



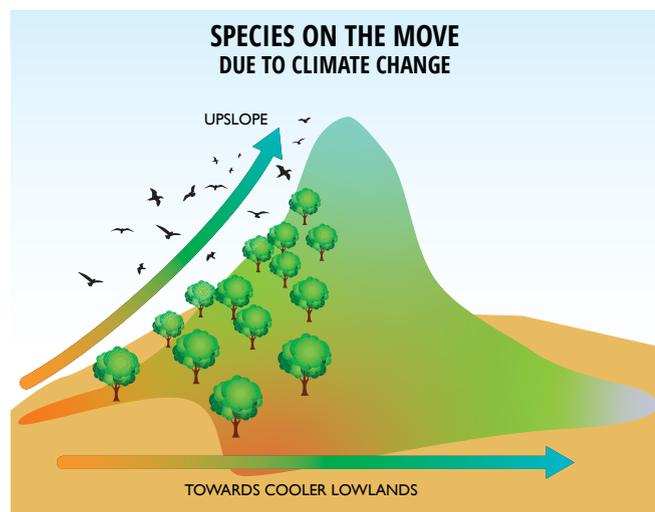
# SIERRA LEONE

Planning for Climate Change: **SPECIES ON THE MOVE**



## WHAT IS AT STAKE

Species are on the move with climate change. Our conservation efforts need to keep pace. Representing all species and all ecosystems in conservation is challenging with moving species. Meeting national development goals and international shared goals depends on early effective planning for species on the move.



## WHAT IS HAPPENING?

Species are moving in response to climate change. Every species has its own unique climatic tolerance, so as temperature and precipitation change, plants and animals move to track suitable climate.

Species are moving upslope in mountains to cooler areas to escape warming. In the lowlands, species have to move longer distances to find cooler landscapes,

This process happens over decades, across many generations for plants and animals, but it is already happening. Nature is being rearranged by climate change in this process will accelerate as climate change intensifies.

Our ability to meet Sustainable Development Goals, combat climate change and conserve nature are all affected by species on the move.

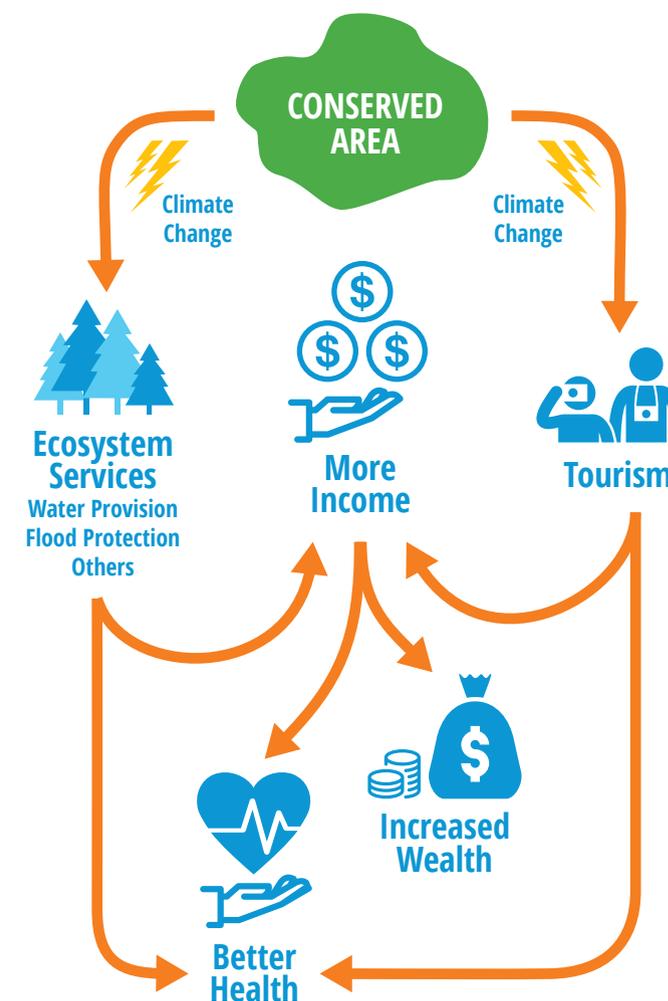
## HOW CAN WE RESPOND?

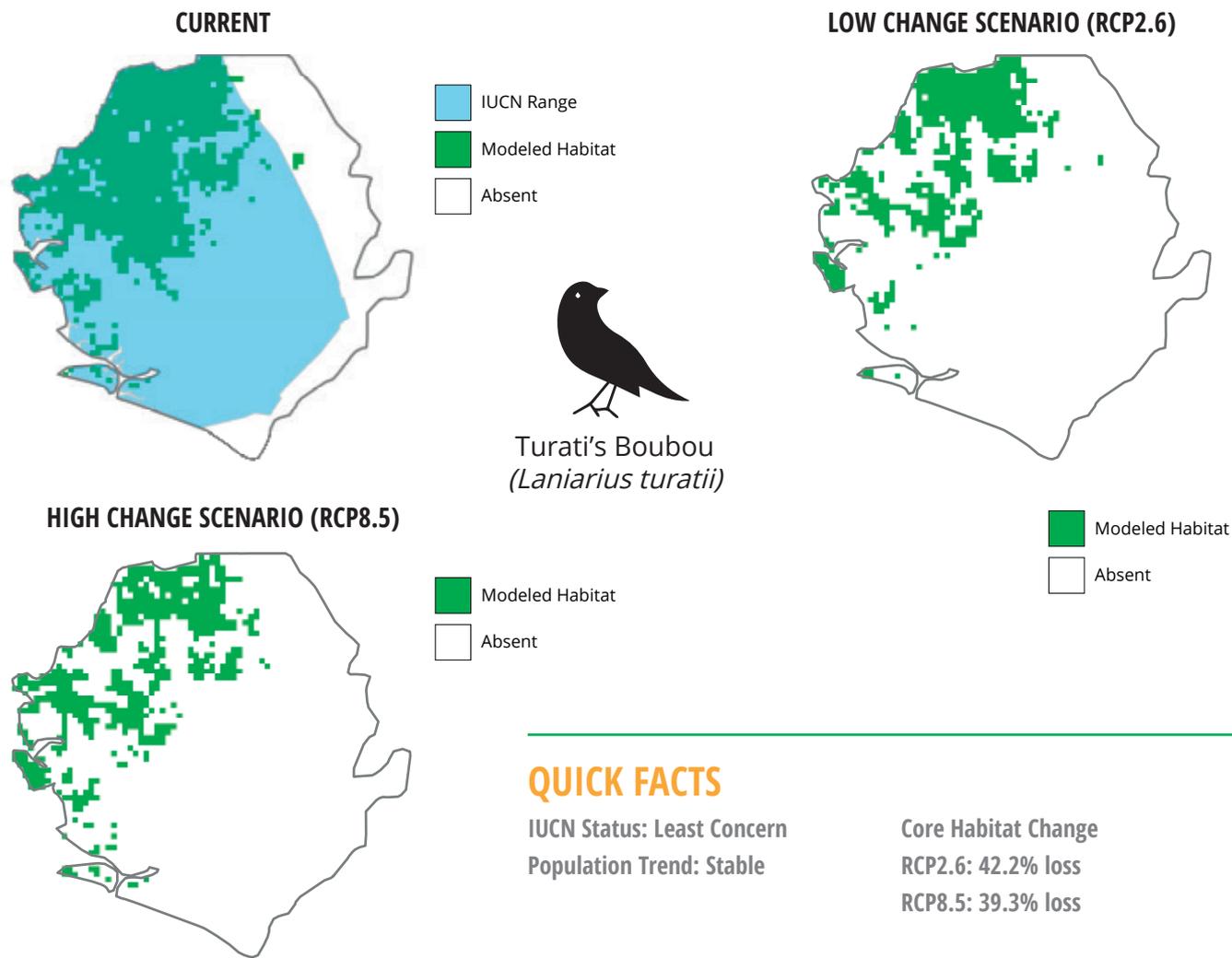
To meet Sustainable Development Goals (SDG), combat climate change and conserve nature we need to plan for species on the move.

SDGs that depend on nature, such as access to fresh water and income from tourism, have to be able to adapt to changing natural conditions in order to deliver benefits to society. Representing all species and ecosystems in conservation areas requires that we understand and plan for species on the move. These core conservation areas provide stability and resilience in natural systems that help maintain carbon stocks and natural vegetation for fighting climate change.

To plan for these changes, we need to understand how fast climate will change in different parts of the country, how species will respond to these changes, including their sensitivity to change, and we need to understand how moving species will rearrange ecosystems.

This report emphasizes the steps needed to conserve nature when species are on the move. When we conserve high priority areas for species and ecosystems on the move, we are maintaining core areas critical for meeting SDGs and conserving biodiversity.





Icon created by Bailey Thompson from the Noun Project

## SPECIES ON THE MOVE

Species are on the move, responding to climate change, all around the world (Pecl et al. 2017). Thousands of species have already moved and millions will be moving in the near future.

Under high climate change scenarios many species will move long distances, while under low climate change

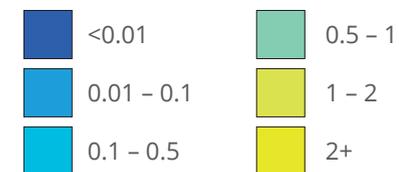
scenarios movements are over shorter distances. Movements in mountains are generally over shorter distances than movements in lowlands.

How far species move depends both on how fast climate changes and on the sensitivity of species to climate change.

## WHERE AND HOW FAST WILL CLIMATE BE CHANGING?

Map at right shows the velocity of temperature change under a high change climate scenario measured in kilometers per year. Areas in yellow are comparatively higher velocity – meaning that a species need to move faster to keep pace with the change in temperature. Areas in blue are lower velocity—so a species does not need to move as quickly to keep pace with suitable climates.

### Velocity (km/yr)



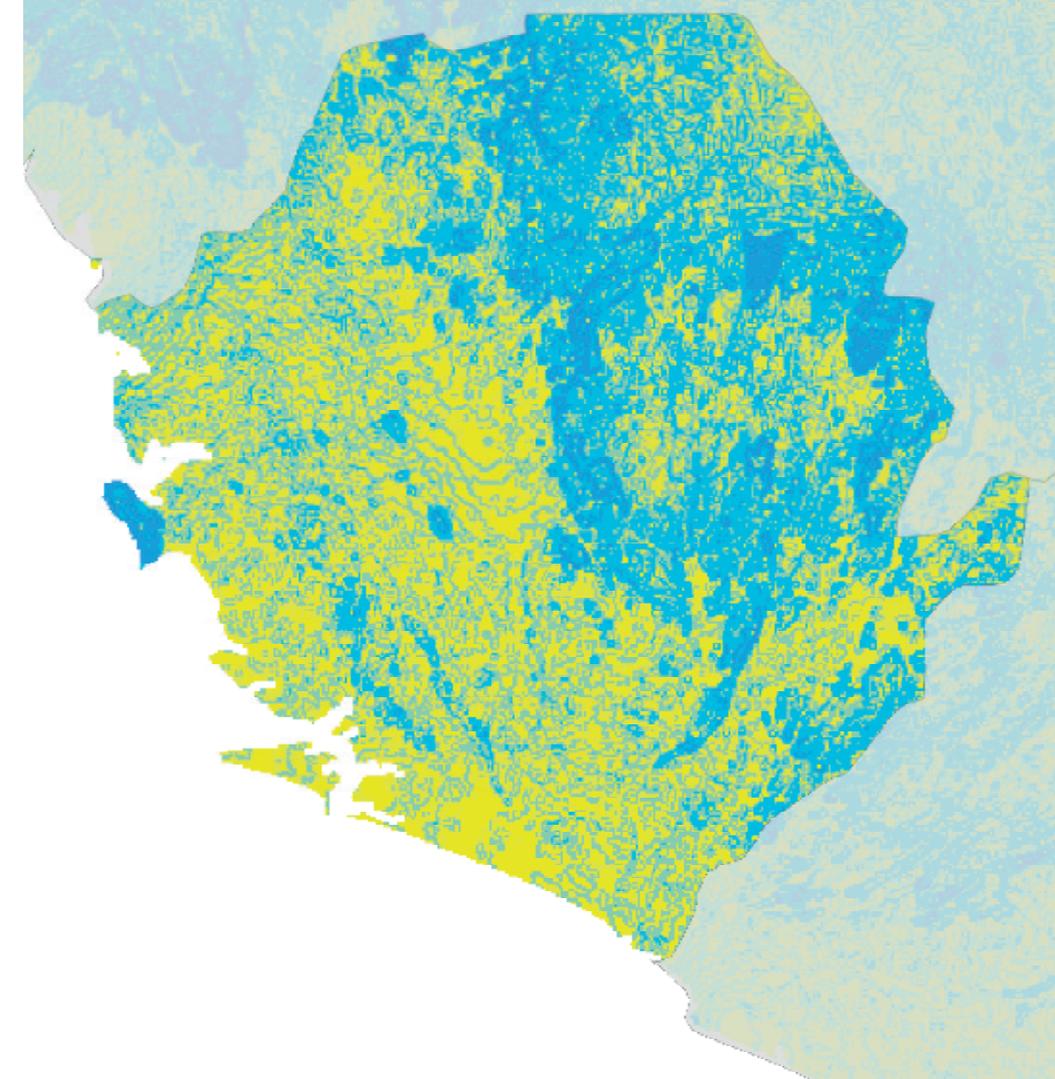
## SPEED OF CHANGE

The speed of climate change, also known as velocity of climate change is generally higher in the lowlands and lower in mountains. This is because mountain species can move shorter distances upslope to find cooler climates, while lowland species may have to move long distances to find cooler climates.

As an example, an antelope in the lowlands that is adapted to moderate temperatures and semi arid

conditions, may need to move up into mountain slopes if lowland conditions become hotter and drier.

Understanding velocity of climate change isn't the only key to managing for climate change. We must also understand how sensitive species are to temperature change. But velocity of climate change allows us to understand areas in which species on the move may be more or less vulnerable to climate change.





## PRIORITIES FOR CONSERVING SPECIES ON THE MOVE

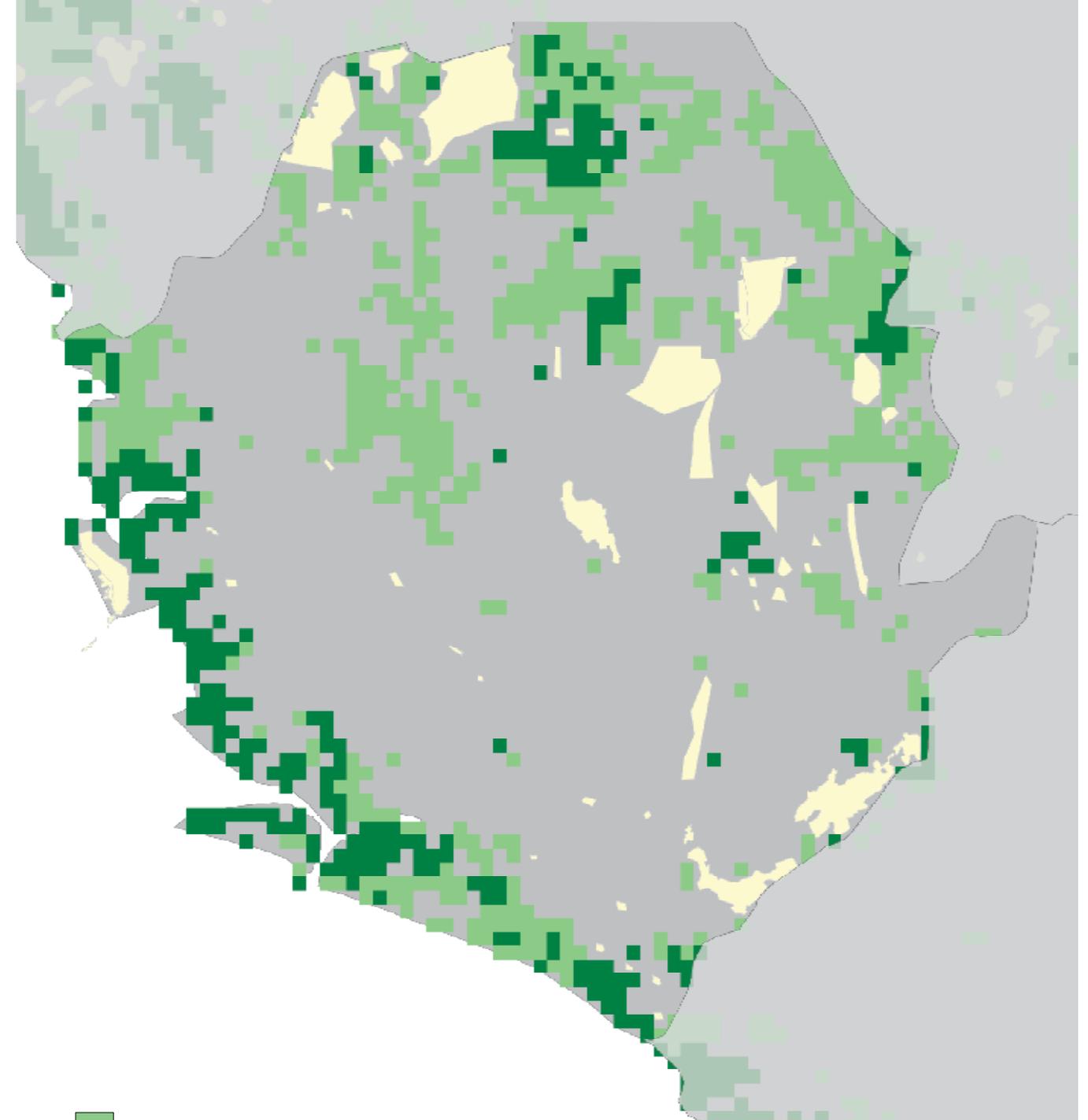
One of the most important goals for conservation areas is to represent all species. This helps ensure that no species extinctions occur. With species on the move due to climate change it is then important to represent all species both where they are now and where they will be in the future.

### AREA PRIORITIES

The entire West Coast of Sierra Leone contains very high priority areas for representing all species in the country. Establishing a protected area on the isthmus of Bonthe will be significant for species as they track changing climates. Opportunities to establish connectivity from the Western Area non-hunting reserve to the Bonthe district will also provide important habitat for species on the move. The area east of Outamba National Park will also help species move into their new ranges.

### SPECIES PRIORITIES

Strategic planning for conserved areas can ensure more complete representation of all species under climate change (Hannah et al. 2005). Map at right shows the highest priority areas to add to the existing network of conserved lands to maximize the representation of species current and modeled future ranges. This prioritization for Sierra Leone uses a 2070 high change climate scenario. The Zonation conservation planning software (Moilanen et al. 2007) was used to determine priorities based on present and future modeled species ranges for over 3,000 plant and animal species.



-  High Priority
-  Highest Priority
-  Protected Areas



## HABITAT CHANGES

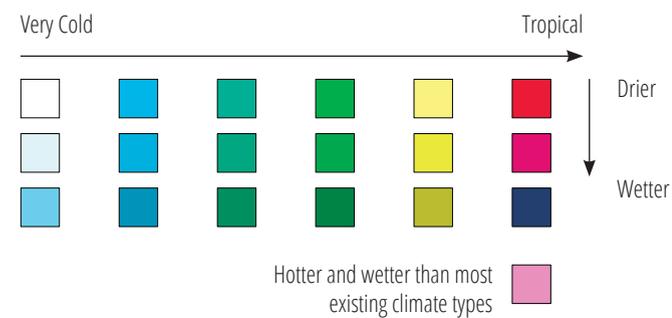
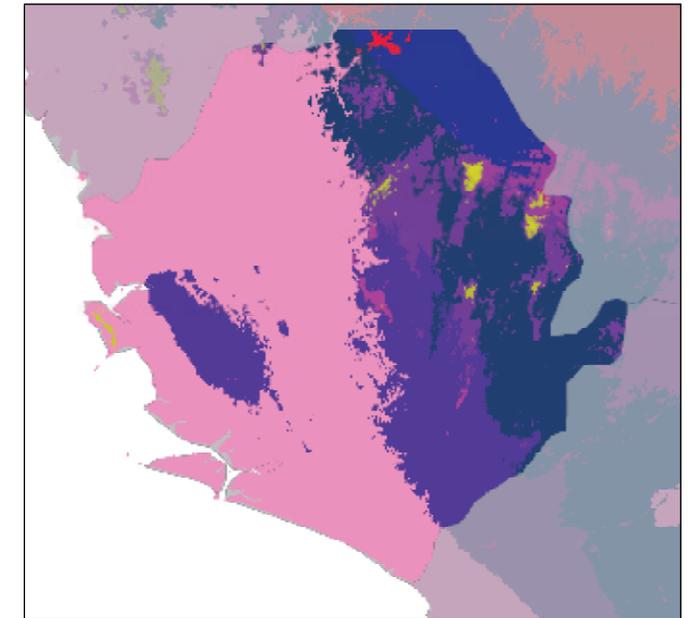
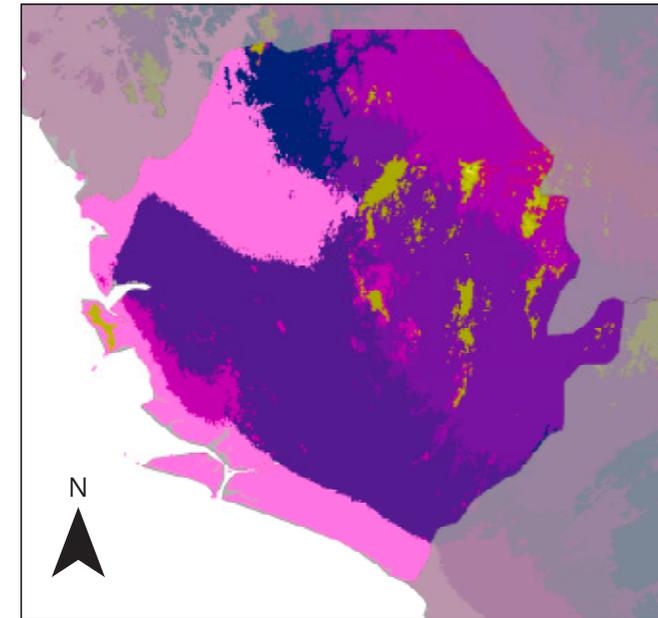
Habitats, or ecosystems, are comprised of groups of species that will respond differently to climate change. Species on the move each respond to climate change according to their unique temperature and precipitation tolerances. As species move differently from one another, some new ecosystems will appear while some existing ecosystems may reduce in size.

### REPRESENTING ALL HABITATS

In conservation planning, a major principle is to maintain representative examples of all habitats. This helps reduce extinctions and improves our understanding of how species relate to one another in specific environments. When ecosystems shift due to climate change, we need to plan to conserve both their present and future locations.

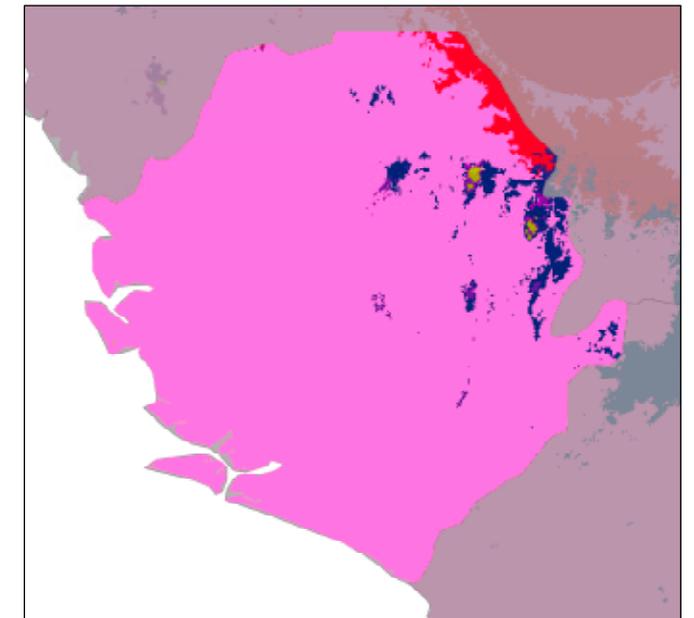
### HABITAT PRIORITIES

It is important to represent isolated and endangered ecosystems. In Sierra Leone, ecosystems most likely to become isolated are montane regions in the east. Elevated regions like the Tonkoli, the Loma Mountains, and the Tingi Hills should be prioritized. Lake Sonfon National Park may also become unique for its continued rainfall while remaining habitats become arid.



### MAPPING HABITAT CHANGES

These three maps show ecosystem climate types and how they may change under a low and high climate change scenarios. Each color depicts a unique climate type representing an ecosystem on the ground. Colors are consistent across scenarios – meaning if an area is currently yellow, that same color yellow will show where that ecosystem will be and whether it is increasing or decreasing in the future scenarios. Climate ecosystem types shown here were produced following the methods of the Global Environmental Stratification (GENS) described in Metzger et al. 2013.



Map at upper left is baseline climate, upper right is the low climate change scenario and lower right is the high climate change scenario. Both future climate projections are the mean of climates of the period 2060-2080 and is the majority agreement across ten global climate models.

# RECOMMENDATIONS

## POLICY

Incorporate models of species and ecosystem change when planning for new conserved areas

Strengthen trans-border conservation efforts to help species moving across international boundaries.

## SPATIAL PLANNING

New conservation should be located in places that are high priorities for current and future representation of species under climate change (p. 7).

Build capacity for species + ecosystem modeling and conservation planning for climate change in national conservation and land-use planning agencies.

## MEDIA

Newspaper, television, radio and internet stories can raise awareness of the need to adapt to climate change, especially to maintain the tourism industry and national wildlife policies.

## FUNDING

Sources of funding for the policy, management and planning to deal with climate change include the Global Environment Facility, which is seeking to ensure conservation investments from erosion in effectiveness due to climate change; from the Green Climate Fund, to help people and wildlife coexist as climate changes, and from foundations and individuals interested in promoting resilience to climate change.



## SIERRA LEONE BY THE NUMBERS

**1.31° C to 3.14° C** projected increase in mean temperature

**67%** of Sierra Leone has greater than 1 km/yr climate velocity

**3855** plant and animal species modeled

**968** existing species will move from Sierra Leone to neighboring countries

**298** new species will enter Sierra Leone from neighboring countries

**15** sustainable development goals depend on the conservation of nature

**9.4%** of Sierra Leone is currently protected area



## THE SPARC PROJECT

Spatial Planning for Area Conservation in Response to Climate Change (SPARC) is the largest effort to predict species responses to climate change ever undertaken. SPARC is coordinated by Conservation International and involves scientists and policy experts from over 20 institutions across the tropics. SPARC was funded by the Global Environment Facility (GEF) to provide information that can help countries plan more effectively for conserved areas considering the effects of climate change.

# RESOURCES

Research supported by Global Environment Facility (GEF)  
Project “Spatial Planning for Area Conservation in Response to  
Climate Change”.

## Project Partners

University of Arizona, University of Leeds, Stellenbosch University,  
Xishuangbanna Tropical Botanical Gardens, CSIRO, Pontificia  
Universidad Católica de Chile

## Resources

Project Information and Results Available at:  
[www.conservation.org/gef/projects/Pages/SPARC.aspx](http://www.conservation.org/gef/projects/Pages/SPARC.aspx)  
[www.resilienceatlas.org](http://www.resilienceatlas.org)  
[www.biendata.org](http://www.biendata.org)  
[www.protectedplanet.net](http://www.protectedplanet.net)  
[www.ecoinformatica.net/GCMcompareR.html](http://www.ecoinformatica.net/GCMcompareR.html)

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