

# AJAE appendix B for: Agricultural Insurance Loss and Relationships to Climate across the Inland Pacific Northwest Region of the United States

The material contained herein is supplementary to the article named in the title and published in the American Journal of Agricultural Economics (AJAE).

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Appendix B documents supplemental Principle Components Analyses (PCA) for the Pacific Northwest (PNW) and the inland Pacific Northwest (iPNW), to better understand the combined effects of differing damage causes, commodities, counties, and years on overall loss.

**1. Supplemental Pacific Northwest (PNW) Principle Components Analysis** In this section we outline a multitude of PCA outputs for the entire three state Pacific Northwest region (Oregon, Idaho, and Washington).

**2. Supplemental Inland Pacific Northwest(iPNW) Principle Components Analysis** Here we outline a multitude of PCA outputs for the 24 county iPNW Pacific Northwest region.

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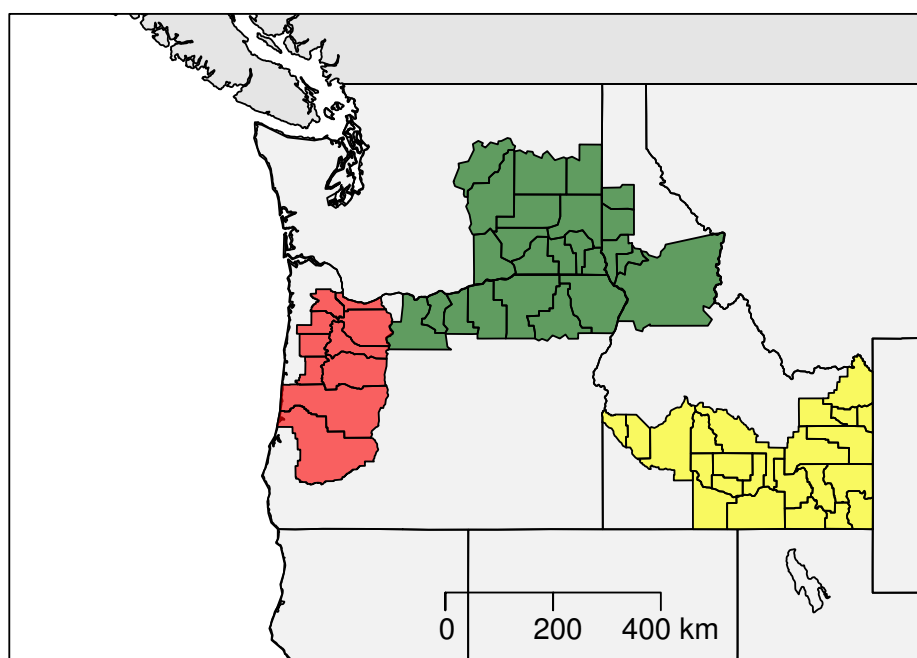


Figure 1: Pacific Northwest study area, which includes agricultural regions for the inland Pacific Northwest, the southern Idaho valley, and the Willamette valley.

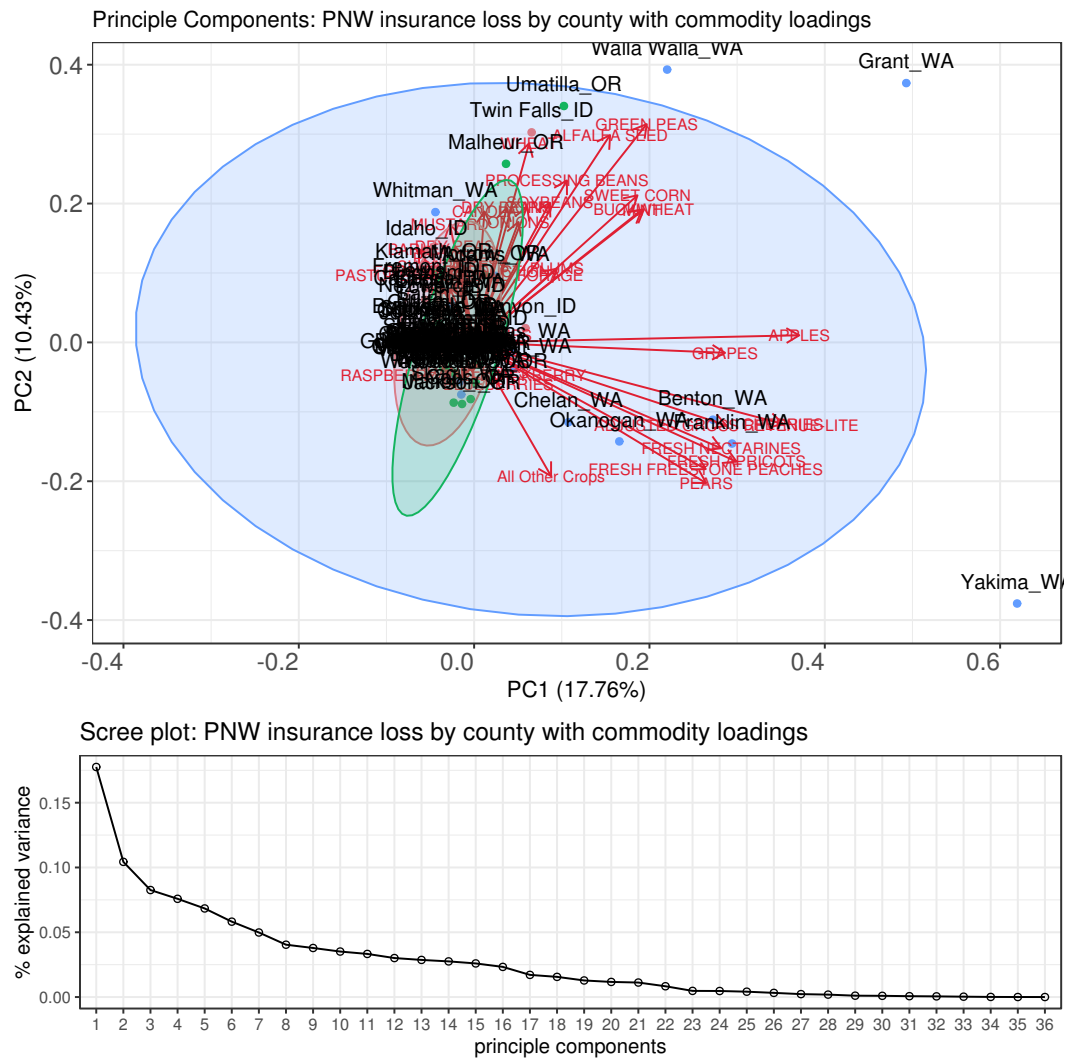


Figure 2: Top panel: Biplot of principle components for insurance loss for the entire PNW, by county, with commodity as the factor loadings. Bottom panel: Scree plot. Data from 2001 to 2015 is used.

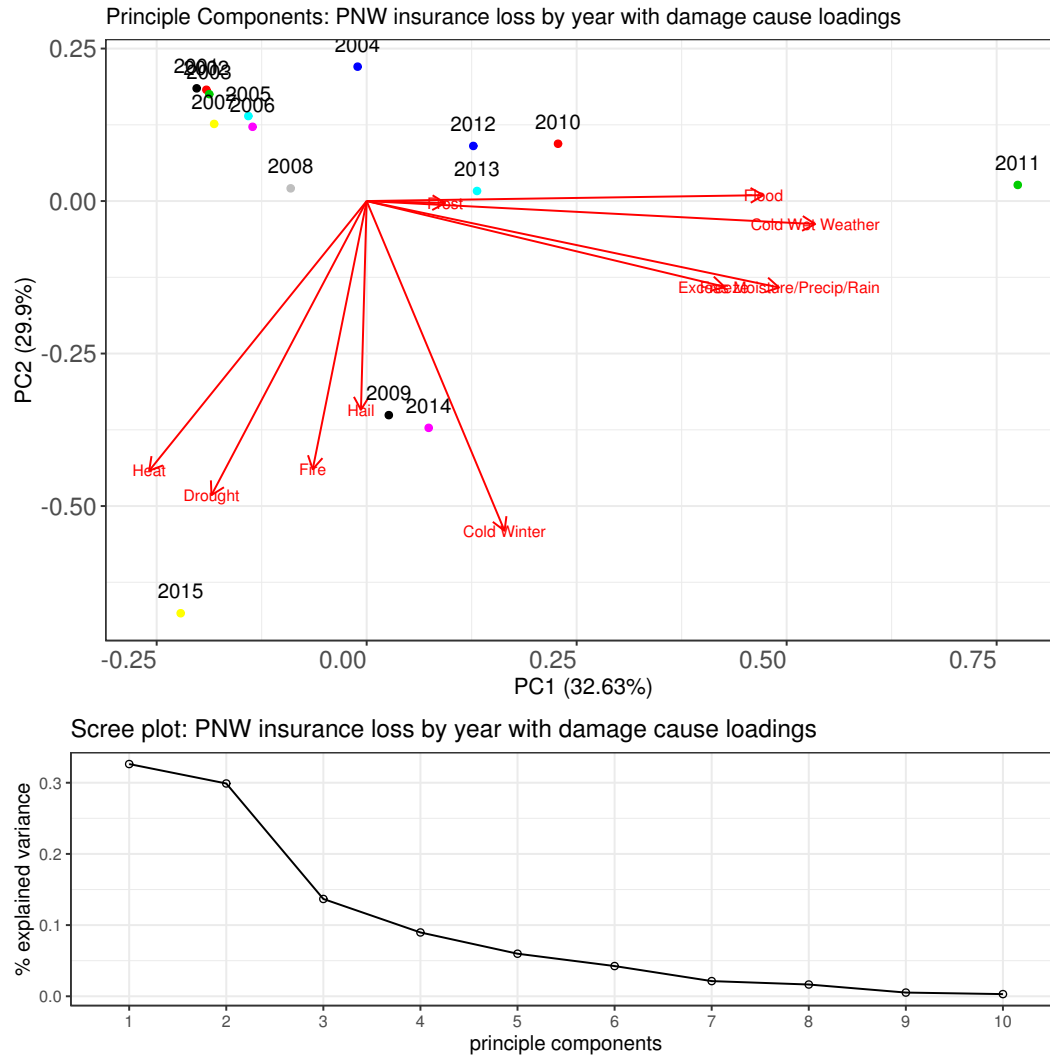


Figure 3: Top panel: biplot of principle components of insurance loss, for the entire PNW, for all commodities by year, with damage cause as the factor loadings. Bottom panel: Scree plot. Data from 2001 to 2015 is used.

### PNW insurance loss, by year with damage cause loadings: 2001 to 2015: Scree plot

Below we have generated a scree plot that shows the proportion of variance explained by the individual components.

## Step 2d. PCA: PNW insurance loss, by MONTH with DAMAGE CAUSE loadings: 2001 to 2015

Here we perform a PCA for the insurance loss for the entire PNW, for all commodities by month, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

### Principle Components: PNW insurance loss by month with damage cause loading

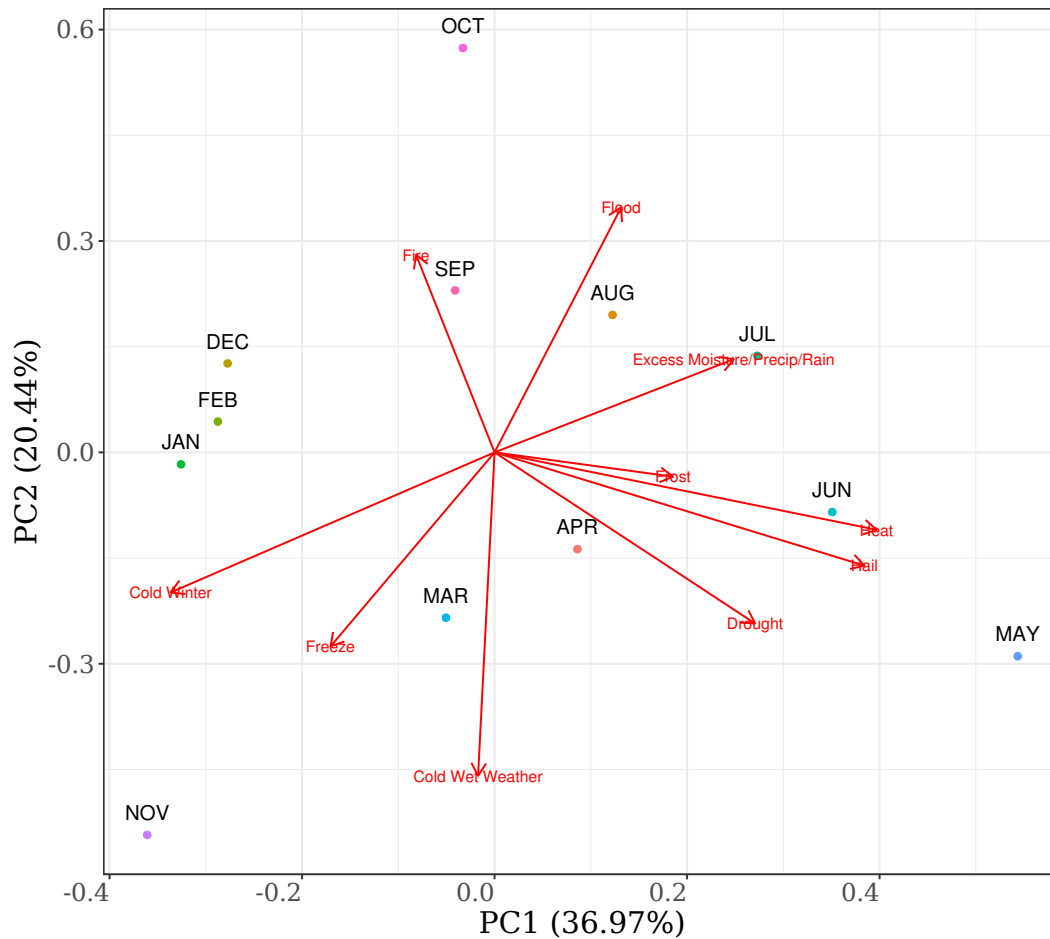


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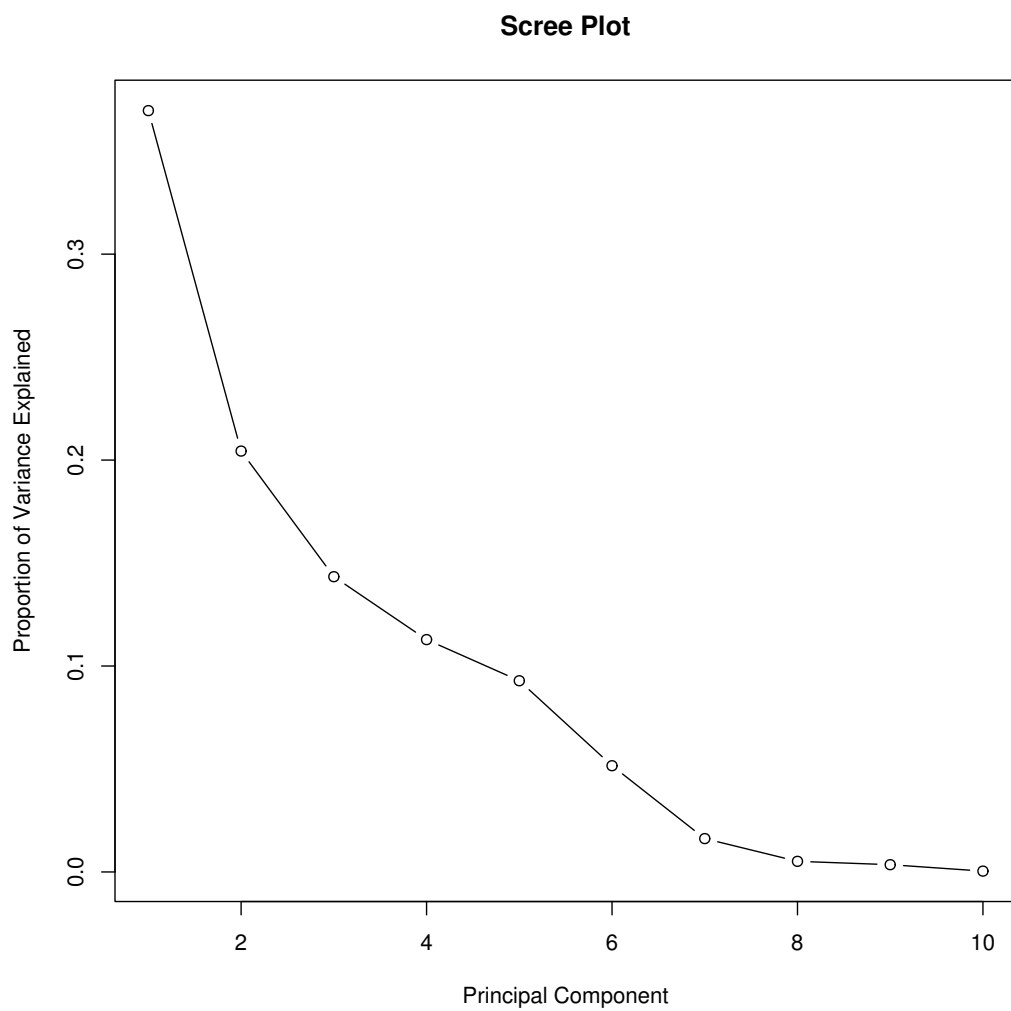


Figure 5: Your caption.

**Step 2e. PCA: PNW WHEAT insurance loss, by YEAR with DAMAGE CAUSE loadings: 2001 to 2015**

Here we perform a PCA for the insurance loss for the entire PNW, for wheat by year, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

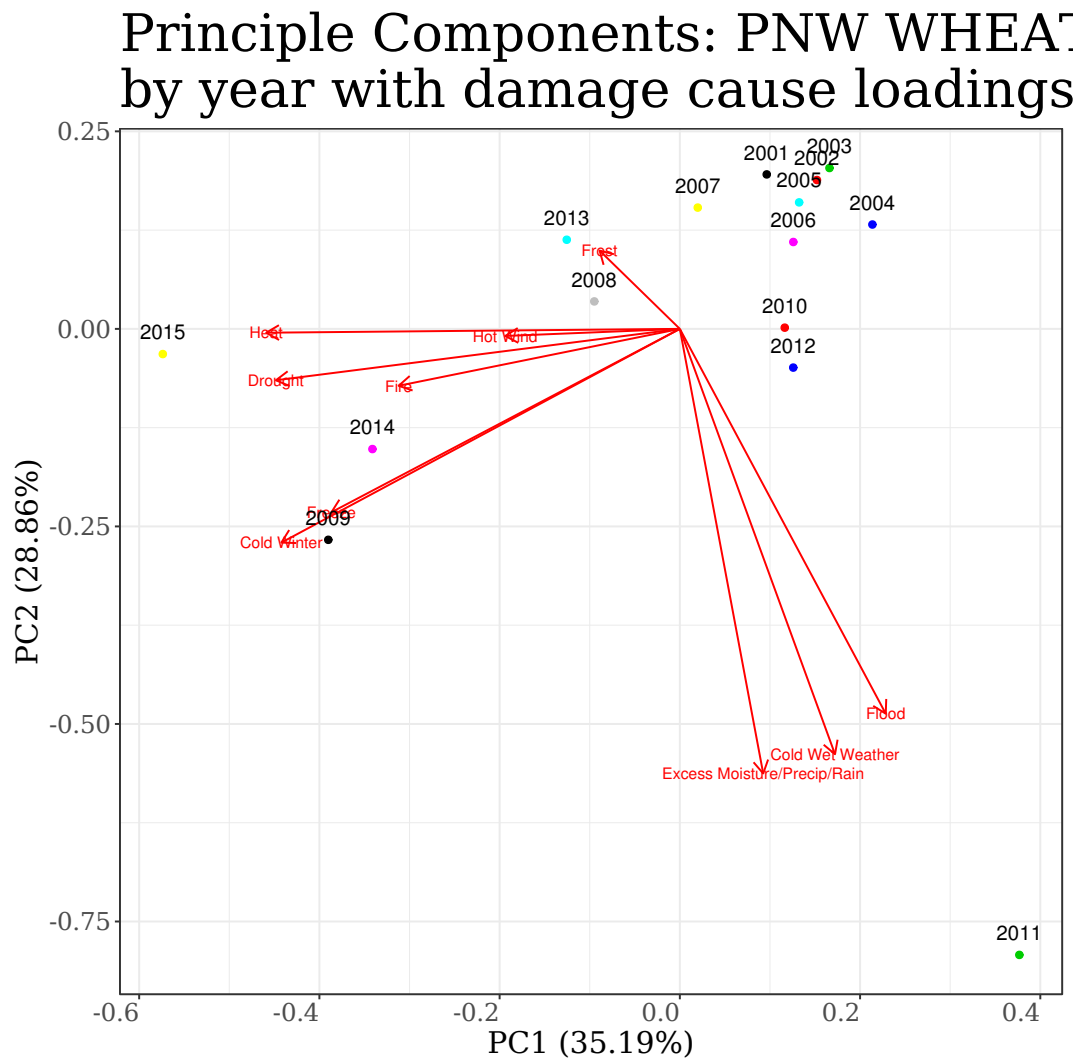


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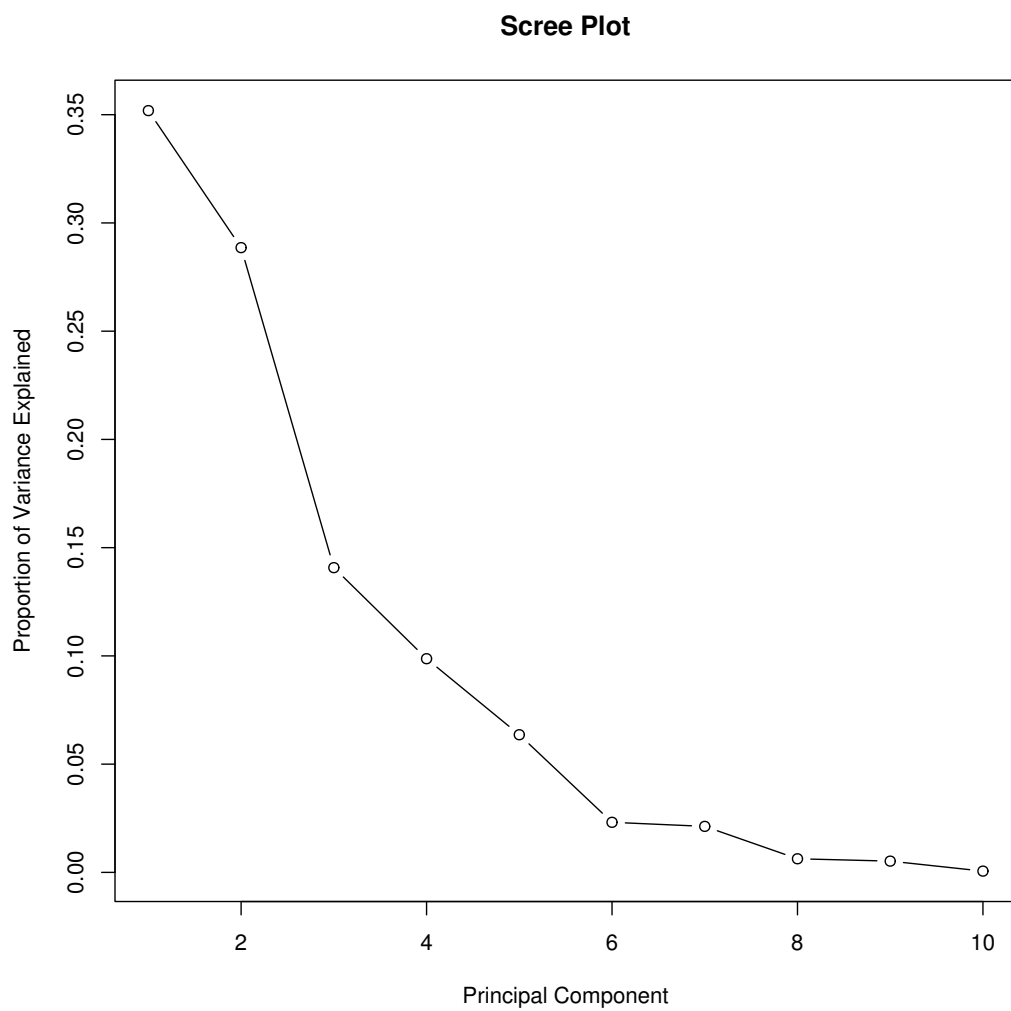


Figure 7: Your caption.

**Step 2f. PCA: PNW WHEAT insurance loss, by COUNTY with DAMAGE CAUSE loadings: 2001 to 2015**

Here we perform a PCA for the insurance loss for the entire PNW, for wheat by county, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

Principle Components: PNW wheat insurance loss by county with damage cause loading

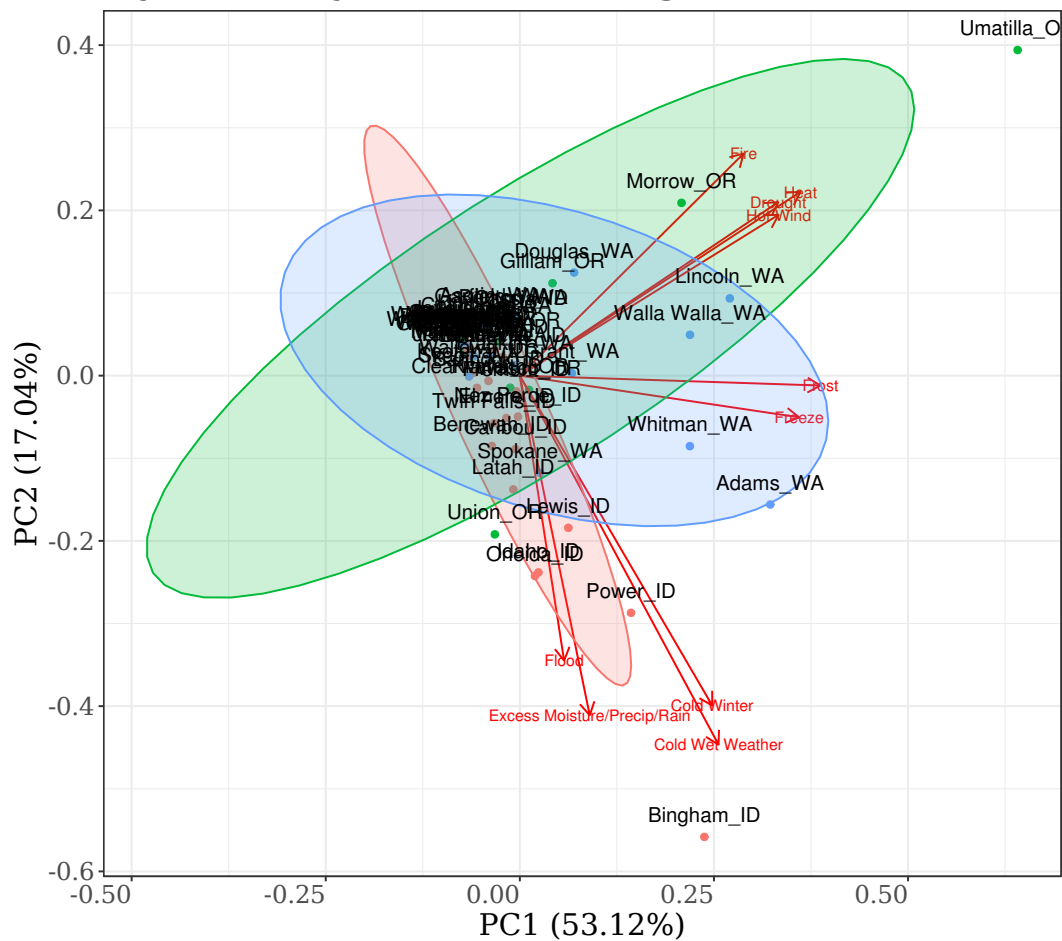


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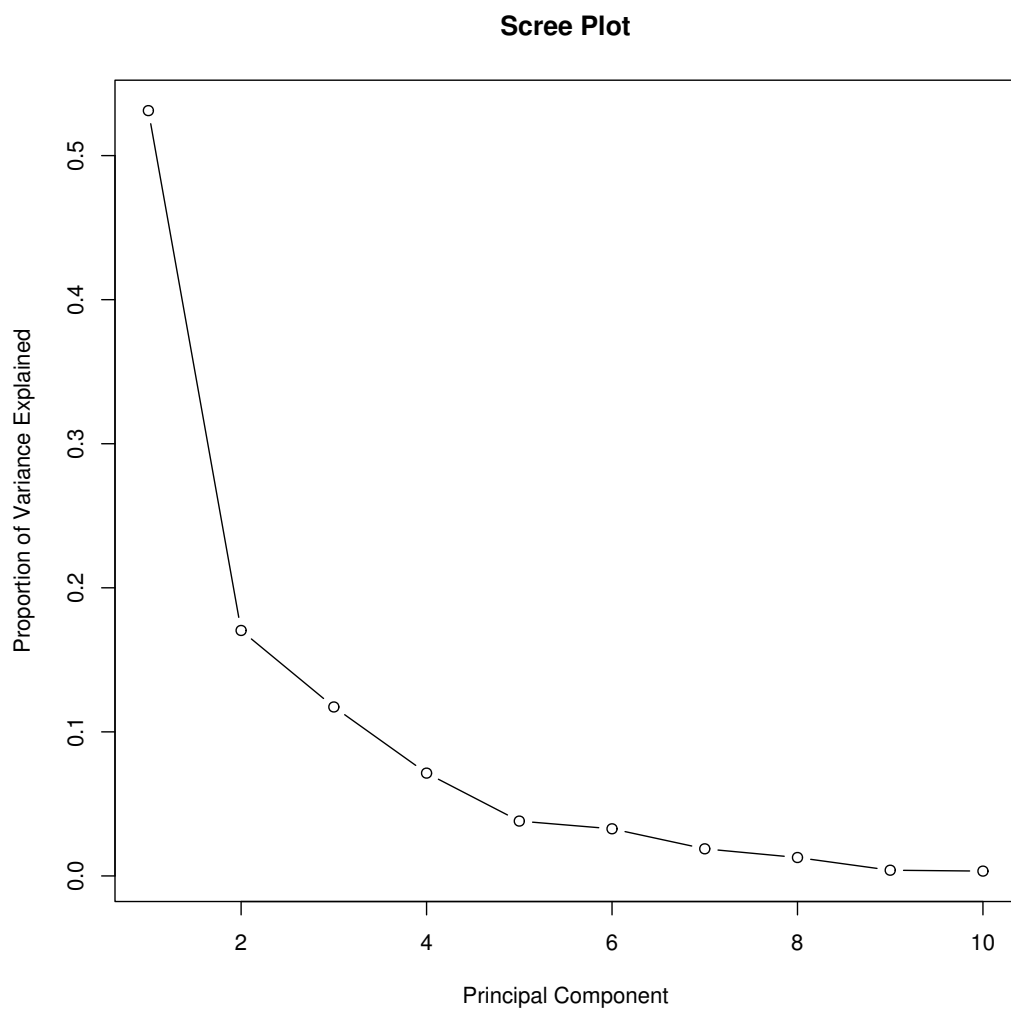


Figure 9: Your caption.

**Step 2g. PCA: PNW APPLES insurance loss, by COUNTY with DAMAGE CAUSE loadings: 2001 to 2015**

Here we perform a PCA for the insurance loss for the entire PNW, for apples by county, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

## Principle Components: PNW apples i by county with damage cause loading

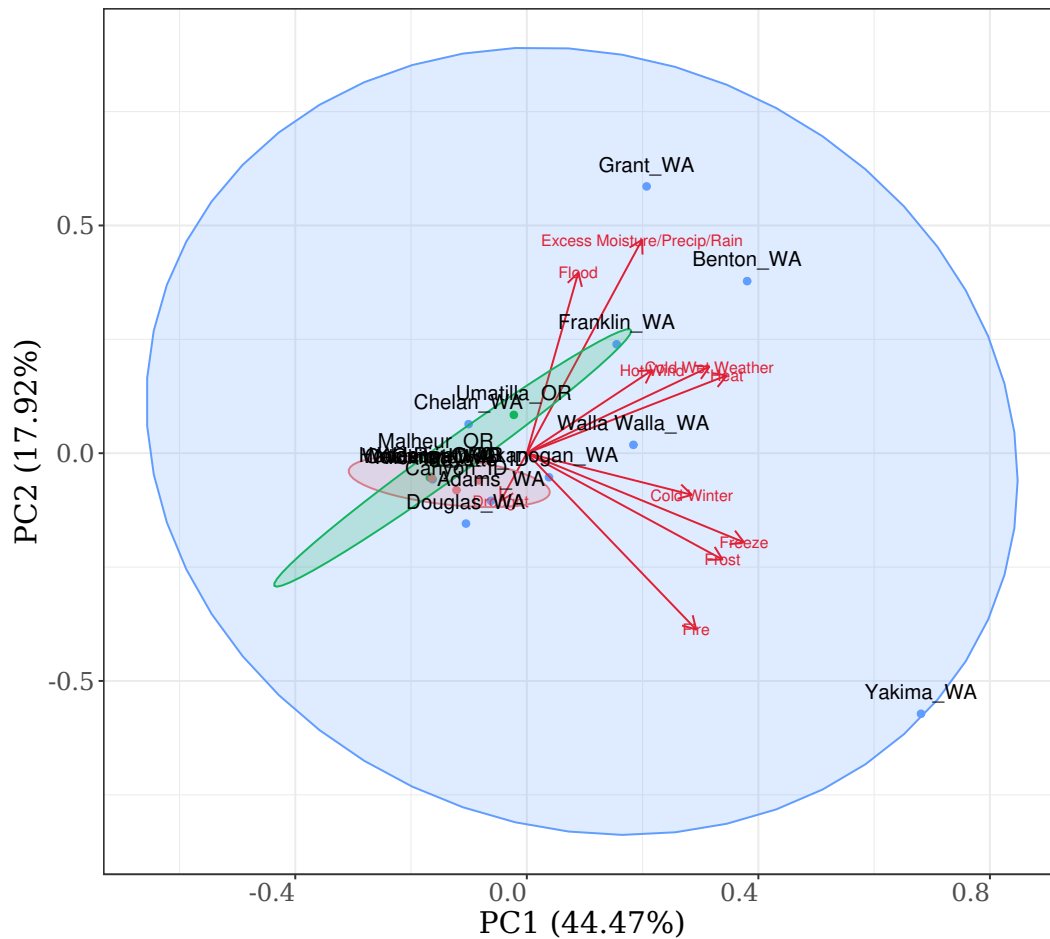


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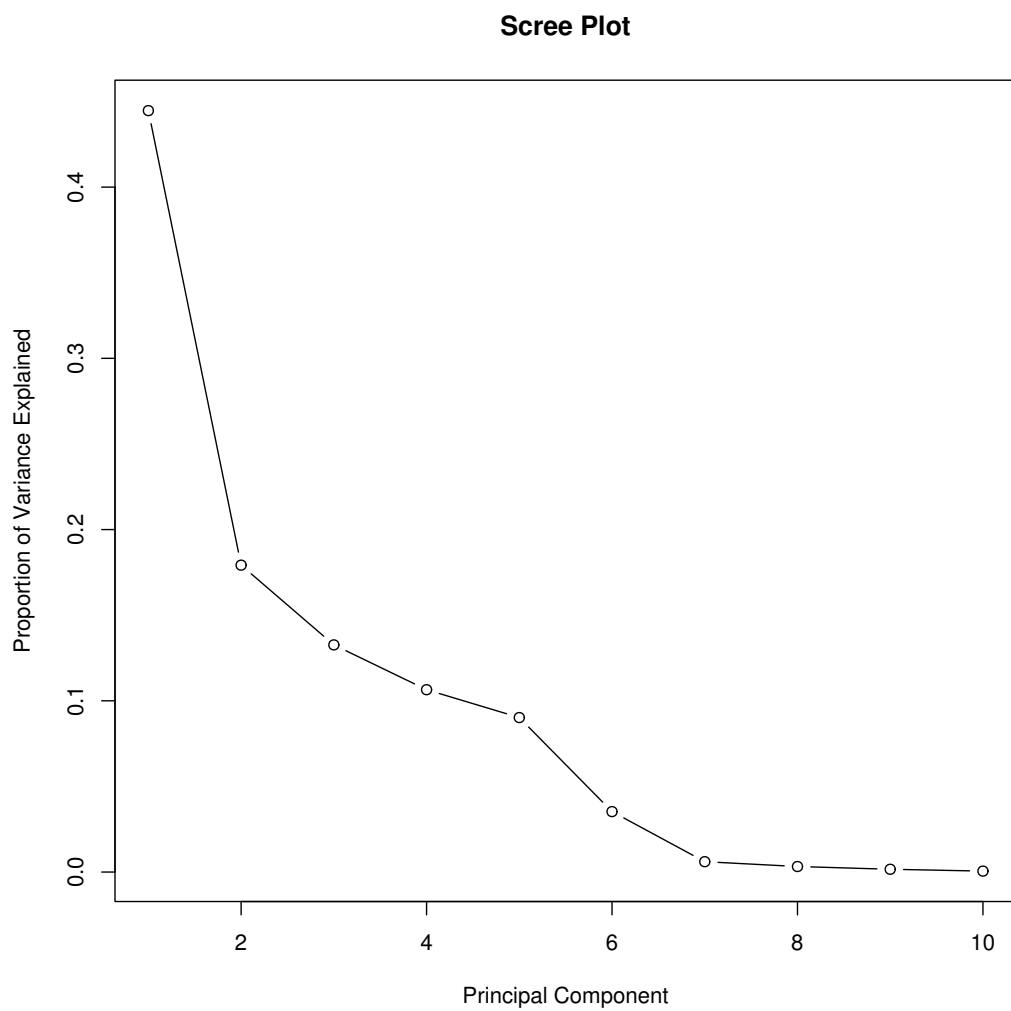


Figure 11: Your caption.

**Step 2h. PCA: PNW BARLEY insurance loss, by COUNTY with DAMAGE CAUSE loadings: 2001 to 2015**

Here we perform a PCA for the insurance loss for the entire PNW, for barley by county, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

Principle Components: PNW barley insurance loss by county with damage cause loading

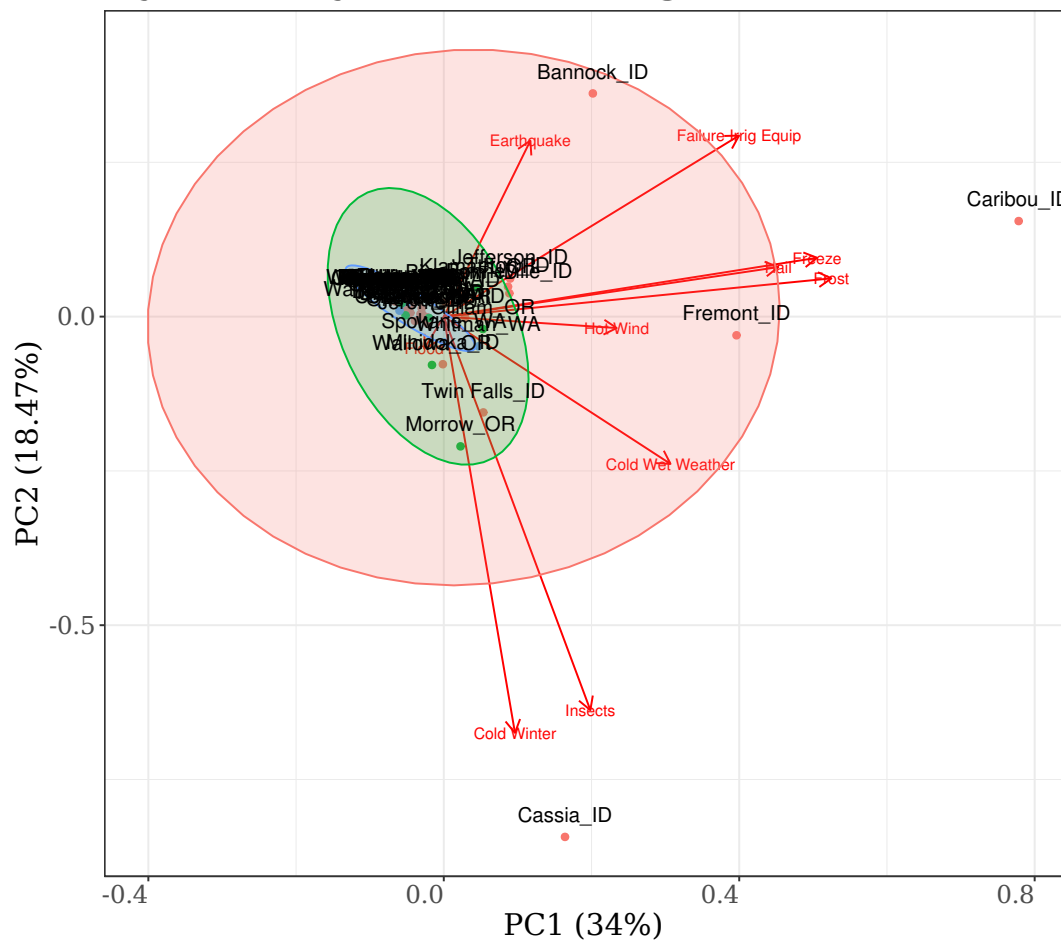


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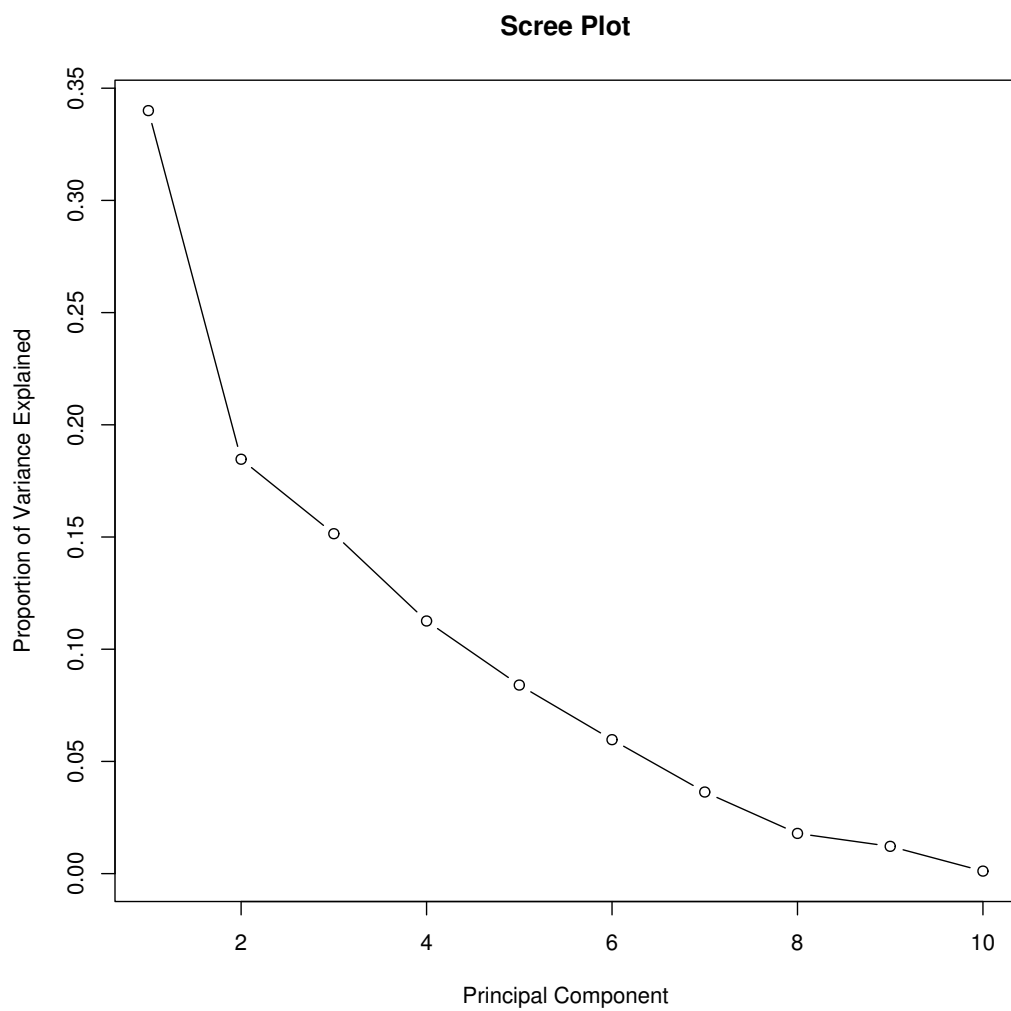


Figure 13: Your caption.

### Step 3. Inland Pacific Northwest(iPNW) PCA.

In step 3, we outline a multitude of PCA outputs for the 24 county iPNW Pacific Norwest region, including:

#### Step 3a. Inland Pacific Northwest (iPNW) Study Area

Here we document the 24 county iPNW study area.

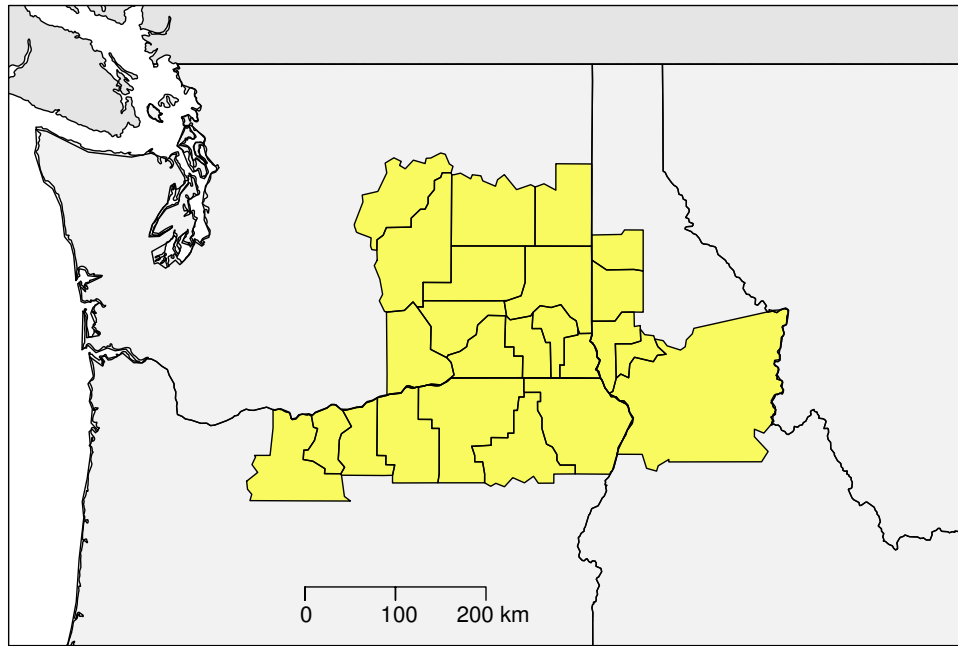


Figure 14: Your caption.



Here we perform a PCA for the insurance loss for the inland PNW, for all commodities by county, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

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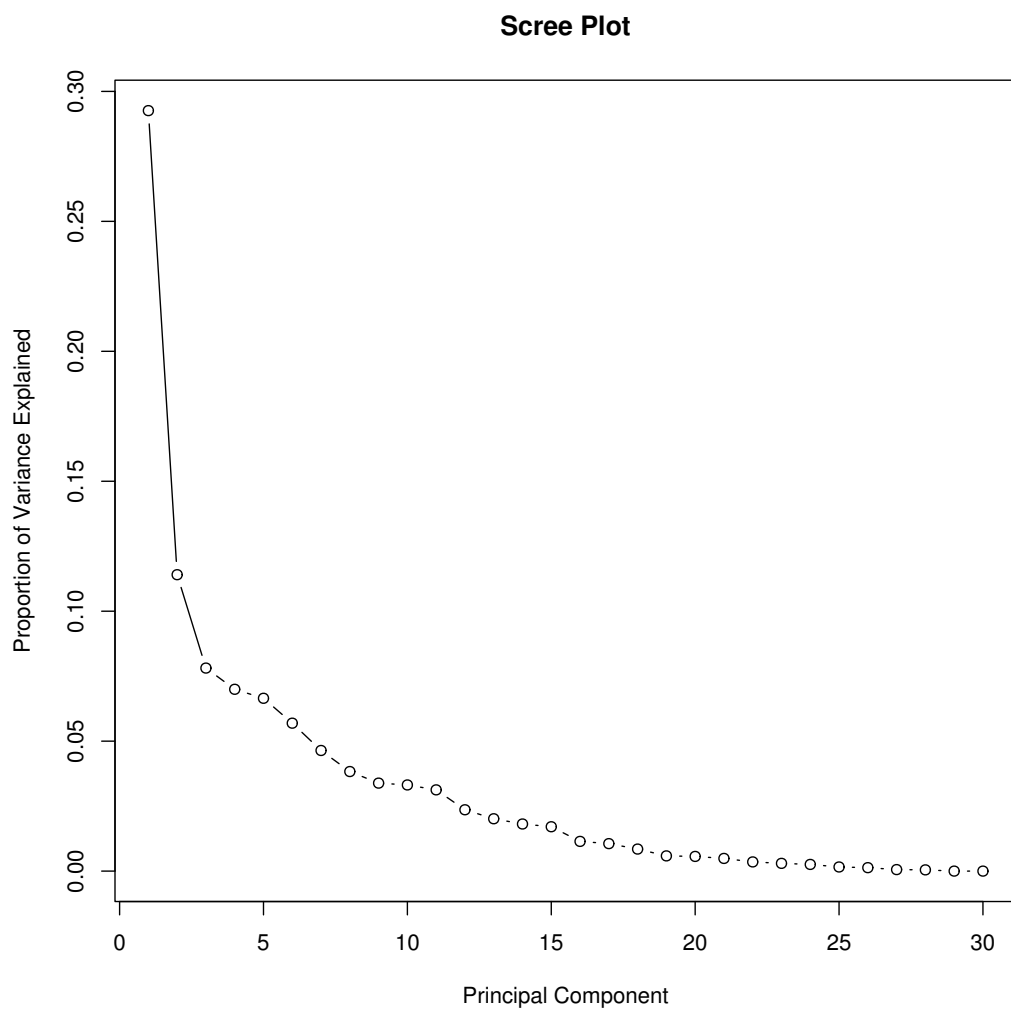


Figure 16: Your caption.

**Step 3c. PCA + KMEANS: WHEAT IPNW insurance loss, by COUNTY with DAMAGE CAUSE loadings: 2001 to 2015**

Here we perform a PCA for the insurance loss for the inland PNW, for wheat by county, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

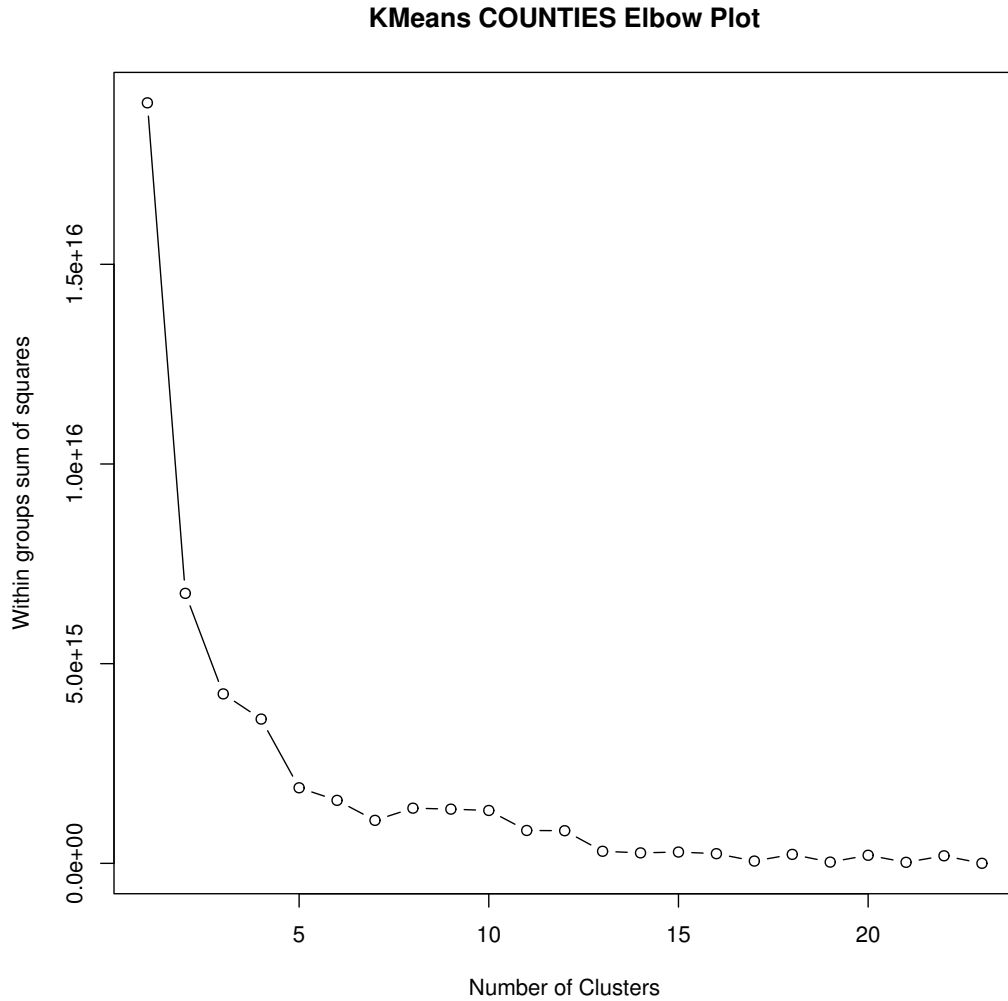
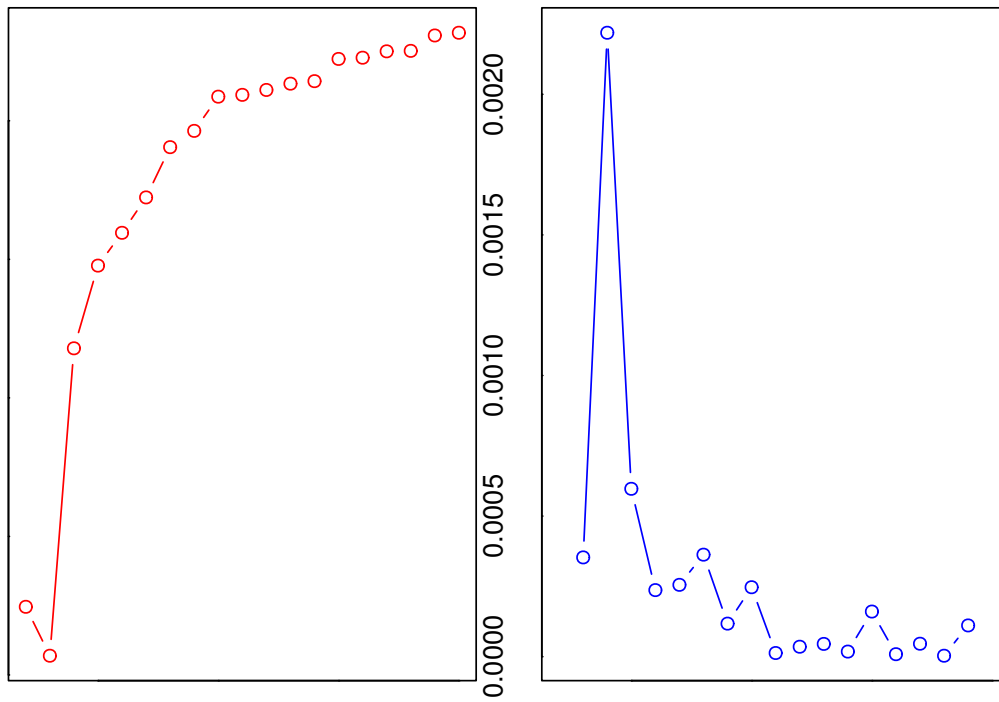
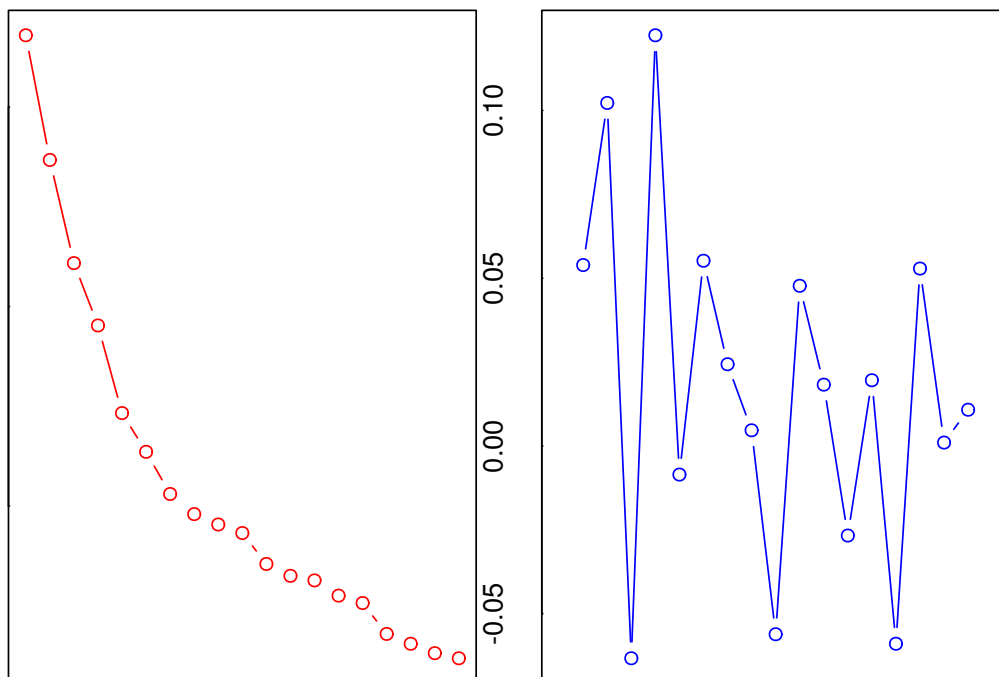


Figure 17: Your caption.



```
## *** : The Hubert index is a graphical method of determining the number of clusters.
##       In the plot of Hubert index, we seek a significant knee that corresponds to a
##       significant increase of the value of the measure i.e the significant peak in Hubert
##       index second differences plot.
##
```



```

## *** : The D index is a graphical method of determining the number of clusters.
##           In the plot of D index, we seek a significant knee (the significant peak in Dindex
##           second differences plot) that corresponds to a significant increase of the value of
##           the measure.
##
## *****
## * Among all indices:
## * 6 proposed 2 as the best number of clusters
## * 4 proposed 3 as the best number of clusters
## * 2 proposed 4 as the best number of clusters
## * 2 proposed 6 as the best number of clusters
## * 1 proposed 7 as the best number of clusters
## * 2 proposed 8 as the best number of clusters
## * 3 proposed 17 as the best number of clusters
## * 1 proposed 19 as the best number of clusters
## * 3 proposed 20 as the best number of clusters
##
##           ***** Conclusion *****
##
## * According to the majority rule, the best number of clusters is 2
##
## *****

```

# Principle Components: IPNW insurar by county with damage cause loading

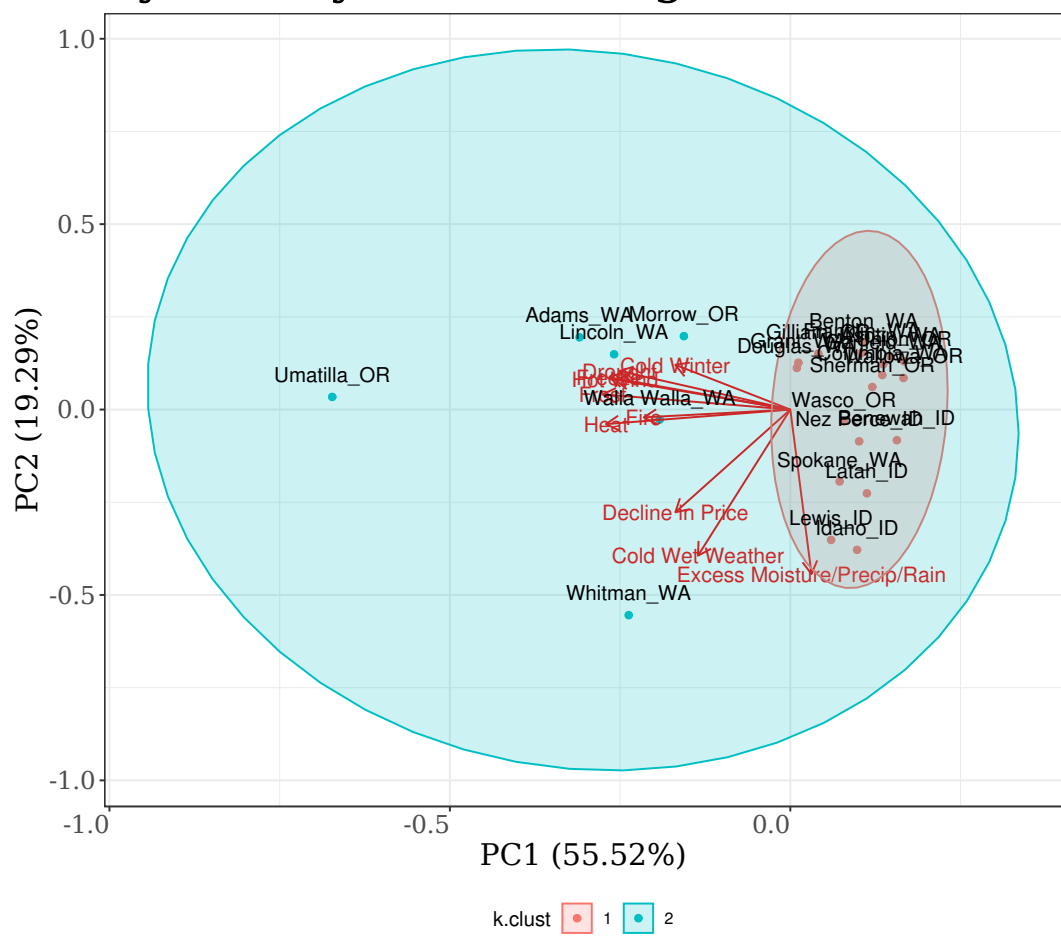


Figure 18: Your caption.

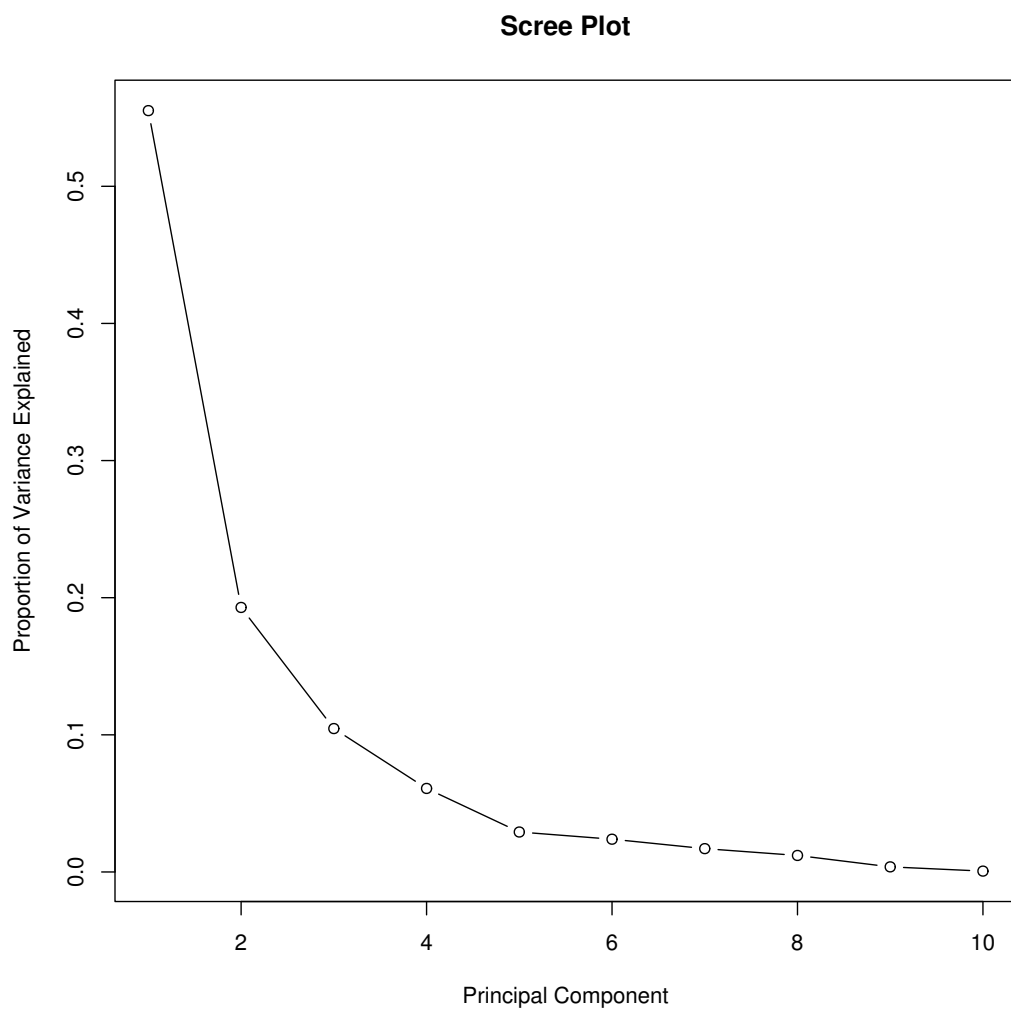



Figure 19: Your caption.



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<https://get.webgl.org>  
for more info

Figure 20: Your caption.



**Step 3d. PCA: IPNW WHEAT loss by COUNTY with DAMAGE CAUSE loadings: PC1 and PC2 table**

Here we summarize our PCA findings for the inland PNW, for wheat by county, using damage cause as the factor loadings. Here we plot PC1 and PC2 loadings as a table.

Damage cause variable loadings by COUNTY

2001-2015

PC1

PC2

Adams\_WA

-3.574

1.325

Asotin\_WA

1.703

0.967

Benewah\_ID

1.807

-0.563

Benton\_WA

1.247

1.232

Columbia\_WA

1.559

0.633

Douglas\_WA

0.111

0.762

Franklin\_WA

1.208

1.038

Garfield\_WA

1.575

0.831

Gilliam\_OR

0.475

1.027

Grant\_WA

0.136

0.859  
Idaho\_ID  
1.132  
-2.574  
Latah\_ID  
1.298  
-1.538  
Lewis\_ID  
0.691  
-2.392  
Lincoln\_WA  
-2.988  
1.015  
Morrow\_OR  
-1.805  
1.347  
Nez Perce\_ID  
1.167  
-0.583  
Sherman\_OR  
1.39  
0.415  
Spokane\_WA  
0.836  
-1.319  
Umatilla\_OR  
-7.766  
0.232  
Union\_OR  
1.928  
0.884  
Walla Walla\_WA  
-2.215  
-0.184  
Wallowa\_OR  
1.918

0.579

Wasco\_OR

0.908

-0.221

Whitman\_WA

-2.74

-3.773

### Step 3e. PCA: IPNW WHEAT loss by COUNTY with DAMAGE CAUSE loadings: Spatial Mapping of PC1 and PC2

Here we summarize our PCA findings for the inland PNW, for wheat by county, using damage cause as the factor loadings. We take PC1 and PC2 loadings and plot each as a map.

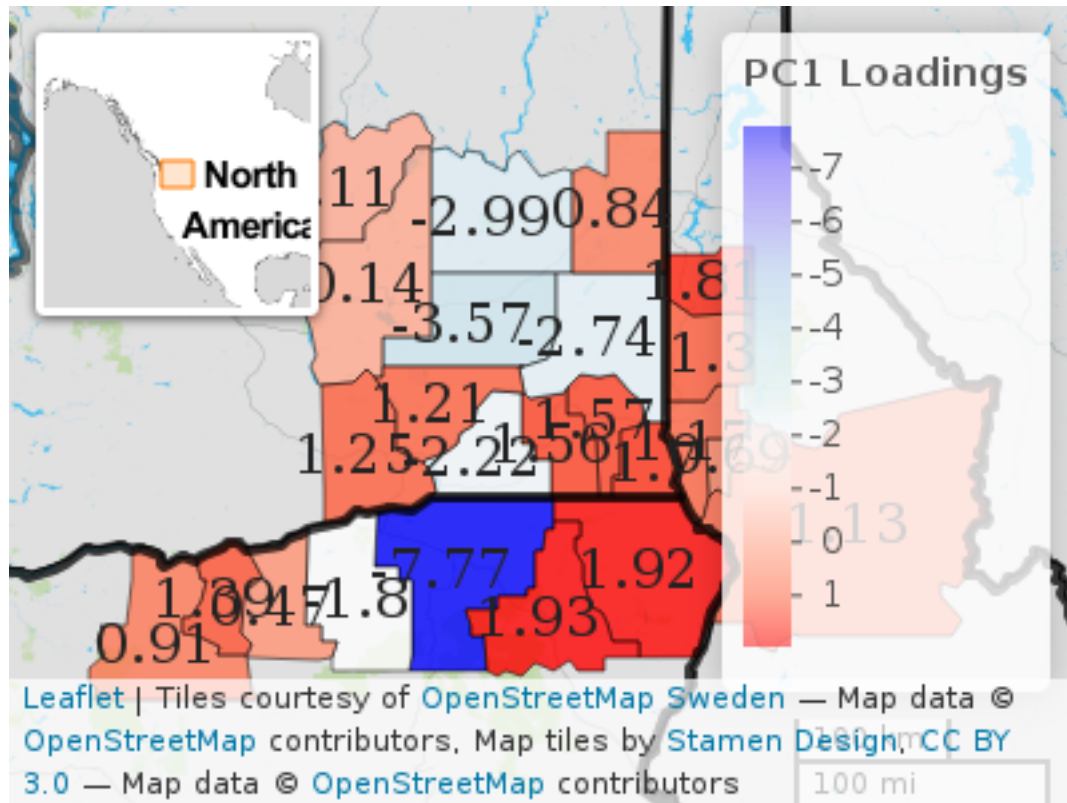


Figure 21: Your caption.

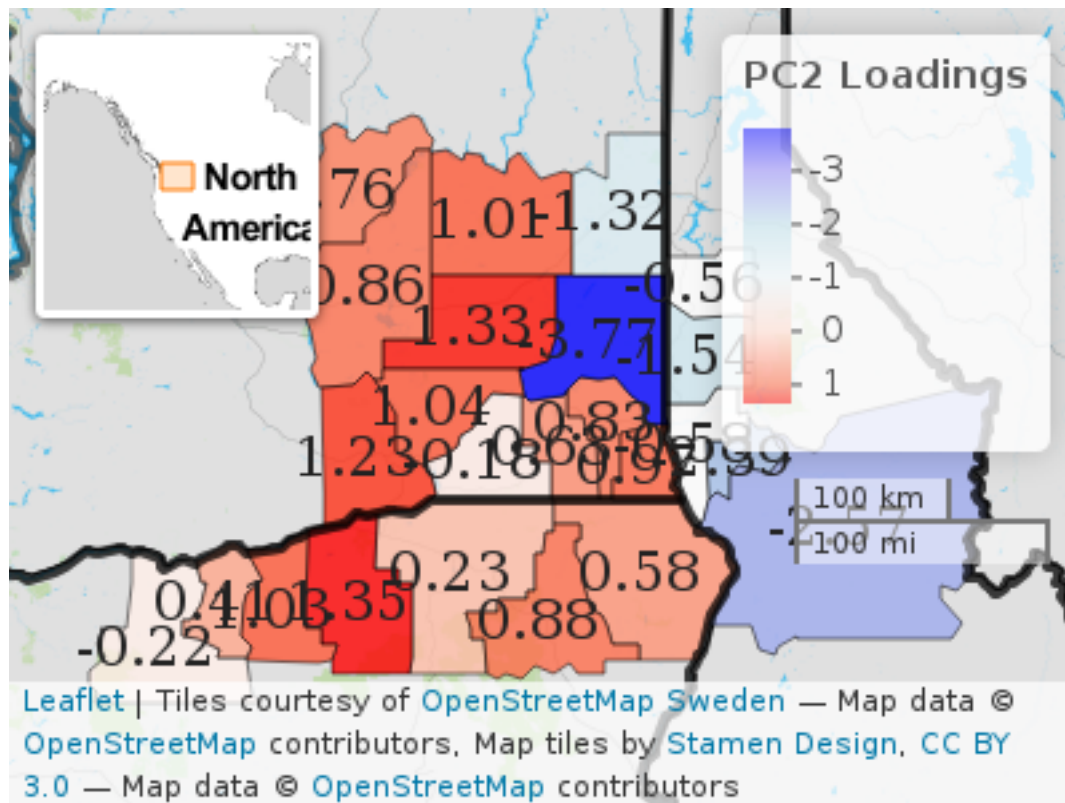


Figure 22: Your caption.

### Step 3f. PCA + KMEANS: IPNW WHEAT insurance loss, by YEAR with DAMAGE CAUSE loadings: 2001 to 2015

Here we perform a PCA for the insurance loss for the inland PNW, for wheat, by year, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

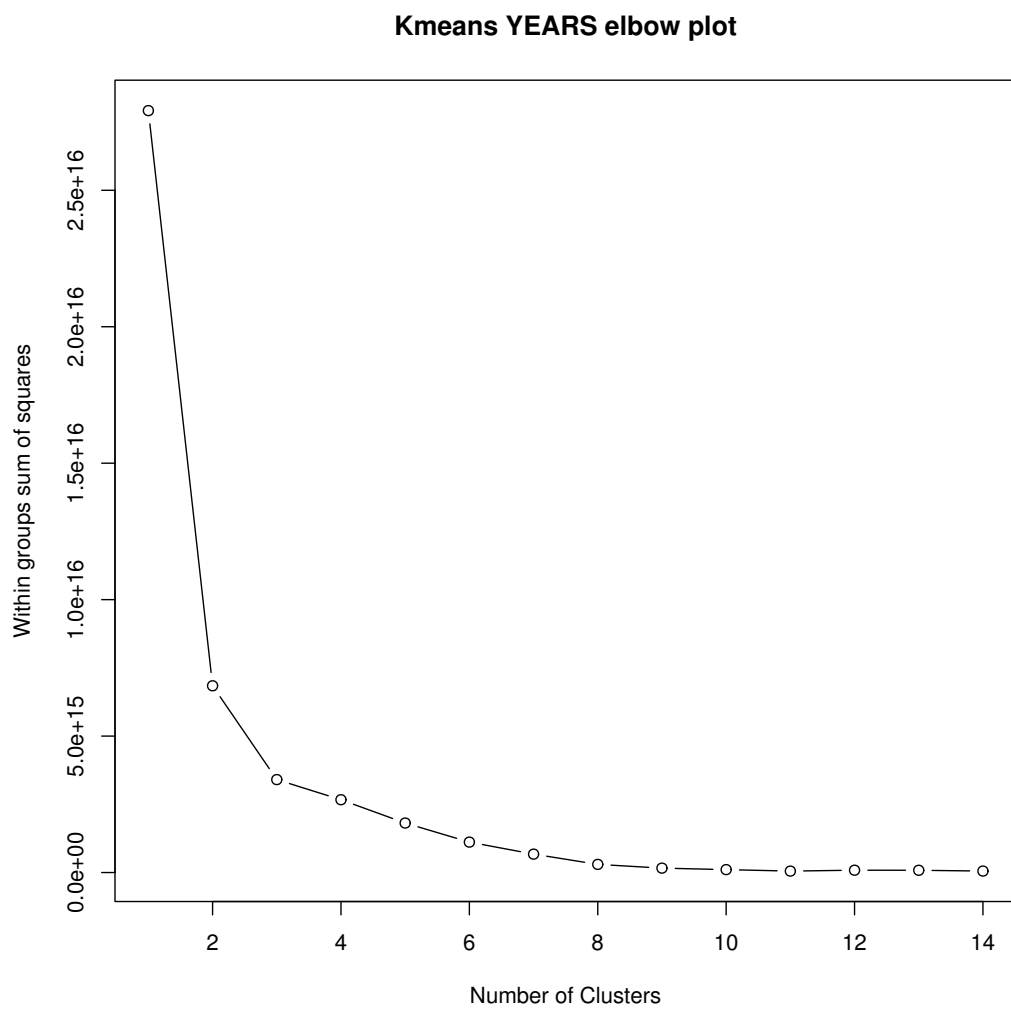


Figure 23: Your caption.

## Principle Components: IPNW insurar by year with damage cause loadings

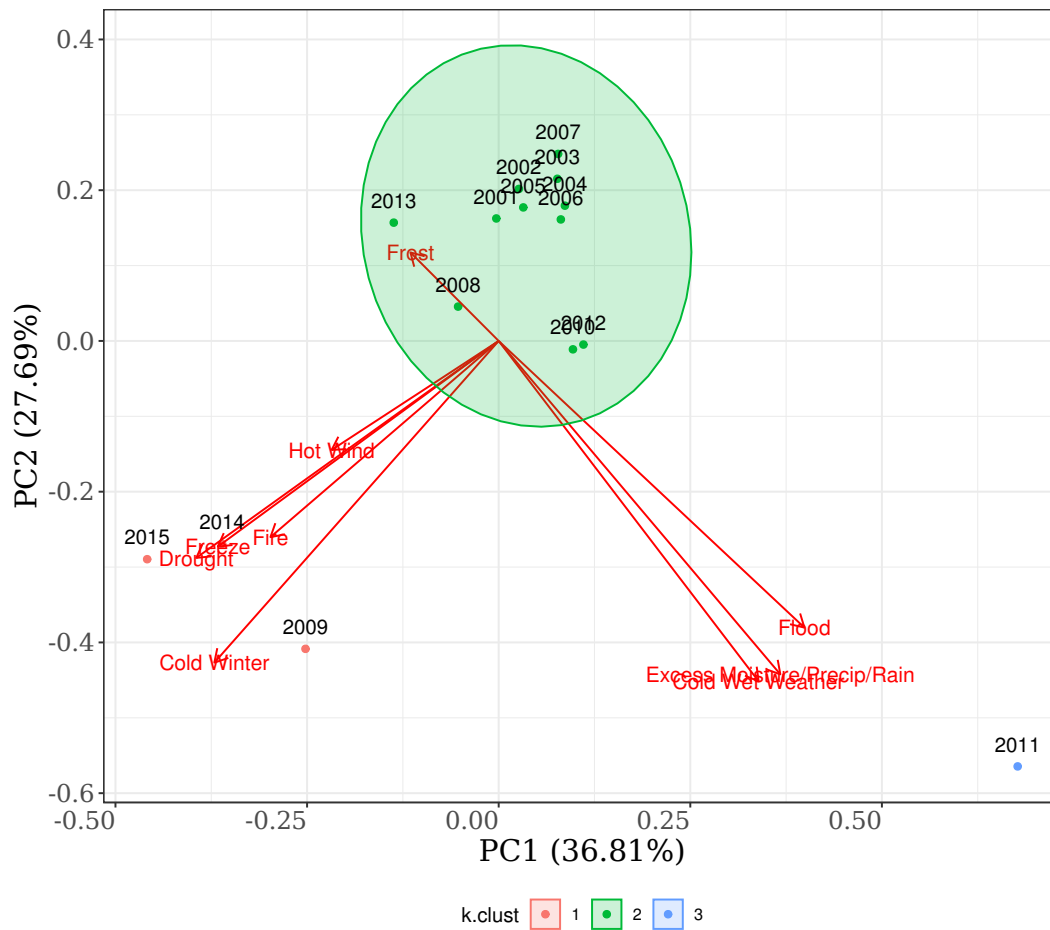


Figure 24: Your caption.

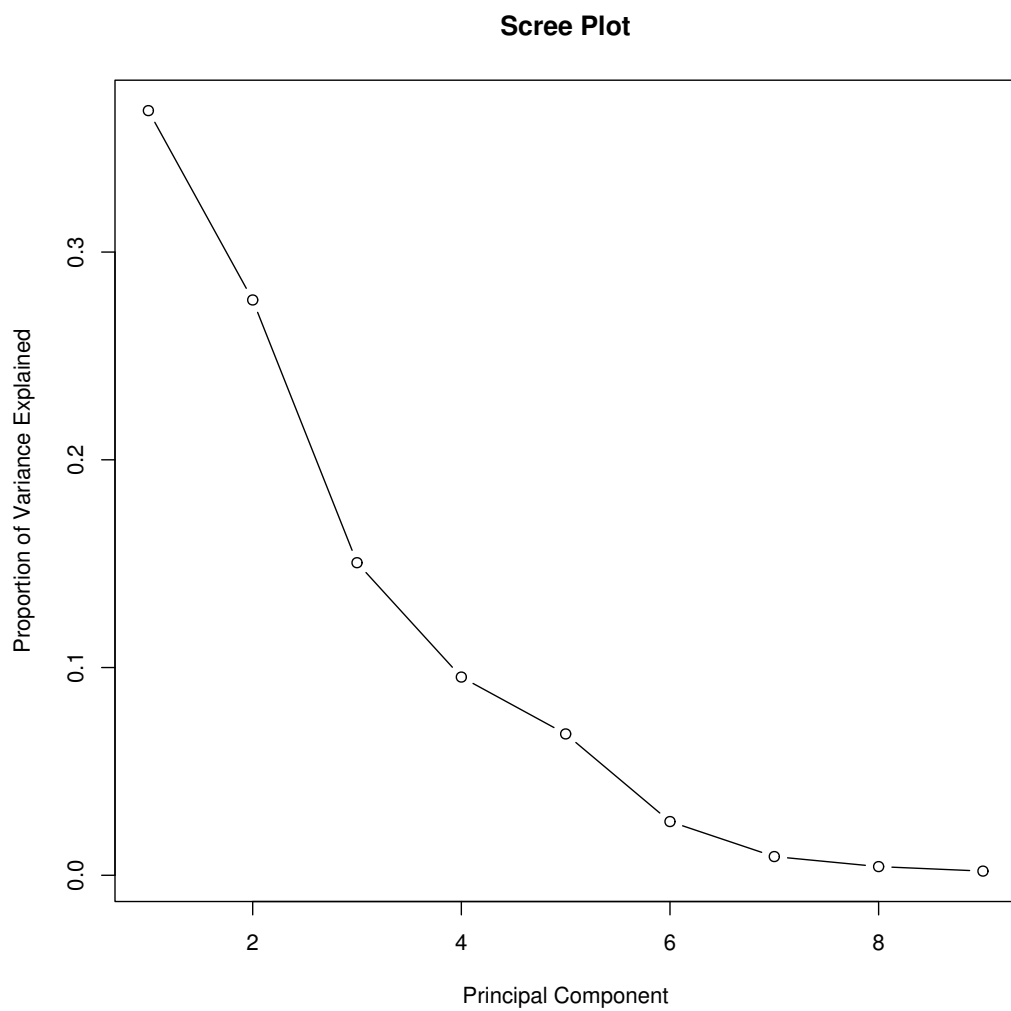


Figure 25: Your caption.



**Step 3g. PCA:IPNW WHEAT insurance loss, by YEAR with DAMAGE CAUSE loadings:  
2001 to 2015: PC1 vs PC2 barplot**

Here we plot PC1 loadings vs PC2 by year, as a barplot, to visualize orthogonal/opposing patterns.

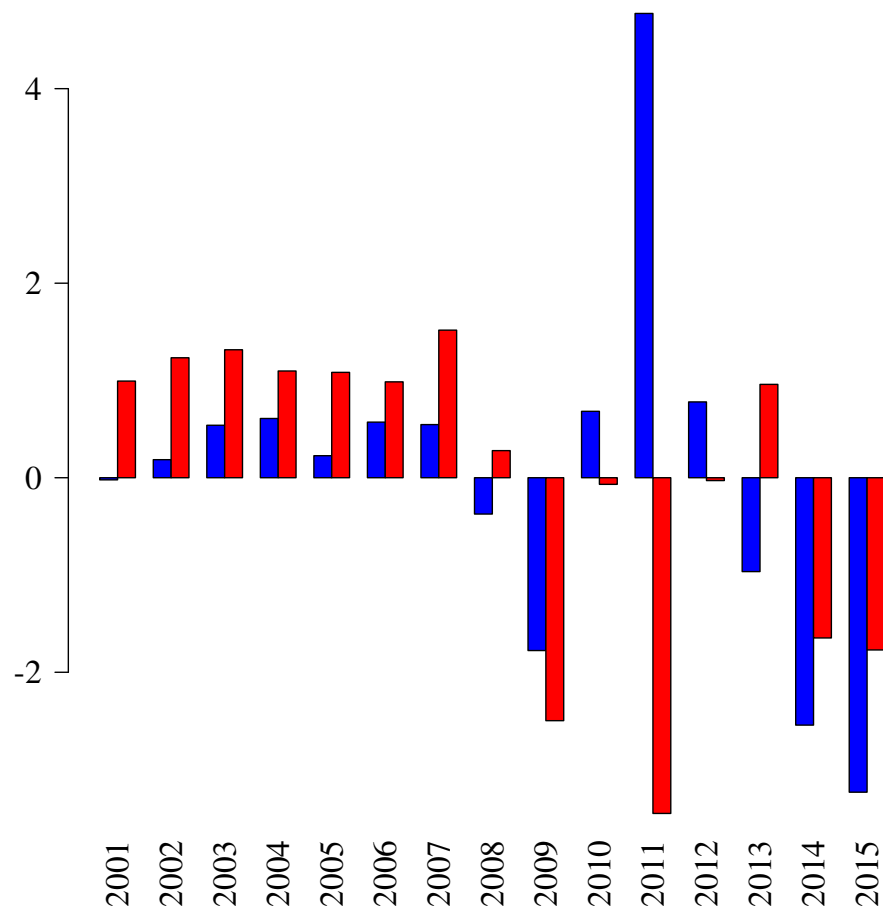


Figure 26: Your caption.

**Step 3h. PCA: IPNW WHEAT loss by YEAR with DAMAGE CAUSE loadings: PC1 and PC2 table**

Here we summarize our PCA findings for the inland PNW, for wheat by year, using damage cause as the factor loadings. Here we plot PC1 and PC2 loadings as a table.

Damage cause variable loadings by YEAR

2001-2015

PC1

PC2

Cold Wet Weather

0.341

-0.455

Cold Winter

-0.374

-0.43

Drought

-0.397

-0.29

Excess Moisture/Precip/Rain

0.37

-0.445

Fire

-0.3

-0.262

Flood

0.402

-0.383

Freeze

-0.369

-0.275

Frost

-0.116

0.118

Hot Wind

-0.219

-0.146

**Step 3i. EXPERIMENTAL: PCA + KMEANS: WHEAT IPNW insurance loss, by COUNTY with DAMAGE CAUSE loadings: 2001 to 2015**

Here we perform a PCA for the insurance loss for the inland PNW, for wheat by county, with damage cause as the factor loadings. Data from 2001 to 2015 is used. We additionally have generated a scree plot that shows the proportion of variance explained by the individual components.

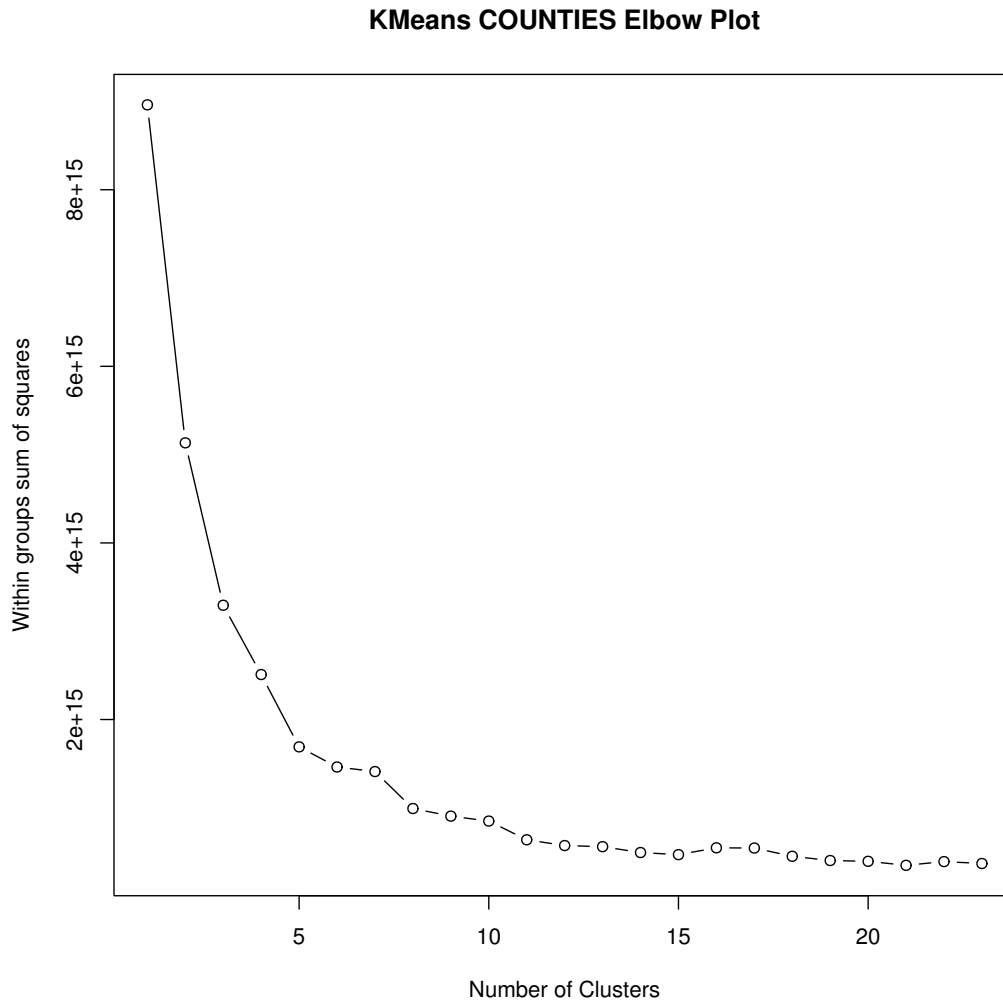


Figure 27: Your caption.

```
## *** : The Hubert index is a graphical method of determining the number of clusters.
##           In the plot of Hubert index, we seek a significant knee that corresponds to a
##           significant increase of the value of the measure i.e the significant peak in Hubert
##           index second differences plot.
##
```

```
## *** : The D index is a graphical method of determining the number of clusters.
##           In the plot of D index, we seek a significant knee (the significant peak in Dindex
##           second differences plot) that corresponds to a significant increase of the value of
```

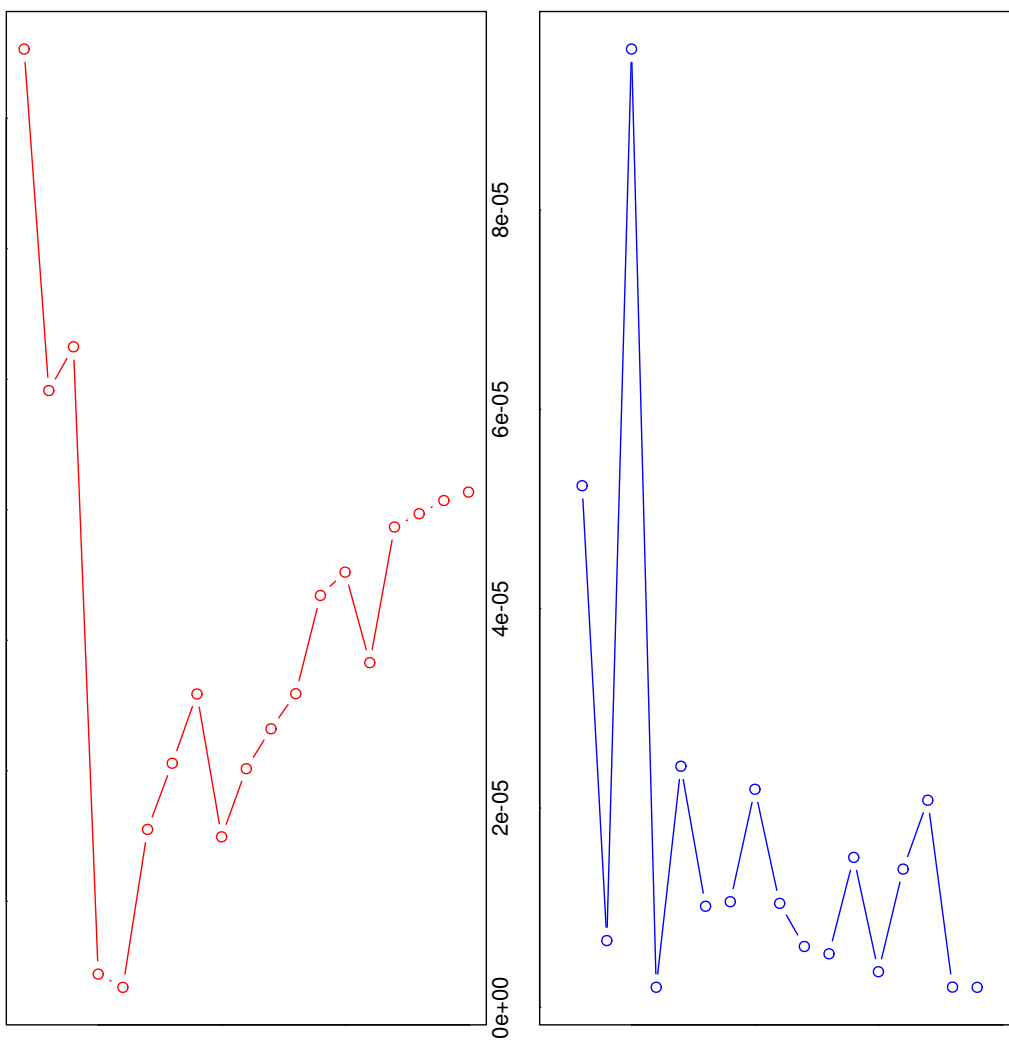


Figure 28: Your caption.

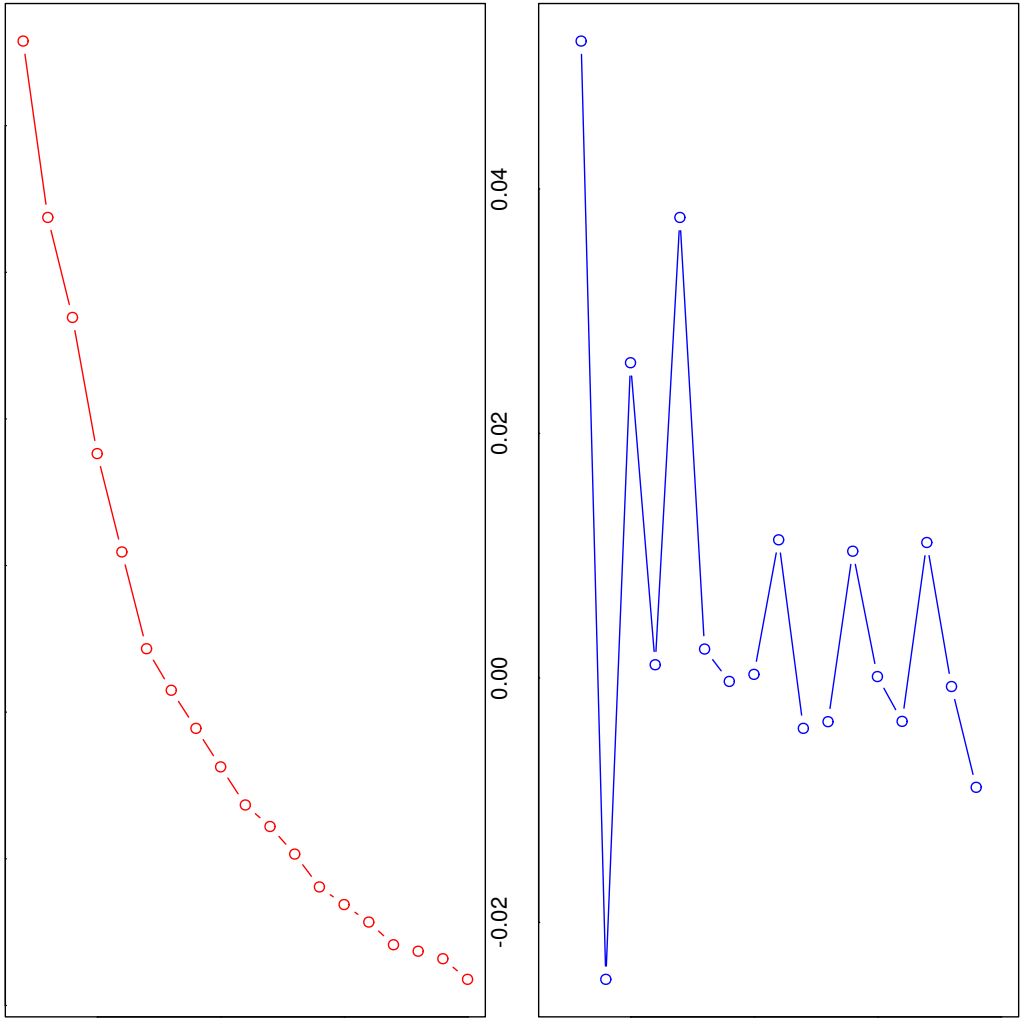


Figure 29: Your caption.

```

##                the measure.
##
## *****
## * Among all indices:
## * 5 proposed 2 as the best number of clusters
## * 5 proposed 3 as the best number of clusters
## * 1 proposed 4 as the best number of clusters
## * 3 proposed 5 as the best number of clusters
## * 4 proposed 10 as the best number of clusters
## * 4 proposed 16 as the best number of clusters
## * 1 proposed 20 as the best number of clusters
##
##                ***** Conclusion *****
##
## * According to the majority rule, the best number of clusters is  2
##
## *****

```

## Principle Components: IPNW insurar

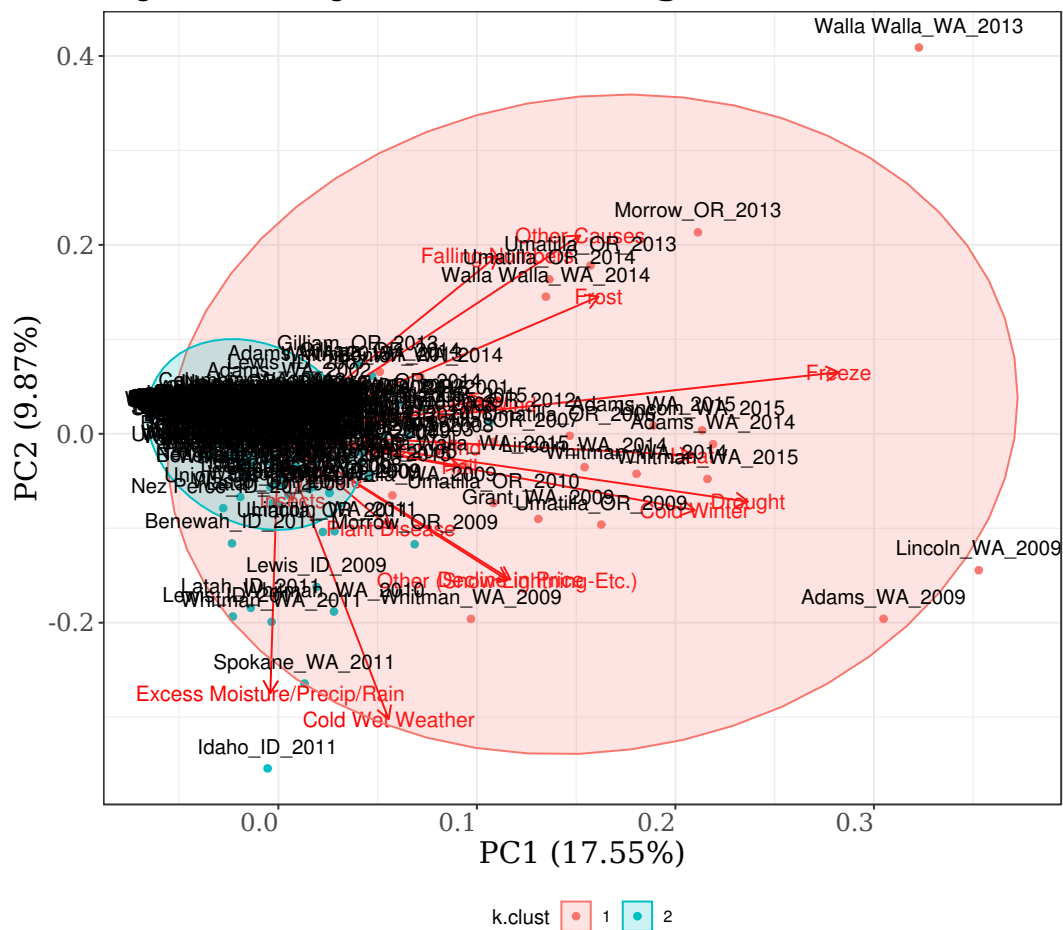


Figure 30: Your caption.

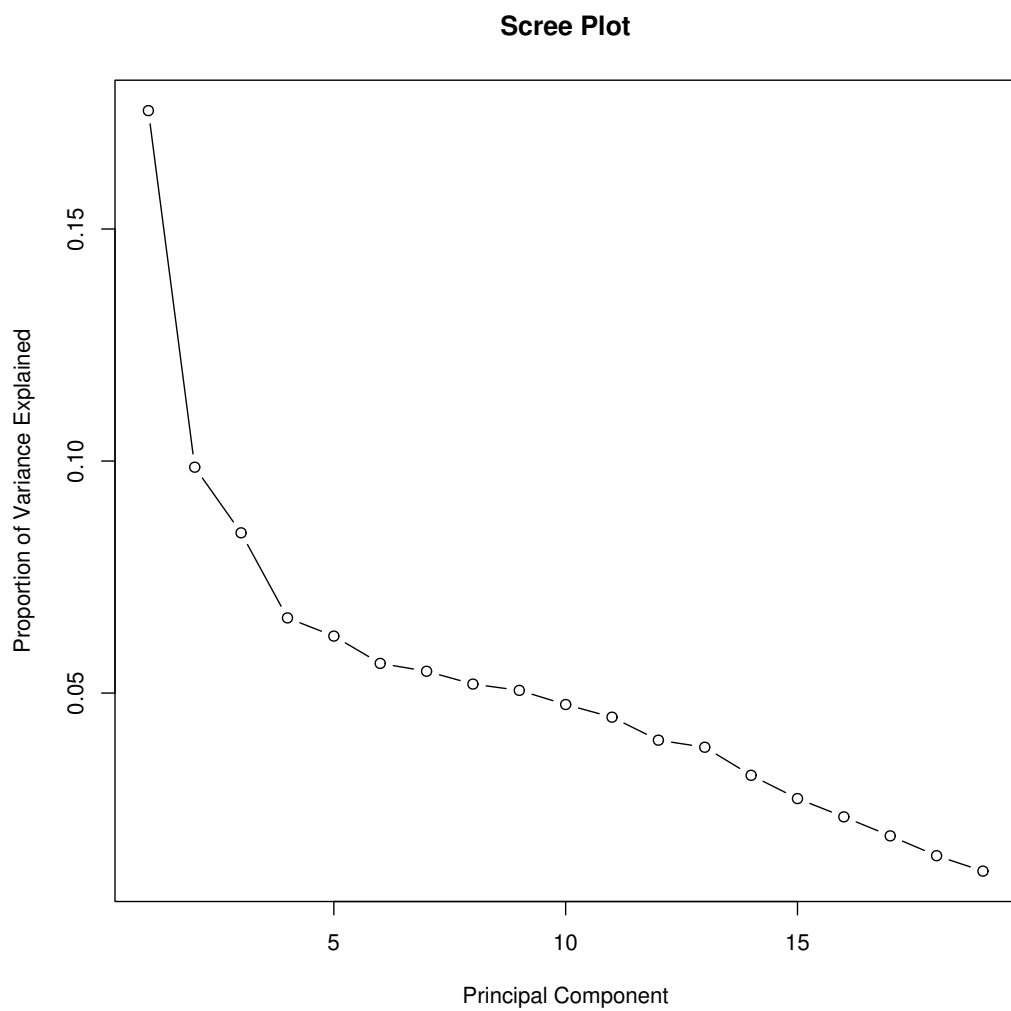


Figure 31: Your caption.