• Cambodia is located in Asia and covers about 176,515 square kilometers of land and 4,520 square kilometers of water. This thus makes Cambodia the 90th largest nation in the world covering a total area of 181,035 square kilometers. [1]

• The Capital city of Cambodia is Phnom Penh

Figure 1: Location map of Cambodia in relation to the rest of the world
BIODIVERSITY DESCRIPTION

• Cambodia holds some of the most treasured biodiversity in South East Asia.
• ‘Its forests still hold (though in decreasing numbers) threatened species such as the Siamese crocodile and Asian elephant that are no longer found in the wild in neighboring countries’. [2]

• More than half of Cambodia is covered with forests.
• The forest are especially dense in the mountains and the southwestern coast.
• Deforestation, and unregulated hunting have caused the wildlife in Cambodia to be quickly depleted.[5]

• Cambodia relies predominantly on its rich biodiversity and other natural resources for its socio-economic development and for most people’s food, livelihoods and well-being.
• In the past decades, high population growth and the increasing economic demands of this growing population have often led to the conversion of natural forests to agriculture, to land degradation and pollution caused by unsustainable agriculture and industries.
• These pressures on biodiversity and its associated ecosystem services are often worsened by the impact of climate change and more frequent natural disasters. [4]
THREATS TO BIODIVERSITY IN CAMBODIA

The major threats for biodiversity in Cambodia are:

1. Land conversion/deforestation
2. Dams, roads and infrastructure including coastal development
3. Sand dredging in waterways
4. Overfishing and illegal fishing techniques
5. Illegal harvest of forest products

Figure 2: Deforestation [3]
CURRENT PROTECTED AREAS

Figure 3: Map displaying the current Protected Areas Network of Cambodia

- The first protected area in Cambodia was Angkor Archaeological Park, declared in 1925, one of the first in south-east Asia.

- There are four extant categories of protected area: national park, wildlife sanctuary, protected landscape and multiple use area. [6]
## Conservation Targets

### Percentage and Species Penalty Factors

<table>
<thead>
<tr>
<th>Conservation Feature</th>
<th>Species Penalty Factor</th>
<th>Target %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species X</td>
<td>10</td>
<td>75</td>
</tr>
<tr>
<td>Species Y</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
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<td>26</td>
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<td>Tenasserim south Thailand semi-evergreen rainforests</td>
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<td>32</td>
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<tr>
<td>Tonal sap freshwater swamp forest</td>
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<td>Tonal sap- Mekong Peat swamp forest</td>
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<td>Southern annamites montane rainforests</td>
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<td>Southeastern indochina dry evergreen forests</td>
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<td>20</td>
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<tr>
<td>Indochina mangroves</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>

- 10 conservation features chosen
- 2 Species and 8 Ecoregions
CONSERVATION TARGETS PERCENTAGE AND SPECIES PENALTY FACTORS

Figure 4: Species distribution map of Species X in Cambodia

Figure 5: Species distribution map of Species Y in Cambodia
CONSERVATION TARGETS PERCENTAGE AND SPECIES PENALTY FACTORS

Figure 6: Map showing the 8 Ecoregions found in Cambodia

- 8 Eco Regions are found in Cambodia and are all included as conservation features to construct this conservation plan.
CONSERVATION planning units (ecological)

Ecological planning units focus on elevation, catchments as well as watersheds and this resulted in 363 planning units,

Figure 7: Map showing the Ecological planning units generated for Cambodia
CONSERVATION planning units (Systematic)

- Systematic planning units are the building blocks of conservation plans and divide the country into equal units and in this case hexagons were used for management. This resulted in 587 planning units.

Figure 8: Map showing the Ecological planning units generated for Cambodia
CONSERVATION PLANNING TENURE EVALUATING PROTECTED AREAS

Figure 9: Tenure map assessing the efficiency of the Protected area network of Cambodia
Figure 10: Areas that can be added to the Protected areas of Cambodia
SYSTEMATIC CONSERVATION PLANNING  EXPLAINING MARXAN

Marxan

New conservation plans

Minimum Cost

Meets user-defined targets

Costs defined in terms of land value, resource harvest, cultural value etc.

Figure 11: Flow Diagrams depicting the core concepts of Marxan
SYSTEMATIC CONSERVATION PLANNING EXPLAINING MARXAN

INPUT AND OUTPUT:

• PLANNING UNIT LAYER: HEXAGONS
• ADD RASTER GROUP OF CONSERVATION TARGETS
• SPECIFY PERCENTAGE TARGET
• PENALTY FACTOR FOR ALL = 10
• USE AUTOFILL SPEC.TYPE
• PLANNING UNIT LAYER = ENABLED
• BOUNDRY LENGTH = ENABLED
• OUTPUT: NEW CONSERVATION PLAN

PARAMETERS:

• SET BOUNDRY LENGTH MODIFIER TO 2
• SET REPEAT RUNS TO 1000
• SET SPECIES MISSING IF PROPORTION OF TARGET IS LOWER THAN 0.95
• SET RUN MODE TO: ANNEALING FOLLOWED BY ITERATIVE IMPROVEMENT
• DID NOT DO COVER COST SURFACE ANALYSIS
Systematic CONSERVATION planning

Figure 12: Maps of possible Marxan output results

- Map of new protected areas generated by Marxan according to the specific targets that were set.
In a Conservation plan produced previously for Germany Marxan produced two maps of protected areas using current climate data as well as future climate data.

These results show that for current climate data the new protected areas meet 20 out of the 20 targets whilst the current protected areas only meet 6 of the targets.

Future climate data shows that the new protected areas would meet 20 out of the 20 targets while the current protected areas only meet 7 targets out of the 20.

Figure 13: Maps of possible Marxan output results
SOURCES OF DATA, ATTRIBUTION AND ACKNOWLEDGEMENTS

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