Projected Climate Change and Impact on Bioclimatic Conditions for Terrestrial cosystems, and on BSAP Priority Areas and the Protected Area Network Within Yunnan Province, China

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PROJECT DOCUMENT

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"Biodiversity Strategy and Action Plan For Yunnan Province, the People's Republic of China (PRC) (TA46089)"

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Executive Summary

Overview

This report presents the results of a quantitative geospatial analysis of projected climate change in Yunnan Province, People's Republic of China (PRC) and its potential impacts on terrestrial ecosystems, biodiversity, and conservation efforts. This study is part of the ABD Technical Assistance Project "Biodiversity Strategy and Action Plan For Yunnan Province, the PRC (TA46089)".

The spatial analysis and modeling results presented in this report are based on a statistically derived bioclimatic stratification of Yunnan Province, using gridded 1km resolution interpolated weather station data averaged from 1960-2000 as the baseline for current conditions. This bioclimatic stratification, and it's reconstruction based upon projected future climate parameters, is used to predict and understand the impact of these projected future climate conditions on the spatial distribution of bioclimatic zones and strata, and by extension, ecosystems and biodiversity by the year 2050.

The projected bioclimatic conditions for the year 2050 are based upon a downscaled (1km resolution) multi-model ensemble (n = 63) of Coupled Model Inter-comparison Project (CIMP-5) Earth System Models (ESM). All four of the IPCC AR5 future Resource Conservation Pathways (RCP), i.e. GHG emission scenarios, have been modeled, analyzed, and are presented in the various tables and figures, in order to give the range of projected climate parameters and impacts.

Results of this geospatial analysis of climate change impacts are presented for the whole of Yunnan Province, for 15 of the 18 Priority Areas listed in the Yunnan Province Biodiversity Strategy Action Plan (BSAP), and for the protected area system of Yunnan. This analysis is intended to provide a basis for understanding the potential impacts of climate change on terrestrial ecosystems and biodiversity conservation across Yunnan, and provide a detailed overview for each BSAP Priority Area. The results are given in a working report format, with much of the data presented as tables or maps, with more detailed results for each of the Priority Areas, and the Protected Area analysis given in the Appendices.

Summary of Results

Overall, the results of this analysis show a quick and drastic change in the spatial distribution of bioclimatic conditions throughout Yunnan Province, and predict significant and increasing biophysical and biological perturbance for species and ecosystems in the near- to medium-term future under all scenarios.

By the year 2050, rapid and significant changes in bioclimatic conditions can be expected across all bioclimatic zones, ecosystems, and within all the BASP Priority Areas and Protected Area within Yunnan Province. By the most conservative estimate, by 2070, and as early as 2049, much of Yunnan will be experiencing novel and unprecedented climatic conditions.

The magnitude of predicted change indicated by our analysis points to profound impacts on terrestrial ecosystems, biodiversity, and ecosystem services across Yunnan Province by 2050 as a result of warming and climate disruption, and the shifting of bioclimatic conditions spatially, particularly within mountainous terrain. This change will impact upon the conservation effectiveness of many protected areas and other biodiversity conservation efforts within Yunnan Province, as ecological conditions within these areas may change beyond limits conducive for the species currently found there, or allow for newly invasive and/or competitive species to expand their niche.

Given the spatial isolation of suitable habitat for many rare, threatened, and endemic species found in Yunnan, the results of this analysis forewarn of a prolonged period of climate perturbation, ecological disruption and climatically-induced habitat loss potentially leading to widespread extinctions, without concerted adaption and conservation efforts to mitigate habitat loss.

The major conclusion to be drawn from this report is the over-riding necessity to recognize the now central role of a rapidly changing climate across Yunnan Province, and the need to incorporate and plan for adaptation within conservation planning, efforts and policy. Below we list some of the major findings of this report:

Major Findings:

Yunnan:

- The climate is likely to accelerate current rapid warming trends, on average becoming generally hotter across all of Yunnan under all RCP emission scenarios. Mean annual temperature averaged across Yunnan is predicted to increase from 1.6° to 2.5°C, by 2050.

- Yunnan Province appears to be one of the faster warming regions within the PRC and the greater East Asian region. Within Yunnan Province, the western and northwestern regions seem to have the most rapid projected rates of warming. Of the 16 prefectures within Yunnan Province, Nujiang, Dali, and Baoshan are warming most rapidly.

- The increase in mean annual temperature by 2050 is greatest in the northwestern parts of Yunnan, approaching and exceeding 3.0 °C increase under the RCP 8.5 scenario in the very northwest of Yunnan. Similarly, both minimum and maximum annual temperatures increase.

- Although the models project a slight increase in precipitation across Yunnan, the observed data shows a decreasing trend in precipitation over the last 50 years. In general, there is a high variability in the projections of precipitation among the models in the ensemble, so that the uncertainty of these projections is high, much higher than for the temperature projections, which have a relatively high

agreement among models, i.e. confidence level.

- Nine major bioclimatic zones, and 33 strata, were identified through this study as currently found within Yunnan, ranging from Extremely Hot and Moist at low elevations, to Extremely Cold and Mesic at high elevations.

- There are substantial changes in both the areal extent and the average elevation of the bioclimatic zones, as projected for 2050. There is a large expansion in the extent of the hotter zones: Extremely Hot and Moist, the Hot and Mesic, and the Extremely Hot and Mesic.

- Tropical forests may see an expansion of their range, however, these areas may then also become susceptible to further risk of clearing for plantation development as they become optimal zones for expansion of rubber production. The optimal area for rubber production shift upwards in mean elevation by more than 300m by 2050, expanding to cover 75% of Xishuangbanna.

- There is a drastic a decrease in the Warm Temperate and Mesic zone, and the highest and colder zones, signaling a potential threat for species and ecosystems adapted to these mid- and high-elevation zones. Temperate forests and high levels of biodiversity found in sub-alpine and alpine zones at higher elevations, appear to be at high risk, as several strata associated with these ecotypes diminish substantially.

- All zones exhibit an upward shift in average elevation, ranging from 284 m to 414 m.

BSAP Priority Areas:

- The increase in mean annual temperature by 2050 for the 15 priority areas ranges from 2.0° to 2.2°C for under the RCP 4.5 scenario, and from 2.3° to 2.7°C under RCP 8.5, with priority areas in the northwestern and western regions showing the largest projected increases.

- The Cold-Temperate Coniferous Forest Zones exhibit the most rapid warming, along with the Humid Evergreen Broadleaf Forest and the Warm Temperate Coniferous Forest. All priority areas reach novel and unprecedented bioclimatic conditions by 2070 under scenario RCP 4.5, while under the RCP 8.5 scenario, that date is reached by 2049.

- For all of the BSAP priority areas there are substantial changes in both the areal extent and the average elevation of the bioclimatic zones, as predicted for 2050, with all bioclimatic zones within priority areas exhibiting an upward shift in average elevation, ranging from 195 m to over 400 m., with an average for all zones under RCP 8.5 of 356 m.

- The percent of the total area of each of the priority areas that shifts to another major bioclimatic zone ranges from 23% to over 80 % under the RCP 8.5 scenario. Likewise, the range of percent shift for strata is from 83 to 100%.

Protected Area Network:

- There are reported to that by the end of 2012, there were 159 nature reserves with a total area of 28,300 km^2 in Yunnan Province, of which just over 23, 000 km^2 are included in our geospatial analysis, and is comprised of both National Nature Reserves and Provincial Nature Reserves. On a whole, 56% of Protected Area in Yunnan is projected to shift to different bioclimatic zone by the year 2050, and 93% of this total Protected Area will shift to a different bioclimatic stratum (under RCP 8.5).

- The single largest bioclimatic zone comprising this Protected Area is the Warm Temperate and Mesic, followed by the Hot and Mesic.

- There is a very substantial increase in the area of the two warmest bioclimatic zones.

- There is a drastic decrease in the two coldest bioclimatic zones indicating that species found in these colder zones may easily find this set of bioclimatic conditions within Yunnan by 2050.

- The upward shift of the average elevation of these bioclimatic zones (i.e. under RCP 8.5) ranges from 249 m, to over 500 m. The average upward shift for all bioclimatic zones is 379 m within all protected area is.

- There is a reduction of area for the coldest strata, and significant shifting of strata within all zones. The average mean elevation of the bioclimatic strata (within all of the Protected Area in Yunnan) is projected to shift 403 m by 2050 (i.e. under RCP 8.5).

- Eight priority areas where ranked, of which only seven contain Protected Area. More than 13,000 km2 (out of a total of 23,000 km2 for all Yunnan), or roughly more than 55% percent of all the Protected Areas in Yunnan, are found within these seven Priority Areas.

- Yunling Mountain and Jinsha Valley have the highest diversity of habitats within Protected Area, i.e., seven zones, although several are small in area, and new zones appears by 2050. The average upwards shift for the mean elevation of the bioclimatic zones within protected area within BASP priority areas is 304 m.

Recommended Climate Change Response Strategies for Biodiversity Conservation:

Based on an improved knowledge base of projected changes, impacts, and responses, and science- and evidence-based decision-making and planning, a number of actions (and tools) are available to incorporate climate change and adaption into conservation at various scales and levels. Mawdsley et al (2009) identified 16 general adaptation strategies that relate directly to the conservation of biological diversity. These strategies can be grouped into four broad categories:

- **Land And Water Protection And Management;**
- **Direct Species Management;**
- **Monitoring And Planning;**
- **Law And Policy.**

Below is a brief enumeration of these broad strategies and actions for addressing climate change for effective biodiversity conservation efforts, planning and policy:

Strategies Related to Land and Water Protection and Management

1. Increase Extent of Protected Areas
2. Improve Representation and Replication within Protected-Area Networks
3. Improve Management and Restoration of Existing Protected Areas to Facilitate Resilience
4. Design New Natural Areas and Restoration Sites to Maximize Resilience
5. Protect Movement Corridors, Stepping Stones, and Refugia
6. Manage and Restore Ecosystem Function Rather than Focusing on Specific Components (Species or Assemblages)
7. Improve the Matrix by Increasing Landscape Permeability to Species Movement

Strategies Related to Direct Species Management

8. Focus Conservation Resources on Species that Might Become Extinct
9. Translocate Species at Risk of Extinction
10. Establish Captive Populations of Species that Would Otherwise Go Extinct
11. Reduce Pressures on Species from Sources Other than Climate Change

Strategies Related to Monitoring and Planning

12. Evaluate and Enhance Monitoring Programs for Wildlife and Ecosystems
13. Incorporate Predicted Climate-Change Impacts into Species and Land-Management Plans, Programs, and Activities
14. Develop Dynamic Landscape Conservation Plans
15. Ensure Wildlife and Biodiversity Needs Are Considered as Part of the Broader Societal Adaptation Process

Strategy Related to Law and Policy

16. Review and Modify Existing Laws, Regulations, and Policies Regarding Wildlife and Natural Resource Management

In developing and planning for conservation, some or all of these strategies and actions must be considered within the specific context of each of the BSAP Priority Areas within Yunnan, and their specific conservation issues and challenges. However, it is recommended that the opportunities for increased connectivity, landscape matrix mosaics and increased permeability, and expansion of protected areas should be explored at an early stage, as these opportunities may be time limited by other ongoing landuse change processes.

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1. Introduction

Yunnan Province in southwestern PRC is both biologically and culturally amongst the richest and most diverse regions in the world (López-Pujol et al., 2006; Yang et al., 2004). It is the source of headwaters and tributaries leading into several major rivers which reach and have impact on the lives of more than 600 million people (Xu 2011a). With an area of 394,000 km^2, and a population of 45.7 million in 2009, Yunnan Province is well recognized for high levels of biological species richness and diversity (Pu et al., 2007), as well as its wide range of ecosystem diversity. Amongst the 30 ecosystems as identified within Yunnan according to the Chinese classification (Guo and Long, 1998), and the 114 forest types found here, are large numbers of endemic, threatened and rare species (WWF, 1996a; 1996b; Yang et al., 2004). Climate change is a key concern for Yunnan Province, as it is throughout the Asian highlands region (Salick et al., 2007; 2009; Xu et al., 2009; Zomer et al., 2013).

Yunnan, as a part of the greater Mekong region, is undergoing a rapid socioeconomic transformation, with much of the rural population still living in relatively poor conditions. Characterized by a highly heterogeneous terrain, fragile environments and increasing climate-induced risks, Yunnan is one of the poorest provinces in the PRC. Global change including land use change and global warming has been and will continue to be among the most important factors impacting on terrestrial ecosystems and biodiversity regionally.

Deforestation, increasing fragmentation of forests, and other landuse changes over the last sixty years (Chapman, 1991; Fox and Vogler, 2005; Z. Li and Fox, 2012), particularly the expansion of agriculture and industrial crops such as rubber and tobacco, has led to significant impacts on biodiversity and ecosystem services throughout Yunnan.. For example, rubber (*Hevea brasiliensis*) is the main industry crop replacing traditional agriculture and forest vegetation in the tropical/sub-tripical regions (Fox and Vogler, 2005; H. Li et al., 2006a; Xu et al., 2005), and is among the major factors driving both deforestation and biodiversity loss (Hu et al., 2007; H. Li et al., 2006b). The implications of this are a decrease in biodiversity (Hu et al., 2007; H. Li et al., 2006b), deterioration of watershed services (Guardiola-Claramonte et al. 2008), and a decline in livelihood options (Xu et al. 2005). Rubber production in Xishuangbanna of southern Yunnan has increased significantly in the last decades, and is continuing to increase, with significant impact on natural systems (H. Li et al., 2008). Zomer et al. (2014) has shown that climate change is likely to exacerbate these trends and the impacts of on-going landuse change on biodiversity.

Climate change is not only likely to substantially exacerbate the impacts of these ongoing biodiversity threats and processes, but also potentially undermines current landuse planning and conservation efforts. The average temperature over Yunnan Province has been increasing since the late 1980s and it has become markedly warmer since the 1990s, with 13 warm winters occurring since 1986 (Cheng and Xie, 2008). After 2000, the increasing trend of rainfall over Yunnan declined, the number

of heat waves and droughts increased, and their frequency of occurrence interval changed from 2- 3 years to 1- 2 years. The drought in 2005 and spring 2006, and during 2009~2011, were respectively the most severe droughts experienced in Yunnan Province in the most recent 20 and 50 years (Qiu 2010). The trend of temperature increase in Yunnan is parallel to the trends for the global, northern hemisphere, and the PRC as a whole, with temperatures in Yunnan changing slightly more than the global average and a little less than the averages for the Northern Hemisphere and the PRC (Lin et al., 2007). The treeline in northwest Yunnan rose by 67 meter in last century (Baker & Moseley 2007); in the 21st century, the altitudinal range of *Abies georgei* forest may decrease by 13-26% (Wong et al. 2010). The elevational distribution of life zones is projected to shift significantly (Xu et al., 2009; Zomer et al, 2014).

In this report, we summarize the expected impacts of climate change within Yunnan Province, as a whole, based upon a geospatial analysis and a multimodel ensemble of the most recent future climate projections across the range of IPCC AR-5 emission scenarios. We then look more specifically at the identified Yunnan Province Biodiversity Strategy Action Plan (BSAP) priority areas, as well as evaluate impacts on the protected area network. A modeling approach based on a statistically derived environmental stratification (Zomer et al, 2013, 2014) is used to predict and understand the nature and magnitude of projected changes in the spatial distribution of bioclimatic conditions within Yunnan Province by the year 2050 (based on a multi-model ensemble approach using an ensemble (n = 63) of downscaled (1 km resolution) CIMP5 Earth System Model projections. Results are presented and articulated (in tablular and map format) for the whole of Yunnan Province, and for 15 of the 18 Priority Areas in the Yunnan Province Biodiversity Strategy Action Plan (BSAP) and the various levels of protected area that make up the protected area system, i.e. including both national and provincial nature reserves . This analysis is intended to provide a basis for understanding the potential impacts of climate change on terrestrial ecosystems, biodiversity conservation, and provide a detailed overview for each of the specific Priority Areas. These results of the analysis of projected climate impacts on the spatial distribution of bioclimatic conditions, with implications for terrestrial ecosystems, are presented here for use and review by the respective various team members of, and to be included in, the ABD Technical Assistance Project “Biodiversity Strategy and Action Plan For Yunnan Province, the PRC (TA46089)”. The results given here in a working report format, with much of the data presented as tables or maps. Summary results for each of the BSAP priority areas are given in Section 5, with more detailed maps and tables provided for each of the Priority areas in the Appendix 1.

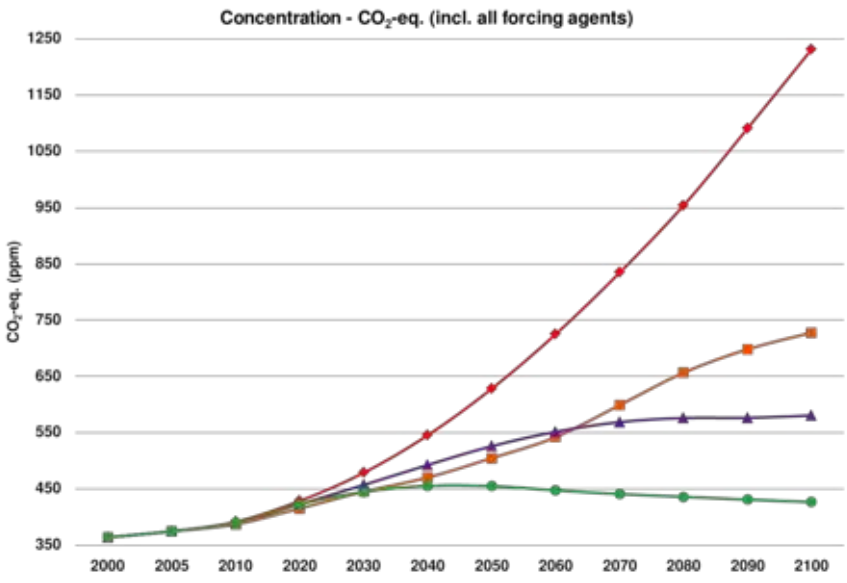
2. Methods Overview:

This report provides an overview of the results from a geospatial analysis of projected climate change in Yunnan Province, PRC. Results have been articulated for the whole of Yunnan, and within the boundaries of 15 priority areas identified within the Biodiversity Strategic Action Plan (BSAP) for Yunnan. The wetland classes (6.1,6.2,6.3) are currently excluded due to their small areal extents and dispersed locations, as the unit of measurement for downscaling does not allow for proper analysis. Although all four of the IPCC AR5 future scenarios (Resource Conservation Pathways – RCP) have been modeled and analyzed, for clarity of presentation, maps sometimes only show results for RCP 4.5 and RCP 8.5 (i.e. not all four of the RCP's), and sometimes for brevity of comparison only RCP 8.5, in keeping with common practice in the literature. All statistics are for all RCP's are given in the summary tables. It is generally agreed that RCP 2.6 (the best case scenario) is unlikely, given current global trends, as reported recently in the IPCC AR5 "Summary for Policy Makers",(IPCC, 2013). In general, comparing RCP 4.5 and 8.5 should provide the full realistic range of future climate projections (Figure 1). RCP 6.0 does not really diverge above RCP 4.5 until after 2060, and before then, i.e. 2050, is relatively similar to RCP 4.5.

a. Projected Changes in Temperature and Precipitation

An analysis, using a multi-model downscaled ensemble (n=63) of CIMP5 Earth System Models (ESM) applied across four representative concentration pathways (RCP), has been used to assess climate change and its impact on temperature and growing conditions by the year 2050 within the 15 selected BSAP Priority Areas. We give the average results of all models within each RCP. A table of all CIMP 5 ESMs used in the analysis is given in Appendix 2.. The RCP's represent the range of approved IPCC AR5 $C0^2$ emission scenarios, with RCP 2.6 representing aggressive mitigation, and RCP 8.5 following a trajectory of "business as usual" (Figure 1). We have used the Worldclim meteorological dataset (Hijmans et al., 2005), which gives climate values based on data averaged from 1960 through 2000, as the current conditions baseline.

Figure 1: IPCC AR5 Representative Concentratin Pathways (emission scenarios) (Source: IPCC, 2013 – WikiCommons).



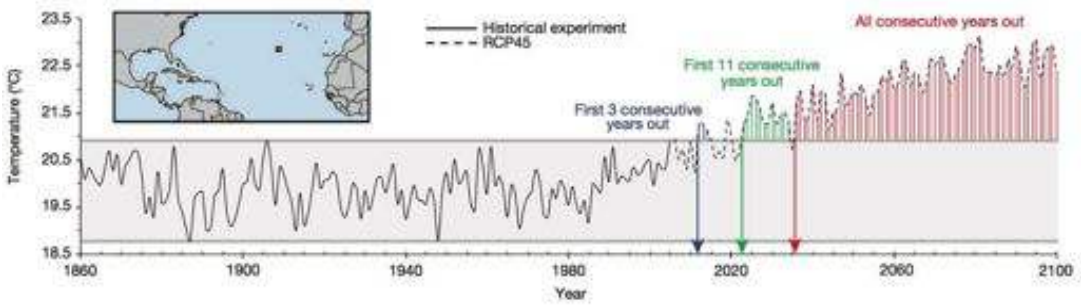
b. Projected Changes in Potential Evapotranspiration and Aridity Index

For each priority area we provide an overview of the expected change in mean annual temperature, mean annual precipitation, mean annual potential evapotranspiration (PET) and the mean annual aridity index (AI). The aridity index (AI) is an integrative measure applicable to assess the moisture (precipitation) available for plant growth, i.e., after evapotranspiration. The higher the value of AI, the more moisture is available. In general, 1.0 represents saturated conditions, i.e., more than enough water, and .65 is approximately a threshold for adequate moisture to support rainfed agriculture under semi-arid conditions. It is based on a ratio of the amount of annual precipitation compared to the PET. The PET, which we have modeled for the entire Yunnan region and each priority area, is a measure of the total potential amount of transpiration (from plants) and evaporation (from soil) that can be expected under existing (or projected) temperature and relative humidity conditions. In short, PET is a measure of the ability of the atmosphere to remove water through ET processes, that is, transpiration by plants, and evaporation from soil and other water sources, such as interception of precipitation by the canopy.. The AI is calculated as the ratio of mean annual precipitation to the mean annual PET. A complete explanation of the methodology used to calculate PET and AI is given in Zomer et al. (2008).

c. Year of Climate Departure

Most ecological and sociological systems can adapt to climate change over time, although this might not be the case for all species. However, the time frame in which climates will reach unprecedented states, that is novel climatic conditions not seen before in that location, may strongly determine the magnitude of disruption in ecosystems and the ability of species to adapt and avoid extinction. We use data provided by Mora et al (2013) to give an indication of the projected timing of climate departure. This index gives an estimate of the year when the climate (i.e., near surface air temperature) exceeds the bounds of historical variability for a particular location, as determined by all consecutive years after that date being outside the bounds of variability over the past 140 years. Although this index gives a date in the future for unprecedented climatic conditions, this does not mean that change is not already occurring. Mora et al., (2013) provide estimates for RCP 4.5 and RCP 8.5, based upon all 39 available CIMP5 models, at a resolution of 100 sq km. When compared spatially, i.e. over the whole of Yunnan, it can give an indication of the relative rate of warming by region and locale. The earlier the date of departure, the more rapid the rate of warming in that locale.

Figure 2: Illustration of the analysis used in determining the year of climate departure (Source: Mora et al., 2013, with permission Nature Publishing Group).



d. Environmental stratification and delineation of bioclimatic zones and strata.

The Global Environmental Stratification classification (GEnS: Metzger et al., 2013), used as a basis for our analysis, is a statistical stratification of the world's land surface into homogeneous bioclimatic strata facilitated by high resolution global climate datasets, representing a considerable advance (Metzger et al., 2013; 2012) over earlier global attempts at bioclimatic or ecosystems mapping (Holdridge, 1947; Thornthwaite, 1948; Peel et al., 2007). Based on a statistical clustering of significant climate variables, the GEnS provides a global stratification that can: a) quantitatively relate the spatial distribution of ecosystems to an identified set of bioclimatic parameters, b) provide a consistent methodology across landscapes and countries that have so far mostly been studied using different protocols, approaches and taxonomies, and c) allow for a statistical modeling of bioclimatic zonal shifts that can be used to estimate the direction and magnitude of impacts on ecosystems due to climatic changes.

The GEnS, based on high resolution geospatial monthly climate datasets averaged from 1960 to 2000 (Hijmans et al., 2005), characterizes recent conditions to stratify the globe into 125 strata, aggregated into 18 zones. This quantitative approach allows for the use of the identified set of statistically significant parameters and the statistical profiles of the various strata to reconstruct the stratification based on projected future conditions (i.e. using the parameter values derived from modeled climate scenarios). The strata continue to represent bioclimatic conditions similar to the original strata (i.e. recent climatic conditions), but may shift in areal extent or location. The change in distribution of the bioclimatic strata is analyzed and used as a surrogate measure to describe the potential projected macro-level impacts of climate change on terrestrial ecosystems (Metzger et al., 2008; Zomer et al., 2013; 2014). When combined with other ecosystem, vegetation, or land use data, these shifts in spatial distribution can be interpreted in terms of projected impacts on ecosystems services, land use, wildlife habitats, risks to endemic or threatened species, or the risks and opportunities associated with future agricultural production. For this study, the zonal nomenclature has been slightly modified to account for conditions as they occur in Yunnan. However, as both strata and zones are labeled by unique alpha-numeric identifiers, the ability to use these for comparative purposes remains.

The geospatial analysis and environmental stratification was performed in ArcGIS 10.2 (ESRI 2013) using the global datasets listed below, along with various national and local secondary datasets and information collected on land use and biodiversity, and a remote sensing based land use change analysis described below, to corroborate and interpret results:

- GEnS: Global Environmental Stratification v. 1 (Metzger et al., 2013)
- WorldClim v. 1.4: Global high-resolution climate surfaces in 1950-2000 (Hijmans et al., 2005)
- CIMP-5: Ensemble of downscaled CIMP5 ESM models (Meehl and Bony, 2011)
- CGIAR-CSI Global Aridity and PET database (Zomer et al., 2008)

- SRTM: CGIAR-CSI SRTM Digital Elevation Model Database v. 4.1 (Jarvis et al., 2008)

e. Modeling of projected future bioclimatic conditions

Metzger et al. (2013) identified a set of significant bioclimatic parameters, based on a statistical screening of the various global climate datasets. Principal Component Analysis (PCA) of the global dataset revealed that 99.9% of the total variation was determined by four variables:

- $T_{mean\ DD > 0}$ is defined as the annual sum of daily mean temperature degrees of days with a mean temperature above 0° C, reflecting latitudinal and altitudinal temperature gradients, and plant growth periods (Hijmans et al. 2005);
- Aridity Index (AI), is defined as the ratio of annual precipitation over annual potential evapotranspiration (PET) and forms an expression of plant available moisture (Zomer et al. 2008);
- Monthly Mean Temperature Seasonality is defined as the standard deviation of the monthly temperature means, and is a measure of temperature seasonality (Hijmans et al. 2005);
- PET Seasonality is defined as the standard deviation of the monthly PET means, and is a measure of seasonality of plant available moisture (Zomer et al. 2008).

These four bioclimatic variables were used as the input to the ISODATA clustering routine in ArcGIS to classify the GEnS environmental strata (Metzger et al. 2013). Projected impacts are modeled by reconstructing the stratification based upon future climate conditions, as modeled by an ensemble of 19 Earth System Models (ESM) provided by the Coupled Model Intercomparison Project – Phase 5 (CIMP5; (Meehl and Bony, 2011)), using the same set of significant bioclimatic variables. The statistical signature profiles of the strata have been reconstructed for Yunnan, based upon a multivariate analysis (maximum likelihood classification) of these four bioclimatic variables. These signature profiles were then used to project the future spatial distribution of the GEnS strata based upon the CIMP5 modeled future climate conditions in 2050.

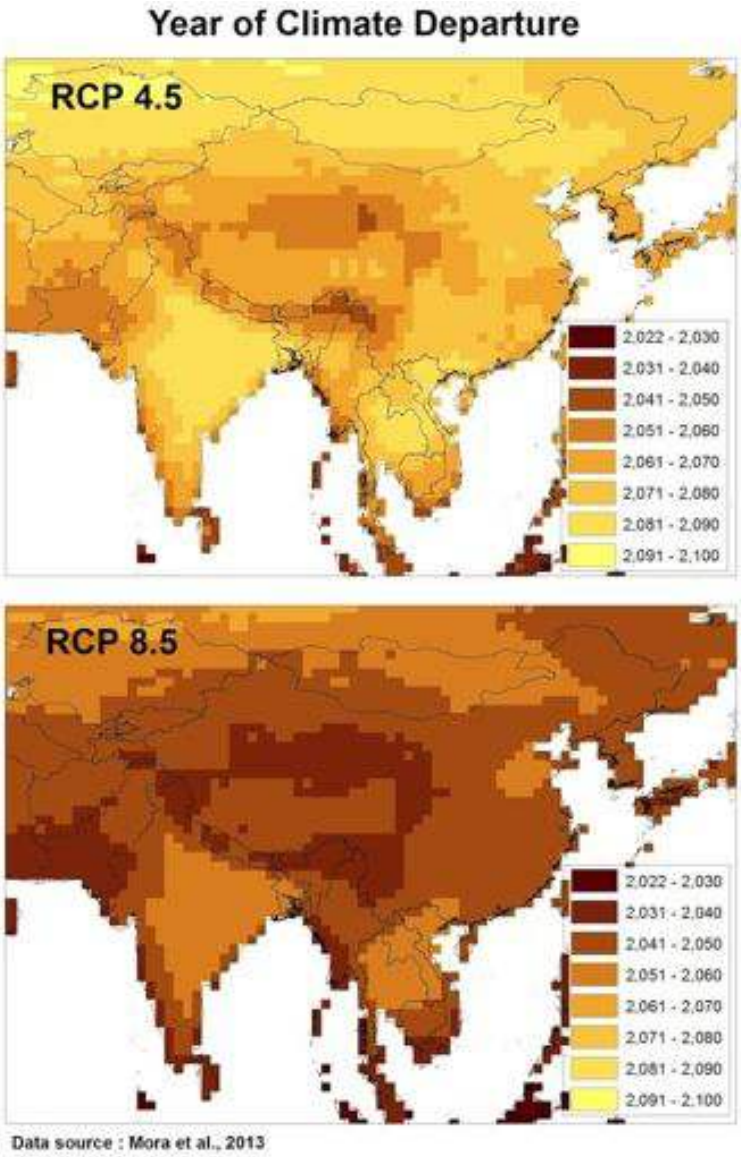
Four emission scenarios, or representative concentration pathways (RCP; (Vuuren et al., 2011) were analyzed using the CIMP5 model predictions for the year 2050 (average of 2040-2060), ranging from RCP 2.6 (aggressive mitigation / lowest emissions) to RCP 8.5 (highest emission scenario). CIMP5 model results were downscaled using the Delta method (Ramirez-Villegas and Jarvis, 2010) to 30 arc sec resolution (equivalent to ~1 km^2 at the equator). The Maximum Likelihood Classification algorithm in ArcGIS 10.2 was used to construct the projected future spatial distribution of strata and zones, using the modeled future climate conditions as predicted by each of the emission scenario combinations (n = 63) as input parameters. All models within each RCP were combined into a majority ensemble result, using the class with the majority of occurrence within any particular grid cell as the class for that location. The rate of occurrence of other classes is used as a measure of the uncertainty among models. Mora et al., 2013 tested the robustness of the CIMP5 model ensemble based on historical observation data (1985-2005) and

found a high correlation when using multi-model averages. Other sources of uncertainty in our analysis include the difficulties associated with model predictions in highly heterogeneous terrain and landscape, such as the mountainous areas of Yunnan.

3. Projected Climate Change in Yunnan Province

Yunnan Province appears to be one of the faster warming regions within the PRC and the greater East Asian region (Figure 3). The estimated year of climate departure for Yunnan (RCP 4.5: 2064; RCP 8.5: 2041) is significantly earlier than for the global average (RCP 4.5: 2069: RCP 8.5: 2047), and average for the PRC as a whole (RCP 4.5: 2069; RCP 8.5: 2044).

Figure 3: Year of climate departure showing the Asian region. Darker colors are warming relatively more rapidly than areas with lighter colors (Data source: Mora et al., 2013).



Of all of the 31 provinces in the PRC (including Taiwan), Yunnan is ranked as the fifth earliest year of climate departure under RCP 4.5, and is the sixth earliest under RCP 8.5 (Table 1). Under the RCP 4.5 scenario, the range of values found within Yunnan for the year of climate departure ranges from 2048 to 2081, and under the RCP 8.5 scenario, it ranges from as early as 2034 to 2050.

Table 1: Average year of climate departure for all of the provinces in China (Data source: Mora et al., 2013).

Year of Climate Departure - RCP 4.5

Province	Mean	Min	Max	Std
Qinghai	2055	2046	2068	4.6
Xizang	2063	2048	2073	4.9
Hainan	2063	2061	2066	2.3
Sichuan	2064	2053	2075	5.6
Yunnan	**2064**	**2048**	**2081**	**9.3**
Taiwan	2065	2064	2065	0.6
Gansu	2065	2056	2074	4.5
Zhejiang	2069	2066	2070	1.2
Shannxi	2069	2058	2073	3.5
Ningxia	2069	2065	2071	2.2
Guangdong	2069	2061	2076	3.4
Xinjiang	2070	2054	2085	7.2
Jiangxi	2070	2067	2072	1.4
Fujian	2070	2068	2073	1.4
Hubei	2071	2064	2079	4.3
Hunan	2072	2069	2075	1.6
Anhui	2072	2066	2079	3.5
Guizhou	2073	2068	2076	1.9
Jiangsu	2074	2071	2078	2.2
Shanxi	2074	2071	2077	1.5
Shanghai	2074	2074	2074	0.0
Shandong	2075	2069	2080	3.5
Henan	2075	2072	2080	2.1
Beijing	2075	2075	2075	0.0
Guangxi	2076	2070	2084	3.8
Neimenggu	2077	2063	2087	6.1
Heilongjiang	2077	2073	2083	2.0
Hebei	2078	2075	2082	1.8
Jilin	2078	2074	2083	3.1
Tianjin	2079	2079	2079	0.0
Liaoning	2079	2073	2084	3.6
China - All	2069	2046	2087	8.4

Year of Climate Departure - RCP 8.5

Province	Mean	Min	Max	Std
Qinghai	2037	2033	2044	2.4
Gansu	2040	2037	2044	1.8
Ningxia	2041	2039	2042	0.9
Sichuan	2041	2036	2047	2.7
Xizang	2041	2035	2046	2.4
Yunnan	**2041**	**2034**	**2050**	**4.7**
Taiwan	2042	2040	2043	1.4
Hainan	2042	2040	2043	1.5
Xinjiang	2043	2034	2050	3.3
Shannxi	2043	2038	2046	1.8
Jiangxi	2044	2042	2047	1.2
Zhejiang	2044	2043	2046	0.8
Fujian	2045	2042	2047	1.3
Guangdong	2045	2041	2048	1.5
Beijing	2045	2045	2045	0.0
Hubei	2046	2042	2049	1.7
Hunan	2046	2043	2048	1.0
Shanxi	2046	2045	2048	0.9
Shanghai	2046	2046	2046	0.0
Anhui	2047	2043	2052	2.8
Heilongjiang	2047	2045	2050	1.2
Tianjin	2047	2047	2047	0.0
Jiangsu	2047	2046	2051	1.5
Guizhou	2047	2045	2049	1.1
Neimenggu	2047	2039	2054	3.9
Hebei	2048	2045	2052	1.9
Liaoning	2048	2045	2052	1.7
Guangxi	2049	2045	2052	1.5
Jilin	2049	2047	2052	1.4
Shandong	2049	2044	2052	2.5
Henan	2050	2047	2052	1.3
China - All	2044	2033	2054	4.3

(Data source: Mora et al 2013)

Within Yunnan Province, the western and northwestern regions seem to have the most rapid projected rate of warming (Figure 4). Of the 16 prefectures within Yunnan Province, Nujiang, Dali, and Baoshan have the earliest dates under both the RCP 4.5 and RCP 8.5 scenarios (Table 2). Nujiang arrives at an unprecedented climate by 2049 under RCP 4.5, and as early as 1034 under RCP 8.5. Kunming, Zhaotong, Honghe, Qujing, Wenshan Prefectures are projected to be warming a significantly slower rates, arriving at an unprecedented climate almost 30 years later (after 2070) under RCP 4.5, and about 10 year later under RCP 8.5.

Figure 4: Year of climate departure for Yunnan province, at a resolution of 100 sq. km. (Data source: Mora et al., 2013).

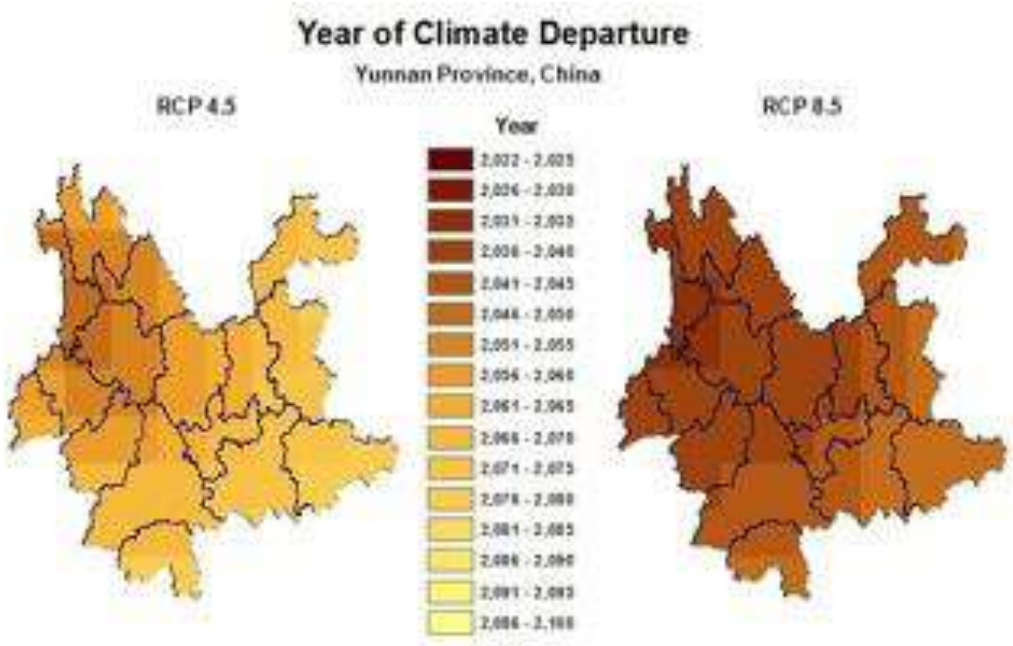


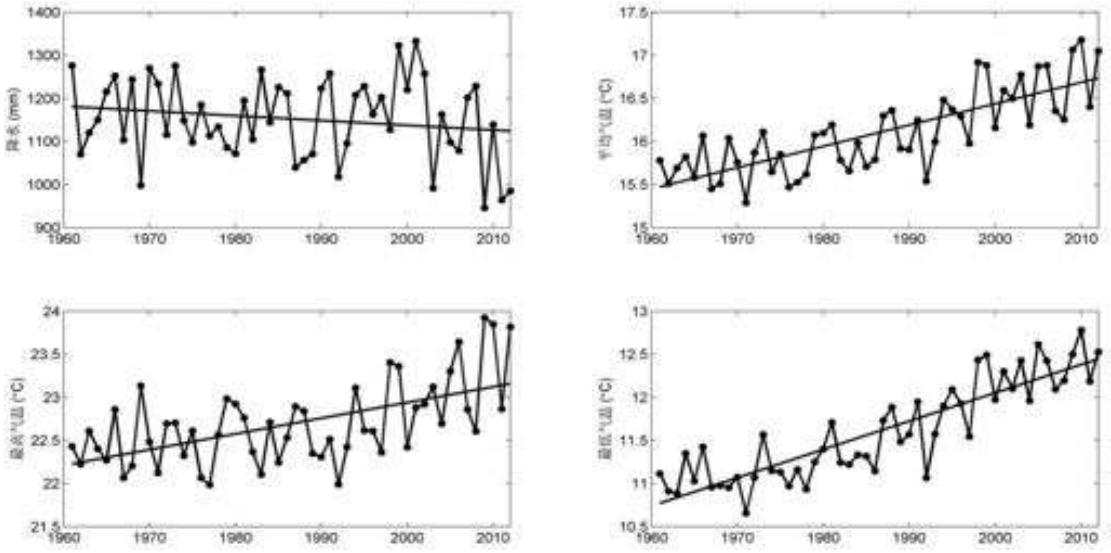
Table 2: Year of climate departure for Yunnan province, by prefectures ranked by earliest date (Data source: Mora et al., 2013).

Year of Climate Departure - Yunnan Province - Prefectures Ranked by Earliest Year

Prefecture	RCP 4.5		Prefecture	RCP 8.5	
	Mean	Std		Mean	Std
Nujiang	2049	0.91	Nujiang	2034	0.00
Dali	2052	0.00	Dali	2036	0.00
Baoshan	2054	0.00	Baoshan	2036	0.00
Deqe	2054	3.23	Lijiang	2036	0.66
Lijiang	2055	1.82	Deqe	2037	1.47
Dehong	2058	3.36	Dehong	2038	0.51
Chuxiong	2059	2.52	Chuxiong	2038	0.76
Lincang	2059	3.91	Lincang	2038	1.16
Simao	2067	2.06	Yuxi	2041	0.00
Xishuangbanna	2067	0.00	Simao	2042	1.37
Yuxi	2068	0.00	Xishuangbanna	2044	0.00
Kunming	2070	0.66	Kunming	2044	0.32
Zhaotong	2072	1.45	Zhaotong	2044	0.47
Honghe	2072	1.74	Honghe	2045	1.91
Qujing	2073	0.51	Qujing	2046	0.20
Wenshan	2075	1.20	Wenshan	2048	0.73
Yunnan - All	**2064**	8.39	**Yunnan - All**	**2041**	4.27

(Data source: Mora et al. 2103)

Figure 5: Observed weather station data (averaged for all of Yunnan), from 1961 to 2012. (Source: China National Climate Center, used with permission).



	Precipitation (mm/10yr)	Mean temperature (℃/10yr)	Maximum temperature (℃/10yr)	Minimum temperature (℃/10yr)
Tendency	-11.08	0.25	0.18	0.33

Based upon weather station data and an analysis of observed trends provided by the China National Climate Center – Beijing, during the period 1961-2012, the actual annual precipitation in Yunnan Province decreased. The mean annual temperature, maximum annual temperature, and minimum annual temperature all had an increasing trend (Figure 5).

The level of decrease in precipitation seen in the observed data is not reflected in the projected results under any of the RCP scenarios (Table 3), all of which project a minimal increase (14 to 24 mm) except RCP 6.0, which predicts a very slight decrease of 4 mm. Generally the CIMP-5 precipitation projections have a high variability among models (compared to temperature which is relatively consistent), and it is generally not considered highly reliable.

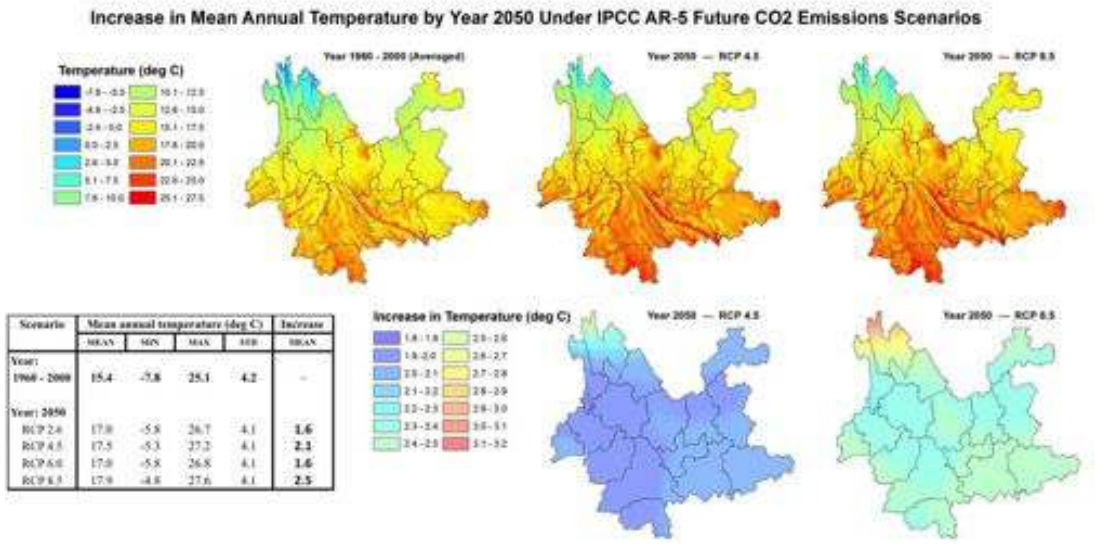
Mean annual temperature for Yunnan is projected to increase on average from 1.6 to 2.5 °C by 2050, according to our analysis (Table 3; Figure 6). As a result, the Aridity Index decreases under all the RCP scenarios, indicating very slightly less moisture availability for plant growth, and slightly less conducive growing condition. Though this is minimal, this effect could be exacerbated by increased seasonality and seasonal variability.

Table 3: Mean annual temperature, annual precipitation, and aridity-wetness Index, averaged for the years 1960 – 2000, and projected under four RCP (emission scenarios).

Yunnan - All

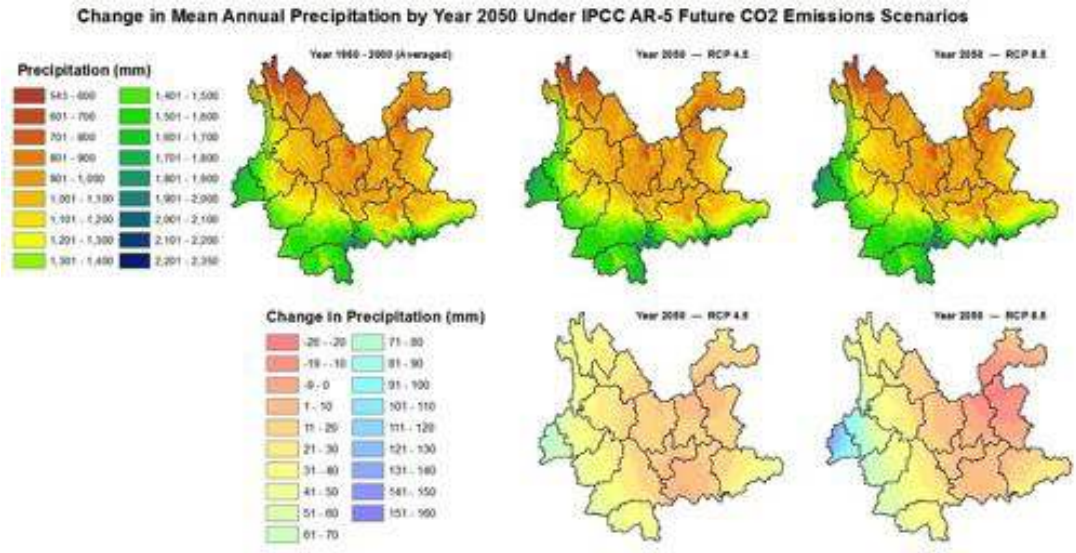
RCP	Mean Annual Temperature				Annual Precipitation				Aridity Index			
	Mean	Min	Max	Std	Mean	Min	Max	Std	Mean	Min	Max	Std
	(C°)				(mm)							
Year: 1960 - 2000	15.4	-7.8	25.1	4.2	1138	543	2239	249	0.93	0.41	2.03	0.18
Year: 2050												
RCP_26	17.0	-5.8	26.7	4.1	1152	580	2305	262	0.89	0.39	1.92	0.18
RCP_45	17.5	-5.3	27.2	4.1	1162	583	2325	258	0.89	0.4	1.89	0.18
RCP_60	17.0	-5.8	26.8	4.1	1134	564	2296	256	0.89	0.39	1.87	0.18
RCP_85	17.9	-4.8	27.6	4.1	1162	584	2330	267	0.88	0.39	1.87	0.18

Figure 6: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under RCP 8.5.



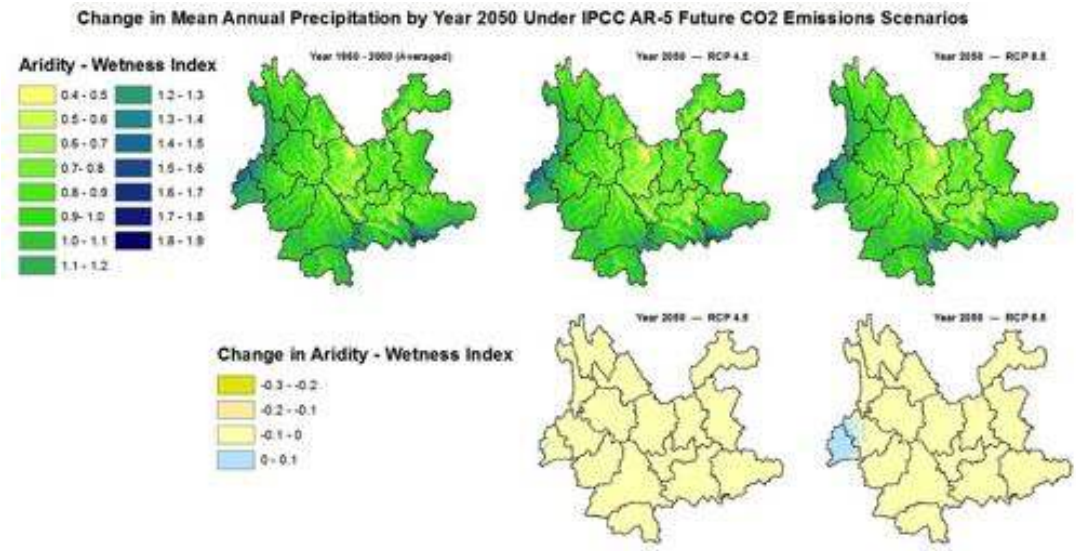
Under both the RCP 4.5 and RCP 8.5 emission scenarios, the increase in mean annual temperature by 2050 is greatest in the northwestern parts of Yunnan, approaching and exceeding 3.0 °C increase under the RCP 8.5 scenario in the very northwest of Yunnan. Similarly, both minimum and maximum annual temperatures increase proportionally.

Figure 7: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under RCP 8.5.



In general, there is a slight increase in precipitation across Yunnan, however this is most pronounced in the western part of the province, with some drying tendency towards the northeast, especially under RCP 8.5. However, there is a high variability among models under both scenarios, so that uncertainty is higher for precipitation than for temperature projections.

Figure 8: Spatial distribution of Aridity Index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under RCP 8.5.



There is very little change in the Aridity Index in any of the RCP scenarios. As temperature goes, so does precipitation, so that on the balance growing conditions remain nearly the same. However, in general, there is a slight decrease in the Aridity Index, indicating slightly drier conditions, or less available moisture for plant growth.

4. Projected Change in Bioclimatic Conditions:

Environmental Stratification of Yunnan Province

Nine major bioclimatic zones were identified through this study as currently found within Yunnan (Figure 9), ranging from Extremely Hot and Moist at low elevations, to Extremely Cold and Mesic at high elevations (Table 4). Mean annual temperatures for these zones are inversely correlated with their average elevation, and range from 1.5°C for the coolest zone at an average elevation of 4,242 asl, to 23.9°C for the warmest zone at an average elevation of 620 m asl. Both the average annual temperature and the average elevation of each of these zones demonstrate an ordered and coherent placement along their respective gradients, indicating the robustness of the stratification when applied in Yunnan. Annual precipitation generally decreases with elevation in a similarly ordered fashion, except for the lowest and hottest zone (a small area). By far the largest zone is the Warm Temperate and Mesic, comprising 175,515 km^2 at an zonal average elevation of 2005 m asl. Southern river valleys and lower elevations are mostly Extremely Hot / Mesic with a small area of Extremely Hot / Moist, moist being less humid than mesic in this classification. This is evidenced by the ordered range of the Aridity Index (AI) with decreasing elevation from the wetter (when PET is considered) Extremely Cold and Mesic (1.03) to the drier Extremely Hot/ Moist zone (0.61).

Figure 9: Bioclimatic stratification of Yunnan Province based on averaged weather station data from 1960-2000, delineated nine major bioclimatic zones.

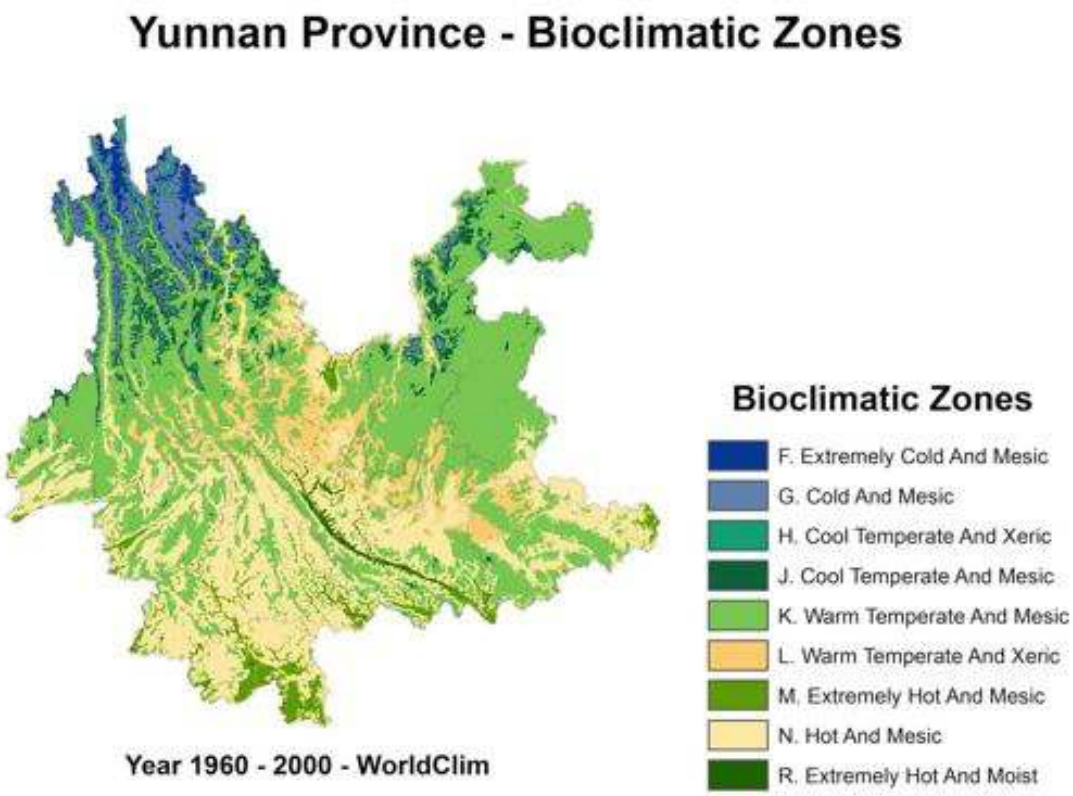


Table 4: Characteristics of the bioclimatic strata based on climate data from 1960 to 2000, showing the area, mean elevation (Mean Elev), mean annual temperature (Mean Temp), mean annual precipitation (Mean Precip), and mean aridity-wetness index (AI). Higher AI values reflect wetter and better plant growth conditions.

Yunnan Province

Bioclimatic Zone	Zone	Area (km^2)	Mean Elev (m asl)	Mean Temp (deg C)	Mean Precip (mm)	Mean AI
Extremely cold and mesic	**F**	5864	4242	1.5	743	1.03
Cold and mesic	**G**	18161	3516	6.1	871	0.99
Cool temperate and xeric	**H**	848	3144	8.5	681	0.67
Cool temperate and moist	**J**	20102	2836	9.9	1027	1.01
Warm temperate and mesic	**K**	175516	2005	14.5	1132	0.96
Warm temperate and xeric	**L**	30968	1807	16.7	959	0.74
Hot and mesic	**N**	113416	1321	19.0	1262	0.91
Extremely hot and mesic	**M**	17552	815	22.0	1332	0.87
Extremely hot and moist	**R**	1299	620	23.9	980	0.61

A similar ordered and environmentally consistent result is evident amongst the 33 strata (Figure 10), along all these climate gradients (Table 5). Average annual temperature ranges from 1.5°C for the highest elevation stratum (avg. elev. 4,760 m asl) to 23.9°C for the lowest stratum (avg. elev. 620 m asl). Annual mean precipitation ranges from 651 mm for one of the higher elevation strata (G4) in the Cold and Mesic Zone to 1,695 mm for stata K2 in the Warm Temperate and Mesic. AI indicates moisture and plant growth conditions are generally conducive for vegetation growth (e.g., AI > .65 is can be considered a threshold for semi-arid) in all strata, with many higher elevation areas exhibiting a surplus of moisture at or above full PET (AI >1.0). A small area (less than 850 km2) of Cold Temperate and Xeric (H5), Hot and Mesic (N4), and Extremely Hot and Moist (R1) can be considered on the drier side in terms of year round plant growth. AI values range from fairly dry to moist (R1 - 0.61) in the Extremely Hot and Mesic zone (620 mm annual precipitation with high evapotranspiration) to very mesic (K2 - 1.68) in the mid-elevation in the Warm Temperate / Mesic zone.

Figure 10: Stratification of Yunnan Province, based on averaged weather station data from 1960-2000, delineated 33 bioclimatic strata within 9 major zones.

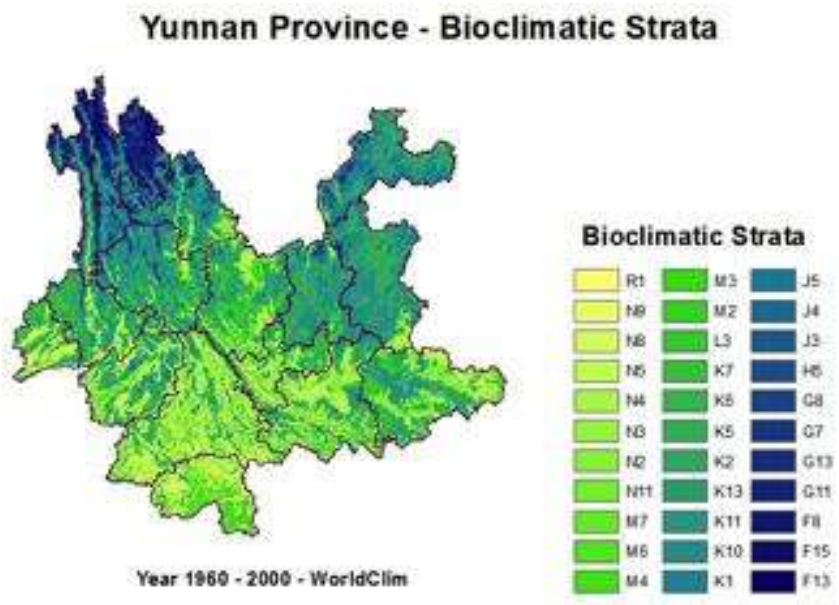


Table 5: Characteristics of GEnS strata based on climate data from 1960 to 2000, showing the area, mean elevation (Mean Elev), mean annual temperature (Mean Temp), mean annual precipitation (Mean Precip), and mean aridity index (AI).

Yunnan Province

Bioclimatic Zone	Strata	Area (km^2)	Mean Elev (m asl)	Mean Temp (deg C)	Mean Precip (mm)	Mean AI
Extremely cold and mesic						
	F8	624	4760	-1.5	718	1.16
	F13	3797	4265	1.4	706	0.98
	F15	1443	3958	3.2	853	1.10
Cold and mesic						
	G7	983	3917	3.4	651	0.80
	G8	298	3616	4.8	1171	1.46
	G11	11013	3608	5.6	802	0.92
	G13	5867	3270	7.5	1024	1.12
Cool temperate and xeric						
	H5	848	3144	8.5	681	0.67
Cool temperate and moist						
	J3	4990	2998	9.0	1092	1.12
	J4	729	2550	11.3	1527	1.48
	J5	14383	2794	10.1	980	0.95
Warm temperate and mesic						
	K1	29360	2352	12.0	1048	0.97
	K2	243	2067	13.2	1695	1.68
	K5	38418	2146	13.5	997	0.87
	K6	1123	1142	14.4	1003	0.95
	K7	14635	1991	14.5	1462	1.27
	K10	60185	1949	15.2	1028	0.85
	K11	758	1438	16.5	1607	1.46
	K13	30794	1662	16.5	1415	1.13
Warm temperate and xeric						
	L3	30968	1807	16.7	959	0.74
Extremely hot and mesic						
	M1	-	-	-	-	-
	M2	4429	785	21.4	1504	1.03
	M3	2195	1137	21.7	799	0.52
	M4	8472	818	22.0	1374	0.88
	M6	59	887	23.0	849	0.54
	M7	2397	563	23.2	1367	0.89
Hot and mesic						
	N2	17368	1489	17.4	1131	0.89
	N3	25955	1376	18.3	1490	1.09
	N4	13138	1590	18.3	922	0.68
	N5	17953	1336	19.3	1033	0.75
	N8	27034	1110	19.9	1494	1.03
	N9	1699	1182	20.1	1197	0.83
	N11	10269	1109	20.8	1148	0.77
Extremely hot and moist						
	R1	1299	620	23.9	980	0.61

Projected Climate Change Impacts on Spatial Distribution of Bioclimatic Conditions

Results of our analysis, using the CIMP5 multi-model ensemble of RCP scenarios for Yunnan Province, are in general agreement with projections cited by the China National Assessment Report on Climate Change (He et al., 2006; Lin et al., 2006; 2007), and correspond with observed recent climate trends for the Himalaya region (Shresta et al., 2012). An overview of the projected future mean annual temperature and precipitation as predicted by each of the CIMP5 models for Yunnan Province in 2050 (Figure 11), shows that the climate is likely to accelerate current warming trends, on average becoming generally hotter within all RCP emission scenarios (Table 6). Mean annual temperature averaged across Yunnan is predicted to increase from 1.6° to 2.5°C, by 2050, or 1.9° C on average for all RCP. These result corresponds closely, but are slightly lower than Lin et al. (2007), who reviewed over 40 combinations of various models for China as a whole under various emission scenarios, and found the country-averaged annual mean temperature for China is projected to increase by 2.3 - 3.3°C by 2050, and 3.9 - 6.0°C by 2100, as compared to the 30-year average of 1961-1990. Weng and Zhou (2006) using a regional climate model (RCM) and weather station data for China from 1951 to 1980, estimated air temperature would increase by 2°C under the SERS-A2 scenario, with an increase in precipitation of 11-17%.

Figure 11: Bioclimatic stratification of Yunnan Province based on averaged weather station data from 1960-2000, and four projected climate change scenarios for 2050.

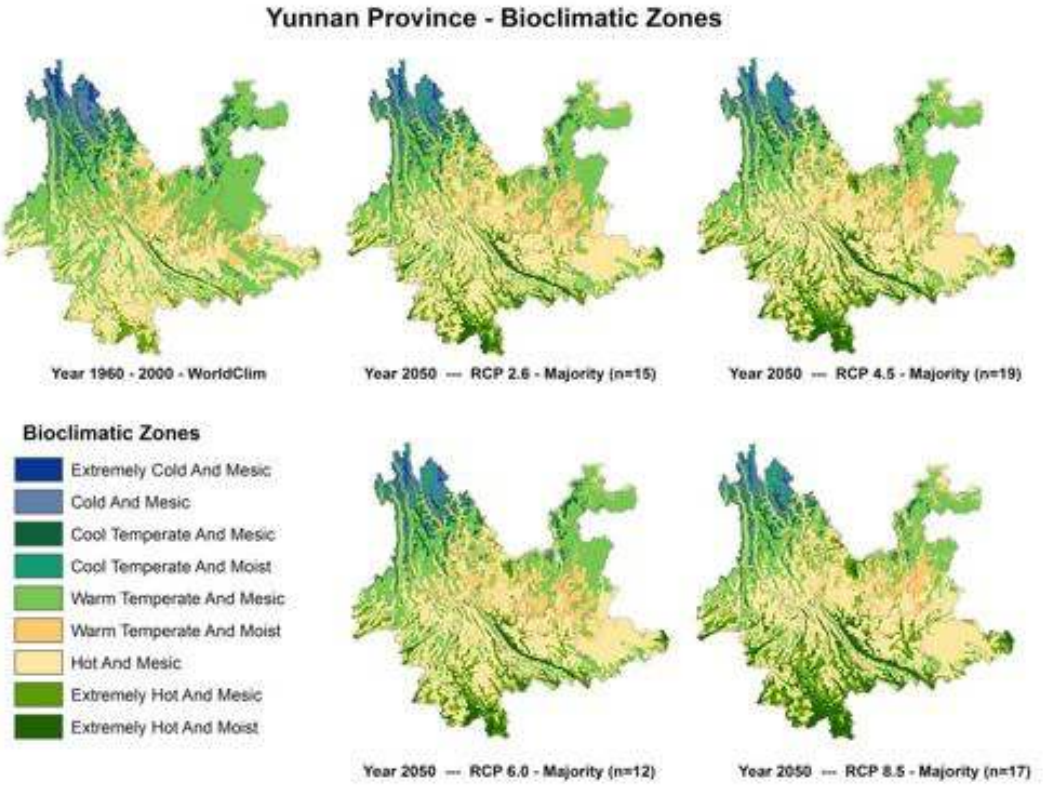


Table 6: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 for RCP 8.5.

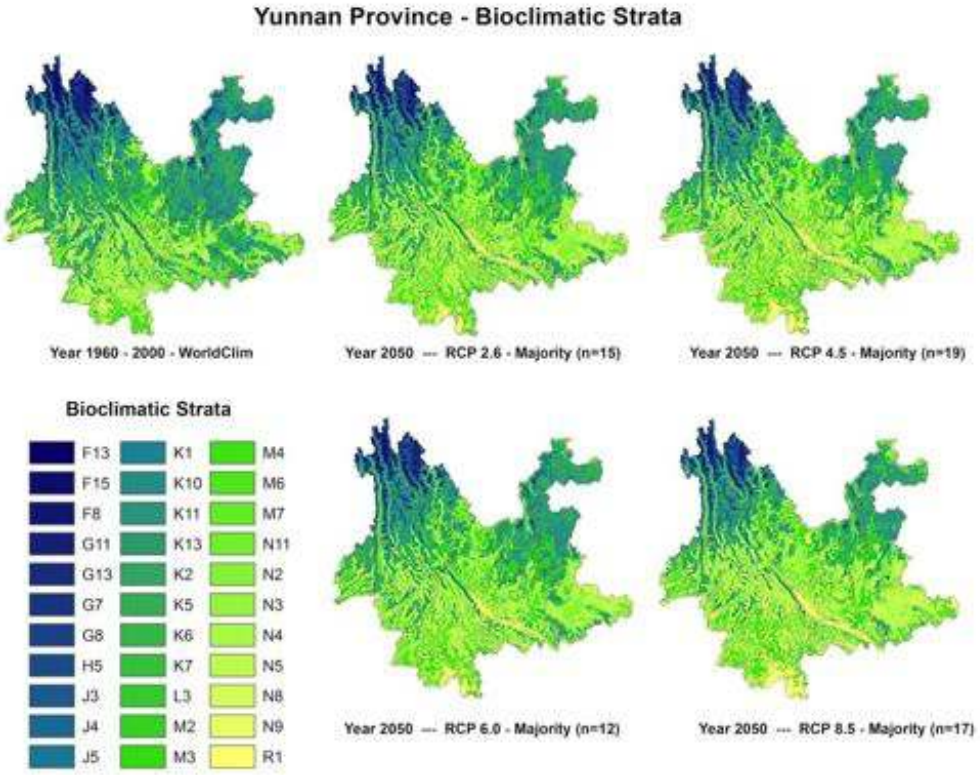
Bioclimatic Zone	Zone	Area (km^2)		Area Change	Mean Elevation (m asl)		Upward Shift)
		2000	RCP85	(km2)	2000	RCP85	(m)
Extremely cold and mesic	F	5864	1392	(4472)	4242	4596	354
Cold and mesic	G	18161	10678	(7483)	3516	3909	393
Cool temperate and xeric	H	848	3952	3104	3144	3541	397
Cool temperate and moist	J	20102	12337	(7765)	2836	3230	394
Warm temperate and mesic	K	175516	91083	(84433)	2005	2312	306
Warm temperate and xeric	L	30968	26772	(4196)	1807	2092	284
Extremely hot and mesic	M	17552	52835	35283	815	1230	414
Hot and mesic	N	113416	153809	40393	1321	1689	367
Extremely hot and moist	R	1299	30868	29569	620	910	290
			Average Upward Shift - All Zones				356

There are substantial changes in both the areal extent (Figure 11) and the average elevation of the bioclimatic zones, as predicted for 2050 (Table 6). Even when averaged for all RCP's, there is a large expansion in the extent of the Extremely Hot and Moist zone (from 1299 to 30,868 km^2), the Hot and Mesic (from 113,416 to 153,809 km^2), and the Extremely Hot and Mesic zone (from 17,552 to 52,835 km^2). There is a drastic a decrease in the Warm Temperate and Mesic zone (from 175,516 km^2 to 91,083 km^2), signaling a potential threat for species, and ecosystems, adapted to these mid-elevation zones. All zones exhibit an upward shift in average elevation (356 m average for all zones in RCP 8.5), ranging from 284 m for the mid elevation Warm Temperate and Mesic, to 414 m for the Extremely Hot and Mesic, while the average elevation of the Cool Temperate and Xeric zone increases 397 m, but its areal extent is increased more than five times.

Likewise, the finer resolution biclimatic strata (Figure 12) shift significantly (Table 7). One small strata (K7) is no longer present in the region by 2050. Generally, all the higher elevation strata are drastically reduced in area as warmer conditions move upslope. All the strata shift substantially upwards in their average elevation (309 m average for all zones), ranging from an upward shift of 224 to 370 m.

A complete and detailed summary analysis of all changes in area and elevation for all zones and strata is given in a series of tables in **Appendix 3.** Additionally, this information is articulated for each of the each of the Priority Areas, summarized in the next section, and included in **Appendix 1**.

Figure 12: Bioclimatic stratification of Yunnan Province based on averaged weather station data from 1960-2000, and four projected climate change scenarios for 2050.



At the higher emission scenario (RCP 8.5) nearly all strata shift to a different stratum (98%), and, more than 65% to a different zone. Overall, these results show a quick and drastic change in the spatial distribution of bioclimatic conditions indicating significant biological perturbances by 2050, with implications for protected areas, threatened biodiversity, and narrow niche endemic species, which may not have the velocity to keep up with the rapid pace of change (Pu et al., 2007; Corlett and Wescott, 2013).

Table 7: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 for RCP 8.5.

Bioclimatic Zone	Zone	Area (km^2)		Area Change	Mean Elevation (m asl)		Upward Shift)
		2000	RCP85	(km2)	2000	RCP85	(m)
Extremely cold and mesic							
	F8	624	70	(554)	4760	5044	283
	F13	3797	579	(3218)	4265	4752	487
	F15	1443	743	(700)	3958	4433	475
Cold and mesic							
	G7	983	1642	659	3917	4318	402
	G8	298	66	(232)	3616	3723	107
	G11	11013	6201	(4812)	3608	3916	307
	G13	5867	2769	(3098)	3270	3654	384
Cool temperate and dry							
	H5	848	3952	3104	3144	3541	397
Cool temperate and moist							
	J3	4990	2542	(2448)	2998	3317	319
	J4	729	1128	399	2550	3032	482
	J5	14383	8667	(5716)	2794	3230	436
Warm temperate and mesic							
	K1	29360	7979	(21381)	2352	2889	537
	K2	243	153	(90)	2067	2605	538
	K5	38418	18569	(19849)	2146	2554	407
	K6	1123	2021	898	1142	1614	472
	K7	14635	6103	(8532)	1991	2445	454
	K10	60185	37692	(22493)	1949	2222	273
	K11	758	1187	429	1438	1816	378
	K13	30794	17379	(13415)	1662	2047	385
Warm temperate and xeric							
	L3	30968	26772	(4196)	1807	2092	284
Hot and mesic							
	N2	17368	20663	3295	1489	1881	392
	N3	25955	20112	(5843)	1376	1699	323
	N4	13138	28636	15498	1590	1922	332
	N5	17953	34058	16105	1336	1646	310
	N8	27034	21348	(5686)	1110	1453	343
	N9	1699	14068	12369	1182	1534	352
	N11	10269	14924	4655	1109	1542	432
Extremely hot and mesic							
	M1	-	117	-	-	1432	-
	M2	4429	11900	7471	785	1134	349
	M3	2195	11749	9554	1137	1451	313
	M4	8472	24724	16252	818	1226	408
	M6	59	666	607	887	1267	380
	M7	2397	3679	1282	563	845	281
Extremely hot and moist							
	R1	1299	30868	29569	620	910	290
				Average Upward Shift			**373**

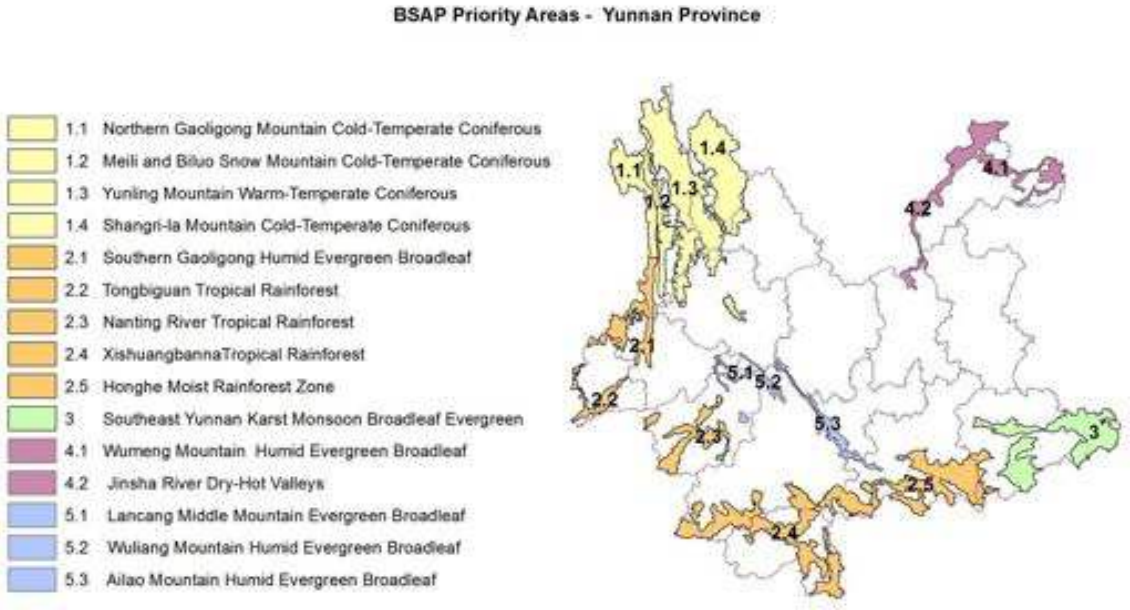
5. Projected Climate Change within BSAP Priority Areas:

This section summarizes results from our analysis of the projected climate change and impacts on bioclimatic conditions wihin the BSAP priority areas.

There are eighteen priority area listed in the BSAP. We give results for 15 of them (Figure13), but have excluded the wetland classes (6.1,6.2,6.3) due to their small areal extents and dispersed locations, as the unit of measurement for downscaling does not allow for proper analysis.

A more detailed presentation of the analysis, with maps, and tables for each of priority areas individually across all the RCPs, is provided as supplementary material in Appendix 1.

Figure 13. Yunnan Province - Yunnan Biodiversity Strategy and Action Plan (BSAP) Priority Areas (Source: Yunnan BSAP, YEPD).



Projections of Climate Change within Priority Areas

The results from our analysis of projected temperature increases within priority areas by 2050 indicate an the increase in mean annual temperature for the 15 priority areas ranges from 2.0° to 2.2°C for RCP 4.5, and from 2.3° to 2.7°C for RCP 8.5 (Table 8), with northwestern and western regions showing the largest projected increases.

Table 8: Mean Annual Temperature for each of the BSAP Priority Areas under current conditions (averaged from 1960-2000) based on downscaled weather station data, and projected for the year 2050 under RCP 4.5 and RCP 8.5.

Mean Annual Temperature (°C)

			RCP45		RCP85	
	Priority Area	**2000**	**2050**	**Increase**	**2050**	**Increase**
1.1	Northern Gaoligong Mountain Cold-Temperate Coniferous	9.7	11.8	2.1	12.2	2.6
1.2	Meili and Biluo Snow Mountain Cold-Temperate Coniferous	8.7	10.7	2.1	11.2	2.5
1.3	Yunling Mountain Warm-Temperate Coniferous	8.3	10.5	2.1	10.9	2.6
1.4	Shangri-la Mountain Cold-Temperate Coniferous	6.1	8.3	2.2	8.8	2.7
2.1	Southern Gaoligong Humid Evergreen Broadleaf	13.0	14.9	1.9	15.3	2.3
2.2	Tongbiguan Tropical Rainforest	18.7	20.7	2.0	21.2	2.4
2.3	Nanting River Tropical Rainforest	16.2	18.2	2.0	18.6	2.4
2.4	XishuangbannaTropical Rainforest	19.4	21.4	2.0	21.8	2.4
2.5	Honghe Moist Rainforest Zone	18.3	20.3	2.1	20.7	2.5
3.0	Southeast Yunnan Karst Monsoon Broadleaf Evergreen	17.9	20.0	2.1	20.4	2.5
4.1	Wumeng Mountain Humid Evergreen Broadleaf	13.6	15.6	2.0	16.0	2.4
4.2	Jinsha River Dry-Hot Valleys	13.8	15.8	2.0	16.2	2.4
5.1	Lancang Middle Mountain Evergreen Broadleaf	13.4	15.3	2.0	15.7	2.4
5.2	Wuliang Mountain Humid Evergreen Broadleaf	14.8	16.7	2.0	17.1	2.4
5.3	Ailao Mountain Humid Evergreen Broadleaf	15.2	17.2	2.0	17.6	2.4

The projected year of climate departure for the various priority areas ranges from 2050 to 2076 under RCP 4.5, and from 2035 to 2049 under RCP 8.5 The Cold-Temperature Coniferous Forest exhibits the earliest date under both scenarios for reaching an unprecedented climate regime, along with the Humid Evergreen Broadleaf Forest and the Warm Temperate Coniferous Forest. Under the RCP 4.5 scenario, all priority areas reach unprecedented bioclimatic conditions by 2070, while under the RCP 8.5 scenario, that date is reached by 2049. Table 9 presents the priority areas ranked by the date of climate departure, i.e. as a measure of the rapidness of warming within that priority area, for both RCP 4.5 and RCP 8.5. Earlier dates can be interpreted to represent a more rapid rate of temperature increase.

Table 9: BSAP Priority Areas Ranked by Year of Climate Departure, giving the mean climate departure year for the priority area, and the standard deviation (Std) (Data source: Mora et al, 2013).

BSAP Priority Areas - Ranked by Year of Climate Departure

RCP 4.5

Priority Area		Climate Departure	
		Mean	Std
1.1	Northern Gaoligong Mountain Cold-Temperate Coniferous	2050	3.4
1.2	Meili and Biluo Snow Mountain Cold-Temperate Coniferous	2050	2.6
2.1	Southern Gaoligong Humid Evergreen Broadleaf	2052	2.6
1.3	Yunling Mountain Warm-Temperate Coniferous	2052	4.2
1.4	Shangri-la Mountain Cold-Temperate Coniferous	2056	3.0
5.1	Lancang Middle Mountain Evergreen Broadleaf	2056	2.7
5.2	Wuliang Mountain Humid Evergreen Broadleaf	2057	3.0
2.3	Nanting River Tropical Rainforest	2061	3.5
2.2	Tongbiguan Tropical Rainforest	2063	3.3
5.3	Ailao Mountain Humid EvergreenBroadleaf	2064	4.5
4.2	Jinsha River Dry-Hot Valleys	2065	3.4
2.4	XishuangbannaTropical Rainforest	2070	3.4
4.1	Wumeng Mountain Humid Evergreen Broadleaf	2070	3.7
2.5	Honghe Moist Rainforest Zone	2073	2.9
3.0	Southeast Yunnan Karst Monsoon Broadleaf Evergreen	2076	1.3

RCP 8.5

Priority Area		Climate Departure	
		Mean	Std
1.1	Meili and Biluo Snow Mountain Cold-Temperate Coniferous	2035	1.4
1.2	Northern Gaoligong Mountain Cold-Temperate Coniferous	2035	1.7
2.1	Southern Gaoligong Humid Evergreen Broadleaf	2036	1.4
1.3	Yunling Mountain Warm-Temperate Coniferous	2036	1.9
1.4	Lancang Middle Mountain Evergreen Broadleaf	2037	1.0
5.1	Wuliang Mountain Humid Evergreen Broadleaf	2038	1.0
5.2	Shangri-la Mountain Cold-Temperate Coniferous	2038	1.1
2.3	Nanting River Tropical Rainforest	2039	1.2
2.2	Tongbiguan Tropical Rainforest	2039	1.2
5.3	Ailao Mountain Humid EvergreenBroadleaf	2040	1.9
4.2	Jinsha River Dry-Hot Valleys	2041	1.7
2.4	Wumeng Mountain Humid Evergreen Broadleaf	2044	2.1
4.1	XishuangbannaTropical Rainforest	2044	2.7
2.5	Honghe Moist Rainforest Zone	2046	2.1
3.0	Southeast Yunnan Karst Monsoon Broadleaf Evergreen	2049	0.8

According to the CIMP5 Earth System Model projections, all priority areas are projected to experience a slight increase in Annual Precipitation (Table 10), ranging from approximately 1% to 4% under RCP 4.5, and from less than 1% to 7% under RCP 8.5, except for the Dry Hot Valleys of the Jinsha River (Priority Area 4.2) which has a slight decrease predicted (1.6%). However, the variability of the precipitation predications amongst the models was quite high.

Table 10: Mean annual precipitation for each of the BSAP Priority Areas under current (year 2000) conditions (i.e. averaged from 1960-2000) based on downscaled weather station data, and projected for the year 2050 under RCP 4.5 and RCP 8.5.

Annual Precipitation (mm)

			RCP45			RCP85		
		2000	2050	Change		2050	Change	
	Priority Area			(mm)	(%)		(mm)	(%)
1.1	Northern Gaoligong Mountain Cold-Temperate Coniferous	1122	1164	43	3.8	1168	47	4.1
1.2	Meili and Biluo Snow Mountain Cold-Temperate Coniferous	1066	1103	37	3.5	1108	42	3.9
1.3	Yunling Mountain Warm-Temperate Coniferous	919	952	33	3.6	953	33	3.6
1.4	Shangri-la Mountain Cold-Temperate Coniferous	801	831	30	3.7	826	25	3.1
2.1	Southern Gaoligong Humid Evergreen Broadleaf	1420	1470	50	3.6	1502	82	5.8
2.2	Tongbiguan Tropical Rainforest	1617	1686	69	4.2	1731	114	7.0
2.3	Nanting River Tropical Rainforest	1363	1405	42	3.1	1421	58	4.3
2.4	XishuangbannaTropical Rainforest	1537	1576	39	2.5	1579	43	2.8
2.5	Honghe Moist Rainforest Zone	1463	1473	10	0.7	1476	13	0.9
3.0	Southeast Yunnan Karst Monsoon Broadleaf Evergreen	1263	1300	36	2.9	1284	20	1.6
4.1	Wumeng Mountain Humid Evergreen Broadleaf	962	981	19	2.0	967	5	0.5
4.2	Jinsha River Dry-Hot Valleys	923	932	10	1.0	908	(15)	(1.6)
5.1	Lancang Middle Mountain Evergreen Broadleaf	1143	1170	27	2.4	1183	40	3.5
5.2	Wuliang Mountain Humid Evergreen Broadleaf	1085	1105	20	1.9	1113	27	2.5
5.3	Ailao Mountain Humid Evergreen Broadleaf	1233	1245	12	1.0	1250	17	1.4

Annual potential evapotranspiration increases for all sites due to the increase in temperature (Table 11). The PET measure is however dependent upon both temperature and precipitation. Increased PET can have a significant effect on soil water content and plant growth. PET increases range from 4.7 to 7.2% under RCP 4.5, and from 5.8 to almost 10% under RCP 8.

Table 11: Annual Potential Evapotranspiration (PET) for each of the BSAP Priority Areas under current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under RCP 4.5 and RCP 8.5.

Annual PET (mm)

			RCP45			RCP85		
		2000	2050	Change		2050	Change	
	Priority Area	(mm)	(mm)	(mm)	(%)	(mm)	(mm)	(%)
1.1	Northern Gaoligong Mountain Cold-Temperate Coniferous	987	1054	67	6.8	1069	82	8.4
1.2	Meili and Biluo Snow Mountain Cold-Temperate Coniferous	956	1023	67	7.0	1038	82	8.6
1.3	Yunling Mountain Warm-Temperate Coniferous	964	1033	69	7.2	1049	86	8.9
1.4	Shangri-la Mountain Cold-Temperate Coniferous	915	987	72	7.8	1006	91	9.9
2.1	Southern Gaoligong Humid Evergreen Broadleaf	1113	1176	63	5.7	1185	72	6.5
2.2	Tongbiguan Tropical Rainforest	1384	1449	65	4.7	1456	72	5.2
2.3	Nanting River Tropical Rainforest	1300	1372	72	5.5	1381	81	6.2
2.4	XishuangbannaTropical Rainforest	1460	1536	76	5.2	1544	85	5.8
2.5	Honghe Moist Rainforest Zone	1285	1368	83	6.5	1381	97	7.5
3.0	Southeast Yunnan Karst Monsoon Broadleaf Evergreen	1228	1309	81	6.6	1328	100	8.1
4.1	Wumeng Mountain Humid Evergreen Broadleaf	1068	1135	67	6.3	1151	84	7.8
4.2	Jinsha River Dry-Hot Valleys	1187	1263	77	6.5	1281	95	8.0
5.1	Lancang Middle Mountain Evergreen Broadleaf	1154	1224	69	6.0	1234	80	6.9
5.2	Wuliang Mountain Humid Evergreen Broadleaf	1212	1280	69	5.7	1292	80	6.6
5.3	Ailao Mountain Humid Evergreen Broadleaf	1227	1299	72	5.9	1311	84	6.8

The Mean Annual Aridity Index for the various BSAP Prority Sites decreases slightly for all sites under both emission scenarios (Table 12), except for a slight increase for the Tropical Rainforest in Tongbiguan. A decrease in the Aridity Index signifies a drier climate regime and less available moisture for plant growth. Although the decreases seen are rather small, they nevertheless indicate a slightly drier climatic regime. Decrease in the Aridity Index ranges from less than 1% to 5.5% under the RCP 4.5 scenario, and from an increase of almost 2% to a decrease of more than 9% (for the Hot Dry Valleys of the Jinsha River) under RCP 8.5.

Table 12: Mean Aridity Index for BSAP Priority Areas for each of the BSAP Priority Areas under current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under RCP 4.5 and RCP 8.5.

Mean Annual Aridity Index (AI)

			RCP45			RCP85		
		2000	2050	Change		2050	Change	
	Priority Area				(%)			(%)
1.1	Northern Gaoligong Mountain Cold-Temperate Coniferous	1.13	1.09	(0.03)	(2.8)	1.08	(0.04)	(3.8)
1.2	Meili and Biluo Snow Mountain Cold-Temperate Coniferous	1.11	1.07	(0.04)	(3.4)	1.06	(0.05)	(4.3)
1.3	Yunling Mountain Warm-Temperate Coniferous	0.95	0.92	(0.03)	(3.4)	0.91	(0.05)	(4.8)
1.4	Shangri-la Mountain Cold-Temperate Coniferous	0.89	0.85	(0.04)	(4.0)	0.83	(0.06)	(6.3)
2.1	Southern Gaoligong Humid Evergreen Broadleaf	1.28	1.25	(0.03)	(2.0)	1.27	(0.01)	(0.6)
2.2	Tongbiguan Tropical Rainforest	1.17	1.17	(0.00)	(0.4)	1.20	0.02	1.8
2.3	Nanting River Tropical Rainforest	1.06	1.03	(0.03)	(2.4)	1.04	(0.02)	(1.8)
2.4	XishuangbannaTropical Rainforest	1.06	1.03	(0.03)	(2.6)	1.03	(0.03)	(2.8)
2.5	Honghe Moist Rainforest Zone	1.15	1.09	(0.06)	(5.3)	1.08	(0.07)	(6.1)
3.0	Southeast Yunnan Karst Monsoon Broadleaf Evergreen	1.03	1.00	(0.03)	(3.4)	0.97	(0.06)	(5.8)
4.1	Wumeng Mountain Humid Evergreen Broadleaf	0.91	0.87	(0.04)	(4.0)	0.85	(0.06)	(6.8)
4.2	Jinsha River Dry-Hot Valleys	0.83	0.78	(0.05)	(5.5)	0.75	(0.08)	(9.2)
5.1	Lancang Middle Mountain Evergreen Broadleaf	1.00	0.96	(0.03)	(3.4)	0.97	(0.03)	(3.1)
5.2	Wuliang Mountain Humid Evergreen Broadleaf	0.91	0.87	(0.03)	(3.6)	0.87	(0.03)	(3.8)
5.3	Ailao Mountain Humid Evergreen Broadleaf	1.01	0.96	(0.05)	(4.6)	0.96	(0.05)	(5.0)

Projected Climate Change Impacts on Bioclimatic Zones within Priority Areas

For all of the BSAP priority areas there are substantial changes in both the areal extent and the average elevation of the bioclimatic zones, as predicted for 2050 (Tables 13, 14). All zones exhibit an upward shift in average elevation (356 m average for all zones in RCP 8.5), ranging from 195 m to over 400 m.

Table 13: Change in spatial distribution of bioclimatic zones by the year 2050 under the RCP 8.5 scenario, for all area within the BSAP priority areas considered together.

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Priority Area: All								
Extremely cold and mesic	**F**	5187	1267	(3,920)	(76)	4314	4658	344
Cold and mesic	**G**	13695	8911	(4,784)	(35)	3574	3977	403
Cool temperate and xeric	**H**	650	3571	2,921	449	3148	3558	409
Cool temperate and moist	**J**	8477	7671	(806)	(10)	2932	3281	350
Warm temperate and mesic	**K**	35140	26513	(8,627)	(25)	1961	2388	427
Warm temperate and xeric	**L**	799	1611	812	102	1509	1704	195
Extremely hot and mesic	**M**	5280	12222	6,942	131	728	1089	361
Hot and mesic	**N**	22743	22441	(302)	(1)	1181	1519	339
Extremely hot and moist	**R**	90	7854	7,764	8,627	461	816	355

Table 14: Change in spatial distribution of bioclimatic zones by the year 2050 under the RCP 8.5 scenario, for each of the BSAP priority areas.

Summary of Priority Area Change in Spatial Distribution of Bioclimatic Zones under RCP 8.5

Priority Area	Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
			2000	RCP85	(km^2)	%	2000	RCP85	(m)
Northern Gaoligong Mountain Temperate Coniferous Forest									
1.1	Extremely cold and mesic	F	289	31	(258)	(89)	4073	4439	365
1.1	Cold and mesic	G	1669	980	(689)	(41)	3518	3789	271
1.1	Cool temperate and moist	J	843	1102	259	31	2978	3346	367
1.1	Warm temperate and mesic	K	1746	2039	293	17	2270	2582	312
1.1	Extremely hot and mesic	M		56	56			1424	
1.1	Hot and mesic	N	65	404	339	522	1419	1814	395
Meili and Biluo Snow Mountain Cold-Temperate Coniferous Forest									
1.2	Extremely cold and mesic	F	491	151	(340)	(69)	4281	4778	497
1.2	Cold and mesic	G	1281	919	(362)	(28)	3549	3848	300
1.2	Cool temperate and xeric	H		15	15			3603	
1.2	Cool temperate and moist	J	722	854	132	18	3011	3350	339
1.2	Warm temperate and mesic	K	1419	1662	243	17	2317	2629	313
1.2	Extremely hot and mesic	M		9				1411	
1.2	Hot and mesic	N	28	331	303	1,082	1493	1799	305
Yunling Mountain Warm Temperate Coniferous Forest									
1.3	Extremely cold and mesic	F	2388	668	(1,720)	(72)	4352	4700	348
1.3	Cold and mesic	G	4846	3351	(1,495)	(31)	3536	3999	463
1.3	Cool temperate and xeric	H	205	999	794	387	3120	3527	406
1.3	Cool temperate and moist	J	4045	3021	(1,024)	(25)	3004	3317	313
1.3	Warm temperate and mesic	K	5151	7705	2,554	50	2501	2749	248
1.3	Warm temperate and xeric	L	15	285	270	1,800	1909	2323	414
1.3	Hot and mesic	N	16	637	621	3,881	1528	2077	549
Shangri-la Mountain Cold-Temperate Coniferous Forest									
1.4	Extremely cold and mesic	F	2012	417	(1,595)	(79)	4313	4564	250
1.4	Cold and mesic	G	5115	3466	(1,649)	(32)	3686	4061	375
1.4	Cool temperate and xeric	H	445	2557	2,112	475	3161	3569	408
1.4	Cool temperate and moist	J	1043	1296	253	24	3050	3375	326
1.4	Warm temperate and mesic	K	1112	1521	409	37	2518	2862	344
1.4	Warm temperate and xeric	L	174	375	201	116	1900	2348	448
1.4	Hot and mesic	N	6	275	269	4,483	1835	1989	154
Southern Gaoligong Mountain Humid Evergreen Broadleaf Forest									
2.1	Cold and mesic	G	284	73	(211)	(74)	3504	3738	235
2.1	Cool temperate and moist	J	772	777	5	1	2926	3135	209
2.1	Warm temperate and mesic	K	3819	3417	(402)	(11)	2193	2298	105
2.1	Extremely hot and mesic	M		22	22			1232	
2.1	Hot and mesic	N	30	616	586	1,953	1315	1755	440
Tongbiguan Tropical Rainforest									
2.2	Warm temperate and mesic	K	377	41	(336)	(89)	1623	1947	324
2.2	Extremely hot and mesic	M	96	791	695	724	657	1056	400
2.2	Hot and mesic	N	1041	526	(515)	(49)	1100	1495	394
2.2	Extremely hot and moist	R		156	156			762	
Nanting River Tropical Rainforest									
2.3	Cold and mesic	G	1		(1)	(100)	3289		
2.3	Cool temperate and moist	J	60	54	(6)	(10)	2908	2957	50
2.3	Warm temperate and mesic	K	2566	1576	(990)	(39)	2082	2301	218
2.3	Extremely hot and mesic	M	190	568	378	199	758	1160	402
2.3	Hot and mesic	N	1216	1505	289	24	1242	1634	392
2.3	Extremely hot and moist	R		330	330			821	
XishuangbannaTropical Rain Forest									
2.4	Warm temperate and mesic	K	1320	112	(1,208)	(92)	1792	2159	367
2.4	Extremely hot and mesic	M	2561	4551	1,990	78	839	1219	380
2.4	Hot and mesic	N	8352	3325	(5,027)	(60)	1242	1578	336
2.4	Extremely hot and moist	R	6	4251	4,245	70,750	581	907	326

Table 14 (cont.): Change in spatial distribution of bioclimatic zones by the year 2050 under the RCP 8.5 scenario, for each of the BSAP priority areas.

Summary of Priority Area Change in Spatial Distribution of Bioclimatic Zones under RCP 8.5 (Cont.)

Priority Area	Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
			2000	RCP85	(km^2)	%	2000	RCP85	(m)
Honghe Moist Rainforest Zone									
2.5	Cool temperate and moist	J	155	9	(146)	(94)	2512	2693	182
2.5	Warm temperate and mesic	K	4509	1946	(2,563)	(57)	1772	2026	254
2.5	Extremely hot and mesic	M	1821	3001	1,180	65	654	1085	431
2.5	Hot and mesic	N	5168	4478	(690)	(13)	1226	1564	337
2.5	Extremely hot and moist	R	84	2303	2,219	2,642	452	747	295
Southeast Karst Monsoon Broadleaf Evergreen Forest									
3.0	Warm temperate and mesic	K	4149	428	(3,721)	(90)	1495	1745	250
3.0	Warm temperate and xeric	L	129		(129)	(100)	1540		
3.0	Extremely hot and mesic	M	585	2729	2,144	366	467	862	395
3.0	Hot and mesic	N	5539	6502	963	17	1039	1379	339
	Extremely hot and moist	R		743	743	#DIV/0!		494	494
Wumeng Mountain Humid Evergreen Forest									
4.1	Cold and mesic	G	138	6	(132)	(96)	2627	2929	302
4.1	Cool temperate and moist	J	519	204	(315)	(61)	2168	2559	392
4.1	Warm temperate and mesic	K	5372	3730	(1,642)	(31)	1312	1582	270
4.1	Warm temperate and xeric	L	135	724	589	436	727	1075	349
4.1	Extremely hot and mesic	M		9	9			699	
4.1	Hot and mesic	N	247	1738	1,491	604	553	889	336
Jinsha River Dry-Hot Valleys									
4.2	Extremely cold and mesic	F	7		(7)	(100)	3973		
4.2	Cold and mesic	G	361	116	(245)	(68)	3273	3666	393
4.2	Cool temperate and moist	J	271	335	64	24	2758	3065	307
4.2	Warm temperate and mesic	K	591	400	(191)	(32)	1953	2470	517
4.2	Warm temperate and xeric	L	211	223	12	6	1417	1857	440
4.2	Extremely hot and mesic	M	24	413	389	1,621	863	1031	169
4.2	Hot and mesic	N	459	423	(36)	(8)	1051	1469	418
4.2	Extremely hot and moist	R		14	14			842	
Lancang Middle Mountain Evergreen Broadleaf									
5.1	Cool temperate and moist	J	20	17	(3)	(15)	3000	3024	25
5.1	Warm temperate and mesic	K	723	570	(153)	(21)	2403	2483	80
5.1	Warm temperate and xeric	L	34		(34)	(100)	1751		
5.1	Extremely hot and mesic	M		2	2			1139	
5.1	Hot and mesic	N	32	218	186	581	1429	1979	550
5.1	Extremely hot and moist	R		2	2			1215	
Wuliang Mountain Humid Evergreen Broadleaf Forest									
5.2	Cool temperate and moist	J	24	2	(22)	(92)	2951	3017	66
5.2	Warm temperate and mesic	K	471	303	(168)	(36)	2359	2542	183
5.2	Warm temperate and xeric	L	64		(64)	(100)	1873		
5.2	Extremely hot and mesic	M		3	3			1337	
5.2	Hot and mesic	N	132	380	248	188	1603	1919	316
5.2	Extremely hot and moist	R		3	3			1264	
Ailao Mountain Humid Evergreen Broadleaf Forest									
5.3	Cool temperate and moist	J	3		(3)	(100)	2957		
5.3	Warm temperate and mesic	K	1815	1063	(752)	(41)	2227	2419	192
5.3	Warm temperate and xeric	L	37	4	(33)	(89)	1921	2290	369
5.3	Extremely hot and mesic	M	3	68	65	2,167	1066	1419	353
5.3	Hot and mesic	N	412	1083	671	163	1554	1873	319
5.3	Extremely hot and moist	R		52	52			1168	

The percent of the total area of each of the priority areas that shifts to another major bioclimatic zone ranges from 23% to over 80 % under the RCP 8.5 scenario. Likewise, the range of percent shift for strata is from 83 to 100%.

Table 15: The percent of the total area of each Priority Area that shifts to another zone or strata by 2050 under the RCP 8.5 scenario.

Percent Shift - RCP 8.5

Priority Area		Zone	Strata
1.1	Northern Gaoligong Mountain Cold-Temperate Coniferous	51	90
1.2	Meili and Biluo Snow Mountain Cold-Temperate Coniferous	48	89
1.3	Yunling Mountain Warm-Temperate Coniferous	56	90
1.4	Shangri-la Mountain Cold-Temperate Coniferous	65	84
2.1	Southern Gaoligong Humid Evergreen Broadleaf	23	83
2.2	Tongbiguan Tropical Rainforest	84	99
2.3	Nanting River Tropical Rainforest	48	95
2.4	XishuangbannaTropical Rainforest	82	100
2.5	Honghe Moist Rainforest Zone	67	95
3.0	Southeast Yunnan Karst Monsoon Broadleaf Evergreen	70	99
4.1	Wumeng Mountain Humid Evergreen Broadleaf	44	98
4.2	Jinsha River Dry-Hot Valleys	75	95
5.1	Lancang Middle Mountain Evergreen Broadleaf	25	98
5.2	Wuliang Mountain Humid Evergreen Broadleaf	41	96
5.3	Ailao Mountain Humid Evergreen Broadleaf	40	96

A detailed presentation in tables and maps of climatic conditions and projected change in the spatial distribution of bioclimatic conditions within each of the 15 Priority Areas is given in Appendix One.

6. Climate change impacts on the Protected Area Network in Yunnan:

Protected Area Network

As reported in current statistics for 2012, there are 159 nature reserves that have been established in Yunnan, coprising a total area of 28,300 km^2, and accounting for 7.2% of the total province area.

In our analysis of protected area, we relied on data from the YEPD, which was provided as the most current and updated data, available as a digital dataset of protected area, but known to be incomplete. In total, we were able to analyze over 23,000 km^2 (i.e., over 83% of the protected area of Yunnan) of various levels of protected areas in Yunnan Province, which included both National Nature Reserves and Provincial Nature Reserves (Figure 14). Based on the YEPD Protected Area dataset, o a whole, 56.6% of all this Protected Area in Yunnan is projected to shift to different bioclimatic zone by the year 2050 (i.e., under RCP 8.5), and 93% of this total Protected Area will shift to a different bioclimatic stratum.

Figure 14: Map showing location of Protected Area in Yunnan, including both provincial and national natural reserves, in relation to BSAP Priority Areas.

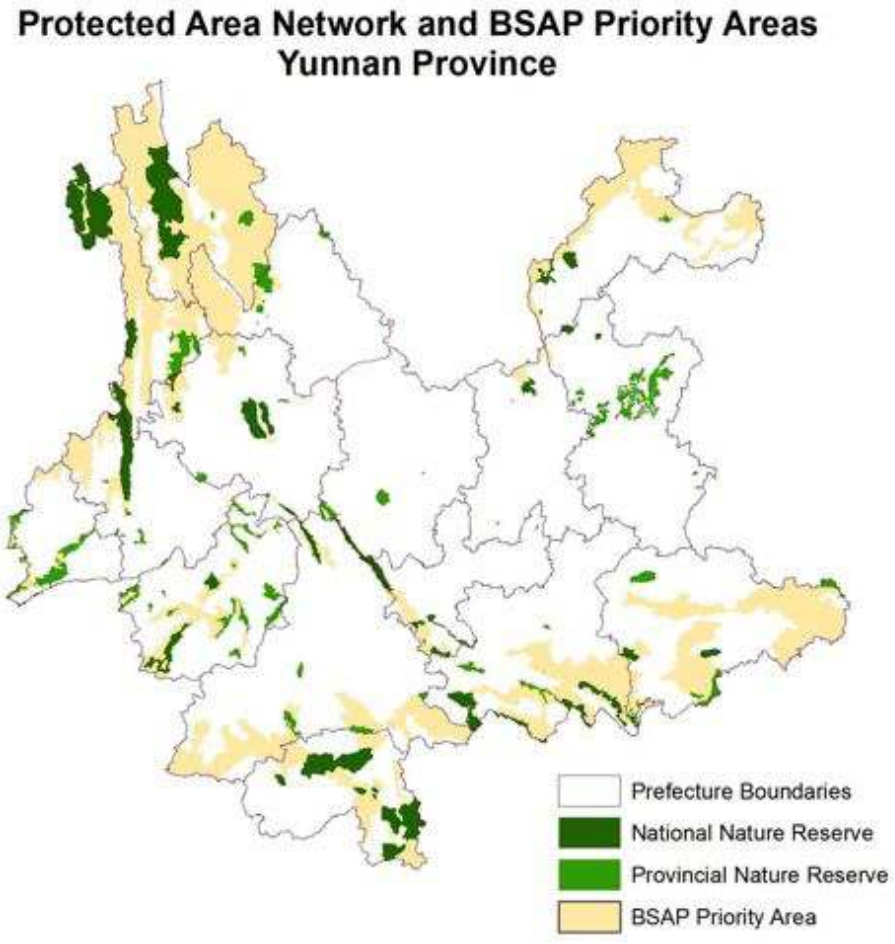


Table 16 shows the distribution of bioclimatic zones within all the Protected Area for all of Yunnan. The single largest bioclimatic zone comprising this Protected Area is the Warm Temperate and Mesic, followed by Hot and Mesic. There is a very significant increase in the area of the two warmest bioclimatic zones, and likewise, a significant decrease in the two coldest bioclimatic zones indicating that species found in these colder zones may not find this set of bioclimatic conditions within Yunnan by 2050. The upward shift of the average elevation of these bioclimatic zones (i.e. under RCP 8.5) ranges from 249 m, to over 500 m for the relatively small areas of "Hot and Mesic" and the expanding "Cool Temperate and Xeric". The average upward shift for all bioclimatic zones is 379 m.

Table 16: Distribution of bioclimatic zones and strata within Protected Area within Yunnan under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under the RCP 8.5 scenario.

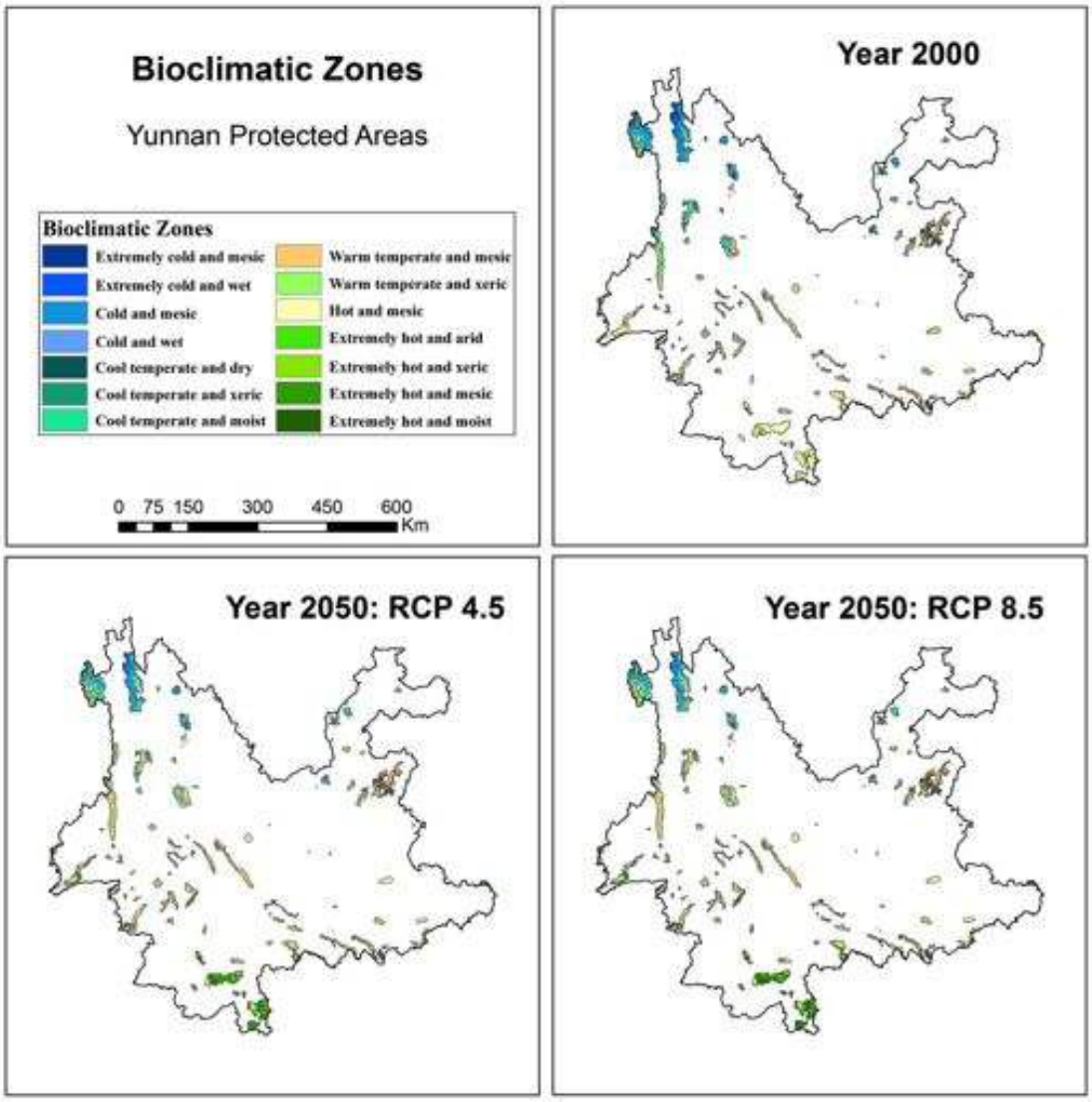
Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Extremely cold and mesic	F	1,345	362	(983)	(73)	4,248	4,617	368
Cold and mesic	G	3,830	2,564	(1,266)	(33)	3,526	3,881	354
Cool temperate and xeric	H	32	304	272	850	2,985	3,510	525
Cool temperate and moist	J	2,590	2,705	115	4	2,937	3,276	339
Warm temperate and mesic	K	9,449	8,471	(978)	(10)	2,225	2,491	265
Warm temperate and xeric	L	403	612	209	52	1,679	2,103	424
Hot and mesic	N	4,370	3,452	(918)	(21)	1,156	1,694	537
Extremely hot and mesic	M	1,592	2,678	1,086	68	777	1,125	348
Extremely hot and moist	R	64	2,527	2,463	3,848	606	855	249
Yunnan - All Protected Area		23675				Average Upward Shift		379

There are similar predicted shifts for the finer resolution bioclimatic strata i.e. which make up the bioclimatic zones (Table 17). There is a reduction of area for the coldest strata, and significant shifting of strata within all zones. The average mean elevation of the bioclimatic strata (within all of the Protected Area in Yunnan) is projected to shift 403 m by 2050 (i.e. under RCP 8.5).

Table 17: Distribution of bioclimatic strata within the protected area network of Yunnan under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under RCP 8.5.

Bioclimatic Zone	Strata	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Extremely cold and mesic								
	F8	166	25	(141)	(85)	4,737	4,855	118
	F13	825	105	(720)	(87)	4,259	4,788	529
	F15	354	232	(122)	(34)	3,995	4,514	519
Cold and mesic								
	G7	15	189	174	1,160	3,762	4,353	590
	G8	112	46	(66)	(59)	3,746	3,862	116
	G11	2,448	1,662	(786)	(32)	3,621	3,919	298
	G13	1,255	667	(588)	(47)	3,319	3,653	334
Cool temperate and xeric								
	H5	32	304	272	850	2,985	3,510	525
Cool temperate and moist								
	J3	1,225	716	(509)	(42)	3,069	3,396	327
	J4	181	523	342	189	2,566	3,072	506
	J5	1,184	1,466	282	24	2,857	3,291	433
Warm temperate and mesic								
	K1	3,297	1,357	(1,940)	(59)	2,563	2,972	410
	K2	162	59	(103)	(64)	2,156	2,460	304
	K5	1,743	1,075	(668)	(38)	2,263	2,642	380
	K7	1,562	1,877	315	20	2,110	2,547	437
	K10	1,220	2,349	1,129	93	2,076	2,368	292
	K11	86	239	153	178	1,460	1,867	407
	K13	1,379	1,515	136	10	1,690	2,171	481
Warm temperate and xeric								
	L3	403	612	209	52	1,679	2,103	424
Hot and mesic								
	N2	85	388	303	356	1,376	2,159	783
	N3	1,346	1,046	(300)	(22)	1,330	1,736	406
	N4	32	500	468	1,463	1,552	1,895	343
	N5	145	211	66	46	1,169	1,642	473
	N8	2,309	1,060	(1,249)	(54)	1,078	1,441	362
	N9	42	201	159	379	1,165	1,512	347
	N11	411	46	(365)	(89)	946	1,496	550
Extremely hot and mesic								
	M1	-	12	-	-	-	1,461	-
	M2	791	1,283	492	62	823	1,168	345
	M3	6	23	17	283	872	1,404	532
	M4	691	1,071	380	55	763	1,153	391
	M6	-	9	-	-	-	806	-
	M7	104	280	176	169	521	791	270
Extremely hot and moist								
	R1	64	2,527	2,463	3,848	606	855	249
Yunnan - All Protected Area		**23675**				**Average Upward Shift**		**403**

Figure 15: Distribution of bioclimatic zones within the protected area network of Yunnan under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5



The distribution of bioclimatic zones within protected area within each of the Priority Areas is given in Table 18. Only 1 of the 15 priority areas does not contain any protected area. Almost 19,000 km^2, out of a total of 23,000 km^2 for all Yunnan (more than 80%) of all protected area is found in these 16 priority areas. More than 13,000 km^2 or roughly more than 55% percent of all the Protected Areas in Yunnan, are found within these five Priority Areas. The number of bioclimatic zones found within each Priority Area is indicative of the diversity of area protected within that Priority Area. For example, Yunling Mountain and Jinsha River Dry-Hot Valleys both have a high diversity of habitats within Protected Area, i.e., seven zones, although several are small in area.. The average upwards shift for the mean elevation of all the bioclimatic zone is 304 m.

Table 18: Distribution of bioclimatic zones within Protected Area within all BSAP Priority Areas, and their change in areal extent and upward shift in mean elevation by the year 2050 under the RCP 8.5 emission scenario.

Protected Area within BSAP Priority Areas - Yunnan

Priority Area	Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
			2000	RCP85	km^2	%	2000	RCP85	(m)
Northern Gaoligong Mountain Temperate Coniferous Forest									
1.1	Extremely cold and mesic	F	285	34	(251)	(88)	4069	4406	337
1.1	Cold and mesic	G	1312	861	(451)	(34)	3524	3788	264
1.1	Cool temperate and moist	J	492	799	307	62	2979	3343	364
1.1	Warm temperate and mesic	K	526	888	362	69	2471	2707	236
1.1	Extremely hot and mesic	M	-	7	-	-	-	1534	-
1.1	Hot and mesic	N	-	26	-	-	-	1964	-
Yunling Mountain Warm Temperate Coniferous Forest									
1.3	Extremely cold and mesic	F	913	259	(654)	(72)	4251	4593	342
1.3	Cold and mesic	G	1587	1363	(224)	(14)	3562	3929	367
1.3	Cool temperate and dry	H	32	177	145	453	2913	3437	524
1.3	Cool temperate and moist	J	940	846	(94)	(10)	3048	3365	317
1.3	Warm temperate and mesic	K	715	1426	711	99	2591	2869	278
1.3	Warm temperate and xeric	L	2	49	47	2350	1937	2315	378
1.3	Hot and mesic	N	-	69	-	-	-	2096	-
Shangri-la Mountain Cold-Temperate Coniferous Forest									
1.4	Extremely cold and mesic	F	135	66	(69)	(51)	4309	4564	255
1.4	Cold and mesic	G	383	189	(194)	(51)	3571	3841	270
1.4	Cool temperate and dry	H	-	127	-	-	-	3660	-
1.4	Cool temperate and moist	J	92	157	65	71	2973	3334	-
1.4	Warm temperate and mesic	K	117	145	28	24	2459	2753	-
1.4	Warm temperate and xeric	L	17	34	17	100	1813	2271	458
1.4	Hot and dry	N	-	26	-	-	-	1917	-
Southern Gaoligong Mountain Humid Evergreen Broadleaf Forest									
2.1	Cold and mesic	G	149	25	(124)	(83)	3382	3666	284
2.1	Cool temperate and moist	J	324	455	131	40	2977	3069	92
2.1	Warm temperate and mesic	K	1045	994	(51)	(5)	2393	2418	25
2.1	Hot and mesic	N	1	45	44	4400	1539	1760	221
Tongbiguan Tropical Rainforest									
2.2	Cool temperate and moist	J	2	-	-	-	2378	-	-
2.2	Warm temperate and mesic	K	255	35	(220)	(86)	1633	2014	
2.2	Extremely hot and mesic	M	77	462	385	500	700	1093	393
2.2	Hot and mesic	N	634	355	(279)	(44)	1132	1482	350
2.2	Extremely hot and moist	R	-	116	-	-	-	784	-

Table 18 (Cont.): Distribution of bioclimatic zones within Protected Area within all BSAP Priority Areas, and their change in areal extent and upward shift in mean elevation by the year 2050 under the RCP 8.5 emission scenario.

Protected Area within BSAP Priority Areas - Yunnan (cont.)

Priority Area	Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
			2000	RCP85	km^2	%	2000	RCP85	(m)
Nanting River Tropical Rainforest									
2.3	Cold and mesic	G	1	-	-	-	3301	-	-
2.3	Cool temperate and moist	J	57	52	(5)	(9)	2865	2910	45
2.3	Warm temperate and mesic	K	981	723	(258)	(26)	2222	2396	174
2.3	Extremely hot and mesic	M	53	85	32	60	747	1156	409
2.3	Hot and mesic	N	215	373	158	73	1261	1651	390
2.3	Extremely hot and moist	R	-	74	-	-	-	798	-
XishuangbannaTropical Rain Forest									
2.4	Warm temperate and mesic	K	73	-	-	-	1637	-	-
2.4	Extremely hot and mesic	M	962	1315	353	37	864	1173	309
2.4	Hot and mesic	N	2217	322	(1895)	(85)	1147	1458	311
2.4	Extremely hot and moist	R	-	1615	-	-	-	918	-
Honghe Moist Rainforest Zone									
2.5	Cool temperate and moist	J	140	9	(131)	(94)	2541	2748	207
2.5	Warm temperate and mesic	K	896	687	(209)	(23)	1908	2162	255
2.5	Hot and mesic	N	234	389	155	66	635	1005	369
2.5	Extremely hot and mesic	M	492	443	(49)	(10)	1152	1585	433
2.5	Extremely hot and moist	R	4	238	234	5850	486	753	267
Southeast Karst Monsoon Broadleaf Evergreen Forest									
3.0	Warm temperate and mesic	K	268	112	(156)	(58)	1570	1819	249
3.0	Extremely hot and mesic	M	113	103	(10)	(9)	416	828	412
3.0	Hot and mesic	N	179	212	33	18	937	1364	427
3.0	Extremely hot and moist	R	-	133	-	-	-	431	-
Wumeng Mountain Humid Evergreen Forest									
4.1	Cool temperate and moist	J	23	-	-	-	2015	-	-
4.1	Warm temperate and mesic	K	34	57	23	68	1744	1853	109
Jinsha River Dry-Hot Valleys									
4.2	Extremely cold and mesic	F	7	-	-	-	3800	-	-
4.2	Cold and mesic	G	333	109	(224)	(67)	3256	3608	352
4.2	Cool temperate and moist	J	155	291	136	88	2760	3065	305
4.2	Warm temperate and mesic	K	63	141	78	124	2113	2539	426
4.2	Warm temperate and xeric	L	4	9	5	125	1158	1709	551
4.2	Extremely hot and mesic	M	-	1	-	-	-	1075	-
4.2	Hot and mesic	N	4	15	11	275	923	1358	435
Lancang Middle Mountain Evergreen Broadleaf									
5.1	Cool temperate and moist	J	20	17	(3)	(15)	2959	2988	29
5.1	Warm temperate and mesic	K	513	449	(64)	(12)	2459	2496	37
5.1	Warm temperate and xeric	L	3	-	-	-	1893	-	-
5.1	Hot and mesic	N	1	71	70	7000	1596	2202	606
Wuliang Mountain Humid Evergreen Broadleaf Forest									
5.2	Cool temperate and moist	J	24	2	(22)	(92)	2945	3134	189
5.2	Warm temperate and mesic	K	269	237	(32)	(12)	2461	2552	91
5.2	Warm temperate and xeric	L	7	-	-	-	1943	*	-
5.2	Hot and mesic	N	14	74	60	429	1488	2091	603
5.2	Extremely hot and moist	R	-	1	-	-	-	1235	-
Ailao Mountain Humid Evergreen Broadleaf Forest									
5.3	Cool temperate and moist	J	3	-	-	-	2922	-	-
5.3	Warm temperate and mesic	K	1015	708	(307)	(30)	2373	2499	126
5.3	Warm temperate and xeric	L	24	5	(19)	(79)	1919	2241	322
5.3	Extremely hot and mesic	M	-	3	-	-	-	1376	-
5.3	Hot and mesic	N	24	348	324	1350	1580	2053	473
5.3	Extremely hot and moist	R	-	2	-	-	-	1345	-
All Protected Area within all BSAP Priority Areas			**18716**				**Average Upward Shift**		**304**

7. Summary and Conclusions:

Overall, the results of this analysis show a quick and drastic change in the spatial distribution of bioclimatic conditions throughout Yunnan Province, and predict significant and increasing biophysical and biological perturbance for species and ecosystems in the near- to medium-term future under all scenarios. The magnitude of predicted change indicated by our analysis points to profound impacts on terrestrial ecosystems, biodiversity, and ecosystem services across Yunnan Province by 2050 as a result of warming and climate disruption, and the shifting of bioclimatic conditions spatially, particularly within mountainous terrain. This change will impact upon the conservation effectiveness of many protected areas and other biodiversity conservation efforts within Yunnan Province as ecological conditions within these areas may change beyond limits conducive for the species currently found there, or allow for newly invasive species.

A major conclusion to be drawn from this report is the over-riding necessity to recognize the now central role of a rapidly changing climate across Yunnan Province, and the need to incorporate and plan for adaptation within conservation planning, efforts and policy. Below we list some of the major findings of this report:

Major Findings:

Yunnan:

- The climate is likely to accelerate current rapid warming trends, on average becoming generally hotter across all of Yunnan under all RCP emission scenarios. Mean annual temperature averaged across Yunnan is predicted to increase from 1.6° to 2.5°C, by 2050.

- Yunnan Province appears to be one of the faster warming regions within the PRC and the greater East Asian region. Within Yunnan Province, the western and northwestern regions seem to have the most rapid projected rates of warming. Of the 16 prefectures within Yunnan Province, Nujiang, Dali, and Baoshan are warming most rapidly.

- The increase in mean annual temperature by 2050 is greatest in the northwestern parts of Yunnan, approaching and exceeding 3.0 °C increase under the RCP 8.5 scenario in the very northwest of Yunnan. Similarly, both minimum and maximum annual temperatures increase.

- Although the models project a slight increase in precipitation across Yunnan, the observed data shows a decreasing trend in precipitation over the last 50 years. In general, there is a high variability in the projections of precipitation among the models in the ensemble, so that the uncertainty of these projections is high, much higher than for the temperature projections, which have a relatively high agreement among models, i.e. confidence level.

- Nine major bioclimatic zones, and 33 strata, were identified through this study as currently found within Yunnan, ranging from Extremely Hot and Moist at low elevations, to Extremely Cold and Mesic at high elevations.

- There are substantial changes in both the areal extent and the average elevation of the bioclimatic zones, as projected for 2050. There is a large expansion in the extent of the hotter zones: Extremely Hot and Moist, the Hot and Mesic, and the Extremely Hot and Mesic.

- Tropical forests may see an expansion of their range, however, these areas may then also become susceptible to further risk of clearing for plantation development as they become optimal zones for expansion of rubber production. The optimal area for rubber production shift upwards in mean elevation by more than 300m by 2050, expanding to cover 75% of Xishuangbanna.

- There is a drastic a decrease in the Warm Temperate and Mesic zone, and the highest and colder zones, signaling a potential threat for species and ecosystems adapted to these mid- and high-elevation zones. Temperate forests and high levels of biodiversity found in sub-alpine and alpine zones at higher elevations, appear to be at high risk, as several strata associated with these ecotypes diminish substantially.

- All zones exhibit an upward shift in average elevation, ranging from 284 m to 414 m.

BSAP Priority Areas:

- The increase in mean annual temperature by 2050 for the 15 priority areas ranges from 2.0° to 2.2°C for under the RCP 4.5 scenario, and from 2.3° to 2.7°C under RCP 8.5, with priority areas in the northwestern and western regions showing the largest projected increases.

- The Cold-Temperate Coniferous Forest Zones exhibit the most rapid warming, along with the Humid Evergreen Broadleaf Forest and the Warm Temperate Coniferous Forest. All priority areas reach novel and unprecedented bioclimatic conditions by 2070 under scenario RCP 4.5, while under the RCP 8.5 scenario, that date is reached by 2049.

- For all of the BSAP priority areas there are substantial changes in both the areal extent and the average elevation of the bioclimatic zones, as predicted for 2050, with all bioclimatic zones within priority areas exhibiting an upward shift in average elevation, ranging from 195 m to over 400 m., with an average for all zones under RCP 8.5 of 356 m.

- The percent of the total area of each of the priority areas that shifts to another major bioclimatic zone ranges from 23% to over 80 % under the RCP 8.5 scenario. Likewise, the range of percent shift for strata is from 83 to 100%.

Protected Area Network:

- There are over 28, 000 km^2 of various levels of protected areas in Yunnan Province., which includes both National Nature Reserves and Provincial Nature Reserves. On a whole, 56% of all the Protected Area in Yunnan we analyzed (23,000 km^2) is projected to shift to different bioclimatic zone by the year 2050, and 93% of this total Protected Area will shift to a different bioclimatic stratum (under RCP 8.5).

- The single largest bioclimatic zone comprising this Protected Area is the Warm Temperate and Mesic, followed by the Hot and Mesic.

- There is a very substantial increase in the area of the two warmest bioclimatic zones.

- There is a drastic decrease in the two coldest bioclimatic zones indicating that species found in these colder zones may easily find this set of bioclimatic conditions within Yunnan by 2050.

- The upward shift of the average elevation of these bioclimatic zones (i.e. under RCP 8.5) ranges from 249 m, to over 500 m. The average upward shift for all bioclimatic zones is 379 m within all protected area is.

- There is a reduction of area for the coldest strata, and significant shifting of strata within all zones. The average mean elevation of the bioclimatic strata (within all of the Protected Area in Yunnan) is projected to shift 403 m by 2050 (i.e. under RCP 8.5).

- Eight priority areas where ranked, of which only one does not contain any Protected Area. More than 13,000 km2 (out of a total of 23,000 km2 for all Yunnan), or roughly more than 55% percent of all the Protected Areas in Yunnan, are found within these eight Priority Areas, and more than 80% in all the 14 priority areas.

- Yunling Mountain and Jinsha Valley have the highest diversity of habitats within Protected Area, i.e., seven zones, although several are small in area, and new zones appears by 2050. The average upwards shift for the mean elevation of the bioclimatic zones within protected area within BASP priority areas is 304 m.

Impacts on specific vegetation types, particular species, or wildlife, are difficult to predict, as the spatial distribution of life forms cannot be defined in purely ecophysiological terms, and are likewise subject to other secondary change processes, for example disruption of pest or pollinator cycles. In general, although species ranges may shift, the ability to survive, adapt or benefit from these changes is species- and site- specific, and depends on factors such as population dynamics,

seed dispersal mechanisms, habitat fragmentation, permeability of the landscape matrix, and physiological adaptability. Improving our understanding of these responses is among many important efforts that must be implemented if conservation strategies and policies are to be effective within the context of a rapidly changing climate. However, given the spatial isolation of suitable habitat for many endemic species found in Yunnan, the results of this analysis forewarn of a prolonged period of climate perturbation and of ecological disruption and potentially widespread extinctions, without concerted conservation efforts to mitigate habitat loss.

Recommended Climate Change Response Strategies for Biodiversity Conservation:

Based on an improved knowledge base of projected changes, impacts, and responses, and science- and evidence-based decision-making and planning, a number of actions (and tools) are available to incorporate climate change and adaption into conservation at various scales and levels. A number of authors have reviewed recommendations for adaptation strategies (Mawdsley et al., 2009), biodiversity management in the face of climate change ((Heller and Zavaleta, 2009), and incorporating climate change into systematic conservation planning (Groves et al., 2012). All stress the need to incorporate a fundamental awareness of on-going rapid climatic change in all levels of conservation planning and policy. In response to anticipated effects of climate change, conservation organizations and government agencies throughout the world are developing “adaptation strategies” at various scales to facilitate the adjustment of human society and ecological systems to altered climate regimes.

Mawdsley et al (2009) identified 16 general adaptation strategies that relate directly to the conservation of biological diversity.

These strategies can be grouped into four broad categories:

- **Land And Water Protection And Management;**
- **Direct Species Management;**
- **Monitoring And Planning;**
- **Law And Policy.**

Tools for implementing these strategies are similar or identical to those already in use by conservationists worldwide (land and water conservation, ecological restoration, agri-environment schemes, species translocation, captive propagation, monitoring, natural resource planning, and legislation/regulation). The authors state that their review indicates natural resource managers already have many tools that can be used to address climate-change effects, However, managers will likely need to apply these tools in novel and innovative ways to meet the unprecedented challenges posed by climate change. Below is a brief enumeration of some of these broad strategies and actions for addressing climate change for effective biodiversity conservation efforts, planning and policy (Source: Mawsley et al., 2009):

Strategies Related to Land and Water Protection and Management

1. Increase Extent of Protected Areas
2. Improve Representation and Replication within Protected-Area Networks
3. Improve Management and Restoration of Existing Protected Areas to Facilitate Resilience
4. Design New Natural Areas and Restoration Sites to Maximize Resilience
5. Protect Movement Corridors, Stepping Stones, and Refugia
6. Manage and Restore Ecosystem Function Rather than Focusing on Specific Components (Species or Assemblages)
7. Improve the Matrix by Increasing Landscape Permeability to Species Movement

Strategies Related to Direct Species Management

8. Focus Conservation Resources on Species that Might Become Extinct
9. Translocate Species at Risk of Extinction
10. Establish Captive Populations of Species that Would Otherwise Go Extinct
11. Reduce Pressures on Species from Sources Other than Climate Change

Strategies Related to Monitoring and Planning

12. Evaluate and Enhance Monitoring Programs for Wildlife and Ecosystems
13. Incorporate Predicted Climate-Change Impacts into Species and Land-Management Plans, Programs, and Activities
14. Develop Dynamic Landscape Conservation Plans
15. Ensure Wildlife and Biodiversity Needs Are Considered as Part of the Broader Societal Adaptation Process

Strategy Related to Law and Policy

16. Review and Modify Existing Laws, Regulations, and Policies Regarding Wildlife and Natural Resource Management

In developing and planning for conservation, some or all of these strategies and actions can be considered within the specific context of each of the ranked BSAP Priority Areas within Yunnan, and their specific conservation issues and challenges. In particular, it is recommend that the opportunities for increased connectivity, landscape matrix mosaics and increased permeability, and expansion of protected areas should be explored at an early stage, as these opportunities may be time limited by other ongoing landuse change processes.

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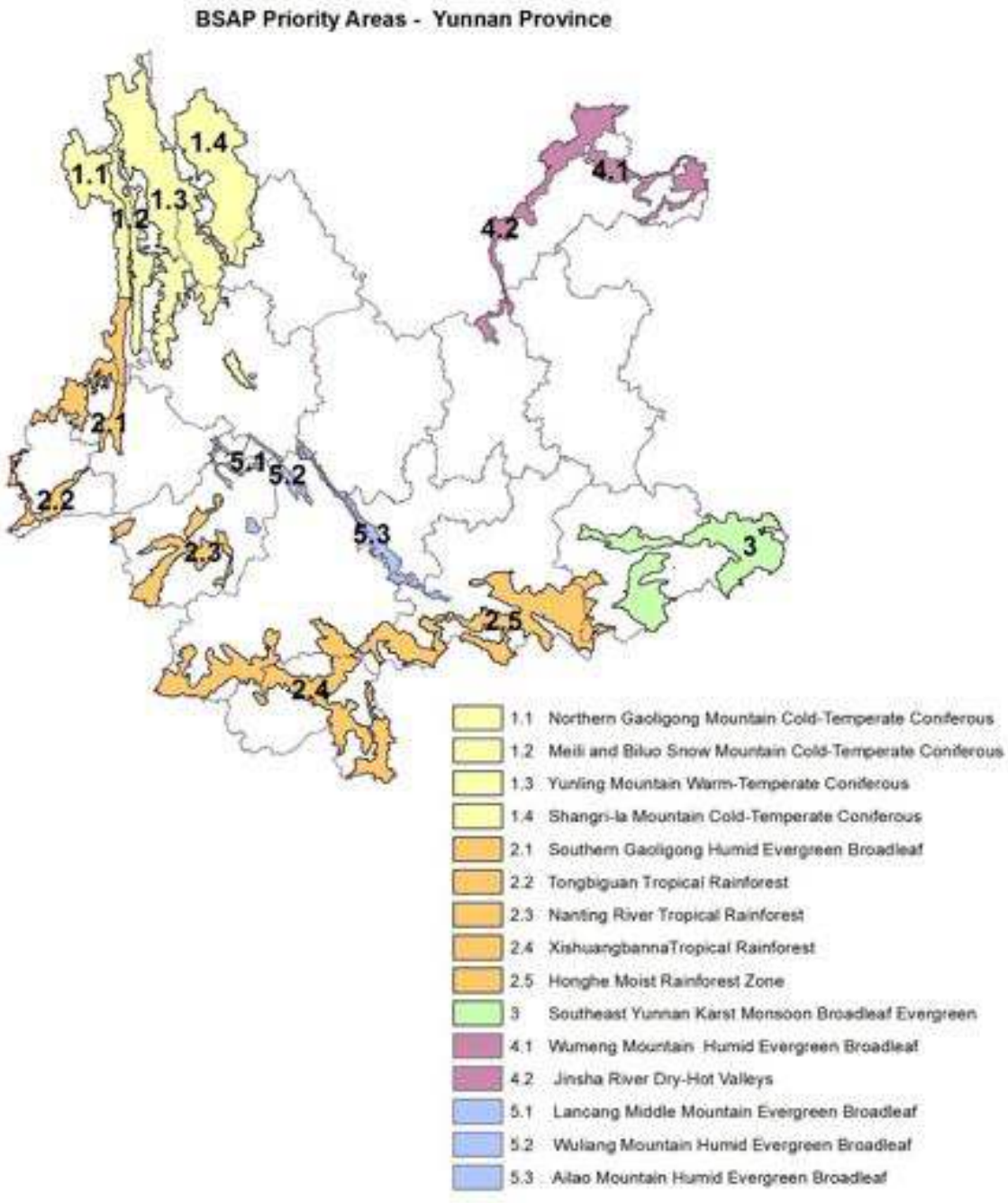
Appendix 1: BSAP Priority Areas:

Climatic conditions and projected impacts on spatial distribution of bioclimatic zones and strata by the year 2050.

This section presents a detailed overview in tables and maps of the current conditions (averaged 1960-2000) and the CIMP5-ESM downscaled projections for the 15 BSAP priority areas. All four RCP scenarios are given in the tables and maps presented here. An overview and synthesis of climate change impacts within all the priority areas is given in the main body text.

Yunnan Province - Yunnan Biodiversity Strategy and Action Plan (BSAP) Priority Areas (Source: Yunnan BSAP, YEPD).



Priority Area: 1.1

Northern Gaoligong Mountain Cold-Temperate Coniferous Forest

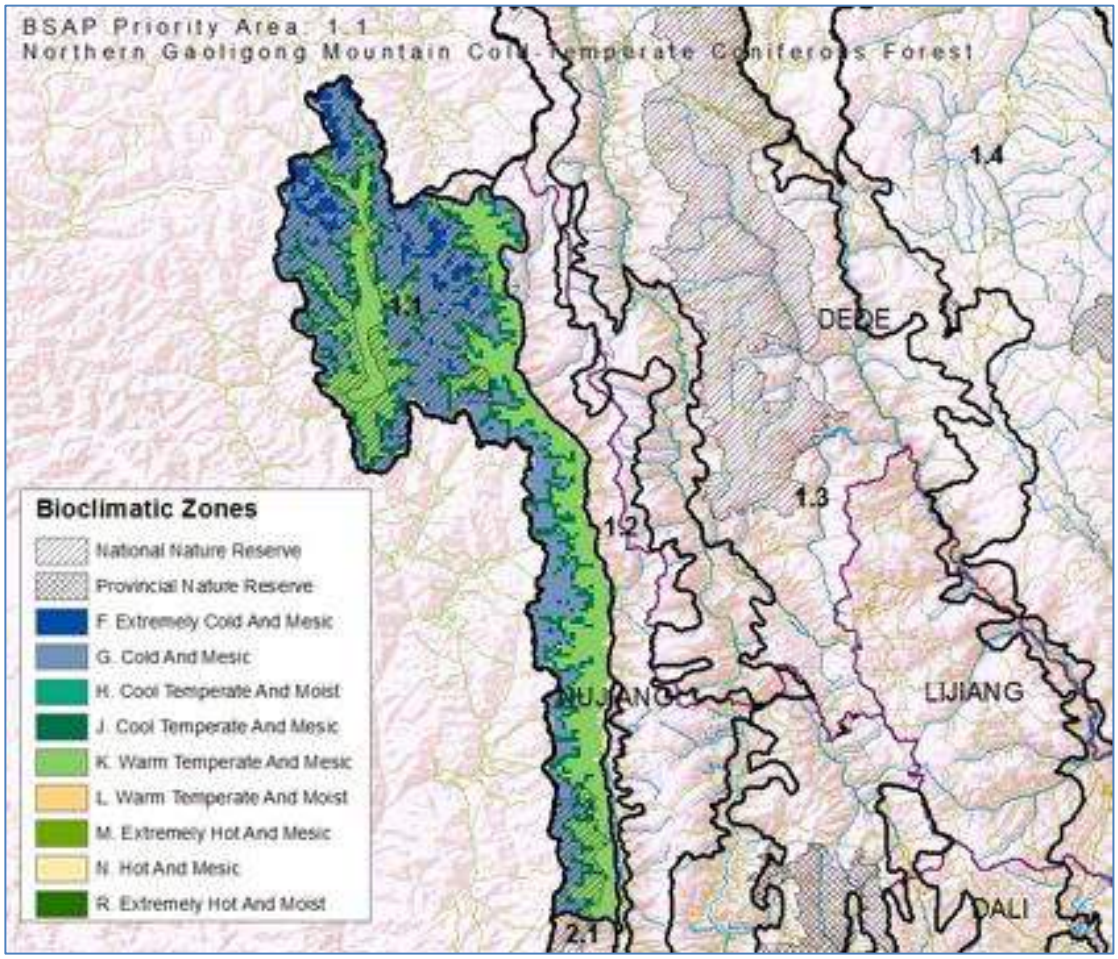
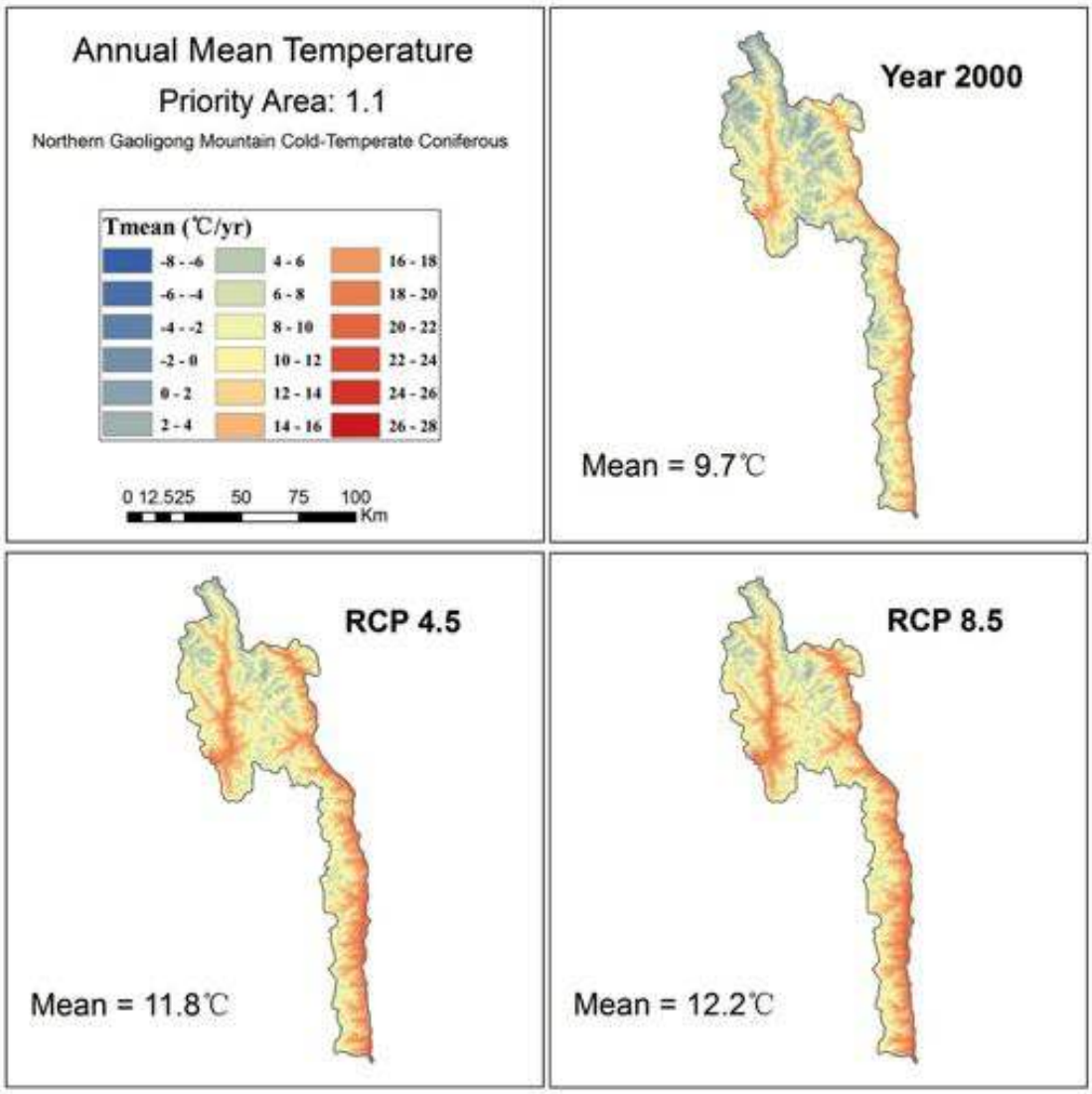


Table 1.1.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

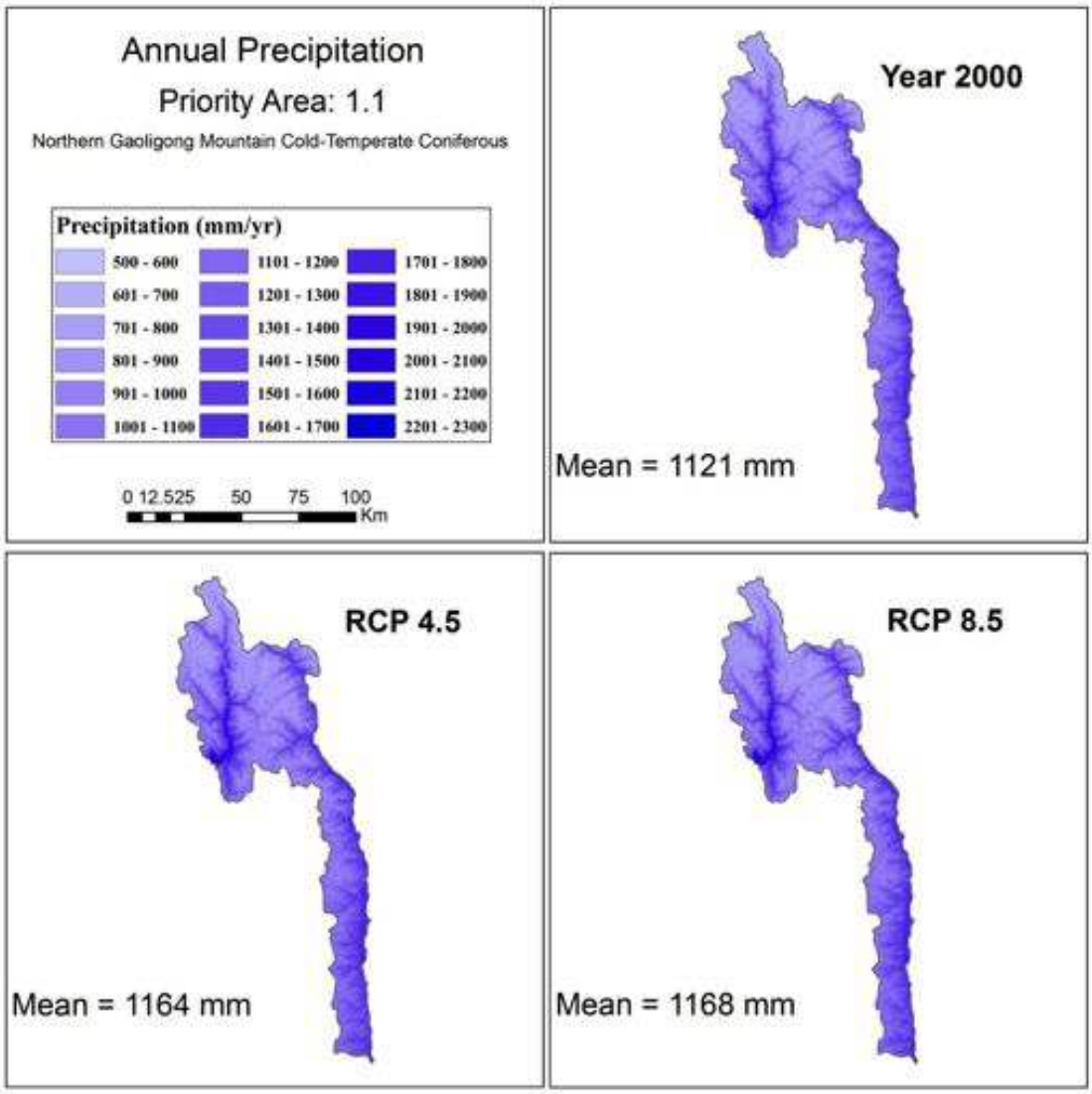
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Extremely cold and mesic	F	304	4032	3.4	790	766	1.03
Cold and mesic	G	1848	3495	6.5	932	870	1.07
Cool temperate and moist	J	869	2963	9.5	1084	980	1.1
Warm temperate and mesic	K	1741	2263	13.3	1353	1123	1.2
Hot and mesic	N	55	1424	17.8	1645	1285	1.28

Figure 1.1.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



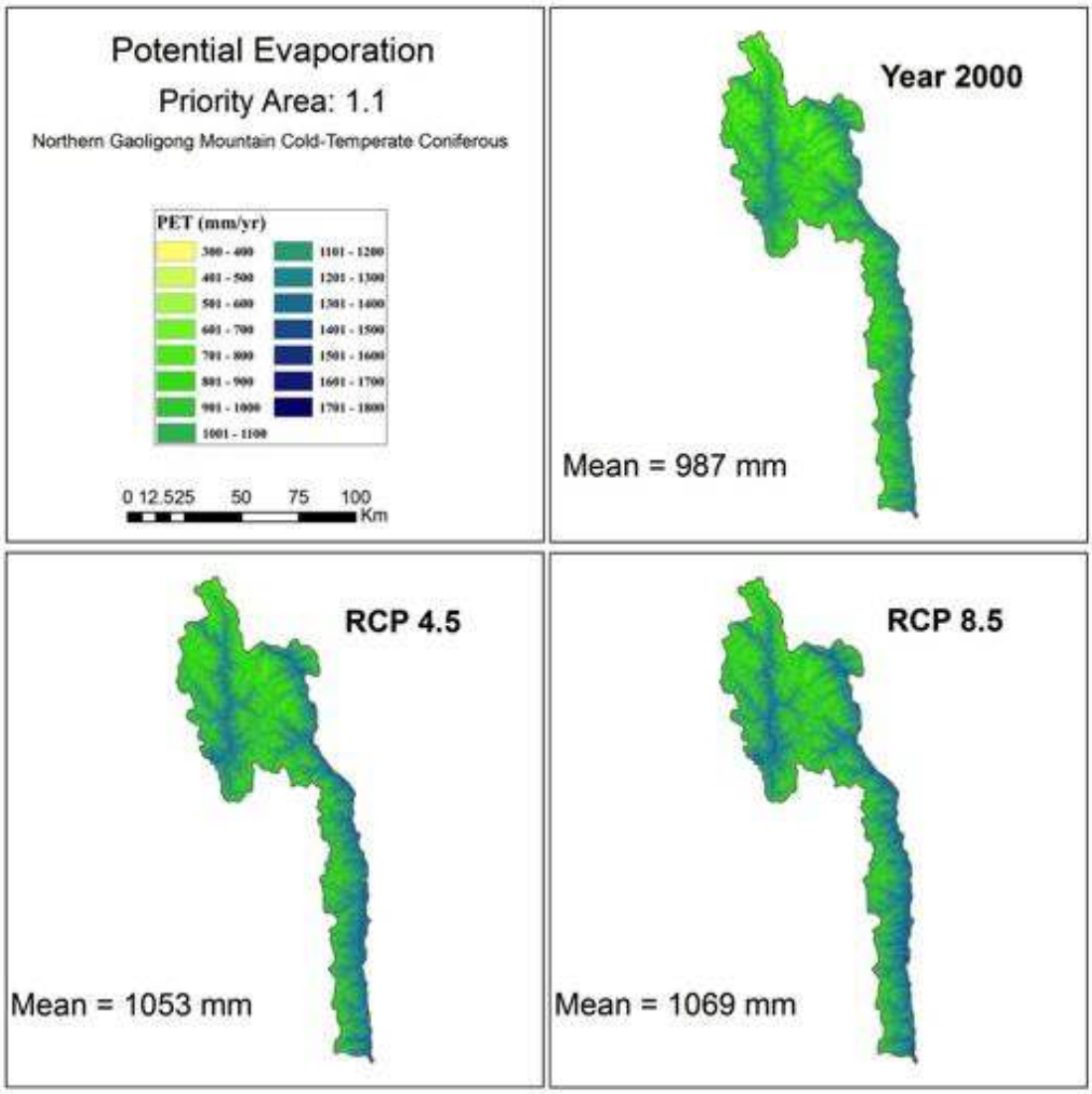
RCP	Mean annual temperature (℃/yr)			
	Mean	Min	Max	Std
2000	9.7	-0.7	19.5	4.1
RCP26	11.3	1.2	20.9	4.0
RCP45	11.8	1.7	21.4	4.0
RCP60	11.4	1.3	21.0	4.0
RCP85	12.2	2.2	21.8	4.0

Figure 1.1.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



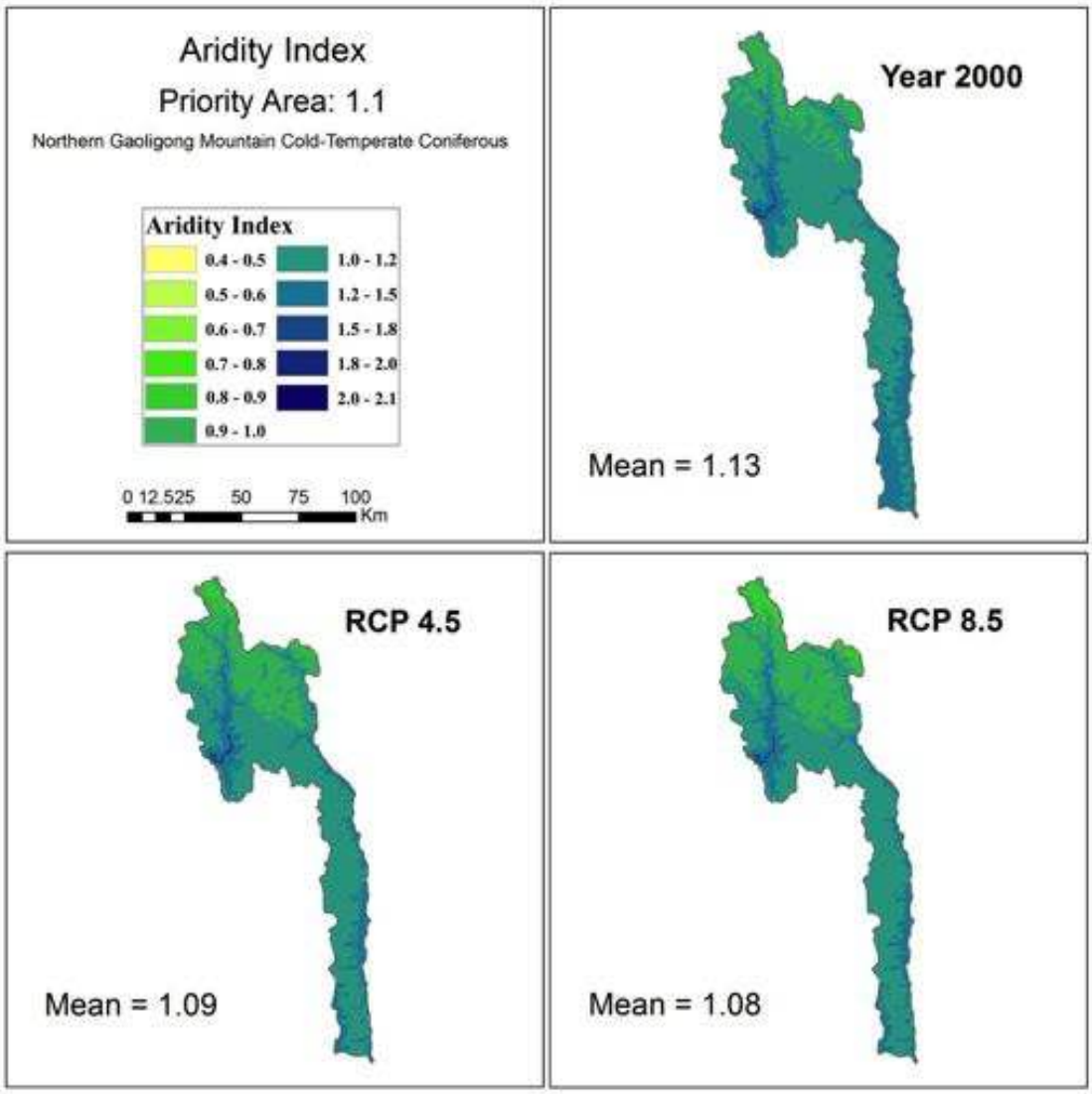
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1122	695	2166	264
RCP26	1156	725	2230	270
RCP45	1164	728	2249	273
RCP60	1149	716	2223	270
RCP85	1168	729	2254	274

Figure 1.1.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	987	639	1347	150
RCP26	1045	704	1402	150
RCP45	1054	715	1411	150
RCP60	1036	698	1388	149
RCP85	1069	732	1423	149

Figure 1.1.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.13	0.90	1.72	0.11
RCP26	1.10	0.88	1.69	0.11
RCP45	1.09	0.88	1.70	0.12
RCP60	1.10	0.88	1.70	0.12
RCP85	1.08	0.86	1.68	0.12

Figure 1.1.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

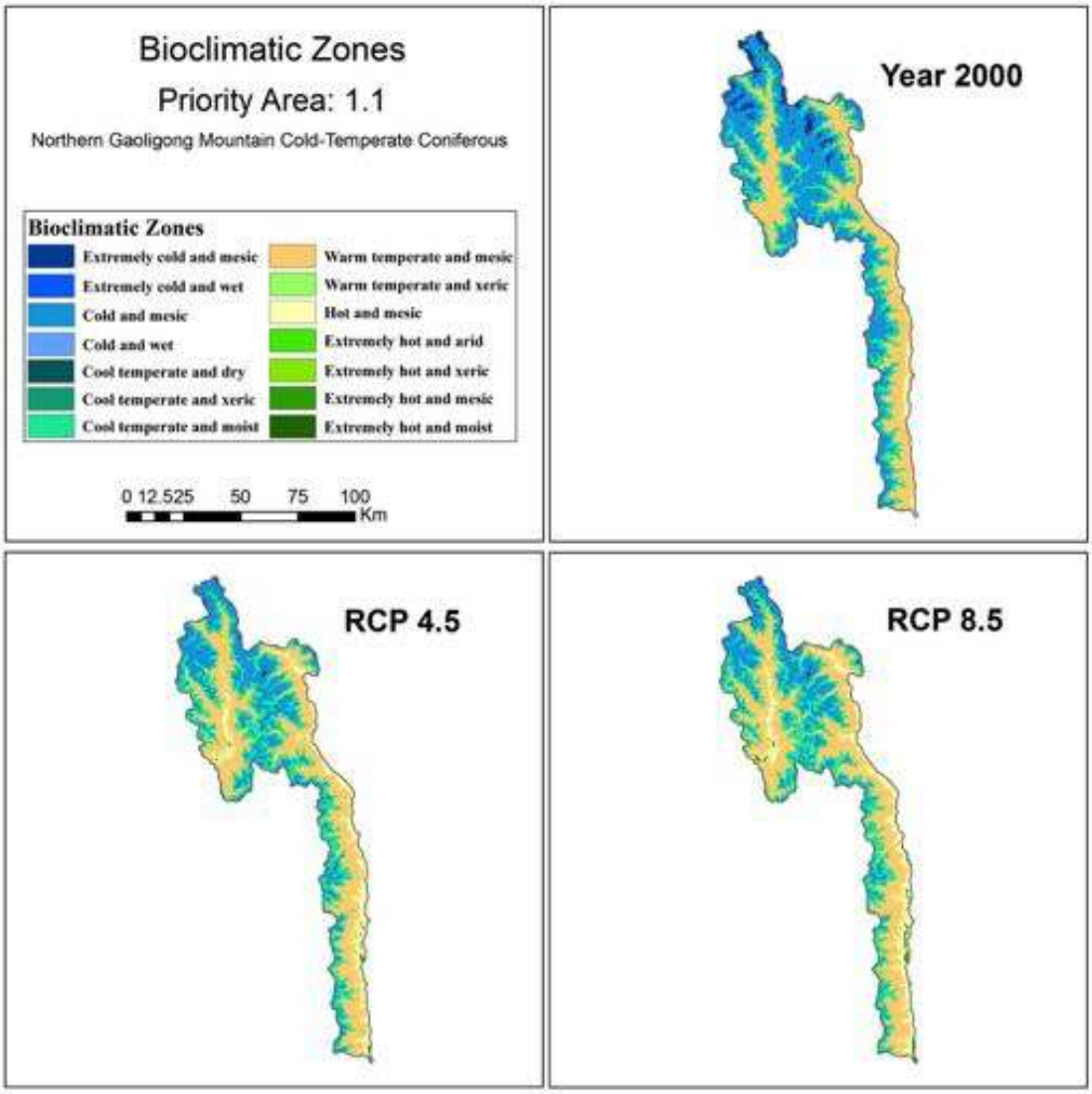


Table 1.1.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.1

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F	289	31	(258)	(89)	4073	4439	365
Cold and mesic	G	1669	980	(689)	(41)	3518	3789	271
Cool temperate and moist	J	843	1102	259	31	2978	3346	367
Warm temperate and mesic	K	1746	2039	293	17	2270	2582	312
Extremely hot and mesic	M		56	56			1424	
Hot and mesic	N	65	404	339	522	1419	1814	395

Figure 1.1.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

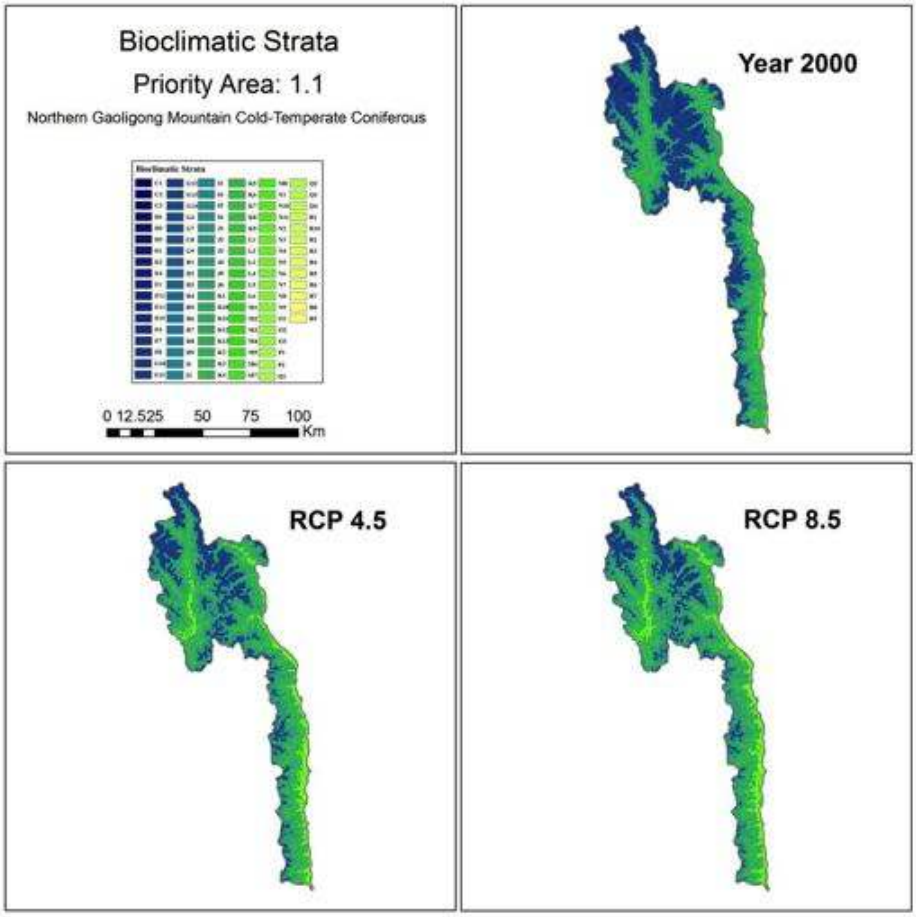


Table 1.1.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.1

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F8	1	-	-	-	4530	-	-
Extremely cold and mesic	F13	155	1	(154)	(99)	4196	4530	334
Extremely cold and mesic	F15	133	30	(103)	(77)	3927	4436	509
Cold and mesic	G7	-	9	-	-	-	4384	-
Cold and mesic	G8	5	-	-	-	3718	-	-
Cold and mesic	G11	1025	546	(479)	(47)	3624	3890	266
Cold and mesic	G13	639	425	(214)	(33)	3347	3646	299
Cool temperate and moist	J3	506	381	(125)	(25)	3056	3453	397
Cool temperate and moist	J4	-	24	-	-	-	3157	-
Cool temperate and moist	J5	337	697	360	107	2862	3294	431
Warm temperate and mesic	K1	875	684	(191)	(22)	2534	2940	406
Warm temperate and mesic	K5	4	165	161	4,025	2591	2696	105
Warm temperate and mesic	K7	548	547	(1)	(0)	2119	2534	415
Warm temperate and mesic	K10	-	47	-	-	-	2498	-
Warm temperate and mesic	K11	30	-	-	-	1558	-	-
Warm temperate and mesic	K13	289	596	307	106	1825	2190	366
Hot and mesic	N3	62	311	249	402	1425	1883	458
Hot and mesic	N8	3	93	90	3,000	1286	1581	295
Extremely hot and mesic	M1	-	23	-	-	-	1550	-
Extremely hot and mesic	M2	-	33	-	-	-	1336	-

Figure 1.1.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

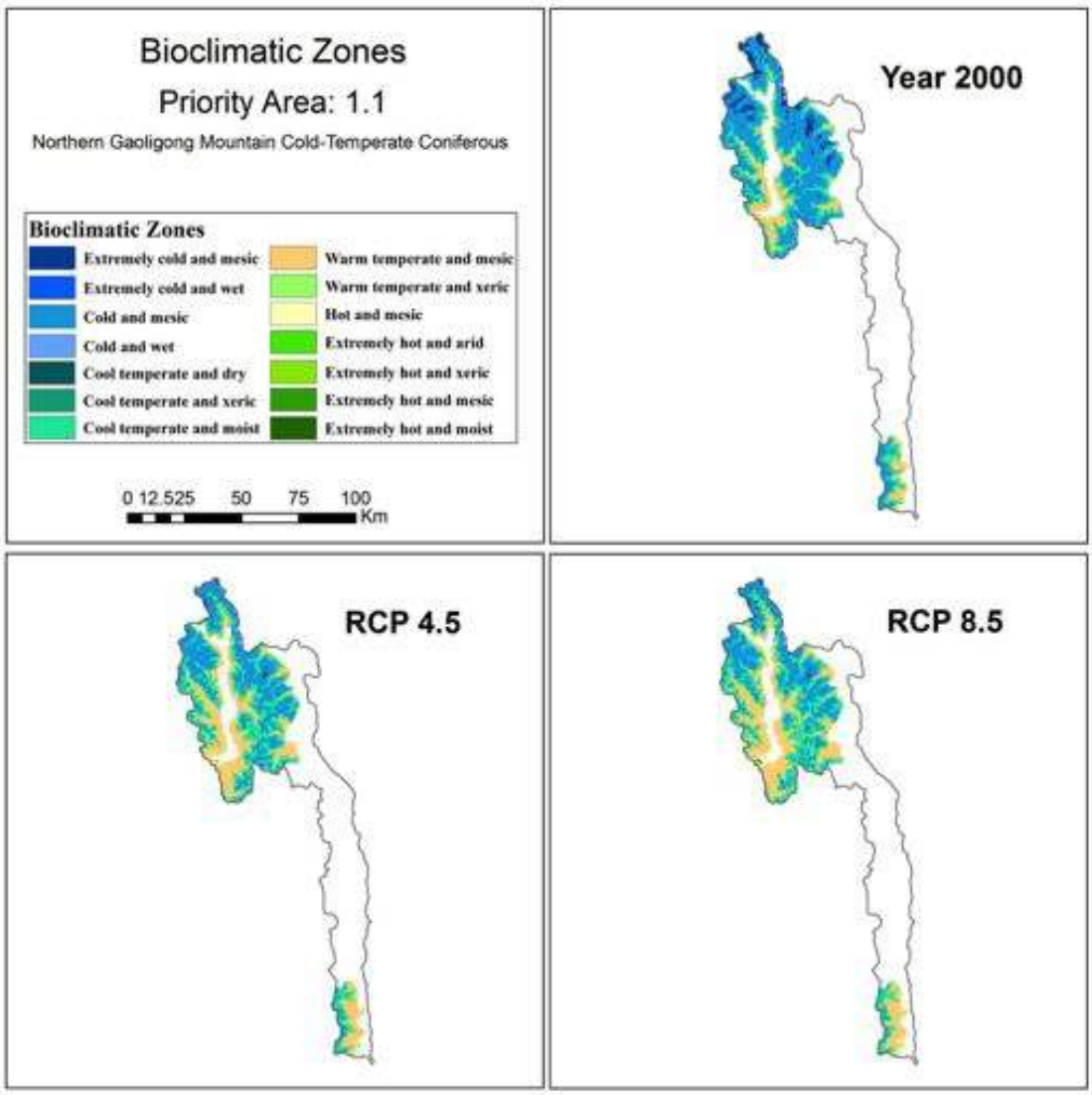


Table 1.1.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.1

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Extremely cold and mesic	F	285	34	(251)	(88)	4069	4406	337
Cold and mesic	G	1312	861	(451)	(34)	3524	3788	264
Cool temperate and moist	J	492	799	307	62	2979	3343	364
Warm temperate and mesic	K	526	888	362	69	2471	2707	236
Extremely hot and mesic	M	-	7	-	-	-	1534	-
Hot and mesic	N	-	26	-	-	-	1964	-

Priority Area 1.2

Meili and Biluo Snow Mountain Cold-Temperate Coniferous Forest

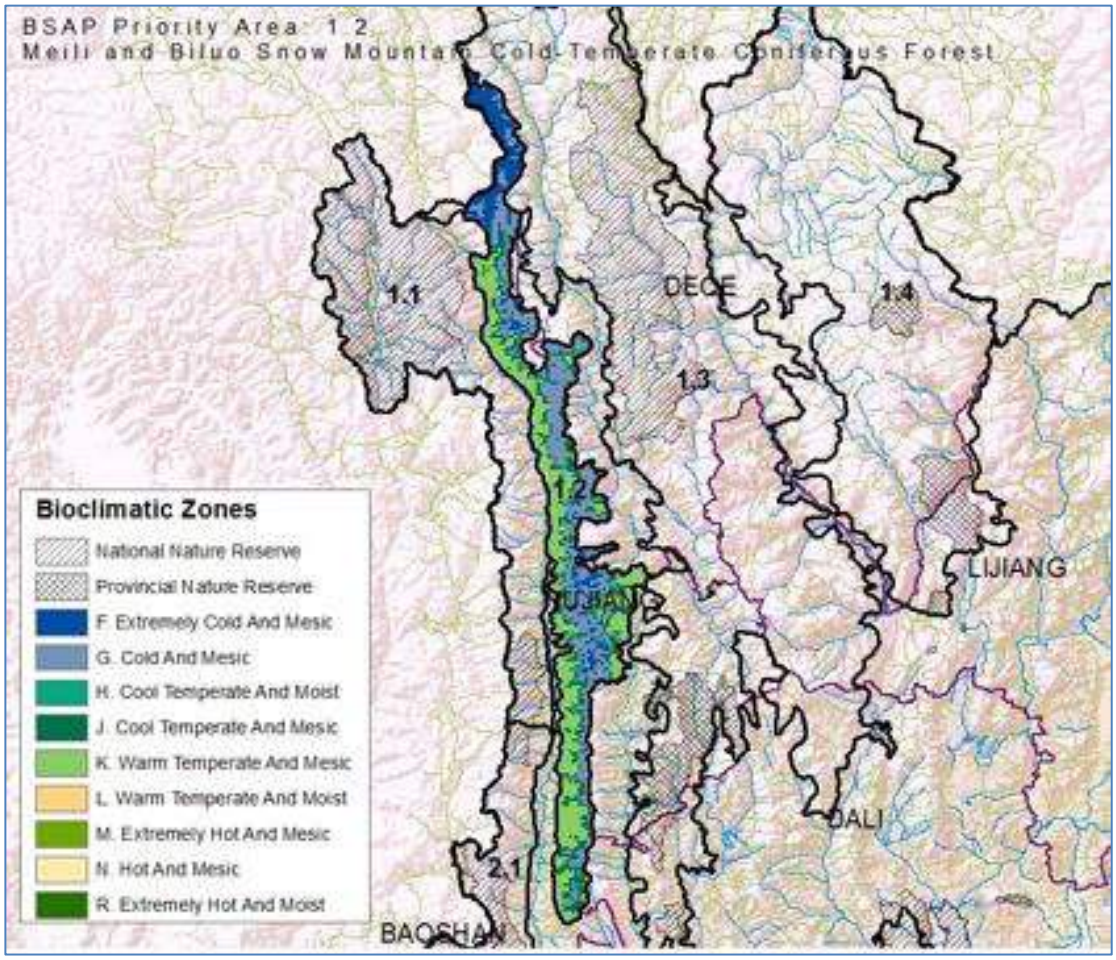
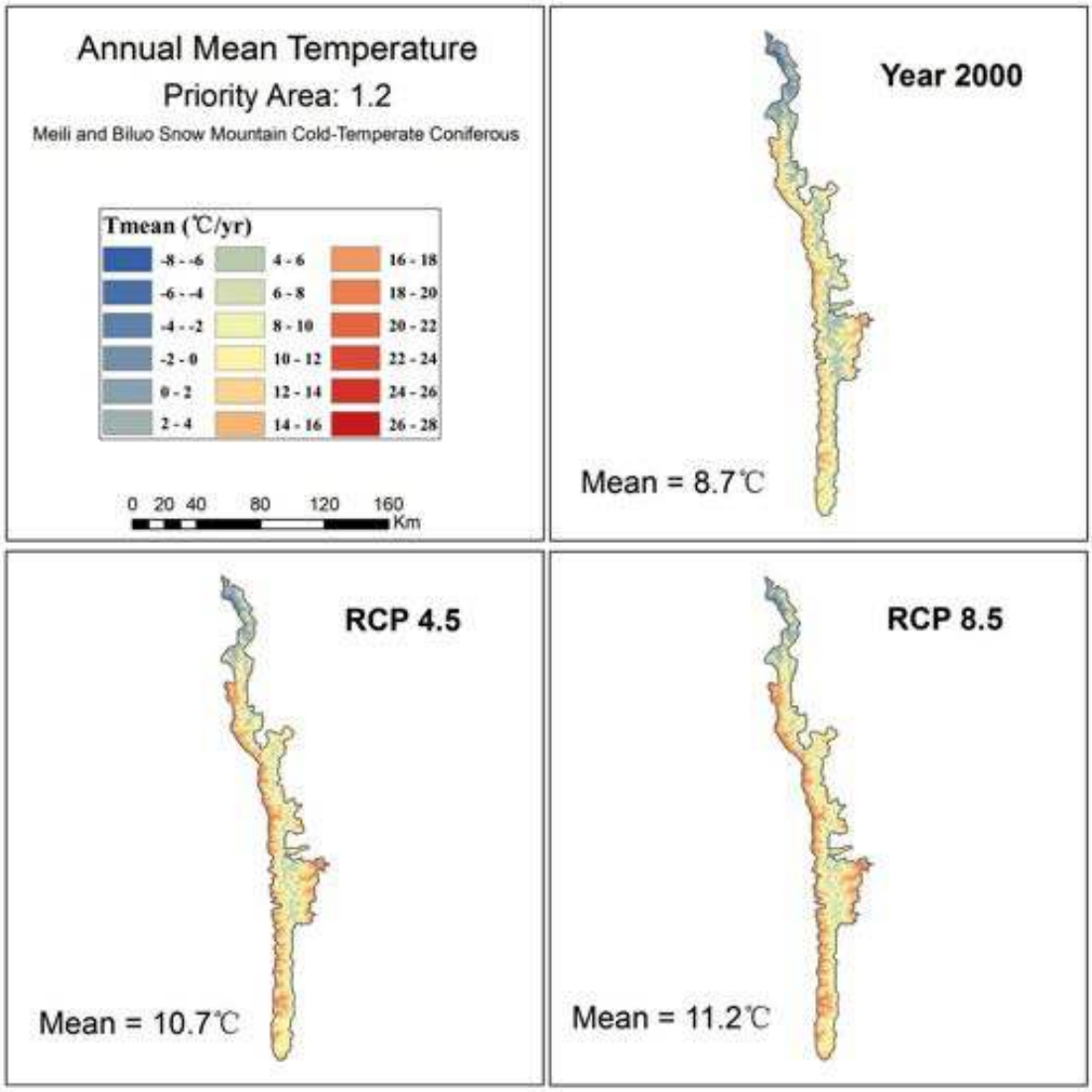


Table 1.2.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 1.2

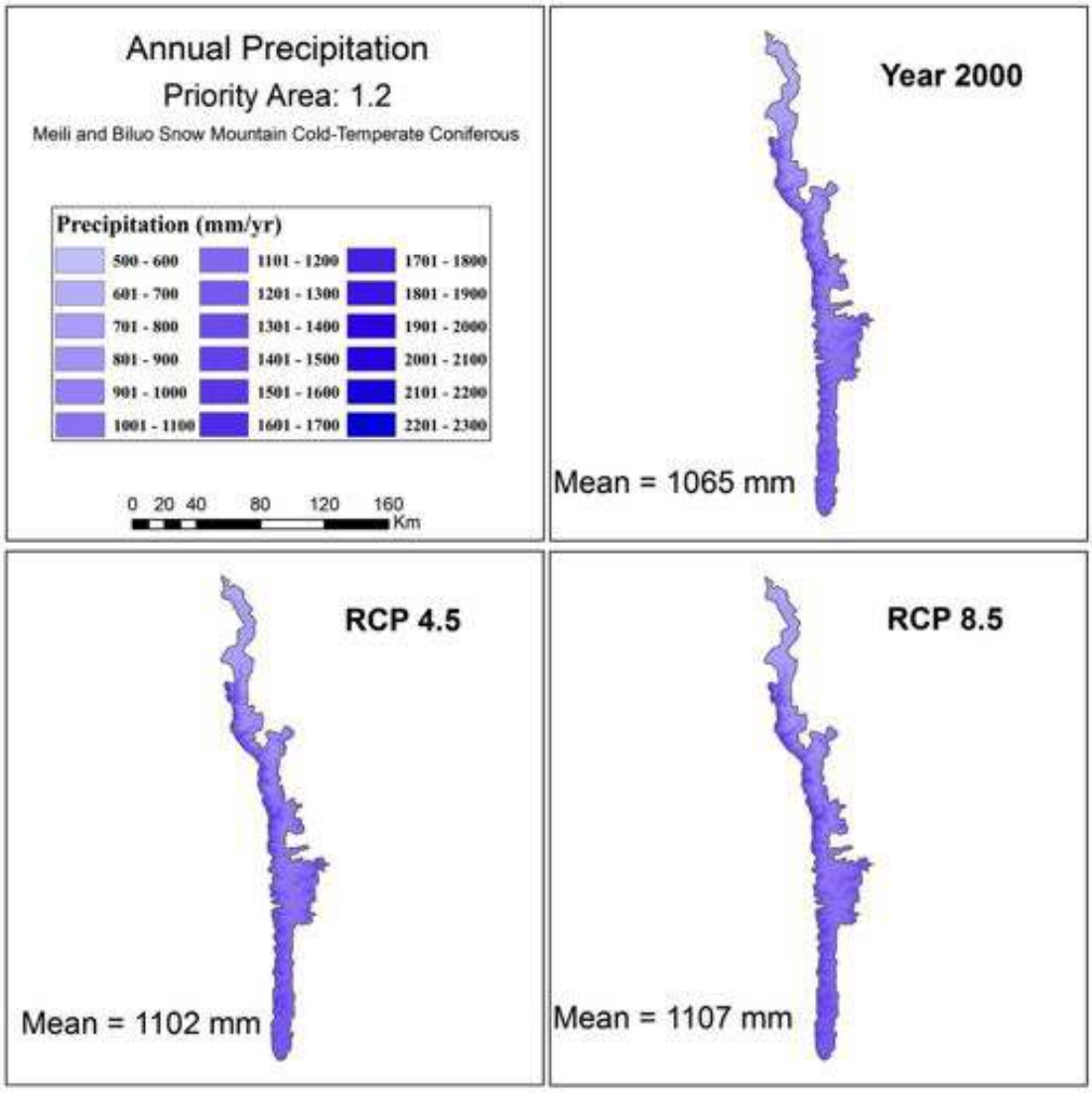
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Extremely cold and mesic	F	502	4322	1.8	787	716	1.11
Cold and mesic	G	1245	3557	6.4	952	868	1.1
Cool temperate and moist	J	717	3032	9.6	1103	989	1.12
Warm temperate and mesic	K	1459	2359	13.5	1299	1133	1.14
Hot and mesic	N	45	1591	17.5	1594	1276	1.25

Figure 1.2.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



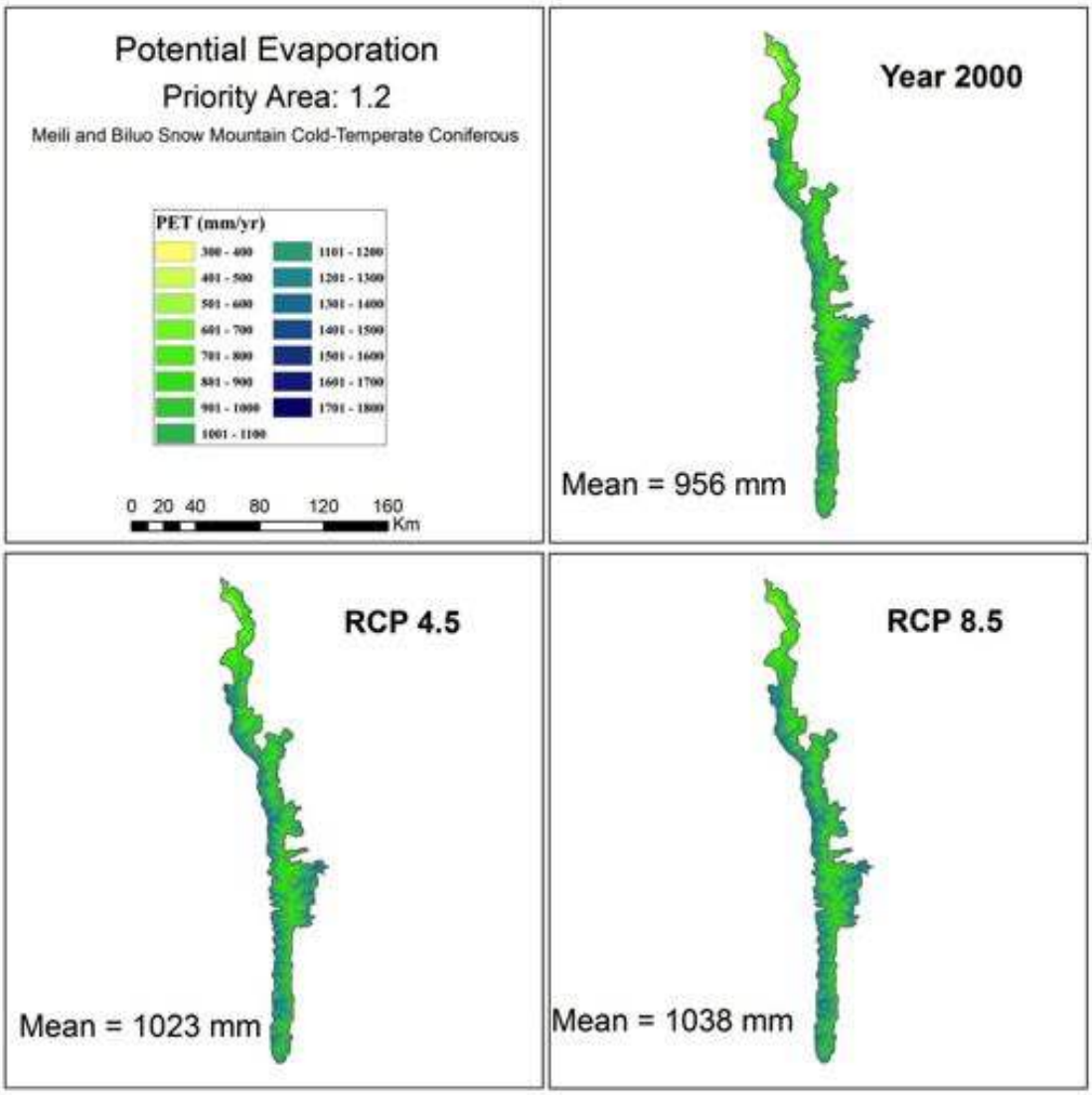
RCP	Mean annual temperature (℃/yr)			
	Mean	Min	Max	Std
2000	8.7	-7.8	18.6	4.3
RCP26	10.3	-5.8	20.2	4.3
RCP45	10.7	-5.3	20.6	4.3
RCP60	10.3	-5.8	20.2	4.3
RCP85	11.2	-4.8	21.0	4.2

Figure 1.2.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



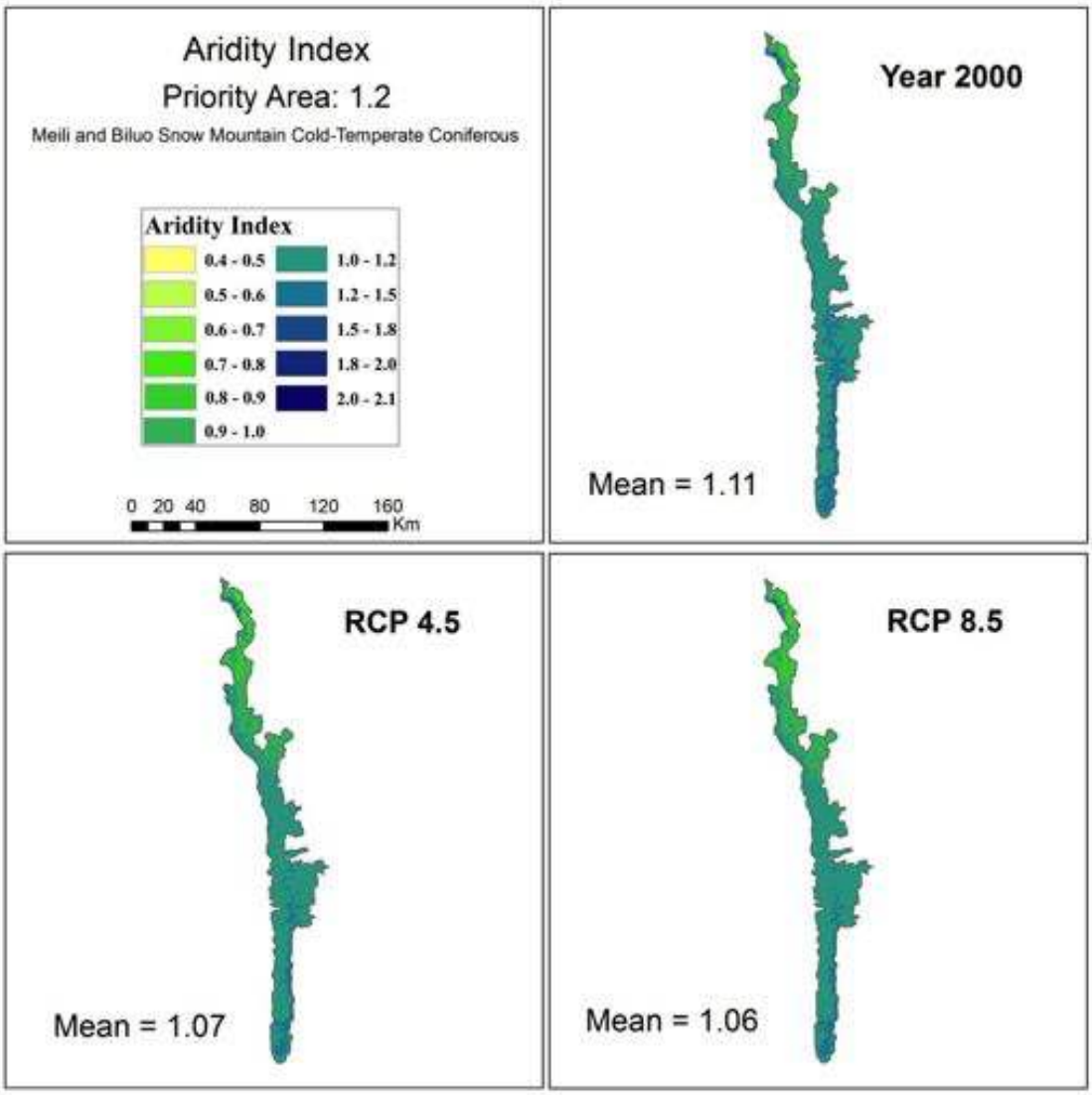
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1066	648	1695	212
RCP26	1095	682	1744	213
RCP45	1103	685	1757	217
RCP60	1087	668	1732	217
RCP85	1108	685	1760	219

Figure 1.2.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	956	378	1314	158
RCP26	1013	446	1373	157
RCP45	1023	460	1381	156
RCP60	1004	442	1362	156
RCP85	1038	478	1395	155

Figure 1.2.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.11	0.77	1.98	0.11
RCP26	1.08	0.76	1.76	0.10
RCP45	1.07	0.75	1.71	0.10
RCP60	1.08	0.75	1.74	0.11
RCP85	1.06	0.74	1.65	0.11

Figure 1.2.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

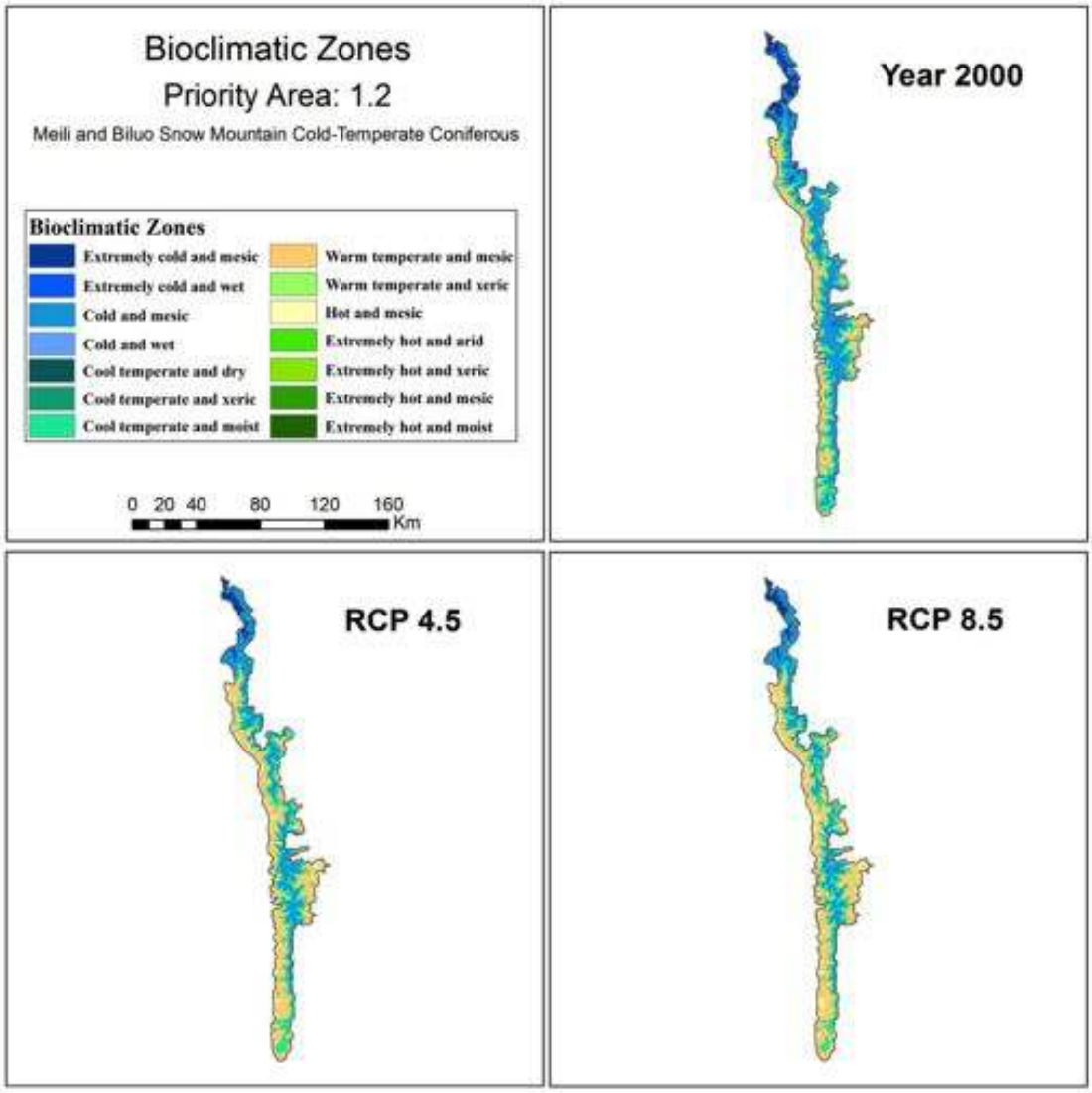


Table 1.2.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.2

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F	491	151	(340)	(69)	4281	4778	497
Cold and mesic	G	1281	919	(362)	(28)	3549	3848	300
Cool temperate and xeric	H		15	15			3603	
Cool temperate and moist	J	722	854	132	18	3011	3350	339
Warm temperate and mesic	K	1419	1662	243	17	2317	2629	313
Extremely hot and mesic	M		9				1411	
Hot and mesic	N	28	331	303	1,082	1493	1799	305

Figure 1.2.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

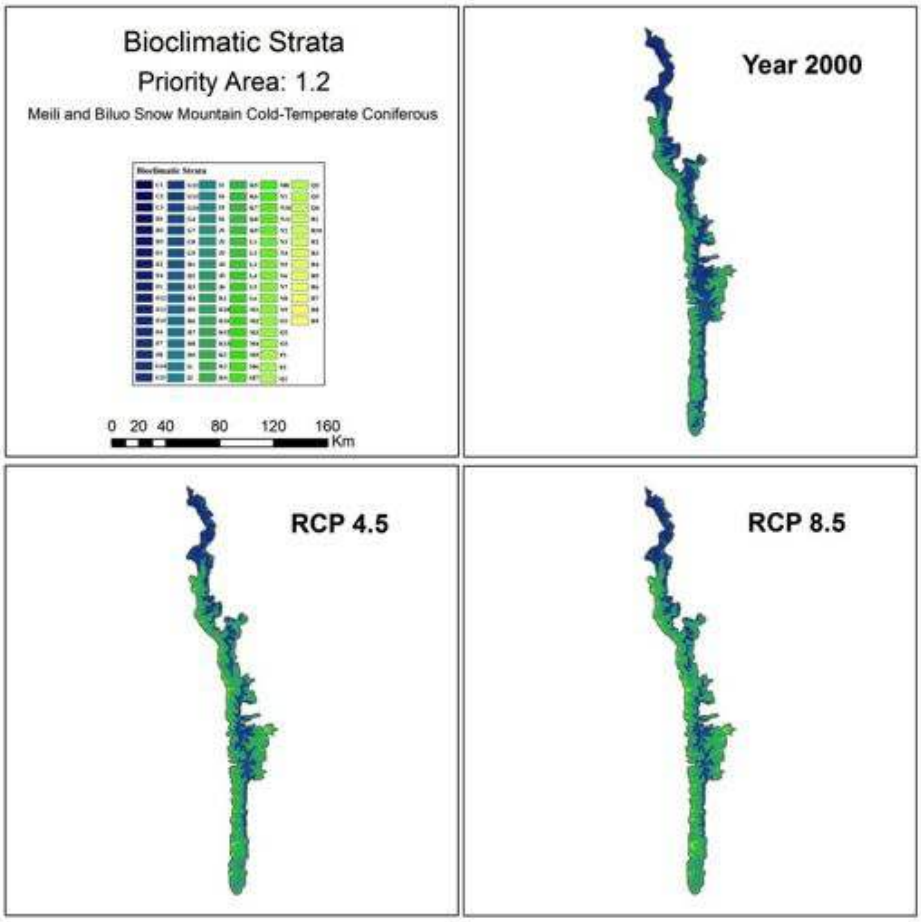
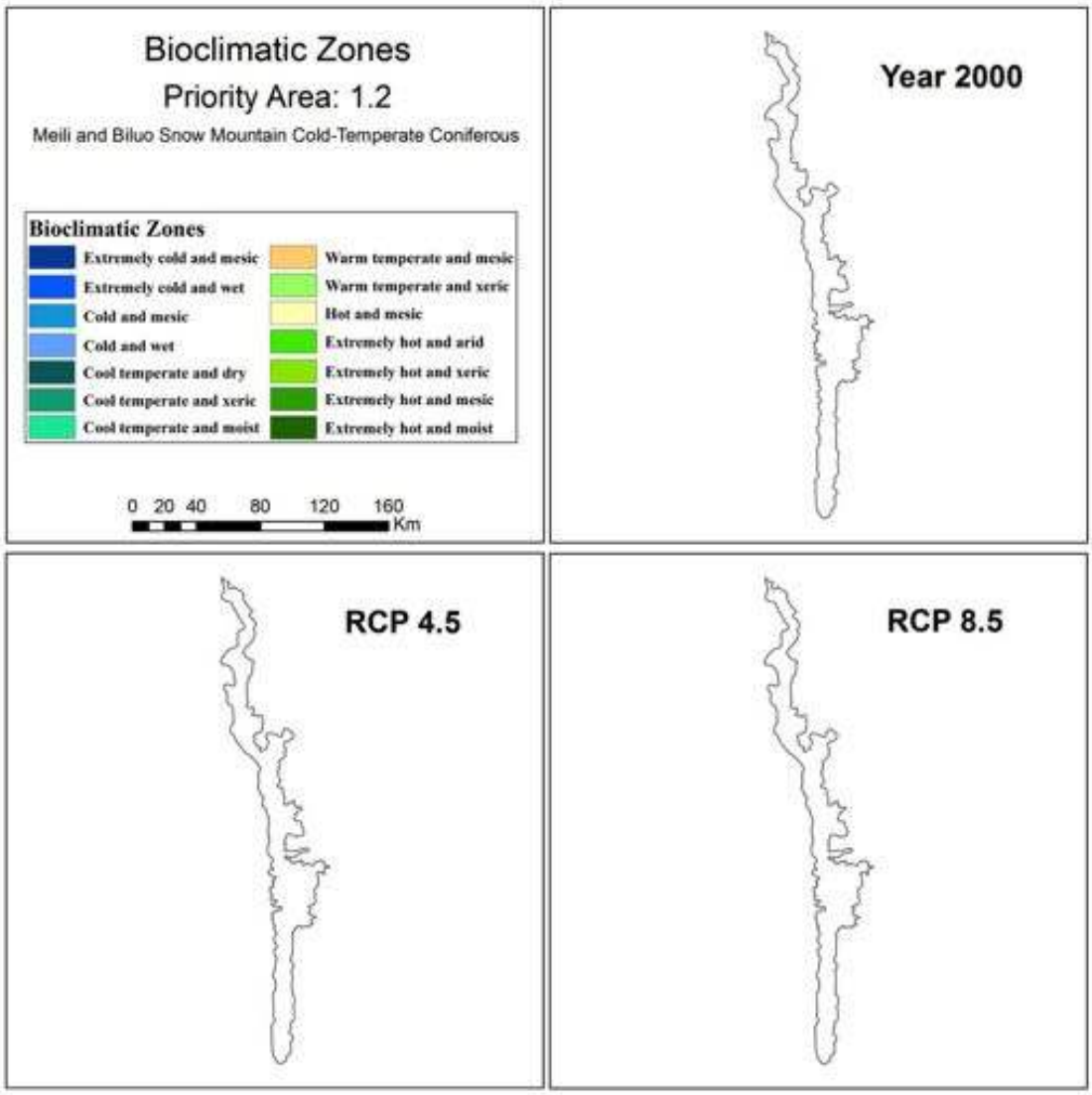


Table 1.2.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.2

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F8	80	25	(55)	(69)	5008	5347	339
Extremely cold and mesic	F13	249	62	(187)	(75)	4293	4831	539
Extremely cold and mesic	F15	162	64	(98)	(60)	3904	4504	600
Cold and mesic	G7	1	56	55	5,500	4090	4387	297
Cold and mesic	G8	27	12	(15)	(56)	3851	4006	155
Cold and mesic	G11	659	338	(321)	(49)	3649	3929	280
Cold and mesic	G13	594	513	(81)	(14)	3422	3733	310
Cool temperate and dry	H5	-	15	-	-	-	3603	-
Cool temperate and moist	J3	414	350	(64)	(15)	3085	3467	382
Cool temperate and moist	J4	-	112	-	-	-	3192	-
Cool temperate and moist	J5	308	392	84	27	2912	3290	378
Warm temperate and mesic	K1	764	549	(215)	(28)	2580	2962	382
Warm temperate and mesic	K5	13	195	182	1,400	2237	2767	530
Warm temperate and mesic	K7	286	325	39	14	2200	2603	402
Warm temperate and mesic	K10	18	109	91	506	2093	2508	415
Warm temperate and mesic	K13	338	484	146	43	1835	2242	406
Hot and mesic	N3	28	240	212	757	1493	1864	370
Hot and dry	N8	-	91	-	-	-	1627	-
Extremely hot and mesic	M2	-	9	-	-	-	1411	-

Figure 1.2.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



Priority Area: 1.3

Yunling Mountain Warm-Temperate Coniferous Forest

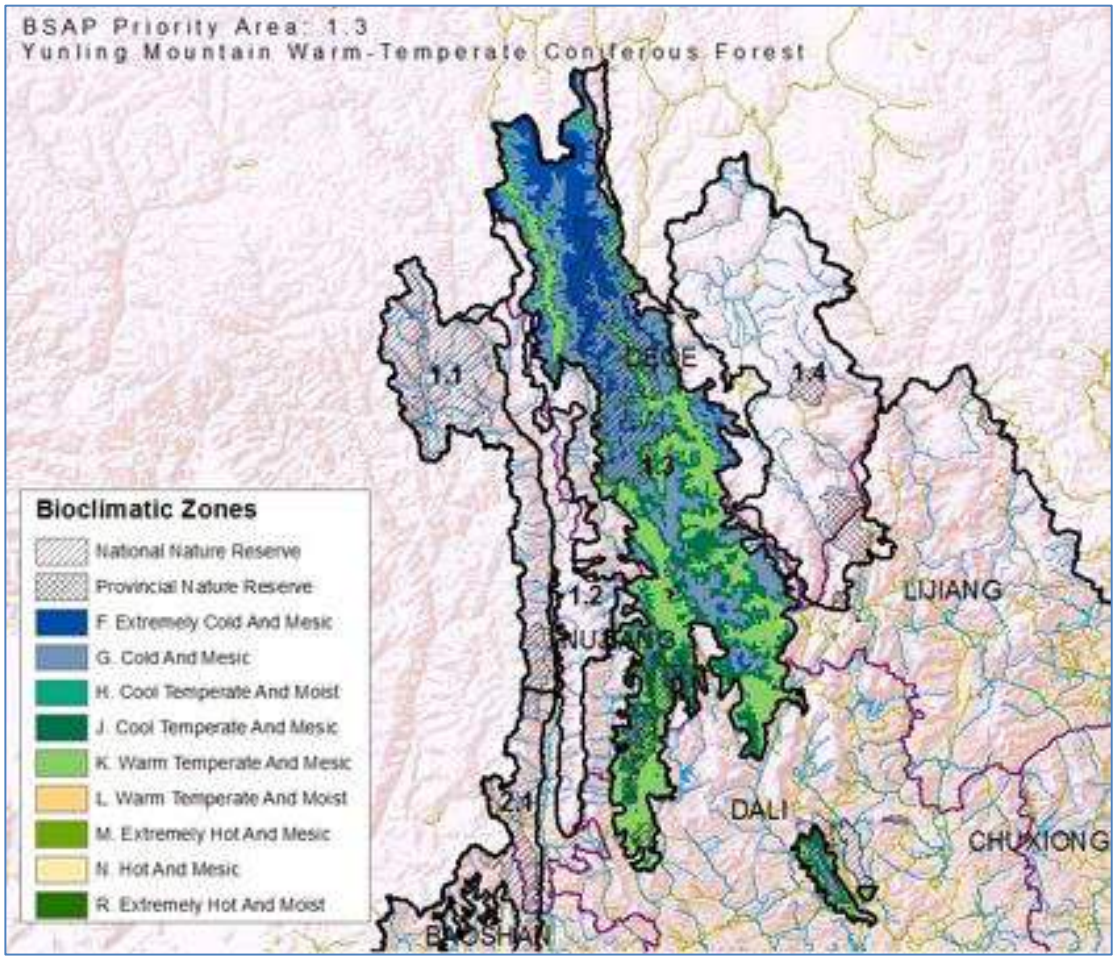
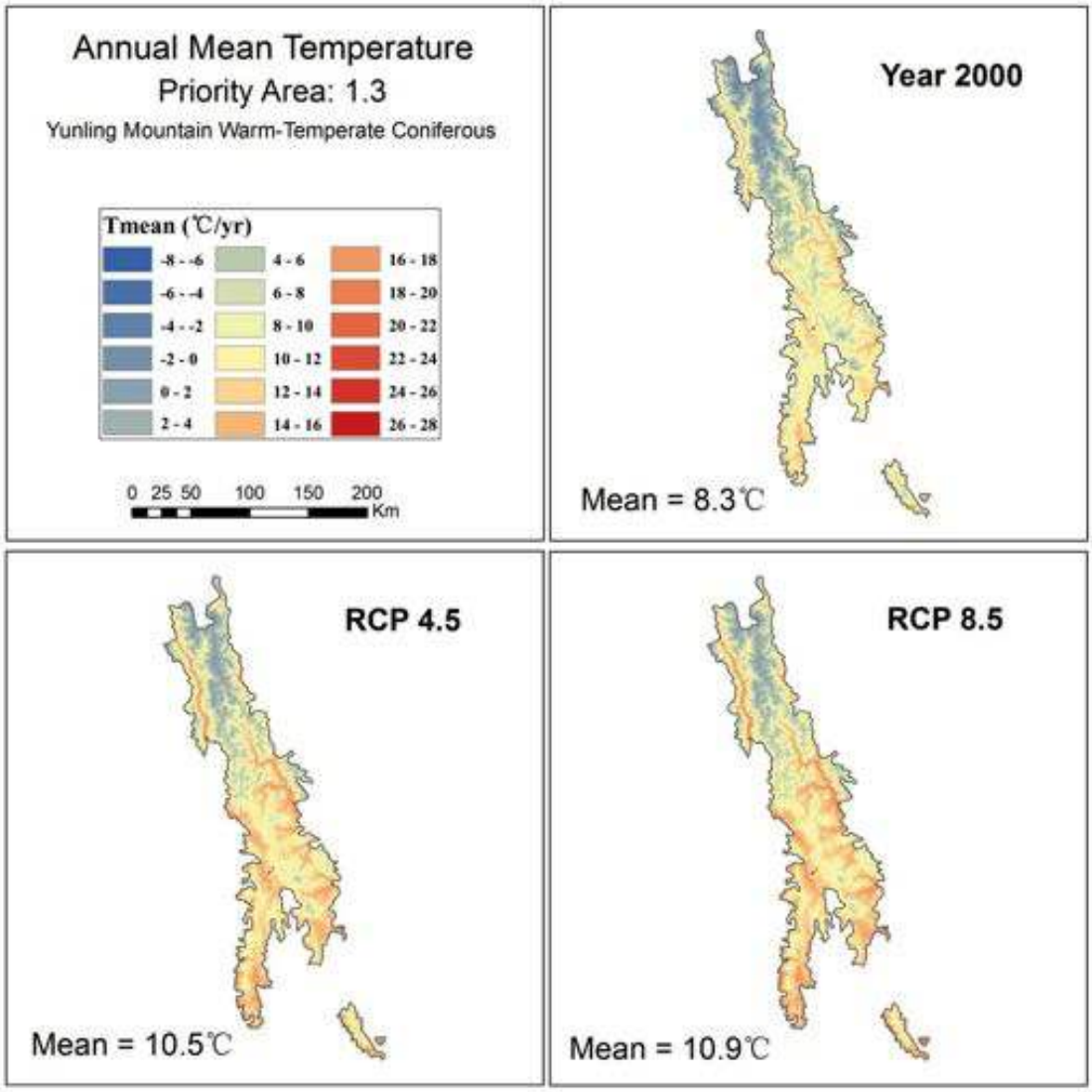


Table 1.3.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 1.3

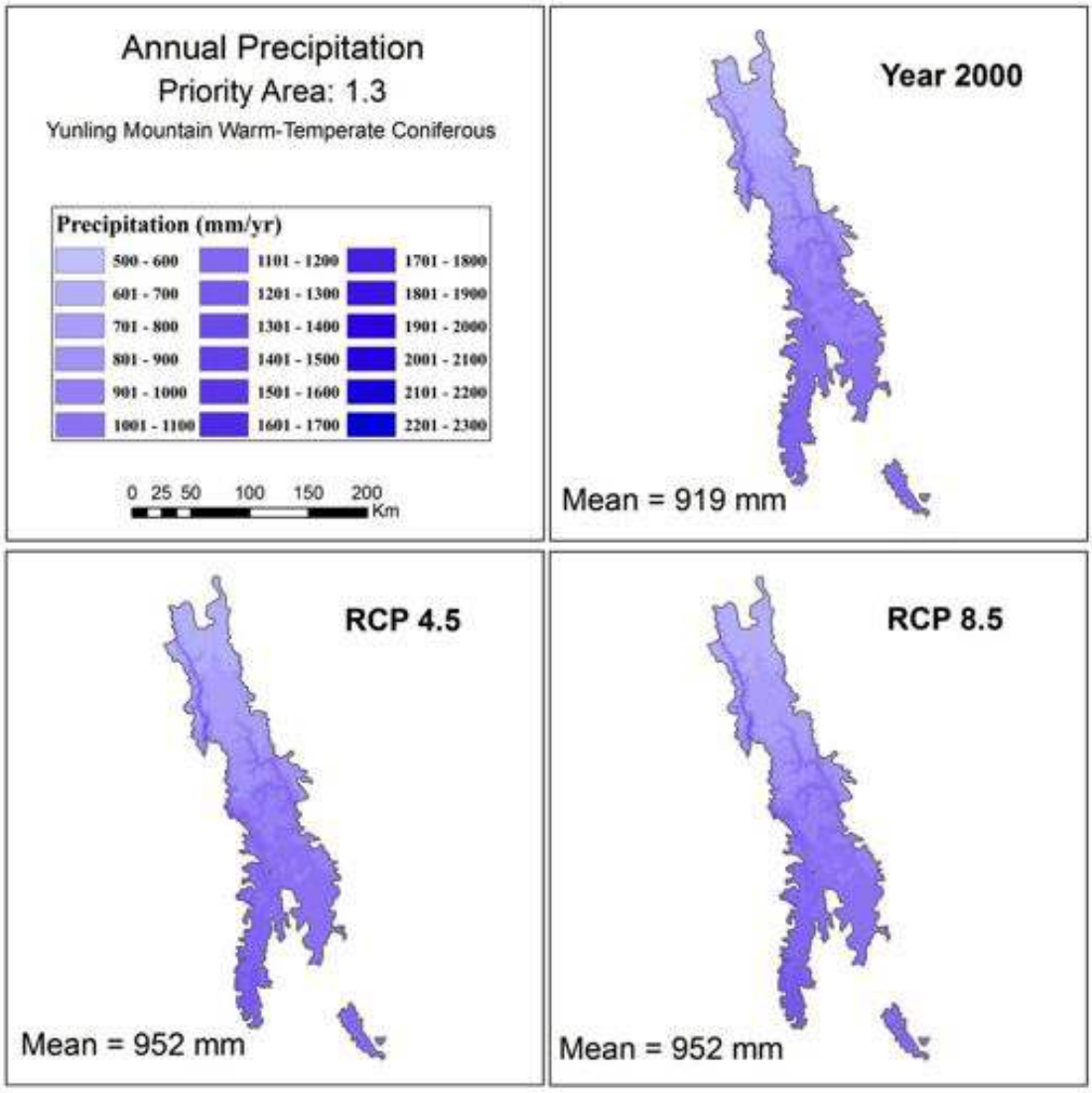
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Extremely cold and mesic	F	2436	4321	1.5	693	720	0.97
Cold and mesic	G	4845	3525	6.2	828	882	0.94
Cool temperate and dry	H	201	3137	8.5	686	997	0.69
Cool temperate and moist	J	4029	2999	9.7	998	1010	0.99
Warm temperate and mesic	K	5131	2524	12.5	1066	1121	0.95
Warm temperate and xeric	L	11	2059	15.4	1027	1242	0.83
Hot and mesic	N	20	1557	17.8	1254	1309	0.96

Figure 1.3.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



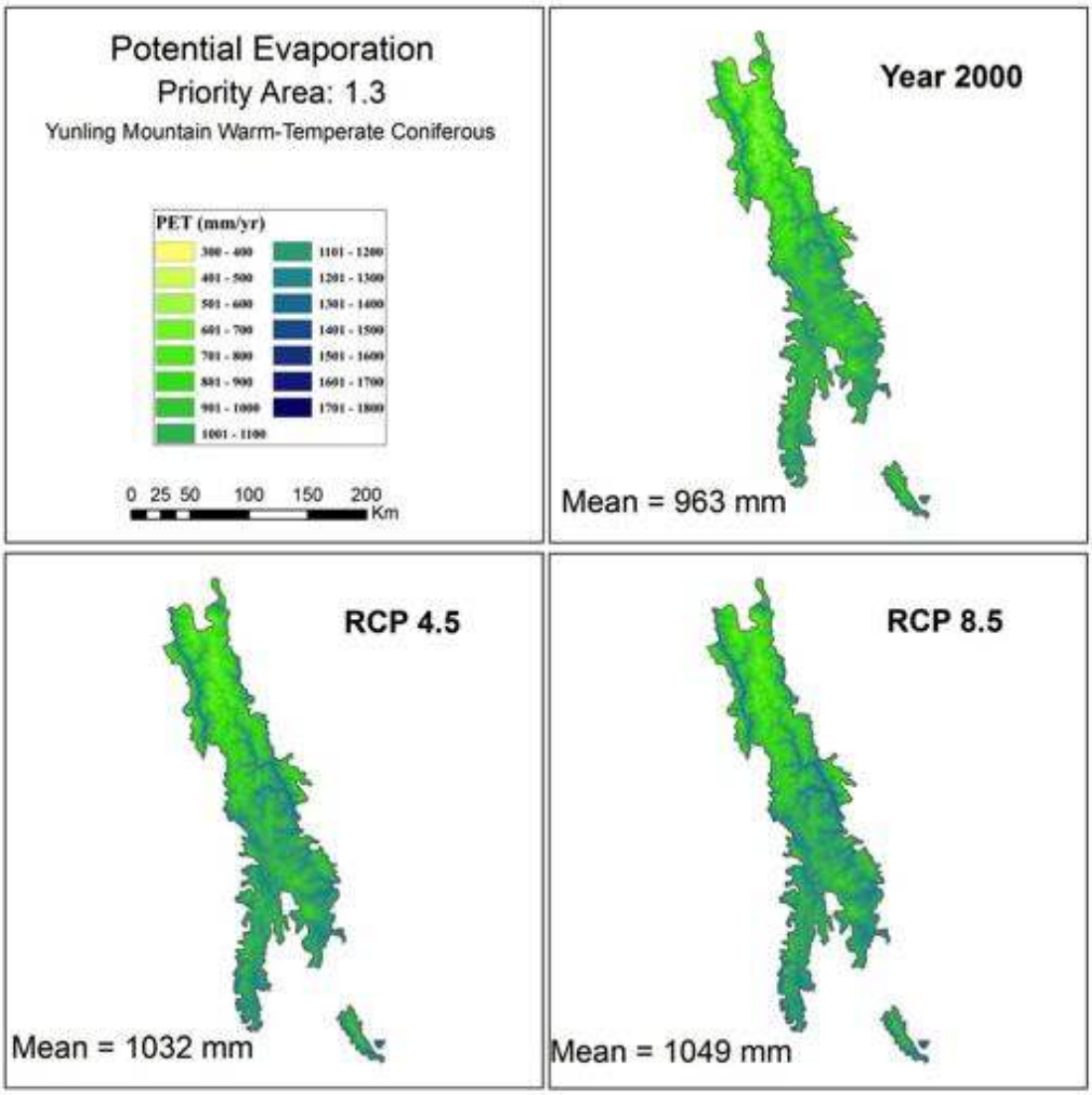
RCP	Mean annual temperature (℃/yr)			
	Mean	Min	Max	Std
2000	8.3	-4.0	18.6	4.1
RCP26	10.0	-1.9	20.1	4.0
RCP45	10.5	-1.4	20.6	4.0
RCP60	10.1	-1.9	20.1	4.0
RCP85	10.9	-0.9	20.9	4.0

Figure 1.3.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



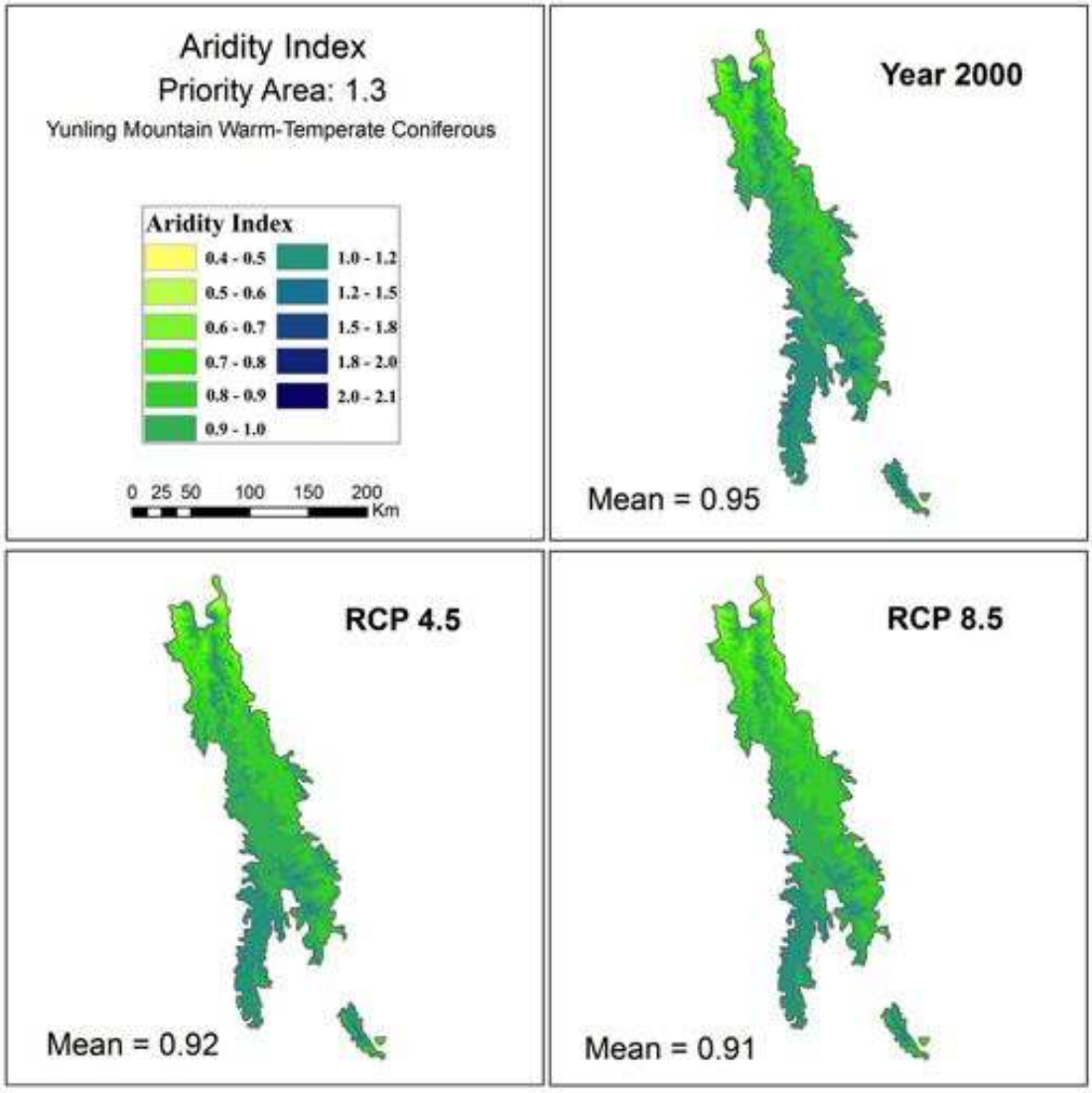
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	919	549	1393	173
RCP26	945	585	1430	169
RCP45	952	589	1442	172
RCP60	931	570	1418	171
RCP85	953	590	1443	174

Figure 1.3.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	964	532	1347	150
RCP26	1022	603	1404	149
RCP45	1033	617	1415	148
RCP60	1012	597	1387	147
RCP85	1049	637	1425	147

Figure 1.3.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	0.95	0.58	1.44	0.11
RCP26	0.93	0.57	1.36	0.10
RCP45	0.92	0.57	1.36	0.10
RCP60	0.92	0.56	1.37	0.11
RCP85	0.91	0.56	1.35	0.11

Figure 1.3.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

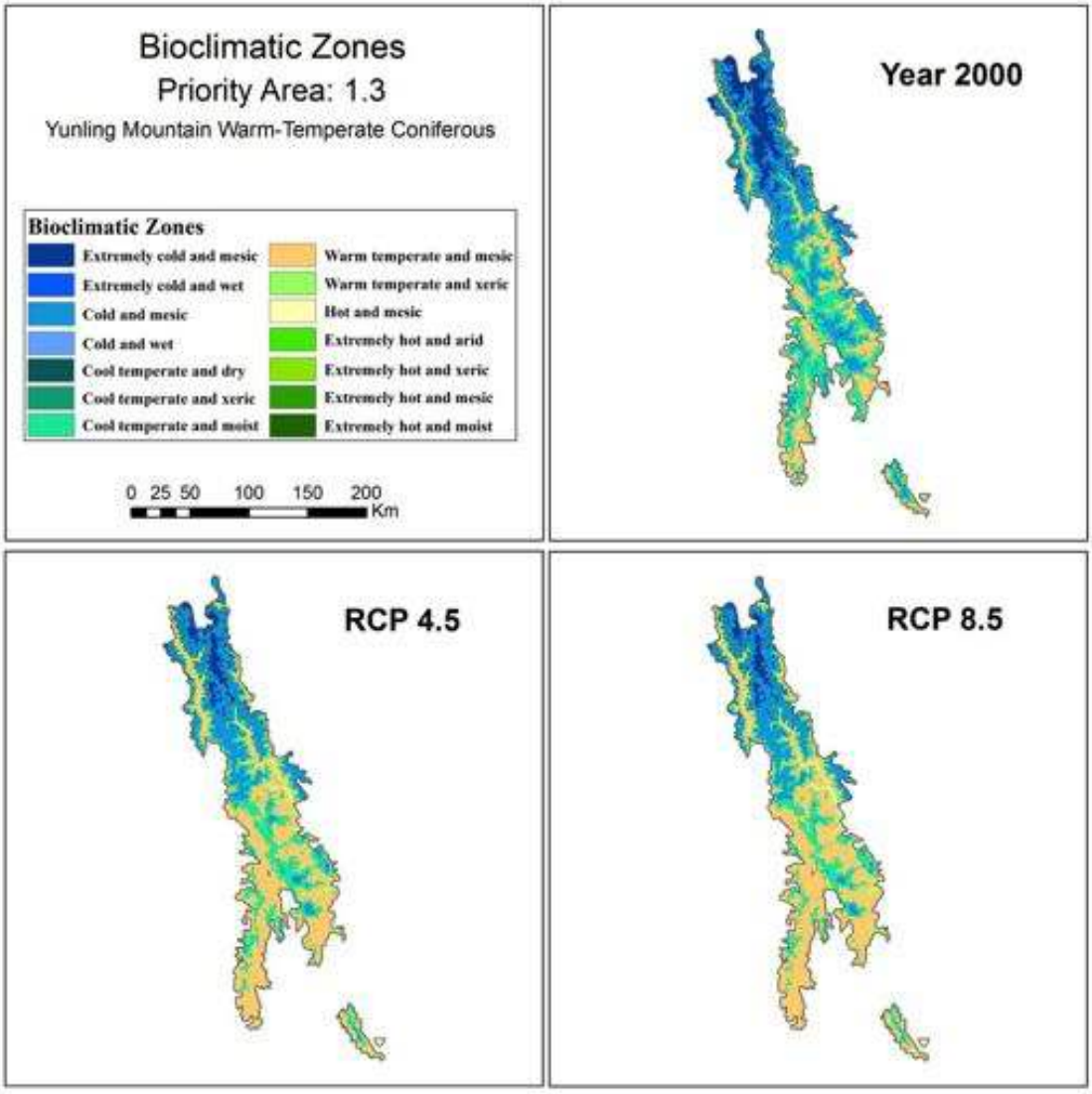


Table 1.3.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.3								
Bioclimatic Zone	**Zone**	**Area (km^2)**		**Area Change**		**Mean Elevation (m asl)**		**Upward Shift**
		2000	**RCP85**	**(km^2)**	**%**	**2000**	**RCP85**	**(m)**
Extremely cold and mesic	**F**	2388	668	(1,720)	(72)	4352	4700	348
Cold and mesic	**G**	4846	3351	(1,495)	(31)	3536	3999	463
Cool temperate and xeric	**H**	205	999	794	387	3120	3527	406
Cool temperate and moist	**J**	4045	3021	(1,024)	(25)	3004	3317	313
Warm temperate and mesic	**K**	5151	7705	2,554	50	2501	2749	248
Warm temperate and xeric	**L**	15	285	270	1,800	1909	2323	414
Hot and mesic	**N**	16	637	621	3,881	1528	2077	549

Figure 1.3.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

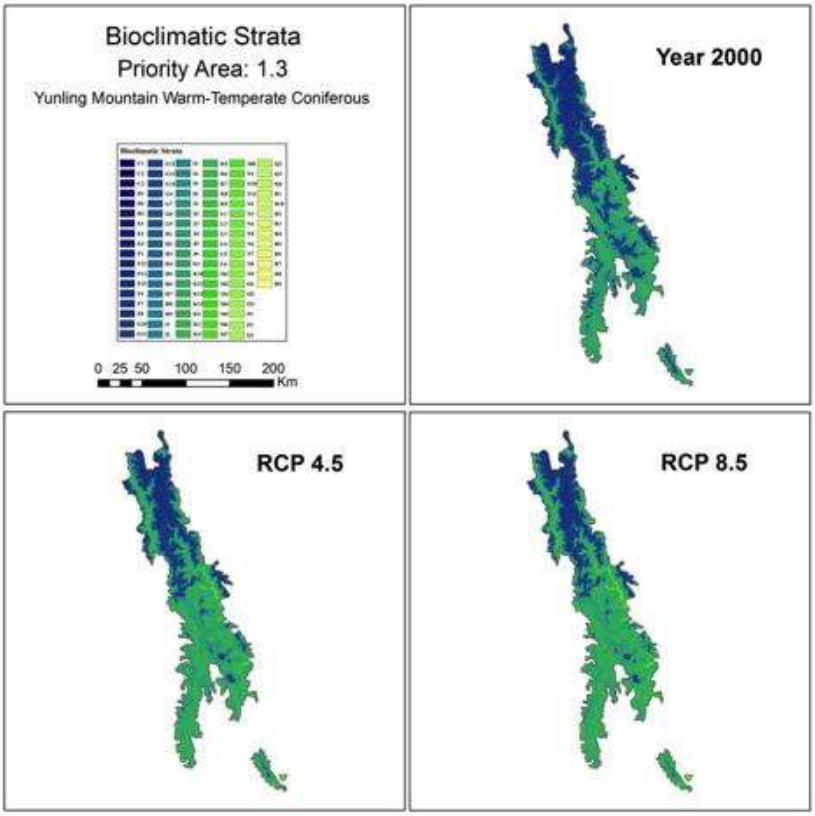


Table 1.3.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.3

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F8	359	2	(357)	(99)	4824	5244	420
Extremely cold and mesic	F13	1725	455	(1,270)	(74)	4318	4793	475
Extremely cold and mesic	F15	304	211	(93)	(31)	3986	4493	507
Cold and mesic	G7	374	860	486	130	3900	4375	475
Cold and mesic	G8	9	1	(8)	(89)	3823	4098	275
Cold and mesic	G11	3145	2049	(1,096)	(35)	3572	3905	333
Cold and mesic	G13	1318	441	(877)	(67)	3344	3701	357
Cool temperate and xeric	H5	205	999	794	387	3120	3527	406
Cool temperate and moist	J3	1038	440	(598)	(58)	3153	3472	320
Cool temperate and moist	J4	-	2	-	-	-	3198	-
Cool temperate and moist	J5	3007	2579	(428)	(14)	2953	3291	338
Warm temperate and mesic	K1	2767	2127	(640)	(23)	2669	3025	356
Warm temperate and mesic	K2	-	13	-	-	-	2833	-
Warm temperate and mesic	K5	1487	2667	1,180	79	2419	2810	391
Warm temperate and mesic	K7	-	101	-	-	-	2624	-
Warm temperate and mesic	K10	787	2390	1,603	204	2157	2529	373
Warm temperate and mesic	K13	110	407	297	270	1845	2233	388
Warm temperate and xeric	L3	15	285	270	1,800	1909	2323	414
Hot and mesic	N2	5	394	389	7,780	1660	2187	527
Hot and mesic	N3	10	93	83	830	1482	1863	381
Hot and dry	N4	-	36	-	-	-	1994	-
Hot and mesic	N5	1	92	91	9,100	1325	1976	651
Hot and dry	N8	-	20	-	-	-	1554	-
Hot and dry	N9	-	2	-	-	-	1511	-

Figure 1.3.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

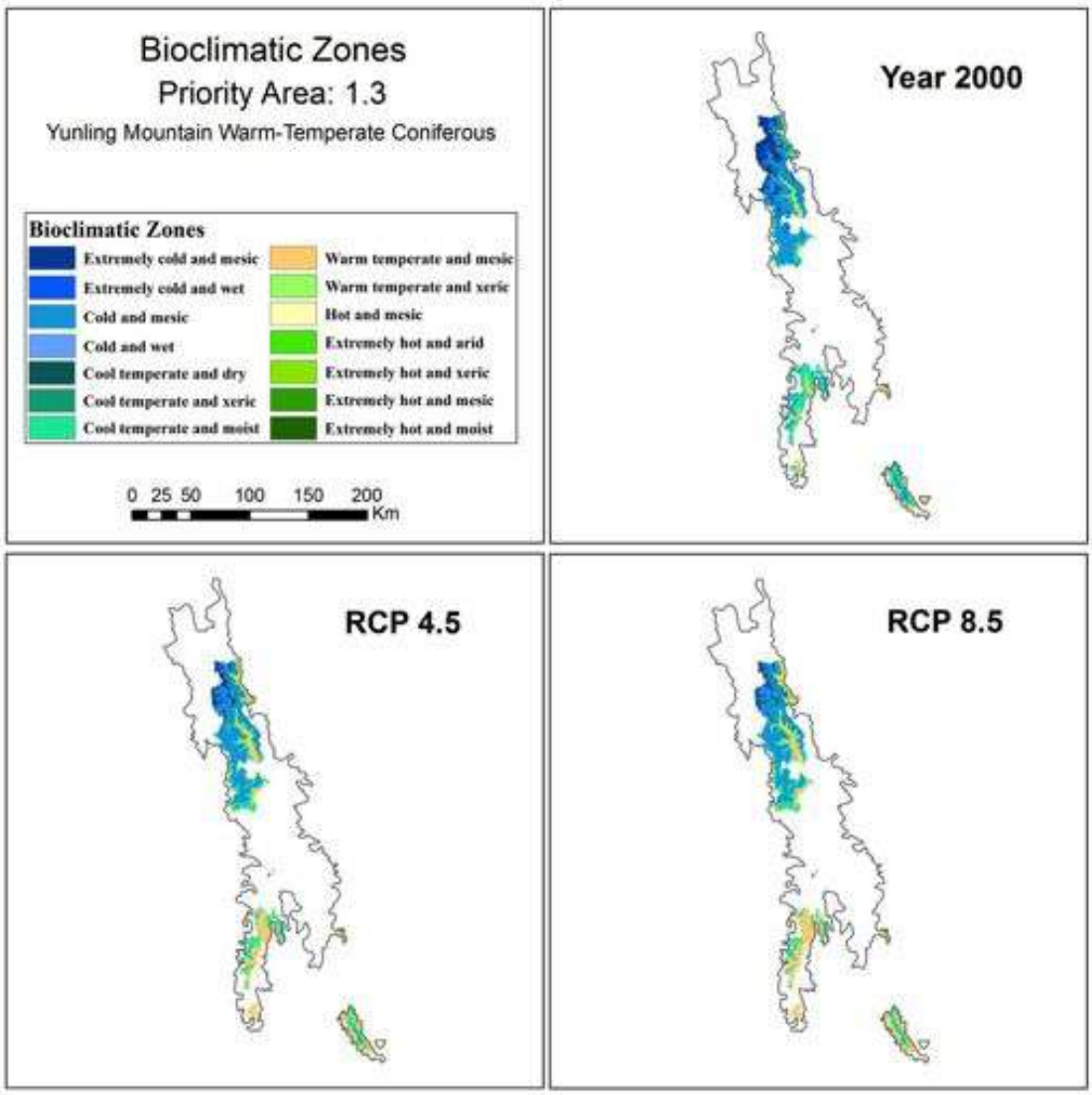


Table 1.3.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.3

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Extremely cold and mesic	F	913	259	(654)	(72)	4251	4593	342
Cold and mesic	G	1587	1363	(224)	(14)	3562	3929	367
Cool temperate and dry	H	32	177	145	453	2913	3437	524
Cool temperate and moist	J	940	846	(94)	(10)	3048	3365	317
Warm temperate and mesic	K	715	1426	711	99	2591	2869	278
Warm temperate and xeric	L	2	49	47	2350	1937	2315	378
Hot and mesic	N	-	69	-	-	-	2096	-

Priority Area: 1.4

Shangri-la Mountain Cold-Temperate Coniferous Forest

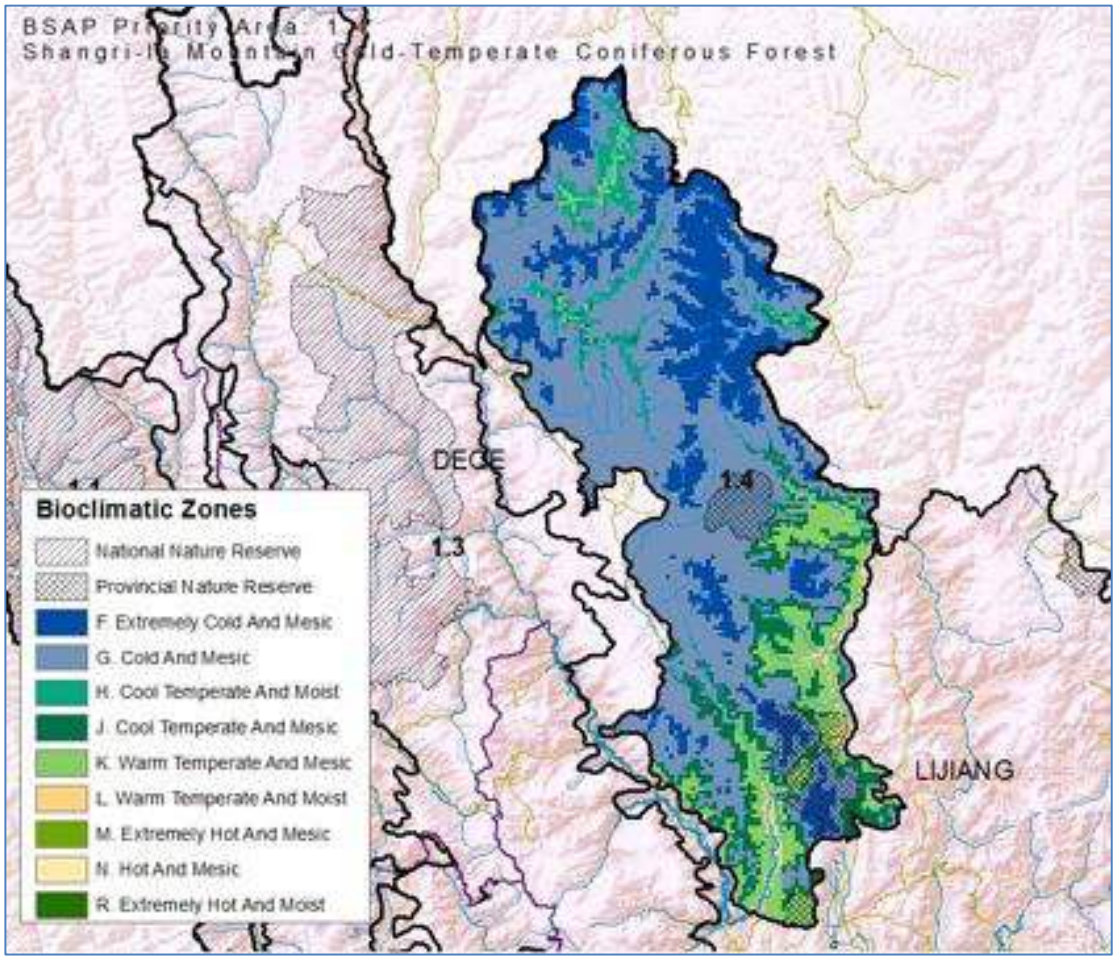
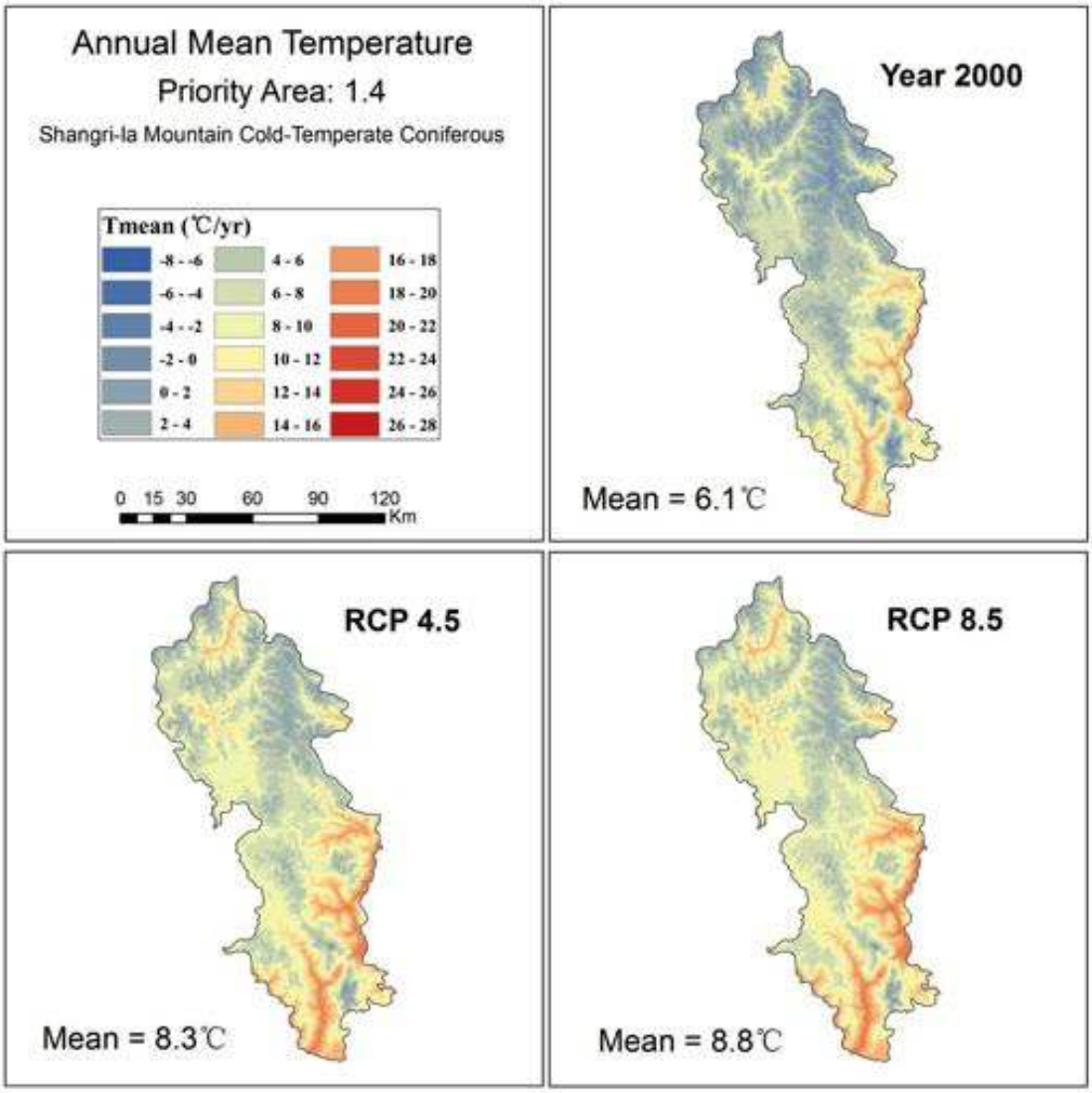


Table 1.4.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 1.4

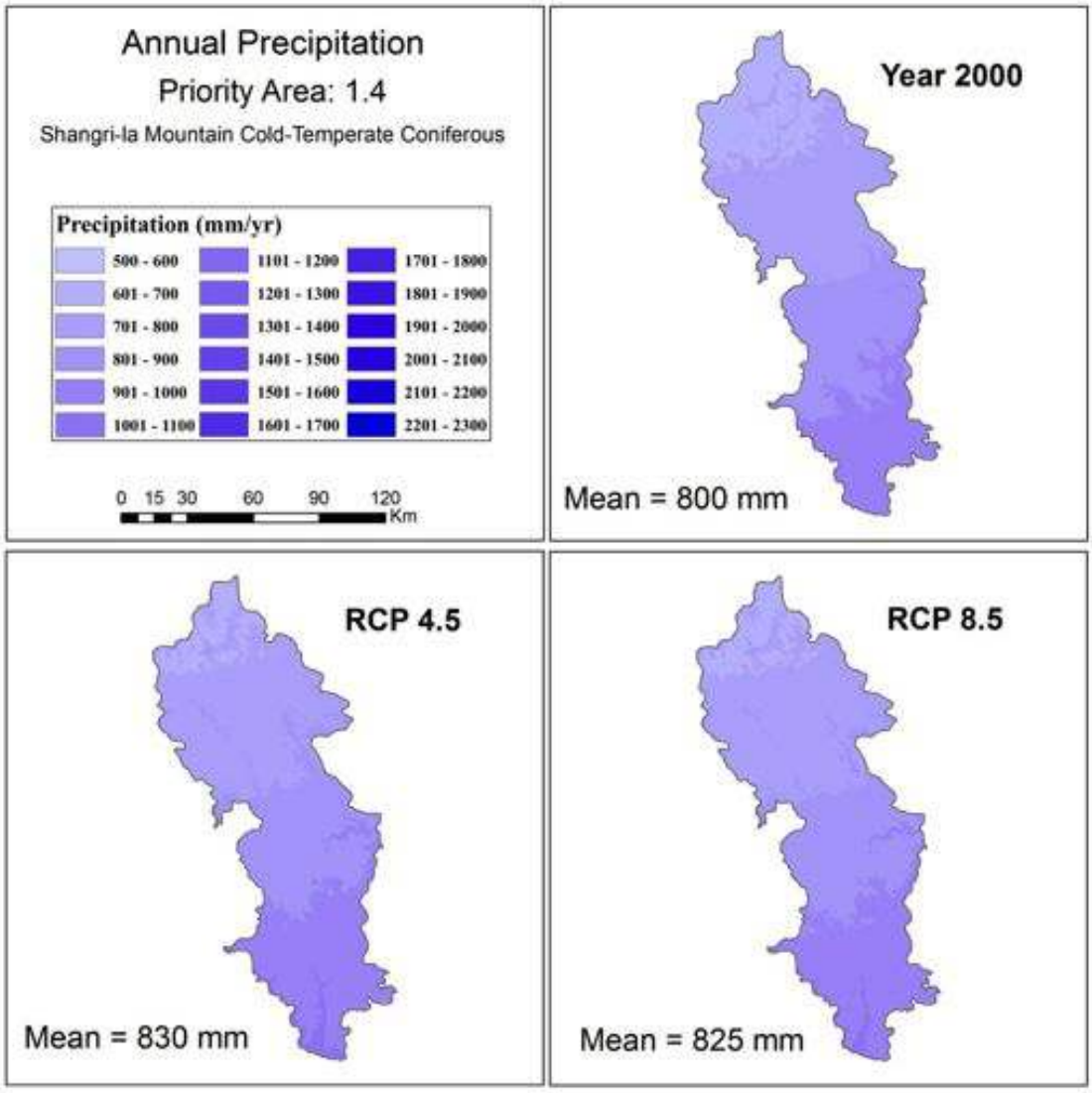
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Extremely cold and mesic	F	2037	4285	1.8	762	752	1.02
Cold and mesic	G	5126	3660	5.4	777	885	0.88
Cool temperate and dry	H	445	3179	8.2	714	1015	0.71
Cool temperate and moist	J	1048	3029	9.5	894	1038	0.86
Warm temperate and mesic	K	1100	2513	12.6	915	1160	0.79
Warm temperate and xeric	L	161	1955	16	960	1285	0.75
Hot and mesic	N	6	1682	17.4	955	1349	0.71

Figure 1.4.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



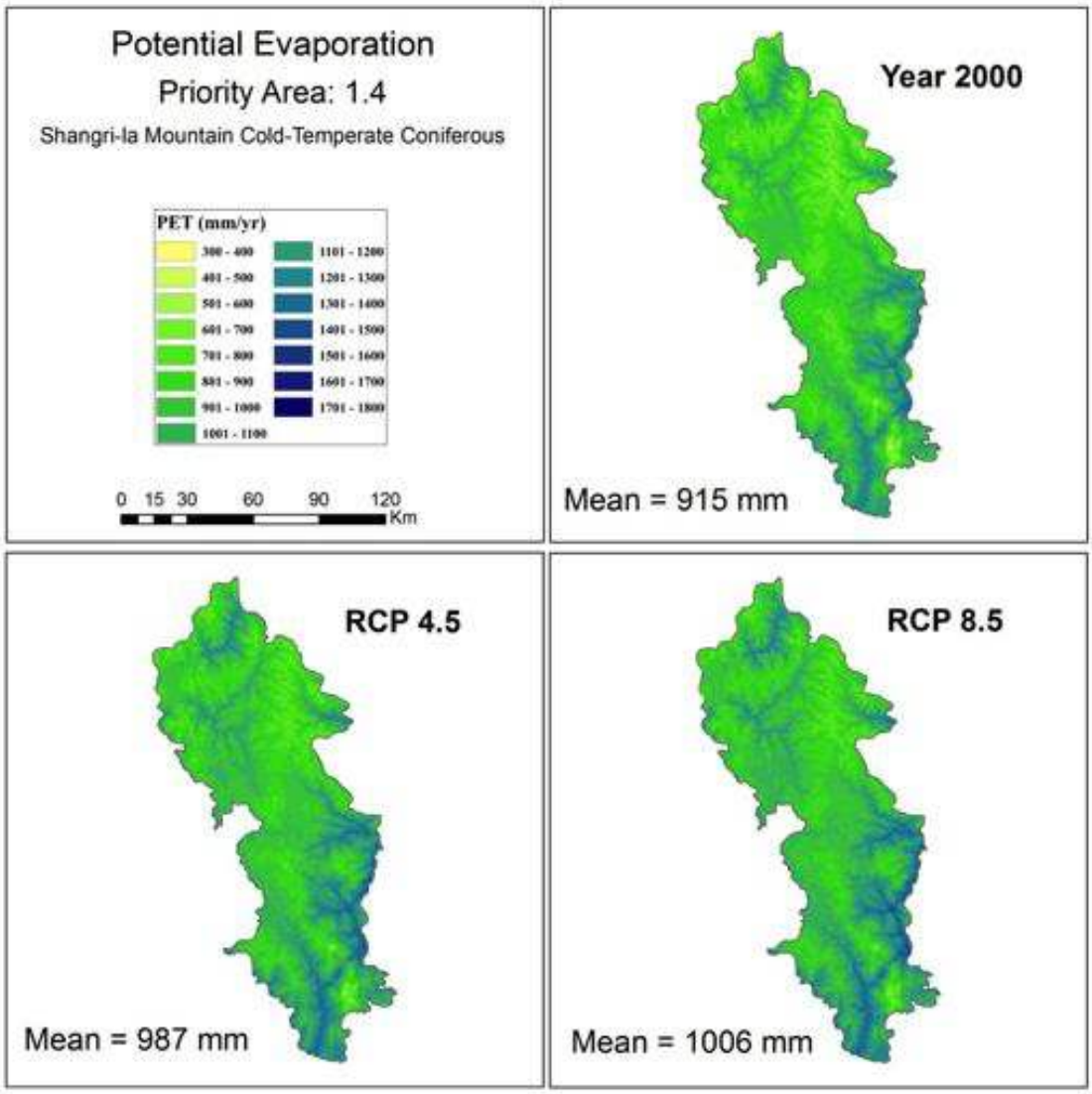
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	6.1	-3.2	18.1	3.8
RCP26	7.9	-1.6	19.7	3.8
RCP45	8.3	-1.2	20.2	3.7
RCP60	7.9	-1.5	19.8	3.8
RCP85	8.8	-0.7	20.6	3.7

Figure 1.4.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



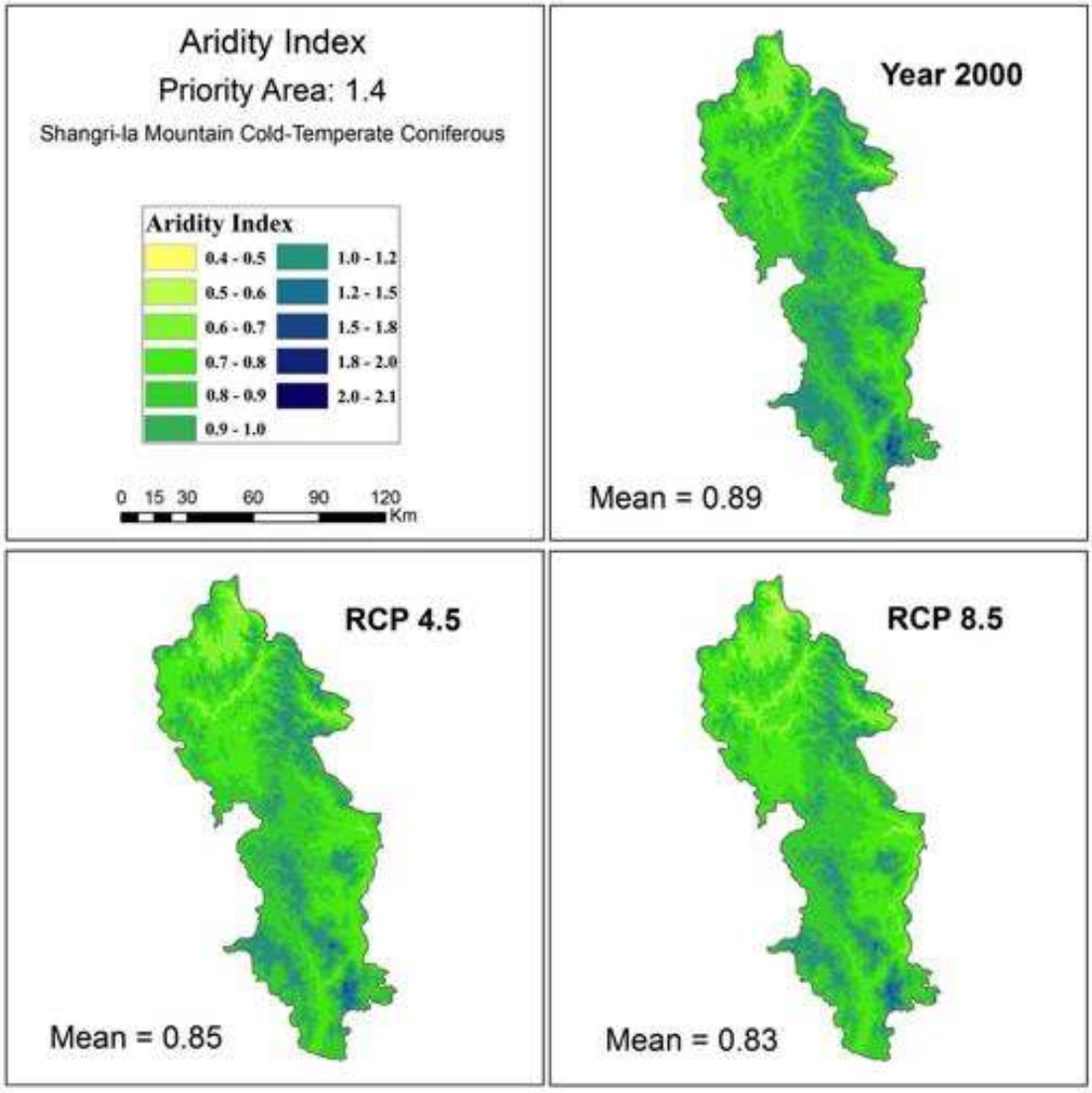
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	801	617	1049	96
RCP26	825	648	1073	92
RCP45	831	652	1082	93
RCP60	805	630	1055	91
RCP85	826	648	1079	93

Figure 1.4.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	915	532	1374	144
RCP26	975	588	1431	143
RCP45	987	600	1440	142
RCP60	967	582	1418	141
RCP85	1006	616	1460	142

Figure 1.4.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	0.89	0.60	1.85	0.13
RCP26	0.86	0.60	1.71	0.11
RCP45	0.85	0.59	1.69	0.11
RCP60	0.84	0.58	1.69	0.11
RCP85	0.83	0.58	1.64	0.11

Figure 1.4.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

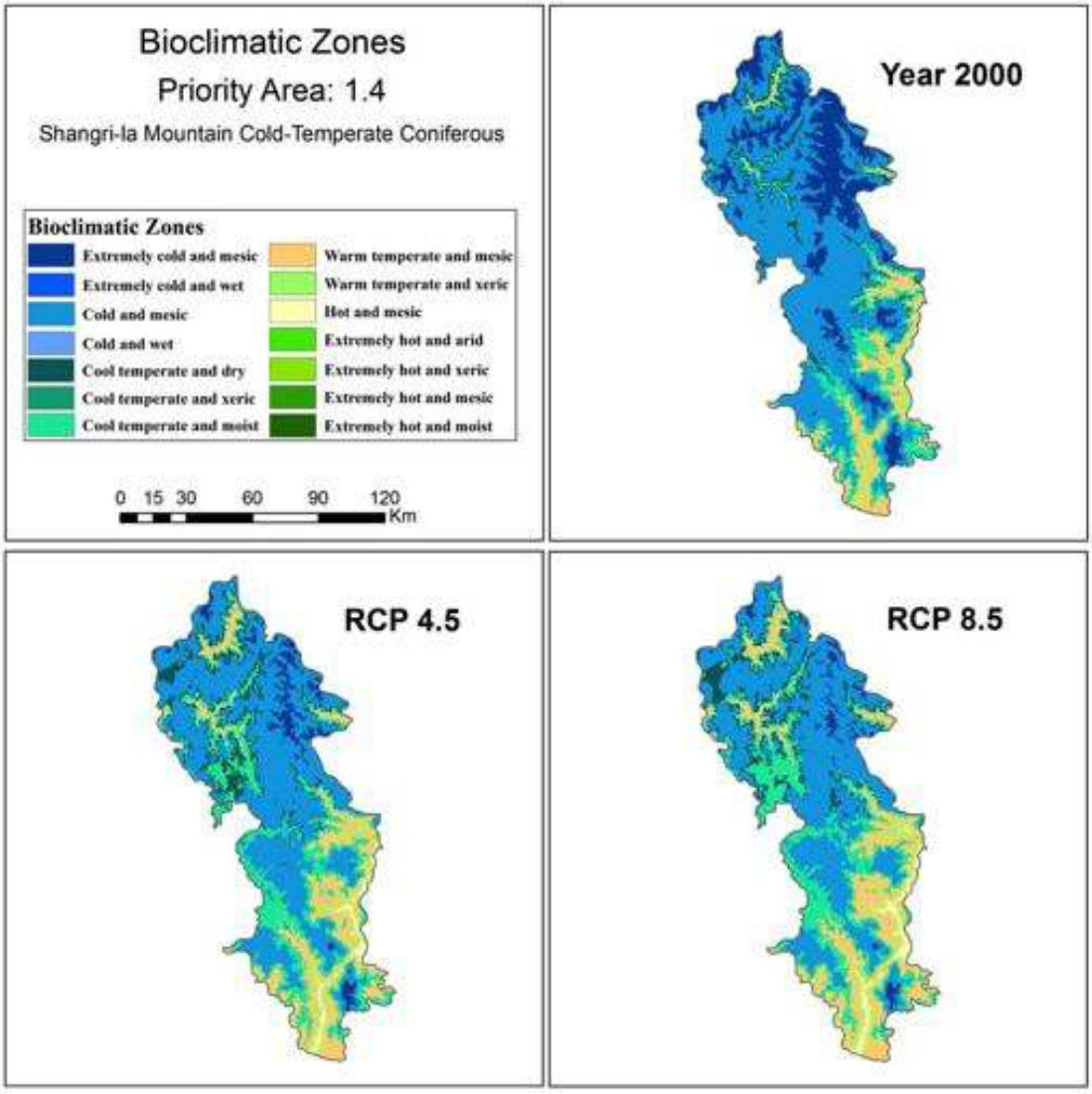


Table 1.4.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.4

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F	2012	417	(1,595)	(79)	4313	4564	250
Cold and mesic	G	5115	3466	(1,649)	(32)	3686	4061	375
Cool temperate and xeric	H	445	2557	2,112	475	3161	3569	408
Cool temperate and moist	J	1043	1296	253	24	3050	3375	326
Warm temperate and mesic	K	1112	1521	409	37	2518	2862	344
Warm temperate and xeric	L	174	375	201	116	1900	2348	448
Hot and mesic	N	6	275	269	4,483	1835	1989	154

Figure 1.4.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

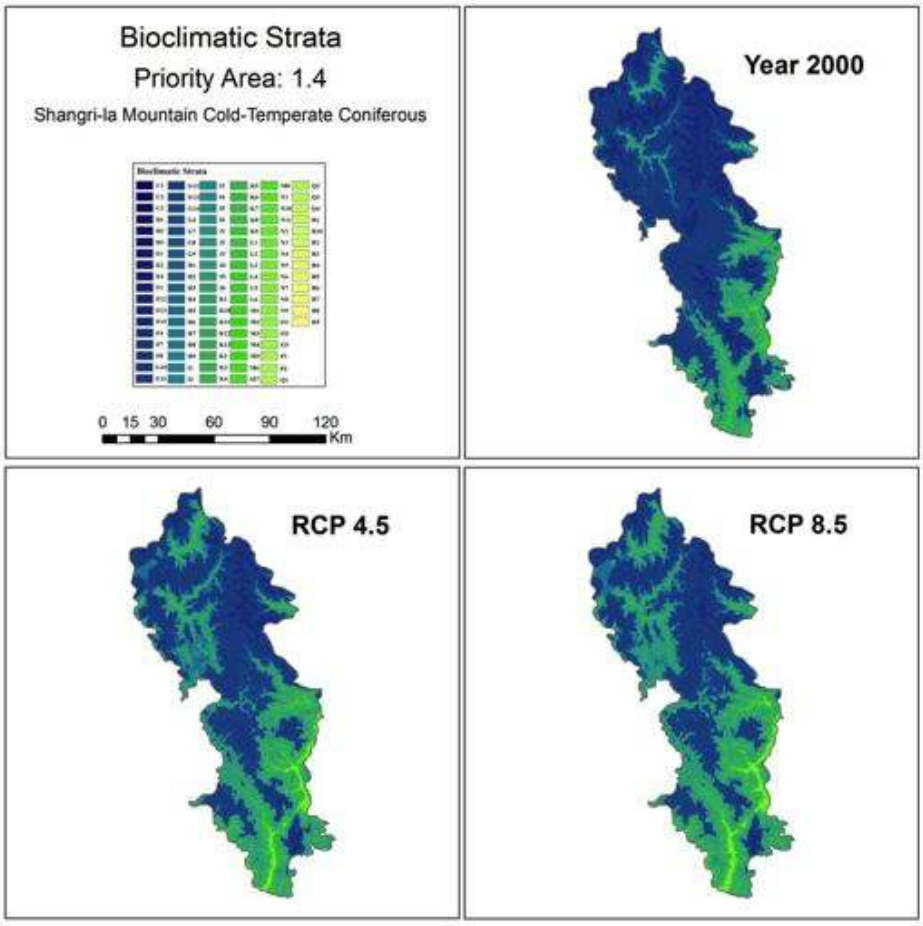


Table 1.4.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.4

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F8	117	28	(89)	(76)	4718	4825	106
Extremely cold and mesic	F13	1424	19	(1,405)	(99)	4341	4755	414
Extremely cold and mesic	F15	471	370	(101)	(21)	4127	4534	407
Cold and mesic	G7	590	680	90	15	3992	4348	356
Cold and mesic	G11	4160	2350	(1,810)	(44)	3672	4031	358
Cold and mesic	G13	365	436	71	19	3343	3776	433
Cool temperate and xeric	H5	445	2557	2,112	475	3161	3569	408
Cool temperate and moist	J3	53	50	(3)	(6)	3209	3671	461
Cool temperate and moist	J5	990	1246	256	26	3041	3364	322
Warm temperate and mesic	K1	460	350	(110)	(24)	2712	3087	375
Warm temperate and mesic	K2	-	2	-	-	-	2859	-
Warm temperate and mesic	K5	418	719	301	72	2478	2897	418
Warm temperate and mesic	K10	234	450	216	92	2208	2630	422
Warm temperate and xeric	L3	174	375	201	116	1900	2348	448
Hot and dry	N2	-	2	-	-	-	2199	-
Hot and mesic	N4	6	195	189	3,150	1835	2051	216
Hot and dry	N5	-	63	-	-	-	1831	-
Hot and dry	N9	-	8	-	-	-	1724	-
Hot and dry	N11	-	7	-	-	-	1908	-

Figure 1.4.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

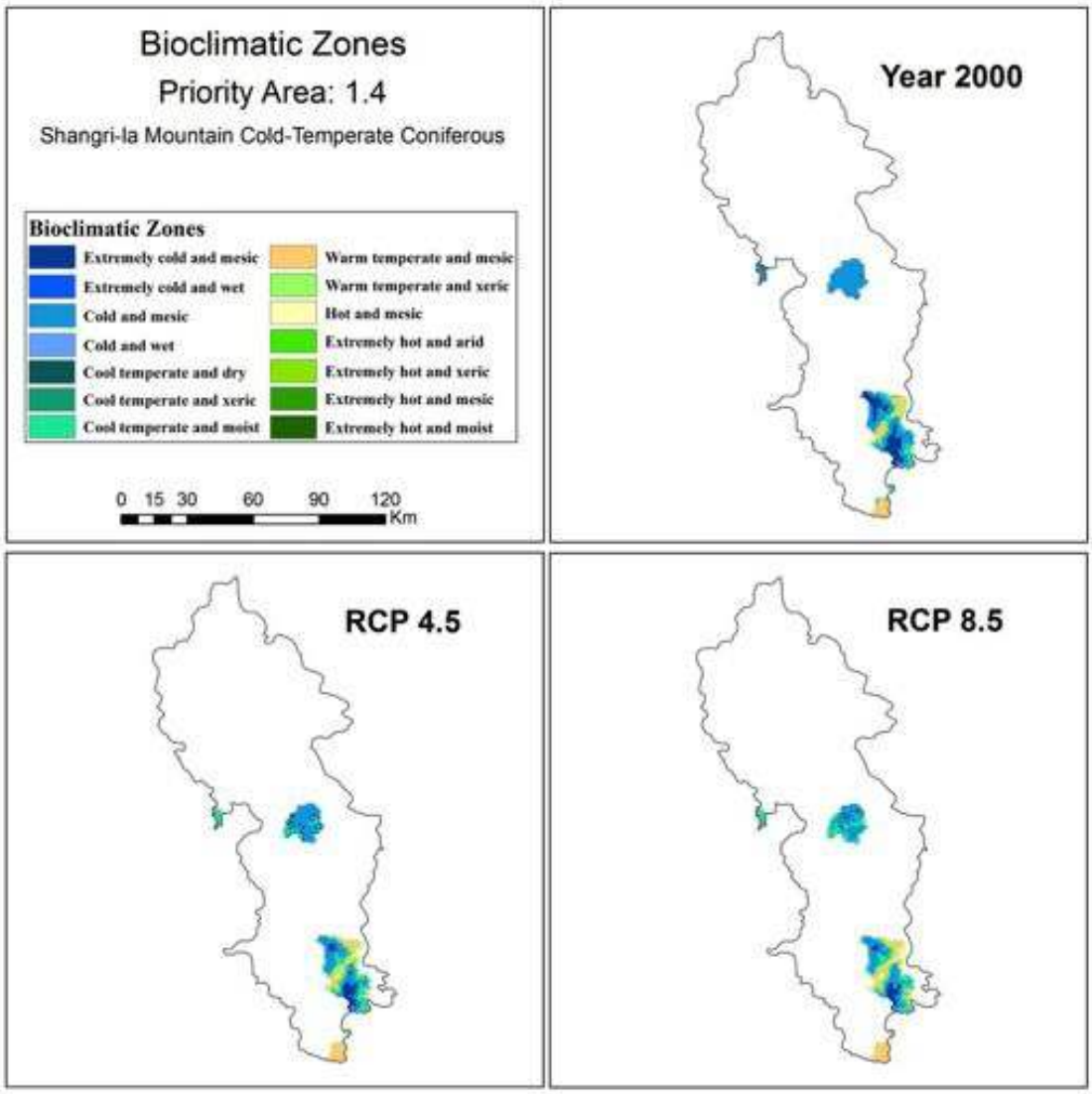


Table 1.4.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 1.4

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Extremely cold and mesic	F	135	66	(69)	(51)	4309	4564	255
Cold and mesic	G	383	189	(194)	(51)	3571	3841	270
Cool temperate and dry	H	-	127	-	-	-	3660	-
Cool temperate and moist	J	92	157	65	71	2973	3334	-
Warm temperate and mesic	K	117	145	28	24	2459	2753	-
Warm temperate and xeric	L	17	34	17	100	1813	2271	458
Hot and dry	N	-	26	-	-	-	1917	-

Priority Area: 2.1

Southern Gaoligong Mountain Humid Evergreen Broadleaf Forest

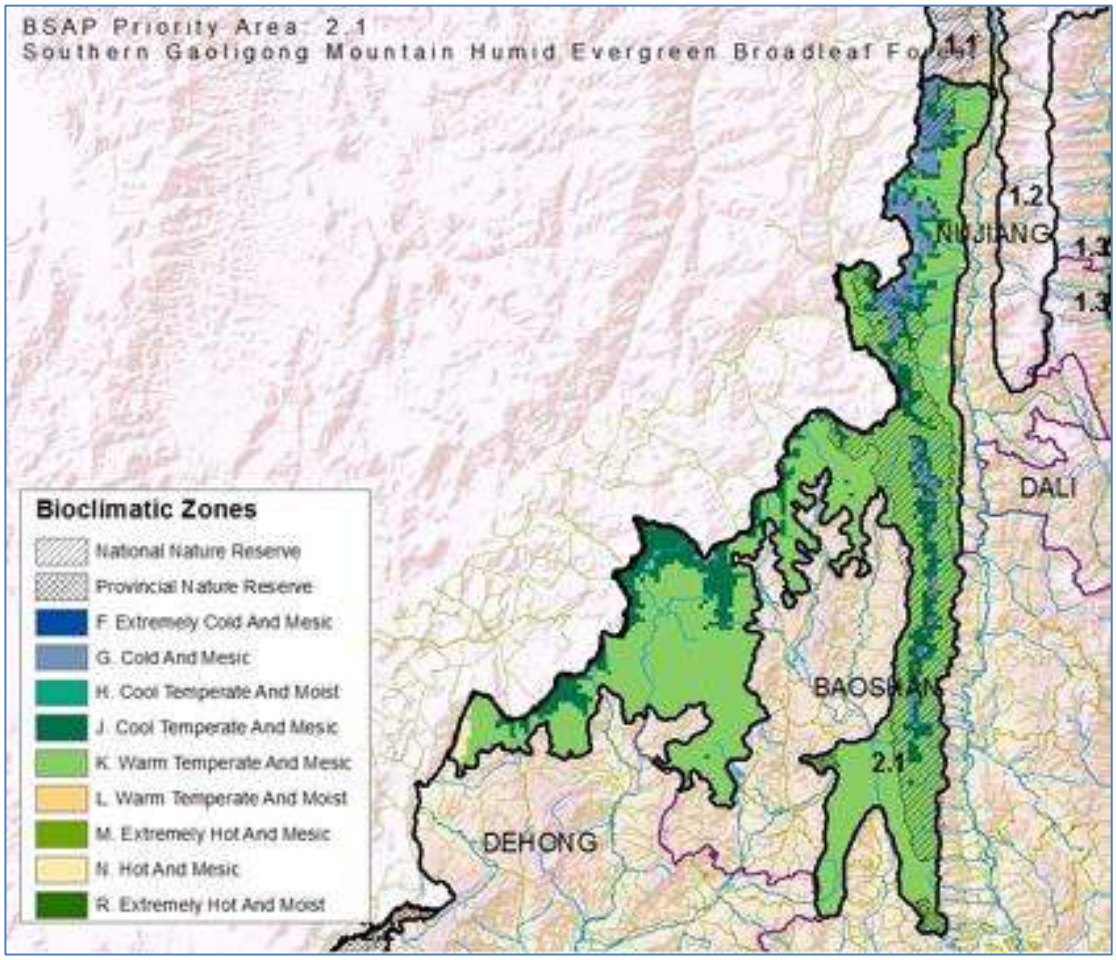
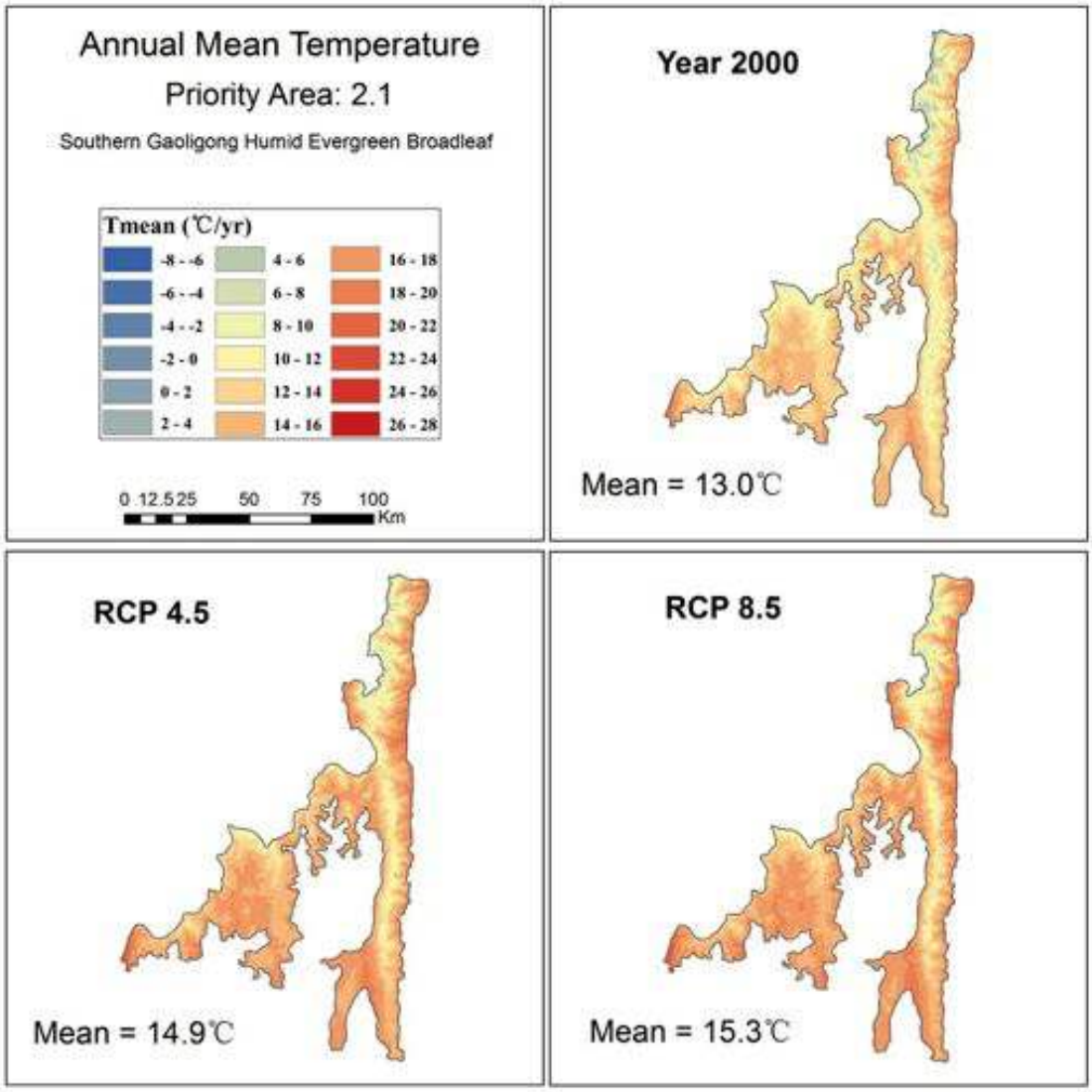


Table 2.1.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 2.1

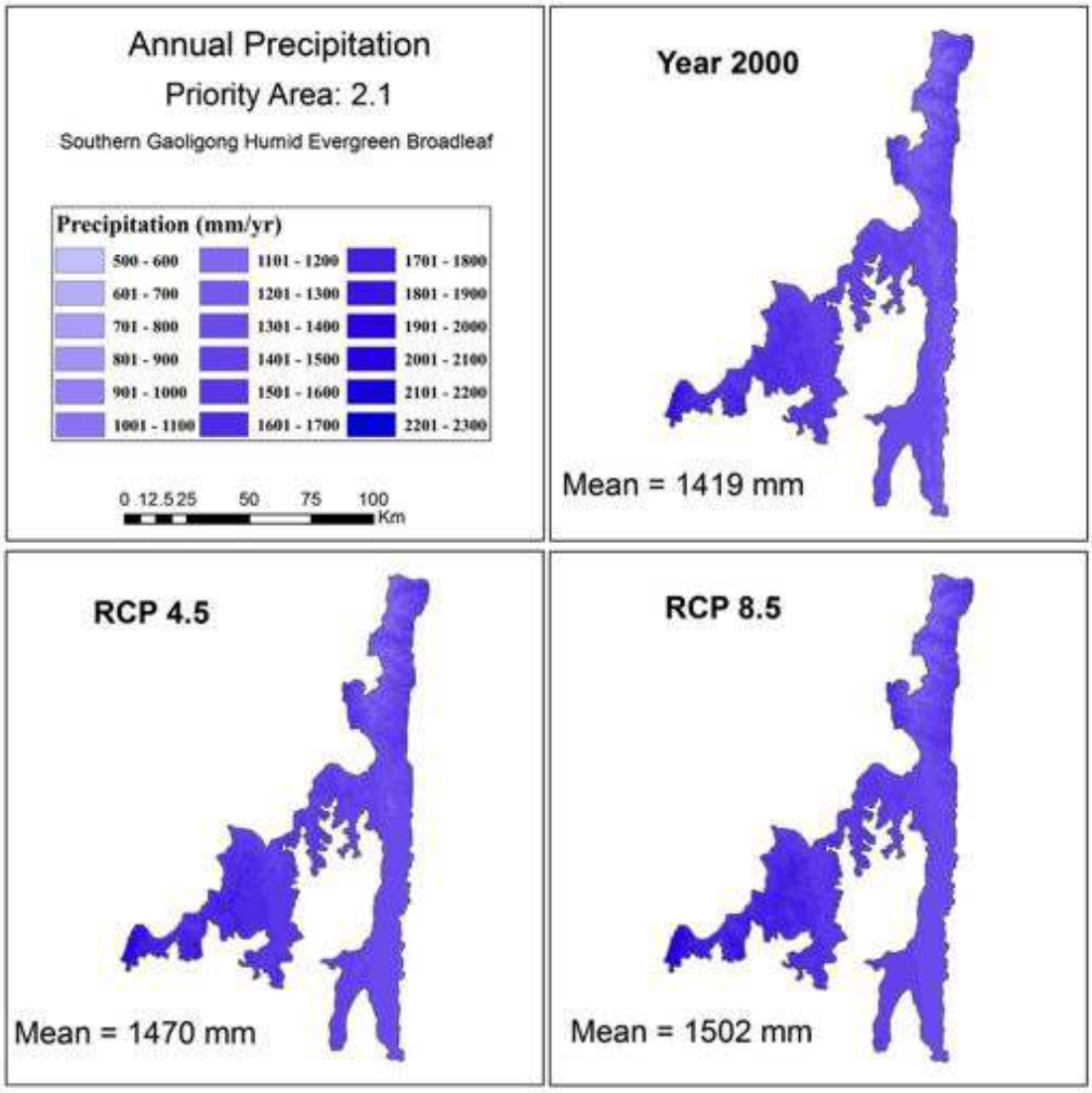
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Cold and mesic	G	300	3416	7.6	1221	906	1.35
Cool temperate and moist	J	830	2864	10.5	1386	1015	1.36
Warm temperate and mesic	K	3838	2170	13.9	1441	1152	1.25
Hot and mesic	N	40	1322	17.8	1734	1297	1.34

Figure 2.1.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



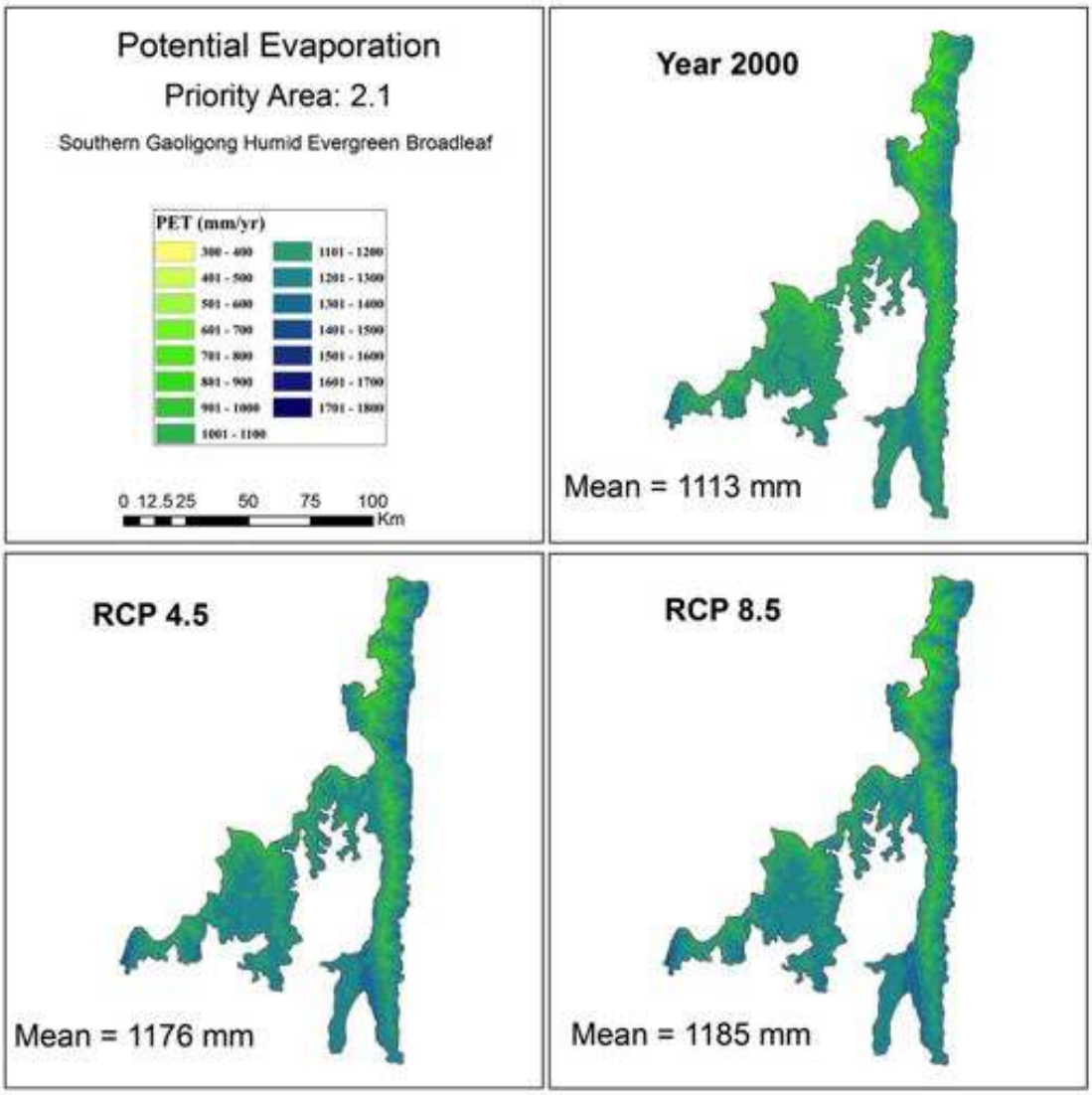
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	13.0	4.0	20.2	2.5
RCP26	14.5	5.5	21.7	2.5
RCP45	14.9	5.9	22.1	2.5
RCP60	14.5	5.5	21.7	2.5
RCP85	15.3	6.3	22.6	2.5

Figure 2.1.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



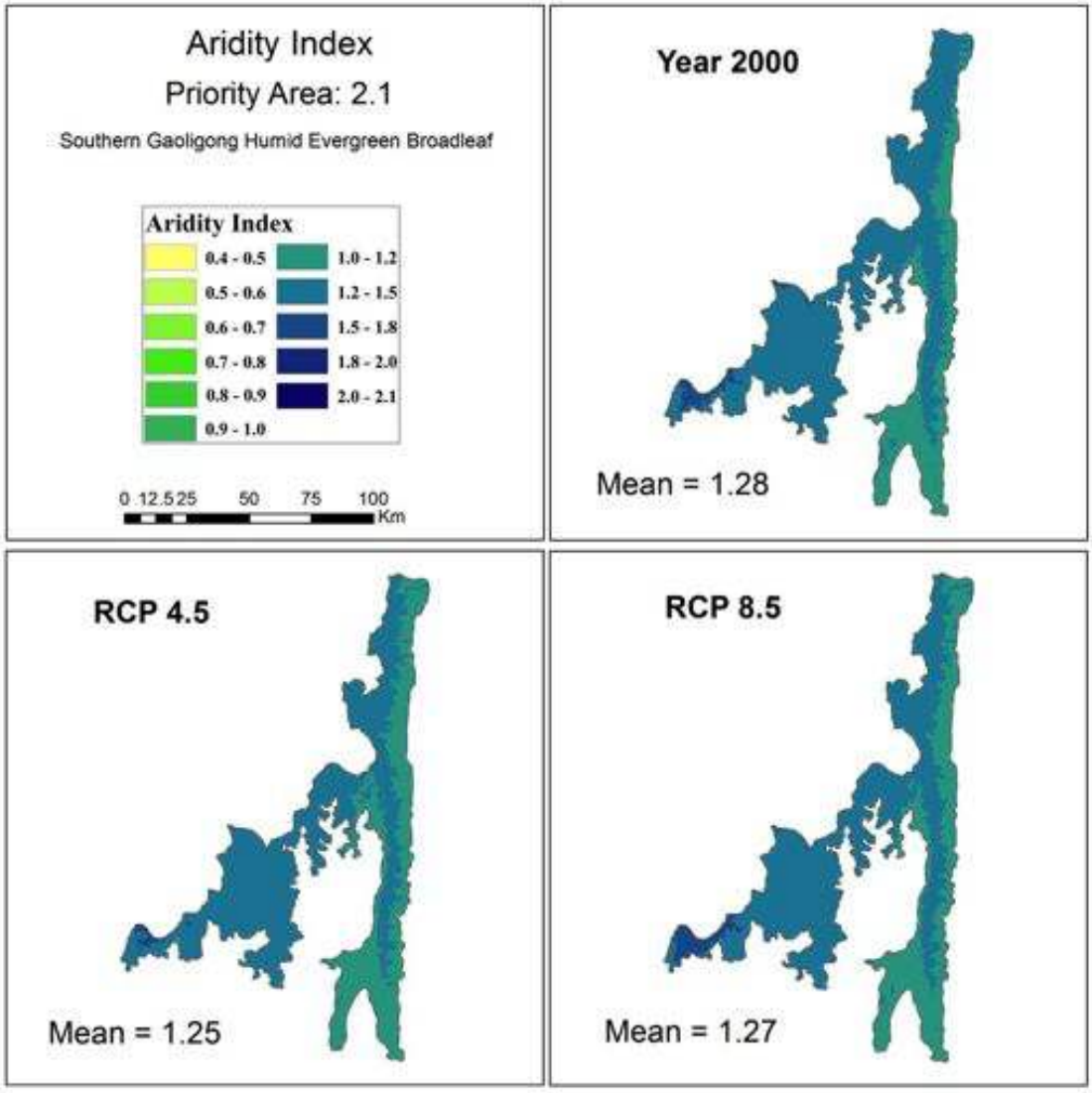
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1420	1096	1882	136
RCP26	1459	1122	1952	143
RCP45	1470	1131	1965	144
RCP60	1471	1123	1971	146
RCP85	1502	1143	2031	153

Figure 2.1.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1113	777	1384	98
RCP26	1166	829	1434	99
RCP45	1176	840	1440	99
RCP60	1152	820	1417	97
RCP85	1185	852	1446	98

Figure 2.1.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.28	1.00	1.57	0.11
RCP26	1.26	0.99	1.54	0.11
RCP45	1.25	0.98	1.53	0.11
RCP60	1.28	1.01	1.57	0.11
RCP85	1.27	1.00	1.57	0.12

Figure 2.1.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

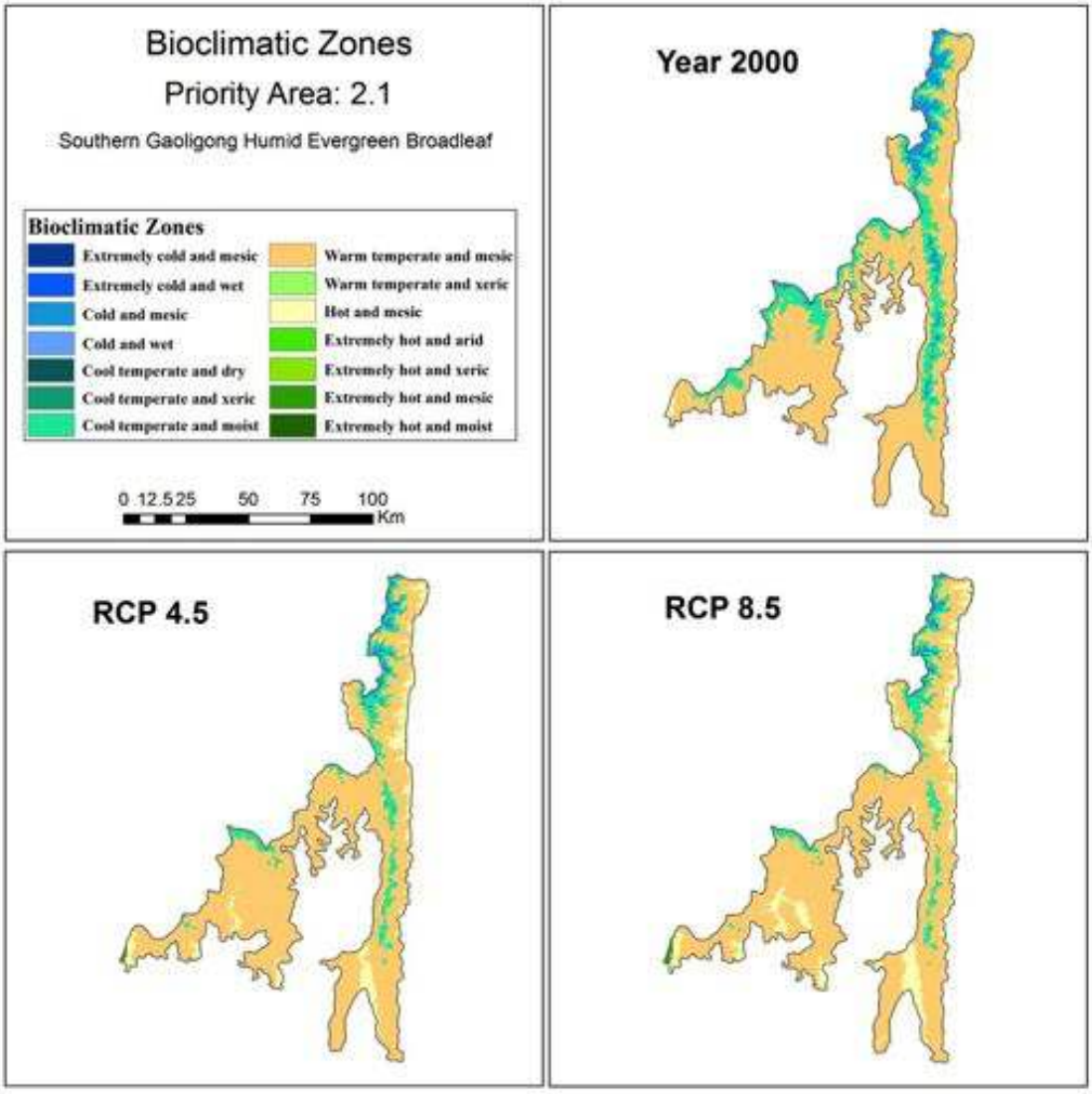


Table 2.1.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.1

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cold and mesic	G	284	73	(211)	(74)	3504	3738	235
Cool temperate and moist	J	772	777	5	1	2926	3135	209
Warm temperate and mesic	K	3819	3417	(402)	(11)	2193	2298	105
Extremely hot and mesic	M		22	22			1232	
Hot and mesic	N	30	616	586	1,953	1315	1755	440

Figure 2.1.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

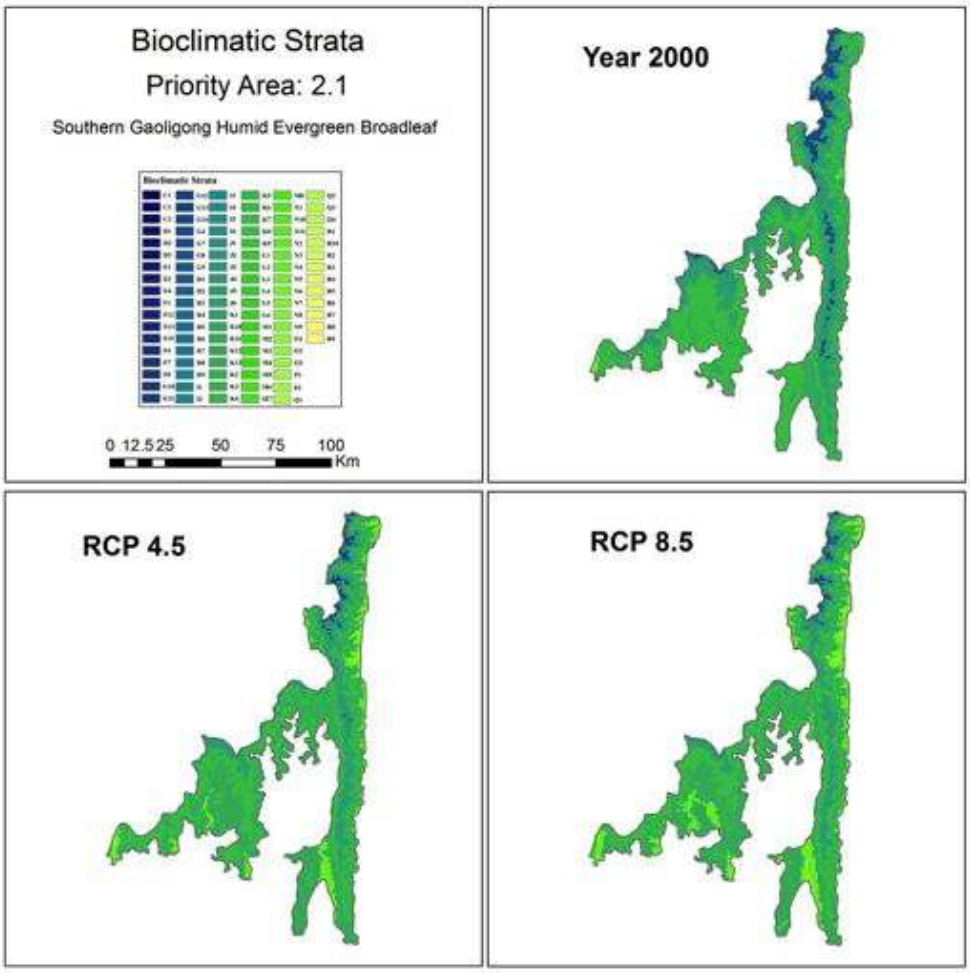


Table 2.1.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.1

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cold and mesic	G8	45	3	(42)	(93)	3769	3889	120
Cold and mesic	G13	239	70	(169)	(71)	3454	3732	278
Cool temperate and moist	J3	435	88	(347)	(80)	3066	3529	462
Cool temperate and moist	J4	337	689	352	104	2744	3084	341
Warm temperate and mesic	K1	941	23	(918)	(98)	2600	2930	330
Warm temperate and mesic	K7	2222	1589	(633)	(28)	2139	2522	383
Warm temperate and mesic	K10	50	-	-	-	1995	-	-
Warm temperate and mesic	K11	-	84	-	-	-	1918	-
Warm temperate and mesic	K13	606	1721	1,115	184	1774	2101	327
Hot and mesic	N3	26	549	523	2,012	1368	1781	414
Hot and mesic	N8	4	67	63	1,575	975	1537	563
Extremely hot and mesic	M1	-	17	-	-	-	1302	-
Extremely hot and mesic	M2	-	1	-	-	-	1058	-
Extremely hot and mesic	M6	-	3	-	-	-	994	-
Extremely hot and mesic	M7	-	1	-	-	-	917	-

Figure 2.1.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

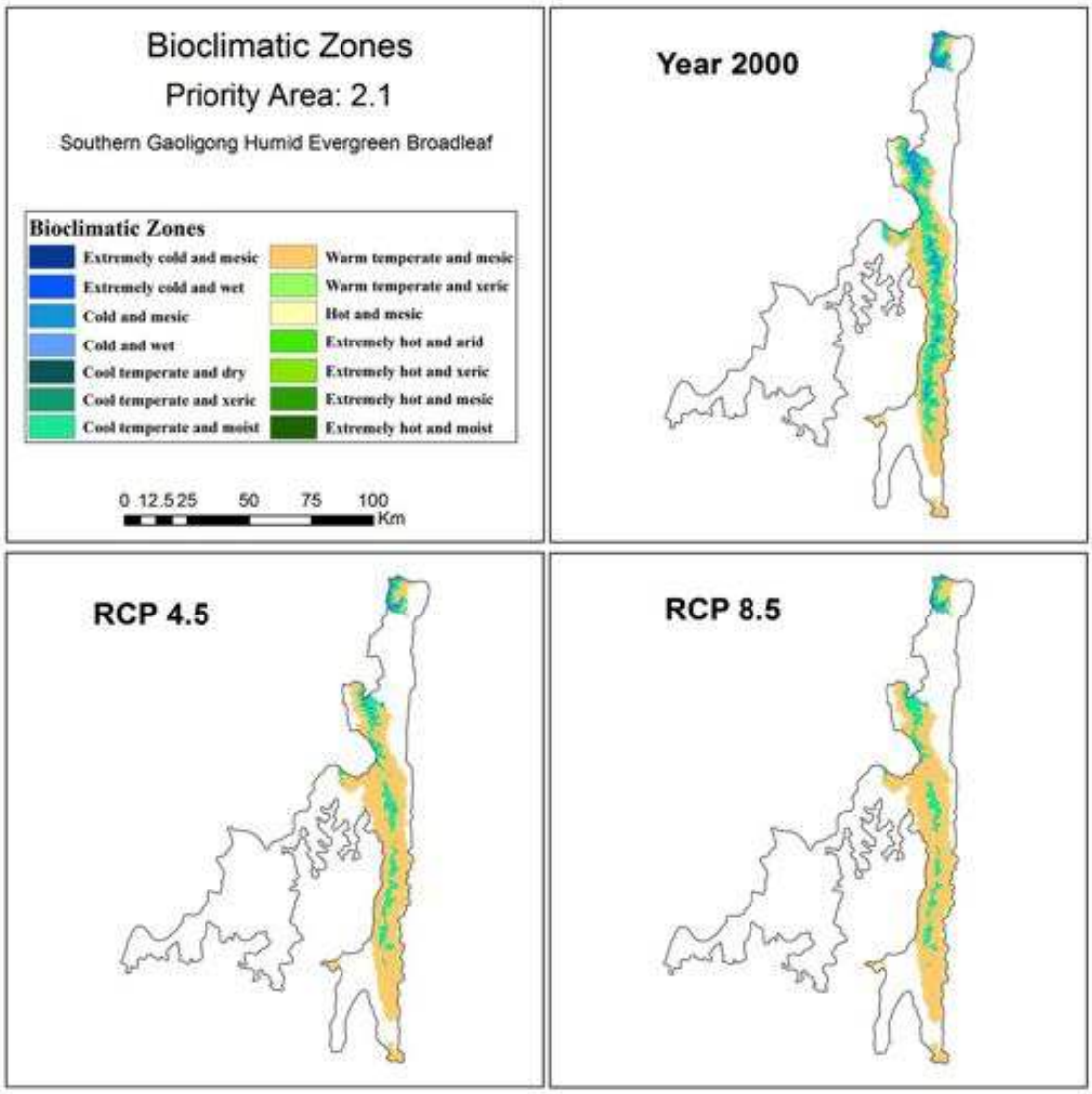


Table 2.1.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.1

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Cold and mesic	G	149	25	(124)	(83)	3382	3666	284
Cool temperate and moist	J	324	455	131	40	2977	3069	92
Warm temperate and mesic	K	1045	994	(51)	(5)	2393	2418	25
Hot and mesic	N	1	45	44	4400	1539	1760	221

Priority Area: 2.2

Tongbiguan Tropical Rainforest

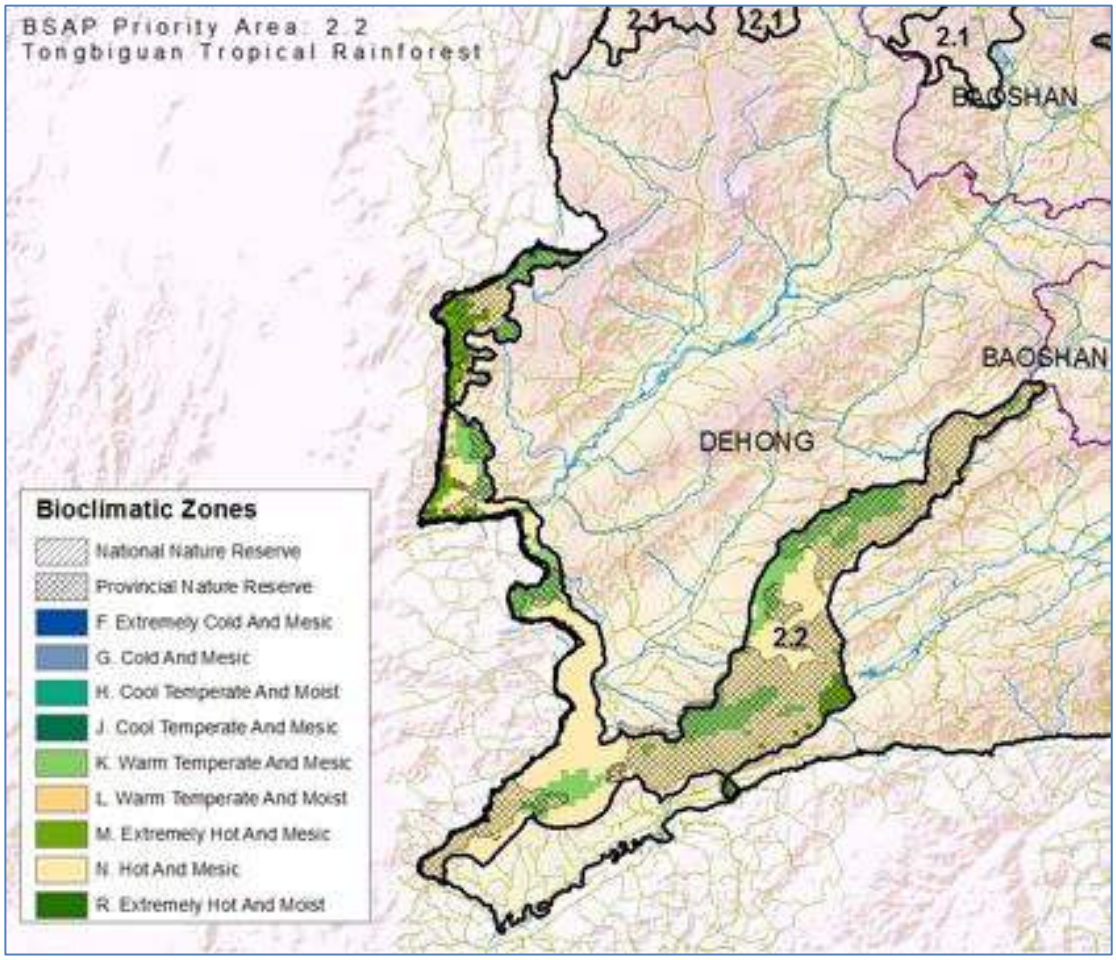
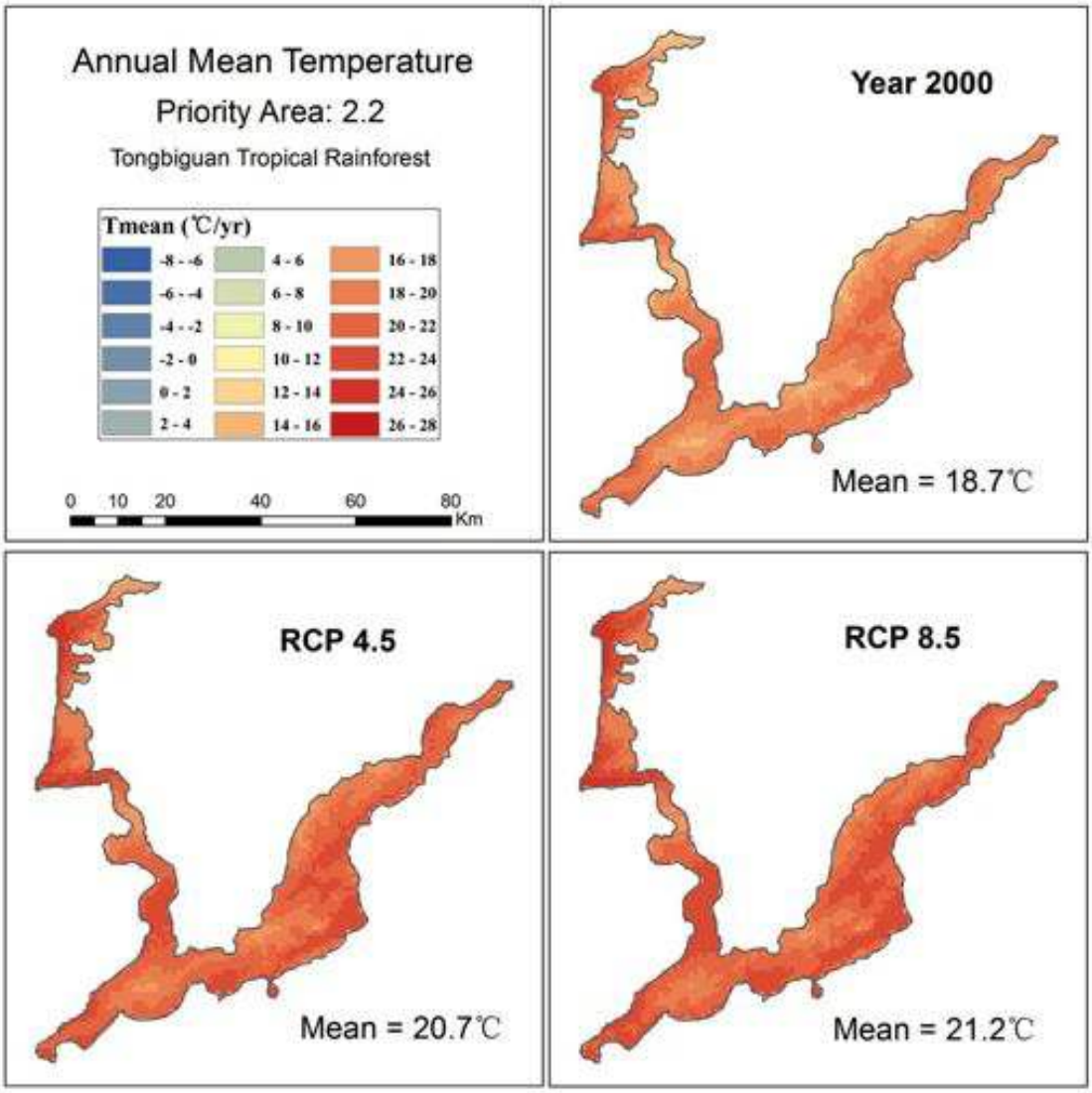


Table 2.2.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 2.2

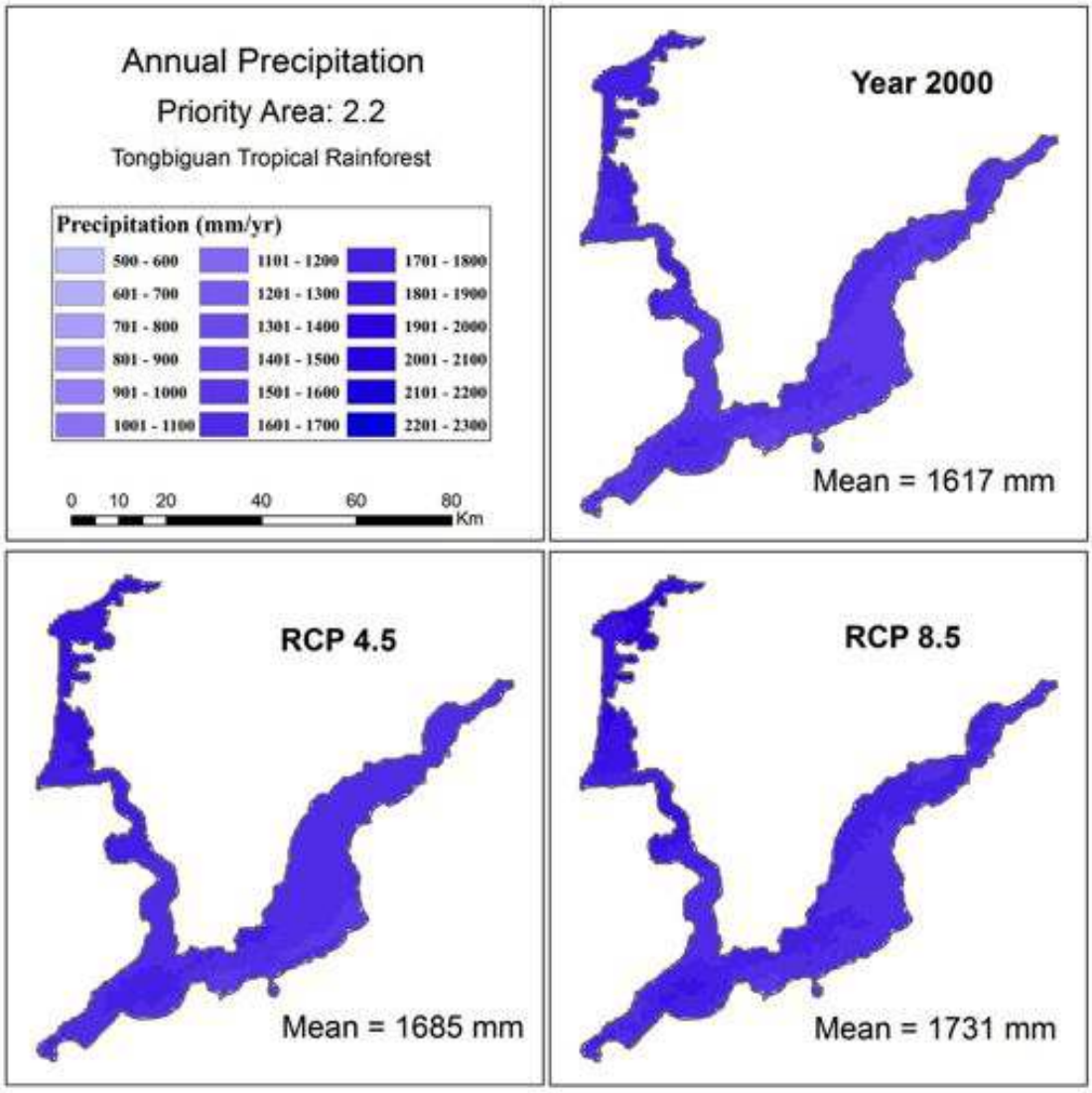
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Cool temperate and moist	J	3	2240	13.1	1715	1119	1.53
Warm temperate and mesic	K	390	1578	16.4	1657	1279	1.3
Extremely hot and mesic	M	121	654	21.5	1656	1487	1.11
Hot and mesic	N	1059	1095	19.2	1599	1407	1.14

Figure 2.2.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



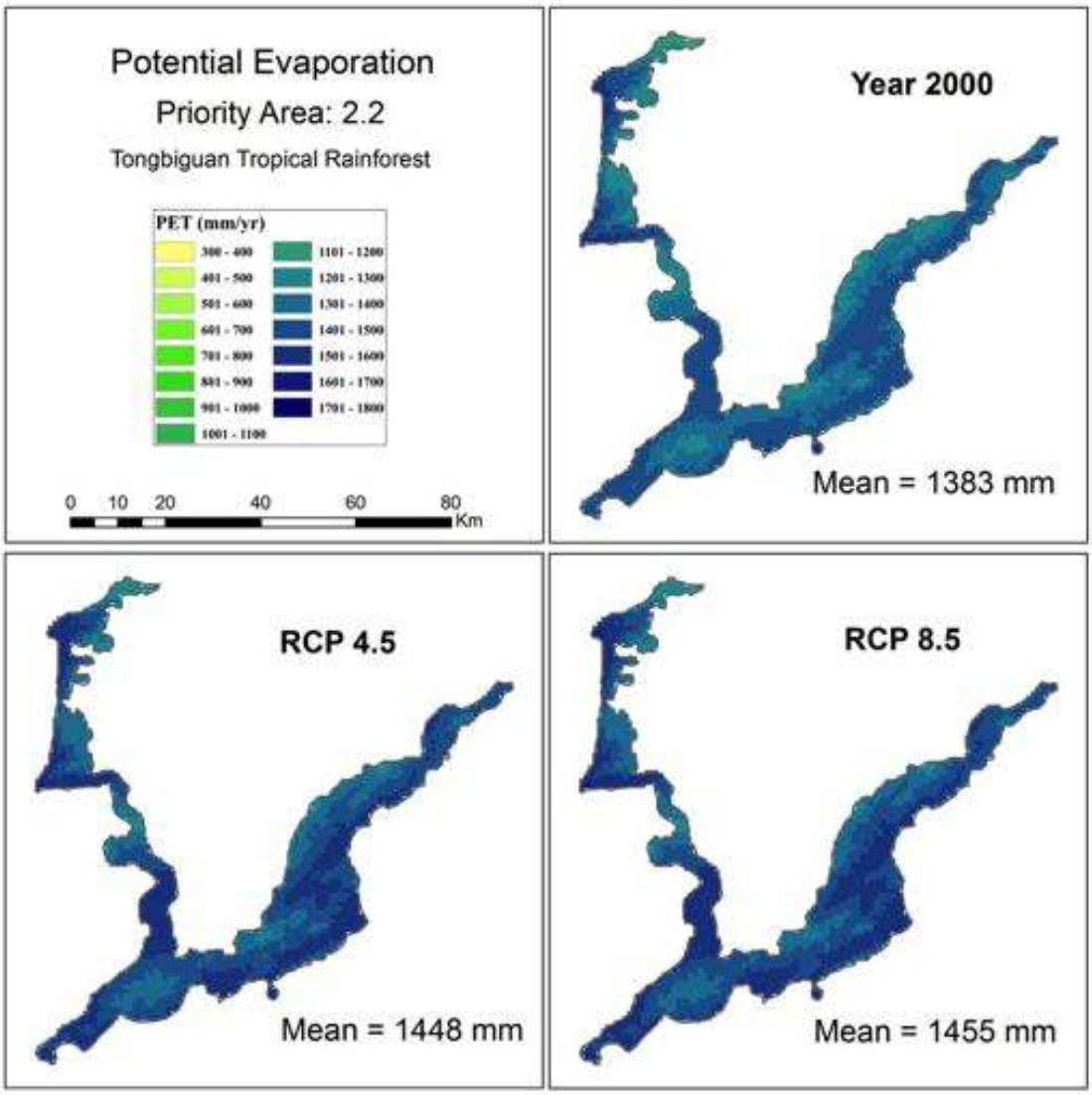
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	18.7	12.6	23.5	1.7
RCP26	20.3	14.2	25.1	1.7
RCP45	20.7	14.6	25.5	1.7
RCP60	20.3	14.2	25.1	1.7
RCP85	21.2	15.0	26.0	1.7

Figure 2.2.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



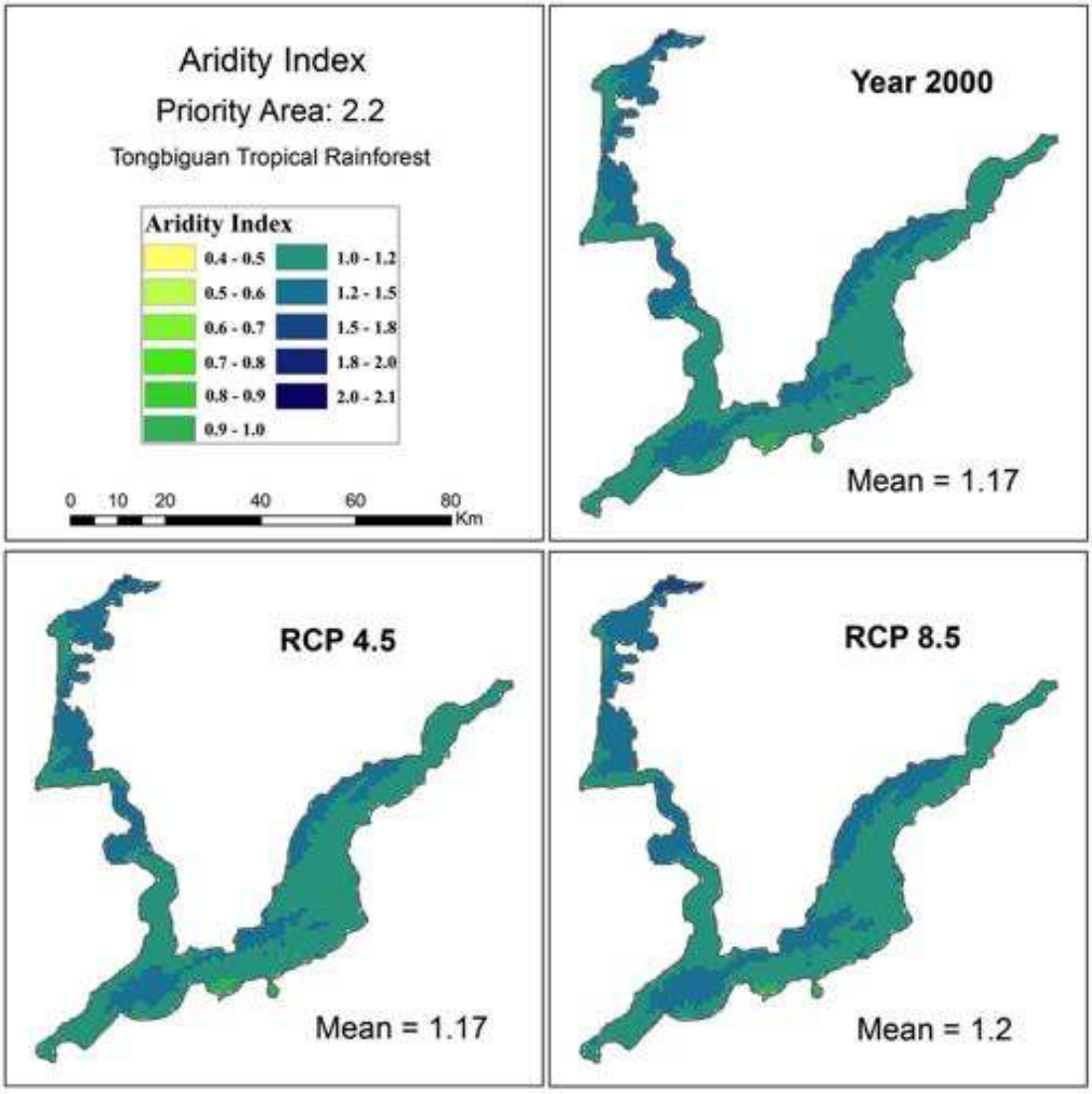
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1617	1453	1785	68
RCP26	1689	1519	1867	73
RCP45	1686	1513	1870	74
RCP60	1688	1515	1876	76
RCP85	1731	1549	1937	82

Figure 2.2.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1384	1097	1554	78
RCP26	1438	1148	1605	78
RCP45	1449	1156	1614	78
RCP60	1426	1136	1591	78
RCP85	1456	1164	1619	78

Figure 2.2.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.17	0.96	1.55	0.10
RCP26	1.18	0.97	1.55	0.10
RCP45	1.17	0.96	1.54	0.10
RCP60	1.19	0.97	1.57	0.11
RCP85	1.20	0.98	1.58	0.11

Figure 2.2.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

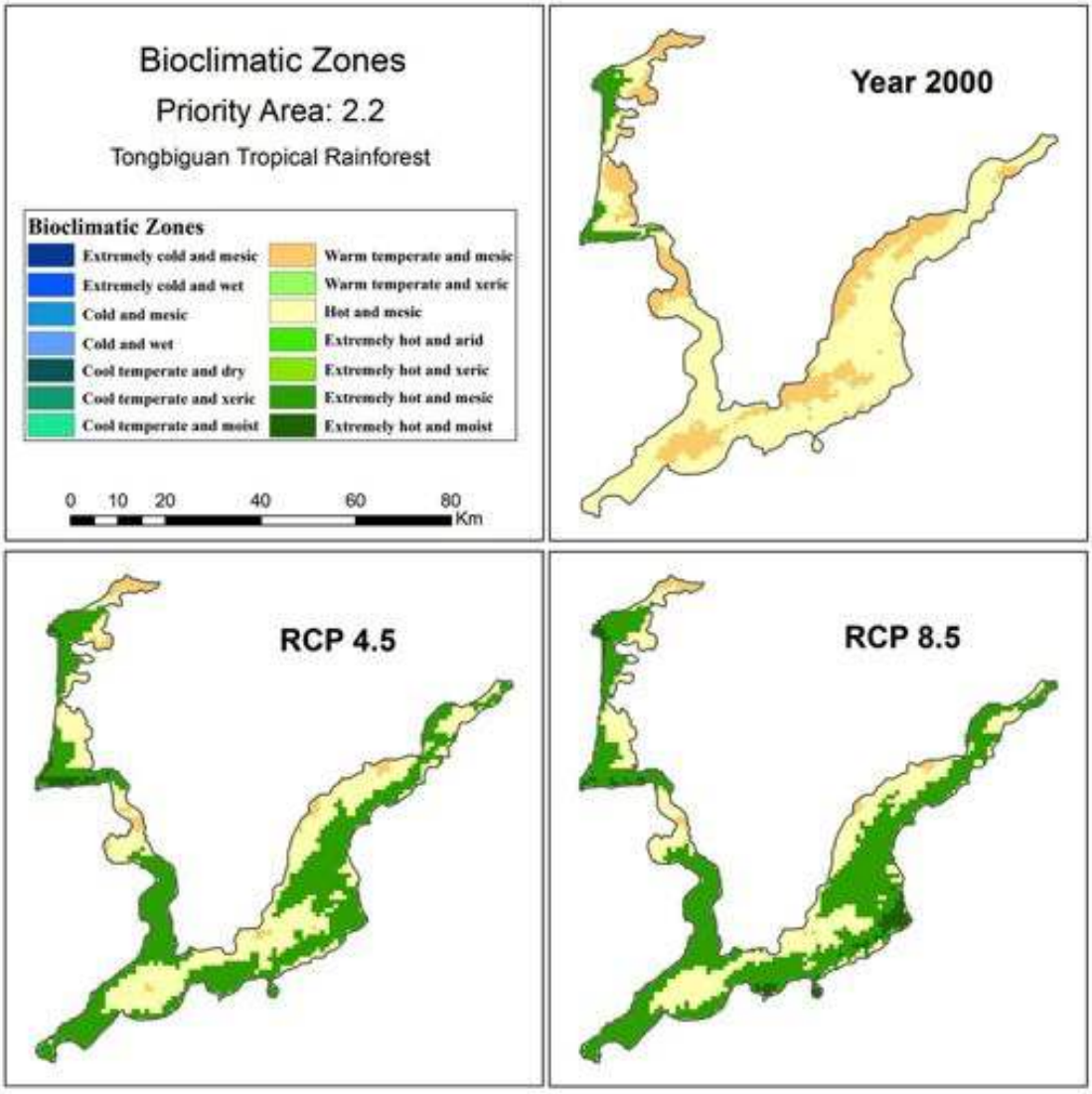


Table 2.2.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.2

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Warm temperate and mesic	K	377	41	(336)	(89)	1623	1947	324
Extremely hot and mesic	M	96	791	695	724	657	1056	400
Hot and mesic	N	1041	526	(515)	(49)	1100	1495	394
Extremely hot and moist	R		156	156			762	

Figure 2.2.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

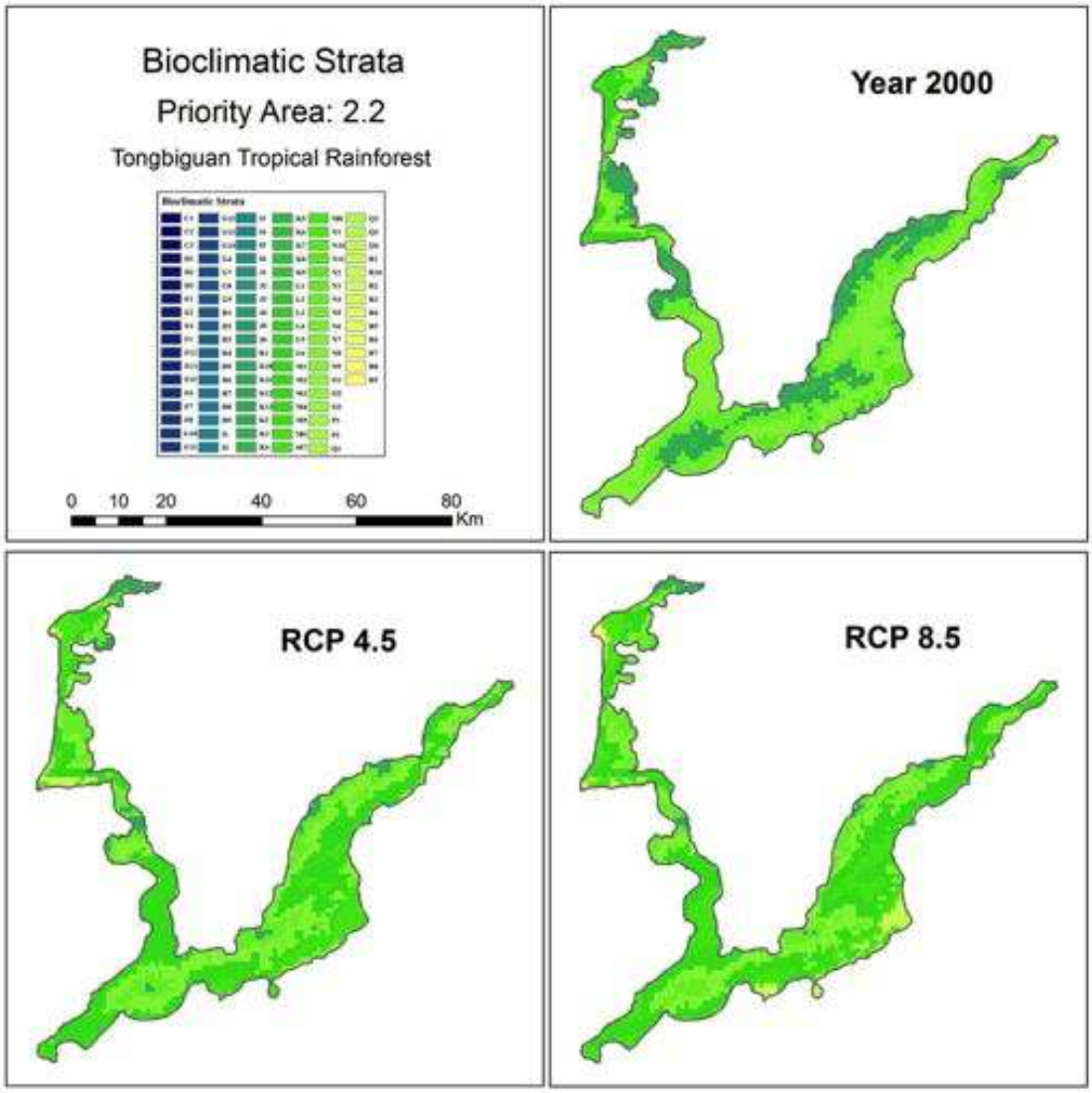


Table 2.2.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.2

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Warm temperate and mesic	K7	82	7	(75)	(91)	1863	2140	277
Warm temperate and mesic	K11	-	17	-	-	-	1865	-
Warm temperate and mesic	K13	295	17	(278)	(94)	1556	1949	393
Hot and mesic	N3	444	198	(246)	(55)	1260	1652	393
Hot and mesic	N8	597	328	(269)	(45)	982	1399	418
Extremely hot and mesic	M1	-	2	-	-	-	1242	-
Extremely hot and mesic	M2	87	569	482	554	687	1109	422
Extremely hot and mesic	M7	9	220	211	2,344	361	918	557
Extremely hot and moist	R1	-	156	-	-	-	762	-

Figure 2.2.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

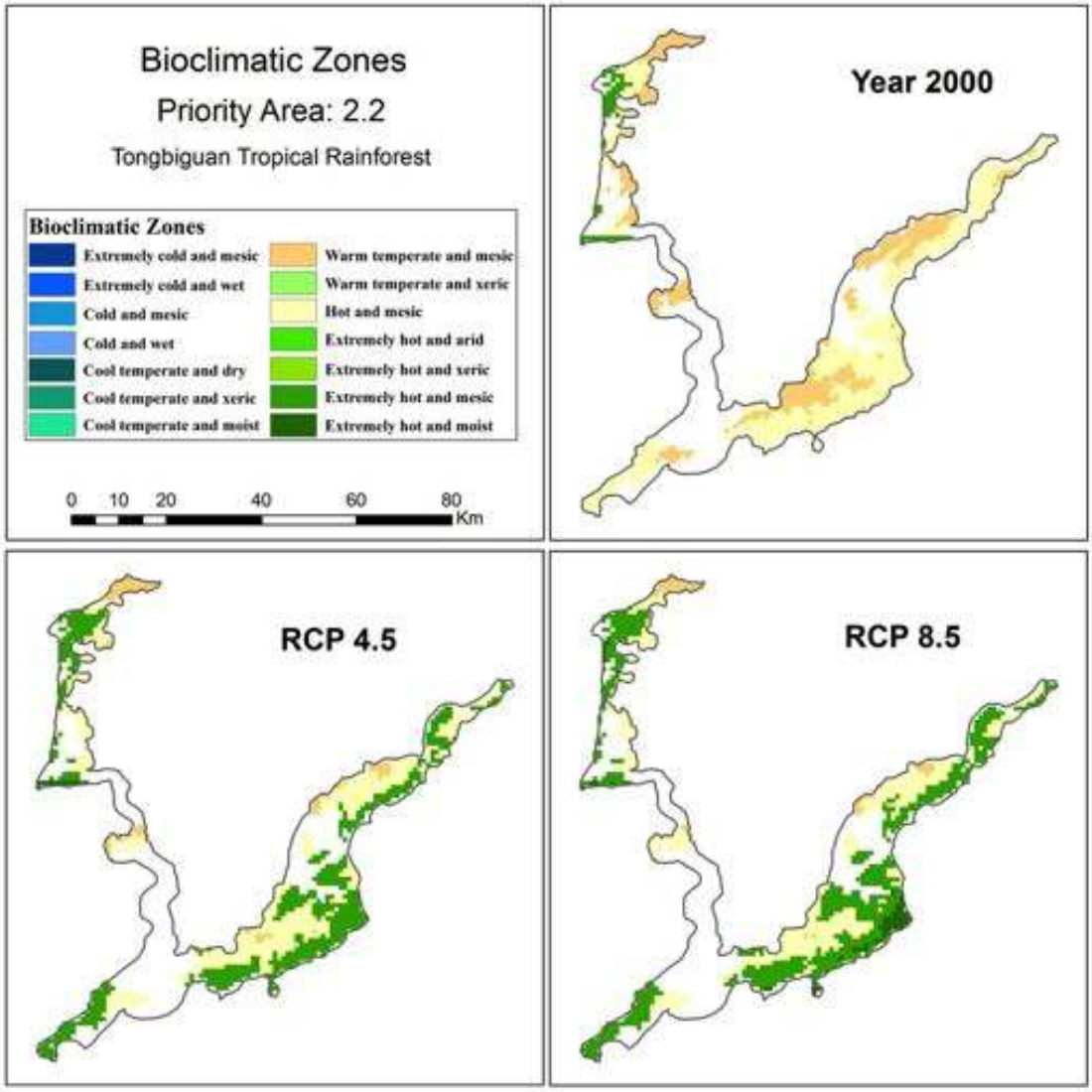


Table 2.2.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.2

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Cool temperate and moist	J	2	-	-	-	2378	-	-
Warm temperate and mesic	K	255	35	(220)	(86)	1633	2014	
Extremely hot and mesic	M	77	462	385	500	700	1093	393
Hot and mesic	N	634	355	(279)	(44)	1132	1482	350
Extremely hot and moist	R	-	116	-	-	-	784	-

Priority Area: 2.3

Nanting River Tropical Rainforest

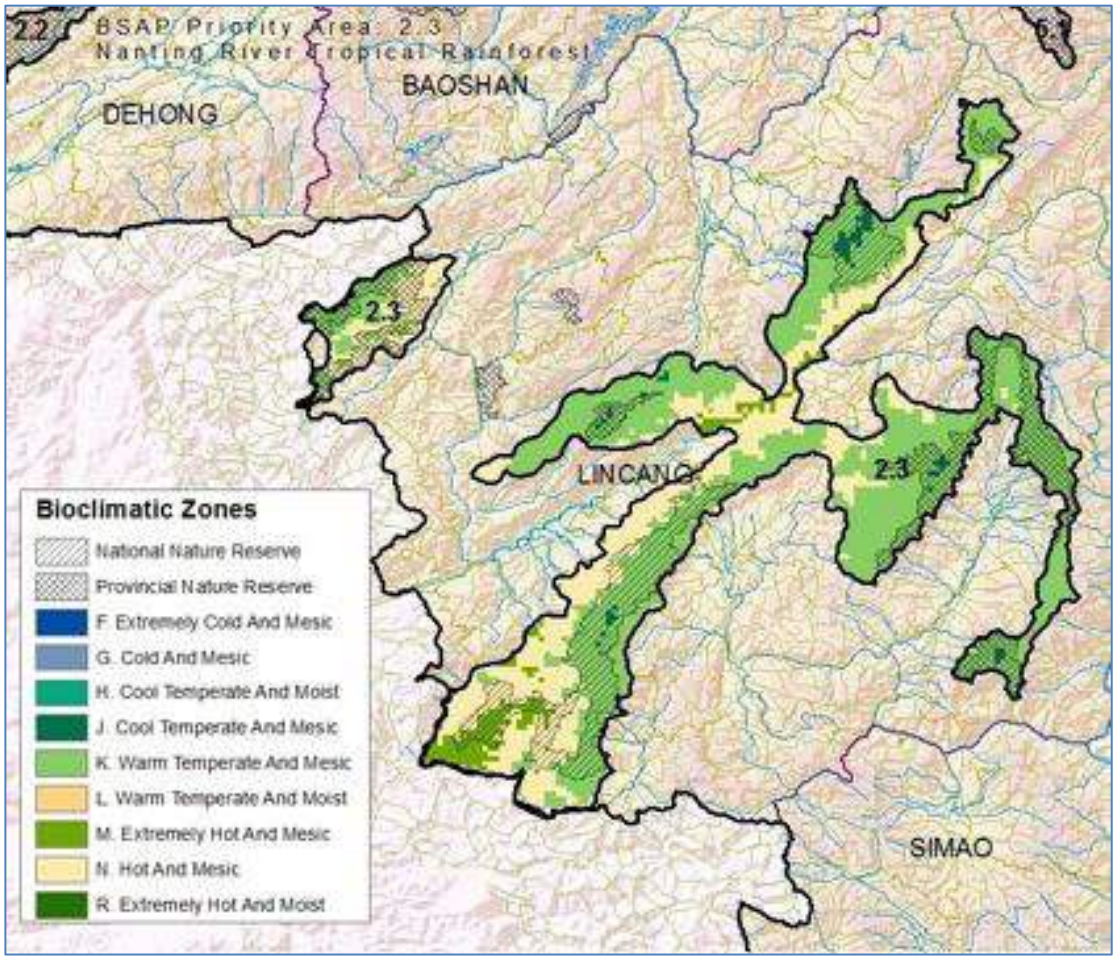
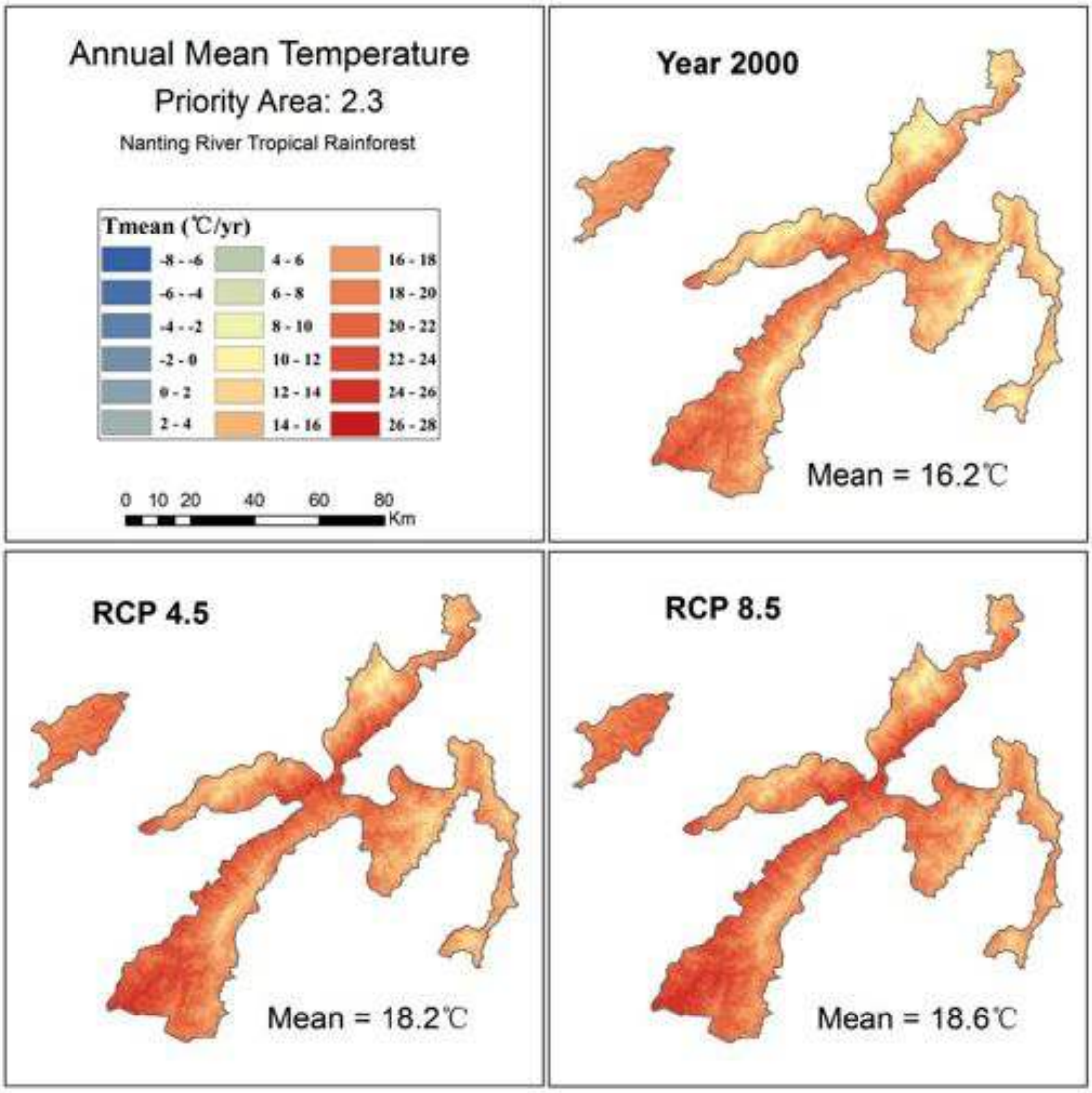


Table 2.3.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 2.3

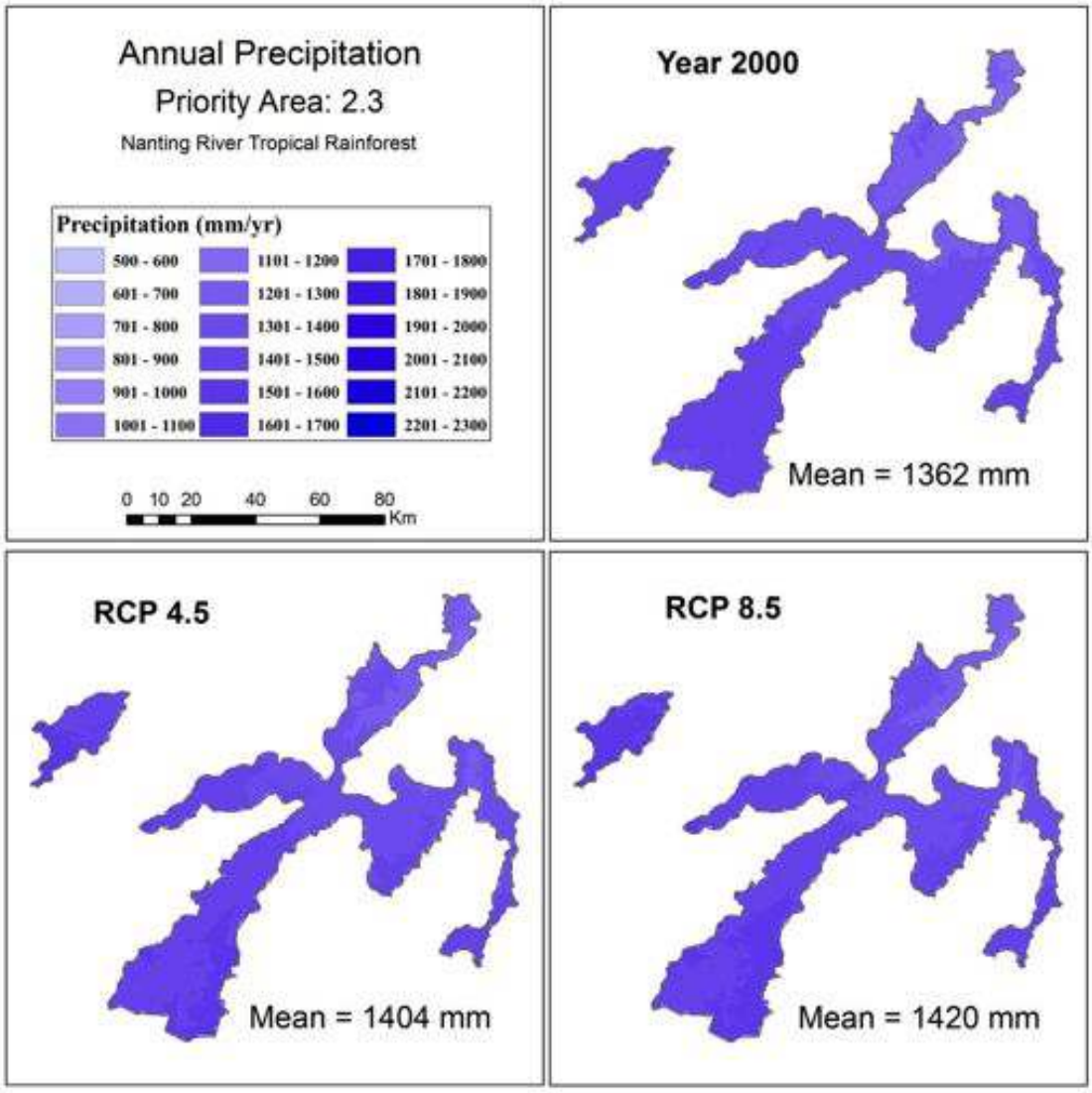
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
	y						
Cold and mesic	G	1	3249	8.1	1336	944	1.42
Cool temperate and moist	J	60	2872	10.4	1361	1040	1.31
Warm temperate and mesic	K	2587	2082	14.6	1349	1224	1.11
Extremely hot and mesic	M	206	767	21.5	1398	1558	0.9
Hot and mesic	N	1219	1246	19	1383	1431	0.97

Figure 2.3.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



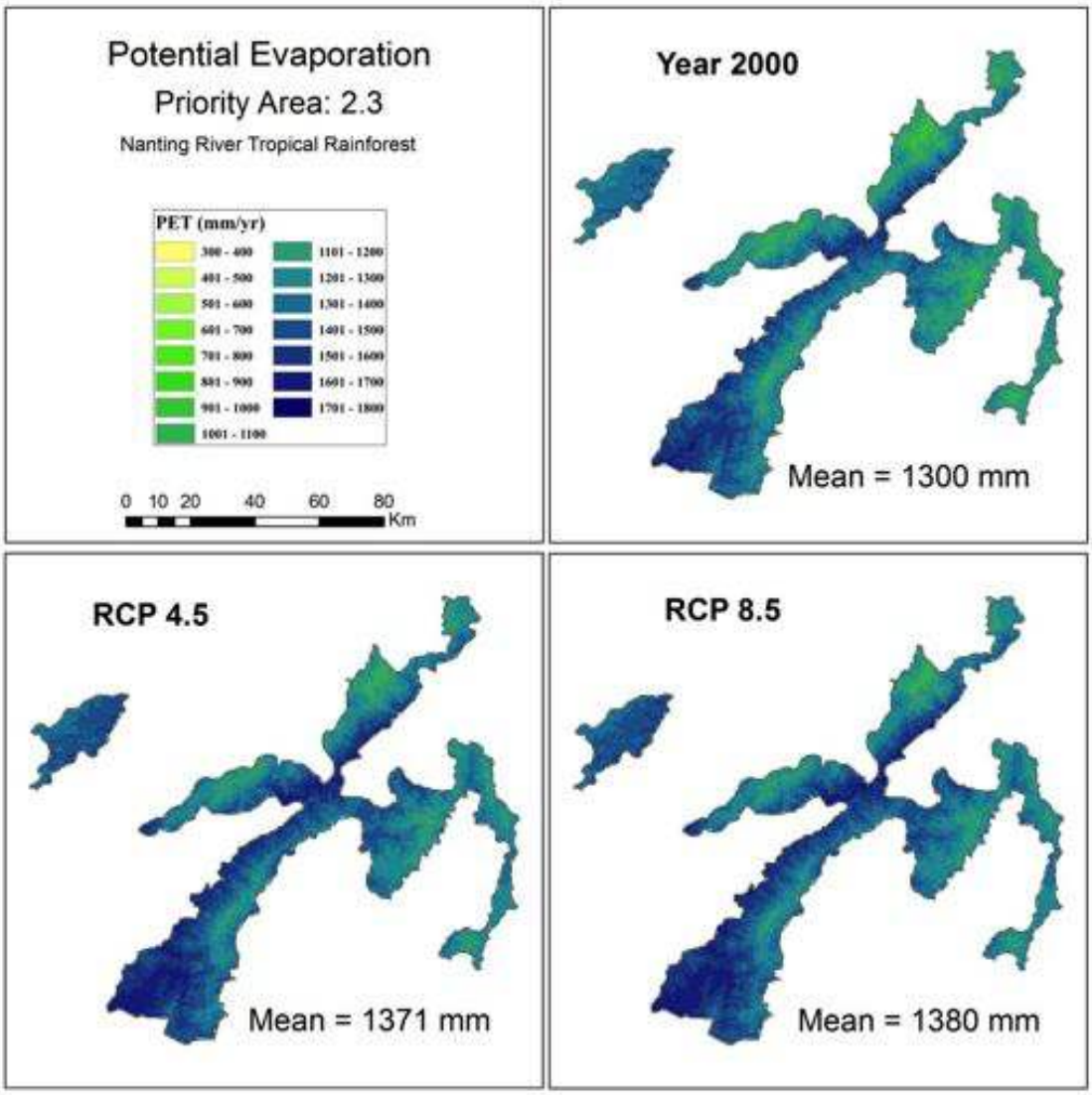
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	16.2	7.9	22.9	2.9
RCP26	17.8	9.4	24.4	2.9
RCP45	18.2	9.9	24.9	2.9
RCP60	17.8	9.5	24.4	2.9
RCP85	18.6	10.3	25.3	2.9

Figure 2.3.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



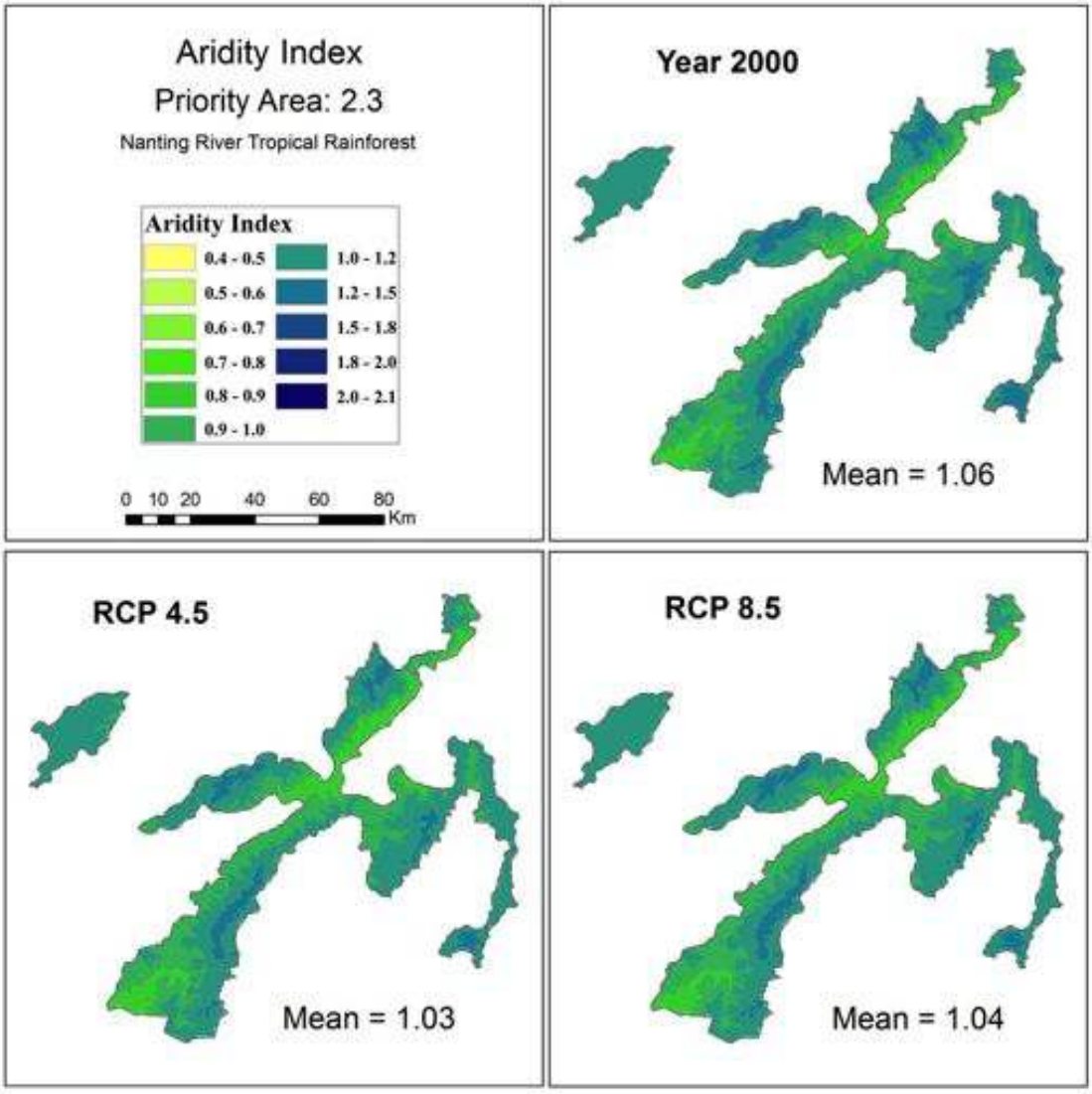
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1363	1129	1498	76
RCP26	1409	1159	1553	83
RCP45	1405	1158	1550	82
RCP60	1400	1155	1539	81
RCP85	1421	1172	1564	83

Figure 2.3.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1300	936	1630	136
RCP26	1358	992	1689	137
RCP45	1372	1005	1702	137
RCP60	1347	981	1678	137
RCP85	1381	1015	1711	137

Figure 2.3.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.06	0.82	1.43	0.11
RCP26	1.05	0.81	1.39	0.11
RCP45	1.03	0.80	1.37	0.10
RCP60	1.05	0.81	1.40	0.11
RCP85	1.04	0.80	1.38	0.10

Figure 2.3.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

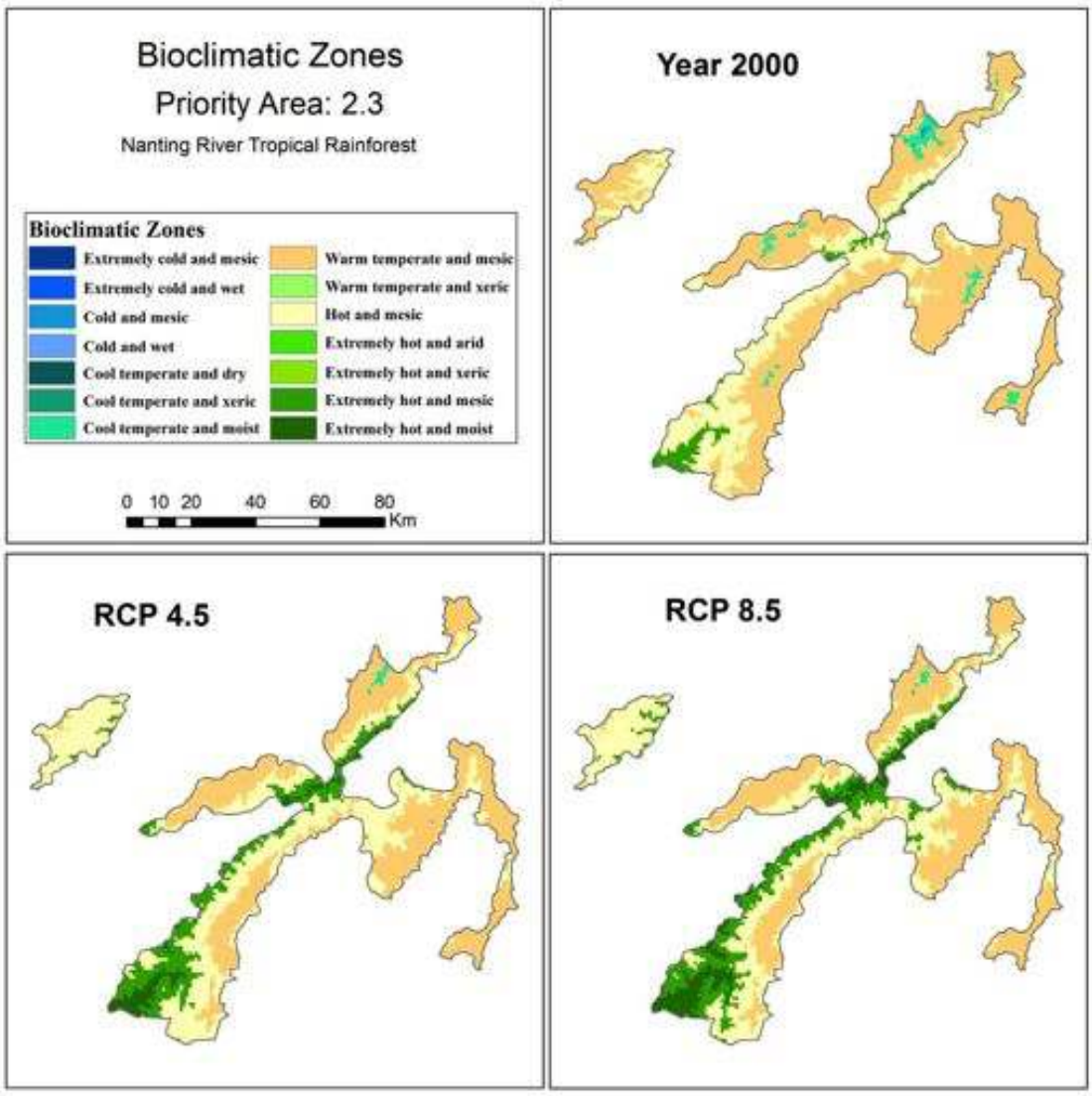


Table 2.3.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.3

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cold and mesic	G	1		(1)	(100)	3289		
Cool temperate and moist	J	60	54	(6)	(10)	2908	2957	50
Warm temperate and mesic	K	2566	1576	(990)	(39)	2082	2301	218
Extremely hot and mesic	M	190	568	378	199	758	1160	402
Hot and mesic	N	1216	1505	289	24	1242	1634	392
Extremely hot and moist	R		330	330			821	

Figure 2.3.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

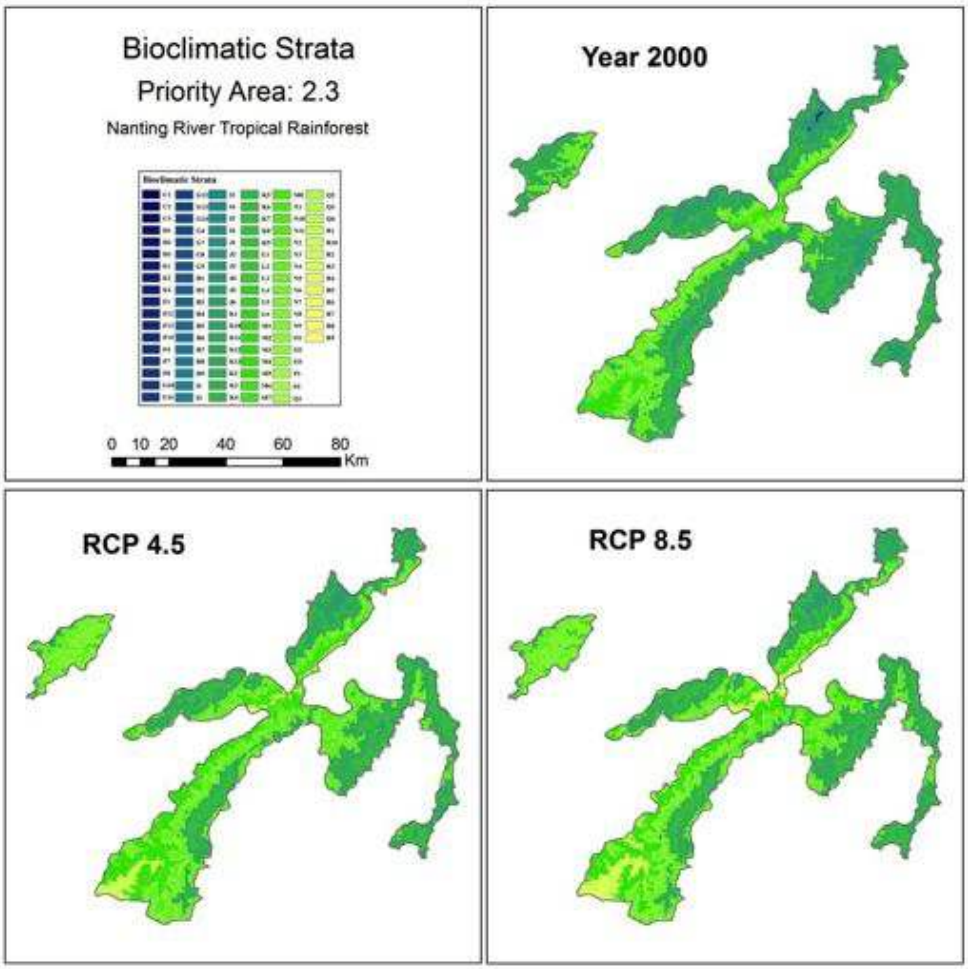


Table 2.3.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.3

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cold and mesic	G13	1	-	-	-	3289	-	-
Cool temperate and moist	J3	33	-	-	-	3034	-	-
Cool temperate and moist	J4	27	54	27	100	2752	2957	205
Warm temperate and mesic	K1	601	-	-	-	2510	-	-
Warm temperate and mesic	K5	34	-	-	-	2255	-	-
Warm temperate and mesic	K7	685	557	(128)	(19)	2210	2532	323
Warm temperate and mesic	K10	167	6	(161)	(96)	2089	2407	318
Warm temperate and mesic	K13	1079	1013	(66)	(6)	1757	2173	416
Hot and mesic	N2	41	10	(31)	(76)	1649	2044	395
Hot and mesic	N3	647	720	73	11	1371	1789	418
Hot and mesic	N5	15	42	27	180	1439	1880	440
Hot and mesic	N8	345	566	221	64	1091	1465	374
Hot and mesic	N9	18	165	147	817	1158	1452	294
Hot and mesic	N11	150	2	(148)	(99)	912	1586	674
Extremely hot and mesic	M2	-	21	-	-	-	1258	-
Extremely hot and mesic	M4	189	547	358	189	759	1156	397
Extremely hot and mesic	M7	1	-	-	-	543	-	-
Extremely hot and moist	R1	-	330	-	-	-	821	-

Figure 2.3.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

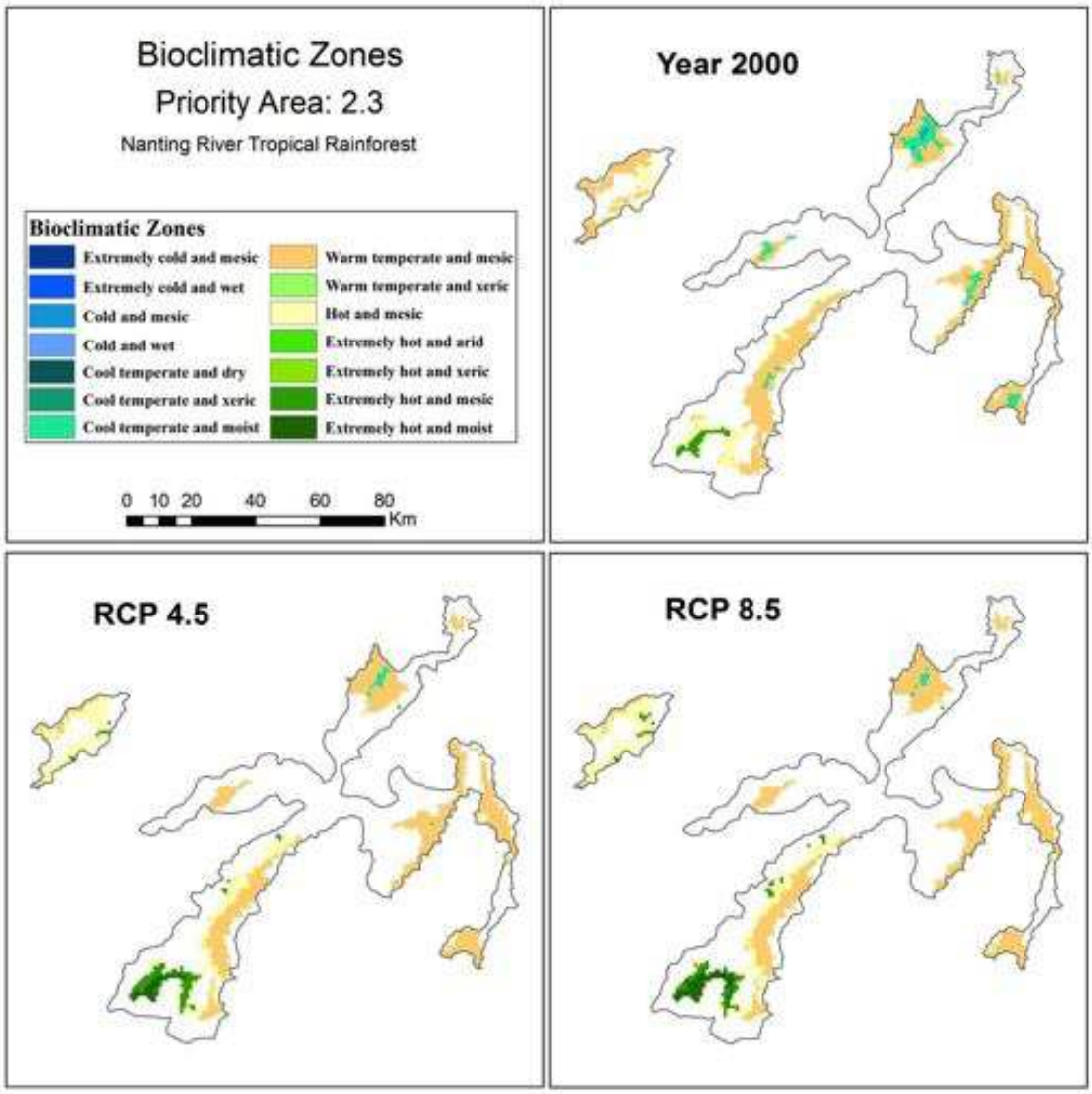


Table 2.3.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.3

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Cold and mesic	G	1	-	-	-	3301	-	-
Cool temperate and moist	J	57	52	(5)	(9)	2865	2910	45
Warm temperate and mesic	K	981	723	(258)	(26)	2222	2396	174
Extremely hot and mesic	M	53	85	32	60	747	1156	409
Hot and mesic	N	215	373	158	73	1261	1651	390
Extremely hot and moist	R	-	74	-	-	-	798	-

Priority Area: 2.4

Xishuangbanna Tropical Rainforest

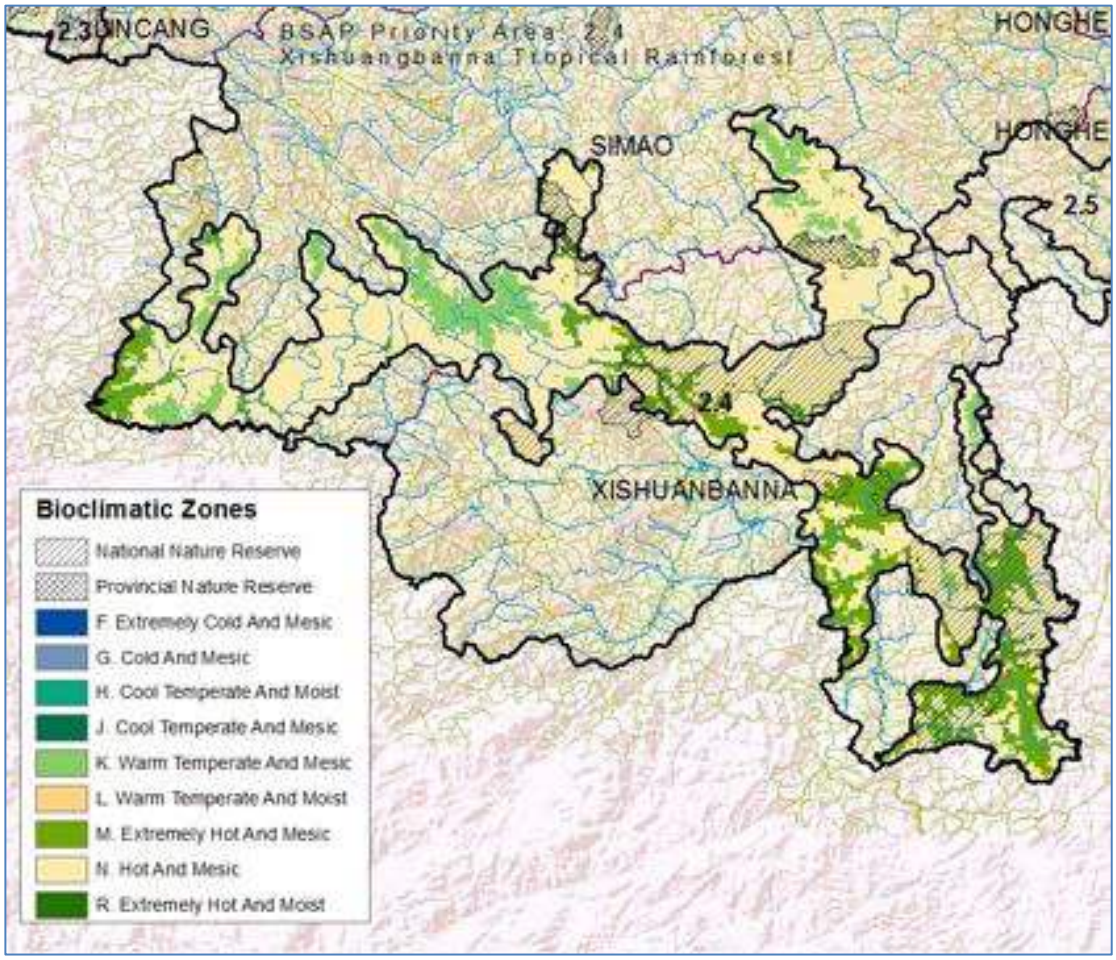
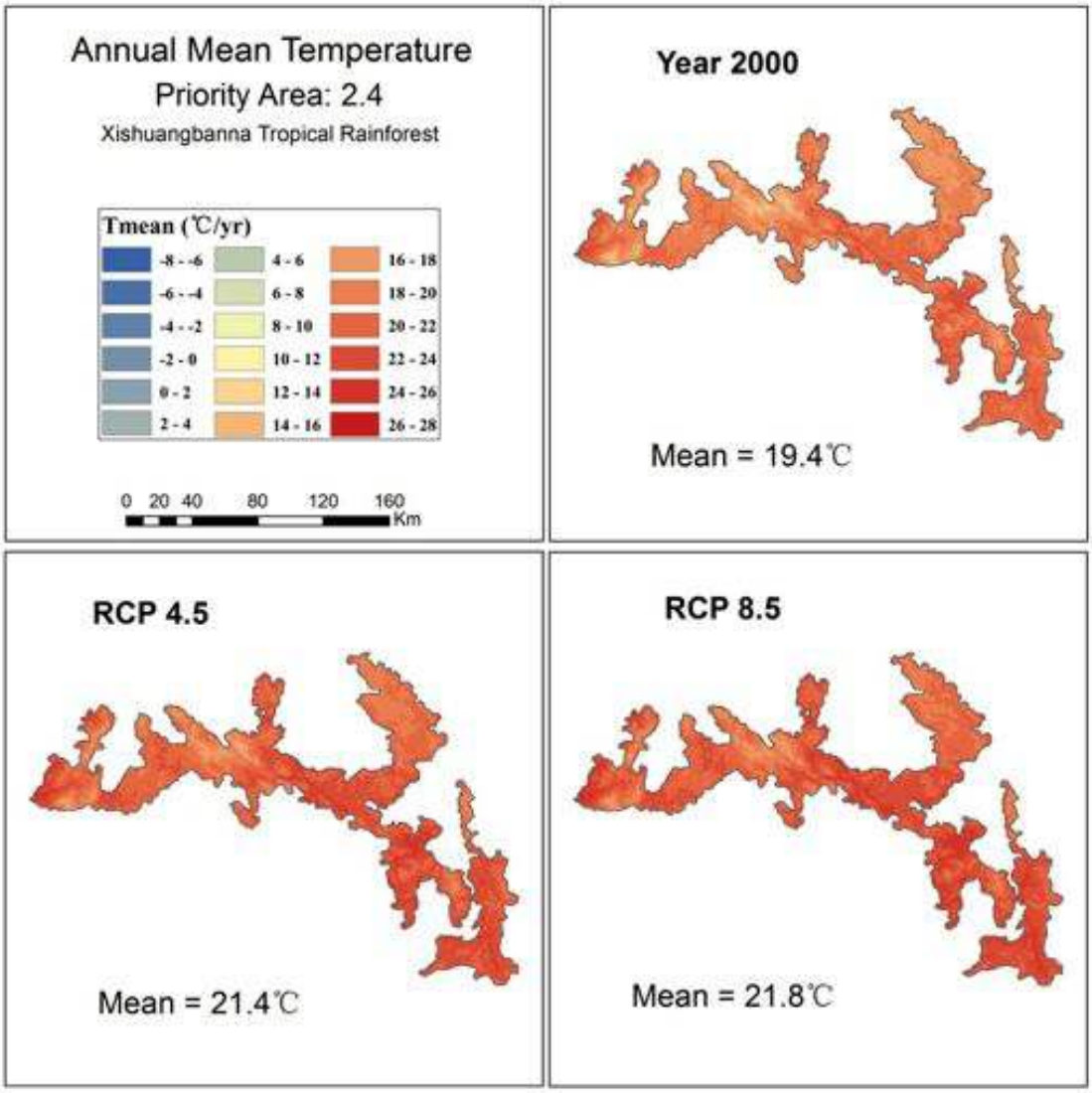


Table 2.4.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 2.4

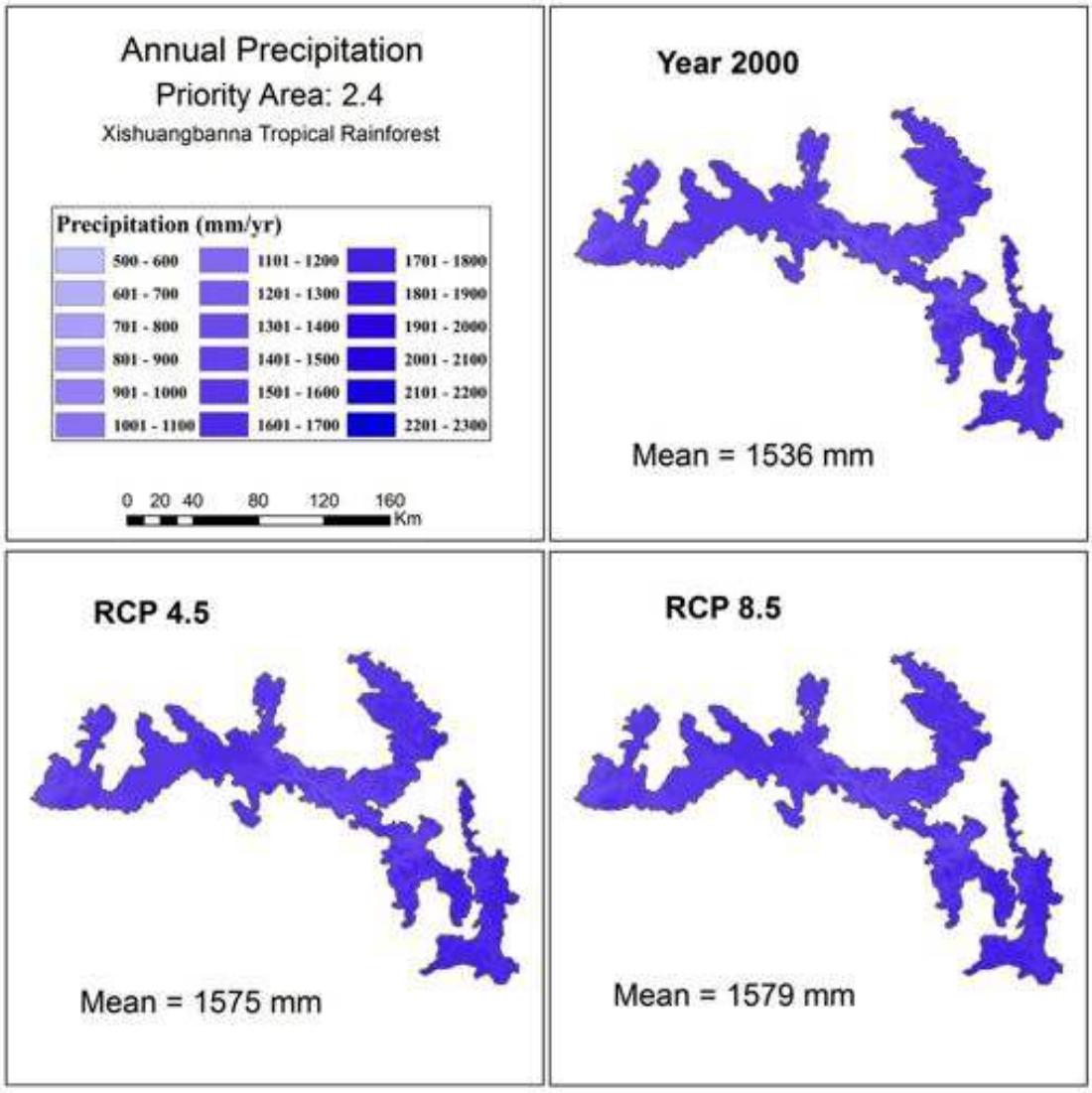
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Warm temperate and mesic	K	1304	1789	16.4	1573	1326	1.19
Extremely hot and mesic	M	2596	859	21.5	1498	1547	0.97
Hot and mesic	N	8380	1246	19.3	1540	1455	1.06
Extremely hot and moist	R	11	604	23.3	1290	1648	0.78

Figure 2.4.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



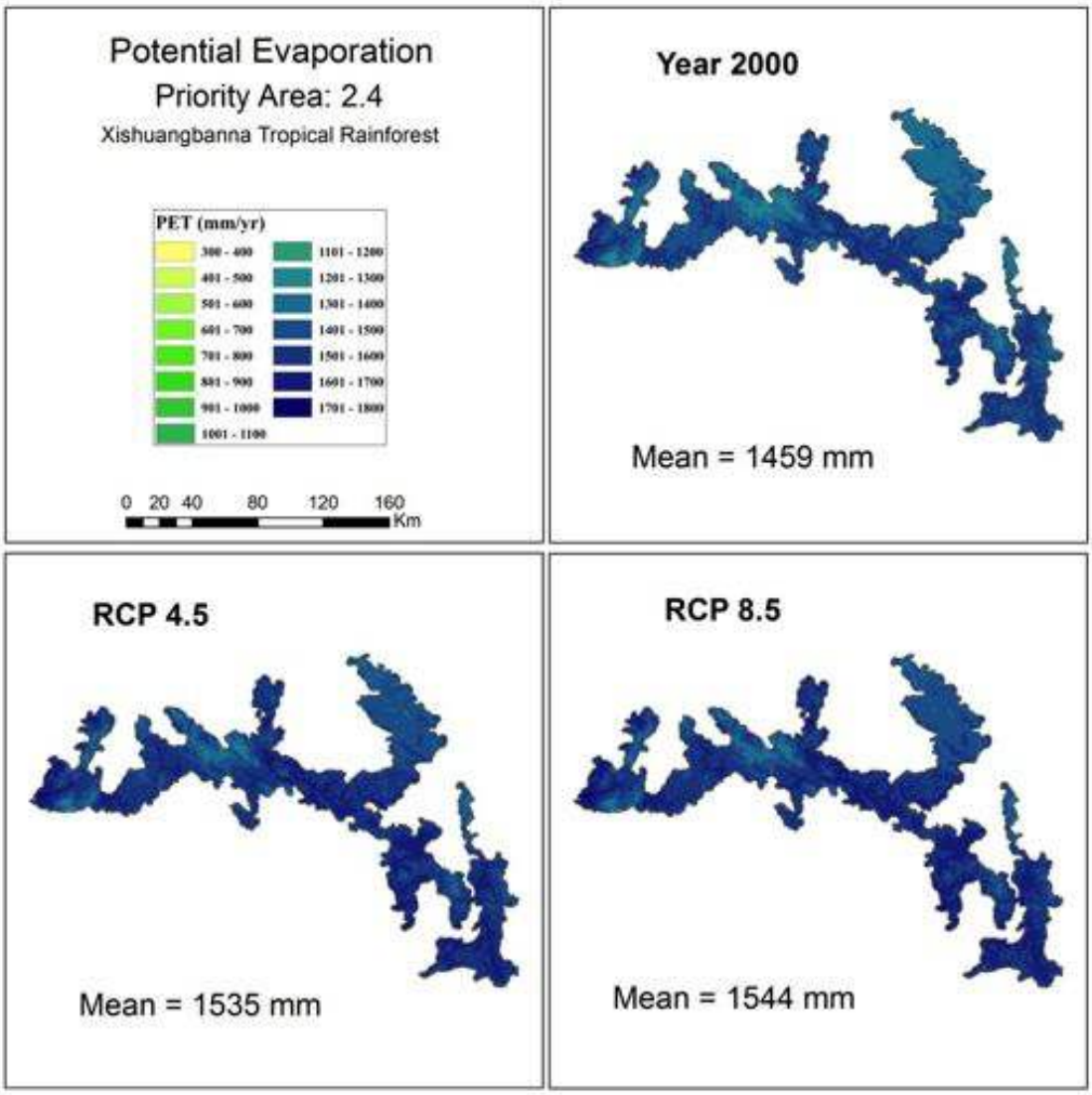
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	19.4	12.9	23.7	1.7
RCP26	20.9	14.5	25.2	1.7
RCP45	21.4	14.9	25.6	1.7
RCP60	21.0	14.5	25.2	1.7
RCP85	21.8	15.3	26.1	1.7

Figure 2.4.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



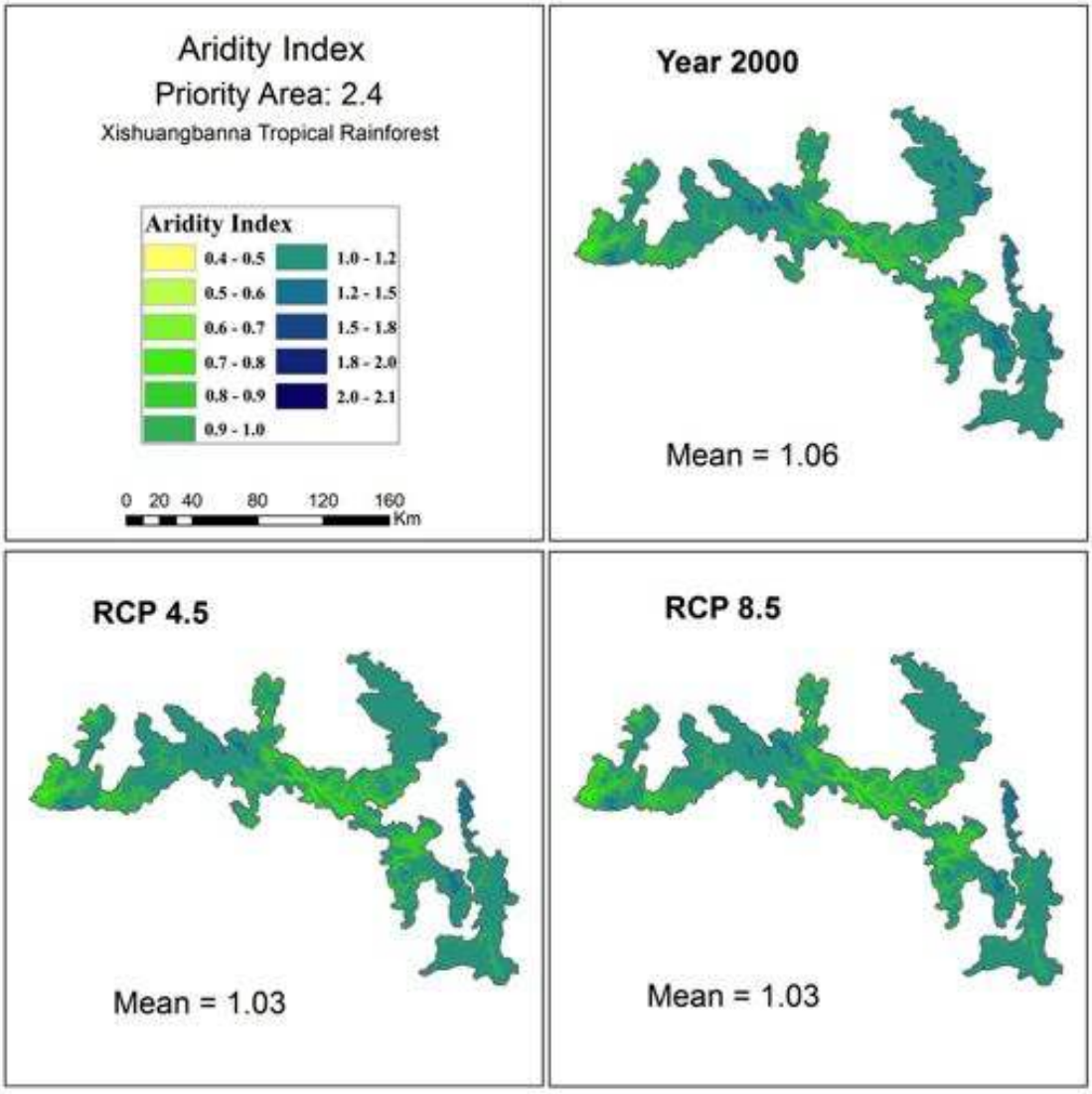
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1537	1227	1762	97
RCP26	1573	1253	1798	97
RCP45	1576	1257	1810	97
RCP60	1527	1216	1730	88
RCP85	1579	1256	1815	96

Figure 2.4.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1460	1175	1667	78
RCP26	1522	1232	1725	79
RCP45	1536	1243	1734	79
RCP60	1514	1224	1714	79
RCP85	1544	1251	1742	79

Figure 2.4.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.06	0.75	1.40	0.11
RCP26	1.04	0.74	1.36	0.10
RCP45	1.03	0.74	1.34	0.10
RCP60	1.01	0.73	1.31	0.10
RCP85	1.03	0.74	1.33	0.10

Figure 2.4.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

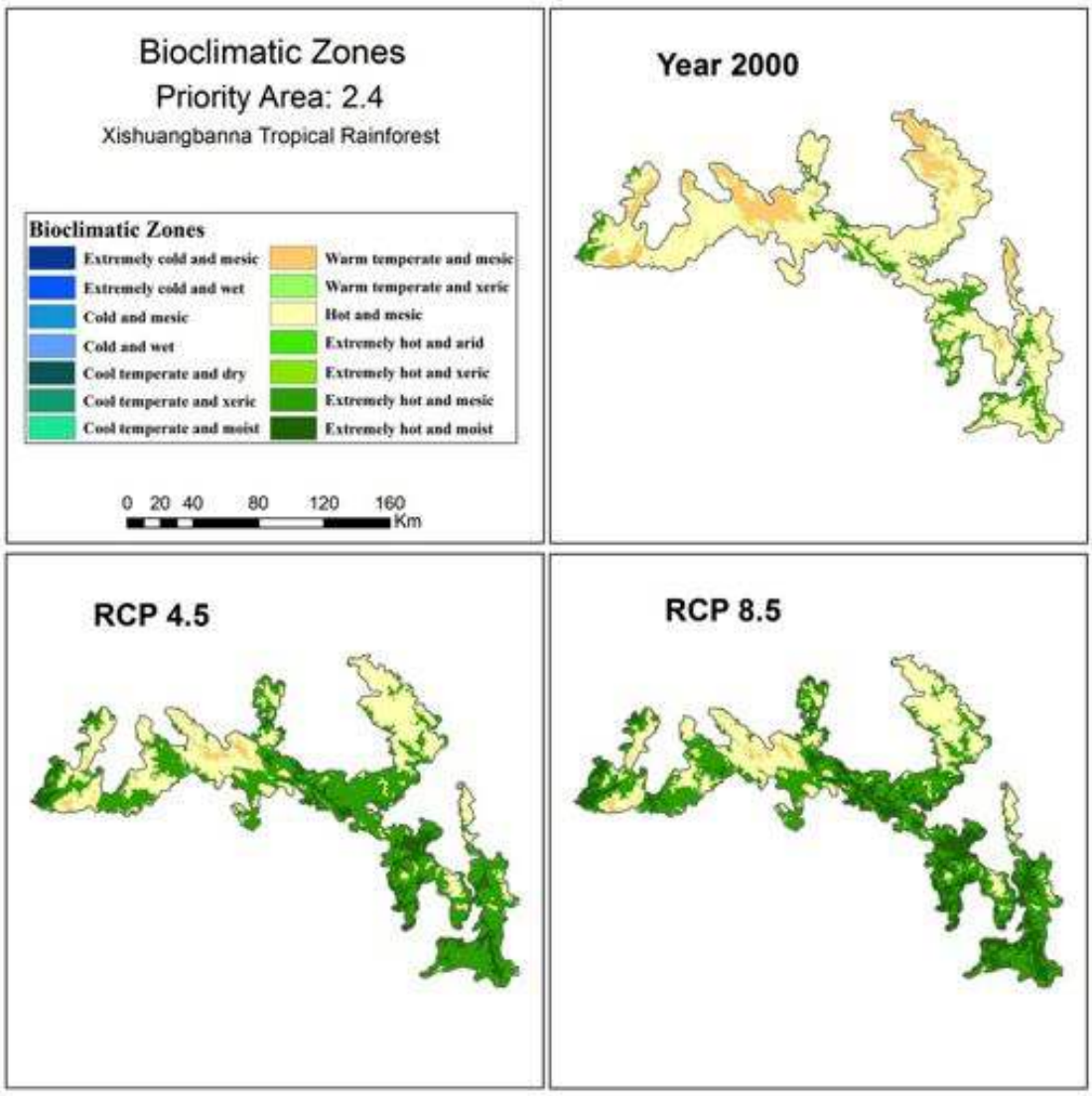


Table 2.4.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.4

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Warm temperate and mesic	K	1320	112	(1,208)	(92)	1792	2159	367
Extremely hot and mesic	M	2561	4551	1,990	78	839	1219	380
Hot and mesic	N	8352	3325	(5,027)	(60)	1242	1578	336
Extremely hot and moist	R	6	4251	4,245	70,750	581	907	326

Figure 2.4.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

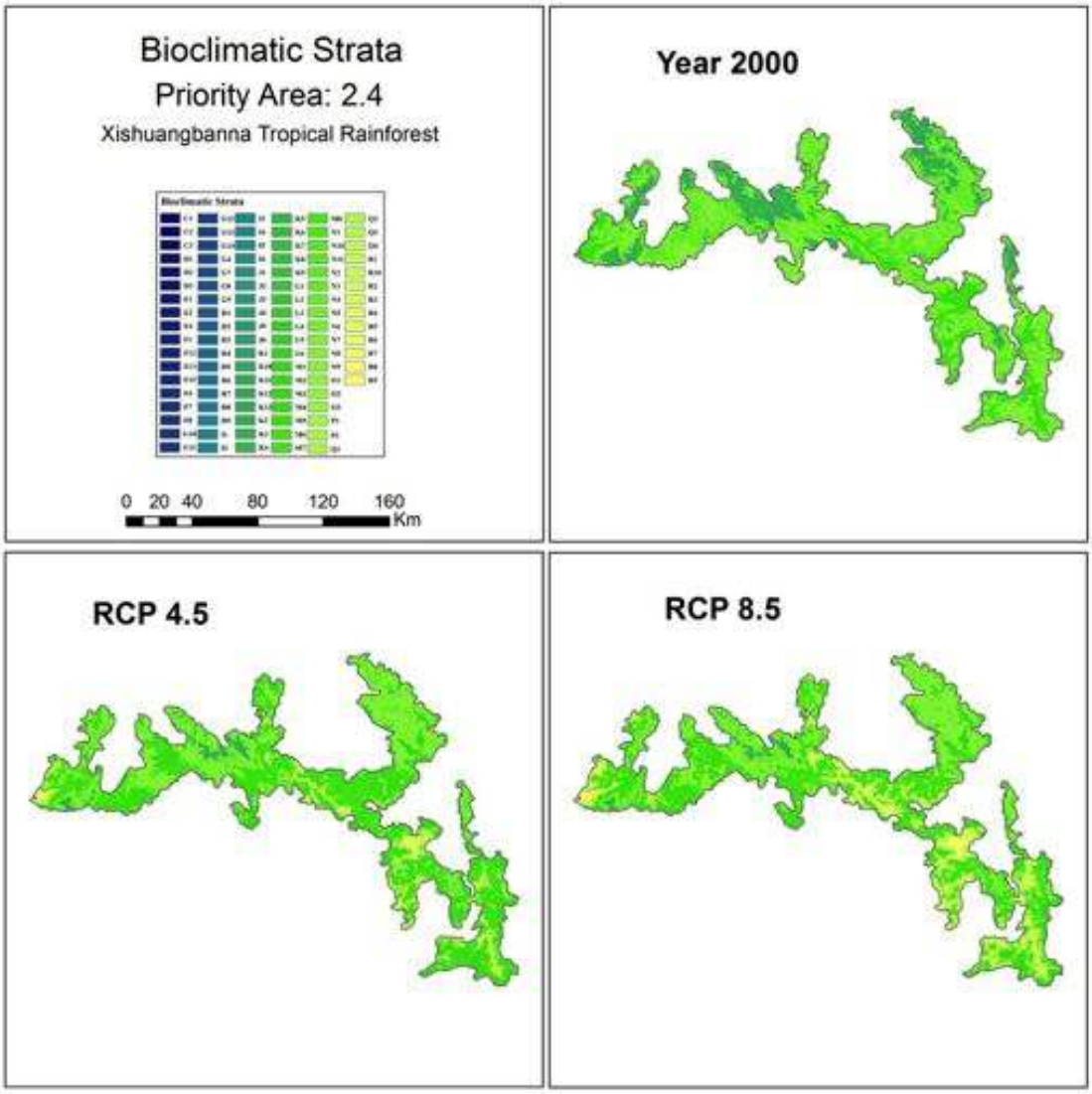


Table 2.4.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.4

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Warm temperate and mesic	K7	134	1	(133)	(99)	2134	2468	334
Warm temperate and mesic	K13	1186	111	(1,075)	(91)	1753	2157	403
Hot and mesic	N3	3161	696	(2,465)	(78)	1427	1847	420
Hot and mesic	N8	4556	2402	(2,154)	(47)	1149	1511	362
Hot and mesic	N11	635	**227**	(408)	(64)	990	1460	470
Extremely hot and mesic	M2	1046	1419	373	36	900	1210	310
Extremely hot and mesic	M4	1424	3100	1,676	118	807	1225	418
Extremely hot and mesic	M7	91	32	(59)	(65)	651	1084	434
Extremely hot and moist	R1	6	4251	4,245	70,750	581	907	326

Figure 2.4.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

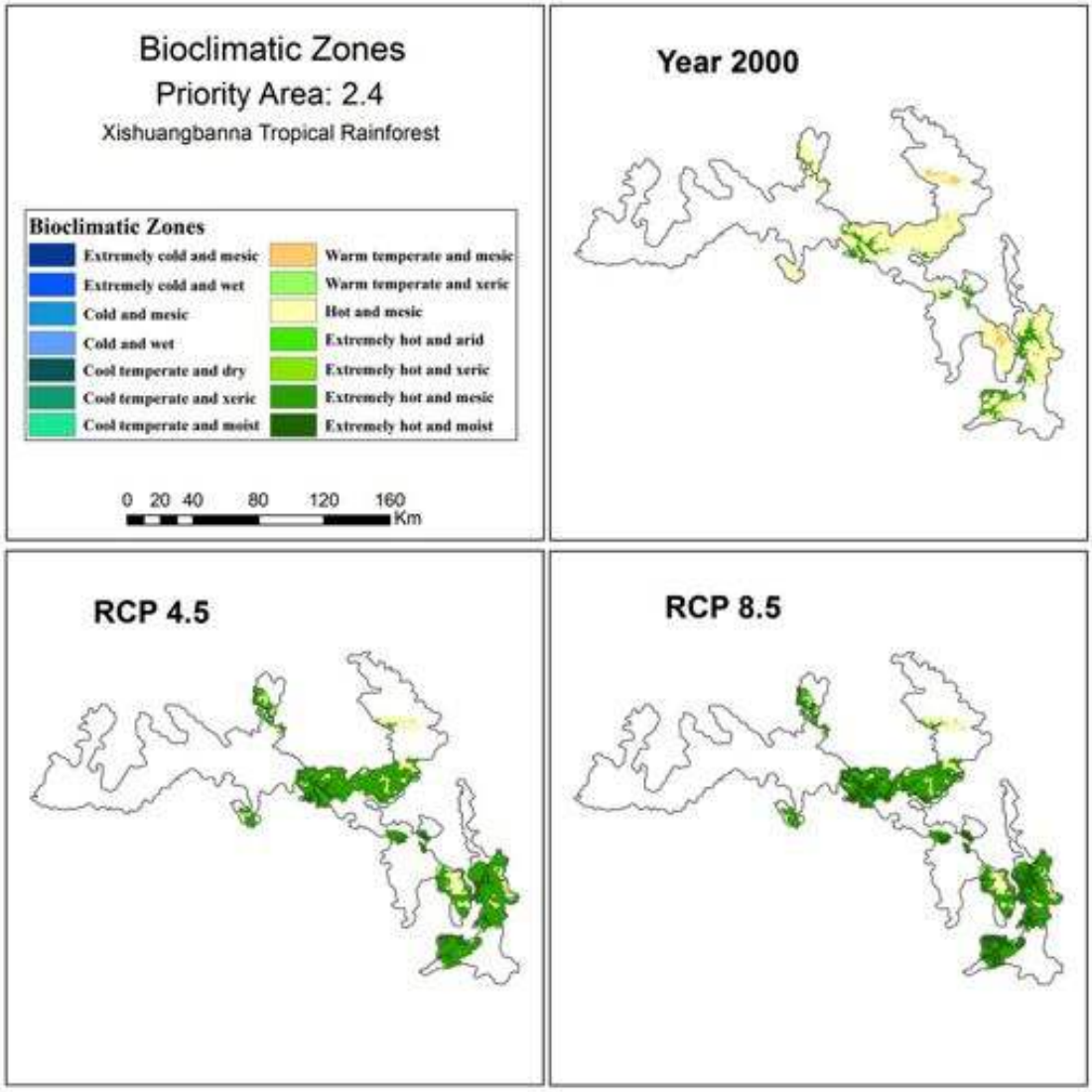


Table 2.4.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.4

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Warm temperate and mesic	K	73	-	-	-	1637	-	-
Extremely hot and mesic	M	962	1315	353	37	864	1173	309
Hot and mesic	N	2217	322	(1895)	(85)	1147	1458	311
Extremely hot and moist	R	-	1615	-	-	-	918	-

Priority Area: 2.5

Honghe Moist Rainforest Zone

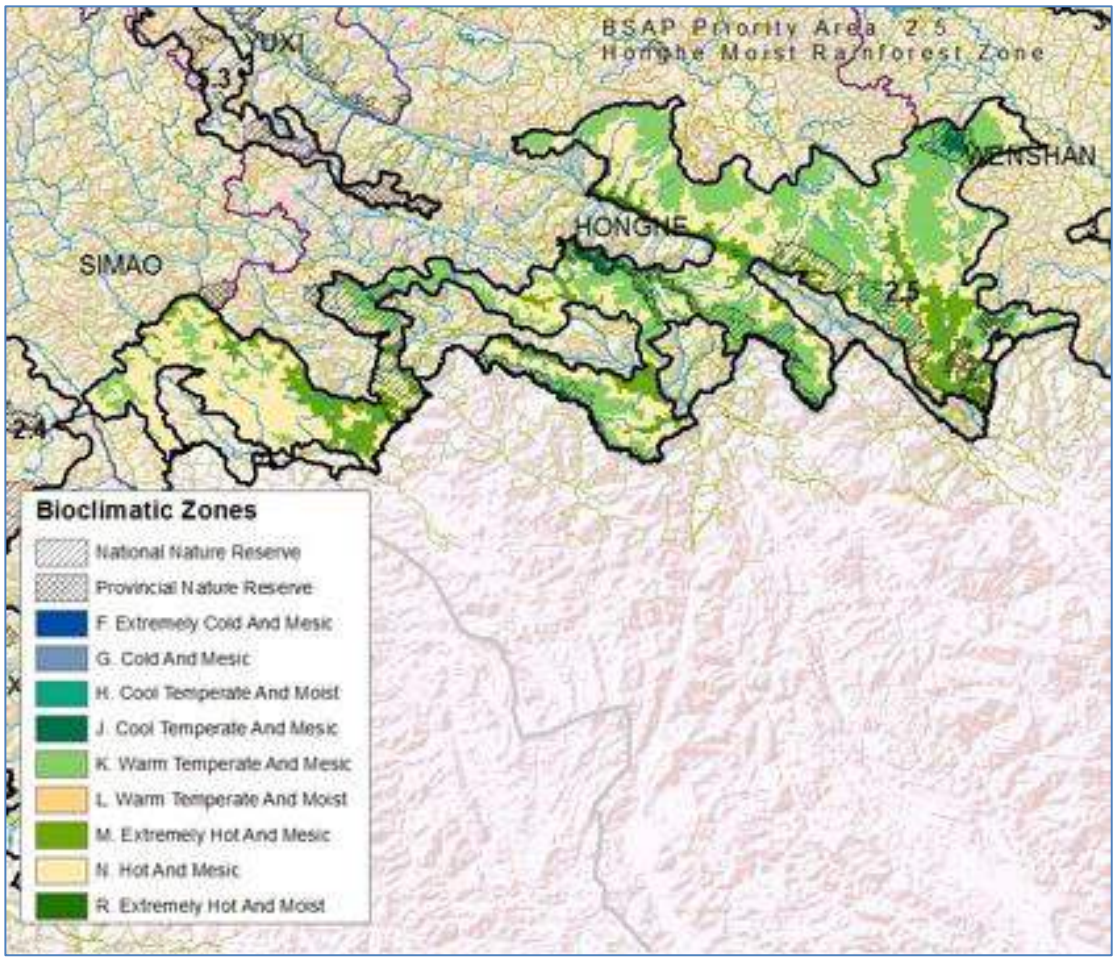
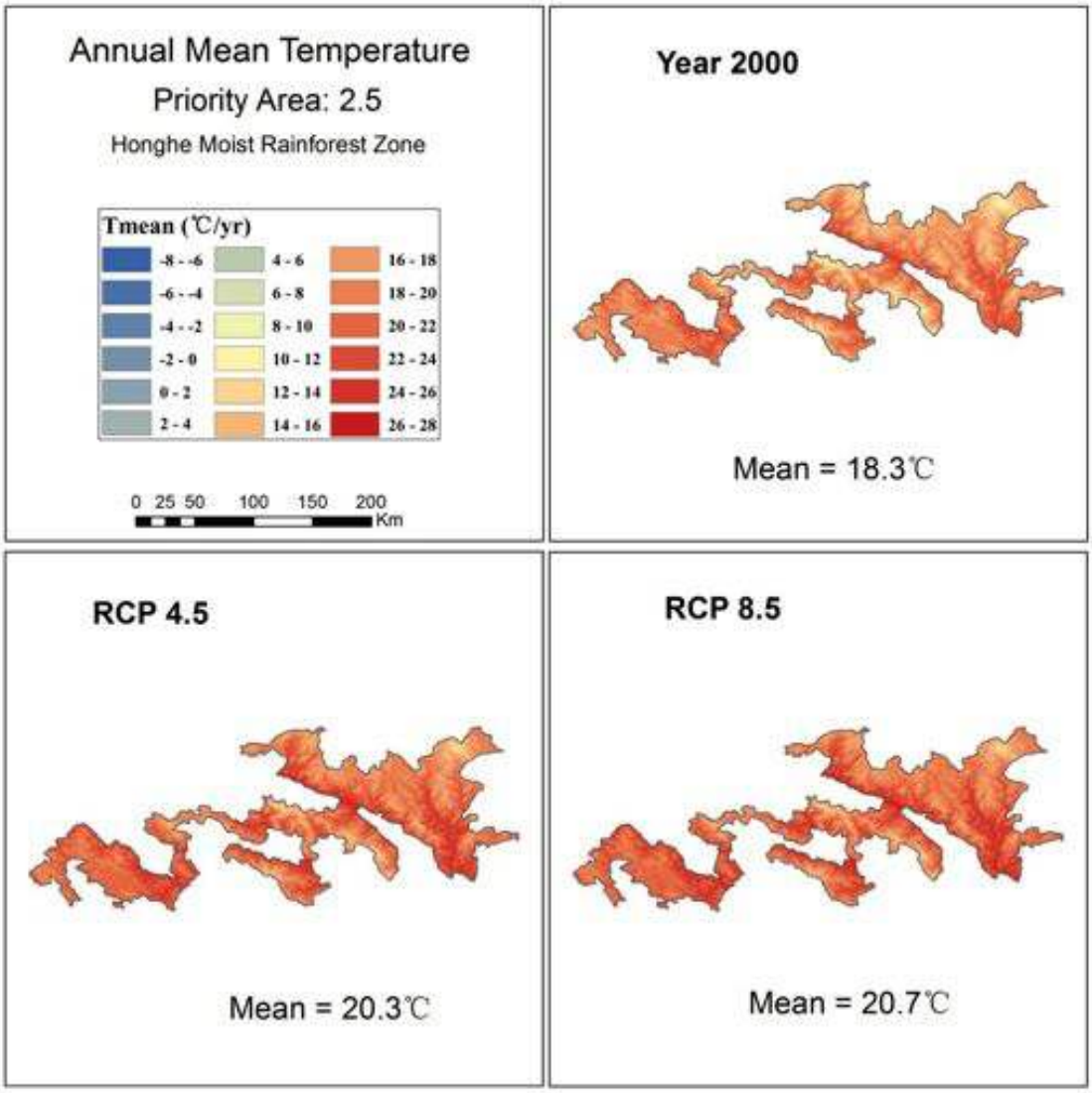


Table 2.5.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 2.5

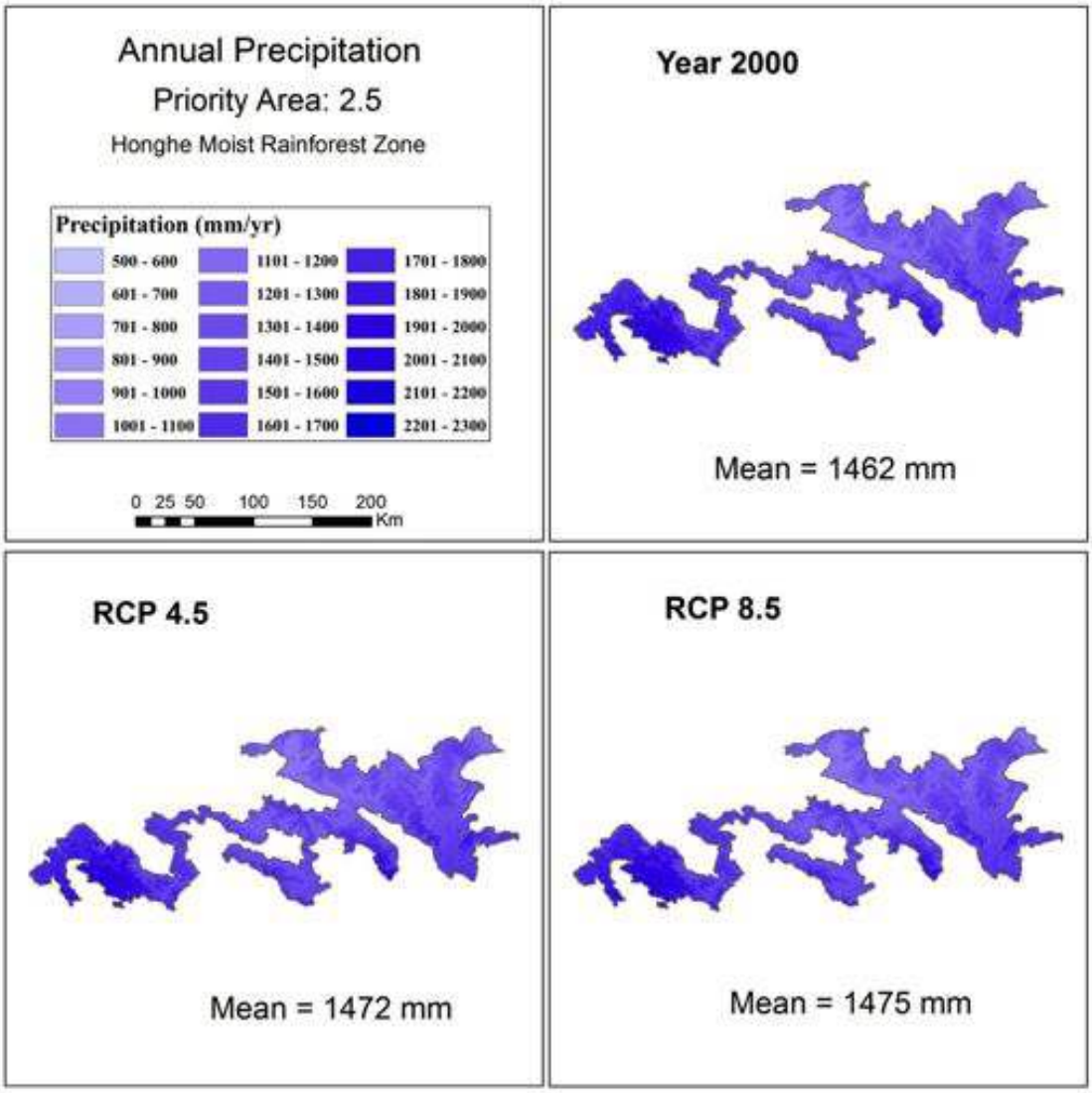
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Cool temperate and moist	J	137	2546	11.3	1611	983	1.64
Warm temperate and mesic	K	4815	1779	15.9	1465	1169	1.26
Extremely hot and mesic	M	1794	652	22.2	1415	1457	0.97
Hot and mesic	N	4902	1191	19.2	1477	1338	1.1
Extremely hot and moist	R	100	362	24.2	1305	1543	0.85

Figure 2.5.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



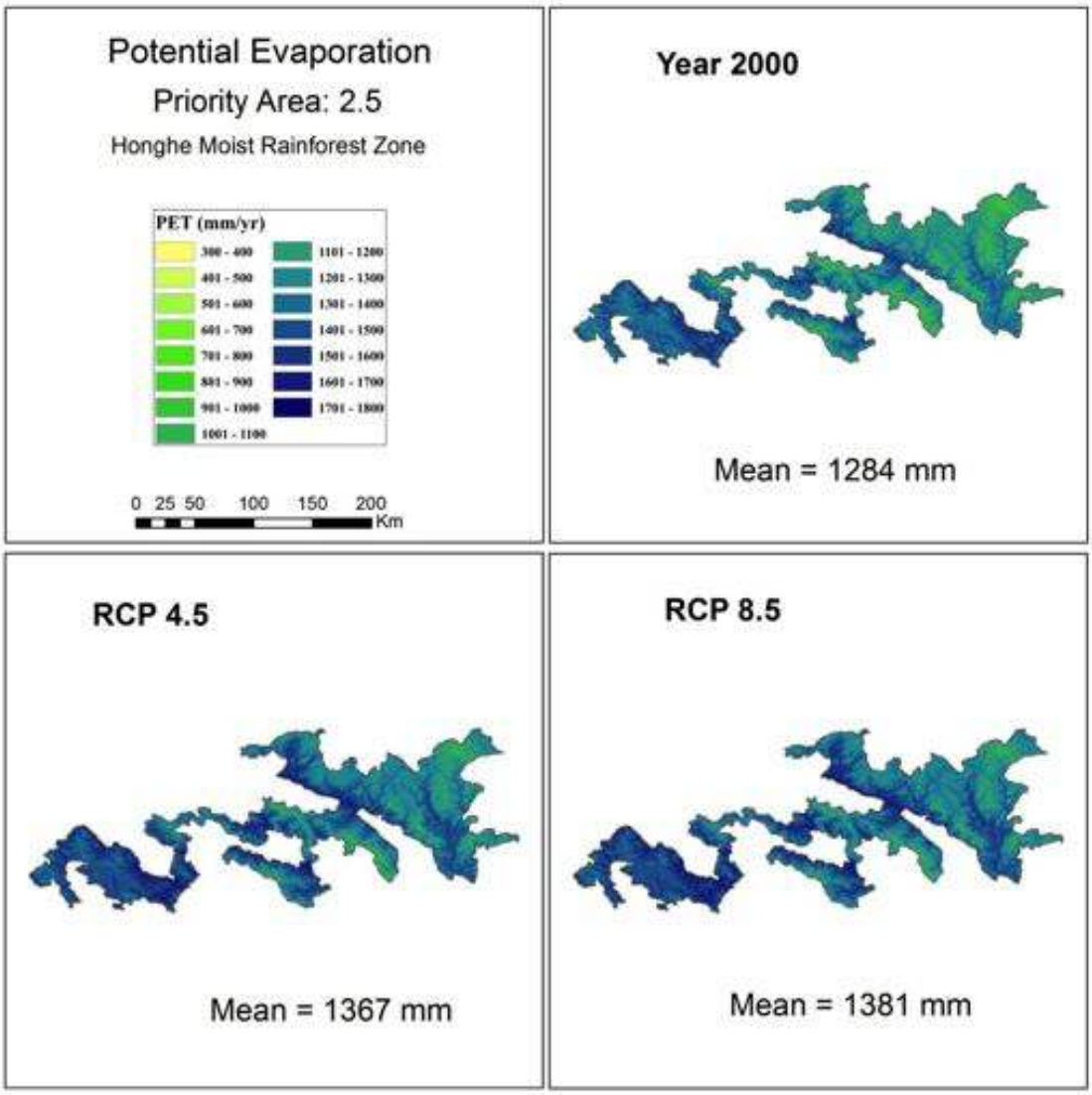
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	18.3	9.2	25.1	2.7
RCP26	19.9	10.9	26.7	2.7
RCP45	20.3	11.3	27.2	2.7
RCP60	19.9	10.8	26.7	2.7
RCP85	20.7	11.7	27.5	2.7

Figure 2.5.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



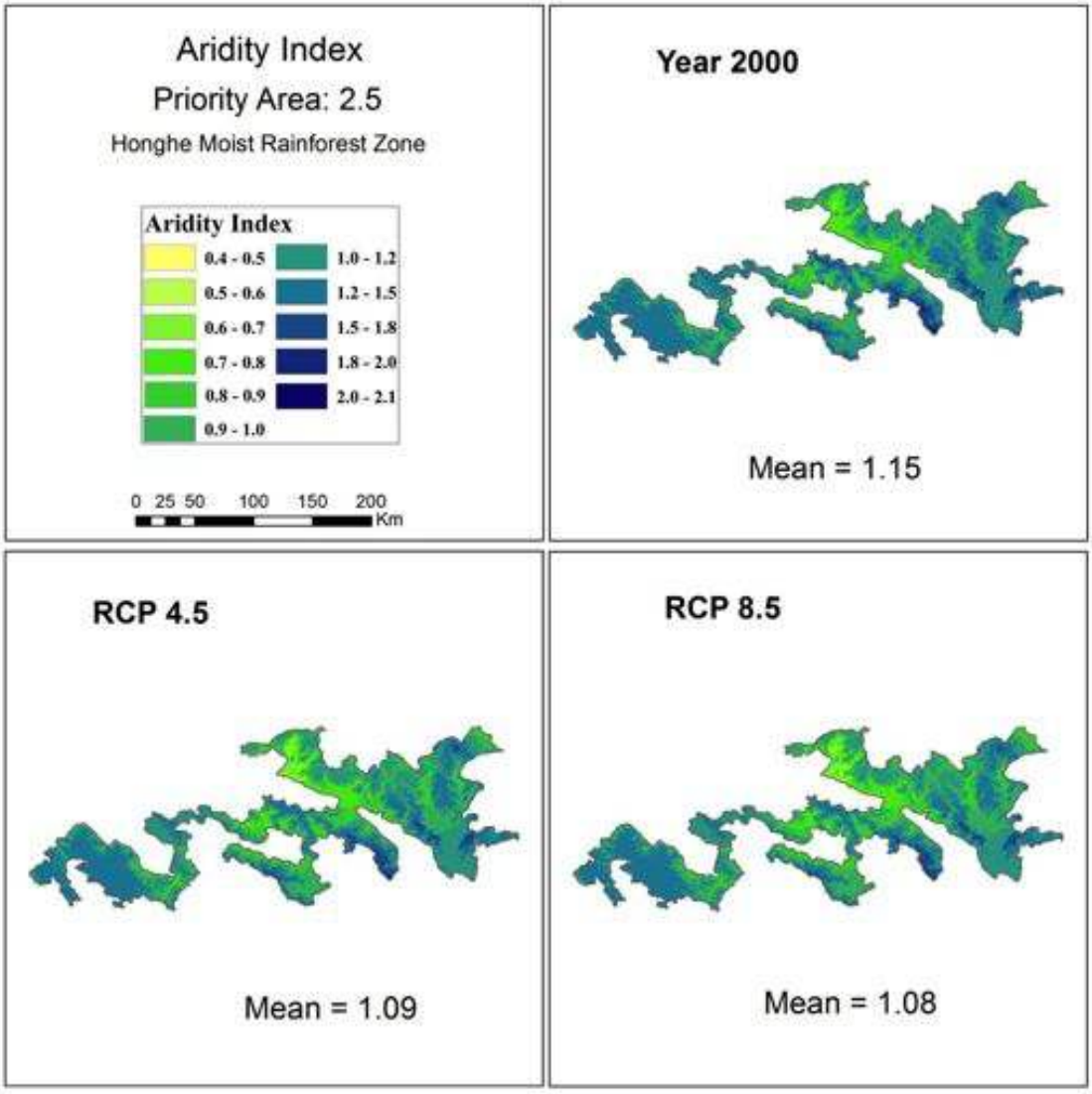
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1463	980	2132	222
RCP26	1472	980	2157	228
RCP45	1473	985	2148	225
RCP60	1424	957	2082	218
RCP85	1476	985	2160	227

Figure 2.5.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1285	895	1622	139
RCP26	1355	965	1698	139
RCP45	1368	974	1709	140
RCP60	1339	950	1676	140
RCP85	1381	989	1723	140

Figure 2.5.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.15	0.68	2.03	0.22
RCP26	1.10	0.65	1.92	0.21
RCP45	1.09	0.65	1.89	0.20
RCP60	1.08	0.64	1.87	0.20
RCP85	1.08	0.64	1.87	0.20

Figure 2.5.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

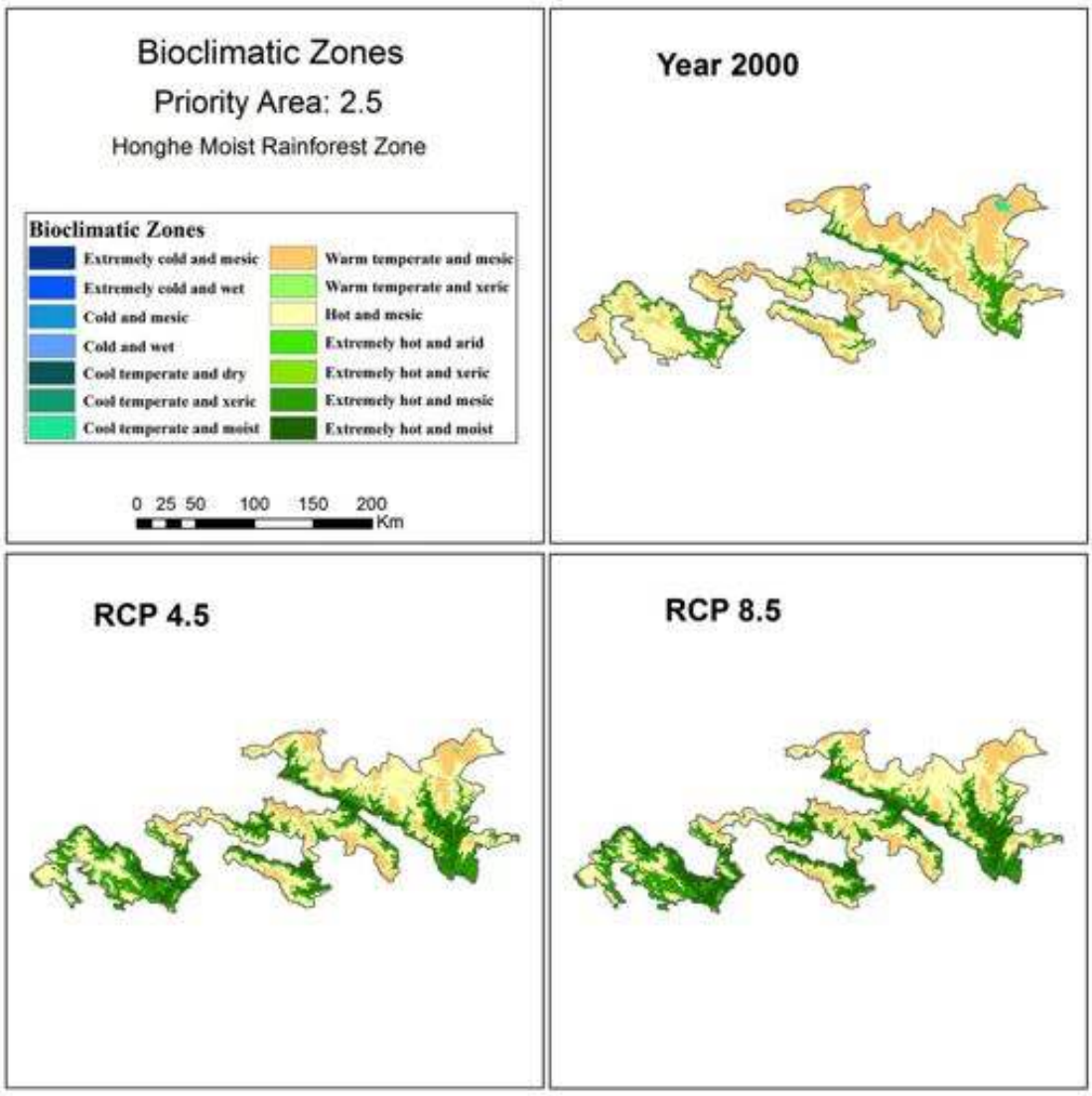


Table 2.5.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.5

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cool temperate and moist	J	155	9	(146)	(94)	2512	2693	182
Warm temperate and mesic	K	4509	1946	(2,563)	(57)	1772	2026	254
Extremely hot and mesic	M	1821	3001	1,180	65	654	1085	431
Hot and mesic	N	5168	4478	(690)	(13)	1226	1564	337
Extremely hot and moist	R	84	2303	2,219	2,642	452	747	295

Figure 2.5.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

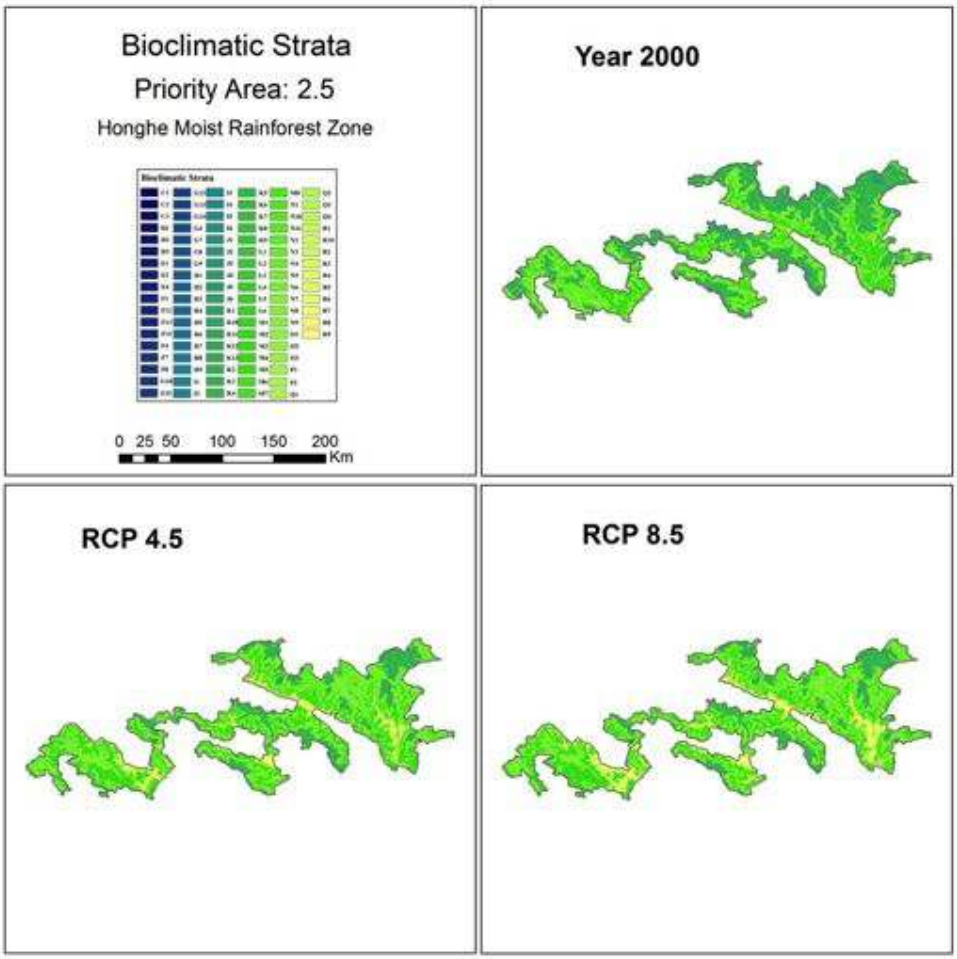


Table 2.5.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.5

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cool temperate and moist	J4	155	9	(146)	(94)	2512	2693	182
Warm temperate and mesic	K1	12	-	-	-	2286	-	-
Warm temperate and mesic	K2	148	49	(99)	(67)	2139	2496	357
Warm temperate and mesic	K7	1595	373	(1,222)	(77)	1967	2294	327
Warm temperate and mesic	K10	60	-	-	-	1937	-	-
Warm temperate and mesic	K11	247	311	64	26	1456	1829	373
Warm temperate and mesic	K13	2447	1213	(1,234)	(50)	1648	1976	327
Hot and mesic	N2	825	48	(777)	(94)	1529	1774	245
Hot and mesic	N3	1722	1536	(186)	(11)	1300	1637	337
Hot and mesic	N5	610	1117	507	83	1282	1653	371
Hot and mesic	N8	1738	1495	(243)	(14)	1028	1425	397
Hot and mesic	N9	32	161	129	403	1054	1562	509
Hot and mesic	N11	241	121	(120)	(50)	984	1452	469
Extremely hot and mesic	M2	930	1763	833	90	722	1170	447
Extremely hot and mesic	M4	518	443	(75)	(14)	686	1163	477
Extremely hot and mesic	M6	-	40	-	-	-	1132	-
Extremely hot and mesic	M7	373	755	382	102	438	837	399
Extremely hot and moist	R1	84	2303	2,219	2,642	452	747	295

Figure 2.5.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

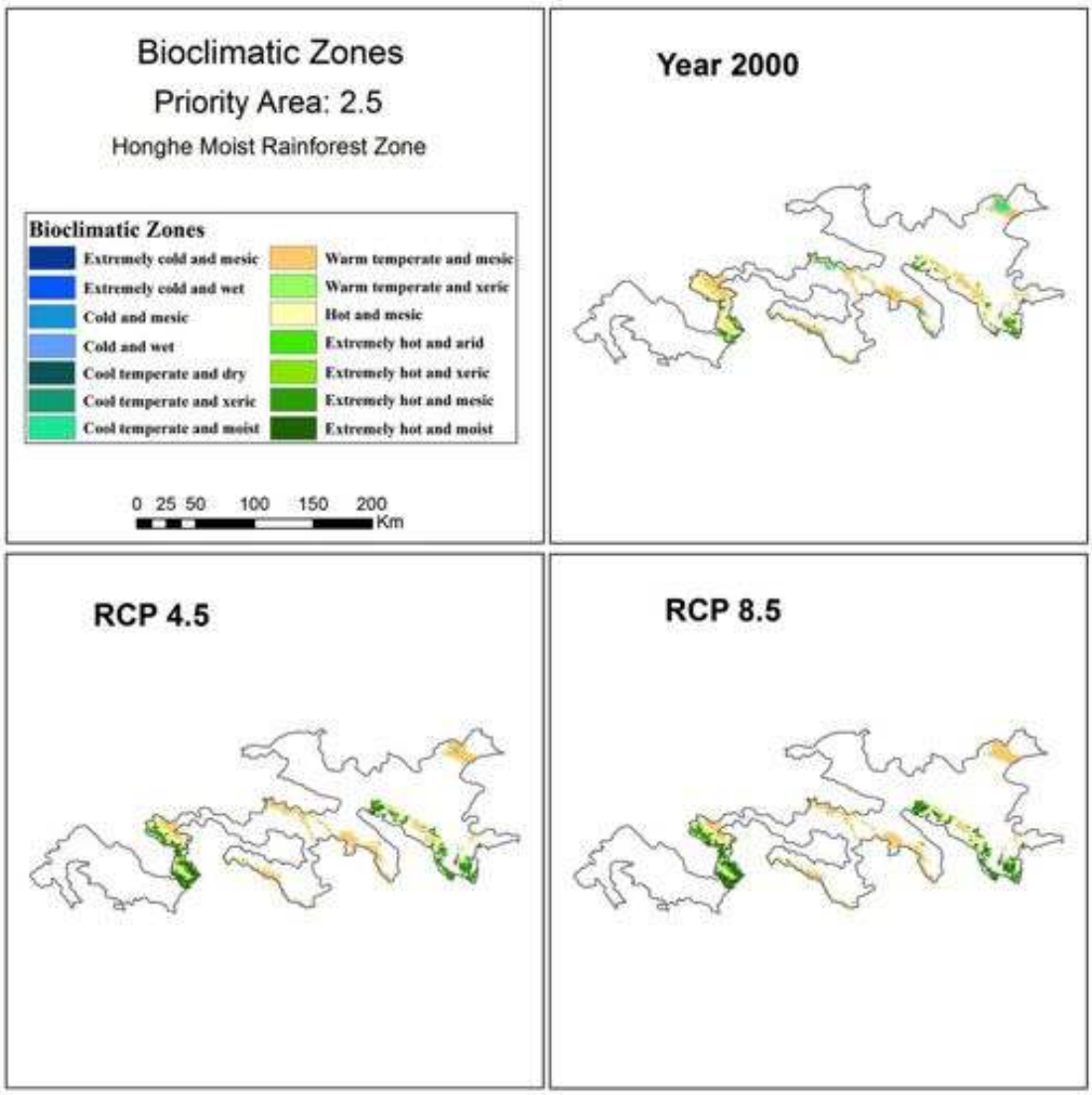


Table 2.5.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 2.5

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Cool temperate and moist	J	140	9	(131)	(94)	2541	2748	207
Warm temperate and mesic	K	896	687	(209)	(23)	1908	2162	255
Hot and mesic	N	234	389	155	66	635	1005	369
Extremely hot and mesic	M	492	443	(49)	(10)	1152	1585	433
Extremely hot and moist	R	4	238	234	5850	486	753	267

Priority Area: 3

Southeast Yunnan Karst Monsoon Broadleaf Evergreen Forest

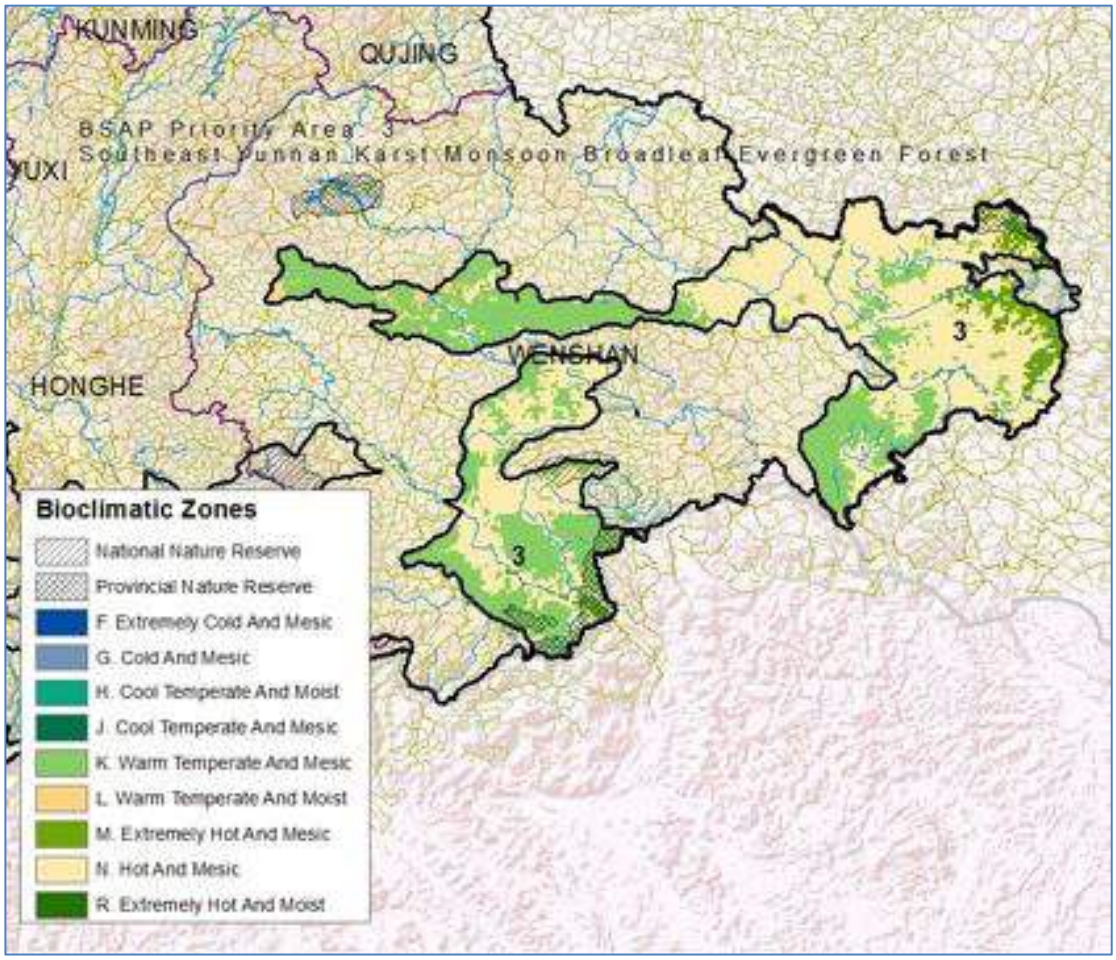
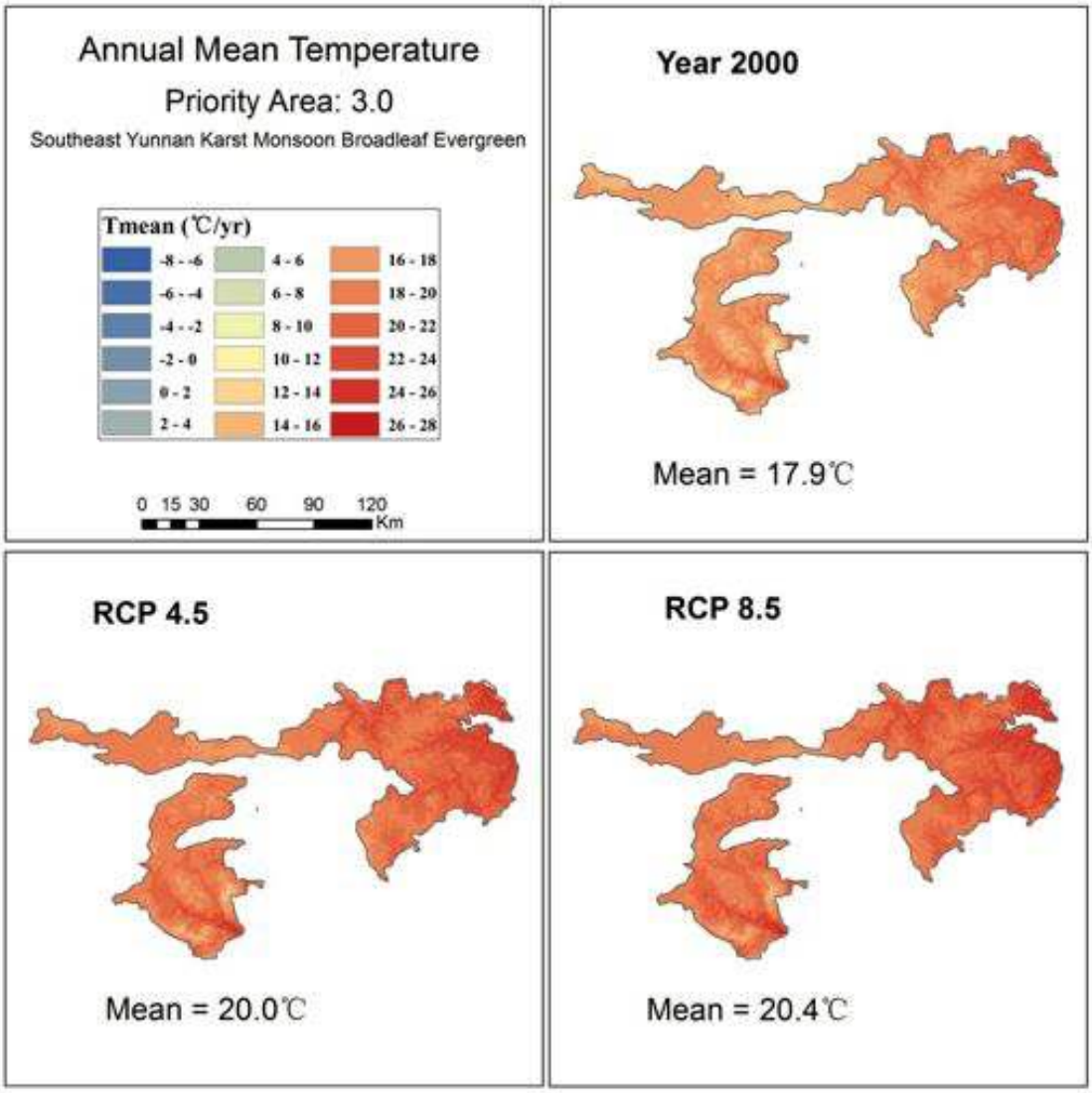


Table 3.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 3

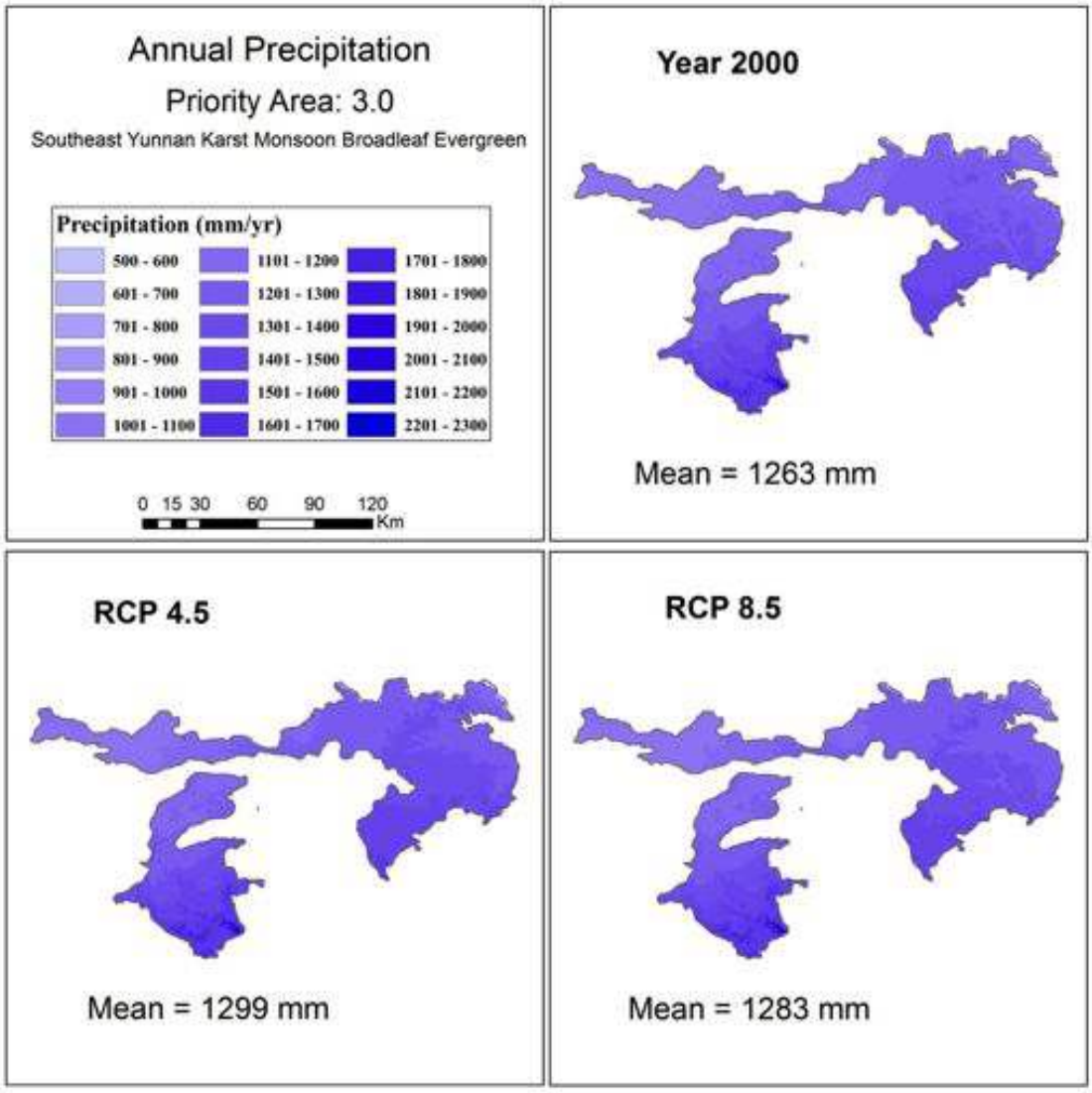
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Warm temperate and mesic	K	4174	1493	16.4	1277	1166	1.1
Warm temperate and xeric	L	143	1545	16.8	1021	1234	0.83
Extremely hot and mesic	M	580	477	21.7	1269	1374	0.92
Hot and mesic	N	5525	1045	18.7	1257	1257	1

Figure 3.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



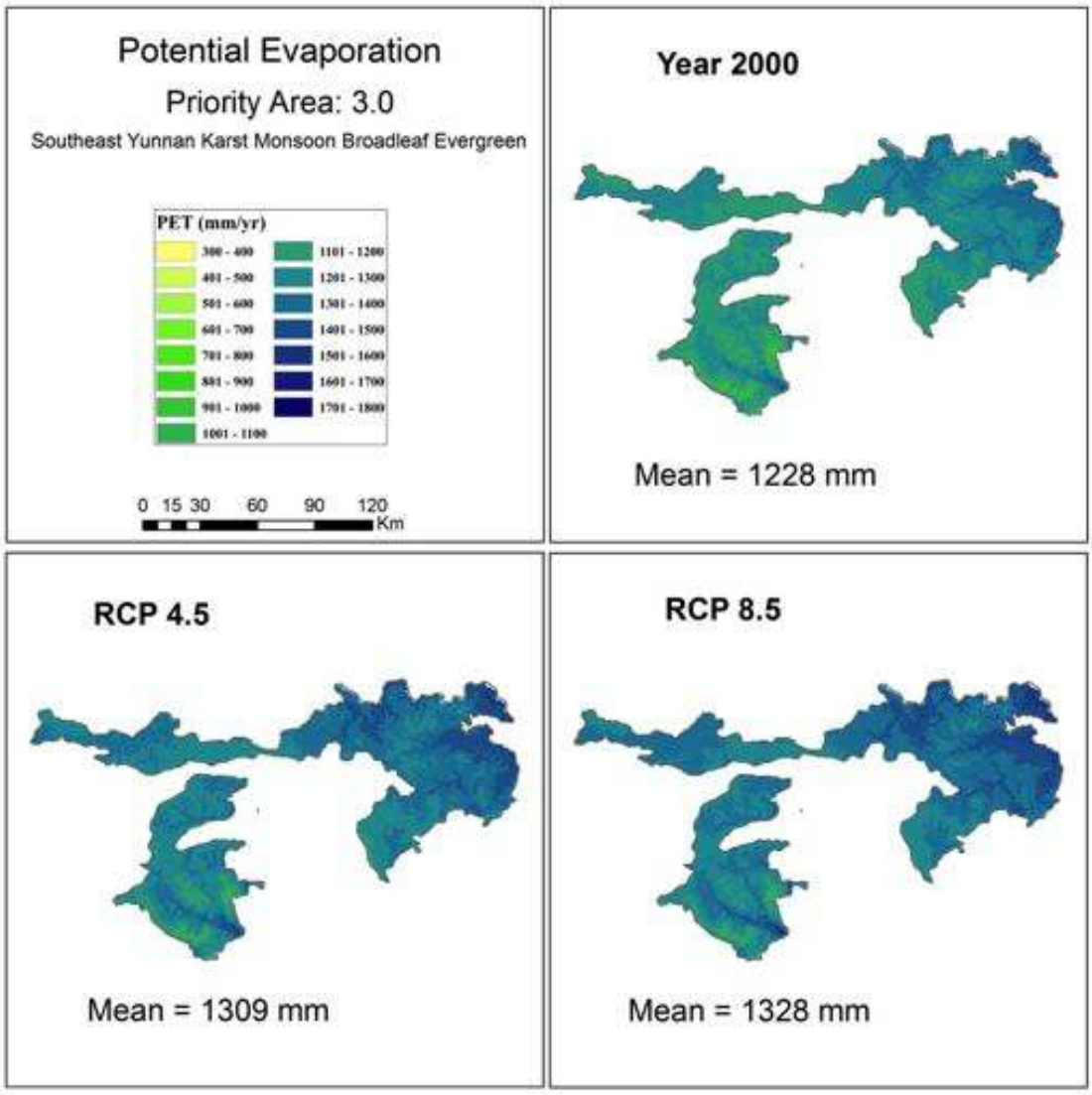
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	17.9	11.8	24.1	1.8
RCP26	19.6	13.4	25.8	1.9
RCP45	20.0	13.8	26.2	1.8
RCP60	19.5	13.3	25.6	1.8
RCP85	20.4	14.2	26.6	1.9

Figure 3.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



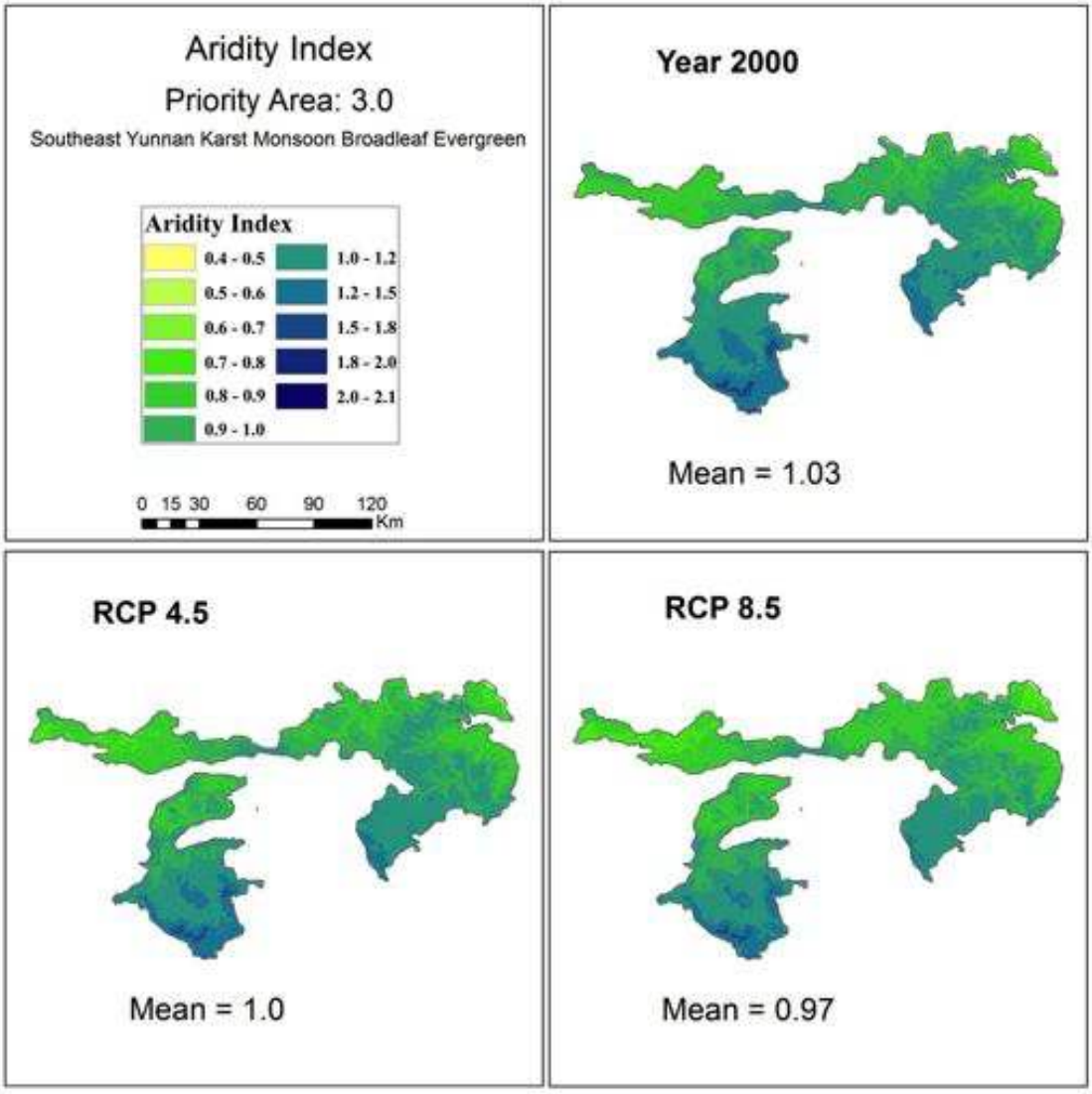
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1263	970	2055	135
RCP26	1274	971	2077	140
RCP45	1300	984	2101	141
RCP60	1232	951	2004	132
RCP85	1284	978	2080	139

Figure 3.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1228	944	1453	76
RCP26	1305	1011	1532	77
RCP45	1309	1021	1536	76
RCP60	1288	996	1514	77
RCP85	1328	1037	1556	77

Figure 3.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.03	0.77	1.81	0.15
RCP26	0.98	0.72	1.72	0.14
RCP45	1.00	0.73	1.72	0.14
RCP60	0.96	0.72	1.68	0.14
RCP85	0.97	0.71	1.69	0.14

Figure 3.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

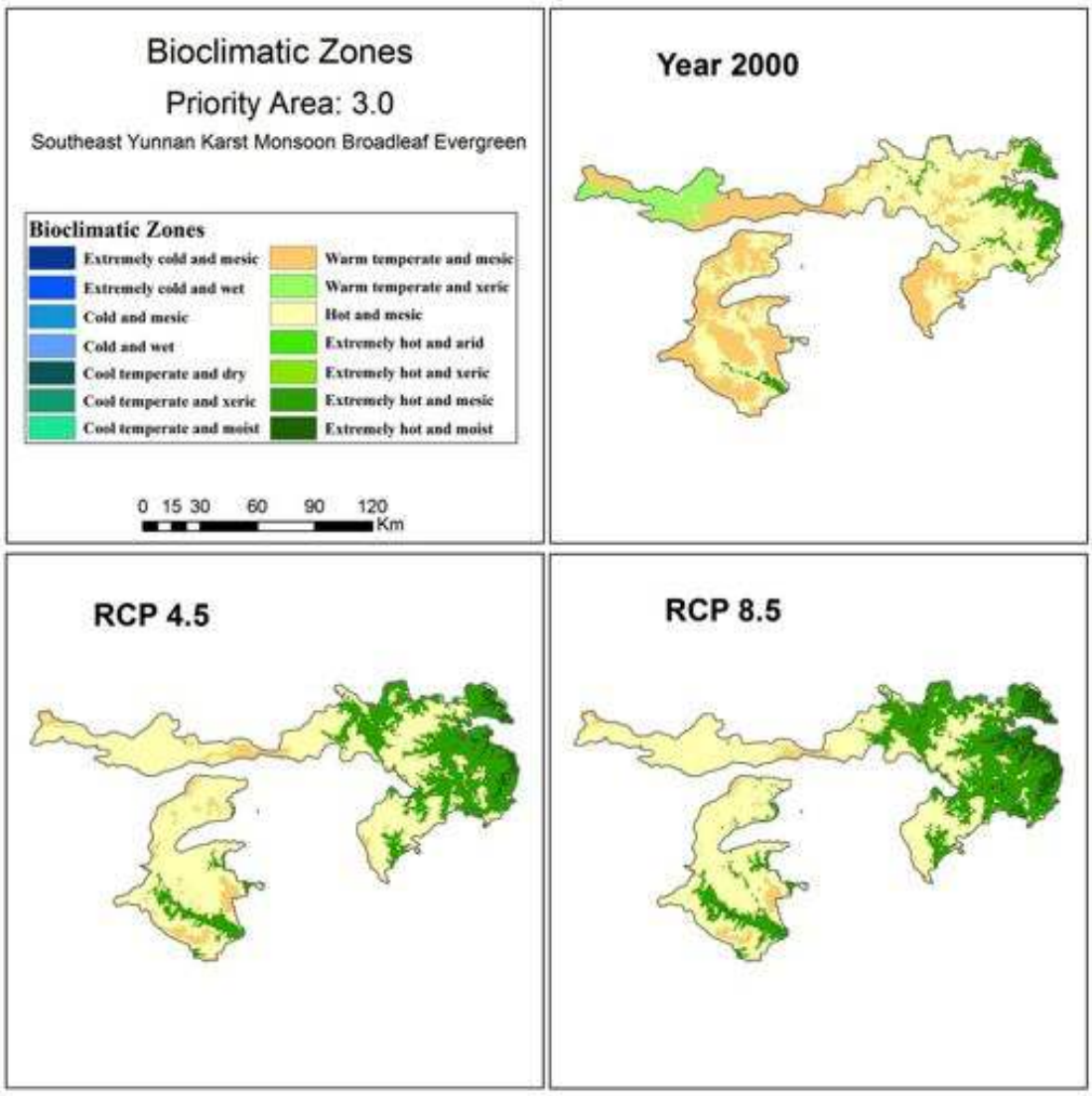


Table 3.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 3

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Warm temperate and mesic	K	4149	428	(3,721)	(90)	1495	1745	250
Warm temperate and xeric	L	129		(129)	(100)	1540		
Extremely hot and mesic	M	585	2729	2,144	366	467	862	395
Hot and mesic	N	5539	6502	963	17	1039	1379	339
Extremely hot and moist	R		743	743	#DIV/0!		494	494

Figure 3.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

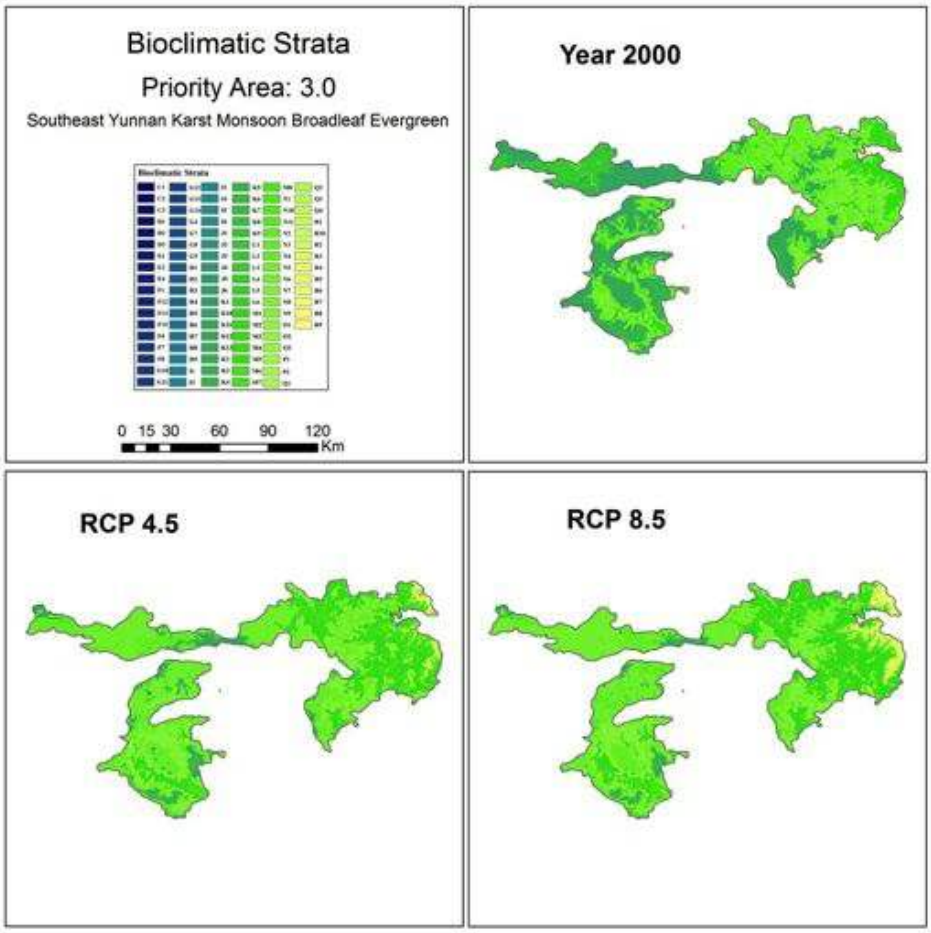


Table 3.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 3

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Warm temperate and mesic	K2	66	6	(60)	(91)	1990	2095	105
Warm temperate and mesic	K5	33	-	-	-	1958	-	-
Warm temperate and mesic	K7	440	29	(411)	(93)	1670	2056	386
Warm temperate and mesic	K10	1507	8	(1,499)	(99)	1621	2069	447
Warm temperate and mesic	K11	52	125	73	140	1496	1805	309
Warm temperate and mesic	K13	2051	260	(1,791)	(87)	1342	1664	322
Warm temperate and xeric	L3	129	-	-	-	1540	-	-
Hot and mesic	N2	2387	519	(1,868)	(78)	1268	1718	450
Hot and mesic	N3	947	1061	114	12	988	1430	442
Hot and dry	N4	-	42	-	-	-	1709	-
Hot and mesic	N5	1170	3247	2,077	178	916	1421	505
Hot and mesic	N8	1001	1507	506	51	709	1149	441
Hot and dry	N9	-	124	-	-	-	1101	-
Hot and mesic	N11	34	2	(32)	(94)	412	965	553
Extremely hot and mesic	M2	447	1691	1,244	278	504	944	439
Extremely hot and mesic	M4	97	349	252	260	340	820	480
Extremely hot and mesic	M6	-	48	-	-	-	803	-
Extremely hot and mesic	M7	41	641	600	1,463	365	675	310
Extremely hot and moist	R1	-	743	-	-	-	494	-

Figure 3.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

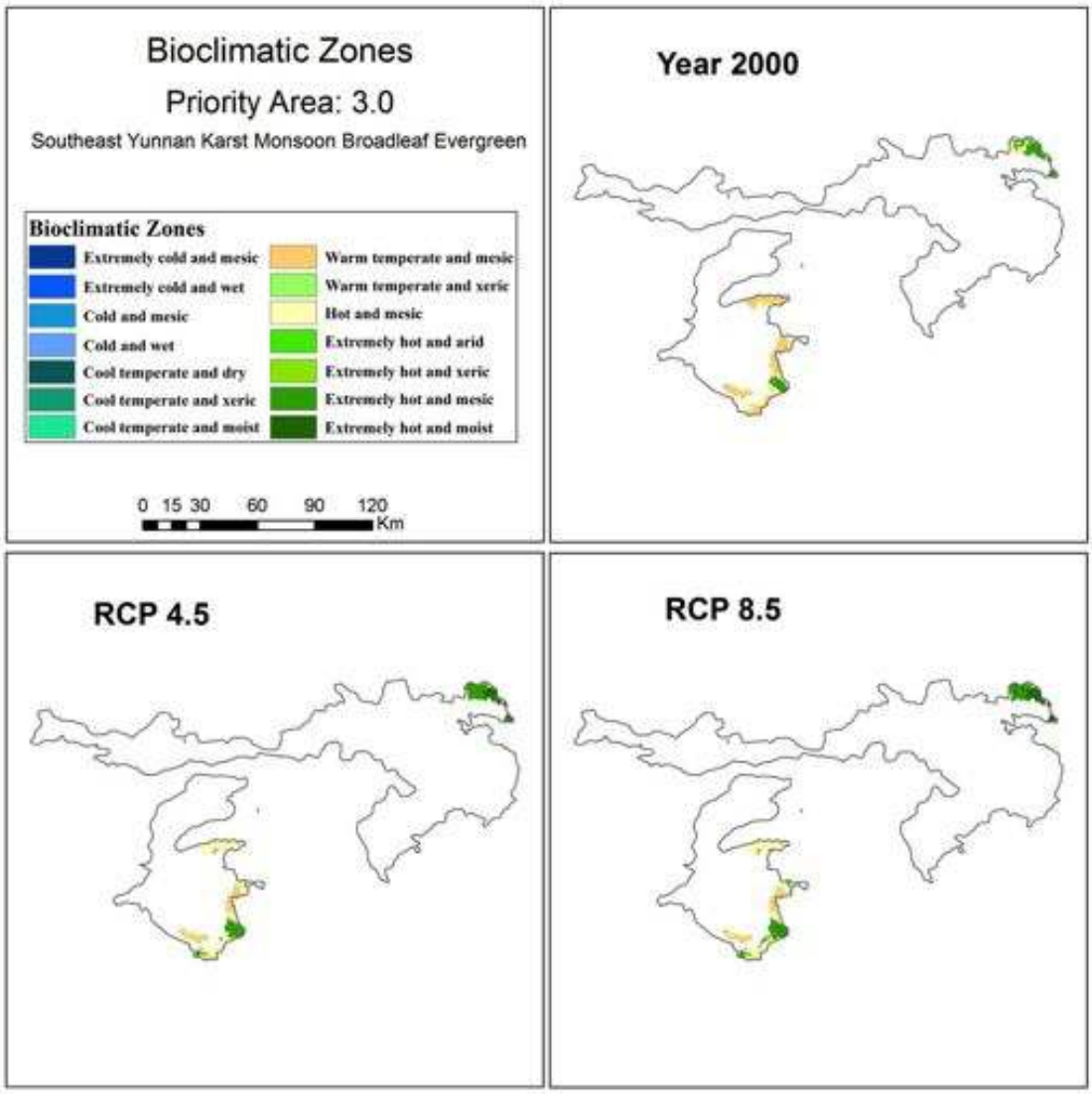


Table 3.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 3

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Warm temperate and mesic	K	268	112	(156)	(58)	1570	1819	249
Extremely hot and mesic	M	113	103	(10)	(9)	416	828	412
Hot and mesic	N	179	212	33	18	937	1364	427
Extremely hot and moist	R	-	133	-	-	-	431	-

Priority Area: 4.1

Wumeng Mountain Humid Evergreen Forest

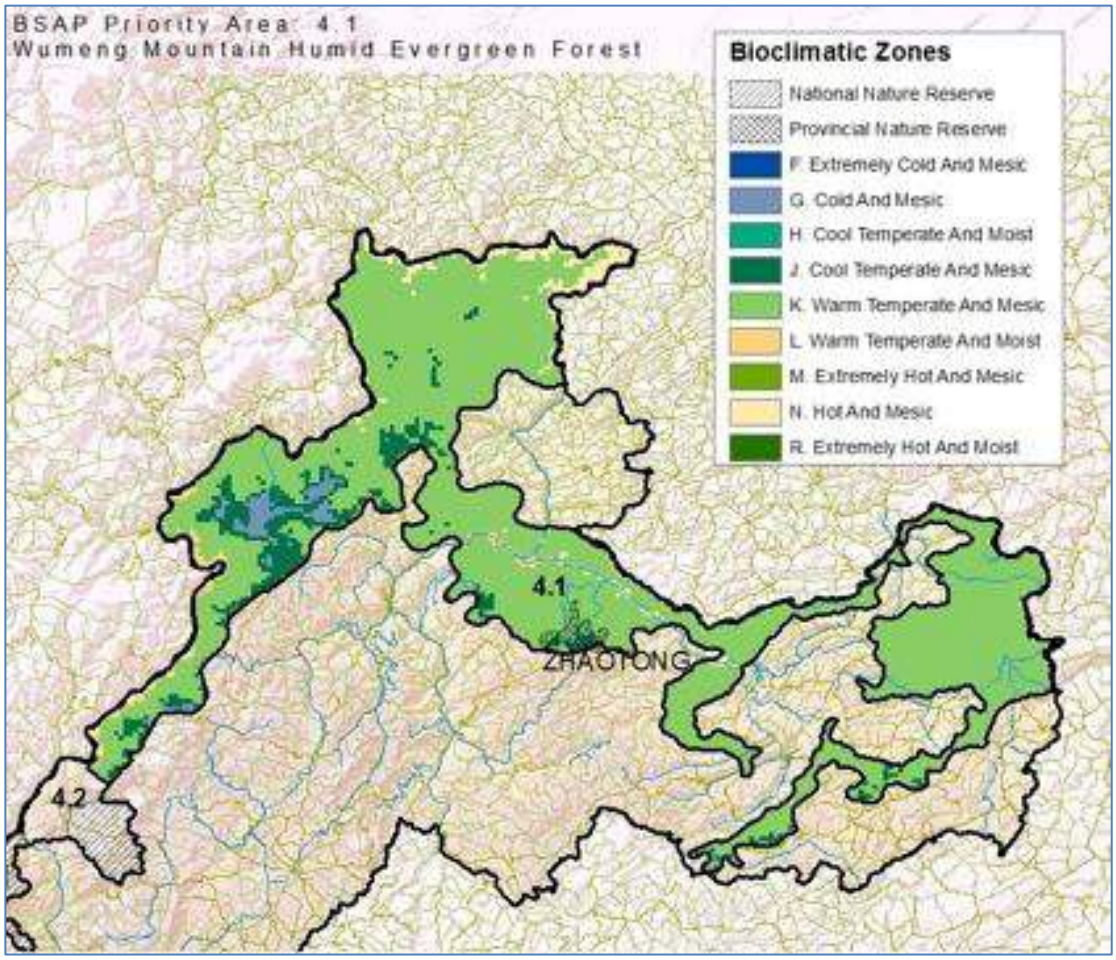
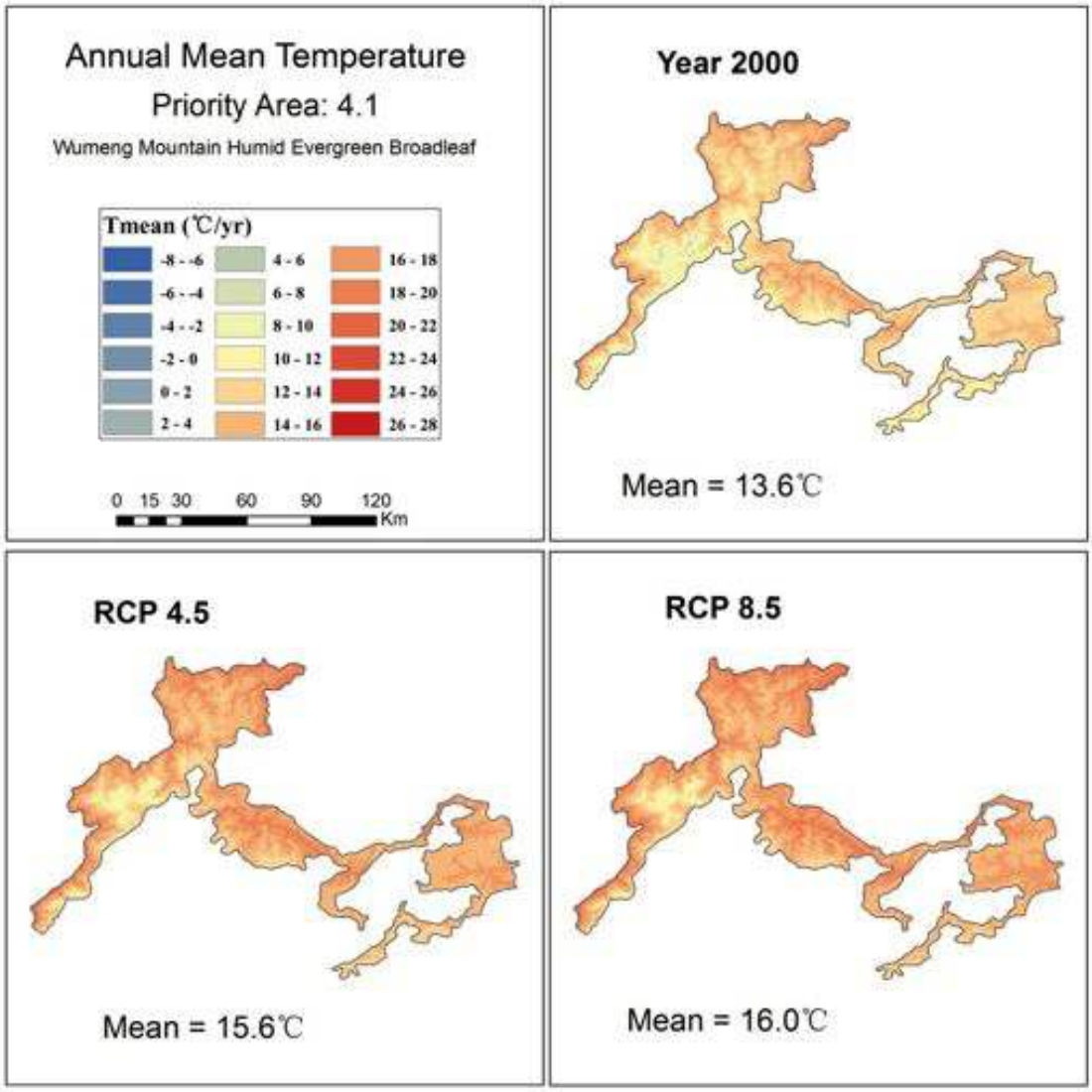


Table 4.1.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 4.1

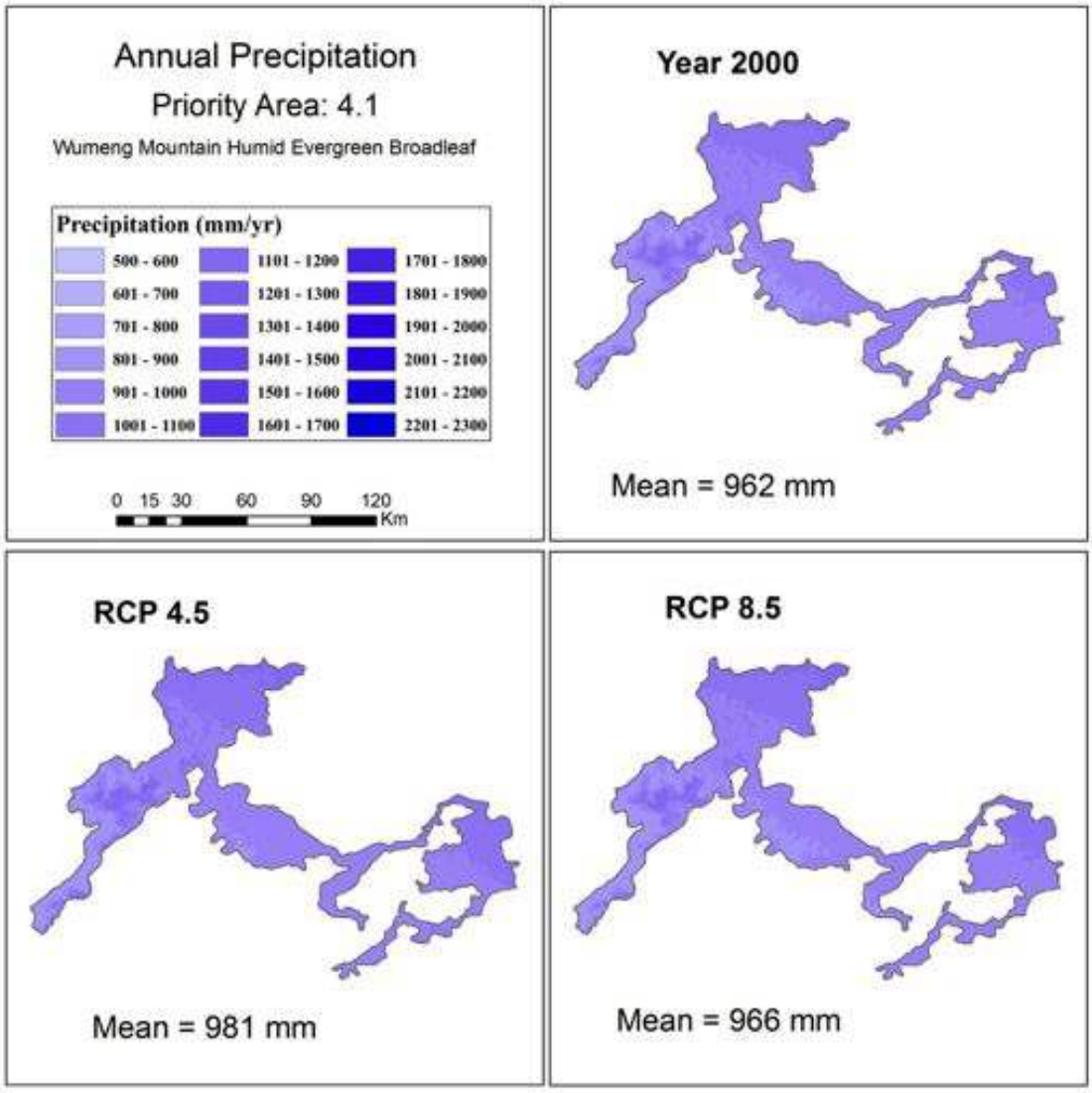
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Cold and mesic	G	83	2685	7.8	1143	870	1.32
Cool temperate and moist	J	601	2208	10.2	1006	957	1.05
Warm temperate and mesic	K	5370	1318	13.8	952	1070	0.89
Warm temperate and xeric	L	138	948	16.4	866	1256	0.69
Hot and mesic	N	288	556	17.5	1015	1214	0.84

Figure 4.1.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



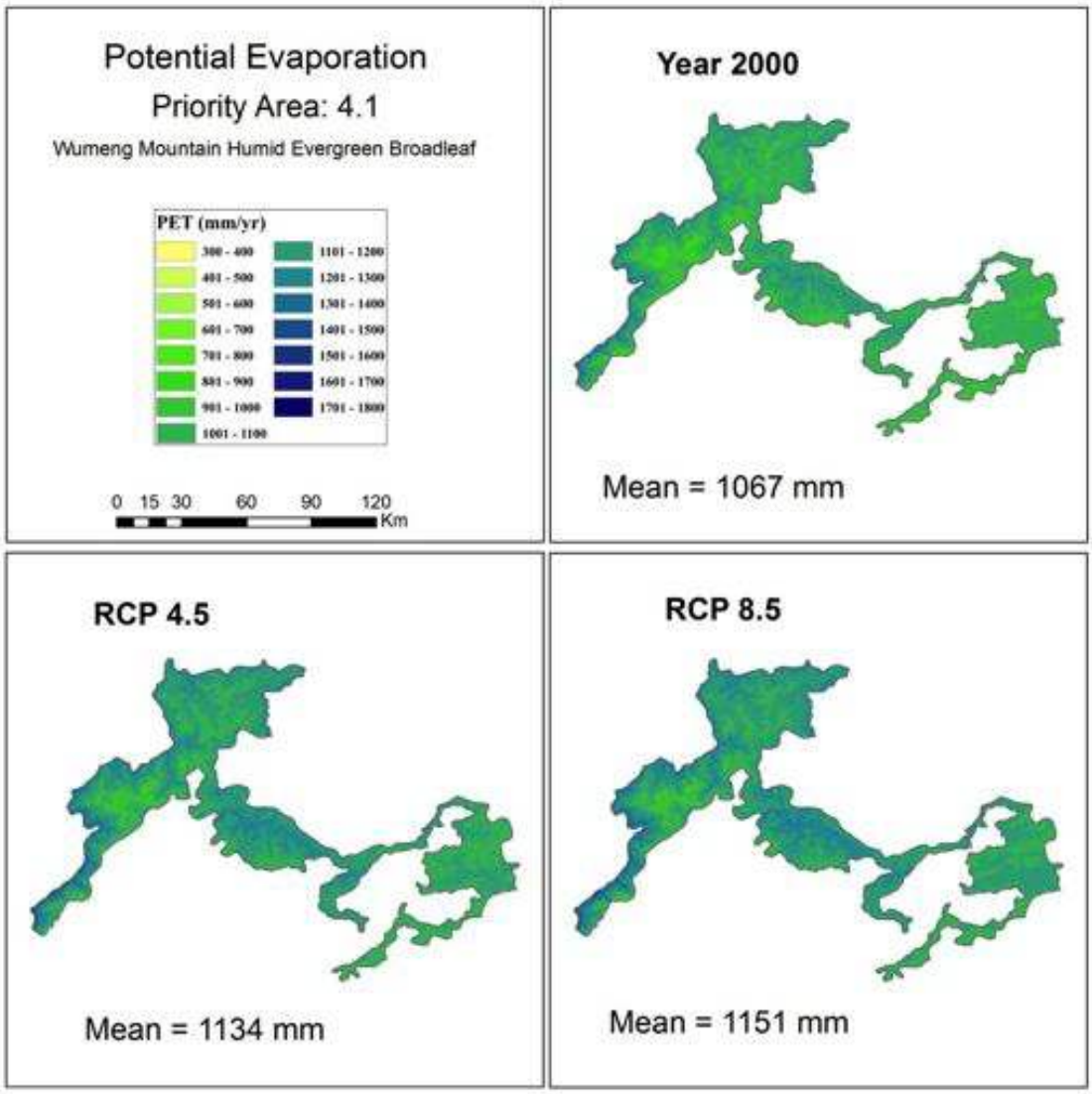
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	13.6	5.9	19.3	2.0
RCP26	15.3	7.6	21.0	2.0
RCP45	15.6	8.0	21.4	2.0
RCP60	15.1	7.5	20.8	2.0
RCP85	16.0	8.4	21.7	2.0

Figure 4.1.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



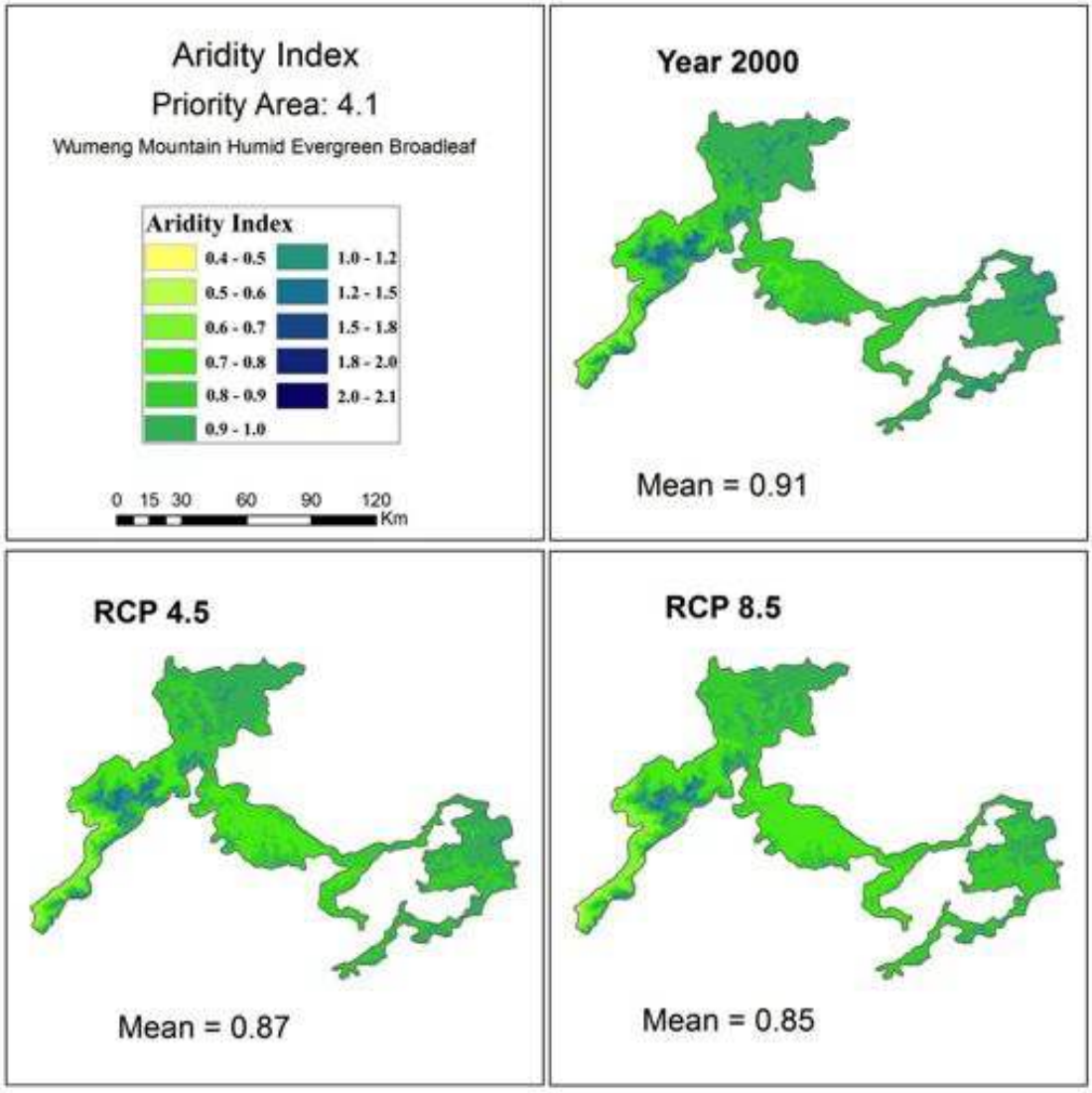
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	962	813	1240	66
RCP26	966	809	1249	70
RCP45	981	827	1268	69
RCP60	942	791	1216	67
RCP85	967	804	1245	70

Figure 4.1.4.1: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1068	806	1384	80
RCP26	1134	866	1457	81
RCP45	1135	869	1457	81
RCP60	1104	841	1428	80
RCP85	1151	885	1476	81

Figure 4.1.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	0.91	0.62	1.54	0.11
RCP26	0.86	0.58	1.44	0.10
RCP45	0.87	0.59	1.46	0.10
RCP60	0.86	0.58	1.45	0.10
RCP85	0.85	0.57	1.41	0.10

Figure 4.1.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

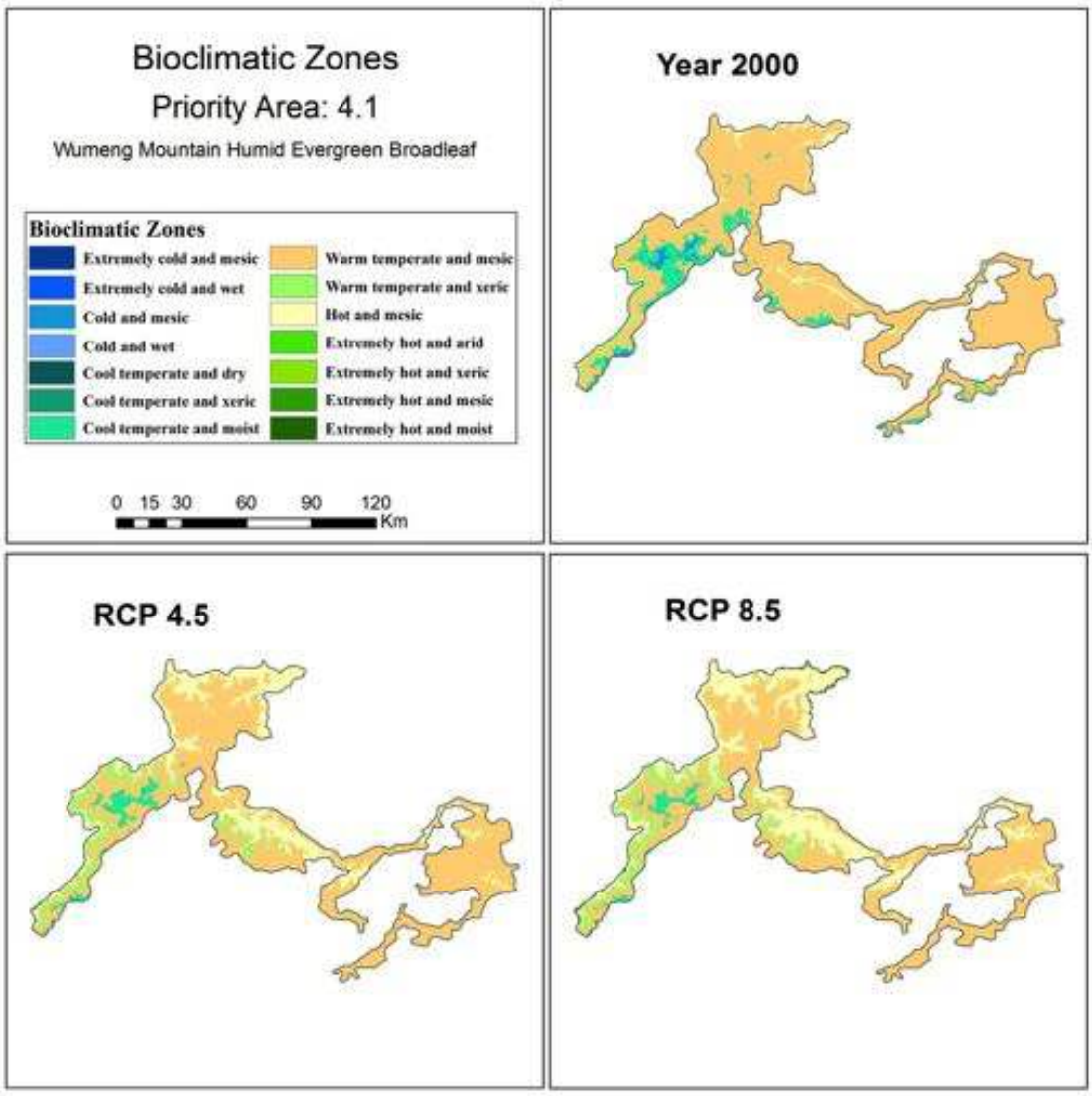


Table 4.1.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 4.1

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cold and mesic	G	138	6	(132)	(96)	2627	2929	302
Cool temperate and moist	J	519	204	(315)	(61)	2168	2559	392
Warm temperate and mesic	K	5372	3730	(1,642)	(31)	1312	1582	270
Warm temperate and xeric	L	135	724	589	436	727	1075	349
Extremely hot and mesic	M		9	9			699	
Hot and mesic	N	247	1738	1,491	604	553	889	336

Figure 4.1.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

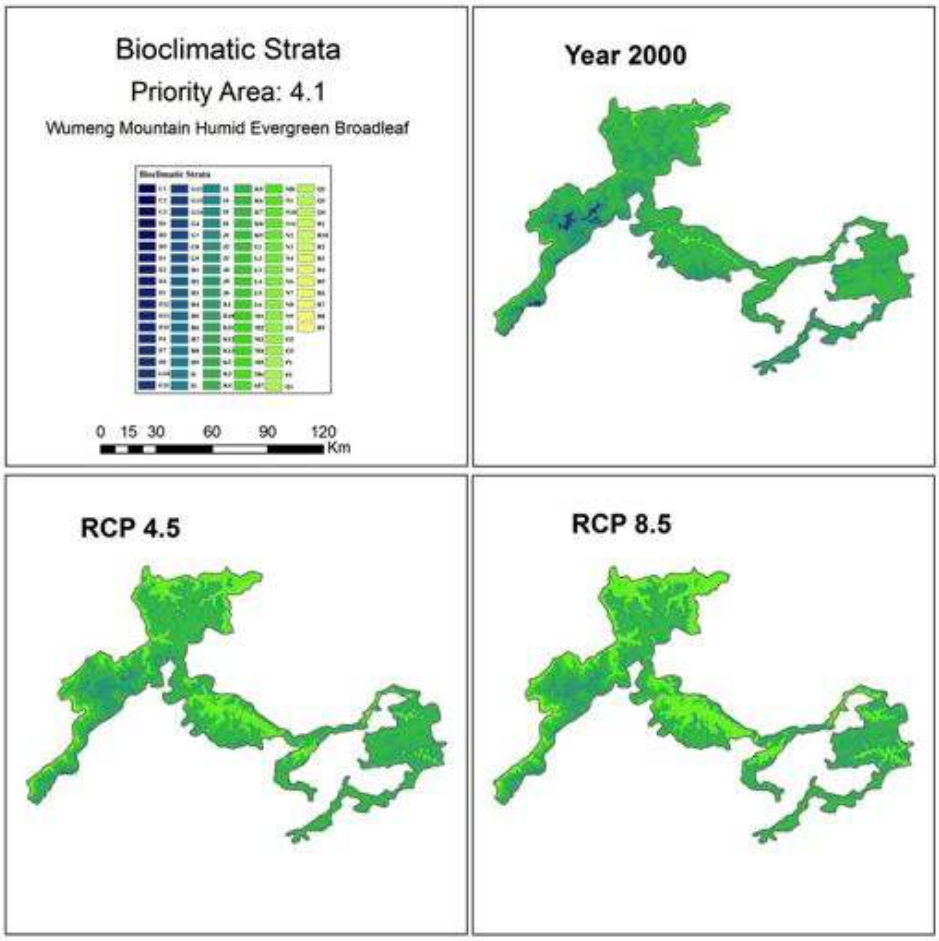


Table 4.1.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 4.1

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cold and mesic	G8	2	-	-	-	2822	-	-
Cold and mesic	G13	136	6	(130)	(96)	2624	2929	304
Cool temperate and moist	J3	160	119	(41)	(26)	2361	2606	246
Cool temperate and moist	J5	359	85	(274)	(76)	2081	2494	412
Warm temperate and mesic	K1	1929	229	(1,700)	(88)	1617	2211	594
Warm temperate and mesic	K5	1642	656	(986)	(60)	1277	1883	606
Warm temperate and mesic	K6	892	1058	166	19	1123	1553	431
Warm temperate and mesic	K10	897	1787	890	99	916	1407	491
Warm temperate and mesic	K11	4	-	-	-	837	-	-
Warm temperate and mesic	K13	8	-	-	-	677	-	-
Warm temperate and xeric	L3	135	724	589	436	727	1075	349
Hot and mesic	N2	217	1096	879	405	543	1000	456
Hot and mesic	N4	30	170	140	467	626	885	259
Hot and dry	N5	-	444	-	-	-	638	-
Hot and dry	N9	-	3	-	-	-	519	-
Hot and dry	N11	-	25	-	-	-	595	-
Extremely hot and mesic	M3	-	9	-	-	-	699	-

Figure 4.1.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

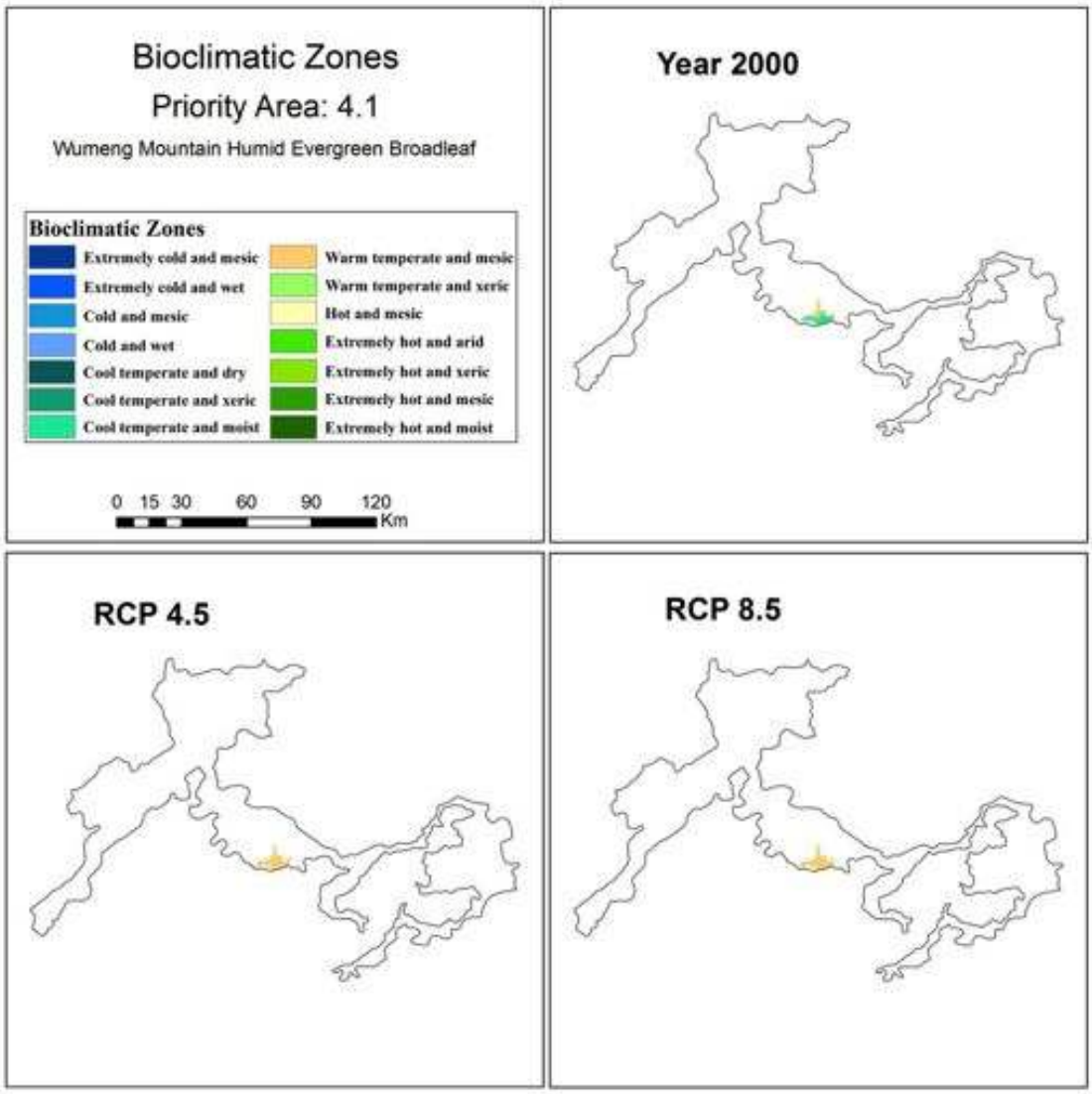


Table 4.1.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 4.1

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Cool temperate and moist	J	23	-	-	-	2015	-	-
Warm temperate and mesic	K	34	57	23	68	1744	1853	109

Priority Area: 4.2

Jinsha River Dry-Hot Valleys

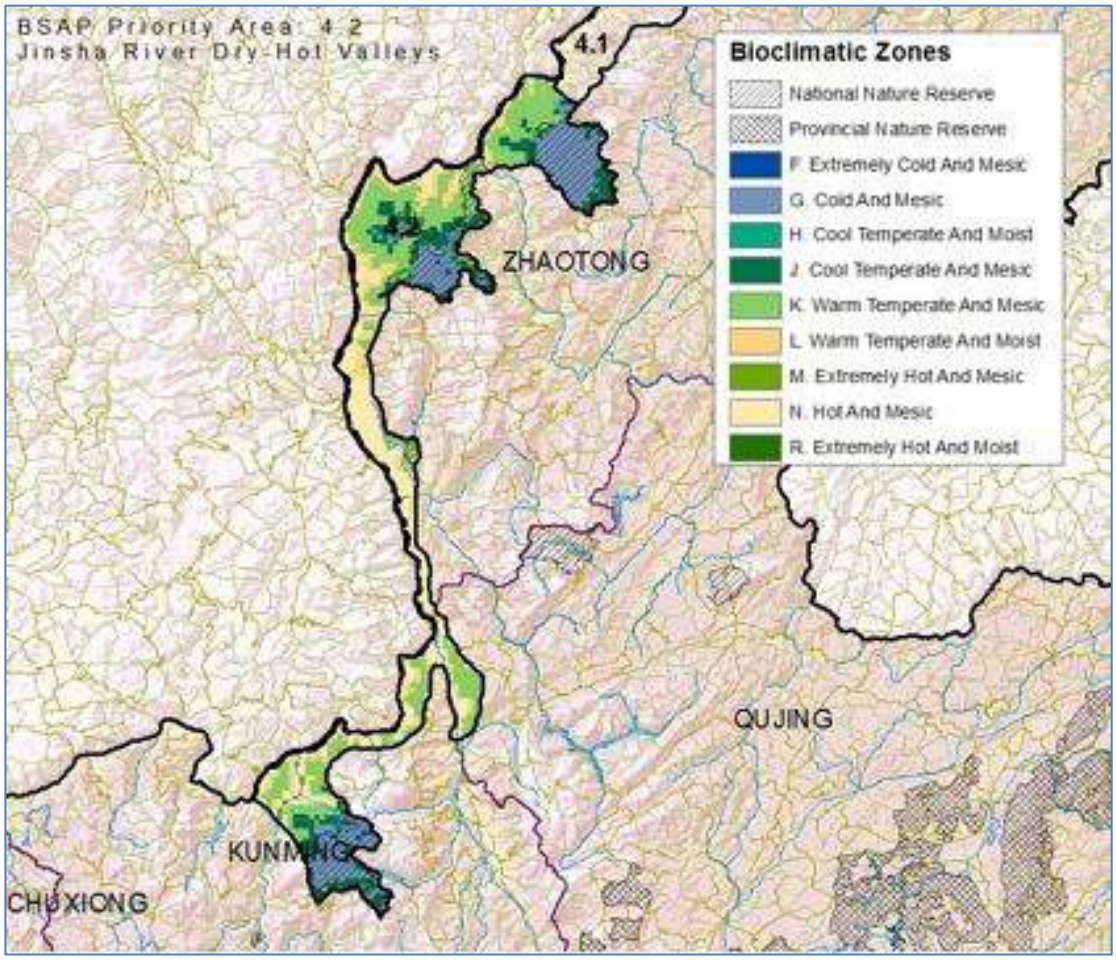
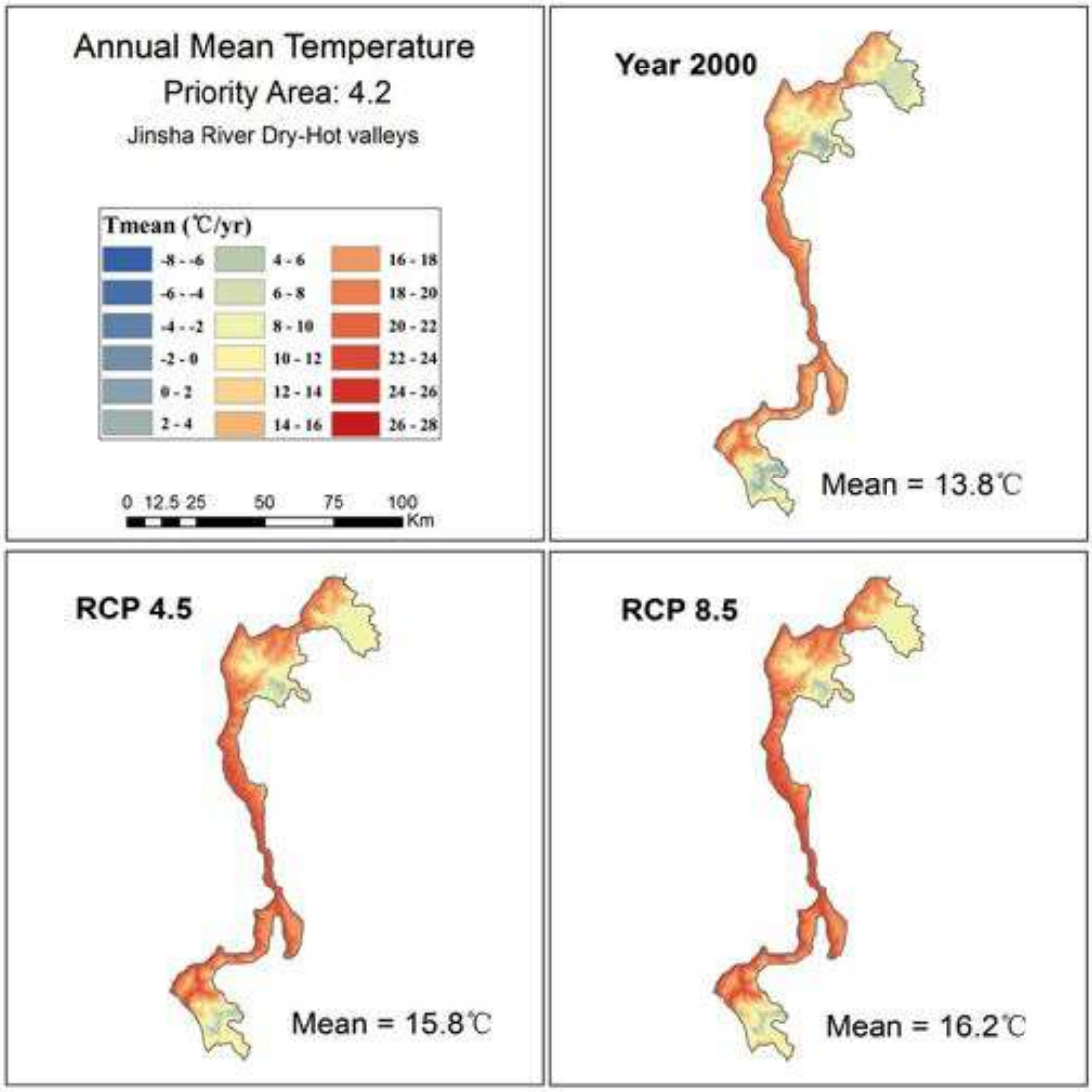


Table 4.2.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 4.2

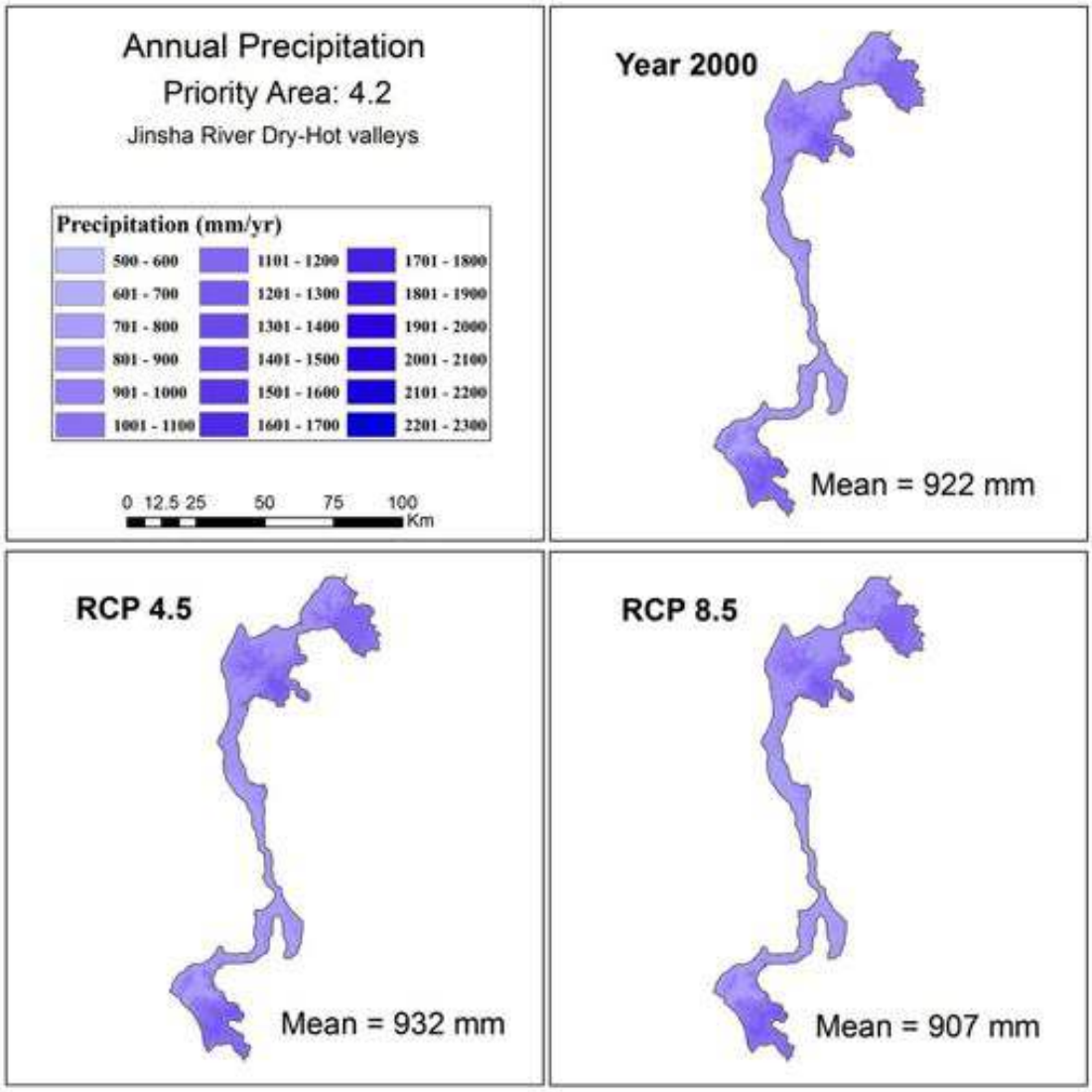
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Extremely cold and mesic	F	7	3755	4.2	1221	781	1.57
Cold and mesic	G	356	3238	6.8	1137	881	1.3
Cool temperate and moist	J	253	2813	9.3	1050	993	1.06
Warm temperate and mesic	K	562	2025	13.6	900	1186	0.77
Warm temperate and xeric	L	196	1509	16.5	835	1308	0.64
Extremely hot and mesic	M	33	966	20.6	746	1481	0.5
Hot and mesic	N	472	1111	18.9	791	1407	0.56

Figure 4.2.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



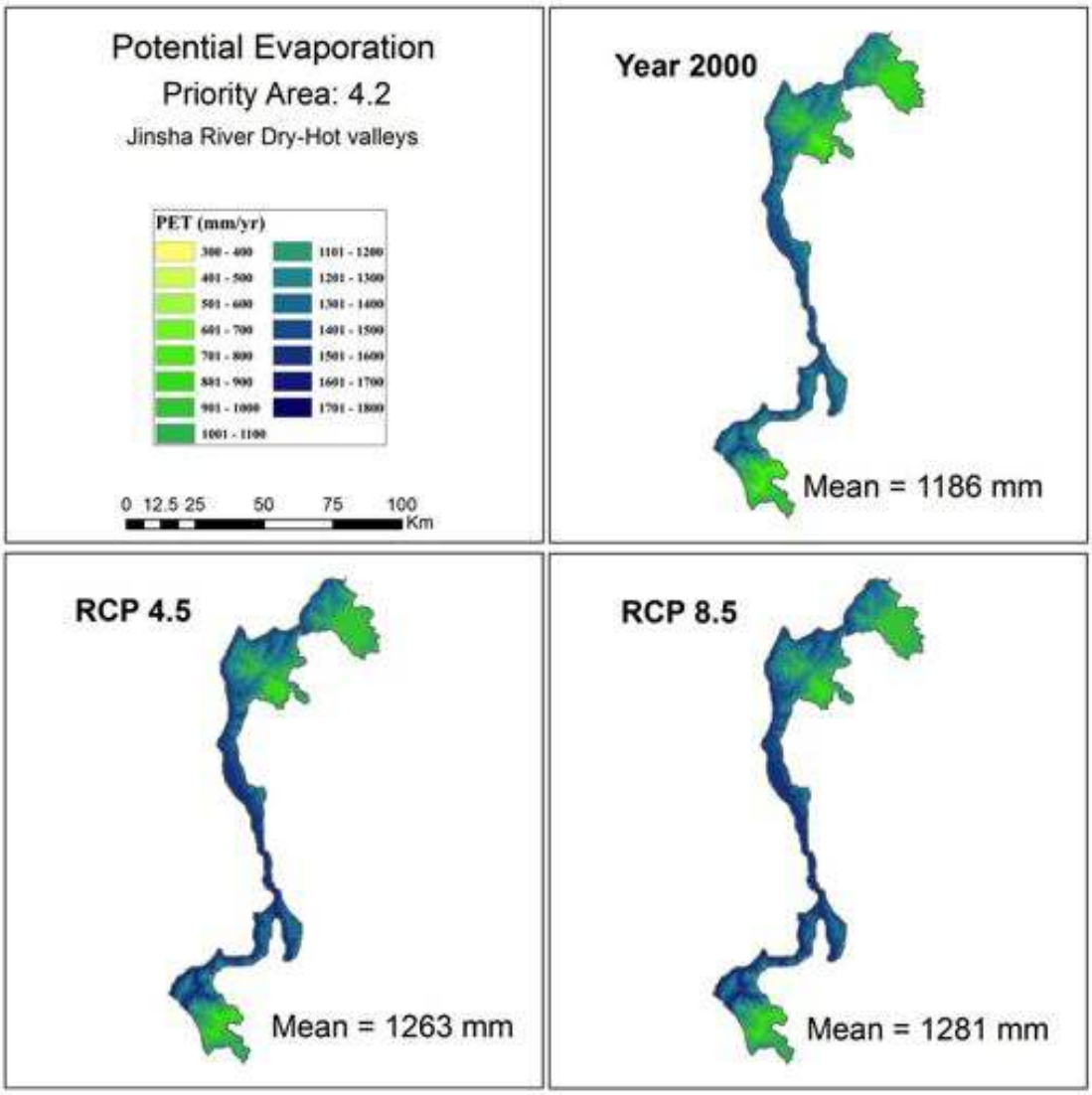
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	13.8	2.5	21.5	4.9
RCP26	15.4	4.1	23.0	4.9
RCP45	15.8	4.5	23.4	4.9
RCP60	15.3	4.1	23.0	4.9
RCP85	16.2	4.9	23.8	4.9

Figure 4.2.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



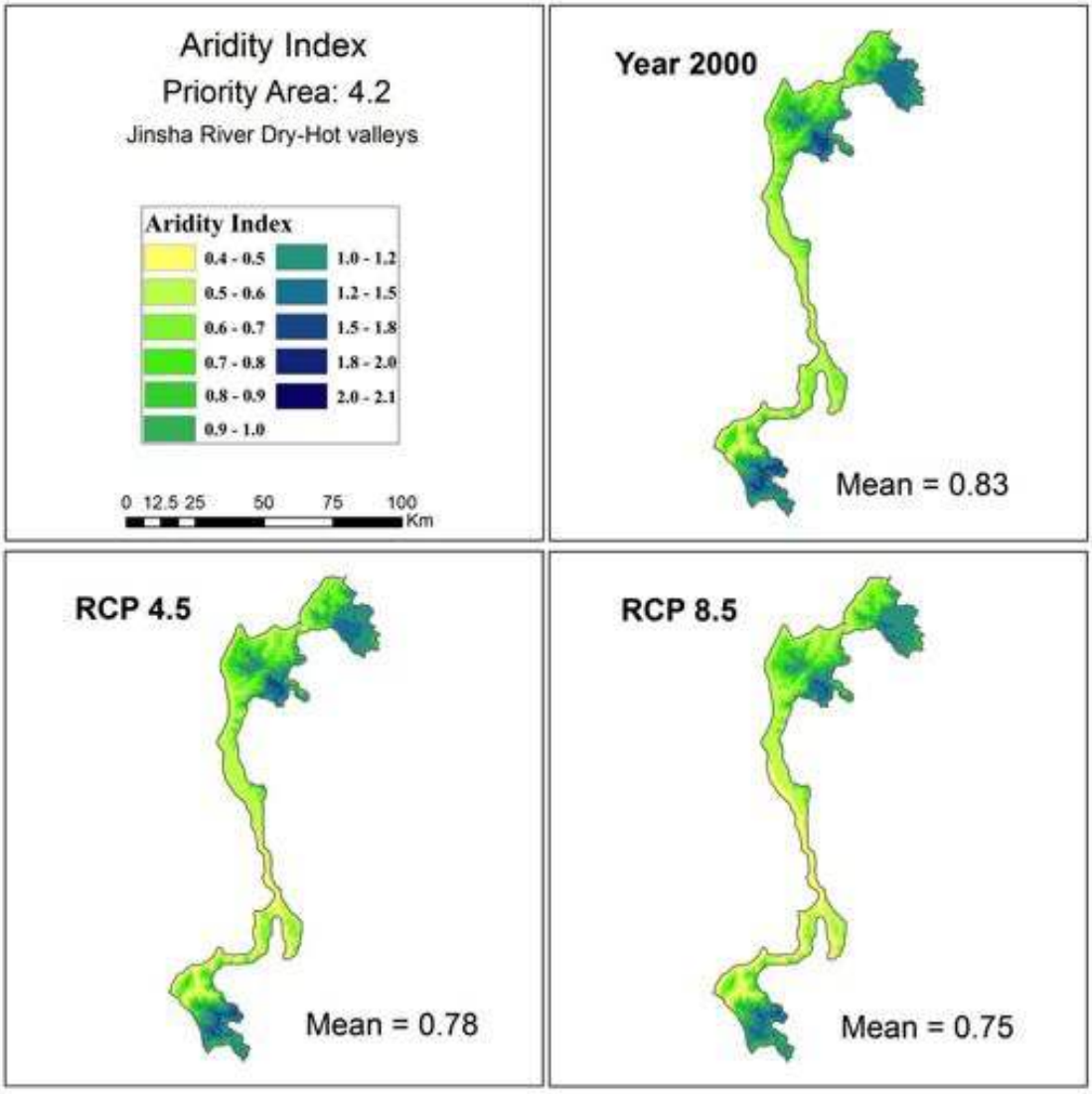
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	923	728	1267	141
RCP26	910	716	1243	139
RCP45	932	733	1275	143
RCP60	899	713	1240	138
RCP85	908	716	1249	140

Figure 4.2.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1187	714	1527	211
RCP26	1260	782	1606	215
RCP45	1263	788	1609	214
RCP60	1235	762	1573	212
RCP85	1281	804	1626	215

Figure 4.2.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	0.83	0.48	1.77	0.30
RCP26	0.77	0.45	1.59	0.27
RCP45	0.78	0.46	1.62	0.27
RCP60	0.77	0.45	1.63	0.27
RCP85	0.75	0.44	1.56	0.26

Figure 4.2.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

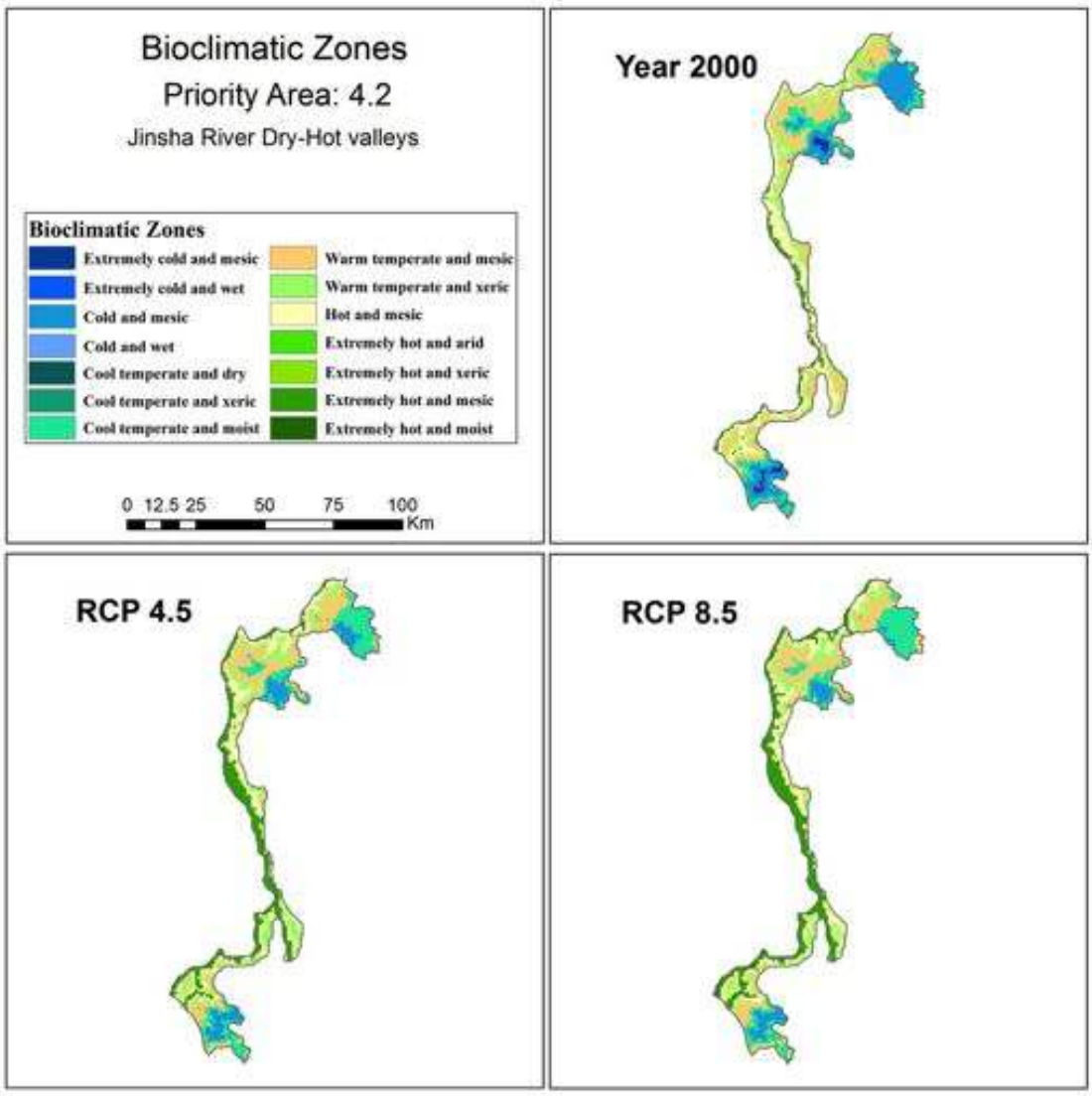


Table 4.2.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 4.2

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F	7		(7)	(100)	3973		
Cold and mesic	G	361	116	(245)	(68)	3273	3666	393
Cool temperate and moist	J	271	335	64	24	2758	3065	307
Warm temperate and mesic	K	591	400	(191)	(32)	1953	2470	517
Warm temperate and xeric	L	211	223	12	6	1417	1857	440
Extremely hot and mesic	M	24	413	389	1,621	863	1031	169
Hot and mesic	N	459	423	(36)	(8)	1051	1469	418
Extremely hot and moist	R		14	14			842	

Figure 4.2.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

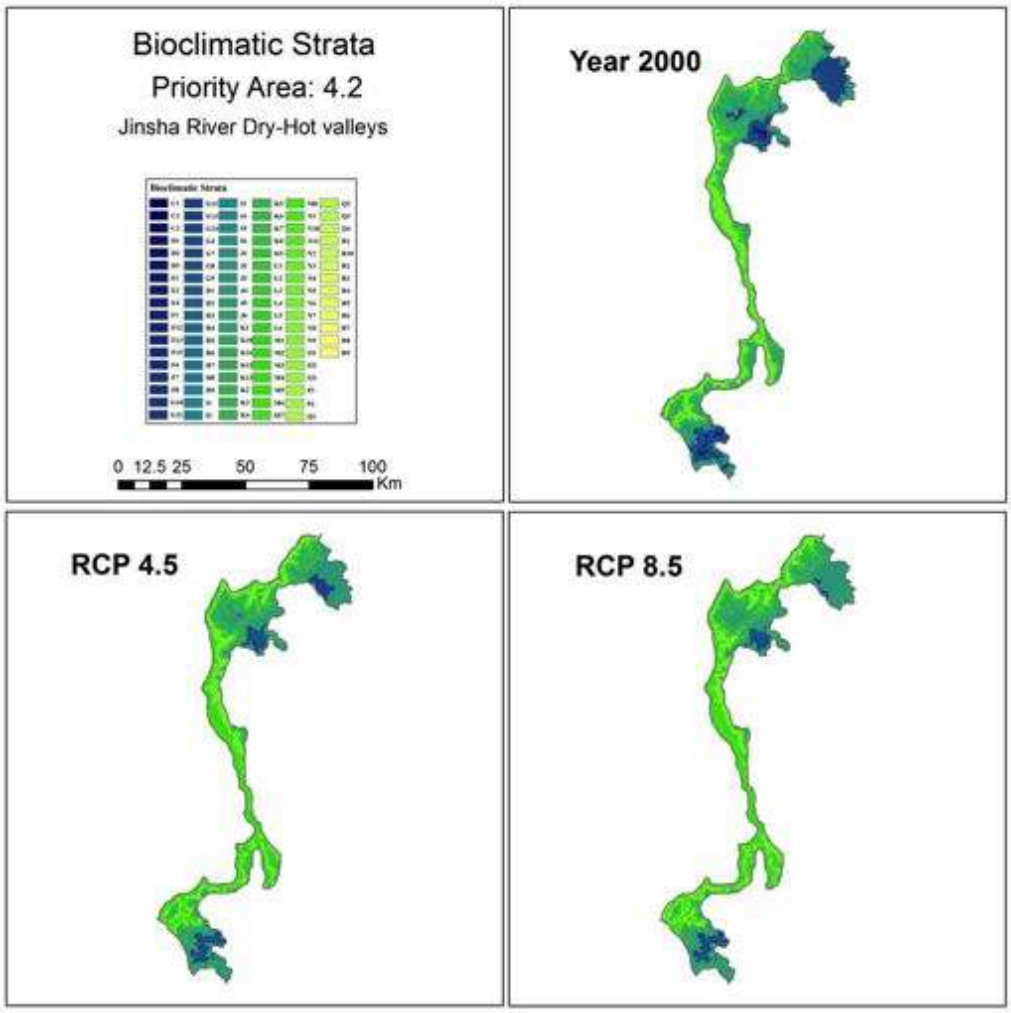


Table 4.2.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 4.2

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Extremely cold and mesic	F8	7	-	-	-	3973	-	-
Cold and mesic	G8	83	45	(38)	(46)	3720	3873	153
Cold and mesic	G13	278	71	(207)	(74)	3140	3535	395
Cool temperate and moist	J3	117	188	71	61	2919	3145	227
Cool temperate and moist	J5	154	147	(7)	(5)	2636	2962	326
Warm temperate and mesic	K1	113	104	(9)	(8)	2356	2783	427
Warm temperate and mesic	K5	179	146	(33)	(18)	2095	2497	402
Warm temperate and mesic	K10	299	150	(149)	(50)	1716	2228	511
Warm temperate and xeric	L3	211	223	12	6	1417	1857	440
Hot and mesic	N4	201	310	109	54	1179	1550	371
Hot and mesic	N5	139	45	(94)	(68)	1029	1472	443
Hot and mesic	N11	119	68	(51)	(43)	860	1098	238
Extremely hot and mesic	M3	24	413	389	1,621	863	1031	169
Extremely hot and moist	R1	-	14	-	-	-	842	-

Figure 4.2.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

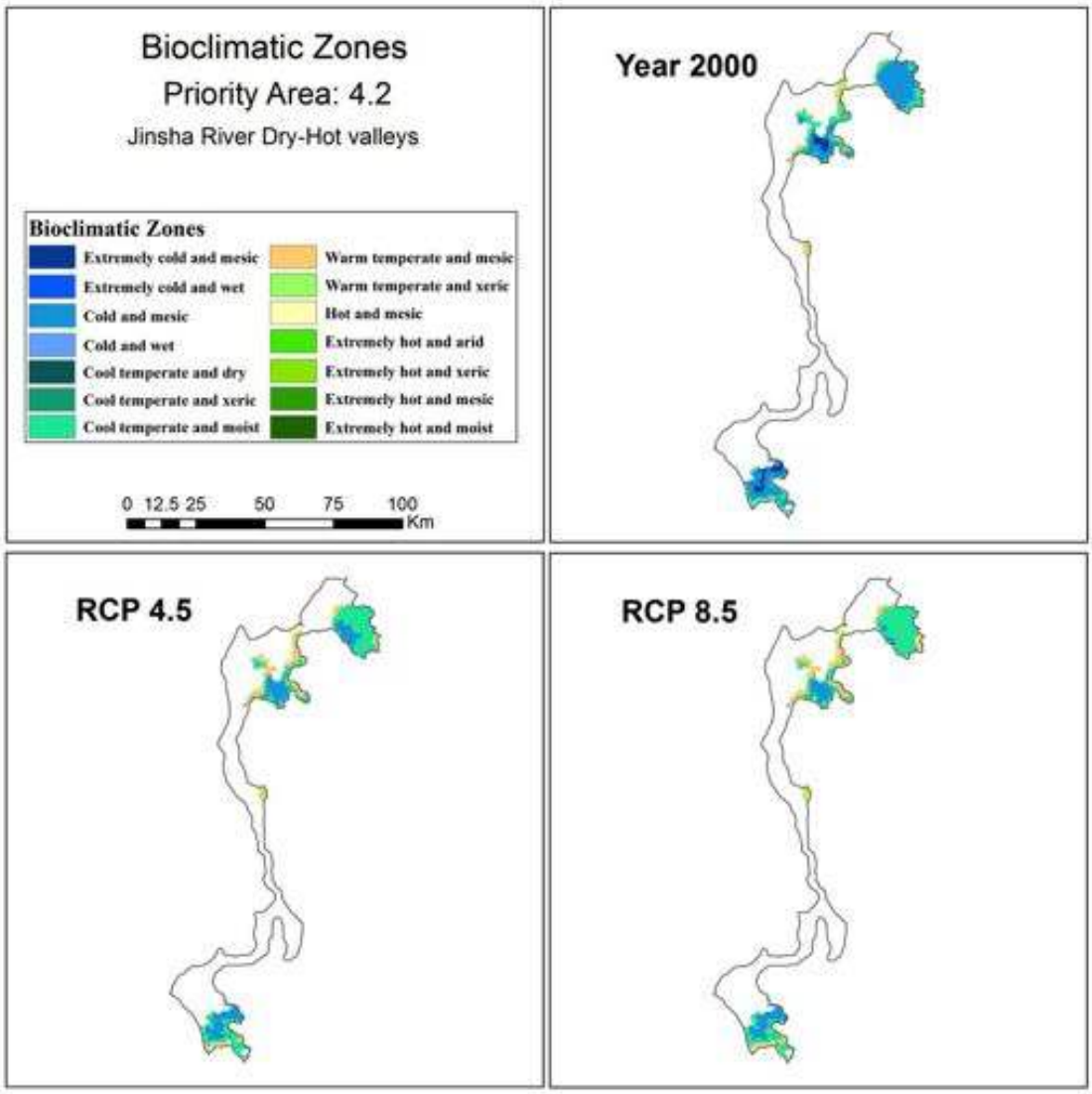


Table 4.2.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 4.2

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Extremely cold and mesic	F	7	-	-	-	3800	-	-
Cold and mesic	G	333	109	(224)	(67)	3256	3608	352
Cool temperate and moist	J	155	291	136	88	2760	3065	305
Warm temperate and mesic	K	63	141	78	124	2113	2539	426
Warm temperate and xeric	L	4	9	5	125	1158	1709	551
Extremely hot and mesic	M	-	1	-	-	-	1075	-
Hot and mesic	N	4	15	11	275	923	1358	435

Priority Area: 5.1

Lancang Middle Mountain Evergreen Broadleaf

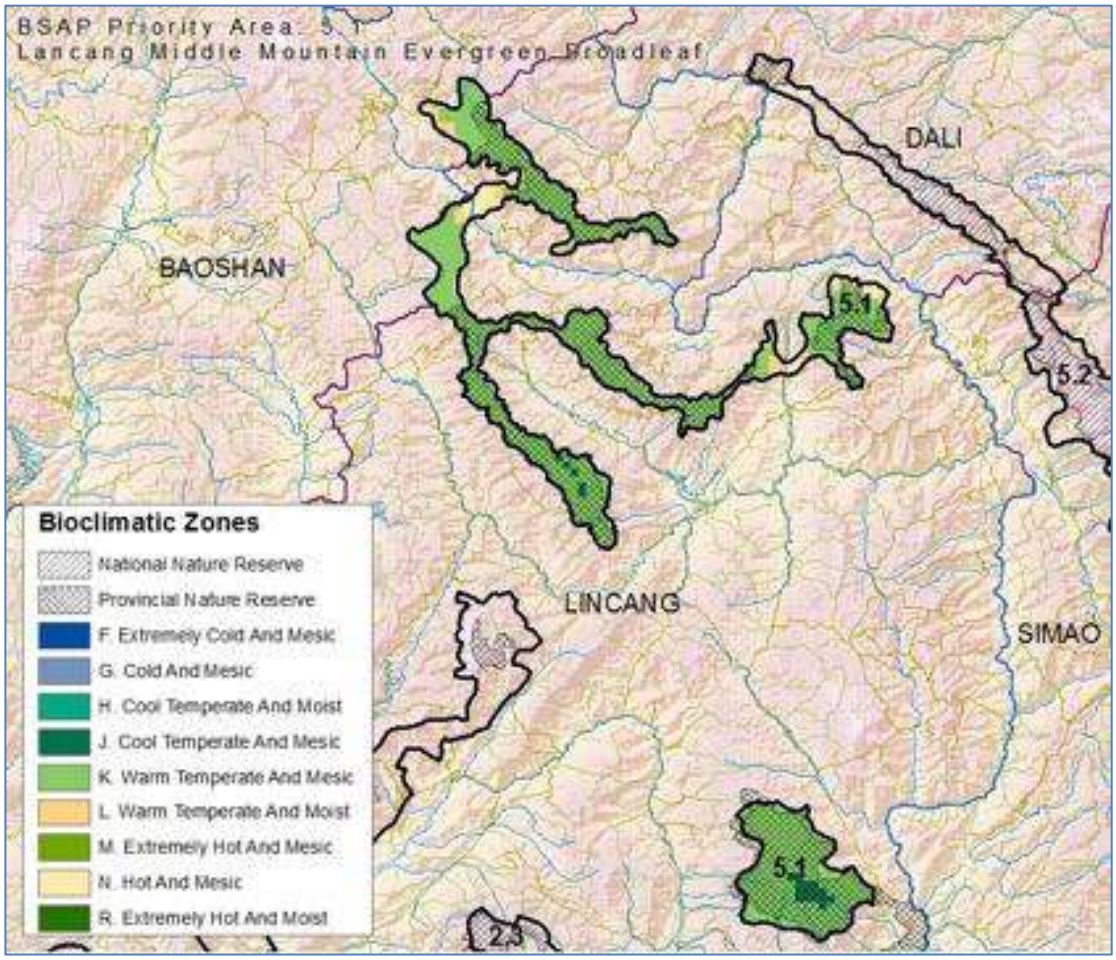
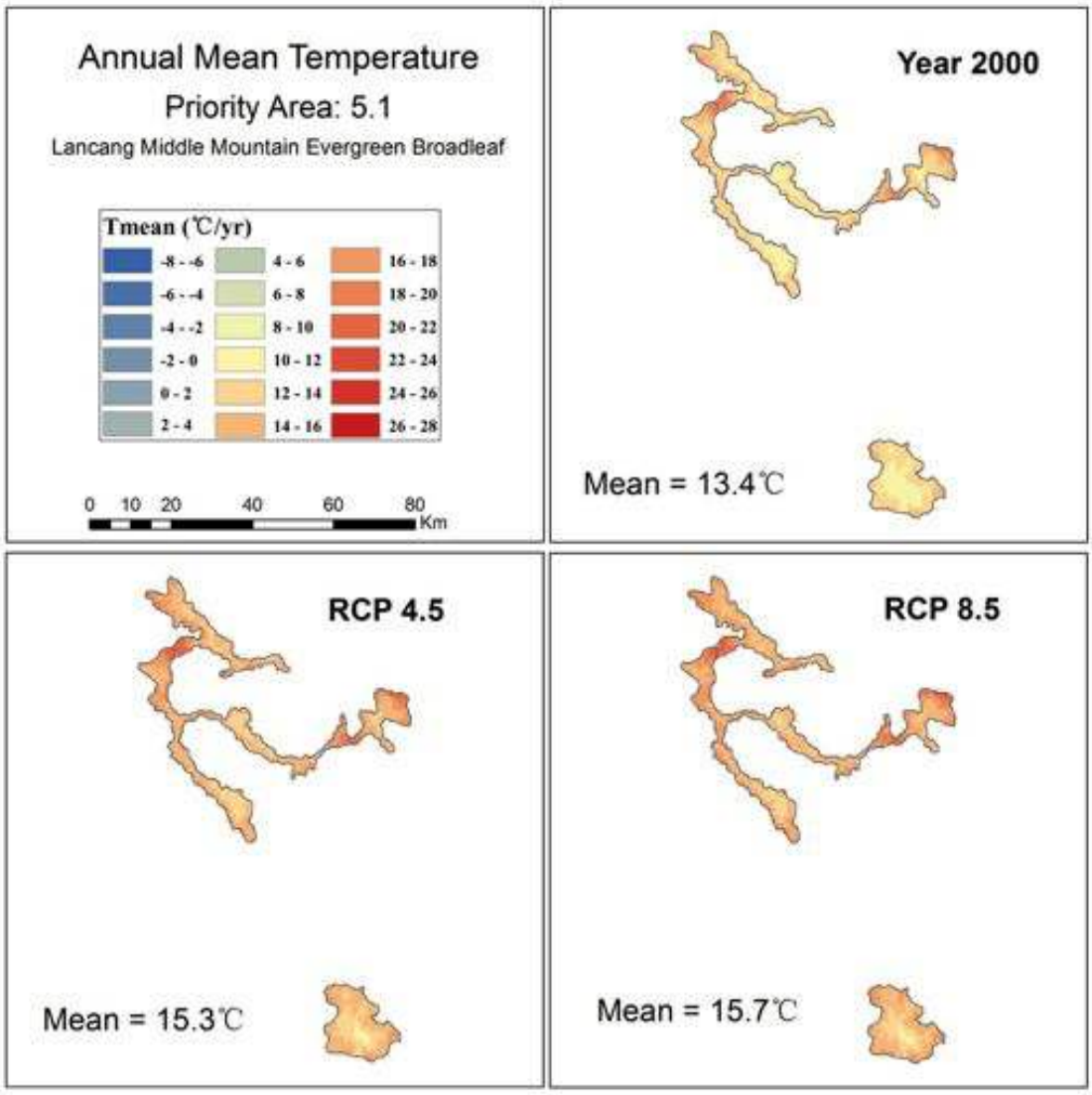


Table 5.1.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 5.1

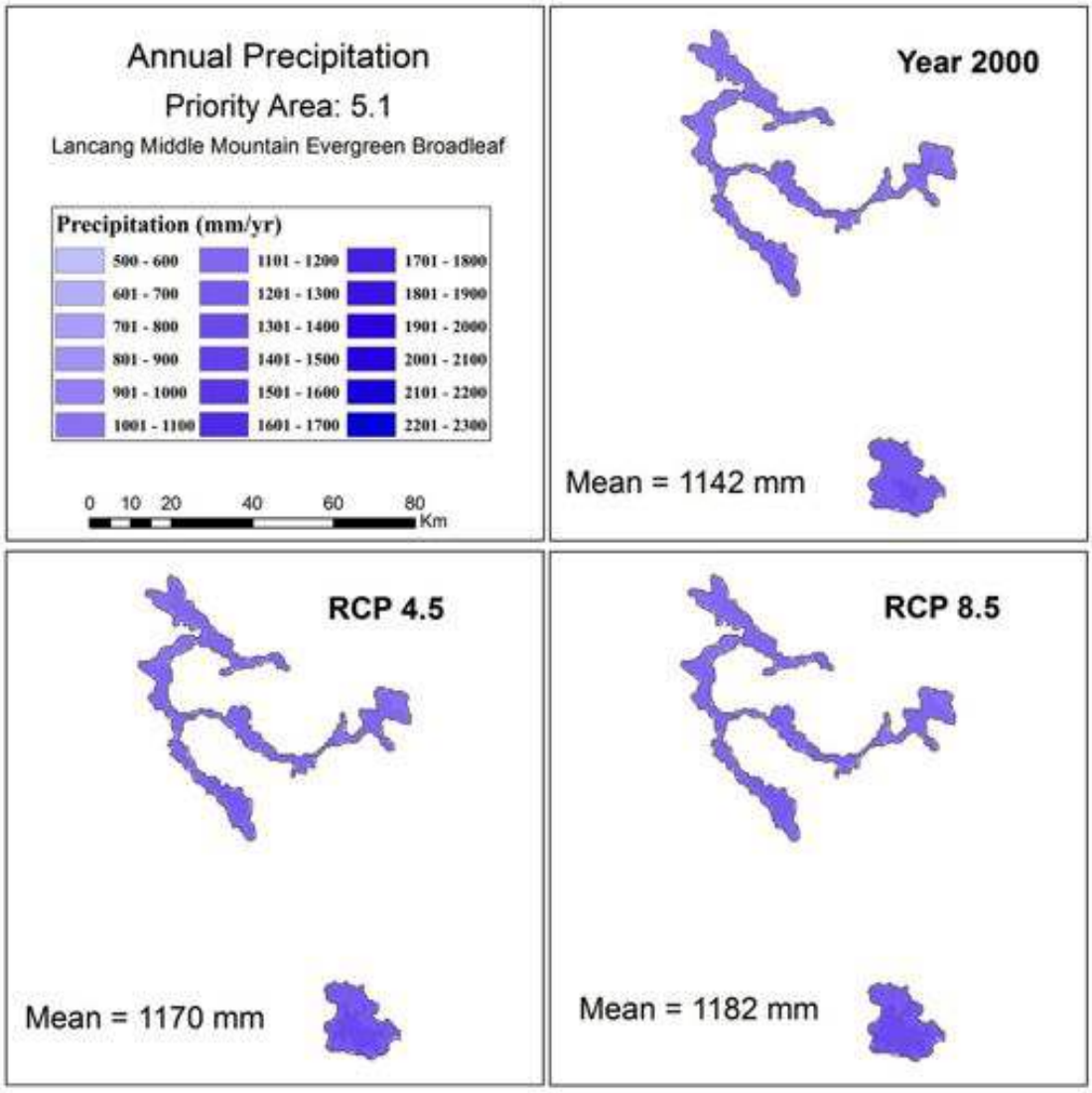
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Cool temperate and moist	J	20	2964	10.4	1278	1037	1.24
Warm temperate and mesic	K	700	2394	13.2	1147	1148	1
Warm temperate and xeric	L	32	1779	16.5	1031	1282	0.81
Hot and mesic	N	31	1462	18.3	1023	1360	0.75

Figure 5.1.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



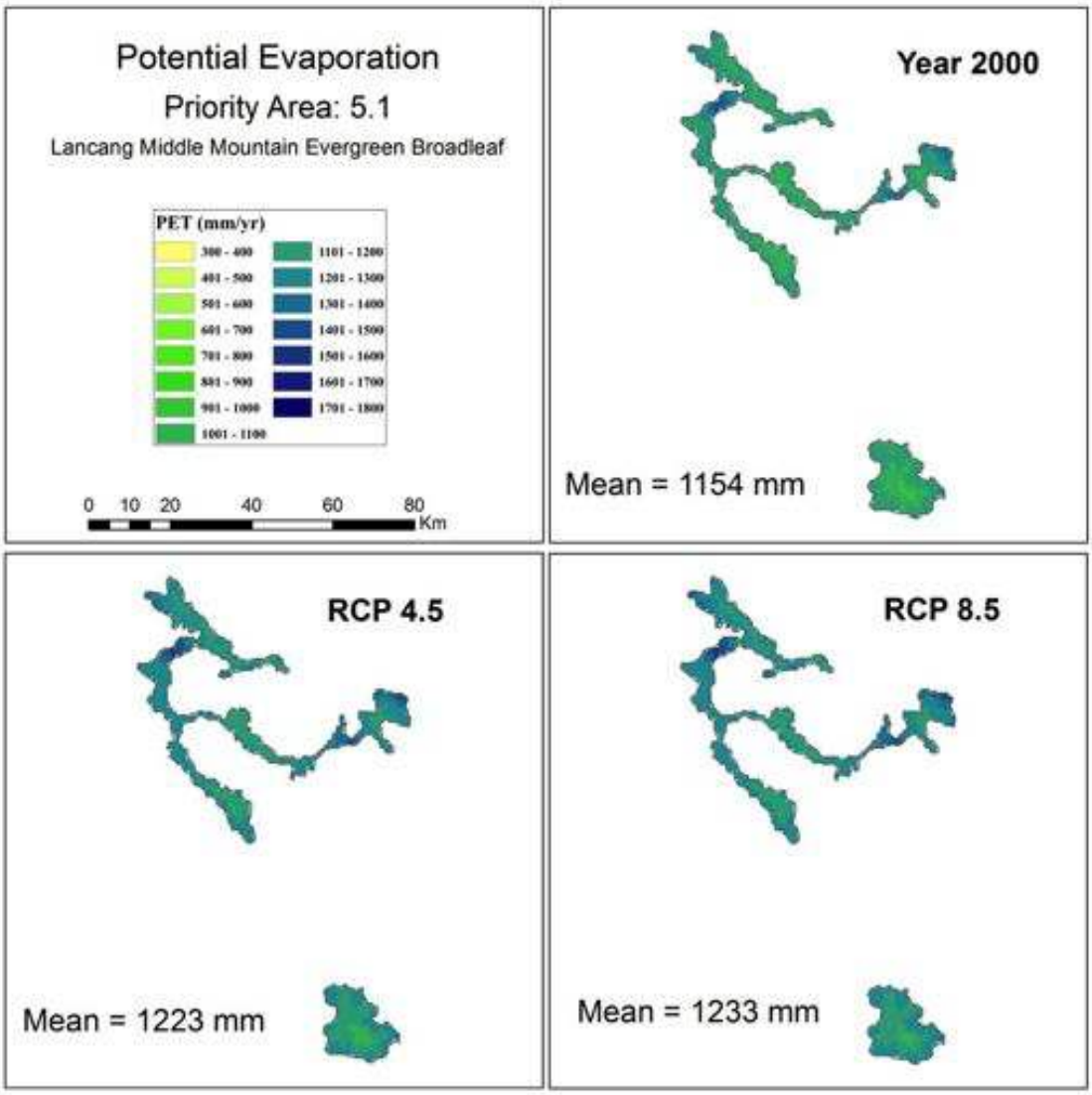
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	13.4	8.7	20.3	1.7
RCP26	14.9	10.2	21.7	1.7
RCP45	15.3	10.6	22.2	1.7
RCP60	14.9	10.2	21.8	1.7
RCP85	15.7	11.1	22.6	1.7

Figure 5.1.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



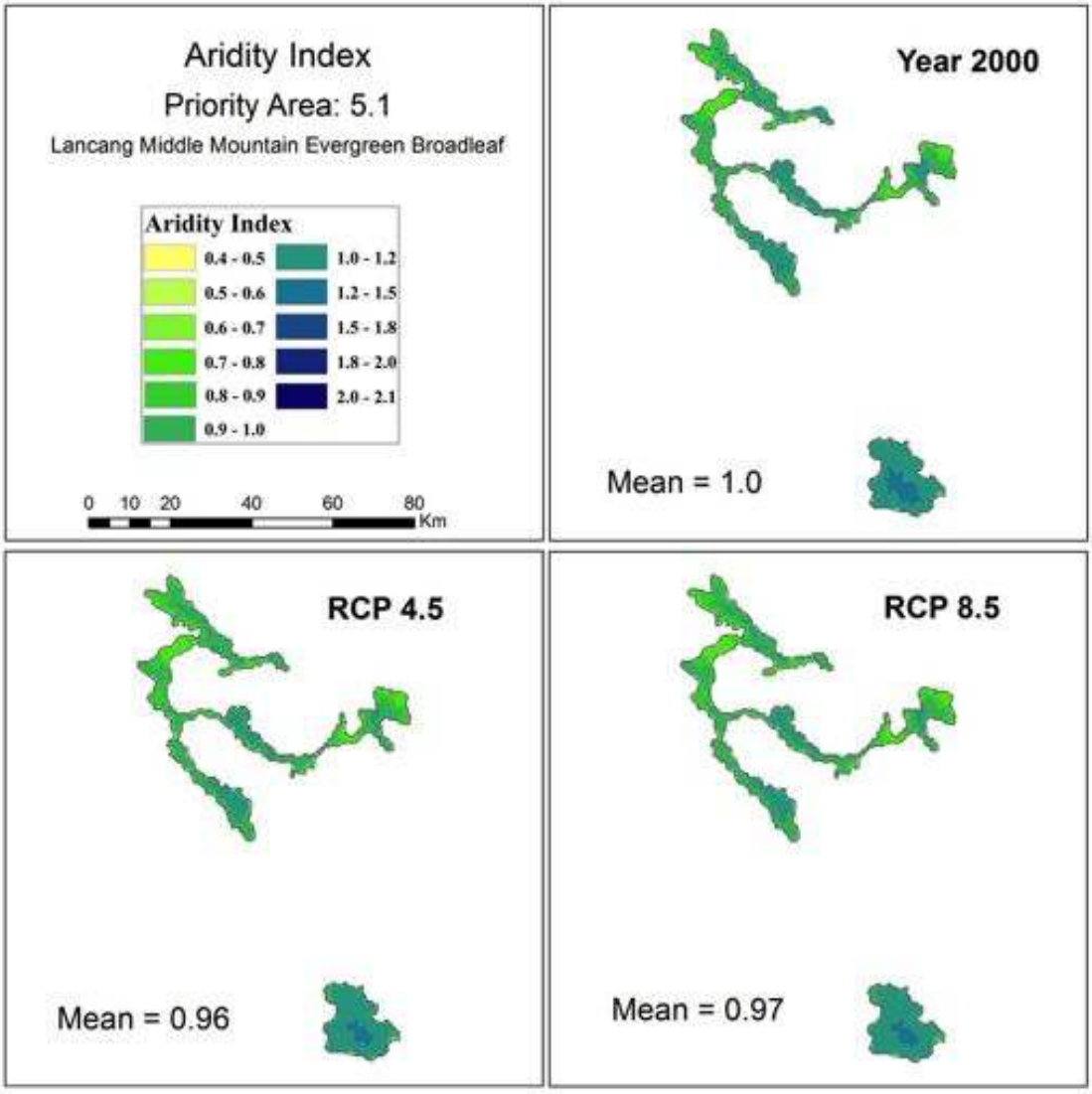
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1143	976	1333	82
RCP26	1168	992	1363	85
RCP45	1170	996	1362	83
RCP60	1163	988	1349	82
RCP85	1183	1005	1375	83

Figure 5.1.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1154	965	1446	71
RCP26	1213	1022	1507	72
RCP45	1224	1034	1516	71
RCP60	1197	1010	1488	71
RCP85	1234	1045	1526	71

Figure 5.1.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.00	0.68	1.38	0.12
RCP26	0.97	0.66	1.33	0.12
RCP45	0.96	0.66	1.32	0.11
RCP60	0.98	0.67	1.34	0.11
RCP85	0.97	0.66	1.32	0.11

Figure 5.1.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

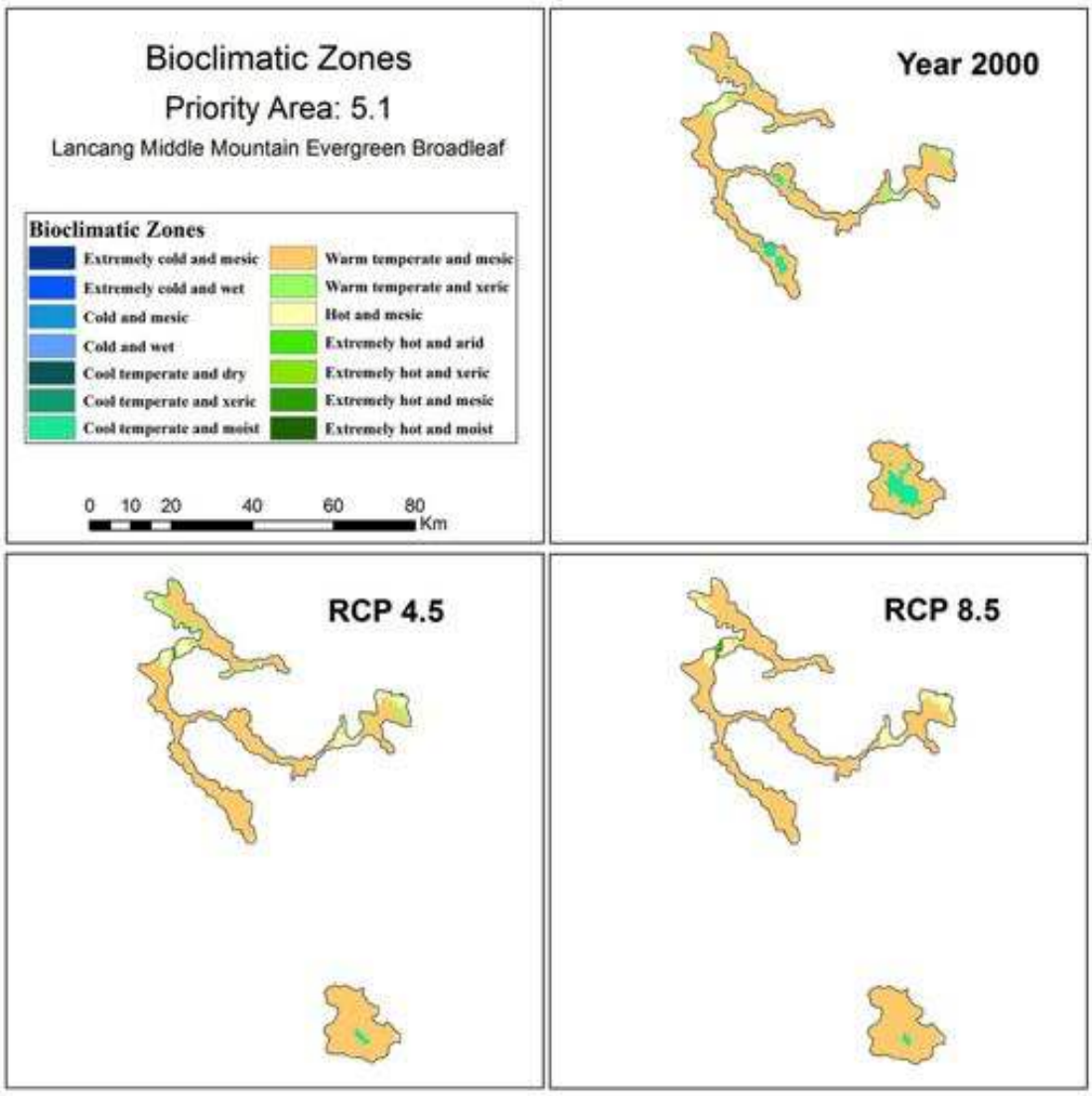


Table 5.1.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.1

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cool temperate and moist	J	20	17	(3)	(15)	3000	3024	25
Warm temperate and mesic	K	723	570	(153)	(21)	2403	2483	80
Warm temperate and xeric	L	34		(34)	(100)	1751		
Extremely hot and mesic	M		2	2			1139	
Hot and mesic	N	32	218	186	581	1429	1979	550
Extremely hot and moist	R		2	2			1215	

Figure 5.1.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

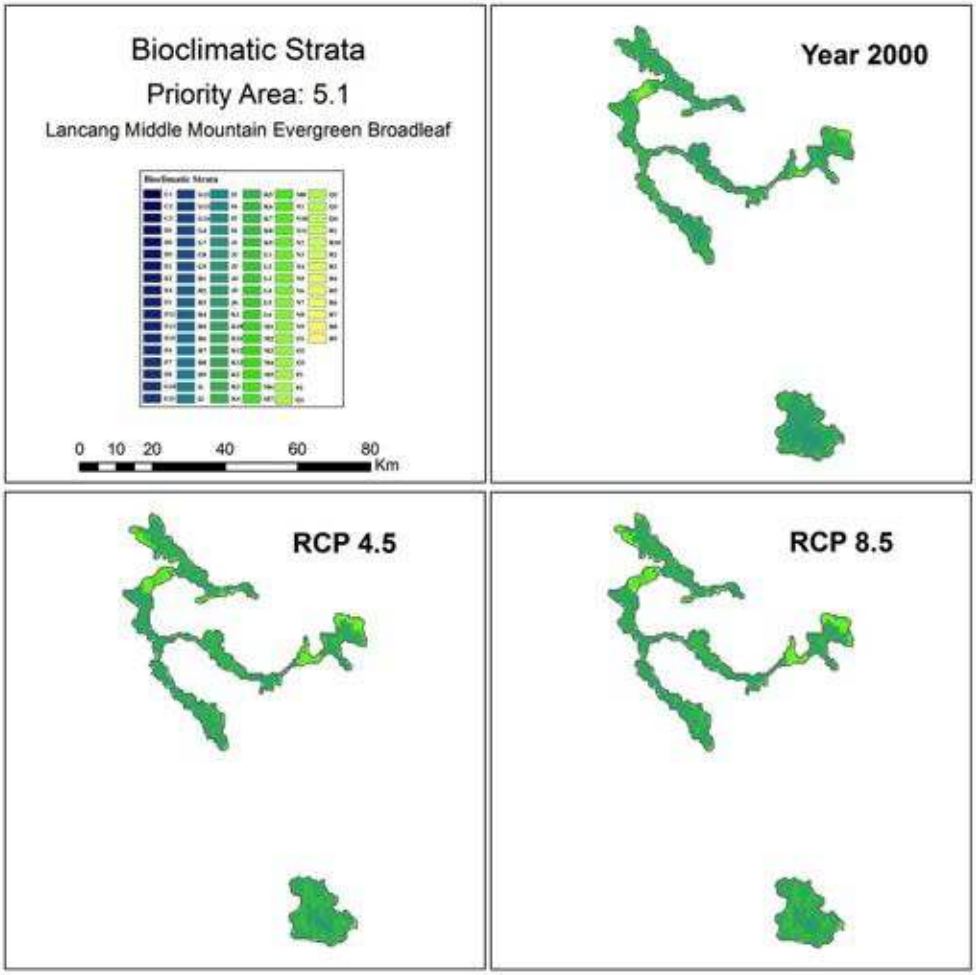


Table 5.1.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.1

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cool temperate and moist	J3	19	-	-	-	3008	-	-
Cool temperate and moist	J4	-	17	-	-	-	3024	-
Cool temperate and moist	J5	1	-	-	-	2843	-	-
Warm temperate and mesic	K1	304	19	(285)	(94)	2599	2818	219
Warm temperate and mesic	K5	238	4	(234)	(98)	2356	2639	283
Warm temperate and mesic	K7	-	134	-	-	-	2651	-
Warm temperate and mesic	K10	181	329	148	82	2137	2430	-
Warm temperate and mesic	K13	-	84	-	-	-	2339	-
Warm temperate and xeric	L3	34	-	(34)	(100)	1751	-	-
Hot and mesic	N2	7	143	136	1,943	1624	2138	514
Hot and mesic	N4	13	-	(13)	(100)	1504	-	-
Hot and mesic	N5	11	50	39	355	1246	1791	545
Hot and dry	N9	-	15	-	-	-	1532	-
Hot and mesic	N11	1	10	9	900	1095	1314	219
Extremely hot and mesic	M4	-	2	-	-	-	1139	-
Extremely hot and moist	R1	-	2	-	-	-	1215	-

Figure 5.1.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

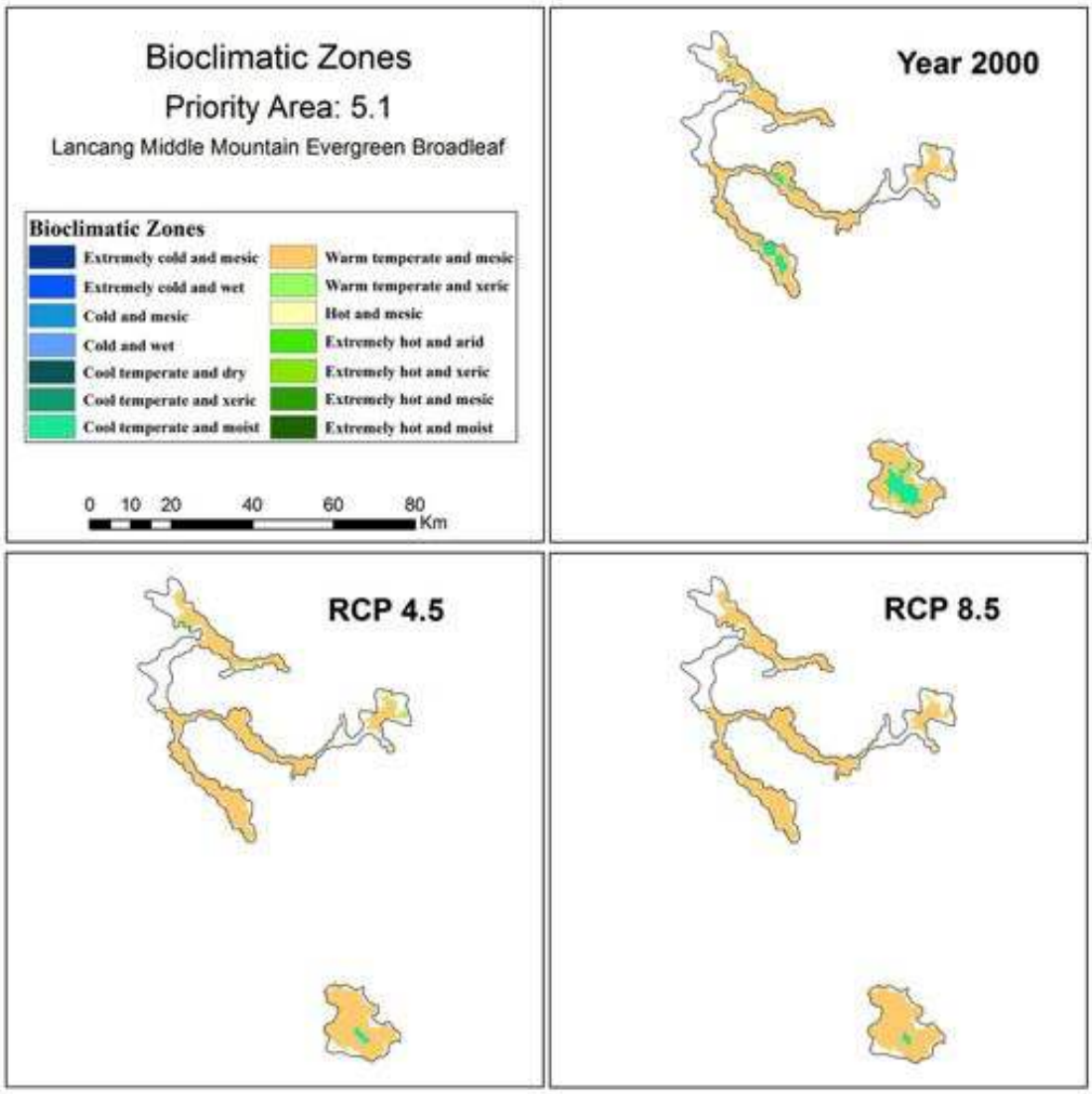


Table 5.1.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.1

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Cool temperate and moist	J	20	17	(3)	(15)	2959	2988	29
Warm temperate and mesic	K	513	449	(64)	(12)	2459	2496	37
Warm temperate and xeric	L	3	-	-	-	1893	-	-
Hot and mesic	N	1	71	70	7000	1596	2202	606

Priority Area: 5.2

Wuliang Mountain Humid Evergreen Broadleaf Forest

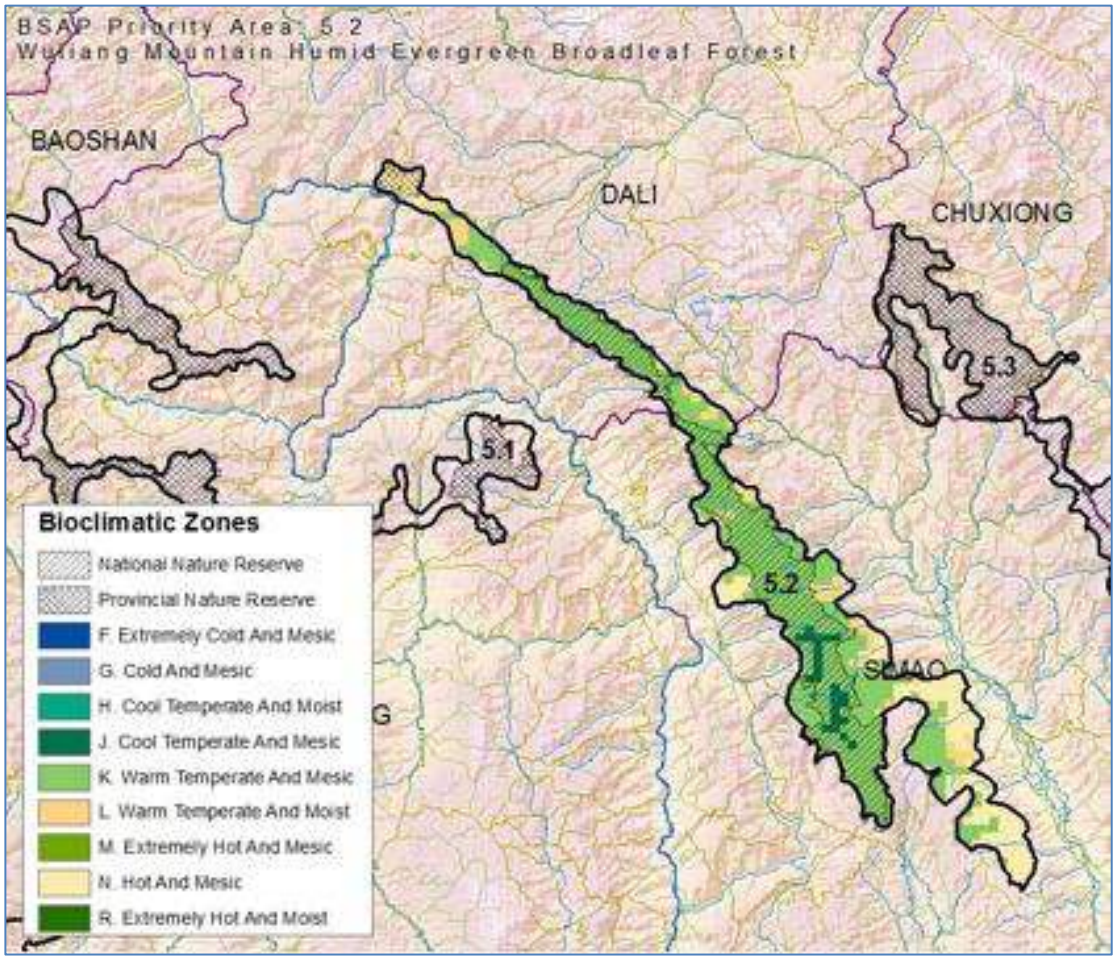
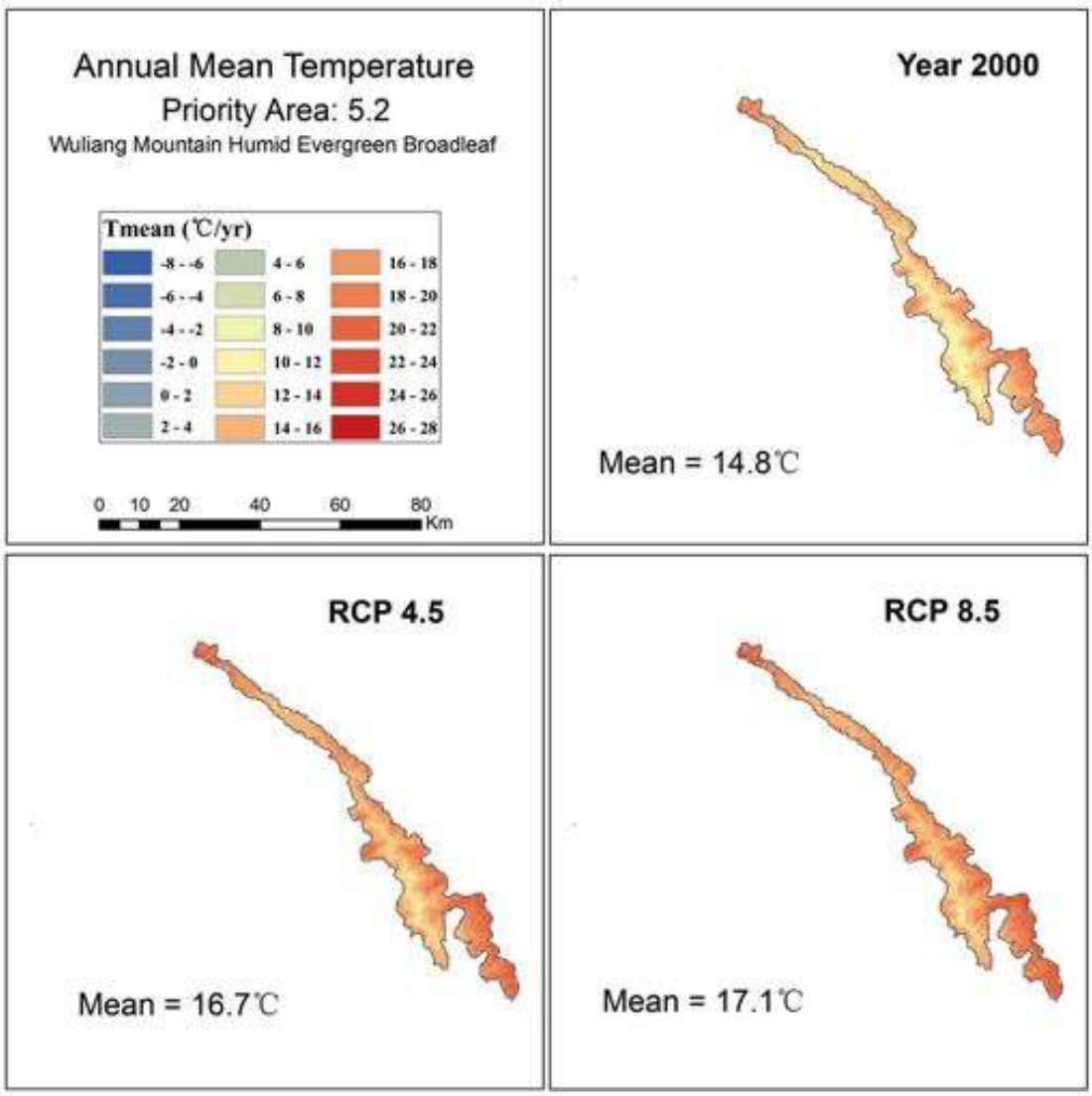


Table 5.2.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Priority Area: 5.2

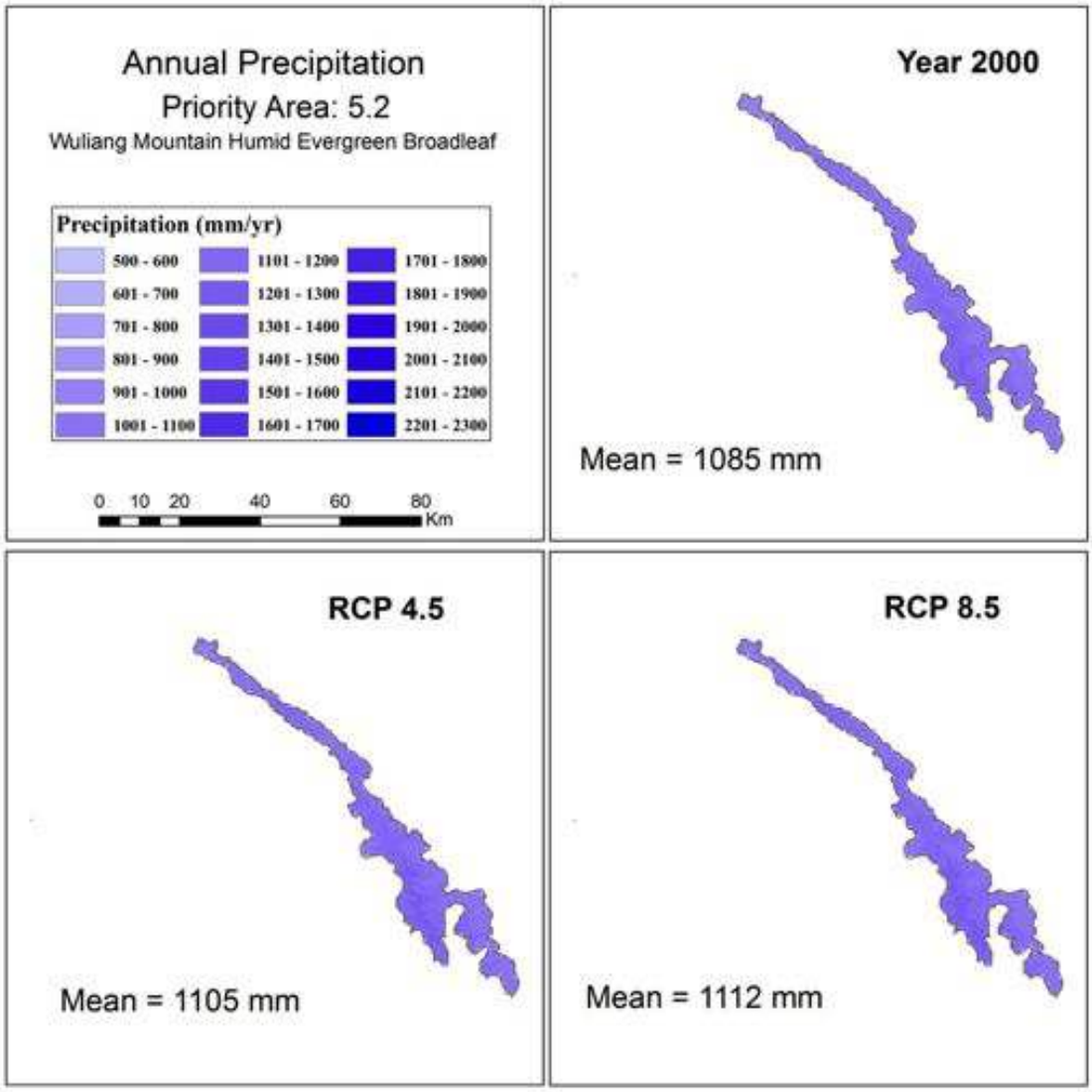
Bioclimatic Zone	Zone	Area	Mean Elev	Mean Temp	Annual Precip	Annual PET	Aridity Index
		km^2	m asl	° C	mm	mm	
Cool temperate and moist	J	24	2903	10.6	1199	1042	1.15
Warm temperate and mesic	K	485	2343	13.8	1107	1170	0.95
Warm temperate and xeric	L	66	1911	16.3	1037	1274	0.82
Hot and mesic	N	125	1646	17.8	1032	1338	0.77

Figure 5.2.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



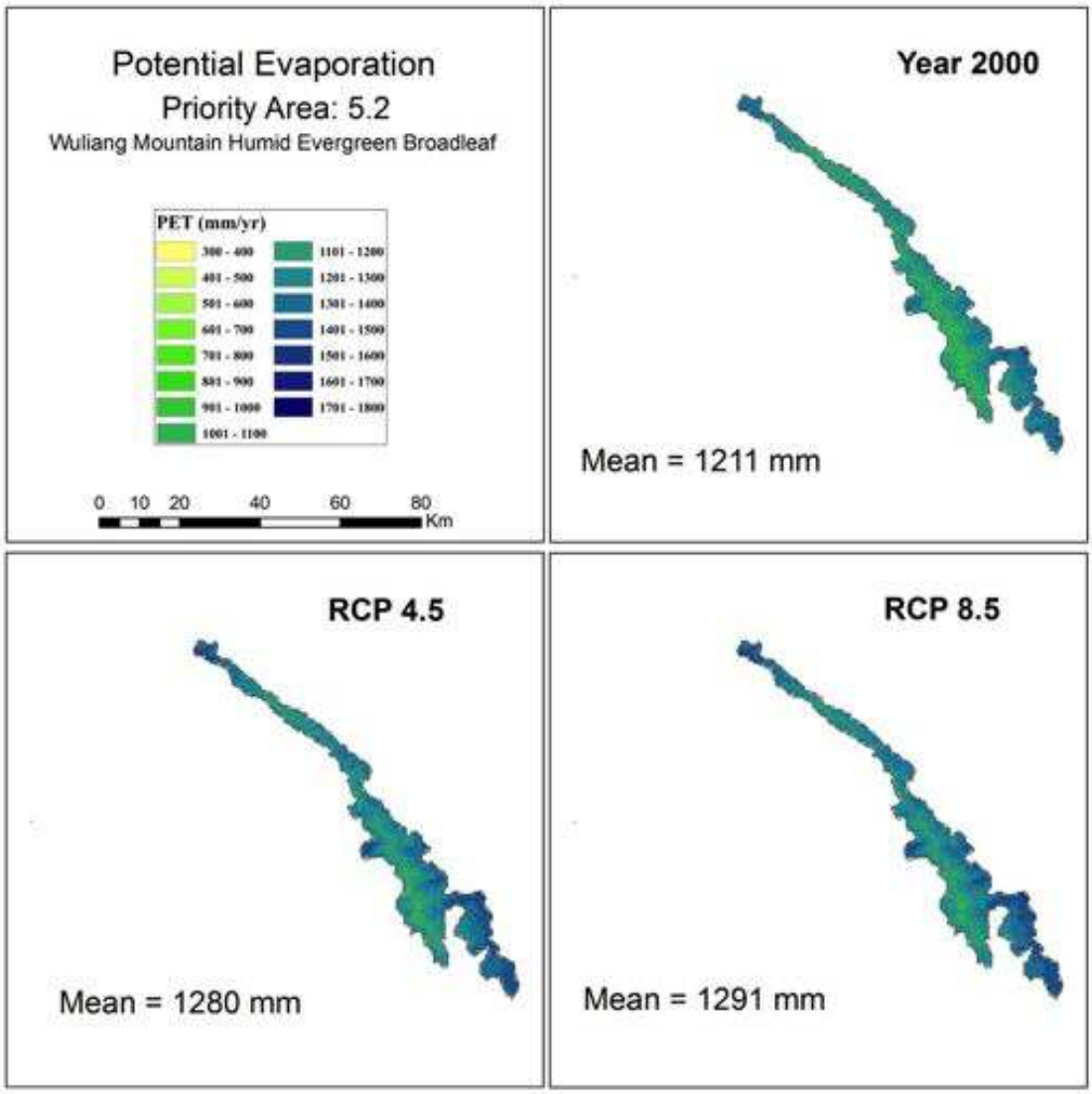
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	14.8	9.0	20.5	2.4
RCP26	16.3	10.5	22.0	2.4
RCP45	16.7	11.0	22.5	2.4
RCP60	16.3	10.6	22.1	2.4
RCP85	17.1	11.4	22.9	2.4

Figure 5.2.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



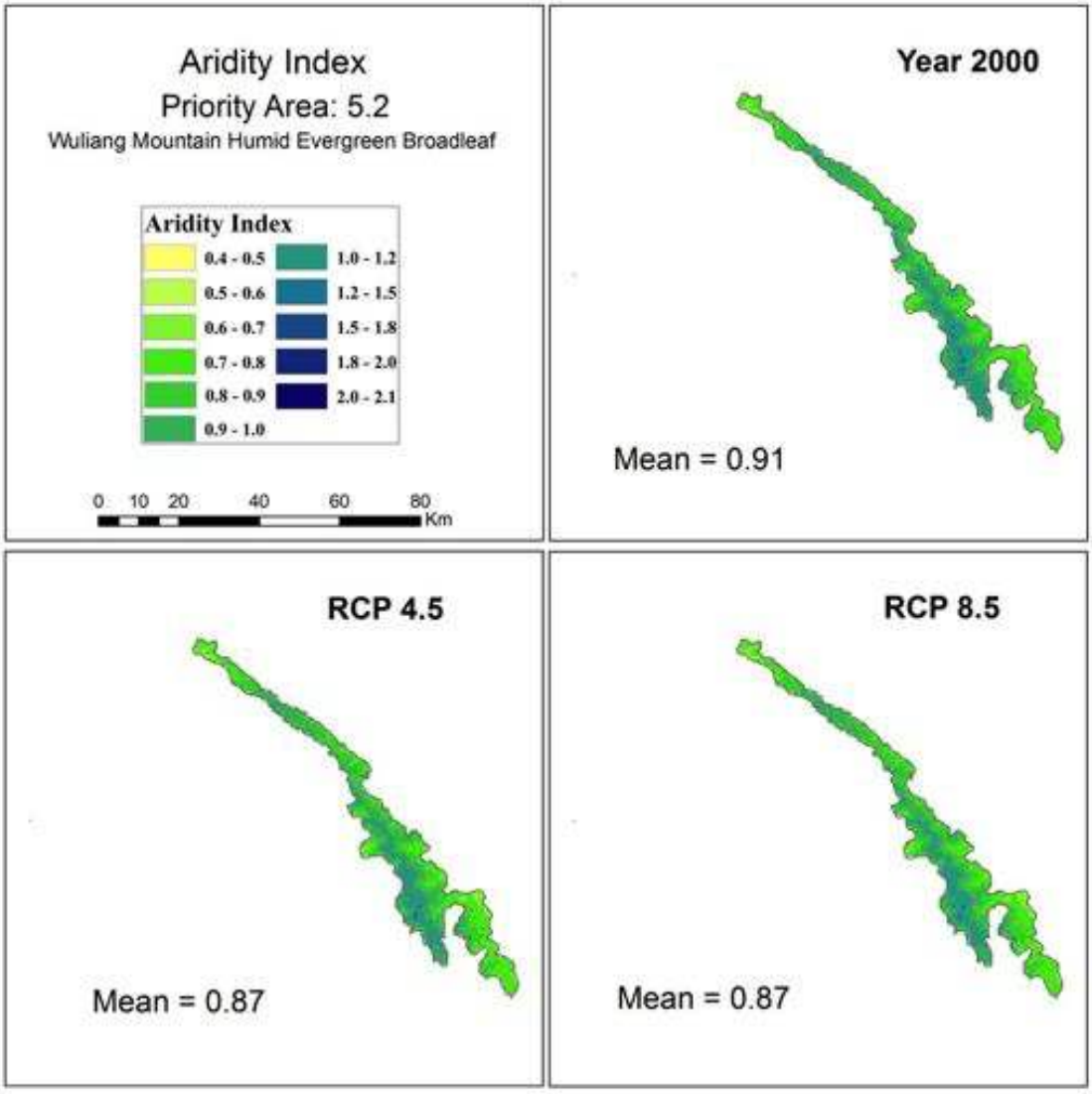
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1085	958	1240	60
RCP26	1102	972	1259	61
RCP45	1105	975	1262	60
RCP60	1091	963	1245	59
RCP85	1113	981	1271	61

Figure 5.2.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1212	976	1462	100
RCP26	1271	1034	1524	100
RCP45	1280	1044	1531	100
RCP60	1253	1020	1502	99
RCP85	1292	1055	1543	100

Figure 5.2.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	0.91	0.66	1.27	0.12
RCP26	0.88	0.64	1.22	0.12
RCP45	0.87	0.64	1.21	0.11
RCP60	0.88	0.64	1.22	0.12
RCP85	0.87	0.64	1.21	0.11

Figure 5.2.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

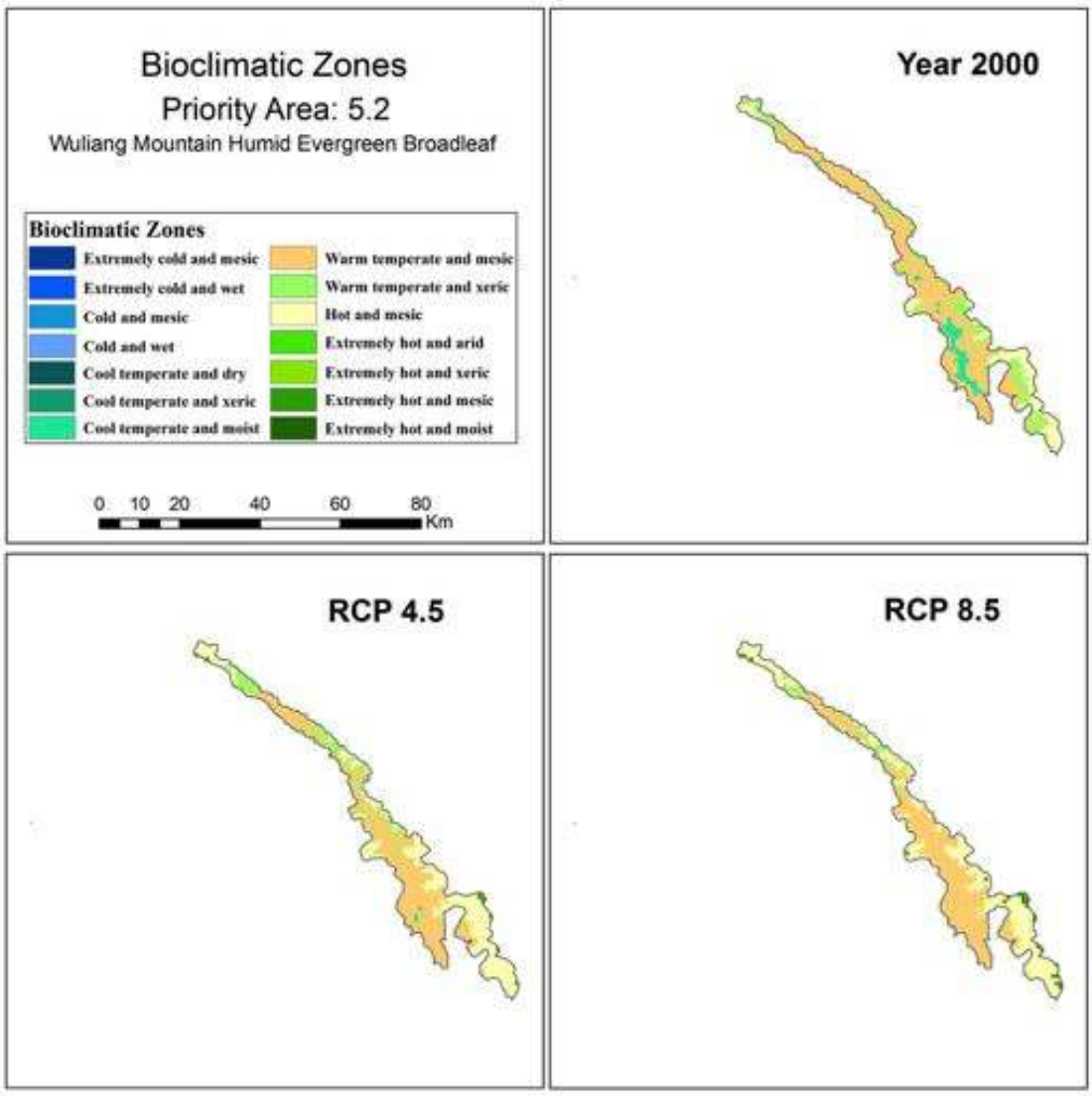


Table 5.2.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.2

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cool temperate and moist	J	24	2	(22)	(92)	2951	3017	66
Warm temperate and mesic	K	471	303	(168)	(36)	2359	2542	183
Warm temperate and xeric	L	64		(64)	(100)	1873		
Extremely hot and mesic	M		3	3			1337	
Hot and mesic	N	132	380	248	188	1603	1919	316
Extremely hot and moist	R		3	3			1264	

Figure 5.2.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

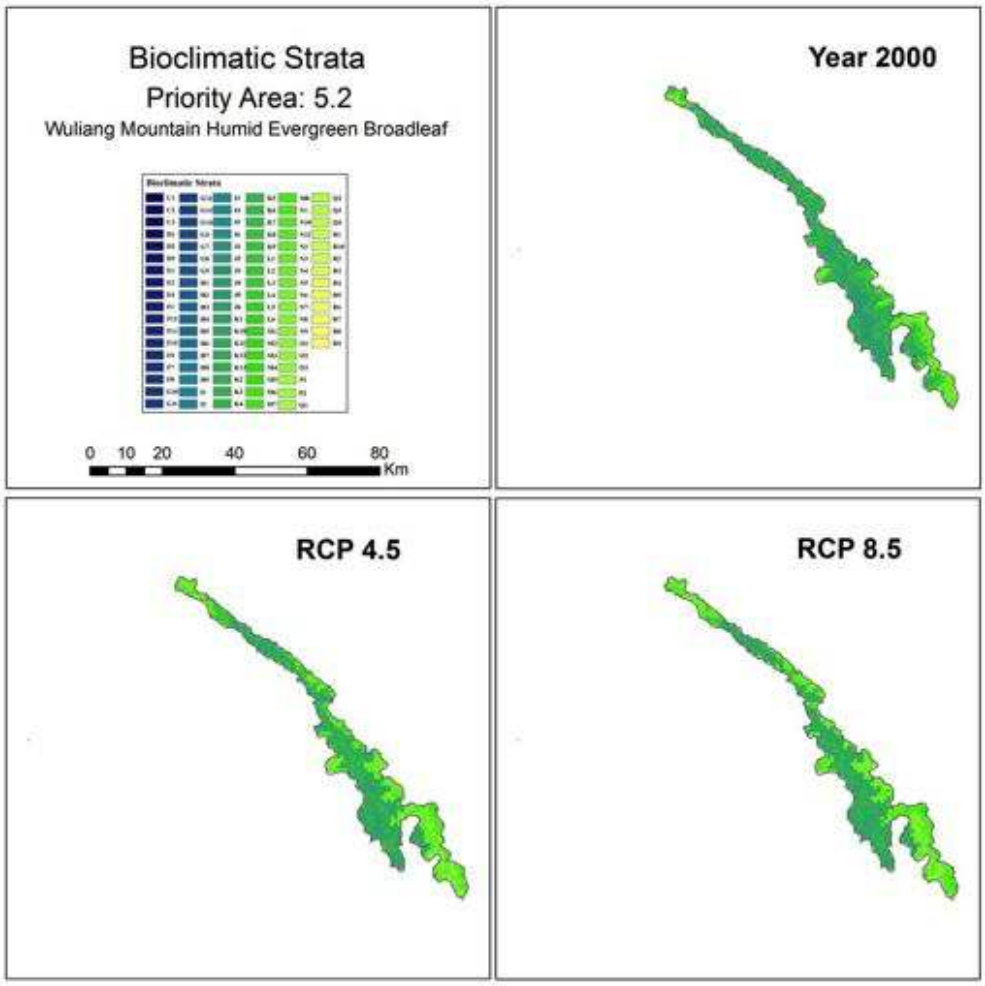


Table 5.2.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.2

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cool temperate and moist	J3	22	-	-	-	2952	-	-
Cool temperate and moist	J4	-	2	-	-	-	3017	-
Cool temperate and moist	J5	2	-	-	-	2932	-	-
Warm temperate and mesic	K1	134	42	(92)	(69)	2641	2883	242
Warm temperate and mesic	K5	140	2	(138)	(99)	2394	2622	227
Warm temperate and mesic	K7	-	7	-	-	-	2731	-
Warm temperate and mesic	K10	197	251	54	27	2141	2479	338
Warm temperate and mesic	K13	-	1	-	-	-	2378	-
Warm temperate and xeric	L3	64	-	-	-	1873	-	-
Hot and mesic	N2	59	162	103	175	1722	2163	441
Hot and mesic	N4	39	4	(35)	(90)	1591	1995	404
Hot and mesic	N5	32	118	86	269	1423	1869	446
Hot and mesic	N9	-	59	-	-	-	1628	-
Hot and mesic	N11	2	37	35	1,750	1212	1468	-
Extremely hot and mesic	M6	-	3	-	-	-	1337	-
Extremely hot and moist	R1	-	3	-	-	-	1264	-

Figure 5.2.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

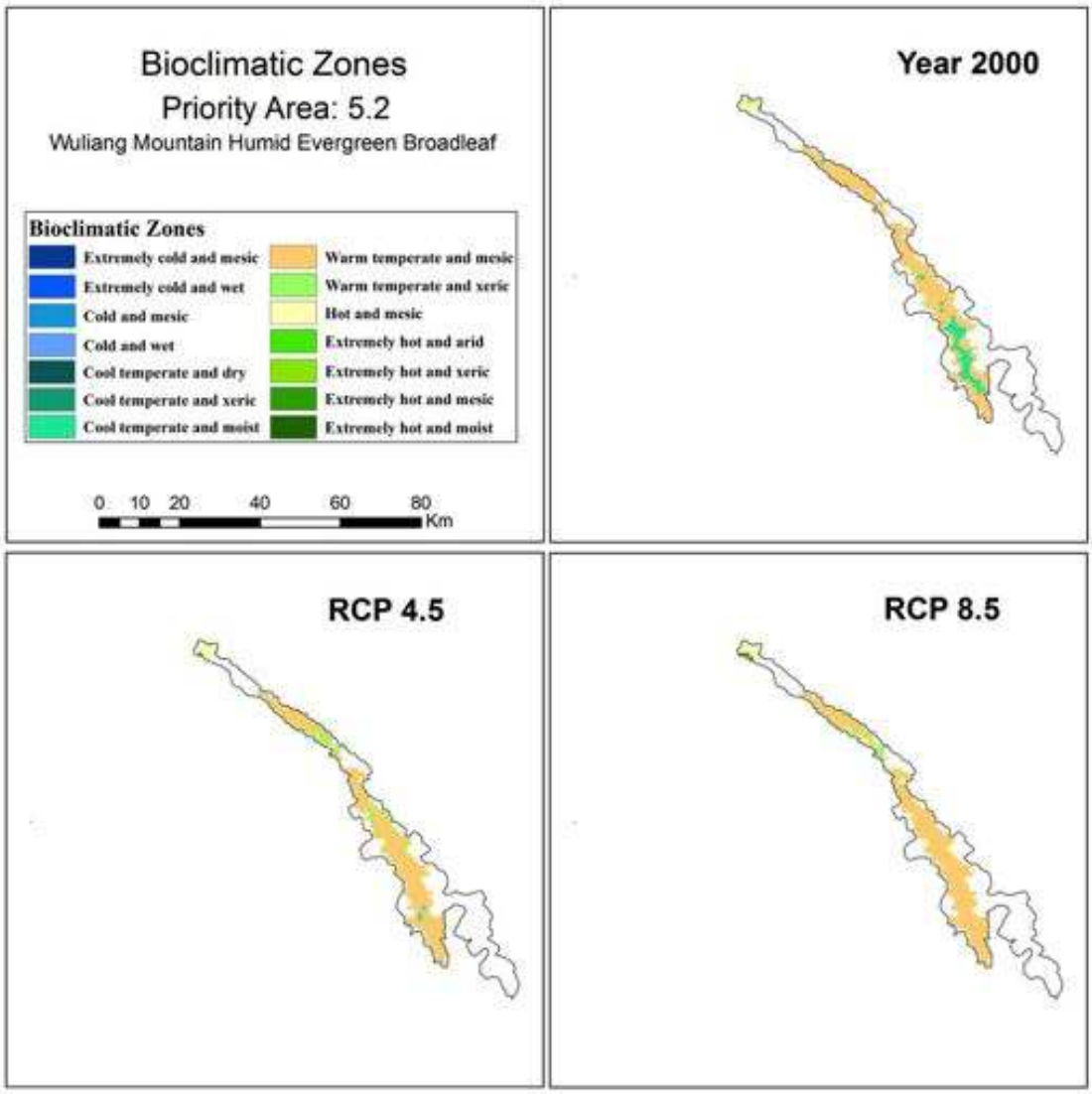


Table 5.2.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.2

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Cool temperate and moist	J	24	2	(22)	(92)	2945	3134	189
Warm temperate and mesic	K	269	237	(32)	(12)	2461	2552	91
Warm temperate and xeric	L	7	-	-	-	1943	*	-
Hot and mesic	N	14	74	60	429	1488	2091	603
Extremely hot and moist	R	-	1	-	-	-	1235	-

Priority Area: 5.3

Ailao Mountain Humid Evergreen Broadleaf Forest

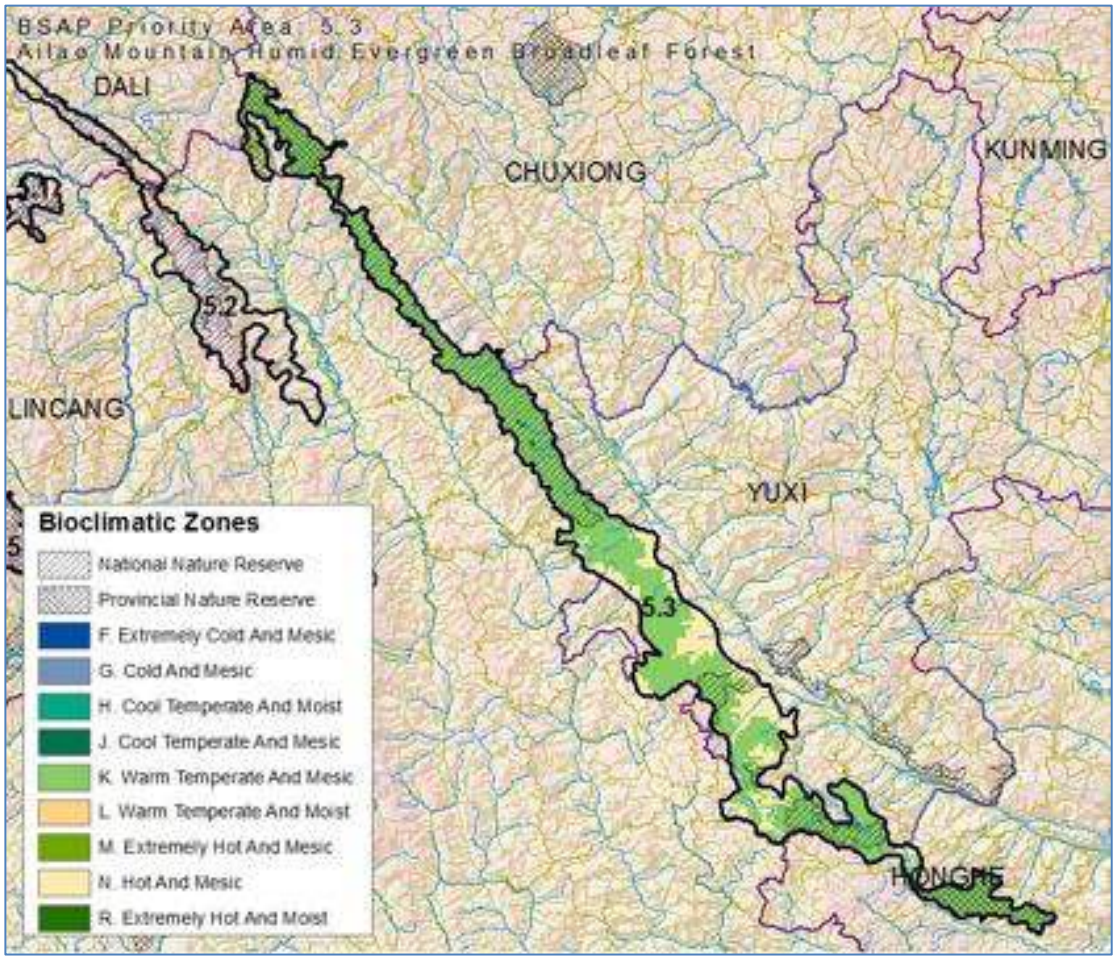
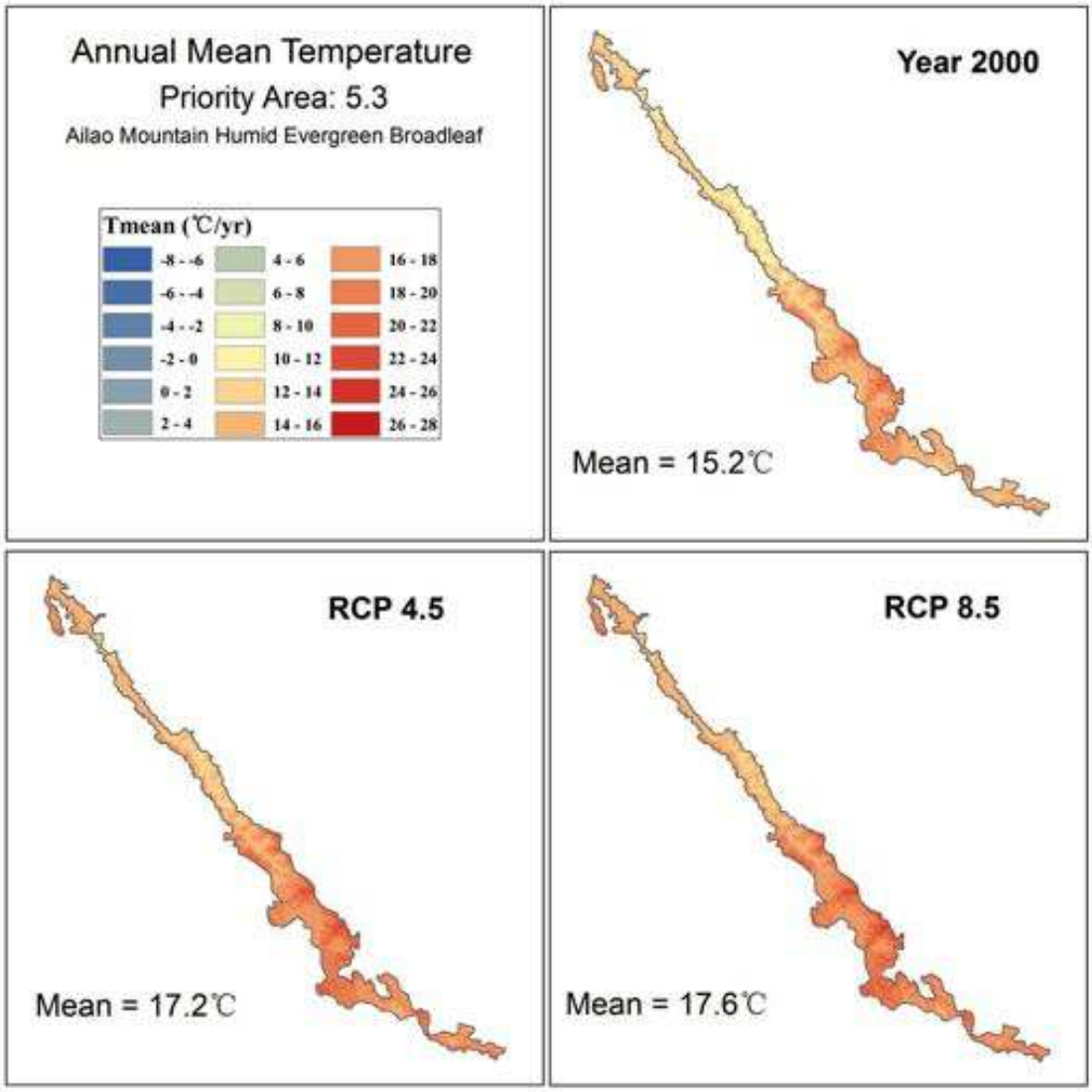


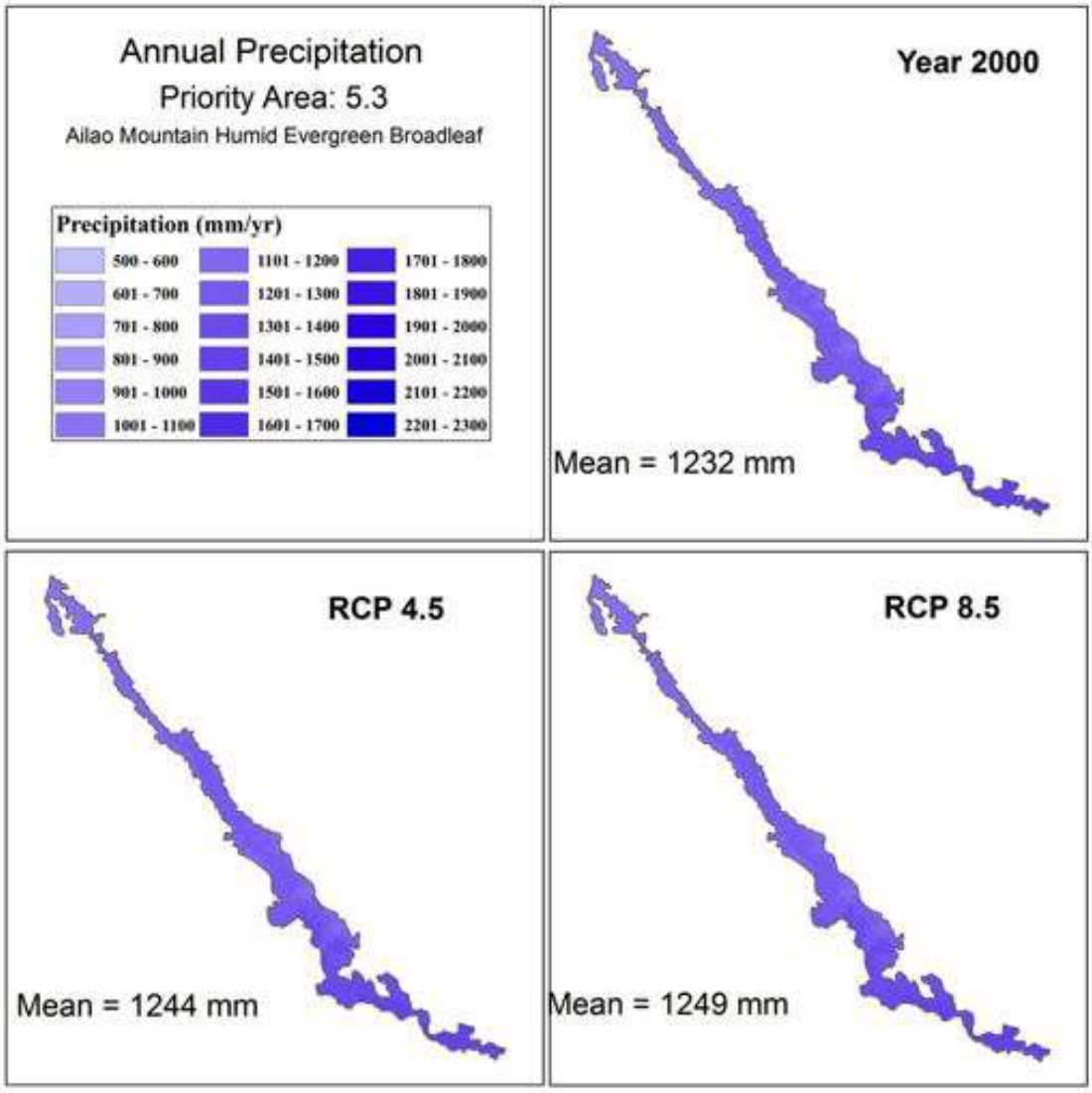
Table 5.3.1: Characteristics of the bioclimatic zones found within the priority area including areal extent, mean annual temperature, mean annual precipitation, mean potential evapotranspiration (PET), and aridity-wetness index (higher values are interpreted as wetter conditions).

Figure 5.3.1: Spatial distribution of mean annual temperature showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



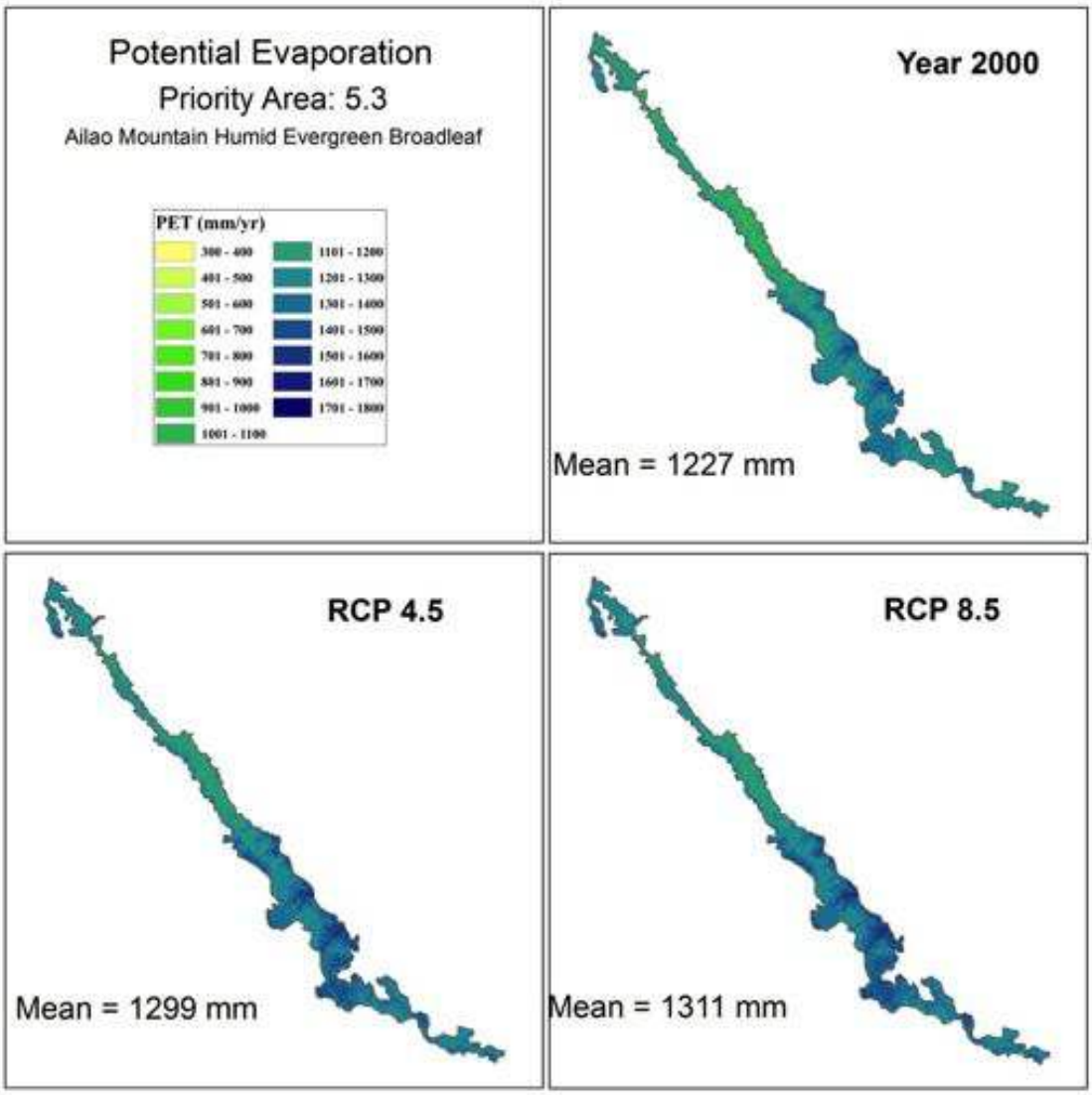
RCP	Mean annual temperature (℃)			
	Mean	Min	Max	Std
2000	15.2	10.0	22.3	2.2
RCP26	16.8	11.5	23.8	2.2
RCP45	17.2	12.0	24.3	2.2
RCP60	16.8	11.6	23.9	2.2
RCP85	17.6	12.4	24.7	2.2

Figure 5.3.2: Spatial distribution of annual precipitation showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



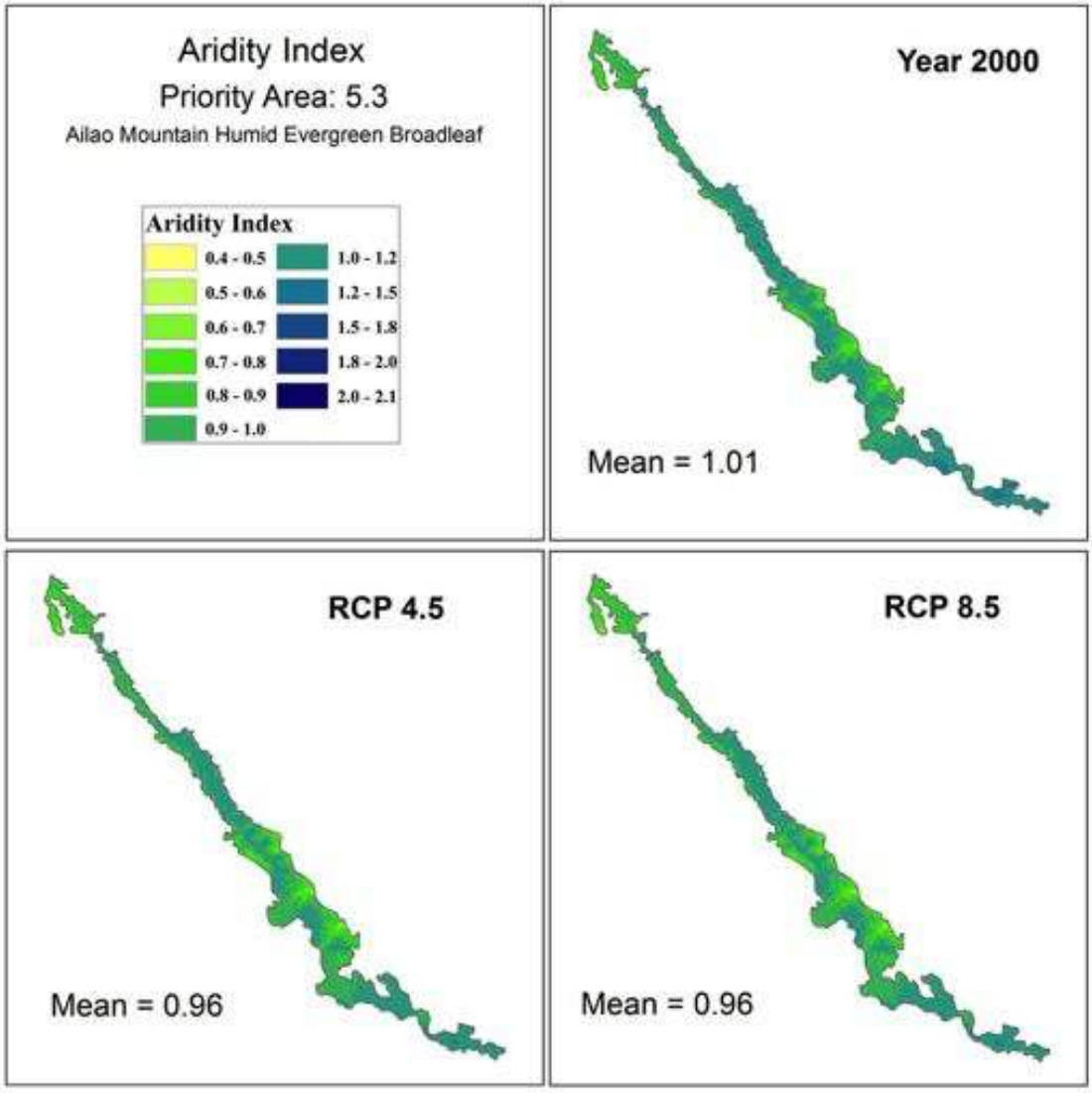
RCP	Annual Precipitation (mm/yr)			
	Mean	Min	Max	Std
2000	1233	882	1471	113
RCP26	1241	890	1473	111
RCP45	1245	896	1474	109
RCP60	1218	881	1430	103
RCP85	1250	899	1482	110

Figure 5.3.3: Spatial distribution of potential evapotranspiration (PET) showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.



RCP	PET (mm/yr)			
	Mean	Min	Max	Std
2000	1227	1008	1534	95
RCP26	1290	1067	1601	96
RCP45	1299	1076	1610	96
RCP60	1271	1051	1578	95
RCP85	1311	1089	1622	96

Figure 5.3.4: Spatial distribution of the aridity-wetness index showing current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5. (Higher values indicate wetter conditions).



RCP	Aridity Index			
	Mean	Min	Max	Std
2000	1.01	0.60	1.31	0.12
RCP26	0.97	0.58	1.24	0.11
RCP45	0.96	0.58	1.23	0.11
RCP60	0.96	0.58	1.22	0.10
RCP85	0.96	0.58	1.23	0.11

Figure 5.3.5: Distribution of bioclimatic zones within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

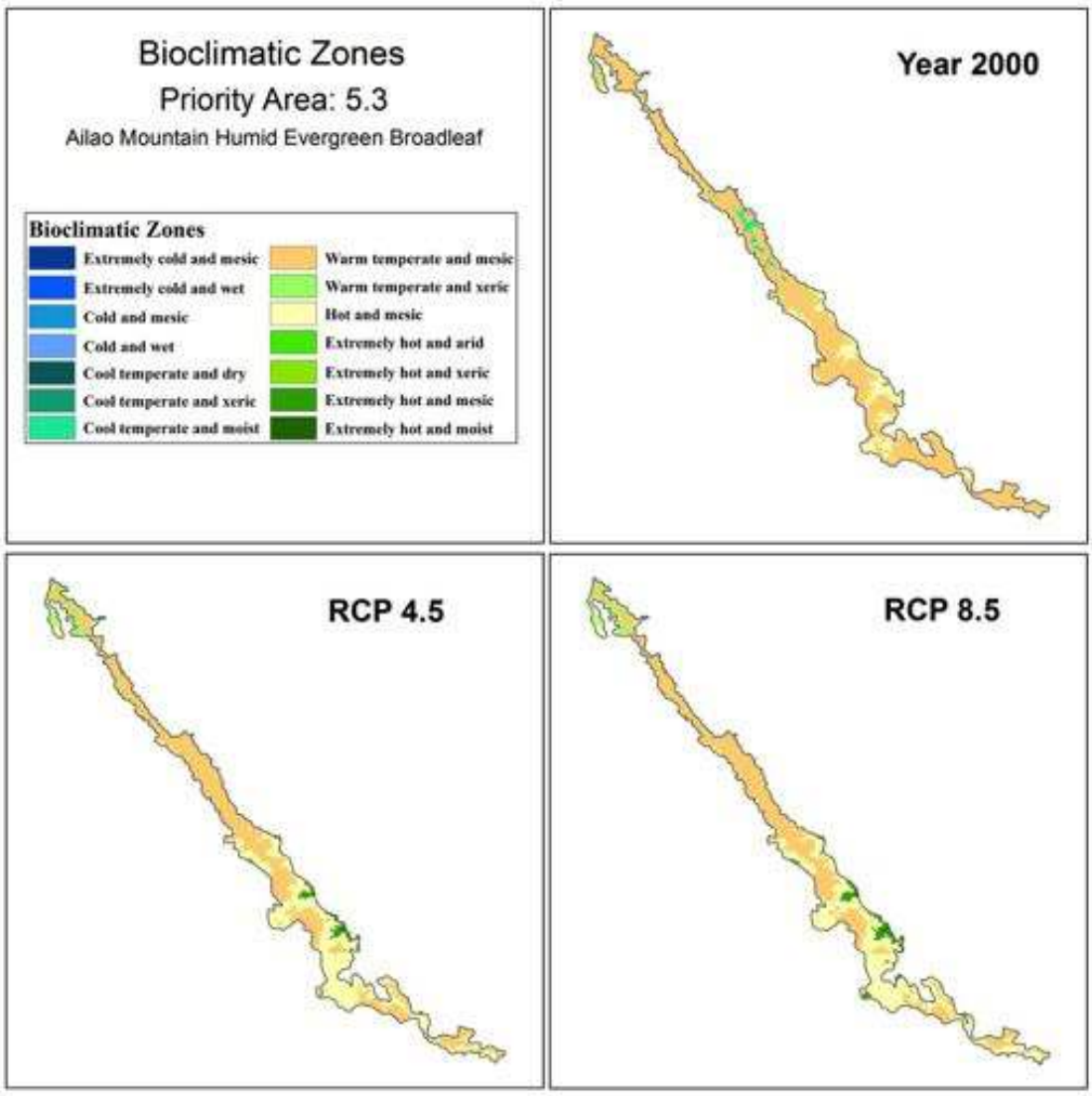


Table 5.3.2: Projected change in areal extent and mean elevation of bioclimatic zones and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.3

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cool temperate and moist	J	3		(3)	(100)	2957		
Warm temperate and mesic	K	1815	1063	(752)	(41)	2227	2419	192
Warm temperate and xeric	L	37	4	(33)	(89)	1921	2290	369
Extremely hot and mesic	M	3	68	65	2,167	1066	1419	353
Hot and mesic	N	412	1083	671	163	1554	1873	319
Extremely hot and moist	R		52	52			1168	

Figure 5.3.6: Distribution of bioclimatic strata within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

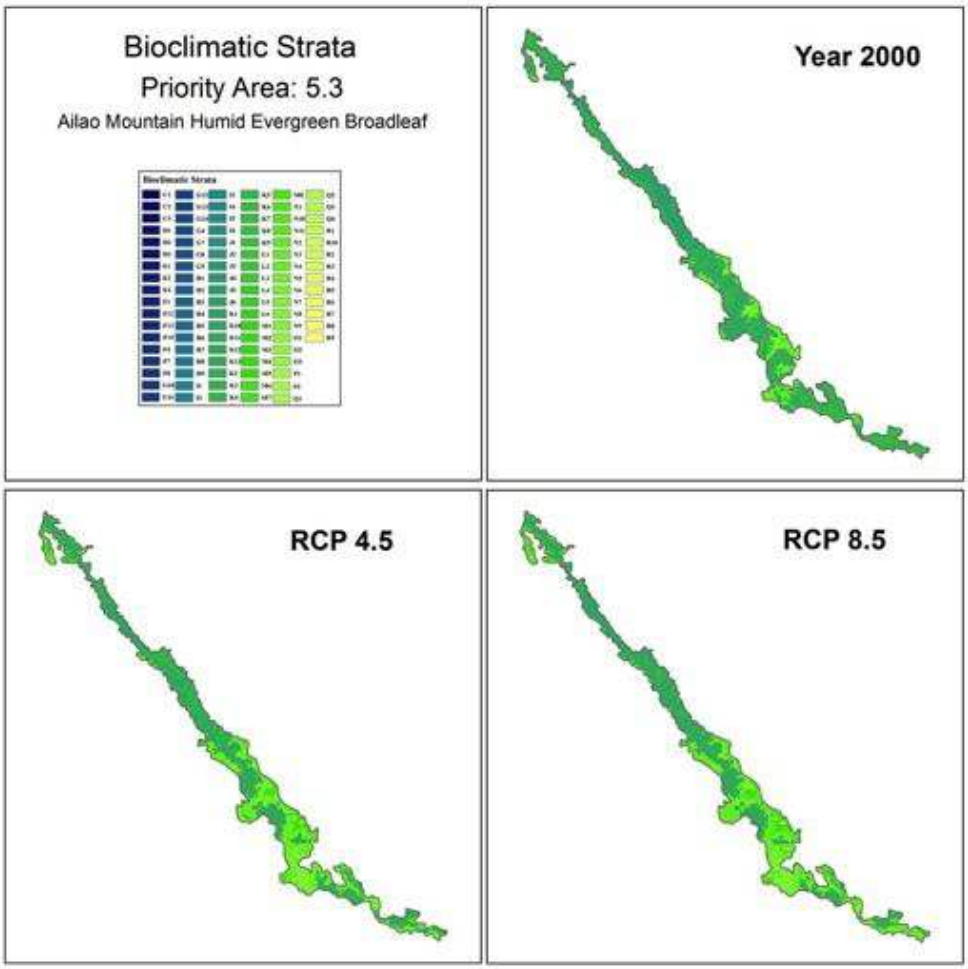


Table 5.3.3: Projected change in areal extent and mean elevation of bioclimatic strata and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.3

Bioclimatic Zone	Zone	Area (km^2)		Area Change		Mean Elevation (m asl)		Upward Shift
		2000	RCP85	(km^2)	%	2000	RCP85	(m)
Cool temperate and moist	J3	3	-	-	-	2957	-	-
Warm temperate and mesic	K1	424	26	(398)	(94)	2633	2852	219
Warm temperate and mesic	K5	226	10	(216)	(96)	2429	2735	306
Warm temperate and mesic	K7	219	142	(77)	(35)	2190	2690	500
Warm temperate and mesic	K10	369	387	18	5	2188	2528	340
Warm temperate and mesic	K13	577	498	(79)	(14)	1889	2228	339
Warm temperate and xeric	L3	37	4	(33)	(89)	1921	2290	369
Hot and mesic	N2	113	141	28	25	1765	2235	470
Hot and mesic	N3	120	373	253	211	1591	1912	321
Hot and mesic	N4	6	29	23	383	1729	2030	301
Hot and mesic	N5	112	180	68	61	1481	1938	457
Hot and mesic	N8	8	99	91	1,138	1410	1689	279
Hot and mesic	N9	12	208	196	1,633	1269	1664	395
Hot and mesic	N11	41	53	12	29	1147	1483	336
Extremely hot and mesic	M3	1	1	0	-	1116	1641	525
Extremely hot and mesic	M4	2	67	65	3,250	1042	1416	375
Extremely hot and moist	R1	-	52	-	-	-	1168	-

Figure 5.3.7: Distribution of Protected Area within the Priority Area, under current conditions (as averaged from 1960-2000), and as projected for the year 2050 under emission scenarios RCP 4.5 and RCP 8.5.

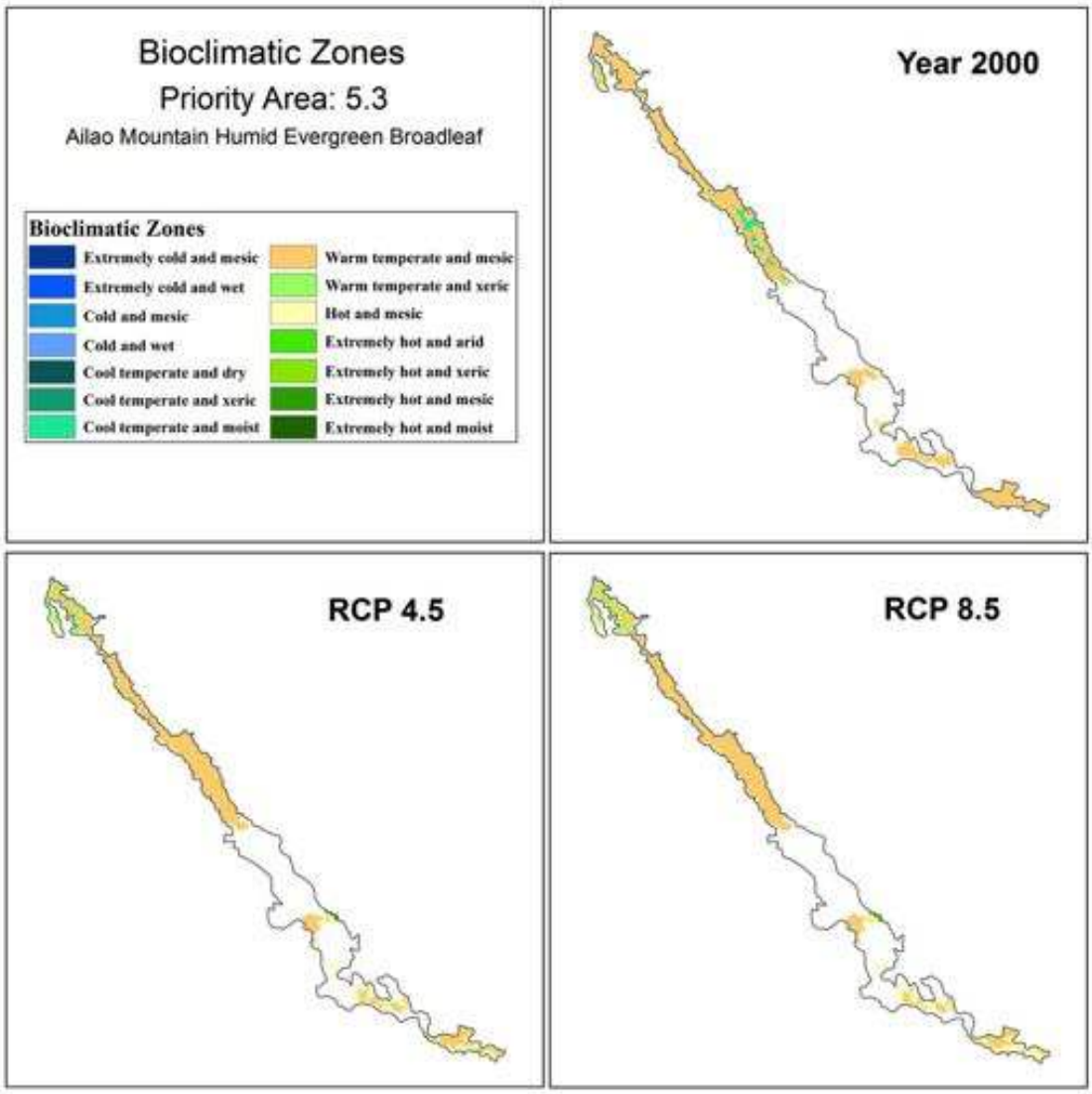


Table 5.3.4: Projected change in areal extent and mean elevation of bioclimatic strata within Protected Area, and their upward shift by 2050 under the RCP 8.5 emission scenario.

Priority Area: 5.3

Bioclimatic Zone	Zone	Protected Area (km^2)		Area Change		Mean Elevation (m asl)		Shift
		2000	RCP85	km^2	%	2000	RCP85	(m)
Cool temperate and moist	J	3	-	-	-	2922	-	-
Warm temperate and mesic	K	1015	708	(307)	(30)	2373	2499	126
Warm temperate and xeric	L	24	5	(19)	(79)	1919	2241	322
Extremely hot and mesic	M	-	3	-	-	-	1376	-
Hot and mesic	N	24	348	324	1350	1580	2053	473
Extremely hot and moist	R	-	2	-	-	-	1345	-

Appendix 2: CIMP 5 - Earth System Models

Table 2.1: CIMP 5 - Earth System Models (CIMP5-ESM) used in the spatial analysis of projected climate change for the year 2050. CIMP5-ESM were downscaled to 1 km resolution using the delta method with the WorldClim dataset used as a baseline (Hijmans et al, 2008).

CENTER	COUNTRY	CIMP5 - ESM	RCP 2.6	RCP 4.5	RCP 6.0	RCP 8.5
Commonwealth Scientific and Industrial Research Organization and Bureau of Meteorology	Australia	ACCESS1-0		X		X
Beijing Climate Center, China Meteorological Administration	China	BCC-CSM1-1	X	X	X	X
National Center for Atmospheric Research	United States	CCSM4	X	X	X	X
National Science Foundation	United States	CESM1-CAM5-1-FV2		X		
Centre National de Recherches Meteorlogiques/Centre Europeen de Recherche et Formation Avancee en Calcul Scientifique	France	CNRM-CM5	X	X		X
NOAA Geophysical Fluid Dynamics Laboratory	United States	GFDL-CM3	X	X		X
NOAA Geophysical Fluid Dynamics Laboratory	United States	GFDL-ESM2G	X	X	X	
NASA Goddard Institute for Space Studies	United States	GISS-E2-R	X	X	X	X
Met Office Hadley Centre	UK	HadGEM2-AO	X	X	X	X
Met Office Hadley Centre	UK	HadGEM2-CC		X		X
Met Office Hadley Centre	UK	HadGEM2-ES	X	X	X	X
Institute for Numerical Mathematics	Russia	INMCM4		X		X
Institut Pierre-Simon Laplace	France	IPSL-CM5A-LR	X	X	X	X
Ocean Research Institute and National Institute for Environmental Studies	Japan	MIROC-ESM-CHEM	X	X	X	X
Japan Agency for Marine-Earth Science and Technology	Japan	MIROC-ESM	X	X	X	X
Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology	Japan	MIROC5	X	X	X	X
Max Planck Institut für Meteorologic	Germany	MPI-ESM-LR	X	X		X
Meteorological Research Institute	Japan	MRI-CGCM3	X	X	X	X
Norwegian Climate Centre	Norway	NorESM1-M	X	X	X	X

Appendix 3: Summary Statistics for Yunnan Province:

Change in Area and Mean Elevation of Bioclimatic Zones and Strata as projected for the year 2050, when compared with current conditions.

Table 3.1: Changes in the areal extent of bioclimatic zones in Yunnan Province under current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under all RCPs.

Bioclimatic Zone	Zone	Area (km^2)				
		2000	RCP26	RCP45	RCP60	RCP85
Extremely cold and mesic	F	5,864	2,775	2,144	2,750	1,392
Cold and mesic	G	18,161	13,091	11,841	12,744	10,678
Cool temperate and xeric	H	848	3,371	3,427	3,596	3,952
Cool temperate and moist	I	20,102	15,368	14,047	15,852	12,337
Warm temperate and mesic	K	175,516	125,896	102,475	116,394	91,083
Warm temperate and xeric	L	30,968	37,236	31,616	40,054	26,772
Extremely hot and mesic	M	17,552	38,573	45,355	37,556	52,835
Hot and mesic	N	113,416	143,269	150,288	139,679	153,809
Extremely hot and moist	R	1,299	14,207	22,533	15,121	30,868

Bioclimatic Zone	Zone	Change in Area (km^2)					
		2000	RCP26	RCP45	RCP60	RCP85	RCP Average
Extremely cold and mesic	F	5864	(3,089)	(3,720)	(3,114)	(4,472)	(3,599)
Cold and mesic	G	18161	(5,070)	(6,320)	(5,417)	(7,483)	(6,073)
Cool temperate and xeric	H	848	2,523	2,579	2,748	3,104	2,739
Cool temperate and moist	I	20102	(4,734)	(6,055)	(4,250)	(7,765)	(5,701)
Warm temperate and mesic	K	175516	(49,620)	(73,041)	(59,122)	(84,433)	(69,069)
Warm temperate and xeric	L	30968	6,268	648	9,086	(4,196)	2,947
Extremely hot and mesic	M	17552	21,021	27,803	20,004	35,283	26,028
Hot and mesic	N	113416	29,853	36,872	26,263	40,393	33,345
Extremely hot and moist	R	1299	12,908	21,234	13,822	29,569	19,383

Bioclimatic Zone	Zone	Percent Change in Area (%)					
		2000	RCP26	RCP45	RCP60	RCP85	RCP Average
Extremely cold and mesic	F	5864	(53)	(63)	(53)	(76)	(61)
Cold and mesic	G	18161	(28)	(35)	(30)	(41)	(33)
Cool temperate and xeric	H	848	298	304	324	366	323
Cool temperate and moist	I	20102	(24)	(30)	(21)	(39)	(28)
Warm temperate and mesic	K	175516	(28)	(42)	(34)	(48)	(39)
Warm temperate and xeric	L	30968	20	2	29	(14)	10
Extremely hot and mesic	M	17552	120	158	114	201	148
Hot and mesic	N	113416	26	33	23	36	29
Extremely hot and moist	R	1299	994	1,635	1,064	2,276	1,492

Table 3.2: Changes in the mean elevation of bioclimatic zones in Yunnan Province under current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under all RCPs.

Bioclimatic Zone	Zone	Mean Elevation (m asl)					
		2000	RCP26	RCP45	RCP60	RCP85	RCP Average
Extremely cold and mesic	F	4242	4435	4504	4430	4596	4491
Cold and mesic	G	3516	3765	3834	3773	3909	3820
Cool temperate and xeric	H	3144	3423	3470	3413	3541	3464
Cool temperate and moist	J	2836	3065	3147	3059	3230	3125
Warm temperate and mesic	K	2005	2181	2240	2179	2312	2228
Warm temperate and xeric	L	1807	1999	2052	1977	2092	2030
Extremely hot and mesic	M	815	1083	1154	1088	1230	1139
Hot and mesic	N	1321	1544	1625	1537	1689	1598
Extremely hot and moist	R	620	779	855	789	950	833
Bioclimatic Zone	Zone	Upward Shift in Mean Elevation by 2050 (m)					
		2000	RCP26	RCP45	RCP60	RCP85	RCP Average
Extremely cold and mesic	F	4242	193	262	188	354	249
Cold and mesic	G	3516	250	318	257	393	304
Cool temperate and xeric	H	3144	279	326	279	397	320
Cool temperate and moist	J	2836	230	311	224	394	290
Warm temperate and mesic	K	2005	176	235	174	306	223
Warm temperate and xeric	L	1807	192	244	170	284	223
Extremely hot and mesic	M	815	267	338	273	414	323
Hot and mesic	N	1321	222	303	215	367	277
Extremely hot and moist	R	620	159	235	169	290	213
			219	288	217	356	269

Table 3.3: Areal extent of bioclimatic strata in Yunnan Province under current conditions (averaged from 1960-200) based on downscaled weather station data, and projected for the year 2050 under all RCPs.

Bioclimatic Zone	Strata	Area (km^2)				
		2000	RCP26	RCP45	RCP60	RCP85
Extremely cold and mesic						
	F8	624	130	96	126	70
	F13	3797	1146	934	1196	579
	F15	1443	1499	1114	1428	743
Cold and mesic						
	G7	983	1908	1729	2126	1642
	G8	298	226	117	221	66
	G11	11013	6895	6882	6977	6201
	G13	5867	4062	3113	3420	2769
Cool temperate and xeric						
	H5	848	3371	3427	3596	3952
Cool temperate and moist						
	J3	4990	3373	3228	3894	2542
	J4	729	1420	1231	1371	1128
	J5	14383	10575	9588	10587	8667
Warm temperate and mesic						
	K1	29360	11529	9836	11912	7979
	K2	243	177	163	177	153
	K5	38418	25323	21212	26579	18569
	K6	1123	1923	2560	2325	2021
	K7	14635	9189	6652	8298	6103
	K10	60185	43846	40764	44639	37692
	K11	758	1317	1145	1211	1187
	K13	30794	22532	20143	21253	17379
Warm temperate and xeric						
	L3	30968	37236	31616	40034	26772
Hot and mesic						
	N2	17368	17680	17814	18614	20663
	N3	25955	22532	20119	19991	20112
	N4	13138	27440	26775	28056	28636
	N5	17953	24394	30511	23721	34058
	N8	27034	19214	20338	16762	21348
	N9	1699	13126	15803	13145	14068
	N11	10269	18883	18928	19390	14924
Extremely hot and mesic						
	M1	-	16	43	20	117
	M2	4429	10639	12566	8242	11900
	M3	2195	7365	8619	7547	11749
	M4	8472	17303	19550	19466	24724
	M6	59	1100	900	957	666
	M7	2397	2150	3677	1324	3679
Extremely hot and moist						
	R1	1299	14207	22533	15121	30868

Table 3.4: Change in areal extent of bioclimatic strata in Yunnan Province under current conditions (averaged from 1960-200) based on downscaled weather station data, compared with projected distribution for the year 2050 under all RCPs.

Bioclimatic Zone	Strata	Area (km^2)	Change in Area (km^2)				
		2000	RCP26	RCP45	RCP60	RCP85	Average
Extremely cold and mesic							
	F8	626	(494)	(528)	(498)	(554)	(519)
	F13	3,797	(2,651)	(2,863)	(2,603)	(3,238)	(2,893)
	F15	1,443	56	(329)	(35)	(700)	(247)
Cold and mesic							
	G7	983	925	746	1,141	659	868
	G8	298	(72)	(181)	(77)	(232)	(141)
	G11	11,013	(4,158)	(4,151)	(4,036)	(4,812)	(4,274)
	G13	5,867	(1,805)	(2,754)	(2,447)	(3,098)	(2,526)
Cool temperate and xeric							
	H5	888	2,523	2,579	2,748	3,104	2,739
Cool temperate and moist							
	J3	4,090	(1,617)	(1,762)	(2,096)	(2,448)	(1,731)
	J4	729	691	902	642	399	659
	J5	14,585	(3,838)	(4,795)	(3,796)	(5,716)	(4,529)
Warm temperate and mesic							
	K1	29,360	(17,891)	(19,524)	(17,448)	(21,381)	(19,046)
	K2	243	(66)	(80)	(66)	(90)	(76)
	K5	38,418	(13,095)	(17,208)	(11,833)	(19,849)	(15,497)
	K6	1,123	800	1,437	1,202	898	1,084
	K7	14,635	(5,446)	(7,980)	(6,337)	(8,582)	(7,075)
	K10	60,185	(16,399)	(19,421)	(15,546)	(22,493)	(18,464)
	K11	758	559	387	453	429	457
	K13	30,794	(8,262)	(10,653)	(9,541)	(13,421)	(10,467)
Warm temperate and xeric							
	L3	30,968	6,268	648	9,066	(4,196)	2,947
Hot and mesic							
	N2	17,368	312	446	1,246	3,295	1,325
	N3	25,955	(3,423)	(5,836)	(5,964)	(5,843)	(5,267)
	N4	13,138	14,302	13,637	14,918	15,498	14,589
	N5	17,953	6,441	12,558	5,768	16,105	10,218
	N8	27,034	(7,820)	(6,696)	(10,272)	(5,686)	(7,619)
	N9	1,699	11,427	14,104	11,446	12,369	12,337
	N11	10,269	8,614	8,659	9,121	4,655	7,762
Extremely hot and mesic							
	M1	0	16	43	30	117	49
	M2	4,429	6,210	8,137	3,813	7,471	6,408
	M3	2,195	5,170	6,424	5,352	9,554	6,625
	M4	8,472	8,831	11,078	10,994	16,252	11,789
	M6	59	1,041	841	898	607	847
	M7	2,397	(267)	1,280	(1,073)	1,282	311
Extremely hot and moist							
	R1	1,299	12,908	21,234	13,822	29,569	19,383

Table 3.5: Mean elevation of bioclimatic strata in Yunnan Province under current conditions (averaged from 1960-200) based on downscaled weather station data, and their upward shift in mean elevation as projected for the year 2050 under all RCPs, and as an average of all the RCPs.

Bioclimatic Zone	Zone	Mean Elevation (m asl)					
		2000	RCP26	RCP45	RCP60	RCP85	RCP Average
Extremely cold and mesic	F	4242	4435	4504	4430	4596	4491
Cold and mesic	G	3516	3765	3834	3773	3909	3820
Cool temperate and xeric	H	3144	3423	3470	3413	3541	3464
Cool temperate and moist	J	2836	3065	3147	3059	3230	3125
Warm temperate and mesic	K	2005	2181	2240	2179	2312	2228
Warm temperate and xeric	L	1807	1999	2051	1977	2092	2030
Extremely hot and mesic	M	815	1083	1154	1068	1230	1139
Hot and mesic	N	1321	1544	1625	1537	1689	1598
Extremely hot and moist	R	620	779	855	789	910	833
Bioclimatic Zone	Zone	Upward Shift in Mean Elevation by 2050 (m)					
		2000	RCP26	RCP45	RCP60	RCP85	RCP Average
Extremely cold and mesic	F	4242	193	262	188	354	249
Cold and mesic	G	3516	250	318	257	393	304
Cool temperate and xeric	H	3144	279	326	279	397	320
Cool temperate and moist	J	2836	230	311	224	394	290
Warm temperate and mesic	K	2005	176	235	174	306	223
Warm temperate and xeric	L	1807	192	244	170	284	223
Extremely hot and mesic	M	815	267	338	273	454	323
Hot and mesic	N	1321	222	303	215	367	277
Extremely hot and moist	R	620	159	235	169	290	213
			219	288	217	356	269