

# AMETHIST GIS Visualization

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```
library(sf)
library(tidyverse)
library(ggmap)
library(ggpubr) #Combining plots
```

## Importing the Boundaries

The boundaries (polygons) are all in .CSV format and i have used the *tidyverse* package to read the data. After reading the data, i am converting the boundaries to a spatial type format using the *sf* package and defining the column holding the Well-Known Text (WKT) markup language for representing vector geometry objects and the Coordinate Reference System (CRS).

For the point data, *Longitude and Latitude* are the columns holding the spatial locations of the points.

```
BangweBoundary <- read_csv("data/BangwePoly.csv") %>%
  st_as_sf(wkt = "WKT", crs = 4326)

NaperiBoundary <- read_csv("data/NaperiPoly.csv") %>%
  st_as_sf(wkt = "WKT" , crs = 4326)

ChirimbaBoundary <- read_csv("data/ChirimbaPoly.csv") %>%
  st_as_sf(wkt = "WKT" , crs = 4326)

BtBoundary <- read_csv("data/blantyre_boundary.csv") %>%
  st_as_sf(wkt = "WKT" , crs = 4326)

SexWorkVenues <- read_csv("data/waypoints_Combined.csv") %>% st_as_sf (coords = c("Longitude", "Latitude"), crs = 4326)
```

## Defining the sex work venues that fall inside a polygon

I have used the *sf* package to define the points that fall inside a particular polygon (Bangwe polygon, Chirimba polygon and Naperi polygon)

```
Bangwe_SexV <- st_intersection(SexWorkVenues, BangweBoundary)

Chirimba_SexV <- st_intersection(SexWorkVenues, ChirimbaBoundary)

Naperi_SexV <- st_intersection(SexWorkVenues, NaperiBoundary)
```

## Append the spatial data

Using base r i have appended all sex venues to one data frame then combining all the polygons to one data frame.

```
AllSexVenues <- bind_rows(Bangwe_SexV,Chirimba_SexV,Naperi_SexV)

AllPolygons <- bind_rows(BangweBoundary, ChirimbaBoundary, NaperiBoundary)

AllPolygons <- rename(AllPolygons,Cluster=Name)
```

```
head(AllSexVenues)
```

```
## Simple feature collection with 6 features and 13 fields
## Geometry type: POINT
## Dimension:      XY
## Bounding box:   xmin: 35.0628 ymin: -15.88519 xmax: 35.08788 ymax: -15.73296
## Geodetic CRS:   WGS 84
## # A tibble: 6 x 14
##   Label Institution Name  descriptio timestamp begin end   altitudeMo tessellate
##   <chr> <chr>      <chr> <lgl>      <lgl>      <lgl> <lgl> <lgl>      <dbl>
## 1 Bar ~ MLW      Bang~ NA        NA        NA        NA    NA    NA        1
## 2 Bar ~ MLW      Bang~ NA        NA        NA        NA    NA    NA        1
## 3 Bar ~ MLW      Bang~ NA        NA        NA        NA    NA    NA        1
## 4 Bar ~ MLW      Bang~ NA        NA        NA        NA    NA    NA        1
## 5 Bar ~ MLW      Bang~ NA        NA        NA        NA    NA    NA        1
## 6 Bar ~ MLW      Bang~ NA        NA        NA        NA    NA    NA        1
## # ... with 5 more variables: extrude <dbl>, visibility <dbl>, drawOrder <lgl>,
## #   icon <lgl>, geometry <POINT [°]>
```

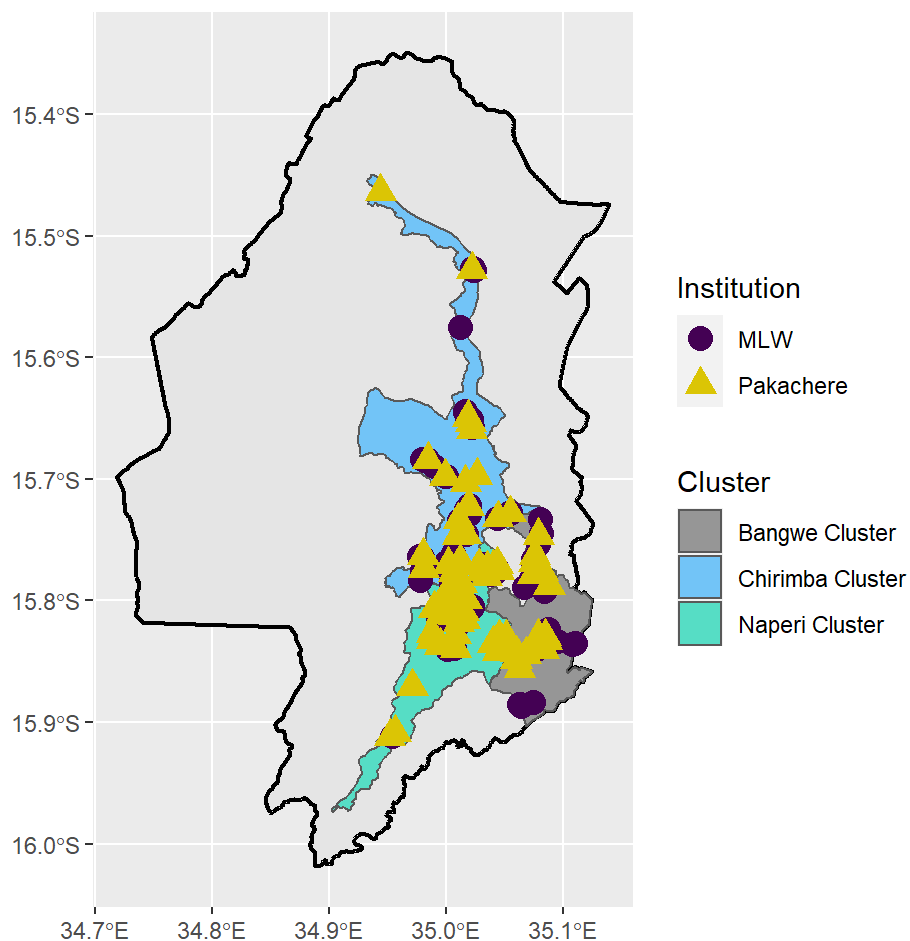
## Generating the plots/visualization

The tidyverse package *ggplot2* is the one i have used for the plots/visualization.

### Map showing MLW and Pakachere identified sex work venues

```
plot1 <- ggplot()+
  geom_sf(data = BtBoundary, color="black", size=0.8)+
  geom_sf(data = AllPolygons, aes(fill = Cluster))+
  #annotation_scale(location="br")+
  #annotation_north_arrow(location="tl")+
  scale_fill_manual(values = c("#969696", "#72c4f7", "#56ddc5"), name= "Cluster")+
  geom_sf(data = AllSexVenues, aes(col=Institution, shape=Institution), size=4)+
  scale_color_manual(values=myColors)+
  theme(legend.position = "right")
```

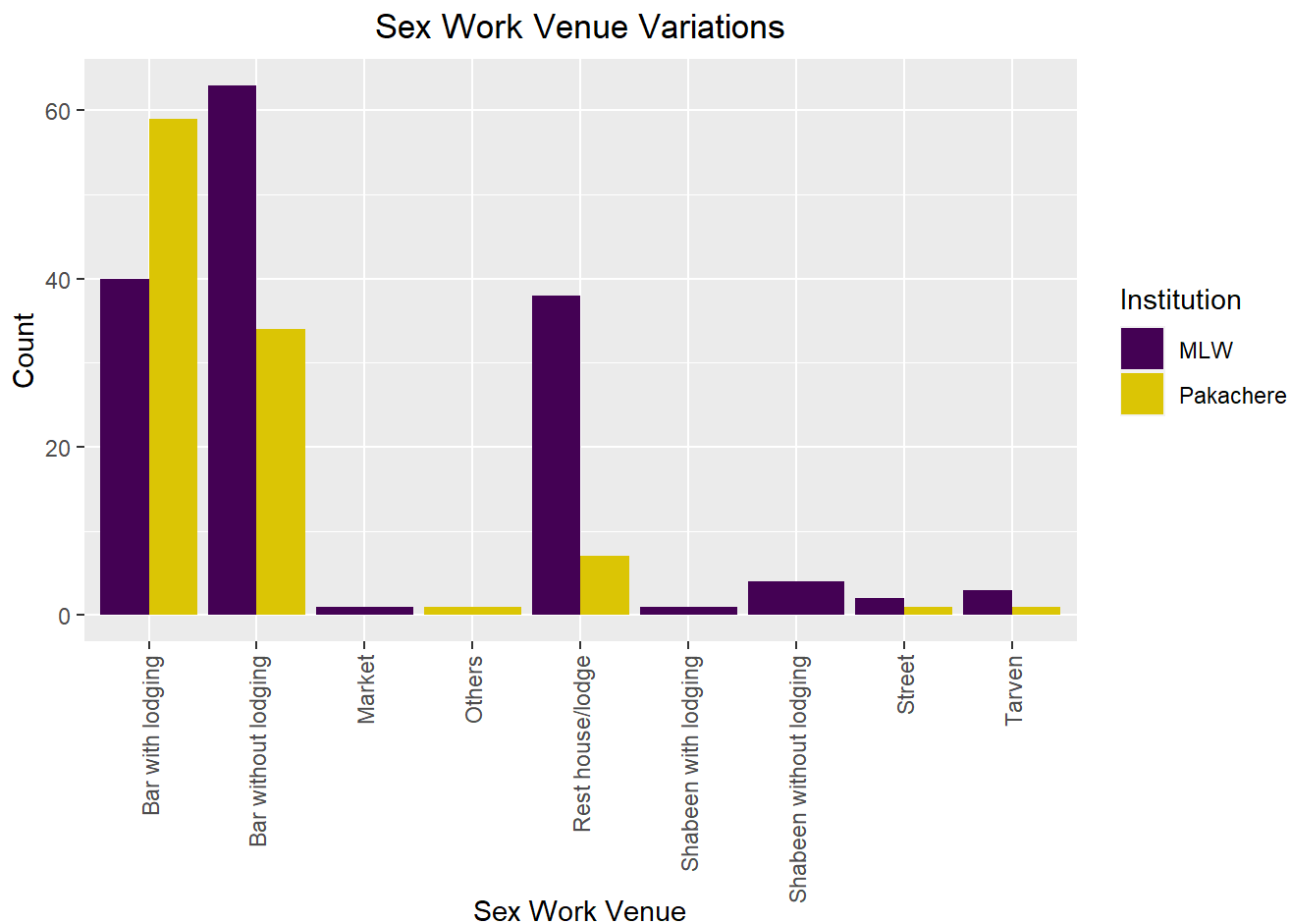
```
plot(plot1)
```



### Sex work variation between MLW and Pakachere

```
plot2 <- ggplot(AllSexVenues) +
  aes(x = Label, fill = Institution) +
  geom_bar(position = "dodge") +
  scale_fill_manual(values = c(MLW = "#440154",
    Pakachere = "#DBC505")) +
  labs(x = "Sex Work Venue", y = "Count", title = "Sex Work Venue Variations") +
  theme_gray() +
  theme(plot.title = element_text(size = 13L, hjust = 0.5), axis.title.y = element_text(
    size = 11L),
    axis.title.x = element_text(size = 11L))+
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1))
```

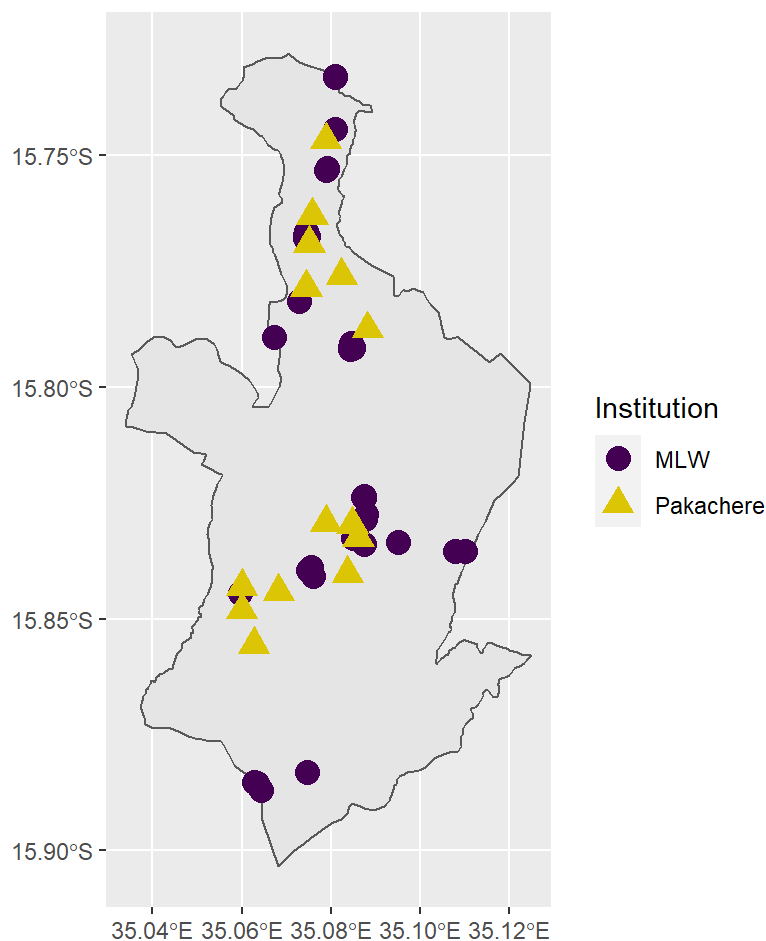
```
plot(plot2)
```



### Bangwe cluster sex work venue distribution

```
PlotBangwe <- ggplot()+
  geom_sf(data = BangweBoundary)+
  #annotation_scale(location="br")+
  # annotation_north_arrow(location="tl")+
  scale_fill_manual(values = c("#969696", "#72c4f7", "#56ddc5"), name= "Cluster")+
  geom_sf(data = Bangwe_SexV, aes(col=Institution, shape=Institution), size=4)+
  scale_color_manual(values=myColors)+
  theme_gray()
```

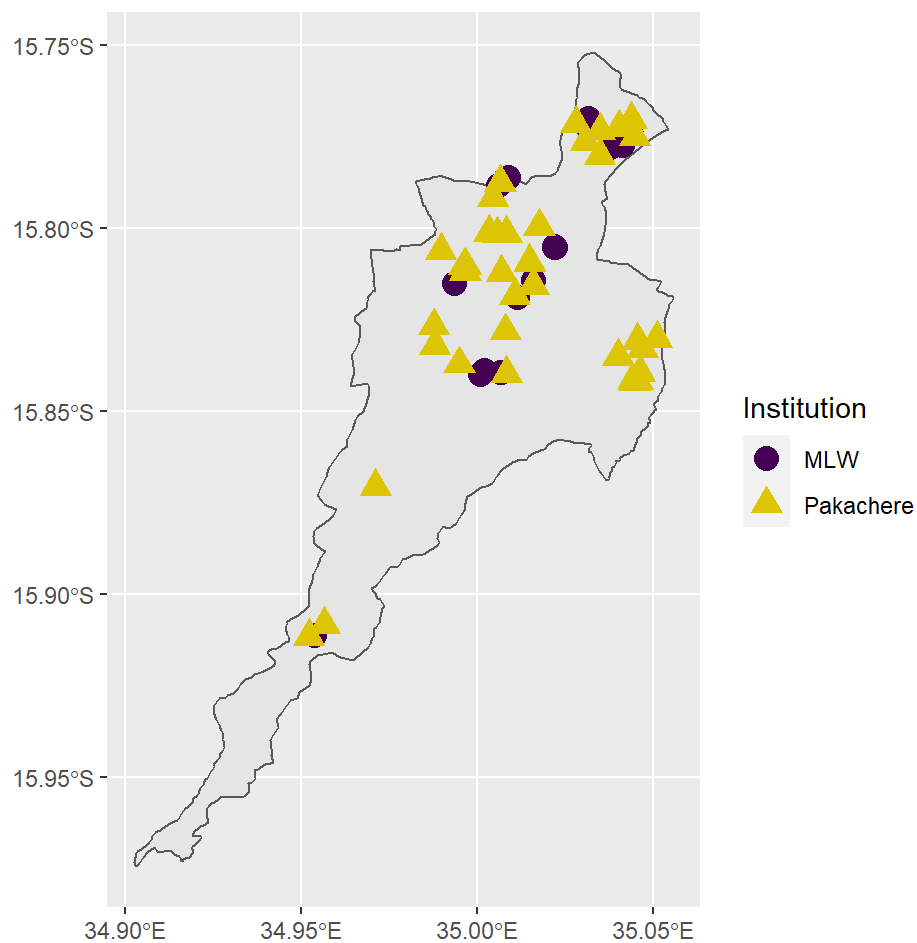
```
plot(PlotBangwe)
```



### Naperi cluster sex work venue distribution

```
PlotNaperi <- ggplot()+
  geom_sf(data = NaperiBoundary)+
  #annotation_scale(location="br")+
  # annotation_north_arrow(location="tl")+
  scale_fill_manual(values = c("#969696", "#72c4f7", "#56ddc5"), name= "Cluster")+
  geom_sf(data = Naperi_SexV, aes(col=Institution, shape=Institution), size=4)+
  scale_color_manual(values=myColors)+
  theme_gray()
```

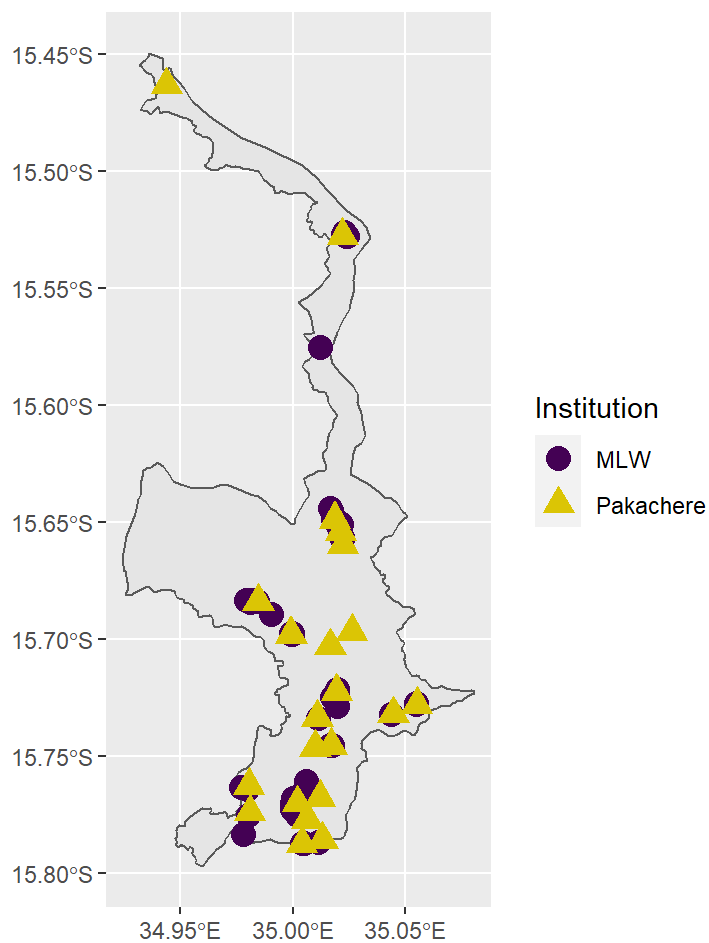
```
plot(PlotNaperi)
```



### Chirimba cluster sex work venue distribution

```
PlotChirimba <- ggplot()+  
  geom_sf(data = ChirimbaBoundary)+  
  #annotation_scale(location="br")+  
  # annotation_north_arrow(location="tl")+  
  scale_fill_manual(values = c("#969696", "#72c4f7", "#56ddc5"), name= "Cluster")+  
  geom_sf(data = Chirimba_SexV, aes(col=Institution, shape=Institution), size=4)+  
  scale_color_manual(values=myColors)+  
  theme_gray()
```

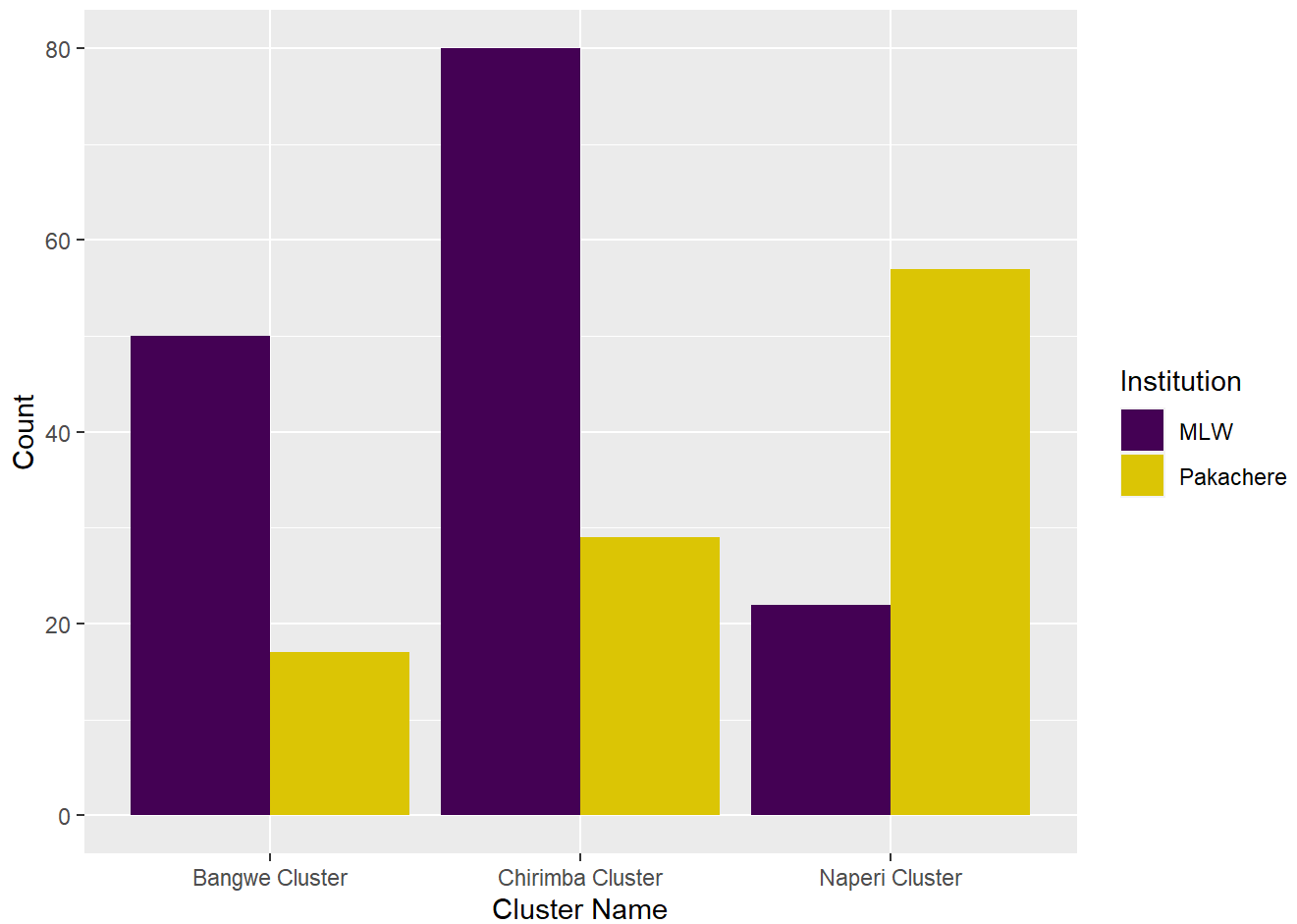
```
plot(PlotChirimba)
```



#### ##### Cluster sex work venue distribution

```
plot3 <- ggplot(AllSexVenues) +
  aes(x = Name, fill = Institution) +
  geom_bar(position = "dodge") +
  scale_fill_manual(values = c(MLW = "#440154",
                              Pakachere = "#DBC505")) +
  labs(x = "Cluster Name", y = "Count") +
  theme_gray() +
  theme(plot.title = element_text(hjust = 0.5))
```

```
plot(plot3)
```



### Combining Plots

```
figure1 <- ggarrange(PlotBangwe, PlotNaperi, PlotChirimba, plot3,  
  labels = c("Bangwe Cluster", "Naperi Cluster", "Chirimba Cluster",  
    "Cluster Variations"),  
  ncol = 2, nrow = 2)
```

```
plot(figure1)
```



