoshone counties. In most areas of the state, December and January have the highest monthly precipitation. Monthly totals decrease irregularly until July and August, which are the driest months. All areas of the state have dry summers and no measurable precipitation in August is fairly common. After August monthly amounts increase until January. With the exception of southeastern Idaho, most areas have a distinct wet winter-dry summer precipitation pattern. In southeastern Idaho (from Salmon to Idaho Falls to Grace) two precipitation peaks are seen: one in late fall and the other in late spring (Abramovich et al., 1998). Thirty-three percent of the annual precipitation occurs during the winter months (December-February), 27 percent in March-May, 15 percent in June-August, and 25 percent in September-November (USDA, 1941).

The average annual snowfall ranges from less than 1/3 of a meter around Lewiston, in Nez Perce county and Swan Falls, in Ada county, to about 20 meters along the Idaho-Montana border in Idaho and Shoshone counties. It exceeds 1.5 meters along the Idaho-Wyoming border, over much of the northern part of the southwestern division, and the northern and northeastern parts of the Panhandle, and exceeds 10 meters in northern Fremont county, the northwestern parts of Adams and Valley counties. Along the Snake River Valley from southern Bingham county to southern Washington county, the average annual amounts can range from less than 1 meter to about 2 meters. Snow has been recorded at some stations in the state in every month of the year.

The last killing frost in the spring usually occurs in early to mid May over the western Snake River Valley near Nampa and Caldwell and in the areas surrounding Lewiston. In the higher elevations in Lemhi, Idaho, and Custer counties the average date is around mid July. At some high altitude locations in central Idaho, frost or freezing temperatures are experienced in nearly ever month of the year.

The first killing frost in the fall usually occurs around early to mid August in the central mountains. Around Lewiston and in areas south of Boise, it is usually deferred until October. Over much of the remainder of the state it is generally recorded some time in September (USDA, 1941).

The average length of the growing season ranges from less than 20 days in the higher elevations of Lemhi, Idaho, and Custer counties to more than 150 days in areas surrounding Lewiston and Boise, Nampa, and Caldwell. Over much of the Panhandle it exceeds 100 days, and in some localities in these areas even 130 days.

Statewide, there is an average of 167 clear days during the year, ranging from 21 in July to 9 in January. There is an average of 94 partly cloudy days during the year, ranging from 10 in May to 7 during the late fall and winter. Finally, 104 cloudy days a year are seen on average, ranging from 15 in January to 3 each in July and August (USDA, 1941).

NATURAL VEGETATION AND AGRICULTURE IN IDAHO

A great deal of the variation seen in climate correlates well with differences in natural vegetation due to the significant influence that climate exerts on vegetation. In fact, such words as desert and tropical are often applied to both climate and vegetation (Vankat, 1979). If a discussion of climate is undertaken, a discussion of vegetation should follow. Therefore, both the natural and introduced (i.e. agricultural etc.) vegetation patterns of Idaho are discussed in this section.

Vegetation is a given combination of life forms and competing taxa with relatively uniform ecological requirements that dominates much of the appearance of the world's landscapes and greatly influences human activities in many areas. Plants are stationary objects that possess distinct physical properties. "Real vegetation" includes all types of vegetation present at a time of observation. Therefore, this term includes man-made vegetation types such as agricultural crops. The term "natural vegetation" is regarded as vegetation that develops without appreciable interference and modification by Man. In many locations, Idaho's land surface does not bear natural vegetation due to activities such as ranching, agriculture, forest thinning, and urbanization.

"Climax vegetation" in the conterminous United States is often thought of as vegetation that existed at the time when European settlers first appeared on the soil in the 16^{th} to 18^{th} centuries. The notion of white-man being the first to influence the vegetation of North America is challenged by some because, to a certain extent, the Native Americans exercised a disrupting influence. Therefore, an exact date when vegetation was considered pristine is somewhat a matter of opinion. The question of timing is raised since the dates of settlement appeared in different locations at different times. To circumvent this problem, the term "potential natural vegetation" was developed and is defined as "…the vegetation that would exist today if man were removed from the scene and if the resulting plant succession were telescoped into a single moment" (Küchler, 1964). Man's activities and influences prior to mapping are permitted to stand while future climatic fluctuations are eliminated. Therefore, "potential natural vegetation" implies a specific period of time and must bear a date if it is to be considered meaningful. Depending on how far one retreats into the past, the climatic differences between now and then increase. Climax vegetation as it was when the first man ever beheld it occurred so long ago that it may have little or nothing in common with the vegetation of the 20th century (Küchler, 1964).

Current vegetation in Idaho ranges from coniferous forests in the mountains to high scrub brush desert in the Snake Plain to grasses in the Palouse and other areas. This wide range of vegetation types results in economic activities that range from tourism to logging to agriculture. The majority of production agriculture takes place in the Palouse and the Snake River Plain and agriculture is found in each county with the exception of Shoshone (Appendix C, Figure 1). Additionally, gardening and orchid operations are found throughout the state.

Idaho's economy is strongly influenced by the forest products industry. Idaho ranks among the seven largest producers of softwood lumber in the United States producing 5 percent of that material for the nation (Idaho Department of Commerce, 1999). This plentiful natural resource has resulted in many building materials companies establishing businesses in the state. Over 200 companies, not including logging enterprises, make up the forest products industry in Idaho. Major paper and wood product manufactures rely on Idaho's forest resources for their industry.

Table 3. Idaho's rank in the nation's agriculture.

Commodity	Rank Among States	Percent of U.S. Production
Potatoes	1	29
Austrian Winter Peas	1	94
Wrinkled Seed Peas	2	42
Lentils	2	38
Sugarbeets	2	17
Dry Edible Peas	2	27
Barley	3	16
All Mint	3	18
Hops	3	7
Onions (Summer Storage)	3	15
Prunes & Plums (Fresh)	4	16
Other Spring Wheat	5	8
Sweet Cherries	5	1
Alfalfa Hay	5	6
Sweet Corn for Processing	6	4
Dry Edible Beans	7	8
All Wheat	7	5
Winter Wheat	8	4
Apples	10	1
All Hay	12	3

Source: 1998 Idaho Agricultural Statistics.

Agriculture and food processing is Idaho's largest industry, contributing 25% to the Gross State Product (Idaho Agricultural Statistics Service, 1998). Farming and agriculture-related business account for cash receipts totaling almost $3 billion and Idaho employs over 18,000 persons in food processing operations and more than 32,000 work on farms and ranches (Idaho Department of Commerce, 1999). There are approximately 22,000 farms and ranches in the state totaling about 13,500,000 acres with an average farm and ranch size of 614 acres (Idaho Agricultural Statistics Service, 1998). The state ranks among the top 5 U.S. producers of 14 agricultural commodities (Table 3). Major national food and beverage companies rely on Idaho's agricultural commodities for their reputations. Idaho's agriculture is as diverse as its climate ranging from traditional crops such as potatoes and grains, to specialty crops such as fruits, mint, and Christmas trees.

LITERATURE REVIEW

The number of different climate classifications is numerous and no one classification can be all things to all people. Many climate classifications have a similar goal which is to accurately map the climate of a large area based on a relatively few number of point observations. Two general approaches are used to achieve the goal: geographical techniques and statistical techniques. Geographic techniques, which were more prevalent in the early part of this century, involve the manual preparation of climate maps through topographic analysis. Statistical techniques, which have become increasingly popular in the last thirty years with the advances made in the computer industry, include methods such as distance-weighting algorithms and multivariate analyses.

It became possible to classify climates worldwide when actual observations covering much of the world's land surface were available. Annual and monthly temperature and precipitation maps were created and when superimposed on one another, interesting patterns became apparent. It was botanists who began to see a close, but not exact relationship between temperature and precipitation and plant life.

Some of the earliest known attempts to classify climate date back to Greek philosophers and geographers who used solar radiation as a basis for classification. Arguably, the best known and most widely recognized climate classification of the world is that developed over a period of 30 years by Wladimir Köppen beginning in 1918. This classification by Köppen divided the land areas of the world into five major climatic categories largely based on temperature and precipitation (Blair, 1942). The major zones, designated by capital letters, A, C, D, & E are based upon temperature while B has a precipitation meaning. Zone A represents tropical climates, zone B represents dry climates, zone C depicts warm, temperate rainy climates with mild winters, zone D represents cold forest climates with severe winters, and zone E represents polar climates (Trewartha, 1954). Within each major group, subgroups are delineated. The method used is strongly influenced by the distribution of plant species (Handbook of Agricultural Meteorology, 1994). In years to follow, modifications were made to the original Köppen classification.

In 1931, Thornthwaite developed a method based on climatic efficiency as related to plant communities. The classification is based on three parameters: (1) precipitation effectiveness ($PE = 115sum[r_i/(T_i - 10)*(10/9)]$, where T_i = mean temperature (ºF) of month i and r_i is its mean precipitation in inches), (2) temperature efficiency ($TE = sum(T_i - 32)/4$, where T_i = mean temperature (ºF) of month i and r_i is its mean precipitation in inches), and (3) the seasonal concentration of rainfall. PE is designated by a letter A – E, TE is designated by a letter A' - F', and the seasonal distribution of rainfall is broken down by: r for year-round precipitation, s for summer drought, w for winter drought, and d for year-round drought

(Trewartha, 1954). Weakness of this system lies in the evaporation term, which completely ignores humidity and wind speed (Handbook of Agricultural Meteorology, 1994).

While there have been many climate classifications developed for the entire globe, there have also been many climate classifications developed for specific regions. In the 1950s, a climate zone map covering the 13 western states of the U.S. was developed (Sunset Western Garden Book, 1995). This classification used winter minimum temperatures, summer high temperatures, length of growing season, humidity, and rainfall patterns as criteria for delineation.

The National Climate Data Center (NCDC) produced a climate classification for the conterminous United States based on annual averages of temperature and precipitation (Fovell & Fovell, 1993). The NCDC classification delineated 14-, and 25-cluster solutions using hierarchical cluster analysis.

The United States Department of Agriculture (USDA) produced a classification scheme based on winter minimum temperature. This scheme resulted in a plant hardiness zone map for the conterminous United States and Canada that established boundaries in increments of 10ºF (USDA, 1960). In later years, the classification was refined to establish boundaries by 5ºF increments.

DeGaetano and Shulman (1989) proposed a twenty-three zone climate classification scheme as an improvement to the USDA plant hardiness zones. As opposed to using one variable (winter minimum temperature), this scheme used maximum and minimum temperature, precipitation, wind speed, sunshine, relative humidity, growing season length, temperature extremes, growth units and elevation. The United States and Canada were divided into 1234 grid cells and cluster analysis was used to identify areas of similar climatic conditions.

In 1991, Douglas et al. (1992) completed a classification depicting agronomic zones for dryland winter wheat producing areas of Washington, Oregon, and Idaho. This classification used annual precipitation, soil depth, and growing degree-days as criteria to delineate the zones. Six zones were delineated and labeled (1) annual crop-wet-cold, (2) annual crop-wet-cool, (3) annual crop-fallow-transition, (4) annual crop-dry, (5) grain-fallow, and (6) irrigated.

Two geo-climate zone classifications for the western region of the United States were produced in 1985 (Jallala & Araji, 1985). The first was based on eleven climatological variables: maximum, average, and minimum temperature of the coldest month of the year, maximum, average, and minimum temperature of the warmest month of the year, annual average temperature, number of frost free days, annual precipitation, January precipitation, and the July precipitation. The second was based on fourteen climatological variables which included the eleven listed above plus longitude, latitude, and elevation.

The task of developing agro-ecological zones for Africa was undertaken by the food and Agricultural Organization (FAO) in the 1970s. This classification applied to eleven crops distributed throughout the country: wheat, paddy rice, maize, pearl millet, sorghum, soybean, cotton, phaseolus bean, white potato, sweet potato, and cassava. The zones were delineated on the basis of growing period. Growing period was defined as the time during which temperature and precipitation were sufficiently available to permit crop growth (Handbook of Agricultural Meteorology, 1994).

An agroclimatic classification was developed for China that used two basic levels of classification. The first divided the whole country into three main areas: (1) east monsoon (46% of the country), (2) Tibet (26%), and (3) northwest (28%). The three main zones were delineated and then subdivided using thermal zones based on degree-days (Handbook of Agricultural Meteorology, 1994).

In 1982, alfalfa-growing areas of the western United States were divided into fourteen climatically distinct zones by using cluster analysis (USDA, 1982). Data for latitude, frost-free days, and mean temperature from 243 locations were subject to cluster analysis. The resulting classification was designed to benefit alfalfa workers in identifying climatological similarities and differences in growing areas of the western United States.

In 1983, New Brunswick was divided into 11 climatic regions by means of multivariate statistical analysis on precipitation, various temperature parameters, elevation, latitude, and longitude (van Groenewoud, 1984). Comparisons of climatic maps with plant community distribution showed that climatic parameters might influence the distribution of vegetation. In a study using similar techniques, Maine was divided into four homogeneous climatic zones and then subdivided into nine climatic zones (Briggs & Lemin, 1992). The climatic zones showed a high degree of correspondence with biophysical regions therefore reinforcing the multivariate analysis results.

In the early 1960s, a map depicting the potential natural vegetation of the conterminous United States was developed (Küchler, 1964). A GIS coverage of Küchler's potential natural vegetation zones was acquired from the Interior Columbia Basin Ecosystem Management Project web site (ICBEMP, 1996). This coverage was used in this study as a means of accessing the accuracy of the multivariate statistical analysis.

The early classifications mentioned above (Köppen, Thornthwaite) were not greatly influenced by which sector of commerce (e.g., agriculture, forestry, etc.) would benefit most from the classification. Ideally, every industry would like to be able to derive useful information from a climate classification. The classifications by USDA, NCDC, DeGaetano and Shulman, etc. were of particular interest to industries such as agriculture, gardening, and forestry. The amount of information that is derivable from a climate classification for an industry is directly related to the goal of the classification (i.e., for whom it is tailored), the climatic variables that go into delineating the zones, and the way in which those variables are used. Ultimately, an ideal classification is specific enough to be beneficial to each individual industry while still being general enough to be useful to all industries.

CHAPTER III: METHODS

In this chapter the data source, geographic information system techniques, and multivariate statistical methods used to create the agroclimate classification are discussed. Additionally, the procedures employed to reproduce the modified Köppen climate classification (hereafter referred to just as the Köppen climate classification; Critchfield, 1983; Table 5) using the source data are presented.

Climate plays an important role in the geographical distribution of agricultural and overall agricultural productivity of a given area. To a certain extent, unirrigated man-made vegetation in the form of crops should follow climatic boundaries. Additional natural factors such as soil type, amount of solar radiation, and topography as well as human factors (economic, social and technological) are recognized as direct influences on the ability to grow crops feasibly in any area. While factors other than climate are recognized as influences on the agricultural productivity of a given area, climate imposes its will either directly or indirectly on these other factors. Many of these factors show a high correlation with climate. Soils are the result of physical and chemical weathering of rock due to precipitation, snowmelt runoff, and freezing and thawing of the surface and near surface material. Acting indirectly through vegetation and animal life (both surface and sub-surface), climate shapes soil makeup. The high correlation between climate and the other factors makes it possible to justify the delineation of agroclimate zones exclusively on the basis of climatic variables that effect crop growth and agricultural production.

The general methodology followed to achieve the stated goals for this study is:

1. Downloaded the PRISM data from the Oregon Climate Service web site (http://www.ocs.orst.edu/prism/prism_new.html) in August 1998.

   1961-1990 Mean Monthly and Annual Average
   - Mean Temperature
   - Maximum Temperature
   - Minimum Temperature
   - Precipitation
   - Growing Degree Days

   1961-90 Mean Annual Average
   - Spring Freeze
   - Fall Freeze
   - Growing Season Length

2. Used the ARC/INFO GIS to reproduce the Köppen climate classification.
3. Used the ARC/INFO GIS to extract the information needed for the agroclimate classification.
4. Used a statistical software package (SAS) to perform statistical analysis.
5. Used the ArcView GIS to display the statistical groupings (i.e. agroclimate zones).
6. Used the ArcView GIS to explore similarities between the agroclimate zones and potential natural vegetation patterns.

DATA SOURCE

With the objective of developing a model to use point data and a digital elevation model (DEM) to estimate patterns of climate in a spatially representative and physically meaningful way, a model titled the Parameter-elevation Regressions on Independent Slopes Model (PRISM) was developed in 1991 by Christopher Daly at Oregon Climate Service. PRISM is an expert system that uses point data and a DEM to generate gridded estimates (approximately 4 Km × 4 Km in size) of climate parameters (Daly et al., 1994). These data are 30-year averages (1960 -1991). PRISM was written by a meteorologist specifically to address climate and attempts to mimic the process that an expert would use to map climate parameters.

The PRISM concept, a combination statistical-geographic approach to mapping, was originally developed for precipitation mapping. However, it was recognized that the model philosophy, i.e., the topographic facet is an important climatic unit and elevation is a primary driver of climate patterns, could be extended to other climate parameters such as temperature, snowfall, and growing degree days. The governing equation in PRISM assumes that for a localized region, elevation is the most important factor in the distribution of temperature and precipitation. To determine values where station data are not available, each station is assigned a weight in the climate-elevation linear regression function based upon several factors: distance, elevation, cluster, vertical layer, topographic facet, coastal proximity, and effective terrain weights.

The PRISM methodology for mapping precipitation in the United States was subject to strenuous and repeated peer-review. A committee of climatologists and hydrologists from both state and federal agencies was formed to evaluate the PRISM techniques for mapping precipitation. Oregon, Idaho, Nevada, and Utah were chosen as test areas and each of these was represented by a State Climatologist with a strong interest in the PRISM approach. The evaluation process lasted two years resulting in several significant improvements to the methodology and "final" precipitation grids for each state in the conterminous United States were produced. Of the PRISM data sets used in this project, only the precipitation grids have been reviewed and are considered "final" (Appendix D). The remaining variables are currently considered "preliminary" and are still in review.

KÖPPEN CLIMATE CLASSIFICATION

As an aside to the stated goals of the overall thesis, an Arc Macro Language (AML) program was written in ARC/INFO to reproduce the Köppen climate classification for the conterminous United States using the PRISM data (Appendix A). This process was carried out prior to creating the agroclimate classification with the intention of seeing how well the PRISM data would reproduce a well-known and currently accepted climate classification. This procedure allowed for an understanding of grid processing in ARC/INFO as well as the ability to compare the ARC/INFO-PRISM results against an existing, hand-drawn output from the first half of this century. Theoretically, the delineation of zones for each method should coincide well.

The Köppen climate classification is based primarily on monthly and annual averages of precipitation and temperature. Twenty-nine files were required as input to the AML (Table 4). All digital data processing was undertaken on Windows NT computer workstations and the ARC/INFO 7.1.1 (ESRI, 1999) geographic information system was used to store and analyze the data. Additionally, ArcView Version 3.1 (ESRI, 1999) was used to display the grid coverages, and layout the Köppen maps for printing.

Table 4. Input variables necessary for reproducing the Köppen climate classification.

Input Variable
Average January precipitation
Average February precipitation
Average March precipitation
Average April precipitation
Average May precipitation
Average June precipitation
Average July precipitation
Average August precipitation
Average September precipitation
Average October precipitation
Average November precipitation
Average December precipitation
Average annual precipitation
Average January temperature
Average February temperature
Average March temperature
Average April temperature
Average May temperature
Average June temperature
Average July temperature
Average August temperature
Average September temperature
Average October temperature
Average November temperature
Average December temperature
Average annual temperature
Digital elevation model
Projection file
Clip coverage

Using the twenty-nine input files, the AML program delineated the grid cells based on the climate classification criteria (Table 5).

VARIABLE SELECTION FOR THE AGROCLIMATE CLASSIFICATION

Many, if not all, climatic variables affect the growth of plants in some way, shape, or form and the relationship between vegetation and climate is complex. However, the principal climatic factors affecting vegetation are temperature, moisture, and length of growing season (Critchfield, 1983).

Jallala, (1981) used a combination of these variables to delineate geo-climate zones for the West. Crops, being a little less hardy than natural vegetation, are less resistant to traumatic events such as extreme temperatures, heavy precipitation, and early frost. A shortened growing season can be devastating to the yield and quality of a crop.

All plants have a minimum, optimum, and maximum threshold for growth (Wang et al., 1982; Knott, 1957). The annual average temperature alone would not be sufficient to reflect all of these threshold values. In addition to the average, extreme temperatures provide an equally if not more meaningful representation of the climatic conditions of a given area. Furthermore, annual values tend to mask the seasonal fluctuations of different geographic location. Even though the value of a given variable at different locations may be similar on an annual basis, the way in which it behaves throughout the year can be quite different. For example, two locations may be similar in their climatic conditions in the spring but different in their climatic conditions in the fall. For many crops, temperature at a given time during the year may be more important that the average annual temperature. Seasonal variations are more representative of the climatic conditions experienced throughout the year.

Table 5. Criteria for classification of major climatic types in modified Köppen system.

Letter			Criteria
A			Avg. temp. of coolest month 18°C or higher
	f		Precip. in driest month at least 6 cm
	m		Precip. in driest month < 6 cm but >= 10 – r/25
	w		Precip. in driest month < 10 – r/25
B			70% or more of annual precip. falls in warmer six months and r < 2t + 28
			70% or more of annual precip. falls in cooler six months and r < 2t
			Neither half of year with more than 70% of annual precip. and r < 2t + 14
	W		r < 1/2 upper limit of applicable requirement for B
	S		r < upper limit for B but more than 1/2 that amount
		h	t > 18°C
		k	t < 18°C
C			Avg. temp. of warmest month > 10°C and of coldest month between 18° and 0°C
	s		Precip. in driest month of summer half of year < 4 cm and < 1/3 the amount in wettest winter month
	w		Precip. in driest month of winter half of year < 1/10 of amount in wettest summer month
	f		Precip. not meeting conditions of either s or w
		a	Avg. temp. of warmest month 22°C or above
		b	Avg. temp. of each of four warmest months 10°C or above; temp. of warmest month below 22°C
		c	Avg. temp. of from one to three months 10°C or above; temp. of warmest month below 22°C
D			Avg. temp. of warmest month > 10°C and of coldest month 0°C or below
	s		Same as under C
	w		Same as under C
	f		Same as under C
		a	Same as under C
		b	Same as under C
		c	Same as under C
		d	Avg. temp. of coldest month below –38°C
E			Avg. temp. of warmest month equal to or below 10°C
	T		Avg. temp. of warmest month between 10° and 0°C
	F		Avg. temp. of warmest month 0°C or below
H			Temp. requirements same as E, but due to altitude (generally above 1500 m)

* t = average annual temperature (°C); r = average annual precipitation (cm).

Source: Critchfield, H. J., 1983: General Climatology. 4th ed. Prentice Hall, 453 pp.

As with temperature, a combination of seasonal precipitation averages and extremes may provide the most representative picture of the moisture conditions that exist for crop growth. Food and nutrients are absorbed by plants through water. Excessive or heavy precipitation can be as devastating as drought to a crop. As with temperature, annual values do little to explain how precipitation is distributed throughout the year. A more representative picture would be to look at the seasonal distribution.

For a crop to be successful in a given area, it needs a long enough period of time to go from the planting of the seed to harvest. Therefore, when the first and last day of freeze occur and how many growing degree-days exist during that time is important.

Sixteen base variables representing extremes and averages of temperature and precipitation as well as growing and freeze information were used to produce the agroclimate classification in this study (Table 6). The first nine temperature variables were in degrees Celsius, the precipitation variables were in millimeters, the total number of growing degree-days was a cumulative value using a base of 10ºC, the total number of freeze free-days was an annual summation, and the fall and spring freeze dates were integers between 1 (January 1^{st}) and 365 (December 31^{st}).

In order to account for the seasonal variability in the climatic variables, temperature, precipitation, and growing degree-days, these were broken down by season (Table 6). Each of the four seasons of the year included three calendar months. September, October, and November made up the fall season while June, July, and August formed the summer season.

Spring included March, April, and May while December, January, and February made up the winter season. The final agroclimate classification in this study was based on the analysis of fifty-five variables (Table 7).

Table 6. Sixteen base variables of the agroclimate classification.

Base Variables
Lowest minimum temperature
Highest minimum temperature
Average minimum temperature
Lowest maximum temperature
Highest maximum temperature
Average maximum temperature
Lowest average temperature
Highest average temperature
Average average temperature
Lowest average precipitation
Highest average precipitation
Average average precipitation
Total number of growing degree-days
Total number of freeze free days
Day on which Fall freeze occurs
Day on which Spring freeze occurs

BROKEN DOWN BY SEASON	
Spring:	September, October, November
Summer:	June, July, August
Fall:	March, April, May
Winter:	December, January, February

GIS PROCEDURES

In this section, the geographic information system procedures employed to prepare the data sets for statistical analysis are discussed. All digital data processing was undertaken on Windows NT computer workstations and the ARC/INFO 7.1.1 (ESRI, 1999) geographic information system was used to store and analyze the information. Additionally, ArcView Version 3.1 (ESRI, 1999) was used to display the coverages, and layout the maps for printing.

A geographic information system is composed of computer hardware, software, methods, individuals, and data describing places in, on, or over the earth's surface. Over the past 10 years, geographic information systems have become an increasingly popular tool for compiling, analyzing and displaying numerous forms of geographically referenced information.

The monthly and annual gridded ASCII data files were converted into ARC/INFO grids using the ASCIIGRID command (Appendix A). Each gridded data layer, a network of uniformly spaced horizontal and perpendicular lines, has a grid cell size approximately 4 Km × 4 Km (Appendix C, Figure 2). Each 4 Km × 4 Km grid cell contains a value estimated by PRISM. The original gridded ASCII data files were in a geographic coordinate system (Latitude/Longitude). Each data layer was projected into the Idaho Transverse Mercator (IDTM) projection using ARC/INFO's PROJECTDEFINE and PROJECT commands (Appendix A). Using a state boundary polygon coverage, a grid MASK was created that represented the outline of the state. If any portion of a given grid cell, or the entire grid cell, was within the state boundary, the cell value was retained. Otherwise, the cell was considered to contain "no-data" for the purpose of analysis (Appendix C, Figure 3). The SETMASK command was employed on each of the variables in order to retain only cell values based on the extent of the previously mentioned MASK.

Using GRID ALGEBRA statements in the GRID module of ARC/INFO, the necessary information was extracted to create the final fifty-five grid coverages (Table 7).

Table 7. Fifty-five variables used in the agroclimate classification.

Variable #	Variable Name	Variable Description
1	tmin_minsp	Lowest minimum monthly temperature (Spring)
2	tmin_minsu	Lowest minimum monthly temperature (Summer)
3	tmin_minf	Lowest minimum monthly temperature (Fall)
4	tmin_minw	Lowest minimum monthly temperature (Winter)
5	tmin_maxsp	Highest minimum monthly temperature (Spring)
6	tmin_maxsu	Highest minimum monthly temperature (Summer)
7	tmin_maxf	Highest minimum monthly temperature (Fall)
8	tmin_maxw	Highest minimum monthly temperature (Winter)
9	tmin_avgsp	Average minimum temperature (Spring)
10	tmin_avgsu	Average minimum temperature (Summer)
11	tmin_avgf	Average minimum temperature (Fall)
12	tmin_avgw	Average minimum temperature (Winter)
13	tmax_minsp	Lowest maximum monthly temperature (Spring)
14	tmax_minsu	Lowest maximum monthly temperature (Summer)
15	tmax_minf	Lowest maximum monthly temperature (Fall)
16	tmax_minw	Lowest maximum monthly temperature (Winter)
17	tmax_maxsp	Highest maximum monthly temperature (Spring)
18	tmax_maxsu	Highest maximum monthly temperature (Summer)
19	tmax_maxf	Highest maximum monthly temperature (Fall)
20	tmax_maxw	Highest maximum monthly temperature (Winter)
21	tmax_avgsp	Average maximum temperature (Spring)
22	tmax_avgsu	Average maximum temperature (Summer)
23	tmax_avgf	Average maximum temperature (Fall)
24	tmax_avgw	Average maximum temperature (Winter)
25	tavg_minsp	Lowest average monthly temperature (Spring)
26	tavg_minsu	Lowest average monthly temperature (Summer)
27	tavg_minf	Lowest average monthly temperature (Fall)
28	tavg_minw	Lowest average monthly temperature (Winter)
29	tavg_maxsp	Highest average monthly temperature (Spring)
30	tavg_maxsu	Highest average monthly temperature (Summer)
31	tavg_maxf	Highest average monthly temperature (Fall)
32	tavg_maxw	Highest average monthly temperature (Winter)
33	tavg_avgsp	Average average temperature (Spring)
34	tavg_avgsu	Average average temperature (Summer)
35	tavg_avgf	Average average temperature (Fall)
36	tavg_avgw	Average average temperature (Winter)
37	ppt_minsp	Lowest average monthly precipitation (Spring)
38	ppt_minsu	Lowest average monthly precipitation (Summer)
39	ppt_minf	Lowest average monthly precipitation (Fall)
40	ppt_minw	Lowest average monthly precipitation (Winter)
41	ppt_maxsp	Highest average monthly precipitation (Spring)
42	ppt_maxsu	Highest average monthly precipitation (Summer)
43	ppt_maxf	Highest average monthly precipitation (Fall)
44	ppt_maxw	Highest average monthly precipitation (Winter)
45	ppt_avgsp	Average average precipitation (Spring)
46	ppt_avgsu	Average average precipitation (Summer)
47	ppt_avgf	Average average precipitation (Fall)
48	ppt_avgw	Average average precipitation (Winter)
49	gddsp	Total number of growing degree days (Spring)
50	gddsu	Total number of growing degree days (Summer)
51	gddf	Total number of growing degree days (Fall)
52	gddw	Total number of growing degree days (Winter)
53	frz_free	Total number of freeze free days (Annual)
54	frz_fall	Date on which freeze occurs in the Fall
55	frz_spr	Date on which freeze occurs in the Spring

The fifty-five projected grids were converted back to ASCII files using the GRIDASCII command. Each of the fifty-five ASCII files were 128 columns by 199 rows resulting in 25,472 cell values. Of the 25,472 cell values, 11,203 had a "no-data" value (i.e. they fall outside of the state boundary) leaving 14,269 values that statistical analysis would take place on.

STATISTICAL PROCEDURES

The statistical procedures used to produce the agroclimate classification in this study are discussed below. Data sets produced in the GIS were read into the Statistical Analysis Software program (SAS), cluster analysis was performed, and a final file depicting the cluster assignments was created and prepared for display and analysis back in the GIS. All statistical analysis was performed with SAS version 6.12 (SAS, 1985).

Cluster analysis involves techniques that produce groupings from data that are initially ungrouped. Measurements of the similarity and dissimilarity between individual observations are calculated as well as measurements of the similarity or dissimilarity between individual clusters. The number of distinct groups that exist in a data set is unknown prior to performing clustering. Two general cluster analysis methods, nonhierarchical and hierarchical, exist as ways to search for the number of clusters in a data set. Nonhierarchical methods involve initially selecting a set of cluster seed points and then building clusters around each of those seed points. Hierarchical clustering involves grouping the observed data points into clusters in a nested sequence of clustering. Although there are many different clustering algorithms, all are designed to maximize the similarity that exists within each grouped clusters and minimize the similarity that exists between the individual groups of clusters.

Within the grid module of ARC/INFO GIS, one method of clustering data is available: ISOCLUSTER. This is a nonhierarchical clustering method using a modified iterative optimization clustering procedure, also known as the migrating means technique, is available. The ISO prefix of the isodata clustering algorithm is an abbreviation for the Iterative Self Organizing way of performing clustering. This type of clustering uses a process that during each iteration all samples are assigned to existing cluster centers and new means are recalculated for every class. One disadvantage of this type of clustering method is that it requires an initial guess as to the number of clusters that are going to exist. A second disadvantage is that it is greatly influenced by the choice of the initial cluster seeds. Therefore, the clustering procedures for this study were performed in SAS.

Within the SAS software package, a plethora of hierarchical clustering techniques are available. Ward's minimum variance hierarchical clustering method was used to produce the agroclimate classification in this study. Ward’s method defines the distance between two clusters to be the square of the distance between the cluster means divided by the sum of the reciprocals of the number of points within each cluster. This clustering method was used in classifications produced by van Groenewoud (1984) and Briggs and Lemin (1992).

The fifty-five ASCII data files were read into SAS using a DATA step and then merged into one data set using the MERGE command (Appendix B). Each of the fifty-five ASCII files were 128 columns by 199 rows resulting in 25,472 observations. The merged data set contained 55 variables and 25,472 observations. A subset of the merged data set was created using a DATA step to exclude the "no-data" values (-9999) from further analysis. “No-data” values were found to total 11,203 (recall that these “no-data” values represent grid cells that fell outside of the state boundary). Therefore, 14,269 observations remained in the subset data set that statistical analysis would take place on.

Using PROC STANDARD, the data were standardize to mean 0 and standard deviation 1. This was a necessity because the variables being analyzed had extremely different numeric values of standard deviation due to the fact they were measured in different units. Failure to standardize would mean that variables with large standard deviations would be more important than variables with small standard deviations when identifying clusters.

PROC PRINCOMP was used to create principal component scores for the data. Principal component analysis (PCA) is a statistical technique that transforms a set of correlated variables into a smaller set of uncorrelated variables. The primary objectives of PCA are to (1) reduce the dimensionality of the data set (whereby discovering the true dimensionality of the data) without losing a large amount of the information contained in the variables and (2) identify new meaningful underlying variables. With PCA, new variables are formed which define as much of the variance in the data as possible. The principal components are formed by linear combinations of the original variables. The total number of variables is reduced and the correlation between the variables is eliminated. The first principal component is a line which explains the most variance in the data and the remaining components give the best linear approximation of the remaining variance. Based on the values of the first five principal components, cluster analysis was used to assess the statistical similarity between the 14,269 grid cells. Using PROC CLUSTER, cluster analysis was run on the five newly created principal component score variables employing Ward's clustering method (APPENDIX C).

Ultimately, all hierarchical clustering methods will produce one cluster containing all the observations. A somewhat arbitrary decision has to be made in determining where the merging of clusters should cease. It was decided prior to performing the cluster analysis that the presence of ten to twenty agroclimate zones (clusters) would be needed to adequately delineate the state. One method of determining where the merging of clusters should cease is to use the pseudo Hotelling's T^2 statistic (PST2) (Johnson, 1998). This statistic is available in SAS and compares the means of two clusters. If the value of PST2 is large, the two clusters should not be combined. If the value of PST2 is small, then the two clusters may be combined. The designation of what is considered "large" and "small" is somewhat relative to the data being analyzed. In most cases it is best to use these values according to how they compare to one another. When the program reduces 19 clusters to 18 clusters, the values of pseudo T^2 statistic increases from 674.8 to 1170; a change of 495.2 (Table 8). When the program reduces 15 clusters to 14 clusters, the values of pseudo T^2 statistic increases from 654.2 to 1377; a change of 722.8. Finally, when the program reduces 9 clusters to 8 clusters, the values of pseudo T^2 statistic increases from 970.8 to 1990; a change of 1019.2.

Table 8. Ward's minimum variance cluster analysis results.

# of clustres	PST2
22	544.3
21	268.1
20	224.9
19	674.8
18	1170
17	335.9
16	464.8
15	654.2
14	1377
13	905.4
12	944.5
11	1442
10	1891
9	970.8
8	1990
7	1374
6	2671
5	1897
4	3429
3	3934
2	4996
1	11396

The values of 674.8 and 654.2 can be considered relatively "small" when compared to many of the other values of PST2 such as 1170 and 1377 which can be thought of as relatively "large". Even thought the change in the PST2 statistic was large when the program reduced 9 clusters to 8 clusters, 970.8 is quite a bit bigger than 674.8 and 654.2 in the context of this data set. Furthermore, it was felt that 9 clusters would not be sufficient to adequately delineating the state. Two instances of cluster reduction mentioned above represent rather large changes in the PST2 statistic of 495.2 and 722.8. Therefore, based on the PST2 statistic, the number of clusters in these data is likely to be somewhere between 15 and 21.

The location of each grid cell with it's associated cluster number (16 cluster solution) is shown in the space defined by the first three principal components (Appendix C, Figures 4 & 5).

Using a final DATA step, ASCII files containing a cluster number for each grid cell for 21, 20, 19, 18, 17, 16, and 15 cluster solutions were created. Each of these files was imported back into ARC/INFO for spatial analysis.

CHAPTER IV: RESULTS AND DISCUSSION

This chapter presents the results of the Köppen climate classification and the agroclimate classification that were created using the PRISM data sets. The Köppen climate classification was reproduced within the ARC/INFO GIS. Geographic information systems and statistical analysis software were used to create the agroclimate classification based on the fifty-five variables discussed in Chapter II. A GIS coverage of the potential natural vegetation of the conterminous United States was used as a means of assessing the accuracy of the cluster solution (Küchler, 1964).

KÖPPEN CLIMATE CLASSIFICATION

The Köppen climate classification AML delineated the conterminous United States based on the criteria in Table 5 (Appendix C, Figure 6). The Köppen climate classification zones for Idaho are shown in Appendix C, Figure 7. The results show that the major zones delineated using the PRISM data line up well with those produced by Köppen classification in the first half of this century (Appendix C, Figure 8). Zone A is shown on the southern tip of Florida and Zone B tends to encompass the western half of the conterminous United States on both maps. Zone C covers most of the southeast and zone D is primarily the northeast on both maps. This demonstrates, with a certain degree of confidence, that the PRISM data can be used to produce climate classification maps.

AGROCLIMATE CLASSIFICATION

For these data, the first five principal components accounted for 97% of the total variance in the original data set (Table 9).

Table 9. Eigenvalues of the correlation matrix.

PC#	Eigenvalue	Difference	Proportion	Cumulative
PRIN1	39.9890	31.0636	0.727072	0.72707
PRIN2	8.9253	6.8982	0.162279	0.88935
PRIN3	2.0271	0.7725	0.036857	0.92621
PRIN4	1.2546	0.3224	0.022811	0.94902
PRIN5	0.9322	0.1998	0.016949	0.96597

There is no one method for selecting the number of components to retain and the choice of five was somewhat arbitrary. An initial method is to simply retain the number of components that explain an arbitrarily large portion of the variance. Originally it was decided that the number of principal components that explained 95% of the variance would be retained. Upon further analysis it was determined that one additional principal component would be retained because it's inclusion produce a zone (zone 1) that showed a correspondence with Küchler's saltbrush-greasewood delineation.

Table 9 shows the eigenvalues of the first five principal components and Table 10 displays the coefficients of the eigenvectors of the PCA of the correlation matrix. Principal component one was positively loaded on temperature variables (Table 10). The loading refers to the magnitude (1 to -1) of the eigenvector associated with each variable. The highest loadings for principal component two were associated with precipitation variables.

Table 10. Eigenvectors of the principal components.

VARIABLE NAME	VARIABLE DESCRIPTION	PRIN1	PRIN2	PRIN3	PRIN4	PRIN5
VAR1	Tmin_minsp	0.138626	0.146128	-.039168	-.114695	-.046285
VAR2	Tmin_minsu	0.149401	0.048921	-.182991	0.030516	0.043453
VAR3	Tmin_minf	0.139287	0.131460	-.027604	-.040586	-.051739
VAR4	Tmin_minw	0.109086	0.222923	0.054006	-.208716	-.065399
VAR5	Tmin_maxsp	0.147144	0.070612	-.185944	-.012621	0.039675
VAR6	Tmin_maxsu	0.143482	0.039681	-.254377	-.008693	0.041127
VAR7	Tmin_maxf	0.126988	0.119134	-.281127	-.146618	0.022565
VAR8	Tmin_maxw	0.123589	0.189543	0.044258	-.190620	-.066479
VAR9	Tmin_avgsp	0.145697	0.110700	-.114941	-.056624	-.003328
VAR10	Tmin_avgsu	0.145499	0.052456	-.236028	-.012026	0.040935
VAR11	tmin_avgf	0.137851	0.136441	-.158164	-.102691	-.010441
VAR12	tmin_avgw	0.115334	0.211640	0.043469	-.195401	-.068193
VAR13	tmax_minsp	0.146452	0.030932	0.193778	0.084168	0.039243
VAR14	tmax_minsu	0.147953	-.072602	0.020121	0.218734	0.025549
VAR15	tmax_minf	0.147202	-.061135	0.150273	0.105993	-.018452
VAR16	tmax_minw	0.132588	0.045015	0.336572	-.077445	-.058167
VAR17	tmax_maxsp	0.150374	-.050385	0.021148	0.201968	0.029803
VAR18	tmax_maxsu	0.145639	-.089506	0.050800	0.219289	0.018050
VAR19	tmax_maxf	0.147008	-.070856	0.093727	0.193785	0.015051
VAR20	tmax_maxw	0.134232	0.050564	0.340824	-.019063	0.007611
VAR21	tmax_avgsp	0.152519	-.018900	0.087086	0.161011	0.034738
VAR22	tmax_avgsu	0.147126	-.080681	0.045166	0.215629	0.019766
VAR23	tmax_avgf	0.147832	-.075153	0.118819	0.163862	-.003382
VAR24	tmax_avgw	0.135232	0.045809	0.334226	-.048322	-.036564
VAR25	tavg_minsp	0.148788	0.094299	0.076968	-.019174	-.004940
VAR26	tavg_minsu	0.154103	-.020914	-.069891	0.142656	0.034423
VAR27	tavg_minf	0.153031	0.033225	0.069273	0.038118	-.036675
VAR28	tavg_minw	0.127909	0.159418	0.190319	-.164528	-.066639
VAR29	tavg_maxsp	0.154855	0.002058	-.071183	0.113404	0.035241
VAR30	tavg_maxsu	0.153431	-.035651	-.092500	0.125903	0.030858
VAR31	tavg_maxf	0.154413	0.019200	-.089713	0.040345	0.020665
VAR32	tavg_maxw	0.135771	0.137326	0.181119	-.124867	-.036987
VAR33	tavg_avgsp	0.155568	0.043051	-.007145	0.062347	0.017754
VAR34	tavg_avgsu	0.154667	-.023384	-.082904	0.122005	0.030768
VAR35	tavg_avgf	0.156919	0.019991	-.003912	0.050438	-.007137
VAR36	tavg_avgw	0.132317	0.151709	0.177487	-.142835	-.058704
VAR37	ppt_minsp	-.094576	0.252578	0.037725	0.136157	0.028510
VAR38	ppt_minsu	-.124996	0.106434	-.064609	-.099624	0.257999
VAR39	ppt_minf	-.102779	0.232502	0.013580	0.109314	0.076129
VAR40	ppt_minw	-.088841	0.249944	-.007771	0.257243	-.074115
VAR41	ppt_maxsp	-.108914	0.224662	0.023806	0.137293	0.056138
VAR42	ppt_maxsu	-.121642	0.171667	0.053528	0.001359	0.183700
VAR43	ppt_maxf	-.087687	0.256941	-.020341	0.197629	-.066872
VAR44	ppt_maxw	-.089527	0.250245	0.006894	0.247521	-.070963
VAR45	ppt_avgsp	-.102917	0.243153	0.033950	0.137046	0.042728
VAR46	ppt_avgsu	-.124540	0.151058	-.008064	-.049141	0.216387
VAR47	ppt_avgf	-.097458	0.254409	-.008432	0.163193	-.006601
VAR48	ppt_avgw	-.089182	0.250849	0.000940	0.248687	-.074932
VAR49	gddsp	0.145639	0.004380	-.035953	0.111097	0.224477
VAR50	gddsu	0.154486	-.025038	-.084311	0.119903	0.041330
VAR51	gddf	0.153311	0.009920	-.052988	0.048071	0.109435
VAR52	gddw	0.060671	0.044731	0.119003	-.107344	0.831929
VAR53	frz_free	0.143515	0.107320	-.152556	-.061092	-.065699
VAR54	frz_fall	0.140971	0.113560	-.122125	-.112394	-.063845
VAR55	frz_spr	-.142623	-.101483	0.169214	0.027450	0.065729

The highest loadings for principal component three were associated with the lowest, average, and highest maximum winter temperatures. Principal component four exhibits the highest loadings with the lowest, average, and highest maximum summer temperatures and the lowest, average, and highest winter precipitation. Principal component five is loading strongly positive on the growing degree-days variables in the winter and spring and on the minimum, maximum, and average precipitation variables in the summer. Once again, choosing to retain five principal components was somewhat arbitrary. However, these five principal components explained 97% of the variability in the original data set and the addition of any more components would have explained only about 3% more variance.

Using the information from the cluster analysis and the potential natural vegetation coverage, a sixteen zones agroclimate classification for Idaho was created using the PRISM data and the fifty-five variables mentioned in Chapter II (Appendix C, Figure 9). The cluster analyses results indicated that the number of clusters in the data set was between 15 and 21. Five principal components and sixteen zones showed the most agreement with the potential natural vegetation coverage. As the number of principal components and/or the number of zones increased, agreement with the individual potential natural vegetation zones did not increase. Therefore, justification for additional agroclimate zones did not seem plausible.

The locations of the grid cells showed fairly strong clustering in the space defined by the first two principal components (Appendix C, Figure 4). The majority of the sixteen clusters of points are compact indicating similarity among the points in a zone with overlap seen at transition zones. Recall that principal component one is associated with temperature and principal component two is associated with precipitation. Cluster 5 and 6 show a great deal of overlap in this space taken up by the first two principal components however, the distinction between the two shows up in space taken up by additional principal components (Figure 5). Therefore, the overall temperature and precipitation of cluster 5 and 6 may be similar but one distinction between the two zones is showing up in there maximum winter temperatures. Additionally, the locations of the grid cells showed fairly good clustering in all of the five dimensional spaces defined by the components.

A map of the agroclimate zones (draped over a shaded relief of the topography) is shown in Appendix C, Figure 10. A map of each individual agroclimate zone is shown in Appendix C, Figures 11-26. The total number of grid cells in each agroclimate zone is shown in Table 11. Table 12 shows the range for each of the sixteen base variable plus the elevation for all the cells in each zone. Table 13 shows the average for each of the sixteen base variables plus the elevation for all the cells in each zone. In general, as the zone numbers increase, the overall climate progresses from warmer, lower elevation to colder, higher elevation (Table 14).

Zone 1 has the highest average annual temperature (10.8ºC), the lowest average minimum temperature (3.5ºC), the greatest number of freeze free days (143), the most growing degree days (2898) and the lowest elevation (750 m) (Table 12). Zone 2 has the highest maximum temperature (32.9ºC), the least average annual precipitation (287 mm), and the lowest minimum precipitation (7 mm). Zone 16 has the lowest average minimum temperature (–15.1ºC), lowest average annual temperature (1.2ºC), the least number of freeze free days

(33), the least number of growing degree days (338), and the highest elevation (2508 m). Zone 10 has the highest average annual precipitation (1529 mm).

Table 11. Total number of grid cells in each agroclimate zone.

Agroclimate zone	Total number of grid cells
1	346
2	771
3	1497
4	1184
5	955
6	745
7	770
8	972
9	1728
10	532
11	421
12	1059
13	1044
14	836
15	766
16	643

As discussed previously, climatic zones should correspond to some degree with vegetation. Therefore, as a means of accessing how well the agroclimate zones correlate with vegetation devoid of human influence since the 1960s, a GIS coverage representing A. W. Küchler's Potential Natural Vegetation of the Conterminous United States was acquired from the Interior Columbia Basin Ecosystem Management Project (ICBEMP) Home Page (Appendix D). Figure 27 (Appendix C) shows that agroclimate zones 10, 15, and 16 appear to be conducive to the growth of western spruce-fir forests. Figure 28 (Appendix C) shows that cedar-hemlock-pine forests tend to correspond with agroclimate zones 7. Grand fir-Douglas fir forest appear to coincide well with agroclimate zone 13 (Appendix C, Figure 29). Figure 30 (Appendix C) displays the agreement between agroclimate zone 1 and saltbrush-greasewood. Finally, Figure 31 (Appendix C) shows that agroclimate zones 2, 3, 5, 6, 9, and 12 cover an areas similar to that covered by sagebrush steppe.

Table 12. Range in each agroclimate zone.

ZONE	Low min. temp. (ºC)	High min. temp. (ºC)	Avg. min. temp. (ºC)	Low max. temp. (ºC)	High max. temp. (ºC)	Avg. max. temp. (ºC)	Low avg. temp. (ºC)	High avg. temp. (ºC)	Avg. avg. temp. (ºC)
1	-6.5 - -2.0	10.0 - 16.8	1.8 - 6.1	2.4 - 6.1	28.8 - 35.4	15.2 - 20.0	-1.8 - 1.5	19.6 - 26.1	8.7 - 12.7
2	-8.6 - -5.7	11.4 - 17.1	1.4 - 4.2	0.8 - 4.0	31.3 - 35.2	16.1 - 19.3	-3.7 - -1.1	22.0 - 25.1	8.9 - 11.2
3	-10.6 - -4.3	7.9 - 15.3	-0.9 - 3.6	-0.8 - 4.8	26.3 - 33.4	13.4 - 17.8	-5.5 - -0.4	18.7 - 23.3	7.3 - 10.2
4	-10.6 - -5.2	6.5 - 13.2	-0.8 - 2.2	-1.7 - 3.0	23.9 - 30.3	11.0 - 15.6	-5.7 - -1.2	16.2 - 21.1	5.8 - 8.6
5	-12.7 - -7.7	5.7 - 12.2	-1.6 - 1.2	-1.6 - 2.0	28.1 - 32.5	13.4 - 16.4	-7.0 - -2.8	17.2 - 21.7	6.3 - 8.3
6	-11.4 - -7.0	5.0 - 10.8	-3.3 - 0.9	0.6 - 5.4	26.9 - 31.7	12.9 - 16.9	-5.2 - -2.4	16.8 - 20.5	5.2 - 8.0
7	-11.2 - -6.2	6.6 - 10.9	-1.7 - 1.3	-2.8 - 1.9	20.6 - 28.3	8.9 - 14.2	-6.5 - -2.6	14.3 - 19.5	4.1 - 7.3
8	-13.2 - -7.7	5.3 - 12.0	-3.7 - 0.6	-2.4 - 2.8	23.7 - 30.2	10.4 - 15.2	-7.1 - -3.1	14.6 - 20.0	4.5 - 6.9
9	-15.8 - -9.3	5.8 - 11.4	-3.8 - -0.4	-3.5 - 0.1	25.4 - 31.0	10.4 - 15.4	-9.2 - -4.9	16.6 - 20.7	4.2 - 6.8
10	-12.7 - -6.4	5.4 - 10.4	-3.2 - 1.0	-5.0 - 0.2	17.7 - 26.0	5.7 - 12.2	-8.7 - -3.2	12.4 - 17.5	1.7 - 6.5
11	-13.1 - -7.8	4.9 - 9.3	-3.5 - -0.4	-3.8 - 1.4	18.9 - 26.6	7.6 - 12.8	-7.7 - -3.1	12.8 - 17.6	2.7 - 6.1
12	-17.3 - -10.4	3.9 - 9.1	-5.5 - -1.8	-3.6 - 1.0	23.3 - 28.8	9.6 - 13.5	-10.1 - -4.6	14.1 - 18.1	2.7 - 5.2
13	-15.8 - -9.9	2.0 - 7.7	-6.3 - -2.1	-4.7 - 2.4	20.6 - 27.6	7.4 - 13.6	-9.5 - -4.7	11.9 - 16.9	1.7 - 4.9
14	-18.4 - -11.3	3.1 - 9.3	-6.5 - -1.5	-5.8 - -0.7	20.1 - 27.1	6.9 - 12.3	-11.1 - -7.3	12.8 - 17.6	1.3 - 4.2
15	-17.4 - -8.6	0.4 - 10.0	-7.4 - 0.0	-6.1 - -0.1	15.6 - 25.0	4.7 - 11.4	-10.7 - -5.8	10.0 - 15.3	-0.1 - 3.7
16	-18.6 - -11.3	-0.3 - 7.4	-8.8 - -3.0	-7.3 - -0.3	16.6 - 25.9	4.1 - 11.2	-12.4 - -7.0	9.3 - 14.5	-1.3 - 2.7

ZONE	Low ppt. (mm)	High ppt. (mm)	Avg. ppt. (mm)	# Frz-free days	Day of fall frz	Day of spring frz	# Gdd	Elev. (m)
1	4 - 30	21 - 84	174 - 756	125 - 163	264 - 284	120 - 139	2005 - 3771	240 - 1194
2	5 - 13	26 - 105	219 - 689	124 - 158	264 - 279	119 - 141	2447 - 3203	639 - 1207
3	6 - 29	26 - 125	192 - 832	106 - 158	256 - 279	121 - 152	1630 - 2721	415 - 1796
4	11 - 44	37 - 177	301 - 1134	97 - 141	252 - 274	130 - 156	1098 - 2169	536 - 2165
5	8 - 36	28 - 129	177 - 852	94 - 130	249 - 270	140 - 160	1332 - 2340	587 - 1802
6	7 - 26	26 - 71	190 - 522	73 - 119	247 - 265	145 - 174	1113 - 1942	883 - 1921
7	16 - 78	72 - 200	629 - 1374	86 - 128	247 - 269	140 - 165	680 - 1724	735 - 2428
8	9 - 49	40 - 197	303 - 1161	59 - 121	231 - 265	144 - 178	702 - 1865	592 - 2455
9	6 - 38	29 - 89	180 - 628	69 - 116	242 - 262	143 - 176	1058 - 2035	1182 - 2125
10	33 - 98	126 - 431	906 - 2865	73 - 123	244 - 266	142 - 173	326 - 1423	1086 - 2696
11	14 - 76	65 - 237	557 - 1407	57 - 103	236 - 260	153 - 181	404 - 1253	1130 - 2654
12	8 - 46	30 - 134	209 - 882	47 - 95	233 - 254	158 - 189	596 - 1377	1113 - 2508
13	16 - 71	65 - 215	583 - 1274	27 - 84	226 - 253	165 - 203	255 - 1150	1304 - 2719
14	10 - 73	38 - 164	256 - 1247	33 - 94	229 - 254	157 - 199	377 - 1290	1703 - 2823
15	22 - 77	101 - 315	826 - 2170	9 - 101	221 - 254	152 - 212	15 - 874	1085 - 3116
16	11 - 69	50 - 193	307 - 1298	2 - 71	214 - 250	179 - 212	0 - 591	1768 - 3259

Table 13. Average in each agroclimate zone.

Zone	Low min. temp. (ºC)	High min. temp. (ºC)	Avg. min. temp. (ºC)	Low max. temp. (ºC)	High max. temp. (ºC)	Avg. max. temp. (ºC)	Low avg. temp. (ºC)	High avg. temp. (ºC)	Avg. avg. temp. (ºC)
1	-5.1	13.3	3.5	3.7	32.7	18.0	-0.7	23.0	10.8
2	-6.9	13.1	2.5	2.5	32.9	17.6	-2.2	23.0	10.1
3	-7.8	11.5	1.3	1.8	30.6	15.8	-3.0	21.0	8.6
4	-6.8	9.2	0.8	0.8	27.3	13.5	-3.0	18.2	7.2
5	-10.4	10.3	-0.3	-0.1	30.2	14.7	-5.2	20.2	7.2
6	-9.9	8.3	-1.3	2.9	29.5	15.2	-3.5	18.9	6.9
7	-7.7	8.5	-0.1	-0.5	25.3	11.9	-4.0	16.8	5.9
8	-10.3	8.3	-1.3	-0.2	27.2	12.9	-5.2	17.8	5.7
9	-13.3	9.1	-2.0	-1.6	29.0	13.4	-7.5	19.1	5.6
10	-8.3	8.5	-0.5	-2.1	22.2	9.5	-5.2	15.3	4.5
11	-10.5	7.2	-2.1	-1.4	24.2	10.7	-5.9	15.7	4.3
12	-13.1	6.7	-3.4	-1.7	26.1	11.6	-7.4	16.4	4.1
13	-12.8	4.6	-4.3	-1.5	24.3	10.8	-7.1	14.4	3.2
14	-14.5	5.9	-4.4	-3.2	24.1	9.9	-8.8	15.0	2.7
15	-12.5	4.7	-4.3	-3.2	21.5	8.5	-7.8	13.1	2.1
16	-15.1	3.6	-5.9	-3.6	21.7	8.4	-9.3	12.6	1.2

Zone	Low ppt. (mm)	High ppt. (mm)	Avg. ppt. (mm)	# Frz-free days	Day of fall frz	Day of spring frz	# Gdd	Elev. (m)
1	12	38	316	143	273	130	2898	750
2	7	39	287	139	272	133	2769	903
3	13	48	365	127	267	140	2207	1184
4	27	97	717	119	262	144	1574	1028
5	16	54	399	112	260	148	1929	1414
6	12	40	312	98	256	157	1591	1609
7	34	143	1033	110	259	149	1222	1213
8	23	76	582	97	255	158	1364	1734
9	17	42	332	93	250	157	1627	1617
10	45	219	1529	104	257	153	857	1518
11	36	129	976	85	250	165	902	1944
12	26	63	518	72	243	172	1040	1914
13	33	128	939	54	238	183	637	2002
14	32	75	598	59	240	181	739	2171
15	44	192	1330	52	238	186	416	2187
16	35	101	765	33	232	200	338	2508

Table 14. General agroclimate zone description.

Zone	Figure Number	General Geographic Area	General Climate	Annual Avg. Temp. (ºC)	Annual Avg. Precip. (mm)
1	11	Around Lewiston; southern Ada and Elmore counties; northern Owyhee county; Lower elevations of western Idaho county.	Hot, dry, low elevation, very long growing season	10.8	316
2	12	Western Snake Plain from Jerome to Washington counties.	Hot, dry, low elevation, very long growing season	10.1	287
3	13	Central Snake Plain and Kootenai county around Coeur d' Alene.	Hot, dry, low elevation, very long growing season	8.6	365
4	14	Lower elevations of the Panhandle from Boundary to Idaho county.	Warm, wet, low elevation, long growing season	7.2	717
5	15	Central Snake Plain around Lincoln and Bingham counties; Central Elmore county up through Adams county.	Warm, dry, mid elevation, long growing season	7.2	399
6	16	Southwest corner of Owyhee county.	Warm, dry, mid elevation, moderate growing season	6.9	312
7	17	Mid-elevation areas east of the Palouse in Benewah, Latah, Shoshone, and Clearwater counties.	Warm, wet, mid elevation, long growing season	5.9	1033
8	18	Higher elevations of Owyhee county, southeastern corner of the state in Bannock, Power and Oneida counties.	Warm, moderately wet, mid elevation, moderate growing season	5.7	582
9	19	Eastern Snake Plain, valleys in Lemhi and Custer counties.	Warm, dry, mid elevation, moderate growing season	5.6	332
10	20	Higher elevations of the Panhandle; eastern Bonner, Shoshone, and Clearwater counties.	Cool, wet, mid elevation, long growing season	4.5	1529
11	21	Central Idaho and Adams counties; small areas in Boise, Elmore, Camas, and Blaine counties; border between Bear Lake and Franklin counties.	Cool, wet, mid elevation, short growing season	4.3	976
12	22	Eastern Idaho in Freemont, Madison, Teton, Bonneville, and Caribou counties; mid-elevations of Lemhi, Valley, and Custer counties.	Cool, moderately wet, mid elevation, short growing season	4.1	518
13	23	Mid-elevations of central Idaho in Idaho, Valley, Adams, Boise, and Lemhi counties.	Cold, wet, high elevation, very short growing season	3.2	939
14	24	Eastern Idaho in Clark and Fremont counties; mid-elevations of Custer and Lemhi counties.	Cold, moderately wet, high elevation, very short growing season	2.7	598
15	25	Higher elevations of Boundary, Idaho, Valley, and Custer counties.	Cold, wet, high elevation, very short growing season	2.1	1330
16	26	Higher elevations of Idaho, Lemhi, and Custer counties.	Cold, wet, high elevation, very short growing season	1.2	765

CHAPTER V: CONCLUSIONS

The primary objectives of this study were to (1) demonstrate that a combination of geographic information systems (GIS) and multivariate statistical procedures could be used to map climate using data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) and to (2) delineate agroclimate zones for the purpose of applying successful dryland agricultural research management practices throughout areas of relative climatic uniformity.

Previous classifications of climate have been based on various combinations of variables. Some of the early classifications used a relatively few number of variables and delineated regions using a geographical approach. More recently, classifications have increased the number of variables used to delineate regions of similar climate and have used a statistically based approach. The agroclimate classification produced in this study uses a comparatively high resolution data set and a large number of climatic variables as the basis for a statistical approach.

Climate plays an important role in the geographical distribution of agricultural and overall agricultural productivity of a given area. Additionally, both natural and human factors are recognized as direct influences on the ability to grow crops feasibly in any area. While factors other than climate are recognized as influences on the agricultural productivity of a given area, climate imposes its will either directly or indirectly on these other factors. This study delineated agroclimate zones solely on climatic variables from PRISM. Specifically, the seasonal distribution of temperature, precipitation, and growing degree-days variables as well as annual freeze-free days, day of first frost in the fall and day of last frost in the fall.

Cluster analysis was used to determine the agroclimate zones in Idaho. The data set in this study contained 14,269 observations that statistical analysis took place on. Ward's clustering method was used to identify areas of climatic similarity. The pseudo T^2 test statistic available in SAS was used to determine where the merging of clusters should cease. It was determined that a sixteen cluster solution was appropriate for these data. Additionally, a GIS coverage depicting Küchler potential natural vegetation zones was used as a means of assessing if the agroclimate zones appeared reasonable. Figure 9 displays the sixteen agroclimate zones and Table 14 discusses the general geographic area and climate of each of the sixteen zones.

The establishment of techniques to help further understand how climate influences agriculture is needed to perpetuate a strong agricultural industry. All agricultural and gardening endeavors are strongly influenced by climate. Climate dictates what crops can be grown in a region and strongly influences the yearly variation of their yields. Optimum production of the food supply requires a thorough understanding of the climate in any given area.

This methodology should be attractive to others since the PRISM data are freely available for the entire United States. Furthermore, the data have undergone extensive review and the results of the PRISM model are held in high regard. Enhancements to an agroclimate classification such as the one produced in this study may involve including variables such as soil type and actual solar radiation received at the surface. Potentially, a soil moisture or evapotranspiration component could be developed to aid in agricultural delineations. Furthermore, a weighting of variables deemed more important than others could be investigated.

The results of this research will benefit farmers, gardeners, ranchers, researchers and persons interested in natural resources planning by providing a basis for applying research information and management recommendations. This spatial representation of multiple climate variables of particular relevance to agriculture and other natural resource planning purposes is available in a readily accessible form to the agricultural community and all interested parties.

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APPENDIX A: AML CODE

Köppen Climate Classification AMLs

```
/*---------------------------Name--------------------------------
/* koeppen.aml
/*--------------------------Purpose------------------------------
/*
/* Drives the Koeppen Climate Classification
/*
/*---------------------Global Variables--------------------------
/*
/*----------------------Local Variables--------------------------
/*
/*------------Other AMLs or Menus run from this AML-------------
/*
/* popup.msg          A message to the user stating what files are needed to run the classification
/* input.aml          Requests files from the user
/* asciigrid.aml      converts the ASCII files into ARC/INFO grids
/* projection.aml     Projects the ARC/INFO grids into a user-defined projection
/* latticeclip.aml    clips the grids by a polygon boundary coverage
/* grids.aml          calculate the grids necessary to perform the classification
/* classes.aml        defines the classes
/*
/*----------------------History---------------------------------
/*
/* Bruce Godfrey November 1998
/*
/*==============================================================
/*
/* create a directory for the user to store the needed data in

&sys mkdir data


/* set the terminal display

/* display popup window with user instructions

&terminal 9999
&popup tools/popup.msg

/* request input files from user
&r tools/input.aml

/*convert the ASCII files to ARC/INFO grids
&type The ASCII files are being converted to ARC/INFO grids

&r tools/asciigrid.aml

/* project the grids
&type The grids are being projected
&r tools/projection.aml

/* clip the grids with a boundary coverage
&type The grids are being clipped with the boundary coverage

&r tools/latticeclip.aml

/* calculate grids that are needed to define the classes
&type Subgrids are being calculated to be used in the classes
```

```
&r tools/grids.aml

/*define the classes
&type Classes are being defined
&r tools/classes.aml
&return
```

There are two cases in which it may be necessary to use the three-parameter transformation for datum transformation in North America: when converting to or from a datum other than NAD27 or NAD83 (such as WGS72), or when the data falls in an area not covered by United States or Canadian solutions.

The most accurate way to convert between WGS84 or WGS72 and NAD27 is the following:

1.) PROJECT the data set from "DATUM WGS84" to "DATUM NAR_C" (uses three parameter method).
2.) Use PROJECTDEFINE to update the datum to "DATUM NAD83".
3.) PROJECT from "DATUM NAD83" to "DATUM NAD27" (uses NADCON method).

Simply reverse the steps to convert from NAD27 to WGS84. This two step method takes advantage of the fact that the most accurate way to convert between NAD83 and NAD27 is the NADCON method. It's possible to convert directly to and from WGS84 and NAD27 (using the equivalent datum NAS_C) but not as accurate.

```
/*This is the first projection file for the PRISM data
input
projection geographic
units dd
datum wgs72
parameters
output
projection geographic
units dd
datum nar_c three
parameters
end
```

```
/*This is the second projection file for the PRISM data
input
projection geographic
units dd
datum nad83
parameters
output
projection albers
units meters
datum nad27
parameters
29 30 00
45 30 00
-96 00 00
23 00 00
0.0
0.0
end
```

```
/*--------------------------Name-------------------------------
/* input.aml
/*-------------------------Purpose-----------------------------
/*
/* Request from the user the files needed to perform the classification
/*
/*--------------------Global Variables-------------------------
/*
/* .precip01      the precipitation ASCII file for January entered by the user
/* .precip02      the precipitation ASCII file for February entered by the user
/* .precip03      the precipitation ASCII file for March entered by the user
/* .precip04      the precipitation ASCII file for April entered by the user
/* .precip05      the precipitation ASCII file for May entered by the user
/* .precip06      the precipitation ASCII file for June entered by the user
/* .precip07      the precipitation ASCII file for July entered by the user
/* .precip08      the precipitation ASCII file for August entered by the user
/* .precip09      the precipitation ASCII file for September entered by the user
/* .precip10      the precipitation ASCII file for October entered by the user
/* .precip11      the precipitation ASCII file for November entered by the user
/* .precip12      the precipitation ASCII file for December entered by the user
/* .precip14      the precipitation ASCII file for the year entered by the user
/* .tavg01        the temperature ASCII file for January entered by the user
/* .tavg02        the temperature ASCII file for February entered by the user
/* .tavg03        the temperature ASCII file for March entered by the user
/* .tavg04        the temperature ASCII file for April entered by the user
/* .tavg05        the temperature ASCII file for May entered by the user
/* .tavg06        the temperature ASCII file for June entered by the user
/* .tavg07        the temperature ASCII file for July entered by the user
/* .tavg08        the temperature ASCII file for August entered by the user
/* .tavg09        the temperature ASCII file for September entered by the user
/* .tavg10        the temperature ASCII file for October entered by the user
/* .tavg11        the temperature ASCII file for November entered by the user
/* .tavg12        the temperature ASCII file for December entered by the user
/* .tavg14        the temperature ASCII file for the year entered by the user
/* .dem           the digital elevation model entered by the user
/* .boundary      a polygon coverage of the area of interest entered by the user
/* .projection    a projection file entered by the user
/*
/*---------------------Local Variables-------------------------
/*
/*-----------Other AMLs or Menus run from this AML-------------
/*
/*---------------------History--------------------------------
/*
/* Bruce Godfrey November 1998
/*
/*==============================================================
/*
&s .precip01 = [getfile 'data/*.asc' 'Select ppt ASCII file for January (01)']
&s .precip02 = [getfile 'data/*.asc' 'Select ppt ASCII file for February (02)']
&s .precip03 = [getfile 'data/*.asc' 'Select ppt ASCII file for March (03)']
&s .precip04 = [getfile 'data/*.asc' 'Select ppt ASCII file for April (04)']
&s .precip05 = [getfile 'data/*.asc' 'Select ppt ASCII file for May (05)']
&s .precip06 = [getfile 'data/*.asc' 'Select ppt ASCII file for June (06)']
&s .precip07 = [getfile 'data/*.asc' 'Select ppt ASCII file for July (07)']
&s .precip08 = [getfile 'data/*.asc' 'Select ppt ASCII file for August (08)']
&s .precip09 = [getfile 'data/*.asc' 'Select ppt ASCII file for September (09)']
&s .precip10 = [getfile 'data/*.asc' 'Select ppt ASCII file for October (10)']
&s .precip11 = [getfile 'data/*.asc' 'Select ppt ASCII file for November (11)']
&s .precip12 = [getfile 'data/*.asc' 'Select ppt ASCII file for December (12)']
&s .precip14 = [getfile 'data/*.asc' 'Select ppt ASCII file annual (14)']
&s .tavg01 = [getfile 'data/*.asc' 'Select t_avg ASCII file for January (01)']
```

```
&s .tavg02 = [getfile 'data/*.asc' 'Select t_avg ASCII file for February (02)']
&s .tavg03 = [getfile 'data/*.asc' 'Select t_avg ASCII file for March (03)']
&s .tavg04 = [getfile 'data/*.asc' 'Select t_avg ASCII file for April (04)']
&s .tavg05 = [getfile 'data/*.asc' 'Select t_avg ASCII file for May (05)']
&s .tavg06 = [getfile 'data/*.asc' 'Select t_avg ASCII file for June (06)']
&s .tavg07 = [getfile 'data/*.asc' 'Select t_avg ASCII file for July (07)']
&s .tavg08 = [getfile 'data/*.asc' 'Select t_avg ASCII file for August (08)']
&s .tavg09 = [getfile 'data/*.asc' 'Select t_avg ASCII file for September (09)']
&s .tavg10 = [getfile 'data/*.asc' 'Select t_avg ASCII file for October (10)']
&s .tavg11 = [getfile 'data/*.asc' 'Select t_avg ASCII file for November (11)']
&s .tavg12 = [getfile 'data/*.asc' 'Select t_avg ASCII file for December (12)']
&s .tavg14 = [getfile 'data/*.asc' 'Select t_avg ASCII file annual (14)']
&s .dem = [getfile 'data/*.dem' 'Select DEM']
&s .boundary = [getcover 'data/*' -poly 'Select a polygon clip coverage']
&s .projection = [getfile 'data/*.prj' 'Select a projection file']
&return
```

```
/*---------------------------Name-------------------------------
/* asciigrid.aml
/*-------------------------Purpose-----------------------------
/*
/* Converts the precipitation, temperature, and dem ASCII files input by the user into ARC/INFO grids
/*
/*---------------------Global Variables-------------------------
/*
/*----------------------Local Variables-------------------------
/*
/*------------Other AMLs or Menus run from this AML-------------
/*
/*----------------------History--------------------------------
/*
/* Bruce Godfrey November 1998
/*
/*============================================================
/*
asciigrid %.precip01% us_ppt_01
asciigrid %.precip02% us_ppt_02
asciigrid %.precip03% us_ppt_03
asciigrid %.precip04% us_ppt_04
asciigrid %.precip05% us_ppt_05
asciigrid %.precip06% us_ppt_06
asciigrid %.precip07% us_ppt_07
asciigrid %.precip08% us_ppt_08
asciigrid %.precip09% us_ppt_09
asciigrid %.precip10% us_ppt_10
asciigrid %.precip11% us_ppt_11
asciigrid %.precip12% us_ppt_12
asciigrid %.precip14% us_ppt_14
asciigrid %.tavg01% us_tavg_01
asciigrid %.tavg02% us_tavg_02
asciigrid %.tavg03% us_tavg_03
asciigrid %.tavg04% us_tavg_04
asciigrid %.tavg05% us_tavg_05
asciigrid %.tavg06% us_tavg_06
asciigrid %.tavg07% us_tavg_07
asciigrid %.tavg08% us_tavg_08
asciigrid %.tavg09% us_tavg_09
asciigrid %.tavg10% us_tavg_10
asciigrid %.tavg11% us_tavg_11
asciigrid %.tavg12% us_tavg_12
asciigrid %.tavg14% us_tavg_14
asciigrid %.dem% us_25m
&return
```

```
/*---------------------------Name--------------------------------
/* projection.aml
/*--------------------------Purpose------------------------------
/*
/* Projects the precipitation, temperature, and dem grids into a common projection
/*
/*---------------------Global Variables--------------------------
/*
/*----------------------Local Variables--------------------------
/*
/*------------Other AMLs or Menus run from this AML-------------
/*
/*----------------------History---------------------------------
/*
/* Bruce Godfrey November 1998
/*
/*=============================================================
/*
project grid us_ppt_01 tmp_ppt_01 %.projection%
project grid us_ppt_02 tmp_ppt_02 %.projection%
project grid us_ppt_03 tmp_ppt_03 %.projection%
project grid us_ppt_04 tmp_ppt_04 %.projection%
project grid us_ppt_05 tmp_ppt_05 %.projection%
project grid us_ppt_06 tmp_ppt_06 %.projection%
project grid us_ppt_07 tmp_ppt_07 %.projection%
project grid us_ppt_08 tmp_ppt_08 %.projection%
project grid us_ppt_09 tmp_ppt_09 %.projection%
project grid us_ppt_10 tmp_ppt_10 %.projection%
project grid us_ppt_11 tmp_ppt_11 %.projection%
project grid us_ppt_12 tmp_ppt_12 %.projection%
project grid us_ppt_14 tmp_ppt_14 %.projection%
project grid us_tavg_01 tmp_tavg_01 %.projection%
project grid us_tavg_02 tmp_tavg_02 %.projection%
project grid us_tavg_03 tmp_tavg_03 %.projection%
project grid us_tavg_04 tmp_tavg_04 %.projection%
project grid us_tavg_05 tmp_tavg_05 %.projection%
project grid us_tavg_06 tmp_tavg_06 %.projection%
project grid us_tavg_07 tmp_tavg_07 %.projection%
project grid us_tavg_08 tmp_tavg_08 %.projection%
project grid us_tavg_09 tmp_tavg_09 %.projection%
project grid us_tavg_10 tmp_tavg_10 %.projection%
project grid us_tavg_11 tmp_tavg_11 %.projection%
project grid us_tavg_12 tmp_tavg_12 %.projection%
project grid us_tavg_14 tmp_tavg_14 %.projection%
project grid us_25m tmp_25m %.projection%


/* the following lines were added when it was determined that two projection files were needed for the PRISM
/*data

project grid tmp_ppt_01 st_ppt_01 data/albers_us2.prj
project grid tmp_ppt_02 st_ppt_02 data/albers_us2.prj
project grid tmp_ppt_03 st_ppt_03 data/albers_us2.prj
project grid tmp_ppt_04 st_ppt_04 data/albers_us2.prj
project grid tmp_ppt_05 st_ppt_05 data/albers_us2.prj
project grid tmp_ppt_06 st_ppt_06 data/albers_us2.prj
project grid tmp_ppt_07 st_ppt_07 data/albers_us2.prj
project grid tmp_ppt_08 st_ppt_08 data/albers_us2.prj
project grid tmp_ppt_09 st_ppt_09 data/albers_us2.prj
project grid tmp_ppt_10 st_ppt_10 data/albers_us2.prj
project grid tmp_ppt_11 st_ppt_11 data/albers_us2.prj
project grid tmp_ppt_12 st_ppt_12 data/albers_us2.prj
```

```
project grid tmp_ppt_14 st_ppt_14 data/albers_us2.prj
project grid tmp_tavg_01 st_tavg_01 data/albers_us2.prj
project grid tmp_tavg_02 st_tavg_02 data/albers_us2.prj
project grid tmp_tavg_03 st_tavg_03 data/albers_us2.prj
project grid tmp_tavg_04 st_tavg_04 data/albers_us2.prj
project grid tmp_tavg_05 st_tavg_05 data/albers_us2.prj
project grid tmp_tavg_06 st_tavg_06 data/albers_us2.prj
project grid tmp_tavg_07 st_tavg_07 data/albers_us2.prj
project grid tmp_tavg_08 st_tavg_08 data/albers_us2.prj
project grid tmp_tavg_09 st_tavg_09 data/albers_us2.prj
project grid tmp_tavg_10 st_tavg_10 data/albers_us2.prj
project grid tmp_tavg_11 st_tavg_11 data/albers_us2.prj
project grid tmp_tavg_12 st_tavg_12 data/albers_us2.prj
project grid tmp_tavg_14 st_tavg_14 data/albers_us2.prj
project grid tmp_25m st_25m data/albers_us2.prj


kill tmp_(!ppt_01 ppt_02 ppt_03 ppt_04 ppt_05 ppt_06 ppt_07 ppt_08 ppt_09 ppt_10 ppt_11 ppt_12 ppt_14!)
kill tmp_(!tavg_01 tavg_02 tavg_03 tavg_04 tavg_05 tavg_06 tavg_07 tavg_08 tavg_09 tavg_10 tavg_11
tavg_12 tavg_14!)
kill tmp_25m


&return
```

```
/*---------------------------Name--------------------------------
/* latticeclip.aml
/*-------------------------Purpose------------------------------
/*
/* Clips the precipitation, temperature, and dem grids by the boundary coverage; kills coverages that are no
/* longer needed.
/*
/*---------------------Global Variables--------------------------
/*
/*----------------------Local Variables--------------------------
/*
/*------------Other AMLs or Menus run from this AML-------------
/*
/*----------------------History---------------------------------
/*
/* Bruce Godfrey November 1998
/*
/*===========================================================
/*
latticeclip st_ppt_01 %.boundary% ppt_01
latticeclip st_ppt_02 %.boundary% ppt_02
latticeclip st_ppt_03 %.boundary% ppt_03
latticeclip st_ppt_04 %.boundary% ppt_04
latticeclip st_ppt_05 %.boundary% ppt_05
latticeclip st_ppt_06 %.boundary% ppt_06
latticeclip st_ppt_07 %.boundary% ppt_07
latticeclip st_ppt_08 %.boundary% ppt_08
latticeclip st_ppt_09 %.boundary% ppt_09
latticeclip st_ppt_10 %.boundary% ppt_10
latticeclip st_ppt_11 %.boundary% ppt_11
latticeclip st_ppt_12 %.boundary% ppt_12
latticeclip st_ppt_14 %.boundary% ppt_14
latticeclip st_tavg_01 %.boundary% tavg_01
latticeclip st_tavg_02 %.boundary% tavg_02
latticeclip st_tavg_03 %.boundary% tavg_03
latticeclip st_tavg_04 %.boundary% tavg_04
latticeclip st_tavg_05 %.boundary% tavg_05
latticeclip st_tavg_06 %.boundary% tavg_06
latticeclip st_tavg_07 %.boundary% tavg_07
latticeclip st_tavg_08 %.boundary% tavg_08
latticeclip st_tavg_09 %.boundary% tavg_09
latticeclip st_tavg_10 %.boundary% tavg_10
latticeclip st_tavg_11 %.boundary% tavg_11
latticeclip st_tavg_12 %.boundary% tavg_12
latticeclip st_tavg_14 %.boundary% tavg_14
latticeclip st_25m %.boundary% id_25ml

/* kill the coverages no longer needed

kill us_ppt_(!01 02 03 04 05 06 07 08 09 10 11 12 14!)
kill us_tavg_(!01 02 03 04 05 06 07 08 09 10 11 12 14!)
kill us_25m
kill st_ppt_(!01 02 03 04 05 06 07 08 09 10 11 12 14!)
kill st_tavg_(!01 02 03 04 05 06 07 08 09 10 11 12 14!)
kill st_25m
&return
```

```
/*---------------------------Name--------------------------------
/* grids.aml
/*-------------------------Purpose------------------------------
/*
/* Creates grids that are necessary to define the different Koeppen classes; kills coverages that are no longer
/* needed
/*
/*---------------------Global Variables--------------------------
/*
/*----------------------Local Variables--------------------------
/*
/*------------Other AMLs or Menus run from this AML-------------
/*
/*----------------------History---------------------------------
/*
/* Bruce Godfrey November 1998
/*
/*=============================================================
/*
/* use "float" to allow a decimal value to be carried
/* divide the grid cell values by 10 to convert them from millimeters to centimeters

grid
ppt01 = float(ppt_01 / 10.0)
ppt02 = float(ppt_02 / 10.0)
ppt03 = float(ppt_03 / 10.0)
ppt04 = float(ppt_04 / 10.0)
ppt05 = float(ppt_05 / 10.0)
ppt06 = float(ppt_06 / 10.0)
ppt07 = float(ppt_07 / 10.0)
ppt08 = float(ppt_08 / 10.0)
ppt09 = float(ppt_09 / 10.0)
ppt10 = float(ppt_10 / 10.0)
ppt11 = float(ppt_11 / 10.0)
ppt12 = float(ppt_12 / 10.0)
ppt14 = float(ppt_14 / 10.0)

/* find the minimum precipitation value for the year
pptmin = min (ppt01, ppt02, ppt03, ppt04, ppt05, ppt06, ppt07, ppt08, ~
ppt09, ppt10, ppt11, ppt12)

/* find the minimum precipitation for the summer months (April - Sept.)
pptsummermin = min (ppt04, ppt05, ppt06, ppt07, ppt08, ppt09)

/* find the minimum precipitation value for the winter months (Oct. - March)
pptwintermin = min (ppt01, ppt02, ppt03, ppt10, ppt11, ppt12)

/* find the maximum precipitation value for the summer months (April - Sept.)
pptsummermax = max (ppt04, ppt05, ppt06, ppt07, ppt08, ppt09)

/* find the maximum precipitation value for the winter months (Oct. - March)
pptwintermax = max (ppt01, ppt02, ppt03, ppt10, ppt11, ppt12)

/* find the total average precipitation value for the year
ppttot = ppt01 + ppt02 + ppt03 + ppt04 + ppt05 + ppt06 + ppt07 + ppt08 + ~
ppt09 + ppt10 + ppt11 + ppt12

/* find the total average precipitation value for the summer months (April - Sept.)
pptsummertot = ppt04 + ppt05 + ppt06 + ppt07 + ppt08 + ppt09

/* find the total average precipitation value for the winter months (Oct. - March)
pptwintertot = ppt01 + ppt02 + ppt03 + ppt10 + ppt11 + ppt12
```

```
/* find the percentage of precipitation that falls in the summer months
pptsummer70 = pptsummertot / ppttot

/* find the percentage of precipitation that falls in the winter months
pptwinter70 = pptwintertot / ppttot

/* kill the coverages that are no longer needed
kill ppt_(!01 02 03 04 05 06 07 08 09 10 11 12 14!)
kill ppt(!01 02 03 04 05 06 07 08 09 10 11 12!)

/* use "float" to allow a decimal value to be carried
/* convert the grid cell values from degrees Fahrenheit to degrees Celsius
tavg01a = float(tavg_01 / 10.0)
tavg01 = (tavg01a - 32) * 5 / 9
tavg02a = float(tavg_02 / 10.0)
tavg02 = (tavg02a - 32) * 5 / 9
tavg03a = float(tavg_03 / 10.0)
tavg03 = (tavg03a - 32) * 5 / 9
tavg04a = float(tavg_04 / 10.0)
tavg04 = (tavg04a - 32) * 5 / 9
tavg05a = float(tavg_05 / 10.0)
tavg05 = (tavg05a - 32) * 5 / 9
tavg06a = float(tavg_06 / 10.0)
tavg06 = (tavg06a - 32) * 5 / 9
tavg07a = float(tavg_07 / 10.0)
tavg07 = (tavg07a - 32) * 5 / 9
tavg08a = float(tavg_08 / 10.0)
tavg08 = (tavg08a - 32) * 5 / 9
tavg09a = float(tavg_09 / 10.0)
tavg09 = (tavg09a - 32) * 5 / 9
tavg10a = float(tavg_10 / 10.0)
tavg10 = (tavg10a - 32) * 5 / 9
tavg11a = float(tavg_11 / 10.0)
tavg11 = (tavg11a - 32) * 5 / 9
tavg12a = float(tavg_12 / 10.0)
tavg12 = (tavg12a - 32) * 5 / 9
tavg14a = float(tavg_14 / 10.0)
tavg14 = (tavg14a - 32) * 5 / 9

/* find the minimum mean temperature value for the year
tavgmin = min (tavg01, tavg02, tavg03, tavg04, tavg05, tavg06, tavg07, ~
tavg08, tavg09, tavg10, tavg11, tavg12)

/* find the maximum mean temperature value for the year
tavgmax = max (tavg01, tavg02, tavg03, tavg04, tavg05, tavg06, tavg07, ~
tavg08, tavg09, tavg10, tavg11, tavg12)

/* find the average temperature that's greater than or equal to 10
if (tavg01 >= 10)
        temp01 = 1
        else temp01 = 0
endif
if (tavg02 >= 10)
        temp02 = 1
        else temp02 = 0
endif
if (tavg03 >= 10)
        temp03 = 1
        else temp03 = 0
endif
if (tavg04 >= 10)
```

```
        temp04 = 1
        else temp04 = 0
endif
if (tavg05 >= 10)
        temp05 = 1
        else temp05 = 0
endif
if (tavg06 >= 10)
        temp06 = 1
        else temp06 = 0
endif
if (tavg07 >= 10)
        temp07 = 1
        else temp07 = 0
endif
if (tavg08 >= 10)
        temp08 = 1
        else temp08 = 0
endif
if (tavg09 >= 10)
        temp09 = 1
        else temp09 = 0
endif
if (tavg10 >= 10)
        temp10 = 1
        else temp10 = 0
endif
if (tavg11 >= 10)
        temp11 = 1
        else temp11 = 0
endif
if (tavg12 >= 10)
        temp12 = 1
        else temp12 = 0
endif

tempsum = sum (temp01, temp02, temp03, temp04, temp05, temp06, temp07, ~
temp08, temp09, temp10, temp11, temp12)

/* find the average temperature for 1, 2, or 3 months that's >= 10
if (tempsum == 1 or tempsum == 2 or tempsum == 3)
        tavg1_3 = 1
        else tavg1_3 = -999
endif

/* find the average temperature for 4 or more months that's >= 10
if (tempsum == 4 or tempsum == 5 or tempsum == 6 or tempsum == 7 or tempsum == 8 or ~
tempsum == 9 or tempsum == 10 or tempsum == 11 or tempsum == 12)
        tavg4 = 1
        else tavg4 = -999
endif

/* kill the coverages that are no longer needed
kill temp(!01 02 03 04 05 06 07 08 09 10 11 12!)
kill tavg_(!01 02 03 04 05 06 07 08 09 10 11 12 14!)
kill tavg(!01 02 03 04 05 06 07 08 09 10 11 12!)
kill tavg(!01a 02a 03a 04a 05a 06a 07a 08a 09a 10a 11a 12a 14a!)
&return
```

```
/*---------------------------Name--------------------------------
/* classes.aml
/*--------------------------Purpose------------------------------
/*
/* Defines the classes for the Koeppen system
/*
/*---------------------Global Variables--------------------------
/*
/*----------------------Local Variables--------------------------
/*
/* grdzmaxA      the maximum value of temporary grid A (either a 1 or -999)
/* grdzmaxAf     the maximum value of temporary grid Af (either a 1 or -999)
/* grdzmaxAm     the maximum value of temporary grid Am (either a 1 or -999)
/* grdzmaxAw     the maximum value of temporary grid Aw (either a 1 or -999)
/* grdzmaxB      the maximum value of temporary grid B (either a 1 or -999)
/* grdzmaxBW     the maximum value of temporary grid BW (either a 1 or -999)
/* grdzmaxBS     the maximum value of temporary grid BS (either a 1 or -999)
/* grdzmaxBWh    the maximum value of temporary grid BWh (either a 1 or -999)
/* grdzmaxBWk    the maximum value of temporary grid BWk (either a 1 or -999)
/* grdzmaxBSh    the maximum value of temporary grid BSh (either a 1 or -999)
/* grdzmaxBSk    the maximum value of temporary grid BSk (either a 1 or -999)
/* grdzmaxC      the maximum value of temporary grid C (either a 1 or -999)
/* grdzmaxCs     the maximum value of temporary grid Cs (either a 1 or -999)
/* grdzmaxCw     the maximum value of temporary grid Cw (either a 1 or -999)
/* grdzmaxCf     the maximum value of temporary grid Cf (either a 1 or -999)
/* grdzmaxCsa    the maximum value of temporary grid Csa (either a 1 or -999)
/* grdzmaxCsb    the maximum value of temporary grid Csb (either a 1 or -999)
/* grdzmaxCsc    the maximum value of temporary grid Csc (either a 1 or -999)
/* grdzmaxCwa    the maximum value of temporary grid Cwa (either a 1 or -999)
/* grdzmaxCwb    the maximum value of temporary grid Cwb (either a 1 or -999)
/* grdzmaxCwc    the maximum value of temporary grid Cwc (either a 1 or -999)
/* grdzmaxD      the maximum value of temporary grid D (either a 1 or -999)
/* grdzmaxDs     the maximum value of temporary grid Ds (either a 1 or -999)
/* grdzmaxDw     the maximum value of temporary grid Dw (either a 1 or -999)
/* grdzmaxDf     the maximum value of temporary grid Df (either a 1 or -999)
/* grdzmaxDsa    the maximum value of temporary grid Dsa (either a 1 or -999)
/* grdzmaxDsb    the maximum value of temporary grid Dsb (either a 1 or -999)
/* grdzmaxDsc    the maximum value of temporary grid Dsc (either a 1 or -999)
/* grdzmaxDsd    the maximum value of temporary grid Dsd (either a 1 or -999)
/* grdzmaxDwa    the maximum value of temporary grid Dwa (either a 1 or -999)
/* grdzmaxDwb    the maximum value of temporary grid Dwb (either a 1 or -999)
/* grdzmaxDwc    the maximum value of temporary grid Dwc (either a 1 or -999)
/* grdzmaxDwd    the maximum value of temporary grid Dwd (either a 1 or -999)
```

/* grdzmaxDfa	the maximum value of temporary grid Dfa (either a 1 or -999)
/* grdzmaxDfb	the maximum value of temporary grid Dfb (either a 1 or -999)
/* grdzmaxDfc	the maximum value of temporary grid Dfc (either a 1 or -999)
/* grdzmaxDfd	the maximum value of temporary grid Dfd (either a 1 or -999)
/* grdzmaxE	the maximum value of temporary grid E (either a 1 or -999)
/* grdzmaxET	the maximum value of temporary grid ET (either a 1 or -999)
/* grdzmaxEF	the maximum value of temporary grid EF (either a 1 or -999)
/* grdzmaxH	the maximum value of temporary grid H (either a 1 or -999)
/* gridA	does the grid "Class_A" exists
/* gridA	does the grid "Class_Af" exists
/* gridA	does the grid "Class_Am" exists
/* gridA	does the grid "Class_Aw" exists
/* gridB	does the grid "Class_B" exists
/* gridB	does the grid "Class_BW" exists
/* gridB	does the grid "Class_BS" exists
/* gridB	does the grid "Class_BWh" exists
/* gridB	does the grid "Class_BWk" exists
/* gridB	does the grid "Class_BSh" exists
/* gridB	does the grid "Class_BSk" exists
/* gridC	does the grid "Class_C" exists
/* gridC	does the grid "Class_Cs" exists
/* gridC	does the grid "Class_Cw" exists
/* gridC	does the grid "Class_Cf" exists
/* gridC	does the grid "Class_Csa" exists
/* gridC	does the grid "Class_Csb" exists
/* gridC	does the grid "Class_Csc" exists
/* gridC	does the grid "Class_Cwa" exists
/* gridC	does the grid "Class_Cwb" exists
/* gridC	does the grid "Class_Cwc" exists
/* gridC	does the grid "Class_Cfa" exists
/* gridC	does the grid "Class_Cfb" exists
/* gridC	does the grid "Class_Cfc" exists
/* gridD	does the grid "Class_D" exists
/* gridD	does the grid "Class_Ds" exists
/* gridD	does the grid "Class_Dw" exists
/* gridD	does the grid "Class_Df" exists
/* gridD	does the grid "Class_Dsa" exists
/* gridD	does the grid "Class_Dsb" exists
/* gridD	does the grid "Class_Dsc" exists
/* gridD	does the grid "Class_Dsd" exists
/* gridD	does the grid "Class_Dwa" exists
/* gridD	does the grid "Class_Dwb" exists
/* gridD	does the grid "Class_Dwc" exists

```
/* gridD            does the grid "Class_Dwd" exists
/* gridD            does the grid "Class_Dfa" exists
/* gridD            does the grid "Class_Dfb" exists
/* gridD            does the grid "Class_Dfc" exists
/* gridD            does the grid "Class_Dfd" exists
/* gridE            does the grid "Class_E" exists
/* gridE            does the grid "Class_ET" exists
/* gridE            does the grid "Class_EF" exists
/* gridH            does the grid "Class_H" exists
/*
/*------------Other AMLs or Menus run from this AML-------------
/*
/*----------------------History--------------------------------
/*
/* Bruce Godfrey November 1998
/*
/*=============================================================
/*
/* go to ARC: prompt and create a workspace to store temporary
/* grids
q
cw temp

/* go back into grid module and define the classes
grid
/* Class A
if (tavgmin >= 18.0)
        temp/tempA = 1
        else temp/tempA = -999
endif

&describe temp/tempA
&s grdzmaxA = %GRD$ZMAX%

&if %grdzmaxA% > 0 &then
        &do
                copy temp/tempA temp/Class_A
        &end
&else
        &do
                &type There are no cells in Class A
        &end
```

```
/* Class A subdivisions
&s gridA = [exists temp/Class_A -grid]
&if %gridA% &then
        &do
                if (temp/Class_A == 1 & pptmin >= 6.0)
                        temp/tempAf = 1
                        else temp/tempAf = -999
                endif

                        &describe temp/tempAf
                        &s grdzmaxAf = %GRD$ZMAX%

                        &if %grdzmaxAf% > 0 &then
                                &do
                                        copy temp/tempAf temp/Class_Af
                                &end
                        &else
                                &do
                                        &type There are no cells in Class Af
                                &end

                if (temp/Class_A == 1 & pptmin < 6.0 & pptmin >= (10 - ppt14 / 25))
                        temp/tempAm = 1
                        else temp/tempAm = -999
                endif

                        &describe temp/tempAm
                        &s grdzmaxAm = %GRD$ZMAX%

                        &if %grdzmaxAm% > 0 &then
                                &do
                                        copy temp/tempAm temp/Class_Am
                                &end
                        &else
                                &do
                                        &type There are no cells in Class Am
                                &end

                if (temp/Class_A == 1 & pptmin < (10 - ppt14 / 25))
                        temp/tempAw = 1
                        else temp/tempAw = -999
                endif
```

```
                        &describe temp/tempAw
                        &s grdzmaxA = %GRD$ZMAX%

                        &if %grdzmaxA% > 0 &then
                                &do
                                        copy temp/tempAw temp/Class_Aw
                                &end
                        &else
                                &do
                                        &type There are no cells in Class Aw
                                &end
        &end

/* Class B
if (pptsummer70 >= 0.7 & ppt14 < (2 * tavg14 + 28) & temp/tempA <> 1 or ~
pptwinter70 >= 0.7 & ppt14 < (2 * tavg14) & temp/tempA <> 1 or ~
pptsummer70 < 0.7 & ppt14 < (2 * tavg14 + 14) & temp/tempA <> 1 or ~
pptwinter70 < 0.7 & ppt14 < (2 * tavg14 + 14) & temp/tempA <> 1)
        temp/tempB = 1
        else temp/tempB = -999
endif

&describe temp/tempB
&s grdzmaxB = %GRD$ZMAX%

&if %grdzmaxB% > 0 &then
        &do
                copy temp/tempB temp/Class_B
        &end
&else
        &do
                &type There are no cells in Class B
    &end

/* Class B subdivisions
&s gridB = [exists temp/Class_B -grid]
&if %gridB% &then
        &do
                if (temp/Class_B == 1 & ppt14 >= (tavg14 + 14) or ~
                temp/Class_B == 1 & ppt14 >= (tavg14 + 7) or ~
                temp/Class_B == 1 & ppt14 >= tavg14)
                        temp/tempBS = 1
                        else temp/tempBS = -999
```

```
endif

        &describe temp/tempBS
        &s grdzmaxBS = %GRD$ZMAX%

        &if %grdzmaxBS% > 0 &then
                &do
                        copy temp/tempBS temp/Class_BS
                &end
        &else
                &do
                        &type There are no cells in Class BS
                &end

        &s gridBS = [exists temp/Class_BS -grid]
                &if %gridBS% &then
                        &do
                                if (temp/Class_BS == 1 & tavg14 >= 18)
                                        temp/tempBSh = 1
                                        else temp/tempBSh = -999
                                endif

                                &describe temp/tempBSh
                                &s grdzmaxBSh = %GRD$ZMAX%

                                        &if %grdzmaxBSh% > 0 &then
                                                &do
                                                        copy temp/tempBSh temp/Class_BSh
                                                &end
                                        &else
                                                &do
                                                        &type There are no cells in Class BSh
                                                &end

                                if (temp/Class_BS == 1 & tavg14 < 18)
                                        temp/tempBSk = 1
                                        else temp/tempBSk = -999
                                endif

                                &describe temp/tempBSk
                                &s grdzmaxBSk = %GRD$ZMAX%

                                        &if %grdzmaxBSk% > 0 &then
```

```
                                        &do
                                                copy temp/tempBSk temp/Class_BSk
                                        &end
                                &else
                                        &do
                                                &type There are no cells in Class BSk
                                        &end
                &end

if (temp/Class_B == 1 & ppt14 < (tavg14 + 14) & temp/tempBS <> 1 or ~
temp/Class_B == 1 & ppt14 < (tavg14 + 7) & temp/tempBS <> 1 or ~
temp/Class_B == 1 & ppt14 < tavg14 & temp/tempBS <> 1)
        temp/tempBW = 1
        else temp/tempBW = -999
endif

        &describe temp/tempBW
        &s grdzmaxBW = %GRD$ZMAX%

        &if %grdzmaxBW% > 0 &then
                &do
                        copy temp/tempBW temp/Class_BW
                &end
        &else
                &do
                        &type There are no cells in Class BW
                &end

        &s gridBW = [exists temp/Class_BW -grid]
                &if %gridBW% &then
                        &do

                                if (temp/Class_BW == 1 & tavg14 >= 18)
                                        temp/tempBWh = 1
                                        else temp/tempBWh = -999
                                endif

                                &describe temp/tempBWh
                                &s grdzmaxBWh = %GRD$ZMAX%

                                        &if %grdzmaxBWh% > 0 &then
                                                &do
                                                        copy temp/tempBWh temp/Class_BWh
```

```
						&end
					&else
						&do
							&type There are no cells in Class BWh
						&end

					if (temp/Class_BW == 1 & tavg14 < 18)
						temp/tempBWk = 1
						else temp/tempBWk = -999
					endif

				&describe temp/tempBWk
				&s grdzmaxBWk = %GRD$ZMAX%

					&if %grdzmaxBWk% > 0 &then
						&do
							copy temp/tempBWk temp/Class_BWk
						&end
					&else
						&do
							&type There are no cells in Class BWk
						&end
			&end
	&end

/* Class C
if (tavgmax > 10.0 & tavgmin > 0.0 & tavgmin < 18.0 & temp/tempA <> 1 & temp/tempB <> 1)
	temp/tempC = 1
	else temp/tempC = -999
endif

&describe temp/tempC
&s grdzmaxC = %GRD$ZMAX%

&if %grdzmaxC% > 0 &then
	&do
		copy temp/tempC temp/Class_C
	&end
&else
	&do
		&type There are no cells in Class C
	&end
```

```
/* Class C subdivisions
&s gridC = [exists temp/Class_C -grid]
&if %gridC% &then
        &do
                if (temp/Class_C == 1 & pptsummermin < 4.0 & pptsummermin < (pptwintermax / 3))
                        temp/tempCs = 1
                        else temp/tempCs = -999
                endif

                        &describe temp/tempCs
                        &s grdzmaxCs = %GRD$ZMAX%

                                &if %grdzmaxCs% > 0 &then
                                        &do
                                                copy temp/tempCs temp/Class_Cs
                                        &end
                                &else
                                        &do
                                                &type There are no cells in Class Cs
                                        &end

                                &s gridCs = [exists temp/Class_Cs -grid]
                                        &if %gridCs% &then
                                        &do

                                                if (temp/Class_Cs == 1 & tavgmax >= 22.0)
                                                        temp/tempCsa = 1
                                                        else temp/tempCsa = -999
                                                endif

                                                        &describe temp/tempCsa
                                                        &s grdzmaxCsa = %GRD$ZMAX%

                                                                &if %grdzmaxCsa% > 0 &then
                                                                        &do
                                                                                copy temp/tempCsa temp/Class_Csa
                                                                        &end
                                                                &else
                                                                        &do
                                                                                &type There are no cells in Class Csa
                                                                &end

                                                if (temp/Class_Cs == 1 & tavg4 == 1 & tavgmax < 22.0)
```

```
                    temp/tempCsb = 1
                    else temp/tempCsb = -999
                endif

                    &describe temp/tempCsb
                    &s grdzmaxCsb = %GRD$ZMAX%

                        &if %grdzmaxCsb% > 0 &then
                            &do
                                copy temp/tempCsb temp/Class_Csb
                            &end
                        &else
                            &do
                                &type There are no cells in Class Csb
                            &end

                if (temp/Class_Cs == 1 & tavg1_3 == 1 & tavgmax < 22.0)
                    temp/tempCsc = 1
                    else temp/tempCsc = -999
                endif

                    &describe temp/tempCsc
                    &s grdzmaxCsc = %GRD$ZMAX%

                        &if %grdzmaxCsc% > 0 &then
                            &do
                                copy temp/tempCsc temp/Class_Csc
                            &end
                        &else
                            &do
                                &type There are no cells in Class Csc
                            &end
            &end

if (temp/Class_C == 1 & pptwintermin < (pptsummermax / 10))
    temp/tempCw = 1
    else temp/tempCw = -999
endif

    &describe temp/tempCw
    &s grdzmaxCw = %GRD$ZMAX%

        &if %grdzmaxCw% > 0 &then
```

```
        &do
                copy temp/tempCw temp/Class_Cw
        &end
&else
        &do
                &type There are no cells in Class Cw
        &end

&s gridCw = [exists temp/Class_Cw -grid]
        &if %gridCw% &then
                &do

                        if (temp/Class_Cw == 1 & tavgmax >= 22.0)
                                temp/tempCwa = 1
                                else temp/tempCwa = -999
                        endif

                                &describe temp/tempCwa
                                &s grdzmaxCwa = %GRD$ZMAX%

                                        &if %grdzmaxCwa% > 0 &then
                                                &do
                                                        copy temp/tempCwa temp/Class_Cwa
                                                &end
                                        &else
                                                &do
                                                        &type There are no cells in Class Cwa
                                                &end

                        if (temp/Class_Cw == 1 & tavg4 == 1 & tavgmax < 22.0)
                                temp/tempCwb = 1
                                else temp/tempCwb = -999
                        endif

                                &describe temp/tempCwb
                                &s grdzmaxCwb = %GRD$ZMAX%

                                        &if %grdzmaxCwb% > 0 &then
                                                &do
                                                        copy temp/tempCwb temp/Class_Cwb
                                                &end
                                        &else
                                                &do
```

```
                                                &type There are no cells in Class Cwb
                                        &end

                        if (temp/Class_Cw == 1 & tavg1_3 == 1 & tavgmax < 22.0)
                                temp/tempCwc = 1
                                else temp/tempCwc = -999
                        endif

                                &describe temp/tempCwc
                                &s grdzmaxCwc = %GRD$ZMAX%

                                        &if %grdzmaxCwc% > 0 &then
                                                &do
                                                        copy temp/tempCwc temp/Class_Cwc
                                                &end
                                        &else
                                                &do
                                                        &type There are no cells in Class Cwc
                                                &end
                &end

if (temp/Class_C == 1 & temp/tempCs <> 1 & temp/tempCw <> 1)
        temp/tempCf = 1
        else temp/tempCf = -999
endif

        &describe temp/tempCf
        &s grdzmaxCf = %GRD$ZMAX%

                &if %grdzmaxCf% > 0 &then
                        &do
                                copy temp/tempCf temp/Class_Cf
                        &end
                &else
                        &do
                                &type There are no cells in Class Cf
                        &end

                &s gridCf = [exists temp/Class_Cf -grid]
                        &if %gridCf% &then
                                &do

                                        if (temp/Class_Cf == 1 & tavgmax >= 22.0)
```

```
        temp/tempCfa = 1
        else temp/tempCfa = -999
endif

        &describe temp/tempCfa
        &s grdzmaxCfa = %GRD$ZMAX%

                &if %grdzmaxCfa% > 0 &then
                        &do
                                copy temp/tempCfa temp/Class_Cfa
                        &end
                &else
                        &do
                                &type There are no cells in Class Cfa
                        &end

if (temp/Class_Cf == 1 & tavg4 == 1 & tavgmax < 22.0)
        temp/tempCfb = 1
        else temp/tempCfb = -999
endif

        &describe temp/tempCfb
        &s grdzmaxCfb = %GRD$ZMAX%

                &if %grdzmaxCfb% > 0 &then
                        &do
                                copy temp/tempCfb temp/Class_Cfb
                        &end
                &else
                        &do
                                &type There are no cells in Class Cfb
                        &end

if (temp/Class_Cf == 1 & tavg1_3 == 1 & tavgmax < 22.0)
        temp/tempCfc = 1
        else temp/tempCfc = -999
endif

        &describe temp/tempCfc
        &s grdzmaxCfc = %GRD$ZMAX%

                &if %grdzmaxCfc% > 0 &then
                        &do
```

```
                                                                                                    copy temp/tempCfc temp/Class_Cfc
                                                                                            &end
                                                                                    &else
                                                                                            &do
                                                                                                    &type There are no cells in Class Cfc
                                                                                            &end
                                                                &end
        &end

/* Class D
if (tavgmax > 10.0 & tavgmin <= 0.0 & temp/tempA <> 1 & temp/tempB <> 1 & temp/tempC <> 1)
        temp/tempD = 1
        else temp/tempD = -999
endif

&describe temp/tempD
&s grdzmaxD = %GRD$ZMAX%

&if %grdzmaxD% > 0 &then
        &do
        copy temp/tempD temp/Class_D
        &end
&else
        &type There are no cells in Class D

/* Class D subdivisions
&s gridD = [exists temp/Class_D -grid]
&if %gridD% &then
        &do
                if (temp/Class_D == 1 & pptsummermin < 4.0 & pptsummermin < (pptwintermax / 3))
                        temp/tempDs = 1
                        else temp/tempDs = -999
                endif

                        &describe temp/tempDs
                        &s grdzmaxDs = %GRD$ZMAX%

                                &if %grdzmaxDs% > 0 &then
                                        &do
                                                copy temp/tempDs temp/Class_Ds
                                        &end
                                &else
                                        &do
```

```
                &type There are no cells in Class Ds
        &end

&s gridDs = [exists temp/Class_Ds -grid]
&if %gridDs% &then
        &do

                if (temp/Class_Ds == 1 & tavgmin < -38.0)
                        temp/tempDsd = 1
                        else temp/tempDsd = -999
                endif

                        &describe temp/tempDsd
                        &s grdzmaxDsd = %GRD$ZMAX%

                                &if %grdzmaxDsd% > 0 &then
                                        &do
                                                copy temp/tempDsd temp/Class_Dsd
                                        &end
                                &else
                                        &do
                                                &type There are no cells in Class Dsd
                                        &end

                if (temp/Class_Ds == 1 & temp/tempDsd <> 1 & tavgmax >= 22.0)
                        temp/tempDsa = 1
                        else temp/tempDsa = -999
                endif

                        &describe temp/tempDsa
                        &s grdzmaxDsa = %GRD$ZMAX%

                                &if %grdzmaxDsa% > 0 &then
                                        &do
                                                copy temp/tempDsa temp/Class_Dsa
                                        &end
                                &else
                                        &do
                                                &type There are no cells in Class Dsa
                                &end

                if (temp/Class_Ds == 1 & temp/tempDsd <> 1 & tavg4 == 1 & tavgmax < 22.0)
                        temp/tempDsb = 1
```

```
                    else temp/tempDsb = -999
                endif

                    &describe temp/tempDsb
                    &s grdzmaxDsb = %GRD$ZMAX%

                        &if %grdzmaxDsb% > 0 &then
                            &do
                                copy temp/tempDsb temp/Class_Dsb
                            &end
                        &else
                            &do
                                &type There are no cells in Class Dsb
                            &end

                if (temp/Class_Ds == 1 & temp/tempDsd <> 1 & tavg1_3 == 1 & tavgmax < 22.0)
                    temp/tempDsc = 1
                    else temp/tempDsc = -999
                endif

                    &describe temp/tempDsc
                    &s grdzmaxDsc = %GRD$ZMAX%

                        &if %grdzmaxDsc% > 0 &then
                            &do
                                copy temp/tempDsc temp/Class_Dsc
                            &end
                        &else
                            &do
                                &type There are no cells in Class Dsc
                            &end
            &end

if (temp/Class_D == 1 & pptwintermin < (pptsummermax / 10))
    temp/tempDw = 1
    else temp/tempDw = -999
endif

    &describe temp/tempDw
    &s grdzmaxDw = %GRD$ZMAX%

        &if %grdzmaxDw% > 0 &then
            &do
```

```
                copy temp/tempDw temp/Class_Dw
        &end
&else
        &do
                &type There are no cells in Class Dw
        &end

&s gridDw = [exists temp/Class_Dw -grid]
&if %gridDw% &then
        &do

                if (temp/Class_Dw == 1 & tavgmin < -38.0)
                        temp/tempDWd = 1
                        else temp/tempDwd = -999
                endif

                        &describe temp/tempDwd
                        &s grdzmaxDwd = %GRD$ZMAX%

                                &if %grdzmaxDwd% > 0 &then
                                        &do
                                                copy temp/tempDwd temp/Class_Dwd
                                        &end
                                &else
                                        &do
                                                &type There are no cells in Class Dwd
                                        &end

                if (temp/Class_Dw == 1 & temp/tempDwd <> 1 & tavgmax >= 22.0)
                        temp/tempDwa = 1
                        else temp/tempDwa = -999
                endif

                                &describe temp/tempDwa
                                &s grdzmaxDwa = %GRD$ZMAX%

                                        &if %grdzmaxDwa% > 0 &then
                                                &do
                                                        copy temp/tempDwa temp/Class_Dwa
                                                &end
                                        &else
                                                &do
                                                        &type There are no cells in Class Dwa
```

```
                                        &end

                              if (temp/Class_Dw == 1 & temp/tempDwd <> 1 & tavg4 == 1 & tavgmax < 22.0)
                                    temp/tempDwb = 1
                                    else temp/tempDwb = -999
                              endif

                                    &describe temp/tempDwb
                                    &s grdzmaxDwb = %GRD$ZMAX%

                                          &if %grdzmaxDwb% > 0 &then
                                                &do
                                                      copy temp/tempDwb temp/Class_Dwb
                                                &end
                                          &else
                                                &do
                                                      &type There are no cells in Class Dwb
                                                &end

                              if (temp/Class_Dw == 1 & temp/tempDwd <> 1 & tavg1_3 == 1 & tavgmax < 22.0)
                                    temp/tempDwc = 1
                                    else temp/tempDwc = -999
                              endif

                                    &describe temp/tempDwc
                                    &s grdzmaxDwc = %GRD$ZMAX%

                                          &if %grdzmaxDwc% > 0 &then
                                                &do
                                                      copy temp/tempDwc temp/Class_Dwc
                                                &end
                                          &else
                                                &do
                                                      &type There are no cells in Class Dwc
                                                &end

                  &end

      if (temp/Class_D == 1 & temp/tempDs <> 1 & temp/tempDw <> 1)
            temp/tempDf = 1
            else temp/tempDf = -999
      endif
```

```
&describe temp/tempDf
&s grdzmaxDf = %GRD$ZMAX%

        &if %grdzmaxDf% > 0 &then
                &do
                        copy temp/tempDf temp/Class_Df
                &end
        &else
                &do
                        &type There are no cells in Class Df
                &end

        &s gridDf = [exists temp/Class_Df -grid]
                &if %gridDf% &then
                        &do

                                if (temp/Class_Df == 1 & tavgmin < -38.0)
                                        temp/tempDfd = 1
                                        else temp/tempDfd = -999
                                endif

                                        &describe temp/tempDfd
                                        &s grdzmaxDfd = %GRD$ZMAX%

                                                &if %grdzmaxDfd% > 0 &then
                                                        &do
                                                                copy temp/tempDfd temp/Class_Dfd
                                                        &end
                                                &else
                                                        &do
                                                                &type There are no cells in Class Dfd
                                                        &end

                                if (temp/Class_Df == 1 & temp/tempDfd <> 1 & tavgmax >= 22.0)
                                        temp/tempDfa = 1
                                        else temp/tempDfa = -999
                                endif

                                        &describe temp/tempDfa
                                        &s grdzmaxDfa = %GRD$ZMAX%

                                                &if %grdzmaxDfa% > 0 &then
                                                        &do
```

```
                                        copy temp/tempDfa temp/Class_Dfa
                                &end
                        &else
                                &do
                                        &type There are no cells in Class Dfa
                                &end

        if (temp/Class_Df == 1 & temp/tempDfd <> 1 & tavg4 == 1 & tavgmax < 22.0)
                temp/tempDfb = 1
                else temp/tempDfb = -999
        endif

                &describe temp/tempDfb
                &s grdzmaxDfb = %GRD$ZMAX%

                        &if %grdzmaxDfb% > 0 &then
                                &do
                                        copy temp/tempDfb temp/Class_Dfb
                                &end
                        &else
                                &do
                                        &type There are no cells in Class Dfb
                                &end

        if (temp/Class_Df == 1 & temp/tempDfd <> 1 & tavg1_3 == 1 & tavgmax < 22.0)
                temp/tempDfc = 1
                else temp/tempDfc = -999
        endif

                &describe temp/tempDfc
                &s grdzmaxDfc = %GRD$ZMAX%

                        &if %grdzmaxDfc% > 0 &then
                                &do
                                        copy temp/tempDfc temp/Class_Dfc
                                &end
                        &else
                                &do
                                        &type There are no cells in Class Dfc
                                &end
    &end
&end
```

```
/* Class H
if (tavgmax <= 10.0 & temp/tempA <> 1 & temp/tempB <> 1 & temp/tempC <> 1 & temp/tempD <> 1 & ~
id_25ml > 1500)
        temp/tempH = 1
        else temp/tempH = -999
endif

&describe temp/tempH
&s grdzmaxH = %GRD$ZMAX%

&if %grdzmaxH% > 0 &then
        &do
                copy temp/tempH temp/Class_H
        &end
&else
        &type There are no cells in Class H


/* Class E
if (tavgmax <= 10.0 & temp/tempA <> 1 & temp/tempB <> 1 & temp/tempC <> 1 & temp/tempD <> 1 & ~
temp/tempH <> 1)
        temp/tempE = 1
        else temp/tempE = -999
endif

&describe temp/tempE
&s grdzmaxE = %GRD$ZMAX%

&if %grdzmaxE% > 0 &then
        &do
        copy temp/tempE temp/Class_E
        &end
&else
        &type There are no cells in Class E


/* Class E subdivisions
&s gridE = [exists temp/Class_E -grid]
&if %gridE% &then
        &do
                if (temp/Class_E == 1 & tavgmax > 0.0)
                        temp/tempET = 1
```

```
                else temp/tempET = -999
        endif

                &describe temp/tempET
                &s grdzmaxET = %GRD$ZMAX%

                &if %grdzmaxET% > 0 &then
                        &do
                                copy temp/tempET temp/Class_ET
                        &end
                &else
                        &do
                                &type There are no cells in Class ET
                        &end

        if (temp/Class_E == 1 & tavgmax < 0.0)
                temp/tempEF = 1
                else temp/tempEF = -999
        endif


                &describe temp/tempEF
                &s grdzmaxEF = %GRD$ZMAX%

                &if %grdzmaxEF% > 0 &then
                        &do
                                copy temp/tempEF temp/Class_EF
                        &end
                &else
                        &do
                                &type There are no cells in Class EF
                        &end
    &end


/* kill the coverages that are no longer needed
kill (!ppt14 pptmin pptsummer70 pptsummermax pptsummermin pptsummertot ppttot ~
pptwinter70 pptwintermax pptwintermin pptwintertot tavg4 tavg1_3 tavg14 tavgmax ~
tavgmin tempsum id_25ml!)

/* delete the variables declared above that start with "g" (which is all of them)
&delvar g*
```

```
/* copy the grids that were found to have a value of "1" from the workspace "temp"
/* into the current workspace
/* Class A
&s gridA = [exists temp/Class_A -grid]
&if %gridA% &then
        &do
                if (temp/Class_A == 1)
                        Class_A = 1
                endif
        &end
&s gridAf = [exists temp/Class_Af -grid]
&if %gridAf% &then
        &do
                if (temp/Class_Af == 1)
                        Class_Af = 2
                endif
        &end
&s gridAm = [exists temp/Class_Am -grid]
&if %gridAm% &then
        &do
                if (temp/Class_Am == 1)
                        Class_Am = 3
                endif
        &end
&s gridAw = [exists temp/Class_Aw -grid]
&if %gridAw% &then
        &do
                if (temp/Class_Aw == 1)
                        Class_Aw = 4
                endif
&end

/* Class B
&s gridB = [exists temp/Class_B -grid]
&if %gridB% &then
        &do
                if (temp/Class_B == 1)
                        Class_B = 5
                endif
        &end
&s gridBS = [exists temp/Class_BS -grid]
&if %gridBS% &then
        &do
```

```
                if (temp/Class_BS == 1)
                        Class_BS = 6
                endif
        &end
&s gridBSh = [exists temp/Class_BSh -grid]
&if %gridBSh% &then
        &do
                if (temp/Class_BSh == 1)
                        Class_BSh = 7
                endif
        &end
&s gridBSk = [exists temp/Class_BSk -grid]
&if %gridBSk% &then
        &do
                if (temp/Class_BSk == 1)
                        Class_BSk = 8
                endif
        &end
&s gridBW = [exists temp/Class_BW -grid]
&if %gridBW% &then
        &do
                if (temp/Class_BW == 1)
                        Class_BW = 9
                        endif
        &end
&s gridBWh = [exists temp/Class_BWh -grid]
&if %gridBSh% &then
        &do
                if (temp/Class_BWh == 1)
                        Class_BWh = 10
                endif
        &end
&s gridBWk = [exists temp/Class_BWk -grid]
&if %gridBWk% &then
        &do
                if (temp/Class_BWk == 1)
                        Class_BWk = 11
                endif
        &end

/* Class C
&s gridC = [exists temp/Class_C -grid]
&if %gridC% &then
```

```
	&do
		if (temp/Class_C == 1)
			Class_C = 12
		endif
	&end
&s gridCs = [exists temp/Class_Cs -grid]
&if %gridCs% &then
	&do
		if (temp/Class_Cs == 1)
			Class_Cs = 13
		endif
	&end
&s gridCsa = [exists temp/Class_Csa -grid]
&if %gridCsa% &then
	&do
		if (temp/Class_Csa == 1)
			Class_Csa = 14
		endif
	&end
&s gridCsb = [exists temp/Class_Csb -grid]
&if %gridCsb% &then
	&do
		if (temp/Class_Csb == 1)
			Class_Csb = 15
		endif
	&end
&s gridCsc = [exists temp/Class_Csc -grid]
&if %gridCsc% &then
	&do
		if (temp/Class_Csc == 1)
			Class_Csc = 16
		endif
	&end
&s gridCw = [exists temp/Class_Cw -grid]
&if %gridCw% &then
	&do
		if (temp/Class_Cw == 1)
			Class_Cw = 17
		endif
	&end
&s gridCwa = [exists temp/Class_Cwa -grid]
&if %gridCwa% &then
	&do
```

```
			if (temp/Class_Cwa == 1)
				Class_Cwa = 18
			endif
		&end
&s gridCwb = [exists temp/Class_Cwb -grid]
&if %gridCwb% &then
		&do
			if (temp/Class_Cwb == 1)
				Class_Cwb = 19
			endif
		&end
&s gridCwc = [exists temp/Class_Cwc -grid]
&if %gridCwc% &then
		&do
			if (temp/Class_Cwc == 1)
				Class_Cwc = 20
			endif
		&end
&s gridCf = [exists temp/Class_Cf -grid]
&if %gridCf% &then
		&do
			if (temp/Class_Cf == 1)
				Class_Cf = 21
			endif
		&end
&s gridCfa = [exists temp/Class_Cfa -grid]
&if %gridCfa% &then
		&do
			if (temp/Class_Cfa == 1)
				Class_Cfa = 22
			endif
		&end
&s gridCfb = [exists temp/Class_Cfb -grid]
&if %gridCfb% &then
		&do
			if (temp/Class_Cfb == 1)
				Class_Cfb = 23
			endif
		&end
&s gridCfc = [exists temp/Class_Cfc -grid]
&if %gridCfc% &then
		&do
			if (temp/Class_Cfc == 1)
```

```
                Class_Cfc = 24
            endif
        &end

/* Class D
&s gridD = [exists temp/Class_D -grid]
&if %gridD% &then
        &do
            if (temp/Class_D == 1)
                Class_D = 25
            endif
        &end
&s gridDs = [exists temp/Class_Ds -grid]
&if %gridDs% &then
        &do
            if (temp/Class_Ds == 1)
                Class_Ds = 26
            endif
        &end
&s gridDsa = [exists temp/Class_Dsa -grid]
&if %gridDsa% &then
        &do
            if (temp/Class_Dsa == 1)
                Class_Dsa = 27
            endif
        &end
&s gridDsb = [exists temp/Class_Dsb -grid]
&if %gridDsb% &then
        &do
            if (temp/Class_Dsb == 1)
                Class_Dsb = 28
            endif
        &end
&s gridDsc = [exists temp/Class_Dsc -grid]
&if %gridDsc% &then
        &do
            if (temp/Class_Dsc == 1)
                Class_Dsc = 29
            endif
        &end
&s gridDsd = [exists temp/Class_Dsd -grid]
&if %gridDsd% &then
        &do
```

```
                    if (temp/Class_Dsd == 1)
                              Class_Dsd = 30
                    endif
          &end
&s gridDw = [exists temp/Class_Dw -grid]
&if %gridDw% &then
          &do
                    if (temp/Class_Dw == 1)
                              Class_Dw = 31
                    endif
          &end
&s gridDwa = [exists temp/Class_Dwa -grid]
&if %gridDwa% &then
          &do
                    if (temp/Class_Dwa == 1)
                              Class_Dwa = 32
                    endif
          &end
&s gridDwb = [exists temp/Class_Dwb -grid]
&if %gridDwb% &then
          &do
                    if (temp/Class_Dwb == 1)
                              Class_Dwb = 33
                    endif
          &end
&s gridDwc = [exists temp/Class_Dwc -grid]
&if %gridDwc% &then
          &do
                    if (temp/Class_Dwc == 1)
                              Class_Dwc = 34
                    endif
          &end
&s gridDwd = [exists temp/Class_Dwd -grid]
&if %gridDwd% &then
          &do
                    if (temp/Class_Dwd == 1)
                              Class_Dwd = 35
                    endif
          &end
&s gridDf = [exists temp/Class_Df -grid]
&if %gridDf% &then
          &do
                    if (temp/Class_Df == 1)
```

```
                        Class_Df = 36
                endif
        &end
&s gridDfa = [exists temp/Class_Dfa -grid]
&if %gridDfa% &then
        &do
                if (temp/Class_Dfa == 1)
                        Class_Dfa = 37
                endif
        &end
&s gridDfb = [exists temp/Class_Dfb -grid]
&if %gridDfb% &then
        &do
                if (temp/Class_Dfb == 1)
                        Class_Dfb = 38
                endif
        &end
&s gridDfc = [exists temp/Class_Dfc -grid]
&if %gridDfc% &then
        &do
                if (temp/Class_Dfc == 1)
                        Class_Dfc = 39
                endif
        &end
&s gridDfd = [exists temp/Class_Dfd -grid]
&if %gridDfd% &then
        &do
                if (temp/Class_Dfd == 1)
                        Class_Dfd = 40
                endif
        &end

/* Class E
&s gridE = [exists temp/Class_E -grid]
&if %gridE% &then
        &do
                if (temp/Class_E == 1)
                        Class_E = 41
                endif
        &end
&s gridET = [exists temp/Class_ET -grid]
&if %gridET% &then
        &do
```

```
            if (temp/Class_ET == 1)
                Class_ET = 42
            endif
        &end
&s gridEF = [exists temp/Class_EF -grid]
&if %gridEF% &then
        &do
            if (temp/Class_EF == 1)
                Class_EF = 43
            endif
        &end

/* Class H
&s gridH = [exists temp/Class_H -grid]
&if %gridH% &then
        &do
            if (temp/Class_H == 1)
                Class_H = 44
            endif
        &end

/* quit the grid module and delete the workspace "temp"
q
dw temp
y
&return
```

```
/*---------------------------Name-------------------------------
/* merge.aml
/*-------------------------Purpose-----------------------------
/*
/* run after koeppen.aml to merge all the individual grids into one, then create a lookup table to associate the
/* letter classifications
/*
/*---------------------Global Variables-------------------------
/*
/*----------------------Local Variables-------------------------
/*
/*------------Other AMLs or Menus run from this AML-------------
/*
/*----------------------History--------------------------------
/*
/* Bruce Godfrey November 1998
/*
/*============================================================
/*
grid
koeppen_us = merge (class_af, class_am, class_aw, class_bsh, class_bsk, class_bwh, class_bwk, class_cfa,
class_cfb, class_csa, class_csb, class_cwa, class_cwb, class_dfa, class_dfb, class_dfc, class_dsa, class_dsb,
class_dsc, class_dwa, class_dwb, class_dwc, class_ef, class_h)
q
&data arc info
ARC
DEFINE CLASSES.LUT
VALUE
4
4
B
CLASS
4
4
C
~
ADD
1
A
2
Af
3
Am
4
Aw
5
B
6
BS
7
BSh
8
BSk
9
BW
10
BWh
11
BWk
12
C
13
```

Cs
14
Csa
15
Csb
16
Csc
17
Cw
18
Cwa
19
Cwb
20
Cwc
21
Cf
22
Cfa
23
Cfb
24
Cfc
25
D
26
Ds
27
Dsa
28
Dsb
29
Dsc
30
Dsd
31
Dw
32
Dwa
33
Dwb
34
Dwc
35
Dwd
36
Df
37
Dfa
38
Dfb
39
Dfc
40
Dfd
41
E
42
ET
43
EF
44

```
H
~
Q STOP
&end
joinitem koeppen_us.vat classes.lut koeppen_us.vat value value
&return
```

Agroclimate Classification AMLs

```
/*This is the projection file for the PRISM data
input
projection geographic
units dd
datum wgs72
parameters
output
projection geographic
units dd
datum nar_c three
parameters
end

input
projection geographic
units dd
datum nad83
parameters
output
projection transverse
units meters
datum nad27
parameters
0.99960
-114 00 00
42 00 00
500000
100000
end
```

```
/*AML name: mask.aml
/*this AML will create a mask to be used for all the PRISM grids
/*the mask that is created is edited to only include grid cells
/*that fall within the state.

/*convert the PRISM ASCII file into an Arc/Info grid
asciigrid ../../prism/precip/us/us_unzipped/us_ppt_01.asc ppt_01

/*clip the grid down to a size that is a little larger than IDAHO
gridclip ppt_01 ppt_01a -118.0 41.0 -110.0 49.25

/*project the grid based on idtm projection parameters
project grid ppt_01a ppt_01prja ../../idtm.prj
project grid ppt_01prja ppt_01prjb ../../idtm2.prj

/*clip the grid using the Idaho buffer coverage
latticeclip ppt_01prjb ../../additional/worksp/statebuf masktemp

/*delete the grids that are no longer needed
kill ppt_01
kill ppt_01a
kill ppt_01prja
kill ppt_01prjb

/*convert the grid to an ASCII file to edit
gridascii masktemp masktemp.asc

/*Now, the ppt01.asc file was edited to create the mask.  When clipping with the statebuf
/*coverage, there were some grid cells kept that fell outside the state boundary.
/*Those grid cell values were changed to -9999.  Only grid cells that that were
/*inside or touching the state boundary coverage were kept.
/*
/* The edited ASCII file was converted to a mask coverage
/*asciigrid masktemp.asc mask

&return
```

```
/*AML name: prism_project&clip.aml
/*convert the PRISM ASCII PRECIP files into Arc/Info grids
&s asciilist = [listfile precip/us/us_unzipped/u*.asc -file]
&s num = [token %asciilist% -count]
&do a = 1 &to %num%
  &s file = [extract %a% %asciilist%]
  &s file2 = [substr %file% 4 6]

  asciigrid precip/us/us_unzipped/%file% %file2%g
  gridclip %file2%g %file2%gc -118.0 41.0 -110.0 49.25

  project grid %file2%gc %file2%gp ../idtm.prj

  project grid %file2%gp %file2%p ../idtm2.prj

  grid
  setwindow mask
  setmask mask
  %file2%m = %file2%p
  q

  copy %file2%m precip/worksp/%file2%
  kill %file2%g
  kill %file2%gc
  kill %file2%gp
  kill %file2%p
  kill %file2%m
&end
```

```
/*AML name: 55_final_variables.aml
/*this AML produces the final 55 coverages for the classification

&watch 55_final_variables.wat
cw grid_coverages
cw ascii_files

/* copy over the needed grids
copy ../../coverages/prism/min/worksp/tmin_01
copy ../../coverages/prism/min/worksp/tmin_02
copy ../../coverages/prism/min/worksp/tmin_03
copy ../../coverages/prism/min/worksp/tmin_04
copy ../../coverages/prism/min/worksp/tmin_05
copy ../../coverages/prism/min/worksp/tmin_06
copy ../../coverages/prism/min/worksp/tmin_07
copy ../../coverages/prism/min/worksp/tmin_08
copy ../../coverages/prism/min/worksp/tmin_09
copy ../../coverages/prism/min/worksp/tmin_10
copy ../../coverages/prism/min/worksp/tmin_11
copy ../../coverages/prism/min/worksp/tmin_12

copy ../../coverages/prism/max/worksp/tmax_01
copy ../../coverages/prism/max/worksp/tmax_02
copy ../../coverages/prism/max/worksp/tmax_03
copy ../../coverages/prism/max/worksp/tmax_04
copy ../../coverages/prism/max/worksp/tmax_05
copy ../../coverages/prism/max/worksp/tmax_06
copy ../../coverages/prism/max/worksp/tmax_07
copy ../../coverages/prism/max/worksp/tmax_08
copy ../../coverages/prism/max/worksp/tmax_09
copy ../../coverages/prism/max/worksp/tmax_10
copy ../../coverages/prism/max/worksp/tmax_11
copy ../../coverages/prism/max/worksp/tmax_12

copy ../../coverages/prism/mean/worksp/tavg_01
copy ../../coverages/prism/mean/worksp/tavg_02
copy ../../coverages/prism/mean/worksp/tavg_03
copy ../../coverages/prism/mean/worksp/tavg_04
copy ../../coverages/prism/mean/worksp/tavg_05
copy ../../coverages/prism/mean/worksp/tavg_06
copy ../../coverages/prism/mean/worksp/tavg_07
copy ../../coverages/prism/mean/worksp/tavg_08
copy ../../coverages/prism/mean/worksp/tavg_09
copy ../../coverages/prism/mean/worksp/tavg_10
copy ../../coverages/prism/mean/worksp/tavg_11
copy ../../coverages/prism/mean/worksp/tavg_12

copy ../../coverages/prism/precip/worksp/ppt_01
copy ../../coverages/prism/precip/worksp/ppt_02
copy ../../coverages/prism/precip/worksp/ppt_03
copy ../../coverages/prism/precip/worksp/ppt_04
copy ../../coverages/prism/precip/worksp/ppt_05
copy ../../coverages/prism/precip/worksp/ppt_06
copy ../../coverages/prism/precip/worksp/ppt_07
copy ../../coverages/prism/precip/worksp/ppt_08
copy ../../coverages/prism/precip/worksp/ppt_09
copy ../../coverages/prism/precip/worksp/ppt_10
copy ../../coverages/prism/precip/worksp/ppt_11
copy ../../coverages/prism/precip/worksp/ppt_12

copy ../../coverages/prism/gdd/worksp/gdd_01
copy ../../coverages/prism/gdd/worksp/gdd_02
```

```
copy ../../coverages/prism/gdd/worksp/gdd_03
copy ../../coverages/prism/gdd/worksp/gdd_04
copy ../../coverages/prism/gdd/worksp/gdd_05
copy ../../coverages/prism/gdd/worksp/gdd_06
copy ../../coverages/prism/gdd/worksp/gdd_07
copy ../../coverages/prism/gdd/worksp/gdd_08
copy ../../coverages/prism/gdd/worksp/gdd_09
copy ../../coverages/prism/gdd/worksp/gdd_10
copy ../../coverages/prism/gdd/worksp/gdd_11
copy ../../coverages/prism/gdd/worksp/gdd_12

copy ../../coverages/prism/freeze_free/worksp/freezefree frz_free
copy ../../coverages/prism/freeze_fall/worksp/freeze_fall frz_fall
copy ../../coverages/prism/freeze_spr/worksp/freeze_spr frz_spr


/*convert degrees fahrenheit*10 to degrees centigrade
grid
tmin_01a = float((tmin_01 / 10.0) - 32) * 5 / 9
tmin_02a = float((tmin_02 / 10.0) - 32) * 5 / 9
tmin_03a = float((tmin_03 / 10.0) - 32) * 5 / 9
tmin_04a = float((tmin_04 / 10.0) - 32) * 5 / 9
tmin_05a = float((tmin_05 / 10.0) - 32) * 5 / 9
tmin_06a = float((tmin_06 / 10.0) - 32) * 5 / 9
tmin_07a = float((tmin_07 / 10.0) - 32) * 5 / 9
tmin_08a = float((tmin_08 / 10.0) - 32) * 5 / 9
tmin_09a = float((tmin_09 / 10.0) - 32) * 5 / 9
tmin_10a = float((tmin_10 / 10.0) - 32) * 5 / 9
tmin_11a = float((tmin_11 / 10.0) - 32) * 5 / 9
tmin_12a = float((tmin_12 / 10.0) - 32) * 5 / 9

tmax_01a = float((tmax_01 / 10.0) - 32) * 5 / 9
tmax_02a = float((tmax_02 / 10.0) - 32) * 5 / 9
tmax_03a = float((tmax_03 / 10.0) - 32) * 5 / 9
tmax_04a = float((tmax_04 / 10.0) - 32) * 5 / 9
tmax_05a = float((tmax_05 / 10.0) - 32) * 5 / 9
tmax_06a = float((tmax_06 / 10.0) - 32) * 5 / 9
tmax_07a = float((tmax_07 / 10.0) - 32) * 5 / 9
tmax_08a = float((tmax_08 / 10.0) - 32) * 5 / 9
tmax_09a = float((tmax_09 / 10.0) - 32) * 5 / 9
tmax_10a = float((tmax_10 / 10.0) - 32) * 5 / 9
tmax_11a = float((tmax_11 / 10.0) - 32) * 5 / 9
tmax_12a = float((tmax_12 / 10.0) - 32) * 5 / 9

tavg_01a = float((tavg_01 / 10.0) - 32) * 5 / 9
tavg_02a = float((tavg_02 / 10.0) - 32) * 5 / 9
tavg_03a = float((tavg_03 / 10.0) - 32) * 5 / 9
tavg_04a = float((tavg_04 / 10.0) - 32) * 5 / 9
tavg_05a = float((tavg_05 / 10.0) - 32) * 5 / 9
tavg_06a = float((tavg_06 / 10.0) - 32) * 5 / 9
tavg_07a = float((tavg_07 / 10.0) - 32) * 5 / 9
tavg_08a = float((tavg_08 / 10.0) - 32) * 5 / 9
tavg_09a = float((tavg_09 / 10.0) - 32) * 5 / 9
tavg_10a = float((tavg_10 / 10.0) - 32) * 5 / 9
tavg_11a = float((tavg_11 / 10.0) - 32) * 5 / 9
tavg_12a = float((tavg_12 / 10.0) - 32) * 5 / 9

/*Lowest, highest, & average minimum temperatures
/********************************************
/* extract the lowest minimum temperature during the spring months
tmin_minsp = min (tmin_03a, tmin_04a, tmin_05a)
```

```
/* extract the lowest minimum temperature during the summer months
tmin_minsu = min (tmin_06a, tmin_07a, tmin_08a)

/* extract the lowest minimum temperature during the fall months
tmin_minf = min (tmin_09a, tmin_10a, tmin_11a)

/* extract the lowest minimum temperature during the winter months
tmin_minw = min (tmin_12a, tmin_01a, tmin_02a)

/* extract the highest minimum temperature during the spring months
tmin_maxsp = max (tmin_03a, tmin_04a, tmin_05a)

/* extract the highest minimum temperature during the summer months
tmin_maxsu = max (tmin_06a, tmin_07a, tmin_08a)

/* extract the highest minimum temperature during the fall months
tmin_maxf = max (tmin_09a, tmin_10a, tmin_11a)

/* extract the highest minimum temperature during the winter months
tmin_maxw = max (tmin_12a, tmin_01a, tmin_02a)

/* calculate the average minimum temperature during the spring months
tmin_avgsp = mean (tmin_03a, tmin_04a, tmin_05a)

/* calculate the average minimum temperature during the summer months
tmin_avgsu = mean (tmin_06a, tmin_07a, tmin_08a)

/* calculate the average minimum temperature during the fall months
tmin_avgf = mean (tmin_09a, tmin_10a, tmin_11a)

/* calculate the average minimum temperature during the winter months
tmin_avgw = mean (tmin_12a, tmin_01a, tmin_02a)

kill tmin_(!01 01a 02 02a 03 03a 04 04a 05 05a 06 06a 07 07a 08 08a 09 09a 10 10a 11 11a 12 12a!)


/*Lowest, highest, & average maximum temperatures
/*********************************************
/* extract the lowest minimum temperature during the spring months
tmax_minsp = min (tmax_03a, tmax_04a, tmax_05a)

/* extract the lowest minimum temperature during the summer months
tmax_minsu = min (tmax_06a, tmax_07a, tmax_08a)

/* extract the lowest minimum temperature during the fall months
tmax_minf = min (tmax_09a, tmax_10a, tmax_11a)

/* extract the lowest minimum temperature during the winter months
tmax_minw = min (tmax_12a, tmax_01a, tmax_02a)

/* extract the highest minimum temperature during the spring months
tmax_maxsp = max (tmax_03a, tmax_04a, tmax_05a)

/* extract the highest minimum temperature during the summer months
tmax_maxsu = max (tmax_06a, tmax_07a, tmax_08a)

/* extract the highest minimum temperature during the fall months
tmax_maxf = max (tmax_09a, tmax_10a, tmax_11a)

/* extract the highest minimum temperature during the winter months
tmax_maxw = max (tmax_12a, tmax_01a, tmax_02a)
```

```
/* calculate the average minimum temperature during the spring months
tmax_avgsp = mean (tmax_03a, tmax_04a, tmax_05a)

/* calculate the average minimum temperature during the summer months
tmax_avgsu = mean (tmax_06a, tmax_07a, tmax_08a)

/* calculate the average minimum temperature during the fall months
tmax_avgf = mean (tmax_09a, tmax_10a, tmax_11a)

/* calculate the average minimum temperature during the winter months
tmax_avgw = mean (tmax_12a, tmax_01a, tmax_02a)

kill tmax_(!01 01a 02 02a 03 03a 04 04a 05 05a 06 06a 07 07a 08 08a 09 09a 10 10a 11 11a 12 12a!)


/*Lowest, highest, & average average temperatures
/*********************************************
/* extract the lowest minimum temperature during the spring months
tavg_minsp = min (tavg_03a, tavg_04a, tavg_05a)

/* extract the lowest minimum temperature during the summer months
tavg_minsu = min (tavg_06a, tavg_07a, tavg_08a)

/* extract the lowest minimum temperature during the fall months
tavg_minf = min (tavg_09a, tavg_10a, tavg_11a)

/* extract the lowest minimum temperature during the winter months
tavg_minw = min (tavg_12a, tavg_01a, tavg_02a)

/* extract the highest minimum temperature during the spring months
tavg_maxsp = max (tavg_03a, tavg_04a, tavg_05a)

/* extract the highest minimum temperature during the summer months
tavg_maxsu = max (tavg_06a, tavg_07a, tavg_08a)

/* extract the highest minimum temperature during the fall months
tavg_maxf = max (tavg_09a, tavg_10a, tavg_11a)

/* extract the highest minimum temperature during the winter months
tavg_maxw = max (tavg_12a, tavg_01a, tavg_02a)

/* calculate the average minimum temperature during the spring months
tavg_avgsp = mean (tavg_03a, tavg_04a, tavg_05a)

/* calculate the average minimum temperature during the summer months
tavg_avgsu = mean (tavg_06a, tavg_07a, tavg_08a)

/* calculate the average minimum temperature during the fall months
tavg_avgf = mean (tavg_09a, tavg_10a, tavg_11a)

/* calculate the average minimum temperature during the winter months
tavg_avgw = mean (tavg_12a, tavg_01a, tavg_02a)

kill tavg_(!01 01a 02 02a 03 03a 04 04a 05 05a 06 06a 07 07a 08 08a 09 09a 10 10a 11 11a 12 12a!)


/*Lowest, highest, & average precipitation
/*********************************************
/* extract the lowest minimum temperature during the spring months
ppt_minsp = min (ppt_03, ppt_04, ppt_05)

/* extract the lowest minimum temperature during the summer months
```

```
ppt_minsu = min (ppt_06, ppt_07, ppt_08)

/* extract the lowest minimum temperature during the fall months
ppt_minf = min (ppt_09, ppt_10, ppt_11)

/* extract the lowest minimum temperature during the winter months
ppt_minw = min (ppt_12, ppt_01, ppt_02)

/* extract the highest minimum temperature during the spring months
ppt_maxsp = max (ppt_03, ppt_04, ppt_05)

/* extract the highest minimum temperature during the summer months
ppt_maxsu = max (ppt_06, ppt_07, ppt_08)

/* extract the highest minimum temperature during the fall months
ppt_maxf = max (ppt_09, ppt_10, ppt_11)

/* extract the highest minimum temperature during the winter months
ppt_maxw = max (ppt_12, ppt_01, ppt_02)

/* calculate the average minimum temperature during the spring months
ppt_avgsp = mean (ppt_03, ppt_04, ppt_05)

/* calculate the average minimum temperature during the summer months
ppt_avgsu = mean (ppt_06, ppt_07, ppt_08)

/* calculate the average minimum temperature during the fall months
ppt_avgf = mean (ppt_09, ppt_10, ppt_11)

/* calculate the average minimum temperature during the winter months
ppt_avgw = mean (ppt_12, ppt_01, ppt_02)

kill ppt_(!01 02 03 04 05 06 07 08 09 10 11 12!)
/********************************************

/*Total growing degree days
/********************************************
/* calculate the total number of gdd during the spring months
gddsp = sum (gdd_03, gdd_04, gdd_05)

/* calculate the total number of gdd during the summer months
gddsu = sum (gdd_06, gdd_07, gdd_08)

/* calculate the total number of gdd during the fall months
gddf = sum (gdd_09, gdd_10, gdd_11)

/* calculate the total number of gdd during the winter months
gddw = sum (gdd_12, gdd_01, gdd_02)

kill gdd_(!01 02 03 04 05 06 07 08 09 10 11 12!)
q
/********************************************


/*convert the grids to ASCII files so they can be used in SAS
copy tmin_minsp grid_coverages\tmin_minsp
copy tmin_minsu grid_coverages\tmin_minsu
copy tmin_minf grid_coverages\tmin_minf
copy tmin_minw grid_coverages\tmin_minw
copy tmin_maxsp grid_coverages\tmin_maxsp
copy tmin_maxsu grid_coverages\tmin_maxsu
copy tmin_maxf grid_coverages\tmin_maxf
```

```
copy tmin_maxw grid_coverages\tmin_maxw
copy tmin_avgsp grid_coverages\tmin_avgsp
copy tmin_avgsu grid_coverages\tmin_avgsu
copy tmin_avgf grid_coverages\tmin_avgf
copy tmin_avgw grid_coverages\tmin_avgw
copy tmax_minsp grid_coverages\tmax_minsp
copy tmax_minsu grid_coverages\tmax_minsu
copy tmax_minf grid_coverages\tmax_minf
copy tmax_minw grid_coverages\tmax_minw
copy tmax_maxsp grid_coverages\tmax_maxsp
copy tmax_maxsu grid_coverages\tmax_maxsu
copy tmax_maxf grid_coverages\tmax_maxf
copy tmax_maxw grid_coverages\tmax_maxw
copy tmax_avgsp grid_coverages\tmax_avgsp
copy tmax_avgsu grid_coverages\tmax_avgsu
copy tmax_avgf grid_coverages\tmax_avgf
copy tmax_avgw grid_coverages\tmax_avgw
copy tavg_minsp grid_coverages\tavg_minsp
copy tavg_minsu grid_coverages\tavg_minsu
copy tavg_minf grid_coverages\tavg_minf
copy tavg_minw grid_coverages\tavg_minw
copy tavg_maxsp grid_coverages\tavg_maxsp
copy tavg_maxsu grid_coverages\tavg_maxsu
copy tavg_maxf grid_coverages\tavg_maxf
copy tavg_maxw grid_coverages\tavg_maxw
copy tavg_avgsp grid_coverages\tavg_avgsp
copy tavg_avgsu grid_coverages\tavg_avgsu
copy tavg_avgf grid_coverages\tavg_avgf
copy tavg_avgw grid_coverages\tavg_avgw
copy ppt_minsp grid_coverages\ppt_minsp
copy ppt_minsu grid_coverages\ppt_minsu
copy ppt_minf grid_coverages\ppt_minf
copy ppt_minw grid_coverages\ppt_minw
copy ppt_maxsp grid_coverages\ppt_maxsp
copy ppt_maxsu grid_coverages\ppt_maxsu
copy ppt_maxf grid_coverages\ppt_maxf
copy ppt_maxw grid_coverages\ppt_maxw
copy ppt_avgsp grid_coverages\ppt_avgsp
copy ppt_avgsu grid_coverages\ppt_avgsu
copy ppt_avgf grid_coverages\ppt_avgf
copy ppt_avgw grid_coverages\ppt_avgw
copy gddsp grid_coverages\gddsp
copy gddsu grid_coverages\gddsu
copy gddf grid_coverages\gddf
copy gddw grid_coverages\gddw
copy frz_free grid_coverages\frz_free
copy frz_fall grid_coverages\frz_fall
copy frz_spr grid_coverages\frz_spr


gridascii tmin_minsp ascii_files\tmin_minsp.asc
gridascii tmin_minsu ascii_files\tmin_minsu.asc
gridascii tmin_minf ascii_files\tmin_minf.asc
gridascii tmin_minw ascii_files\tmin_minw.asc
gridascii tmin_maxsp ascii_files\tmin_maxsp.asc
gridascii tmin_maxsu ascii_files\tmin_maxsu.asc
gridascii tmin_maxf ascii_files\tmin_maxf.asc
gridascii tmin_maxw ascii_files\tmin_maxw.asc
gridascii tmin_avgsp ascii_files\tmin_avgsp.asc
gridascii tmin_avgsu ascii_files\tmin_avgsu.asc
gridascii tmin_avgf ascii_files\tmin_avgf.asc
gridascii tmin_avgw ascii_files\tmin_avgw.asc
```

```
gridascii tmax_minsp ascii_files\tmax_minsp.asc
gridascii tmax_minsu ascii_files\tmax_minsu.asc
gridascii tmax_minf ascii_files\tmax_minf.asc
gridascii tmax_minw ascii_files\tmax_minw.asc
gridascii tmax_maxsp ascii_files\tmax_maxsp.asc
gridascii tmax_maxsu ascii_files\tmax_maxsu.asc
gridascii tmax_maxf ascii_files\tmax_maxf.asc
gridascii tmax_maxw ascii_files\tmax_maxw.asc
gridascii tmax_avgsp ascii_files\tmax_avgsp.asc
gridascii tmax_avgsu ascii_files\tmax_avgsu.asc
gridascii tmax_avgf ascii_files\tmax_avgf.asc
gridascii tmax_avgw ascii_files\tmax_avgw.asc
gridascii tavg_minsp ascii_files\tavg_minsp.asc
gridascii tavg_minsu ascii_files\tavg_minsu.asc
gridascii tavg_minf ascii_files\tavg_minf.asc
gridascii tavg_minw ascii_files\tavg_minw.asc
gridascii tavg_maxsp ascii_files\tavg_maxsp.asc
gridascii tavg_maxsu ascii_files\tavg_maxsu.asc
gridascii tavg_maxf ascii_files\tavg_maxf.asc
gridascii tavg_maxw ascii_files\tavg_maxw.asc
gridascii tavg_avgsp ascii_files\tavg_avgsp.asc
gridascii tavg_avgsu ascii_files\tavg_avgsu.asc
gridascii tavg_avgf ascii_files\tavg_avgf.asc
gridascii tavg_avgw ascii_files\tavg_avgw.asc
gridascii ppt_minsp ascii_files\ppt_minsp.asc
gridascii ppt_minsu ascii_files\ppt_minsu.asc
gridascii ppt_minf ascii_files\ppt_minf.asc
gridascii ppt_minw ascii_files\ppt_minw.asc
gridascii ppt_maxsp ascii_files\ppt_maxsp.asc
gridascii ppt_maxsu ascii_files\ppt_maxsu.asc
gridascii ppt_maxf ascii_files\ppt_maxf.asc
gridascii ppt_maxw ascii_files\ppt_maxw.asc
gridascii ppt_avgsp ascii_files\ppt_avgsp.asc
gridascii ppt_avgsu ascii_files\ppt_avgsu.asc
gridascii ppt_avgf ascii_files\ppt_avgf.asc
gridascii ppt_avgw ascii_files\ppt_avgw.asc
gridascii gddsp ascii_files\gddsp.asc
gridascii gddsu ascii_files\gddsu.asc
gridascii gddf ascii_files\gddf.asc
gridascii gddw ascii_files\gddw.asc
gridascii frz_free ascii_files\frz_free.asc
gridascii frz_fall ascii_files\frz_fall.asc
gridascii frz_spr ascii_files\frz_spr.asc

kill (!tmin_minsp tmin_minsu tmin_minf tmin_minw tmin_maxsp tmin_maxsu tmin_maxf tmin_maxw tmin_avgsp
tmin_avgsu ~
tmin_avgf tmin_avgw tmax_minsp tmax_minsu tmax_minf tmax_minw tmax_maxsp tmax_maxsu tmax_maxf
tmax_maxw ~
tmax_avgsp tmax_avgsu tmax_avgf tmax_avgw tavg_minsp tavg_minsu tavg_minf tavg_minw tavg_maxsp
tavg_maxsu ~
tavg_maxf tavg_maxw tavg_avgsp tavg_avgsu tavg_avgf tavg_avgw ppt_minsp ppt_minsu ppt_minf ppt_minw
ppt_maxsp ~
ppt_maxsu ppt_maxf ppt_maxw ppt_avgsp ppt_avgsu ppt_avgf ppt_avgw gddsp gddsu gddf gddw frz_free
frz_fall frz_spr!)

&watch &off

&return
```

```
/*AML name: combine.aml
/*combines all the attibutes from the base variables with the cluster number
asciigrid sas_zones16_5PCS.asc sas_zones
grid
copy ../../../16_base_variables/tmin_min
copy ../../../16_base_variables/tmin_max
copy ../../../16_base_variables/tmin_14a
copy ../../../16_base_variables/tmax_min
copy ../../../16_base_variables/tmax_max
copy ../../../16_base_variables/tmax_14a
copy ../../../16_base_variables/tavg_min
copy ../../../16_base_variables/tavg_max
copy ../../../16_base_variables/tavg_14a
tmin_minc10 = (tmin_min * 10)
tmin_maxc10 = (tmin_max * 10)
tmin_14c10 = (tmin_14a * 10)
tmax_minc10 = (tmax_min * 10)
tmax_maxc10 = (tmax_max * 10)
tmax_14c10 = (tmax_14a * 10)
tavg_minc10 = (tavg_min * 10)
tavg_maxc10 = (tavg_max * 10)
tavg_14c10 = (tavg_14a * 10)

copy ../../../16_base_variables/ppt_min
copy ../../../16_base_variables/ppt_max
copy ../../../16_base_variables/ppt_14
copy ../../../16_base_variables/frz_free
copy ../../../16_base_variables/frz_fall
copy ../../../16_base_variables/frz_spr
copy ../../../16_base_variables/gdd_14
copy ../../../../coverages/prism/dem/worksp/us_25m

sas16_5PCS = combine (sas_zones, tmin_minc10, tmin_maxc10, tmin_14c10, tmax_minc10, tmax_maxc10, ~
            tmax_14c10, tavg_minc10, tavg_maxc10, tavg_14c10, ppt_min, ppt_max, ppt_14, ~
            frz_free, frz_fall, frz_spr, gdd_14, us_25m)
kill (!tmin_min tmin_max tmin_14a tmax_min tmax_max tmax_14a tavg_min tavg_max tavg_14a tmin_minc10 ~
    tmin_maxc10 tmin_14c10 tmax_minc10 tmax_maxc10 tmax_14c10 tavg_minc10 tavg_maxc10 tavg_14c10
ppt_min ~
    ppt_max ppt_14 frz_free frz_fall frz_spr gdd_14 us_25m!)
q
&return
```

APPENDIX B: SAS CODE

```
/*READ THE DATA FILES IN*/

data v1; infile 'e:\thesis\sas_classification\worksp_final\tmin_minsp.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var1 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v2; infile 'e:\thesis\sas_classification\worksp_final\tmin_minsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var2 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v3; infile 'e:\thesis\sas_classification\worksp_final\tmin_minf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var3 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v4; infile 'e:\thesis\sas_classification\worksp_final\tmin_minw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var4 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v5; infile 'e:\thesis\sas_classification\worksp_final\tmin_maxsp.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var5 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v6; infile 'e:\thesis\sas_classification\worksp_final\tmin_maxsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
```

```
   do col = 1 to 128 ;
     input var6 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v7; infile 'e:\thesis\sas_classification\worksp_final\tmin_maxf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var7 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v8; infile 'e:\thesis\sas_classification\worksp_final\tmin_maxw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var8 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v9; infile 'e:\thesis\sas_classification\worksp_final\tmin_avgsp.asc' firstobs=7 linesize=1500 ;
 do row  = 1 to 199 ;
   do col = 1 to 128 ;
     input var9 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v10; infile 'e:\thesis\sas_classification\worksp_final\tmin_avgsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var10 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v11; infile 'e:\thesis\sas_classification\worksp_final\tmin_avgf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var11 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
```

```
run ;

data v12; infile 'e:\thesis\sas_classification\worksp_final\tmin_avgw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var12 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v13; infile 'e:\thesis\sas_classification\worksp_final\tmax_minsp.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var13 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v14; infile 'e:\thesis\sas_classification\worksp_final\tmax_minsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var14 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v15; infile 'e:\thesis\sas_classification\worksp_final\tmax_minf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var15 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v16; infile 'e:\thesis\sas_classification\worksp_final\tmax_minw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var16 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v17; infile 'e:\thesis\sas_classification\worksp_final\tmax_maxsp.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var17 @@ ;
     output ;
```

```
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v18; infile 'e:\thesis\sas_classification\worksp_final\tmax_maxsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var18 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v19; infile 'e:\thesis\sas_classification\worksp_final\tmax_maxf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var19 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v20; infile 'e:\thesis\sas_classification\worksp_final\tmax_maxw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var20 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v21; infile 'e:\thesis\sas_classification\worksp_final\tmax_avgsp.asc' firstobs=7 linesize=1500 ;
 do row  = 1 to 199 ;
   do col = 1 to 128 ;
     input var21 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v22; infile 'e:\thesis\sas_classification\worksp_final\tmax_avgsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var22 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v23; infile 'e:\thesis\sas_classification\worksp_final\tmax_avgf.asc' firstobs=7 linesize=1500 ;
```

```
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var23 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v24; infile 'e:\thesis\sas_classification\worksp_final\tmax_avgw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var24 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v25; infile 'e:\thesis\sas_classification\worksp_final\tavg_minsp.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var25 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v26; infile 'e:\thesis\sas_classification\worksp_final\tavg_minsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var26 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v27; infile 'e:\thesis\sas_classification\worksp_final\tavg_minf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var27 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v28; infile 'e:\thesis\sas_classification\worksp_final\tavg_minw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var28 @@ ;
     output ;
   end ;
 end ;
run ;
```

```
/*proc print ; */
run ;

data v29; infile 'e:\thesis\sas_classification\worksp_final\tavg_maxsp.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var29 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v30; infile 'e:\thesis\sas_classification\worksp_final\tavg_maxsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var30 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v31; infile 'e:\thesis\sas_classification\worksp_final\tavg_maxf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var31 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v32; infile 'e:\thesis\sas_classification\worksp_final\tavg_maxw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var32 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v33; infile 'e:\thesis\sas_classification\worksp_final\tavg_avgsp.asc' firstobs=7 linesize=1500 ;
 do row  = 1 to 199 ;
   do col = 1 to 128 ;
     input var33 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v34; infile 'e:\thesis\sas_classification\worksp_final\tavg_avgsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var34 @@ ;
```

```
    output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;


data v35; infile 'e:\thesis\sas_classification\worksp_final\tavg_avgf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var35 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v36; infile 'e:\thesis\sas_classification\worksp_final\tavg_avgw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var36 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v37; infile 'e:\thesis\sas_classification\worksp_final\ppt_minsp.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var37 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v38; infile 'e:\thesis\sas_classification\worksp_final\ppt_minsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var38 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v39; infile 'e:\thesis\sas_classification\worksp_final\ppt_minf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var39 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;
```

```
data v40; infile 'e:\thesis\sas_classification\worksp_final\ppt_minw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var40 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v41; infile 'e:\thesis\sas_classification\worksp_final\ppt_maxsp.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var41 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v42; infile 'e:\thesis\sas_classification\worksp_final\ppt_maxsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var42 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v43; infile 'e:\thesis\sas_classification\worksp_final\ppt_maxf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var43 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v44; infile 'e:\thesis\sas_classification\worksp_final\ppt_maxw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var44 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v45; infile 'e:\thesis\sas_classification\worksp_final\ppt_avgsp.asc' firstobs=7 linesize=1500 ;
 do row  = 1 to 199 ;
   do col = 1 to 128 ;
     input var45 @@ ;
     output ;
   end ;
```

```
 end ;
run ;
/*proc print ; */
run ;

data v46; infile 'e:\thesis\sas_classification\worksp_final\ppt_avgsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var46 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v47; infile 'e:\thesis\sas_classification\worksp_final\ppt_avgf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var47 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v48; infile 'e:\thesis\sas_classification\worksp_final\ppt_avgw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var48 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v49; infile 'e:\thesis\sas_classification\worksp_final\gddsp.asc' firstobs=7 linesize=1500 ;
 do row  = 1 to 199 ;
   do col = 1 to 128 ;
     input var49 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v50; infile 'e:\thesis\sas_classification\worksp_final\gddsu.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
   do col = 1 to 128 ;
     input var50 @@ ;
     output ;
   end ;
 end ;
run ;
/*proc print ; */
run ;

data v51; infile 'e:\thesis\sas_classification\worksp_final\gddf.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
```

```
  do col = 1 to 128 ;
    input var51 @@ ;
    output ;
  end ;
 end ;
run ;
/*proc print ; */
run ;

data v52; infile 'e:\thesis\sas_classification\worksp_final\gddw.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
  do col = 1 to 128 ;
    input var52 @@ ;
    output ;
  end ;
 end ;
run ;
/*proc print ; */
run ;

data v53; infile 'e:\thesis\sas_classification\worksp_final\frz_free.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
  do col = 1 to 128 ;
    input var53 @@ ;
    output ;
  end ;
 end ;
run ;
/*proc print ; */
run ;

data v54; infile 'e:\thesis\sas_classification\worksp_final\frz_fall.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
  do col = 1 to 128 ;
    input var54 @@ ;
    output ;
  end ;
 end ;
run ;
/*proc print ; */
run ;

data v55; infile 'e:\thesis\sas_classification\worksp_final\frz_spr.asc' firstobs=7 linesize=1500 ;
 do row = 1 to 199 ;
  do col = 1 to 128 ;
    input var55 @@ ;
    output ;
  end ;
 end ;
run ;
/*proc print ; */
run ;


/* MERGE THE DATA SETS INTO ONE*/

data all ;
 id = _n_ ;
 merge v1 v2 v3 v4 v5 v6 v7 v8 v9 v10 v11 v12 v13 v14 v15 v16 v17 v18 v19 v20 v21 v22 v23 v24 v25 v26 v27
v28 v29
      v30 v31 v32 v33 v34 v35 v36 v37 v38 v39 v40 v41 v42 v43 v44 v45 v46 v47 v48 v49 v50 v51 v52 v53 v54
v55 ;
```

```
run ;

/* CREATE A NEW DATA SET THAT EXCLUDES THE NODATA VALUES*/

data subset ; set all ;
 if var1 ne -9999 ;
 keep id var1 var2 var3 var4 var5 var6 var7 var8 var9 var10 var11 var12 var13 var14 var15 var16 var17 var18
var19
        var20 var21 var22 var23 var24 var25 var26 var27 var28 var29 var30 var31 var32 var33 var34 var35 var36
        var37 var38 var39 var40 var41 var42 var43 var44 var45 var46 var47 var48 var49 var50 var51 var52 var53
        var54 var55 ;
run ;

/* STANDARDIZE THE DATA TO MEANS ZERO AND STD ONE*/

proc standard data = subset out = zj mean = 0 std = 1 ;
  var var1 var2 var3 var4 var5 var6 var7 var8 var9 var10 var11 var12 var13 var14 var15 var16 var17 var18 var19
        var20 var21 var22 var23 var24 var25 var26 var27 var28 var29 var30 var31 var32 var33 var34 var35 var36
        var37 var38 var39 var40 var41 var42 var43 var44 var45 var46 var47 var48 var49 var50 var51 var52 var53
        var54 var55 ;
run ;

/* CREATE PRINCIPAL COMPONENT SCORES TO CLUSTER*/

proc princomp data = zj out = scores ;
  var var1 var2 var3 var4 var5 var6 var7 var8 var9 var10 var11 var12 var13 var14 var15 var16 var17 var18 var19
        var20 var21 var22 var23 var24 var25 var26 var27 var28 var29 var30 var31 var32 var33 var34 var35 var36
        var37 var38 var39 var40 var41 var42 var43 var44 var45 var46 var47 var48 var49 var50 var51 var52 var53
        var54 var55 ;
run ;

/*CLUSTER SOLUTION*/

proc cluster data = scores method = ward ccc pseudo outtree = tree ;
  var PRIN1 PRIN2 PRIN3 PRIN4 PRIN5 ;
id id ;
run ;

proc tree data = tree graphics ;
run ;

proc tree data = tree out = treeout nclusters = 16 noprint ;
copy PRIN1 PRIN2 PRIN3 PRIN4 PRIN5 ;
id id ;
run;

proc sort data=treeout; by id;
run;

data join ;
 merge scores treeout ; by id ;
run ;

/*
proc print data=join ;
 var id cluster PRIN1 PRIN2 ;
run ;
*/


/* CREATE A OUPUT FILE TO PLOT PRIN1 VS. PRIN2 PRIN3 PRIN4 PRIN5 IN EXCEL*/
```

```
data xlchart ;
 update join all ;
 by id ;
 keep id cluster PRIN1 PRIN2 PRIN3 PRIN4 PRIN5 ;
run ;
data out ; set xlchart;
 file 'e:\thesis\sas_classification\worksp_final\pringraph\ward55_pca.asc' ;
 put cluster PRIN1 PRIN2 PRIN3 PRIN4 PRIN5 ;
run ;



/* CREATE AN OUTPUT FILE 128 COLUMNS BY 199 ROWS TO USE IN ARC/INFO*/

data output ;
 update join all ;
 by id ;
 keep id cluster ;
 title 'Final output dataset' ;
run ;

data outfile ; set output ;
 file 'e:\thesis\sas_classification\worksp_final\zones\temp.asc' ;
 put cluster ;
run ;

data infile ;
keep c1 c2 c3 c4 c5 c6 c7 c8 c9 c10
    c11 c12 c13 c14 c15 c16 c17 c18 c19 c20
    c21 c22 c23 c24 c25 c26 c27 c28 c29 c30
    c31 c32 c33 c34 c35 c36 c37 c38 c39 c40
    c41 c42 c43 c44 c45 c46 c47 c48 c49 c50
    c51 c52 c53 c54 c55 c56 c57 c58 c59 c60
    c61 c62 c63 c64 c65 c66 c67 c68 c69 c70
    c71 c72 c73 c74 c75 c76 c77 c78 c79 c80
    c81 c82 c83 c84 c85 c86 c87 c88 c89 c90
    c91 c92 c93 c94 c95 c96 c97 c98 c99 c100
    c101 c102 c103 c104 c105 c106 c107 c108 c109 c110
    c111 c112 c113 c114 c115 c116 c117 c118
    c119 c120 c121 c122 c123 c124 c125 c126 c127 c128;
infile 'e:\thesis\sas_classification\worksp_final\zones\temp.asc';
 input @1 c1
          #2 @1 c2
          #3 @1 c3
          #4 @1 c4
          #5 @1 c5
          #6 @1 c6
          #7 @1 c7
          #8 @1 c8
          #9 @1 c9
          #10 @1 c10
          #11 @1 c11
          #12 @1 c12
          #13 @1 c13
          #14 @1 c14
          #15 @1 c15
          #16 @1 c16
          #17 @1 c17
          #18 @1 c18
          #19 @1 c19
          #20 @1 c20
```

#21 @1 c21
#22 @1 c22
#23 @1 c23
#24 @1 c24
#25 @1 c25
#26 @1 c26
#27 @1 c27
#28 @1 c28
#29 @1 c29
#30 @1 c30
#31 @1 c31
#32 @1 c32
#33 @1 c33
#34 @1 c34
#35 @1 c35
#36 @1 c36
#37 @1 c37
#38 @1 c38
#39 @1 c39
#40 @1 c40
#41 @1 c41
#42 @1 c42
#43 @1 c43
#44 @1 c44
#45 @1 c45
#46 @1 c46
#47 @1 c47
#48 @1 c48
#49 @1 c49
#50 @1 c50
#51 @1 c51
#52 @1 c52
#53 @1 c53
#54 @1 c54
#55 @1 c55
#56 @1 c56
#57 @1 c57
#58 @1 c58
#59 @1 c59
#60 @1 c60
#61 @1 c61
#62 @1 c62
#63 @1 c63
#64 @1 c64
#65 @1 c65
#66 @1 c66
#67 @1 c67
#68 @1 c68
#69 @1 c69
#70 @1 c70
#71 @1 c71
#72 @1 c72
#73 @1 c73
#74 @1 c74
#75 @1 c75
#76 @1 c76
#77 @1 c77
#78 @1 c78
#79 @1 c79
#80 @1 c80
#81 @1 c81
#82 @1 c82

```
        #83 @1 c83
        #84 @1 c84
        #85 @1 c85
        #86 @1 c86
        #87 @1 c87
        #88 @1 c88
        #89 @1 c89
        #90 @1 c90
        #91 @1 c91
        #92 @1 c92
        #93 @1 c93
        #94 @1 c94
        #95 @1 c95
        #96 @1 c96
        #97 @1 c97
        #98 @1 c98
        #99 @1 c99
        #100 @1 c100
        #101 @1 c101
        #102 @1 c102
        #103 @1 c103
        #104 @1 c104
        #105 @1 c105
        #106 @1 c106
        #107 @1 c107
        #108 @1 c108
        #109 @1 c109
        #110 @1 c110
        #111 @1 c111
        #112 @1 c112
        #113 @1 c113
        #114 @1 c114
        #115 @1 c115
        #116 @1 c116
        #117 @1 c117
        #118 @1 c118
        #119 @1 c119
        #120 @1 c120
        #121 @1 c121
        #122 @1 c122
        #123 @1 c123
        #124 @1 c124
        #125 @1 c125
        #126 @1 c126
        #127 @1 c127
        #128 @1 c128
        ;
run ;


data out ;
 set infile ;
 file 'e:\thesis\sas_classification\worksp_final\zones\sas_zones.asc' linesize=1500 ;
 put
c1
c2
c3
c4
c5
c6
c7
c8
```

c9
c10
c11
c12
c13
c14
c15
c16
c17
c18
c19
c20
c21
c22
c23
c24
c25
c26
c27
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c31
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c58
c59
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c61
c62
c63
c64
c65
c66
c67
c68
c69
c70

```
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c80
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c82
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c107
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c109
c110
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c112
c113
c114
c115
c116
c117
c118
c119
c120
c121
c122
c123
c124
c125
c126
c127
c128
;
run ;
```

```
/* CREATE AN OUTPUT FILE FOR PRIN1*/
/* CREATE AN OUTPUT FILE 128 COLUMNS BY 199 ROWS TO USE IN ARC/INFO*/

data output2 ;
 update join all ;
 by id ;
 keep id PRIN1 ;
 title 'Final PRIN1 output dataset' ;
run ;

data outfile2 ; set output2 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\temp2.asc' ;
 put PRIN1 ;
run ;

data infile2 ;
keep c1 c2 c3 c4 c5 c6 c7 c8 c9 c10
    c11 c12 c13 c14 c15 c16 c17 c18 c19 c20
    c21 c22 c23 c24 c25 c26 c27 c28 c29 c30
    c31 c32 c33 c34 c35 c36 c37 c38 c39 c40
    c41 c42 c43 c44 c45 c46 c47 c48 c49 c50
    c51 c52 c53 c54 c55 c56 c57 c58 c59 c60
    c61 c62 c63 c64 c65 c66 c67 c68 c69 c70
    c71 c72 c73 c74 c75 c76 c77 c78 c79 c80
    c81 c82 c83 c84 c85 c86 c87 c88 c89 c90
    c91 c92 c93 c94 c95 c96 c97 c98 c99 c100
    c101 c102 c103 c104 c105 c106 c107 c108 c109 c110
    c111 c112 c113 c114 c115 c116 c117 c118
    c119 c120 c121 c122 c123 c124 c125 c126 c127 c128;
infile 'e:\thesis\sas_classification\worksp_final\zones\temp2.asc';
 input @1 c1
          #2 @1 c2
          #3 @1 c3
          #4 @1 c4
          #5 @1 c5
          #6 @1 c6
          #7 @1 c7
          #8 @1 c8
          #9 @1 c9
          #10 @1 c10
          #11 @1 c11
          #12 @1 c12
          #13 @1 c13
          #14 @1 c14
          #15 @1 c15
          #16 @1 c16
          #17 @1 c17
          #18 @1 c18
          #19 @1 c19
          #20 @1 c20
          #21 @1 c21
          #22 @1 c22
          #23 @1 c23
          #24 @1 c24
          #25 @1 c25
          #26 @1 c26
          #27 @1 c27
          #28 @1 c28
          #29 @1 c29
          #30 @1 c30
          #31 @1 c31
```

#32 @1 c32
#33 @1 c33
#34 @1 c34
#35 @1 c35
#36 @1 c36
#37 @1 c37
#38 @1 c38
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#40 @1 c40
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#43 @1 c43
#44 @1 c44
#45 @1 c45
#46 @1 c46
#47 @1 c47
#48 @1 c48
#49 @1 c49
#50 @1 c50
#51 @1 c51
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#58 @1 c58
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#68 @1 c68
#69 @1 c69
#70 @1 c70
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#74 @1 c74
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#76 @1 c76
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#93 @1 c93

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        #94 @1 c94
        #95 @1 c95
        #96 @1 c96
        #97 @1 c97
        #98 @1 c98
        #99 @1 c99
        #100 @1 c100
        #101 @1 c101
        #102 @1 c102
        #103 @1 c103
        #104 @1 c104
        #105 @1 c105
        #106 @1 c106
        #107 @1 c107
        #108 @1 c108
        #109 @1 c109
        #110 @1 c110
        #111 @1 c111
        #112 @1 c112
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        #114 @1 c114
        #115 @1 c115
        #116 @1 c116
        #117 @1 c117
        #118 @1 c118
        #119 @1 c119
        #120 @1 c120
        #121 @1 c121
        #122 @1 c122
        #123 @1 c123
        #124 @1 c124
        #125 @1 c125
        #126 @1 c126
        #127 @1 c127
        #128 @1 c128
        ;
run ;


data out2 ;
 set infile2 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\PRIN1.asc' linesize=3000 ;
 put
c1
c2
c3
c4
c5
c6
c7
c8
c9
c10
c11
c12
c13
c14
c15
c16
c17
c18
c19
```

c20
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c78
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c80
c81

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c82
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c106
c107
c108
c109
c110
c111
c112
c113
c114
c115
c116
c117
c118
c119
c120
c121
c122
c123
c124
c125
c126
c127
c128
;
run ;


/* CREATE AN OUTPUT FILE FOR PRIN2*/
/* CREATE AN OUTPUT FILE 128 COLUMNS BY 199 ROWS TO USE IN ARC/INFO*/

data output3 ;
 update join all ;
 by id ;
 keep id PRIN2 ;
 title 'Final PRIN2 output dataset' ;
run ;
```

```
data outfile3 ; set output3 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\temp3.asc' ;
 put PRIN2 ;
run ;

data infile3 ;
keep c1 c2 c3 c4 c5 c6 c7 c8 c9 c10
    c11 c12 c13 c14 c15 c16 c17 c18 c19 c20
    c21 c22 c23 c24 c25 c26 c27 c28 c29 c30
    c31 c32 c33 c34 c35 c36 c37 c38 c39 c40
    c41 c42 c43 c44 c45 c46 c47 c48 c49 c50
    c51 c52 c53 c54 c55 c56 c57 c58 c59 c60
    c61 c62 c63 c64 c65 c66 c67 c68 c69 c70
    c71 c72 c73 c74 c75 c76 c77 c78 c79 c80
    c81 c82 c83 c84 c85 c86 c87 c88 c89 c90
    c91 c92 c93 c94 c95 c96 c97 c98 c99 c100
    c101 c102 c103 c104 c105 c106 c107 c108 c109 c110
    c111 c112 c113 c114 c115 c116 c117 c118
    c119 c120 c121 c122 c123 c124 c125 c126 c127 c128;
infile 'e:\thesis\sas_classification\worksp_final\zones\temp3.asc';
 input @1 c1
            #2 @1 c2
            #3 @1 c3
            #4 @1 c4
            #5 @1 c5
            #6 @1 c6
            #7 @1 c7
            #8 @1 c8
            #9 @1 c9
            #10 @1 c10
            #11 @1 c11
            #12 @1 c12
            #13 @1 c13
            #14 @1 c14
            #15 @1 c15
            #16 @1 c16
            #17 @1 c17
            #18 @1 c18
            #19 @1 c19
            #20 @1 c20
            #21 @1 c21
            #22 @1 c22
            #23 @1 c23
            #24 @1 c24
            #25 @1 c25
            #26 @1 c26
            #27 @1 c27
            #28 @1 c28
            #29 @1 c29
            #30 @1 c30
            #31 @1 c31
            #32 @1 c32
            #33 @1 c33
            #34 @1 c34
            #35 @1 c35
            #36 @1 c36
            #37 @1 c37
            #38 @1 c38
            #39 @1 c39
            #40 @1 c40
            #41 @1 c41
            #42 @1 c42
```

#43 @1 c43
#44 @1 c44
#45 @1 c45
#46 @1 c46
#47 @1 c47
#48 @1 c48
#49 @1 c49
#50 @1 c50
#51 @1 c51
#52 @1 c52
#53 @1 c53
#54 @1 c54
#55 @1 c55
#56 @1 c56
#57 @1 c57
#58 @1 c58
#59 @1 c59
#60 @1 c60
#61 @1 c61
#62 @1 c62
#63 @1 c63
#64 @1 c64
#65 @1 c65
#66 @1 c66
#67 @1 c67
#68 @1 c68
#69 @1 c69
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#81 @1 c81
#82 @1 c82
#83 @1 c83
#84 @1 c84
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#86 @1 c86
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#89 @1 c89
#90 @1 c90
#91 @1 c91
#92 @1 c92
#93 @1 c93
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#99 @1 c99
#100 @1 c100
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#103 @1 c103
#104 @1 c104

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        #105 @1 c105
        #106 @1 c106
        #107 @1 c107
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        #111 @1 c111
        #112 @1 c112
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        #114 @1 c114
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        #117 @1 c117
        #118 @1 c118
        #119 @1 c119
        #120 @1 c120
        #121 @1 c121
        #122 @1 c122
        #123 @1 c123
        #124 @1 c124
        #125 @1 c125
        #126 @1 c126
        #127 @1 c127
        #128 @1 c128
        ;
run ;


data out3 ;
 set infile3 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\PRIN2.asc' linesize=3000 ;
 put
c1
c2
c3
c4
c5
c6
c7
c8
c9
c10
c11
c12
c13
c14
c15
c16
c17
c18
c19
c20
c21
c22
c23
c24
c25
c26
c27
c28
c29
c30
```

c31
c32
c33
c34
c35
c36
c37
c38
c39
c40
c41
c42
c43
c44
c45
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c47
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c49
c50
c51
c52
c53
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c92

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c114
c115
c116
c117
c118
c119
c120
c121
c122
c123
c124
c125
c126
c127
c128
;
run ;


/* CREATE AN OUTPUT FILE FOR PRIN3*/
/* CREATE AN OUTPUT FILE 128 COLUMNS BY 199 ROWS TO USE IN ARC/INFO*/

data output4 ;
 update join all ;
 by id ;
 keep id PRIN3 ;
 title 'Final PRIN3 output dataset' ;
run ;

data outfile4 ; set output4 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\temp4.asc' ;
 put PRIN3 ;
run ;

data infile4 ;
keep c1 c2 c3 c4 c5 c6 c7 c8 c9 c10
     c11 c12 c13 c14 c15 c16 c17 c18 c19 c20
     c21 c22 c23 c24 c25 c26 c27 c28 c29 c30
     c31 c32 c33 c34 c35 c36 c37 c38 c39 c40
     c41 c42 c43 c44 c45 c46 c47 c48 c49 c50
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    c51 c52 c53 c54 c55 c56 c57 c58 c59 c60
    c61 c62 c63 c64 c65 c66 c67 c68 c69 c70
    c71 c72 c73 c74 c75 c76 c77 c78 c79 c80
    c81 c82 c83 c84 c85 c86 c87 c88 c89 c90
    c91 c92 c93 c94 c95 c96 c97 c98 c99 c100
    c101 c102 c103 c104 c105 c106 c107 c108 c109 c110
    c111 c112 c113 c114 c115 c116 c117 c118
    c119 c120 c121 c122 c123 c124 c125 c126 c127 c128;
infile 'e:\thesis\sas_classification\worksp_final\zones\temp4.asc';
 input @1 c1
         #2 @1 c2
         #3 @1 c3
         #4 @1 c4
         #5 @1 c5
         #6 @1 c6
         #7 @1 c7
         #8 @1 c8
         #9 @1 c9
         #10 @1 c10
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         #12 @1 c12
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         #14 @1 c14
         #15 @1 c15
         #16 @1 c16
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         #19 @1 c19
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         #21 @1 c21
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         #23 @1 c23
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         #26 @1 c26
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         #46 @1 c46
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        #123 @1 c123
        #124 @1 c124
        #125 @1 c125
        #126 @1 c126
        #127 @1 c127
        #128 @1 c128
        ;
run ;


data out4 ;
 set infile4 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\PRIN3.asc' linesize=3000 ;
 put
c1
c2
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c127
c128
;
run ;
```

```
/* CREATE AN OUTPUT FILE FOR PRIN4*/
/* CREATE AN OUTPUT FILE 128 COLUMNS BY 199 ROWS TO USE IN ARC/INFO*/

data output5 ;
 update join all ;
 by id ;
 keep id PRIN4 ;
 title 'Final PRIN4 output dataset' ;
run ;

data outfile5 ; set output5 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\temp5.asc' ;
 put PRIN4 ;
run ;

data infile5 ;
keep c1 c2 c3 c4 c5 c6 c7 c8 c9 c10
    c11 c12 c13 c14 c15 c16 c17 c18 c19 c20
    c21 c22 c23 c24 c25 c26 c27 c28 c29 c30
    c31 c32 c33 c34 c35 c36 c37 c38 c39 c40
    c41 c42 c43 c44 c45 c46 c47 c48 c49 c50
    c51 c52 c53 c54 c55 c56 c57 c58 c59 c60
    c61 c62 c63 c64 c65 c66 c67 c68 c69 c70
    c71 c72 c73 c74 c75 c76 c77 c78 c79 c80
    c81 c82 c83 c84 c85 c86 c87 c88 c89 c90
    c91 c92 c93 c94 c95 c96 c97 c98 c99 c100
    c101 c102 c103 c104 c105 c106 c107 c108 c109 c110
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    c111 c112 c113 c114 c115 c116 c117 c118
    c119 c120 c121 c122 c123 c124 c125 c126 c127 c128;
infile 'e:\thesis\sas_classification\worksp_final\zones\temp5.asc';
 input @1 c1
           #2 @1 c2
           #3 @1 c3
           #4 @1 c4
           #5 @1 c5
           #6 @1 c6
           #7 @1 c7
           #8 @1 c8
           #9 @1 c9
           #10 @1 c10
           #11 @1 c11
           #12 @1 c12
           #13 @1 c13
           #14 @1 c14
           #15 @1 c15
           #16 @1 c16
           #17 @1 c17
           #18 @1 c18
           #19 @1 c19
           #20 @1 c20
           #21 @1 c21
           #22 @1 c22
           #23 @1 c23
           #24 @1 c24
           #25 @1 c25
           #26 @1 c26
           #27 @1 c27
           #28 @1 c28
           #29 @1 c29
           #30 @1 c30
           #31 @1 c31
           #32 @1 c32
           #33 @1 c33
           #34 @1 c34
           #35 @1 c35
           #36 @1 c36
           #37 @1 c37
           #38 @1 c38
           #39 @1 c39
           #40 @1 c40
           #41 @1 c41
           #42 @1 c42
           #43 @1 c43
           #44 @1 c44
           #45 @1 c45
           #46 @1 c46
           #47 @1 c47
           #48 @1 c48
           #49 @1 c49
           #50 @1 c50
           #51 @1 c51
           #52 @1 c52
           #53 @1 c53
           #54 @1 c54
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           #59 @1 c59
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        #122 @1 c122
        #123 @1 c123
        #124 @1 c124
        #125 @1 c125
        #126 @1 c126
        #127 @1 c127
        #128 @1 c128
        ;
run ;


data out5 ;
 set infile5 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\PRIN4.asc' linesize=3000 ;
 put
c1
c2
c3
c4
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c127
c128
;
run ;




/* CREATE AN OUTPUT FILE FOR PRIN5*/
/* CREATE AN OUTPUT FILE 128 COLUMNS BY 199 ROWS TO USE IN ARC/INFO*/

data output6 ;
 update join all ;
 by id ;
 keep id PRIN5 ;
 title 'Final PRIN5 output dataset' ;
run ;

data outfile6 ; set output6 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\temp6.asc' ;
 put PRIN5 ;
run ;

data infile6 ;
keep c1 c2 c3 c4 c5 c6 c7 c8 c9 c10
    c11 c12 c13 c14 c15 c16 c17 c18 c19 c20
    c21 c22 c23 c24 c25 c26 c27 c28 c29 c30
    c31 c32 c33 c34 c35 c36 c37 c38 c39 c40
    c41 c42 c43 c44 c45 c46 c47 c48 c49 c50
    c51 c52 c53 c54 c55 c56 c57 c58 c59 c60
    c61 c62 c63 c64 c65 c66 c67 c68 c69 c70
    c71 c72 c73 c74 c75 c76 c77 c78 c79 c80
    c81 c82 c83 c84 c85 c86 c87 c88 c89 c90
    c91 c92 c93 c94 c95 c96 c97 c98 c99 c100
    c101 c102 c103 c104 c105 c106 c107 c108 c109 c110
    c111 c112 c113 c114 c115 c116 c117 c118
    c119 c120 c121 c122 c123 c124 c125 c126 c127 c128;
infile 'e:\thesis\sas_classification\worksp_final\zones\temp6.asc';
 input @1 c1
          #2 @1 c2
          #3 @1 c3
          #4 @1 c4
          #5 @1 c5
```

#6 @1 c6
#7 @1 c7
#8 @1 c8
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#41 @1 c41
#42 @1 c42
#43 @1 c43
#44 @1 c44
#45 @1 c45
#46 @1 c46
#47 @1 c47
#48 @1 c48
#49 @1 c49
#50 @1 c50
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#52 @1 c52
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;
```

```
run ;


data out6 ;
 set infile6 ;
 file 'e:\thesis\sas_classification\worksp_final\zones\PRIN5.asc' linesize=3000 ;
 put
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;
run ;
```

APPENDIX C: FIGURES & MAPS

Figure 1. Agriclutural areas of Idaho.

Figure 2. Example of spatial gridded data (resampled to 12Km cell size for clarity).

Figure 3. Example of spatially gridded data with 'no data' values removed.

Figure 4. Graph of principal component 1 vs. principal component 2.

Figure 5. Graph of principal component 1 vs. principal component 3.

Figure 6. Köppen classification for the conterminous U.S. using PRISM data.

Figure 7. Köppen classificaton for Idaho using PRISM data.

Figure 8. Agreement of the major Köppen zones using the PRISM data with those produced by Köppen.

Figure 9. Agroclimate classificaton.

Figure 10. Agroclimate classification draped over a shaded relief.

Figure 11. Agroclimate zone 1.

Figure 12. Agroclimate zone 2.

Figure 13. Agroclimate zone 3.

Figure 14. Agroclimate zone 4.

Figure 15. Agroclimate zone 5.

Figure 16. Agroclimate zone 6.

Figure 17. Agroclimate zone 7.

Figure 18. Agroclimate zone 8.

Figure 19. Agroclimate zone 9.

Figure 20. Agroclimate zone 10.

Figure 21. Agroclimate zone 11.

Figure 22. Agroclimate zone 12.

Figure 23. Agroclimate zone 13.

Figure 24. Agroclimate zone 14.

Figure 25. Agroclimate zone 15.

Figure 26. Agroclimate zone 16.

Figure 27. Agreement of western spuce-fir forests with agroclimate zones 10, 15, and 16.

Figure 28. Agreement of cedar-hemlock-pine forests with agroclimate zones 7 and 10.

Figure 29. Agreement of grand fir-douglas fir forests with agroclimate zone 13.

Figure 30. Agreement of saltbrush-greasewood with agroclimate zone 1.

Figure 31. Agreement of sagebrush steppe with agroclimate zones 2, 3, 5, 6, 9, and 12.

APPENDIX D: METADATA

PRISM METADATA

United States Average Monthly or Annual Precipitation, 1961-90

Metadata:

Identification_Information
Data_Quality_Information
Spatial_Data_Organization_Information
Spatial_Reference_Information
Entity_and_Attribute_Information
Distribution_Information
Metadata_Reference_Information

Identification_Information:
Citation:
Citation_Information:
Originator:
Chris Daly of Oregon State University and George Taylor of the Oregon Climate Service at Oregon State University
Publication_Date: 199804
Title: United States Average Monthly or Annual Precipitation, 1961-90
Publication_Information:
Publication_Place: Portland, Oregon, USA
Publisher:
Water and Climate Center of the Natural Resources Conservation Service

Description:
Abstract:

This ftp site contains spatially gridded precipitation of average monthly and annual precipitation for the climatological period 1961-90. Distribution of the point measurements to a spatial grid was accomplished using the PRISM model, developed by Chris Daly of PRISM Services/Oregon State University. Care should be taken in estimating precipitation values at any single point on the map. Precipitation estimated for each grid cell is an average over the entire area of that cell; thus, point precipitation can be estimated at a spatial precision no better than half the resolution of a cell. For example, the Oregon precipitation data was distributed at a resolution of approximately 4km. Therefore, point precipitation can be estimated at a spatial precision no better than 2km. However, the overall distribution of precipitation features is thought to be accurate. For further information, the online PRISM homepage can be found at <URL:http://www.ocs.orst.edu/prism/prism_new.html>.

Purpose:

Display and/or analyses requiring spatially distributed monthly or annual precipitation for the climatological period 1961-90.

Supplemental_Information:

There are many methods of interpolating precipitation from monitoring stations to grid points. Some provide estimates of acceptable accuracy in flat terrain, but few have been able to adequately explain the extreme, complex variations in precipitation that occur in mountainous regions. Significant progress in this area has been achieved through the development of PRISM (Parameter-elevation Regressions on Independent Slopes Model). PRISM is an analytical model that uses point data and a digital elevation model (DEM) to generate gridded estimates of monthly and annual precipitation (as well as other climatic parameters). PRISM is well suited to regions with mountainous terrain, because it incorporates a conceptual framework that addresses the spatial scale and pattern of orographic precipitation.

Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 19610101

Ending_Date: 19901231
Currentness_Reference:
Climatological period from which the point observations were taken.

Status:
Progress: Complete
Maintenance_and_Update_Frequency:
None planned for the 1961-90 climatological period. However, this data set will most likely be updated in 2001 for the new 1971-2000 climatological period.

Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -126.020833333333
East_Bounding_Coordinate: -64.979166666667
North_Bounding_Coordinate: 50.020833333333
South_Bounding_Coordinate: 24.062500000000
Keywords:
Theme:
Theme_Keyword_Thesaurus: None
Theme_Keyword: raster data
Theme_Keyword: precipitation
Theme_Keyword: grid cell
Place:
Place_Keyword_Thesaurus: None
Place_Keyword: United States, USA
Access_Constraints:
n/a, no restrictions apply

Use_Constraints:
Acknowledgement of the following agencies in products derived from these data: Natural Resources Conservation Service (NRCS) Water and Climate Center, NRCS National Cartography and Geospatial Center (NCGC), PRISM Model, and the Oregon Climate Service at Oregon State University.

Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Oregon Climate Service at Oregon State University
Contact_Address:
Address_Type: mailing address
Address:
Strand Ag Hall 326, Oregon Climate Service, Oregon State University
City: Corvallis
State_or_Province: OR
Postal_Code: 97331-2209
Country: USA
Contact_Voice_Telephone: (541) 737-5705
Contact_Facsimile_Telephone: (541) 737-5710
Contact_Electronic_Mail_Address: oregon@oce.orst.edu

Security_Information:
Security_Classification_System: None
Security_Classification: Unclassified
Security_Handling_Description: None
Native_Data_Set_Environment: SunOS, 5.5.1, sun4m UNIX

Data_Quality_Information:
Logical_Consistency_Report:
All data were based on the same averaging period (1961-1990). Similar quality assurance procedures were used with all input data sets.
Completeness_Report:

Point estimates of precipitation originated from the following sources: National Weather Service Cooperative (COOP) stations, 2) Natural Resources Conservation Service (NRCS) SNOTEL, 3) local networks. All COOP station data were subjected to quality control checks by the National Climatic Data Center (NCDC).
Positional_Accuracy:
Horizontal_Positional_Accuracy:
Horizontal_Positional_Accuracy_Report:
Accuracy of this data set is based on the original specification of the Defense Mapping Agency (DMA) 1 degree digital elevation models (DEM). The stated accuracy of the original DEMs are 130 m circular error with 90% probability.
Quantitative_Horizontal_Positional_Accuracy_Assessment:
Horizontal_Positional_Accuracy_Value: 130 m with 90% probability.
Horizontal_Positional_Accuracy_Explanation:
The broad DMA production objective for 1-degree DEM's.
Lineage:
Source_Information:
Source_Citation:
Citation_Information:
Originator: National Climatic Data Center (NCDC)
Publication_Date: 1991
Title:
U.S. National 1961-1990 Climate Normals, Climatography of the United States No. 81
Publication_Information:
Publication_Place: Asheville, NC, USA
Publisher: National Climatic Data Center (NCDC)
Type_of_Source_Media: digital files
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 19610101
Ending_Date: 19901231
Source_Currentness_Reference: ground condition
Source_Citation_Abbreviation: CLIM81
Source_Contribution:
Location and values of known average monthly and annual precipitation
Source_Information:
Source_Citation:
Citation_Information:
Originator: Natural Resources Conservation Service
Publication_Date: 1991
Title:
Cooperative Snow Survey Data of Federal - State - Private Cooperative Snow Surveys
Series_Information:
Series_Name:
Cooperative Snow Survey Data of Federal - State - Private Cooperative Snow Surveys
Issue_Identification: Annual issue for Western US states
Publication_Information:
Publication_Place: Portland, OR, USA
Publisher:
Natural Resources Conservation Service, Water and Climate Center
Type_of_Source_Media: digital files, paper reports, online
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 19610101
Ending_Date: 19901231
Source_Currentness_Reference: ground condition
Source_Citation_Abbreviation: SNOTEL (SNOwpack TELemetry)
Source_Contribution:
Location and values of known average monthly and annual precipitation
Source_Information:
Source_Citation:

Citation_Information:
Originator:
Natural Resources Conservation Service, Water and Climate Center
Publication_Date: Unpublished material
Title: Local Precipitation monitoring networks
Type_of_Source_Media: digital files
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 19610101
Ending_Date: 19901231
Source_Currentness_Reference: ground condition
Source_Citation_Abbreviation: LOCAL
Source_Contribution:
Location and values of known average monthly and annual precipitation
Source_Information:
Source_Citation:
Citation_Information:
Originator: Defense Mapping Agency
Publication_Date: 1985
Title:
1:250,000-scale Digital Elevation Models (DEM) also known as 1-Degree DEM's
Online_Linkage: <URL:http://edcwww.cr.usgs.gov/doc/edchome/ndcdb/ndcdb.html>
Publication_Information:
Publication_Place: Washington, DC
Publisher: U.S. Geological Survey
Type_of_Source_Media: digital files
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 1985
Source_Currentness_Reference: Publication Date
Source_Citation_Abbreviation: DEM
Source_Contribution:
Terrain surface input to PRISM model for estimation of precipitaion between known points.

Process_Step:
Process_Description:
It is beyond the scope of this metadata to document the processes involved in generating spatially gridded precipitation using the PRISM model. However, the processes are documented in numerous conference proceedings and journal articles. The references can be found online at <URL:http://www.ocs.orst.edu/prism/prism_new.html>.
Process_Date: 199804

Spatial_Data_Organization_Information:
Direct_Spatial_Reference_Method: Raster
Raster_Object_Information:
Raster_Object_Type: Grid Cell
Row_Count: 623
Column_Count: 1465

Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Geographic:
Latitude_Resolution: .04166666666
Longitude_Resolution: .04166666666
Geographic_Coordinate_Units: Decimal degrees
Geodetic_Model:

Horizontal_Datum_Name: World Geodetic Spheroid 1972 (WGS 1972)
Ellipsoid_Name: WGS72
Semi-major_Axis: 6378135.0
Denominator_of_Flattening_Ratio: 298.26

Entity_and_Attribute_Information:
Detailed_Description:
Entity_Type:
Entity_Type_Label: average precipitation grid cell value
Entity_Type_Definition: ASCII values
Entity_Type_Definition_Source: Self-evident
Attribute:
Attribute_Label: average precipitation grid cell value
Attribute_Definition: spatially gridded average precipitation
Attribute_Definition_Source:
Daly, C., R.P. Neilson, and D.L. Phillips, 1994: A Statistical-Topographic Model for Mapping Climatological Precipitation over Mountainous Terrain. J. Appl. Meteor., 33,140-158.
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 1500000
Enumerated_Domain:
Enumerated_Domain_Value: <=-1
Enumerated_Domain_Value_Definition: no data available or outside of range domain
Enumerated_Domain_Value_Definition_Source: Oregon Climate Service PRISM Project
Attribute_Units_of_Measure: mm * 100
Attribute_Measurement_Resolution: 1

Distribution_Information:
Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Oregon Climate Service
Contact_Address:
Address_Type: mailing address
Address: 316 Strand Agricultural Hall
City: Corvallis
State_or_Province: OR
Postal_Code: 97331
Country: USA
Contact_Voice_Telephone: (541) 737-5705
Contact_Facsimile_Telephone: (541) 737-5710
Contact_Electronic_Mail_Address: oregon@oce.orst.edu
Distribution_Liability:
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Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:

Format_Name: ARC/INFO ASCII Grid
Digital_Transfer_Option:
Online_Option:
Computer_Contact_Information:
Network_Address: <URL:http://www.ocs.orst.edu/prism/prism_new.html> or
Fees: none
Technical_Prerequisites:
Geographic data are intended for use in a Geographic Information System (GIS). In addition, this publication contains menu and display programs that operate 16 Mb RAM (absolute minimum), CD-ROM drive with ISO 9660 software driver, Graphics card (640x480 pixels with 256 colors, prefer 1024x1024 with 65,535 colors), Color monitor, mouse, and keyboard.

Metadata_Reference_Information:
Metadata_Date: 19980423
Metadata_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Tye Parzybok
Contact_Address:
Address_Type: mailing address
Address:
Strand Ag Hall 326, Oregon Climate Service, Oregon State University
City: Corvallis
State_or_Province: OR
Postal_Code: 97331-2209
Country: USA
Contact_Voice_Telephone: (541) 737-5705
Contact_Facsimile_Telephone: (541) 737-5710
Contact_Electronic_Mail_Address: parzy@oce.orst.edu
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: 19940608
Metadata_Security_Information:
Metadata_Security_Classification_System: None
Metadata_Security_Classification: Unclassified
Metadata_Security_Handling_Description: None

Generated by mp on Tue Jul 7 13:38:06 1998

KÖPPEN CLIMATE CLASSIFICATION METADATA

State Climate Services for Idaho

Identification_Information:
Citation:
Citation_Information:
Originator: Bruce Godfrey - State Climate Services for Idaho
Publication_Date: 1999
Publication_Time:
Title: Koeppen Climate Classification Edition: 1
Geospatial_Data_Presentation_Form: map
Series_Information:
Series_Name:
Issue_Identification:
Publication_Information:
Publication_Place: Moscow, Idaho
Publisher:
Other_Citation_Details:
Online_Linkage: http://snow.ag.uidaho.edu/Clim_Map
Description:
Abstract:
The Koeppen Climate Classification grid coverages were produced using gridded estimates of precipitation, temperature, and elevation from the PRISM (Parameter-elevation Regressions on Independent Slopes Model). The model was developed at Oregon State University and information about the gridded ASCII data sets can be obtained from: http://www.ocs.orst.edu/prism/prism_new.html.
Purpose:
To delineate climate zones based on the Koeppen Climate Classification Criteria. The criteria used to delineate the zones may be obtained from: http://snow.ag.uidaho.edu/Clim_Map/criteria.html.
Supplemental_Information:
Procedures_Used: 1. Aquired the PRISM ASCII files from Oregon Climate Service (http://www.ocs.orst.edu/prism/prism_new.html). 2. Aquired the United State boundary coverage (1:2,000,000) from the GAP Analysis Project Office at the University of Idaho (http://www.wildlife.uidaho.edu/). This coverage was orignally obtained by GAP from the ESRI data site (www.esri.com). 3. Ran the main aml (koeppen.aml) to produce the classification. 4. Merged the individual grids into one grid containing the lowest subclasses.

Revisions: none
Reviews_Applied_to_Data: none
Related_Spatial_and_Tabular_Data_Sets: none
Other_References_Cited: n/a
Notes: n/a
Status:
Progress:
Maintenance_and_Update_Frequency:
Access_Constraints: Public
Use_Constraints: This information is not accurate for legal or navigational purposes.
This information is for use by State Climate Services for Idaho.
Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person:
Contact_Organization: State Climate Services for Idaho
Contact_Position:
Contact_Address:
Address_Type: mailing address
Address: State Climate Services, University of Idaho, Department of Biological & Agricultural

Engineering, EP425
City: Moscow
State_or_Province: Idaho
Postal_Code: 83844-0904
Country: USA
Contact_Voice_Telephone: 208-885-7004
Contact_Facsimile_Telephone: 208-885-7908
Contact_Electronic_Mail_Address: climate@uidaho.edu
Hours_of_Service: 0900-1700 Pacific Time
Contact_Instructions: Additional data at--
<http://snow.ag.uidaho.edu/Clim_map>
Data_Set_Credit: Bruce Godfrey, State Climate Services for Idaho.
Security_Information:
Security_Classification_System: None
Security_Classification: Unclassified
Security_Handling_Description: None
Native_Data_Set_Environment: WindowsNT 4.0 SP3, ARC/INFO version 7.2.1

Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Planar:
Map_Projection:
Map_Projection_Name: Albers
1st Standard Parallel: 29 30 00
2nd Standard Parallel: 45 30 00
Longitude_of_Central_Meridian: -96
Latitude_of_Projection_Origin: 23
False_Easting: 0.0
False_Northing: 0.0
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method:
Coordinate_Representation:
Abscissa_Resolution:
Ordinate_Resolution:
Planar_Distance_Units: Meters
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1927
Ellipsoid_Name: Clarke 1866
Semi-major_Axis:
Denominator_of_Flattening_Ratio:

Entity_and_Attribute_Information:
Number of Files: three
File Name: koeppen_##.vat (## = area of interest; i.e. a state)
Attribute Label: VALUE; CLASS; COUNT
Attribute Definition:
Detailed Description:

VALUE	CLASS
1	A
2	Af
3	Am
4	Aw
5	B
6	BS
7	BSh
8	BSk
9	BW
10	BWh
11	BWk

12	C
13	Cs
14	Csa
15	Csb
16	Csc
17	Cw
18	Cwa
19	Cwb
20	Cwc
21	Cf
22	Cfa
23	Cfb
24	Cfc
25	D
26	Ds
27	Dsa
28	Dsb
29	Dsc
30	Dsd
31	Dw
32	Dwa
33	Dwb
34	Dwc
35	Dwd
36	Df
37	Dfa
38	Dfb
39	Dfc
40	Dfd
41	E
42	ET
43	EF
44	H

File Name: koeppen_##.bnd
Attribute Label: XMIN; YMIN; XMAX; YMAX
Attribute Definition: Coverage boundary file.
Detailed Description: Boundary file.
File Name: koeppen_##.sta
Attribute Label: MIN; MAX; MEAN; STDV
Attribute Definition:
Detailed Description:

Distribution_Information:
Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Organization: State Climate Services
Contact_Person:
Contact_Position:
Contact_Address:
Address_Type: mailing address
Address: State Climate Services, University of Idaho,
Department of Biological & Agricultural Engineering, EP425
City: Moscow
State_or_Province: Idaho
Postal_Code: 83844-0904
Country: USA
Contact_Voice_Telephone: 208-885-7004
Contact_Facsimile_Telephone: 208-885-7908
Contact_Electronic_Mail_Address: climate@uidaho.edu

Hours_of_Service: 0900-1700 Pacific Time
Contact_Instructions: Additional data at <http://snow.ag.uidaho.edu/Clim_map>
Resource_Description:
Distribution_Liability:
Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name: ARCE ARC/INFO Export format
File_Decompression_Technique: default ARC EXPORT
compression.

Metadata_Reference_Information:
Metadata_Date: 19990401
Metadata_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person:
Contact_Organization: State Climate Services
Contact_Position:
Contact_Address:
Address_Type: mailing address
Address: State Climate Services, University of Idaho,
Department of Biological & Agricultural Engineering, EP425
City: Moscow
State_or_Province: Idaho
Postal_Code: 83844-0904
Country: USA
Contact_Voice_Telephone: 208-885-7004
Contact_Facsimile_Telephone: 208-885-7908
Contact_Electronic_Mail_Address: climate@uidaho.edu
Hours_of_Service: 0900-1700 Pacific Time
Contact_Instructions:
Additional data at--
Metadata_Standard_Name: Metadata
Metadata_Standard_Version:
Metadata_Time_Convention:
Metadata_Security_Information:
Metadata_Security_Classification_System: None
Metadata_Security_Classification: Unclassified
Metadata_Security_Handling_Description: None

IDAHO LAND COVER METADATA

Metadata:
Identification_Information:

Citation:
Citation_Information:
Originator: Landscape Dynamics Lab
Publication_Date: 19990210
Title: GRID IDVEG -- Idaho Land Cover
Edition: Version 2.1, February 10, 1999
Geospatial_Data_Presentation_Form: map
Series_Information:
Series_Name: Idaho State Land Cover Revision
Issue_Identification:
Publication_Information:
Publication_Place: Moscow, ID
Publisher: Idaho Cooperative Fish and Wildlife Research Unit
Online_Linkage:
<URL:http://www.wildlife.uidaho.edu/data/idveg.tar.gz>

Description:

Abstract:

The Idaho Cooperative Fish and Wildlife Research Unit's Landscape Dynamics Lab compiled the Idaho Land Cover Classification from Redmond et al.'s (1997) Current Vegetation Map of Northern Idaho and Western Montana and Homer's (1998) Idaho/Western Wyoming Landcover Classification. These sources were crosswalked and merged to produce a unified land cover map for Idaho. This coverage is stored as an ARC/INFO grid with a 0.09ha (30m) cell size and a 2ha minimum mapping unit.

Purpose:

These data were developed for the Idaho Gap Analysis Project. They comply to minimum standards of the Gap Analysis Program of the Biological Resources Division, US Geological Survey as of January 1, 1999. These data are intended to aid in state level assessment of natural resources and are not intended for use at a scale greater than 1:100,000.

Supplemental_Information:

Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 19990210
Currentness_Reference: Current as of publication date of each source

Status:
Progress: Complete
Maintenance_and_Update_Frequency: None Planned

Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -117.8213021
East_Bounding_Coordinate: -110.59569566
North_Bounding_Coordinate: 49.13585278
South_Bounding_Coordinate: 41.69658246

Keywords:
Theme:
Theme_Keyword_Thesaurus: none
Theme_Keyword:

Place:
Place_Keyword_Thesaurus: none
Place_Keyword:

Access_Constraints:
None

Use_Constraints:
These data are not to be used at scales greater than 1:100,000.

Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Jason Karl
Contact_Organization: Landscape Dynamics LAb
Contact_Position: GIS Analyst
Contact_Address:
Address_Type: mailing and physical address
Address: Idaho Cooperative Fish and Wildlife Research Unit
City: Moscow
State_or_Province: Idaho
Postal_Code: 83844-1141
Country: USA
Contact_Voice_Telephone: 208-885-5788
Contact_Facsimile_Telephone: 208-885-6960
Contact_Electronic_Mail_Address: jason@artemisia.wildlife.uidaho.edu

Data_Set_Credit:

Native_Data_Set_Environment:
SunOS, 5.5.1, sun4u UNIX
ARC/INFO version 7.2.1

Cross_Reference:
Citation_Information:
Originator: Landscape Dynamics Lab
Publication_Date: 19990210
Title: Gap Analysis of Idaho Vegetation
Geospatial_Data_Presentation_Form: map
Series_Information:
Series_Name:
Issue_Identification:
Publication_Information:
Publication_Place: Moscow, Idaho
Publisher: Idaho Cooperative Fish and Wildlife Research Unit
Online_Linkage: <http://www.wildlife.uidaho.edu/idgap.htm>

Data_Quality_Information:
Attribute_Accuracy:
Attribute_Accuracy_Report:
Accuracy is estimated at 67.27% (range 53.89% to 93.39%) for northern Idaho based on a scene by scene fuzzy set analysis. For southern Idaho, accuracy is estimated at 69.3% (range 63.6% to 79.3%) based on total percent correct over 9 regions.

Logical_Consistency_Report:
Not applicable for raster data.

Completeness_Report:
All cells within Idaho boundary have an attributed cover type

Positional_Accuracy:
Horizontal_Positional_Accuracy:

Horizontal_Positional_Accuracy_Report:
Unknown

Lineage:
Source_Information:
Source_Citation:
Citation_Information:
Originator: Redmond et al., Wildlife Spatial Analysis Lab
Publication_Date: 19960612
Title: Current Vegetation Map of Northern Idaho and Western Montana
Geospatial_Data_Presentation_Form: map
Series_Information:
Series_Name:
Issue_Identification:
Publication_Information:
Publication_Place: Missoula, MT
Publisher: Montana Cooperative Fish and Wildlife Research Unit
Source_Scale_Denominator: 24000
Type_of_Source_Media: Landsat Thematic Mapper Image
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 19960612
Source_Currentness_Reference: Current as of publication date
Source_Citation_Abbreviation:
Source_Contribution: Idaho north of the Salmon River

Source_Information:
Source_Citation:
Citation_Information:
Originator: Homer, C.G., Remote Sensing/GIS Laboratories
Publication_Date: 19981030
Title: Idaho/Western Wyoming Landcover Classification
Geospatial_Data_Presentation_Form: map
Series_Information:
Series_Name:
Issue_Identification:
Publication_Information:
Publication_Place: Logan, UT
Publisher: Utah State University
Source_Scale_Denominator: 24000
Type_of_Source_Media: Landsat Thematic Mapper Image
Source_Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 19981030
Source_Currentness_Reference: Current as of publication date
Source_Citation_Abbreviation:
Source_Contribution: Idaho south of the Salmon River

Process_Step:
Process_Description:
Clipped out the north Idaho portion from Redmond et al.'s Northern Idaho and Western Montana grid using the CLIPPER.AML provided by the Wildlife Spatial Analysis Lab, Missoula, MT.
Process_Date: 19981001

Process_Step:
Process_Description:
MERGEd riparian grid of northern Idaho with upland grid to make a single land cover grid for northern Idaho
Process_Date: 19981001

Process_Step:
Process_Description:
Projected the northern Idaho portion from albers into Idaho Transverse Mercator using PROJECT GRID, maintaining 30m cell size
Process_Date: 19981001

Process_Step:
Process_Description:
RECLASSed the values of the northern Idaho land cover grid to match the Idaho Land Cover Classification values.
Process_Date: 19981001

Process_Step:
Process_Description:
Clipped out southern Idaho from Homer's Idaho/Western Wyoming Landcover Classification using a SELECTMASK function in GRID with the Idaho state boundary as a 30m resolution mask grid.
Process_Date: 19981001

Process_Step:
Process_Description:
Reprojected the southern Idaho portion from UTM, Zone 12, Datum NAD83 into Idaho Transverse Mercator, Datum NAD27. Used the NADCON datum conversion program within ARC PROJECT. Maintained 30m cell size.
Process_Date: 19981001

Process_Step:
Process_Description:
RECLASSed the values of southern Idaho to match the Idaho Land Cover Classification values.
Process_Date: 19981001

Process_Step:
Process_Description:
MERGEd the north and south Idaho landcover grids, assigning dominance to the south Idaho grid.
Process_Date: 19981001

Process_Step:
Process_Description:
First draft of metadata created by jason using
FGDCMETA.AML ver. 1.2 05/14/98 on ARC/INFO data set /projects/gap2/covs/idveg
Process_Date: 19990210

Spatial_Data_Organization_Information:
Direct_Spatial_Reference_Method: Raster
Raster_Object_Information:
Raster_Object_Type: Grid Cell
Row_Count: 27554
Column_Count: 17570

Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Planar:
Map_Projection:
Map_Projection_Name: Transverse Mercator
Transverse_Mercator:
Scale_Factor_at_Central_Meridian: 0.99960000
Longitude_of_Central_Meridian: -114
Latitude_of_Projection_Origin: 42
False_Easting: 500000.00000
False_Northing: 100000.00000
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: coordinate pair
Coordinate_Representation:

```
      Abscissa_Resolution: 30.0
      Ordinate_Resolution: 30.0
     Planar_Distance_Units: Meters
   Geodetic_Model:
    Horizontal_Datum_Name: North American Datum of 1927
    Ellipsoid_Name:  Clarke 1866
    Semi-major_Axis: 6378206.4
    Denominator_of_Flattening_Ratio: 294.98

Entity_and_Attribute_Information:
  Overview_Description:
   Entity_and_Attribute_Overview:
    >
    >IDVEG.VAT:
    >
    >COLUMN   ITEM NAME       WIDTH OUTPUT  TYPE N.DEC  ALTERNATE NAME
    >   1  VALUE              4    10    B     -
    >   5  COUNT              4    10    B     -
    >
    >
    >IDVEG.STA:
    >
    >COLUMN   ITEM NAME       WIDTH OUTPUT  TYPE N.DEC  ALTERNATE NAME
    >   1  MIN                    8    15    F     3
    >   9  MAX                    8    15    F     3
    >  17  MEAN                   8    15    F     3
    >  25  STDV                   8    15    F     3
    >
    >
    >Idaho Vegetation and Land Cover Classification System
    >Modified from Redmond et al. (1997) and Homer et al. (1998)
    >
    >  1000 Urban or Developed Land
    >  1000 Urban
    >  1001 High Intensity Urban
    >  1002 Low Intensity Urban
    >  1101 Disturbed, High
    >  1102 Disturbed, Low
    >  2000 Agricultural
    >  2000 Agricultural land
    >  3000 Non-Forested Lands
    >  31xx - Grasslands
    >  3101 Foothills Grassland
    >  3102 Disturbed Grassland
    >  3103 Herbaceous Clearcut
    >  3104 Montane Parklands and Subalpine Meadow
    >  3105 Wet Meadow
    >  3106 Herbaceous Burn
    >  3107 Shrub/Steppe Annual Grass-Forb
    >  3109 Perennial Grassland
    >  3110 Perennial Grass Slope
    >  32xx Mesic Shrublands
    >  3201 Mesic Upland Shrubs
    >  3202 Warm Mesic Shrubs
    >  3203 Cold Mesic Shrubs
    >  33xx Xeric Shrublands
    >  3301 Curlleaf Mountain Mahogany
    >  3304 Bitterbrush
    >  3305 Mountain Big Sagebrush
    >  3306 Wyoming Big Sagebrush9
    >  3307 Basin & Wyoming Big Sagebrush
    >  3308 Black Sagebrush Steppe
```

> 3309 Silver Sage
> 3310 Salt-desert Shrub
> 3312 Rabbitbrush
> 3315 Low Sagebrush
> 3316 Mountain Low Sagebrush
> 4000 Forest Uplands
> 41xx Broadleaf Forest
> 4101 Aspen
> 4102 Cottonwood
> 4103 Maple
> 42xx Needleleaf Forest
> 4201 Englemann Spruce
> 4202 Lodgepole Pine
> 4205 Limber Pine
> 4206 Ponderosa Pine
> 4207 Grand Fir
> 4208 Subalpine Fir
> 4210 Western Red Cedar
> 4211 Western Hemlock
> 4212 Douglas-fir
> 4215 Western Larch
> 4216 Douglas-fir/Limber Pine
> 4217 Subalpine Pine
> 4218 Subalpine fir/Whitebark Pine
> 4219 Mixed Whitebark Pine Forest
> 4220 Mixed Subalpine Forest
> 4221 Mixed Mesic Forest
> 4222 Mixed Xeric Forest
> 4223 Douglas-fir/Lodgepole Pine
> 4225 Douglas-fir/Grand Fir
> 4226 Western Red Cedar/Grand Fir Forest
> 4227 Western Red Cedar/Western Hemlock
> 4228 Western Larch/Lodgepole Pine
> 4229 Western Larch/Douglas-fir
> 4230 Utah Juniper
> 4231 Western Juniper
> 4232 Pinyon Pine/Juniper
> 43xx Mixed Needleleaf/Broadleaf Forest
> 4301 Mixed Needleleaf/Broadleaf Forest
> 44xx Standing Burnt or Dead Timber
> 4401 Standing Burnt or Dead Timber
> 5000 Water
> 6000 Riparian and Wetland Areas
> 61xx Forested Riparian
> 6101 Needleleaf Dominated Riparian
> 6102 Broadleaf Dominated Riparian
> 6103 Needleleaf/Broadleaf Dominated Riparian
> 6104 Mixed Riparian (Forest and Non-forest)
> 62xx Non-forested Riparian
> 6201 Graminoid or Forb Dominated Riparian
> 6202 Shrub Dominated Riparian
> 6203 Mixed Non-forest Riparian
> 63xx Wetlands
> 6301 Deep Marsh
> 6302 Shallow Marsh
> 6303 Aquatic Bed
> 6304 Mud Flat
> 7000 Barren Land
> 7201 Sand Dune
> 7202 Vegetated Sand Dune
> 7300 Exposed Rock
> 7301 Lava

> 7302 Vegetated Lava
> 7800 Mixed Barren Land
> 7900 Shoreline and Stream Gravel Bars
> 8000 Alpine Meadow
> 8100 Alpine Meadow
> 9000 Snow, Ice, Cloud or Cloud Shadow
> 9100 Perennial Ice or Snow

Entity_and_Attribute_Detail_Citation: none

Distribution_Information:
Distributor:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: Landscape Dynamics Lab
Contact_Position: Lab Manager
Contact_Address:
Address_Type: mailing and physical address
Address: Idaho Cooperative Fish and Wildlife Research Unit
City: Moscow
State_or_Province: ID
Postal_Code: 83844-1141
Country: USA
Contact_Voice_Telephone: 208-885-5788
Contact_Instructions: Contact via email
Contact_Electronic_Mail_Address: jason@artemisia.wildlife.uidaho.edu

Distribution_Liability:

Not to be used at scales greater than 1:100,000. Not to be used for navigational purposes.

Metadata_Reference_Information:
Metadata_Date: 19990210
Metadata_Review_Date: (yyyymmdd)
Metadata_Future_Review_Date: (yyyymmdd)
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: Landscape Dynamics Lab
Contact_Person: Jason Karl
Contact_Position: GIS Analyst
Contact_Address:
Address_Type: mailing and physical address
Address: Idaho Cooperative Fish and Wildlife Research Unit
City: Moscow
State_or_Province: ID
Postal_Code: 83844-1141
Country: USA
Contact_Voice_Telephone: 208-885-5788
Contact_Facsimile_Telephone: 208-885-9080
Contact_Electronic_Mail_Address: jason@artemisia.wildlife.uidaho.edu
Metadata_Standard_Name:
FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: Version of June 8, 1994
Metadata_Access_Constraints: none
Metadata_Use_Constraints: none

KUCHLER'S POTENTIAL NATURAL VEGETATION METADATA

$Export Name: BVBPNVKU
$Pathname: /emp/crbv/crb/veg/kuchler
19-NOV-96

Theme Name:	KUCHLER'S POTENTIAL NATURAL VEGETATION
Theme Id:	424
Theme Abbrev:	VEGPNVKU
Export Name:	BVBPNVKU

Disclaimer:
****
The ICBEMP cannot assure the reliability or suitability of this information for a particular purpose. Original data was compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
****

Project Name: ICBEMP

IDENTIFICATION INFORMATION

Theme Description:	KUCHLER'S POTENTIAL NATURAL VEGETATION (1964)
Coverage Extent:	COLUMBIA RIVER BASIN
Source:	US FOREST SERVICE
Last Update:	10-FEB-95
Feature Type:	POLYGON
Distrib Limit:	NONE
Theme Keywords:	VEGETATION, POTENTIAL, KUCHLER
Data Resolution:	
Projection:	ICBEMP ALBERS
File Pathname:	/emp/crbv/crb/veg/kuchler

Comments: Captured from A.W. Kuchler's Potential Natural Vegetation of the Conterminous United States, 1964 (2nd edition 1975). The point data (sparse locations of Juniper, Joshua tree and sequoia) are in the KUCH_PT coverage. See "manual to accompany the map", American Geographical Society, Special publication No. 36, New York, 1964.

SOURCE INFORMATION

Source System:	ARC/INFO
Source Scale:	1:3168000
Source Projection:	ALBERS
Capture Method:	Scanned US map of Kuchler's potential natural vegetation. Rasterized, processed in LT4X, and converted to Arc/Info.

CUSTODIAN INFORMATION

Contact Org:	ICBEMP
Contact Person:	BECKY GRAVENMIER
Contact Phone:	(509) 522-4052
Email Id:	DG: B.GRAVENMIER:R06F14D06A
Contact Address:	112 E. POPLAR STREET WALLA WALLA, WA 99362

PROCESSING INFORMATION

Theme Generation: All 'xxx' lakes are now '0'

Lineage:

Data Transfer:

Procedure Contact: THANG LAM

ATTRIBUTE INFORMATION

==

Label Type: ARC
Table Name: KUCHLER.PAT
Length: 2
Attrib Name: KUCHLER_CD
Attrib Value Type: I

Attribute Value	Description
	KUCHLER CODE
0	WATER
1	SPRUCE-CEDAR HEMLOCK FOREST
2	CEDAR-HEMLOCK-DOUGLAS FIR FOREST
3	SILVER FIR-DOUGLAS FIR FOREST
4	FIR-HEMLOCK FOREST
5	MIXED CONIFER FOREST
6	REDWOOD FOREST
7	RED FIR FOREST
8	LODGEPOLE PINE-SUBALPINE FOREST
9	PINE-CYPRESS FOREST
10	PONDEROSA SHRUB FOREST
11	WESTERN PONDEROSA FOREST
12	DOUGLAS FIR FOREST
13	CEDAR-HEMLOCK-PINE FOREST
14	GRAND FIR-DOUGLAS FIR FOREST
15	WESTERN SPRUCE-FIR FOREST
16	EASTERN PONDEROSA FOREST
17	BLACK HILLS PINE FOREST
18	PINE-DOUGLAS FIR FOREST
19	ARIZONA PINE FOREST
20	SPRUCE-FIR-DOUGLAS FIR FOREST
21	SOUTHWESTERN SPRUCE-FIR FOREST
22	GREAT BASIN PINE FOREST
23	JUNIPER-PINYON WOODLAND
24	JUNIPER STEPPE WOODLAND
25	ALDER-ASH FOREST
26	OREGON OAKWOODS
28	MOSAIC NUMBERS 2 AND 26
29	CALIFORNIA MIXED EVERGREEN FOREST
30	CALIFORNIA OAKWOODS
33	CHAPARRAL
34	MONTANE CHAPARRAL
35	COASTAL SAGEBRUSH
37	MOUNTAIN MAHOGANY-OAK SCRUB
38	GREAT BASIN SAGEBRUSH
39	BLACKBRUSH
40	SALTBRUSH-GREASEWOOD
41	CREOSOTE BUSH
46	DESERT: VEGETATION LARGELY ABSENT
47	FESCUE-OATGRASS
48	CALIFORNIA STEPPE

49	TULE MARSHES
50	FESCUE-WHEATGRASS
51	WHEATGRASS-BLUEGRASS
52	ALPINE MEADOWS AND BARREN
55	SAGEBRUSH STEPPE
56	WHEATGRASS-NEEDLEGRASS SHRUBSTEPPE
57	GALLETA-THREE AWN SHRUBSTEPPE
63	FOOTHILLS PRAIRIE
64	GRAMA-NEEDLEGRASS-WHEATGRASS
65	GRAMA-BUFFALO GRASS
66	WHEATGRASS-NEEDLEGRASS
70	SANDSAGE-BLUESTEM PRAIRIE
75	NEBRASKA SANDHILLS PRAIRIE
98	NORTHERN FLOODPLAIN FOREST

==

Label Type: ARC
Table Name: KUCHLER.PAT
Length: 35
Attrib Name: KUCHLER_NAME
Attrib Value Type: C

Attribute Value	Description
	SAME AS KUCHLER_CD DESCRIPTIONS

==

AGROCLIMATE CLASSIFICATION METADATA

State Climate Services for Idaho

Identification_Information:
Citation:
Citation_Information:
Originator: Bruce Godfrey - State Climate Services for Idaho
Publication_Date: 1999
Publication_Time:
Title: Agroclimate Classification for Idaho Edition: 1
Geospatial_Data_Presentation_Form: map
Series_Information:
Series_Name:
Issue_Identification:
Publication_Information:
Publication_Place: Moscow, Idaho
Publisher:
Other_Citation_Details:
Online_Linkage: http://snow.ag.uidaho.edu/Clim_Map
Description:
Abstract:
Multivariate statistical analysis and geographic information systems were used to delineate Idaho into homogeneous agroclimate zones for the purpose of applying successful dryland agricultural research practices and management decisions throughout these areas of relative climatic uniformity. Data used to produce the classification are from The Parameter-elevation Regressions on Independent Slopes Model (PRISM), developed at Oregon State University. PRISM has produced gridded estimates of mean monthly and annual climatic parameters from point data and a digital elevation model (DEM). Principal components analysis was performed on 55 variables including various temperature and precipitation parameters, the number of growing degree days, the annual number of freeze-free days, the annual day of freeze in the fall, and the annual day of freeze in the spring. Cluster analysis identified 16 agroclimate zones in the state each having similar climatic conditions regardless of it's spatial location. As a result, successful dryland agricultural practices and management decisions that are based on new technologies and developed for one part of the state may potentially be applied to other parts of the state that fall within the same agroclimate zone.
Purpose:
To demonstrate that a combination of geographic information systems (GIS) and multivariate statistical procedures could be used to map climate using data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) and to 2. delineate agroclimate zones for the purpose of applying successful dryland agricultural research management practices throughout areas of relative climatic uniformity.
Supplemental_Information:
Procedures_Used: 1. Downloaded PRISM data, 2. Used GIS to extract necessary information from gridded spatial data, 3. Used statistical software package (SAS) to perform cluster analysis, 4. Used GIS to display the statistical groupings (agroclimate zones), Used GIS to look for correspondence between agroclimate zones and potential natural vegetation patterns.
Revisions: none
Reviews_Applied_to_Data: none
Related_Spatial_and_Tabular_Data_Sets: none
Other_References_Cited: n/a
Notes: n/a
Status:
Progress:
Maintenance_and_Update_Frequency:
Access_Constraints: Public
Use_Constraints: This information is not accurate for legal or navigational purposes.

This information is for use by State Climate Services for Idaho.
Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person:
Contact_Organization: State Climate Services for Idaho
Contact_Position:
Contact_Address:
Address_Type: mailing address
Address: State Climate Services, University of Idaho, Department of Biological & Agricultural Engineering, EP425
City: Moscow
State_or_Province: Idaho
Postal_Code: 83844-0904
Country: USA
Contact_Voice_Telephone: 208-885-7004
Contact_Facsimile_Telephone: 208-885-7908
Contact_Electronic_Mail_Address: climate@uidaho.edu
Hours_of_Service: 0900-1700 Pacific Time
Contact_Instructions: Additional data at--
<http://snow.ag.uidaho.edu/Clim_map>
Data_Set_Credit: Bruce Godfrey, State Climate Services for Idaho.
Security_Information:
Security_Classification_System: None
Security_Classification: Unclassified
Security_Handling_Description: None
Native_Data_Set_Environment: WindowsNT 4.0 SP3, ARC/INFO version 7.2.1

Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Planar:
Map_Projection:
Map_Projection_Name: Idaho Transverse Mercator (IDTM)
Transverse_Mercator:
Scale_Factor_at_Central_Meridian: 0.99960
Longitude_of_Central_Meridian: -114
Latitude_of_Projection_Origin: 42
False_Easting: 500000.00000
False_Northing: 100000.00000
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method:
Coordinate_Representation:
Abscissa_Resolution:
Ordinate_Resolution:
Planar_Distance_Units: Meters
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1927
Ellipsoid_Name: Clarke 1866
Semi-major_Axis:
Denominator_of_Flattening_Ratio:

Entity_and_Attribute_Information:
Number of Files: three
File Name: .vat
Attribute Label:
Attribute Definition:
Detailed Description:
File Name: .bnd

Attribute Label:
Attribute Definition: Coverage boundary file.
Detailed Description: Boundary file.
File Name: .sta
Attribute Label:
Attribute Definition:
Detailed Description:

Distribution_Information:
Distributor:
Contact_Information:
Contact_Person_Primary:
Contact_Organization: State Climate Services
Contact_Person:
Contact_Position:
Contact_Address:
Address_Type: mailing address
Address: State Climate Services, University of Idaho,
Department of Biological & Agricultural Engineering, EP425
City: Moscow
State_or_Province: Idaho
Postal_Code: 83844-0904
Country: USA
Contact_Voice_Telephone: 208-885-7004
Contact_Facsimile_Telephone: 208-885-7908
Contact_Electronic_Mail_Address: climate@uidaho.edu
Hours_of_Service: 0900-1700 Pacific Time
Contact_Instructions: Additional data at <http://snow.ag.uidaho.edu/Clim_map>
Resource_Description:
Distribution_Liability:
Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name: ARCE ARC/INFO Export format
File_Decompression_Technique: default ARC EXPORT
compression.

Metadata_Reference_Information:
Metadata_Date: 19990401
Metadata_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person:
Contact_Organization: State Climate Services
Contact_Position:
Contact_Address:
Address_Type: mailing address
Address: State Climate Services, University of Idaho,
Department of Biological & Agricultural Engineering, EP425
City: Moscow
State_or_Province: Idaho
Postal_Code: 83844-0904
Country: USA
Contact_Voice_Telephone: 208-885-7004
Contact_Facsimile_Telephone: 208-885-7908
Contact_Electronic_Mail_Address: climate@uidaho.edu
Hours_of_Service: 0900-1700 Pacific Time
Contact_Instructions:

Additional data at--
Metadata_Standard_Name: Metadata
Metadata_Standard_Version:
Metadata_Time_Convention:
Metadata_Security_Information:
Metadata_Security_Classification_System: None
Metadata_Security_Classification: Unclassified
Metadata_Security_Handling_Description: None
