Multivariate Patterns in Potential Environmental Covariates of Elk Abundance in Three Oregon Management Regions

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Authorization to Submit Thesis

This thesis of Aakansha R. Solomon submitted for the degree of Master of Science with a Major in Environmental Science and titled "Multivariate Patterns in Potential Environmental Covariates of Elk Abundance in Three Oregon Management Regions," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

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Abstract

The purpose of this study was to evaluate top-down and bottom-up effects controlling elk (*Cervus elaphus*) recruitment by making inferences concerning the predator-prey dynamics of elk and mountain lions (*Puma concolor*) inhabiting Northeast Oregon ecosystems. We formulated hypotheses about the environmental drivers of the number of elk observed in annual surveys, bulls per hundred cows, and calves per hundred cows in annual surveys of three elk populations in Northeast Oregon. The study analyzed key environmental factors gathered from 1962-2007 which potentially control the elk population growth rate in three management units: the Snake, Wenaha, and Desolation areas. The study was conducted using principal component analysis, canonical correlation analysis, and multiple regression analysis to determine covariates to characterize potential top-down and bottom-up effects which defined elk abundance and recruitment in all three management units. Overall, in Wenaha area, 70% of variation in elk recruitment as measured by calf to cow ratios was induced by the cougar abundance and total elk harvest. In the Snake and Desolation areas respectively, 54% and 40% of the variation in elk abundance was explained by the cougar abundance and harsh weather climate. The correlation patterns in the Snake unit was consistent with additive mortality from predation while the patterns in the Wenaha unit was consistent with compensatory mortality from predation. The Desolation unit was consistent with both the additive and compensatory mortality from predation. Elk biologists and managers could conduct field research from these findings to test methods of preventing elk populations from declining in Northeast Oregon.

Key words: top-down, bottom-up, *Cervus elaphus*, *Puma concolor*, Northeast Oregon, population abundance

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Dedication

To my beloved parents, Ajay and Kamini Solomon, my brother, Ebenezer Solomon, for supporting me through all of it. Your endless love, financial sacrifices, and prayers have constantly motivated me to do better. I would also like to thank my friends; Callen Trapp, Randi Notte, and Sakhi Scott for being so welcoming whenever I needed help.

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Chapter 1: Introduction

1.1 Introduction

Introduction to elk and Northeast Oregon system

In the Western United States, elk are multifaceted animals which serve a variety of purposes. Spiritually, elk are a clan animal to the "Temagami Band of Ojibwa (Hughes 1976), Assiniboine, Rapid, Blackfoot and Cree" (Kuhnlein and Humphries 2017) and is believed to be a symbol of manliness, courage, and strength. Elk also add to the country's economy through game hunting, the meat market, and tourism (Popp et al. 2014). Ecologically, elk help determine the relationships between plant species within a specific geographical unit through browsing activity (Popp et al. 2014). The cultural, economic, and ecological importance makes elk the most studied ungulate in prey- predator relationships (Eisenberg et al. 2014).

General introduction to three management units

In the ranges of Northeast Oregon, three management units where elk habituate, the Snake, Desolation, and Wenaha units, served as the focus of the present study. The goal of the Oregon Department of Fish and Wildlife (ODFW) is to improve the elk population in the three management units. With respect to the Snake region, the department wants to keep 3,800 elk in the region by improving the elk to cow ratios. 92% of the Snake area is marked by having public land and the rest as private (Oregon Hunting Seasons and Regulations 2021). In Desolation, the area has 87% public lands and is recognized for having greater harvest ratios of fully grown and aged bulls than the other Northeast Oregon units (Oregon Hunting Seasons and Regulations 2021). As a result, Desolation has become the hunter's desired spot for game hunting. The Wenaha area mostly consists of 70% of public lands which are maintained by the U. S. Forest Service (Oregon Hunting Seasons and Regulations 2021) and the ODFW which manages the eastern part of the unit (Rearden et al. 2011). From 1961 to the present, a minority of elk in Wenaha region spend their summertime in the Wenaha basin (Wenaha Wildlife Area Management Plan 2007).

Low recruitment ratios

The current management goal is to improve recruitment and survival of the elk. The management efforts to achieve the goal includes eliminating cow harvest, adjusting bull harvest, and reducing the impacts of predation on elk herds (Idaho Big Game 2019 and 2020). Since the 1960's, elk recruitment has been continuously dropping in Northeast Oregon (Oregon Department of Fish and Wildlife 2003). Overall, the issue is that cow harvest is increasing, driving down recruitment rates (Idaho Big Game 2019 and 2020).

Importance of thesis research

For large predators like cougars, elk are a source of prey (Popp et al. 2014). When the presence of cougars keeps the elk population in check, the elk population is controlled by top-down interactions. Bottom-up effects consist of influencers that can affect the richness and efficiency of vegetation such as precipitation, disruption, and solar power (Power 1992). The predominant focus in wildlife science for over half of a century has been on bottom-up factors (Allen 1962). It has been noticed lately that top-down factors have been underutilized in the planning of management units. If the failure to acknowledge the top-down factors in the ecosystem continues for too long it will result in the loss of biodiversity (Silliman and Angelini 2012). Top-down and bottom-up effects need to be studied further to understand the roles they play in managing elk populations. Understanding the top-down and bottom-up effects, will help develop "science-based options for managing elk and their habitats in future years" (Minnesota Department of Natural Resources 2016).

Literature review

Previous research has been devoted to studying variables that control elk populations. Johnson et al. (2013) completed a longitudinal study in Oregon which identified variables such as hunter-killed elk, cougar harvest, estimated elk population, and weather. The top-down and bottom-up effects of elk population control may explain yearly variation and long-term trends of pregnancy, juveniles-at-heel in late autumn, and juvenile elk recruitment in spring.

Johnson et al. (2013) observed that age, August precipitation, and cougar index had positive effects on pregnancy status whereas previous year winter severity (year t-1) and elk density had negative effects. In case of juveniles-at-heel in late autumn, August precipitation and August precipitation (t-1), interaction terms like elk density (t-1) × cougar index, age of elk had positive effects whereas individual cougar index, elk density (t-1), and winter precipitation (t-1) had negative effects. The August precipitation (t-1), lactation rate, interaction terms like elk density (t-1) × cougar index had positive effects on juvenile recruitment whereas individual cougar index and elk density (t-1) had negative effects. The variables which were not significant in explaining variation in elk recruitment were mainly temperature, precipitation, and winter severity.

Overall, the yearly variation in models of pregnancy, juveniles-at-heel in late autumn, and juvenile recruitment, was mostly influenced by August precipitation, while on the other hand, long term trends were influenced by cougar densities with comparatively weak effects on elk density (Johnson et al. 2013). These three models were all found to be the contributing factors towards achieving the "reproductive success of elk" (Johnson et al. 2013). Wisdom and Cook (2000) had also proposed that the survival of the adult female and juvenile elk are paramount if long-term stability of elk is desired, but Riggs et al. (2000) had found that "long-term declines in productivity" of elk were related to density dependent factors (Fowler 1987).

The elk population is determined by population density within the ecological unit (Fujiwara and Takada 2001). In addition to such density dependence, there are unpredictable environmental factors present in both space and time which also affect the population. In ecological research, the question of whether populations are more influenced by density dependent or density independent factors has long been of interest (Dennis et al. 1994). Studies have shown that variations in predation risk can influence the population density and even the community structure of elk. Elk environments and population density are affected by different predation levels (Laundré et al. 2014). Studying prey-predator systems could help in estimating species-specific predation risk which is vital for understanding the working factors that control species density (Laundré et al. 2014). Predation affecting elk population density is a form of top-down control. Plant productivity which are controlled by climate variance in precipitation and evapotranspiration is an example of bottom-up control (Laundré et al. 2014). As a result, because of the interaction of top-down and bottom-up factors, predation appears to enable lag year activities that helps stabilize the prey-predator cycles (Laundré et al. 2014). Such relationship regulates elk population through cougar predation and food supplies.

Relationships among the potential predictor variables contributing to elk recruitment

Cougar population abundance has always been higher in Northeast Oregon. Cougars have mostly attacked newborns (1 to 3 months), which were found in the area close to lush greenery (Ellis 2020), (Rearden et al. 2011). Therefore, the quantity and quality of forage is positively correlated to predation (Rearden et al. 2011). Silviculture is the practice of controlling the productivity of the forest using various treatments (US Forest Service). Managed silvicultural regeneration or harvesting allows elk browsing activity which impacts forest's growth positively (Weaver and Weckerly 2011). Elk herbivory of aspen along with low-intensity fire boosts aspen's regeneration, producing greater forage opportunity in the long term (Hillis 2016), (Romme et al. 1995), (Baker et al.1997). After regeneration, pre-commercial thinning helps enhance quality and composition of the tree stands (US Forest Service).

Abundant palatable forage depends on the presence of precipitation (Gaillard et al. 1998). As compared to high precipitation, low precipitation has proved itself to be positively correlated with the ability of elk to reproduce and maintain themselves (Brodie et al. 2013), (Lukacs et al. 2018). The weather patterns influence the population size of elk. Elk spend summer months in the mountain snowfields and then move to lower elevations in the winter months to avoid winter storms and find food (Roosevelt Elk 2019). Females move to areas with dense vegetation to take care of calves whereas, bulls move from one region to another to attain peak body conditions. Therefore, gestation has been positively related with dietary factors which provide elk healthy sustainable environment.

In Northeast Oregon, weather is "distinguished with springtime May and June to July untimely summer precipitation, followed by hot and dry weather of mid-July to September" (Bryant 1993), leading to variations in the growth of vegetation, around elk mating time (September- October), therefore affecting the protein (Skovlin 1981), and digestive energies of elk (Holechek et al. 1981), (Johnson et al. 2004), (Johnson et al. 2013). "Cows in good body condition during breeding" have higher birth rate and calf survival. The survival of calves has been related to heavier birth weight which predicts the survival of the young elk (Thorne, et al., 1976; Keech, et al., 2000). The survival of young elk can be a critical factor in increasing population growth rates (Gaillard 2000).

Management of the elk population

Wildlife biologists need to know whether the population is stable, increasing, or decreasing, therefore, the data is collected on wildlife populations (Carpenter). "The complexity of biological systems requires the collection of data on a continuing basis (Carpenter)." Continuous population monitoring allows elk managers to study "elk trend data" to validate "population models." For e.g., "Low bull/cow ratios usually indicate excessive bull harvest, [whereas], low calf/cow ratios suggest poor calf survival" (Wenaha Wildlife Area Management Plan 2007), (Idaho Department of Fish and Game 2014).

Exploratory data analysis helps to understand the "patterns that occur in nature" (Ecology and Evolution 2014). Many studies involving the management of wildlife are based on multivariate statistics to discover wildlife trends (Gnanadesikan 1977). Variable selection allows researchers to "screen out of many variables [to] a few that are important" (Gnanadesikan 1977:6). The variables are further are classified as dependent and independent (measurements) to explain the relationship of environmental factors affecting the species of interest in the ecological setup (Ecology and Evolution 2014).

Gaps in knowledge

This study proved itself useful as previous research such as Lukacs (2018) points out that there was a data gap when it comes to "not [having] data for all combinations of ecotype and carnivore community, therefore limiting our inference on interactions;" but in this case, carnivore community, top-down and bottom-up factors, and ecotype were considered in a longitudinal study.

Objectives of the present study

Research question: What environmental predictors of abundance and recruitment are important for the success of elk populations and their management?

Chapter 2: Methods

2.1 Data

Variable Documentation

Riggs et al. (2021) assembled a large dataset from Oregon Department of Fish and Wildlife annual reports on elk populations and potential population regulatory factors in three management units, namely the Snake River, Desolation, and Wenaha regions of Northeast Oregon. The data was reconstructed using cross referencing between the department's computer records and field forms. For data validation, the older sources were used. The dataset had 172 variables in each of the three regions (Table A1-1). The data were collected over the period of 46 years from 1962 to 2007.

The data included one set of dependent variables that measured elk population. There were 12 sets of independent variables where the groups were divided according to the way elk populations were affected. The sets of independent variables were cougar abundance; mortality factors; weather factors; interspecific competition factors (elk × 12 elk unit months); landscape factors (ha); landscape summer and winter range factors (ha); burn factors (ha); regeneration factors (ha); non-regeneration factors (ha); pre-commercial thinning factors (ha), forestry factors (ha). There were two groups of weather factors; those that were studied by Creel and Creel et al. (2009) and Hansen et al. (2012: Model 20 and 24) and those that were studied by Jonson et al. (2015), Lukacs et al. (2018), and Peek et al. (2002) (Table A1-1). For e.g., elk population variables included the number of elk observed (N_Obs) in annual surveys, bulls per hundred cows observed (B:100C) in annual surveys, and calves per hundred cows observed (CALF:100C) in annual surveys.

From 172 variables (Table A1-1), 15 pre-commercial thinning variables were removed because there was not enough data for analysis leaving 157 variables. Any variable without observations for at least 80% of the years in this study were excluded from the analysis since the variables did not meet the normality assumption. From the 157 variables remaining after data preparation, 74 variables were left in each management unit (Table A1-2). Next, tests for multicollinearity were performed to keep only one variable where independent variables were highly correlated with each other (Table A1-3 to 17). After evaluating the tests of multicollinearity in each of the three management units, 44 of 74 in Snake, 50 of 74 in Desolation, and 52 of 74 variables in Wenaha were remaining. As a result, only seven of the 13 original sets were kept for each of the three management units. Principal Component Analysis (PCA) was applied first to each of the seven sets within each management unit (Table A1-18).

2.2 Principal Component Analysis

PCA is a data transformation tool that takes multi-variable datasets, determines the main sources of variation in the dataset, and combines the variables as linear combinations. These linear combinations, called principal components (PC's), are uncorrelated and are ranked by the amount of variance they explain within the full dataset. Because the multiple principal components returned are uncorrelated, the resultant groups of variables maintain sufficient variance for further statistical analysis (Gnanadesikan 1977:6).

PCA is used when initial datasets do not have pre-organized groups of independent and dependent variables, rather, the relationships between variables are unknown. Therefore, PCA was used to identify the ecologically viable combinations of variables to be used in subsequent CCA and Multiple regression analysis.

The basis of PCA is the construction of new variables in the form of linear combinations of the observed variables that capture the most variance. The coefficients in a given linear combination or PC are weights that indicate how strongly correlated are the original variable and the PC. Frequently different subgroups of original variables are the important contributors to different PC's, leading to plausible scientific interpretations of PC's as for instance "summer temperature variables" or "winter precipitation variables," etc. In some cases, substantial reduction in dimensionality of a dataset can result when only a small subset of the PC's account for a large proportion of the variability in the original data. An understanding of the ecological system of interest should be applied to make sure the important variables in a PC are reasonably ecologically related (Gnanadesikan 1977:6).

Higher eigenvalues correspond to PCs that account for higher variability. The eigenvalues help determine how many PCs are needed to capture a substantial portion of the variability in the data. The first PC corresponds to the largest eigenvalue and captures the largest proportion of variability. Subsequent PCs have successively smaller eigenvalues and capture smaller proportions of variability. The eigenvalues, variation, and the cumulative percentage retained by the PCs was extracted using the *factoextra* package (Kassambara and Mundt 2020).

PCA was conducted separately on the seven different variable sets to reduce the dimensionality of the original 13 data sets for each of the three management units (Table A1-18). The squared cosine indicates the contribution of a principal component using the squared distance from the observed variable with the highest contribution to the principal component to the origin. It corresponds to the square of the cosine of the angle from the right triangle made with the origin, the observed variable with the highest contribution to the principal component , and its projection on the component (Abdi and Williams 2010). The squared cosine (cos^2) was used to select the components with the highest importance for the given observed variables. Smaller angles between the variable and the dimension are indication of higher contribution of the variable to the principal component. One to two variables were selected from within each factor group based on cos^2 values.

2.3 Canonical Correlation Analysis

Canonical variate analysis is used for analyzing group structure in multivariate data. The first pair of canonical variate axes are directions in multivariate space that maximally separate the pre-defined groups of interest specified in the data. The second pair is constructed from the residuals of the first pair in order to maximize the correlation between them. The calculated canonical variates are automatically orthogonal, i.e., they are independent from each other.

Multiple regression produces one equation to represent the relationship between one dependent variable and a single independent variable or set of variables. When a dataset has multiple dependent variables, multiple equations would be needed to describe the relationships between independent and dependent variables. Canonical correlation analysis was used to produce a single relational equation between all dependent variables and independent variables, thereby reducing the number of comparisons needed and lowering the risk of committing a Type I error.

To conduct CCA, data were divided into two sets. The first set consisted of the elk variables, and the second set consisted of environmental variables. The elk variables included the number of elk observed (N_Obs) in annual surveys, the recruitment of bulls per hundred cows observed (B:100C) in annual surveys, and the recruitment of calves per hundred cows observed(CALF:100C) in annual surveys. CCA was performed separately for the three management units. The environmental variables that emerged as important in the PCA were selected for inclusion in the CCA. To evaluate canonical correlations, the *CCA* statistical package was used (González and Déjean 2021).

The number of canonical dimensions (the number of linear combinations) was equal to the number of variables in the smallest variable group, which is elk variables. Ultimately, the number of significant canonical dimensions may be fewer than the total number. For the statistical significance test, the Wilks lambda test within the CCP package was used (Menzel 2009).

2.4 Multiple Regression Analysis

Multiple regression analysis was used to develop a model between the elk dependent variables and the environmental independent variables highlighted by CCA (Table A1-22 to 24). To perform multiple regression analysis, the statistical package *car* was used (Fox, Weisberg, and Price 2019). The linear model is represented as below (equation 1) where Y represents the dependent variable, α, β_1, β_2, and β_n are coefficients, and x_1, x_2, and x_n are predictor variables.

$$\mathbf{Y} = \alpha + \boldsymbol{\beta}_1 x_1 + \boldsymbol{\beta}_2 x_2 + \ldots \boldsymbol{\beta}_n x_n \text{ (equation 1)}$$

Analysis of Variance (ANOVA) was conducted based on type-two sum of squares with no interaction terms included. Final model selections included those with higher R^2-values which indicated a better model fit.

Data analysis for all three units followed this general workflow:

1. PCA was conducted on the 13 original sets with seven sets being significant. PC's that together captured at least 80% of the variability in the data were obtained. The 80% proportion of variance was an informal cutoff point. The remaining sets contained ten variables in the Snake, ten variables in the Desolation, and 11 variables in the Wenaha management unit, respectively.
2. Next, the dependent variables were termed as elk variables and the independent as environmental variables (Table A1-22 to 24). CCA was conducted on the same variables identified by the PCA. For CCA, the cougar abundance (set two) was selected and analyzed for each of the three management units. Therefore, for each management unit, there were three dependent measurements and the number of independent variables increased in each of the three management units by one i.e., cougar population (reconstructed).
3. The variables identified from the CCA as the most important in the PCA were used in further analysis. Multiple regression analysis was conducted to model the relationship between environmental variables and elk variables.

Chapter 3: Results

3.1 Principal Component Analysis

3.1.1 Snake Management Unit

Overall, the proportion of variance was used to determine the dimensionality in the Snake, Desolation, and Wenaha management unit, respectively.

For the population size/growth factors, (Table 3-4), the cosines showed that component one contributed highly to the number of elk observed (N_Obs) in annual surveys with $\cos^2$ value of 0.78 while component two contributed to the recruitment of bulls per hundred cows observed (B:100C) in annual surveys with $\cos^2$ value of 0.85. On the contrary, component three did not show significant $\cos^2$ values (Fig. 3-1).

The sum of all the eigenvalues gave a total variance of three. The proportion of variation elucidated by each eigenvalue is given in the second column (Table 3-1). For example, 1.438 divided by 3 equals 0.479, or about 47.9% of the variation elucidated by the first eigenvalue. The cumulative percentage was attained by adding the consecutive proportions of variation described to obtain the total in the end. Hence, about 85.58% of the variation was described by the first two eigenvalues together. An eigenvalue which is more than one depicts that the PCs explain "more variance than accounted by one of the original variables in the standardized data" (Kassambara 2017). Due to high $\cos^2$ value found for the recruitment of bulls per hundred cows observed (B:100C), principal component two brings substantial additional information from the data. Together, these two dimensions/PCs had an eigenvalue of 2.55 and the cumulative variance of 85.5% for the population size/growth factor. (Hayden 2018). The tables depict the PCs that together capture at least 80% of the variability in the data, the 80% percent taken as an informal cutoff point.

The population size factors had the largest proportion of variance being 85.5% with respect to the first two dimensions (Table 3-1). In the case of the elk variables, there were three original variables the number of elk observed (N_Obs) in annual surveys, the number of calves per hundred cows observed (CALF:100C) in annual surveys, the recruitment of bulls per hundred cows observed (B:100C) in annual surveys (Table A1-19). PCA produced two new variables, PC1 and PC2, in the form of linear combinations of the three original variables which jointly accounted for 85.5% of the variability in the original three variables (as measured by their diagonalized variance-covariance matrix).

For the mortality factors, (Table 3-5), the cosines showed that component one contributed highly to the total of regulated harvest (ET_HARV) with $\cos^2$ value of 0.96 (Fig. 3-2). The mortality factors had the second largest proportion of variance being 68.8% with respect to the first dimension (Table 3-1). In the case of the environmental variables, there was one original variable the total of regulated harvest (ET_HARV) (Table A1-19). PCA produced one new variable, PC1, in the form of linear combination of the original variables, which accounted for 68.8% of the variability. Hence, in the Snake management unit, the dimensionality in the population size factor was less than that in the mortality factors.

3.1.2 Desolation Management Unit

For the population size/growth factors, (Table 3-6), the cosines showed that component one contributed highly to the number of elk observed (N_Obs) in annual surveys with $\cos^2$ value of 0.70 while component two contributed to the recruitment of bulls per hundred cows observed (B:100C) in annual surveys with $\cos^2$ value of 0.87. On the contrary, component three did not show significant $\cos^2$ values (Fig. 3-3). The population size factor had the largest proportion of variance being 80.3% with respect to the first two dimensions (Table 3-2). In the case of the elk variables, there were two original variables the number of elk observed (N_Obs) in annual surveys, the recruitment of bulls per hundred cows observed (B:100C) in annual surveys (Table A1-20). PCA produced two new variables, PC1 and PC2, which jointly accounted for 80.3% of the variability.

For the mortality factors, (Table 3-7), the cosines showed that component one contributed highly to the landscape total area regeneration harvest (ha) (Ha_Rgen_TOT) with $\cos^2$ value of 0.89 (Fig. 3-4). The silviculture factors (regeneration) had the second largest proportion of variance being 73.9% with respect to the first dimension (Table 3-2). In the case of the environmental variables, there was one original variable, the landscape total area regeneration harvest (ha) (Ha_Rgen_TOT) (Table A1-20). PCA produced one new variable, PC1, which accounted for 73.9% of the variability. Hence, in the Desolation management unit, the dimensionality in the population size factor was less than that in the silviculture factor (regeneration).

3.1.3 Wenaha Management Unit

For the mortality factors, (Table 3-8), the cosines showed that component one contributed highly to the total of regulated harvest (ET_HARV) with $\cos^2$ value of 0.99 (Fig. 3-5). The mortality factor had the largest proportion of variance being 80.3% with respect to its first dimension (Table 3-3). In the case of the environmental variables, there was one original variable, the total of regulated harvest (ET_HARV) (Table A1-21). PCA produced one new variable, PC1, which accounted for 80.3% of the variability.

For the population size/growth factors, (Table 3-9), the cosines showed that component one contributed highly to the number of elk observed (N_Obs) in annual surveys with $\cos^2$ value of 0.76 and to the recruitment of bulls per hundred cows observed (B:100C) in annual surveys with $\cos^2$ value of 0.79. On the contrary, component two did not show significant $\cos^2$ values (Fig. 3-6). The population size factors had the second largest proportion of variance 75.6% with respect to the first dimension (Table 3-3). In the case of the elk variables, there were three original variables the number of elk observed (N_Obs) in annual surveys, the number of calves per hundred cows observed (CALF:100C) in annual surveys , the recruitment of bulls per hundred cows observed (B:100C) in annual surveys (Table A1-21). PCA produced one new variable, PC1, which accounted for 75.6% of the variability. Hence, in the Wenaha management unit, the dimensionality in the mortality factors was less than that in the population size factor.

3.2 Canonical Correlation Analysis

3.2.1 Snake Management Unit

The elk and environmental variables that emerged as important in the PCA were selected for inclusion in the CCA for the Snake (Table A1-19), Desolation (Table A1-20), and Wenaha (Table A1-21) management units.

Tests of dimensionality for the canonical correlation analysis, as shown in (Table 3-10), indicated that first of three canonical dimensions were statistically significant at the .05 level. Dimension one had a canonical correlation of 0.85 between the sets of variables with $P = 0.0001$.

In the Snake management unit, the standardized canonical coefficients for the first two dimensions across both sets of variables were measured. For the elk variables, the first canonical dimension was strongly influenced by the number of elk observed (N_Obs) in annual surveys (-1.09) and for the second dimension, the number of bulls per hundred cows observed (B:100C) in annual surveys (-0.85) and the number of calves per hundred cows (CALF:100C) observed in annual surveys (-1.02). For the environmental variables, the first dimension was comprised of cougar population (reconstructed) (-0.91). For the second dimension, winter severity index, biological year, adapted from Jonson et al. (2015) (W_J_WSI_NoStandard_t) (0.76), the total of regulated harvest (ET_HARV) (-0.66) and [Ha_Rgen_TOT] + [Ha_NRgen_TOT] + [Ha_Pct_TOT] (Ha_AllForestry_TOT) (-1.08) were the dominating variables (Table A1-22).

3.2.2 Desolation Management Unit

Tests of dimensionality for the canonical correlation analysis, as shown in (Table 3-11), indicated that none of the three canonical dimensions were statistically significant at the .05 level. Dimension one had a canonical correlation of 0.75 between the sets of variables with $P = 0.681$.

In the Desolation management unit, the standardized canonical coefficients for the first two dimensions across both sets of variables were measured. For the elk variables, the first canonical dimension was strongly influenced by the number of elk observed (N_Obs) in annual surveys (-0.92) and for the second dimension, the number of bulls per hundred cows observed (B:100C) in annual surveys (-0.80) and the number of calves per hundred cows observed (CALF:100C) in annual surveys (-0.50). For the environmental variables, the first dimension was comprised of cougar population (reconstructed) (-0.52) and winter severity index, biological year, adapted from Jonson et al. (2015) (W_J_WSI_NoStandard_t) (-1.14), and November through March, biological year, adapted from Lukacs et al. (2018) (W_L_TotWPpt_1103_t) (-1.17). For the second dimension, November through March, biological year, adapted from Lukacs et al. (2018) (W_L_TotWPpt_1103_t) (-0.84), and [Ha_Rgen_TOT] + [Ha_NRgen_TOT] + [Ha_Pct_TOT] (Ha_AllForestry_TOT) (-0.96) were the dominating variables (Table A1-23).

3.2.3 Wenaha Management Unit

Tests of dimensionality for the canonical correlation analysis, as shown in (Table 3-12), indicated that first of three canonical dimensions were statistically significant at the .05 level. Dimension one had a canonical correlation of 0.92 between the sets of variables with $P = 3.779052e\text{-}06$.

In the Wenaha management unit, the standardized canonical coefficients for the first two dimensions across both sets of variables were measured. For the elk variables, the first canonical dimension was strongly influenced by the number of calves per hundred cows observed (CALF:100C) in annual surveys (0.59) and for the second dimension, the number of bulls per hundred cows observed (B:100C) in annual surveys (1.12) and the number of calves per hundred cows observed (CALF:100C) in annual surveys (1.37). For the environmental variables, the first dimension was comprised of the total of regulated harvest (ET_HARV) (-0.82) and landscape total area non-regeneration harvest (ha) (Ha_NRgen_TOT) (0.78). For the second dimension, cougar population (reconstructed) (-0.80), and the total of regulated harvest (ET_HARV) (-0.62) and average minimum temperature, May, biological year, adapted from Hansen (2012: Model 24) (W_H24_TMIN_05_t) (0.56) were the dominating variables (Table A1-22), and landscape total area non-regeneration harvest (ha) (Ha_NRgen_TOT) (1.30) (Table A1-24).

3.3 Multiple Regression Analysis

3.3.1 Snake Management Unit

The variability in the cougar abundance, winter severity index, and average maximum temperature accounted for 54% (R^2 = 0.54) of the variance in the number of elk observed (N_Obs) in annual surveys (Table 3-13 to 14). The independent variables, cougar abundance (COUGAR_POP_RECON1) and winter severity index, biological year, adapted from Jonson et al. ((2015) W_J_WSI_NoStandard_t), were found to be highly significant with a P = 1.28e-06 and P = 0.009, respectively. However, average maximum temperature, July through September, biological year, adapted from Hansen ((2012: Model 20) W_H20_TMAX_0709_t.), was found to be marginally significant with a P = 0.079. Hence, the null hypothesis was rejected. On the other hand, models for the number of bulls per hundred cows (B:100C) and the number of calves per hundred cows (CALF:100C) observed in annual surveys displayed less significant R^2 -values (Table A1-25 to 28).

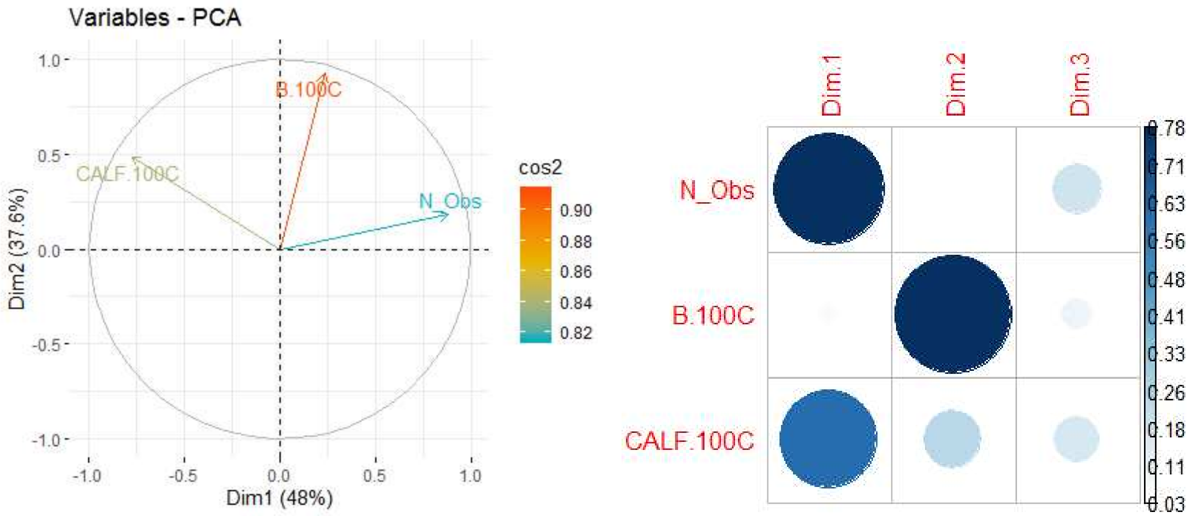
3.3.2 Desolation Management Unit

The variability in the cougar abundance, winter severity index, and total winter precipitation accounted for 40% (R^2 = 0.40) of the variance in the number of elk observed (N_Obs) in annual surveys (Table 3-15 to 16). The independent variables, cougar abundance (COUGAR_POP_RECON1) was found to be highly significant with a P = 0.006. However, winter severity index, biological year, adapted from Jonson et al. (2015) W_J_WSI_NoStandard_t), and total winter precipitation, November through March, biological year, adapted from Lukacs et al. ((2018) W_L_TotWPpt_1103_t) were found to be marginally significant with a P = 0.037 and P = 0.080, respectively. Hence, the null hypothesis was rejected. On the other hand, models for the number of bulls per hundred cows

(B:100C) and the number of calves per hundred cows (CALF:100C) observed in annual surveys displayed less significant R^2-values (Table A1-29 to 32).

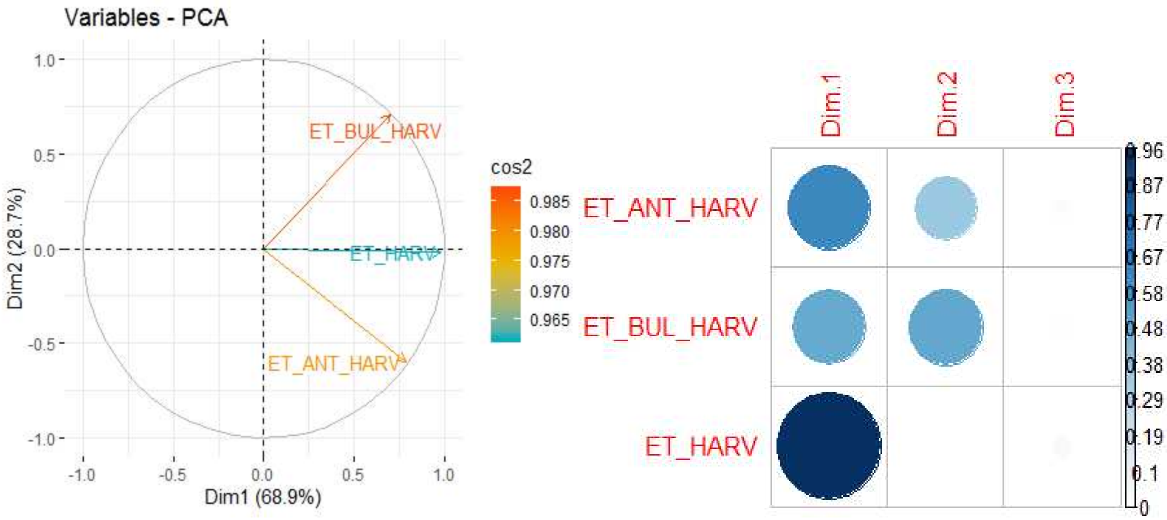
3.3.3 Wenaha Management Unit

The variability in the cougar abundance and total elk harvest accounted for 70% (R^2 = 0.70) of the variance in the number of calves per hundred cows observed (CALF:100C) in annual surveys (Table 3-17 to 18). The independent variables, cougar abundance (COUGAR_POP_RECON1) was found to be highly significant with a P = 0.002 and the total of regulated harvest (ET_HARV) was highly significant as well with a P = 1.2e-06. Hence, the null hypothesis was rejected. On the other hand, models for the number of elk observed (N_Obs) and the number of bulls per hundred cows (B:100C) observed in annual surveys displayed less significant R^2 -values (Table A1-33 to 36).



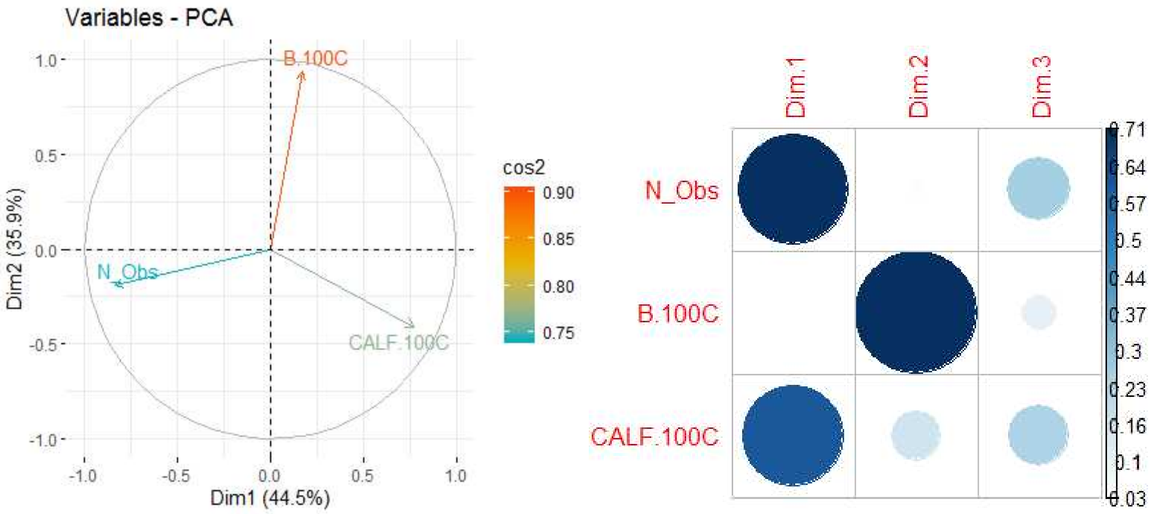
47.9%	37.6%	14.4%

Figure 3-1: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Snake management unit's group one.
a) PCA: B:100C and N_Obs contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to three i.e., 47.9 to 14.4%. Three variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



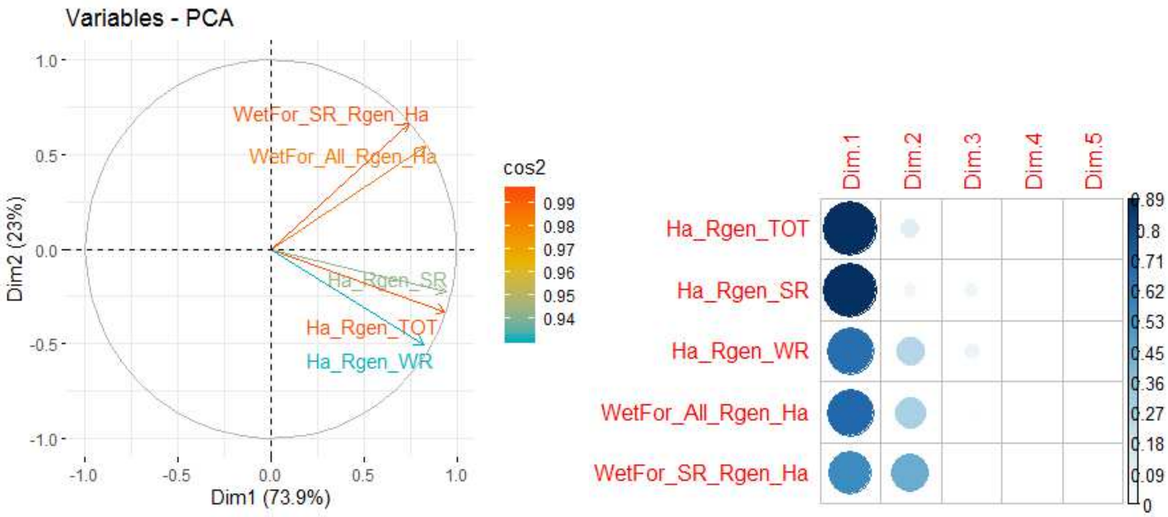
68.8%	28.7%	2.3%

Figure 3-2: Visualization of the PCA plot based on cos^2 values correlation between first two principal components is featured inside the correlation circle for Snake management unit's group three. a) PCA: ET_HARV contributed the most to dimension one. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to three i.e., 68.8 to 2.3%. Three variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



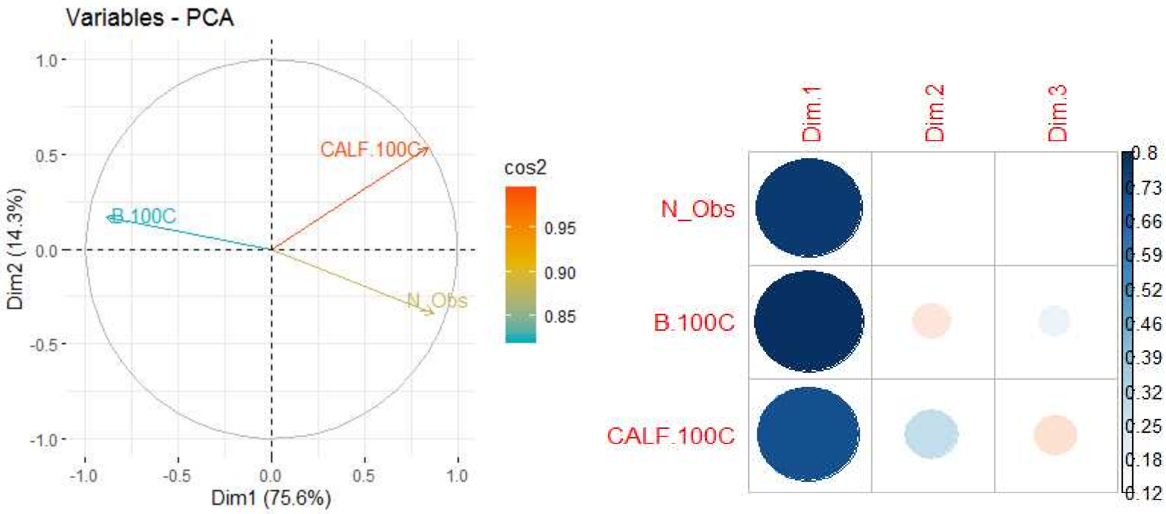
44.5%	35.8%	19.6%

Figure 3-3: Visualization of the PCA plot based on cos^2 values correlation between first two principal components is featured inside the correlation circle for Desolation management unit's group one. a) PCA: B:100C and N_Obs contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to three i.e., 44.5 to 19.6%. Three variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



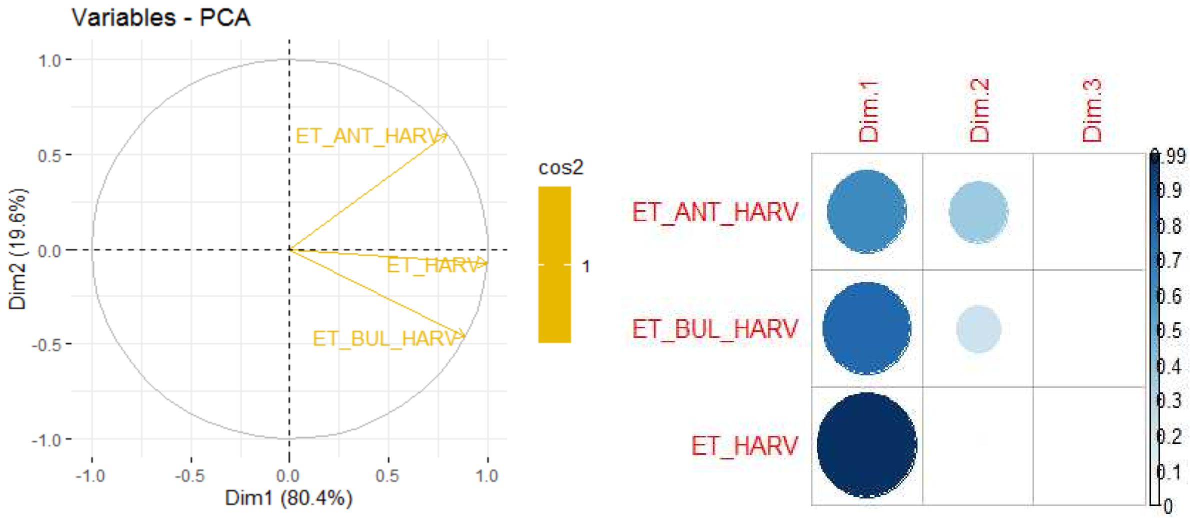
73.9%	23.0%	2.8%	0.3%	0%

Figure 3-4: Visualization of the PCA plot based on cos^2 values correlation between first two principal components is featured inside the correlation circle for Desolation management unit's group ten. a) PCA: Ha_Regen_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 73.9 to 0%. Five variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



75.6%	14.2%	10.0%

Figure 3-5: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Wenaha management unit's group one.
a) PCA: CALF:100C contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to three i.e., 75.6 to 10.0%. Three variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



80.3%	19.6%	0%

Figure 3-6: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Wenaha management unit's group three.
a) PCA: ET_HARV contributed the most to dimension one. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to three i.e., 80.3 to 0%. Three variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.

Table 3-1: PCA results for the Snake management unit. The eigenvalues measuring the amount of variation were retained by each of the principal components. The proportion of variation explained by each eigenvalue was given in the third column. The cumulative percentage explained was obtained by adding the successive proportions of variation explained to obtain the running total of 85%. Group descriptions can be found in Table A1-1.

Group	Dimension	Eigenvalue	Variance (%)	Cumulative Variance (%)
1:Population size/growth Factors	**Dim.1**	**1.4388649**	**47.96216**	**47.96216**
	Dim.2	**1.1285580**	**37.61860**	**85.58076**
3: Mortality Factors	**Dim.1**	**2.06691395**	**68.897132**	**68.89713**
4: Weather Factors	Dim.1	2.5842250	28.713611	28.71361
5: Weather Factors	Dim.1	3.67029163	26.2163688	26.21637
10: Silviculture Factors (Regeneration)	Dim.1	2.440646	61.01614	61.01614
11: Silviculture Factors (Non-Regeneration)	Dim.1	2.660185	44.33642	44.33642
13: Silviculture Factors (Forestry)	Dim.1	2.565945	51.3189	51.31890

Table 3-2: PCA results for the Desolation management unit. The eigenvalues measuring the amount of variation were retained by each of the principal components. The proportion of variation explained by each eigenvalue was given in the third column. The cumulative percentage explained was obtained by adding the successive proportions of variation explained to obtain the running total of 85%. Group descriptions can be found in Table A1-1.

Group	Dimension	Eigenvalue	Variance (%)	Cumulative Variance (%)
1:Population size/growth Factors	**Dim.1** **Dim.2**	**1.3352565** **1.0759419**	**44.50855** **35.86473**	**44.50855** **80.37328**
3: Mortality Factors	Dim.1	2.134952	71.16507	71.16507
4: Weather Factors	Dim.1	2.5585151	28.427945	28.42795
5:Weather Factors	Dim.1	3.98472596	28.4623283	28.46233
10: Silviculture Factors (Regeneration)	**Dim.1**	**3.697327**	**73.94653**	**73.94653**
11: Silviculture Factors (Non-Regeneration)	Dim.1	3.018217	50.30361	50.30361
13: Silviculture Factors (Forestry)	Dim.1	5.461994	54.61994	54.61994

Table 3-3: PCA results for the Wenaha management unit. The eigenvalues measuring the amount of variation were retained by each of the principal components. The proportion of variation explained by each eigenvalue was given in the third column. The cumulative percentage explained was obtained by adding the successive proportions of variation explained to obtain the running total of 85%. Group descriptions can be found in Table A1-1.

Group	Dimension	Eigenvalue	Variance (%)	Cumulative Variance (%)
1:Population size/growth Factors	**Dim.1**	**2.2694161**	**75.6472**	**75.6472**
3: Mortality Factors	**Dim.1**	**2.411643**	**80.38811**	**80.38811**
4: Weather Factors	Dim.1	2.6091323	28.990359	28.99036
	Dim.2	1.7026878	18.918753	47.90911
5:Weather Factors	Dim.1	3.73350953	26.6679252	26.66793
10: Silviculture Factors (Regeneration)	Dim.1	2.711172	54.22344	54.22344
11:Silviculture Factors (Non-Regeneration)	Dim.1	4.698839	58.73549	58.73549
13: Silviculture Factors (Forestry)	Dim.1	4.583875	45.83875	45.83875

Table 3-4: PCA squared cosine values for the Snake management unit with respect to elk population size/ growth factor (group one). The bolded variables and the values were significant.

Variables	Dim.1	Dim.2
N_Obs	**0.78190791**	0.03338096
B.100C	0.05444974	**0.85834837**
CALF.100C	0.60250728	0.23682864

Table 3-5: PCA squared cosine values for the Snake management unit with respect to the mortality factor (group three). The bolded variables and the values were significant.

Variables	Dim.1	Dim.2
ET_ANT_HARV	0.6185502	0.361333787
ET_BUL_HARV	0.4870112	0.499814168
ET_HARV	**0.9613525**	0.000441848

Table 3-6: PCA squared cosine values for the Desolation management unit with respect to the elk population/size factor (group one). The bolded variables and the values were significant.

Variables	Dim.1	Dim.2
N_Obs	**0.70665028**	0.03568419
B.100C	0.02865093	**0.87283350**
CALF.100C	0.59995530	0.16742419

Table 3-7: PCA squared cosine values for the Desolation management unit with respect to the silviculture factors regeneration (group ten). The bolded variables and the values were significant.

Variables	Dim.1	Dim.2
Ha_Rgen_TOT	**0.8933929**	0.11076895
Ha_Rgen_SR	0.8805843	0.05191514
WetFor_All_Rgen_Ha	0.6748667	0.25584469
WetFor_SR_Rgen_Ha	0.6951514	0.28980960

Table 3-8: PCA squared cosine values for the Wenaha management unit with respect to the mortality factors (group three). The bolded variables and the values were significant.

Variables	Dim.1	Dim.2
ET_ANT_HARV	0.6319250	0.368074987
ET_BUL_HARV	0.7848345	0.215165468
ET_HARV	**0.9948837**	0.005116252

Table 3-9: PCA squared cosine values for the Wenaha management unit with respect to the elk population growth/size factors (group one). The bolded variables and the values were significant.

Variables	Dim.1	Dim.2
N_Obs	**0.7650528**	0.11705215
B.100C	**0.7950964**	0.02778106
CALF.100C	0.7092668	0.28281383

Table 3-10: Tests of Canonical Dimensions: Canonical Multi-dimensional view. CCA results for the Snake management unit: Population size/growth by three dimensions, N_Obs, B:100C, and CALF:100C. Dimensions with significant *p*-values are bolded. Group descriptions can be found in Table A1-1.

Dimension	Corr.	F	df1	df2	*p*-value
1	**0.85**	3.01	24	70.208	**0.0001**
2	0.65	1.66	14	50.000	0.0948
3	0.43	0.99	6	26.000	0.4519

Table 3-11: Tests of Canonical Dimensions: Canonical Multi-dimensional view. CCA results for the Desolation management unit: Population size/growth by three dimensions, N_Obs, B:100C, and CALF:100C. Dimensions with significant *p*-values were not found in the Desolation management unit. Group descriptions can be found in Table A1-1.

Dimension	Corr.	F	df1	df2	*p*-value
1	0.75	0.82	24	41.205	0.681
2	0.44	0.33	14	30.000	0.984
3	0.25	0.17	6	16.000	0.978

Table 3-12: Tests of Canonical Dimensions: Canonical Multi-dimensional view. CCA results for the Wenaha management unit: Population size/growth by three dimensions, N_Obs, B:100C, and CALF:100C. Dimensions with significant *p*-values are bolded. Group descriptions can be found in Table A1-1.

Dimension	Corr.	F	df1	df2	*p*-value
1	**0.92**	3.84	27	67.814	**3.779052e-06**
2	0.67	1.42	16	48.000	0.1694902
3	0.38	0.63	7	25.000	0.7192791

Table 3-13: Multiple regression result for the Snake management unit with the number of elk observed (N_Obs) in annual surveys as dependent and other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	-0.409	0.68496
COUGAR_POP_RECON1	5.833	1.28e-06
W_H20_TMAX_0709_t.	1.806	0.07953
W_J_WSI_NoStandard_t	-2.747	0.00943
F-statistic	16.43	
Adj-R^2	0.5491	
p-value	7.864e-07	

Table 3-14: Anova results (Type II tests) for the multiple regression described in Table 3-7 for the Snake management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
COUGAR_POP_RECON1	8127492	1	34.0181	1.283e-06
W_H20_TMAX_0709_t.	779204	1	3.2614	0.079535
W_J_WSI_NoStandard_t	1803121	1	7.5471	0.009433
Residuals	8362078	35		

Table 3-15: Multiple regression result for the Desolation management unit with the number of elk observed (N_Obs) in annual surveys as dependent and other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	3.283	0.0034
COUGAR_POP_RECON1	2.980	0.0069
W_J_WSI_NoStandard_t	2.220	0.0370
W_L_TotWPpt_1103_t	-1.834	0.0803
F-statistic	6.591	
Adj-R^2	0.4015	
p-value	0.02403	

Table 3-16: Anova results (Type II tests) for the multiple regression described in Table 3-9 for the Desolation management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
COUGAR_POP_RECON1	497485	1	8.8829	0.00690
W_J_WSI_NoStandard_t	276075	1	4.9295	0.03701
W_L_TotWPpt_1103_t	188283	1	3.3619	0.08029
Residuals	1232101	22		

Table 3-17: Multiple regression result for the Wenaha management unit with the recruitment of calves per 100 cows observed (CALF:100C) in annual surveys as dependent and other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	6.241	4.2e-07
COUGAR_POP_RECON1	-3.249	0.00261
ET_HARV	5.888	1.2e-06
F-statistic	43.19	
Adj-R^2	0.701	
p-value	4.625e-10	

Table 3-18: Anova results (Type II tests) for the multiple regression described in Table 3-11 for the Wenaha management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
COUGAR_POP_RECON1	493.37	1	10.556	0.00261
ET_HARV	1620.64	1	34.673	1.202e-06
Residuals	1589.17	34		

Chapter 4: Discussion

4.1 Principal Component Analysis

Elk variables the number of elk observed (N_Obs) in annual surveys, the number of bulls per hundred cows observed (B:100C) in annual surveys, and the number of calves per hundred cows observed (CALF:100C) in annual surveys had the largest proportion of variance with respect to the first two PCs in the Snake and Desolation units and the second largest proportion of variance with respect to PC1 in the Wenaha unit. Environmental variables, specifically mortality factor total of regulated harvest (ET_HARV) , had the highest proportion of variance in the Wenaha and second highest in the Snake with respect to PC1. Following mortality factor, silviculture factor (regeneration) the landscape total area regeneration harvest (ha) (Ha_Regen_TOT), had the second largest proportion of variance in the Desolation with respect to PC1 (Table 3-1 to 3). The new PCs, also known as latent or hidden variables, captured the contribution which was not observable in the raw data.

The results above indicated that in the Snake management unit, the dimensionality in the population size factor was less than that in the mortality factor. In the Desolation management unit, the dimensionality in the population size factor was less than that in the silviculture factor (regeneration). In the Wenaha management unit, the dimensionality in the mortality factor was less than that in the population size factor. PCA allowed reducing the dimensionality of data in these management units, while keeping as much variation as possible which benefitted the further analysis (Table A1-19 to 21).

4.2 Canonical Correlation Analysis

Within the three management units, the Snake and Wenaha units were found to have a significant first dimension to describe the relationship between the two sets of variables i.e., elk variables and environmental variables. The three dimensions in the Desolation unit did not prove to be statistically significant (Table 3-10 to 12).

With respect to the first dimension of the elk variables in the Snake unit, the number of elk observed (N_Obs) in annual surveys had a high magnitude of (-1.09). They had a direct relationship with the cougar population (-0.91) environmental variable. With respect to the first dimension of the elk variables in the Desolation, the number of elk observed

(N_Obs) in annual surveys had a high magnitude of (-0.92). It had a direct relationship with the cougar population (-0.52), average maximum temperature, July through September, biological year, adapted from Hansen (2012: Model 20) (W_H20_TMAX_0709_T. (-0.38)), winter severity index, biological year, adapted from Jonson et al. (2015) (W_J_WSI_NoStandard_t (-1.14)), and an inverse relationship with total winter precipitation, November through March, biological year, adapted from Lukacs et al. (2018) (W_L_TotWPpt_1103_t (1.17)) environmental variables. With respect to the first dimension of the elk variable in the Wenaha, the number of calves per hundred cows observed (CALF:100C) in annual surveys had a high magnitude of (0.59). It had a direct relationship with total of regulated harvest (ET_HARV (0.82)), landscape total area regeneration harvest (Ha_Regen_TOT (1.17)), landscape total area non-regeneration harvest (Ha_NRgen_TOT (0.78)), and an inverse relationship with [Ha_Rgen_TOT] + [Ha_NRgen_TOT] + [Ha_Pct_TOT] (Ha_AllForestry_TOT (-1.33)) environmental variables (Table A1-22 to 24).

4.3 Multiple Regression Analysis

The cougar population was constantly a significant contributing predictor in all the three management units. It implies that in all three management units of Northeast Oregon, cougar abundance was of the utmost importance to be observed and controlled. The results supported the fact that "wildlife managers should consider the potential negative effects of cougars on ungulate populations in areas where juvenile recruitment has been chronically low" (Knopff et al. 2010). However, while top-down factors like cougar predation are significant in controlling the elk population, bottom-up factors also need to be considered (Table 3-13 to 18).

Predictors such as adverse climatic effects from the summer and winter, along with the appearances of cougars, both put elk's survival in great danger (Fowler 1981). Top-down and bottom-up factors, such as cougar abundance, along with the harsh weather climate, could cause the declining patterns of elk abundance in the Snake and the Desolation management units. It is true that weather could not be controlled by the elk managers, managing the elk environment in a way which responds effectively to the expected climate could be beneficial to elk's survival (Lukacs 2018). Therefore, based on the final models in the Snake and Desolation management units, managers should focus on direct mortality factors to maintain the number of elk observed (N_Obs) in annual surveys (Table 3-13 to 16).

Based on the final model which supports the fact that cougars are likely to get attracted and hunt the new-born calves (Ellis 2020), in the Wenaha management unit, managers should focus on maintaining the number of calves per hundred cows observed (CALF:100C) in annual surveys. Predictors which shaped elk's ecology in Wenaha were solely top-down effects which deviated from the Snake and Desolation units, which was interesting (Table 3-17 to 18). Even with the deviation, the analysis from the data could be relied upon as data points being captured from 1974 to 2007 had 70% of the variation in elk recruitment.

Conclusion

The conclusion is that top-down and bottom-up effects both had the most impact on elk population according to the statistical analysis. Multiple regression analysis seems to suggest that in the Snake and Desolation management units, top-down factors like cougar abundance consistently prevailed as a one of the main factors in weakening the elk population along with other bottom-up factors such as harsh weather climate. On the other hand, Wenaha unit is being solely governed by top-down factors. Population dynamics are challenging to study as the elk populations are hunted by predators and affected by bottom-up and top-down factors.

But the results tempered with canonical correlation analysis which reflected that top-down factor is exclusively accountable for the Snake management unit and additive mortality is playing a major role in this unit. In this unit, where additive mortality is present, hunting is viewed as an additional source of mortality to increase the total annual mortality. Whereas the Desolation management unit is both top-down and bottom-up affected which suggests that some mortality is likely additive, and some mortality is compensatory which is the combination of the two. Also, in the Wenaha management unit, it is solely bottom-up affected, which suggests compensatory mortality. Compensatory mortality focuses on elk dying from one cause, such as starvation or predation, cannot die from another cause such as hunting.

These findings do not lead to obvious results as it is an observational study.

Overall, the study suggests that top-down and bottom-up forces are not mutually exclusive of each other and neither the additive nor compensatory mortality. Based on the statistical data analyzed in this study further field research should be conducted to test the validity of the patterns observed in this study.

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Table A1-1: List of variables in original data set with all the 172 variable names and descriptions with respect to the 13 different groups considered for the Snake, Desolation, and Wenaha management units. All three-management units had the same number and order of variables.

Variable number	Variable name	Description
1.	UNIT	Desolation, Snake, Wenaha
2.	CALBIO_YEAR	Biological calendar year (for summer and winter range elk)
Dependent variable number	**Variable name for Group 1**	**Population size/growth Factors**
1.	N_Obs	Number of elk observed in annual survey
2.	B:100C	Recruitment, bulls per 100 cows (observed)
3.	CALF:100C	Recruitment, calves per 100 cows (observed)
Independent variable number	**Variable name for group 2**	**Cougar Abundance Factor**
1.	COUGAR_POP_RECON1	Cougar population size (reconstructed)
Independent variable number	**Variable name for group 3**	**Mortality Factors**
1.	ET_ANT_HARV	Regulated harvest of antlerless elk (from survey)
2.	ET_BUL_HARV	Regulated harvest of antlered elk (from survey)
3.	ET_HARV	Total of regulated harvest (sum of antlerless and antlered)
Independent variable number	**Variable name for group 4**	**Weather Factors (Creel and Creel, and Hansen Models)**
1.	W_C_PPT_1003_t	Precipitation, October through March, biological year, adapted from Creel and Creel (2009)
2.	W_C_PPT_0409_t	Precipitation, April through September, biological year, adapted from Creel and Creel (2009)

3.	W_H20_TMAX_0709_t	Average maximum temperature, July through September, biological year, adapted from Hansen (2012: Model 20)
4.	W_H20_TMAX_0709_t1	Average maximum temperature, July through September, previous biological year, adapted from Hansen (2012: Model 20)
5.	W_H20_TMIN_05_t	Average minimum temperature, May, biological year, adapted from Hansen (2012: Model 20)
6.	W_H20_TMIN_05_t1	Average minimum temperature, May, previous biological year, adapted from Hansen (2012: Model 20)
7.	W_H24_TMAX_0708_t	Average maximum temperature, July through August, biological year, adapted from Hansen (2012: Model 24)
8.	W_H24_TMAX_0709_t1	Average maximum temperature, July through September, previous biological year, adapted from Hansen (2012: Model 24)
9.	W_H24_PPT_0809_t	Total precipitation, August through September, biological year, adapted from Hansen (2012: Model 24)
10.	W_H24_PPT_0809_t1	Total precipitation, August through September, previous biological year, adapted from Hansen (2012: Model 24)
11.	W_H24_TMIN_05_t	Average minimum temperature, May, biological year, adapted from Hansen (2012: Model 24)
12.	W_H24_TMIN_05_t1	Minimum temperature, May, previous biological year, adapted from Hansen (2012: Model 24)

Independent variable number	Variable name for group 5	Weather Factors (Johnson, Lukacs, and Peek Models)
1.	W_J_SumPPT_08_t	Precipitation, August, summer range, biological year, adapted from Johnson et al. (2015)
2.	W_J_SumPPT_08_t1	Precipitation, August, summer range, previous biological year, adapted from Johnson et al. (2015)

3.	W_J_WinPPT_1202_t	Precipitation, August, summer range, biological year, adapted from Johnson et al. (2015)
4.	W_J_WinPPT_1202_t1	Precipitation, August, summer range, biological year, adapted from Johnson et al. (2015)
5.	W_J_WinTMIN_1202_t	Minimum temperature, December through February, winter range, biological year, adapted from Johnson et al. (2015)
6.	W_J_WinTMIN_1202_t1	Minimum temperature, December through February, winter range, biological year, adapted from Johnson et al. (2015)
7.	W_J_WSI_NoStandard_t	Winter severity index, biological year, adapted from Jonson et al. (2015)
8.	W_J_WSI_NoStandard_t1	Winter severity index, previous biological year, adapted from Jonson et al. (2015)
9.	W_L_ESPpt_0506_t	Early summer precipitation, May through June, biological year, adapted from Lukacs et al. (2018)
10.	W_L_LSPpt_0809_t	Late summer precipitation, August through September, biological year, adapted from Lukacs et al. (2018)
11.	W_L_EWPpt_1112_t	Early winter precipitation, November through December, biological year, adapted from Lukacs et al. (2018)
12.	W_L_TotWPpt_1103_t	Total winter precipitation, November through March, biological year, adapted from Lukacs et al. (2018)
13.	W_P_PPT_04_t	Precipitation, April, biological year, adapted from Peek et al. (2002)
14.	W_P_PPT_06_t	Precipitation, June, biological year, adapted from Peek et al. (2002)
15.	W_P_PPT_08_t	Precipitation, August, biological year, adapted from Peek et al. (2002)
16.	W_P_PPT_10_t	Precipitation, October, biological year, adapted from Peek et al. (2002)
17.	W_P_PPT_12_t	Precipitation, December, biological year, adapted from Peek et al. (2002)

Independent variable number	Variable name for group 6	Inter-specific competition Factors
1.	ObsElkUnitMonths	Elk population expressed as a 12-month grazing demand (elk*12)
2.	POP2_ElkUnitMonths	Elk population (reconstructed) expressed as a 12-month grazing demand (elk*12)

3.	MDeer_EUM	Mule deer population (reconstructed) expressed in elk unit months (metabolic equivalent *12)
4.	SheepCattle_EUM	Sheep and cattle population aggregate expressed in elk unit months (metabolic equivalents, compounded by number of sheep and cattle grazing months)
5.	AllLivestock_EUM	All-livestock population aggregate (includes equines) expressed in elk unit months (metabolic equivalents, compounded by number of species-specific grazing months)

Independent variable number	Variable name for group 7	Landscape Factors (hectares)
1.	Landscape_All_Map_Ha	Landscape total area (ha)
2.	NonFor_All_Map_Ha	Landscape area attributable to non-forest site potentials (ha)
3.	WoodFor_All_Map_Ha	Landscape area attributable to woodland and forest site potentials (ha)
4.	AllFor_All_Map_Ha	Landscape area attributable to forest site potentials (ha)
5.	WetFor_All_Map_Ha	Landscape area attributable to wet forest site potentials (ha)
6.	RipAsp_All_Map_Ha	Landscape area attributable to riparian and aspen site potentials (ha)
7.	Landscp_All_Map_AWAP	Landscape annual productivity potential (AWAP, kg/ha), weighted on area of environmental site potential (ESP) and accounting for interpolated canopy cover in woodlands and forests (%)
8.	NonFor_All_Map_AWAP	Non-forest annual productivity potential (kg/ha), weighted on area of non-forest environmental site potentials (a constant)
9.	WoodFor_All_Map_AWAP	Woodland and forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
10.	AllFor_All_Map_AWAP	Forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
11.	WetFor_All_Map_AWAP	Wet forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
12.	RipAsp_All_Map_AWAP	Riparian and aspen forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy

		cover (%)
13.	Landscape_TP	[Landscape_All_Map_Ha] x [Landscp_All_Map_AWAP], Landscape total undergrowth production potential (kg)
14.	NonFor_All_Map_TP	[NonFor_All_Map_Ha] x [NonFor_All_Map_AWAP], Non-forest total biomass production potential (kg, a constant)
15.	WoodFor_All_Map_TP	[WoodFor_All_Map_Ha] x [WoodFor_All_Map_AWAP], Woodland and forest undergrowth production potential (kg)
16.	AllFor_All_Map_TP	[AllFor_All_Map_Ha] x [AllFor_All_Map_AWAP], Forest undergrowth production potential (kg)
17.	WetFor_All_Map_TP	[WetFor_All_Map_Ha] x [WetFor_All_Map_AWAP], Wet forest undergrowth production potential (kg)
18.	RipAsp_All_Map_TP	[RipAsp_All_Map_Ha] x [RipAsp_All_Map_AWAP], Riparian and aspen undergrowth production potential (kg)

Independent variable number	Variable name for group 8	Landscape Summer/Winter Range Factors (hectares)
1.	SR_Map_Ha	Summer range total area (ha)
2.	NonFor_SR_Map_Ha	Summer range area attributable to non-forest site potentials (ha)
3.	WoodFor_SR_Map_Ha	Summer range area attributable to woodland and forest site potentials (ha)
4.	AllFor_SR_Map_Ha	Summer range area attributable to forest site potentials (ha)
5.	WetFor_SR_Map_Ha	Summer range area attributable to wet forest site potentials (ha)
6.	RipAsp_SR_Map_Ha	Summer range area attributable to riparian and aspen site potentials (ha)
7.	SR_Map_AWAP	Summer range annual productivity potential (AWAP, kg/ha), weighted on area of environmental site potential (ESP) and accounting for interpolated canopy cover in woodlands and forests (%)

8.	NonFor_SR_Map_AWAP	Summer range, non-forest annual productivity potential (kg/ha), weighted on area of non-forest environmental site potentials (a constant)
9.	WoodFor_SR_Map_AWAP	Summer range, woodland and forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
10.	AllFor_SR_Map_AWAP	Summer range, forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
11.	WetFor_SR_Map_AWAP	Summer range, wet forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
12.	RipAsp_SR_Map_AWAP	Summer range, riparian and aspen forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
13.	SR_TP	[Landscape_SR_Map_Ha] x [Landscp_SR_Map_AWAP], Summer range undergrowth production potential (kg)
14.	NonFor_SR_Map_TP	[NonFor_SR_Map_Ha] x [NonFor_SR_Map_AWAP], Summer range, non-forest undergrowth production potential (kg, a constant)
15.	WoodFor_SR_Map_TP	[WoodFor_SR_Map_Ha] x [WoodFor_SR_Map_AWAP], Summer range woodland and forest undergrowth production potential (kg)
16.	AllFor_SR_Map_TP	[AllFor_SR_Map_Ha] x [AllFor_SR_Map_AWAP], Summer range forest undergrowth production potential (kg)
17.	WetFor_SR_Map_TP	[WetFor_SR_Map_Ha] x [WetFor_SR_Map_AWAP], Summer range, wet forest undergrowth production potential (kg)
18.	RipAsp_SR_Map_TP	[RipAsp_SR_Map_Ha] x [RipAsp_SR_Map_AWAP], Summer range, riparian and aspen undergrowth production potential (kg)

19.	WR_Map_Ha	Winter range total area (ha)
20.	NonFor_WR_Map_Ha	Winter range area attributable to non-forest site potentials (ha)
21.	WoodFor_WR_Map_Ha	Winter range area attributable to woodland and forest site potentials (ha)
22.	AllFor_WR_Map_Ha	Winter range area attributable to forest site potentials (ha)
23.	WetFor_WR_Map_Ha	Winter range area attributable to wet forest site potentials (ha)
24.	RipAsp_WR_Map_Ha	Winter range area attributable to riparian and aspen site potentials (ha)
25.	WR_Map_AWAP	Winter range annual productivity potential (AWAP, kg/ha), weighted on area of environmental site potential (ESP) and accounting for interpolated canopy cover in woodlands and forests (%)
26.	NonFor_WR_Map_AWAP	Winter range, non-forest annual productivity potential (kg/ha), weighted on area of non-forest environmental site potentials (a constant)
27.	WoodFor_WR_Map_AWAP	Winter range, woodland and forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
28.	AllFor_WR_Map_AWAP	Winter range, forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
29.	WetFor_WR_Map_AWAP	Winter range, wet forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
30.	RipAsp_WR_Map_AWAP	Winter range, riparian and aspen forest annual productivity potential (AWAP, kg/ha), weighted on ESP areas and accounting for interpolated overstory canopy cover (%)
31.	WR_TP	[Landscape_WR_Map_Ha] x [Landscp_WR_Map_AWAP], winter range undergrowth production potential (kg)
32.	NonFor_WR_Map_TP	[NonFor_WR_Map_Ha] x [NonFor_WR_Map_AWAP], winter range, non-forest undergrowth production potential (kg, a constant)
33.	WoodFor_WR_Map_TP	[WoodFor_WR_Map_Ha] x [WoodFor_WR_Map_AWAP], winter range woodland and forest undergrowth production

		potential (kg)
34.	AllFor_WR_Map_TP	[AllFor_WR_Map_Ha] x [AllFor_WR_Map_AWAP], winter range forest undergrowth production potential (kg)
35.	WetFor_WR_Map_TP	[WetFor_WR_Map_Ha] x [WetFor_WR_Map_AWAP], winter range, wet forest undergrowth production potential (kg)
36.	RipAsp_WR_Map_TP	[RipAsp_WR_Map_Ha] x [RipAsp_WR_Map_AWAP], winter range, riparian, and aspen undergrowth production potential (kg)

Independent variable number	Variable name for group 9	Burn Factors (hectares)
1.	Ha_Burn_TOT	Landscape total area burned (ha)
2.	Ha_Burn_SR	Summer range area burned (ha)
3.	Ha_Burn_WR	Winter range area burned (ha)
4.	Tot_Burn_%	Percentage of Landscape burned
5.	SR_Burn_%	Percentage of summer range burned
6.	WR_Burn_%	Percentage of winter range burned
7.	NonFor_All_Burn_Ha	Non-forest total area burned (ha)
8.	WoodFor_All_Burn_Ha	Woodland and forest total area burned (ha)
9.	AllFor_All_Burn_Ha	Forest total area burned (ha)
10.	WetFor_All_Burn_Ha	Wet forest total area burned (ha)
11.	RipAsp_All_Burn_Ha	Riparian and aspen total area burned (ha)
12.	NonFor_SR_Burn_Ha	Non-forest summer range burned (ha)
13.	WoodFor_SR_Burn_Ha	Woodland and forest summer range burned (ha)

14.	AllFor_SR_Burn_Ha	Forest summer range burned (ha)
15.	WetFor_SR_Burn_Ha	Wet forest summer range burned (ha)
16.	RipAsp_SR_Burn_Ha	Riparian and aspen summer range burned (ha)
17.	NonFor_WR_Burn_Ha	Non-forest winter range burned (ha)
18.	WoodFor_WR_Burn_Ha	Woodland and forest winter range burned (ha)
19.	AllFor_WR_Burn_Ha	Forest winter range burned (ha)
20.	WetFor_WR_Burn_Ha	Wet forest winter range burned (ha)
21.	RipAsp_WR_Burn_Ha	Riparian and aspen winter range burned (ha)

Independent variable number	Variable name for group 10	Silviculture Factors (regeneration) (hectares)
1.	Ha_Rgen_TOT	Landscape total area regeneration harvest
2.	Ha_Rgen_SR	Summer range total area regeneration harvest
3.	Ha_Rgen_WR	Winter range total area regeneration harvest
4.	WoodFor_All_Rgen_Ha	Woodland and forest total area regeneration harvest (ha)
5.	AllFor_All_Rgen_Ha	Forest total area regeneration harvest (ha)
6.	WetFor_All_Rgen_Ha	Wet forest total area regeneration harvest (ha)
7.	WoodFor_SR_Rgen_Ha	Woodland and forest summer range regeneration harvest (ha)
8.	AllFor_SR_Rgen_Ha	Forest summer range regeneration harvest (ha)
9.	WetFor_SR_Rgen_Ha	Wet forest summer range regeneration harvest (ha)
10.	WoodFor_WR_Rgen_Ha	Woodland and forest winter range regeneration harvest (ha)
11.	AllFor_WR_Rgen_Ha	Forest winter range regeneration harvest (ha)

Independent variable number	Variable name for group 11	Silviculture Factors (non-regeneration) (hectares)
1.	Ha_NRgen_TOT	Landscape total area non-regeneration harvest (ha)
2.	Ha_NRgen_SR	Summer range total area non-regeneration harvest (ha)
3.	Ha_NRgen_WR	Winter range total area non-regeneration harvest (ha)
4.	WoodFor_All_NRgen_Ha	Woodland and forest total area non-regeneration harvest (ha)
5.	AllFor_All_NRgen_Ha	Forest total area non-regeneration harvest (ha)
6.	WetFor_All_NRgen_Ha	Wet forest total area non-regeneration harvest (ha)
7.	RipAsp_All_NRgen_Ha	Riparian and aspen total area non-regeneration harvest (ha)
8.	WoodFor_SR_NRgen_Ha	Woodland and forest summer range non-regeneration harvest (ha)
9.	AllFor_SR_NRgen_Ha	Forest summer range non-regeneration harvest (ha)
10.	WetFor_SR_NRgen_Ha	Wet forest summer range non-regeneration harvest (ha)
11.	RipAsp_SR_NRgen_Ha	Riparian and aspen summer range non-regeneration harvest (ha)
12.	WoodFor_WR_NRgen_Ha	Woodland and forest winter range non-regeneration harvest (ha)
13.	AllFor_WR_NRgen_Ha	Forest winter range non-regeneration harvest (ha)
14.	WetFor_WR_NRgen_Ha	Wet forest winter range non-regeneration harvest (ha)

Independent variable number	Variable name for group 12	Pre-Commercial Thinning Factors (hectares)
1.	Ha_Pct_TOT	Landscape total area pre-commercial thinning (ha)
2.	Ha_Pct_SR	Summer range total area pre-commercial thinning (ha)

3.	Ha_Pct_WR	Winter range total area pre-commercial thinning (ha)
4.	WoodFor_All_Pct_Ha	Woodland and forest total area pre-commercial thinning (ha)
5.	AllFor_All_Pct_Ha	Forest total area pre-commercial thinning (ha)
6.	WetFor_All_Pct_Ha	Wet forest total area pre-commercial thinning (ha)
7.	RipAsp_All_Pct_Ha	Riparian and aspen total area pre-commercial thinning (ha)
8.	WoodFor_SR_Pct_Ha	Woodland and forest summer range pre-commercial thinning (ha)
9.	AllFor_SR_Pct_Ha	Forest summer range pre-commercial thinning (ha)
10.	WetFor_SR_Pct_Ha	Wet forest summer range pre-commercial thinning (ha)
11.	RipAsp_SR_Pct_Ha	Riparian and aspen summer range pre-commercial thinning (ha)
12.	WoodFor_WR_Pct_Ha	Woodland and forest winter range pre-commercial thinning (ha)
13.	AllFor_WR_Pct_Ha	Forest winter range pre-commercial thinning (ha)
14.	WetFor_WR_Pct_Ha	Wet forest winter range pre-commercial thinning (ha)
15.	RipAsp_WR_Pct_Ha	Riparian and aspen winter range pre-commercial thinning (ha)

Independent variable number	Variable name for group 13	Silviculture Factors (forestry)
1.	Ha_AllForestry_TOT	[Ha_Rgen_TOT] + [Ha_NRgen_TOT] + [Ha_Pct_TOT]
2.	Ha_AllForestry_SR	[Ha_Rgen_SR] + [Ha_NRgen_SR] + [Ha_Pct_SR]
3.	Ha_AllForestry_WR	[Ha_Rgen_WR] + [Ha_NRgen_WR] + [Ha_Pct_WR]
4.	WoodFor_All_AllForestry_Ha	[WoodFor_All_Rgen_Ha]+[WoodFor_All_NRgen_Ha]+[WoodFor_All_Pct_Ha]

5.	AllFor_All_AllForestry_Ha	[AllFor_All_Rgen_Ha]+[AllFor_All_NRgen_Ha]+[AllFor_All_Pct_Ha]
6.	WetFor_All_AllForestry_Ha	[WetFor_All_Rgen_Ha]+[WetFor_All_NRgen_Ha]+[WetFor_All_Pct_Ha]
7.	RipAsp_All_AllForestry_Ha	[RipAsp_All_Rgen_Ha]+[RipAsp_All_NRgen_Ha]+[RipAsp_All_Pct_Ha]
8.	WoodFor_SR_AllForestry_Ha	[WoodFor_SR_Rgen_Ha]+[WoodFor_SR_NRgen_Ha]+[WoodFor_SR_Pct_Ha]
9.	AllFor_SR_AllForestry_Ha	[AllFor_SR_Rgen_Ha]+[AllFor_SR_NRgen_Ha]+[AllFor_SR_Pct_Ha]
10.	WetFor_SR_AllForestry_Ha	[WetFor_SR_Rgen_Ha]+[WetFor_SR_NRgen_Ha]+[WetFor_SR_Pct_Ha]
11.	RipAsp_SR_AllForestry_Ha	[RipAsp_SR_Rgen_Ha]+[RipAsp_SR_NRgen_Ha]+[RipAsp_SR_Pct_Ha]
12.	WoodFor_WR_AllForestry_Ha	[WoodFor_WR_Rgen_Ha]+[WoodFor_WR_NRgen_Ha]+[WoodFor_WR_Pct_Ha]
13.	AllFor_WR_AllForestry_Ha	[AllFor_WR_Rgen_Ha]+[AllFor_WR_NRgen_Ha]+[AllFor_WR_Pct_Ha]
14.	WetFor_WR_AllForestry_Ha	[WetFor_WR_Rgen_Ha]+[WetFor_WR_NRgen_Ha]+[WetFor_WR_Pct_Ha]

Table A1-2: Dataset completeness across units was visually evaluated using histograms, data availability was identical in all three management units. Groups with more than 20% missing data were removed from the analysis.

Group	Variables Count	Data completeness: Percentage of missing data
1: Population size/growth	3	< than 20%
2: Direct Mortality Factors	1	> than 20%
3: Mortality Factors	3	< than 20%
4: Weather Factors	12	< than 20%
5: Weather Factors	17	< than 20%
6: Inter-specific competition	5	> than 20%
7:Landscape Factors	18	> than 20%
8: Landscape Summer Range/ Landscape Winter Range	36	> than 20%
9: Burn Factors	21	> than 20%
10: Silviculture Factors (Regeneration)	11	< than 20%
11: Silviculture Factors (Non- Regeneration)	14	< than 20%
12: Pre-Commercial Thinning Factors	15	> than 20%
13: Silviculture Factors (Forestry)	14	< than 20%

greater than (>) or less than (<)

Table A1-3: Group four of the Snake management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary

Group 4: Weather Variables	
Used variables	Unused variables
W_H24_TMAX_0709_t1	W_H20_TMAX_0709_t1.
W_H24_TMIN_05_t	W_H20_TMIN_05_t
W_H24_TMIN_05_t1	W_H20_TMIN_05_t1

Table A1-4: Group five of the Snake management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 5: Weather Variables	
Used variables	Unused variables
W_J_SumPPT_08_t	W_P_PPT_08_t
W_J_WSI_NoStandard_t1	W_J_WinPPT_1202_t1.
W_J_WSI_NoStandard_t	W_J_WinPPT_1202_t

Table A1-5: Group ten of the Snake management unit contained four pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 10: Silviculture Variables	
Used variables	Unused variables
Ha_Rgen_TOT	AllFor_All_Rgen_Ha, Wood For_AllRgen_Ha
Ha_Rgen_SR	AllFor_SR_Rgen_Ha, WoodFor_SR_Rgen_Ha
WetFor_SR_Rgen_Ha	WetFor_All_Rgen_Ha
Ha_Rgen_WR	WoodFor_WR_Rgen_Ha, AllFor_WR_Rgen_Ha

Table A1-6: Group eleven of the Snake management unit contained four pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 11: Silviculture Variables	
Used variables	Unused variables
Ha_NRgen_TOT	WoodFor_All_NRgen_Ha, AllFor_All_NRgen_Ha
Ha_NRgen_SR	AllFor_SR_NRgen_Ha, WoodFor_SR_NRgen_Ha
WetFor_WR_NRgen_Ha	RipAsp_All_NRgen_Ha, RipAsp_SR_NRgen_Ha
Ha_NRgen_WR	WoodFor_WR_NRgen_Ha, AllFor_WR_NRgen_Ha

Table A1-7: Group thirteen of the Snake management unit contained five pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 13: Silviculture Variables	
Used variables	Unused variables
Ha_AllForestry_TOT	AllFor_AllForestry_Ha, WoodFor_AllForestry_Ha
Ha_AllForestry_SR	WoodFor_SR_AllForestry_Ha, AllFor_SR_AllForestry_Ha
Ha_AllForestry_WR	WoodFor_WR_AllForestry_Ha, AllFor_WR_AllForestry_Ha
WetFor_All_AllForestry_Ha	WetFor_SR_All_Forestry_Ha
WetFor_WR_AllForestry_Ha	RipAsp_SR_All_Forestry_Ha, RipAsp_All_AllForestry_Ha

Table A1-8: Group four of the Desolation management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 4: Weather Variables	
Used variables	Unused variables
W_H24_TMAX_0709_t1	W_H20_TMAX_0709_t1.
W_H24_TMIN_05_t	W_H20_TMIN_05_t
W_H24_TMIN_05_t1	W_H20_TMIN_05_t1

Table A1-9: Group five of the Desolation management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 5: Weather Variables	
Used variables	Unused variables
W_J_SumPPT_08_t	W_P_PPT_08_t
W_J_WSI_NoStandard_t1	W_J_WinPPT_1202_t1.
W_J_WSI_NoStandard_t	W_J_WinPPT_1202_t

Table A1-10: Group ten of the Desolation management unit contained five pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 10: Silviculture Variables	
Used variables	Unused variables
Ha_Rgen_TOT	Wood For_AllRgen_Ha
Ha_Rgen_SR	WoodFor_SR_Rgen_Ha
WetFor_SR_Rgen_Ha	AllFor_SR_Rgen_Ha
Ha_Rgen_WR	WoodFor_WR_Rgen_Ha, AllFor_WR_Rgen_Ha
WetFor_All_Rgen_Ha	AllFor_All_Rgen_Ha

Table A1-11: Group eleven of the Desolation management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 11: Silviculture Variables	
Used variables	Unused variables
Ha_NRgen_TOT	WoodFor_All_NRgen_Ha, AllFor_All_NRgen_Ha, WetFor_All_NRgen_Ha
Ha_NRgen_SR	AllFor_SR_NRgen_Ha, WoodFor_SR_NRgen_Ha, WetFor_SR_NRgen_Ha
Ha_NRgen_WR	WoodFor_WR_NRgen_Ha, AllFor_WR_NRgen_Ha

Table A1-12: Group thirteen of the Desolation management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 13: Silviculture Variables	
Used variables	Unused variables
Ha_AllForestry_TOT	WoodFor_AllForestry_Ha
Ha_AllForestry_SR	WoodFor_SR_AllForestry_Ha, AllFor_SR_AllForestry_Ha
Ha_AllForestry_WR	WoodFor_WR_AllForestry_Ha

Table A1-13: Group four of the Wenaha management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 4: Weather Variables	
Used variables	Unused variables
W_H24_TMAX_0709_t1	W_H20_TMAX_0709_t1.
W_H24_TMIN_05_t	W_H20_TMIN_05_t
W_H24_TMIN_05_t1	W_H20_TMIN_05_t1

Table A1-14: Group five of the Wenaha management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 5: Weather Variables	
Used variables	Unused variables
W_J_SumPPT_08_t	W_P_PPT_08_t
W_J_WSI_NoStandard_t1	W_J_WinPPT_1202_t1.
W_J_WSI_NoStandard_t	W_J_WinPPT_1202_t

Table A1-15: Group ten of the Wenaha management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 10: Silviculture Variables	
Used variables	Unused variables
Ha_Rgen_TOT	Wood For_AllRgen_Ha, AllFor_All_Rgen_Ha
Ha_Rgen_SR	WoodFor_SR_Rgen_Ha, AllFor_SR_Rgen_Ha
Ha_Rgen_WR	WoodFor_WR_Rgen_Ha, AllFor_WR_Rgen_Ha

Table A1-16: Group eleven of the Wenaha management unit contained five pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 11: Silviculture Variables	
Used variables	Unused variables
Ha_NRgen_TOT	WoodFor_All_NRgen_Ha
Ha_NRgen_SR	AllFor_SR_NRgen_Ha, WoodFor_SR_NRgen_Ha
Ha_NRgen_WR	WoodFor_WR_NRgen_Ha
WetFor_All_NRgen_Ha	RipAsp_All_NRgen_Ha
WetFor_SR_NRgen_Ha	RipAsp_SR_NRgen_Ha

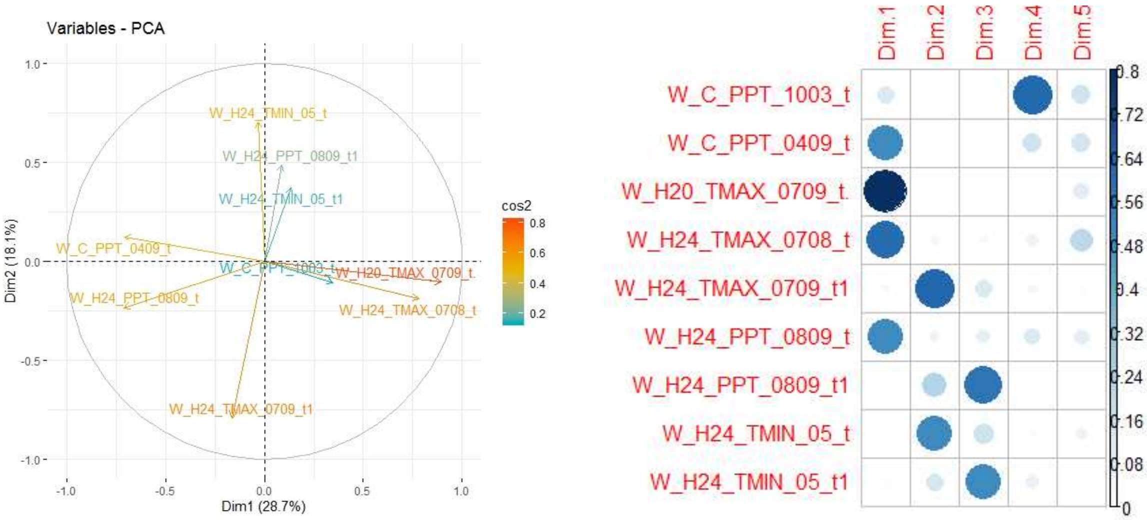
Table A1-17: Group thirteen of the Wenaha management unit contained three pairs of data with identical values. In order to reduce redundancy only one was kept and the choice was arbitrary.

Group 13: Silviculture Variables	
Used variables	Unused variables
Ha_AllForestry_TOT	WoodFor_AllForestry_Ha
Ha_AllForestry_SR	WoodFor_SR_AllForestry_Ha, AllFor_SR_AllForestry_Ha
Ha_AllForestry_WR	WoodFor_WR_AllForestry_Ha

Table A1-18: List of remaining variables selected by consideration of histogram and variables contributing to multicollinearity. Variables were kept if they had less than 20% missing data and if they did not contribute to multicollinearity. Seven out thirteen groups were remaining and six were removed because none of their variables met these criteria. The variables within each group were then evaluated by PCA to determine their cumulative variance.

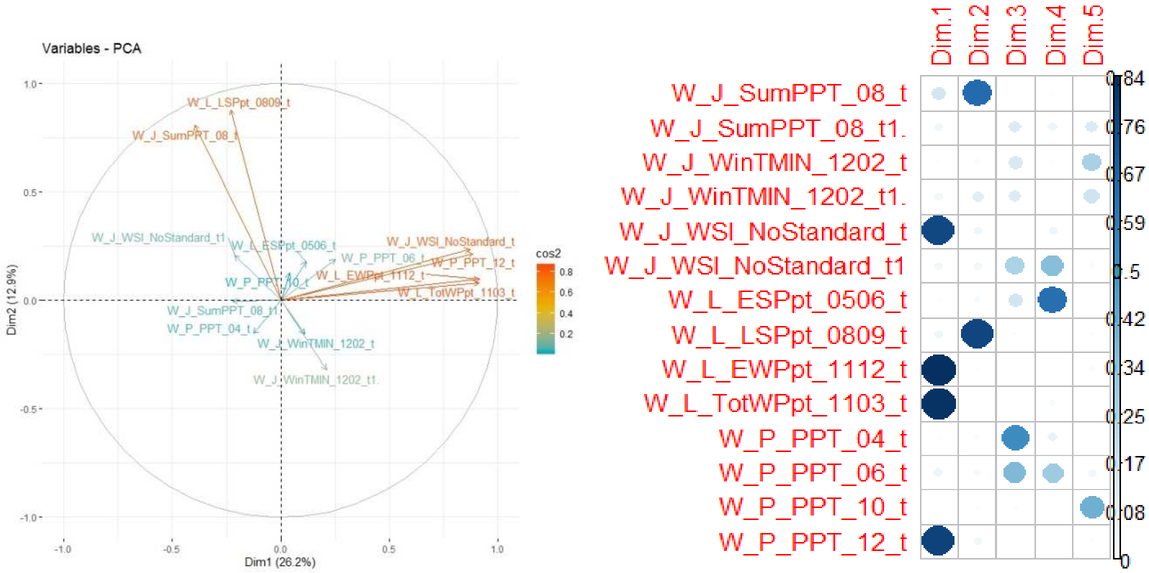
Groups	Snake Management Unit	Desolation Management Unit	Wenaha Management Unit
1: Population size/growth Factors	N_Obs B:100C CALF:100C (N=3)	N_Obs B:100C CALF:100C (N=3)	N_Obs B:100C CALF:100C (N=3)
3: Mortality Factors	ET_ANT_HARV ET_BUL_HARV ET_HARV (N=3)	ET_ANT_HARV ET_BUL_HARV ET_HARV (N=3)	ET_ANT_HARV ET_BUL_HARV ET_HARV (N=3)
4: Weather Factors	W_C_PPT_1003_t W_C_PPT_0409_t W_H20_TMAX_0709_t. W_H24_TMAX_0708_t W_H24_TMAX_0709_t1 W_H24_PPT_0809_t W_H24_PPT_0809_t1 W_H24_TMIN_05_t W_H24_TMIN_05_t1 (N=9)	W_C_PPT_1003_t W_C_PPT_0409_t W_H20_TMAX_0709_t. W_H24_TMAX_0708_t W_H24_TMAX_0709_t1 W_H24_PPT_0809_t W_H24_PPT_0809_t1 W_H24_TMIN_05_t W_H24_TMIN_05_t1 (N=9)	W_C_PPT_1003_t W_C_PPT_0409_t W_H20_TMAX_0709_t. W_H24_TMAX_0708_t W_H24_TMAX_0709_t1 W_H24_PPT_0809_t W_H24_PPT_0809_t1 W_H24_TMIN_05_t W_H24_TMIN_05_t1 (N=9)
5: Weather Factors	W_J_SumPPT_08_t W_J_SumPPT_08_t1. W_J_WinTMIN_1202_ W_J_WinTMIN_1202_t1 W_J_WSI_NoStandard_t W_J_WSI_NoStandard_t1 W_L_ESPpt_0506_t W_L_LSPpt_0809_t W_L_EWPpt_1112_t W_L_TotWPpt_1103_t W_P_PPT_04_t W_P_PPT_06_t W_P_PPT_10_t W_P_PPT_12_t (N=14)	W_J_SumPPT_08_t W_J_SumPPT_08_t1. W_J_WinTMIN_1202_t W_J_WinTMIN_1202_t1. W_J_WSI_NoStandard_t W_J_WSI_NoStandard_t1 W_L_ESPpt_0506_t W_L_LSPpt_0809_t W_L_EWPpt_1112_t W_L_TotWPpt_1103_t W_P_PPT_04_t W_P_PPT_06_t W_P_PPT_10_t W_P_PPT_12_t (N=14)	W_J_SumPPT_08_t W_J_SumPPT_08_t1. W_J_WinTMIN_1202_t W_J_WinTMIN_1202_t1 W_J_WSI_NoStandard_t W_J_WSI_NoStandard_t1 W_L_ESPpt_0506_t W_L_LSPpt_0809_t W_L_EWPpt_1112_t W_L_TotWPpt_1103_t W_P_PPT_04_t W_P_PPT_06_t W_P_PPT_10_t W_P_PPT_12_t (N=14)
10: Silviculture Factors (Regeneration)	Ha_Rgen_TOT Ha_Rgen_SR Ha_Rgen_WR WetFor_SR_Rgen_Ha (N=4)	Ha_Rgen_TOT Ha_Rgen_SR Ha_Rgen_WR WetFor_All_Rgen_Ha WetFor_SR_Rgen_Ha (N=5)	Ha_Rgen_TOT Ha_Rgen_SR Ha_Rgen_WR WetFor_All_Rgen_Ha WetFor_SR_Rgen_Ha (N=5)
11: Silviculture Factors (Non-Regeneration)	Ha_NRgen_TOT Ha_NRgen_SR Ha_NRgen_WR WetFor_All_NRgen_Ha WetFor_SR_NRgen_Ha WetFor_WR_NRgen_Ha (N=6)	Ha_NRgen_TOT Ha_NRgen_SR Ha_NRgen_WR RipAsp_All_NRgen_Ha RipAsp_SR_NRgen_Ha WetFor_WR_NRgen_Ha (N=6)	Ha_NRgen_TOT Ha_NRgen_SR Ha_NRgen_WR AllFor_All_NRgen_Ha WetFor_All_NRgen_Ha WetFor_SR_NRgen_Ha AllFor_WR_NRgen_Ha WetFor_WR_NRgen_Ha (N=8)

13: Silviculture Factors (Forestry)	Ha_AllForestry_TOT Ha_AllForestry_SR Ha_AllForestry_WR WetFor_All_AllForestry_Ha WetFor_WR_AllForestry_Ha (N=5)	Ha_AllForestry_TOT, AllFor_All_AllForestry_Ha WetFor_All_AllForestry_Ha Ha_AllForestry_SR WetFor_SR_AllForestry_Ha RipAsp_All_AllForestry_Ha RipAsp_SR_AllForestry_Ha Ha_AllForestry_WR AllFor_WR_AllForestry_Ha WetFor_WR_AllForestry_Ha (N=10)	Ha_AllForestry_TOT AllFor_All_AllForestry_Ha Ha_AllForestry_SR WetFor_All_AllForestry_Ha RipAsp_All_AllForestry_Ha WetFor_SR_AllForestry_Ha RipAsp_SR_AllForestry_Ha Ha_AllForestry_WR AllFor_WR_AllForestry_Ha WetFor_WR_AllForestry_Ha (N=10)



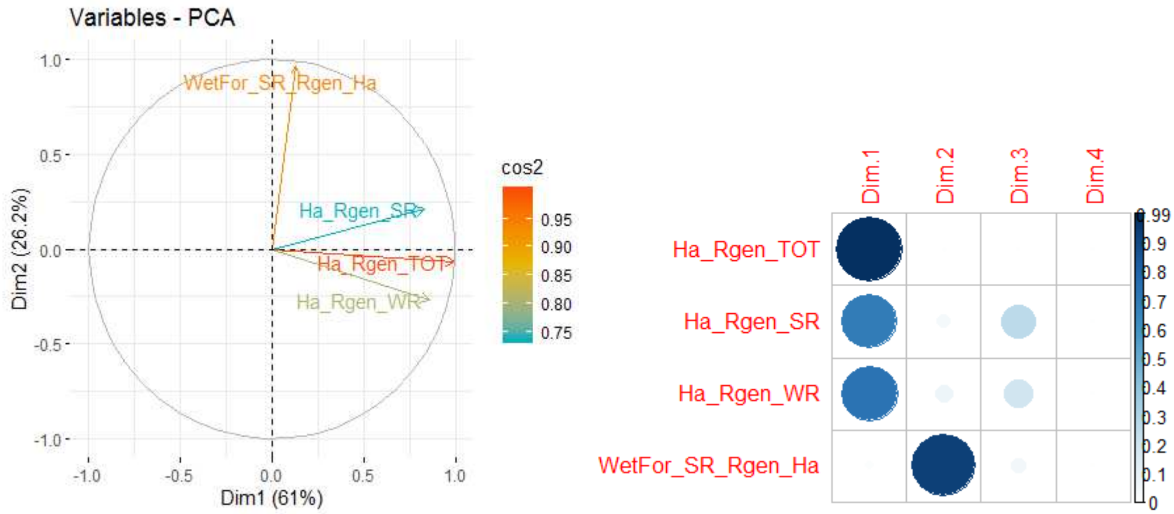
28.7 %	18.0%	16.4%	11.9%	8.7%

Figure 3-7: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Snake management unit's group four. a) PCA: W_H20_TMAX_0709_t. contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 28.7 to 8.7%. Nine variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



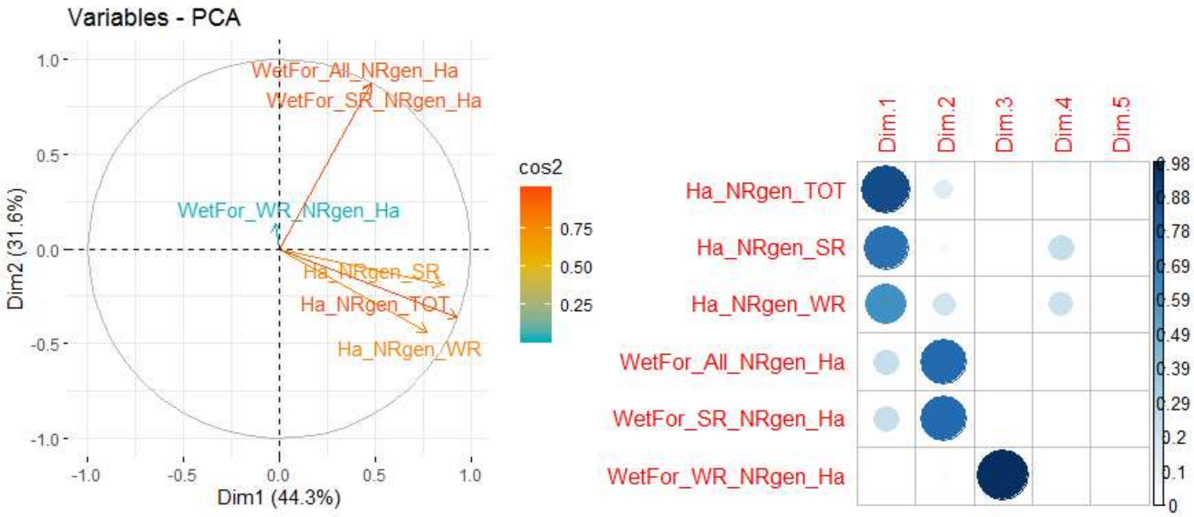
26.2%	12.9%	12.5%	11.1%	7.9%

Figure 3-8: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Snake management unit's group five.
a) PCA: W_J_WSI_NoStandard_t. contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 26.2 to 7.9%. Fourteen variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



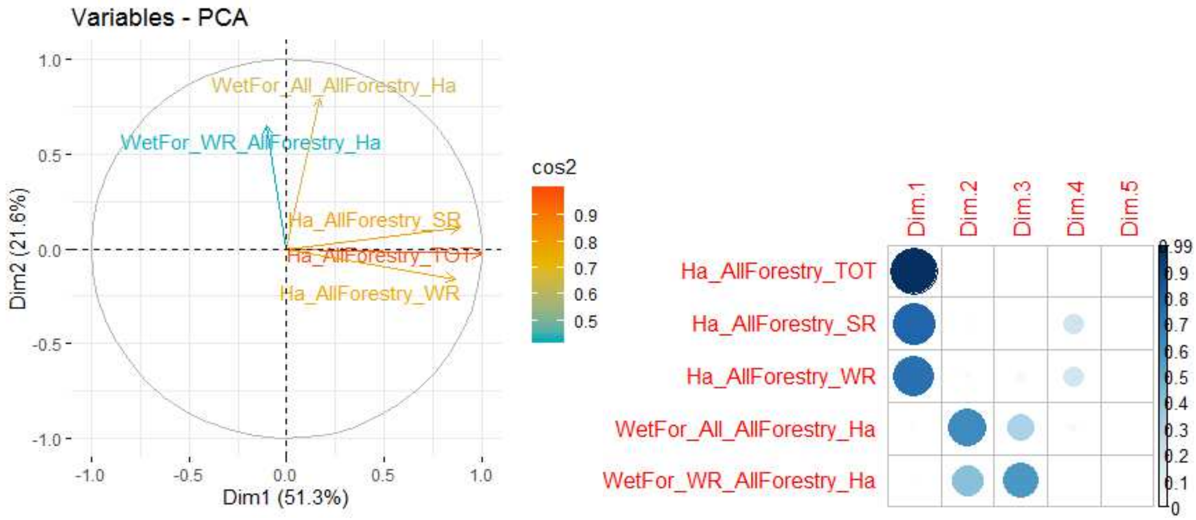
61.0%	26.2%	12.7%	0%

Figure 3-9: Visualization of the PCA plot based on cos^2 values correlation between first two principal components is featured inside the correlation circle for Snake management unit's group ten.
a) PCA: Ha_Regen_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to four i.e., 61 to 0%. Four variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



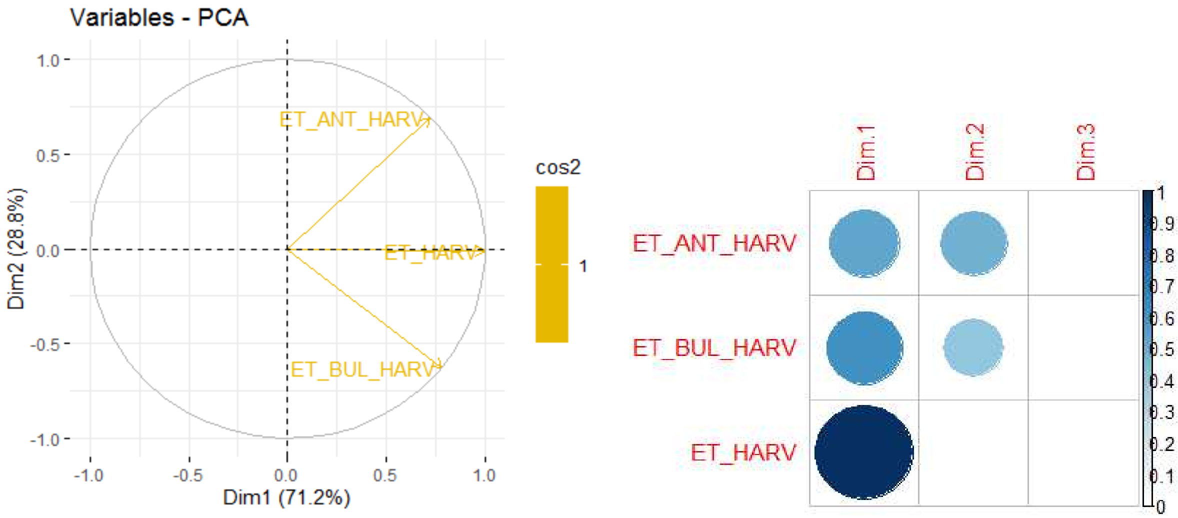
44.3%	31.6%	16.6%	8%

Figure 3-10: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Snake management unit's group eleventh. a) PCA: Ha_NRgen_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to four i.e., 44.3 to 8%. Six variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



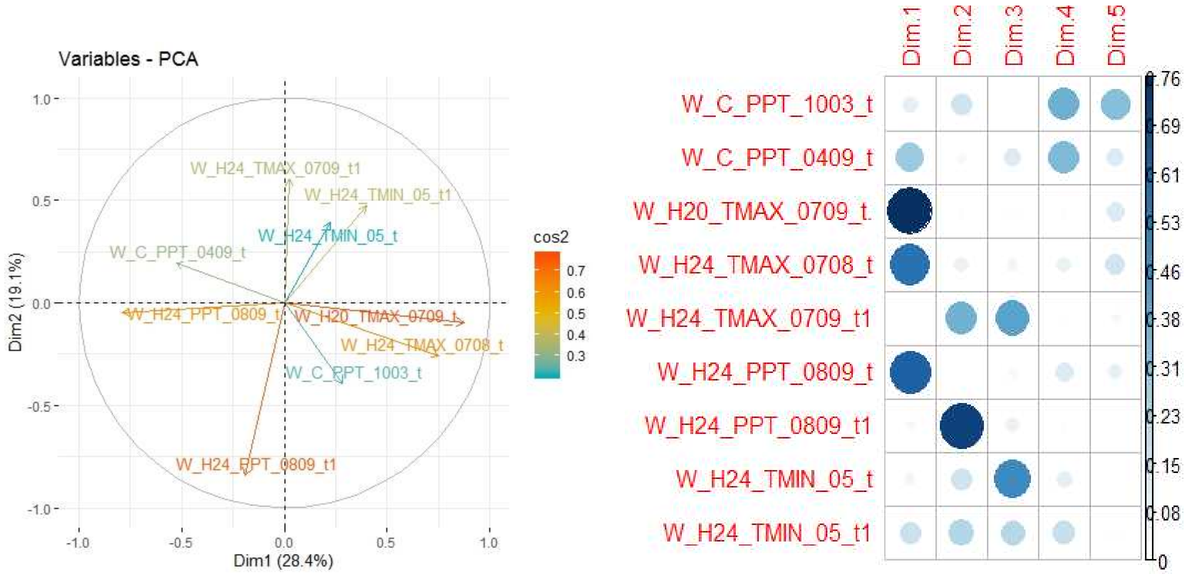
51.3%	21.6%	18.8%	8.3%

Figure 3-11: Visualization of the PCA plot based on cos^2 values correlation between first two principal components is featured inside the correlation circle for Snake management unit's group thirteenth. a) PCA: Ha_AllForestry_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to four i.e., 51.3 to 8.3%. Five variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



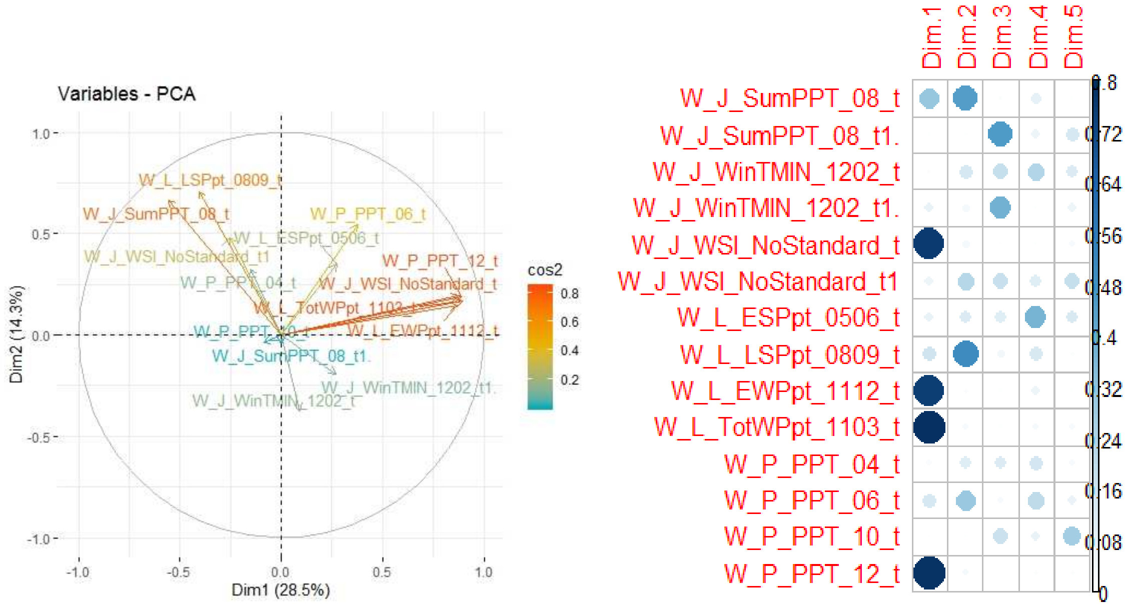
71.1%	29.0%	0%

Figure 3-12: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Desolation management unit's group three. a) PCA: ET_HARV contributed the most to dimension one. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to three i.e., 71.3 to 0%. Three variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



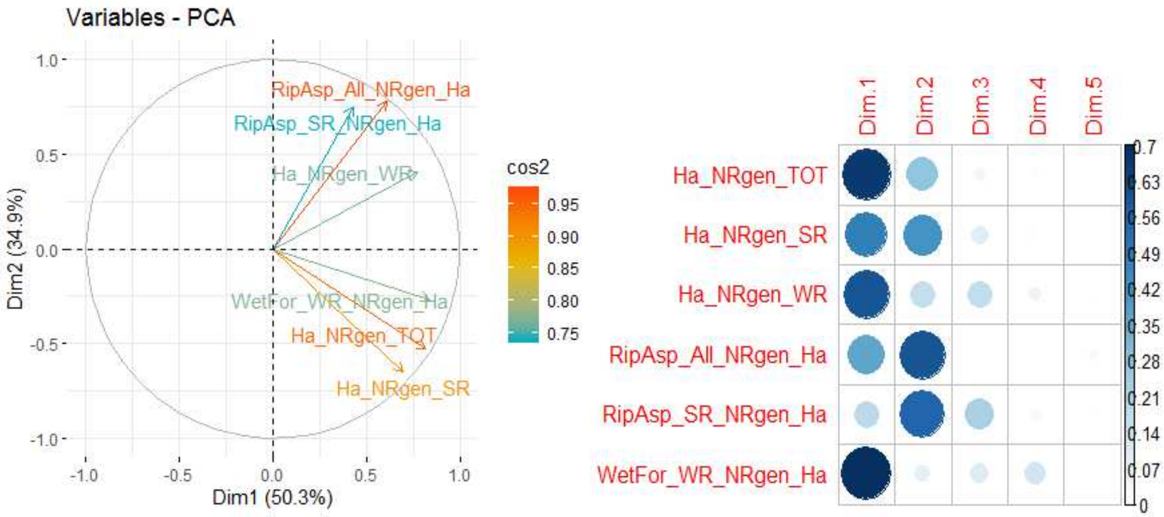
28.4%	19.0%	15.4%	13.1%	9.1%

Figure 3-13: Visualization of the PCA plot based on cos^2 values correlation between first two principal components is featured inside the correlation circle for Desolation management unit's group four. a) PCA: W_H20_TMAX_0709_t. contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 28.4 to 9.1%. Nine variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



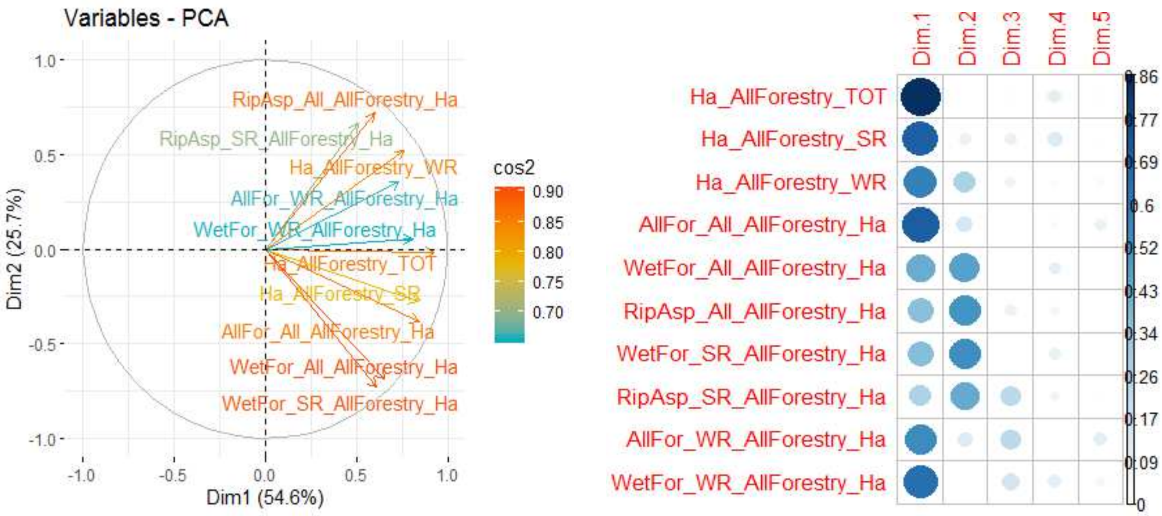
28.4%	14.3%	12.1%	10.9%	7.7%

Figure 3-14: Visualization of the PCA plot based on cos^2 values correlation between first two principal components is featured inside the correlation circle for Desolation management unit's group five. a) PCA: W_J_WSI_NoStandard_t contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 28.4 to 7.7%. Fourteen variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



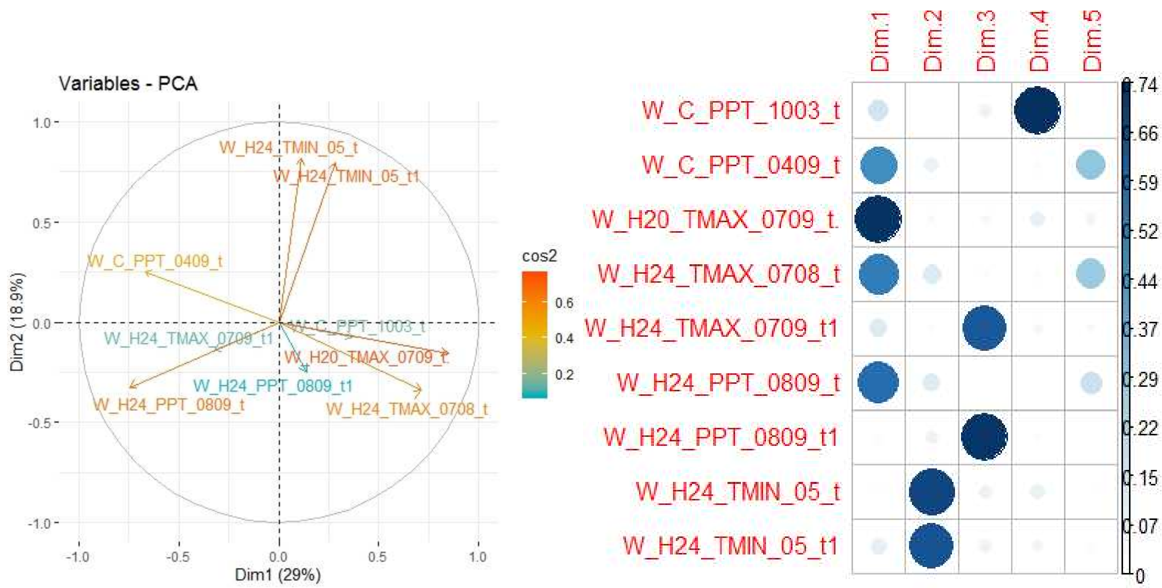
50.3%	34.89%	10.3%	0.8%

Figure 3-15: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Desolation management unit's group eleventh. a) PCA: Ha_NRgen_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to four i.e., 50.3 to 0.8%. Six variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



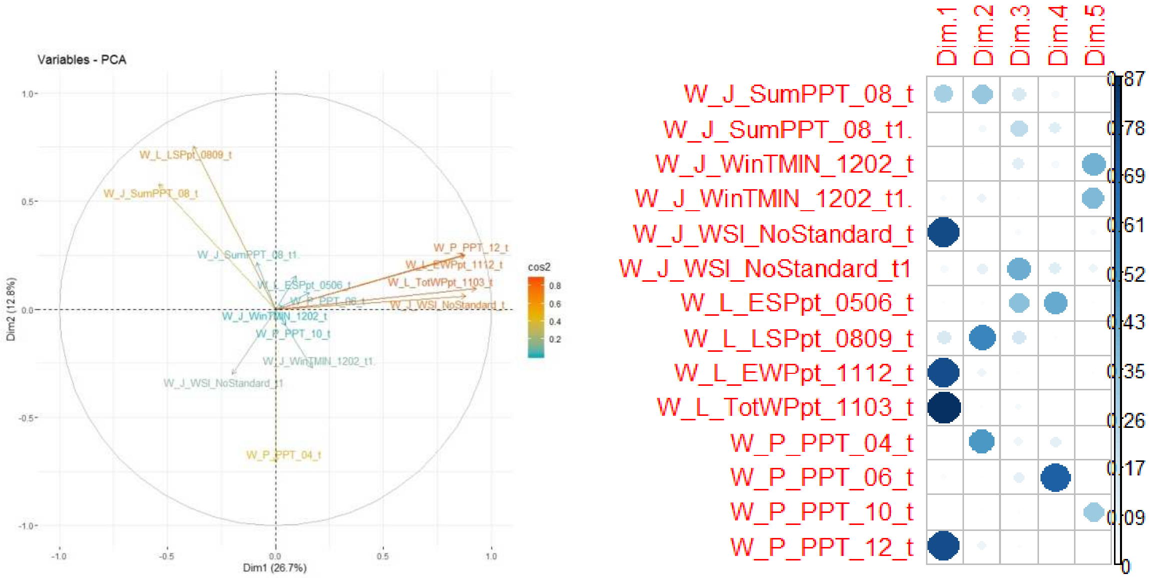
54.6%	25.7%	8.6%	6.3%	0%

Figure 3-16: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Desolation management unit's group thirteenth. a) PCA: Ha_AllForestry_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 54.6 to 0%. Ten variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



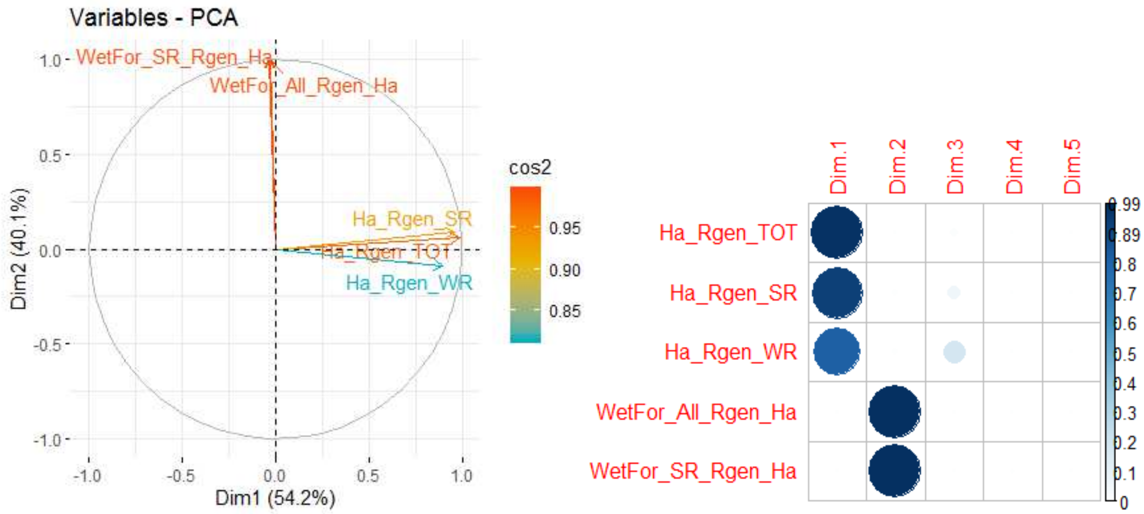
28.9%	18.9%	17.3%	11.3%	9.0%

Figure 3-17: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Wenaha management unit's group four. a) PCA: W_H20_TMAX_0709_t. contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 28.9 to 9.0%. Nine variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



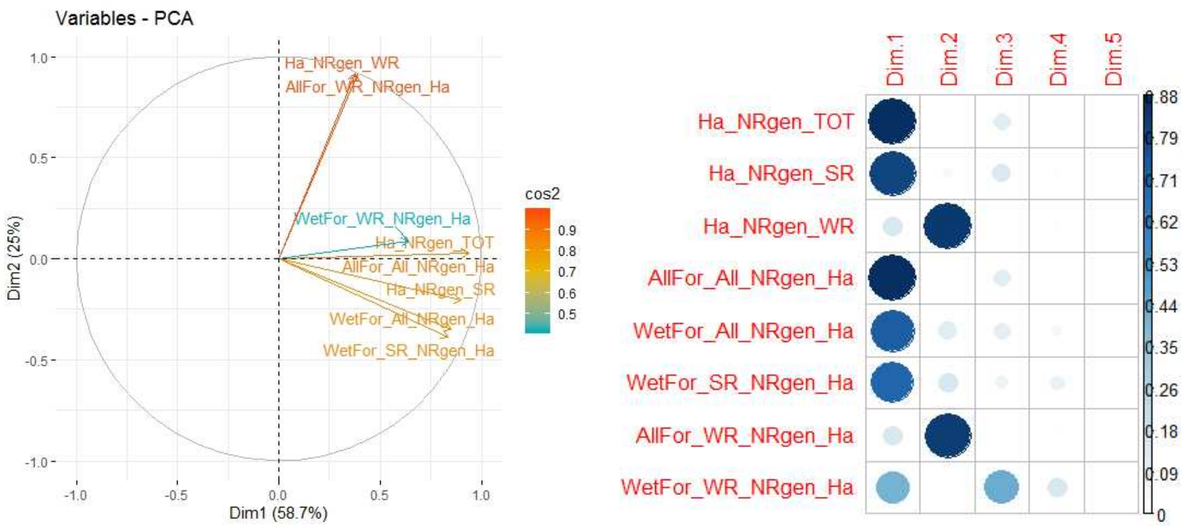
26.6%	12.8%	12.3%	11.4%	8.8%

Figure 3-18: Visualization of the PCA plot based on cos² values correlation between first two principal components is featured inside the correlation circle for Wenaha management unit's group five. a) PCA: W_J_WSI_NoStandard_t and W_L_TotWppt_1103_t contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 26.6 to 8.8%. Fourteen variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



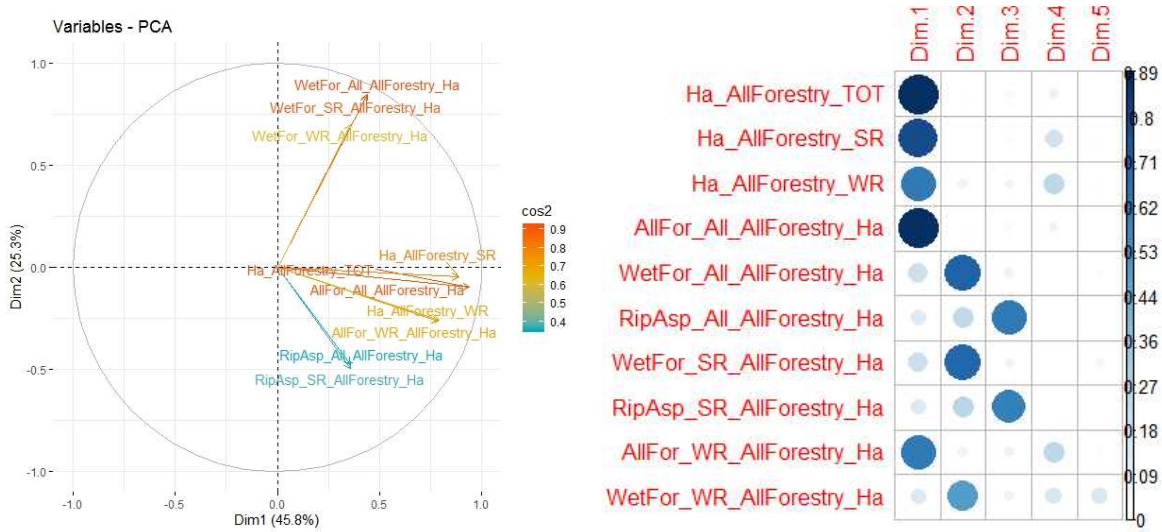
54.2%	40.1%	5.5%	0.2%	0%

Figure 3-19: Visualization of the PCA plot based on cos^2 values correlation between first two principal components is featured inside the correlation circle for Wenaha management unit's group ten. a) PCA: Ha_Regen_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 54.2 to 0%. Five variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



58.7%	25.0%	12.2%	0.1%	0%

Figure 3-20: Visualization of the PCA plot based on $\cos^2$ values correlation between first two principal components is featured inside the correlation circle for Wenaha management unit's group eleventh. a) PCA: Ha_NRgen_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 58.7 to 0%. Eight variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.



45.8%	25.3%	16.1%	9.4%	2.7%

Figure 3-21: Visualization of the PCA plot based on cos[2] values correlation between first two principal components is featured inside the correlation circle for Wenaha management unit's group thirteenth. a) PCA: Ha_AllForestry_TOT contributed the most to dimension one and two. b) Correlation matrix plot indicating the size of the correlation with the colored circles. Below is the cumulative variance percentage showing that it decreased from component one to five i.e., 45.8 to 2.7%. Ten variables contributing to the principal components were displayed. Group descriptions can be found in Table A1-1.

Table A1-19: Variables obtained from PCA with respect to seven different groups were then considered for CCA and Multiple regression analysis with respect to the Snake management unit. Group descriptions can be found in Table A1-1.

Group	Snake Management Unit
1:Population Size/growth Factors	N_Obs, B:100C, CALF:100C
3:Mortality Factors	ET_HARV
4:Weather Factors	W_H20_TMAX_0709_t.
5:Weather Factors	W_J_WSI_No Standard _t, W_L_EWPpt_1112_t
10: Silviculture Factors (Regeneration)	Ha_Rgen_TOT
11: Silviculture Factors (Non-Regeneration)	Ha_NRgen_TOT
13: Silviculture Factors (Forestry)	Ha_AllForestry_TOT

Table A1-20: Variables obtained from PCA with respect to seven different groups were then considered for CCA and Multiple regression analysis with respect to the Desolation management unit. Group descriptions can be found in Table A1-1.

Group	Desolation Management Unit
1:Population Size/growth Factors	N_Obs, B:100C, CALF:100C
3:Mortality Factors	ET_HARV
4:Weather Factors	W_H20_TMAX_0709_t.
5:Weather Factors	W_J_WSI_NoStandard_t, W_L_TotWPpt_1103_t
10: Silviculture Factors (Regeneration)	Ha_Rgen_TOT
11: Silviculture Factors (Non-Regeneration)	Ha_NRgen_TOT
13: Silviculture Factors (Forestry)	Ha_AllForestry_TOT

Table A1-21: Variables obtained from PCA with respect to seven different groups were then considered for CCA and Multiple regression analysis with respect to the Wenaha management unit. Group descriptions can be found in Table A1-1.

Group	Wenaha Management Unit
1:Population Size/growth Factors	N_Obs, B:100C, CALF:100C
3:Mortality Factors	ET_HARV
4:Weather Factors	W_H20_TMAX_0709_t., W_H24_TMIN_05_t
5:Weather Factors	W_J_WSI_NoStandard_t, W_L_TotWPpt_1103_t
10: Silviculture Factors (Regeneration)	Ha_Rgen_TOT
11: Silviculture Factors (Non- Regeneration)	Ha_NRgen_TOT
13: Silviculture Factors (Forestry)	Ha_AllForestry_TOT

Table A1-22: Potential variables identified for the Snake management unit by the PCA were analyzed using CCA. Dimension three belonging to CALF:100C was not analyzed as tests of canonical dimensions displayed that dimension three by itself was not significant. Bolded variable contained high correlation with one elk variable.

Standardized Canonical Coefficients: Dimensions			
	1	2	3
Elk Variables			
N_Obs	**-1.09**	0.76	-0.17
B:100C	0.17	-0.85	1.34
CALF:100C	-0.35	-1.02	-0.11
Environmental Variables			
COUGAR_POP_RECON1	**-0.91**	0.12	0.10
ET_HARV	-0.23	-0.66	0.64
W_H20_TMAX_0709_t.	-0.22	0.20	0.27
W_J_WSI_NoStandard_t	0.15	-0.76	0.33
W_L_EWPpt_1112_t	0.02	0.13	-0.20
Ha_Rgen_TOT	0.04	0.30	-0.21
Ha_NRgen_TOT	-0.19	0.39	0.74
Ha_AllForestry_TOT	0.00	-1.08	-1.20

Table A1-23: Potential variables identified for the Desolation management unit by the PCA were analyzed using CCA. Dimension three belonging to CALF:100C was not analyzed as tests of canonical dimensions displayed that dimension three by itself was not significant. Bolded variables contained high correlation with one elk variable.

Standardized Canonical Coefficients: Dimensions			
	1	2	3
Elk Variables			
N_Obs	**-0.92**	-0.11	-0.43
B:100C	-0.21	-0.80	0.58
CALF:100C	0.20	-0.50	-0.89
Environmental Variables			
COUGAR_POP_RECON1	**-0.52**	-0.43	-0.09
ET_HARV	-0.14	-0.15	-0.70
W_H20_TMAX_0709_t.	-0.38	0.15	0.32
W_J_WSI_NoStandard_t	**-1.14**	0.59	-0.17
W_L_TotWPpt_1103_t	**1.17**	-0.84	-0.13
Ha_Rgen_TOT	-0.28	1.14	-0.37
Ha_NRgen_TOT	-0.23	0.55	-0.61
Ha_AllForestry_TOT	0.31	-0.96	0.53

Table A1-24: Potential variables identified for the Wenaha management unit by the PCA were analyzed using CCA. Dimension three belonging to CALF:100C was not analyzed as tests of canonical dimensions displayed that dimension three by itself was not significant. Bolded variables contained high correlation with one elk variable.

	Standardized Canonical Coefficients: Dimensions		
	1	2	3
Elk Variables			
N_Obs	0.06	-0.32	2.12
B:100C	-0.43	1.12	1.15
CALF:100C	**0.59**	1.37	-0.93
Environmental Variables			
COUGAR_POP_RECON1	-0.19	-0.80	-0.04
ET_HARV	**0.82**	-0.62	0.78
W_H20_TMAX_0709_t.	-0.03	0.12	0.59
W_H24_TMIN_05_t	0.01	0.56	0.79
W_L_TotWPpt_1103_t	-0.20	0.03	0.67
W_J_WSI_NoStandard_t	0.03	0.01	-0.79
Ha_Rgen_TOT	**1.17**	2.64	-1.85
Ha_NRgen_TOT	**0.78**	1.30	-1.87
Ha_AllForestry_TOT	**-1.33**	-2.88	1.99

Table A1-25: Multiple regression results for the Snake management unit with the recruitment of bulls per 100 cows observed (B:100C) in annual surveys as the dependent variable with other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	2.482	0.0187
COUGAR_POP_RECON1	2.468	0.0193
ET_HARV	1.803	0.0811
Ha_Rgen_TOT	-1.948	0.0605
F-stat	4.247	
Adj-R^2	0.2227	
p-value	0.01263	

Table A1-26: Anova results (Type II tests) for the multiple regression described in Table A1-25 for the Snake management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
COUGAR_POP_RECON1	68.45	1	6.0896	0.01932
ET_HARV	36.54	1	3.2506	0.08113
Ha_Rgen_TOT	42.65	1	3.7942	0.06053
Residuals	348.46	31		

Table A1-27: Multiple regression result for the Snake management unit with the recruitment of calves per 100 cows observed (CALF:100C) in annual surveys as dependent and other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	14.869	<2e-16
Ha_Rgen_TOT	2.235	0.0307
Ha_NRgen_TOT	1.687	0.0989
F-stat	5.774	
Adj-R^2	0.175	
p-value	0.006009	

Table A1-28: Anova results (Type II tests) for the multiple regression described in Table A1-27 for the Snake management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
Ha_Rgen_TOT	556.5	1	4.9960	0.03065
Ha_NRgen_TOT	316.9	1	2.8447	0.09892
Residuals	4789.9	43		

Table A1-29: Multiple regression result for the Desolation management unit with the recruitment of bulls per 100 cows observed (B:100C) in annual surveys as dependent and other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	8.126	2.66e-10
Ha_NRgen_TOT	2.980	0.00468
F-statistic	8.88	
Adj-R^2	0.149	
p-value	0.004681	

Table A1-30: Anova results (Type II tests) for the multiple regression described in Table A1-29 for the Desolation management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
Ha_NRgen_TOT	297.7	1	8.8802	0.004681
Residuals	1475.0	44		

Table A1-31: Multiple regression result for the Desolation management unit with the recruitment of calves per 100 cows observed (CALF:100C) in annual surveys as dependent and other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	22.819	<2e-16
Ha_Rgen_TOT	-1.395	0.17
F-statistic	1.945	
Adj-R^2	0.02056	
p-value	0.1701	

Table A1-32: Anova results (Type II tests) for the multiple regression described in Table A1-31 for the Desolation management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
Ha_Rgen_TOT	196.1	1	1.9449	0.1701
Residuals	4437.4	44		

Table A1-33: Multiple regression result for the Wenaha management unit with the number of elk observed (N_Obs) in annual surveys as dependent and other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	5.799	9.84e-07
ET_HARV	4.109	0.000197
Ha_Rgen_TOT	1.864	0.069806
F-statistic	15.02	
Adj-R^2	0.4062	
p-value	1.456e-05	

Table A1-34: Anova results (Type II tests) for the multiple regression described in Table A1-33 for the Wenaha management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
ET_HARV	8447392	1	16.883	0.0001975
Ha_Rgen_TOT	1739221	1	3.476	0.0698056
Residuals	19513881	39		

Table A1-35: Multiple regression result for the Wenaha management unit with the recruitment of bulls per 100 cows observed (B:100C) in annual surveys as dependent and other independent variables.

Independent variables	*t*-value	*p*-value
Intercept	13.324	< 2e-16
ET_HARV	-6.949	1.72e-08
F-statistic	48.29	
Adj-R^2	0.5237	
p-value	1.72e-08	

Table A1-36: Anova results (Type II tests) for the multiple regression described in Table A1-35 for the Wenaha management unit.

Independent variables	Sum Sq.	Df	*F*-value	*p*-value
ET_HARV	732.48	1	48.288	1.72e-08
Residuals	637.11	42		

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	N_Obs	B:100C	CALF:100C
1.	Snake	1962		21.33	53.33
2.	Snake	1963		18.75	51.5
3.	Snake	1964	1137	22.22	58.97
4.	Snake	1965	1111	19.84	47.45
5.	Snake	1966	1180	14.69	45.5
6.	Snake	1967	1477	9.09	59.74
7.	Snake	1968	1459	6.89	45.81
8.	Snake	1969	1775	1.28	40.43
9.	Snake	1970	1723	3.86	48.07
10.	Snake	1971	1642	8.43	36.75
11.	Snake	1972	1788	6.02	38.35
12.	Snake	1973	1949	3.98	41.19
13.	Snake	1974	1924	6.69	41.84
14.	Snake	1975	1838	5.69	36.97
15.	Snake	1976	1787	1.09	34.42
16.	Snake	1977	1640	3	30.4
17.	Snake	1978	2779	11	34.98
18.	Snake	1979	2815	9.19	34.38
19.	Snake	1980	3375	11	36.96
20.	Snake	1981	2607	14.15	25.61
21.	Snake	1982	2703	8.81	33.68
22.	Snake	1983	3181	11.15	28
23.	Snake	1984	3323	10.74	27.73
24.	Snake	1985	3552	10.28	37.9
25.	Snake	1986	3705	12.57	37.33
26.	Snake	1987	4073	13.02	34.3
27.	Snake	1988	3215	11.94	35.32
28.	Snake	1989	3926	11.43	17.24
29.	Snake	1990	3420	10.75	25.19
30.	Snake	1991	3435	8.34	31.66
31.	Snake	1992	3582	14.22	33.78
32.	Snake	1993	3866	15.73	24.87
33.	Snake	1994	3154	13.15	33.01
34.	Snake	1995	3104	13.37	31.24
35.	Snake	1996	2302	14.01	17.63
36.	Snake	1997	2227	8.32	25.32
37.	Snake	1998	1930	8.17	19.6
38.	Snake	1999	2320	8.02	18.98
39.	Snake	2000	2163	7.92	13.11
40.	Snake	2001	2508	7.2	18.31
41.	Snake	2002	2368	8.73	19.71
42.	Snake	2003	2835	13.03	23.72
43.	Snake	2004	2296	13	18.9
44.	Snake	2005	2776	9	19.8
45.	Snake	2006	3310	17.01	21.43
46.	Snake	2007	3298	14.31	15.74

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	COUGAR_POP_RECON1
1.	Snake	1962	
2.	Snake	1963	
3.	Snake	1964	
4.	Snake	1965	
5.	Snake	1966	
6.	Snake	1967	
7.	Snake	1968	
8.	Snake	1969	12
9.	Snake	1970	14
10.	Snake	1971	9
11.	Snake	1972	10
12.	Snake	1973	9
13.	Snake	1974	15
14.	Snake	1975	16
15.	Snake	1976	19
16.	Snake	1977	19
17.	Snake	1978	23
18.	Snake	1979	23
19.	Snake	1980	23
20.	Snake	1981	21
21.	Snake	1982	26
22.	Snake	1983	28
23.	Snake	1984	38
24.	Snake	1985	34
25.	Snake	1986	35
26.	Snake	1987	32
27.	Snake	1988	26
28.	Snake	1989	23
29.	Snake	1990	22
30.	Snake	1991	22
31.	Snake	1992	20
32.	Snake	1993	22
33.	Snake	1994	22
34.	Snake	1995	14
35.	Snake	1996	11
36.	Snake	1997	8
37.	Snake	1998	9
38.	Snake	1999	9
39.	Snake	2000	12
40.	Snake	2001	12
41.	Snake	2002	10
42.	Snake	2003	12
43.	Snake	2004	13
44.	Snake	2005	14
45.	Snake	2006	17
46.	Snake	2007	11

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	ET_ANT_HARV	ET_BUL_HARV	ET_HARV
1.	Snake	1962		143	143
2.	Snake	1963		173	173
3.	Snake	1964		260	260
4.	Snake	1965		324	324
5.	Snake	1966	66	295	361
6.	Snake	1967	108	340	448
7.	Snake	1968	152	276	428
8.	Snake	1969	74	269	343
9.	Snake	1970	121	307	428
10.	Snake	1971	144	682	826
11.	Snake	1972	119	217	336
12.	Snake	1973	156	285	441
13.	Snake	1974	122	262	384
14.	Snake	1975	178	225	403
15.	Snake	1976	118	250	368
16.	Snake	1977	91	222	313
17.	Snake	1978	0	77	77
18.	Snake	1979	73	157	230
19.	Snake	1980	346	210	556
20.	Snake	1981	550	253	803
21.	Snake	1982	191	191	382
22.	Snake	1983	89	134	223
23.	Snake	1984	178	164	342
24.	Snake	1985			
25.	Snake	1986	246	155	401
26.	Snake	1987	138	200	338
27.	Snake	1988	233	148	381
28.	Snake	1989	273	268	541
29.	Snake	1990	309	228	537
30.	Snake	1991	314	181	495
31.	Snake	1992	395	210	605
32.	Snake	1993	310	212	522
33.	Snake	1994	353	232	585
34.	Snake	1995	385	242	627
35.	Snake	1996	372	210	582
36.	Snake	1997	288	188	476
37.	Snake	1998	105	75	180
38.	Snake	1999	16	75	91
39.	Snake	2000	29	119	148
40.	Snake	2001	3	121	124
41.	Snake	2002	16	141	157
42.	Snake	2003	36	156	192
43.	Snake	2004	7	231	238
44.	Snake	2005	11		
45.	Snake	2006	0		
46.	Snake	2007	0		

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_C_PPT_1003_t	W_C_PPT_0409_t
1.	Snake	1962	512.44	251.75
2.	Snake	1963	511.37	224.72
3.	Snake	1964	517	270.14
4.	Snake	1965	707.75	335.14
5.	Snake	1966	423.86	332.82
6.	Snake	1967	604.52	152.57
7.	Snake	1968	535.93	216.29
8.	Snake	1969	595.75	297.62
9.	Snake	1970	623	247.55
10.	Snake	1971	664.29	309.18
11.	Snake	1972	663.65	284.08
12.	Snake	1973	437.09	255.05
13.	Snake	1974	845.64	175.71
14.	Snake	1975	580.36	190.43
15.	Snake	1976	686.11	302.37
16.	Snake	1977	233.44	307.55
17.	Snake	1978	618.48	288.89
18.	Snake	1979	465.5	350.99
19.	Snake	1980	521.88	230.63
20.	Snake	1981	502.36	355.06
21.	Snake	1982	715.23	299.23
22.	Snake	1983	664.88	340.37
23.	Snake	1984	580.39	291
24.	Snake	1985	445.41	368.83
25.	Snake	1986	554.03	307.44
26.	Snake	1987	380.71	319.12
27.	Snake	1988	379.63	199.55
28.	Snake	1989	542.83	248.61
29.	Snake	1990	390.23	298.71
30.	Snake	1991	390.01	299.37
31.	Snake	1992	367.09	256.78
32.	Snake	1993	534.2	252.21
33.	Snake	1994	346.57	378.44
34.	Snake	1995	619.19	202.6
35.	Snake	1996	623.7	341.1
36.	Snake	1997	734.87	285.68
37.	Snake	1998	484.93	366.88
38.	Snake	1999	681.31	437.22
39.	Snake	2000	534.65	175.05
40.	Snake	2001	316.59	202.79
41.	Snake	2002	546.63	215.89
42.	Snake	2003	521.43	183.75
43.	Snake	2004	467.83	255.03
44.	Snake	2005	339.24	355.05
45.	Snake	2006	629.65	271.97
46.	Snake	2007	452.32	250.6

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H20_TMAX_0709_t	W_H24_TMAX_0708_t
1.	Snake	1962	26.84	30.69
2.	Snake	1963	25.5	26.37
3.	Snake	1964	26.66	27.05
4.	Snake	1965	24.45	26.5
5.	Snake	1966	23.64	26.39
6.	Snake	1967	26.87	28.08
7.	Snake	1968	29.5	30.71
8.	Snake	1969	24.73	26.73
9.	Snake	1970	25.97	27.86
10.	Snake	1971	24.94	28.62
11.	Snake	1972	25.76	29.1
12.	Snake	1973	24.42	27.3
13.	Snake	1974	25.95	28.56
14.	Snake	1975	26.02	26.69
15.	Snake	1976	25.4	26.28
16.	Snake	1977	24.6	25.08
17.	Snake	1978	24.7	27.38
18.	Snake	1979	23.6	25.62
19.	Snake	1980	27.11	28
20.	Snake	1981	24.2	25.48
21.	Snake	1982	26.48	28.08
22.	Snake	1983	24.19	26.14
23.	Snake	1984	24.08	26.06
24.	Snake	1985	25.22	28.06
25.	Snake	1986	24.16	27.89
26.	Snake	1987	23.82	27.17
27.	Snake	1988	25.48	25.6
28.	Snake	1989	25.82	27.71
29.	Snake	1990	24.64	25.89
30.	Snake	1991	27.11	27.45
31.	Snake	1992	26.93	28.35
32.	Snake	1993	24.37	25.95
33.	Snake	1994	21.95	21.71
34.	Snake	1995	27.5	28.93
35.	Snake	1996	24.63	25.19
36.	Snake	1997	25.36	28.34
37.	Snake	1998	24.66	25.86
38.	Snake	1999	27.83	29.4
39.	Snake	2000	25.65	27.38
40.	Snake	2001	25.63	28.58
41.	Snake	2002	27.46	28.46
42.	Snake	2003	26.21	27.76
43.	Snake	2004	27.9	30.27
44.	Snake	2005	25.07	27.68
45.	Snake	2006	26.15	28.67
46.	Snake	2007	26.93	29.28

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_TMAX_0709_t1	W_H24_PPT_0809_t
1.	Snake	1962	26.64	25.81
2.	Snake	1963	26.84	26.37
3.	Snake	1964	25.5	22.02
4.	Snake	1965	26.66	37.42
5.	Snake	1966	24.45	49.28
6.	Snake	1967	23.64	22.18
7.	Snake	1968	26.87	14.04
8.	Snake	1969	29.5	59.8
9.	Snake	1970	24.73	18.31
10.	Snake	1971	25.97	37.4
11.	Snake	1972	24.94	26.58
12.	Snake	1973	25.76	30.79
13.	Snake	1974	24.42	29.15
14.	Snake	1975	25.95	5.59
15.	Snake	1976	26.02	33.2
16.	Snake	1977	25.4	43.81
17.	Snake	1978	24.6	65.66
18.	Snake	1979	24.7	49.93
19.	Snake	1980	23.6	21.43
20.	Snake	1981	27.11	40.98
21.	Snake	1982	24.2	18.8
22.	Snake	1983	26.48	38.46
23.	Snake	1984	24.19	31.05
24.	Snake	1985	24.08	39.23
25.	Snake	1986	25.22	65.78
26.	Snake	1987	24.16	52.38
27.	Snake	1988	23.82	7.59
28.	Snake	1989	25.48	14.57
29.	Snake	1990	25.82	62.71
30.	Snake	1991	24.64	20.49
31.	Snake	1992	27.11	2.79
32.	Snake	1993	26.93	20.41
33.	Snake	1994	24.37	20.42
34.	Snake	1995	21.95	8.18
35.	Snake	1996	27.5	29.3
36.	Snake	1997	24.63	15.36
37.	Snake	1998	25.36	32.95
38.	Snake	1999	24.66	41.54
39.	Snake	2000	27.83	21.25
40.	Snake	2001	25.65	29.84
41.	Snake	2002	25.63	6.97
42.	Snake	2003	27.46	21.03
43.	Snake	2004	26.21	21.72
44.	Snake	2005	27.9	51.05
45.	Snake	2006	25.07	8.08
46.	Snake	2007	26.15	28.67

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_PPT_0809_t1	W_H24_TMIN_05_t
1.	Snake	1962	44.53	2.6
2.	Snake	1963	25.81	2.43
3.	Snake	1964	26.37	3.42
4.	Snake	1965	22.02	1.94
5.	Snake	1966	37.42	1.5
6.	Snake	1967	49.28	2.8
7.	Snake	1968	22.18	2.22
8.	Snake	1969	14.04	2.3
9.	Snake	1970	59.8	4.23
10.	Snake	1971	18.31	2.94
11.	Snake	1972	37.4	3.76
12.	Snake	1973	26.58	3.23
13.	Snake	1974	30.79	3.32
14.	Snake	1975	29.15	1.84
15.	Snake	1976	5.59	1.96
16.	Snake	1977	33.2	2.62
17.	Snake	1978	43.81	2.65
18.	Snake	1979	65.66	2.83
19.	Snake	1980	49.93	3.88
20.	Snake	1981	21.43	3.94
21.	Snake	1982	40.98	3.93
22.	Snake	1983	18.8	2.66
23.	Snake	1984	38.46	3.85
24.	Snake	1985	31.05	1.97
25.	Snake	1986	39.23	4.04
26.	Snake	1987	65.78	3.45
27.	Snake	1988	52.38	5.58
28.	Snake	1989	7.59	3.65
29.	Snake	1990	14.57	2.77
30.	Snake	1991	62.71	2.62
31.	Snake	1992	20.49	2.19
32.	Snake	1993	2.79	5.04
33.	Snake	1994	20.41	6.45
34.	Snake	1995	20.42	4.38
35.	Snake	1996	8.18	3.59
36.	Snake	1997	29.3	2.32
37.	Snake	1998	15.36	5.25
38.	Snake	1999	32.95	4.78
39.	Snake	2000	41.54	2.04
40.	Snake	2001	21.25	4.34
41.	Snake	2002	29.84	4.77
42.	Snake	2003	6.97	1.76
43.	Snake	2004	21.03	3.63
44.	Snake	2005	21.72	4.61
45.	Snake	2006	51.05	5.62
46.	Snake	2007	8.08	5.27

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_TMIN_05_t1
1.	Snake	1962	1.98
2.	Snake	1963	2.6
3.	Snake	1964	2.43
4.	Snake	1965	3.42
5.	Snake	1966	1.94
6.	Snake	1967	1.5
7.	Snake	1968	2.8
8.	Snake	1969	2.22
9.	Snake	1970	2.3
10.	Snake	1971	4.23
11.	Snake	1972	2.94
12.	Snake	1973	3.76
13.	Snake	1974	3.23
14.	Snake	1975	3.32
15.	Snake	1976	1.84
16.	Snake	1977	1.96
17.	Snake	1978	2.62
18.	Snake	1979	2.65
19.	Snake	1980	2.83
20.	Snake	1981	3.88
21.	Snake	1982	3.94
22.	Snake	1983	3.93
23.	Snake	1984	2.66
24.	Snake	1985	3.85
25.	Snake	1986	1.97
26.	Snake	1987	4.04
27.	Snake	1988	3.45
28.	Snake	1989	5.58
29.	Snake	1990	3.65
30.	Snake	1991	2.77
31.	Snake	1992	2.62
32.	Snake	1993	2.19
33.	Snake	1994	5.04
34.	Snake	1995	6.45
35.	Snake	1996	4.38
36.	Snake	1997	3.59
37.	Snake	1998	2.32
38.	Snake	1999	5.25
39.	Snake	2000	4.78
40.	Snake	2001	2.04
41.	Snake	2002	4.34
42.	Snake	2003	4.77
43.	Snake	2004	1.76
44.	Snake	2005	3.63
45.	Snake	2006	4.61
46.	Snake	2007	5.62

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_SumPPT_08_t	W_J_SumPPT_08_t1
1.	Snake	1962	16.3	62.72
2.	Snake	1963	18.69	16.3
3.	Snake	1964	14.33	18.69
4.	Snake	1965	40.97	14.33
5.	Snake	1966	76.27	40.97
6.	Snake	1967	18.66	76.27
7.	Snake	1968	3.21	18.66
8.	Snake	1969	68.24	3.21
9.	Snake	1970	0	68.24
10.	Snake	1971	0	0
11.	Snake	1972	10.2	0
12.	Snake	1973	23.39	10.2
13.	Snake	1974	5.45	23.39
14.	Snake	1975	8.61	5.45
15.	Snake	1976	58.5	8.61
16.	Snake	1977	63.05	58.5
17.	Snake	1978	57	63.05
18.	Snake	1979	52.58	57
19.	Snake	1980	37.09	52.58
20.	Snake	1981	17.92	37.09
21.	Snake	1982	5.52	17.92
22.	Snake	1983	24.67	5.52
23.	Snake	1984	36.48	24.67
24.	Snake	1985	38.07	36.48
25.	Snake	1986	47.06	38.07
26.	Snake	1987	21.72	47.06
27.	Snake	1988	12.05	21.72
28.	Snake	1989	7.34	12.05
29.	Snake	1990	81.95	7.34
30.	Snake	1991	42.38	81.95
31.	Snake	1992	2.58	42.38
32.	Snake	1993	12.93	2.58
33.	Snake	1994	38.64	12.93
34.	Snake	1995	3.04	38.64
35.	Snake	1996	44.82	3.04
36.	Snake	1997	8.87	44.82
37.	Snake	1998	28.71	8.87
38.	Snake	1999	7.12	28.71
39.	Snake	2000	36.77	7.12
40.	Snake	2001	2.26	36.77
41.	Snake	2002	4.2	2.26
42.	Snake	2003	20.75	4.2
43.	Snake	2004	23.81	20.75
44.	Snake	2005	53.58	23.81
45.	Snake	2006	3.96	53.58
46.	Snake	2007	14.49	3.96

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_WinTMIN_1202_t	W_J_WinTMIN_1202_t1
1.	Snake	1962	-6.72	-4.04
2.	Snake	1963	-5.08	-6.72
3.	Snake	1964	-5.92	-5.08
4.	Snake	1965	-5.07	-5.92
5.	Snake	1966	-5.28	-5.07
6.	Snake	1967	-3.17	-5.28
7.	Snake	1968	-5.05	-3.17
8.	Snake	1969	-7.28	-5.05
9.	Snake	1970	-3.39	-7.28
10.	Snake	1971	-4.95	-3.39
11.	Snake	1972	-6.26	-4.95
12.	Snake	1973	-6.66	-6.26
13.	Snake	1974	-4.41	-6.66
14.	Snake	1975	-5.64	-4.41
15.	Snake	1976	-4.73	-5.64
16.	Snake	1977	-5.59	-4.73
17.	Snake	1978	-3.05	-5.59
18.	Snake	1979	-9.15	-3.05
19.	Snake	1980	-4.4	-9.15
20.	Snake	1981	-2.69	-4.4
21.	Snake	1982	-5.43	-2.69
22.	Snake	1983	-2.98	-5.43
23.	Snake	1984	-7.33	-2.98
24.	Snake	1985	-9.09	-7.33
25.	Snake	1986	-5.13	-9.09
26.	Snake	1987	-5.51	-5.13
27.	Snake	1988	-5.15	-5.51
28.	Snake	1989	-7.17	-5.15
29.	Snake	1990	-4.67	-7.17
30.	Snake	1991	-6.23	-4.67
31.	Snake	1992	-2.85	-6.23
32.	Snake	1993	-7.36	-2.85
33.	Snake	1994	-4.17	-7.36
34.	Snake	1995	-3.42	-4.17
35.	Snake	1996	-4.99	-3.42
36.	Snake	1997	-4.7	-4.99
37.	Snake	1998	-3.58	-4.7
38.	Snake	1999	-4.61	-3.58
39.	Snake	2000	-3.49	-4.61
40.	Snake	2001	-5.01	-3.49
41.	Snake	2002	-5.3	-5.01
42.	Snake	2003	-2.47	-5.3
43.	Snake	2004	-3.67	-2.47
44.	Snake	2005	-2.89	-3.67
45.	Snake	2006	-4.27	-2.89
46.	Snake	2007	-4.22	-4.27

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_WSI_NoStandard_t	W_J_WSI_NoStandard_t1
1.	Snake	1962	113.91	107.37
2.	Snake	1963	114.73	113.91
3.	Snake	1964	109.88	114.73
4.	Snake	1965	244.43	109.88
5.	Snake	1966	95.46	244.43
6.	Snake	1967	138.82	95.46
7.	Snake	1968	141.11	138.82
8.	Snake	1969	180.44	141.11
9.	Snake	1970	188.57	180.44
10.	Snake	1971	156.14	188.57
11.	Snake	1972	177.33	156.14
12.	Snake	1973	108.23	177.33
13.	Snake	1974	182.78	108.23
14.	Snake	1975	194.53	182.78
15.	Snake	1976	188.44	194.53
16.	Snake	1977	45.6	188.44
17.	Snake	1978	205.42	45.6
18.	Snake	1979	156.4	205.42
19.	Snake	1980	135.28	156.4
20.	Snake	1981	146.01	135.28
21.	Snake	1982	203.64	146.01
22.	Snake	1983	140.31	203.64
23.	Snake	1984	143.86	140.31
24.	Snake	1985	99.64	143.86
25.	Snake	1986	151.01	99.64
26.	Snake	1987	84.65	151.01
27.	Snake	1988	120.97	84.65
28.	Snake	1989	118	120.97
29.	Snake	1990	87.02	118
30.	Snake	1991	82.28	87.02
31.	Snake	1992	70.75	82.28
32.	Snake	1993	130.66	70.75
33.	Snake	1994	116.28	130.66
34.	Snake	1995	131.47	116.28
35.	Snake	1996	184.14	131.47
36.	Snake	1997	198.05	184.14
37.	Snake	1998	119.32	198.05
38.	Snake	1999	172.59	119.32
39.	Snake	2000	159.63	172.59
40.	Snake	2001	78.1	159.63
41.	Snake	2002	130.46	78.1
42.	Snake	2003	178.47	130.46
43.	Snake	2004	156.92	178.47
44.	Snake	2005	64.76	156.92
45.	Snake	2006	132.08	64.76
46.	Snake	2007	117.83	132.08

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_L_ESPpt_0506_t	W_L_LSPpt_0809_t
1.	Snake	1962	108.97	52.14
2.	Snake	1963	108.51	53.07
3.	Snake	1964	115.82	44.17
4.	Snake	1965	146.41	74.87
5.	Snake	1966	100.61	98.92
6.	Snake	1967	64.01	44.28
7.	Snake	1968	101.92	28.39
8.	Snake	1969	100.82	120.41
9.	Snake	1970	121.35	37.05
10.	Snake	1971	118.26	75.5
11.	Snake	1972	149.15	53.55
12.	Snake	1973	89.9	61.49
13.	Snake	1974	72.74	59.02
14.	Snake	1975	57.41	11.23
15.	Snake	1976	102.67	66.34
16.	Snake	1977	99.84	88.05
17.	Snake	1978	107.05	131.77
18.	Snake	1979	94.74	99.68
19.	Snake	1980	84.47	42.98
20.	Snake	1981	172.01	82.02
21.	Snake	1982	157.02	38.15
22.	Snake	1983	88.45	77.29
23.	Snake	1984	95.9	62.6
24.	Snake	1985	172.52	78.82
25.	Snake	1986	108.22	132.2
26.	Snake	1987	92.55	105.79
27.	Snake	1988	101.15	15.16
28.	Snake	1989	128.1	28.96
29.	Snake	1990	121.87	125.16
30.	Snake	1991	144.4	41.57
31.	Snake	1992	159.29	5.63
32.	Snake	1993	77.74	40.66
33.	Snake	1994	155.38	40.77
34.	Snake	1995	101.07	16.25
35.	Snake	1996	131.04	58.6
36.	Snake	1997	121.06	31.15
37.	Snake	1998	96.27	66.68
38.	Snake	1999	231.86	83.49
39.	Snake	2000	78.24	41.91
40.	Snake	2001	93.28	59.9
41.	Snake	2002	79.81	14.32
42.	Snake	2003	74.1	41.98
43.	Snake	2004	98.14	43.66
44.	Snake	2005	174.46	102.65
45.	Snake	2006	156.51	16.22
46.	Snake	2007	98.57	57.02

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_L_EWPpt_1112_t	W_L_TotWPpt_1103_t
1.	Snake	1962	158.44	334.55
2.	Snake	1963	145.74	311.37
3.	Snake	1964	148.16	353.46
4.	Snake	1965	300.01	501.62
5.	Snake	1966	83.31	301.41
6.	Snake	1967	186.94	410.96
7.	Snake	1968	132.16	327.2
8.	Snake	1969	191.03	402.61
9.	Snake	1970	113.06	420.18
10.	Snake	1971	187.42	440.13
11.	Snake	1972	198.53	472.47
12.	Snake	1973	162.81	300.74
13.	Snake	1974	322.53	605.25
14.	Snake	1975	147.39	430.99
15.	Snake	1976	189.48	424.7
16.	Snake	1977	42.92	161.08
17.	Snake	1978	252.9	442.75
18.	Snake	1979	137.45	347.24
19.	Snake	1980	106.77	345.79
20.	Snake	1981	178.54	367.49
21.	Snake	1982	208.71	487.81
22.	Snake	1983	153.26	421.98
23.	Snake	1984	205.71	423.37
24.	Snake	1985	172.73	285.29
25.	Snake	1986	108.29	377.32
26.	Snake	1987	101.56	282.88
27.	Snake	1988	115.25	293.32
28.	Snake	1989	171.42	405.35
29.	Snake	1990	56.01	248.95
30.	Snake	1991	121.47	260.51
31.	Snake	1992	161.47	264.04
32.	Snake	1993	155.54	361.83
33.	Snake	1994	85.83	235.59
34.	Snake	1995	172.67	431.63
35.	Snake	1996	204.77	433.79
36.	Snake	1997	279.75	512.19
37.	Snake	1998	98.53	319.28
38.	Snake	1999	236.28	493.81
39.	Snake	2000	157.91	385.15
40.	Snake	2001	81.47	187.33
41.	Snake	2002	157.53	359.69
42.	Snake	2003	138.41	402.35
43.	Snake	2004	160.61	340.27
44.	Snake	2005	99.66	216.83
45.	Snake	2006	175.44	414.25
46.	Snake	2007	194.89	334.44

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_P_PPT_04_t	W_P_PPT_06_t
1.	Snake	1962	71.19	29.58
2.	Snake	1963	51.04	27.26
3.	Snake	1964	87.49	77.85
4.	Snake	1965	69.81	110.26
5.	Snake	1966	96.67	55.02
6.	Snake	1967	27.92	48.56
7.	Snake	1968	74.49	58.44
8.	Snake	1969	51.45	51.1
9.	Snake	1970	75.54	72.8
10.	Snake	1971	63.9	69.59
11.	Snake	1972	54.91	89.54
12.	Snake	1973	79.81	38.46
13.	Snake	1974	28.88	31.85
14.	Snake	1975	87.27	28.89
15.	Snake	1976	86.87	58.55
16.	Snake	1977	74.78	58.48
17.	Snake	1978	15.02	32.15
18.	Snake	1979	101.87	32.53
19.	Snake	1980	85.39	28.2
20.	Snake	1981	53.45	74.97
21.	Snake	1982	55.8	91.12
22.	Snake	1983	89.25	60.36
23.	Snake	1984	68.42	56.61
24.	Snake	1985	82.24	92.93
25.	Snake	1986	44.72	34.58
26.	Snake	1987	69.49	39.45
27.	Snake	1988	29.84	50.27
28.	Snake	1989	71.26	57.53
29.	Snake	1990	42.68	40.47
30.	Snake	1991	78.72	41.74
31.	Snake	1992	80.11	46
32.	Snake	1993	67.03	58.25
33.	Snake	1994	102.97	107.63
34.	Snake	1995	63.01	44.88
35.	Snake	1996	91.91	75.57
36.	Snake	1997	109.08	23.23
37.	Snake	1998	98.82	56.6
38.	Snake	1999	67.67	80.63
39.	Snake	2000	40.11	41.68
40.	Snake	2001	34.68	35.36
41.	Snake	2002	81.54	38.87
42.	Snake	2003	52.76	46.05
43.	Snake	2004	92.73	23.95
44.	Snake	2005	45.88	57.12
45.	Snake	2006	78.18	64.41
46.	Snake	2007	84.16	54.62

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_P_PPT_10_t	W_P_PPT_12_t
1.	Snake	1962	73.98	45.3
2.	Snake	1963	116.66	43.45
3.	Snake	1964	33.81	41.26
4.	Snake	1965	29.14	127.62
5.	Snake	1966	25.17	14.32
6.	Snake	1967	53.29	65.03
7.	Snake	1968	101.4	51.47
8.	Snake	1969	70.89	57.48
9.	Snake	1970	55.66	52.77
10.	Snake	1971	63.93	50.1
11.	Snake	1972	39.72	62.14
12.	Snake	1973	27.31	55.15
13.	Snake	1974	34.8	83.44
14.	Snake	1975	9.61	54.56
15.	Snake	1976	122.66	86.85
16.	Snake	1977	22.09	14.22
17.	Snake	1978	47.45	105.02
18.	Snake	1979	4.82	63.78
19.	Snake	1980	74.06	31.25
20.	Snake	1981	27.74	70.77
21.	Snake	1982	74.16	70.06
22.	Snake	1983	81.63	52.95
23.	Snake	1984	30.05	68.8
24.	Snake	1985	62.97	51.2
25.	Snake	1986	61.56	20.88
26.	Snake	1987	21.76	12.52
27.	Snake	1988	0	47.19
28.	Snake	1989	12.32	26.64
29.	Snake	1990	56.13	9.83
30.	Snake	1991	60.02	36.57
31.	Snake	1992	29.39	29
32.	Snake	1993	43.98	42.25
33.	Snake	1994	35.98	28.08
34.	Snake	1995	44.29	46.08
35.	Snake	1996	71.2	63.89
36.	Snake	1997	60.58	90.4
37.	Snake	1998	57.16	34.03
38.	Snake	1999	27.3	64.79
39.	Snake	2000	45.77	51.36
40.	Snake	2001	83.03	27.88
41.	Snake	2002	69.65	49.63
42.	Snake	2003	14.7	51.83
43.	Snake	2004	16.52	67.15
44.	Snake	2005	45.97	31.78
45.	Snake	2006	58.03	53.65
46.	Snake	2007	21.75	45.32

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_Rgen_TOT	Ha_Rgen_SR
1.	Snake	1962	139.96	130.05
2.	Snake	1963	228.39	202.13
3.	Snake	1964	70.73	65.85
4.	Snake	1965	483.48	36.6
5.	Snake	1966	483.06	279
6.	Snake	1967	4.4	4.4
7.	Snake	1968	0	0
8.	Snake	1969	0	0
9.	Snake	1970	322.36	180.62
10.	Snake	1971	26.89	3.96
11.	Snake	1972	28.88	28.88
12.	Snake	1973	166.84	96.35
13.	Snake	1974	0	0
14.	Snake	1975	202.79	189.72
15.	Snake	1976	213.82	168.6
16.	Snake	1977	183.35	124.27
17.	Snake	1978	242.5	242.5
18.	Snake	1979	39.14	16.42
19.	Snake	1980	679.78	210.12
20.	Snake	1981	98.03	89.16
21.	Snake	1982	0	0
22.	Snake	1983	75.07	75.07
23.	Snake	1984	0	0
24.	Snake	1985	0	0
25.	Snake	1986	0	0
26.	Snake	1987	27.44	16.57
27.	Snake	1988	0	0
28.	Snake	1989	0	0
29.	Snake	1990	44.53	0.66
30.	Snake	1991	76	20.03
31.	Snake	1992	9.5	0.08
32.	Snake	1993	0	0
33.	Snake	1994	0	0
34.	Snake	1995	18.7	18.7
35.	Snake	1996	0	0
36.	Snake	1997	0	0
37.	Snake	1998	0	0
38.	Snake	1999	34.71	34.71
39.	Snake	2000	0	0
40.	Snake	2001	0	0
41.	Snake	2002	0	0
42.	Snake	2003	0	0
43.	Snake	2004	0	0
44.	Snake	2005	0	0
45.	Snake	2006	0	0
46.	Snake	2007	0	0

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_Rgen_WR	WetFor_SR_Rgen_Ha
1.	Snake	1962	9.91	54.55
2.	Snake	1963	26.27	5.79
3.	Snake	1964	4.88	3.89
4.	Snake	1965	446.88	0
5.	Snake	1966	204.06	0
6.	Snake	1967	0	0
7.	Snake	1968	0	0
8.	Snake	1969	0	0
9.	Snake	1970	141.74	0
10.	Snake	1971	22.93	0
11.	Snake	1972	0	0
12.	Snake	1973	70.48	0
13.	Snake	1974	0	0
14.	Snake	1975	13.07	0
15.	Snake	1976	45.22	0
16.	Snake	1977	59.08	0
17.	Snake	1978	0	0
18.	Snake	1979	22.72	0
19.	Snake	1980	469.66	0
20.	Snake	1981	8.87	0
21.	Snake	1982	0	0
22.	Snake	1983	0	0
23.	Snake	1984	0	0
24.	Snake	1985	0	0
25.	Snake	1986	0	0
26.	Snake	1987	10.88	0
27.	Snake	1988	0	0
28.	Snake	1989	0	0
29.	Snake	1990	43.87	0
30.	Snake	1991	55.96	0
31.	Snake	1992	9.42	0
32.	Snake	1993	0	0
33.	Snake	1994	0	0
34.	Snake	1995	0	0
35.	Snake	1996	0	0
36.	Snake	1997	0	0
37.	Snake	1998	0	0
38.	Snake	1999	0	0
39.	Snake	2000	0	0
40.	Snake	2001	0	0
41.	Snake	2002	0	0
42.	Snake	2003	0	0
43.	Snake	2004	0	0
44.	Snake	2005	0	0
45.	Snake	2006	0	0
46.	Snake	2007	0	0

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_NRgen_TOT	Ha_NRgen_SR	Ha_NRgen_WR
1.	Snake	1962	238.02	238.02	0
2.	Snake	1963	67.64	67.64	0
3.	Snake	1964	305.35	244.59	60.75
4.	Snake	1965	76.66	47.94	28.73
5.	Snake	1966	926.35	526.37	399.98
6.	Snake	1967	122.13	64.89	57.24
7.	Snake	1968	166.43	55.8	110.63
8.	Snake	1969	29.44	29.24	0.2
9.	Snake	1970	16.22	16.22	0
10.	Snake	1971	0.52	0.52	0
11.	Snake	1972	295.76	197.6	98.16
12.	Snake	1973	350.6	218.68	131.92
13.	Snake	1974	25.87	12.99	12.88
14.	Snake	1975	122.58	108.8	13.78
15.	Snake	1976	383.5	101.1	282.4
16.	Snake	1977	254.13	133	121.13
17.	Snake	1978	389.54	304.58	84.96
18.	Snake	1979	384.97	266.68	118.29
19.	Snake	1980	111.94	91.86	20.09
20.	Snake	1981	8.68	8.68	0
21.	Snake	1982	0	0	0
22.	Snake	1983	64.48	64.48	0
23.	Snake	1984	0	0	0
24.	Snake	1985	67.57	67.57	0
25.	Snake	1986	0.54	0.54	0
26.	Snake	1987	900.56	187.73	712.84
27.	Snake	1988	6.4	6.4	0
28.	Snake	1989	30.38	30.38	0
29.	Snake	1990	0	0	0
30.	Snake	1991	9.96	9.96	0
31.	Snake	1992	448.97	392.23	56.74
32.	Snake	1993	3.63	3.63	0
33.	Snake	1994	0	0	0
34.	Snake	1995	343	272.71	70.29
35.	Snake	1996	19.8	19.12	0.69
36.	Snake	1997	0	0	0
37.	Snake	1998	0	0	0
38.	Snake	1999	130.81	19.52	111.29
39.	Snake	2000	0	0	0
40.	Snake	2001	0	0	0
41.	Snake	2002	0	0	0
42.	Snake	2003	0	0	0
43.	Snake	2004	0	0	0
44.	Snake	2005	0	0	0
45.	Snake	2006	0	0	0
46.	Snake	2007	0	0	0

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_All_NRgen_Ha	WetFor_SR_NRgen_Ha
1.	Snake	1962	0	0
2.	Snake	1963	0	0
3.	Snake	1964	233	233
4.	Snake	1965	14.1	13.66
5.	Snake	1966	0	0
6.	Snake	1967	0	0
7.	Snake	1968	0	0
8.	Snake	1969	0	0
9.	Snake	1970	0	0
10.	Snake	1971	0	0
11.	Snake	1972	45.7	42.02
12.	Snake	1973	0	0
13.	Snake	1974	10.38	0.09
14.	Snake	1975	0	0
15.	Snake	1976	0	0
16.	Snake	1977	0	0
17.	Snake	1978	0	0
18.	Snake	1979	0	0
19.	Snake	1980	0	0
20.	Snake	1981	0	0
21.	Snake	1982	0	0
22.	Snake	1983	0	0
23.	Snake	1984	0	0
24.	Snake	1985	0	0
25.	Snake	1986	0	0
26.	Snake	1987	0	0
27.	Snake	1988	0	0
28.	Snake	1989	0	0
29.	Snake	1990	0	0
30.	Snake	1991	0	0
31.	Snake	1992	0	0
32.	Snake	1993	3.05	3.05
33.	Snake	1994	0	0
34.	Snake	1995	0	0
35.	Snake	1996	0	0
36.	Snake	1997	0	0
37.	Snake	1998	0	0
38.	Snake	1999	0	0
39.	Snake	2000	0	0
40.	Snake	2001	0	0
41.	Snake	2002	0	0
42.	Snake	2003	0	0
43.	Snake	2004	0	0
44.	Snake	2005	0	0
45.	Snake	2006	0	0
46.	Snake	2007	0	0

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_WR_NRgen_Ha
1.	Snake	1962	0
2.	Snake	1963	0
3.	Snake	1964	0
4.	Snake	1965	0.44
5.	Snake	1966	0
6.	Snake	1967	0
7.	Snake	1968	0
8.	Snake	1969	0
9.	Snake	1970	0
10.	Snake	1971	0
11.	Snake	1972	3.67
12.	Snake	1973	0
13.	Snake	1974	10.29
14.	Snake	1975	0
15.	Snake	1976	0
16.	Snake	1977	0
17.	Snake	1978	0
18.	Snake	1979	0
19.	Snake	1980	0
20.	Snake	1981	0
21.	Snake	1982	0
22.	Snake	1983	0
23.	Snake	1984	0
24.	Snake	1985	0
25.	Snake	1986	0
26.	Snake	1987	0
27.	Snake	1988	0
28.	Snake	1989	0
29.	Snake	1990	0
30.	Snake	1991	0
31.	Snake	1992	0
32.	Snake	1993	0
33.	Snake	1994	0
34.	Snake	1995	0
35.	Snake	1996	0
36.	Snake	1997	0
37.	Snake	1998	0
38.	Snake	1999	0
39.	Snake	2000	0
40.	Snake	2001	0
41.	Snake	2002	0
42.	Snake	2003	0
43.	Snake	2004	0
44.	Snake	2005	0
45.	Snake	2006	0
46.	Snake	2007	0

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_AllForestry_TOT	Ha_AllForestry_SR
1.	Snake	1962	377.98	368.07
2.	Snake	1963	296.03	269.77
3.	Snake	1964	376.08	310.44
4.	Snake	1965	560.14	84.54
5.	Snake	1966	1409.41	805.37
6.	Snake	1967	126.53	69.29
7.	Snake	1968	166.43	55.8
8.	Snake	1969	29.44	29.24
9.	Snake	1970	338.58	196.84
10.	Snake	1971	27.41	4.48
11.	Snake	1972	324.64	226.48
12.	Snake	1973	517.44	315.03
13.	Snake	1974	25.87	12.99
14.	Snake	1975	325.37	298.52
15.	Snake	1976	597.32	269.7
16.	Snake	1977	437.48	257.27
17.	Snake	1978	632.04	547.08
18.	Snake	1979	424.11	283.1
19.	Snake	1980	791.72	301.98
20.	Snake	1981	106.71	97.84
21.	Snake	1982	0	0
22.	Snake	1983	139.55	139.55
23.	Snake	1984	0	0
24.	Snake	1985	67.57	67.57
25.	Snake	1986	0.54	0.54
26.	Snake	1987	928	204.3
27.	Snake	1988	6.4	6.4
28.	Snake	1989	30.38	30.38
29.	Snake	1990	44.53	0.66
30.	Snake	1991	85.96	29.99
31.	Snake	1992	458.47	392.31
32.	Snake	1993	3.63	3.63
33.	Snake	1994	0	0
34.	Snake	1995	361.7	291.41
35.	Snake	1996	19.8	19.12
36.	Snake	1997	0	0
37.	Snake	1998	0	0
38.	Snake	1999	165.52	54.23
39.	Snake	2000	0	0
40.	Snake	2001	0	0
41.	Snake	2002	0	0
42.	Snake	2003	0	0
43.	Snake	2004	0	0
44.	Snake	2005	0	0
45.	Snake	2006	0	0
46.	Snake	2007	0	0

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_AllForestry_WR	WetFor_All_AllForestry_Ha
1.	Snake	1962	9.91	54.55
2.	Snake	1963	26.27	5.79
3.	Snake	1964	65.63	236.89
4.	Snake	1965	475.61	14.1
5.	Snake	1966	604.04	0
6.	Snake	1967	57.24	0
7.	Snake	1968	110.63	0
8.	Snake	1969	0.2	0
9.	Snake	1970	141.74	0
10.	Snake	1971	22.93	0
11.	Snake	1972	98.16	45.7
12.	Snake	1973	202.4	0
13.	Snake	1974	12.88	10.38
14.	Snake	1975	26.85	0
15.	Snake	1976	327.62	0
16.	Snake	1977	180.21	0
17.	Snake	1978	84.96	0
18.	Snake	1979	141.01	0
19.	Snake	1980	489.75	0
20.	Snake	1981	8.87	0
21.	Snake	1982	0	0
22.	Snake	1983	0	0
23.	Snake	1984	0	0
24.	Snake	1985	0	0
25.	Snake	1986	0	0
26.	Snake	1987	723.72	0
27.	Snake	1988	0	0
28.	Snake	1989	0	0
29.	Snake	1990	43.87	0
30.	Snake	1991	55.96	0
31.	Snake	1992	66.16	0
32.	Snake	1993	0	3.05
33.	Snake	1994	0	0
34.	Snake	1995	70.29	0
35.	Snake	1996	0.69	0
36.	Snake	1997	0	0
37.	Snake	1998	0	0
38.	Snake	1999	111.29	0
39.	Snake	2000	0	0
40.	Snake	2001	0	0
41.	Snake	2002	0	0
42.	Snake	2003	0	0
43.	Snake	2004	0	0
44.	Snake	2005	0	0
45.	Snake	2006	0	0
46.	Snake	2007	0	0

Table A1-37: Original data set with observations for the Snake management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_WR_AllForestry_Ha
1.	Snake	1962	0
2.	Snake	1963	0
3.	Snake	1964	0
4.	Snake	1965	0.44
5.	Snake	1966	0
6.	Snake	1967	0
7.	Snake	1968	0
8.	Snake	1969	0
9.	Snake	1970	0
10.	Snake	1971	0
11.	Snake	1972	3.67
12.	Snake	1973	0
13.	Snake	1974	10.29
14.	Snake	1975	0
15.	Snake	1976	0
16.	Snake	1977	0
17.	Snake	1978	0
18.	Snake	1979	0
19.	Snake	1980	0
20.	Snake	1981	0
21.	Snake	1982	0
22.	Snake	1983	0
23.	Snake	1984	0
24.	Snake	1985	0
25.	Snake	1986	0
26.	Snake	1987	0
27.	Snake	1988	0
28.	Snake	1989	0
29.	Snake	1990	0
30.	Snake	1991	0
31.	Snake	1992	0
32.	Snake	1993	0
33.	Snake	1994	0
34.	Snake	1995	0
35.	Snake	1996	0
36.	Snake	1997	0
37.	Snake	1998	0
38.	Snake	1999	0
39.	Snake	2000	0
40.	Snake	2001	0
41.	Snake	2002	0
42.	Snake	2003	0
43.	Snake	2004	0
44.	Snake	2005	0
45.	Snake	2006	0
46.	Snake	2007	0

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	N_Obs	B:100C	CALF:100C
1.	Desolation	1962	615	15.96	38.3
2.	Desolation	1963	367	13.79	44.83
3.	Desolation	1964	624	10.1	40.4
4.	Desolation	1965	638	7.00	56.00
5.	Desolation	1966	557	20.00	25.71
6.	Desolation	1967	417	10.96	36.99
7.	Desolation	1968	445	41.67	33.33
8.	Desolation	1969	482	5.06	49.37
9.	Desolation	1970	457	4.60	45.98
10.	Desolation	1971	538	3.51	38.60
11.	Desolation	1972	387	7.23	37.35
12.	Desolation	1973	647	8.27	27.07
13.	Desolation	1974	472	4.72	35.85
14.	Desolation	1975	820	13.25	46.99
15.	Desolation	1976	605	1.19	60.71
16.	Desolation	1977	671	0.00	53.45
17.	Desolation	1978	716	16.85	49.44
18.	Desolation	1979	790	6.57	27.01
19.	Desolation	1980	718	7.14	39.61
20.	Desolation	1981	585	6.98	31.78
21.	Desolation	1982	1177	11.38	49.70
22.	Desolation	1983	480	6.01	32.62
23.	Desolation	1984	965	6.44	38.63
24.	Desolation	1985	656	9.93	40.44
25.	Desolation	1986	401	6.45	39.52
26.	Desolation	1987	753	6.67	35.44
27.	Desolation	1988	969	5.77	30.02
28.	Desolation	1989	483	10.36	27.49
29.	Desolation	1990	817	4.90	27.96
30.	Desolation	1991	921	5.35	32.26
31.	Desolation	1992	569	14.08	28.17
32.	Desolation	1993	740	4.91	34.11
33.	Desolation	1994	1233	6.04	26.77
34.	Desolation	1995	857	5.94	48.20
35.	Desolation	1996	576	9.86	26.53
36.	Desolation	1997	556	9.88	51.74
37.	Desolation	1998	809	12.19	30.74
38.	Desolation	1999	1303	7.37	32.79
39.	Desolation	2000	1064	10.60	32.21
40.	Desolation	2001	1037	11.81	39.96
41.	Desolation	2002	1520	8.49	24.61
42.	Desolation	2003	1238	6.32	17.81
43.	Desolation	2004	1237	7.00	17.2
44.	Desolation	2005	676	8.22	48.40
45.	Desolation	2006	1329	8.33	33.65
46.	Desolation	2007	710	6.25	20.54

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	COUGAR_POP_RECON1
1.	Desolation	1962	
2.	Desolation	1963	
3.	Desolation	1964	
4.	Desolation	1965	
5.	Desolation	1966	
6.	Desolation	1967	
7.	Desolation	1968	
8.	Desolation	1969	
9.	Desolation	1970	
10.	Desolation	1971	
11.	Desolation	1972	
12.	Desolation	1973	
13.	Desolation	1974	
14.	Desolation	1975	
15.	Desolation	1976	
16.	Desolation	1977	
17.	Desolation	1978	
18.	Desolation	1979	
19.	Desolation	1980	
20.	Desolation	1981	
21.	Desolation	1982	0
22.	Desolation	1983	0
23.	Desolation	1984	0
24.	Desolation	1985	0
25.	Desolation	1986	0
26.	Desolation	1987	0
27.	Desolation	1988	0
28.	Desolation	1989	0
29.	Desolation	1990	0
30.	Desolation	1991	0
31.	Desolation	1992	0
32.	Desolation	1993	2
33.	Desolation	1994	5
34.	Desolation	1995	6
35.	Desolation	1996	6
36.	Desolation	1997	9
37.	Desolation	1998	13
38.	Desolation	1999	17
39.	Desolation	2000	19
40.	Desolation	2001	27
41.	Desolation	2002	30
42.	Desolation	2003	27
43.	Desolation	2004	19
44.	Desolation	2005	21
45.	Desolation	2006	20
46.	Desolation	2007	15

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	ET_ANT_HARV	ET_BUL_HARV	ET_HARV
1.	Desolation	1962	67	553	620
2.	Desolation	1963	109	472	581
3.	Desolation	1964	144	495	639
4.	Desolation	1965	293	725	1018
5.	Desolation	1966	156	403	559
6.	Desolation	1967	165	338	503
7.	Desolation	1968	61	287	348
8.	Desolation	1969	67	277	344
9.	Desolation	1970	93	410	503
10.	Desolation	1971			
11.	Desolation	1972	104	442	546
12.	Desolation	1973	48	320	368
13.	Desolation	1974	71	613	684
14.	Desolation	1975			
15.	Desolation	1976	158	505	663
16.	Desolation	1977	126	523	649
17.	Desolation	1978	272	794	1066
18.	Desolation	1979	615	513	1128
19.	Desolation	1980	373	386	759
20.	Desolation	1981	373	181	554
21.	Desolation	1982	385	743	1128
22.	Desolation	1983	494	583	1077
23.	Desolation	1984	356	430	786
24.	Desolation	1985			
25.	Desolation	1986	105	497	602
26.	Desolation	1987	125	518	643
27.	Desolation	1988	225	337	562
28.	Desolation	1989	129	132	261
29.	Desolation	1990	69	543	612
30.	Desolation	1991	219	123	342
31.	Desolation	1992	361	496	857
32.	Desolation	1993	289	603	892
33.	Desolation	1994	185	478	663
34.	Desolation	1995	459	611	1070
35.	Desolation	1996	169	653	822
36.	Desolation	1997	388	380	768
37.	Desolation	1998	445	428	873
38.	Desolation	1999	507	461	968
39.	Desolation	2000	359	493	852
40.	Desolation	2001	155	142	297
41.	Desolation	2002	407	182	589
42.	Desolation	2003	189	248	437
43.	Desolation	2004	374	393	767
44.	Desolation	2005	267	178	445
45.	Desolation	2006	224	354	578
46.	Desolation	2007	236	387	0.00

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_C_PPT_1003_t	W_C_PPT_0409_t
1.	Desolation	1962	417.9	151.74
2.	Desolation	1963	424.3	184.53
3.	Desolation	1964	417.52	236.83
4.	Desolation	1965	694.24	220.08
5.	Desolation	1966	344.07	263.03
6.	Desolation	1967	491.77	145.82
7.	Desolation	1968	414.99	156.33
8.	Desolation	1969	483.66	211.15
9.	Desolation	1970	541.99	245.73
10.	Desolation	1971	536.89	233.96
11.	Desolation	1972	541.34	223.6
12.	Desolation	1973	353.82	207.75
13.	Desolation	1974	688.95	144.76
14.	Desolation	1975	495.87	167.07
15.	Desolation	1976	576.38	193.2
16.	Desolation	1977	200.89	247.49
17.	Desolation	1978	493.7	222.05
18.	Desolation	1979	451.26	283.31
19.	Desolation	1980	473.64	219.28
20.	Desolation	1981	395.96	276.9
21.	Desolation	1982	624.24	274.99
22.	Desolation	1983	592.77	337.35
23.	Desolation	1984	596.43	243.95
24.	Desolation	1985	468.44	361.54
25.	Desolation	1986	524.25	199.96
26.	Desolation	1987	380.24	182.56
27.	Desolation	1988	339.2	167.96
28.	Desolation	1989	515.01	171.05
29.	Desolation	1990	321.6	267.41
30.	Desolation	1991	351.17	216.9
31.	Desolation	1992	324.16	264.67
32.	Desolation	1993	476.31	209.6
33.	Desolation	1994	279.3	305.27
34.	Desolation	1995	516.68	197.13
35.	Desolation	1996	546.82	261.77
36.	Desolation	1997	609.85	229.98
37.	Desolation	1998	422.63	252.19
38.	Desolation	1999	560.47	321.5
39.	Desolation	2000	516.55	121.2
40.	Desolation	2001	292.89	130.26
41.	Desolation	2002	452.44	187.08
42.	Desolation	2003	402.92	135.24
43.	Desolation	2004	454.38	207.23
44.	Desolation	2005	324.44	281
45.	Desolation	2006	528.02	230.27
46.	Desolation	2007	358.48	229.54

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H20_TMAX_0709_t	W_H24_TMAX_0708_t
1.	Desolation	1962	24.3	27.8
2.	Desolation	1963	23.16	23.74
3.	Desolation	1964	23.41	23.68
4.	Desolation	1965	22.03	23.83
5.	Desolation	1966	21.26	23.59
6.	Desolation	1967	23.61	24.67
7.	Desolation	1968	26.59	27.75
8.	Desolation	1969	22.52	23.93
9.	Desolation	1970	23.46	24.77
10.	Desolation	1971	23.44	26.72
11.	Desolation	1972	23.89	27.38
12.	Desolation	1973	22.7	25.53
13.	Desolation	1974	23.71	25.86
14.	Desolation	1975	24.29	24.71
15.	Desolation	1976	23.3	23.76
16.	Desolation	1977	22.21	22.66
17.	Desolation	1978	22.67	25.34
18.	Desolation	1979	21.47	23.6
19.	Desolation	1980	24.43	25.19
20.	Desolation	1981	22.45	23.66
21.	Desolation	1982	24.21	25.71
22.	Desolation	1983	21.86	24
23.	Desolation	1984	21.91	23.52
24.	Desolation	1985	23.27	26
25.	Desolation	1986	22.18	25.74
26.	Desolation	1987	21.27	24.4
27.	Desolation	1988	23.38	23.49
28.	Desolation	1989	23.94	25.69
29.	Desolation	1990	22.18	23.31
30.	Desolation	1991	24.61	24.98
31.	Desolation	1992	24.42	25.41
32.	Desolation	1993	22.44	24.03
33.	Desolation	1994	20.01	19.61
34.	Desolation	1995	25.27	26.56
35.	Desolation	1996	22.87	23.36
36.	Desolation	1997	23.77	26.53
37.	Desolation	1998	23.05	24.34
38.	Desolation	1999	25.66	27.14
39.	Desolation	2000	23.41	24.88
40.	Desolation	2001	23.3	25.8
41.	Desolation	2002	24.87	25.98
42.	Desolation	2003	24.06	25.47
43.	Desolation	2004	26	27.97
44.	Desolation	2005	23.05	25.45
45.	Desolation	2006	24.14	26.6
46.	Desolation	2007	24.6	26.51

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_TMAX_0709_t1	W_H24_PPT_0809_t
1.	Desolation	1962	24.41	17.7
2.	Desolation	1963	24.3	21.62
3.	Desolation	1964	23.16	29.17
4.	Desolation	1965	23.41	21.98
5.	Desolation	1966	22.03	43.05
6.	Desolation	1967	21.26	17.37
7.	Desolation	1968	23.61	9.27
8.	Desolation	1969	26.59	43.82
9.	Desolation	1970	22.52	11.36
10.	Desolation	1971	23.46	25.17
11.	Desolation	1972	23.44	24.34
12.	Desolation	1973	23.89	25.76
13.	Desolation	1974	22.7	30.55
14.	Desolation	1975	23.71	2.2
15.	Desolation	1976	24.29	13.7
16.	Desolation	1977	23.3	49.16
17.	Desolation	1978	22.21	45.11
18.	Desolation	1979	22.67	38.51
19.	Desolation	1980	21.47	29.37
20.	Desolation	1981	24.43	26.43
21.	Desolation	1982	22.45	15.05
22.	Desolation	1983	24.21	44.94
23.	Desolation	1984	21.86	28.29
24.	Desolation	1985	21.91	50.83
25.	Desolation	1986	23.27	31.84
26.	Desolation	1987	22.18	28.59
27.	Desolation	1988	21.27	4.66
28.	Desolation	1989	23.38	11.06
29.	Desolation	1990	23.94	44.86
30.	Desolation	1991	22.18	16.3
31.	Desolation	1992	24.61	8.56
32.	Desolation	1993	24.42	16.73
33.	Desolation	1994	22.44	24.58
34.	Desolation	1995	20.01	9.77
35.	Desolation	1996	25.27	20.68
36.	Desolation	1997	22.87	11.71
37.	Desolation	1998	23.77	17.4
38.	Desolation	1999	23.05	24.9
39.	Desolation	2000	25.66	11.95
40.	Desolation	2001	23.41	14.3
41.	Desolation	2002	23.3	13.15
42.	Desolation	2003	24.87	14.6
43.	Desolation	2004	24.06	17.51
44.	Desolation	2005	26	36.26
45.	Desolation	2006	23.05	4.01
46.	Desolation	2007	24.14	16.29

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_PPT_0809_t1	W_H24_TMIN_05_t
1.	Desolation	1962	26.33	0.77
2.	Desolation	1963	17.7	0.2
3.	Desolation	1964	21.62	1.33
4.	Desolation	1965	29.17	-1.55
5.	Desolation	1966	21.98	-0.76
6.	Desolation	1967	43.05	0.19
7.	Desolation	1968	17.37	-0.58
8.	Desolation	1969	9.27	0.59
9.	Desolation	1970	43.82	2.18
10.	Desolation	1971	11.36	0.64
11.	Desolation	1972	25.17	1.26
12.	Desolation	1973	24.34	1.43
13.	Desolation	1974	25.76	1.41
14.	Desolation	1975	30.55	0.07
15.	Desolation	1976	2.2	0.1
16.	Desolation	1977	13.7	-0.18
17.	Desolation	1978	49.16	-0.35
18.	Desolation	1979	45.11	0.14
19.	Desolation	1980	38.51	0.99
20.	Desolation	1981	29.37	1.38
21.	Desolation	1982	26.43	1.49
22.	Desolation	1983	15.05	-0.39
23.	Desolation	1984	44.94	0.98
24.	Desolation	1985	28.29	-0.6
25.	Desolation	1986	50.83	0.96
26.	Desolation	1987	31.84	0.63
27.	Desolation	1988	28.59	2.86
28.	Desolation	1989	4.66	1.31
29.	Desolation	1990	11.06	0.3
30.	Desolation	1991	44.86	0.51
31.	Desolation	1992	16.3	-0.24
32.	Desolation	1993	8.56	2.99
33.	Desolation	1994	16.73	4.02
34.	Desolation	1995	24.58	2.3
35.	Desolation	1996	9.77	1.33
36.	Desolation	1997	20.68	0.04
37.	Desolation	1998	11.71	2.8
38.	Desolation	1999	17.4	1.72
39.	Desolation	2000	24.9	-0.81
40.	Desolation	2001	11.95	1.57
41.	Desolation	2002	14.3	1.91
42.	Desolation	2003	13.15	0.47
43.	Desolation	2004	14.6	1.38
44.	Desolation	2005	17.51	1.74
45.	Desolation	2006	36.26	3.18
46.	Desolation	2007	4.01	2.28

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_TMIN_05_t1
1.	Desolation	1962	-0.2
2.	Desolation	1963	0.77
3.	Desolation	1964	0.2
4.	Desolation	1965	1.33
5.	Desolation	1966	-1.55
6.	Desolation	1967	-0.76
7.	Desolation	1968	0.19
8.	Desolation	1969	-0.58
9.	Desolation	1970	0.59
10.	Desolation	1971	2.18
11.	Desolation	1972	0.64
12.	Desolation	1973	1.26
13.	Desolation	1974	1.43
14.	Desolation	1975	1.41
15.	Desolation	1976	0.07
16.	Desolation	1977	0.1
17.	Desolation	1978	-0.18
18.	Desolation	1979	-0.35
19.	Desolation	1980	0.14
20.	Desolation	1981	0.99
21.	Desolation	1982	1.38
22.	Desolation	1983	1.49
23.	Desolation	1984	-0.39
24.	Desolation	1985	0.98
25.	Desolation	1986	-0.6
26.	Desolation	1987	0.96
27.	Desolation	1988	0.63
28.	Desolation	1989	2.86
29.	Desolation	1990	1.31
30.	Desolation	1991	0.3
31.	Desolation	1992	0.51
32.	Desolation	1993	-0.24
33.	Desolation	1994	2.99
34.	Desolation	1995	4.02
35.	Desolation	1996	2.3
36.	Desolation	1997	1.33
37.	Desolation	1998	0.04
38.	Desolation	1999	2.8
39.	Desolation	2000	1.72
40.	Desolation	2001	-0.81
41.	Desolation	2002	1.57
42.	Desolation	2003	1.91
43.	Desolation	2004	0.47
44.	Desolation	2005	1.38
45.	Desolation	2006	1.74
46.	Desolation	2007	3.18

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_SumPPT_08_t	W_J_SumPPT_08_t1
1.	Desolation	1962	15.93	37.73
2.	Desolation	1963	10.46	15.93
3.	Desolation	1964	13.69	10.46
4.	Desolation	1965	18.69	13.69
5.	Desolation	1966	72.31	18.69
6.	Desolation	1967	7.62	72.31
7.	Desolation	1968	4.26	7.62
8.	Desolation	1969	63.34	4.26
9.	Desolation	1970	0	63.34
10.	Desolation	1971	0.2	0
11.	Desolation	1972	9.04	0.2
12.	Desolation	1973	20.9	9.04
13.	Desolation	1974	9.5	20.9
14.	Desolation	1975	4.62	9.5
15.	Desolation	1976	26.72	4.62
16.	Desolation	1977	81.96	26.72
17.	Desolation	1978	42.84	81.96
18.	Desolation	1979	31.18	42.84
19.	Desolation	1980	45.04	31.18
20.	Desolation	1981	7.01	45.04
21.	Desolation	1982	6.43	7.01
22.	Desolation	1983	26.78	6.43
23.	Desolation	1984	30.38	26.78
24.	Desolation	1985	63.58	30.38
25.	Desolation	1986	18.12	63.58
26.	Desolation	1987	5.88	18.12
27.	Desolation	1988	5.87	5.88
28.	Desolation	1989	9.19	5.87
29.	Desolation	1990	67.31	9.19
30.	Desolation	1991	29.66	67.31
31.	Desolation	1992	10.78	29.66
32.	Desolation	1993	12.92	10.78
33.	Desolation	1994	48.36	12.92
34.	Desolation	1995	5.83	48.36
35.	Desolation	1996	25.54	5.83
36.	Desolation	1997	9.19	25.54
37.	Desolation	1998	7.19	9.19
38.	Desolation	1999	2	7.19
39.	Desolation	2000	23.58	2
40.	Desolation	2001	1.22	23.58
41.	Desolation	2002	6.63	1.22
42.	Desolation	2003	15.99	6.63
43.	Desolation	2004	16.05	15.99
44.	Desolation	2005	46.45	16.05
45.	Desolation	2006	1.88	46.45
46.	Desolation	2007	9.72	1.88

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_WinTMIN_1202_t	W_J_WinTMIN_1202_t1
1.	Desolation	1962	-6.89	-4.2
2.	Desolation	1963	-5.2	-6.89
3.	Desolation	1964	-6	-5.2
4.	Desolation	1965	-5.11	-6
5.	Desolation	1966	-5.93	-5.11
6.	Desolation	1967	-3.7	-5.93
7.	Desolation	1968	-4.89	-3.7
8.	Desolation	1969	-7.09	-4.89
9.	Desolation	1970	-3.89	-7.09
10.	Desolation	1971	-4.86	-3.89
11.	Desolation	1972	-5.94	-4.86
12.	Desolation	1973	-6.91	-5.94
13.	Desolation	1974	-4.59	-6.91
14.	Desolation	1975	-5.48	-4.59
15.	Desolation	1976	-5.13	-5.48
16.	Desolation	1977	-7.14	-5.13
17.	Desolation	1978	-3.08	-7.14
18.	Desolation	1979	-10.34	-3.08
19.	Desolation	1980	-5.07	-10.34
20.	Desolation	1981	-3.71	-5.07
21.	Desolation	1982	-5.36	-3.71
22.	Desolation	1983	-3.15	-5.36
23.	Desolation	1984	-7.42	-3.15
24.	Desolation	1985	-8.96	-7.42
25.	Desolation	1986	-5.85	-8.96
26.	Desolation	1987	-5.74	-5.85
27.	Desolation	1988	-5.75	-5.74
28.	Desolation	1989	-7.5	-5.75
29.	Desolation	1990	-5	-7.5
30.	Desolation	1991	-6.65	-5
31.	Desolation	1992	-2.85	-6.65
32.	Desolation	1993	-8.21	-2.85
33.	Desolation	1994	-4.38	-8.21
34.	Desolation	1995	-3.97	-4.38
35.	Desolation	1996	-5.06	-3.97
36.	Desolation	1997	-5.33	-5.06
37.	Desolation	1998	-4.02	-5.33
38.	Desolation	1999	-4.89	-4.02
39.	Desolation	2000	-3.94	-4.89
40.	Desolation	2001	-4.97	-3.94
41.	Desolation	2002	-5.1	-4.97
42.	Desolation	2003	-3.1	-5.1
43.	Desolation	2004	-4.2	-3.1
44.	Desolation	2005	-3.88	-4.2
45.	Desolation	2006	-4.72	-3.88
46.	Desolation	2007	-4.82	-4.72

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_WSI_NoStandard_t	W_J_WSI_NoStandard_t1
1.	Desolation	1962	133.69	131.97
2.	Desolation	1963	133.04	133.69
3.	Desolation	1964	135.64	133.04
4.	Desolation	1965	328.58	135.64
5.	Desolation	1966	116.33	328.58
6.	Desolation	1967	169.3	116.33
7.	Desolation	1968	146.76	169.3
8.	Desolation	1969	196.65	146.76
9.	Desolation	1970	256.44	196.65
10.	Desolation	1971	168.26	256.44
11.	Desolation	1972	192.86	168.26
12.	Desolation	1973	142.68	192.86
13.	Desolation	1974	220.24	142.68
14.	Desolation	1975	225.46	220.24
15.	Desolation	1976	194.51	225.46
16.	Desolation	1977	56.34	194.51
17.	Desolation	1978	192.72	56.34
18.	Desolation	1979	197.29	192.72
19.	Desolation	1980	150.13	197.29
20.	Desolation	1981	159.19	150.13
21.	Desolation	1982	278.23	159.19
22.	Desolation	1983	212.19	278.23
23.	Desolation	1984	236.86	212.19
24.	Desolation	1985	143.61	236.86
25.	Desolation	1986	194.78	143.61
26.	Desolation	1987	143.68	194.78
27.	Desolation	1988	157.69	143.68
28.	Desolation	1989	194.89	157.69
29.	Desolation	1990	125.29	194.89
30.	Desolation	1991	123.72	125.29
31.	Desolation	1992	88.35	123.72
32.	Desolation	1993	178.74	88.35
33.	Desolation	1994	158.97	178.74
34.	Desolation	1995	159.68	158.97
35.	Desolation	1996	231.84	159.68
36.	Desolation	1997	243.23	231.84
37.	Desolation	1998	188.32	243.23
38.	Desolation	1999	217.81	188.32
39.	Desolation	2000	181.78	217.81
40.	Desolation	2001	92.54	181.78
41.	Desolation	2002	155.12	92.54
42.	Desolation	2003	184.71	155.12
43.	Desolation	2004	217.98	184.71
44.	Desolation	2005	89.9	217.98
45.	Desolation	2006	202.3	89.9
46.	Desolation	2007	122	202.3

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_L_ESPpt_0506_t	W_L_LSPpt_0809_t
1.	Desolation	1962	73.67	30.27
2.	Desolation	1963	83.34	40.09
3.	Desolation	1964	71.81	49.43
4.	Desolation	1965	90.42	38.43
5.	Desolation	1966	81.86	77.71
6.	Desolation	1967	60.29	35.53
7.	Desolation	1968	74.49	16.56
8.	Desolation	1969	74.77	79.93
9.	Desolation	1970	128.18	21.22
10.	Desolation	1971	98.27	43.83
11.	Desolation	1972	99.82	43.9
12.	Desolation	1973	91.13	47.39
13.	Desolation	1974	48.67	54.04
14.	Desolation	1975	40.07	3.86
15.	Desolation	1976	59.76	26.36
16.	Desolation	1977	56.36	98.32
17.	Desolation	1978	95.15	82.45
18.	Desolation	1979	71.69	71.29
19.	Desolation	1980	63.69	56.12
20.	Desolation	1981	142.76	47.22
21.	Desolation	1982	149.75	26.49
22.	Desolation	1983	106.28	78.74
23.	Desolation	1984	108.42	53.05
24.	Desolation	1985	142.91	95.3
25.	Desolation	1986	75.36	61.98
26.	Desolation	1987	52.67	50.22
27.	Desolation	1988	84.18	8.92
28.	Desolation	1989	82.87	19.21
29.	Desolation	1990	83.07	78.21
30.	Desolation	1991	82.18	28.74
31.	Desolation	1992	159.99	18.35
32.	Desolation	1993	62.62	27.04
33.	Desolation	1994	121.26	48.63
34.	Desolation	1995	119.86	18.1
35.	Desolation	1996	127.7	41.35
36.	Desolation	1997	112.67	20.9
37.	Desolation	1998	74.93	33.87
38.	Desolation	1999	145.26	42.85
39.	Desolation	2000	50.54	24.38
40.	Desolation	2001	63.23	23.83
41.	Desolation	2002	70.58	20.78
42.	Desolation	2003	64.01	26.38
43.	Desolation	2004	65.09	33.46
44.	Desolation	2005	140.47	66.04
45.	Desolation	2006	144.13	8
46.	Desolation	2007	118.93	33.19

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_L_EWPpt_1112_t	W_L_TotWPpt_1103_t
1.	Desolation	1962	128.63	271.37
2.	Desolation	1963	112.13	243.71
3.	Desolation	1964	131.07	285.4
4.	Desolation	1965	258.36	461.01
5.	Desolation	1966	73.96	233.93
6.	Desolation	1967	180.53	329.06
7.	Desolation	1968	100.5	232.87
8.	Desolation	1969	170.82	325.15
9.	Desolation	1970	101.28	360.84
10.	Desolation	1971	135.73	325.56
11.	Desolation	1972	175.65	360.51
12.	Desolation	1973	127.2	232.27
13.	Desolation	1974	277.84	459.95
14.	Desolation	1975	123.41	338.2
15.	Desolation	1976	134.64	327.59
16.	Desolation	1977	31.25	131.91
17.	Desolation	1978	185.4	333.42
18.	Desolation	1979	129.08	319.85
19.	Desolation	1980	97.91	296.43
20.	Desolation	1981	125.59	283.52
21.	Desolation	1982	206.47	448.49
22.	Desolation	1983	143.2	382.9
23.	Desolation	1984	227.44	447.92
24.	Desolation	1985	183.18	305.34
25.	Desolation	1986	126.83	365.9
26.	Desolation	1987	111.1	298.25
27.	Desolation	1988	96.34	260.64
28.	Desolation	1989	178.89	404.82
29.	Desolation	1990	45.16	211.83
30.	Desolation	1991	103.79	245.71
31.	Desolation	1992	147.49	235.74
32.	Desolation	1993	164.96	351.42
33.	Desolation	1994	65.66	205.45
34.	Desolation	1995	154.01	353.77
35.	Desolation	1996	207.03	400.47
36.	Desolation	1997	243.38	413.47
37.	Desolation	1998	78.14	292.86
38.	Desolation	1999	186.77	381.88
39.	Desolation	2000	118.1	333.57
40.	Desolation	2001	77.5	173.36
41.	Desolation	2002	134.41	281.87
42.	Desolation	2003	98.31	301.07
43.	Desolation	2004	142.28	320.55
44.	Desolation	2005	82.93	178.68
45.	Desolation	2006	168.31	353.47
46.	Desolation	2007	137.03	247.25

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_P_PPT_04_t	W_P_PPT_06_t
1.	Desolation	1962	35.26	18.81
2.	Desolation	1963	53.98	9.25
3.	Desolation	1964	76.81	37.92
4.	Desolation	1965	37.34	89.8
5.	Desolation	1966	55.85	47.32
6.	Desolation	1967	17.37	53.95
7.	Desolation	1968	50.35	37.56
8.	Desolation	1969	24.04	42.52
9.	Desolation	1970	75.19	94.34
10.	Desolation	1971	35.81	59.68
11.	Desolation	1972	41.99	60.8
12.	Desolation	1973	44.09	42.55
13.	Desolation	1974	21.33	13.58
14.	Desolation	1975	80.04	20.31
15.	Desolation	1976	55.05	41.87
16.	Desolation	1977	63.83	35.44
17.	Desolation	1978	14.7	27.33
18.	Desolation	1979	97.36	33.02
19.	Desolation	1980	81.34	25.96
20.	Desolation	1981	41.71	71.46
21.	Desolation	1982	57.06	75.46
22.	Desolation	1983	58.24	73.84
23.	Desolation	1984	45.69	49.89
24.	Desolation	1985	67.98	78.85
25.	Desolation	1986	31.77	32.84
26.	Desolation	1987	46.54	11.56
27.	Desolation	1988	17.58	42.26
28.	Desolation	1989	53.94	58.87
29.	Desolation	1990	66.81	29.12
30.	Desolation	1991	76.2	36.78
31.	Desolation	1992	60.03	54.85
32.	Desolation	1993	43.61	53.01
33.	Desolation	1994	81.32	78.59
34.	Desolation	1995	49.5	31.84
35.	Desolation	1996	75.69	68.7
36.	Desolation	1997	81.12	34.59
37.	Desolation	1998	82.55	41.52
38.	Desolation	1999	48.13	44.83
39.	Desolation	2000	36.19	19.34
40.	Desolation	2001	26.46	28.31
41.	Desolation	2002	62.8	38.51
42.	Desolation	2003	37.28	30.81
43.	Desolation	2004	81.74	8.94
44.	Desolation	2005	40.15	33.62
45.	Desolation	2006	59.45	40.57
46.	Desolation	2007	66.87	50.89

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_P_PPT_10_t	W_P_PPT_12_t
1.	Desolation	1962	52.61	55.19
2.	Desolation	1963	108.11	46.64
3.	Desolation	1964	20.14	43.74
4.	Desolation	1965	31.33	168.08
5.	Desolation	1966	12.05	17.15
6.	Desolation	1967	44.66	80.54
7.	Desolation	1968	71.64	48.43
8.	Desolation	1969	56.36	72.71
9.	Desolation	1970	50.39	73.93
10.	Desolation	1971	66.69	49.72
11.	Desolation	1972	40.71	90.34
12.	Desolation	1973	26.22	70.76
13.	Desolation	1974	43.43	110.18
14.	Desolation	1975	7.66	74.8
15.	Desolation	1976	91.83	75.83
16.	Desolation	1977	25.39	9.51
17.	Desolation	1978	40.1	91.55
18.	Desolation	1979	8.9	69.34
19.	Desolation	1980	73.44	28.56
20.	Desolation	1981	32.64	73.64
21.	Desolation	1982	44.27	113.31
22.	Desolation	1983	79.83	93.14
23.	Desolation	1984	18.08	124.58
24.	Desolation	1985	68.75	68.77
25.	Desolation	1986	46.67	27.29
26.	Desolation	1987	17.65	19.53
27.	Desolation	1988	3.46	60.2
28.	Desolation	1989	4.31	55.28
29.	Desolation	1990	40.3	15.34
30.	Desolation	1991	63.6	46.36
31.	Desolation	1992	36.99	29.19
32.	Desolation	1993	35.16	65.14
33.	Desolation	1994	28.41	43.06
34.	Desolation	1995	54.85	48.66
35.	Desolation	1996	43.02	82.67
36.	Desolation	1997	61.56	134.46
37.	Desolation	1998	52.49	39.98
38.	Desolation	1999	25.93	75.21
39.	Desolation	2000	40.82	49.58
40.	Desolation	2001	68.53	36.99
41.	Desolation	2002	58.05	65.78
42.	Desolation	2003	9.98	68.63
43.	Desolation	2004	22.92	83.02
44.	Desolation	2005	70.84	45.74
45.	Desolation	2006	48.69	82.13
46.	Desolation	2007	29.97	51.17

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_Rgen_TOT	Ha_Rgen_SR	Ha_Rgen_WR
1.	Desolation	1962	0	0	0
2.	Desolation	1963	23.05	22.42	0.63
3.	Desolation	1964	0	0	0
4.	Desolation	1965	0	0	0
5.	Desolation	1966	0.56	0.01	0.56
6.	Desolation	1967	8.07	3.4	4.67
7.	Desolation	1968	9.63	5.99	3.63
8.	Desolation	1969	0	0	0
9.	Desolation	1970	0	0	0
10.	Desolation	1971	10.63	10.63	0
11.	Desolation	1972	0	0	0
12.	Desolation	1973	0	0	0
13.	Desolation	1974	59.21	35.42	23.79
14.	Desolation	1975	39.27	39.27	0
15.	Desolation	1976	11.41	0	11.41
16.	Desolation	1977	10.74	2.68	8.06
17.	Desolation	1978	3.83	3.83	0
18.	Desolation	1979	10.37	9.58	0.79
19.	Desolation	1980	0.04	0.04	0
20.	Desolation	1981	3.57	1.77	1.8
21.	Desolation	1982	75.17	61.63	13.54
22.	Desolation	1983	23.7	15.81	7.89
23.	Desolation	1984	79.74	52.9	26.83
24.	Desolation	1985	96.58	88.33	8.24
25.	Desolation	1986	112.93	105.35	7.58
26.	Desolation	1987	54.3	32.59	21.71
27.	Desolation	1988	94.85	85.98	8.87
28.	Desolation	1989	175.5	80.49	95.02
29.	Desolation	1990	644.82	443.76	201.06
30.	Desolation	1991	167.22	80.34	86.88
31.	Desolation	1992	80.06	80.06	0.01
32.	Desolation	1993	125.81	122.99	2.82
33.	Desolation	1994	34.19	31	3.19
34.	Desolation	1995	45.41	44.53	0.88
35.	Desolation	1996	95.53	43.14	52.39
36.	Desolation	1997	0.66	0.66	0
37.	Desolation	1998	0	0	0
38.	Desolation	1999	5.03	5.03	0
39.	Desolation	2000	11.58	11.58	0
40.	Desolation	2001	0.09	0.09	0
41.	Desolation	2002	92.56	92.56	0
42.	Desolation	2003	3.14	3.14	0
43.	Desolation	2004	0	0	0
44.	Desolation	2005	8.33	8.33	0
45.	Desolation	2006	20.92	20.92	0
46.	Desolation	2007	32.1	32.1	0

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_All_Rgen_Ha	WetFor_SR_Rgen_Ha
1.	Desolation	1962	0	0
2.	Desolation	1963	23.05	22.42
3.	Desolation	1964	0	0
4.	Desolation	1965	0	0
5.	Desolation	1966	0.56	0.01
6.	Desolation	1967	8.07	3.4
7.	Desolation	1968	9.63	5.99
8.	Desolation	1969	0	0
9.	Desolation	1970	0	0
10.	Desolation	1971	10.63	10.63
11.	Desolation	1972	0	0
12.	Desolation	1973	0	0
13.	Desolation	1974	35.26	33.6
14.	Desolation	1975	39.26	39.26
15.	Desolation	1976	1.21	0
16.	Desolation	1977	0.29	0.29
17.	Desolation	1978	3.83	3.83
18.	Desolation	1979	3.57	3.57
19.	Desolation	1980	0.04	0.04
20.	Desolation	1981	3.24	1.71
21.	Desolation	1982	67.8	57.07
22.	Desolation	1983	14.17	11.81
23.	Desolation	1984	15.64	12.03
24.	Desolation	1985	14.88	12.02
25.	Desolation	1986	23.42	20.1
26.	Desolation	1987	23	17.49
27.	Desolation	1988	42.94	38.89
28.	Desolation	1989	19.82	12.59
29.	Desolation	1990	65.27	44.73
30.	Desolation	1991	57.94	28.06
31.	Desolation	1992	39.94	39.94
32.	Desolation	1993	58.08	56.15
33.	Desolation	1994	30.2	27.32
34.	Desolation	1995	8.36	8.33
35.	Desolation	1996	41.47	36.81
36.	Desolation	1997	0.28	0.28
37.	Desolation	1998	0	0
38.	Desolation	1999	0	0
39.	Desolation	2000	1.41	1.41
40.	Desolation	2001	0	0
41.	Desolation	2002	92.56	92.56
42.	Desolation	2003	3.14	3.14
43.	Desolation	2004	0	0
44.	Desolation	2005	8.33	8.33
45.	Desolation	2006	20.92	20.92
46.	Desolation	2007	32.1	32.1

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_NRgen_TOT	Ha_NRgen_SR	Ha_NRgen_WR
1.	Desolation	1962	40.07	40.07	0
2.	Desolation	1963	178.75	148.52	30.23
3.	Desolation	1964	46.44	46.44	0
4.	Desolation	1965	379.9	379.9	0
5.	Desolation	1966	0	0	0
6.	Desolation	1967	13.45	13.45	0
7.	Desolation	1968	580.27	543.44	36.83
8.	Desolation	1969	0	0	0
9.	Desolation	1970	0	0	0
10.	Desolation	1971	453.27	430.6	22.67
11.	Desolation	1972	32.68	31.71	0.97
12.	Desolation	1973	56.84	44.63	12.21
13.	Desolation	1974	0	0	0
14.	Desolation	1975	30.27	25.86	4.4
15.	Desolation	1976	0	0	0
16.	Desolation	1977	31.29	3.77	27.51
17.	Desolation	1978	5.96	5.96	0
18.	Desolation	1979	17.35	9.39	7.96
19.	Desolation	1980	0	0	0
20.	Desolation	1981	1.12	1.12	0
21.	Desolation	1982	13.88	13.88	0
22.	Desolation	1983	13.88	4.4	9.47
23.	Desolation	1984	60.13	11.21	48.91
24.	Desolation	1985	4.46	4.46	0
25.	Desolation	1986	254.22	90.29	163.93
26.	Desolation	1987	30.93	23.31	7.61
27.	Desolation	1988	48.87	29.45	19.43
28.	Desolation	1989	13.32	4.84	8.48
29.	Desolation	1990	58.21	28.09	30.12
30.	Desolation	1991	33.82	15.39	18.42
31.	Desolation	1992	20.54	20.54	0
32.	Desolation	1993	48.55	3.71	44.85
33.	Desolation	1994	16.93	11.81	5.12
34.	Desolation	1995	1.81	1.81	0
35.	Desolation	1996	0	0	0
36.	Desolation	1997	32.34	2.45	29.9
37.	Desolation	1998	11.1	10.27	0.83
38.	Desolation	1999	3.91	3.91	0
39.	Desolation	2000	0	0	0
40.	Desolation	2001	0	0	0
41.	Desolation	2002	342.84	342.75	0.09
42.	Desolation	2003	17.74	5.98	11.76
43.	Desolation	2004	0	0	0
44.	Desolation	2005	3.86	3.86	0
45.	Desolation	2006	25.6	25.6	0
46.	Desolation	2007	0.26	0	0.26

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	RipAsp_All_NRgen_Ha	WetFor_WR_NRgen_Ha
1.	Desolation	1962	0	0
2.	Desolation	1963	0	30.23
3.	Desolation	1964	0	0
4.	Desolation	1965	0	0
5.	Desolation	1966	0	0
6.	Desolation	1967	0	0
7.	Desolation	1968	0	36.83
8.	Desolation	1969	0	0
9.	Desolation	1970	0	0
10.	Desolation	1971	0	22.67
11.	Desolation	1972	0	0.97
12.	Desolation	1973	0	0
13.	Desolation	1974	0	0
14.	Desolation	1975	0	4.4
15.	Desolation	1976	0	0
16.	Desolation	1977	7.36	7.36
17.	Desolation	1978	4.51	0
18.	Desolation	1979	4.66	4.66
19.	Desolation	1980	0	0
20.	Desolation	1981	1.12	0
21.	Desolation	1982	7.48	0
22.	Desolation	1983	0.39	0.31
23.	Desolation	1984	9.45	3.38
24.	Desolation	1985	4.19	0
25.	Desolation	1986	33.39	22.71
26.	Desolation	1987	15.08	2.08
27.	Desolation	1988	18.45	2.44
28.	Desolation	1989	3.14	2
29.	Desolation	1990	10.03	4.21
30.	Desolation	1991	11.03	9.07
31.	Desolation	1992	1.32	0
32.	Desolation	1993	13.17	9.57
33.	Desolation	1994	3.55	1.28
34.	Desolation	1995	0.95	0
35.	Desolation	1996	0	0
36.	Desolation	1997	0.05	0.03
37.	Desolation	1998	5.18	0.08
38.	Desolation	1999	1.24	0
39.	Desolation	2000	0	0
40.	Desolation	2001	0	0
41.	Desolation	2002	3.67	0.09
42.	Desolation	2003	0.46	0.03
43.	Desolation	2004	0	0
44.	Desolation	2005	0	0
45.	Desolation	2006	0	0
46.	Desolation	2007	0	0.26

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	RipAsp_SR_NRgen_Ha
1.	Desolation	1962	0
2.	Desolation	1963	0
3.	Desolation	1964	0
4.	Desolation	1965	0
5.	Desolation	1966	0
6.	Desolation	1967	0
7.	Desolation	1968	0
8.	Desolation	1969	0
9.	Desolation	1970	0
10.	Desolation	1971	0
11.	Desolation	1972	0
12.	Desolation	1973	0
13.	Desolation	1974	0
14.	Desolation	1975	0
15.	Desolation	1976	0
16.	Desolation	1977	0
17.	Desolation	1978	4.51
18.	Desolation	1979	0
19.	Desolation	1980	0
20.	Desolation	1981	1.12
21.	Desolation	1982	7.48
22.	Desolation	1983	0.08
23.	Desolation	1984	6.07
24.	Desolation	1985	4.19
25.	Desolation	1986	10.68
26.	Desolation	1987	13
27.	Desolation	1988	16.01
28.	Desolation	1989	1.14
29.	Desolation	1990	5.82
30.	Desolation	1991	1.96
31.	Desolation	1992	1.32
32.	Desolation	1993	3.6
33.	Desolation	1994	2.27
34.	Desolation	1995	0.95
35.	Desolation	1996	0
36.	Desolation	1997	0.02
37.	Desolation	1998	5.1
38.	Desolation	1999	1.24
39.	Desolation	2000	0
40.	Desolation	2001	0
41.	Desolation	2002	3.58
42.	Desolation	2003	0.43
43.	Desolation	2004	0
44.	Desolation	2005	0
45.	Desolation	2006	0
46.	Desolation	2007	0

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_AllForestry_TOT	Ha_AllForestry_SR
1.	Desolation	1962	40.07	40.07
2.	Desolation	1963	201.8	170.94
3.	Desolation	1964	46.44	46.44
4.	Desolation	1965	379.9	379.9
5.	Desolation	1966	0.56	0.01
6.	Desolation	1967	21.52	16.85
7.	Desolation	1968	589.9	549.43
8.	Desolation	1969	0	0
9.	Desolation	1970	19.86	19.86
10.	Desolation	1971	502.28	441.23
11.	Desolation	1972	75.29	74.32
12.	Desolation	1973	79.97	44.63
13.	Desolation	1974	70.15	35.42
14.	Desolation	1975	69.54	65.13
15.	Desolation	1976	40.74	29.33
16.	Desolation	1977	52.83	6.45
17.	Desolation	1978	129.71	69.76
18.	Desolation	1979	45.08	36.33
19.	Desolation	1980	39.34	39.34
20.	Desolation	1981	104.17	54.68
21.	Desolation	1982	98.25	84.71
22.	Desolation	1983	115.92	98.55
23.	Desolation	1984	159.41	83.65
24.	Desolation	1985	101.04	92.79
25.	Desolation	1986	447.36	214.37
26.	Desolation	1987	113.28	56.48
27.	Desolation	1988	143.72	115.43
28.	Desolation	1989	194.83	91.34
29.	Desolation	1990	981.82	637.15
30.	Desolation	1991	568.72	232.53
31.	Desolation	1992	564.79	377.48
32.	Desolation	1993	388.68	284.62
33.	Desolation	1994	79.42	57.27
34.	Desolation	1995	197.7	192.22
35.	Desolation	1996	224.25	171.86
36.	Desolation	1997	498.16	468.27
37.	Desolation	1998	74.34	73.51
38.	Desolation	1999	206.2	206.2
39.	Desolation	2000	169.29	169.29
40.	Desolation	2001	0.09	0.09
41.	Desolation	2002	541.4	537.99
42.	Desolation	2003	62.98	29.18
43.	Desolation	2004	14.64	14.64
44.	Desolation	2005	12.19	12.19
45.	Desolation	2006	46.52	46.52
46.	Desolation	2007	33.46	33.2

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_AllForestry_WR	AllFor_All_AllForestry_Ha
1.	Desolation	1962	0	40.07
2.	Desolation	1963	30.86	201.8
3.	Desolation	1964	0	46.44
4.	Desolation	1965	0	379.9
5.	Desolation	1966	0.56	0.56
6.	Desolation	1967	4.67	21.52
7.	Desolation	1968	40.46	589.9
8.	Desolation	1969	0	0
9.	Desolation	1970	0	19.86
10.	Desolation	1971	61.05	488.31
11.	Desolation	1972	0.97	74.29
12.	Desolation	1973	35.34	79.1
13.	Desolation	1974	34.73	38.22
14.	Desolation	1975	4.4	69.53
15.	Desolation	1976	11.41	30.47
16.	Desolation	1977	46.37	18.29
17.	Desolation	1978	59.95	119.98
18.	Desolation	1979	8.75	34.98
19.	Desolation	1980	0	39.34
20.	Desolation	1981	49.49	94.45
21.	Desolation	1982	13.54	84.48
22.	Desolation	1983	17.36	92.4
23.	Desolation	1984	75.74	43.96
24.	Desolation	1985	8.24	19.07
25.	Desolation	1986	232.99	96.44
26.	Desolation	1987	56.79	58.84
27.	Desolation	1988	28.3	61.39
28.	Desolation	1989	103.5	28.97
29.	Desolation	1990	344.66	225.23
30.	Desolation	1991	336.18	405.55
31.	Desolation	1992	187.32	475.91
32.	Desolation	1993	104.06	275.27
33.	Desolation	1994	22.16	59.38
34.	Desolation	1995	5.48	157.05
35.	Desolation	1996	52.39	170.09
36.	Desolation	1997	29.9	464.31
37.	Desolation	1998	0.83	68.42
38.	Desolation	1999	0	198.5
39.	Desolation	2000	0	153.4
40.	Desolation	2001	0	0
41.	Desolation	2002	3.41	198.33
42.	Desolation	2003	33.8	32.5
43.	Desolation	2004	0	14.64
44.	Desolation	2005	0	12.19
45.	Desolation	2006	0	46.52
46.	Desolation	2007	0.26	33.4

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_All_AllForestry_Ha	WetFor_SR_AllForestry_Ha
1.	Desolation	1962	40.07	40.07
2.	Desolation	1963	201.8	170.94
3.	Desolation	1964	46.44	46.44
4.	Desolation	1965	379.9	379.9
5.	Desolation	1966	0.56	0.01
6.	Desolation	1967	21.52	16.85
7.	Desolation	1968	589.9	549.43
8.	Desolation	1969	0	0
9.	Desolation	1970	9.05	9.05
10.	Desolation	1971	464.33	441.23
11.	Desolation	1972	33.04	32.07
12.	Desolation	1973	5.45	0
13.	Desolation	1974	35.26	33.6
14.	Desolation	1975	69.53	65.12
15.	Desolation	1976	22.47	21.26
16.	Desolation	1977	7.65	0.29
17.	Desolation	1978	54.98	54.93
18.	Desolation	1979	8.47	3.81
19.	Desolation	1980	0.04	0.04
20.	Desolation	1981	18.78	13.92
21.	Desolation	1982	75.34	64.61
22.	Desolation	1983	37.26	34.59
23.	Desolation	1984	25.09	18.1
24.	Desolation	1985	19.07	16.21
25.	Desolation	1986	64.33	37.94
26.	Desolation	1987	40.12	30.86
27.	Desolation	1988	61.39	54.9
28.	Desolation	1989	25.38	16.15
29.	Desolation	1990	91.8	66.46
30.	Desolation	1991	91.36	38.46
31.	Desolation	1992	99.49	93
32.	Desolation	1993	103.8	88.88
33.	Desolation	1994	34.11	29.61
34.	Desolation	1995	33.98	33.95
35.	Desolation	1996	58.05	53.39
36.	Desolation	1997	19.28	19.25
37.	Desolation	1998	8.68	8.6
38.	Desolation	1999	24.83	24.83
39.	Desolation	2000	17.39	17.39
40.	Desolation	2001	0	0
41.	Desolation	2002	108.74	108.65
42.	Desolation	2003	10.1	9.76
43.	Desolation	2004	12.6	12.6
44.	Desolation	2005	12.19	12.19
45.	Desolation	2006	46.52	46.52
46.	Desolation	2007	33.4	33.14

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	AllFor_WR_AllForestry_Ha	WetFor_WR_AllForestry_Ha
1.	Desolation	1962	0	0
2.	Desolation	1963	30.86	30.86
3.	Desolation	1964	0	0
4.	Desolation	1965	0	0
5.	Desolation	1966	0.56	0.56
6.	Desolation	1967	4.67	4.67
7.	Desolation	1968	40.46	40.46
8.	Desolation	1969	0	0
9.	Desolation	1970	0	0
10.	Desolation	1971	47.08	23.1
11.	Desolation	1972	0.97	0.97
12.	Desolation	1973	34.47	5.45
13.	Desolation	1974	4.62	1.66
14.	Desolation	1975	4.4	4.4
15.	Desolation	1976	1.21	1.21
16.	Desolation	1977	18	7.36
17.	Desolation	1978	51.67	0.05
18.	Desolation	1979	4.66	4.66
19.	Desolation	1980	0	0
20.	Desolation	1981	46.73	4.86
21.	Desolation	1982	10.72	10.72
22.	Desolation	1983	2.67	2.67
23.	Desolation	1984	6.99	6.99
24.	Desolation	1985	2.86	2.86
25.	Desolation	1986	46.98	26.4
26.	Desolation	1987	27.77	9.27
27.	Desolation	1988	6.49	6.49
28.	Desolation	1989	9.23	9.23
29.	Desolation	1990	76.46	25.34
30.	Desolation	1991	238.74	52.89
31.	Desolation	1992	161.08	6.49
32.	Desolation	1993	60.48	14.92
33.	Desolation	1994	15.34	4.49
34.	Desolation	1995	2.62	0.04
35.	Desolation	1996	4.66	4.66
36.	Desolation	1997	0.03	0.03
37.	Desolation	1998	0.08	0.08
38.	Desolation	1999	0	0
39.	Desolation	2000	0	0
40.	Desolation	2001	0	0
41.	Desolation	2002	3.32	0.09
42.	Desolation	2003	13	0.34
43.	Desolation	2004	0	0
44.	Desolation	2005	0	0
45.	Desolation	2006	0	0
46.	Desolation	2007	0.26	0.26

Table A1-38: Original data set with observations for the Desolation management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	RipAsp_All_AllForestry_Ha	RipAsp_SR_AllForestry_Ha
1.	Desolation	1962	0	0
2.	Desolation	1963	0	0
3.	Desolation	1964	0	0
4.	Desolation	1965	0	0
5.	Desolation	1966	0	0
6.	Desolation	1967	0	0
7.	Desolation	1968	0	0
8.	Desolation	1969	0	0
9.	Desolation	1970	1.65	1.65
10.	Desolation	1971	0.43	0
11.	Desolation	1972	0.36	0.36
12.	Desolation	1973	3.38	0
13.	Desolation	1974	35.26	33.6
14.	Desolation	1975	23.81	23.81
15.	Desolation	1976	1.21	0
16.	Desolation	1977	7.65	0.29
17.	Desolation	1978	8.89	8.84
18.	Desolation	1979	8.47	3.81
19.	Desolation	1980	0.04	0.04
20.	Desolation	1981	8.95	6.62
21.	Desolation	1982	75.28	64.55
22.	Desolation	1983	24.8	22.13
23.	Desolation	1984	25.09	18.1
24.	Desolation	1985	19.07	16.21
25.	Desolation	1986	60.01	33.62
26.	Desolation	1987	40.12	30.86
27.	Desolation	1988	61.39	54.9
28.	Desolation	1989	22.96	13.73
29.	Desolation	1990	86.43	61.68
30.	Desolation	1991	76.41	30.98
31.	Desolation	1992	50.61	48.72
32.	Desolation	1993	75.62	64.12
33.	Desolation	1994	34.09	29.59
34.	Desolation	1995	12.73	12.7
35.	Desolation	1996	45.04	40.38
36.	Desolation	1997	8.19	8.16
37.	Desolation	1998	7.54	7.46
38.	Desolation	1999	4.79	4.79
39.	Desolation	2000	1.42	1.42
40.	Desolation	2001	0	0
41.	Desolation	2002	5.79	5.7
42.	Desolation	2003	0.77	0.43
43.	Desolation	2004	0	0
44.	Desolation	2005	0	0
45.	Desolation	2006	0	0
46.	Desolation	2007	0.87	0.87

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	N_Obs	B:100C	CALF:100C
1.	Wenaha	1962	2062	6.58	45.83
2.	Wenaha	1963	521	2.86	44.68
3.	Wenaha	1964	1930	10.49	47.13
4.	Wenaha	1965	1963	7	45.77
5.	Wenaha	1966	2482	8.56	37.28
6.	Wenaha	1967	3131	5.21	48.44
7.	Wenaha	1968	1784	7.87	58.03
8.	Wenaha	1969	2889	2.95	45.57
9.	Wenaha	1970	3027	3.4	39.32
10.	Wenaha	1971		3.8	45.57
11.	Wenaha	1972	2385	8.68	50.08
12.	Wenaha	1973	3051	3.18	55.91
13.	Wenaha	1974	3222	5.73	38.55
14.	Wenaha	1975	2915	4.48	37.24
15.	Wenaha	1976	3274	3.09	43.64
16.	Wenaha	1977		3.97	40.43
17.	Wenaha	1978	3861	2.88	46.01
18.	Wenaha	1979	2531	1.8	34.7
19.	Wenaha	1980	4117	4.5	40.75
20.	Wenaha	1981	3415	3.05	32.24
21.	Wenaha	1982	3262	2.3	44.37
22.	Wenaha	1983	2294	5.56	30.98
23.	Wenaha	1984	2358	3.32	32.63
24.	Wenaha	1985	2257	4.45	23.71
25.	Wenaha	1986	3289	4.04	30.06
26.	Wenaha	1987	3314	3.37	35.43
27.	Wenaha	1988	2783	5.81	30.86
28.	Wenaha	1989	2272	4.42	18.97
29.	Wenaha	1990	2228	3.34	25.5
30.	Wenaha	1991	2084	6.97	24.93
31.	Wenaha	1992	2072	12.44	16.94
32.	Wenaha	1993	2019	9.88	21.99
33.	Wenaha	1994	1411	13.24	23.03
34.	Wenaha	1995	1773	17.41	22.63
35.	Wenaha	1996	1217	14	13.4
36.	Wenaha	1997	1138	11.89	14.1
37.	Wenaha	1998	1237	15.64	16.23
38.	Wenaha	1999	1043	8.96	12.14
39.	Wenaha	2000	1383	20.38	12.17
40.	Wenaha	2001	895	11.82	13.64
41.	Wenaha	2002	911	11.09	14.79
42.	Wenaha	2003	1186	13.55	20.07
43.	Wenaha	2004	1006	20.51	16.21
44.	Wenaha	2005	1167	16.22	20.44
45.	Wenaha	2006	1373	20.63	30.27
46.	Wenaha	2007	1197	18.96	13.33

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	COUGAR_POP_RECON1
1.	Wenaha	1962	
2.	Wenaha	1963	
3.	Wenaha	1964	
4.	Wenaha	1965	
5.	Wenaha	1966	
6.	Wenaha	1967	
7.	Wenaha	1968	
8.	Wenaha	1969	0
9.	Wenaha	1970	0
10.	Wenaha	1971	0
11.	Wenaha	1972	0
12.	Wenaha	1973	0
13.	Wenaha	1974	2
14.	Wenaha	1975	3
15.	Wenaha	1976	6
16.	Wenaha	1977	5
17.	Wenaha	1978	7
18.	Wenaha	1979	6
19.	Wenaha	1980	8
20.	Wenaha	1981	16
21.	Wenaha	1982	25
22.	Wenaha	1983	26
23.	Wenaha	1984	34
24.	Wenaha	1985	38
25.	Wenaha	1986	49
26.	Wenaha	1987	56
27.	Wenaha	1988	55
28.	Wenaha	1989	58
29.	Wenaha	1990	55
30.	Wenaha	1991	49
31.	Wenaha	1992	49
32.	Wenaha	1993	40
33.	Wenaha	1994	32
34.	Wenaha	1995	22
35.	Wenaha	1996	25
36.	Wenaha	1997	28
37.	Wenaha	1998	28
38.	Wenaha	1999	31
39.	Wenaha	2000	26
40.	Wenaha	2001	34
41.	Wenaha	2002	40
42.	Wenaha	2003	42
43.	Wenaha	2004	47
44.	Wenaha	2005	37
45.	Wenaha	2006	38
46.	Wenaha	2007	39

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	ET_ANT_HARV	ET_BUL_HARV	ET_HARV
1.	Wenaha	1962	53	502	555
2.	Wenaha	1963	21	713	734
3.	Wenaha	1964	108	943	1051
4.	Wenaha	1965	351	786	1137
5.	Wenaha	1966	399	681	1080
6.	Wenaha	1967	270	765	1035
7.	Wenaha	1968	486	819	1305
8.	Wenaha	1969	271	532	803
9.	Wenaha	1970	171	403	574
10.	Wenaha	1971	312	628	940
11.	Wenaha	1972	306	460	766
12.	Wenaha	1973	125	559	684
13.	Wenaha	1974	303	668	971
14.	Wenaha	1975			
15.	Wenaha	1976	365	467	832
16.	Wenaha	1977	161	781	942
17.	Wenaha	1978	212	930	1142
18.	Wenaha	1979	425	668	1093
19.	Wenaha	1980	177	462	639
20.	Wenaha	1981	371	306	677
21.	Wenaha	1982	660	473	1133
22.	Wenaha	1983	194	476	670
23.	Wenaha	1984	306	543	849
24.	Wenaha	1985			
25.	Wenaha	1986	262	388	650
26.	Wenaha	1987	257	235	492
27.	Wenaha	1988	415	195	610
28.	Wenaha	1989	540	287	827
29.	Wenaha	1990	328	267	595
30.	Wenaha	1991	206	158	364
31.	Wenaha	1992	134	228	362
32.	Wenaha	1993	210	186	396
33.	Wenaha	1994	116	144	260
34.	Wenaha	1995	100	147	247
35.	Wenaha	1996	64	137	201
36.	Wenaha	1997	92	125	217
37.	Wenaha	1998	107	124	231
38.	Wenaha	1999	63	141	204
39.	Wenaha	2000	48	128	176
40.	Wenaha	2001	36	130	166
41.	Wenaha	2002	44	73	117
42.	Wenaha	2003	21	161	182
43.	Wenaha	2004	48	67	115
44.	Wenaha	2005	33	152	185
45.	Wenaha	2006	0	92	92
46.	Wenaha	2007	0	72	72

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_C_PPT_1003_t	W_C_PPT_0409_t
1.	Wenaha	1962	607.46	231.34
2.	Wenaha	1963	518.86	235.59
3.	Wenaha	1964	602.76	244.85
4.	Wenaha	1965	892.53	272.41
5.	Wenaha	1966	464.43	330.75
6.	Wenaha	1967	675.68	162.09
7.	Wenaha	1968	563.97	185.57
8.	Wenaha	1969	685.53	320.61
9.	Wenaha	1970	680.55	267.45
10.	Wenaha	1971	671.17	313.1
11.	Wenaha	1972	760.86	309.33
12.	Wenaha	1973	514.86	261.38
13.	Wenaha	1974	949.29	181.4
14.	Wenaha	1975	650.15	230.95
15.	Wenaha	1976	938.44	271.61
16.	Wenaha	1977	305.57	315.23
17.	Wenaha	1978	663.35	283.04
18.	Wenaha	1979	629.48	348.2
19.	Wenaha	1980	621.36	276.64
20.	Wenaha	1981	607.08	325.02
21.	Wenaha	1982	839.08	319.54
22.	Wenaha	1983	700.29	349.5
23.	Wenaha	1984	738.37	315.44
24.	Wenaha	1985	635.96	371.1
25.	Wenaha	1986	587.94	249.79
26.	Wenaha	1987	491.76	266.01
27.	Wenaha	1988	469.87	203.89
28.	Wenaha	1989	705.8	226.19
29.	Wenaha	1990	451.48	310.53
30.	Wenaha	1991	570.24	275.42
31.	Wenaha	1992	513.6	303.46
32.	Wenaha	1993	571.19	259.45
33.	Wenaha	1994	440.47	394.77
34.	Wenaha	1995	731.39	212.57
35.	Wenaha	1996	804.92	324.38
36.	Wenaha	1997	908.56	272.15
37.	Wenaha	1998	506.49	297.01
38.	Wenaha	1999	714.61	351.88
39.	Wenaha	2000	672.84	181.63
40.	Wenaha	2001	415.06	243.29
41.	Wenaha	2002	647.25	238.64
42.	Wenaha	2003	599.79	213.58
43.	Wenaha	2004	605.84	208.47
44.	Wenaha	2005	386.53	384.32
45.	Wenaha	2006	651.04	245.87
46.	Wenaha	2007	647.05	280.39

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H20_TMAX_0709_t	W_H24_TMAX_0708_t
1.	Wenaha	1962	26.48	30.1
2.	Wenaha	1963	24.75	25.48
3.	Wenaha	1964	25.93	26.12
4.	Wenaha	1965	23.71	25.58
5.	Wenaha	1966	23.69	26.11
6.	Wenaha	1967	25.39	26.29
7.	Wenaha	1968	28.79	29.86
8.	Wenaha	1969	24.02	25.71
9.	Wenaha	1970	24.88	26.25
10.	Wenaha	1971	24.75	28.19
11.	Wenaha	1972	25.49	28.92
12.	Wenaha	1973	24.33	27.14
13.	Wenaha	1974	25.57	27.96
14.	Wenaha	1975	26.12	26.66
15.	Wenaha	1976	25.41	26.16
16.	Wenaha	1977	24.63	24.87
17.	Wenaha	1978	24.67	27.53
18.	Wenaha	1979	23.8	25.92
19.	Wenaha	1980	26.69	27.52
20.	Wenaha	1981	24.23	25.41
21.	Wenaha	1982	26.17	27.79
22.	Wenaha	1983	24.34	26.21
23.	Wenaha	1984	23.88	25.97
24.	Wenaha	1985	24.81	27.53
25.	Wenaha	1986	24.06	27.63
26.	Wenaha	1987	23.78	26.81
27.	Wenaha	1988	25.77	25.86
28.	Wenaha	1989	25.8	27.4
29.	Wenaha	1990	24.35	25.36
30.	Wenaha	1991	26.94	27.2
31.	Wenaha	1992	26.36	27.43
32.	Wenaha	1993	24.07	25.87
33.	Wenaha	1994	21.99	21.72
34.	Wenaha	1995	27.01	28.29
35.	Wenaha	1996	24.43	24.84
36.	Wenaha	1997	25.09	27.77
37.	Wenaha	1998	24.91	26.16
38.	Wenaha	1999	27.64	29.01
39.	Wenaha	2000	25.16	26.65
40.	Wenaha	2001	24.93	27.46
41.	Wenaha	2002	26.67	27.59
42.	Wenaha	2003	25.46	26.87
43.	Wenaha	2004	27.54	29.55
44.	Wenaha	2005	25.1	27.56
45.	Wenaha	2006	25.93	28.28
46.	Wenaha	2007	26.51	28.47

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_TMAX_0709_t1	W_H24_PPT_0809_t
1.	Wenaha	1962	26.11	27.37
2.	Wenaha	1963	26.48	30.77
3.	Wenaha	1964	24.75	26.82
4.	Wenaha	1965	25.93	29.55
5.	Wenaha	1966	23.71	51.89
6.	Wenaha	1967	23.69	23.04
7.	Wenaha	1968	25.39	9.12
8.	Wenaha	1969	28.79	62.67
9.	Wenaha	1970	24.02	13.28
10.	Wenaha	1971	24.88	34.83
11.	Wenaha	1972	24.75	34.79
12.	Wenaha	1973	25.49	33.13
13.	Wenaha	1974	24.33	38.05
14.	Wenaha	1975	25.57	2.35
15.	Wenaha	1976	26.12	22.29
16.	Wenaha	1977	25.41	48.08
17.	Wenaha	1978	24.63	62.85
18.	Wenaha	1979	24.67	46.29
19.	Wenaha	1980	23.8	27.2
20.	Wenaha	1981	26.69	35.17
21.	Wenaha	1982	24.23	16.15
22.	Wenaha	1983	26.17	45.04
23.	Wenaha	1984	24.34	34.01
24.	Wenaha	1985	23.88	46.26
25.	Wenaha	1986	24.81	41.98
26.	Wenaha	1987	24.06	43.12
27.	Wenaha	1988	23.78	6.58
28.	Wenaha	1989	25.77	11.27
29.	Wenaha	1990	25.8	60.36
30.	Wenaha	1991	24.35	10.19
31.	Wenaha	1992	26.94	6.08
32.	Wenaha	1993	26.36	27.73
33.	Wenaha	1994	24.07	21.1
34.	Wenaha	1995	21.99	11.18
35.	Wenaha	1996	27.01	22.37
36.	Wenaha	1997	24.43	11.11
37.	Wenaha	1998	25.09	24.65
38.	Wenaha	1999	24.91	27.55
39.	Wenaha	2000	27.64	26.26
40.	Wenaha	2001	25.16	29.37
41.	Wenaha	2002	24.93	9.24
42.	Wenaha	2003	26.67	20.74
43.	Wenaha	2004	25.46	20.85
44.	Wenaha	2005	27.54	55.09
45.	Wenaha	2006	25.1	2.85
46.	Wenaha	2007	25.93	22.6

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_PPT_0809_t1	W_H24_TMIN_05_t
1.	Wenaha	1962	41.45	2.52
2.	Wenaha	1963	27.37	2.08
3.	Wenaha	1964	30.77	3.4
4.	Wenaha	1965	26.82	1.87
5.	Wenaha	1966	29.55	2.24
6.	Wenaha	1967	51.89	2.82
7.	Wenaha	1968	23.04	2.56
8.	Wenaha	1969	9.12	2.84
9.	Wenaha	1970	62.67	3.83
10.	Wenaha	1971	13.28	2.92
11.	Wenaha	1972	34.83	3.77
12.	Wenaha	1973	34.79	3.46
13.	Wenaha	1974	33.13	3.29
14.	Wenaha	1975	38.05	2.09
15.	Wenaha	1976	2.35	1.95
16.	Wenaha	1977	22.29	2.34
17.	Wenaha	1978	48.08	2.23
18.	Wenaha	1979	62.85	2.73
19.	Wenaha	1980	46.29	3.98
20.	Wenaha	1981	27.2	3.58
21.	Wenaha	1982	35.17	3.47
22.	Wenaha	1983	16.15	2.53
23.	Wenaha	1984	45.04	3.2
24.	Wenaha	1985	34.01	2.2
25.	Wenaha	1986	46.26	3.79
26.	Wenaha	1987	41.98	3.7
27.	Wenaha	1988	43.12	5.3
28.	Wenaha	1989	6.58	3.18
29.	Wenaha	1990	11.27	2.94
30.	Wenaha	1991	60.36	2.96
31.	Wenaha	1992	10.19	2.37
32.	Wenaha	1993	6.08	5.36
33.	Wenaha	1994	27.73	6.31
34.	Wenaha	1995	21.1	5.28
35.	Wenaha	1996	11.18	4.2
36.	Wenaha	1997	22.37	2.5
37.	Wenaha	1998	11.11	4.98
38.	Wenaha	1999	24.65	4.32
39.	Wenaha	2000	27.55	2.54
40.	Wenaha	2001	26.26	3.81
41.	Wenaha	2002	29.37	3.74
42.	Wenaha	2003	9.24	2.75
43.	Wenaha	2004	20.74	3.56
44.	Wenaha	2005	20.85	4.38
45.	Wenaha	2006	55.09	5.31
46.	Wenaha	2007	2.85	4.6

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_H24_TMIN_05_t1
1.	Wenaha	1962	1.91
2.	Wenaha	1963	2.52
3.	Wenaha	1964	2.08
4.	Wenaha	1965	3.4
5.	Wenaha	1966	1.87
6.	Wenaha	1967	2.24
7.	Wenaha	1968	2.82
8.	Wenaha	1969	2.56
9.	Wenaha	1970	2.84
10.	Wenaha	1971	3.83
11.	Wenaha	1972	2.92
12.	Wenaha	1973	3.77
13.	Wenaha	1974	3.46
14.	Wenaha	1975	3.29
15.	Wenaha	1976	2.09
16.	Wenaha	1977	1.95
17.	Wenaha	1978	2.34
18.	Wenaha	1979	2.23
19.	Wenaha	1980	2.73
20.	Wenaha	1981	3.98
21.	Wenaha	1982	3.58
22.	Wenaha	1983	3.47
23.	Wenaha	1984	2.53
24.	Wenaha	1985	3.2
25.	Wenaha	1986	2.2
26.	Wenaha	1987	3.79
27.	Wenaha	1988	3.7
28.	Wenaha	1989	5.3
29.	Wenaha	1990	3.18
30.	Wenaha	1991	2.94
31.	Wenaha	1992	2.96
32.	Wenaha	1993	2.37
33.	Wenaha	1994	5.36
34.	Wenaha	1995	6.31
35.	Wenaha	1996	5.28
36.	Wenaha	1997	4.2
37.	Wenaha	1998	2.5
38.	Wenaha	1999	4.98
39.	Wenaha	2000	4.32
40.	Wenaha	2001	2.54
41.	Wenaha	2002	3.81
42.	Wenaha	2003	3.74
43.	Wenaha	2004	2.75
44.	Wenaha	2005	3.56
45.	Wenaha	2006	4.38
46.	Wenaha	2007	5.31

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_SumPPT_08_t	W_J_SumPPT_08_t1
1.	Wenaha	1962	21	65.08
2.	Wenaha	1963	17.68	21
3.	Wenaha	1964	23.35	17.68
4.	Wenaha	1965	27.09	23.35
5.	Wenaha	1966	97.86	27.09
6.	Wenaha	1967	20.12	97.86
7.	Wenaha	1968	1.02	20.12
8.	Wenaha	1969	77.27	1.02
9.	Wenaha	1970	0	77.27
10.	Wenaha	1971	0.83	0
11.	Wenaha	1972	13.32	0.83
12.	Wenaha	1973	24.68	13.32
13.	Wenaha	1974	6.94	24.68
14.	Wenaha	1975	4.4	6.94
15.	Wenaha	1976	44.51	4.4
16.	Wenaha	1977	94.85	44.51
17.	Wenaha	1978	67.44	94.85
18.	Wenaha	1979	40.27	67.44
19.	Wenaha	1980	50.32	40.27
20.	Wenaha	1981	19.71	50.32
21.	Wenaha	1982	2.71	19.71
22.	Wenaha	1983	31.48	2.71
23.	Wenaha	1984	39.23	31.48
24.	Wenaha	1985	52.52	39.23
25.	Wenaha	1986	30.33	52.52
26.	Wenaha	1987	19.37	30.33
27.	Wenaha	1988	8.04	19.37
28.	Wenaha	1989	2.91	8.04
29.	Wenaha	1990	107.71	2.91
30.	Wenaha	1991	19.52	107.71
31.	Wenaha	1992	10.28	19.52
32.	Wenaha	1993	27.9	10.28
33.	Wenaha	1994	43.9	27.9
34.	Wenaha	1995	2.69	43.9
35.	Wenaha	1996	19.23	2.69
36.	Wenaha	1997	6.85	19.23
37.	Wenaha	1998	15.93	6.85
38.	Wenaha	1999	8.71	15.93
39.	Wenaha	2000	58.56	8.71
40.	Wenaha	2001	0.32	58.56
41.	Wenaha	2002	9.27	0.32
42.	Wenaha	2003	30.71	9.27
43.	Wenaha	2004	22.31	30.71
44.	Wenaha	2005	85.2	22.31
45.	Wenaha	2006	0.75	85.2
46.	Wenaha	2007	11.25	0.75

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_WinTMIN_1202_t	W_J_WinTMIN_1202_t1
1.	Wenaha	1962	-6.46	-3.73
2.	Wenaha	1963	-4.91	-6.46
3.	Wenaha	1964	-5.25	-4.91
4.	Wenaha	1965	-4.75	-5.25
5.	Wenaha	1966	-4.93	-4.75
6.	Wenaha	1967	-2.62	-4.93
7.	Wenaha	1968	-4.6	-2.62
8.	Wenaha	1969	-7.36	-4.6
9.	Wenaha	1970	-3.5	-7.36
10.	Wenaha	1971	-4.75	-3.5
11.	Wenaha	1972	-6.22	-4.75
12.	Wenaha	1973	-6.62	-6.22
13.	Wenaha	1974	-4.37	-6.62
14.	Wenaha	1975	-5.42	-4.37
15.	Wenaha	1976	-4.41	-5.42
16.	Wenaha	1977	-5.95	-4.41
17.	Wenaha	1978	-2.7	-5.95
18.	Wenaha	1979	-9.07	-2.7
19.	Wenaha	1980	-4.36	-9.07
20.	Wenaha	1981	-3	-4.36
21.	Wenaha	1982	-4.96	-3
22.	Wenaha	1983	-2.57	-4.96
23.	Wenaha	1984	-6.72	-2.57
24.	Wenaha	1985	-8.7	-6.72
25.	Wenaha	1986	-5.38	-8.7
26.	Wenaha	1987	-5.06	-5.38
27.	Wenaha	1988	-5.05	-5.06
28.	Wenaha	1989	-7.04	-5.05
29.	Wenaha	1990	-3.9	-7.04
30.	Wenaha	1991	-6	-3.9
31.	Wenaha	1992	-2.38	-6
32.	Wenaha	1993	-7.76	-2.38
33.	Wenaha	1994	-3.74	-7.76
34.	Wenaha	1995	-3.5	-3.74
35.	Wenaha	1996	-4.67	-3.5
36.	Wenaha	1997	-4.68	-4.67
37.	Wenaha	1998	-3.31	-4.68
38.	Wenaha	1999	-4.16	-3.31
39.	Wenaha	2000	-3.25	-4.16
40.	Wenaha	2001	-5.23	-3.25
41.	Wenaha	2002	-4.34	-5.23
42.	Wenaha	2003	-2.73	-4.34
43.	Wenaha	2004	-3.86	-2.73
44.	Wenaha	2005	-3.68	-3.86
45.	Wenaha	2006	-4.23	-3.68
46.	Wenaha	2007	-4.35	-4.23

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_J_WSI_NoStandard_t	W_J_WSI_NoStandard_t1
1.	Wenaha	1962	158.45	182.5
2.	Wenaha	1963	146.21	158.45
3.	Wenaha	1964	159.43	146.21
4.	Wenaha	1965	352.38	159.43
5.	Wenaha	1966	138.36	352.38
6.	Wenaha	1967	204.46	138.36
7.	Wenaha	1968	176.62	204.46
8.	Wenaha	1969	242.03	176.62
9.	Wenaha	1970	297.16	242.03
10.	Wenaha	1971	187.15	297.16
11.	Wenaha	1972	254.39	187.15
12.	Wenaha	1973	173.59	254.39
13.	Wenaha	1974	278.69	173.59
14.	Wenaha	1975	272.19	278.69
15.	Wenaha	1976	283.55	272.19
16.	Wenaha	1977	62.75	283.55
17.	Wenaha	1978	242.25	62.75
18.	Wenaha	1979	227.72	242.25
19.	Wenaha	1980	183.37	227.72
20.	Wenaha	1981	204.6	183.37
21.	Wenaha	1982	299.72	204.6
22.	Wenaha	1983	220.92	299.72
23.	Wenaha	1984	227.42	220.92
24.	Wenaha	1985	158.23	227.42
25.	Wenaha	1986	204.72	158.23
26.	Wenaha	1987	123.01	204.72
27.	Wenaha	1988	174.96	123.01
28.	Wenaha	1989	198.46	174.96
29.	Wenaha	1990	141.23	198.46
30.	Wenaha	1991	132.24	141.23
31.	Wenaha	1992	124.05	132.24
32.	Wenaha	1993	165.44	124.05
33.	Wenaha	1994	194.54	165.44
34.	Wenaha	1995	200.93	194.54
35.	Wenaha	1996	280.37	200.93
36.	Wenaha	1997	298.45	280.37
37.	Wenaha	1998	163.15	298.45
38.	Wenaha	1999	251.18	163.15
39.	Wenaha	2000	224.58	251.18
40.	Wenaha	2001	107.08	224.58
41.	Wenaha	2002	176.99	107.08
42.	Wenaha	2003	217.7	176.99
43.	Wenaha	2004	225.6	217.7
44.	Wenaha	2005	97.78	225.6
45.	Wenaha	2006	222.67	97.78
46.	Wenaha	2007	186.26	222.67

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_L_ESPpt_0506_t	W_L_LSPpt_0809_t
1.	Wenaha	1962	92.1	52.78
2.	Wenaha	1963	93.5	59.63
3.	Wenaha	1964	78.2	51.93
4.	Wenaha	1965	101.63	57.65
5.	Wenaha	1966	95.03	99.93
6.	Wenaha	1967	55.55	45.12
7.	Wenaha	1968	88.17	17.73
8.	Wenaha	1969	99.89	121.14
9.	Wenaha	1970	115.9	26.2
10.	Wenaha	1971	109.79	67.97
11.	Wenaha	1972	146.2	67.54
12.	Wenaha	1973	92.92	64.53
13.	Wenaha	1974	62.44	74.05
14.	Wenaha	1975	53.8	4.6
15.	Wenaha	1976	84.12	44.2
16.	Wenaha	1977	84.99	93.28
17.	Wenaha	1978	107.49	123.1
18.	Wenaha	1979	76.63	91.5
19.	Wenaha	1980	86.7	53.11
20.	Wenaha	1981	155.33	68.95
21.	Wenaha	1982	152.25	31.46
22.	Wenaha	1983	78.36	87.25
23.	Wenaha	1984	106.25	65.81
24.	Wenaha	1985	163.99	89.44
25.	Wenaha	1986	93.74	83.08
26.	Wenaha	1987	76.19	84.2
27.	Wenaha	1988	99.31	12.56
28.	Wenaha	1989	102.88	21.67
29.	Wenaha	1990	99.53	117.54
30.	Wenaha	1991	127.55	20.24
31.	Wenaha	1992	182.92	11.97
32.	Wenaha	1993	60.73	54.48
33.	Wenaha	1994	146.16	41.51
34.	Wenaha	1995	87.45	21.94
35.	Wenaha	1996	143.57	43.76
36.	Wenaha	1997	107.28	21.48
37.	Wenaha	1998	70.17	47.3
38.	Wenaha	1999	182.78	54.29
39.	Wenaha	2000	69.08	50.67
40.	Wenaha	2001	115.18	57.66
41.	Wenaha	2002	92.34	17.81
42.	Wenaha	2003	89.91	40.49
43.	Wenaha	2004	59.94	40.42
44.	Wenaha	2005	165.71	106.64
45.	Wenaha	2006	154.15	5.72
46.	Wenaha	2007	118.14	44.2

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_L_EWPpt_1112_t	W_L_TotWPpt_1103_t
1.	Wenaha	1962	206.52	393.22
2.	Wenaha	1963	161.27	326.14
3.	Wenaha	1964	200.54	422.69
4.	Wenaha	1965	401.3	622.16
5.	Wenaha	1966	97.51	333.41
6.	Wenaha	1967	249.93	457.52
7.	Wenaha	1968	165.22	342.96
8.	Wenaha	1969	238.22	459.02
9.	Wenaha	1970	138.52	475.35
10.	Wenaha	1971	186.19	437.45
11.	Wenaha	1972	268.94	539.36
12.	Wenaha	1973	217.38	352.52
13.	Wenaha	1974	426.94	692.86
14.	Wenaha	1975	197.82	488.38
15.	Wenaha	1976	299.16	587.24
16.	Wenaha	1977	68.16	195.22
17.	Wenaha	1978	292.73	469.29
18.	Wenaha	1979	209.75	455.76
19.	Wenaha	1980	145.99	402.63
20.	Wenaha	1981	201.81	430.02
21.	Wenaha	1982	256.75	576.65
22.	Wenaha	1983	183.9	464.36
23.	Wenaha	1984	267.8	538.53
24.	Wenaha	1985	265.97	394.95
25.	Wenaha	1986	120.7	411.62
26.	Wenaha	1987	166.15	356.65
27.	Wenaha	1988	134.62	359.1
28.	Wenaha	1989	260.23	532.08
29.	Wenaha	1990	105.09	308.5
30.	Wenaha	1991	172.58	351.94
31.	Wenaha	1992	254.96	365.15
32.	Wenaha	1993	219.26	400.9
33.	Wenaha	1994	107	311.92
34.	Wenaha	1995	259.04	508.93
35.	Wenaha	1996	282.46	571.78
36.	Wenaha	1997	334.3	612.84
37.	Wenaha	1998	118.59	319.18
38.	Wenaha	1999	282.64	520.63
39.	Wenaha	2000	215.48	474.75
40.	Wenaha	2001	113.22	239.04
41.	Wenaha	2002	194.49	416.06
42.	Wenaha	2003	127.81	444.53
43.	Wenaha	2004	203.11	425.14
44.	Wenaha	2005	127.3	253.79
45.	Wenaha	2006	207.01	455.43
46.	Wenaha	2007	276.28	468.6

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_P_PPT_04_t	W_P_PPT_06_t
1.	Wenaha	1962	64.31	26.2
2.	Wenaha	1963	66.1	18.17
3.	Wenaha	1964	85.57	43.51
4.	Wenaha	1965	64.95	76.59
5.	Wenaha	1966	70.54	64.65
6.	Wenaha	1967	18.67	42.49
7.	Wenaha	1968	65.48	39.23
8.	Wenaha	1969	44.91	51.96
9.	Wenaha	1970	99.09	80.05
10.	Wenaha	1971	70.3	64.74
11.	Wenaha	1972	50.97	80.66
12.	Wenaha	1973	74.86	36.08
13.	Wenaha	1974	27.69	21.92
14.	Wenaha	1975	134.42	25.79
15.	Wenaha	1976	88.89	49.78
16.	Wenaha	1977	92.13	50.69
17.	Wenaha	1978	15.37	27.16
18.	Wenaha	1979	133.34	27.65
19.	Wenaha	1980	109.15	32.23
20.	Wenaha	1981	54.73	68.98
21.	Wenaha	1982	79.06	82.59
22.	Wenaha	1983	75.7	46.89
23.	Wenaha	1984	52.88	59.83
24.	Wenaha	1985	65.12	93.4
25.	Wenaha	1986	46.05	40.31
26.	Wenaha	1987	57.88	22.12
27.	Wenaha	1988	37.89	43.79
28.	Wenaha	1989	82.47	51.8
29.	Wenaha	1990	50.34	34.6
30.	Wenaha	1991	92.97	51.39
31.	Wenaha	1992	86.35	58.89
32.	Wenaha	1993	80.84	44.06
33.	Wenaha	1994	123.52	91.1
34.	Wenaha	1995	57.17	38.15
35.	Wenaha	1996	100.64	78.63
36.	Wenaha	1997	123.69	27.06
37.	Wenaha	1998	111.1	38.74
38.	Wenaha	1999	54.11	50.39
39.	Wenaha	2000	34.33	34.48
40.	Wenaha	2001	38.75	51.89
41.	Wenaha	2002	97	44.83
42.	Wenaha	2003	52.34	56.29
43.	Wenaha	2004	87.76	6.23
44.	Wenaha	2005	55.27	46.7
45.	Wenaha	2006	63.9	48.72
46.	Wenaha	2007	86.13	57.96

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	W_P_PPT_10_t	W_P_PPT_12_t
1.	Wenaha	1962	87.29	82.88
2.	Wenaha	1963	112.98	58.43
3.	Wenaha	1964	27.78	55.88
4.	Wenaha	1965	43.62	195.93
5.	Wenaha	1966	22.67	21.62
6.	Wenaha	1967	71.06	97.02
7.	Wenaha	1968	108.88	64.25
8.	Wenaha	1969	88.46	88.73
9.	Wenaha	1970	71.91	81.67
10.	Wenaha	1971	93.42	54.03
11.	Wenaha	1972	62.35	110.97
12.	Wenaha	1973	36.89	100.04
13.	Wenaha	1974	41.63	142.61
14.	Wenaha	1975	3.82	88.68
15.	Wenaha	1976	109.22	130.92
16.	Wenaha	1977	36.58	21.24
17.	Wenaha	1978	57.25	130.65
18.	Wenaha	1979	9.46	95.14
19.	Wenaha	1980	99.59	44.32
20.	Wenaha	1981	58.24	93.6
21.	Wenaha	1982	78.27	115.8
22.	Wenaha	1983	95.09	86.71
23.	Wenaha	1984	26.56	112.13
24.	Wenaha	1985	97.21	91.89
25.	Wenaha	1986	78.89	22.61
26.	Wenaha	1987	25.08	18.77
27.	Wenaha	1988	0	62.26
28.	Wenaha	1989	9.78	53.07
29.	Wenaha	1990	46.09	28.44
30.	Wenaha	1991	106.3	52.54
31.	Wenaha	1992	39.15	48.03
32.	Wenaha	1993	45.92	64.23
33.	Wenaha	1994	28.91	59.14
34.	Wenaha	1995	71.59	69.26
35.	Wenaha	1996	85.59	82.12
36.	Wenaha	1997	115.26	156.15
37.	Wenaha	1998	102.06	45.13
38.	Wenaha	1999	31.74	107.22
39.	Wenaha	2000	57.6	75.81
40.	Wenaha	2001	102.89	41.36
41.	Wenaha	2002	92.51	68.89
42.	Wenaha	2003	27.22	68.6
43.	Wenaha	2004	44.67	82.47
44.	Wenaha	2005	51.94	51.66
45.	Wenaha	2006	46.06	85.34
46.	Wenaha	2007	33.34	71.37

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_Rgen_TOT	Ha_Rgen_SR	Ha_Rgen_WR
1.	Wenaha	1962	12.24	3.48	8.77
2.	Wenaha	1963	63.45	37.92	25.53
3.	Wenaha	1964	13.02	13.02	0
4.	Wenaha	1965	190.53	152.33	38.2
5.	Wenaha	1966	12.96	12.96	0
6.	Wenaha	1967	60.71	37.97	22.74
7.	Wenaha	1968	331.67	312.19	19.49
8.	Wenaha	1969	241.47	173.25	68.22
9.	Wenaha	1970	347.26	317.72	29.54
10.	Wenaha	1971	360.41	333.4	27.01
11.	Wenaha	1972	429.69	402.7	27
12.	Wenaha	1973	459.45	331.8	127.65
13.	Wenaha	1974	1438.73	1312.15	126.58
14.	Wenaha	1975	379.52	282.75	96.76
15.	Wenaha	1976	2177.28	1638.28	539
16.	Wenaha	1977	693.35	565.91	127.44
17.	Wenaha	1978	712.8	712.57	0.23
18.	Wenaha	1979	1475.55	1379.25	96.29
19.	Wenaha	1980	819.16	727.18	91.98
20.	Wenaha	1981	254.14	217.1	37.04
21.	Wenaha	1982	1239.51	1088.31	151.2
22.	Wenaha	1983	24.14	21.79	2.35
23.	Wenaha	1984	31.19	30.6	0.59
24.	Wenaha	1985	8.6	8.06	0.54
25.	Wenaha	1986	109.94	109.94	0
26.	Wenaha	1987	123.45	122.1	1.35
27.	Wenaha	1988	124.26	124.26	0
28.	Wenaha	1989	150.42	146.38	4.04
29.	Wenaha	1990	290.24	287.24	3
30.	Wenaha	1991	168	165.44	2.57
31.	Wenaha	1992	21.12	21.12	0
32.	Wenaha	1993	172.87	172.14	0.73
33.	Wenaha	1994	88.71	55.01	33.69
34.	Wenaha	1995	8.17	7.67	0.5
35.	Wenaha	1996	0	0	0
36.	Wenaha	1997	139.08	139.08	0
37.	Wenaha	1998	3.07	3.07	0
38.	Wenaha	1999	4.01	2.9	1.11
39.	Wenaha	2000	0	0	0
40.	Wenaha	2001	294.92	244.1	50.82
41.	Wenaha	2002	640.02	629.94	10.08
42.	Wenaha	2003	275.86	255.14	20.71
43.	Wenaha	2004	325	291.02	33.98
44.	Wenaha	2005	155.99	124.56	31.43
45.	Wenaha	2006	107.56	106.71	0.85
46.	Wenaha	2007	221.57	127.24	94.33

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_All_Rgen_Ha	WetFor_SR_Rgen_Ha
1.	Wenaha	1962	3.48	3.48
2.	Wenaha	1963	3.8	3.8
3.	Wenaha	1964	0	0
4.	Wenaha	1965	7.48	7.48
5.	Wenaha	1966	7.64	7.64
6.	Wenaha	1967	0	0
7.	Wenaha	1968	0	0
8.	Wenaha	1969	12.07	12.07
9.	Wenaha	1970	0	0
10.	Wenaha	1971	0	0
11.	Wenaha	1972	0	0
12.	Wenaha	1973	23.27	20.93
13.	Wenaha	1974	43.94	43.94
14.	Wenaha	1975	2.38	1.26
15.	Wenaha	1976	25	25
16.	Wenaha	1977	10.55	6.94
17.	Wenaha	1978	4.28	4.28
18.	Wenaha	1979	33.58	7.43
19.	Wenaha	1980	30.64	26.21
20.	Wenaha	1981	2.42	2.42
21.	Wenaha	1982	0	0
22.	Wenaha	1983	0	0
23.	Wenaha	1984	30.48	30.23
24.	Wenaha	1985	3.45	2.91
25.	Wenaha	1986	24.87	24.87
26.	Wenaha	1987	60.65	59.35
27.	Wenaha	1988	46.67	46.67
28.	Wenaha	1989	150.33	146.31
29.	Wenaha	1990	280.68	278.21
30.	Wenaha	1991	167.65	165.25
31.	Wenaha	1992	21.12	21.12
32.	Wenaha	1993	172.29	171.96
33.	Wenaha	1994	67	53.32
34.	Wenaha	1995	7.22	6.95
35.	Wenaha	1996	0	0
36.	Wenaha	1997	138.72	138.72
37.	Wenaha	1998	3.07	3.07
38.	Wenaha	1999	4.01	2.9
39.	Wenaha	2000	0	0
40.	Wenaha	2001	294.92	244.1
41.	Wenaha	2002	640.02	629.94
42.	Wenaha	2003	275.86	255.14
43.	Wenaha	2004	325	291.02
44.	Wenaha	2005	155.99	124.56
45.	Wenaha	2006	107.56	106.71
46.	Wenaha	2007	221.57	127.24

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_NRgen_TOT	Ha_NRgen_SR	Ha_NRgen_WR
1.	Wenaha	1962	0	0	0
2.	Wenaha	1963	117.14	22.98	94.16
3.	Wenaha	1964	104.16	104.16	0
4.	Wenaha	1965	210.06	65.12	144.94
5.	Wenaha	1966	91.24	84.2	7.04
6.	Wenaha	1967	40.94	40.94	0
7.	Wenaha	1968	105.92	85.97	19.95
8.	Wenaha	1969	80.88	64.99	15.89
9.	Wenaha	1970	110.97	17.57	93.41
10.	Wenaha	1971	76.7	59.89	16.81
11.	Wenaha	1972	849.62	570.81	278.82
12.	Wenaha	1973	191.68	127.65	64.04
13.	Wenaha	1974	314.19	223.04	91.15
14.	Wenaha	1975	163.07	123.56	39.51
15.	Wenaha	1976	210.92	138.18	72.74
16.	Wenaha	1977	224.39	154.54	69.85
17.	Wenaha	1978	107.83	101.84	5.99
18.	Wenaha	1979	307.09	197.11	109.98
19.	Wenaha	1980	518.24	438.54	79.7
20.	Wenaha	1981	367.62	367.29	0.33
21.	Wenaha	1982	37.91	37.44	0.47
22.	Wenaha	1983	99.15	33.92	65.23
23.	Wenaha	1984	259.83	245.83	13.99
24.	Wenaha	1985	90.78	90.78	0
25.	Wenaha	1986	24.2	16.64	7.57
26.	Wenaha	1987	10.77	5.05	5.72
27.	Wenaha	1988	1107.75	1093.74	14.01
28.	Wenaha	1989	207.73	119.84	87.89
29.	Wenaha	1990	20.79	14.58	6.2
30.	Wenaha	1991	440.52	322.5	118.03
31.	Wenaha	1992	28.3	25.2	3.1
32.	Wenaha	1993	1108.12	1096.45	11.67
33.	Wenaha	1994	820.09	732.64	87.45
34.	Wenaha	1995	274.33	274.33	0
35.	Wenaha	1996	226.07	35.06	191.01
36.	Wenaha	1997	398.66	398.66	0
37.	Wenaha	1998	310.06	56.38	253.68
38.	Wenaha	1999	730.78	601.8	128.99
39.	Wenaha	2000	158.44	158.44	0
40.	Wenaha	2001	191.23	167.68	23.55
41.	Wenaha	2002	627.28	536.34	90.95
42.	Wenaha	2003	231.28	231.28	0
43.	Wenaha	2004	303.96	303.96	0
44.	Wenaha	2005	30.27	30.27	0
45.	Wenaha	2006	177.2	156.47	20.72
46.	Wenaha	2007	26	24.8	1.2

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	AllFor_All_NRgen_Ha	WetFor_All_NRgen_Ha
1.	Wenaha	1962	0	0
2.	Wenaha	1963	102.69	51
3.	Wenaha	1964	104.16	0
4.	Wenaha	1965	209.97	69.99
5.	Wenaha	1966	91.06	91.06
6.	Wenaha	1967	40.94	20.05
7.	Wenaha	1968	93.55	7.58
8.	Wenaha	1969	80.88	22.88
9.	Wenaha	1970	109.17	0
10.	Wenaha	1971	69.56	43.7
11.	Wenaha	1972	849.63	15.63
12.	Wenaha	1973	191.59	6.16
13.	Wenaha	1974	313.33	11.97
14.	Wenaha	1975	163.07	2.07
15.	Wenaha	1976	210.56	39.39
16.	Wenaha	1977	224.39	5.57
17.	Wenaha	1978	106.19	16.68
18.	Wenaha	1979	304.64	12.47
19.	Wenaha	1980	512.12	77.73
20.	Wenaha	1981	367.56	2.31
21.	Wenaha	1982	37.61	0.24
22.	Wenaha	1983	99.15	8.14
23.	Wenaha	1984	259.82	2.44
24.	Wenaha	1985	90.78	7.4
25.	Wenaha	1986	23.77	23.77
26.	Wenaha	1987	7.85	7.85
27.	Wenaha	1988	1107.76	15.45
28.	Wenaha	1989	207.73	10.83
29.	Wenaha	1990	15.54	15.54
30.	Wenaha	1991	437.56	437.56
31.	Wenaha	1992	26.9	26.9
32.	Wenaha	1993	1108.11	1108.11
33.	Wenaha	1994	820.09	820.09
34.	Wenaha	1995	274.33	274.33
35.	Wenaha	1996	226.07	34.93
36.	Wenaha	1997	398.39	398.39
37.	Wenaha	1998	310.06	34.93
38.	Wenaha	1999	730.46	730.46
39.	Wenaha	2000	158.44	158.44
40.	Wenaha	2001	183.63	183.63
41.	Wenaha	2002	627.28	627.28
42.	Wenaha	2003	231.27	231.27
43.	Wenaha	2004	303.96	303.96
44.	Wenaha	2005	30.27	30.27
45.	Wenaha	2006	177.13	177.13
46.	Wenaha	2007	26	26

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_SR_NRgen_Ha	AllFor_WR_NRgen_Ha
1.	Wenaha	1962	0	0
2.	Wenaha	1963	9.25	79.71
3.	Wenaha	1964	0	0
4.	Wenaha	1965	60.46	144.94
5.	Wenaha	1966	84.2	6.86
6.	Wenaha	1967	20.05	0
7.	Wenaha	1968	0	7.58
8.	Wenaha	1969	22.88	15.89
9.	Wenaha	1970	0	91.71
10.	Wenaha	1971	33.58	10.12
11.	Wenaha	1972	15.63	278.82
12.	Wenaha	1973	6.16	64.04
13.	Wenaha	1974	11.67	90.65
14.	Wenaha	1975	2.07	39.51
15.	Wenaha	1976	39.39	72.74
16.	Wenaha	1977	5.57	69.85
17.	Wenaha	1978	12.33	4.36
18.	Wenaha	1979	12.47	107.53
19.	Wenaha	1980	62.85	75.2
20.	Wenaha	1981	2.04	0.27
21.	Wenaha	1982	0.07	0.18
22.	Wenaha	1983	8.14	65.23
23.	Wenaha	1984	2.44	13.99
24.	Wenaha	1985	7.4	0
25.	Wenaha	1986	16.64	7.14
26.	Wenaha	1987	4.97	2.88
27.	Wenaha	1988	15.45	14.01
28.	Wenaha	1989	10.54	87.89
29.	Wenaha	1990	14.45	1.09
30.	Wenaha	1991	322.5	115.06
31.	Wenaha	1992	24.33	2.58
32.	Wenaha	1993	1096.45	11.66
33.	Wenaha	1994	732.65	87.44
34.	Wenaha	1995	274.33	0
35.	Wenaha	1996	0.99	191.01
36.	Wenaha	1997	398.39	0
37.	Wenaha	1998	33.25	253.68
38.	Wenaha	1999	601.47	128.99
39.	Wenaha	2000	158.44	0
40.	Wenaha	2001	167.58	16.04
41.	Wenaha	2002	536.34	90.95
42.	Wenaha	2003	231.27	0
43.	Wenaha	2004	303.96	0
44.	Wenaha	2005	30.27	0
45.	Wenaha	2006	156.41	20.73
46.	Wenaha	2007	24.8	1.2

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_WR_NRgen_Ha
1.	Wenaha	1962	0
2.	Wenaha	1963	41.75
3.	Wenaha	1964	0
4.	Wenaha	1965	9.53
5.	Wenaha	1966	6.86
6.	Wenaha	1967	0
7.	Wenaha	1968	7.58
8.	Wenaha	1969	0
9.	Wenaha	1970	0
10.	Wenaha	1971	10.12
11.	Wenaha	1972	0
12.	Wenaha	1973	0
13.	Wenaha	1974	0.3
14.	Wenaha	1975	0
15.	Wenaha	1976	0
16.	Wenaha	1977	0
17.	Wenaha	1978	4.36
18.	Wenaha	1979	0
19.	Wenaha	1980	14.88
20.	Wenaha	1981	0.27
21.	Wenaha	1982	0.18
22.	Wenaha	1983	0
23.	Wenaha	1984	0
24.	Wenaha	1985	0
25.	Wenaha	1986	7.14
26.	Wenaha	1987	2.88
27.	Wenaha	1988	0
28.	Wenaha	1989	0.29
29.	Wenaha	1990	1.09
30.	Wenaha	1991	115.06
31.	Wenaha	1992	2.58
32.	Wenaha	1993	11.66
33.	Wenaha	1994	87.44
34.	Wenaha	1995	0
35.	Wenaha	1996	33.94
36.	Wenaha	1997	0
37.	Wenaha	1998	1.68
38.	Wenaha	1999	128.99
39.	Wenaha	2000	0
40.	Wenaha	2001	16.04
41.	Wenaha	2002	90.95
42.	Wenaha	2003	0
43.	Wenaha	2004	0
44.	Wenaha	2005	0
45.	Wenaha	2006	20.73
46.	Wenaha	2007	1.2

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_AllForestry_TOT	Ha_AllForestry_SR
1.	Wenaha	1962	12.24	3.48
2.	Wenaha	1963	180.59	60.9
3.	Wenaha	1964	117.18	117.18
4.	Wenaha	1965	400.59	217.45
5.	Wenaha	1966	104.2	97.16
6.	Wenaha	1967	101.65	78.91
7.	Wenaha	1968	437.59	398.16
8.	Wenaha	1969	322.35	238.24
9.	Wenaha	1970	458.23	335.29
10.	Wenaha	1971	437.11	393.29
11.	Wenaha	1972	1279.31	973.51
12.	Wenaha	1973	651.13	459.45
13.	Wenaha	1974	1752.92	1535.19
14.	Wenaha	1975	542.59	406.31
15.	Wenaha	1976	2437.54	1825.8
16.	Wenaha	1977	930.94	733.65
17.	Wenaha	1978	820.63	814.41
18.	Wenaha	1979	1782.64	1576.36
19.	Wenaha	1980	1337.4	1165.72
20.	Wenaha	1981	672.68	635.31
21.	Wenaha	1982	1353.63	1201.96
22.	Wenaha	1983	179.99	112.41
23.	Wenaha	1984	308.47	293.88
24.	Wenaha	1985	123.31	122.77
25.	Wenaha	1986	168.01	155.44
26.	Wenaha	1987	229.92	214.31
27.	Wenaha	1988	1340.63	1326.62
28.	Wenaha	1989	442.09	338.54
29.	Wenaha	1990	491.81	435.05
30.	Wenaha	1991	707.38	572.02
31.	Wenaha	1992	147.16	130.34
32.	Wenaha	1993	1507.11	1387.36
33.	Wenaha	1994	1078.55	804.08
34.	Wenaha	1995	554.15	527.65
35.	Wenaha	1996	494.48	251.65
36.	Wenaha	1997	739.7	679.14
37.	Wenaha	1998	624.83	280.73
38.	Wenaha	1999	888.36	717.6
39.	Wenaha	2000	448.67	334.59
40.	Wenaha	2001	668.71	580.87
41.	Wenaha	2002	1387.44	1232.67
42.	Wenaha	2003	536.74	516.02
43.	Wenaha	2004	668.02	624.17
44.	Wenaha	2005	186.26	154.83
45.	Wenaha	2006	299.03	277.45
46.	Wenaha	2007	344.99	192.76

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	Ha_AllForestry_WR	AllFor_All_AllForestry_Ha
1.	Wenaha	1962	8.77	12.25
2.	Wenaha	1963	119.69	166.14
3.	Wenaha	1964	0	117.18
4.	Wenaha	1965	183.14	400.5
5.	Wenaha	1966	7.04	104.02
6.	Wenaha	1967	22.74	101.65
7.	Wenaha	1968	39.44	425.22
8.	Wenaha	1969	84.11	322.27
9.	Wenaha	1970	122.95	456.43
10.	Wenaha	1971	43.82	429.97
11.	Wenaha	1972	305.82	1279.32
12.	Wenaha	1973	191.69	643.48
13.	Wenaha	1974	217.73	1752.07
14.	Wenaha	1975	136.27	542.59
15.	Wenaha	1976	611.74	2437.19
16.	Wenaha	1977	197.29	930.65
17.	Wenaha	1978	6.22	819
18.	Wenaha	1979	206.27	1772.99
19.	Wenaha	1980	171.68	1324.99
20.	Wenaha	1981	37.37	672.62
21.	Wenaha	1982	151.67	1353.33
22.	Wenaha	1983	67.58	179.99
23.	Wenaha	1984	14.58	307.75
24.	Wenaha	1985	0.54	123.31
25.	Wenaha	1986	12.58	167.58
26.	Wenaha	1987	15.61	226.95
27.	Wenaha	1988	14.01	1340.64
28.	Wenaha	1989	103.55	442
29.	Wenaha	1990	56.76	477
30.	Wenaha	1991	135.38	704.07
31.	Wenaha	1992	16.82	145.76
32.	Wenaha	1993	119.74	1505.62
33.	Wenaha	1994	274.47	1050.5
34.	Wenaha	1995	26.5	552.64
35.	Wenaha	1996	242.84	494.24
36.	Wenaha	1997	60.56	739.03
37.	Wenaha	1998	344.09	623.33
38.	Wenaha	1999	170.77	888.04
39.	Wenaha	2000	114.08	448.49
40.	Wenaha	2001	87.84	661.02
41.	Wenaha	2002	154.78	1387.44
42.	Wenaha	2003	20.71	536.73
43.	Wenaha	2004	43.85	668.02
44.	Wenaha	2005	31.43	186.26
45.	Wenaha	2006	21.57	298.96
46.	Wenaha	2007	152.23	340.77

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_All_AllForestry_Ha	RipAsp_All_AllForestry_Ha
1.	Wenaha	1962	3.48	3.48
2.	Wenaha	1963	54.8	54.8
3.	Wenaha	1964	0	0
4.	Wenaha	1965	77.47	77.47
5.	Wenaha	1966	98.7	98.7
6.	Wenaha	1967	20.05	20.05
7.	Wenaha	1968	7.58	7.58
8.	Wenaha	1969	34.95	34.95
9.	Wenaha	1970	0	0
10.	Wenaha	1971	43.7	43.7
11.	Wenaha	1972	15.63	15.63
12.	Wenaha	1973	29.43	29.43
13.	Wenaha	1974	55.91	55.91
14.	Wenaha	1975	4.45	4.45
15.	Wenaha	1976	95.39	64.39
16.	Wenaha	1977	20.23	16.12
17.	Wenaha	1978	20.96	20.96
18.	Wenaha	1979	46.05	46.05
19.	Wenaha	1980	108.37	108.37
20.	Wenaha	1981	55.65	4.91
21.	Wenaha	1982	73.97	5.01
22.	Wenaha	1983	56.3	8.67
23.	Wenaha	1984	45.13	20.19
24.	Wenaha	1985	23.23	10.85
25.	Wenaha	1986	68.71	33.26
26.	Wenaha	1987	114.98	31.56
27.	Wenaha	1988	151.03	29.16
28.	Wenaha	1989	204.81	34.9
29.	Wenaha	1990	403.76	47.69
30.	Wenaha	1991	641.68	43.76
31.	Wenaha	1992	101.74	49.98
32.	Wenaha	1993	1367.83	25.55
33.	Wenaha	1994	926.83	57.3
34.	Wenaha	1995	382.8	12.84
35.	Wenaha	1996	148.17	4.96
36.	Wenaha	1997	620.34	18.05
37.	Wenaha	1998	231.56	11.37
38.	Wenaha	1999	819.07	27.42
39.	Wenaha	2000	318.09	6.76
40.	Wenaha	2001	578.39	32.07
41.	Wenaha	2002	1311.37	5.04
42.	Wenaha	2003	530.49	4.98
43.	Wenaha	2004	665.33	2.29
44.	Wenaha	2005	186.26	7.93
45.	Wenaha	2006	293.98	26.43
46.	Wenaha	2007	270.09	0

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_SR_AllForestry_Ha	RipAsp_SR_AllForestry_Ha
1.	Wenaha	1962	3.48	3.48
2.	Wenaha	1963	13.05	13.05
3.	Wenaha	1964	0	0
4.	Wenaha	1965	67.94	67.94
5.	Wenaha	1966	91.84	91.84
6.	Wenaha	1967	20.05	20.05
7.	Wenaha	1968	0	0
8.	Wenaha	1969	34.95	34.95
9.	Wenaha	1970	0	0
10.	Wenaha	1971	33.58	33.58
11.	Wenaha	1972	15.63	15.63
12.	Wenaha	1973	27.09	27.09
13.	Wenaha	1974	55.61	55.61
14.	Wenaha	1975	3.33	3.33
15.	Wenaha	1976	95.39	64.39
16.	Wenaha	1977	16.62	12.51
17.	Wenaha	1978	16.61	16.61
18.	Wenaha	1979	19.9	19.9
19.	Wenaha	1980	89.06	89.06
20.	Wenaha	1981	55.38	4.64
21.	Wenaha	1982	73.8	4.84
22.	Wenaha	1983	56.3	8.67
23.	Wenaha	1984	44.88	19.94
24.	Wenaha	1985	22.69	10.31
25.	Wenaha	1986	58.8	26.13
26.	Wenaha	1987	109.69	27.38
27.	Wenaha	1988	151.03	29.16
28.	Wenaha	1989	200.41	34.42
29.	Wenaha	1990	366.14	44.09
30.	Wenaha	1991	516.7	37.27
31.	Wenaha	1992	97.87	47.41
32.	Wenaha	1993	1320.05	20.13
33.	Wenaha	1994	795.9	41.51
34.	Wenaha	1995	374.28	12.57
35.	Wenaha	1996	107.86	4.32
36.	Wenaha	1997	600.69	16.75
37.	Wenaha	1998	205.77	4.6
38.	Wenaha	1999	674.6	27.41
39.	Wenaha	2000	276.17	5.96
40.	Wenaha	2001	511.27	15.94
41.	Wenaha	2002	1195.86	5.04
42.	Wenaha	2003	509.77	4.98
43.	Wenaha	2004	623.08	0
44.	Wenaha	2005	154.83	6.89
45.	Wenaha	2006	272.41	21.92
46.	Wenaha	2007	164.86	0

Table A1-39: Original data set with observations for the Wenaha management unit with the seven different groups retained from data cleaning were used for PCA.

S/N	UNIT	CALBIO_YEAR	WetFor_WR_AllForestry_Ha	AllFor_WR_AllForestry_Ha
1.	Wenaha	1962	0	8.77
2.	Wenaha	1963	41.75	105.24
3.	Wenaha	1964	0	0
4.	Wenaha	1965	9.53	183.14
5.	Wenaha	1966	6.86	6.86
6.	Wenaha	1967	0	22.74
7.	Wenaha	1968	7.58	27.07
8.	Wenaha	1969	0	84.11
9.	Wenaha	1970	0	121.25
10.	Wenaha	1971	10.12	37.13
11.	Wenaha	1972	0	305.82
12.	Wenaha	1973	2.34	186.04
13.	Wenaha	1974	0.3	217.23
14.	Wenaha	1975	1.12	136.27
15.	Wenaha	1976	0	611.74
16.	Wenaha	1977	3.61	197.11
17.	Wenaha	1978	4.36	4.59
18.	Wenaha	1979	26.14	196.62
19.	Wenaha	1980	19.31	162.41
20.	Wenaha	1981	0.27	37.31
21.	Wenaha	1982	0.18	151.38
22.	Wenaha	1983	0	67.58
23.	Wenaha	1984	0.24	14.23
24.	Wenaha	1985	0.54	0.54
25.	Wenaha	1986	9.92	12.15
26.	Wenaha	1987	5.29	12.72
27.	Wenaha	1988	0	14.01
28.	Wenaha	1989	4.41	103.54
29.	Wenaha	1990	37.62	51.12
30.	Wenaha	1991	124.97	132.23
31.	Wenaha	1992	3.88	16.3
32.	Wenaha	1993	47.78	118.43
33.	Wenaha	1994	130.93	248.1
34.	Wenaha	1995	8.51	25.91
35.	Wenaha	1996	40.31	242.59
36.	Wenaha	1997	19.66	60.52
37.	Wenaha	1998	25.8	342.59
38.	Wenaha	1999	144.47	170.77
39.	Wenaha	2000	41.91	114.08
40.	Wenaha	2001	67.11	80.33
41.	Wenaha	2002	115.52	154.78
42.	Wenaha	2003	20.71	20.71
43.	Wenaha	2004	42.26	43.86
44.	Wenaha	2005	31.43	31.43
45.	Wenaha	2006	21.58	21.58
46.	Wenaha	2007	105.23	148.01