INSTITUTS FRANÇAIS DE RECHERCHE EN INDE
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PONDY PAPERS IN ECOLOGY

DATA PAPER – HIGH-RESOLUTION TOPOGRAPHIC AND BIOCLIMATIC DATA FOR THE SOUTHERN WESTERN GHATS OF INDIA (IFP_ECODATA_BIOCLIM)

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INSTITUT FRANÇAIS DE PONDICHÉRY
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8

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The Institut français de Pondichéry (IFP) or French Institute of Pondicherry, is a financially autonomous research institution under the dual tutelage of the French Ministry of Foreign and European Affairs (MAEE) and the French National Centre for Scientific Research (CNRS). It was established in 1955 under the terms agreed to in the Treaty of Cession between the Indian and French governments. It has three basic missions: research, expertise and training in human and social sciences and ecology in South and South-East Asia. More specifically, its domains of interest include Indian cultural knowledge and heritage (Sanskrit language and literature, history of religions, Tamil studies, ..), contemporary social dynamics (in the areas of health, economics and environment) and the natural ecosystems of South India (sustainable management of biodiversity).

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This data paper has been prepared following the Ecological Metadata format proposed by Michener *et al.* (1997). It is accompanied with data archives downloadable from the IFP Biodiversity Portal at http://www.ifpindia.org/biodiversityportal/.

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Summary

The Western Ghats form a 1,600 km long escarpment that runs parallel to the southwestern coast of Peninsular India. This relief barrier, which orographically exacerbate the summer monsoon rains, is responsible for steep bioclimatic gradients that have long been recognized as one of the major ecological determinants for the forest vegetation of the region. We report here gridded topographic and bioclimatic data at 30' lat/lon (ca. 1 km) resolution that cover an area of about 70,000 km^2 of the southern Western Ghats, between 74 to 78° E and 8 to 16° N. These data have been extracted from three main sources: the SRTM (NASA Shuttle Radar Topography Mission) 90 m Digital Elevation Data, version 4 (http://srtm.csi.cgiar.org/) from which were secondarily derived aspect and slope; a digitized version of the bioclimatic maps of the Western Ghats by Pascal (1982) based on various sources of long series of climatic records over the period 1950-1980, from which were derived annual rainfall, mean temperature of the coldest month and dry season length; the WORLDCLIM database, version 1.4 (http://www.worldclim.org/), which provides monthly interpolated rainfall and temperature data from series of at least 10 years records over the 1950–2000 period.

Key-words: Digital Elevation Model, India, long-term bioclimatic interpolations, SRTM, Southern Western Ghats, WOLDCLIM.

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I. DATA SET DESCRIPTORS.

A. Data set identity. High-resolution topographic and bioclimatic data for the southern Western Ghats of India.

B. Data set identification code. IFP_ECODATA_BIOCLIM

C. Data set descriptors.

1. Originator. Ecology Department, French Institute of Pondicherry, 11 St Louis Street, 605001 Pondicherry, India (ifpeco@ifpindia.org).

2. Abstract. The Western Ghats form a 1,600 km long escarpment that runs parallel to the southwestern coast of Peninsular India. This relief barrier, which orographically exacerbate the summer monsoon rains, is responsible for steep bioclimatic gradients that have long been recognized as one of the major ecological determinants for the forest vegetation of the region. We report here gridded topographic and bioclimatic data at 30' lat/lon (ca. 1 km) resolution that cover an area of about 70,000 km^2 of the southern Western Ghats, between 74 to 78° E and 8 to 16° N. These data have been extracted from three main sources: the SRTM (NASA Shuttle Radar Topography Mission) 90 m Digital Elevation Data, version 4 (http://srtm.csi.cgiar.org/) from which were secondarily derived aspect and slope; a digitized version of the bioclimatic maps of the Western Ghats by Pascal (1982) based on various sources of long series of climatic records over the period 1950-1980, from which were derived annual rainfall, mean temperature of the coldest month and dry season length; the WORLDCLIM database, version 1.4 (http://www.worldclim.org/), which provides monthly interpolated rainfall and temperature data from series of at least 10 years records over the 1950–2000 period.

D. Key words. Digital Elevation Model, India, long-term bioclimatic interpolations, SRTM, Southern Western Ghats, WOLDCLIM.

II. RESEARCH ORIGIN DESCRIPTORS.

A. Site description.

1. Site type. The Western Ghats (WG) form a mountain range that extends along the western coast of Arabian Sea and that, along with the island of Sri Lanka, is classified as one of the world biodiversity hotspots (Myers *et al.* 2000).

2. Geography. The WG cover an area of 160,000 km^2 and stretch for 1,600 km along the west coast of India, 40 km away on average from the shore line, from the Tapti river (21° N, state of Maharastra) to Kanyakumari, the southernmost tip of the Indian peninsula (8° N, state of Tamil Nadu). We consider here only the southern part of the WG, i.e. an area ca. 70,000 km^2 between 74 to 78° E and 8 to 16° N.

3. Habitat. The southern WG shelter a wide array of non-equatorial tropical vegetation, from fragments of wet evergreen to dry deciduous forest habitats in various stages of degradation to mountain forests and grasslands, alternating with zones converted into agroforests, monoculture plantations and agriculture. About 4,000 species of flowering plants including 1,600 species (40%) endemic to this region have been reported (Manokaran *et al.* 1997).

4. Geology, landform. In the southern part of the Western Ghats, bedrock is composed of metamorphic rocks from the Precambrian shield, with a prevalence of volcano-sedimentary material north of 14° N, and gneisses with intrusive granites in the south. The more recent sediments deposits are confined to the coastal plain. The soils are ferralitic (laterites) to fersialitic (red soils), with a massive development of kaolinite as a product of rock weathering where the annual soil water balance is consistently positive (*i.e.* above 1,200 mm rainfall; Bourgeon 1989, Gunnel & Bourgeon 1997).

5. Watersheds, hydrology. Dozens of rivers originate in the WG, including the peninsula's three major eastward-flowing rivers (Godavari, Krishna and Kaveri), which are important sources of drinking water, irrigation, and power.

6. Climate. The windward side of the WG receives heavy rains as the monsoon progresses from south to north. In the coastal plain the annual rainfall exceeds 2,000 mm, commonly reaching more than 5,000 mm near the crest of the Ghats, with local peaks even much beyond this value, like in Agumbe with regular records above 8,000 mm. To the interior region a

rapid diminishing of rainfall from 2,000 mm to 900 mm is observed within a distance of 10 – 50 km. Convective rains prior to and following the monsoon, augment the total rainfall received at the transitional zone. Between the coastline and the crest of the Ghats, at elevations above 800 m, mean coldest month temperature is 23°C, while in the hilly terrains at medium elevations (800 – 1,400 m) it varies between 16 and 23°C. Correlating with the sharp decrease in rainfall beyond the crest of the Ghats, the length of the dry season rapidly increases in the west-east direction. However, the monsoon onset in the south, which moves northwards up to the Himalayas and then retreats in the reverse, creates a differential seasonal pattern with latitude, which does not correlate with rainfall. Consequently, the dry season length increases also from south to north.

B. Sampling design.

The study area was gridded into 801 by 401 0.01-DD/WGS84 cells (i.e. 30s' lat/lon or 1.11 km square), starting from the south-westernmost corner at 73.995 E and 7.995 N in Decimal Degrees (DD). It consequently covers a rectangle from approximately 74 to 78° E and 8 to 16° N. The study region was delineated from this matrix as a subset of cells bearing positive values for the topographic and bioclimatic variables, while the error code -9999 was attached to all cells outside the study region.

C. Research methods.

1. Laboratory/field methods.

• *Topographical layers.* The elevation layer comes from the SRTM (NASA Shuttle Radar Topography Mission) 90 m Digital Elevation Data, version 4 (Jarvis *et al.* 2008; http://srtm.csi.cgiar.org/), which have been resampled at 0.01 DD resolution using the nearest neighbour resampling method available in ArcView GIS 3.2a (ESRI Inc., Redlands, CA). Aspect (in degree) and slope (in %) were then derived for each cell using ArcView.

• *Pascal's bioclimatic layers.* The bioclimatic maps of Pascal (1982) were prepared in the framework of the IFP vegetation mapping programme for the Western Ghats of India (Pascal *et al.* 1982a, b, 1984, 1992; Pascal 1986; Pascal & Ramesh 1996; Ramesh *et al.* 1997, 2002). The climatic data were collected from various official and private sources like the Bureau of Economic and Statistics, India Meteorological Departments, Electricity Boards, Forest Departments and Estates. Rainfall records from more than 3,000 rain gauges and temperature data from about 50 stations have been collected and carefully examined regarding their continuity, number of years of observation, reliability of readings, etc. Only series longer than 5 years and up to 30 years over the period 1950-1980 have been used. For mapping purpose, the data have been grouped into classes. Seven rainfall classes coded from 1 to 7 were considered (in $mm.yr^{-1}$): $P > 5{,}000$; $2{,}000 < P \leq 5{,}000$; $1{,}500 < P \leq 2{,}000$; $1{,}200 < P \leq 1{,}500$; $900 < P \leq 1{,}200$; $600 < P \leq 900$; $P \leq 600$. Five temperature classes have been defined from the mean temperature of the coldest month (t) and the mean minimum temperature of the coldest month (m). They are coded from 1 to 5 (in °C): $t < 13.5°$; $13.5° < t \leq 16°$; $16° < t \leq 23°$ and $m \leq 15°$; $16° < t \leq 23°$ and $m > 15°$; $23° < t$. The dry season length was computed as the mean number of dry months per year following the definition of Bagnouls and Gaussen (1953), which considers a month as dry when rainfall (in mm) is equal or less than twice the value of its mean temperature (in °C). The bioclimatic maps of Pascal (1982) present interpolated surfaces combining the rainfall and temperature classes. The length of the dry season is superimposed as interpolated isolines defining classes coded from 1 to 9, which correspond to a dry season lasting for 1 to 2 up to 9 to 10 months in a year. Since the original data are hardly accessible, the above variables have been extracted from a georeferenced, digitized version of the paper map, as three independent layers resampled at 0.01 DD resolution.

• *Wordclim layers*. average monthly precipitation (in mm), average monthly minimum temperature (in °C * 10) and average monthly maximum temperature (in °C * 10) were extracted from the WORLDCLIM database, version 1.4 (Hijmans *et al*. 2005; http://www.worldclim.org/), which provides data interpolated at 0.01 DD resolution from series of at least 10 years records over the 1950–2000 period.

2. Instrumentation. All data layers have been worked out with ArcView GIS version 3.2a (ESRI Inc., Redlands, CA).

3. Legal/organizational requirements. The SRTM data are distributed without restrictions (http://www2.jpl.nasa.gov/srtm/mou.html), while WORLDCLIM data are freely available for academic and other non-commercial use http://www.worldclim.org/. Pascal (1982) bioclimatic data are also made freely available by the IFP for non-commercial purpose.

D. Project personnel. Quentin Renard (International Volunteer), G. Muthusankar (Engineer in Geomatics) and Raphaël Pélissier (Head of Ecology Department) are all affiliated to the

French Institute of Pondicherry. Jean-Pierre Pascal generated the bioclimatic data when also affiliated to the IFP.

III. DATA SET STATUS AND ACCESSIBILITY.

A. Status.

1. Latest update. The data set was prepared during year 2008.

2. Latest archive date. August 2009.

3. Metadata status. Up to date till August 2009.

4. Data verification. The data were verified by careful examination and crosschecking of coloured level maps generated from the data using ArcView. These maps are given in an appendix to this document.

B. Accessibility.

1. Storage location and medium. Ecological data archives of the French Institute of Pondicherry (http://www.ifpindia.org/). Paper and digitized bioclimatic maps of Pascal (1982) are stored at the Geomatics and Applied Informatics Laboratory (LIAG) of the French Institute of Pondicherry. SRTM and WORLDCLIM data are available from websites http://srtm.csi.cgiar.org/ and http://www.worldclim.org/, respectively.

2. Contact person(s). Head of Ecology Department (ifpeco@ifpindia.org) and Head of Geomatics and Applied Informatics Laboratory, French Institute of Pondicherry, 11 St. Louis Street, 605001 Pondicherry, India, tel. +91 413 2334 168, fax +91 413 2339 534.

3. Copyright restrictions. None.

4. Proprietary restrictions. Due citations to Jarvis *et al.* (2008) for SRTM Digital Elevation Model, Hijmans *et al.* (2005) for the WORLDCLIM database and Pascal (1982) for the Western Ghats bioclimatic maps, as well as to the present data paper should be included within any publication based on this dataset.

IV. DATA STRUCTURAL DESCRIPTORS.

A. Identity. Data are downloadable as three independent zip archives:

1. IFP_ECODATA_BIOCLIM_Archive1.zip (1.4 Mo). Contains the topographical layers:

- IFP_ECODATA_BIOCLIM_Elevation.txt contains SRTM elevation values (in m) resampled at 0.01 DD resolution.
- IFP_ECODATA_BIOCLIM_Slope.txt contains 0.01-DD resolution slope values (in %) derived from SRTM elevation data.
- IFP_ECODATA_BIOCLIM_Aspect.txt contains 0.01-DD resolution aspect values (in degree) derived from SRTM elevation data.

2. IFP_ECODATA_BIOCLIM_Archive2.zip (44 Ko). Contains Pascal (1982) bioclimatic layers:

- IFP_ECODATA_BIOCLIM_Rainfall.txt contains integer codes for the 7 Pascal's classes of mean annual rainfall resampled at 0.01-DD resolution (in $mm.yr^{-1}$): 1 = $P \leq 600$; 2 = $600 < P \leq 900$; 3 = $900 < P \leq 1{,}200$; 4 = $1{,}200 < P \leq 1{,}500$; 5 = $1{,}500 < P \leq 2{,}000$; 6 = $2{,}000 < P \leq 5{,}000$; 7 = $P > 5{,}000$.
- IFP_ECODATA_BIOCLIM_MinTemp.txt contains integer codes for the 5 Pascal's classes of temperature resampled at 0.01-DD resolution (in °C): 1 = $t < 13.5°$; 2 = $13.5° < t \leq 16°$; 3 = $16° < t \leq 23°$ and $m \leq 15°$; 4 = $16° < t \leq 23°$ and $m > 15°$; 5 = $t > 23°$, with t being the mean temperature of the coldest month and m the mean minimum temperature of the coldest month.
- IFP_ECODATA_BIOCLIM_DrySeason.txt contains integer codes for the 9 Pascal's classes of mean dry season length: 1 = 1 to 2 months; 2 = 2 to 3 months; 3 = 3 to 4 months; 4 = 4 to 5 months; 5 = 5 to 6 months; 6 = 6 to 7 months; 7 = 7 to 8 months; 8 = 8 to 9 months; 9 = 9 to 10 months.

3. IFP_ECODATA_BIOCLIM_Archive3.zip (4.7 Mo). Contains the WORLDCLIM bioclimatic layers:

- IFP_ECODATA_BIOCLIM_P1.txt to IFP_ECODATA_BIOCLIM_P12.txt contains values of the mean monthly rainfall values (in mm), from January (P1) to December (P12), with a 0.01-DD resolution.

- IFP_ECODATA_BIOCLIM_Tmax1.txt to IFP_ECODATA_BIOCLIM_Tmax12.txt contains values of the mean average monthly maximum temperature (°C * 10), from January (Tmax1) to December (Tmax12), with a 0.01-DD resolution.
- IFP_ECODATA_BIOCLIM_Tmin1.txt to IFP_ECODATA_BIOCLIM_Tmin12.txt contains values of the mean average monthly minimum temperature (°C * 10), from January (Tmin1) to December (Tmin12), with a 0.01-DD resolution.

B. Size. All data file contain the same number of rows (801) and columns (401) corresponding to 0.01-DD cells. No headers are included. Uncompressed file size are:

IFP_ECODATA_BIOCLIM_Elevation.txt	1.4 Mo
IFP_ECODATA_BIOCLIM_Slope.txt	2.4 Mo.
IFP_ECODATA_BIOCLIM_Aspect.txt	2.3 Mo.
IFP_ECODATA_BIOCLIM_Rainfall.txt	1.3 Mo.
IFP_ECODATA_BIOCLIM_MinTemp.txt	1.3 Mo.
IFP_ECODATA_BIOCLIM_DrySeason.txt	1.3 Mo.
IFP_ECODATA_BIOCLIM_P1.txt to IFP_ECODATA_BIOCLIM_P3.txt	1.1 Mo.
IFP_ECODATA_BIOCLIM_P4.txt to IFP_ECODATA_BIOCLIM_P6.txt	1.3 Mo.
IFP_ECODATA_BIOCLIM_P7.txt	1.4 Mo.
IFP_ECODATA_BIOCLIM_P8.txt	1.3 Mo.
IFP_ECODATA_BIOCLIM_P9.txt and IFP_ECODATA_BIOCLIM_P10.txt	1.4 Mo.
IFP_ECODATA_BIOCLIM_P11.txt	1.3 Mo.
IFP_ECODATA_BIOCLIM_P12.txt	1.2 Mo.
IFP_ECODATA_BIOCLIM_Tmax1.txt to IFP_ECODATA_BIOCLIM_Tmax8.txt	1.4 Mo.
IFP_ECODATA_BIOCLIM_Tmax9.txt	2.1 Mo.
IFP_ECODATA_BIOCLIM_Tmax10.txt to IFP_ECODATA_BIOCLIM_Tmax12.txt	1.4 Mo.
IFP_ECODATA_BIOCLIM_Tmin1.txt to IFP_ECODATA_BIOCLIM_Tmin12.txt	1.4 Mo.

C. Format type and storage mode. The data files are in ASCII text format, space delimited.

D. Header information. The data files do not contain any header, but the following lines can be added at the beginning of each text file (.txt) to transform them into ASCII files (.asc) readable by most GIS softwares:

```
ncols        401
nrows        801
xllcorner    73.995
yllcorner    7.995
cellsize     0.01
NODATA_value -9999
```

ncols and *nrows* give the number of columns and rows of the grid; *xllcorner* and *yllcorner* correspond to longitude and latitude of the south-westernmost corner of the grid in Decimal

Degrees (DD/WGS84); *cellsize* is the size of the square cell of the grid (0.01 DD); NODATA_value is the code used for missing values.

E. Special characters. -9999 is the code used for missing values, also used to delineate the study region within the square matrices of 801 rows by 401 columns.

F. Authentication procedures. Sums of all numeric values (including the error code -9999) in each data file are given below:

IFP_ECODATA_BIOCLIM_Elevation.txt	-1052015625
IFP_ECODATA_BIOCLIM_Slope.txt	-1162172479
IFP_ECODATA_BIOCLIM_Aspect.txt	-1127063325
IFP_ECODATA_BIOCLIM_Rainfall.txt	-1828951135
IFP_ECODATA_BIOCLIM_MinTemp.txt	-1828905984
IFP_ECODATA_BIOCLIM_DrySeason.txt	-1828765864
IFP_ECODATA_BIOCLIM_P1.txt	-1108133264
IFP_ECODATA_BIOCLIM_P2.txt	-1107757200
IFP_ECODATA_BIOCLIM_P3.txt	-1106446063
IFP_ECODATA_BIOCLIM_P4.txt	-1097581850
IFP_ECODATA_BIOCLIM_P5.txt	-1084790279
IFP_ECODATA_BIOCLIM_P6.txt	-1061107656
IFP_ECODATA_BIOCLIM_P7.txt	-1033184177
IFP_ECODATA_BIOCLIM_P8.txt	-1062251373
IFP_ECODATA_BIOCLIM_P9.txt	-1077782307
IFP_ECODATA_BIOCLIM_P10.txt	-1073002343
IFP_ECODATA_BIOCLIM_P11.txt	-1093763341
IFP_ECODATA_BIOCLIM_P12.txt	-1104146284
IFP_ECODATA_BIOCLIM_Tmax1.txt	-1047313393
IFP_ECODATA_BIOCLIM_Tmax2.txt	-1043036933
IFP_ECODATA_BIOCLIM_Tmax3.txt	-1038403755
IFP_ECODATA_BIOCLIM_Tmax4.txt	-1037001131
IFP_ECODATA_BIOCLIM_Tmax5.txt	-1038614704
IFP_ECODATA_BIOCLIM_Tmax6.txt	-1046041046
IFP_ECODATA_BIOCLIM_Tmax7.txt	-1049668348
IFP_ECODATA_BIOCLIM_Tmax8.txt	-1049159561
IFP_ECODATA_BIOCLIM_Tmax9.txt	-1507753292
IFP_ECODATA_BIOCLIM_Tmax10.txt	-1047333476
IFP_ECODATA_BIOCLIM_Tmax11.txt	-1048598625
IFP_ECODATA_BIOCLIM_Tmax12.txt	-1049071575
IFP_ECODATA_BIOCLIM_Tmin1.txt	-1072213753
IFP_ECODATA_BIOCLIM_Tmin2.txt	-1069628211
IFP_ECODATA_BIOCLIM_Tmin3.txt	-1065133620
IFP_ECODATA_BIOCLIM_Tmin4.txt	-1061155571
IFP_ECODATA_BIOCLIM_Tmin5.txt	-1060666116
IFP_ECODATA_BIOCLIM_Tmin6.txt	-1062745370
IFP_ECODATA_BIOCLIM_Tmin7.txt	-1063882617
IFP_ECODATA_BIOCLIM_Tmin8.txt	-1064073843
IFP_ECODATA_BIOCLIM_Tmin9.txt	-1064705917
IFP_ECODATA_BIOCLIM_Tmin10.txt	-1065099216
IFP_ECODATA_BIOCLIM_Tmin11.txt	-1068316405
IFP_ECODATA_BIOCLIM_Tmin12.txt	-1071791218

V. SUPPLEMENTAL DESCRIPTORS.

A. Data acquisition. See the respective primary references, Pascal (1982), Hijmans *et al.* (2005) and Jarvis *et al.* (2008).

B. Publications and results. This dataset has been generated in the framework of a study on forest fire occurrences in the Western Ghats by Renard (2008). The digitized maps of Pascal (1982) have been used in various studies conducted by IFP staff, including Belna (2006), Venugopal (2008) and Ramesh *et al.* (2009).

VI. LITERATURE CITED.

Bagnouls, F. and Gaussen, H. 1953. Saison sèche et régime xérothermique. *Documents pour les cartes des productions végétales* **3**: 1-47.

Belna, K. 2006. *Analysis of the floristic variation across the 1-ha plots laid out in the Western Ghats of Karnataka for the FFEM project*. Rapport de stage de Césure INAPG, Institut Français de Pondichéry, India. 54 pp.

Bourgeon, G. 1989. *Explanatory booklet on the reconnaissance soil map of forest area - Western Karnataka and Goa*. Institut Français de Pondichéry, India. 204 pp.

Gunnell, Y. and Bourgeon, G. 1997. Soils and climatic geomorphology on the Karnataka Plateau, peninsular India. *Catena* **29**: 239-262.

Hijmans, R. J., Cameron, S. E., Parra, J. L., Jones, P. G. and Jarvis, A. 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology* **25**: 1965-1978.

Jarvis, A., Reuter, H. I., Nelson, A., and Guevara, E. 2008. *Hole-filled SRTM for the globe Version 4*. http://srtm.csi.cgiar.org.

Manokaran, N., Uniyal, V. K. and Kumar, C. S. 1997. The biodiversity wealth and its conservation in Kerala. Pp. 103-124 In P. Pushpangadan, K. Ravi and V. Santosh (Eds.). *Conservation and economic evaluation of biodiversity*. Oxford University Press & India Book House**,** New Dehli, India.

Michener, W. K., Brunt, J. W., Helly, J. J., Kirchner, T. B. and Stafford, S. G. 1997. Nongeospatial metadata for ecological sciences. *Ecological Applications* **7**: 330-342.

Myers, N., Mittermeier, R., Mittermeier, C., Da Fonseca, G. and Kent, J. 2000. Biodiversity hot-spots for conservation priorities. *Nature* **403**: 853-858.

Pascal, J.-P. 1982. *Bioclimates of the Western Ghats*. Institut Français de Pondichéry, India. 3 pp. + 2 map sheets.

Pascal, J.-P. 1986. *Explanatory booklet of vegetation maps 1, 2 and 3*. Institut Français de Pondichéry, India. 88 pp.

Pascal, J.-P. and Ramesh B. R. 1996. *Notes on vegetation maps 4*. Institut Français de Pondichéry, India. 66 pp.

Pascal, J.-P., Shyam Sunder & Meher-Homji, V. M. 1982a. *Vegetation Map of South India – Map 3: Mercara - Mysore*. Institut Français de Pondichéry, India. 1 sheet.

Pascal, J.-P., Shyam Sunder & Meher-Homji, V. M. 1982b. *Vegetation Map of South India – Map 2: Shimoga*. Institut Français de Pondichéry, India. 1 sheet.

Pascal, J.-P., Shyam Sunder & Meher-Homji, V. M. 1984. *Vegetation Map of South India – Map 1: Belgaum – Darwar –Panaji*. Institut Français de Pondichéry, India. 1 sheet.

Pascal, J.-P., Ramesh, B. R. & Kichenassamy, K. 1992. *Vegetation Map of South India – Map 4: Bangalore – Salem*. Institut Français de Pondichéry, India. 1 sheet.

Ramesh, B. R., de Franceschi, D. & Pascal, J.-P. 1997. *Vegetation Map of South India – Map 6: Thiruvananthapuram – Tirunelveli*. Institut Français de Pondichéry, India. 1 sheet.

Ramesh, B. R., de Franceschi, D. & Pascal, J.-P. 2002. *Vegetation Map of South India – Map 5: Coimbatore – Thrissur*. Institut Français de Pondichéry, India. 1 sheet.

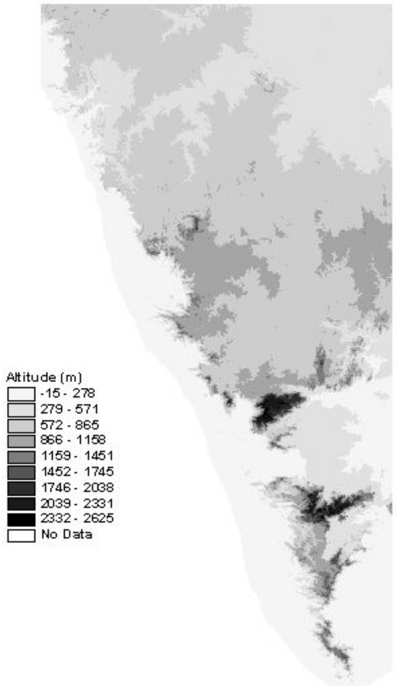
Ramesh, B. R., Venugopal, P. D., Pélissier, R., Patil, S. V., Couteron, P. and Swaminath, M. H. 2009. Mesoscale patterns in the floristic composition of forests in the central Western Ghats of Karnataka, India. *Biotropica*, in press.

Renard, Q. 2008. *Modelling fires occurrences in the Western Ghats from MODIS images*. Internal study report, Institut Français de Pondichéry, India. 51 pp.

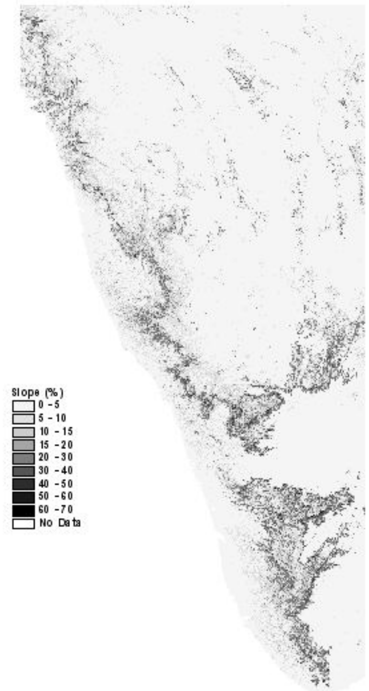
Venugopal, P. D. 2008. *Regional patterns in the floristic composition and structure of forests in the Western Ghats, India*. Internal study report, Institut Français de Pondichéry, India. 56 pp.

VII. APPENDIX.

A. Maps of topographical layers derived from SRTM data



IFP_ECODATA_BIOCLIM_Rainfall.txt



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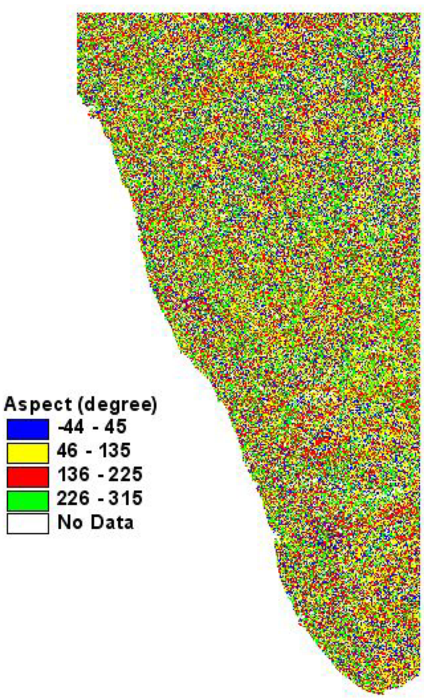
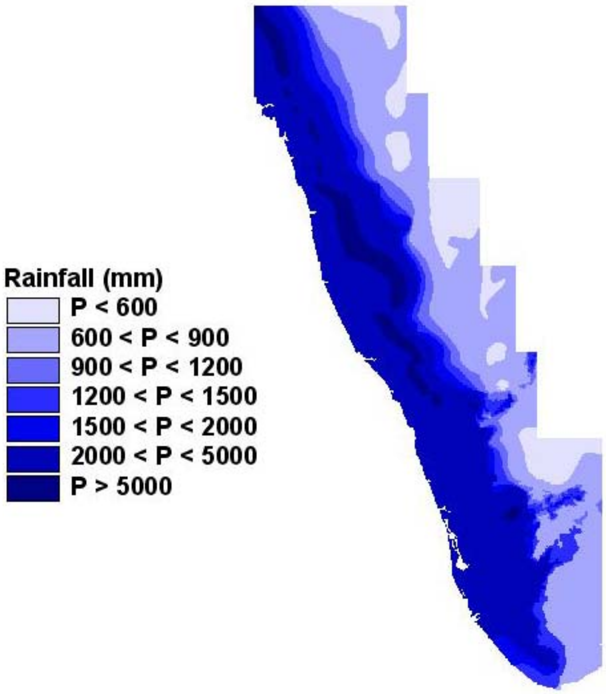


IFP_ECODATA_BIOCLIM_Aspect.txt

B. Maps of bioclimatic layers derived from Pascal (1982)



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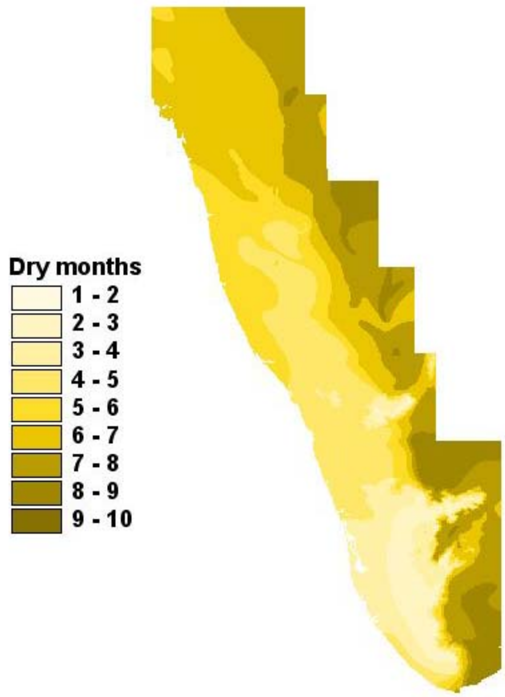
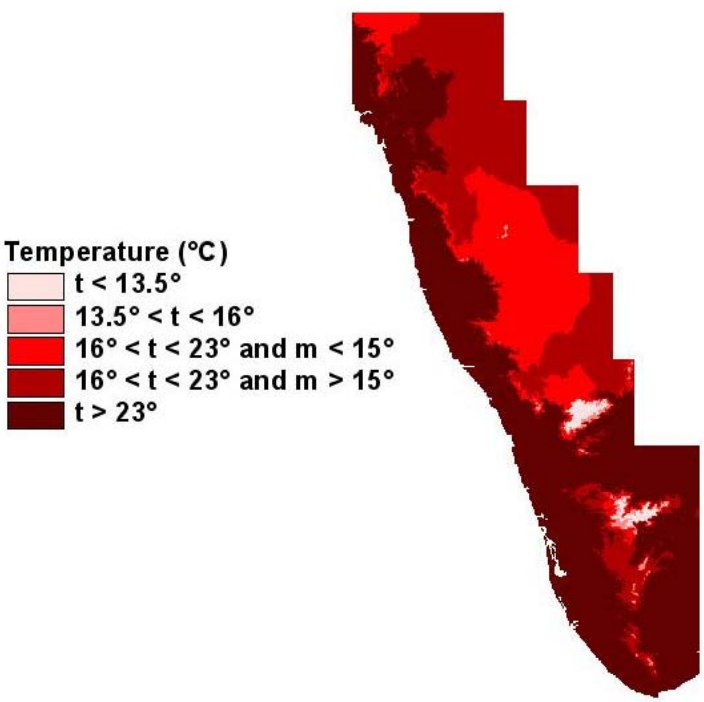
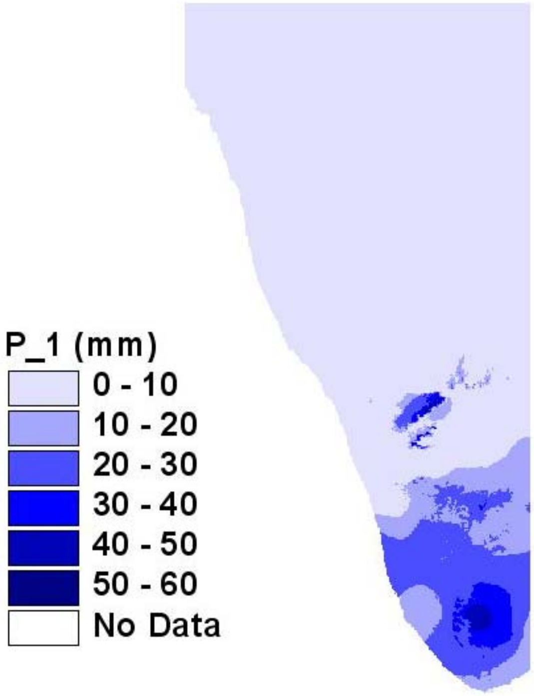


IFP_ECODATA_BIOCLIM_DrySeason.txt

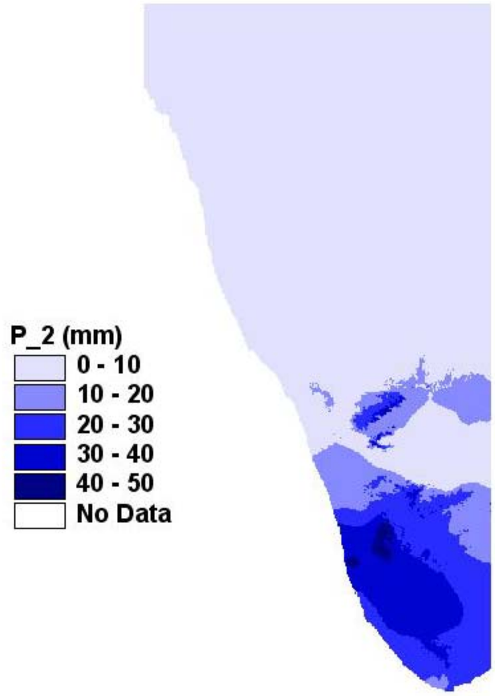


IFP_ECODATA_BIOCLIM_MinTemp.txt

C. Maps of bioclimatic layers derived from WORLDCLIM data



IFP_ECODATA_BIOCLIM_P1.txt



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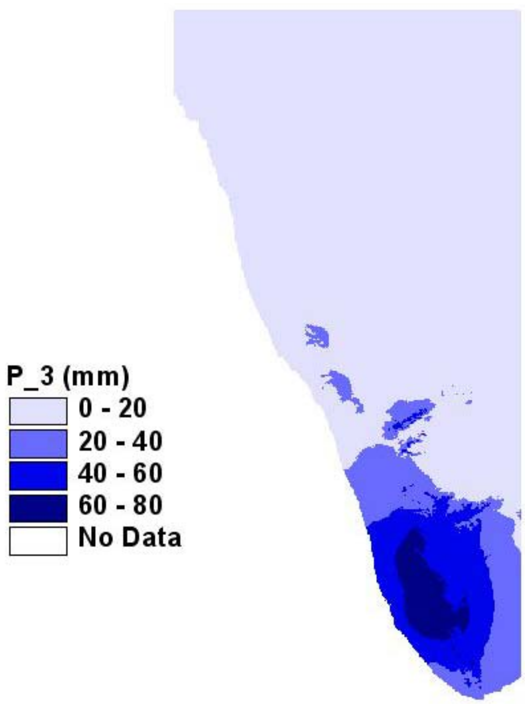

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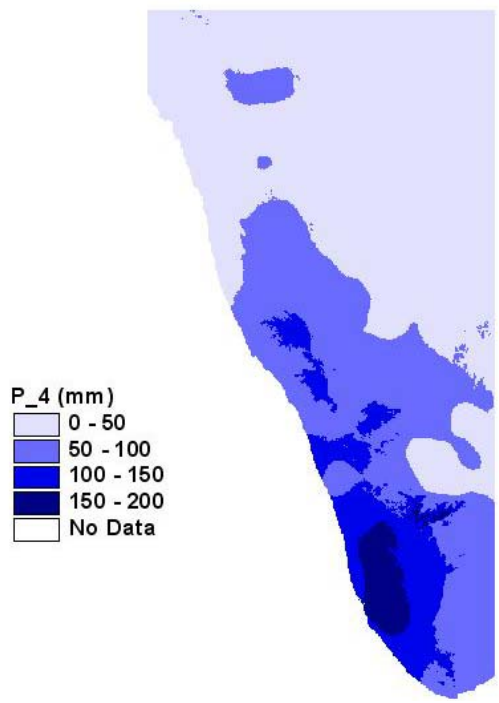

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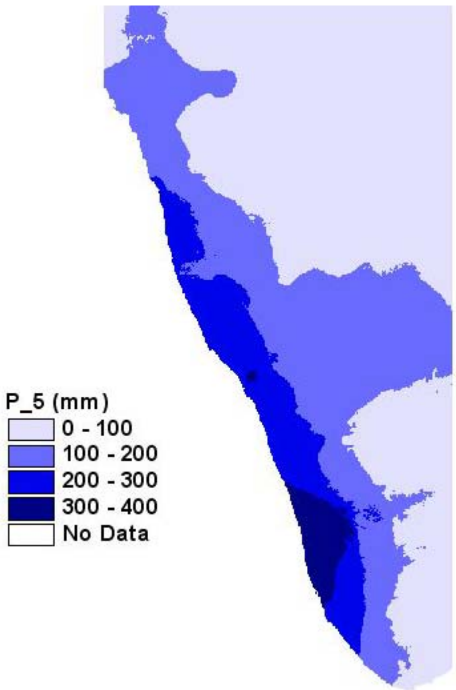

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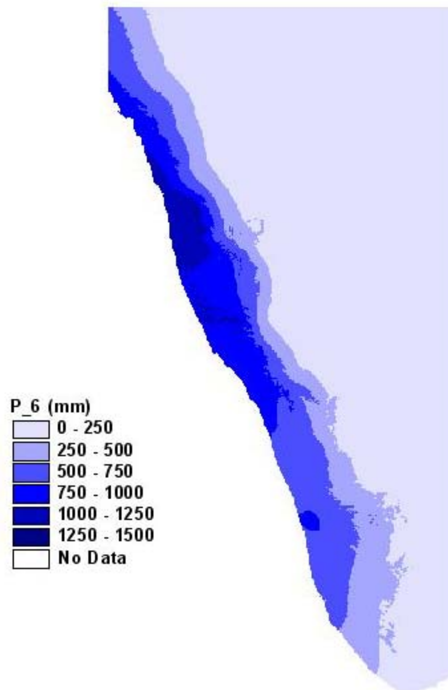

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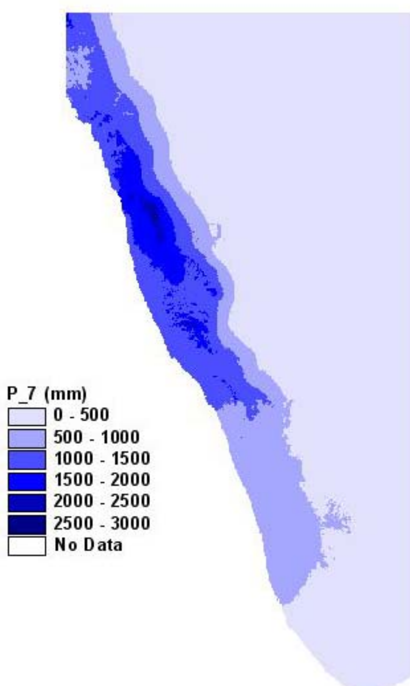

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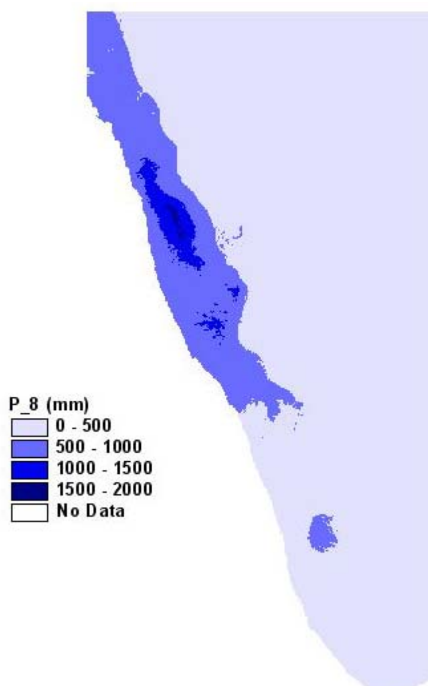

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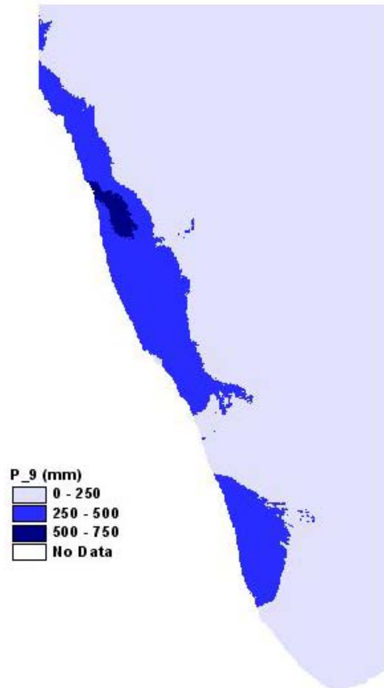

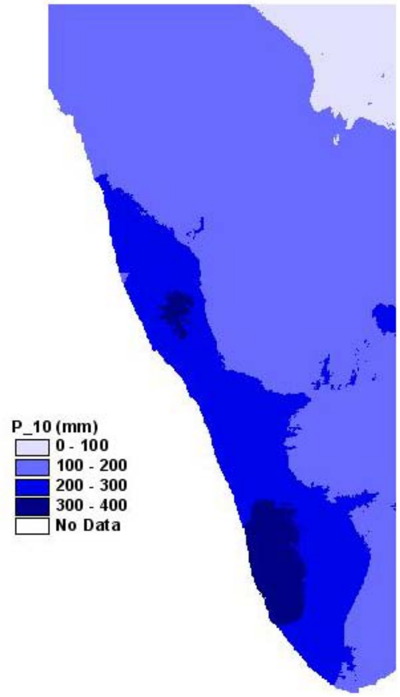

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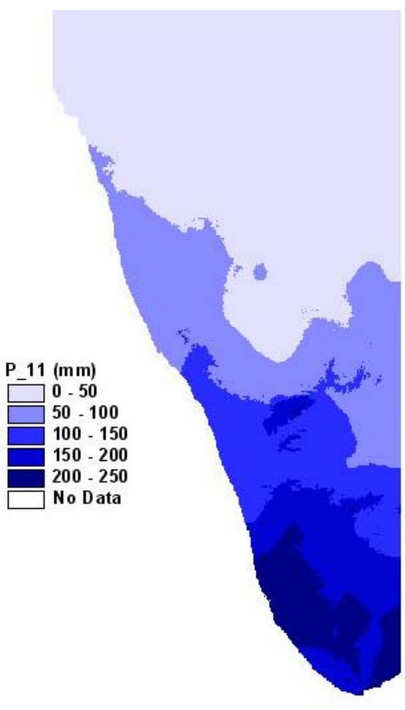

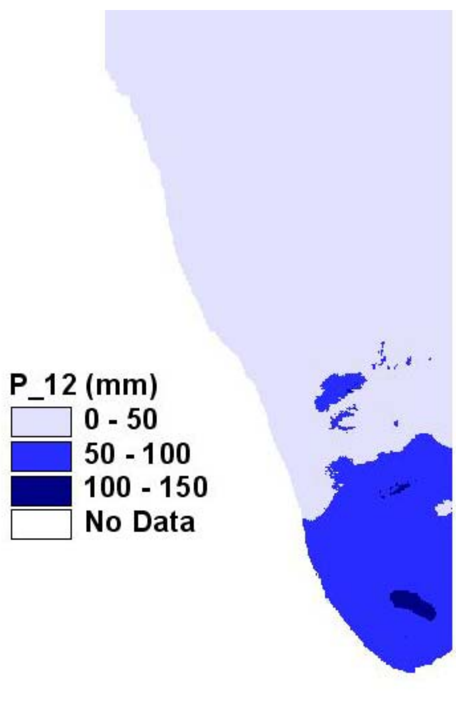

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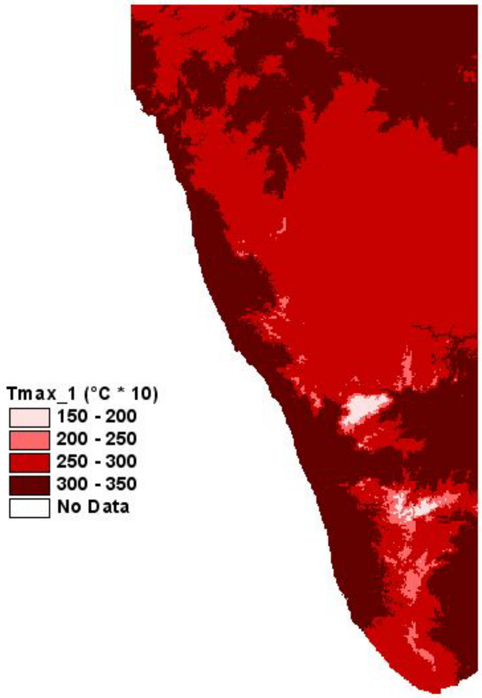
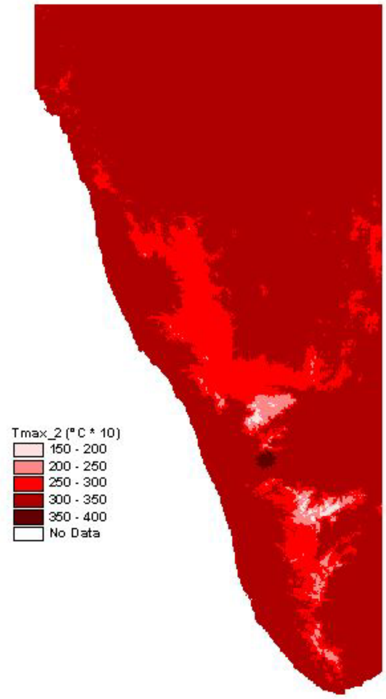
IFP_ECODATA_BIOCLIM_P12.txt





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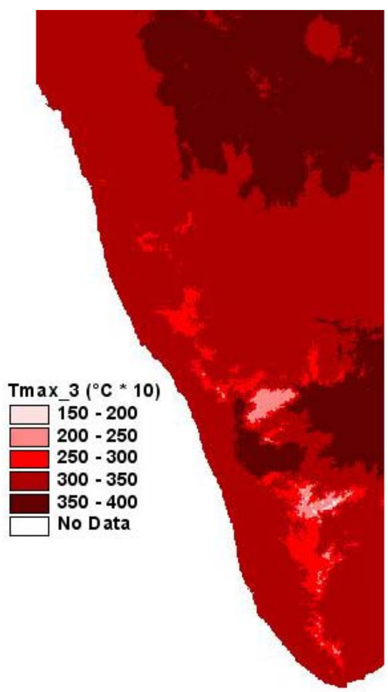

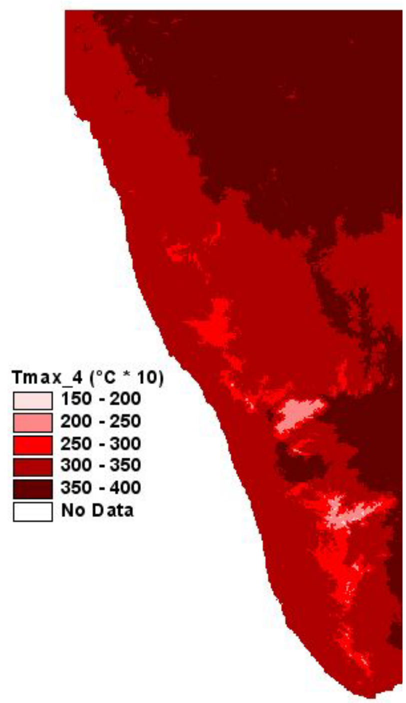

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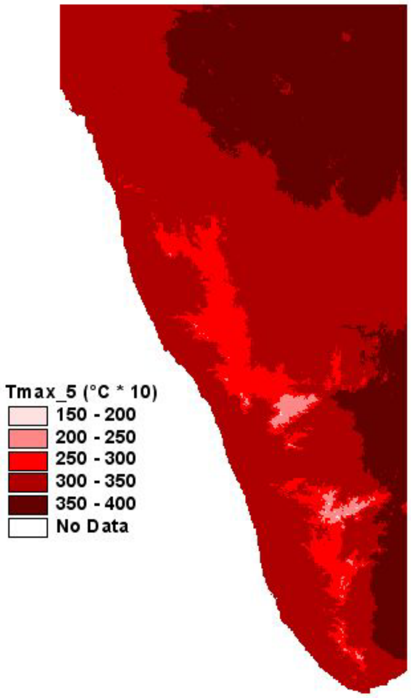

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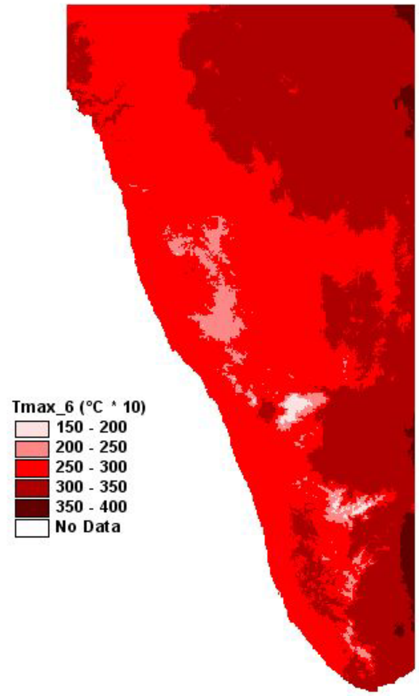

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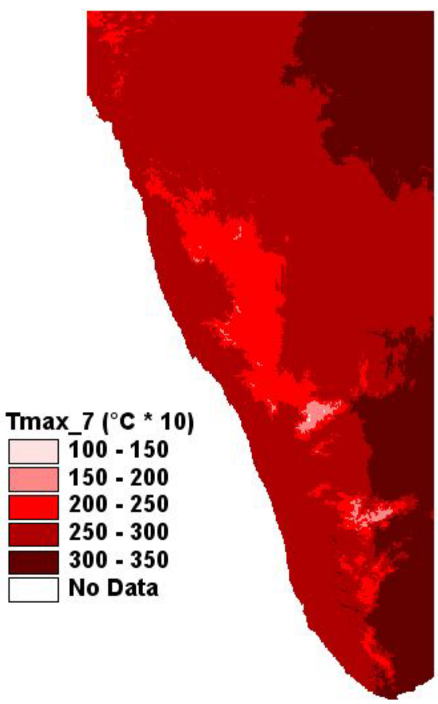

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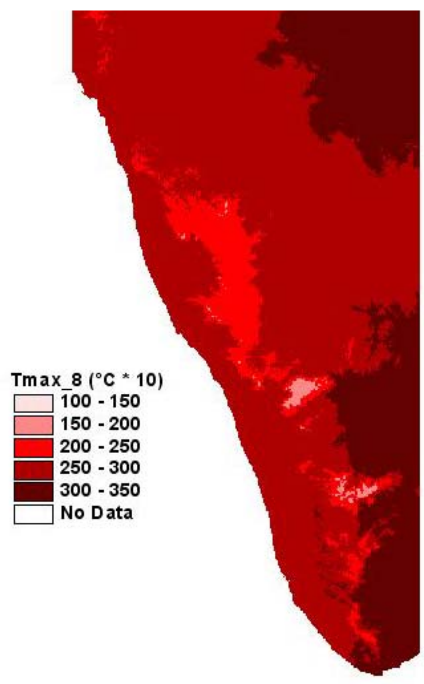

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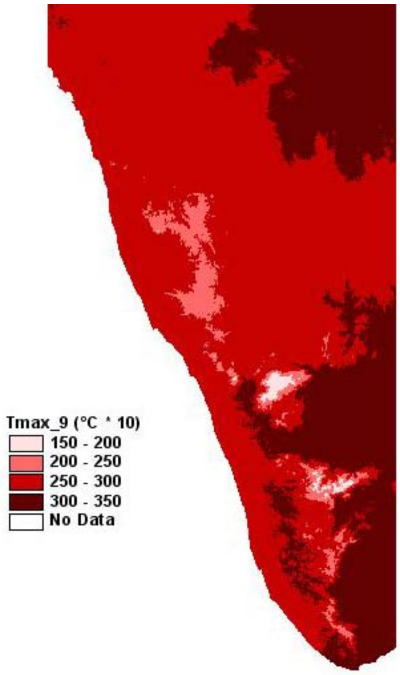

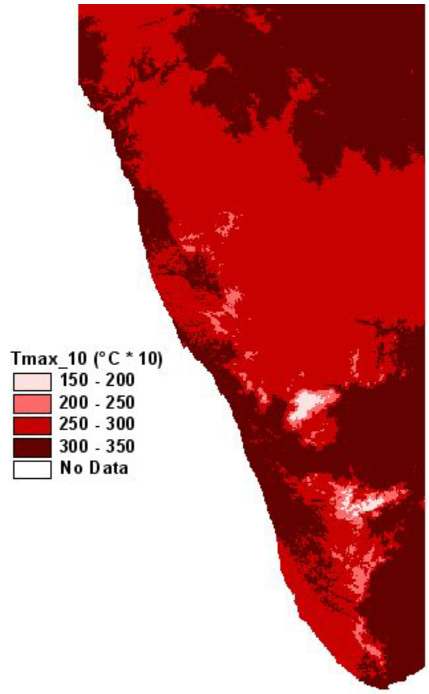

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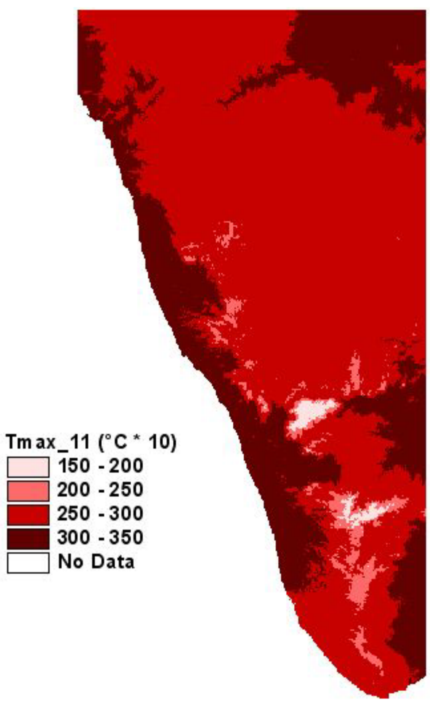

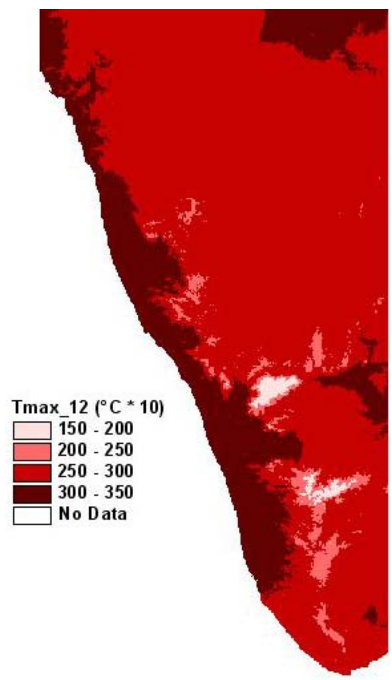

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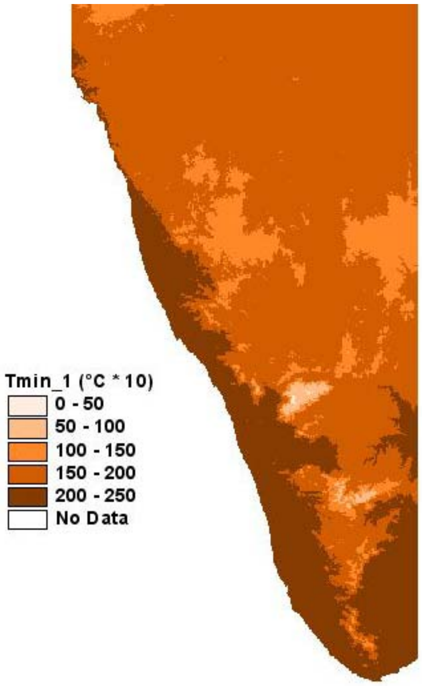

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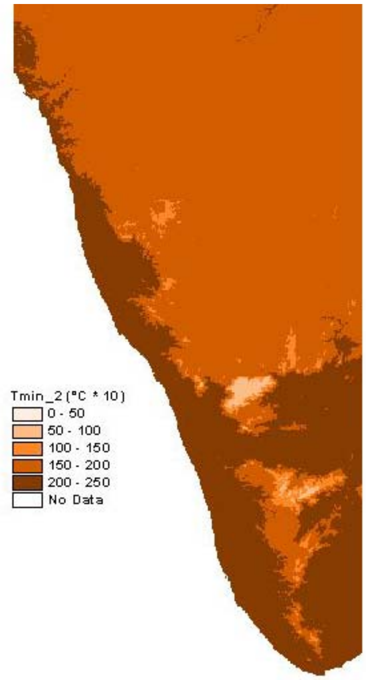

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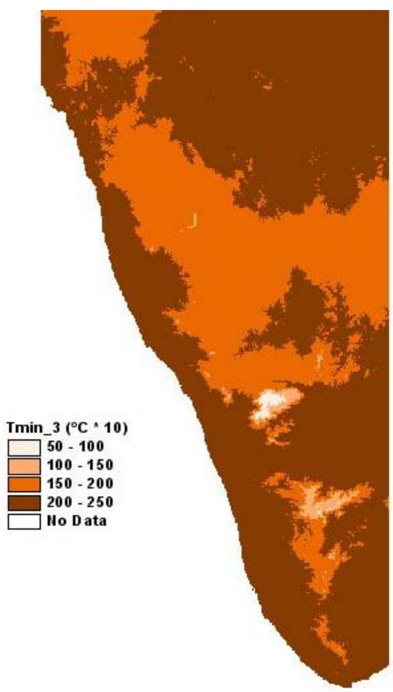

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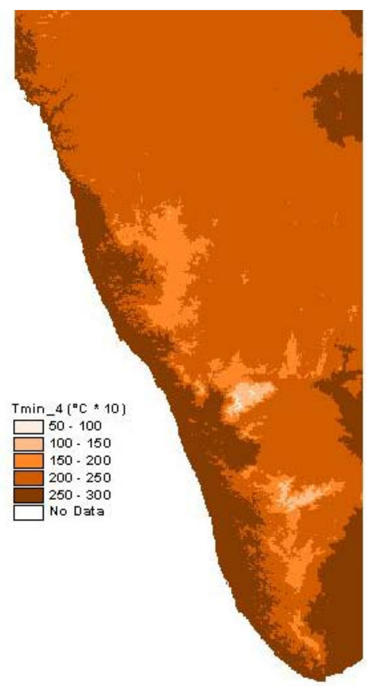

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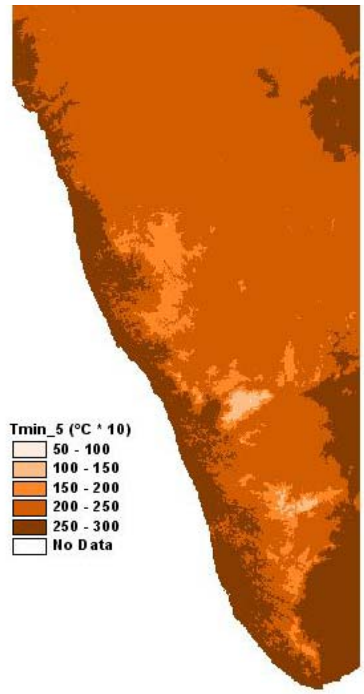

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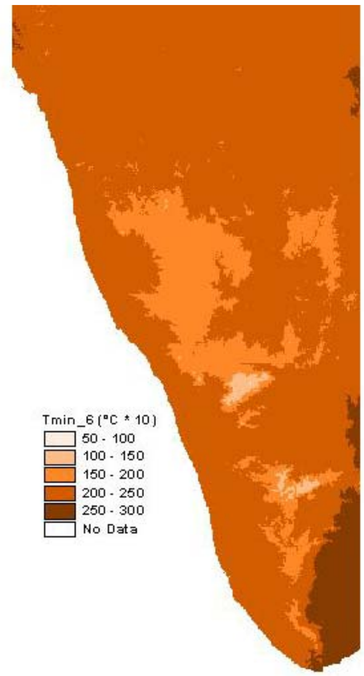

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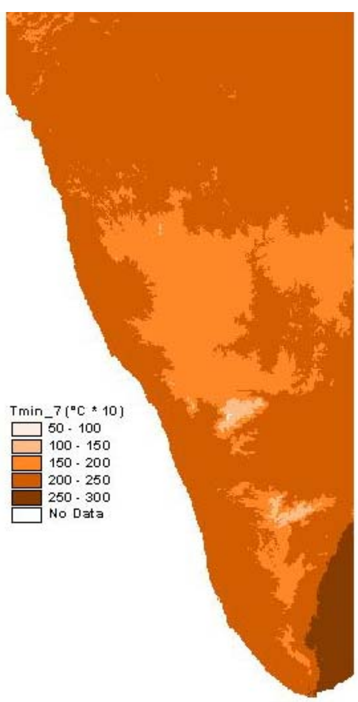

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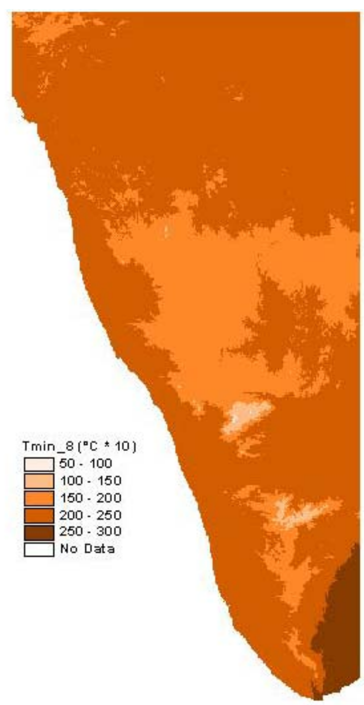

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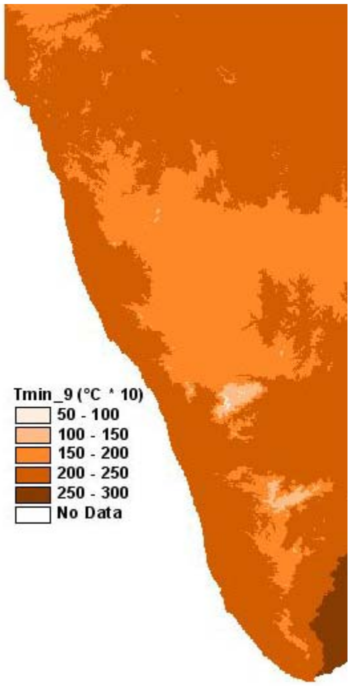

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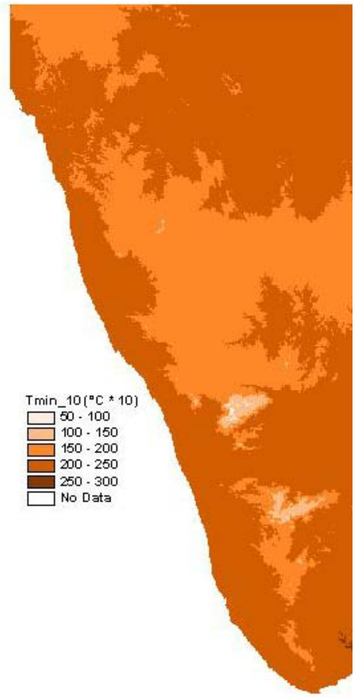

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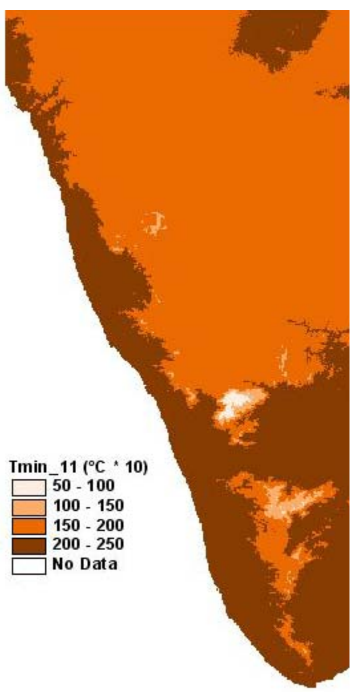

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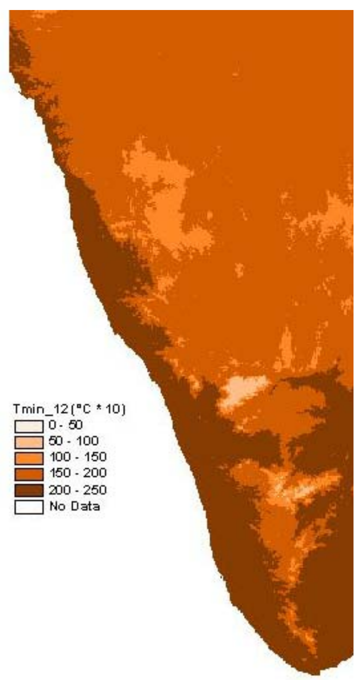

IFP_ECODATA_BIOCLIM_Tmin12.txt

Pondy Papers in Ecology

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8. QUENTIN RENARD, G. MUTHUSANKAR, RAPHAEL PÉLISSIER. Data Paper: High-resolution topographical and bioclimatic data for the Southern Western Ghats of India (IFP_ECODATA_BIOCLIM). 2009, n° 8, 21p.

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