An introduction to Systematic conservation planning with prioritzr

Martin Jung & Louise O'Connor

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Preface

Welcome to the training course in systematic conservation planning with the prioritzr. This training course was originally held at the 2024 European Congress of Conservation biology in Bologna, although the materials found here will be preserved even after the conference and be openly available to everyone.

What you will learn

- The basic concepts of Systematic conservation planning (SCP) and Integer Linear Programming (ILP) in particular
- How to prepare your input data for a Conservation planning project
- How to setup and run your first prioritization
- How outputs can be analysed and interpreted.
- How to adding complexity factors and changing your conservation planning outcomes
- Advanced topics such as management zones

Completing all course materials will take you on average 120 minutes, although people who have been exposed to similar methods or introduction before might take less. training materials before might less amount of time.

In this training course a number of different terms will be used. Whenever there are uncertainties with regards to definitions, see the Glossary.

If you have already heard before about the basic concepts of SCP and ILP (For example from the lecture then feel to jump to section 2 and data preparation Chapter 2.

> **i** Before you start…
>
> In order to run the materials on this course website, some preparatory steps need to be taken. Please see the installation instructions in Appendix A if you have never used **prioritizr** before!

Part I

Introduction to SCP

1 Introduction

This is a book created from markdown and executable code.

See Hanson *et al.* (2019) for additional discussion of optimality in linear programming.

1.1 Systematic conservation planning

1.1.1 Key concepts

1.2 Exact algorithms and integer programming

1.3 Tools and software

Part II

Problem creation

2 Preparing input data

2.1 Planning units

Say something about what a PU file is, load and plot from the example data

2.2 Features

Explain what features are and plot

2.3 Costs

Explain what costs are and how they are used

2.4 Other constraints (Protected areas)

Showcase a protected area file and exclusion areas as example

2.5 Other data for the prioritization

Mention weights, targets, etc and give example for each

2.6 Preparing data in different formats

Showcase different dataformats as input alternative

```
library(tidyverse)
trees |>                                                    ①
  mutate(
  volume_girth = volume * girth                             ②
  )
```

① Take dataset and mutate
② Update with interaction term

3

Part III

Solving a problem

4 Solving a conservation planning problem

4.1 Ensure that a solver is available

4.2 Create a solution

4.3 Plot the solution

5 Interpret and analyse outputs

5.1 Plot the solution

5.2 Calculate performance evaluation metrics

Area statistics, Mean representation, Target shortfall

5.3 Irreplaceability

Calculater ferrier irreplacibility and RWR

Part IV

Adding complexity

6 Objective functions

6.1 The need for targets

6.2 Minimum set

6.3 Maximum coverage

6.4 Creating ranked priority maps

7 Adding complexity to conservation planning

7.1 Decision variables

7.2 Adding (socio-economic) costs

7.3 Feature weights

7.4 Linear penalities

Part V

Advanced topics

8 Connectivity

8.1 Spatial coherence

8.2 Connectivity constraints

Glossary

Table 8.1: A glossary of key terms used in this Training course

Term	Abbreviation if any	Definition
CARE	CARE	A often used abbreviation that stands for ***C****onnectivity*, ***A****dequacy*, ***R****epresentation*, and ***E****ffectiveness* which key principles that should be considered when designing a conservation network. See the Marxan website for more information.
Conservation Prioritization		The computational process of identifying (spatial) priorities for a given conservation objective (such as for identifying protected areas). Usually comes in in the form of a map.
Integer		In programmatic terms a full number (e.g. -1, 1, 2, 3, …)
Integer Linear Programming	ILP	Mathematical problem formulation using Linear Programming (ILP) where the variables are integer values and the objective function and equations are linear.
Planning unit	PU	The fundamental unit at which decisions in SCP are realized. Can be of multiple formats such as grid cells or farms
Systematic Conservation Planning	SCP	A framework and step-wise approach towards mapping conservation areas. Usually involves multiple steps such as the identification of a problem and the theory of change, data collection and preparation, conservation prioritization, evaluation and finally implementation. See Margules & Pressey (2000)

References

Hanson, J.O., Schuster, R., Strimas-Mackey, M. & Bennett, J.R. (2019). Optimality in prioritizing conservation projects. *Methods in Ecology and Evolution*, *10*, 1655–1663.

Margules, C.R. & Pressey, R.L. (2000). Systematic conservation planning. *Nature*, *405*, 243–253.

A Installation of all software

A.1 Say something about Rstudio

A.2 Say something about R

A.3 Say something about R tools

A.4 Say something about R packages