General Form of Distributions

$$F(x) = G\{H_\xi(\frac{x}{\sigma})\}$$

Parametric Families

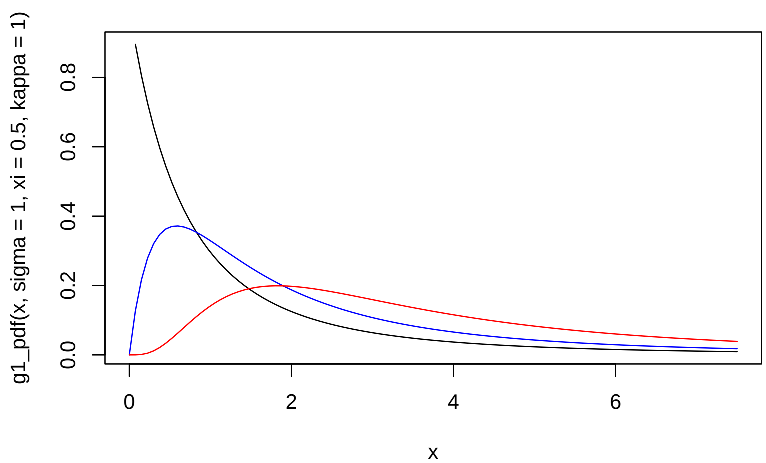
1. $G(v) = v^\kappa, \ \kappa > 0$

$$F_1(x) = \{1 - [1 + \xi(\frac{x}{\sigma})]^{-1/\xi}\}^\kappa$$

$$f_1(x) = \frac{\kappa}{\sigma}[1 + \xi(\frac{x}{\sigma})]^{-(1/\xi+1)}\{1 - [1 + \xi(\frac{x}{\sigma})]^{-1/\xi}\}^{\kappa-1}$$

```
g1_pdf <- function(x, sigma = sigma, xi = xi, kappa = kappa) {
    lpdf <- log(kappa) - log(sigma) - (1/xi + 1) * log(1 + xi *
        (x/sigma)) + (kappa - 1) * log(1 - (1 + xi * (x/sigma))^(-1/xi))
    return(exp(lpdf))
}

curve(g1_pdf(x, sigma = 1, xi = 0.5, kappa = 1), xlim = c(0,
    7.5))
curve(g1_pdf(x, sigma = 1, xi = 0.5, kappa = 2), xlim = c(0,
    7.5), add = TRUE, col = "blue")
curve(g1_pdf(x, sigma = 1, xi = 0.5, kappa = 5), xlim = c(0,
    7.5), add = TRUE, col = "red")
```



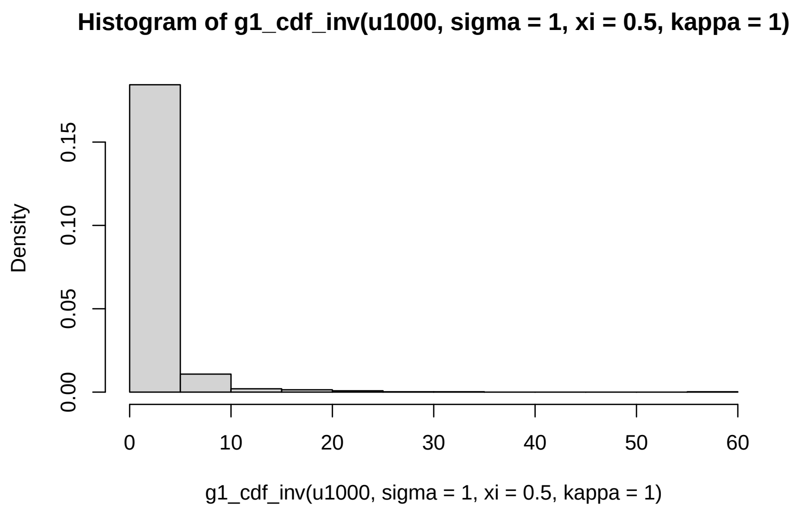
$$F^{-1}(u) = \frac{\sigma}{\xi}[(1 - u^{1/\kappa})^{-\xi} - 1]$$

```
g1_cdf <- function(x, sigma = sigma, xi = xi, kappa = kappa) {
    (1 - (1 + xi * (x/sigma))^(-1/xi))^kappa
}

g1_cdf_inv <- function(u, sigma = sigma, xi = xi, kappa = kappa) {
```

```
    (sigma/xi) * ((1 - u^(1/kappa))^-xi - 1)
}

u1000 <- runif(1000)
hist(g1_cdf_inv(u1000, sigma = 1, xi = 0.5, kappa = 1), freq = FALSE)
```



2. $G(v) = pv^{\kappa_1} + (1-p)v^{\kappa_2},\ \kappa_1, \kappa_2 > 0$
3. $G(v) = 1 - Q_\delta\{(1-v)^\delta\},\ \delta > 0, \quad Q_\delta \sim \text{Beta}(1/\delta, 2)$
4. $G(v) = [1 - Q_\delta\{(1-v)^\delta\}]^{\kappa/2},\ \kappa, \delta > 0$

Burned area model

$[\text{area} \mid \sigma^{(L)}, \xi^{(L)}] = G\{H_\xi(\frac{x}{\sigma})\}$

Parameters
$\log(\boldsymbol{\sigma}^{(\boldsymbol{L})}) = \boldsymbol{\alpha} + \boldsymbol{X}_{s_i,t_i}\boldsymbol{\beta} + \Phi_{s_i,t_i}$
$\xi^{(GPD)} = 1/\xi^{(L)}$
$\sigma^{(GPD)} = \sigma^{(GPD)}/\xi^{(L)}$