

# **Course: Basics of Environmental Engineering (Climatology)**



## **Main topic: Humidity**

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- ❖ Introduction to humidity(air)
- ❖ Types of humidity
- ❖ Impacts of humidity on crop plant
- ❖ Factors that affects humidity
- ❖ Relationship between humidity and  
Temperature

# Interactive quiz answers

1. What is humidity?
2. What's the difference between Relative and Absolute humidity?
3. Why does it feel hotter when it's humid?
4. Humidity a measure of amount of..... In the air?
  - a) Rain drops
  - b) Air pressure
  - c) Temperature
  - d) Water vapor
5. Humidity is the amount of what in the air?
  - A. Water vapor
  - B. Butter
  - C. Clouds
  - D. Cheese
6. What are the types of humidity?

## Introduction to Humidity

**Humidity:** refers to the concentration of water vapor present

in the air.

The level of humidity in the air is determined by factors

such as:

- ❖ Temperature,
- ❖ Pressure, and
- ❖ The amount of water vapor present in the atmosphere.



# Introduction to humidity

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such as:

- ❖ Temperature,
- ❖ Pressure, and
- ❖ The amount of water vapor present in the atmosphere.

- ❖ Humidity is a measurement of the amount of water vapor present in the atmosphere or a gas.
- ❖ Humidity is high when there is a lot of water vapor in the air. The higher the humidity, the wetter it feels outside.
- ❖ The temperature and pressure of the environment being measured impact humidity. In cool air, a fixed amount of water vapor results in higher humidity than in warm air.
- ❖ Humidity is crucial to comprehend because it impacts both weather and climate and global climate change.
- ❖ Understanding how humidity affects indoor surroundings can help you decide where to store your books, clothing, and other vital objects in your home.

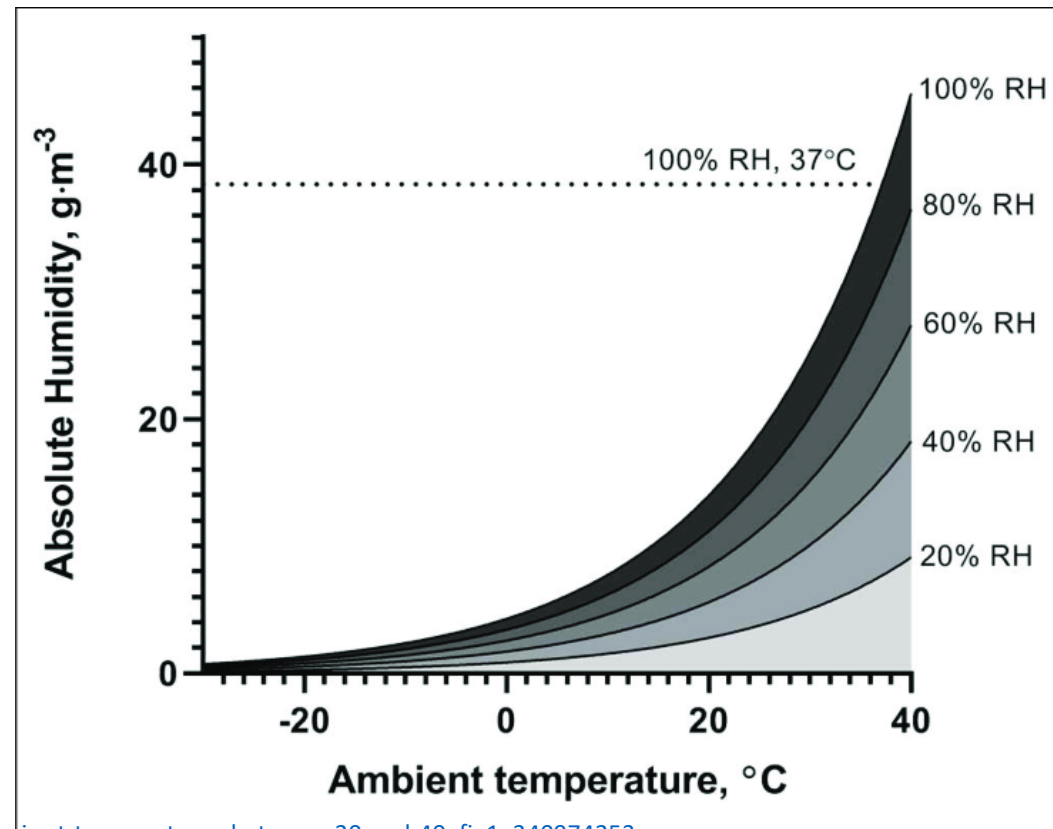
# Introduction to humidity

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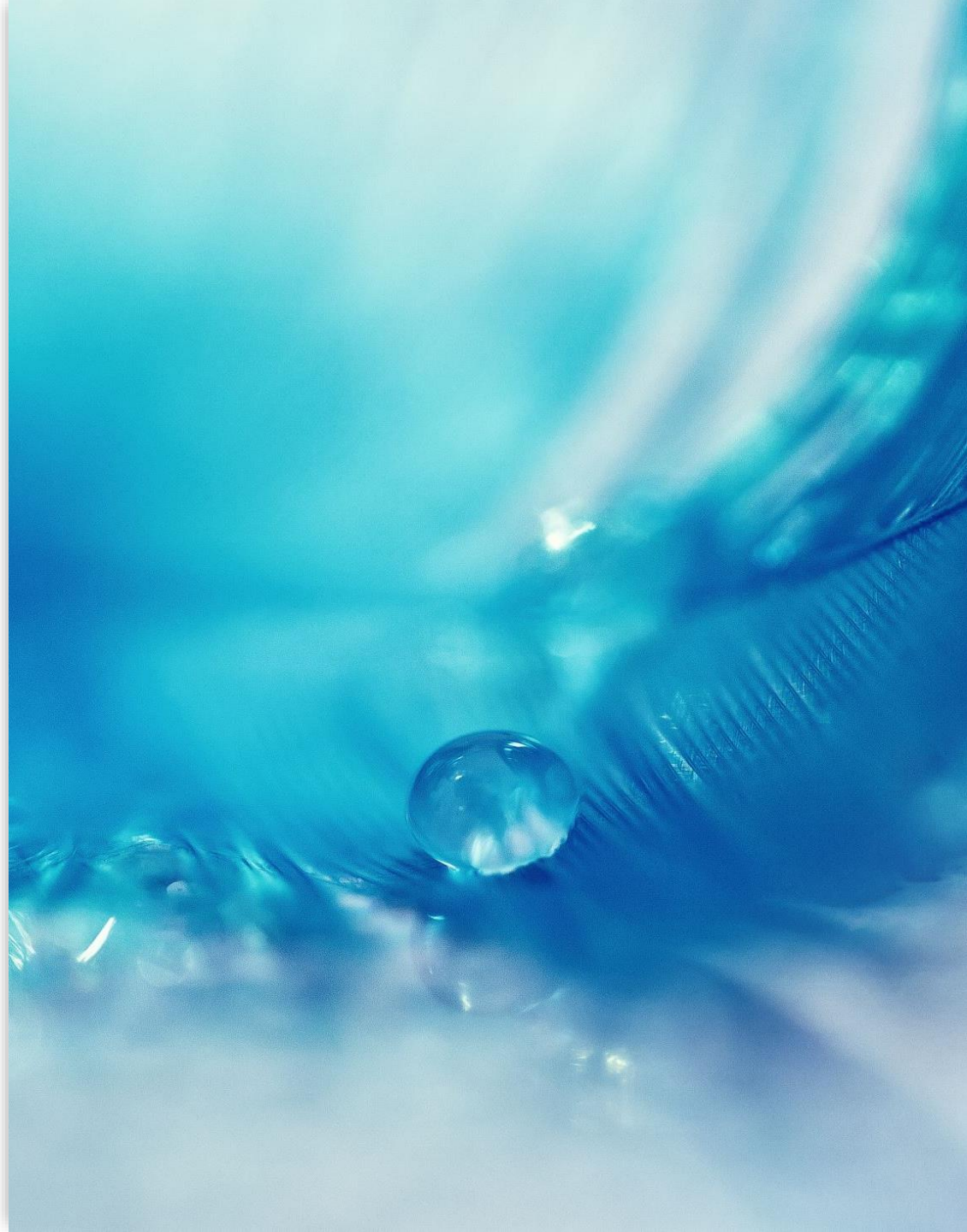
# Introduction to humidity

- 1. Absolute Humidity:** Absolute humidity is the total mass of water vapor in a specific volume of air, measured in grams per cubic meter or grams per kilogram of air, and accurately indicates the actual concentration of water vapor in the atmosphere.

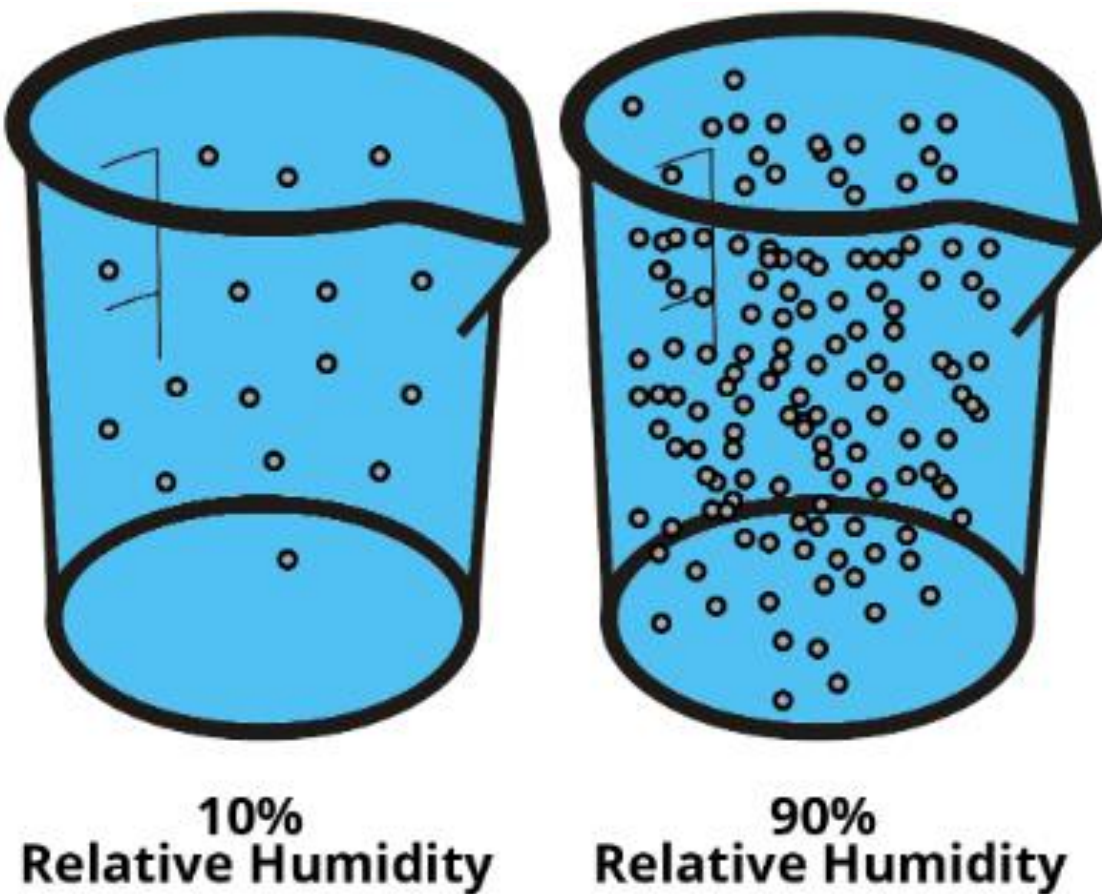


# Introduction to humidity

**2. Relative Humidity:** Relative humidity is a percentage that compares air vapor content to its maximum capacity at a specific temperature, with warmer air holding more moisture, indicating its proximity to saturation.



# Introduction to humidity



Source 3: <https://help.blustream.io/support/solutions/articles/14000064914-what-is-relative-humidity->



## Types of Humidity

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**3. Specific Humidity:** Specific humidity is the ratio of water vapor mass to total moist air parcel mass, expressed in grams per kilogram, indicating the weight of water vapor in dry air.

## Types of Humidity

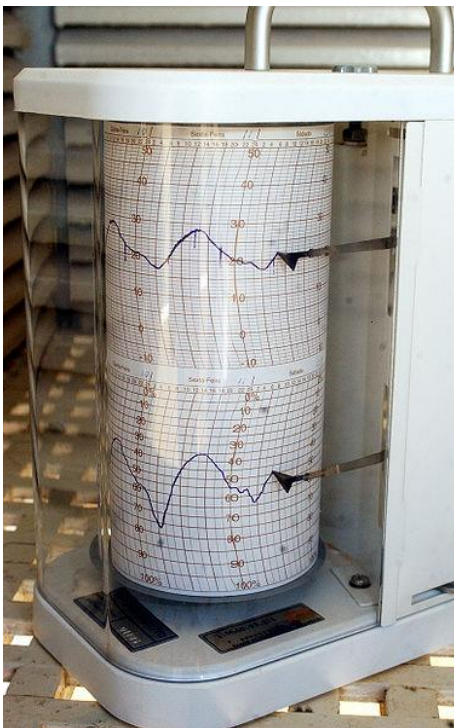
Absolute Humidity	Relative Humidity
The actual amount of the water vapor present in the air is commonly referred to as absolute humidity	Relative humidity is percentage of the amount of moisture the air could possibly hold
It is expressed in of moisture per cubic meter of the air (g/cubic meter)	It is expressed in percentage as the ratio of vapor pressure to saturated vapor pressure
Absolute Humidity is totally independent of the temperature	If the temperature goes up, relative humidity goes down and vice-versa.



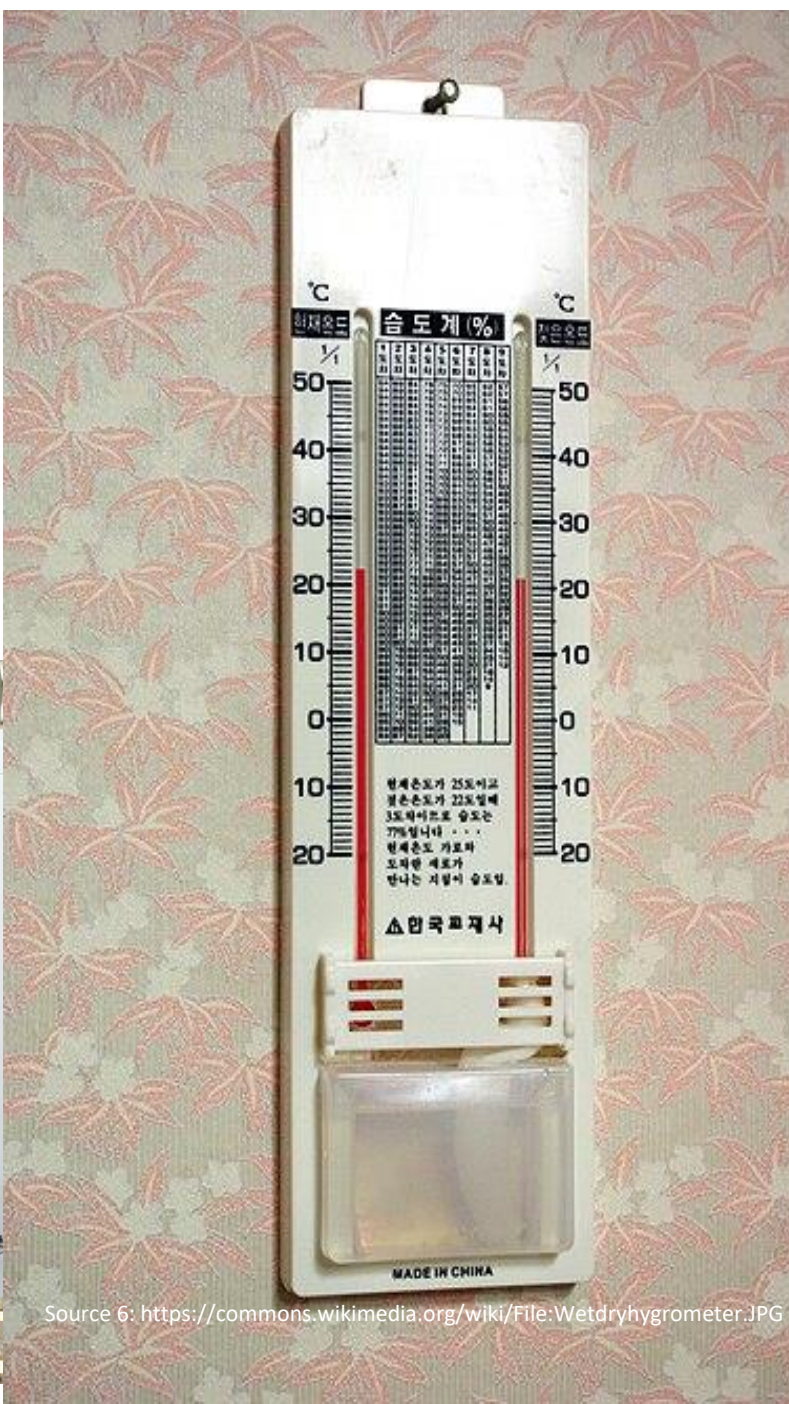
Source 4: [https://commons.wikimedia.org/wiki/File:Nippara\\_Limestone\\_Cave\\_Thermo\\_Hygrometer.jpg](https://commons.wikimedia.org/wiki/File:Nippara_Limestone_Cave_Thermo_Hygrometer.jpg)

# Introduction to humidity

## Tools used for measuring humidity



Source 5: <https://commons.wikimedia.org/w/index.php?title=File:Umidaderelativa.jpg&oldid=796630294>.



Source 6: <https://commons.wikimedia.org/wiki/File:Wetdryhygrometer.JPG>

## Factors that affect relative humidity

**Amount of water**: If you **increase the amount of water in the air** (by adding it due to **evaporation**), Relative humidity will **go up**.

**Temperature**: Since warm air can hold more water than cold air, **if you lower the temperature** the Relative Humidity will **go up**, even if you don't add more water.

## Impacts of humidity on crop plant

### Positive impacts

- ❖ Adequate humidity levels support optimal transpiration in crop plants, facilitating water and nutrient movement.
- ❖ This also supports photosynthesis by allowing efficient carbon dioxide uptake and oxygen release through stomatal openings, thereby enhancing plant growth.

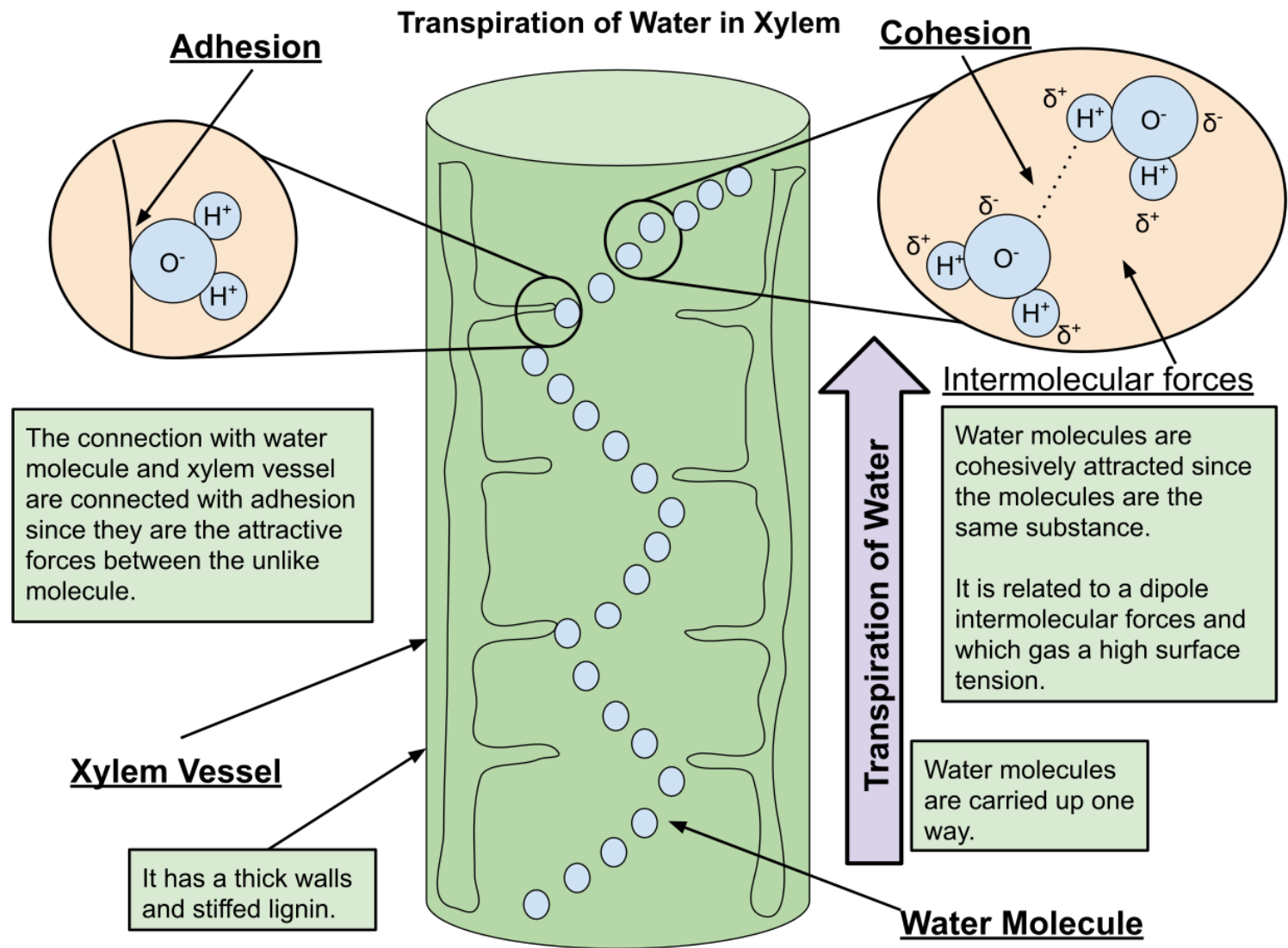
# Impacts of humidity on crop plant

## Positive impacts

- **Preventing Water Stress:** Plants are better able to control their water balance and lessen the chance of withering and dehydration when there is enough moisture in the air.
- **Disease Prevention:** Plant health is promoted by balanced humidity levels, which inhibit the growth of diseases that prefer either dry or extremely humid environments.
- **Enhanced Nutrient Uptake:** Plants can absorb nutrients properly when there is an ideal humidity level. Plants can more effectively absorb vital elements from the soil when humidity levels are right, which fosters general growth and development.



# Positive impacts cont'd



Source7:[https://en.wikipedia.org/wiki/Transpiration#/media/File:Transpiration\\_of\\_Water\\_in\\_Xylem.svg](https://en.wikipedia.org/wiki/Transpiration#/media/File:Transpiration_of_Water_in_Xylem.svg)

## Negative impacts

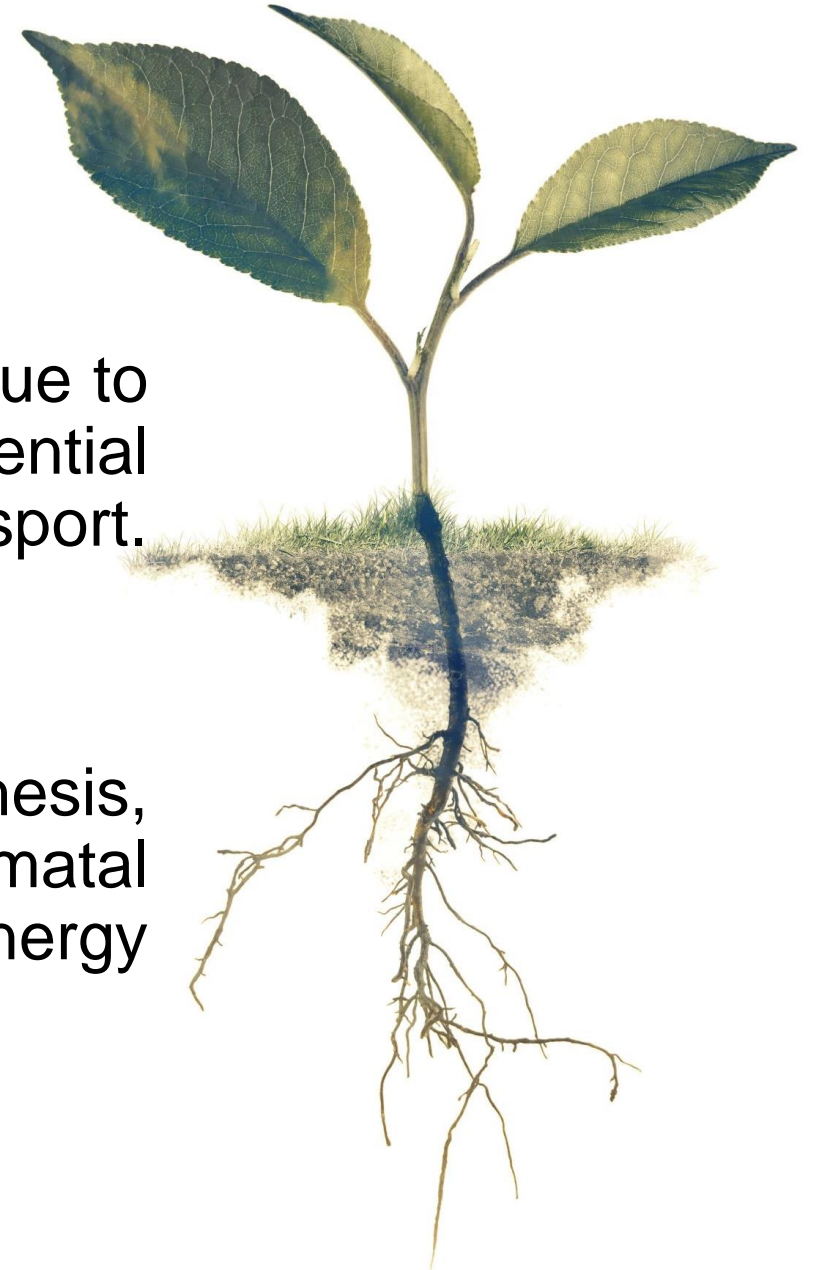
High humidity increases the risk of fungal diseases like powdery mildew, downy mildew, and botrytis, which can damage plant tissues, reduce photosynthesis, and lead to stunted growth or death.

Additionally, excessive humidity can hinder the transpiration process, causing plants to struggle to absorb nutrients efficiently, leading to nutrient deficiencies and poor growth.

## Negative impacts cont'd

High humidity can cause stunted growth in plants due to reduced evapotranspiration rates, which are essential for maintaining turgor pressure and nutrient transport. This can lead to weak stems and reduced vigor.

Additionally, high humidity can decrease photosynthesis, which requires carbon dioxide intake through stomatal openings on leaves. This can result in decreased energy production and overall plant productivity.



# Negative impacts cont'd



High humidity levels can lead to pest infestations like fungus gnats, aphids, and spider mites, which can damage plant tissues, feed on sap, and transmit diseases.



Additionally, excessive soil moisture can cause root rot, caused by fungal pathogens that thrive in waterlogged conditions, causing root decay and impaired nutrient absorption in plants.

# Negative impacts cont'd

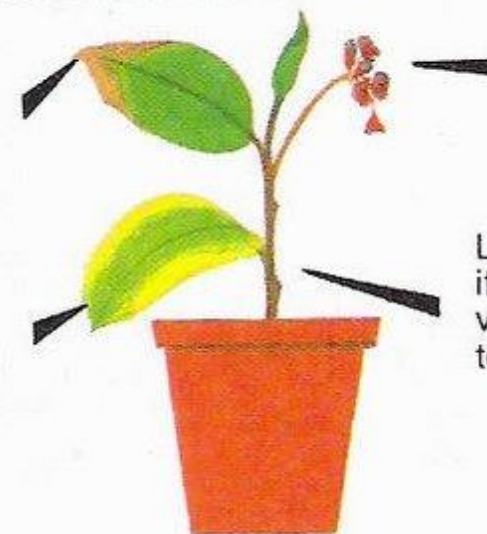
## DANGER SIGNS: TOO LITTLE HUMIDITY

Leaf tips  
brown and  
shrivelled

Buds and  
flowers  
shivel  
and fall

Leaf edges  
turn yellow;  
wilting  
may occur

Leaves fall  
if plant is  
very sensitive  
to dry air



## DANGER SIGNS: TOO MUCH HUMIDITY

Patches of  
grey mould  
on leaves

Flowers  
covered  
with grey  
mould

Patches of  
rot on leaves  
or stems.  
Cacti and  
Succulents  
very sensitive



Source8: <https://fairfaxgardening.org/humid-dry-plants/>

# Factors influencing humidity

- ❖ **Temperature:** Temperature plays a significant role in determining humidity levels. Warmer air has the capacity to hold more water vapor than cooler air. As the temperature increases, the air's ability to retain moisture also increases, leading to higher humidity levels.
- ❖ **Location:** The proximity to water bodies such as oceans, lakes, or rivers can impact humidity levels in an area. Areas closer to large water bodies tend to have higher humidity due to increased evaporation and moisture content in the air.

# Factors influencing humidity cont'd

- ❖ **Time of Day:** Humidity levels fluctuate throughout the day based on temperature variations. Relative humidity is typically highest around sunrise when temperatures are lower and decreases as temperatures rise during the day, reaching its lowest point in the afternoon.
- ❖ **Weather Conditions:** Weather patterns such as rainfall, fog, or clear skies can affect humidity levels. Rainfall adds moisture to the air, increasing humidity, while clear skies and dry conditions can lead to lower humidity levels.

## **Factors influencing humidity cont'd**

- ❖ **Seasonal Variations:** Different seasons experience varying levels of humidity due to changes in temperature and weather patterns. For example, summer months often have higher humidity compared to winter months.
- ❖ **Altitude:** Humidity decreases with altitude as air pressure drops. Higher altitudes generally have lower humidity levels compared to low-lying areas.

# Factors influencing humidity cont'd

- ❖ **Wind Patterns:** Wind can influence humidity by transporting moisture from one area to another. Windy conditions may lead to changes in local humidity levels depending on where the air is coming from.
- ❖ **Pressure:** Atmospheric pressure can affect humidity by influencing the rate at which water evaporates or condenses. High-pressure systems generally promote clearer skies and lower humidity levels, while low-pressure systems may lead to cloud formation and increased humidity.

## **Factors influencing humidity cont'd**

- ❖ **Vegetation and Land Cover:** Vegetation and land cover impact humidity through processes like transpiration, where plants release water vapor into the atmosphere. Regions with dense vegetation typically have higher humidity levels due to increased evapotranspiration rates compared to arid or urban areas with less vegetation cover.
- ❖ **Human Activities:** Human activities such as industrial processes, agriculture, and urbanization can contribute to changes in local humidity levels. Factors like deforestation, irrigation practices, and pollution can alter natural moisture cycles and impact regional humidity patterns.

# Relationship between humidity and temperature

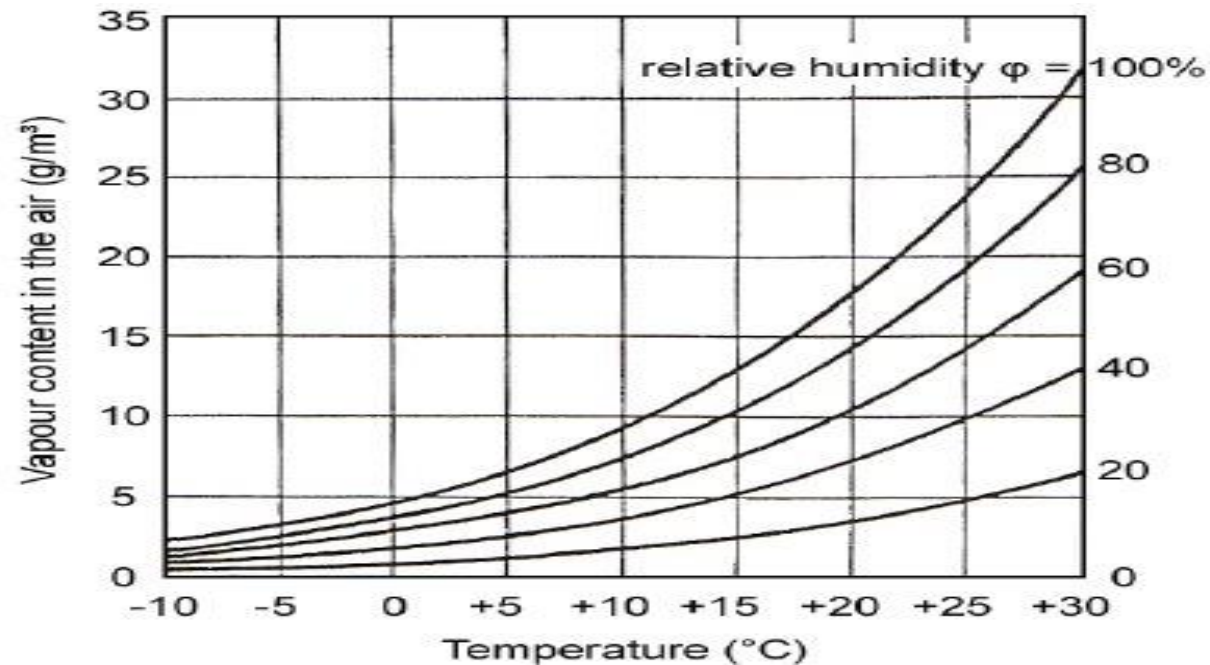
- **Inverse Proportionality:** As temperature increases, relative humidity decreases, leading to drier air. Conversely, as temperature decreases, relative humidity increases, resulting in moister air.
- **Relative Humidity:** Relative humidity is a key indicator of the moisture content in the air concerning its temperature. It is expressed as a percentage and represents the ratio of the actual water vapor present in the air to the maximum amount of water vapor that can be held at that temperature. When relative humidity reaches 100%, the air becomes saturated.

# Relationship between humidity and temperature cont'd

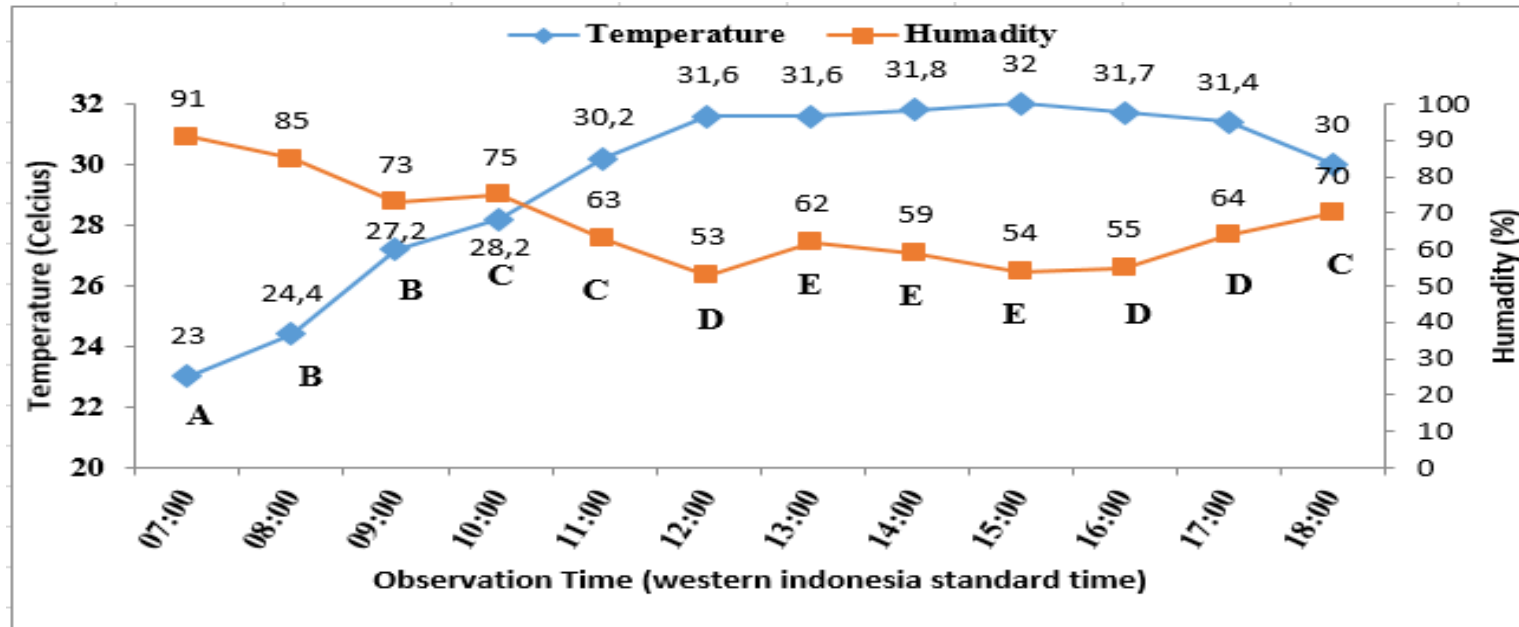
- **Dew Point:** The dew point is the temperature at which air becomes saturated with moisture, leading to condensation and potentially precipitation. It indicates the point at which the air cannot hold any more water vapor. The relationship between relative humidity and dew point is direct, with higher dew points correlating to higher moisture content in the air.
- **Effect on Comfort:** Higher temperatures with high humidity can make individuals feel hotter due to reduced evaporative cooling from sweat, while lower temperatures with high humidity can lead to a damp chill.

## Relationship between humidity and temperature cont'd

- **Impact on Flora and Fauna:** Temperature and humidity play a significant role in shaping ecosystems by influencing plant growth, animal behavior, and overall biodiversity.
- Variations in these factors can impact species distribution and survival.



# Relationship between humidity and temperature cont'd



Source 10: [https://www.researchgate.net/figure/Relationship-between-air-temperature-and-humidity-with-visibility-of-mirage-on-September\\_fig4\\_338134967](https://www.researchgate.net/figure/Relationship-between-air-temperature-and-humidity-with-visibility-of-mirage-on-September_fig4_338134967)

## ANSWERS OF QUIZ

### 1. What is humidity?

- ❖ humidity refers to the concentration of water vapor present in the air.

### 2. What's the difference between Relative and Absolute humidity?

#### solution

#### **Absolute Humidity:**

- Absolute humidity is the measure of water vapor in the air, regardless of temperature.
- It is expressed as grams of moisture per cubic meter of air (g/m<sup>3</sup>).
- It represents the actual amount of water vapor present in the air.
- Absolute humidity is independent of temperature.

#### **Relative Humidity:**

- Relative humidity measures water vapor relative to the temperature of the air.
- It is expressed as a percentage and indicates the actual moisture content compared to the potential moisture content at a given temperature.
- Warmer air can hold more moisture than colder air, affecting relative humidity levels.
- Relative humidity is dependent on temperature; it changes with variations in temperature.

## **Answer of quiz**

### **3. Why does it feel hotter when it's humid?**

#### **ANSWER:**

❖ Our body naturally cools itself by sweating so that the ambient air evaporating that sweat cools us down. When there is higher humidity in the atmosphere, a higher dew point, sweat doesn't evaporate as much and our body struggles to cool itself. Because there is not as much sweat evaporating, we feel hotter.

### **4. Humidity a measure of amount of..... In the air?**

- a) Rain drops**
- b) Air pressure**
- c) Temperature**
- d) Water vapor**

## **Answers of Quiz**

5. Humidity is the amount of what in the air?

A. Water vapor

B. Butter

C. Clouds

D. Cheese

• 6. What are the types of humidity?

• Relative humidity

• Absolute humidity

• Specific humidity



**Conclusion**

Understanding and monitoring humidity levels are crucial for various applications ranging from weather forecasting to human comfort and health.

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