Figure 1: Location map indicating Cambodia and its neighboring countries Laos, Vietnam, and Thailand. Phnom Penh is the capital city of Cambodia.
Biodiversity Description and Threats

- One of the most biodiverse countries in Southeast Asia.
- Biodiversity supports Cambodians ecologically, economically and culturally.
- Has seven biodiversity management regions across the country: South-western coastal ranges and marine waters, Northern plains, North-eastern forest, Kampong Cham, Mekong Delta region, Tonle Sap floodplain, and North-western region.
- It is home to more than 135 species of mammals, 599 species of birds, 173 species of reptiles, 72 species of amphibians, 350 species of moths and butterflies, 955 fresh and marine fish and aquatic species, and more than 4,500 vascular plant species.
Figure 2: The ecoregions of Cambodia.
CURRENT PROTECTED AREAS

Figure 3: These are protected areas in Cambodia. Cambodia had almost 50 protected areas in 2017. These covered more than 7.5 million hectares – the equivalent of 41 percent of the country’s total land. In October 2017 it was reported that the environment ministry was preparing to recommend a further six areas for protection.
Figure 4: This illustrates the species distribution of species 1 which is dominating about 5453.913 km$^2$ of the country. Of this species I would conserve 20%.
CONSERVATION TARGETS PERCENTAGE AND SPECIES PENALTY FACTORS

Figure 5: This illustrates the species distribution of species 1 which is dominating about 9098 km² of the country. I would conserve 35% of this species because it occurs in the position where most of the species in Cambodia occur.
Figure 6: This illustrates the species distribution of species 1 which is dominating about 579.05 km\(^2\) of the country.
CONSERVATION TARGETS PERCENTAGE AND SPECIES PENALTY FACTORS

Conservation target 4

Background
Species Distribution
CONSERVATION TARGETS  PERCENTAGE AND SPECIES PENALTY FACTORS

Conservation target 5

Map of Cambodia with conservation target areas marked in red.
CONSERVATION planning units (ecological)

Figure 9: Ecological planning units, a union between the water basins and the ecoregions in Cambodia.
CONSERVATION planning units (Systematic)

Figure 10: The systematic planning unit (hexagons). Breaks the country down into small planning units.
Figure 11: Showing the tenure which is the protected areas and roads and rails combined.
Marxan uses planning unit as building blocks of a conservation plan. A few maps are needed for marxan and these are the tenure and the tenure pass map. These maps divide the country into small manageable pieces which can be separated from one another.

A conservation plan should follow the CARE (Connected Adequate Representative and Efficient) which is the fundamental principle, which protects biodiversity and the livelihoods of people who depend on it.

Marxan then builds a network beginning with the highest value to the reserve network and works on finding the minimum set which includes not only species richness but complementarity (efficiency and boundary length).

The penalty occurs when there is a lot of small fragmented isolated populations.

A mathematic concept called stimulated annealing is used to find the minimum set that achieves the goal at a low cost.
There are two parts done when running Marxan:

- **Part 1**: The species that are going to be conserved are placed in one group as they will be used for both parts of Marxan.
- The hexagon (systematic planning unit) and the species are uploaded into Marxan.
- They are loaded at a specific penalty (usually start with 10).
- The tenure map is inserted as a passes map.
- Marxan is adjusted to 0.95
- The run mode that is used in this part is the heuristic. Run Marxan

- **Part 2**: The same process is followed however the tenure pass file is used.
- The boundary length is adjusted to two and repeat runs are 1000.
- The heuristic mode is changed to “apply simulated annealing followed by iterative improvement.
- The threshold is changed to 1200, penalty factor A: 9 and penalty factor B: 2
- Run Marxan again.
Systematic CONSERVATION planning
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