

R version 3.2.1 (2015-06-18) -- "World-Famous Astronaut"  
Copyright (C) 2015 The R Foundation for Statistical Computing  
Platform: x86\_64-apple-darwin13.4.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.  
You are welcome to redistribute it under certain conditions.  
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.  
Type 'contributors()' for more information and  
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or  
'help.start()' for an HTML browser interface to help.  
Type 'q()' to quit R.

```
> rm(list=ls())
> library(nlme)
>
> setwd("/Users/paulino/Downloads/Diana")
>
> clima=read.csv(row.names=1,file="clima.csv",header=TRUE)
> suelo=read.csv(row.names=1,file="suelo.csv",header=TRUE)
>
>
> pca.suelo=prcomp(suelo,center=TRUE,scale=TRUE)
>
> plot(pca.suelo)
summary(pca.suelo)
plot(pca.suelo$x[,1:2],pch=19,xlab="PC1 (49%)",ylab="PC2 (21%)")
text(pca.suelo$x[,1:2],rownames(suelo),pos=1,cex=0.50)
```

```
pca.clima=prcomp(clima,center=TRUE,scale=TRUE)
plot(pca.clima)
summary(pca.clima)
```

```
plot(pca.clima$x[,1:2],pch=19,xlab="PC1 (90%)",ylab="PC2 (9%)")
text(pca.clima$x[,1:2],rownames(clima),pos=1,cex=0.50)
```

```
Total=c(17,15,9,14,20,14,6,97,0,
         6, 54, 24, 27, 6, 42, 21,
         30, 5, 12,48)
```

```
sites=c(rep("AC",5),rep("N",5),rep("IC",5),rep("LV",5))
sites=as.factor(sites)
```

```

attach(suelo)

fm=lm(Total~sites+ CC + PMP + pH + MO + N + P + K + cl + sand +
cenizas + CT + N_grass)

summary(fm)

anova(fm)

fm=lm(Total~pca.clima$x[,1]+ CC + PMP + pH + MO + N + P + K + cl +
sand + cenizas + CT + N_grass)

lTotal=log(Total+1)

fm=lm(lTotal~sites+ CC + PMP + pH + MO + N + P + K + cl + sand +
cenizas + CT + N_grass)
summary(fm)
anova(fm)

fm=lm(lTotal~pca.clima$x[,1]+ CC + PMP + pH + MO + N + P + K + cl +
sand + cenizas + CT + N_grass)
summary(pca.suelo)
Importance of components:

```

	PC1	PC2	PC3	PC4	PC5	PC6
Standard deviation	2.4544	1.7744	1.4044	0.79114	0.78781	0.50669
Proportion of Variance	0.4634	0.2422	0.1517	0.04815	0.04774	0.01975
Cumulative Proportion	0.4634	0.7056	0.8573	0.90546	0.95320	0.97295

```


```

	PC8	PC9	PC10	PC11	PC12	PC13
Standard deviation	0.2906	0.2072	0.12880	0.03926	0.001359	1.19e-16
Proportion of Variance	0.0065	0.0033	0.00128	0.00012	0.000000	0.00e+00
Cumulative Proportion	0.9953	0.9986	0.99988	1.00000	1.000000	1.00e+00

```

> plot(pca.suelo$x[,1:2],pch=19,xlab="PC1 (49%)",ylab="PC2 (21%)")
> text(pca.suelo$x[,1:2],rownames(suelo),pos=1,cex=0.50)
>
>
> pca.clima=prcomp(clima,center=TRUE,scale=TRUE)
> plot(pca.clima)
summary(pca.clima)

plot(pca.clima$x[,1:2],pch=19,xlab="PC1 (90%)",ylab="PC2 (9%)")
text(pca.clima$x[,1:2],rownames(clima),pos=1,cex=0.50)

Total=c(17,15,9,14,20,14,6,97,0,
6, 54, 24, 27, 6, 42, 21,
30, 5, 12,48)

```

```

sites=c(rep("AC",5),rep("N",5),rep("IC",5),rep("LV",5))
sites=as.factor(sites)

attach(suelo)

fm=lm(Total~sites+ CC + PMP + pH + MO + N + P + K + cl + sand +
cenizas + CT + N_grass)

summary(fm)

anova(fm)

fm=lm(Total~pca.clima$x[,1]+ CC + PMP + pH + MO + N + P + K + cl +
sand + cenizas + CT + N_grass)

lTotal=log(Total+1)

fm=lm(lTotal~sites+ CC + PMP + pH + MO + N + P + K + cl + sand +
cenizas + CT + N_grass)
summary(fm)
anova(fm)

fm=lm(lTotal~pca.clima$x[,1]+ CC + PMP + pH + MO + N + P + K + cl +
sand + cenizas + CT + N_grass)
anova(fm)

fm_mixed=lme(lTotal~CC + PMP + pH + MO + N + P + K + cl + sand +
cenizas + CT + N_grass,random=~1|sites)

Pontox=c(0,0,0,0,0,6,3,26,0,1,25,24,27,6,21,0,5,0,0,44)
sites=c(rep("AC",5),rep("N",5)
> summary(pca.clima)
Importance of components:
              PC1      PC2      PC3      PC4      PC5
Standard deviation  2.1223 0.68898 0.14565 6.555e-16 2.941e-16
Proportion of Variance 0.9008 0.09494 0.00424 0.000e+00 0.000e+00
Cumulative Proportion 0.9008 0.99576 1.00000 1.000e+00 1.000e+00
>
> plot(pca.clima$x[,1:2],pch=19,xlab="PC1 (90%)",ylab="PC2 (9%)")
> text(pca.clima$x[,1:2],rownames(clima),pos=1,cex=0.50)
>
>
> Total=c(17,15,9,14,20,14,6,97,0,
+         6, 54, 24, 27, 6, 42, 21,
+         30, 5, 12,48)
>
>
> sites=c(rep("AC",5),rep("N",5),rep("IC",5),rep("LV",5))

```

```

> sites=as.factor(sites)
>
> attach(suelo)
>
> fm=lm(Total~sites+ CC + PMP + pH + MO + N + P + K + cl + sand +
cenizas + CT + N_grass)
>
> summary(fm)

```

Call:

```
lm(formula = Total ~ sites + CC + PMP + pH + MO + N + P + K +
    cl + sand + cenizas + CT + N_grass)
```

Residuals:

	1	2	3	4	5	6	7
8	-0.85364	0.99556	1.68139	0.06196	-1.88526	-0.66507	-3.59383
	3.16066						
	9	10	11	12	13	14	15
16	8.82753	-7.72929	-3.94848	3.10968	-3.12069	1.13429	2.82519
	2.47798						
	17	18	19	20			
	-3.95127	-2.79614	-1.02579	5.29522			

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	41252.4677	38290.6633	1.077	0.34196
sitesIC	16.6295	14.5312	1.144	0.31628
sitesLV	17.2155	16.1129	1.068	0.34552
sitesN	22.1830	11.5655	1.918	0.12756
CC	-4.0130	1.2355	-3.248	0.03143 *
PMP	9.0778	2.6083	3.480	0.02534 *
pH	16.8988	6.5437	2.582	0.06117 .
MO	2.6670	0.9568	2.787	0.04945 *
N	-317.4383	89.9053	-3.531	0.02421 *
P	0.7413	0.1150	6.447	0.00298 **
K	-26.1554	5.3477	-4.891	0.00810 **
cl	-3.6753	1.3694	-2.684	0.05501 .
sand	-0.9837	0.7046	-1.396	0.23522
cenizas	-420.0784	382.6447	-1.098	0.33393
CT	-708.7483	660.4793	-1.073	0.34366
N_grass	60.4809	15.6673	3.860	0.01814 *

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 8.247 on 4 degrees of freedom  
Multiple R-squared: 0.9722, Adjusted R-squared: 0.8681  
F-statistic: 9.338 on 15 and 4 DF, p-value: 0.02178

```

>
> anova(fm)
Analysis of Variance Table

Response: Total
      Df Sum Sq Mean Sq F value Pr(>F)
sites   3  619.4   206.5   3.0355 0.15571
CC       1  587.3   587.3   8.6357 0.04245 *
PMP      1  124.5   124.5   1.8303 0.24751
pH       1 1275.6  1275.6  18.7548 0.01234 *
MO       1    9.6    9.6    0.1406 0.72672
N        1   21.0   21.0    0.3085 0.60820
P        1 4564.0  4564.0  67.1055 0.00121 **
K        1   518.0   518.0   7.6160 0.05087 .
cl       1   469.2   469.2   6.8993 0.05839 .
sand     1    32.8    32.8   0.4826 0.52547
cenizas  1   164.7   164.7   2.4213 0.19468
CT       1   126.9   126.9   1.8663 0.24366
N_grass  1 1013.5  1013.5  14.9022 0.01814 *
Residuals 4   272.1    68.0

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
>
> fm=lm(Total~pca.clima$x[,1]+ CC + PMP + pH + MO + N + P + K + cl +
sand + cenizas + CT + N_grass)
>
> lTotal=log(Total+1)
>
> fm=lm(lTotal~sites+ CC + PMP + pH + MO + N + P + K + cl + sand +
cenizas + CT + N_grass)
summary(fm)
anova(fm)

fm=lm(lTotal~pca.clima$x[,1]+ CC + PMP + pH + MO + N + P + K + cl +
sand + cenizas + CT + N_grass)
anova(fm)

fm_mixed=lme(lTotal~CC + PMP + pH + MO + N + P + K + cl + sand +
cenizas + CT + N_grass,random=~1|sites)

Pontox=c(0,0,0,0,0,6,3,26,0,1,25,24,27,6,21,0,5,0,0,44)
sites=c(rep("AC",5),rep("N",5),rep("IC",5),rep("LV",5))
sites=as.factor(sites)

lm(Pontox~sites)

anova(lm(Pontox~sites))

boxplot(Pontox~sites)

```

```
lPontox=log(Pontox+1)
anova(lm(lPontox~sites))
```

```
#Kruskal-Wallis
```

```
kruskal.test(Pontox,sites)
```

```
> summary(fm)
```

```
Call:
```

```
lm(formula = lTotal ~ sites + CC + PMP + pH + MO + N + P + K +
    cl + sand + cenizas + CT + N_grass)
```

```
Residuals:
```

```
      1      2      3      4      5      6      7
8
-0.041068 -0.039744 -0.129601  0.047398  0.163015  0.123129  0.008866
-0.150147
      9     10     11     12     13     14     15
16
-0.234050  0.252201  0.186329  0.257104  0.071166 -0.220014 -0.294586
0.283239
      17     18     19     20
      0.173078 -0.203211 -0.008418 -0.244688
```

```
Coefficients:
```

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	4.402e+01	1.882e+03	0.023	0.98247	
sitesIC	1.020e+00	7.144e-01	1.428	0.22660	
sitesLV	3.936e-01	7.922e-01	0.497	0.64538	
sitesN	7.004e-02	5.686e-01	0.123	0.90790	
CC	-2.083e-01	6.074e-02	-3.430	0.02654	*
PMP	4.840e-01	1.282e-01	3.774	0.01953	*
pH	9.200e-01	3.217e-01	2.860	0.04594	*
MO	1.563e-01	4.704e-02	3.324	0.02928	*
N	-1.809e+01	4.420e+00	-4.092	0.01495	*
P	1.844e-02	5.653e-03	3.261	0.03105	*
K	-1.053e+00	2.629e-01	-4.007	0.01604	*
cl	-1.336e-01	6.732e-02	-1.984	0.11820	
sand	1.951e-03	3.464e-02	0.056	0.95779	
cenizas	-9.710e-01	1.881e+01	-0.052	0.96131	
CT	-6.481e-01	3.247e+01	-0.020	0.98503	
N_grass	3.559e+00	7.702e-01	4.621	0.00987	**

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.4054 on 4 degrees of freedom
```

```
Multiple R-squared:  0.9656,    Adjusted R-squared:  0.8368
```

F-statistic: 7.495 on 15 and 4 DF, p-value: 0.03241

```
> anova(fm)
```

Analysis of Variance Table

Response: lTotal

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
sites	3	2.7469	0.9156	5.5701	0.065263 .
CC	1	2.0907	2.0907	12.7181	0.023454 *
PMP	1	0.5828	0.5828	3.5451	0.132845
pH	1	1.9053	1.9053	11.5902	0.027166 *
MO	1	0.0020	0.0020	0.0120	0.918032
N	1	0.0012	0.0012	0.0072	0.936305
P	1	5.1139	5.1139	31.1092	0.005065 **
K	1	0.0971	0.0971	0.5909	0.484959
cl	1	1.3530	1.3530	8.2304	0.045520 *
sand	1	0.1181	0.1181	0.7183	0.444444
cenizas	1	0.9375	0.9375	5.7033	0.075318 .
CT	1	0.0222	0.0222	0.1348	0.732076
N_grass	1	3.5100	3.5100	21.3525	0.009875 **
Residuals	4	0.6575	0.1644		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```
>
```

```
> fm=lm(lTotal~pca.clima$x[,1]+ CC + PMP + pH + MO + N + P + K + cl + sand + cenizas + CT + N_grass)
```

```
> anova(fm)
```

Analysis of Variance Table

Response: lTotal

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
pca.clima\$x[, 1]	1	0.2966	0.2966	1.6429	0.247232
CC	1	4.2343	4.2343	23.4568	0.002871 **
PMP	1	0.5540	0.5540	3.0691	0.130352
pH	1	1.5712	1.5712	8.7038	0.025606 *
MO	1	0.0893	0.0893	0.4946	0.508228
N	1	0.0111	0.0111	0.0615	0.812476
P	1	3.7313	3.7313	20.6703	0.003906 **
K	1	0.1808	0.1808	1.0015	0.355580
cl	1	1.6336	1.6336	9.0495	0.023754 *
sand	1	0.0105	0.0105	0.0584	0.817167
cenizas	1	0.0687	0.0687	0.3805	0.560021
CT	1	0.0667	0.0667	0.3697	0.565458
N_grass	1	5.6070	5.6070	31.0612	0.001415 **
Residuals	6	1.0831	0.1805		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```
>
```

```
> fm_mixed=lme(lTotal~CC + PMP + pH + MO + N + P + K + cl + sand + cenizas + CT + N_grass,random=~1|sites)
```

```

>
>
> Pontox=c(0,0,0,0,0,6,3,26,0,1,25,24,27,6,21,0,5,0,0,44)
> sites=c(rep("AC",5),rep("N",5),rep("IC",5),rep("LV",5))
> sites=as.factor(sites)
>
> lm(Pontox~sites)

Call:
lm(formula = Pontox ~ sites)

Coefficients:
(Intercept)      sitesIC      sitesLV      sitesN
-3.178e-15    2.060e+01    9.800e+00    7.200e+00

>
> anova(lm(Pontox~sites))
Analysis of Variance Table

Response: Pontox
      Df Sum Sq Mean Sq F value Pr(>F)
sites   3 1094.0   364.67   2.6179 0.08665 .
Residuals 16 2228.8   139.30

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
> boxplot(Pontox~sites)
>
> lPontox=log(Pontox+1)
> anova(lm(lPontox~sites))
Analysis of Variance Table

Response: lPontox
      Df Sum Sq Mean Sq F value  Pr(>F)
sites   3  22.523   7.5077   6.288 0.005051 **
Residuals 16 19.104   1.1940

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

>
> #Kruskal-Wallis
>
> kruskal.test(Pontox,sites)

      Kruskal-Wallis rank sum test

data:  Pontox and sites
Kruskal-Wallis chi-squared = 10.03, df = 3, p-value = 0.01832

```