

prioritizr

**Maximum cover objective function/  
Función objetivo de cobertura máxima**



prioritizr.net

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# Human-readable code/ Código entendible

Mental model/ Modelo mental

```
problem <- data +  
           objective +  
           constraints +  
           penalties +  
           decision type +  
           solver  
  
solution <- solve(problem)
```

# Minimum set objective function/ **Función objetivo de conjunto mínimo**

## Mental model/ **Modelo mental**

```
problem <- data +  
  objective +  
  constraints +  
  penalties +  
  decision type +  
  solver
```

```
solution <- solve(problem)
```

## Code/**Código**

```
p <- problem(areas, feats) %>%  
  add_min_set_objective() %>%  
  add_relative_targets(0.1) %>%  
  add_boundary_penalties(5) %>%  
  add_binary_decisions() %>%  
  add_rsymphony_solver()
```

```
solution <- solve(p)
```

# Objective functions/ Funciones objetivo

<https://prioritizr.net/reference/objectives.html>

The following objectives can be added to a conservation planning problem :

`add_min_set_objecti...` Minimize the cost of the solution whilst ensuring that all targets are met. This objective is similar to that used in *Marxan*.

`add_max_cover_objec...` Represent at least one instance of as many features as possible within a given budget.

`add_max_features_ob...` Fulfill as many targets as possible while ensuring that the cost of the solution does not exceed a budget.

`add_min_shortfall_o...` Minimize the shortfall for as many targets as possible while ensuring that the cost of the solution does not exceed a budget.

`add_max_phylo_div_o...` Maximize the phylogenetic diversity of the features represented in the solution subject to a budget.

`add_max_phylo_end_o...` Maximize the phylogenetic endemism of the features represented in the solution subject to a budget.

`add_max_utility_obj...` Secure as much of the features as possible without exceeding a budget.

# Maths: minimum set/ Matemática: Conjunto mínimo

$$\text{Minimize } \sum_{i=1}^I x_i c_i$$

subject to

$$\sum_{i=1}^I x_i r_{ij} \geq T_j \quad \forall j \in J$$

$x_i$  = decisions variable (e.g. specifying whether planning unit  $i$  has been selected (1) or not (0)) / Variable de decisión (Ej. Especificando si la unidad de planeación  $i$  se ha seleccionado (1) o no (0))

$c_i$  = cost of planning unit  $i$  / costo de la unidad de planeación  $i$

$r_{ij}$  = amount of feature  $j$  in planning unit  $i$  / Cantidad de la característica  $j$  en la unidad de planeación  $i$

$T_j$  = target for feature  $j$  / Meta de la característica  $j$

The first term is the objective function and the second is the set of constraints. / El primer término es la función objetivo y el segundo término son las restricciones

# Maths: maximum cover-utility/ Matemática: Cobertura-utilidad máxima

$$\text{Maximize } \sum_{i=1}^I -s c_i x_i + \sum_{j=1}^J a_j w_j$$

*subject to*

$$a_j = \sum_{i=1}^I x_i r_{ij} \quad \forall j \in J$$

$$\sum_{i=1}^I x_i c_i \leq B$$

$s$  = scaling factor for cost/ factor de escala para el costo

$c_i$  = cost of planning unit  $i$ / costo de la unidad de planeación  $i$

$x_i$  = decisions variable (e.g. specifying whether planning unit  $i$  has been selected (1) or not (0))/ Variable de decisión (Ej. Especificando si la unidad de planeación  $i$  se ha seleccionado (1) o no (0))

$r_{ij}$  = amount of feature  $j$  in planning unit  $i$ / Cantidad de la característica  $j$  en la unidad de planeación  $i$

$a_j$  = amount of feature  $j$  represented in the solution/ cantidad de la característica  $j$  representada en la solución

$w_j$  = weight for feature  $j$ / peso de la característica  $j$

$B$  = budget allocated for the solution/ presupuesto asignado para la solución

# Min set and max cover difference/ **Diferencia entre conjunto mínimo y cobertura máxima**

- **Minimum set/ Conjunto mínimo:**
  - Minimize the cost/area of a solution while meeting feature targets/ **Minimiza el costo/área de una solución mientras cumple con las características meta**
- **Maximum cover/ Cobertura máxima:**
  - Minimize the cost/area of a solution while staying within a budget and maximizing feature representation/ **Minimiza el costo/área de una solución mientras cumple con un presupuesto y maximiza la representación de las características meta**

# What's the difference in prioritizr? / ¿Cuál es la diferencia en prioritizr?

## Minimum set/ Conjunto mínimo

```
p1 <- problem(pu, features) %>%  
  add_min_set_objective() %>%  
  add_relative_targets(T) %>%  
  add_binary_decisions() %>%  
  add_default_solver(gap = 0)  
  
s1 <- solve(p1)
```

## Maximum cover/ Cobertura máxima

```
p2 <- problem(pu, features) %>%  
  add_max_utility_objective(B) %>%  
  add_feature_weights(w) %>%  
  add_binary_decisions() %>%  
  add_default_solver(gap = 0)  
  
s2 <- solve(p2)
```



# What's the difference in prioritizr? / ¿Cuál es la diferencia en prioritizr?

Minimum set/ Conjunto mínimo

Maximum cover/ Cobertura máxima

