# Characterization and evaluation of soils of Aizawl district, Mizoram, India using remote sensing and GIS techniques

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**Abstract**: Physiographic mapping of Aizawl district was carried out by using remote sensing and GIS techniques. Physiographic unit wise distribution of soil and properties were correlated in GIS environment. Taxonomic classification of soils of Aizawl district was categorized into 14 series, 8 subgroups, 3 great soil group and suborder and three soil orders of which, Inceptisols is the dominant order followed by Ultisols and Entisols. All the soils were acidic in reaction (pH ranged from 4.56 to 6.08). Organic carbon content varied from 0.38 to 1.94 % and it decreased with depth which might be due to the decrease in the organic matter content. Cation Exchange Capacity (CEC) varied from 2.28 to 26.15 cmol ($p^+$). Magnesium was the dominant exchangeable cation ranging from 0.2 to 4.6 meq/100 g, calcium ranged from 0.1 to 1.6 meq/100 g, potassium from 0.05 to 0.54 meq/100 g and sodium from 0.10 to 0.35 meq/100 g. Based on present observations, the area has been classified into land capability class IIe, IIIe, IVe, VIe and VIIe, and the major limitation was moderate to severe soil erosion in all the physiographic units.

**Keywords**: Physiography, Characterization, Classification, Soil, Remote Sensing and GIS

## 1. Introduction

Soils are the most valuable life supporting natural resource for the society since they produce food, a basic requirement to our very existence. More than 90% of world's food production is dependent on soil (Venkataratnam and Manchanda, 1997). For a sustained utilisation of the soil resource, it is imperative to know the nature, characteristics and extent of different soils. Reliable information on soil and land resources is prerequisite in suggesting suitable land use plan and management of land resources. For optimum utilization of available land resources on a sustainable basis, timely and reliable information on soils regarding their nature, extent and spatial distribution along with their potentials and limitations is important (Devi and Kumar, 2008). The use of remote sensing techniques have reduced field work to a considerable extent and soil boundaries are more precisely delineated than in conventional methods. The potential utility of remote sensing data has been well recognized in mapping and assessing land attributes such as physiography, soils, land use/ land cover, relief and soil erosion pattern (Potdar et al., 2003; Velmurugan and Carlos, 2009). The satellite data are utilized in preparing small scale soil resource maps showing soil subgroups and their association for about three decades (Mirajkar and Srinivasan, 1975; NRSA, 1979 & 1981). The soils of Mizoram are the product of slow diagenic changes of acidic parent material causing inherent soil acidity and high precipitation further aggravates this problem due to leaching of basic cations (Mishra and Saithantluanga, 2000). Soils are generally fertile and responsive to fertilizer application. It is rich in organic carbon content but very poor in available phosphorus and potassium content. Rocks of this area are generally sandstone and shale, the derived soils are mostly red and yellow loamy. According to the genetic system or major soil group classification, soils of Aizawl district falls under red and lateritic soils (Sehgal, 2005). However, detailed report about the soils of Aizawl district was not known so far. Present investigation was therefore undertaken to classify the soils upto series level by using physiographic soil mapping using remote sensing and GIS techniques.

## 2. Materials and methods

The study area is situated in the northern part of Mizoram between 24°25'16" and 23°18'17" N Latitudes and 92°37'03" and 93°11'45" E Longitudes covering an area of 3576.31 sq.km (Figure 1). Soil survey of the area was carried out using digital data of IRS-P6 LISS III of 27th January, 2006 with a resolution of 23.5m. Base map was prepared from Survey of India topographical sheets number 83D/15, 83D/16, 84A/9, 84A/10, 84A/11, 84A/13, 84A/14 84A/15, 84E/1, 84E/2, 83H/3 and 83H/4. Mizoram receives about 2500mm rainfall annually and the land is covered by dense and diversified vegetation. Land use/land cover map delineated from the satellite imagery and the digital elevation model (DEM) prepared by using Geographic Information System (GIS) were utilised for generation of physiographic unit. The physiographic unit and soil profiles studied at ground truth and analysis were incorporated for preparing soil map of the area. The soil map was prepared in the scale of 1:50,000. The Arc GIS software was used for spatial and attribute database generation and preparation of thematic maps. The soil taxonomic classification was done according to Soil Taxonomy (1988) on the basis of their physico-chemical and morphological properties and by traversing the area. Sample strips selection was done for detailed examination of the soils occurring in various units. A total of 143 soil profiles were examined, out of which 14 soil profiles, which represents each physiographic unit were processed and

analysed for various physico chemical properties by using standard methods such as pH (Goel and Trivedi, 1992), Organic carbon (Okalebo et al., 1993), Sodium and Potassium by the standard procedures of (Jackson, 1973), Mechanical analysis by hydrometer method (Bouyoucos, 1962), Cation Exchange Capacity (CEC) by the method of (Schollenberger and Simon, 1945), Calcium and Magnesium by complex-metric titration using ethylene diamine tetra-acetic acid (EDTA) (Barrows and Simpson, 1962). Percent Base Saturation (BS) was calculated by dividing the sum of basic ions (S) by total cations (T) multiplied by 100 as: S/T x 100. The soil colour was measured by using Munsell colour chart. Land capability classification was generated under GIS environment by using the criteria laid by Klingebiel and Montgomery (1961) in which each physiographic unit were given weightage for their suitability or unsuitability for cultivation, forestry, grassland or other uses for sustained production. The physiographic unit that have the least limitations or hazard and respond best to management were given highest category.

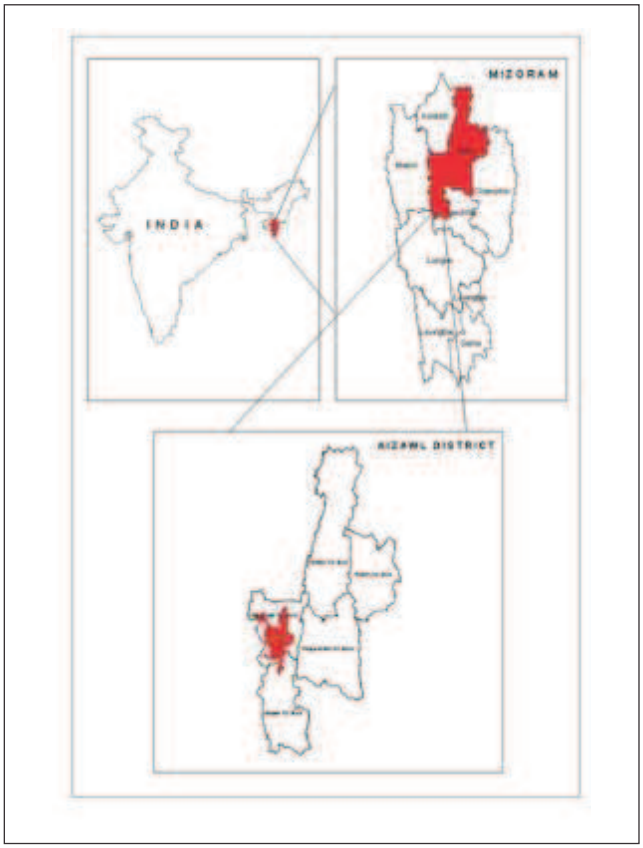


*Figure 1: Location Map of Aizawl District, Mizoram*

## 3. Results and discussion

Aizawl district of Mizoram experiences warm humid sub-tropical climate. It is under the direct influence of monsoon. The average annual rainfall during the years 2000 to 2010 is recorded 2560 mm. On the basis of rainfall and humidity, the soil moisture regime is classified as Udic as the soil moisture control section is not dry in any part for as long as 90 cumulative days. It is observed that the mean summer temperature (June to August) is 24.56ºC and mean winter temperature (December to February) is 18.0ºC and their difference is 6.56ºC which exceeds 5ºC and the soil qualify for Hyperthermic temperature class to be used as family modifiers. Physiographic soil map is given in Figure 2.

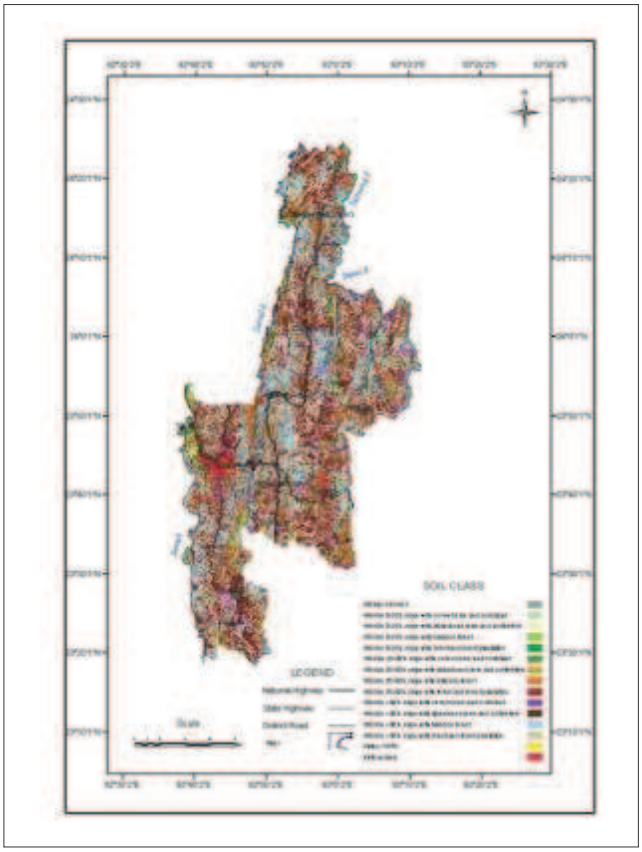

*Figure 2: Physiographic unit wise distribution of soil of Aizawl District, Mizoram*

### 3.1 Soil characteristics and description

On the basis of field observations and laboratory analysis, soils of the area have been classified into 14 soil series (Table 1). The soils of Sialsuk and Vervek series are deep to very deep, dark yellowish brown (10YR 4/3) to yellowish brown (10YR 5/6) in colour, clay loam, well drained with moderate to severe erosion. Soils of Thingsulthliah are very deep, dark yellowish brown (10YR 4/4) to brownish yellow (10YR 6/6), strongly acidic with sandy clay loam surface and clay loam to clay sub-surface, well-drained on hill side slopes and hill crest/top, moderate to severe erosion and cutans are formed. Soils of Khawlian are very deep, dark yellowish brown to strong brown (7.5YR 4/6), sandy clay to clay sub-surface, very strongly acidic, well drained on hill side slopes with moderate to severe erosion, translocated silicate clay cutans are also formed. Soils of Aibawk have very deep, dark yellowish brown to strong brown (7.5YR 4/6), clay loam, very strongly acidic, well drained on hill side slopes with moderate to severe erosion. Soils of Sihphir are very deep, dark yellowish brown, sandy clay loam to clay, medium to

strongly acidic, well drained on hill side slope, moderate to severe erosion with cutans. Soils of Aizawl are very deep, dark yellowish to dark brown, strongly acidic surface and very strongly acidic sub-surface, clay loam to clay, well-drained, hill side slopes with moderate erosion. Suangpuilawn soils are very deep, dark brown to strong brown, sandy clay loam to clay, strongly acidic to very strongly acidic, well drained, hill side slopes with moderate erosion. Chalfilh and Darlawn soils are very deep, dark brown to dark yellowish brown, clay to sandy clay loam, very strongly acidic, well drained, moderate erosion with cutans. Tawizo soil are very deep, dark brown(10YR 3/3) to yellowish red(7.5YR 5/6), clay loam to clay, very strongly acid, well drained on hill side slopes with severe to moderate erosion, patchy thin cutans are formed. Tuirini soils are very deep, yellowish brown to brownish yellow (10YR 6/6), clay loam to sandy clay loam, medium to strongly acidic on narrow valley, poorly drained with slight erosion. Soils of Tuivawl are deep to very deep, dark brown to dark yellowish brown, sandy clay loam surface and clay sub-surface, very strongly acidic, poorly drained, narrow valley with slight erosion while Saitual soils have very deep, dark brown to strong brown, sandy clay loam to clay loam, strongly acidic, moderately well drained with moderate erosion. In general soils of different profiles in Aizawl are medium to strongly acidic in reaction (pH 4.56-6.08) and experiencing moderate to heavy soil erosion.

### 3.2 Physico chemical properties

Organic carbon content varies from 0.38 to 1.94 % and most of the soils are in medium category and in almost all the soils the organic carbon content decreased with depth which might be due to the decrease in the organic matter content with increasing depth. Cation exchange capacity (CEC) of soils varied from 2.28 to 26.15 cmol ($p^+$). Magnesium is the dominant exchangeable cation ranged from 0.2 to 4.6 meq/100 g, Calcium from 0.1 to 1.6 meq/100 g, Potassium from 0.05 to 0.54 meq/100 g and sodium from 0.10 to 0.35 meq/100 g (Table 2).

### 3.3 Soil classification

Soil taxonomy is a comprehensive classification system which keys out soil Order, Suborder, Great group, Sub-group and Family in different steps. The investigation reveals that soils of Aizawl district is divided into three soil order viz. Entisols, Inceptisols and Ultisols (Table 1). Inceptisols is the dominant order followed by Ultisols and then Entisols, this finding is similar to the findings of (NBSS and Directorate of Agriculture, 2001, unpublished data). The physiographic classification and their area covered are given in table 3 and the soil map based on the physiographic unit is represented in Figure 2. The soils/pedons of Tuirini, Tuivawl, Saitual, Aizawl, Sialsuk, Aibawk, Suangpuilawn and Darlawn series have Cambic horizon and thus were categorized as Inceptisols and Ochrepts suborder owing to the presence of Umbric epipedon. It is less than 25 cm in thickness and soil temperature regime is warmer than mesic. As this pedons base saturation (BS) is less than 60% and have udic soil moisture regime hence classified as Dystrochrepts soil group. The series Tuirini has been classified under the subgroup Aquic owing to the decrease in organic carbon content with depth and do not have a lithic contact and argillic horizon in the pedon. The series Aizawl, Sialsuk, and Aibawk belongs to subgroup Typic owing to decrease in organic carbon content with depth and characterized by moderately deep, deep to hard rock. The series Tuivawl belongs to subgroup Fluventic owing to their formation on flood plains of rivers draining regions. The series Saitual belongs to subgroup Fluventic Umbric by having darker epipedons than the Typic. The series Suangpuilawn and Darlawn belongs to subgroup Umbric as this soil occurred in steep slope. The soils/pedons of Sihphir, Thingsulthliah, Khawlian, Chalfilh and Tawizo series have clay enriched subsurface horizons with base saturation less than 35%, so they are classified under soil order Ultisols and Udults suborder owing to udic soil moisture regime. These were classified under soil group Hapludults owing to the presence of Ochric epipedon and a thin or moderately thick Argillic horizon. The series Sihphir, Thingsulthliah and Khawlian belongs to the subgroup Typic as this soils are freely drained soils, have an Ochric epipedon that is not both thick and sandy while the series Chalfilh and Tawizo belongs to the subgroup Humic owing to the presence of Umbric epipedon. The soils/pedons of vervek series belongs to the order Entisols as these soils does not have any diagnostic horizon. As these soils are not permanently saturated with water and have slope greater than 25 %, they are classified as suborder Orthents and soil group Udorthens owing to the Udic soil moisture regime. These soils are not saturated with water for as long as 1 month within the surface and there is no lithic contact within 50 cm of the surface, they are classified as Typic Udorthens.

### 3.4 Land capability classification

Land capability classification serves as a guide to assess suitability of the land for cultivation, grazing and forest plantation (Klingebiel and Montgomery, 1961) and therefore key to spatial planning and forecasting of land suitability. It is a broad grouping of soils based on their limitations. The grouping of soils into capabilities facilitates to produce crops and pasture plants without deterioration over a long period of time. It is mainly based on the (i) inherent soil properties, (ii) external land features, and (iii) environmental factors that limit the land use. The soils of Aizawl have been classified into 5 land capability classes i.e. IIe, IIIe, IVe, VIe and VIIe. Land capability class I to IV are cultivable and crops can be grown under proper and specific soil management whereas Class V to VIII are not suitable for crops but are suited to permanent vegetation. The statistics of land capability classes are given in Table 4 and the capability map on Figure 3. In all the soils, the major limitation was moderate to severe soil erosion owing to gentle to very steep slopes. Therefore, soil conservation planning is required urgently. This may include afforestation, sustainable agro-horticulture system and conservation of natural vegetation along the gradient.

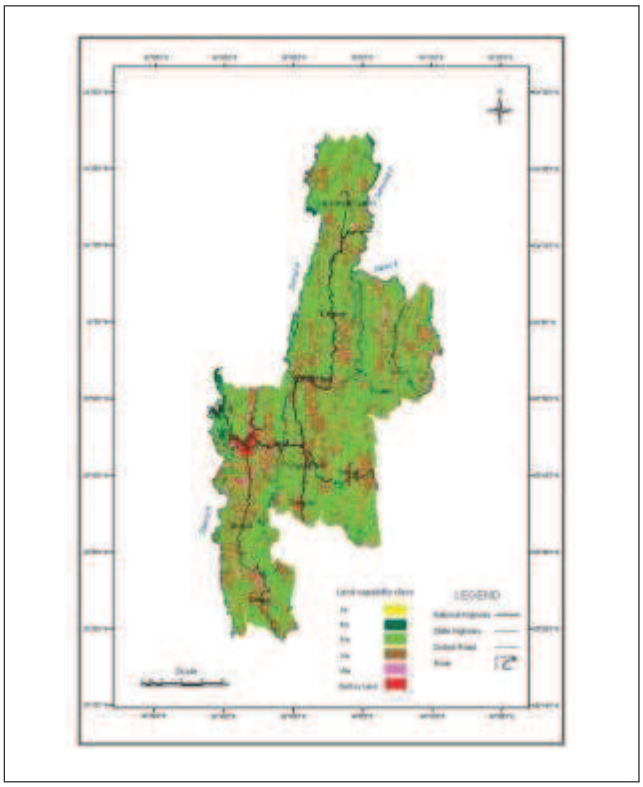

*Figure 3: Land Capability map of Aizawl District, Mizoram*

## 4. Conclusion

It can be concluded from the observations that the dominant soil order of Aizawl district is 'Inceptisols' indicating that the soil is young. Soils are deep to very deep from steep to very steep slopes including hill ridges. Because of steepness of the slopes, soil erosion is predominating setback followed by heavy rainfall resulted into leaching of basic ions and soil becomes highly acidic. However, the area is suitable for agricultural and horticultural cultivation and allied activities such as sericulture and forest plantation etc. for sustainable management of land resources.

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*Table 1: Soil classification of Aizawl district*

| Soil Classification | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sl no** | **Proposed soil series** | **Order** | **Sub order** | **Great soil group** | **Sub group** | **Family** | **Land capability class** |
| 1 | Vervek | Entisols | Orthents | Udorthents | Typic Udorthents | Loamy Skeletal, Mixed, Hyperthermic | IVe |
| 2 | Tuirini | Inceptisols | Ochrepts | Dystrochrepts | Aquic Dystrochrepts | Fine Loamy, Mixed, Hyperthermic | IIe |
| | Tuivawl | | | | Fluventic Dystrochrepts | Fine Loamy, Mixed, Hyperthermic | IIe |
| | Saitual | | | | Fluventic Umbric Dystrochrepts | Fine Loamy, Mixed, Hyperthermic | IIe |
| | Aizawl | | | | Typic Dystrochrepts | Fine Loamy, Mixed, Hyperthermic | IIIe |
| | Sialsuk | | | | | Loamy Skeletal, Mixed, Hyperthermic | IVe &VIIe |
| | Aibawk | | | | | Clayey, Mixed, Hyperthermic | IIIe & IVe |
| | Suangpuilawn | | | | Umbric Dystrochrepts | Fine Loamy, Mixed, Hyperthermic | IIIe & VIe |
| | Darlawn | | | | | Loamy Skeletal, Mixed, Hyperthermic | IVe & VIe |
| 3 | Sihphir | Ultisols | Udults | Hapludults | Typic Hapludults | Fine Loamy, Mixed, Hyperthermic | IVe & VIIe |
| | Thingsulthliah | | | | | Loamy Skeletal, Mixed, Hyperthermic | IIIe, IVe & VIIe |
| | Khawlian | | | | Humic Hapludults | Fine loamy, Mixed, Hyperthermic | IIIe |
| | Chalfilh | | | | | Clayey, Mixed, Hyperthermic | IVe & VIe |
| | Tawizo | | | | | Loamy Skeletal, Mixed, Hyperthermic | IVe & VIe |

*Table 2: Physico chemical properties of soils of Aizawl district*

| **Horizon** | **Depth cm** | **Mechanical analysis** | | | **pH (1:2)** | **OC %** | **CEC Meq/100 g** | **Exchangeable bases Meq/100 g** | | | | BS (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Sand** | **Silt** | **Clay** | | | | **$Ca^{++}$** | **$Mg^{++}$** | **$K^{+}$** | **$Na^{+}$** | |
| Vervek - Loamy skeletal, mixed, Hyperthermic, Typic Udorthens | | | | | | | | | | | | |
| A1 | 0-14 | 42 | 23 | 35 | 5.45 | 1.35 | 26.15 | 1.5 | 1.5 | 0.54 | 0.35 | 14.65 |
| AC | 15-25 | 43 | 21 | 34 | 5.25 | 1.10 | 25.42 | 1.3 | 1.1 | 0.36 | 0.25 | 12.62 |
| C | 26-55 | 44 | 21 | 35 | 5.12 | 1.00 | 25.32 | 1.1 | 1.0 | 0.35 | 0.22 | 10.90 |
| | | | | | | | | | | | | |
| Sialsuk - Loamy skeletal, mixed, Hyperthermic, Typic Dystrochrepts | | | | | | | | | | | | |
| Ap | 0-14 | 42 | 19 | 39 | 5.15 | 1.55 | 7.88 | 0.6 | 4.6 | 0.14 | 0.14 | 56.22 |
| A1 | 15-34 | 41 | 22 | 37 | 5.25 | 1.46 | 6.05 | 0.11 | 3.4 | 0.08 | 0.15 | 50.37 |
| A3 | 35-60 | 42 | 23 | 35 | 5.12 | 1.24 | 5.83 | 0.3 | 2.1 | 0.07 | 0.15 | 45.07 |
| B2 | 61-80 | 42 | 24 | 34 | 5.07 | 0.95 | 6.89 | 0.3 | 2.5 | 0.11 | 0.19 | 45.04 |
| C | 81-110 | 44 | 25 | 31 | 5.03 | 0.87 | 6.19 | 0.2 | 2.6 | 0.09 | 0.17 | 49.00 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aibawk - Fine loamy, mixed, Hyperthermic, Typic Dystrochrepts | | | | | | | | | | | | |
| Ap | 0-14 | 40 | 21 | 39 | 4.88 | 1.24 | 9.58 | 0.5 | 3.9 | 0.11 | 0.14 | 48.26 |
| A1 | 15-34 | 41 | 21 | 36 | 4.72 | 1.15 | 8.86 | 0.3 | 3.7 | 0.11 | 0.13 | 42.77 |
| A3 | 35-60 | 39 | 22 | 39 | 4.71 | 0.95 | 9.72 | 0.5 | 2.3 | 0.11 | 0.19 | 32.56 |
| B2 | 61-88 | 38 | 25 | 37 | 4.60 | 0.72 | 10.94 | 0.4 | 3.1 | 0.11 | 0.17 | 32.68 |
| C | 89-115 | 37 | 22 | 40 | 4.56 | 0.54 | 10.74 | 0.5 | 3.1 | 0.10 | 0.12 | 35.80 |
| Darlawn - Loamy skeletal, mixed, Hyperthermic, Umbric Dystrochrepts | | | | | | | | | | | | |
| A1 | 0-14 | 42 | 19 | 39 | 5.35 | 1.22 | 5.06 | 0.7 | 1.9 | 0.24 | 0.14 | 63.08 |
| A3 | 15-34 | 40 | 20 | 40 | 5.24 | 1.11 | 6.19 | 0.6 | 2.6 | 0.21 | 0.14 | 58.96 |
| B2 | 35-60 | 44 | 13 | 43 | 5.12 | 1.08 | 4.62 | 0.6 | 0.9 | 0.19 | 0.15 | 34.18 |
| B3 | 61-90 | 41 | 12 | 47 | 5.04 | 0.78 | 5.52 | 0.6 | 1.0 | 0.32 | 0.17 | 42.37 |
| C | 91-126 | 39 | 13 | 48 | 5.01 | 0.61 | 4.60 | 0.8 | 0.8 | 0.23 | 0.14 | 43.50 |
| Suangpuilawn - Fine loamy, mixed, Hyperthermic, Umbric Dystrochrepts | | | | | | | | | | | | |
| A11 | 0-14 | 47 | 24 | 29 | 5.87 | 1.62 | 7.67 | 1.1 | 2.1 | 0.09 | 0.15 | 53.94 |
| A12 | 15-34 | 46 | 24 | 30 | 5.72 | 1.56 | 7.82 | 1.0 | 2.1 | 0.13 | 0.18 | 45.56 |
| A3 | 35-60 | 42 | 22 | 36 | 5.35 | 1.24 | 5.64 | 0.4 | 1.1 | 0.12 | 0.21 | 39.03 |
| B2 | 61-90 | 40 | 20 | 40 | 5.08 | 0.88 | 4.92 | 0.6 | 0.9 | 0.10 | 0.16 | 34.35 |
| B3 | 91-112 | 40 | 18 | 42 | 4.84 | 0.72 | 4.54 | 0.4 | 0.8 | 0.12 | 0.17 | 30.93 |
| C | 113-135 | 34 | 17 | 49 | 4.65 | 0.52 | 4.72 | 0.2 | 0.6 | 0.13 | 0.19 | 24.54 |
| Tuivawl - Fine loamy, mixed, Hyperthermic, Fluventic Dystrochrepts | | | | | | | | | | | | |
| AP | 0-14 | 52 | 19 | 29 | 4.82 | 0.99 | 6.01 | 0.6 | 1.8 | 0.12 | 0.19 | 45.16 |
| A1 | 15-38 | 52 | 18 | 30 | 4.75 | 0.77 | 5.39 | 0.4 | 1.4 | 0.09 | 0.20 | 38.82 |
| A3 | 38-60 | 44 | 20 | 36 | 4.70 | 0.48 | 4.38 | 0.2 | 1.0 | 0.08 | 0.19 | 33.83 |
| B2 | 61-82 | 45 | 16 | 39 | 4.61 | 0.41 | 4.04 | 0.2 | 0.9 | 0.01 | 0.12 | 30.84 |
| B3 | 91-108 | 35 | 20 | 45 | 4.55 | 0.38 | 3.29 | 0.1 | 0.8 | 0.07 | 0.12 | 25.47 |
| Saitual - Fine loamy, mixed, Hyperthermic, Fluventic Umbric Dystrochrepts | | | | | | | | | | | | |
| Ap | 0-14 | 53 | 19 | 28 | 5.48 | 1.12 | 4.89 | 0.6 | 1.1 | 0.18 | 0.18 | 44.07 |
| A1 | 15-30 | 50 | 20 | 30 | 5.42 | 1.05 | 3.36 | 0.6 | 0.9 | 0.11 | 0.12 | 43.87 |
| A3 | 30-48 | 50 | 18 | 32 | 5.25 | 0.95 | 3.06 | 0.4 | 0.6 | 0.14 | 0.14 | 34.18 |
| B1 | 48-70 | 41 | 22 | 37 | 5.23 | 0.88 | 2.68 | 0.2 | 0.2 | 0.09 | 0.18 | 29.71 |
| B3 | 71-105 | 40 | 22 | 38 | 5.18 | 0.67 | 2.74 | 0.2 | 0.2 | 0.06 | 0.11 | 21.22 |
| Tuirini - Fine loamy, mixed, Hyperthermic, Aquic Dystrochrepts | | | | | | | | | | | | |
| Ap | 0-14 | 41 | 19 | 40 | 6.08 | 1.44 | 7.79 | 1.1 | 2.9 | 0.09 | 0.19 | 40.79 |
| A1 | 15-30 | 43 | 20 | 37 | 5.45 | 1.24 | 6.35 | 0.8 | 2.6 | 0.07 | 0.16 | 43.62 |
| A3 | 30-56 | 44 | 19 | 37 | 5.38 | 1.08 | 6.77 | 0.6 | 2.5 | 0.08 | 0.22 | 44.92 |
| B2 | 57-82 | 46 | 18 | 36 | 5.31 | 0.76 | 5.89 | 0.4 | 1.8 | 0.06 | 0.28 | 47.34 |
| B3 | 83-112 | 48 | 20 | 32 | 5.22 | 0.65 | 4.27 | 0.4 | 0.9 | 0.14 | 0.27 | 50.42 |
| C | 113-125 | 50 | 19 | 31 | 5.11 | 0.62 | 5.66 | 0.6 | 1.1 | 0.22 | 0.21 | 51.22 |
| Aizawl - Clayey, mixed, Hyperthermic Typic Dystrochrepts | | | | | | | | | | | | |
| Ap | 0-14 | 43 | 19 | 38 | 5.44 | 1.68 | 5.66 | 0.6 | 1.6 | 0.31 | 0.18 | 48.80 |
| A1 | 15-34 | 40 | 20 | 40 | 5.40 | 1.55 | 4.85 | 0.4 | 1.4 | 0.26 | 0.15 | 52.66 |
| A3 | 35-49 | 40 | 19 | 41 | 5.26 | 0.92 | 3.75 | 0.2 | 1.2 | 0.17 | 0.12 | 38.96 |
| B2 | 50-72 | 34 | 21 | 45 | 5.11 | 0.78 | 3.13 | 0.2 | 0.8 | 0.11 | 0.14 | 42.62 |
| B3 | 83-102 | 32 | 18 | 50 | 4.98 | 0.59 | 2.90 | 0.1 | 0.6 | 0.12 | 0.12 | 39.15 |
| C | 103-128 | 31 | 17 | 52 | 4.92 | 0.51 | 2.28 | 0.1 | 0.4 | 0.15 | 0.11 | 43.01 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sihphir– Fine Loamy, mixed, Hyperthermic, Typic Hapludults | | | | | | | | | | | | |
| A1 | 0 – 12 | 46 | 21 | 33 | 5.84 | 2.14 | 12.71 | 2.1 | 2.9 | 0.25 | 0.21 | 42.94 |
| B21t | 12 – 28 | 45 | 20 | 35 | 5.67 | 1.76 | 10.93 | 1.4 | 2.6 | 0.22 | 0.17 | 34.78 |
| B22t | 28 – 62 | 37 | 21 | 42 | 5.46 | 1.42 | 8.54 | 0.6 | 1.0 | 0.15 | 0.17 | 27.27 |
| B23t | 62 – 84 | 36 | 20 | 44 | 5.25 | 0.94 | 8.18 | 0.4 | 1.0 | 0.13 | 0.11 | 23.62 |
| B3 | 84–118 | 35 | 19 | 46 | 5.21 | 0.81 | 7.11 | 0.2 | 1.0 | 0.11 | 0.14 | 23.36 |
| A1 | 0 – 12 | 46 | 21 | 33 | 5.84 | 2.14 | 12.71 | 2.1 | 2.9 | 0.25 | 0.21 | 42.94 |
| Thingsulthliah - Loamy skeletal, mixed, Hyperthermic, Typic Hapludults | | | | | | | | | | | | |
| A1 | 0-14 | 48 | 20 | 32 | 5.65 | 1.44 | 10.91 | 1.4 | 2.6 | 0.26 | 0.14 | 42.27 |
| B1t | 15-38 | 46 | 19 | 35 | 5.54 | 1.25 | 9.80 | 1.6 | 1.8 | 0.18 | 0.17 | 33.72 |
| B2t | 39-72 | 45 | 17 | 38 | 5.46 | 1.08 | 9.74 | 1.6 | 1.4 | 0.14 | 0.15 | 33.31 |
| B3 | 73-96 | 42 | 18 | 40 | 5.32 | 0.82 | 8.58 | 0.8 | 0.9 | 0.12 | 0.11 | 24.77 |
| C | 96-126 | 37 | 18 | 45 | 5.21 | 0.74 | 7.87 | 0.6 | 1.0 | 0.11 | 0.18 | 24.19 |
| Khawlian – Fine loamy, mixed, Hyperthermic, Humic Hapludults | | | | | | | | | | | | |
| A1 | 0-14 | 46 | 11 | 43 | 5.21 | 1.94 | 8.07 | 1.1 | 2.7 | 0.24 | 0.12 | 51.69 |
| B1t | 15-38 | 45 | 13 | 42 | 4.92 | 1.58 | 7.99 | 1.0 | 1.2 | 0.16 | 0.16 | 33.67 |
| B21t | 39-61 | 38 | 16 | 46 | 4.82 | 1.32 | 7.16 | 1.2 | 0.6 | 0.16 | 0.18 | 31.60 |
| B22t | 62-82 | 35 | 17 | 48 | 4.71 | 0.92 | 6.32 | 0.6 | 0.8 | 0.14 | 0.13 | 27.22 |
| B3 | 83-105 | 31 | 19 | 50 | 4.65 | 0.65 | 5.18 | 0.4 | 0.6 | 0.08 | 0.10 | 22.85 |
| C | 106-126 | 27 | 20 | 53 | 4.61 | 0.51 | 5.17 | 0.2 | 0.4 | 0.07 | 0.12 | 15.73 |
| Chalfilh - Clayey, mixed, Hyperthermic, Humic Hapludults | | | | | | | | | | | | |
| A1 | 0-14 | 34 | 19 | 47 | 4.96 | 1.67 | 8.63 | 1.2 | 1.6 | 0.11 | 0.12 | 35.15 |
| B1t | 15-35 | 36 | 19 | 45 | 4.82 | 1.15 | 9.15 | 0.8 | 2.1 | 0.08 | 0.14 | 34.42 |
| B21t | 36-67 | 37 | 17 | 46 | 4.76 | 0.92 | 8.51 | 0.6 | 1.3 | 0.06 | 0.12 | 29.52 |
| B22t | 68-92 | 31 | 18 | 51 | 4.67 | 0.72 | 8.53 | 0.6 | 1.4 | 0.17 | 0.14 | 27.39 |
| B3 | 93-127 | 49 | 22 | 29 | 4.63 | 0.56 | 7.93 | 0.6 | 1.3 | 0.05 | 0.16 | 26.94 |
| Tawizo - Loamy skeletal, mixed, Hyperthermic, Humic Hapludults | | | | | | | | | | | | |
| A1 | 0-14 | 37 | 24 | 39 | 4.92 | 1.18 | 6.07 | 0.4 | 1.6 | 0.19 | 0.17 | 39.04 |
| B21t | 15-35 | 39 | 22 | 39 | 4.84 | 1.11 | 6.42 | 0.4 | 1.4 | 0.12 | 0.18 | 29.97 |
| B22t | 36-61 | 38 | 20 | 42 | 4.67 | 0.86 | 7.61 | 0.6 | 1.2 | 0.14 | 0.28 | 31.70 |
| B3 | 62-98 | 35 | 19 | 46 | 4.62 | 0.72 | 6.81 | 0.6 | 0.8 | 0.16 | 0.17 | 25.16 |
| C | 99-130 | 33 | 18 | 49 | 4.61 | 0.65 | 5.60 | 0.4 | 0.4 | 0.11 | 0.14 | 23.29 |

*Table 3: Soil Statistics of Aizawl District, Mizoram*

| Map Symbol | Physiography | Soil Composition | Area (km$^2$) | % |
|---|---|---|---|---|
| 1 | Hill top/Hill Crest | L.S. Typic Dystrochrepts<br>L.S. Typic Udorthents<br>L.S. Typic Hapludults | 10.73 | 0.30 |
| 2 | Hill side 10-25% slope with agriculture/Horticulture land/ Shifting cultivation | Clayey Typic Hapludults<br>F.L. Typic Dystrochrepts<br>F.L. Typic Hapludults | 9.66 | 0.27 |

| | | | | |
|---|---|---|---|---|
| 3 | Hill side 10-25% slope with Secondary/ open forest/ Scrubland/ Abandoned Shifting cultivation | F.L. Typic Dystrochrepts<br>L.S. Typic Hapludults<br>Clayey Typic Dystochrepts | 17.88 | 0.50 |
| 4 | Hill side 10-25% slope with bamboo forest | F.L. Umbric Dystrochrepts<br>F.L. Humic Hapludults<br>Clayey Typic Hapludults | 63.3 | 1.77 |
| 5 | Hill side 10-25% slope with Primary forest/ Dense forest/ Forest plantation | F.L. Humic Hapludults<br>F.L. Umbric Dystrochrepts<br>Clayey Typic Dystochrepts | 40.05 | 1.12 |
| 6 | Hill side 25-50% slope with agriculture/horticulture land/ Shifting cultivation | Clayey Typic dystrochrepts<br>L.S. Umbric Dystrochrepts<br>L.S. Typic Hapludults | 113.01 | 3.16 |
| 7 | Hill side 25-50% slope with Secondary/ open forest/ Scrubland/ Abandoned Shifting cultivation | L.S. Typic Hapludults<br>L.S. Umbric Dystrochrepts<br>F.L. Humic Hapludults | 201.35 | 5.63 |
| 8 | Hill side 25-50% slope with bamboo forest | L.S. Humic Hapludults<br>Clayey Typic Dystrochrepts<br>F.L. Umbric Dystrochrepts | 718.12 | 20.08 |
| 9 | Hill side 25-50% slope with Primary forest/ Dense forest/ Forest plantation | F.L. Umbric Dystrochrepts<br>F.L. Humic Hapludults<br>L.S. Typic Hapludults | 630.50 | 17.63 |
| 10 | Hill side >50% slope with agriculture/horticulture land/ Shifting cultivation | F.L. Typic Hapludults<br>L.S. Typic Dystochrepts<br>L.S. Umbric Dystrochrepts | 96.2 | 2.69 |
| 11 | Hill side >50% slope with Secondary/ open forest/ Scrubland/ Abandoned Shifting cultivation | L.S. Umbric Dystrochrepts<br>F.L. Humic Hapludults<br>L.S. Typic Hapludults | 203.49 | 5.69 |
| 12 | Hill side >50% slope with bamboo forest | L.S. Humic Hapludults<br>F.L. Umbric Dystrochrepts<br>L.S. Typic Hapludults | 602.97 | 16.86 |
| 13 | Hill side >50% slope with Primary forest/ Dense forest/ Forest plantation | L.S. Umbric Dystrochrepts<br>L.S. Humic Hapludults<br>F.L. Umbric Dystrochrepts | 779.64 | 21.8 |
| 14 | Valley | F.L. Aquic Dystrochrepts<br>F.L. Fluventic Dystrochrepts<br>F.L. Fluventic Umbric Dystrochrepts | 26.46 | 0.74 |

| | | | | |
|---|---|---|---|---|
| 15 | Built up land | | 48.64 | 1.36 |
| 16 | Water body | | 14.31 | 0.4 |
| | Total | | 3576.31 | 100.00 |

*L.S. = Loamy skeletal, F.L.= Fine loamy*

*Table 4: Land capability statistics of Aizawl district, Mizoram*

| Sl no | Land capability class | Brief description | Area | |
|---|---|---|---|---|
| | | | Sqkm | % |
| 1 | IIe | Good arable land on gentle slopes, susceptible to slight water erosion, very deep soil, suitable for agricultural development. | 26.46 | 0.74 |
| 2 | IIIe | Moderately good land on strongly sloping to steep, susceptible to severe water erosion, deep to very deep soil, suitable for agricultural and horticultural development. | 130.89 | 3.66 |
| 3 | IVe | Fairly good land on steep to very steep slopes and hill ridge, highly susceptible to water erosion, deep to very deep soil, suitable for agro-horticultural, sericulture and silvipastoral development. | 1673.71 | 46.80 |
| 4 | VIe | Land with moderate limitations on very steep, highly susceptible to water erosion, deep to very deep soil, suitable for horticultural plantation and forestry. | 1382.60 | 38.66 |
| 5 | VIIe | Land with severe limitations on very steep slopes, subject to severe erosion. Unsuitable for cultivation but suitable for social forestry and grazing. | 299.70 | 8.38 |
| 6 | Built up land | | 48.64 | 1.36 |
| 7 | Water body | | 14.31 | 0.4 |
| | | TOTAL | 3576.31 | 100 |