2022 CANADIAN LAND TRUST SUMMIT | SOMMET NATIONAL DES ORGANISMES DE CONSERVATION 2022

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A Prioritization Tool for "Where To Work" in Conservation

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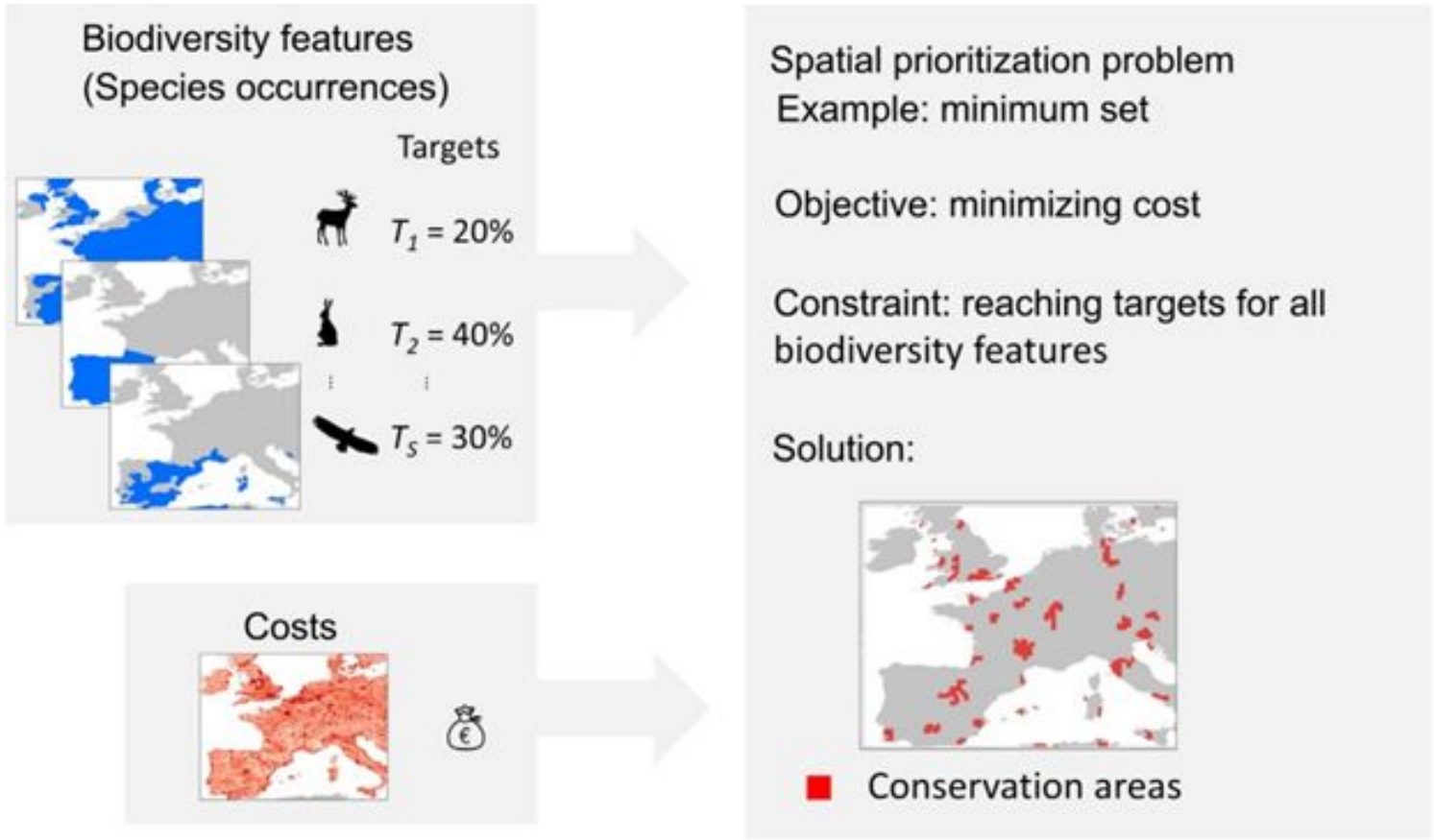
NATURE CONSERVANCY CANADA

Systematic Conservation Planning / Prioritization

- Limited resources for conservation

- Meeting conservation objectives by a repeatable, and structured approach for designing new protected areas (Margules & Pressey, 2000).

Schematic representation of the spatial conservation prioritization



(Andrello *et al*., 2022., Journal of Trends in Ecology and Evolution)

Land Trust activities

- To Long term protection of

 Natural and/or cultural heritage of lands
 Ecological integrity
 Habitat for species and sustainability of the ecosystem
 Watershed areas, riparian areas, streams and other water sources
 .,etc

- Place land and water in trust for the common benefit of this and future generations of all life

- Research & Inventory of Priority areas, species, values and features for stewardship and conservation.

NCC approach to land conservation

- A systematic and standardized approach to land conservation.

- Identifying priority areas by accounting for many different variables

- Prioritization tools help land trusts and municipalities make better decisions:

  - **Where to focus conservation efforts**
  - **How to allocate limited resources**

- **Tool1 and Tool2**: Two web-based decision support tools.

NCC's tools

- **"Where To Work":** spatial prioritization tool
- Web-based user interface that finds optimal conservation solutions for land protection
- Interfaces with the *prioritizr* R package, which solves conservation problems following a defined set of rules

- **"What To Do":** land management prioritization tool
- Identifies management approach that provides the largest conservation gain for unit of investment – under development

Definitions in tool1 with a simple example:

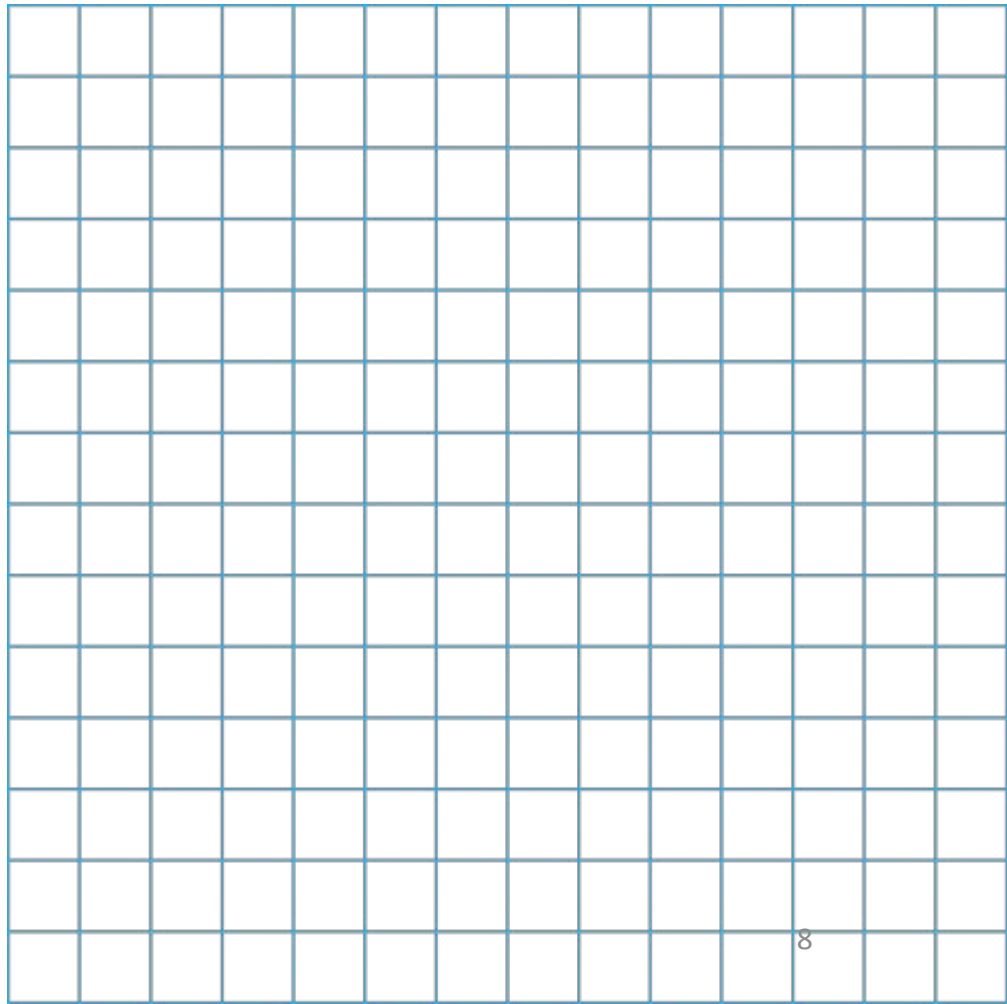
Planning Unit

- A spatial locality (or area) that can be managed independently from other localities
- In large-scale planning exercises, landscapes are often divided into equal-area (e.g., 1 km2) grid or other shapes cells

Weight

- Describes properties of places that can impede or improve conservation efforts (-100 to 100).
- To completely avoid a weight use a value of -100.
- To include as much of the weight as possible use a value of +100
- zero : that it is not considered at all in the prioritization.

Study area

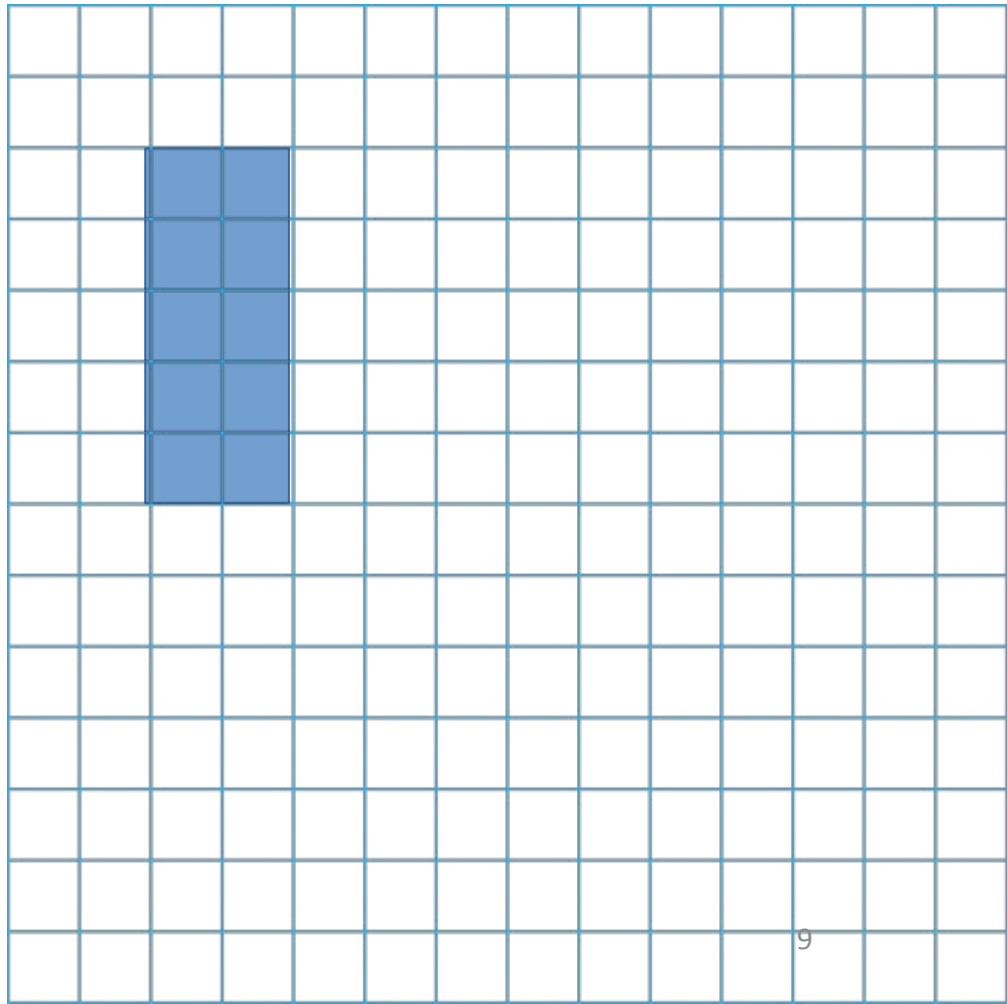


Prioritization example:

Includes

- Refers to areas that are already managed for conservation; to build on the current reserve network, these areas should be automatically included.

Current protected areas

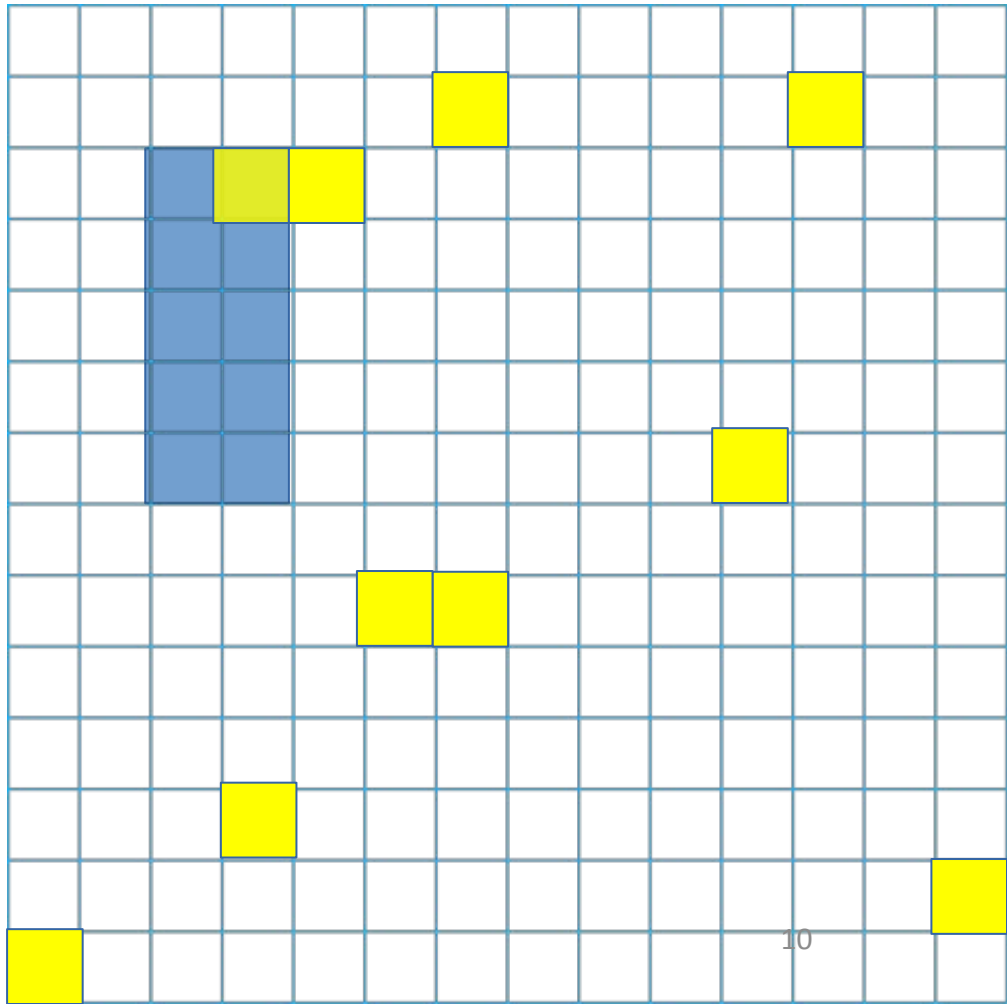


Prioritization example:

Themes

Describe facets of biodiversity that are important for conservation (e.g., species, habitats, ecosystems).

10 pixels species A



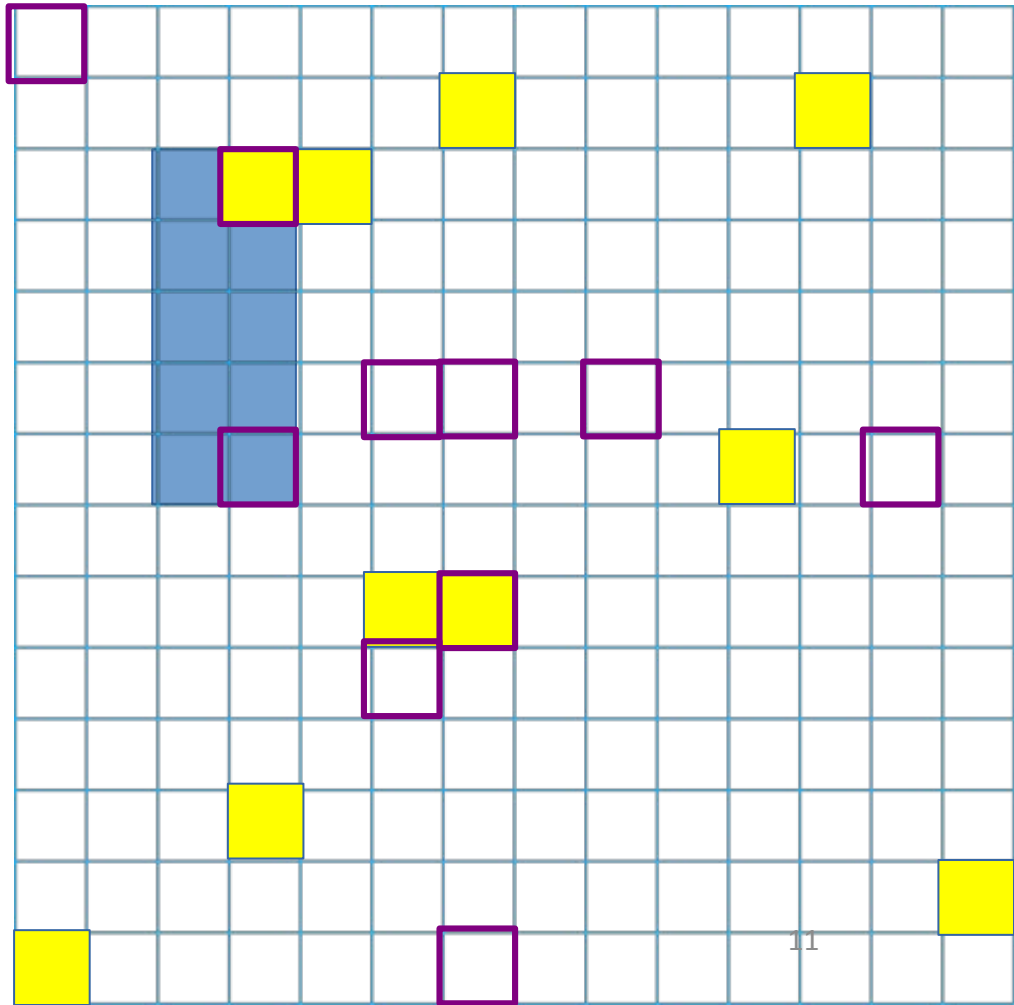
Prioritization example:

Feature

- Some Themes can contain multiple components that are termed Features.

- **Multiple themes:** To minimize negative effects of the compounding impacts of threats and to protect biodiversity

10 pixels species B



How does this all fit together?

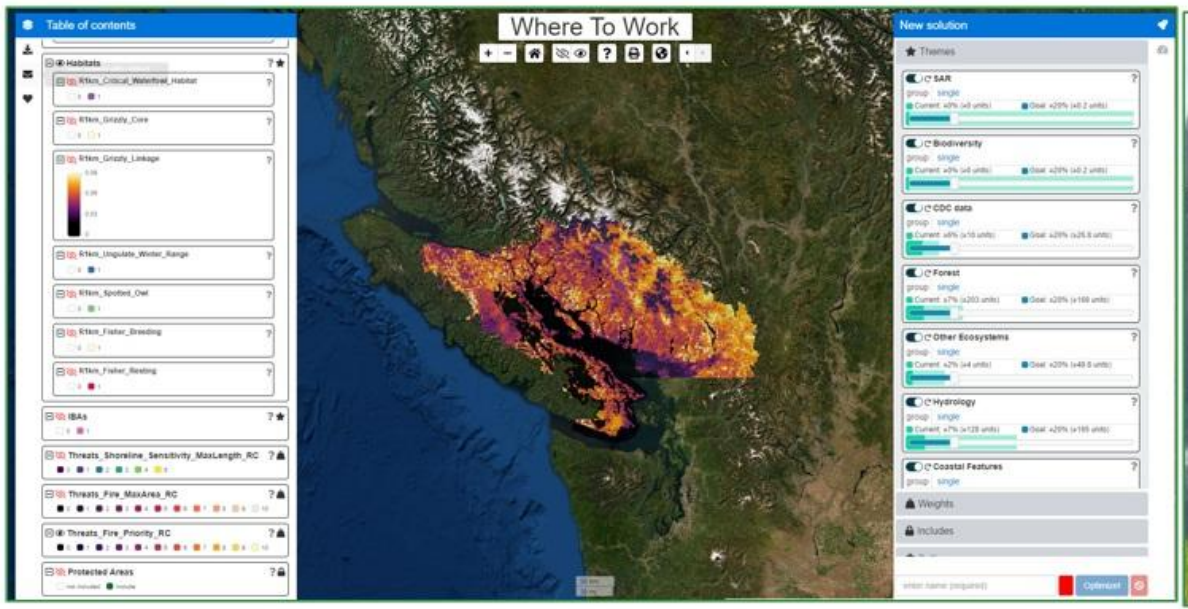
Themes for Goal Setting

Habitat for:

- Species at Risk (SAR)
- Endemics
- General biodiversity

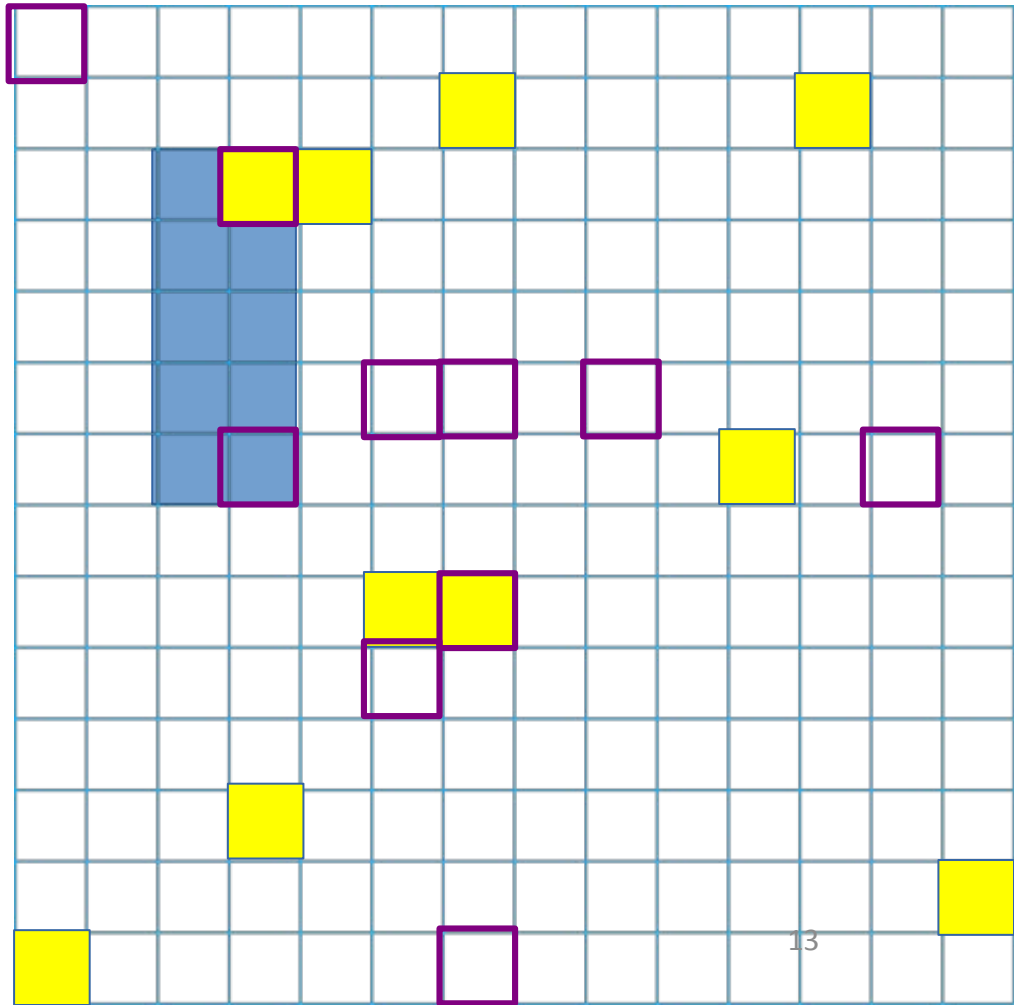
Themes for Weights

Key Biodiversity Areas	Habitat
Under-represented areas	Carbon
Climate change resilience	Freshwater
Connectivity	Access
Direct human pressures	



Prioritization example:

Current protected areas protects 10% of species A range and 20% of species B range

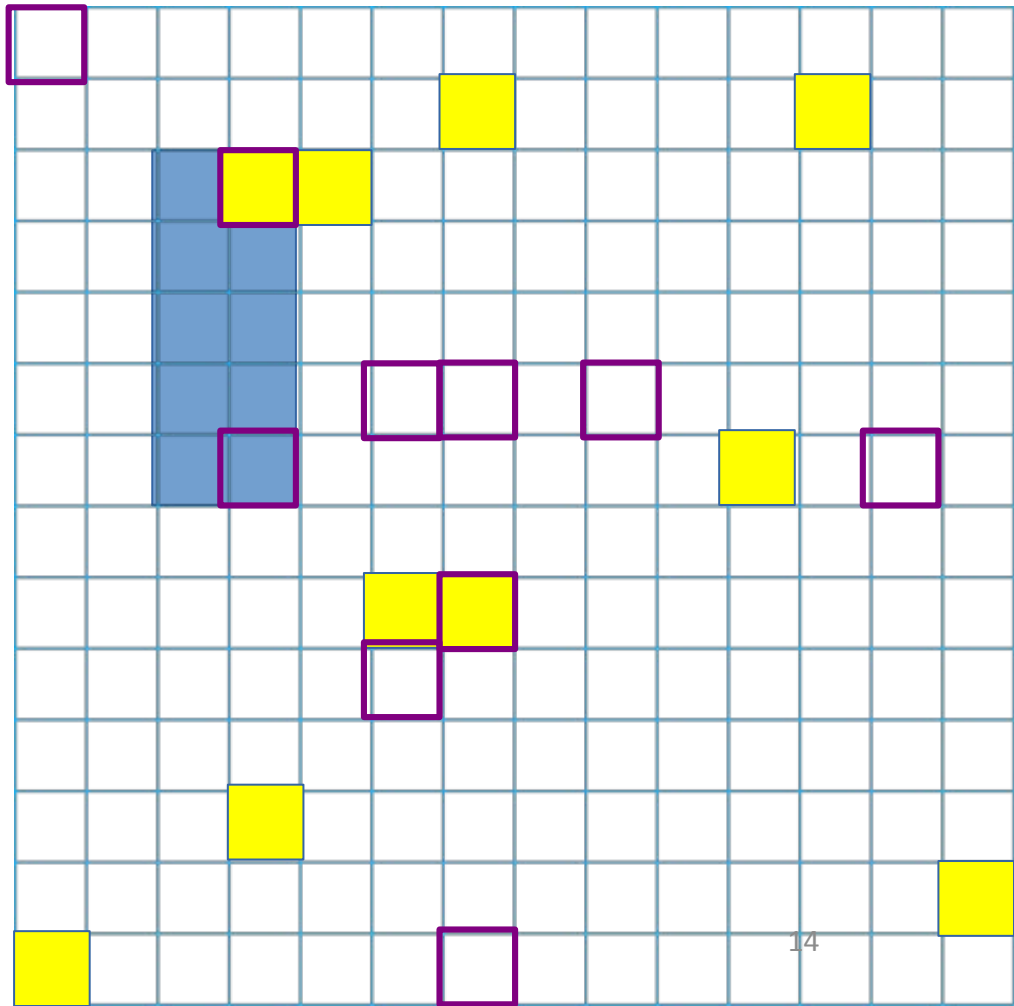


Prioritization example:

Need 30% of range of each species to be protected:

Goals

To help safeguard Themes, you can set goals to ensure a minimum level of coverage by solutions (e.g., setting a goal of 30% ensures that 30% of the overall spatial extent of the theme is covered by the solution).

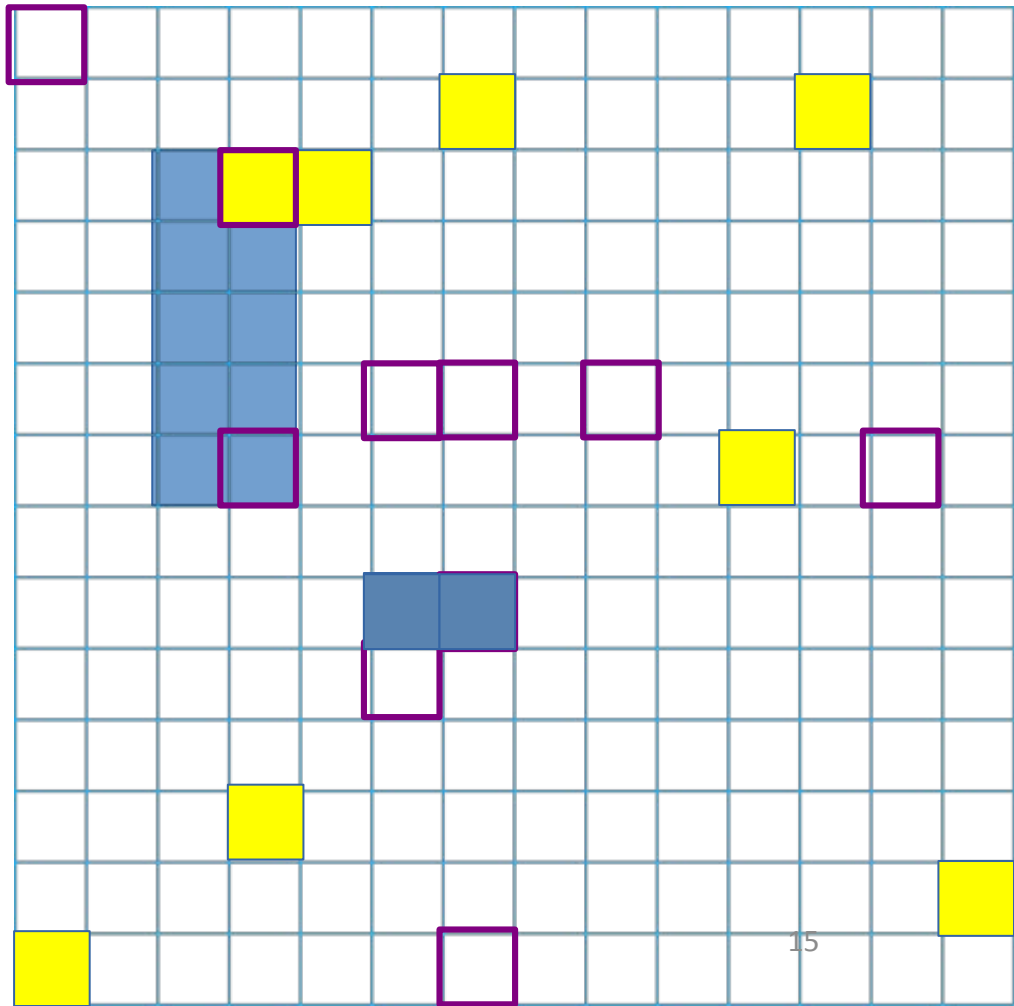


Prioritization example:

30% of range of each species is protected

Reserve

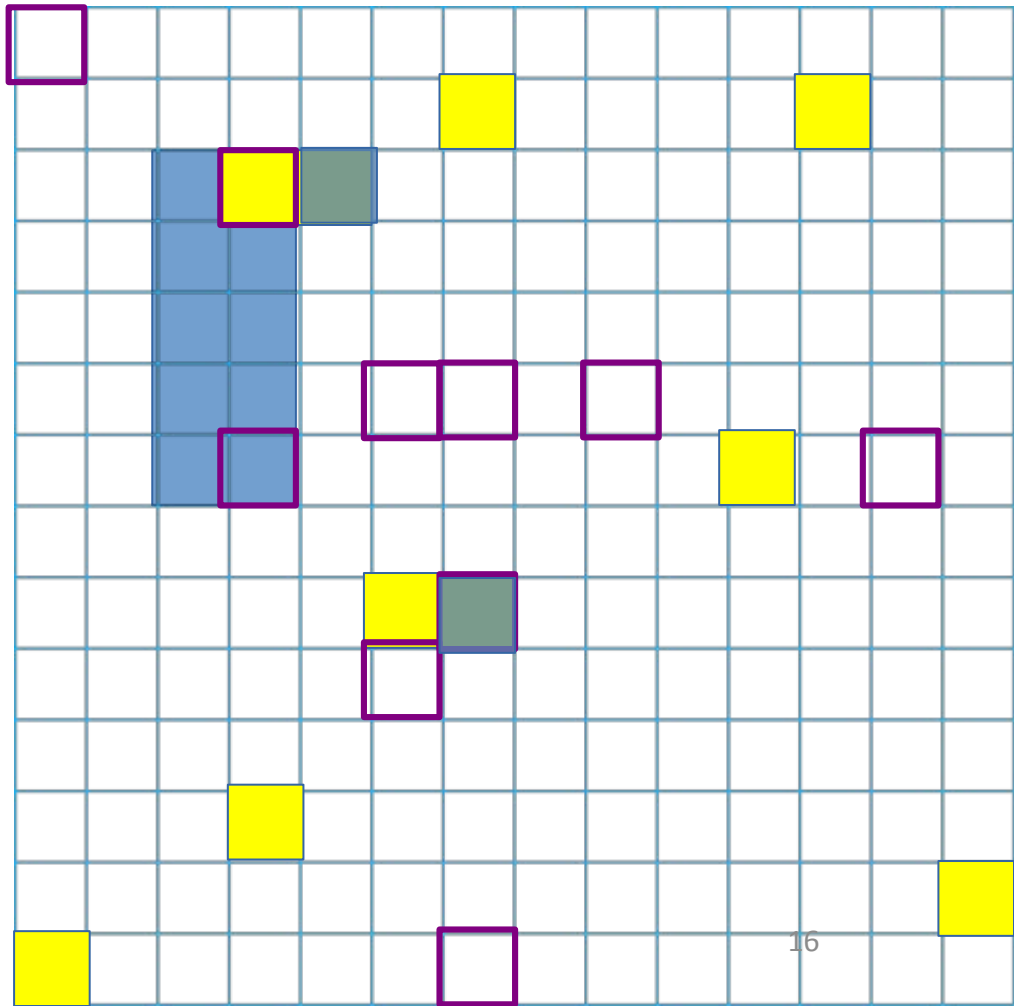
- A contiguous set of planning unit selected for prioritization



Prioritization example:

But also 30% of range of each species can be protected in many other configurations …

Optimization **algorithms** help us with this challenge (e.g simulated annealing, Linear programing, Greedy, etc)



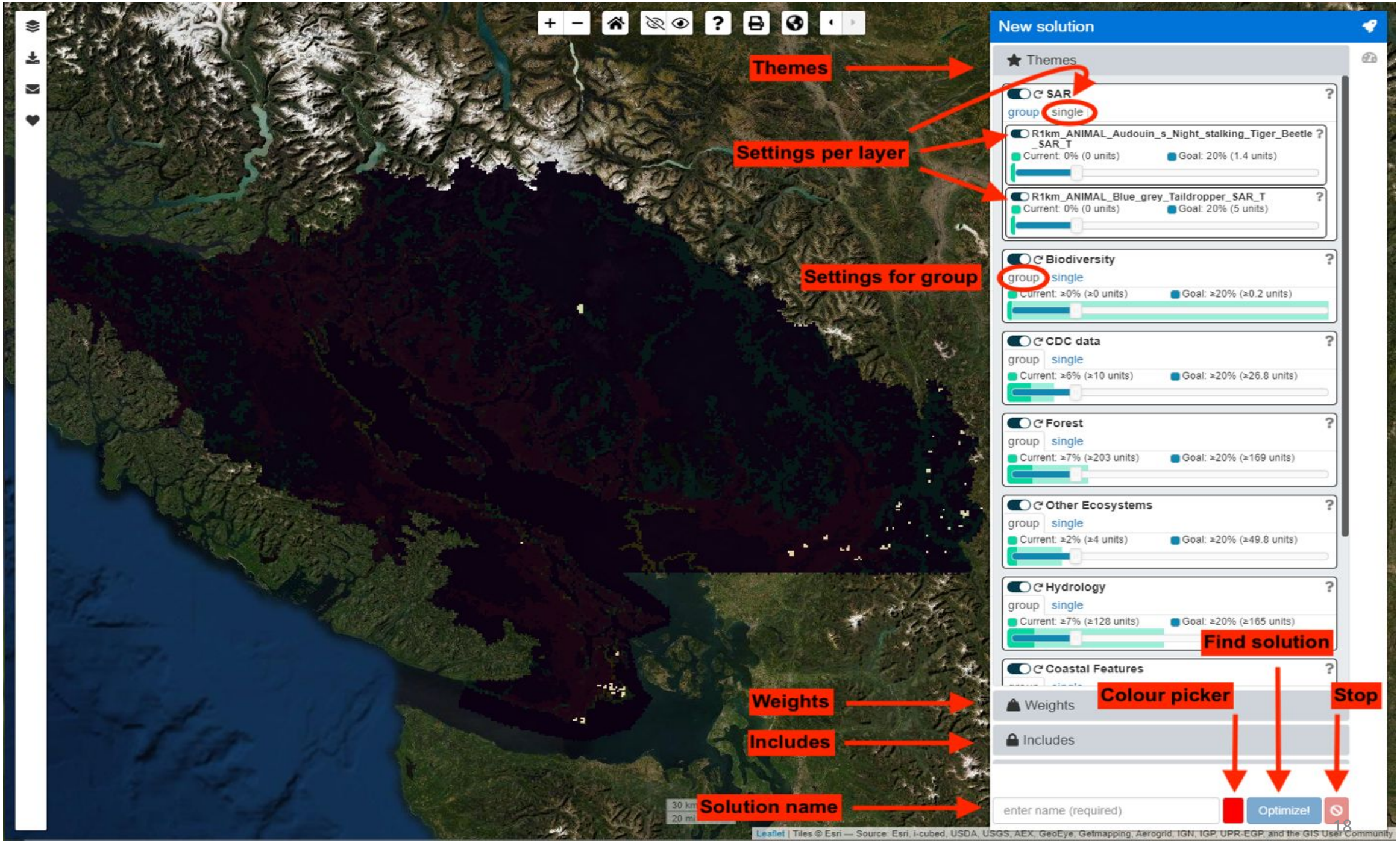
Algorithm

- An optimization technique that aims maximize performance according to certain criteria.

- The algorithms used are guaranteed to find the optimal result (Hanson et al., 2020; Groves and Game, 2016)

 Able to analyze large, complex datasets efficiently, providing near real-time analysis for stakeholder meetings and discussions (Hanson et al., 2020).

Using an optimization algorithm for conservation planning is a complicated task and needs a good knowledge of programing.


New solution
Themes
Themes
SAR
group
single
R1km_ANIMAL_Audouin_s_Night_stalking_Tiger_Beetle _SAR_T
Current: 0% (0 units)
Goal: 20% (1.4 units)
Settings per layer
R1km_ANIMAL_Blue_grey_Taildropper_SAR_T
Current: 0% (0 units)
Goal: 20% (5 units)
Biodiversity
Settings for group
group
single
Current: ≥0% (≥0 units)
Goal: ≥20% (≥0.2 units)
CDC data
group
single
Current: ≥6% (≥10 units)
Goal: ≥20% (≥26.8 units)
Forest
group
single
Current: ≥7% (≥203 units)
Goal: ≥20% (≥169 units)
Other Ecosystems
group
single
Current: ≥2% (≥4 units)
Goal: ≥20% (≥49.8 units)
Hydrology
group
single
Current: ≥7% (≥128 units)
Goal: ≥20% (≥165 units)
Find solution
Coastal Features
Weights
Colour picker
Stop
Includes
Weights
Includes
Solution name
enter name (required)
Optimize!
Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community

Features/Metrics included in our case study

- **Species at Risk (SAR) and Endemics**

Amphibians, Birds, Mammals, Reptiles, Bumble bees (42 species), Butterflies, Boreal avian birds, etc.

Species at Risk (SAR) and Endemics and Representation datasets can be defined into two types of data: range maps or occurrence data.

Included into the prioritization tool depending on specific goals.

An updated Protected Areas Network dataset be made available for Tool 1 to calculate the current percentage of a species' range that is protected.

- **Ecoregions**

For Species at Risk and Endemics

Specifically, we recommend the tool automatically calculate the level of representation of each ecoregion within the Protected Areas Network.

The user would then be aware of current nation-wide representation levels and can direct their focus to under-represented ecoregions.

- **Key Biodiversity Areas (KBAs)**

We recommend including them into the prioritization tool as a weight that will favour places with KBAs, if all other considerations are equal.

- **Connectivity**

Incorporating national structural **connectivity**

To help create a more resilient landscape across Canada

Incorporating this data as a weight that will favour maximizing connectivity.

- **Climate Change metrics**

Incorporating **climate change** metrics as a weight that will favour areas with climatic conditions that support biodiversity, such as analogous future climates.

We recommend the use of climate velocity, climate extremes and climate refugia data at this point.

- **Direct human pressure**

Incorporating **direct human pressures** with the Canada-specific human footprint dataset produced by University of Northern British Columbia.

We recommended incorporating this feature as a weight that will favour minimizing exposure to human pressures.

Some considerations

- What is optimal mathematically may not be optimal from a practicality standpoint , and the results are dependent on the input data.

- Tool is intended for decision support, but is not meant to dictate final decisions.

- The framework for Tool 1 should be thoroughly re-evaluated every five years, to synchronise with NCC’s strategic plan

Availability

- The tool is available as an online web application: https://ncc.carleton.ca

- All code for the *Where to Work* tool is publicly available on GitHub here: https://github.com/NCC-CNC/wheretowork

Thank you for your attention

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