Course Name: Bioclimatic Architecture: Futureproofing with Simple and Advanced Passive Strategies

Professor: Dr. Iyer Vijayalaxmi Kasinath

Department of Architecture,

School of Planning and Architecture, Vijayawada

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Classification of Climate

Hello everybody. So as I had told you in the last class, in today's class we will be looking at climate types and their classification. So we will be looking at two ways in which the climate is classified. So in this class we will look at what controls the climate. How is climate classified? What have been the methods? And what is this KOEPPEN climate classification? The most widely accepted way of classifying climate in the world. The major vegetation zones by Candolle, which comprise of tropical moist climate, dry climate, moist mid-latitude climate with mild winters, moist mid-latitude climate with cold winters, and the polar climate.

We also look at the Thornthwaite classification. And we will also touch upon the climate zones of India. But this time, this class is primarily on Koeppen climate classification and climate classification based on vegetation of the place. So, what controls climate? So, we will talk about what controls climate.

But there are a few things to consider. First up, it's where you are on earth. Where is your location? That is your latitude. Then how high you are above sea level? That's elevation. Also, how close you are to big bodies of water or mountains.

The way air moves around over a long time also plays a part. And let's not forget about the oceans, their currents. These make a lot of difference too. All these things work together to decide how hot or cold and how rainy or snowy or arid a place can get. And that in turn affects what plants and animals can live there.

So climate actually controls a lot in a region. Talking about climate classification, it's like sorting things into groups based on their similarities. But why do we do it for climate? Well, instead of describing every single detail about weather in a place, we can use a few words to sum it up. This helps us to understand what kind of weather to expect in different regions throughout the year. It's handy for things like choosing materials for building that

can withstand the weather or deciding which crops will go well in a certain weather.

So climate classification makes life easier by giving us a quick idea of what to expect in a place. We will now explore different methods used to classify climate. First up is the genetic method, which looks at the causes behind climate patterns. It considers factors like air masses, circulation systems, solar radiation, and how the land's shape affects weather. Then there is the empirical method, which relies on actual data like temperature and rainfall.

It sets specific boundaries to group similar climates together. So, if two places have similar weather patterns, they will be grouped together. Both methods help us understand and categorize climates, making it easier to study and predict weather conditions in different regions. The genetic method classifies climate on the basis of its casual elements, the activity, and the characteristics of all factors that give rise to the spatial and temporal patterns of climate data. They are qualitative so that climatic regions are designated in a subjective manner rather than as a result of the application of some rigorous differentiating formula.

For example, air masses, circulation system, solar radiation, topographic effects. Then you have the empirical method. The empirical method makes use of observed environmental data such as temperature, humidity and precipitation. Empirical classifications use predetermined class boundaries to classify the climate types. These require climatic data.

Similar climatic conditions in two locations will be categorized into one group. For example, the Vladimir Koppen classification. Now, let us look at the Koppen climate classification. So, dwelling into the Koppen climate classification system, it is a method that is used to categorize different climates around the world. Originally, this was developed by Koppen, but later this was refined by Geigger and Pohl in 1953.

What makes Koppen's system stand out is its specific quantitative nature. It uses numbers to define temperature and rainfall, making it more precise, empirical, and measurable. Each climate is assigned a letter code with a specific meaning, which is determined by formulas. Koppen also relied on vegetation zones, which was identified by Candolle in 1874 as they reflect the overall climate of an area. The vegetation is more a mirror of the climate of this place.

This system helps us understand and communicate about the diverse climate found across the globe. The Koppen system recognizes five major climatic types. Each type is designated by a capital letter. Capital A denotes Tropical Moist climate. So, when we explore the Koppen climate classification system, which categorizes based on five main

types each marked by capital letter, where A stands for tropical moist climates, B stands for dry climate, A stands for tropical moist climate, B stands for dry climate, C stands for moist mid-latitude climate with mild winters and D stands for moist mid-latitude climate with cold winters, E stands for polar climates and H for cold due to elevation.

So, you notice how A, C, D and E represent humid climates. A, C, D and E represent humid climates, whereas B stands for a dry climate. The system helps us understand and communicate about the different climates across the globes. So, you can see this is A, which is tropical, B is dry, C is moist temperate. and E is polar, I need to change the colour.

So, this is how the climate is classified across the world according to Koppen, but it does not stop here. He goes into further classifying the climate beyond these alphabets. So, the modified open system describes five major climate groups. A tropical humid, B is dry, C is mild mid latitude, D is severe mid latitude, E is polar and H is highland. These are further subdivided into a total of 14 individual climate types along with the special category of high land climate.

Now, with these subdivisions, they totally come to 14 climate types, and these have sub-categories. For example, A, which is tropical humid, is further divided into tropical wet, tropical monsoon, and tropical savanna. Each of this is given a particular alphabet. Tropical wet is Af, tropical monsoon is Am, tropical savanna is Aw. The dry climate is subdivided into subtropical and mid-latitude.

Subtropical is classified as desert type and steppe type with their own notations or indications. The mid-latitude is further classified as desert and steppe. Again, they have their classification. Mild mid latitude is classified as Mediterranean, which comprises of two classifications: humid tropical and marine west coast, each with two sub-classifications. Severe mid latitude is further classified into humid continental and subarctic, both with 4 + 4, 8 classification.

Polar is classified as Tundra and icecap, and highland is only highland. So, the major climate groups are these A, B, C, D, E's. Then you have the climate type and then you have the subtype of the climate. You have the climate type, and then this is the subtype. So, for C and D climates, the subcategories are A is warmest and D is coldest.

For C and D, you have warmest and coldest. So, you have a range. The seasons of dryness are indicated by the small letters m, f, and s, where f is no dry season, m is monsoon climate, w is winter dry season, and s is summer dry season. The capital letter S and W are employed to designate the two subdivisions of dry climate which is semi arid or steppe known as S and arid or desert which is W. Like this, there is classification done based on the climate

indicated with alphabets.

So this is how, after classifying the whole world weather is classified like this as per Koppen classification with all the classifications placed here. Let us look at the tropical climate, also called equatorial climates. According to Koppen, this is found near the equator and extends to about 15 to 25 degrees north and south. Here are the defining traits. It's the warmest climate zone with an average monthly temperature above 18 degrees Celsius.

Annual rainfall exceeds 1500 millimeters. It has high humidity and warmth, leading to frequent cumulus or cumulonimbus cloud formation almost every day. This climate nurtures lush rainforests and diverse ecosystems. Understanding tropical climate helps us appreciate their importance and how they support life on our planet. Within the tropical zone, we find three subcategories, each based on temperature and dryness.

First is Af climate, which is characterized by humid conditions with rainfall exceeding 6 cm even in the driest month. Precipitation is evenly spread throughout the year, and temperatures show little daily variation. Next, the Am climate represents a monsoon pattern with a brief dry season but overall wet conditions throughout the year, fostering dense forests. Lastly, the Aw climate features a winter dry season w with at least one month seeing less than 6 cm of rainfall. Despite this dry spell, temperatures remain consistently high throughout the year.

Understanding these subcategories will help us grasp the diversity within tropical regions. Then we have the dry or arid climate, which is found between the latitudes 20 to 35 degrees north and south of the equator. Here is what characterizes it. Firstly, there is little or no annual precipitation, making it very dry. The atmosphere loses more water through evaporation and transpiration than it gains from rainfall.

Consequently, vegetation is sparse or absent due to the scarcity of water. This climate poses challenges for life and agriculture but also offers a unique ecosystem that is adapted to survive in the harshest of conditions. Understanding arid climate helps us appreciate the resilience of life in diverse environments across the globe. Within the dry type B climate, there are hot H and cold K zones leading to four distinct types. Firstly, Bwh represents the subtropical desert climate.

While the average annual temperature surpasses 18 degrees Celsius, Bsh signifies the subtropical steppe climate with a mean annual temperature also above 18 degrees Celsius. Moving to the cold zones, you have the Bwk which denotes the mid-latitude cold desert climate. This is characterized by mean annual temperatures below 18 degrees Celsius.

Lastly, BSK refers to the middle latitude and cold steppy climate where the mean annual temperature remains below 18 degrees Celsius. Understanding these subcategories helps us grasp the diversity within dry climates.

Then you have the temperate climate or mesothermal climate. Temperate or mesothermal climates are found within latitudes 30 to 50 degrees north and south of the equator. They are characterized by warm summers with high humidity and mild winters. The warmest month typically exceeds 10 degrees Celsius, while the coldest month falls between 18 degrees and 3 degrees Celsius. These climate zones are often situated along the edges of continents, particularly along eastern and western coastlines.

Understanding these climates helps us recognize the enjoyable variations in weather patterns experienced in such regions. The temperate climates occupying latitudes between 30 to 50 degrees north and south of the equator exhibit three primary precipitation-based classifications. In the CF climate, rainfall persists throughout the year, with the driest summer month receiving over 12 inches of precipitation, akin to Western Europe. Contrastingly, the CW climate experiences dry winters, with 10 times more rainfall occurring in the wettest summer month compared to the driest winter month. Conversely, the CS climate is characterized by dry summers with three times more rainfall in the wettest winter month than the driest summer month and less than 1.

2 inches of precipitation in the driest summer month. This pattern mirrors Mediterranean climates. These distinctions, alongside variations in temperature such as warm summers, cold winters, and abbreviated cold summer periods, delineate the nuanced diversity within the temperate regions. Then you have the continental climates. Continental climates are commonly found between latitudes 40 and 75 degrees north and south of the equator.

Though they are rare in the southern hemisphere, here's what characterizes them. The warmest month averages above 10 degrees Celsius while the coldest month falls below 3 degrees Celsius. These climates often occur in the heart of continents. Summers are typically warm to cool, while winters tend to be very cold. Understanding continental climates helps us appreciate the distinct seasonal variations experienced in these interior regions, which can influence everything from agriculture to daily life.

The continental climate zone is divided into three main categories according to precipitation: the continental dry summer, which is Ds, the continental dry winter, which is Dw and the continental humid zone which is Ddf. Like temperate climates, they are further subdivided according to temperature. Dfa denotes hot summer humid continental climate, Dfb denotes warm summer humid continental climate, Dfc denotes sub-arctic climate and Dfd denotes extremely cold sub-arctic climate. Dsa denotes hot, dry, summer

continental climate.

Dsb denotes warm, dry, summer continental climate. Dsc denotes subarctic climate, and Dsd denotes very cold subarctic climate. Polar climates situated above 70 degrees latitude in regions like the Arctic, Greenland and Antarctic exhibit persistently cold temperatures and limited vegetation. With the warmest month never surpassing 10 degrees Celsius and annual precipitation less than 25 cm, they are extremely dry. These climates are categorized into two types based on vegetation. Et tundra climate characterized by sparse vegetation and permafrost and Ef ice cap climate which is entirely covered by ice or snow.

Understanding these distinctions help us appreciate the unique environmental conditions present in polar regions. Thus you can see that you have A as tropical which is classified as rainforest F, M monsoon, W savannah dry winter, S savannah dry summer. B dry which comprises of W arid, S semi steppy, H hot, K cold. C temperate has W dry winter, F no dry season, S dry summer.

A hot summer, B warm summer, C cold summer. It is the third classification. D continental has dry winter, no dry season, dry summer with A hot summer, B warm summer, C cold summer, D very cold winter and E polar has tundra and ice cap. So, if we have to classify dry, B dry then Bwh would mean dry arid desert hot climate.

Bwk would denote dry semi arid cold climate. and so on. So, this is how we would be describing the climate. Next, we move on to the major vegetation zones. Let's talk about the major vegetation zones identified by Candolle in 1874. There are five main groups, each influenced by temperature and moisture. First, we have megatherm plants that love warmth and lots of moisture, mainly found in tropical climates.

Then there are xerophytes, plants that thrive in dry conditions and high temperatures. Next up mesotherms. These are plants that like moderate temperatures found in tropical and subtropical regions. After that microtherms, which prefer colder climates, often in high elevations. Lastly Hekistotherms which are plants tough enough to withstand harsh winters in cold and alpine regions.

These groups help us understand where different plants grow best. So Thornthwaite was an American climatologist, and he introduced his classification of North American climates in 1931 and expanded it to cover global climates in 1933, with a revised version in 1948. His system, like Koppens relies on empirical data. Thornthwaite emphasized the role of natural vegetation in indicating climate and recognized precipitation, temperature, and evaporation as key factors. He used precipitation and temperature effectiveness to delineate climatic boundaries.

By considering these factors, Thornthwaite's scheme offers insight into the complexities of climate, highlighting the interplay between natural elements and their influence on regional climates worldwide. With this we have seen how climate is classified, at least on three different basis and how Koppen's climate is notified because Koppen's climate classification is accepted worldwide and how to denote it, its classification, subclassification, and third-level classification also we have seen. With this, we stop today's class, and in the next class we will see how India is classified and the acceptable terms in the Indian context. Thank you.