

## CHAPTER V : ECOLOGICAL NICHE MODELING

The most commonly used datasets in ecological niche modelling are that of the worldclim (includes precipitation, temperature and bioclimatic variables) and the physiographic data sets (elevation, slope, aspect, and topography). The variables included in the data set are monthly total precipitation, and monthly mean, minimum and maximum temperature, and 19 derived bioclimatic variables. Bioclimatic variables are derived from the monthly temperature and rainfall values in order to generate more biologically meaningful variables and are often used in ecological niche modeling. The bioclimatic variables represent annual trends (e.g., mean annual temperature, annual precipitation) seasonality (e.g., annual range in temperature and precipitation) and extreme or limiting environmental factors.

**Table No. 11. Distribution of the studied plants and their coordinates in India.**

Name of the species	Location	Longitude / Latitude
<i>P. stylosum</i> var. <i>laciniata</i>	Bhawani (Kerala)	76° 32.19'E / 11° 3.34'N
	Kunthipuzha (Kerala)	76° 26.35'E / 10° 59.26'N
	Sairandhri (Kerala)	76° 26.44'E / 11° 5.33'N
	Valara (Kerala)	76° 54.35'E / 10° 1.35'N
	Pooyamkutty (Kerala)	76° 46.36'E / 10° 9.37'N
	Erumeli (Kerala)	76° 50.33'E / 9° 28.4'N
<i>Z. lichenoides</i>	Cheeyappara (Kerala)	76° 50.27'E / 10° 2.47'E
	Nilambur (Kerala)	76° 13.18'E / 11° 16.37'N
	Kulathupuzha (Kerala)	77° 3.33'E / 8° 54.32'N
	Erumeli (Kerala)	76° 50.33'E / 9° 28.4'N
	Valara (Kerala)	76° 54.35'E / 10° 1.35'N
	Cheeyappara (Kerala)	76° 50.27'E / 10° 2.47'E
	Pooyamkutty (Kerala)	76° 46.36'E / 10° 9.37'N
	Charpa (Kerala)	76° 34.39'E / 10° 17.45'N
	Athirapalli (Kerala)	76° 34.04'E / 10° 16.59'N
	Mukkadavu (Kerala)	76° 10.51'E / 11° 51.46'N
	Kadavu (Kerala)	75° 52.22'E / 11° 11.37'N
	Kallar (Kerala)	77° 8.43'E / 9° 48.29'N
	Ponmudi (Kerala)	77° 6.58'E / 8° 45.34'N
	Nelliampathy (Kerala)	76° 41.28'E / 10° 32.15'N
Thommenkuthu (Kerala)	76° 43.13'E / 9° 57.22'N	
Vellathooval (Kerala)	76° 49.25'E / 9° 57.37'N	

	Kuthungal (Kerala)	77° 6.18'E / 9° 56.18'N
	Tirunelli (Kerala)	75° 59.48'E / 11° 54.27'N
	Munnar(Kerala)	77° 3.31'E / 10° 5.37'N
	Kunthipuzha (Kerala)	76° 26.35'E / 10° 59.26'N
	Vizagapatnam (Andhra Pradesh)	83° 14.46'E / 17° 40.22'N
	Inglun (Maharashtra)	73° 42.34'E / 19° 12.27'N
	Cauvery falls (Tamil Nadu)	77° 10.04'E / 12° 17.35'N
	Khasi hills (Meghalaya)	91°54.08'E / 25° 40.03'N
<i>W. selaginoides</i>	Pooyamkutty (Kerala)	76° 46.36'E / 10° 9.37'N
	Parambikulam (Kerala)	76° 48.55'E / 10° 23.45'N
	Anamalais (Tamil Nadu)	76° 56.54'E / 11° 00.58'N

Most suitable habitat for *Polypleurum stylosum* var. *laciniata* is in Western Ghats (PLATE NO.XXXIX) The Maxent model's internal jack-knife test of variable importance showed that Temperature Seasonality and Temperature Annual Range were the two most important predictors of *Polypleurum* (PLATE NO.XXXIX, Table No.12).

Most suitable habitat for *Zeylanidium lichenoides* is predicted in Kerala and in the southern part of Karnataka (PLATE NO. XXXX). The Maxent model's internal jack-knife test of variable importance showed that Temperature Seasonality and Temperature Annual Range were the two most important predictors of *Zeylanidium* (PLATE NO.XXXX, Table No.13).

Most suitable habitat for *Willisia selaginoides* is in Kerala, Tamil Nadu and Karnataka (PLATE NO. XXXXI). The Maxent model's internal jack-knife test of variable importance showed that Temperature Seasonality is the most important predictors of *Willisia* (PLATE NO. XXXXI, Table No.14).

## DISCUSSION

ENMs can be very helpful in providing insights regarding the factors responsible for the geographical distribution of species. Understanding the broad scale environmental factors and predicting the potential areas of distribution for the species would help in inventorying the species populations, designing conservation measures, and identifying reintroduction sites for the threatened species.

The study has provided a predicted habitat distribution map of *Willisia*, *Polypleurum* and *Zeylanidium* in India. Most suitable habitat for *Polypleurum stylosum* var. *laciniata* is in Western Ghats whereas for *Willisia selaginoides*, it is in Kerala, Tamil Nadu and Karnataka and for *Zeylanidium lichenoides* it is predicted in Kerala and in the southern part of Karnataka. The habitat distribution map of these species can help in discover new populations, identify top priority survey sites and set priorities to restore the natural habitat for effective conservation of *Willisia* and *Polypleurum*. On the basis of predicted distribution, *Z. lichenoides* shows wider distribution and wide range of habitat specificity. However, *P. stylosum* var. *laciniata* and *W. selaginoides* show a narrow distribution. This study would help in re-introduction of species to their suitable natural habitats identified through ENM.