

Step 5

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Using GIS to identify VCA intersection point with NHD line (fanhead point)

The elevation of the VCA polygon intersection with the NHDplus line needs to be identified from GIS. The point where this intersection occurs is called the fanhead point. From our query, we found the fanhead point for this dataset, which is a intersection between the NHDplus line and the valley generated from the Valley Confinement Algorithm tool.

(This is just test data. Users will need to change values according to their analysis)

```
Fan_head_start_point_elev <- 680 # Elevation of VCA shape file intersection  
Point with NHD Line
```

Working Directory -----

```
setwd("F:/RunningModel") # Users will need to change their working directory  
depending upon where the data is stored.
```

Packages -----

There are some dependencies that needs to be installed.

```
if (!require (tidyverse)) {install.packages ("tidyverse")}  
  
library(tidyverse)  
  
if (!require (readxl)) {install.packages ("readxl")}
```

Importing data -----

Below is sample data. Users can import their own data to run the code. To run this code, please make sure that the column which has elevation data is named **dem_result**

```
library(readxl)  
  
data_frame <- read_excel("F:\\Fire_Mapping\\Data_Frames\\Rough_Patch.xlsx")  
  
data_frame <- data_frame %>%  
  arrange(desc(dem_result))  
  
data_frame$`OBJECTID *` <- row.names(data_frame )  
  
ID_Fan_head_start_point_ID <- data_frame %>%  
  filter(dem_result == Fan_head_start_point_elev)
```

```
ID_Fan_head_start_point <- as.numeric(ID_Fan_head_start_point_ID$`OBJECTID *`
)
```

Initiation Point —————

The initiation point is the point on the slope where the debris flow originates. It is estimated as half the vertical distance between the top of the drainage divide and the fanhead point.

```
elev_initiation_point <- (max(data_frame$dem_result) - Fan_head_start_point_elev)/2
elev_initiation_point <- elev_initiation_point + Fan_head_start_point_elev
```

```
Initiation_Point_DataFrame <- data_frame %>%
  filter(dem_result >= elev_initiation_point) %>%
  arrange(dem_result) %>%
  filter(row_number()==1)
```

The dataframe starts from the top and its ID is given 1. So, we need to compute downward distance. The distance is computed to the fanhead point. Subtracting ID of the fanhead point and the initiation Point:

```
distance <- (ID_Fan_head_start_point -
  as.numeric(Initiation_Point_DataFrame$`OBJECTID *`))*30
```

The distance is only up to the fanhead Point.

Computing Value of Alpha —————

Alpha is the angle of reach, the declination of a line that connects the head of a failed mass to the distal end of the deposit. It is calculated as a linear function of the average slope of the travel path. Once alpha is calculated, the runout length can be calculated as the distance between the initiation point and the point at which the alpha slope profile becomes lower than the topographic profile.

```
alpha <- ((elev_initiation_point -
  Fan_head_start_point_elev)/distance)*0.88
```

```
alpha <- alpha[1]
```

```
Topo_profile <- data_frame %>%
  filter (dem_result <= elev_initiation_point)
```

```
Topo_profile$rev_row <- (0:(length(Topo_profile$`OBJECTID *`)-1))
```

```

Topo_profile <- Topo_profile %>%
  mutate(alpha_profile = elev_initiation_point -
           (rev_row*30*alpha))

# Length <- Length(Topo_profile$`OBJECTID *`) * 30

# The points are 30 meters apart.

run_out_length <- Topo_profile %>%
  filter(dem_result < alpha_profile)

print (run_out_length)

## # A tibble: 257 x 26
##   `OBJECTID *` `Shape *` ORIG_FID OBJECTID_1   COMID FDATE
##   <chr>        <chr>      <dbl>    <dbl>    <dbl> <dtm>
## 1 58          Point        1        2 23895908 2001-02-21 00:00:00
## 2 60          Point        1        2 23895908 2001-02-21 00:00:00
## 3 61          Point        1        2 23895908 2001-02-21 00:00:00
## 4 62          Point        1        2 23895908 2001-02-21 00:00:00
## 5 63          Point        1        2 23895908 2001-02-21 00:00:00
## 6 64          Point        1        2 23895908 2001-02-21 00:00:00
## 7 65          Point        1        2 23895908 2001-02-21 00:00:00
## 8 66          Point        1        2 23895908 2001-02-21 00:00:00
## 9 67          Point        1        2 23895908 2001-02-21 00:00:00
## 10 68         Point        1        2 23895908 2001-02-21 00:00:00
## # ... with 247 more rows, and 20 more variables: RESOLUTION <chr>,
## #   GNIS_ID <dbl>, GNIS_NAME <chr>, LENGTHKM <dbl>, REACHCODE <dbl>,
## #   FLOWDIR <chr>, WBAREACOMI <dbl>, FTYPE <chr>, FCODE <dbl>,
## #   SHAPE_LENG <dbl>, ENABLED <lgl>, GNIS_NBR <dbl>, Shape_Le_1 <dbl>,
## #   ComID_1 <dbl>, TotDASqKM <dbl>, DivDASqKM <dbl>, CUMDRAINAG <dbl>,
## #   dem_result <dbl>, rev_row <int>, alpha_profile <dbl>

```