# Hypsometric Curves and Integrals of Yanze Sub-Catchments

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I. Overview

In order to simplify the process of generating data required to draw an hypsometric curve of each sub-catchment in Yanze watershed, an ArcMap model was developed to perform the five steps involved in this process in one go. These steps are: 1) extract the DEM of the sub-catchment, 2) reclassify the DEM into classes of equidistant elevation height, 3) convert the reclassified DEM to vector using the 'Value' field, 4) dissolve the features using the 'Value' field, 5) calculate the area of each polygon, 6) export the table to a text file.
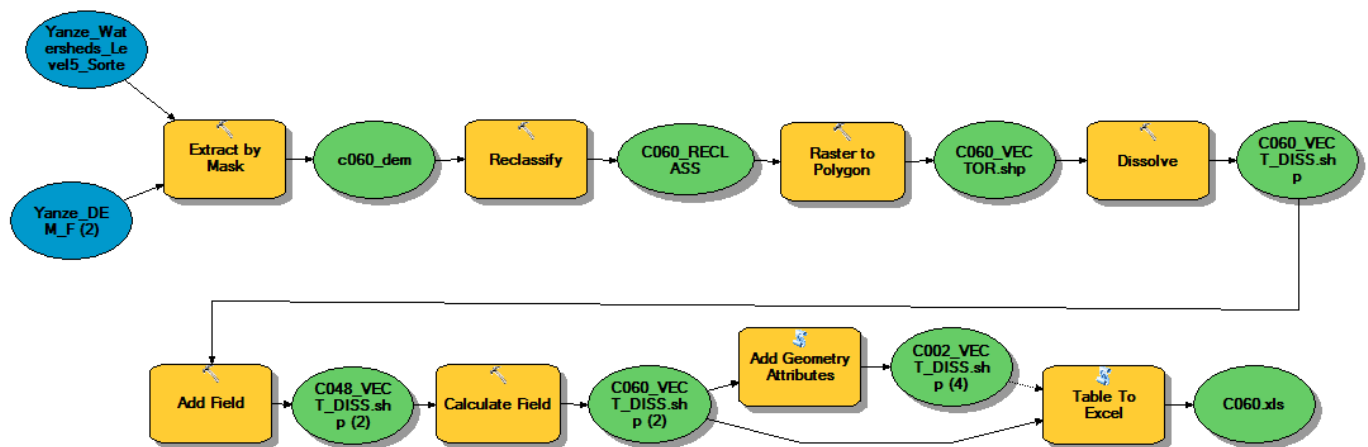
ArcGIS Hypsometric Integral Model

The present report outlines the results of this process. For each of the 93 sub-catchments of Yanze watershed, we will import the text file generated from ArcMap and process it to generate the hypsometric curve and integral for the sub-catchment.

II. Used R Packages

In addition to the core R libraries, the following are the packages that we will be using to generate hypsometric curves and integrals for Yanze sub-catchments:

```r
library(dplyr) # For preprocessing data
library(ggplot2) # For drawing the hypsometric curve
library(sjPlot) # For producing the coefficient table of the fitted model
library(PolynomF) # For building a polynomial equation of the model and integrating it
library(knitr)
```

III. Results Per Sub-Catchment

The text file exported from ArcMap will be imported into R for processing. First, the unnecessary variables will be deleted and only the elevation intervals and corresponding areas will remain. Secondly, the data will be normalized (for elevation, we first substract the minimum elevation and then divide by the range. For area, we divide each entry by the total area of the sub-catchment). Thirdly, we plot the data on a 2D chart showing the curve drawn from the normalized data. Finally, we fit a 3rd degree polynomial equation to the data and integrate it within the limits of 0 and 1 to produce the hypsometric integral metric of the sub-catchment.

```r
watersheds <- 1:60
min_max <- read.csv("Minimum-Maximum.csv", header = TRUE)

all_data <- list()
for (i in watersheds){
  if (i < 10)
    n <- paste("C00", i, sep = "")
  else
    n <- paste("C0", i, sep = "")

# Read in the data and preprocess it
minimum <- min_max$minimum[i]
maximum <- min_max$maximum[i]
file <- paste(n, ".csv", sep = "")
data <- read.csv(file)
data <- data %>% select(ELEV, AREA_GEO)
data <- mutate(data, ELEV_NORM = (ELEV - minimum)/(maximum - minimum))
data <- mutate(data, AREA_NORM = cumsum(AREA_GEO)/sum(AREA_GEO))

# Build the Hypsometric curve object
g <- ggplot(data = data, aes(x = AREA_NORM, y = ELEV_NORM))
g <- g + geom_line(color = "blue", size = 2)
g <- g + geom_point(color = "green", size = 3, shape = 18)
g <- g + labs(title = paste(i, ". Hypsometric Curve  of Catchment ", n, sep = ""), x = "% of Relative Area"
, y = "% of Relative Elevation")
g <- g + theme(panel.background = element_rect(fill = "#BFD5E3", colour = "#6D9EC1", size = 2, linetype = "s
olid"), panel.grid.major = element_line(size = 0.5, linetype = 'solid',colour = "white"), panel.grid.minor
= element_line(size = 0.25, linetype = 'solid', colour = "white"))

# Determine the Hypsometric Integral
# First, let's define a polynomial equation that fits the curve
fit = lm(ELEV_NORM ~ poly(AREA_NORM, 3), data = data)

# Second, we display the coefficients of the fitted equation in a well-formatted table
# If the p-values of any of them is too high or the R-squared value is too low, then a better model will nee
d to be fitted
coef_table <- tab_model(fit)

# Finally, we build the polynomial equation and calculate the integral
x <- polynom()
p = summary(fit)$coefficients[2,1] * x + summary(fit)$coefficients[3,1] * x^2 + summary(fit)$coefficients[4
,1] * x^3
HI <- integral(p, c(0,1))

# Output the results
print(g)
#print(coef_table)
print(paste("The polynomial equation of sub-catchment ", n, " is ", p, sep = ""))
print(paste("The hypsometric integral of sub-catchment ", n, " is ", round(HI, 3), sep = ""))
#Build the main data frame
catchment_details <- list("minimum" = minimum, "maximum" = maximum, "data" = data, "equation" = p, "h_integr
al" = HI)
all_data[[n]] <- catchment_details
}
```
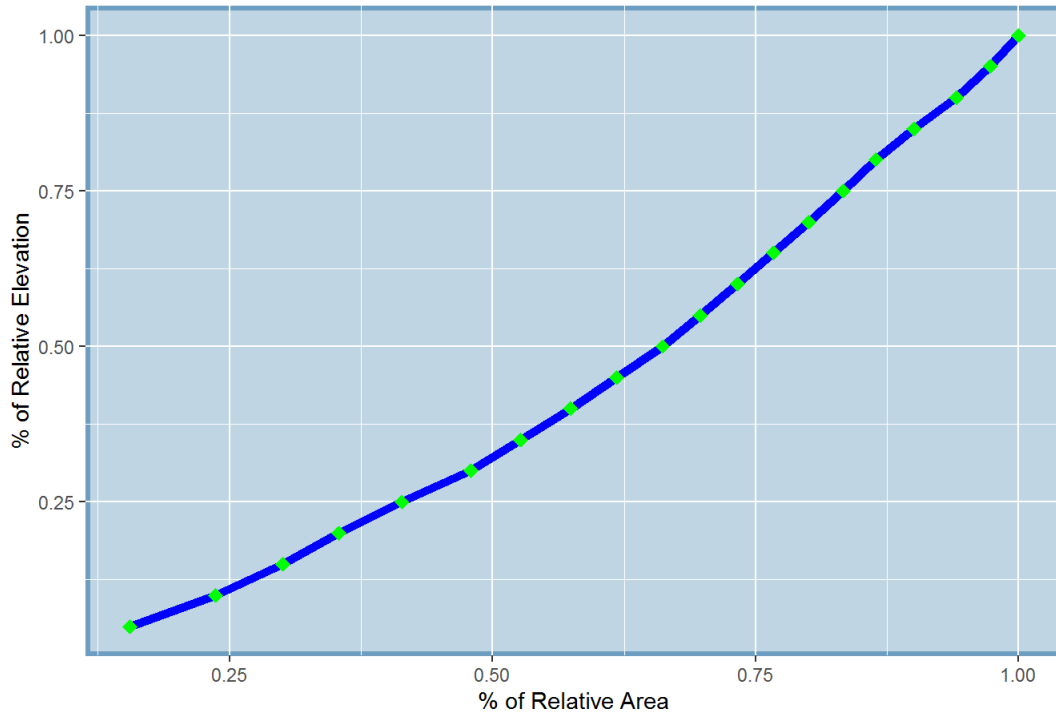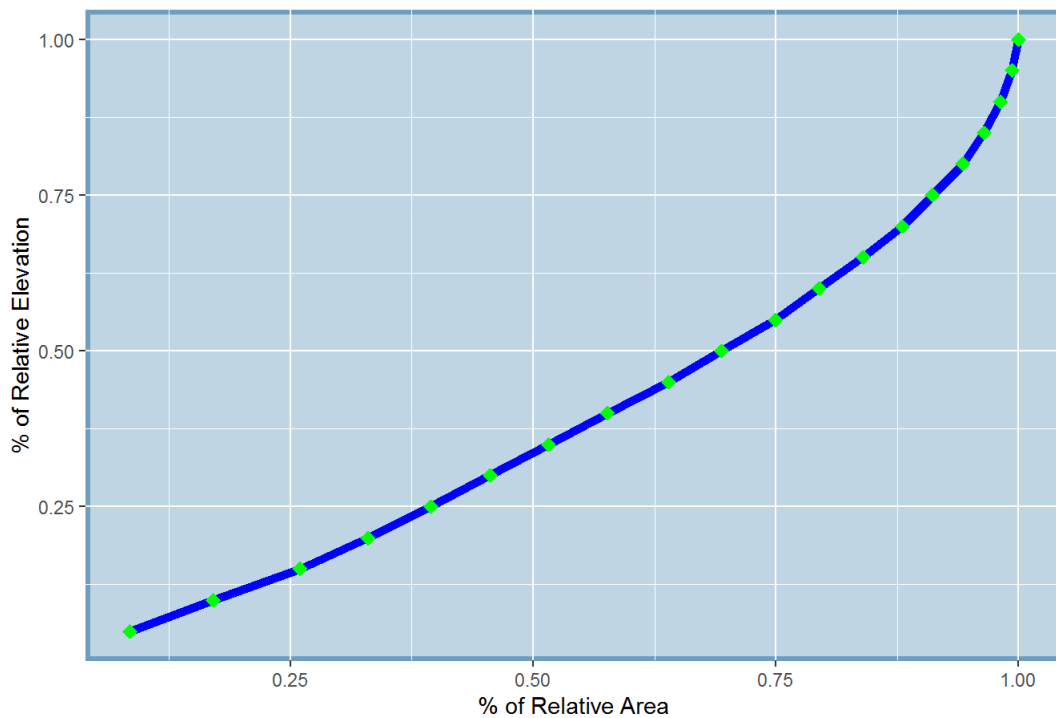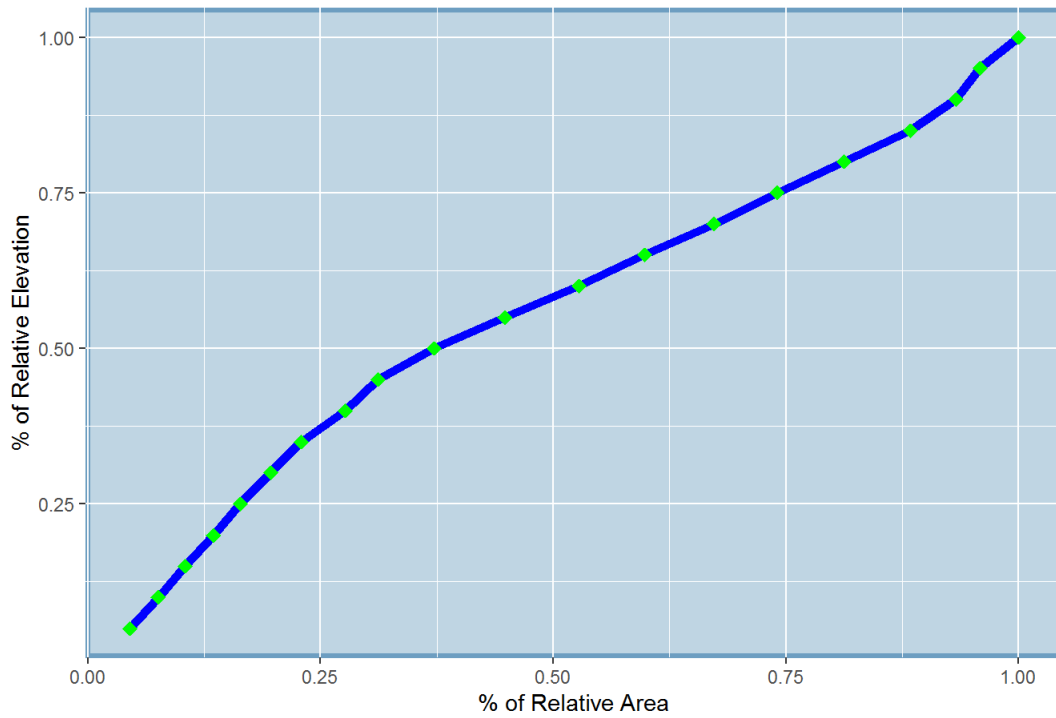
1. Hypsometric Curve of Catchment C001


```
## [1] "The polynomial equation of sub-catchment C001 is 1.27761218182317*x + 0.171301171778388*x^2 - 0.0051
35978839262782*x^3"
## [1] "The hypsometric integral of sub-catchment C001 is 0.695"
```
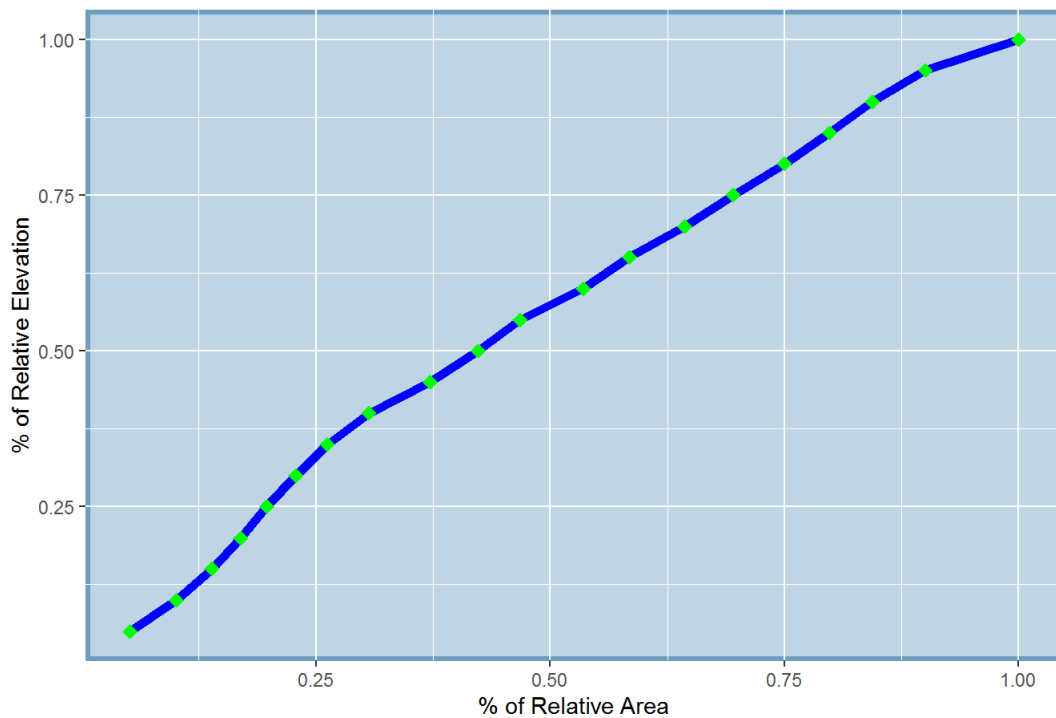
2. Hypsometric Curve of Catchment C002


```
## [1] "The polynomial equation of sub-catchment C002 is 1.2629321551127*x + 0.222579470326882*x^2 + 0.09731
74654596634*x^3"
## [1] "The hypsometric integral of sub-catchment C002 is 0.73"
```

3. Hypsometric Curve of Catchment C003


```
## [1] "The polynomial equation of sub-catchment C003 is 1.27484986253041*x - 0.135721454620197*x^2 + 0.1338
95850061023*x^3"
## [1] "The hypsometric integral of sub-catchment C003 is 0.626"
```

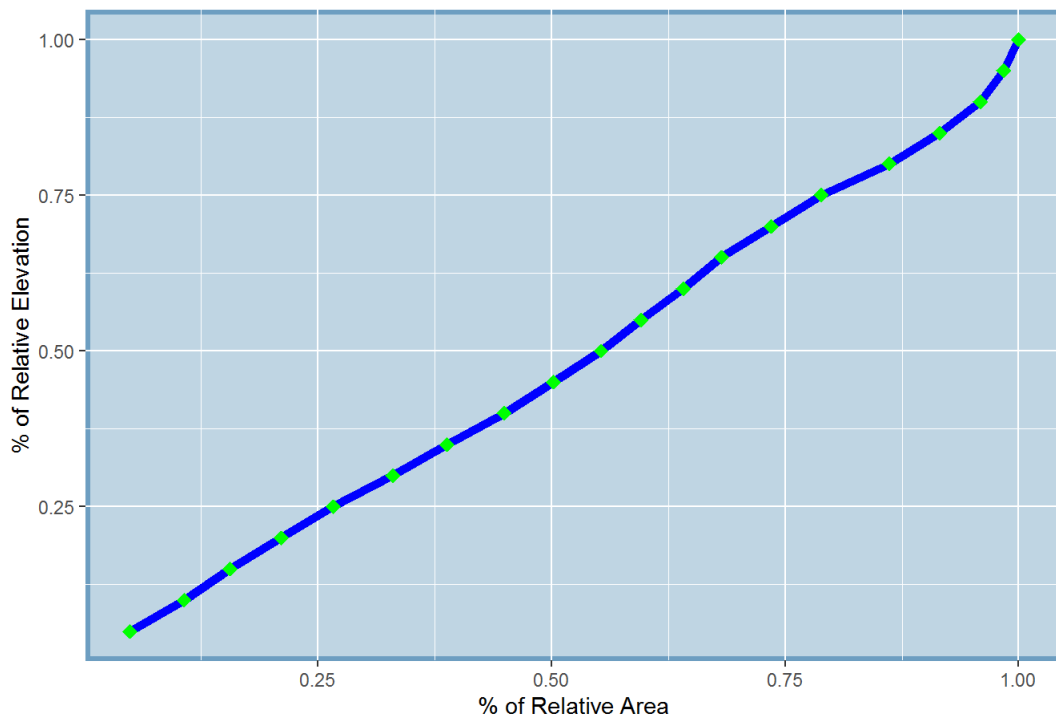## 4. Hypsometric Curve of Catchment C004


```
## [1] "The polynomial equation of sub-catchment C004 is 1.28304863090052*x - 0.10715647093451*x^2 + 0.03738
7222937117*x^3"
## [1] "The hypsometric integral of sub-catchment C004 is 0.615"
```

5. Hypsometric Curve of Catchment C005
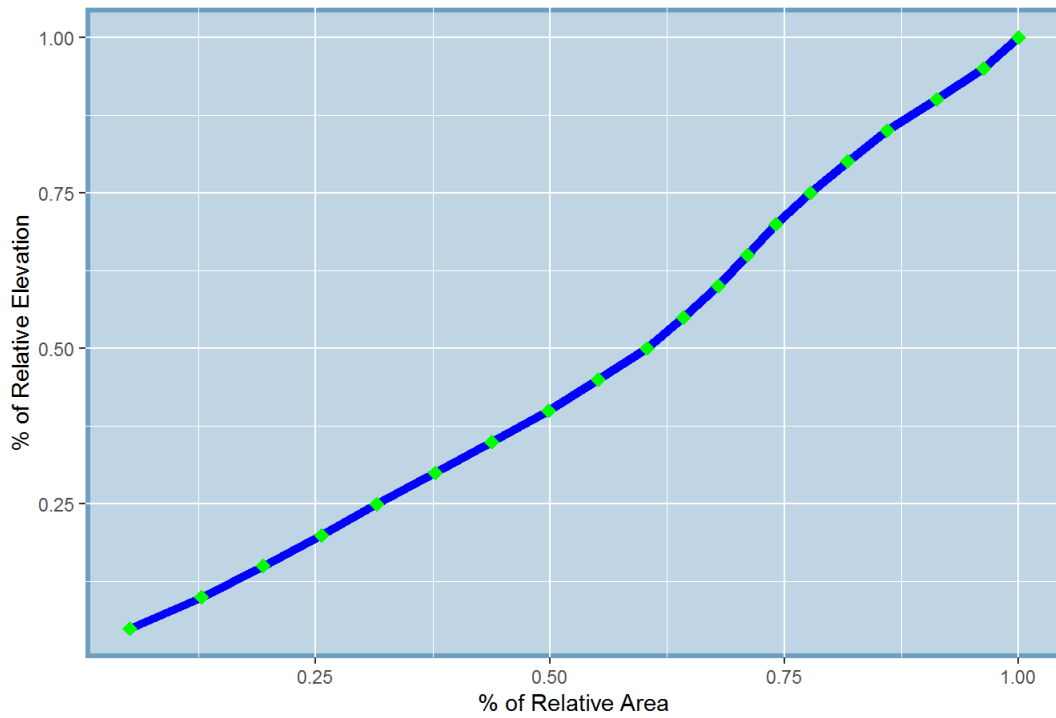

```
## [1] "The polynomial equation of sub-catchment C005 is 1.28044618582375*x + 0.136881677669805*x^2 - 0.0238
119490422969*x^3"
## [1] "The hypsometric integral of sub-catchment C005 is 0.68"
```
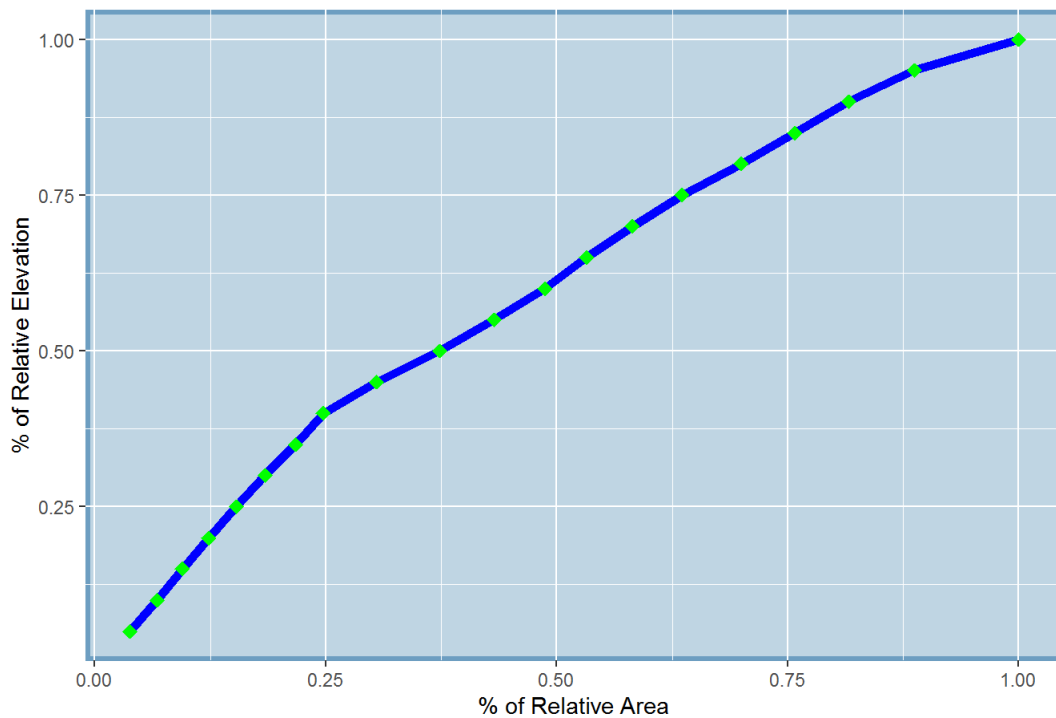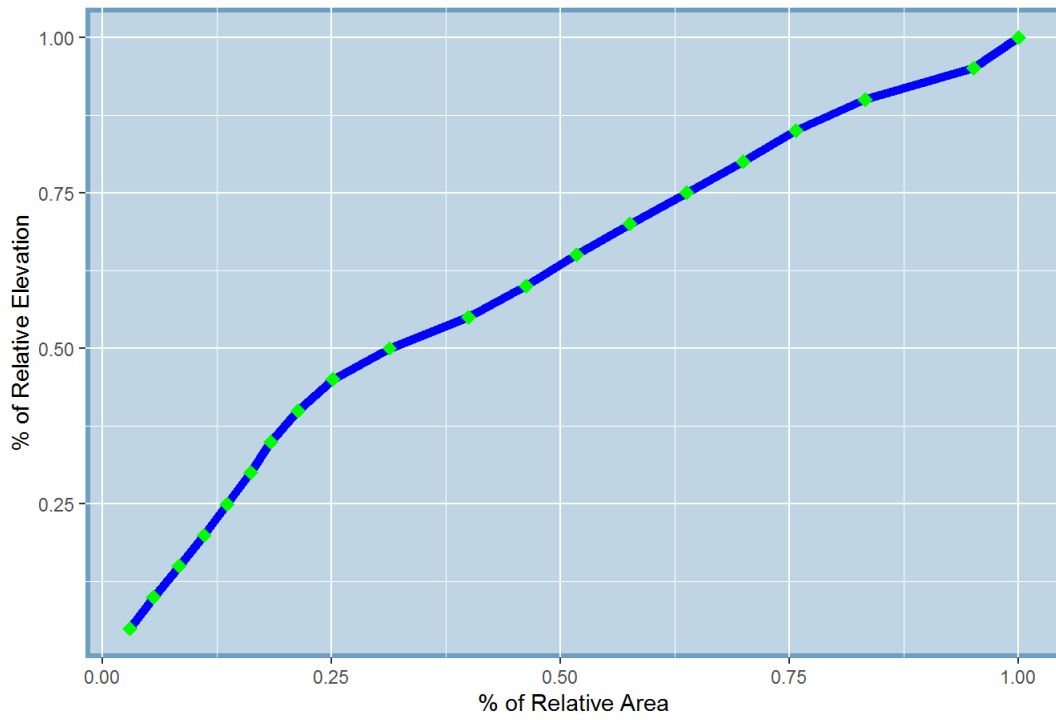
6. Hypsometric Curve of Catchment C006


```
## [1] "The polynomial equation of sub-catchment C006 is 1.28716839730947*x + 0.0469243916539962*x^2 + 0.008
1950770262518*x^3"
## [1] "The hypsometric integral of sub-catchment C006 is 0.661"
```

7. Hypsometric Curve of Catchment C007
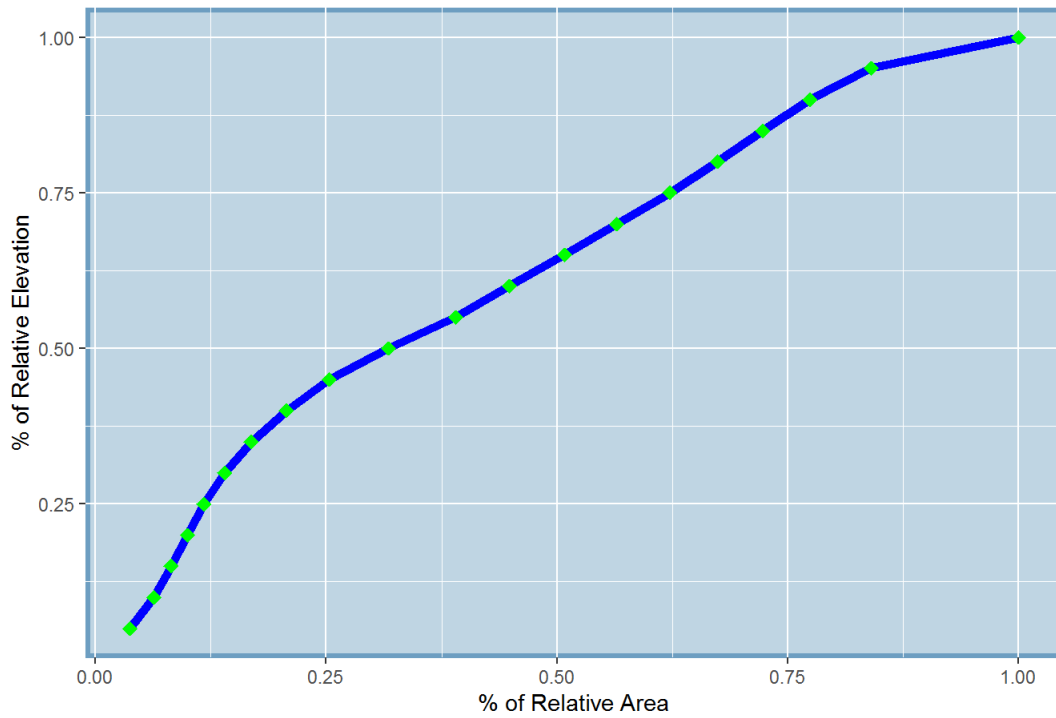

```
## [1] "The polynomial equation of sub-catchment C007 is 1.26616631131587*x - 0.193304447107123*x^2 + 0.0816
663952397969*x^3"
## [1] "The hypsometric integral of sub-catchment C007 is 0.589"
```

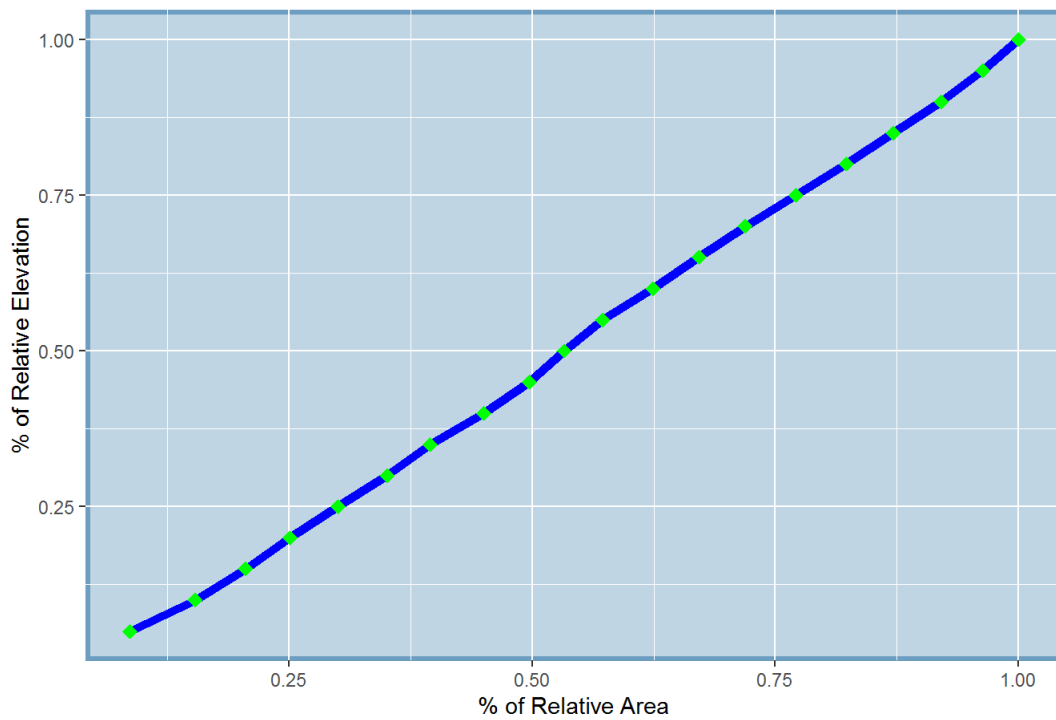## 8. Hypsometric Curve of Catchment C008


```
## [1] "The polynomial equation of sub-catchment C008 is 1.27629596035856*x - 0.163531874097781*x^2 + 0.0483
456547366394*x^3"
## [1] "The hypsometric integral of sub-catchment C008 is 0.596"
```

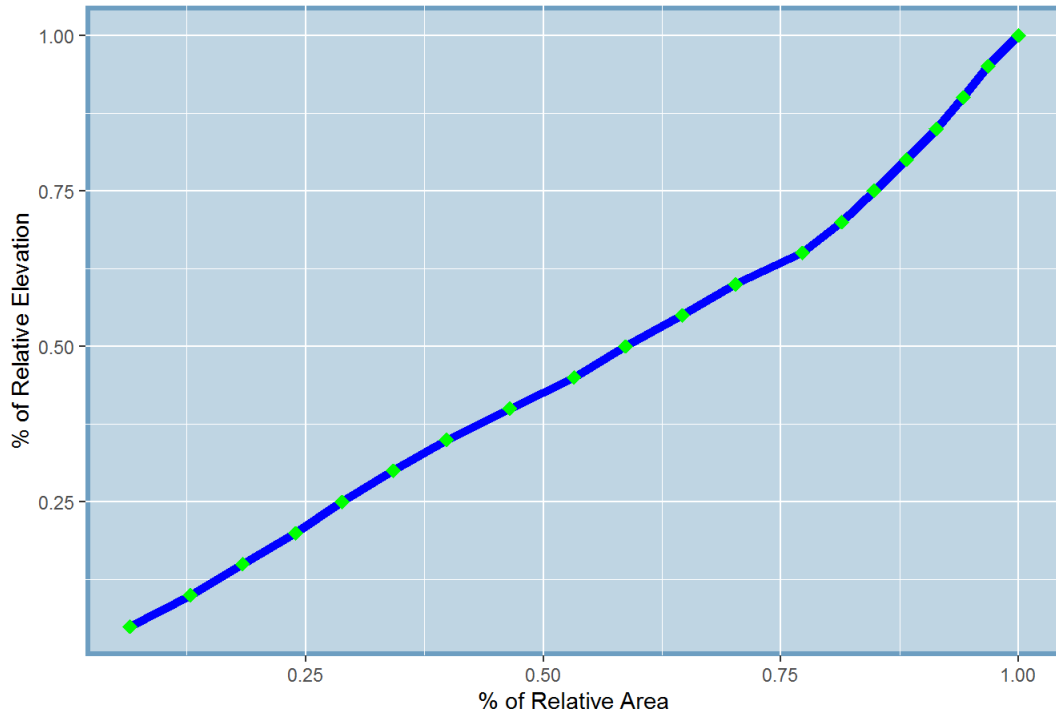## 9. Hypsometric Curve of Catchment C009


```
## [1] "The polynomial equation of sub-catchment C009 is 1.2661381101438*x - 0.206363605916641*x^2 + 0.10041
1423501086*x^3"
## [1] "The hypsometric integral of sub-catchment C009 is 0.589"
```

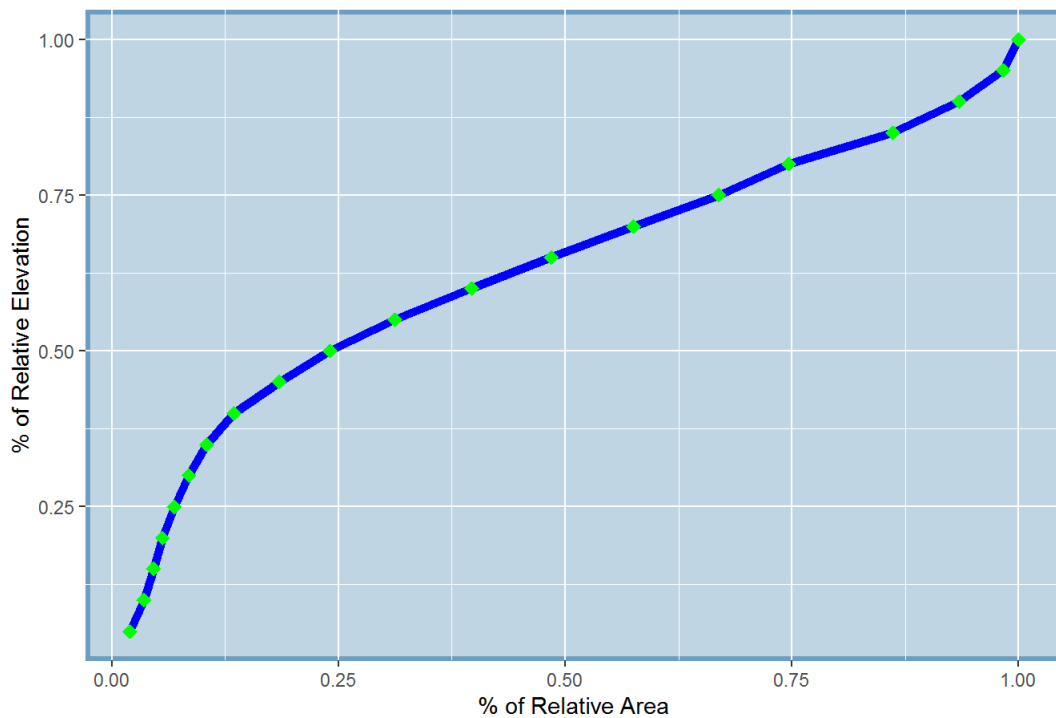## 10. Hypsometric Curve of Catchment C010


```
## [1] "The polynomial equation of sub-catchment C010 is 1.28891811902337*x + 0.011956467818896*x^2 - 0.0165
834789322343*x^3"
## [1] "The hypsometric integral of sub-catchment C010 is 0.644"
```

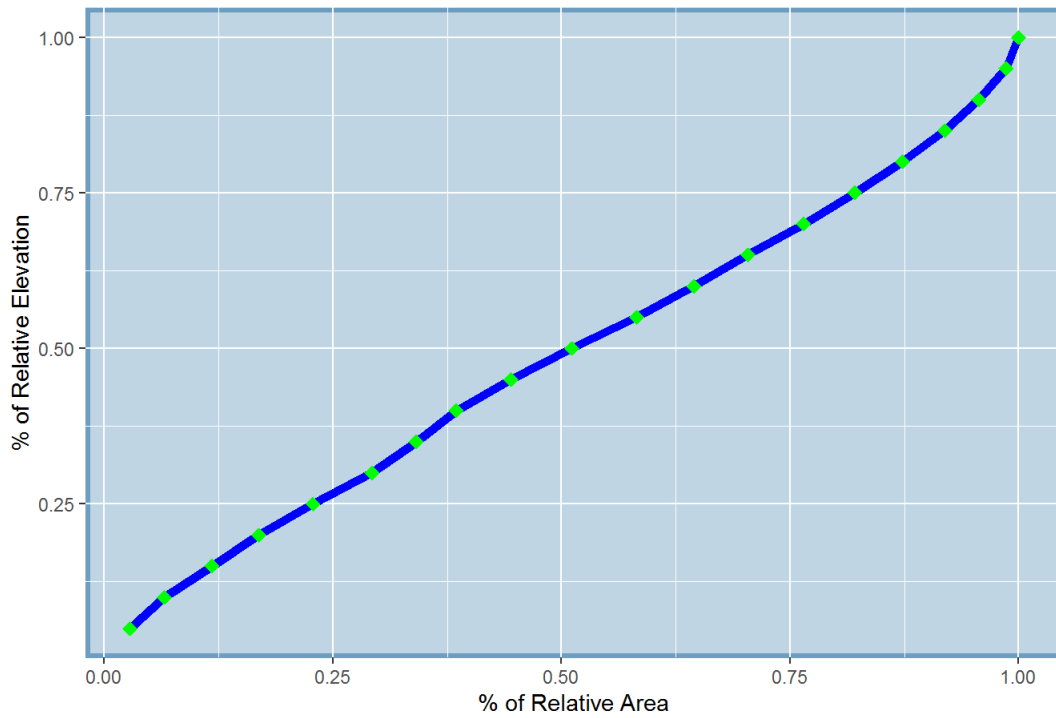## 11. Hypsometric Curve of Catchment C011


```
## [1] "The polynomial equation of sub-catchment C011 is 1.28113825577415*x + 0.106813695532629*x^2 + 0.0884
16263376668*x^3"
## [1] "The hypsometric integral of sub-catchment C011 is 0.698"
```

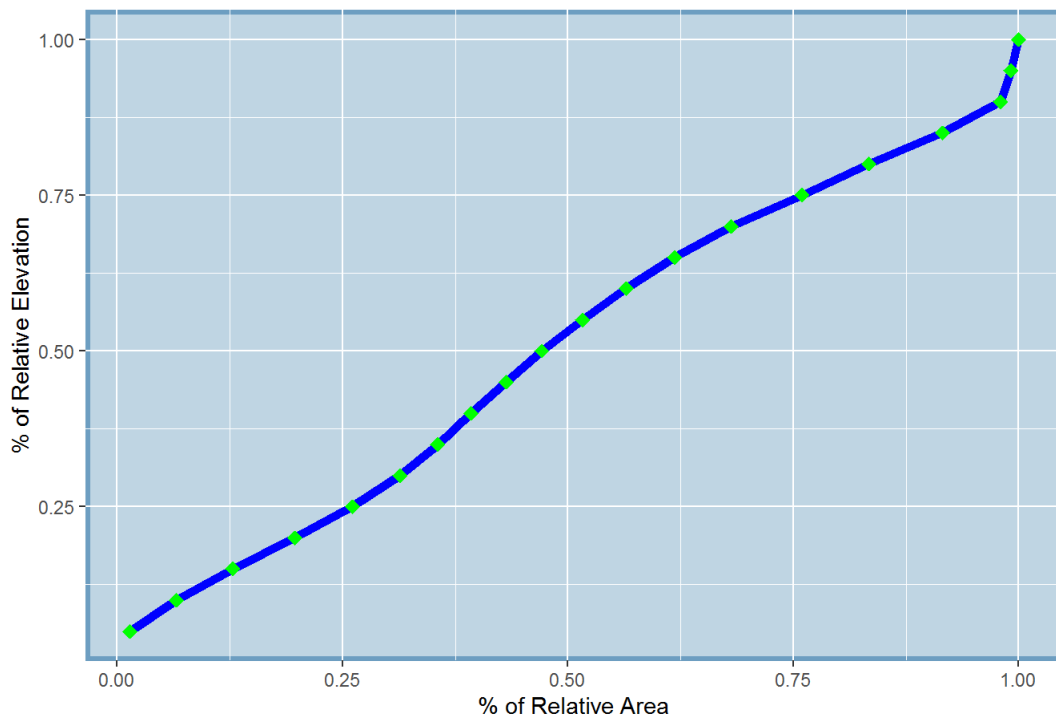## 12. Hypsometric Curve of Catchment C012


```
## [1] "The polynomial equation of sub-catchment C012 is 1.24359725085384*x - 0.229279885192258*x^2 + 0.2130
72855393587*x^3"
## [1] "The hypsometric integral of sub-catchment C012 is 0.599"
```

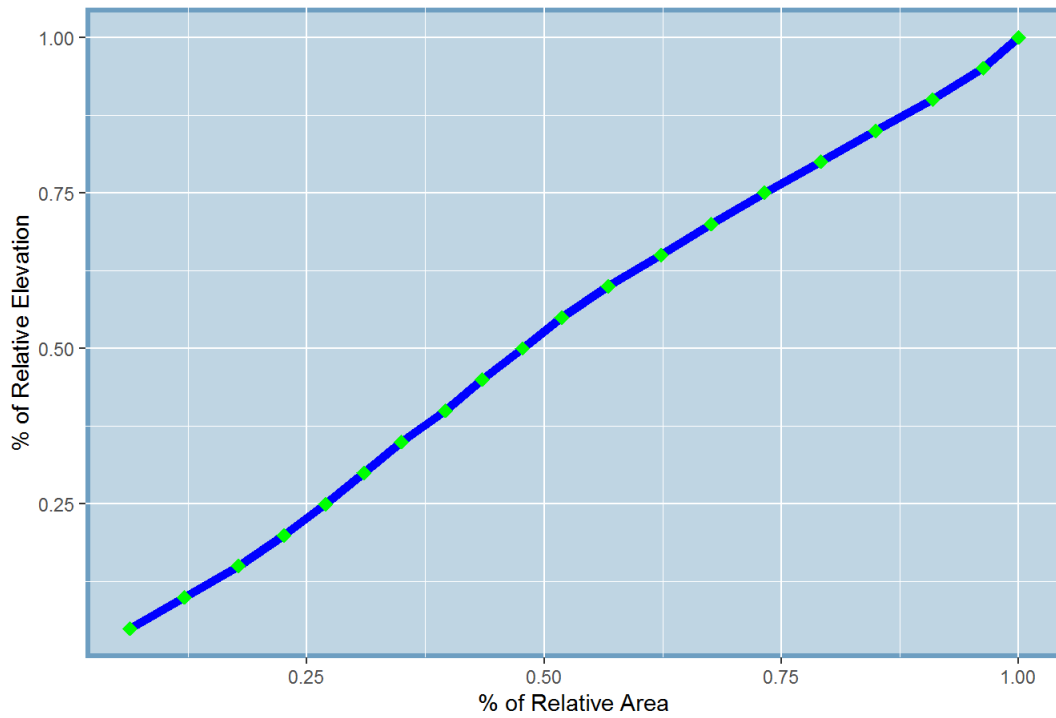## 13. Hypsometric Curve of Catchment C013


```
## [1] "The polynomial equation of sub-catchment C013 is 1.28613044642308*x + 0.0306528465970845*x^2 + 0.071
1655919757962*x^3"
## [1] "The hypsometric integral of sub-catchment C013 is 0.671"
```

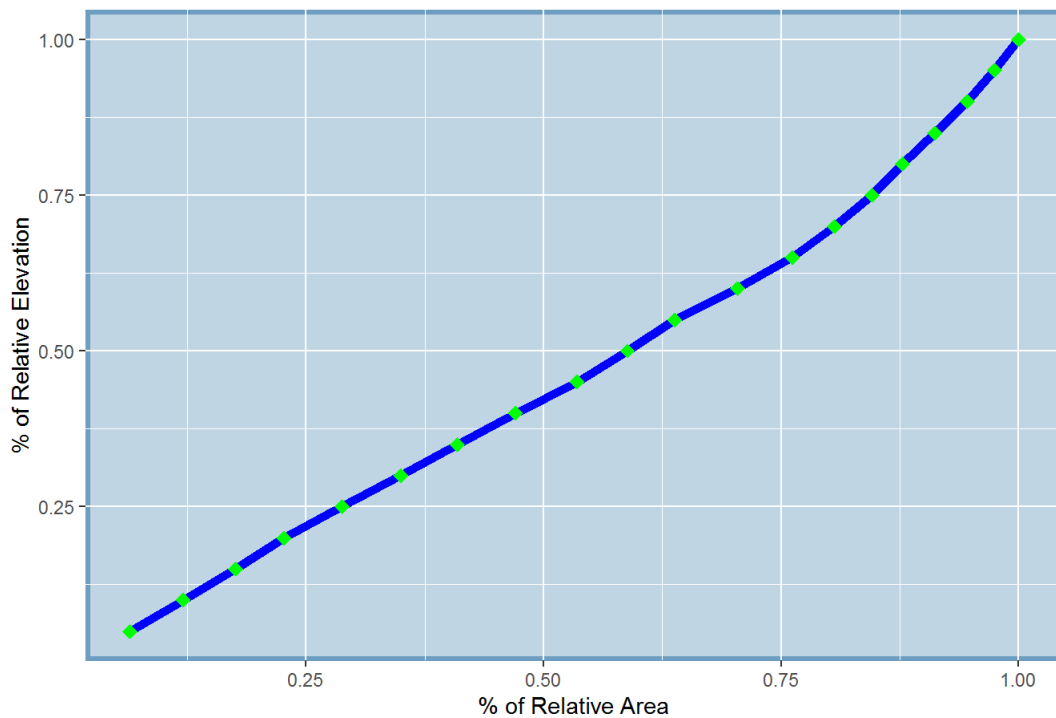## 14. Hypsometric Curve of Catchment C014


```
## [1] "The polynomial equation of sub-catchment C014 is 1.28423323144377*x - 0.0433971182254848*x^2 - 0.041
3260410513917*x^3"
## [1] "The hypsometric integral of sub-catchment C014 is 0.617"
```

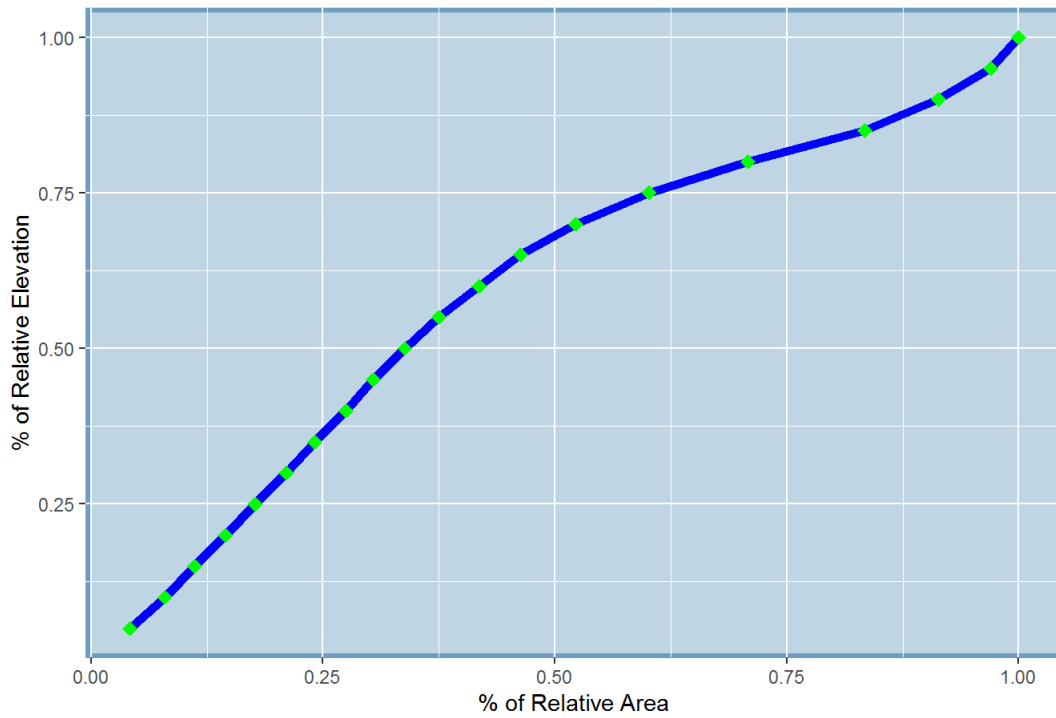## 15. Hypsometric Curve of Catchment C015


```
## [1] "The polynomial equation of sub-catchment C015 is 1.28699326928903*x - 0.0609393741977899*x^2 - 0.023
0013033564739*x^3"
## [1] "The hypsometric integral of sub-catchment C015 is 0.617"
```

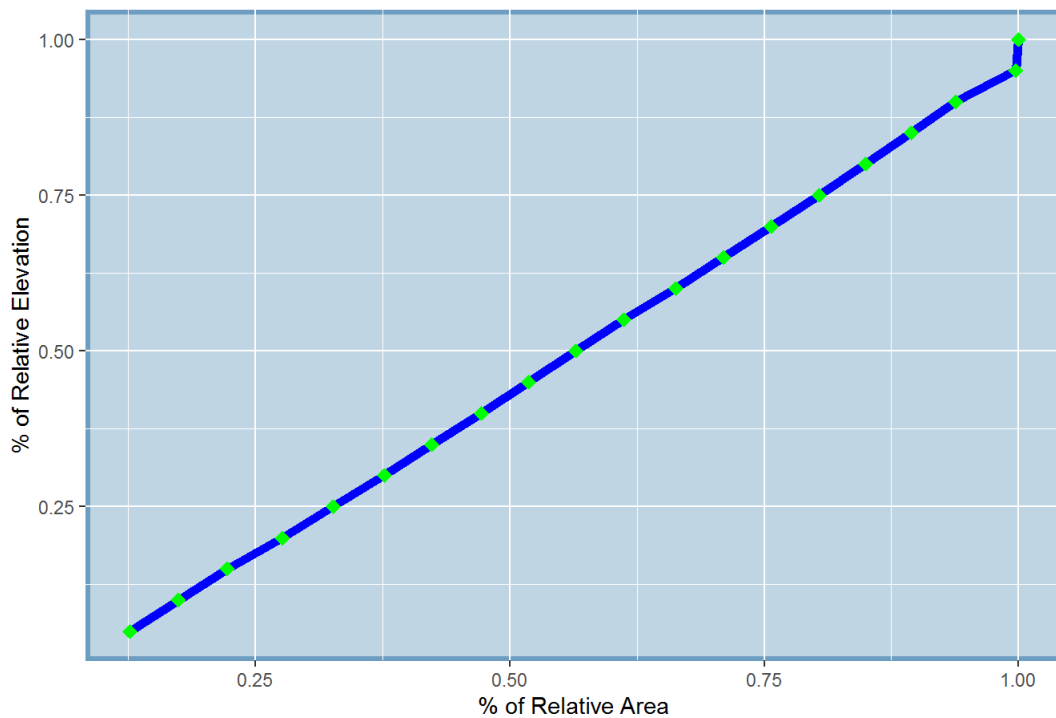## 16. Hypsometric Curve of Catchment C016


```
## [1] "The polynomial equation of sub-catchment C016 is 1.28187225037501*x + 0.112204111221902*x^2 + 0.0769
014834091043*x^3"
## [1] "The hypsometric integral of sub-catchment C016 is 0.698"
```

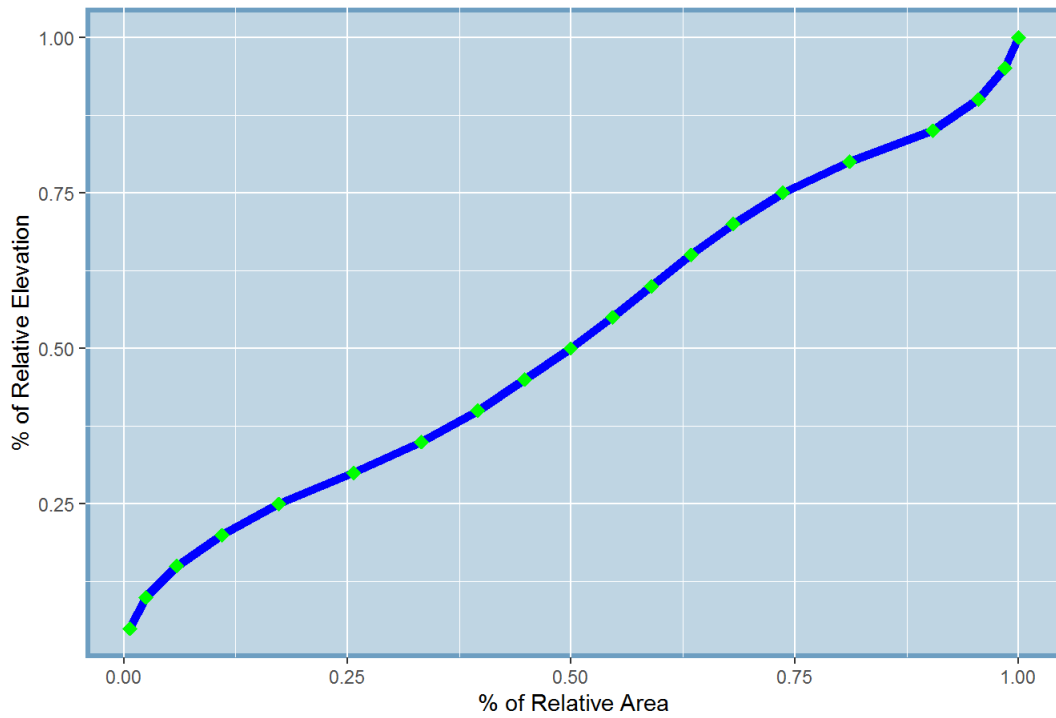## 17. Hypsometric Curve of Catchment C017


```
## [1] "The polynomial equation of sub-catchment C017 is 1.25352829888515*x - 0.285400295713206*x^2 + 0.0548
846030477538*x^3"
## [1] "The hypsometric integral of sub-catchment C017 is 0.545"
```

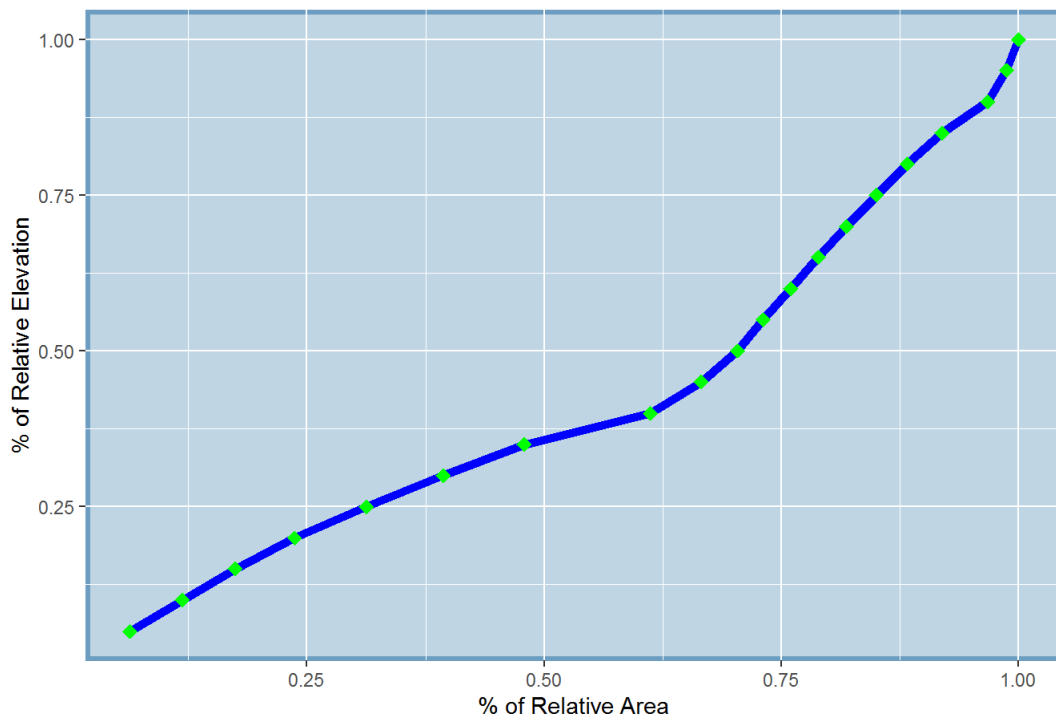## 18. Hypsometric Curve of Catchment C018


```
## [1] "The polynomial equation of sub-catchment C018 is 1.28859227639044*x + 0.0280822561862533*x^2 + 0.007
20293960791559*x^3"
## [1] "The hypsometric integral of sub-catchment C018 is 0.655"
```

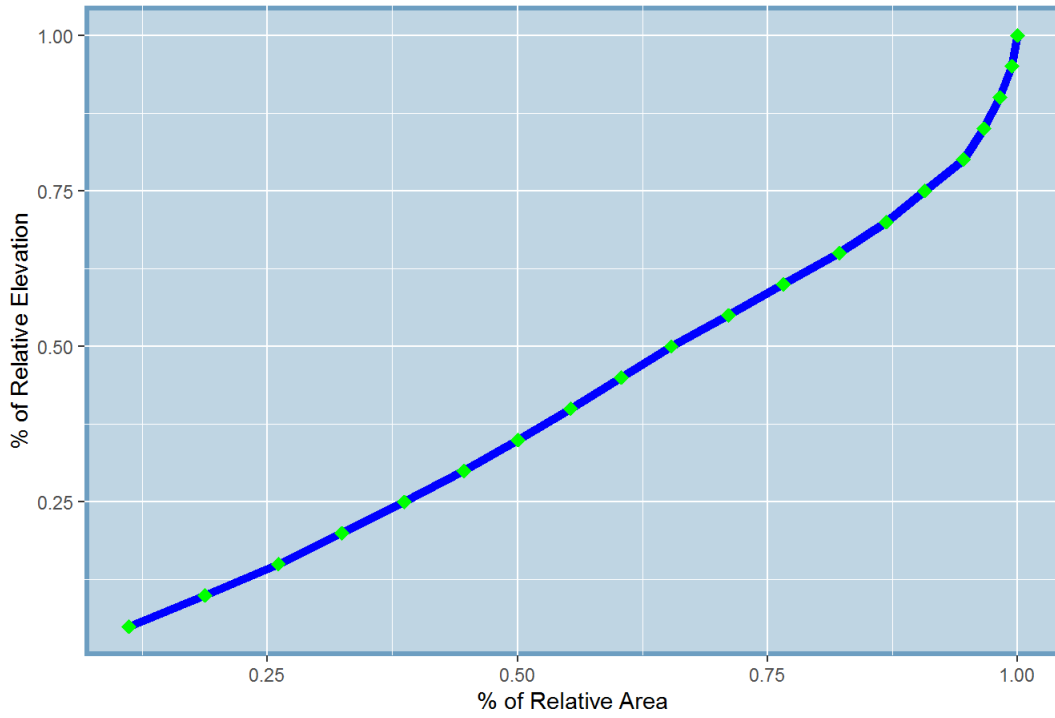## 19. Hypsometric Curve of Catchment C019


```
## [1] "The polynomial equation of sub-catchment C019 is 1.28610367544731*x + 0.0161430102952616*x^2 - 0.001
76681054789048*x^3"
## [1] "The hypsometric integral of sub-catchment C019 is 0.648"
```

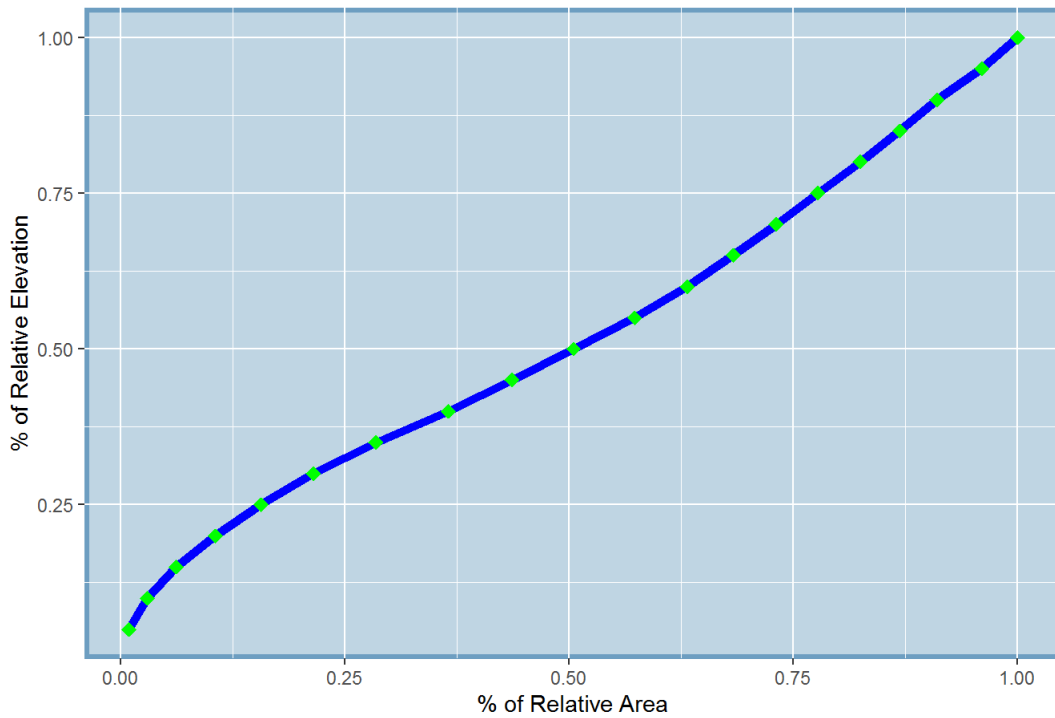## 20. Hypsometric Curve of Catchment C020


```
## [1] "The polynomial equation of sub-catchment C020 is 1.25638067249527*x + 0.252169855904079*x^2 + 0.1062
54777110315*x^3"
## [1] "The hypsometric integral of sub-catchment C020 is 0.739"
```
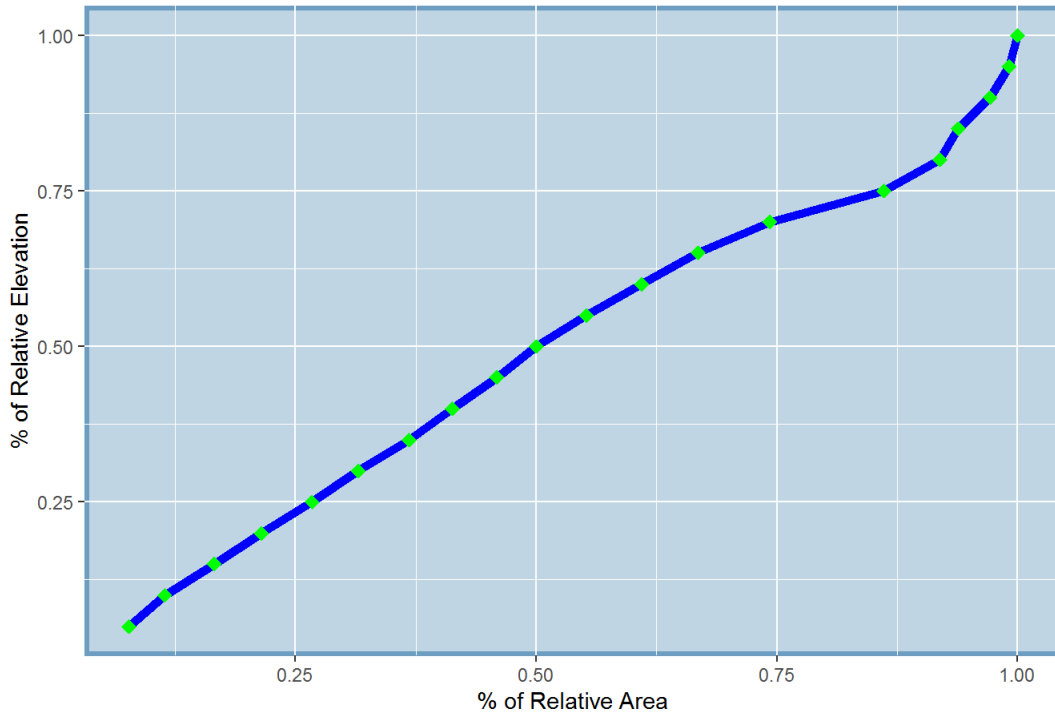
21. Hypsometric Curve of Catchment C021


```
## [1] "The polynomial equation of sub-catchment C021 is 1.27303017389804*x + 0.160514326701456*x^2 + 0.0714
072386773223*x^3"
## [1] "The hypsometric integral of sub-catchment C021 is 0.708"
```

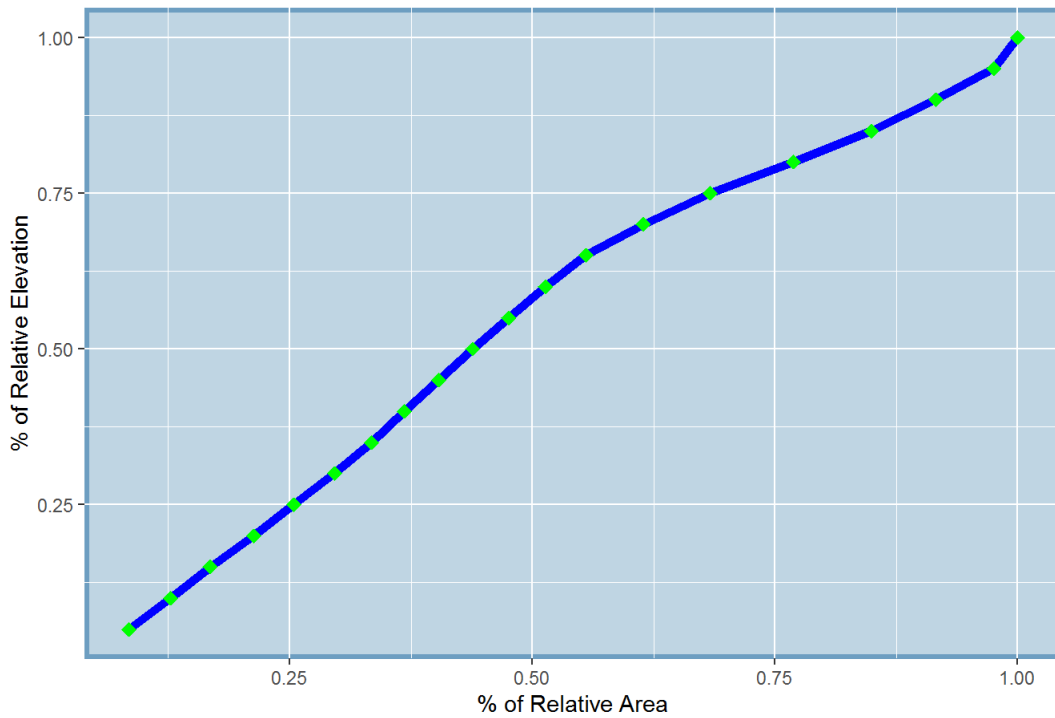## 22. Hypsometric Curve of Catchment C022


```
## [1] "The polynomial equation of sub-catchment C022 is 1.28454019611061*x + 0.053182127129581*x^2 + 0.0832
826652509102*x^3"
## [1] "The hypsometric integral of sub-catchment C022 is 0.681"
```
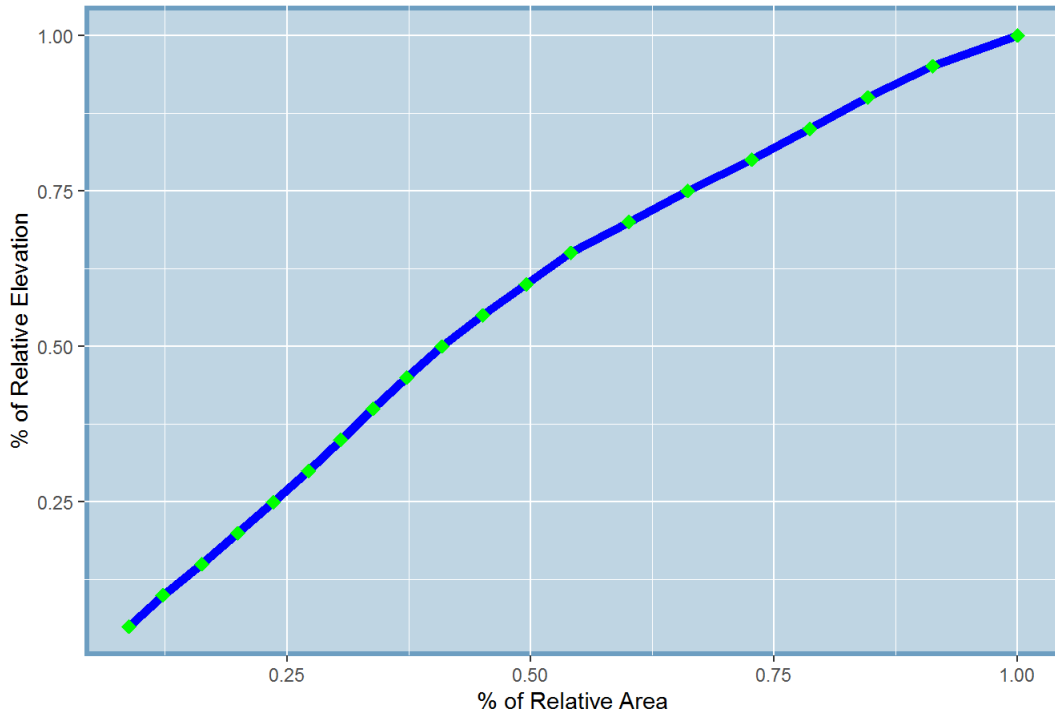
23. Hypsometric Curve of Catchment C023


```
## [1] "The polynomial equation of sub-catchment C023 is 1.2828248980157*x - 0.0408485947128282*x^2 + 0.0486
411002544701*x^3"
## [1] "The hypsometric integral of sub-catchment C023 is 0.64"
```

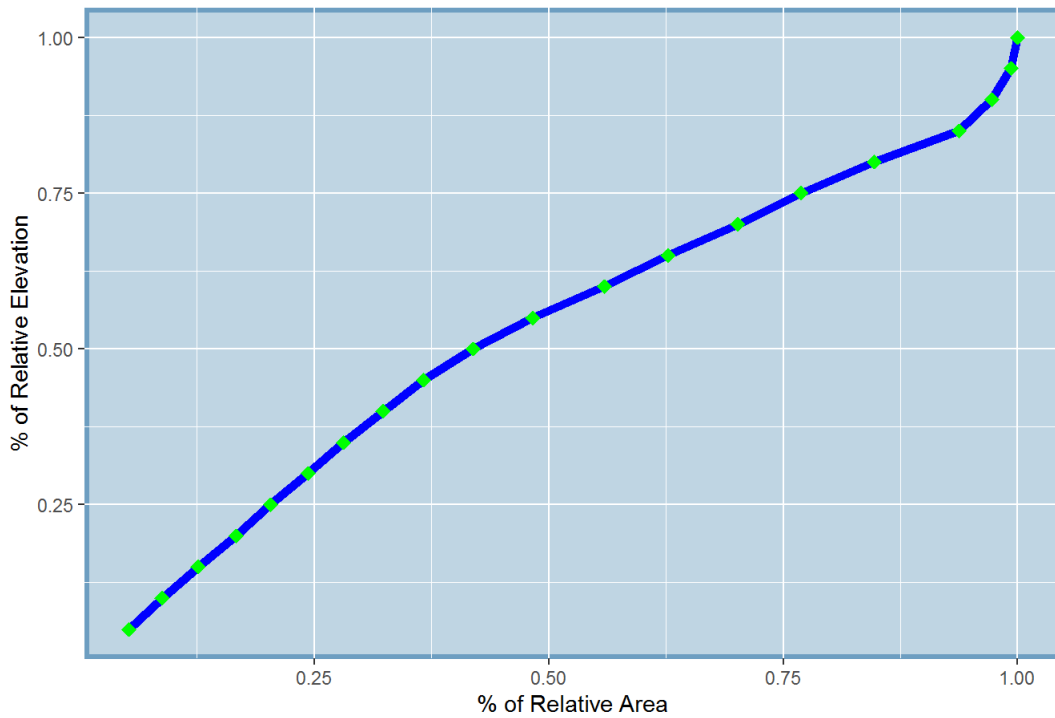## 24. Hypsometric Curve of Catchment C024


```
## [1] "The polynomial equation of sub-catchment C024 is 1.27618612015661*x - 0.165667613501*x^2 - 0.0156104
502739941*x^3"
## [1] "The hypsometric integral of sub-catchment C024 is 0.579"
```
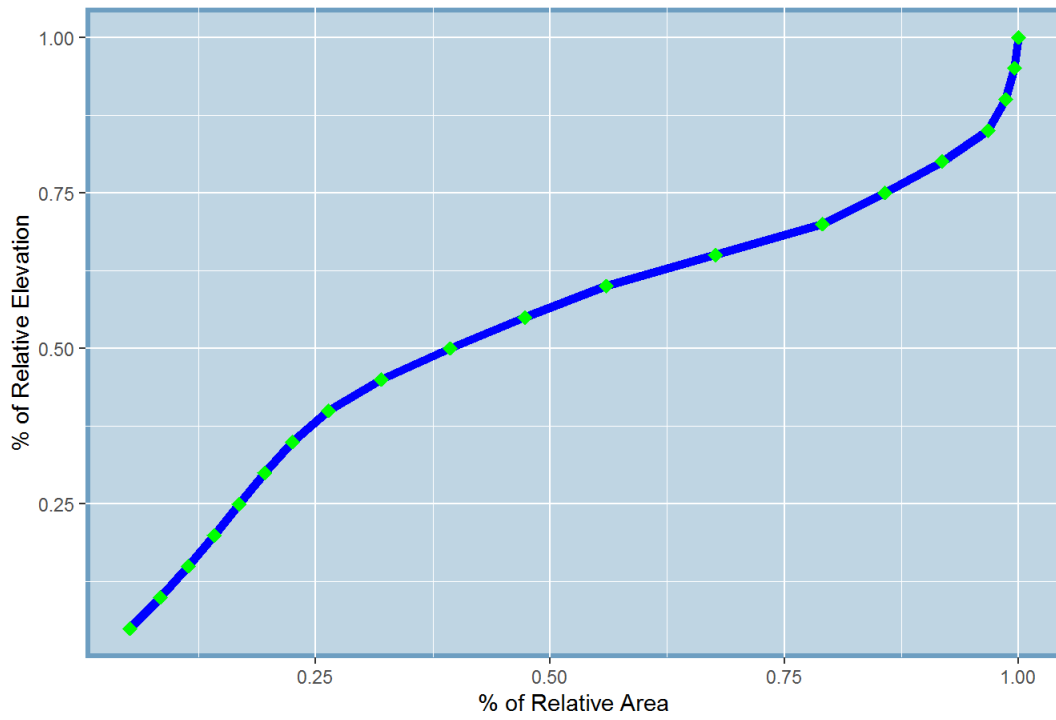
25. Hypsometric Curve of Catchment C025


```
## [1] "The polynomial equation of sub-catchment C025 is 1.27642004808936*x - 0.178127471580244*x^2 + 0.0025
4464836607342*x^3"
## [1] "The hypsometric integral of sub-catchment C025 is 0.579"
```
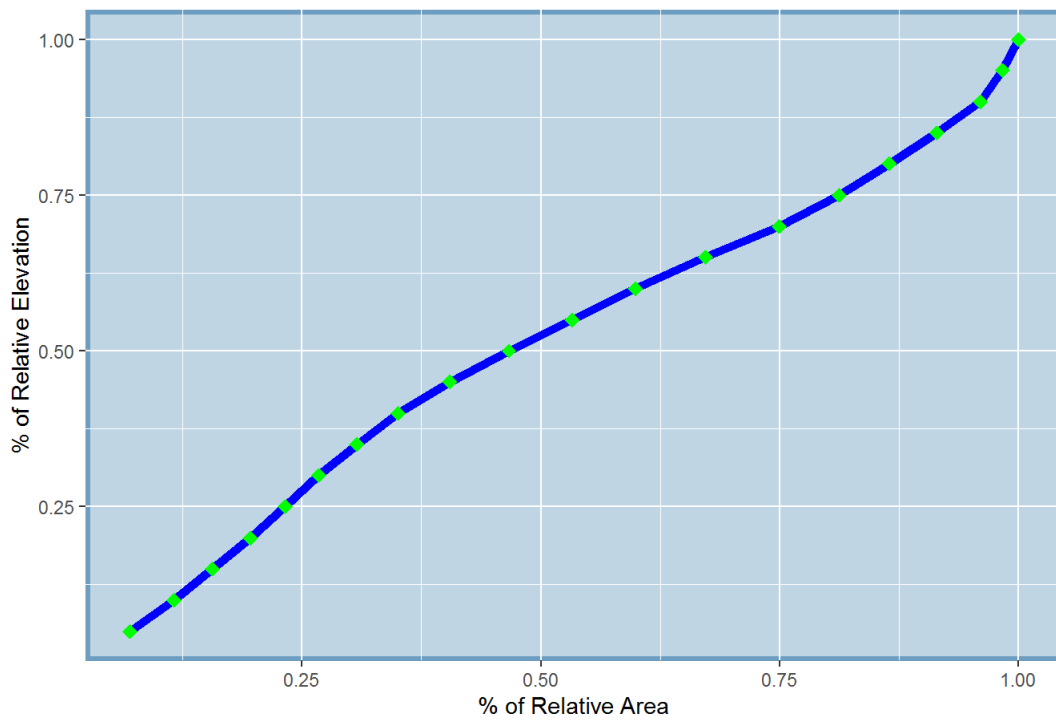
26. Hypsometric Curve of Catchment C026


```
## [1] "The polynomial equation of sub-catchment C026 is 1.27875129063079*x - 0.119221665316888*x^2 + 0.0867
383690068952*x^3"
## [1] "The hypsometric integral of sub-catchment C026 is 0.621"
```
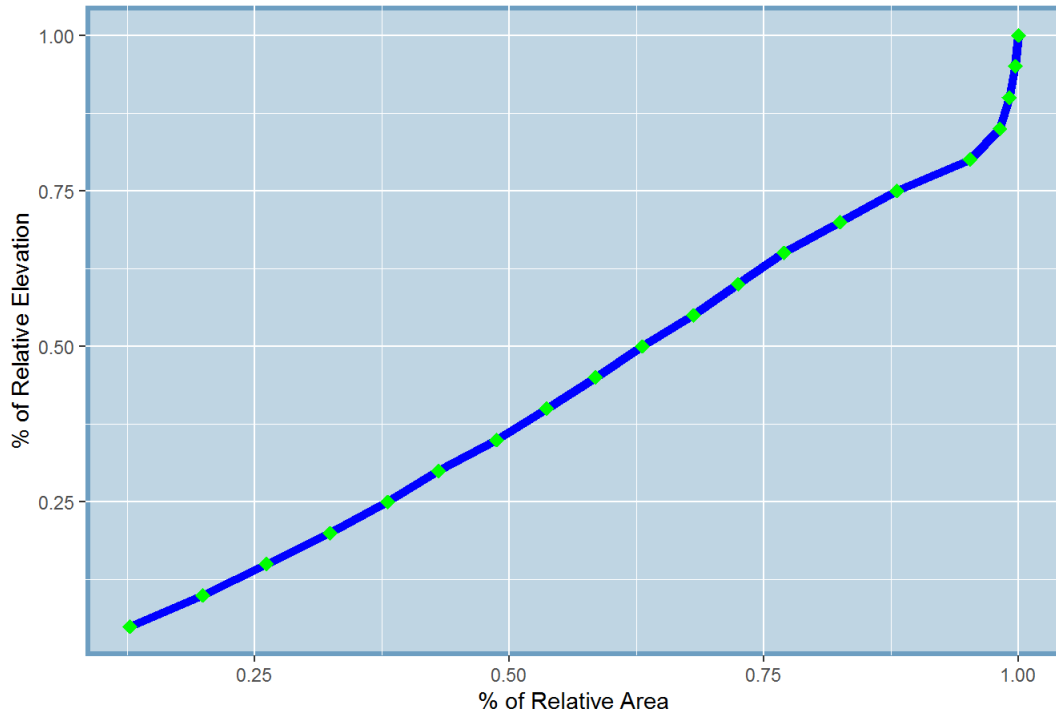
27. Hypsometric Curve of Catchment C027


```
## [1] "The polynomial equation of sub-catchment C027 is 1.26437310974189*x - 0.122763027035182*x^2 + 0.2022
99818276498*x^3"
## [1] "The hypsometric integral of sub-catchment C027 is 0.642"
```
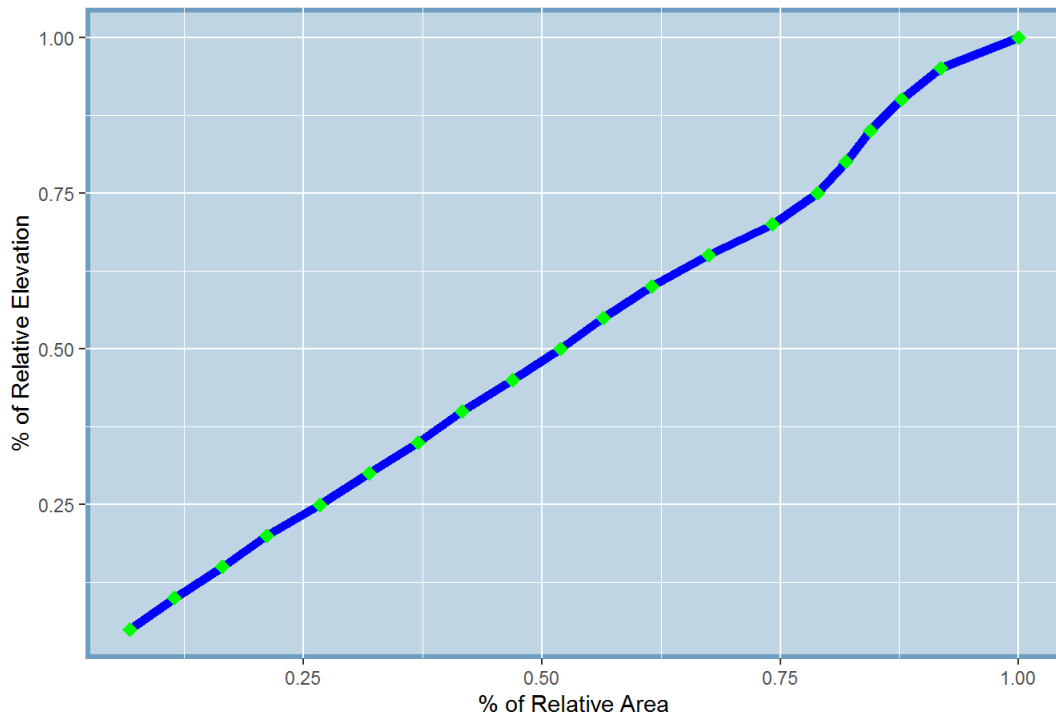
28. Hypsometric Curve of Catchment C028


```
## [1] "The polynomial equation of sub-catchment C028 is 1.28239143813282*x - 0.0641360655846747*x^2 + 0.101
992559146493*x^3"
## [1] "The hypsometric integral of sub-catchment C028 is 0.645"
```
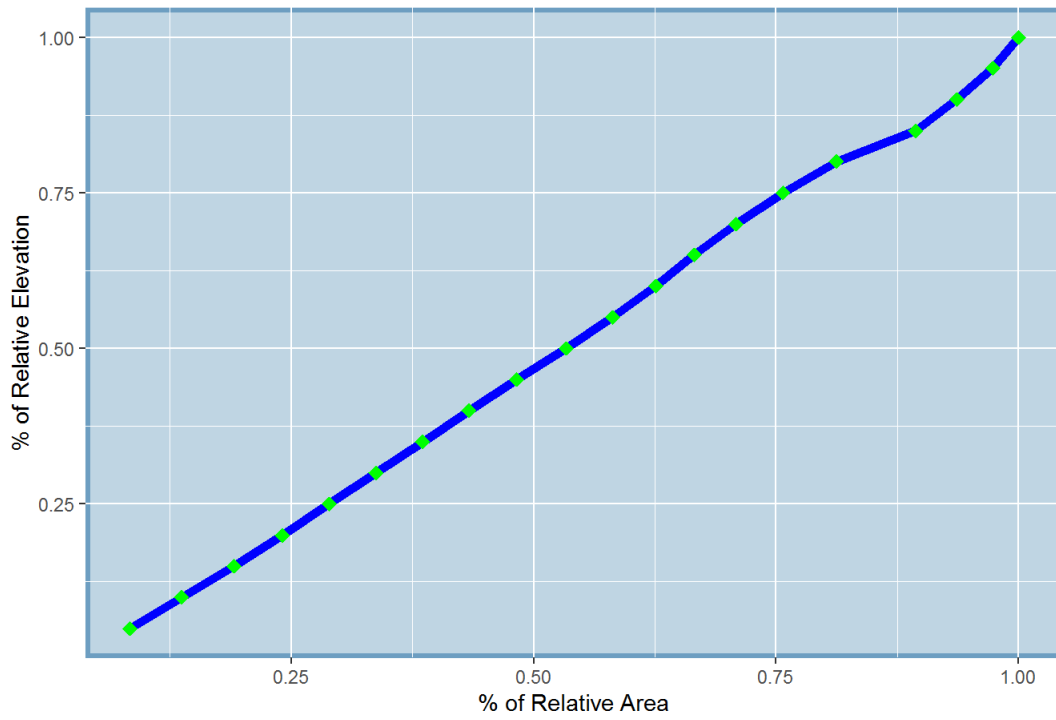
29. Hypsometric Curve of Catchment C029


```
## [1] "The polynomial equation of sub-catchment C029 is 1.28018695870478*x + 0.0973149641458673*x^2 + 0.018
6489647165711*x^3"
## [1] "The hypsometric integral of sub-catchment C029 is 0.677"
```
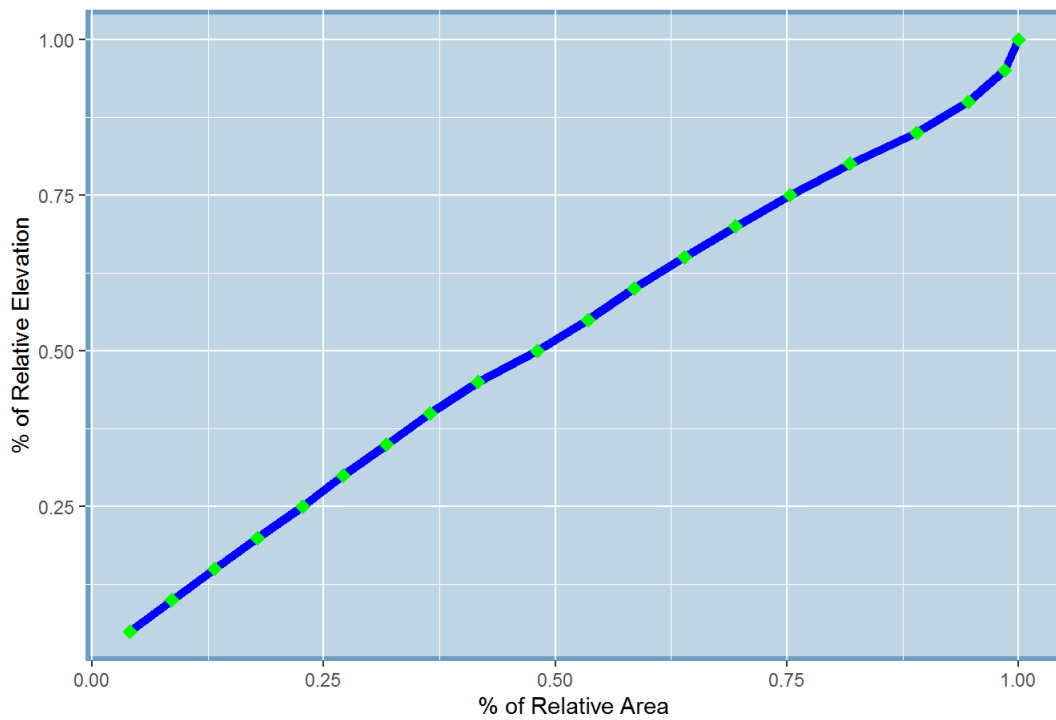
30. Hypsometric Curve of Catchment C030


```
## [1] "The polynomial equation of sub-catchment C030 is 1.28742566638042*x + 0.0337550429670693*x^2 + 0.019
1796644995827*x^3"
## [1] "The hypsometric integral of sub-catchment C030 is 0.66"
```
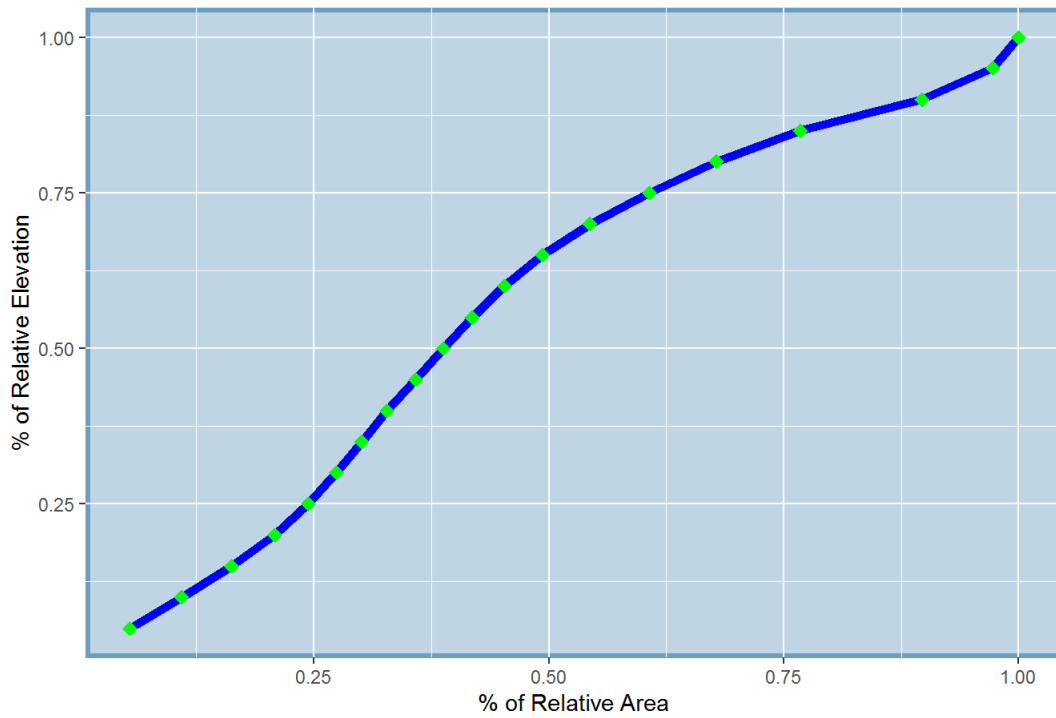
31. Hypsometric Curve of Catchment C031


```
## [1] "The polynomial equation of sub-catchment C031 is 1.28857350519038*x - 0.00231646401003393*x^2 - 0.01
39108435258136*x^3"
## [1] "The hypsometric integral of sub-catchment C031 is 0.64"
```
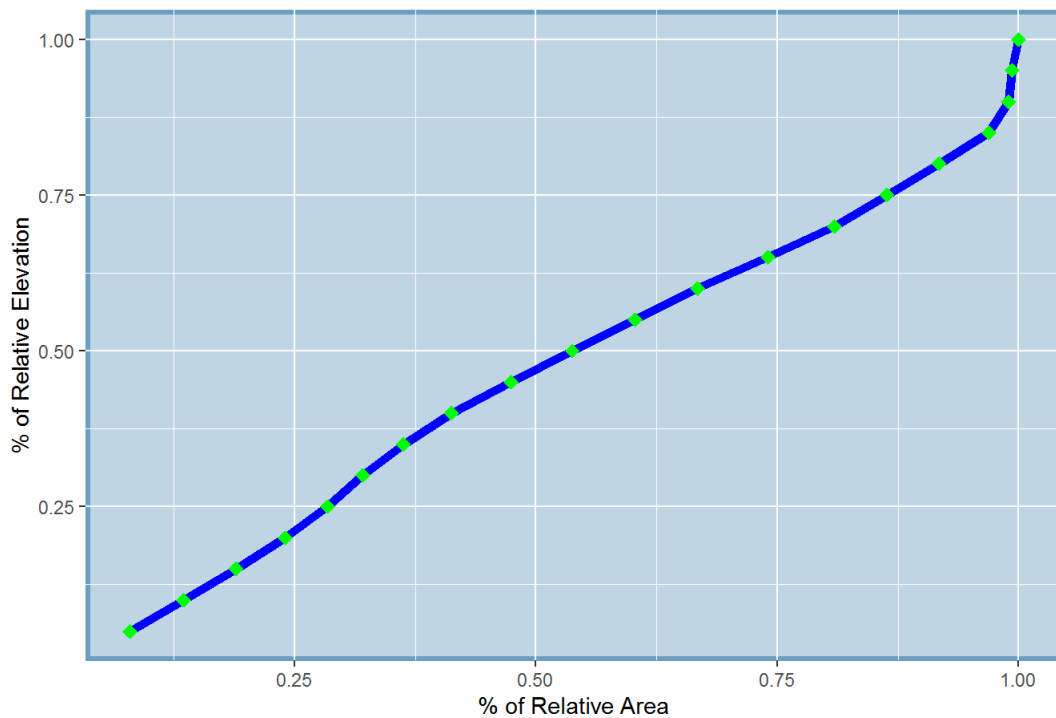
32. Hypsometric Curve of Catchment C032


```
## [1] "The polynomial equation of sub-catchment C032 is 1.28749237583819*x - 0.0472693865526811*x^2 + 0.027
6134346800396*x^3"
## [1] "The hypsometric integral of sub-catchment C032 is 0.635"
```

33. Hypsometric Curve of Catchment C033


```
## [1] "The polynomial equation of sub-catchment C033 is 1.25722997029658*x - 0.254955420708251*x^2 - 0.0566
279415093859*x^3"
## [1] "The hypsometric integral of sub-catchment C033 is 0.529"
```

34. Hypsometric Curve of Catchment C034


```
## [1] "The polynomial equation of sub-catchment C034 is 1.28223679548389*x + 0.000469322829572341*x^2 + 0.0
826855933397754*x^3"
## [1] "The hypsometric integral of sub-catchment C034 is 0.662"
```

35. Hypsometric Curve of Catchment C035


```
## [1] "The polynomial equation of sub-catchment C035 is 1.20670880480719*x + 0.427002414679821*x^2 + 0.1461
58116006252*x^3"
## [1] "The hypsometric integral of sub-catchment C035 is 0.782"
```
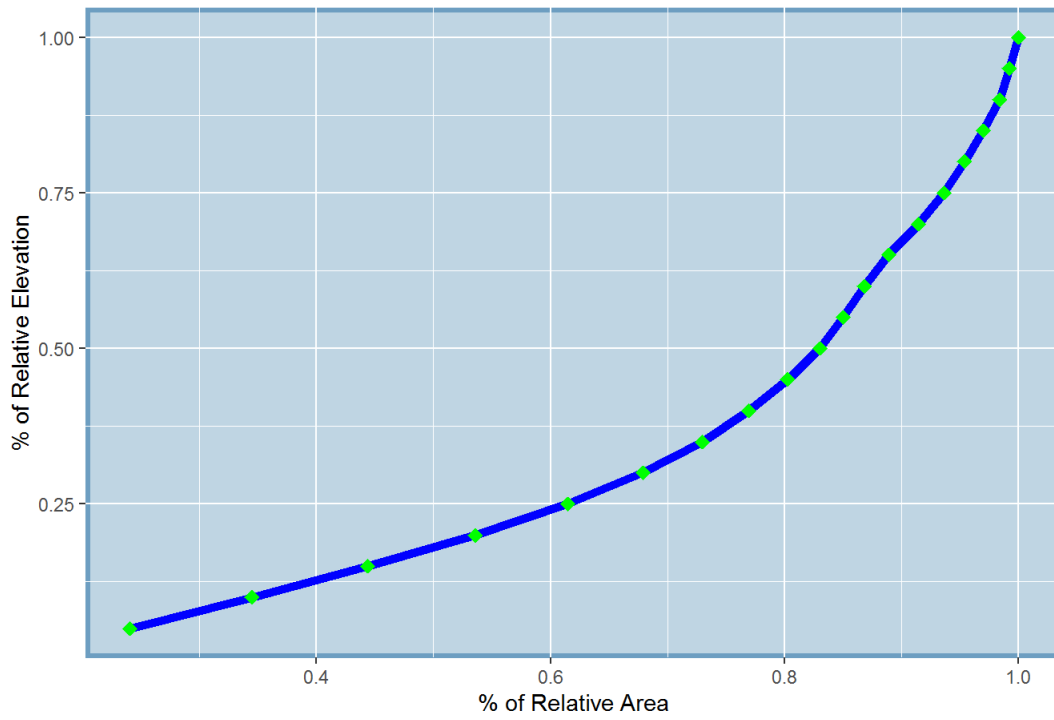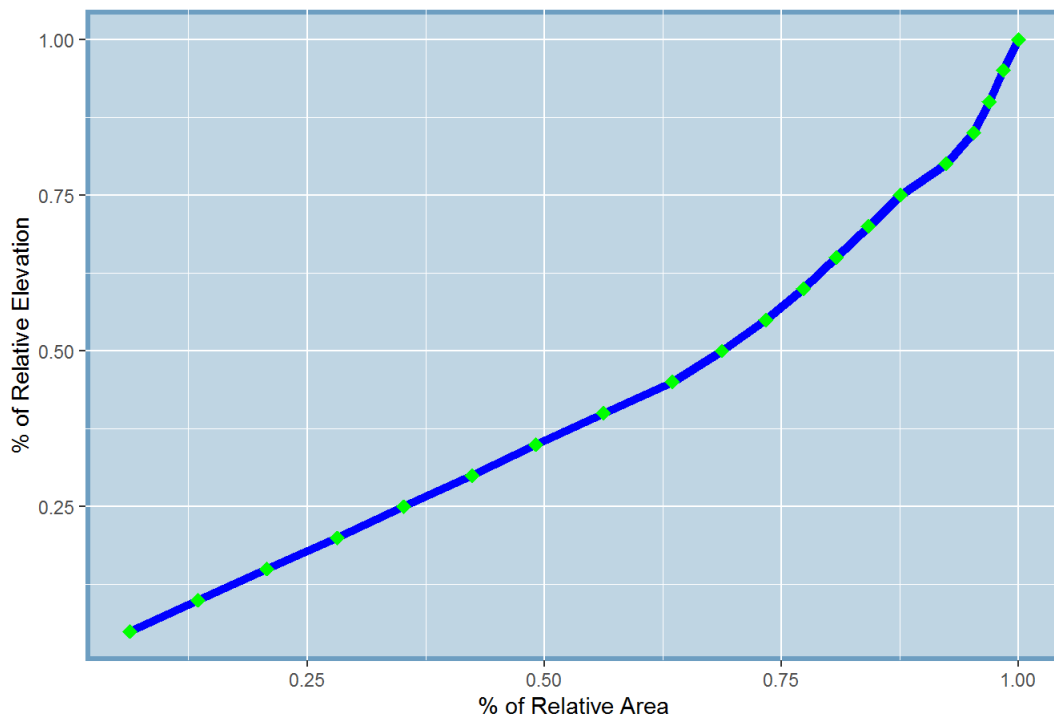
36. Hypsometric Curve of Catchment C036


```
## [1] "The polynomial equation of sub-catchment C036 is 1.26449321830936*x + 0.226489133812401*x^2 + 0.0970
681130550851*x^3"
## [1] "The hypsometric integral of sub-catchment C036 is 0.732"
```

37. Hypsometric Curve of Catchment C037


```
## [1] "The polynomial equation of sub-catchment C037 is 1.27935687267828*x - 0.152833697709948*x^2 + 0.0289
935372063837*x^3"
## [1] "The hypsometric integral of sub-catchment C037 is 0.596"
```
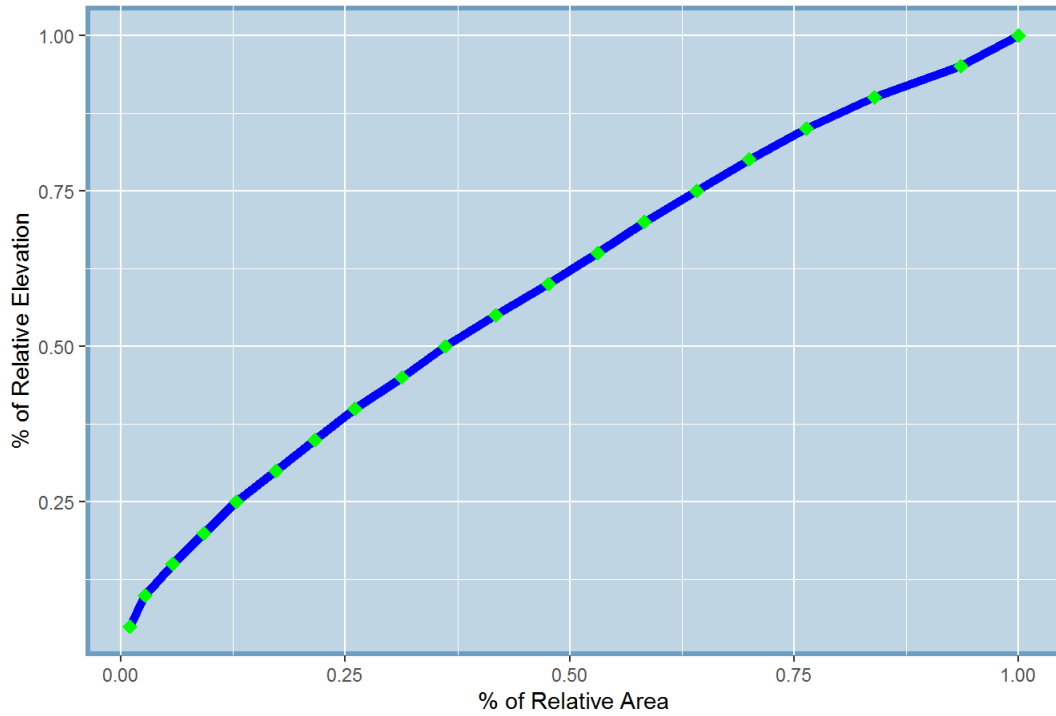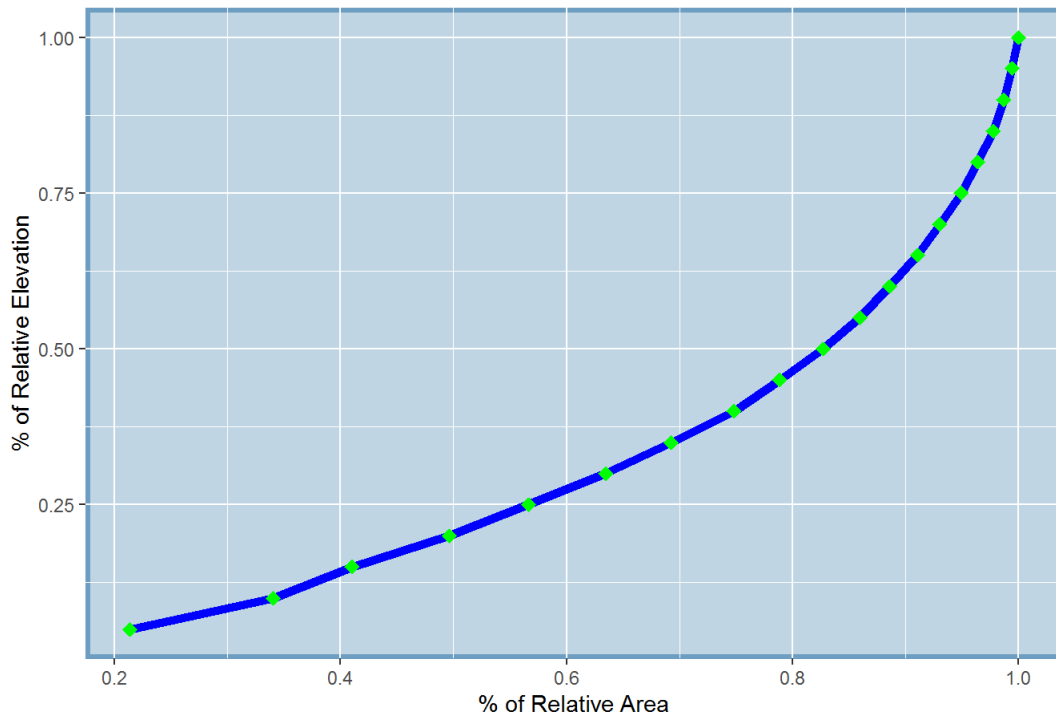
38. Hypsometric Curve of Catchment C038


```
## [1] "The polynomial equation of sub-catchment C038 is 1.21725865472522*x + 0.373556953150406*x^2 + 0.1705
51100000897*x^3"
## [1] "The hypsometric integral of sub-catchment C038 is 0.776"
```

39. Hypsometric Curve of Catchment C039


```
## [1] "The polynomial equation of sub-catchment C039 is 1.26577195135516*x + 0.23208740145983*x^2 + 0.05301
96042060589*x^3"
## [1] "The hypsometric integral of sub-catchment C039 is 0.724"
```
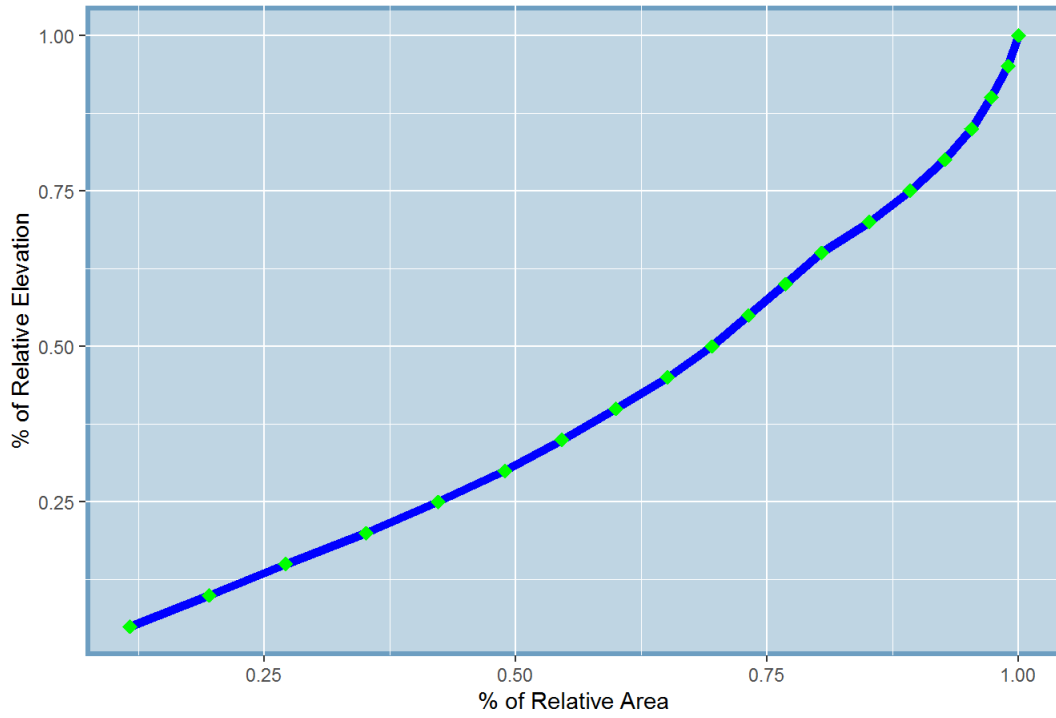
40. Hypsometric Curve of Catchment C040
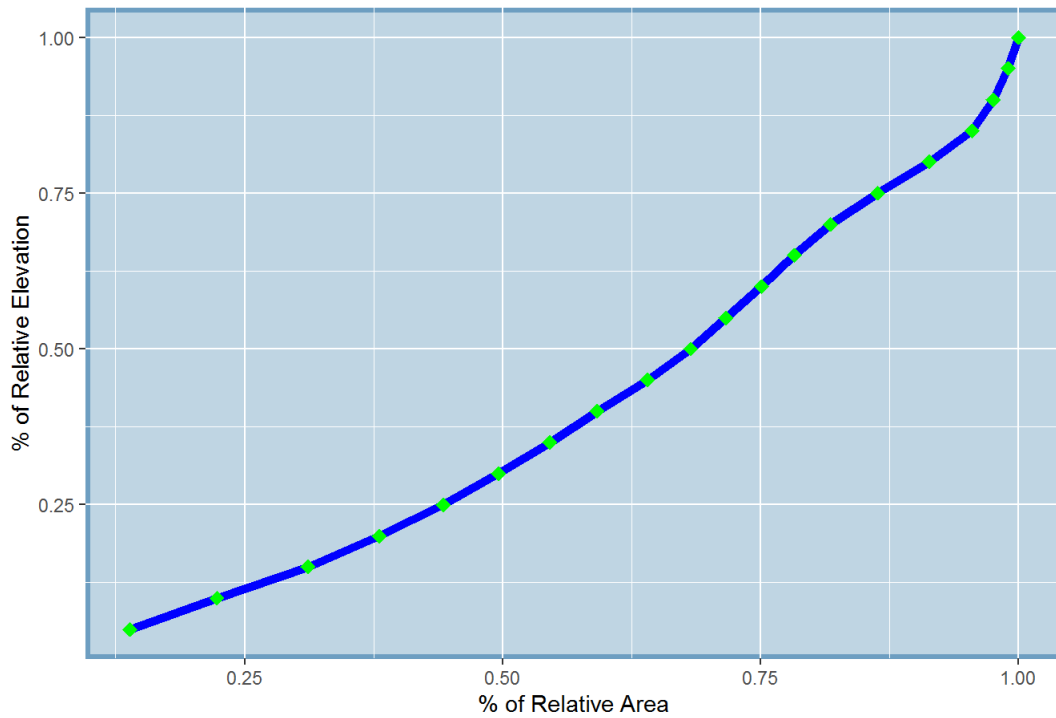

```
## [1] "The polynomial equation of sub-catchment C040 is 1.2724226441497*x + 0.196874545047254*x^2 - 0.00336
95753326692*x^3"
## [1] "The hypsometric integral of sub-catchment C040 is 0.701"
```

41. Hypsometric Curve of Catchment C041
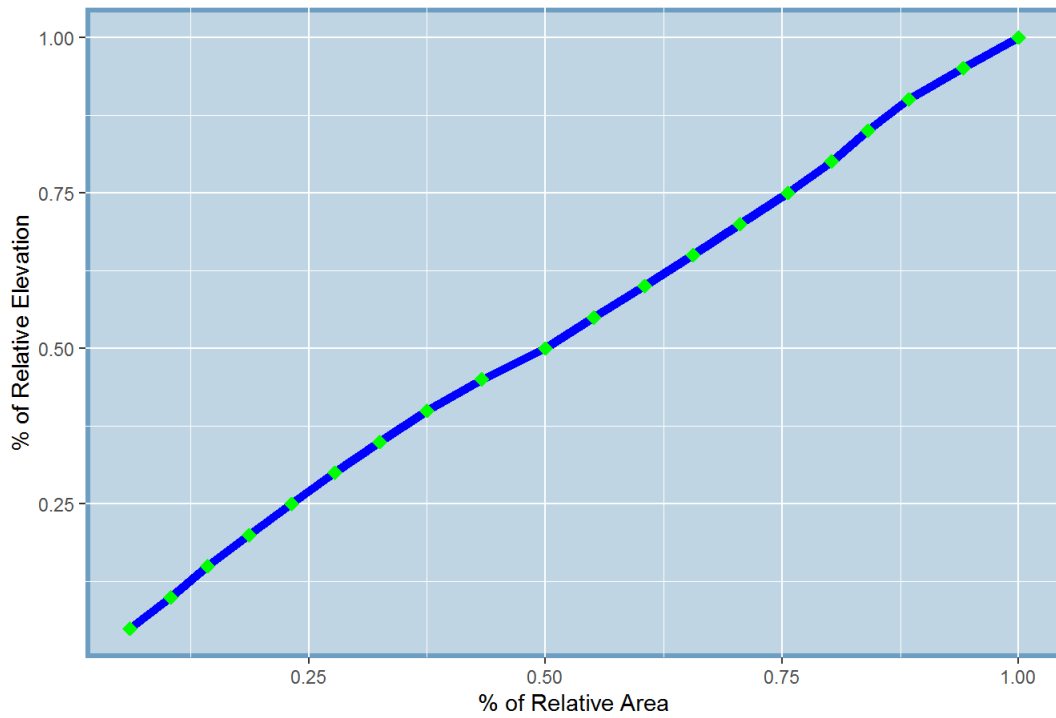

```
## [1] "The polynomial equation of sub-catchment C041 is 1.28841925048401*x - 0.00812884410587891*x^2 + 0.03
59857278829095*x^3"
## [1] "The hypsometric integral of sub-catchment C041 is 0.65"
```

42. Hypsometric Curve of Catchment C042


```
## [1] "The polynomial equation of sub-catchment C042 is 1.28057450184189*x - 0.129466920382362*x^2 - 0.0534
511252973178*x^3"
## [1] "The hypsometric integral of sub-catchment C042 is 0.584"
```

43. Hypsometric Curve of Catchment C043


```
## [1] "The polynomial equation of sub-catchment C043 is 1.19124192026037*x + 0.427687763765586*x^2 + 0.2119
00338117855*x^3"
## [1] "The hypsometric integral of sub-catchment C043 is 0.791"
```
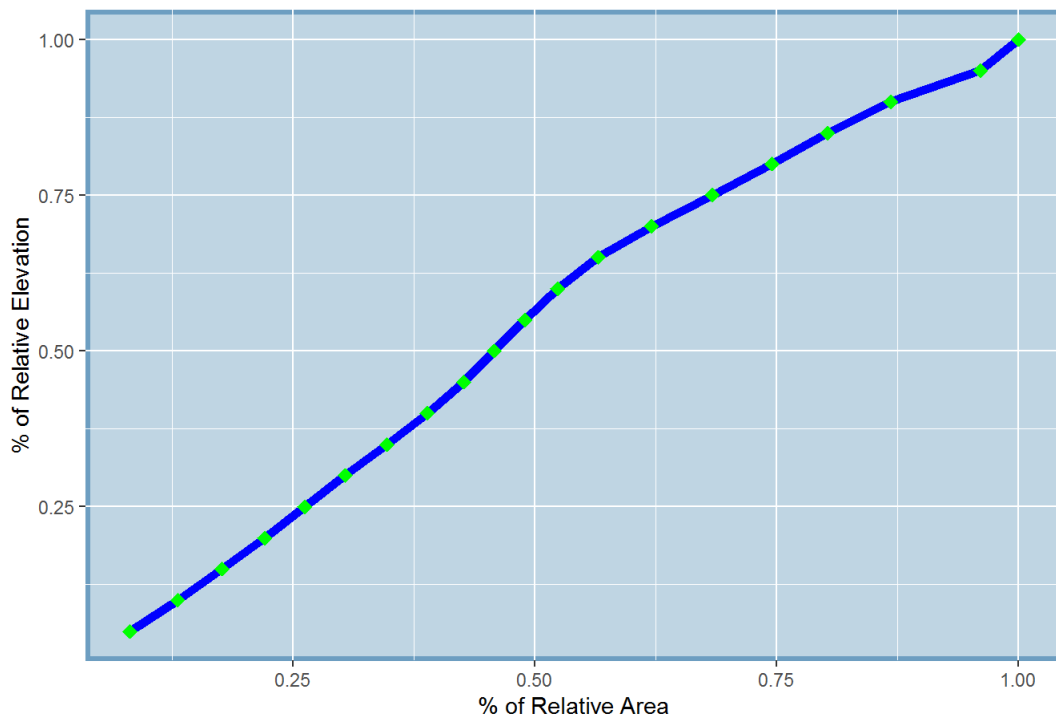
44. Hypsometric Curve of Catchment C044


```
## [1] "The polynomial equation of sub-catchment C044 is 1.27068520657246*x - 0.208228399634919*x^2 + 0.0613
145537768993*x^3"
## [1] "The hypsometric integral of sub-catchment C044 is 0.581"
```

45. Hypsometric Curve of Catchment C045


```
## [1] "The polynomial equation of sub-catchment C045 is 1.28264863453384*x + 0.0213466768667033*x^2 - 0.119
924736860762*x^3"
## [1] "The hypsometric integral of sub-catchment C045 is 0.618"
```
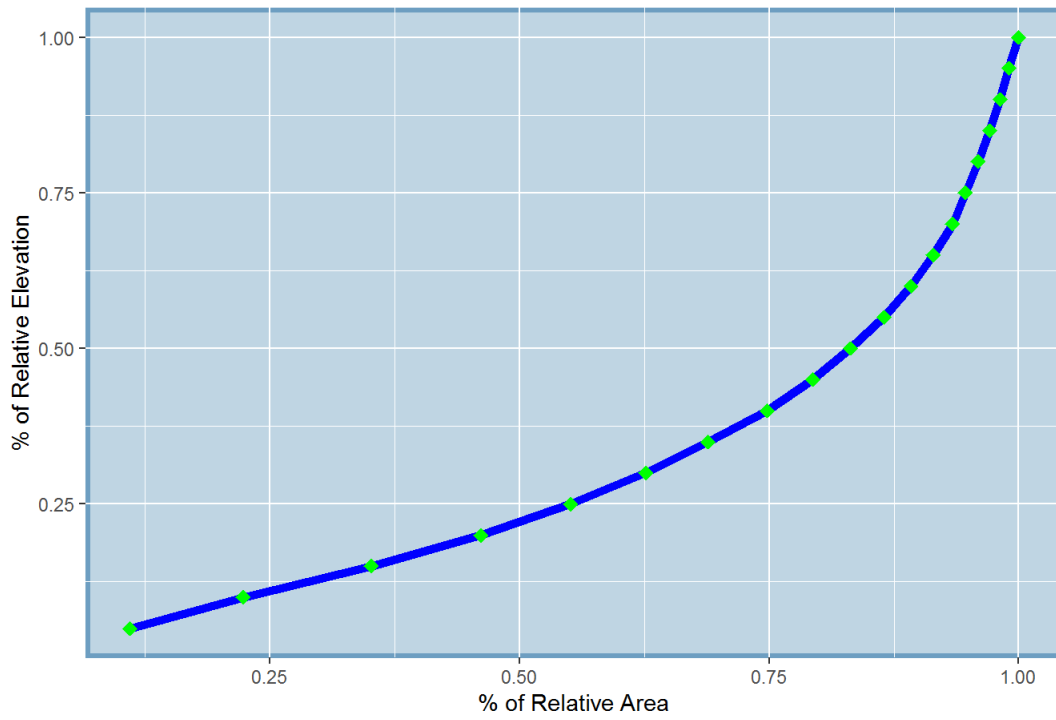
46. Hypsometric Curve of Catchment C046


```
## [1] "The polynomial equation of sub-catchment C046 is 1.2878839158049*x + 0.0292804060943213*x^2 + 0.0465
781227155415*x^3"
## [1] "The hypsometric integral of sub-catchment C046 is 0.665"
```
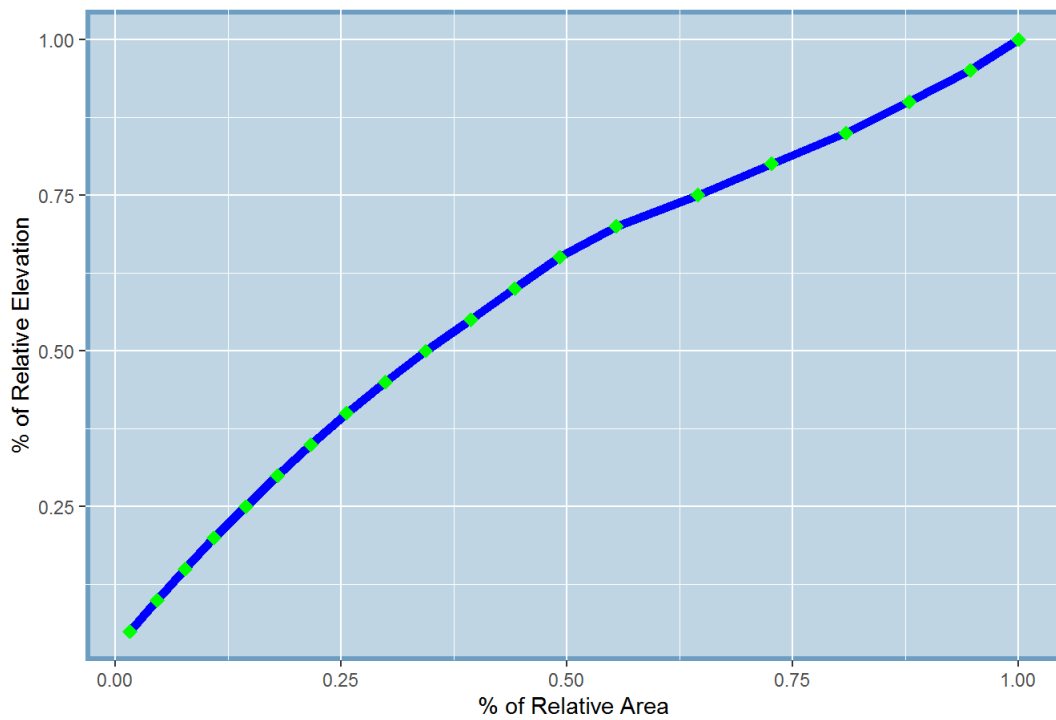
47. Hypsometric Curve of Catchment C047
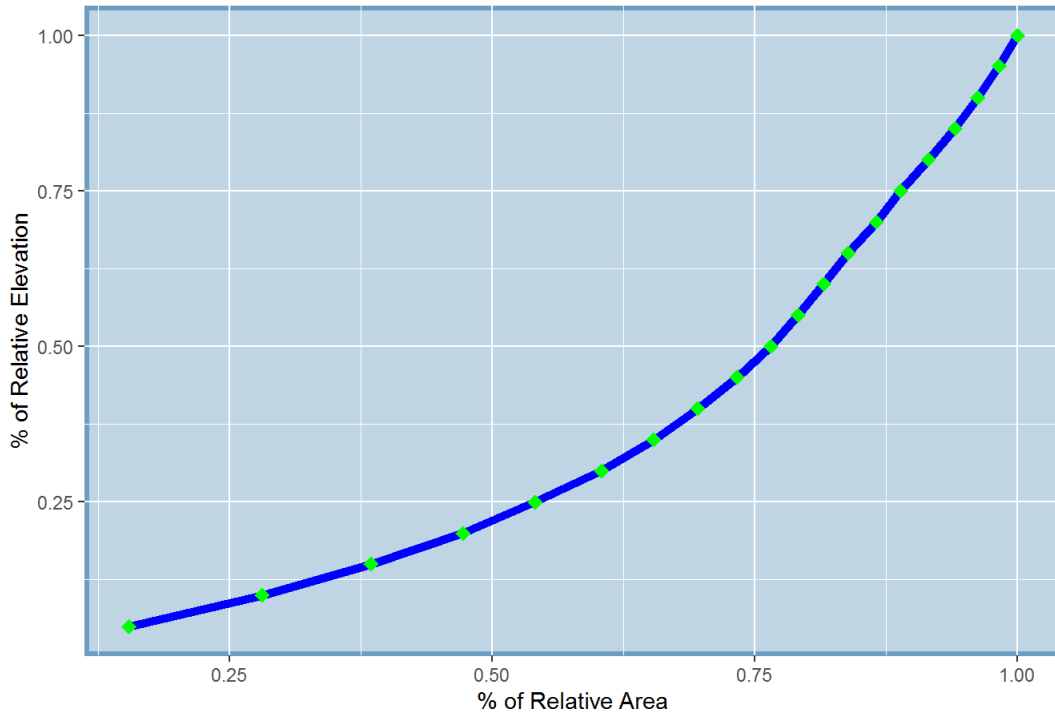

```
## [1] "The polynomial equation of sub-catchment C047 is 1.23181724957754*x + 0.374094288905986*x^2 + 0.0634
161576510671*x^3"
## [1] "The hypsometric integral of sub-catchment C047 is 0.756"
```
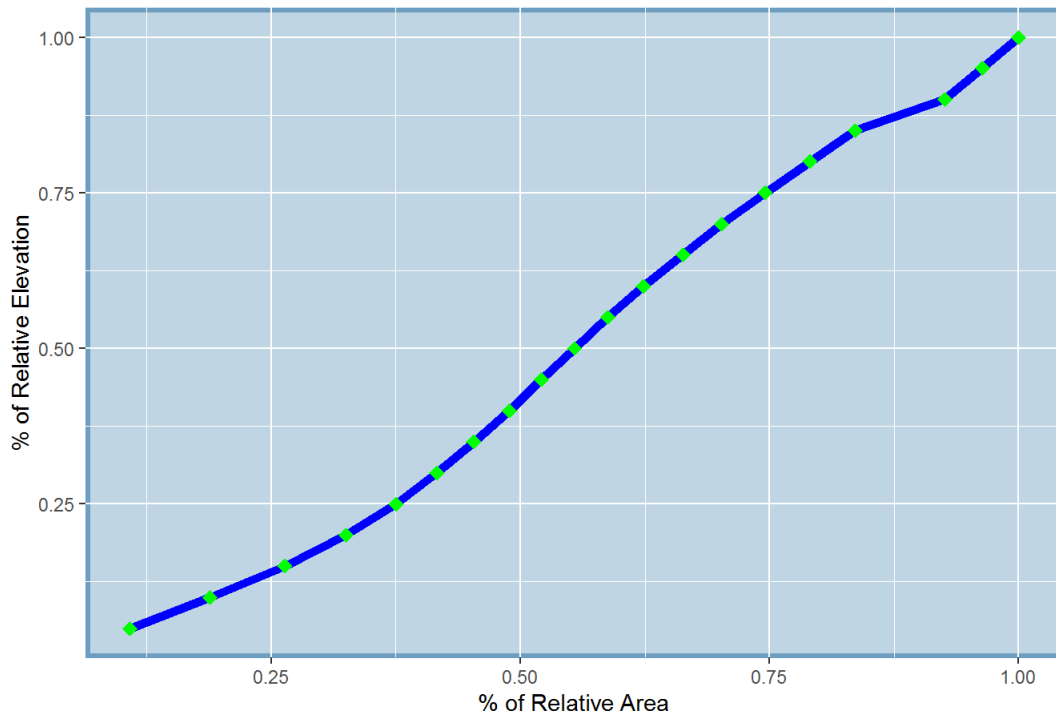
48. Hypsometric Curve of Catchment C048
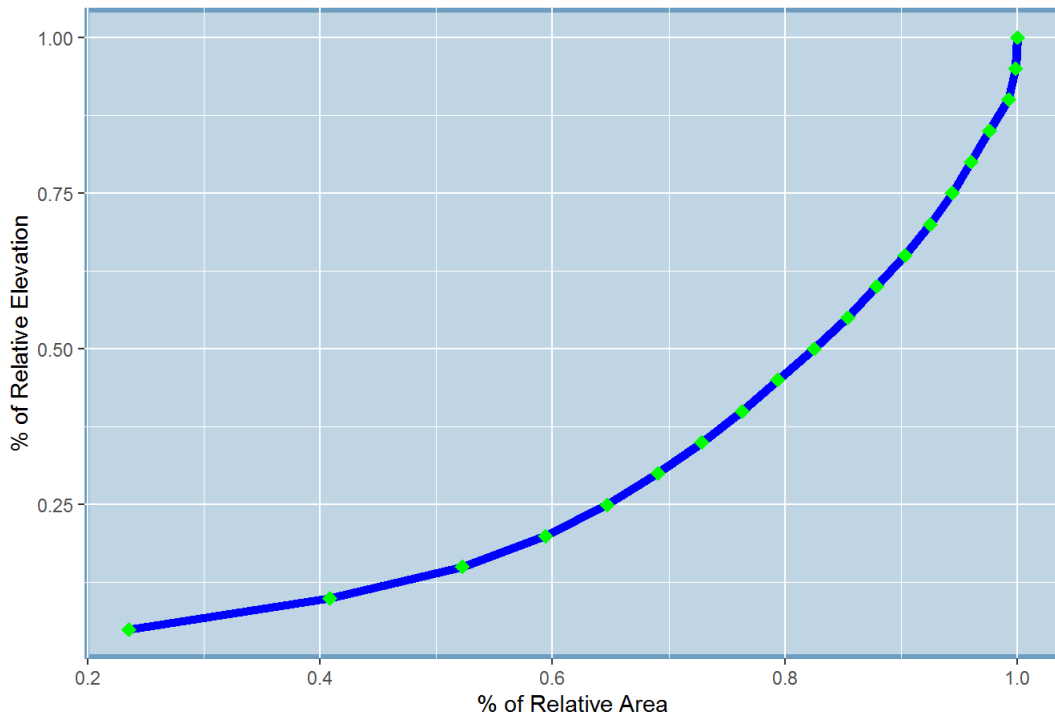

```
## [1] "The polynomial equation of sub-catchment C048 is 1.2061353222591*x + 0.437053773390657*x^2 + 0.10283
7438841376*x^3"
## [1] "The hypsometric integral of sub-catchment C048 is 0.774"
```

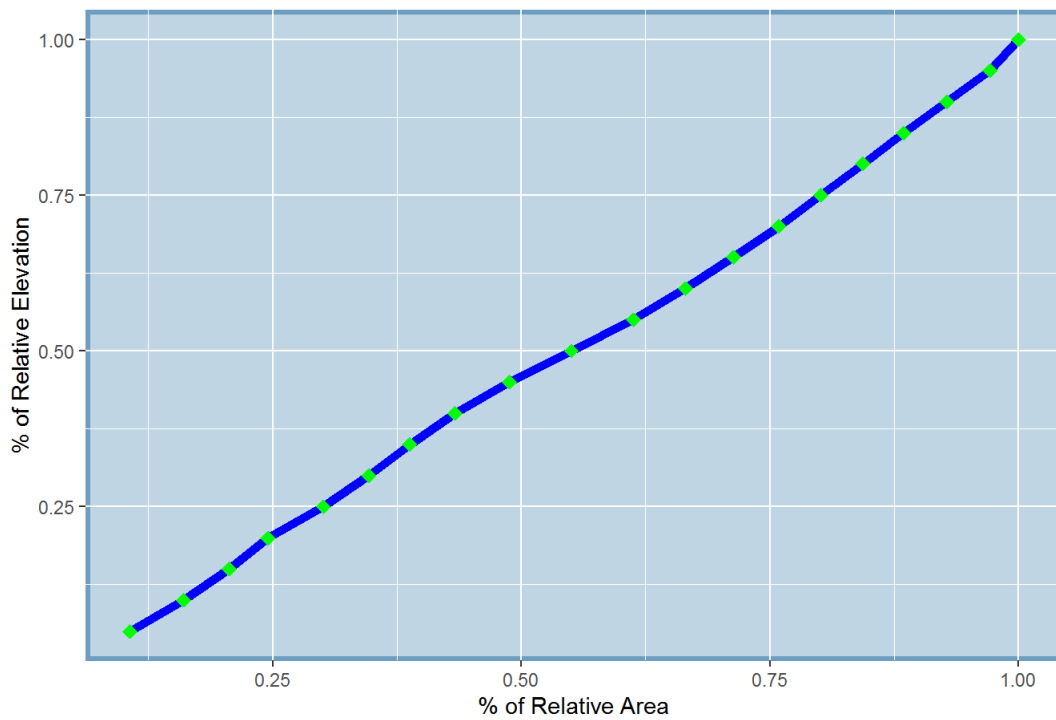## 49. Hypsometric Curve of Catchment C049
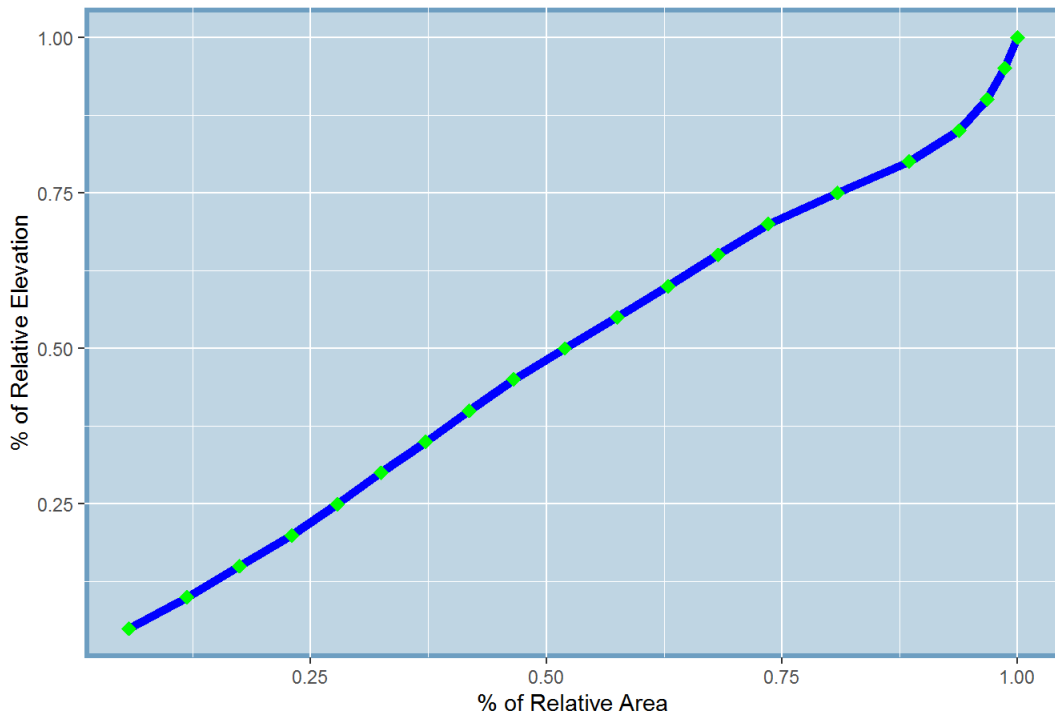

```
## [1] "The polynomial equation of sub-catchment C049 is 1.28656288633172*x - 0.00602819410832792*x^2 + 0.02
00301190668794*x^3"
## [1] "The hypsometric integral of sub-catchment C049 is 0.646"
```

50. Hypsometric Curve of Catchment C050
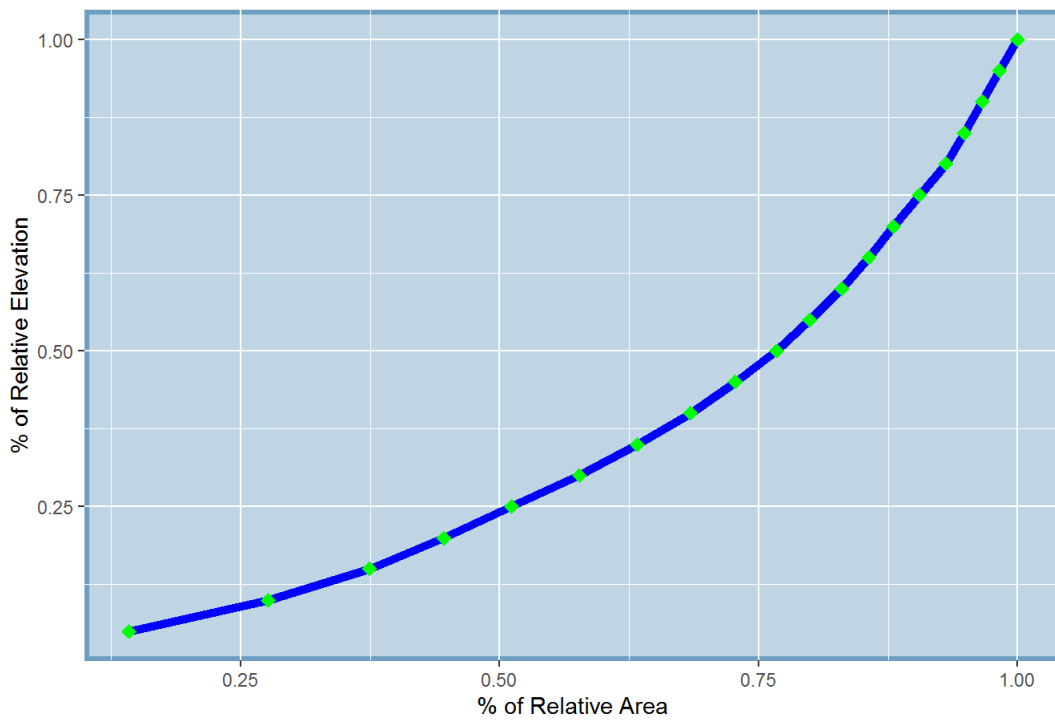

```
## [1] "The polynomial equation of sub-catchment C050 is 1.2368314301777*x + 0.349054369726396*x^2 + 0.09827
85007536756*x^3"
## [1] "The hypsometric integral of sub-catchment C050 is 0.759"
```

51. Hypsometric Curve of Catchment C051


```
## [1] "The polynomial equation of sub-catchment C051 is 1.17888194039112*x + 0.451996734839404*x^2 + 0.2118
98627798948*x^3"
## [1] "The hypsometric integral of sub-catchment C051 is 0.793"
```

52. Hypsometric Curve of Catchment C052
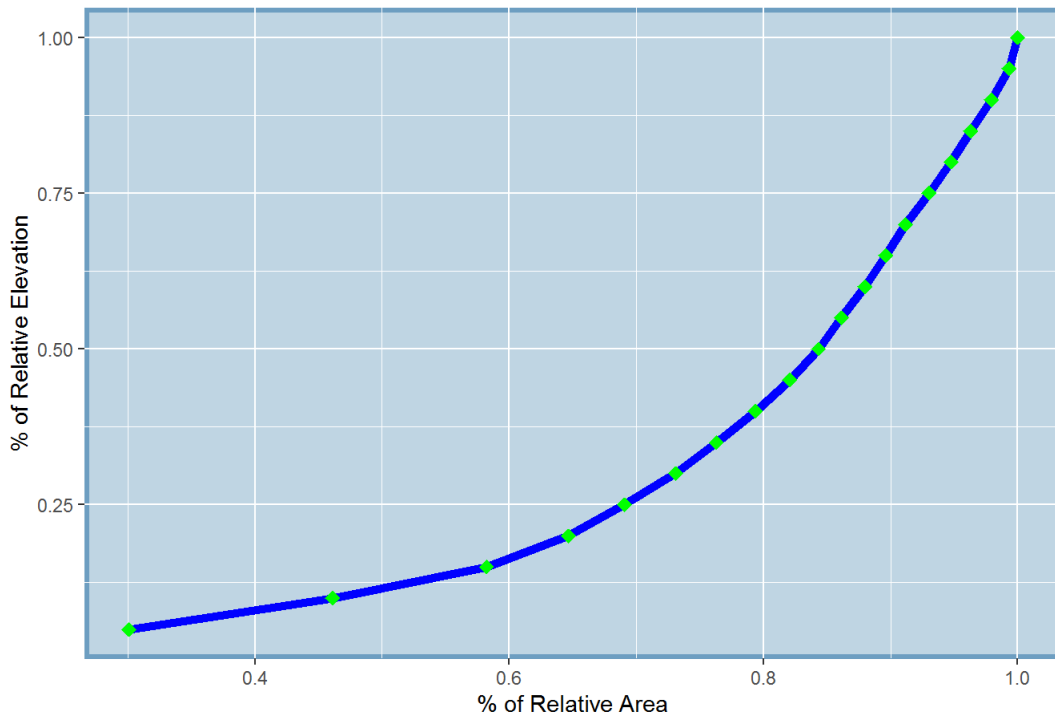

```
## [1] "The polynomial equation of sub-catchment C052 is 1.1911269486409*x + 0.482675815607605*x^2 + 0.09949
89673341095*x^3"
## [1] "The hypsometric integral of sub-catchment C052 is 0.781"
```

53. Hypsometric Curve of Catchment C053


```
## [1] "The polynomial equation of sub-catchment C053 is 1.26814688657089*x + 0.216196391643668*x^2 - 0.0599
612709875136*x^3"
## [1] "The hypsometric integral of sub-catchment C053 is 0.691"
```

54. Hypsometric Curve of Catchment C054


```
## [1] "The polynomial equation of sub-catchment C054 is 1.20108129972929*x + 0.451592067568326*x^2 + 0.1028
89174737825*x^3"
## [1] "The hypsometric integral of sub-catchment C054 is 0.777"
```
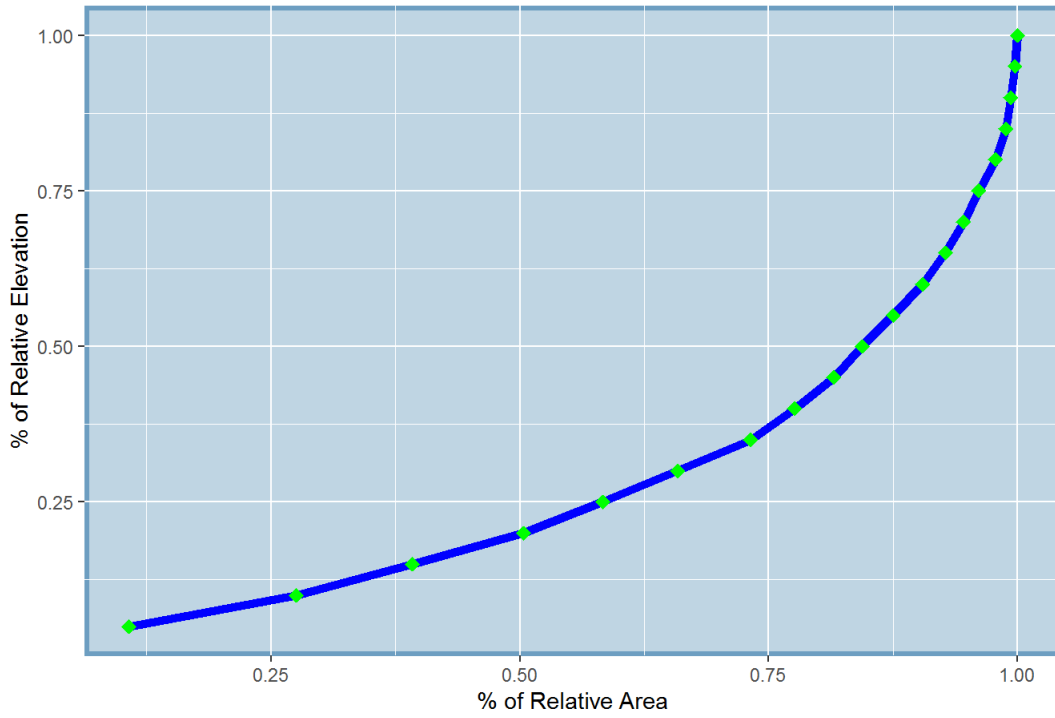
55. Hypsometric Curve of Catchment C055


```
## [1] "The polynomial equation of sub-catchment C055 is 1.16717068974855*x + 0.52097294429153*x^2 + 0.16024
3237485564*x^3"
## [1] "The hypsometric integral of sub-catchment C055 is 0.797"
```

56. Hypsometric Curve of Catchment C056
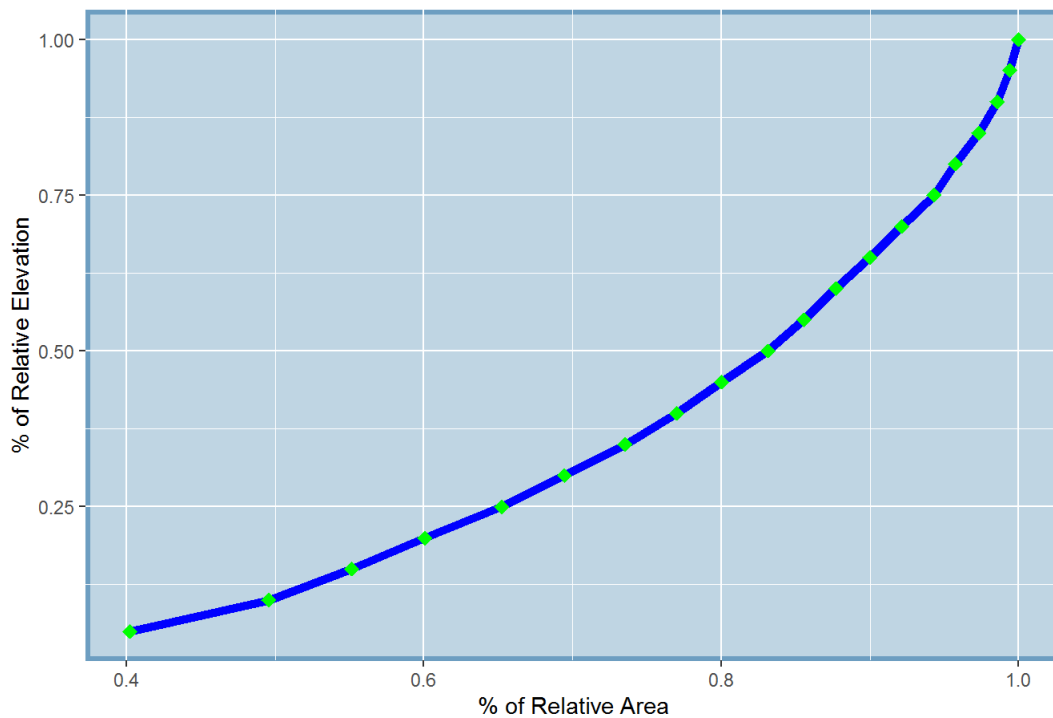

```
## [1] "The polynomial equation of sub-catchment C056 is 1.24551191179111*x + 0.315591250084385*x^2 + 0.0882
424043163123*x^3"
## [1] "The hypsometric integral of sub-catchment C056 is 0.75"
```
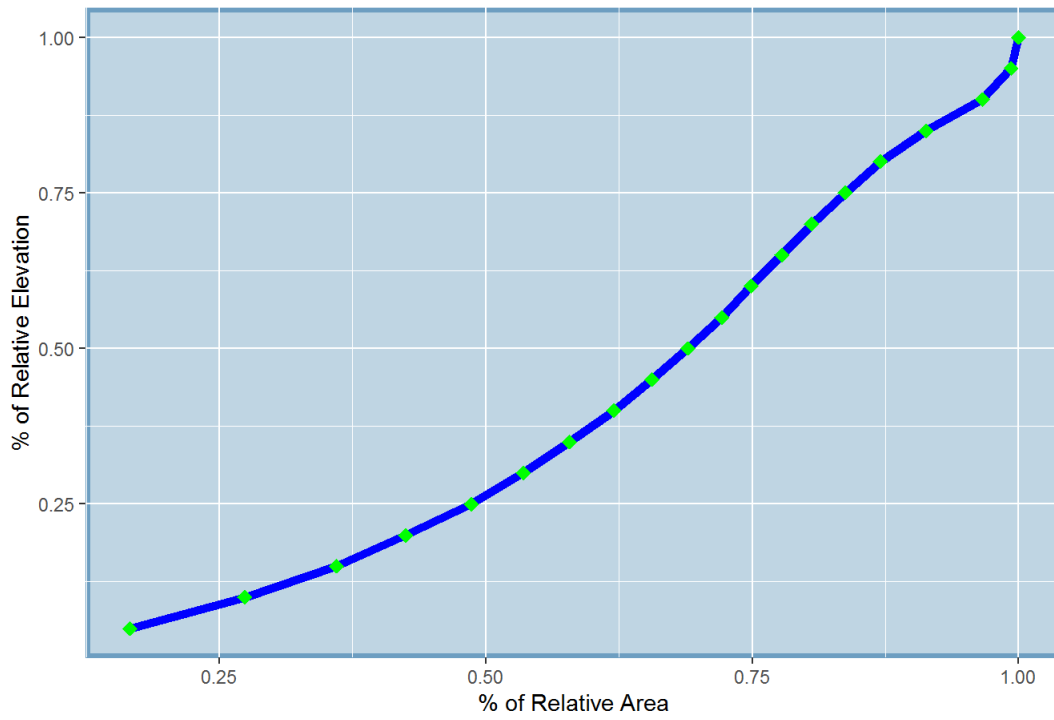
57. Hypsometric Curve of Catchment C057
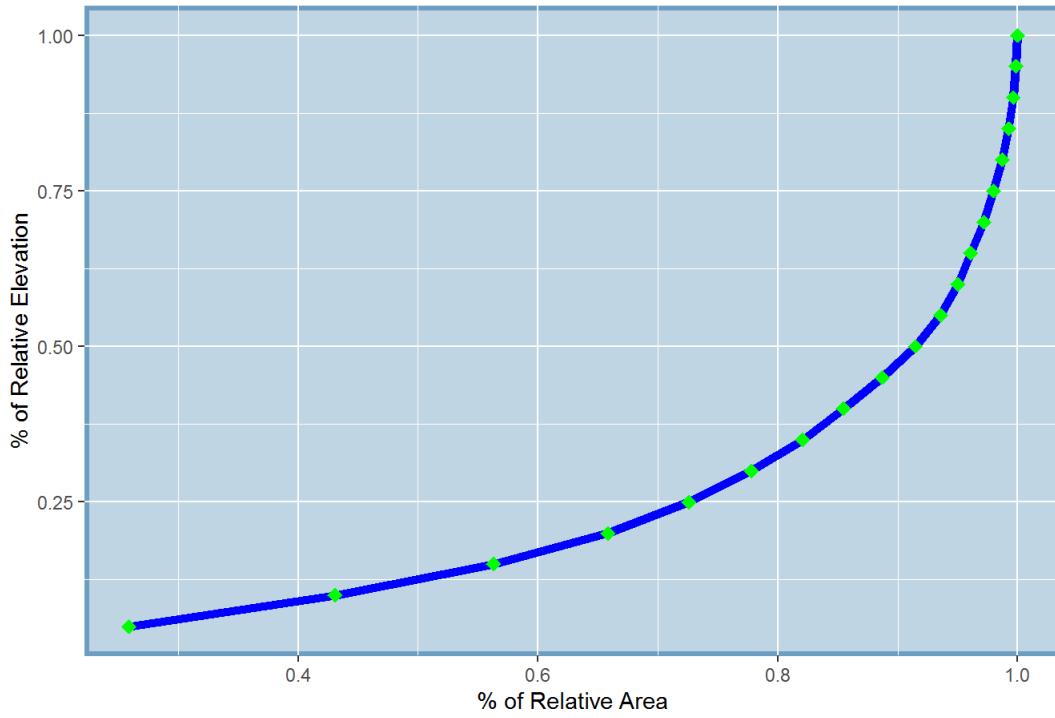

```
## [1] "The polynomial equation of sub-catchment C057 is 1.12546439012818*x + 0.520854788190361*x^2 + 0.2684
82471249938*x^3"
## [1] "The hypsometric integral of sub-catchment C057 is 0.803"
```
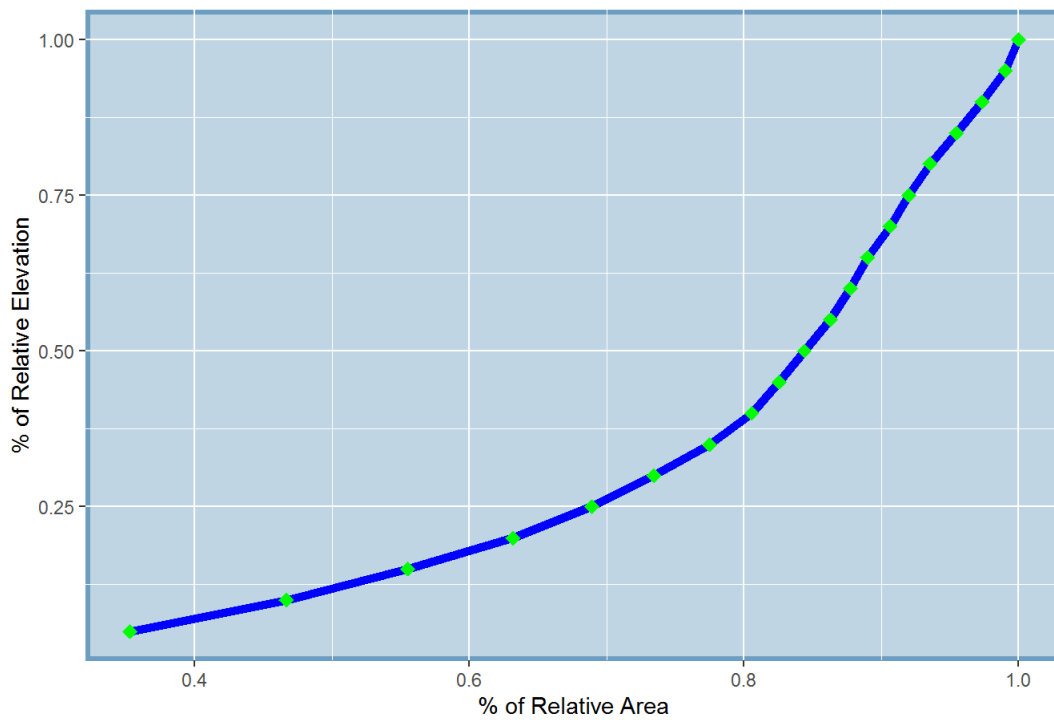
58. Hypsometric Curve of Catchment C058


```
## [1] "The polynomial equation of sub-catchment C058 is 1.28485214888492*x + 0.00458088975259705*x^2 + 0.10
3040301627517*x^3"
## [1] "The hypsometric integral of sub-catchment C058 is 0.67"
```
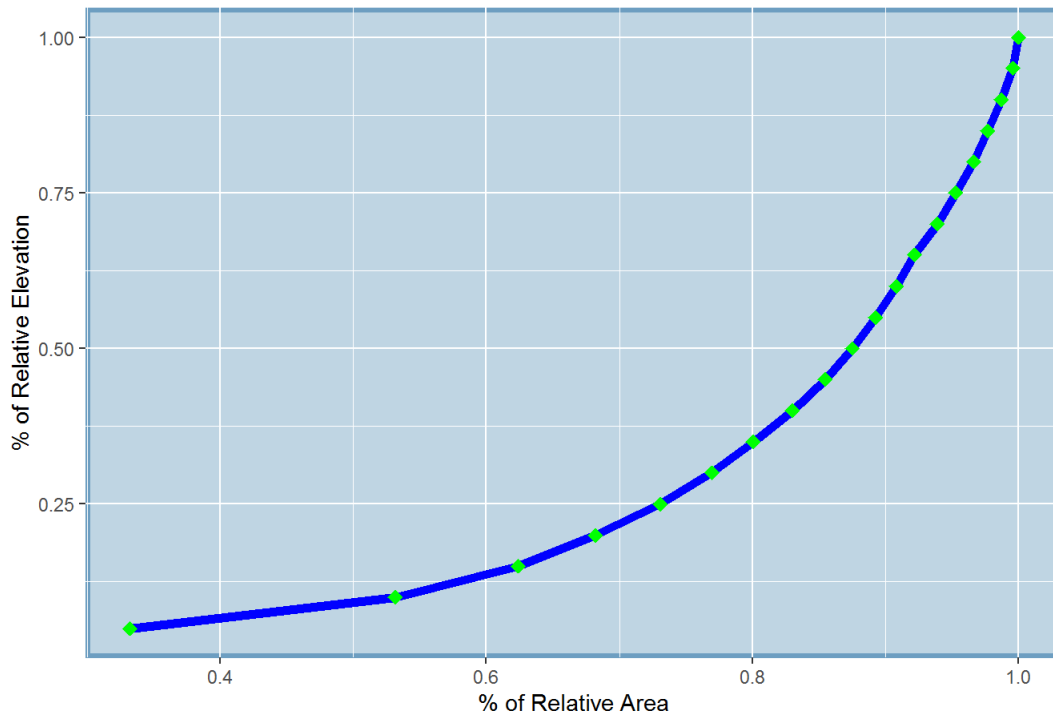
59. Hypsometric Curve of Catchment C059
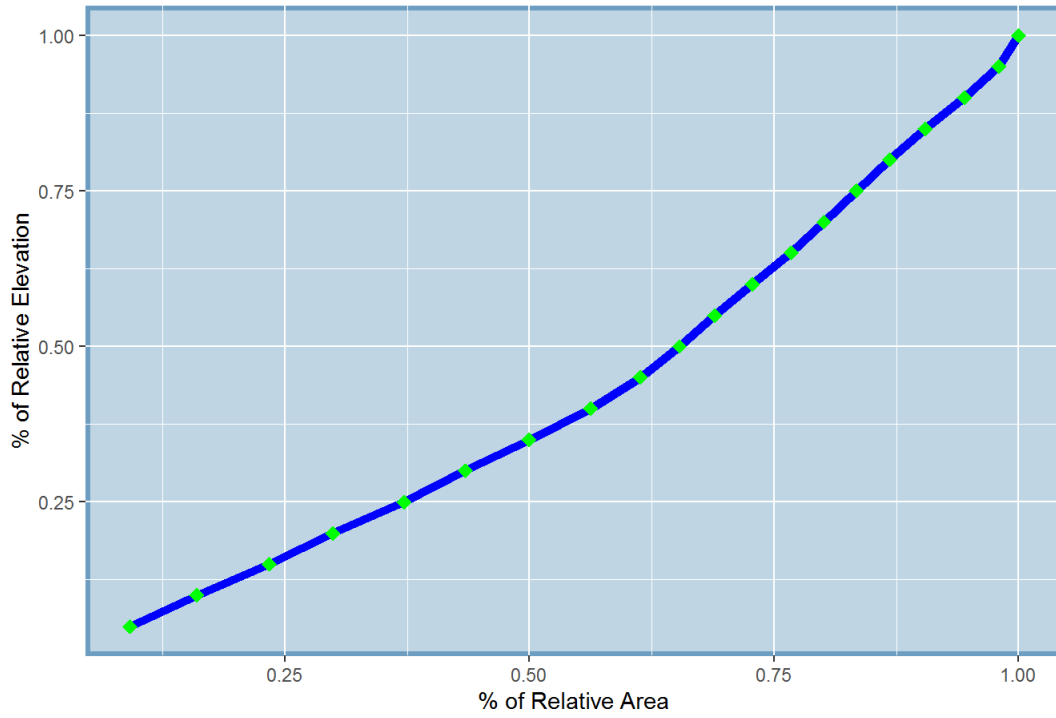

```
## [1] "The polynomial equation of sub-catchment C059 is 1.27319062695545*x + 0.199057856924446*x^2 + 0.0214
547991819763*x^3"
## [1] "The hypsometric integral of sub-catchment C059 is 0.708"
```

60. Hypsometric Curve of Catchment C060
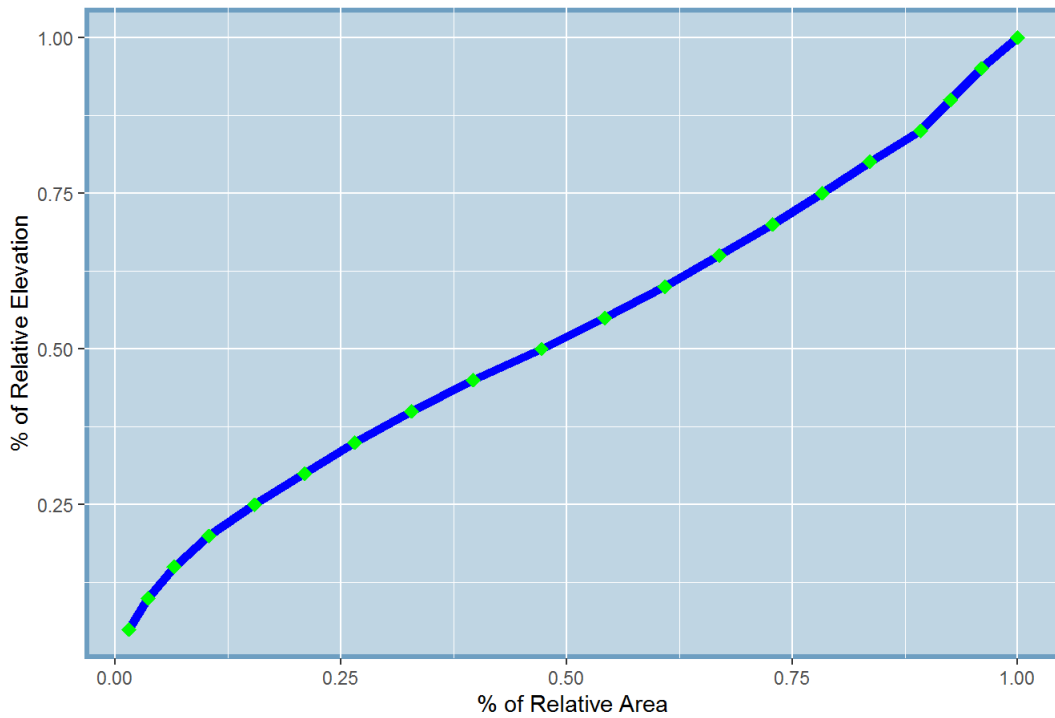


```
## [1] "The polynomial equation of sub-catchment C060 is 1.28855141197897*x + 0.0183974349015636*x^2 - 0.003
98425644516104*x^3"
## [1] "The hypsometric integral of sub-catchment C060 is 0.649"
```
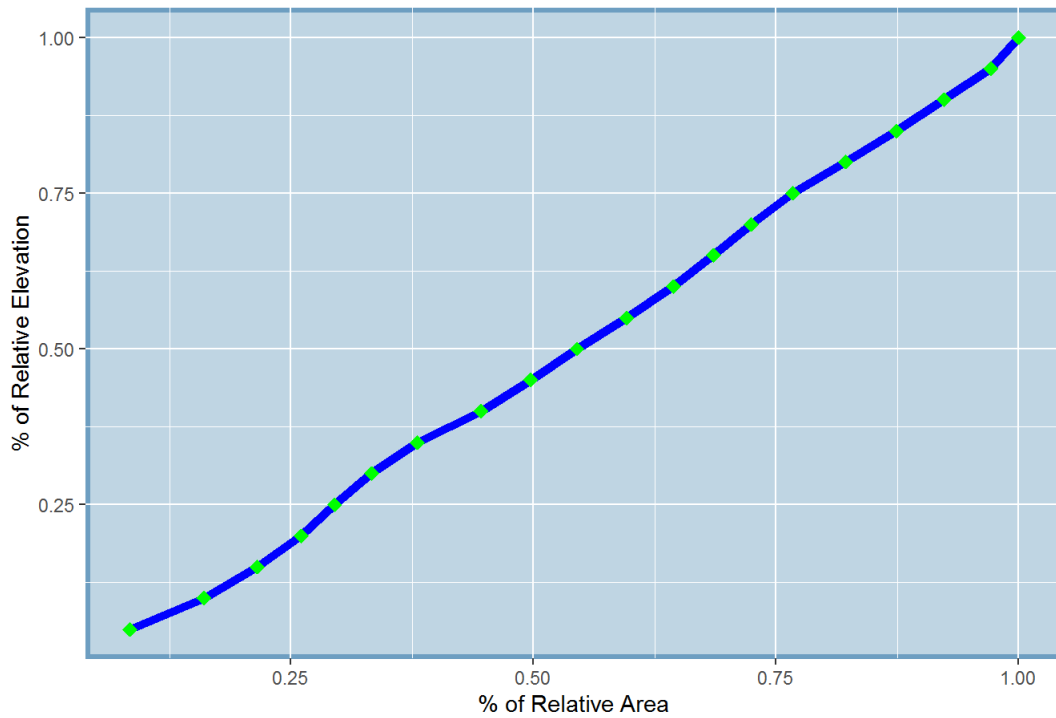
IV. Summary of Results

```
summary_table <- data.frame(x1 = character(),
                 x2 = numeric(),
                 x3 = numeric(),
                 x4 = numeric(),
                 x5 = numeric(),
                 stringsAsFactors = FALSE)
colnames(summary_table)<-c("CODE","MIN_ELEV", "MAX_ELEV", "AREA", "H_INTEGRAL")
 for (i in watersheds){
     if (i < 10)
     n <- paste("C00", i, sep = "")
   else
     n <- paste("C0", i, sep = "")
 CODE <- n
 MIN_ELEV <- all_data[[n]]$minimum
 MAX_ELEV <- all_data[[n]]$maximum
 AREA <- round(sum(all_data[[n]]$data$AREA_GEO),2)
 H_INTEGRAL <- round(all_data[[n]]$h_integral,3)
 summary_table[i,] <- c(CODE, MIN_ELEV, MAX_ELEV, AREA, H_INTEGRAL)
 }
kable(summary_table)
```

CODE	MIN_ELEV	MAX_ELEV	AREA	H_INTEGRAL
C001	1370	1667	43.7	0.695
C002	1378	1718	35.35	0.73
C003	1394	1784	23.96	0.626
C004	1395	1805	36.51	0.615
C005	1400	1674	35.85	0.68
C006	1410	1760	60.15	0.661
C007	1419	1810	44.85	0.589
C008	1433	1826	42.8	0.596
C009	1428	1778	50.5	0.589
C010	1423	1760	27.47	0.644
C011	1437	1827	56.23	0.698
C012	1451	1849	48.74	0.599
C013	1454	1890	116.83	0.671
C014	1504	1824	129.39	0.617
C015	1534	1952	95.29	0.617
C016	1540	1934	72.25	0.698
C017	1546	1781	150.45	0.545
C018	1556	1761	54.52	0.655
C019	1681	1996	92.08	0.648
C020	1561	2055	276.46	0.739
C021	1565	1807	58.24	0.708
C022	1631	2071	215.4	0.681
C023	1569	1838	38.83	0.64
C024	1571	1843	65.12	0.579
C025	1574	1855	45.82	0.579
C026	1580	1910	63.65	0.621
C027	1584	1985	103.36	0.642
C028	1586	1968	98.3	0.645

CODE	MIN_ELEV	MAX_ELEV	AREA	H_INTEGRAL
C029	1589	1895	58.76	0.677
C030	1594	1923	55.77	0.66
C031	1599	1977	150.96	0.64
C032	1604	2048	313.53	0.635
C033	1606	2008	147.45	0.529
C034	1607	2010	90.8	0.662
C035	1609	1952	74.24	0.782
C036	1611	2012	188.29	0.732
C037	1656	1963	111.75	0.596
C038	1613	1784	103.83	0.776
C039	1621	2011	212.27	0.724
C040	1622	1956	102.17	0.701
C041	1621	1946	131.63	0.65
C042	1631	2007	130.34	0.584
C043	1637	2002	81.3	0.791
C044	1687	2009	121.94	0.581
C045	1639	2047	163.58	0.618
C046	1643	1950	42.79	0.665
C047	1646	2044	126.82	0.756
C048	1655	1946	106.17	0.774
C049	1664	1995	68.18	0.646
C050	1661	2006	108.94	0.759
C051	1670	1786	29.47	0.793
C052	1639	1933	78.37	0.781
C053	1631	1959	187.36	0.691
C054	1624	1890	61.49	0.777
C055	1633	1874	64.52	0.797
C056	1647	1871	23.54	0.75
C057	1653	2076	116.72	0.803
C058	1675	2092	127.68	0.67
C059	1666	2134	133.8	0.708
C060	1673	2169	181.8	0.649