Natural Physical Environment of Tibet

Chhering Tandup
(Asstt. Professor), Faculty of Earth Sciences,
Institute of Mountain Environment,
Bhaderwah Campus, University of Jammu.

Paper Received on: 21/09/2014
Paper Reviewed on: 21/09/2014
Paper Accepted on: 25/09/2014

Abstract

This paper is focused on the natural physical environment of Tibet. Tibet, like most regions of the Himalayas, is divided into several distinct terrains and climates. Tibet is famous with the name of 'Roof of the World' and always in the media because of political crises. The Tibetan Plateau is also known as the Qinghai-Tibetan (Qingzang) Plateau is a vast, elevated plateau in Central Asia or East Asia covering most of the Tibet Autonomous Region and Qinghai Province in western China, as well as part of Ladakh in Jammu and Kashmir. This paper will give a brief account about the physiographic divisions, climate, drainage system, vegetation, soils etc. of Tibet. Tibet is Bordered India, Bhutan, Nepal and Sikkim to the south and the west, Yunan Province to the southeast, Sichuan Province to the east with Qinghai Province and Xinjiang Uygur Autonomous Region to the north, Tibet is the second largest region in China (after Xinjiang Uygur Autonomous Region), occupying a total area of over 1,200,000 sq m (463,320 sq miles), at an average altitude of more than 4,000m (13,123 ft). This paper is based on the review of literature and various maps are constructed by using Arc View GIS version 10.

Keywords: Physical Environment, Plateau, Climate, Physiographic, Drainage System, Arc View GIS.

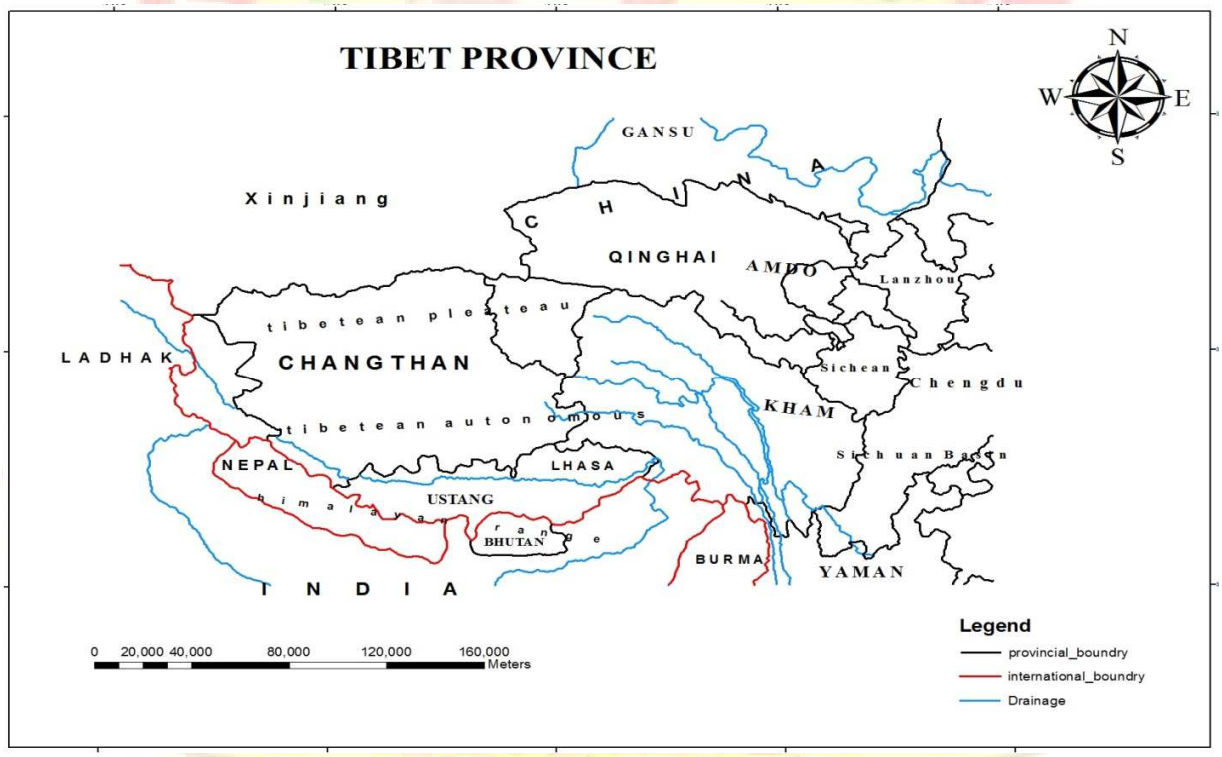
1. Introduction

Tibet autonomous region is a buffer state between India in the South-West and China in the North-East. The region is going under political crises since 1960's after exile of His Holiness 14th Dalai Lama Ji and his followers. It is also the highest plateau of the world having average height of 4500 mts from the mean see level. All the majore Himalayan rivers are originated from the Tibet Plateau. Tibetan exiles

claim 75 million Chinese now live in Tibet alongside six million Tibetans.

Location

Tibet autonomous region is located at longitude 78°25'-99° 06' east and latitude 26° 44'-36° 32' north on the southwest border of China and covers the majority of the Qinghai-Tibet Plateau. Bordering India, Bhutan, Nepal and Sikkim to the south and the west, Yunan Province to the southeast, Sichuan Province to the east with Qinghai Province and Xinjiang Uygur Autonomous Region to the north, Tibet is the second largest region in China (after Xinjiang Uygur Autonomous Region), occuping a total area of over 1,200,000 sq km (463,320 sq miles), at an average altitude of more than 4,000m (13,123 ft). Tibet is an amazing combination of sceneries including mountains, plains, foothills, valleys and also known as 'Roof of the World'. Tibet always remains in political conflicts for long. We can broadly divide the whole Tibet into south and north Tibet.



MAP: 1

South Tibet: Mt. Everest soars to a height of some 8850m (29,017.16 ft) skyward and together with several other mountain ranges with an average altitude of 6,000m (19,685 ft), constitutes the

Himalayan mountain range as the highest mountainous area in the south of Tibet. With the higher western end of this area being dry and freezing, the eastern region is temperate, humid and densely forested. Meanwhile, between the Himalayas and the Gangdise, the Yarlung Tsangpo River winds its way through this region leaving a fertile agricultural area of lakes, basins and river valleys along its course.

North Tibet: Vast plateaus in the north of Tibet, specifically around the Kunlun Mountain, the Tanggula Mountain and between the Gangdise and the Nyainqentanglha Mountains, cover 2/3 of the total area of Tibet. Dotted with numerous lakes and basins, the plateaus, among which Changtang Plateau is the best known, provide rich animal husbandry products for other parts of Tibet.

East Tibet: The tortuous ways of Nu, Lancang and Jinsha Rivers cut through the majestic Hengduan Mountain range, creating breathtaking landscapes of high mountains and deep canyons. Higher in the north and lower in the south, the mountain and canyon area in the eastern part of Tibet presents a wide diversity of fauna and flora as well as a unique combination of snow-capped peaks and verdant hillside forests.

2. Physiographic Division

Physiography of any area is related to constant changes occurring over geological time. These are subjected to modifications of surface configuration caused by natural agents those operate in an orderly progressive cyclical sequence. All these physical, chemical and biological changes help in the modification of the earth's surface. The latitudinal extent of Tibet from 27° to 36° and the variation of topography within the plateau, with altitudes between 500 m and more than 8,848 m, leads to a pronounced horizontal and vertical zonation of climatic patterns and therefore to a difficult regionalization of vegetation and land-use. According to Zhao (1986) and Zhao (1994) seven main physiogeographic subregions can be delineated. Tibet, like most regions of the Himalayas, is divided into several distinct terrains and climates.

In general, the entire region of Tibet is an elevated territory presenting a system of alternating valleys and mountain ranges and plateau. The plateau is most important physiographic feature of Tibet in terms of areal coverage. The region can be divided the plateau, mountain ranges and river valleys in terms of physiography.

2.a) The Plateau:

The Tibetan Plateau also known as the Qinghai-Tibetan (Qingzang) Plateau is a vast, elevated plateau in Central Asia or East Asia covering most of the Tibet Autonomous Region and Qinghai Province in western China, as well as part of Ladakh in Jammu and Kashmir. It stretches approximately 1,000 kilometres north to south and 2,500 kilometres east to west. With an average elevation exceeding 4,500 metres (14,800 ft), the Tibetan Plateau is sometimes called "the Roof of the World" and is the world's highest and largest plateau, with an area of 2.5 million km2.

The Tibetan Plateau is surrounded by massive mountain ranges. The plateau is bordered to the south by the Himalayan range, to the north by the Kunlun Range which separates it from the Tarim Basin, and to the northeast by the Qilian Range which separates the plateau from the Hexi Corridor and Gobi Desert. To the east and southeast the plateau gives way to the forested gorge and ridge geography of the mountainous headwaters of the Salween, Mekong, and Yangtze rivers in western Sichuan and southwest Qinghai. In the west the curve of the rugged Karakoram range of northern Kashmir embraces it.

The Tibetan Plateau is bounded on the north by a broad escarpment where the altitude drops from around 5,000 meters to 1,500 meters in less than 150 kilometers. Along the escarpment is a range of mountains. In the west the Kunlun Mountains separate the plateau from the Tarim Basin. About half way across the Tarim the bounding range becomes the Altyn-Tagh and the Kunluns, by convention, continue somewhat to the south. In the 'V' formed by this split is the western part of the Qaidam Basin. The Altyn-Tagh ends near the Dangjin pass on the Dunhuang-Golmud road. To the west are short ranges called the Danghe, Yema, Shule and Tulai Nanshans. The eastern most range is the Qilian Mountains. The line of mountains continues east of the plateau as the Qin Mountains which separate the Ordos Region from Sichuan. North of the mountains runs the Gansu or Hexi Corridor this was the main silk route from China proper to the west.

The plateau is a high-altitude arid steppe interspersed with mountain ranges and large brackish lakes. Annual precipitation ranges from 100 to 300 millimeters and falls mainly as hailstorms. The southern and eastern edges of the steppe have grasslands which can sustainably support populations of nomadic herdsmen, although frost occurs for six months of the year. Permafrost occurs over extensive parts of the plateau. Proceeding to the north and northwest, the plateau becomes progressively higher, colder

and drier, until reaching the remote Changthang region in the northwestern part of the plateau. Here the average altitude exceeds 5,000 meters and winter temperatures can drop to −40 °C.

2.b) The Mountain Ranges of Tibet

The Kunlun, Karakoram, Tanggula, Gangdise, Nyainqentanglha and Himalayas mountain ranges span the Tibet Autonomous Region from east to west, while the Hengduan Mountain range uniquely winds its way from south to north. Among the fourteen mountains in the world that exceed 8,000 m, five stand in Tibet. Mt. Everest, the world highest, awesomely reaches 8850m (29,017.16 ft). Some other peaks, such as Mt. Kailash, although lower in altitude, are noted for their great significance in religious beliefs of the region. The following are the important mountain ranges of Tibet.

a. The Daxue Mountains

The Daxue mean “Great Snow Mountains" is a great mountain range in the western part of Sichuan province in Southwest China. It is part of the Hengduan Mountains a complicated system of mountain ranges of western Sichuan, which itself is adjacent to the eastern edge of the Tibetan Plateau. The Daxue Mountain Range runs for several hundred kilometers in the general north-south direction, mostly within Sichuan’s Tibetan Autonomous Prefecture. It separates the basins of the Yalong River (to the west) and the Dadu River (to the east). Both rivers flow in the general southern direction, and are tributaries of the Yangtze. The tallest peak of the range, the Gongga Shan (Minya Konka), measures 7,556 meters in height. It is located in the southern part of the range.

b. The Ganesh Himal Mountain

Is a sub-range of the Himalaya located mostly in north-central Nepal, but some peaks lie on the border with Tibet. The Trisuli Gandaki valley on the east separates it from the Langtang Himal. The Budhi (Buri), Gandaki valley and the Shyar Khola valley on the west separate it from the Sringi Himal and the Mansiri Himal. The highest peak in the range is Yangra (Ganesh I), 7,422 m.

c. The Mahalangur Himal

The Mahalangur Himal is a section of the Himalaya in northeast Nepal and south-central Tibet extending from the pass Nangpa La between Rolwaling Himal and Cho Oyu east to the Arun River. It includes Mount Everest, Lhotse, Makalu, and Cho Oyu — four of earth's six highest peaks.

d. The Namcha Barwa Himal

Namcha Barwa Himal is also known as Namjagbarwa syntaxis or Namjagbarwa Group Complex, is the easternmost section of the Himalaya in southeastern Tibet and northeastern India. This section spans 180 km. from the headwaters of the Siyom River on the international border North East into Tibet to the canyon of the Yarlung Tsangpo (the Brahmaputra in India), where the Himalaya are said to end, although high ranges actually continue another 300 km. east.

e. The Nyenchen Tanglha

Nyenchen Tanglha is a 700km long mountain range located in the Tibet Autonomous Region, at an average latitude of 30°30'N and a longitude between 90°E and 97°E. Together with the Gangdise range located further west, it forms the Trans-Himalaya, which runs parallel to the main Himalayan range north of the Yarlung Tsangpo river. The range is divided into two main parts: the West and East Nyenchen Tanglha, with a division at the 5432m high Tro La pass, near Lhari.

West Nyenchen Tanglha includes the four highest peaks in the range, all above 7000m: Mount Nyenchen Tanglha (7162m), Nyenchen Tanglha II (7117m), Nyenchen Tanglha III (7046m) and Jomo Gangtse (7048m), all located in Damxung (Damshung) County of Lhasa Prefecture.

East Nyenchen Tanglha, located in the prefecture of Nagchu, Chamdo and Nyingchi, marks the water divide between the Yarlung Tsangpo to the south and the Nak Chu river (which becomes the Nujiang and Salween in its lower reach) to the north.

f. The Rolwaling Himal

The Rolwaling Himal is a section of the Himalaya in east-central Nepal along the Tibet border. It lies west of the Mahalangur (Mount Everest) section and east of the Langtang section. Melungtse 7181m and Melungtse II 7023m are inside Tibet.

g. The Tanggula Mountain

The Tanggula Mountain is a mountain range in the central part of the Tibetan Plateau. Administratively, the western part of the range is in Nagqu Prefecture of the Tibet Autonomous Region; the highest, central part, in the border area of Nagqu Prefecture and Tanggula Town of the Qinghai Province and the eastern section, in the border area of Nagqu and the Yushu Tibetan Autonomous

Prefecture of Qinghai. The elevations of the main ridge average more than 5,000 m. The Yangtze River originates in this mountain range and Peak Geladandong is the tallest peak in the range. The Qinghai-Tibet Highway and the Qinghai-Tibet Railway cross the Tanggula Mountains at Tanggula Mountain Pass. This is the highest point of the Qinghai-Tibet Railway, and the highest point of any railway in the world, at 5,072 meters above sea level.

3. Natural Drainage of Tibet:

Tibet region is the origin sources of major rivers of the world. The prime rivers of Tibet are The Tsangpo, Yagkze, Salween, Mekong and Nayeng Rivers. The Asias largest rivers are originated from Tibet Plateau. So, Tibet is known as the water bowl of the world. The different rivers of Tibet are mentioned below;

a. The Yarlung Tsangpo

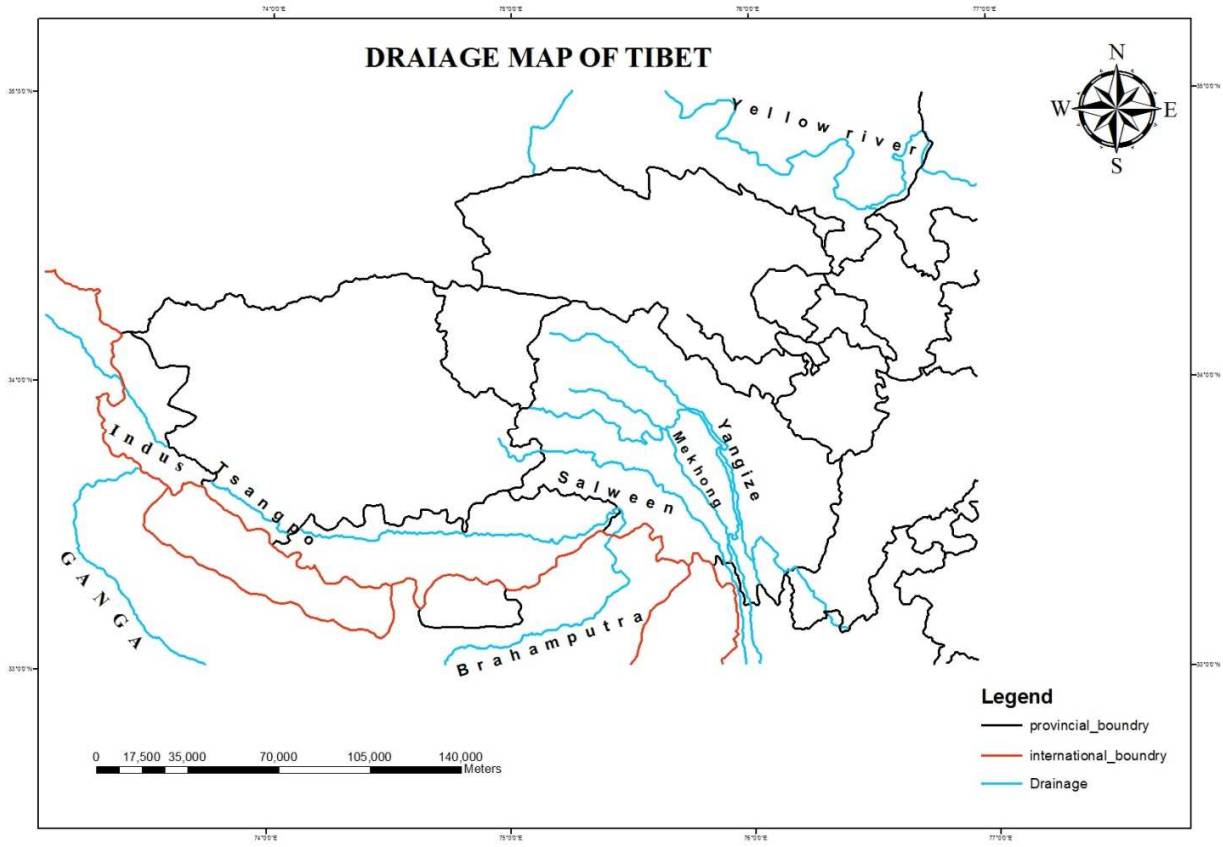
The Yarlung Tsangpo or Yarlung River is a water course that originates at Tamlung Tso lake in western Tibet, southeast of Mount Kailash and Lake Manasarovar. It later forms the South Tibet Valley and Yarlung Tsangpo Grand Canyon, before passing through the state of Arunachal Pradesh, India, where it is known as the Dihang It is sometimes called Yarlung Zangbo or Yarlung Zangbo Jiang. The suffix Tsangpo (or Zangbo, Zangbu) denotes a river flowing from or through Tsang, i.e. Tibet west of Lhasa. Downstream from Arunachal Pradesh the river becomes wider and at this point is called the Brahmaputra River. From Assam (India) the river has entered Bangladesh at Ramnabazar point. From there it used to flow eastward and joined Megna River near Bhairavbazar. At present the main channel of the river is called Jamuna River, which follows southward to meet Ganges known in Bangladesh as the Padma.

b. The Nyang River

The Nyang River is a major river in south-west Tibet and the longest tributary of the Yarlung Tsangpo River. The Nyang has a length of 307.5 kms and originates at 5,000 meters above the sea level from the Chuomuliangla, west of the Mila Mountain. The river joins the Yarlung Tsangpo in Cemeng, Nyingchi, 2,580 meters below its source.

c. The Salween

The Salween which means "Angry River" in Chinese (The river is actually named after the Nu tribe that lives in the area). The river is about 2,815 kilometers long, that flows from the Tibetan Plateau into the Andaman Sea in Southeast Asia. It drains a narrow and mountainous watershed of 324,000 square kilometers that extends into the countries of China, Burma and Thailand.



MAP: II

d. The Mekong

The Mekong is a river in Southeast Asia. Its estimated length is 4,350 km and it drains an area of 795,000 Square km. From the Tibetan Plateau this river runs through China's Yunnan province, Burma (Myanmar), Laos, Thailand, Cambodia and Vietnam.

3. Lakes

Lake Rakshastaal is a lake in Tibet, lying close to the west of Lake Manasarovar and Mount Kailash.

The Satluj River originates at Rakshastaal northwestern tip. Despite its close proximity to Lake Mansarovar—over the road to Purang County, Lake Rakshastaal does not share the lore of worship with its east neighbor. Named "lake of the rakshasa" in Sanskirt.

a. Yamdrok Lake

Yamdrok Lake or Yamzho Yumco is one of the three largest sacred lakes in Tibet. It is over 72 km long. The lake is surrounded by many snowcapped mountains and is fed by numerous small streams. The lake does have an outlet stream at its far western end.

b. Lake Mansarovar

Lake Mansarovar lies at 4,590 meters above mean sea level, a relatively high elevation for a large freshwater lake on the mostly saline lake-studded Tibetan Plateau. Despite claims to the contrary, there are hundreds of higher freshwater lakes in the world. Lake Mansarovar is relatively round in shape with the circumference of 88 kilometres. Its depth reaches a maximum depth of 90 m and its surface area is 320 square kilometres. It is connected to nearby Lake Rakshastal by the natural Ganga Chhu channel. Manasarovar is near the source of the Sutlej River which is the easternmost large tributary of the Indus. Nearby are the sources of the Brahmaputra River, the Indus River, and the Karnali River (Ghaghara), an important tributary of the Ganges River.

c. Dagze Lake

Dagze Lake is one of many inland lakes in Tibet, with a present area of 260 km². In glacial times, the region was considerably wetter, and lakes were correspondingly much larger. Changes in climate have resulted in greater aridity on the Tibetan Plateau. The numerous concentric rings that circle the lake are fossil shorelines, and attest to the historical presence of a larger, deeper lake.

d. Namtso

Namtso or Lake Nam is a mountain lake on the border between Damxung County of Lhasa Prefecture and Baingoin County of Nagqu Prefecture in the Tibet Autonomous Region of China. Namtso was born in the Paleogene age, as a result of Himalayan tectonic plate movements. The lake lies at an elevation of 4,718 m, and has a surface area of 1,920 square kilometres. This salt lake is the largest lake in the Tibet Autonomous Region.

e. Dragsum Tsho

Dragsum literally meaning "three rocks" in Tibetan, is a lake covering 28 square kilometres in Gongbo'gyamda County, Nyingchi Prefecture of the Tibet Autonomous Region in China, approximately 300 km east of Lhasa in Tibet. At 3,700 meters over sea level it is about 18 km long and has an average width of approximately 1.5 kilometres. The deepest point of the green lake measures 120 meters. The lake is also known as Gongga Lake

4. Climatic Classification of Tibet

The climate of Tibet is classified by different agencies. Here we are discussing the climatic classification of the Chinese Academy of Sciences (CAS) 1982.

Climatic Classification of the Chinese Academy of Sciences (CAS) 1982

In this very detailed classification (CAS 82) eight climatic sub-regions have been defined within the Tibet Plateau (Tab 1). Determinants like the mean annual temperature, the mean temperature of the warmest month, the mean absolute minimum temperature of the year, the period of days with a mean daily temperature above 10 °C, the total annual precipitation and the aridity index were considered.

1) Subregion LIA - Tropical Mountain Monsoon Region with moist climate on the Southern slope of the Himalayan Chain: The mean annual temperature in this sub-region exceeds 18 °C, while the mean temperature of the warmest month is approximately 24 °C. The lowest annual temperature is above 5 °C. The climate is moist and hot, with the total annual precipitation in most places exceeding 2,500 mm.

2) Subregion LU A - Subtropical Mountain Monsoon Region with moist climate on the southern slope of the Himalayan Chain: The mean annual temperature in sub-region LIIA varies between 12° and 18 °C and the mean daily temperature of more than 180 days exceeds or equals 10 °C. The mean monthly temperature of the warmest month is between 18 ° and 24 °C and the lowest temperature of the year is approximately -10 °C. There is precipitation of approximately 1,000 mm/year. The slopes and hills are covered with subtropical evergreen broad-leaf forests, the valleys and alluvial cones being used for growing cereals (harvested two times per year) and for the cultivation of orchards. The aridity index is below 1.0.

3) Subregion HIIIB - Plateau Temperate Monsoon Region with semi-moist climate in southeast Tibet:

This sub region is characterized by a mean annual temperature of between 8 ° and 12 °C and by 150 to 180 days a year with mean daily temperatures equal to or above 10 °C. The mean temperature of the warmest month is 10°- 18 °C, and the annual minimum temperature lies above - 23 °C. The total annual precipitation amounts to approximately 600 mm.

4) Subregion HIIIC - Plateau Temperate Monsoon Region with semi-arid climate of Southern Tibet: The mean annual temperature in subregion HIIIC lies between 4° and 8°C, there being about 150 days a year with mean temperatures equal to or above 10 °C, while the mean monthly temperature of the warmest month and the lowest annual temperature correspond with those of subregion HIIIB. The annual precipitation of subregion HIIIC lies between 200-500 mm.

5) Subregion HIVD - The mean annual temperature lies between 0 ° and 2 °C, there being approximately 100 days per year with mean temperatures equal to or above 10 °C. The annual minimum temperature is below -23 °C. The total annual precipitation is between 50 mm and 200 mm.

6) Subregion HVB - Plateau Frigid Monsoon Region with semi-moist climate in Naqu: The mean annual temperature varies between -2 ° and 0°C, while there are less than 50 days per year with mean temperatures equal to or above 10 °C. The mean monthly temperature of the warmest month lies between 6° and 10 °C. The total annual precipitation reaches from 400 mm to 700 mm and the aridity index is between 1.0 and 1.5. The areas of Naqu, Nierong and Suoxi belong to sub region HVB, in which the sparsely vegetated soils are mainly used for animal husbandry. Hailstorms occur very often in this climatic sub region.

7) Sub region HVC - Plateau Frigid Monsoon Region with semi-arid climate of Qiangtang: The climatic conditions of this sub region are similar to sub region HVB, but the total annual precipitation is reduced to 100 to 300 mm.

8) Sub region HVID - Plateau Frigid Monsoon Region with arid climate of the Kunlun area: The mean annual temperature in this climatic sub region is below - 4°C and the mean monthly temperature of the warmest month reading approximately 6°C. The total annual precipitation amounts to 100-150 mm.

Conclusion

It can be concluded from the above discussion that the Tibet region is the highest plateau of the world and sources of major rivers in the Himalaya. The indigenous people of the Tibet is living in exile and

they are demanding the Tibet Autonomous region. Tibet is a high altitude, rugged, mountainous region with a harsh climate. This has resulted in a limited resources base, where cultivable land is limited to the zone below 4,000 meters. People of Tibet have adopted themselves to harsh environment of the region according to needs, and the physical environment of Tibet is one of the determining factors influencing the society of Tibet.

References

Boer, M. a. Koster, E. (1992): Greenhouse-impact on cold climate ecosystems and landscapes. **Cremlingen. Chen, Q. G.** (1996): The snow disaster and its defense strategy in Yushu Tibetan Prefecture of Qinghai Province. In: Pratacultural Science 13(6), 60-63 (in Chinese).

Goldstein, M. C. a. Beall, C. M. (1990): Nomads of western Tibet: survival of a way of life. Berkeley.

Ho, P. (1996): Ownership and control in Chinese rangeland management since Mao: the case of free-riding in Ningxia. Pastoral Development Network 39 c. Overseas Develop ment Institute, London.

Kerven, C. A. Lunch, C. (1999): The future of pastoralist in central Asia. In: Eldridge, D. a. Freundenberger, D. (eds.): People and Rangelands. - Proceedings of VI International Rangelands Congress. Townsville, 1042-1048.

Kunelius, H. T.; Kim, D. A.; Hirota a. Zhu, T. (1993): Factors required sustaining pastoral farming systems and foraging supply in winter cold zones. In: Baker, M. J. (ed.): Grasslands for our world. New Zealand, SIR Publishing, 198-203.

Linziduojie, L. (1996): Environment and Development of the Qinghai-Tibetan Plateau. China Tibetology Publish ing House, Beijing.

Miller, D. J. a. Bedunah, D. J. (1993): High-elevation range land in the Himalayan and Tibetan Plateau: issues, per spectives and strategies for livestock development and resource conservation. In: Baker, M. J. (ed.): Grassland for our world. New Zealand: SIR Publishing, 618-623.

Shi, Z. T. (1996): Regional characters of natural disaster in marginal monsoon belt of China. In: Journal of Arid Land Resources and Environment 10(4), 1-7 (in Chinese).

Swift, J. (1999): Pastoral institutions and approaches to risk management and poverty alleviation in Central Asian countries in transition..

Trewartha, G. T. (1954): An introduction to climate. New York.,

Williams, D. M. (1996): Grassland enclosures: Catalyst of land degradation in Inner Mongolia. In: Human Organi sation 55 (3), 307-313. Wu, N. (1997a): Ecological Situation of High-frigid Range land and Its Sustainability - A Case Study on the Con straints and Approaches in Pastoral Western