

# EFFECT OF CLIMATE CHANGE ON SMALL RUMINANTS PRODUCTION (Sheep & Goats)

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ARC-ANIMAL PRODUCTION

27/10/2021



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# Introduction

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- **Climate change is an overtime change in climate and its variables.**
- **However, climate change can manifest four ways.**
  - **Increase of seasonal and inter-annual variability**
  - **Gradual changes in mean climate conditions.**
  - **Increase in frequency of extreme events.**
  - **Rapid climate changes that lead to catastrophic shift in ecosystems.**

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# Impact of climate change on small ruminants

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- The increasing incidences of extreme events will have negative impact on ecosystems.
- Heat wave that was experienced in 2016/17 and 2018/19 in S.A. was clear indication.
- The impact of climate change to small ruminant can be classified into indirect and direct.
  - Indirect impact relates to feed availability and diseases,
  - Direct impact relates to high temperature, radiation and rainfall,

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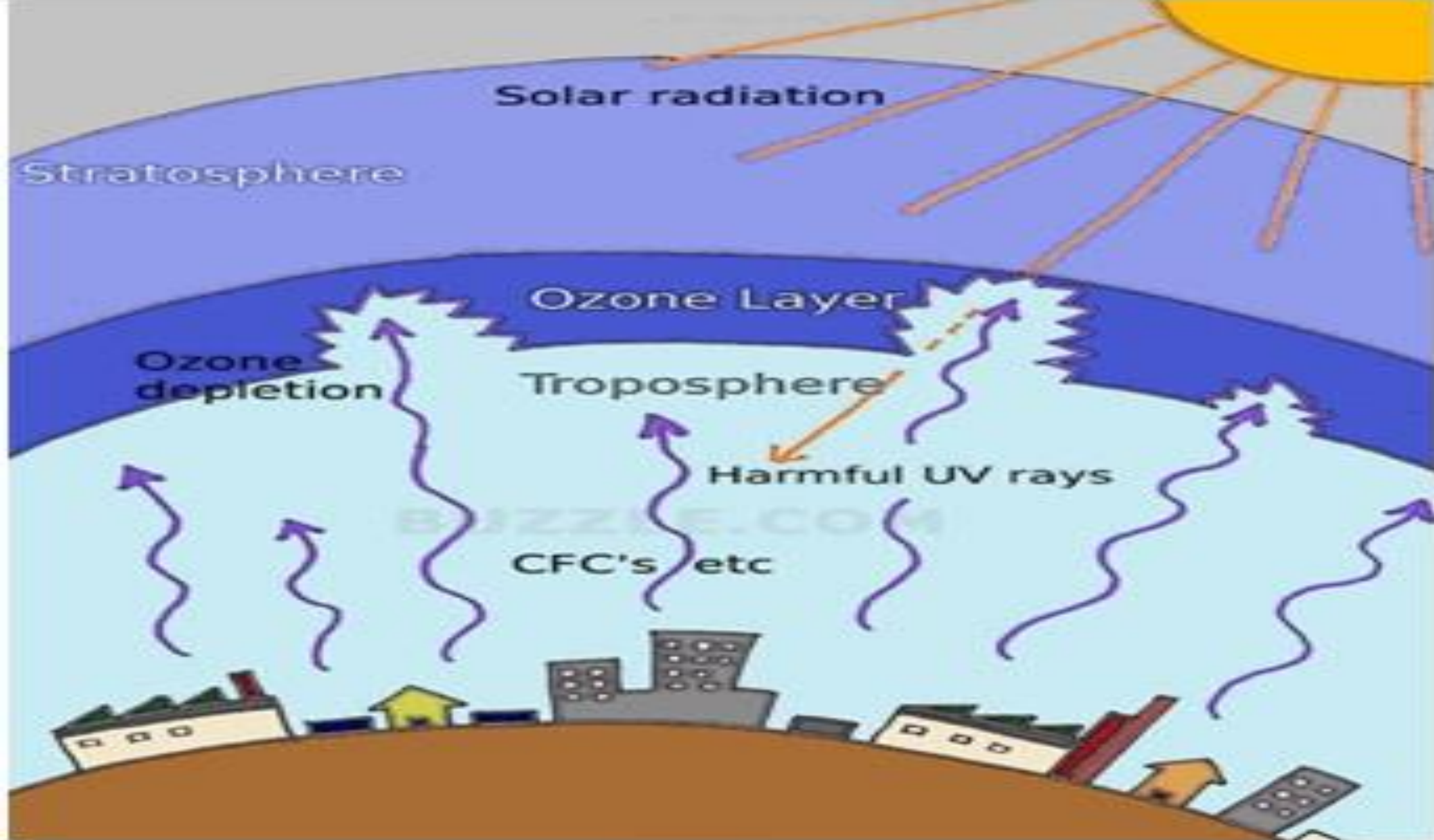


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# Indirect impact of climate change

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- Livestock plays a crucial role in the livelihood of people.
- Composition of pastures.
- Increases extreme condition such as drought.
- Greater intensity of rainfall.

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# Impact of Climate Change

# on Livestock

Increase of Temperature

### Water

- Increase water consumption 2 to 3 times

### Forage

- Decrease nutrient availability
- Increase herbage growth on C4 species (30- 35 °C)
- Decreases feed intake and efficiency of feed conversion (mostly livestock that are fed large amounts of high-quality feeds )

### Production

- High producing dairy cows decrease milk production
- Meat production in ruminants decreases because of a reduction in body size, carcass weight, and fat thickness

### Reproduction

- Decreases reproduction of cows, pigs and poultry of both sexes
- Reduce reproduction efficiency on hens and consequently egg production

### Health

- May induce high mortality in grazing cattle
- New diseases may effect livestock immunity
- Prolonged high temperature may affect livestock health (e.g. Protein and lipid metabolism, liver functionality)

Precipitation variation

### Forage

- Long dry seasons decrease:
  - Forage quality
  - Forage growth
  - Biodiversity

### Diseases

- Increases:
  - Pathogens
  - Parasites
  - Disease spreading
  - Disease transmission
  - New diseases
  - Outbreak of severe disease
  - Spreading of vector-born diseases

- Floods change:
  - Form & structure of roots
  - Leaf growth rate

Increase of CO<sub>2</sub>

### Forage

- Changes in herbage growth (more effect on C3 species)

- Decreases forage quality (more effect on C3 species)

- Positive effects on plants:

- Partial stomata closure
- Reduce transpiration
- Improve water-use efficiency

### Forage

- Affect composition of pasture by:

- Shifting of seasonal pattern
- Changing optimal growth rate
- Changing availability of water

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# Direct impact of climate change to small ruminants

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- Impact of climate in small ruminants include heat stress.
- Under heat stress small ruminant reduces activities.
- Sheep reduce rumination by 76%.
- Goat reduce urination and defecation however, respiration increases.
- Heat stress induces infertility.
- Heat stress lead to early embryonic death and restrict development.

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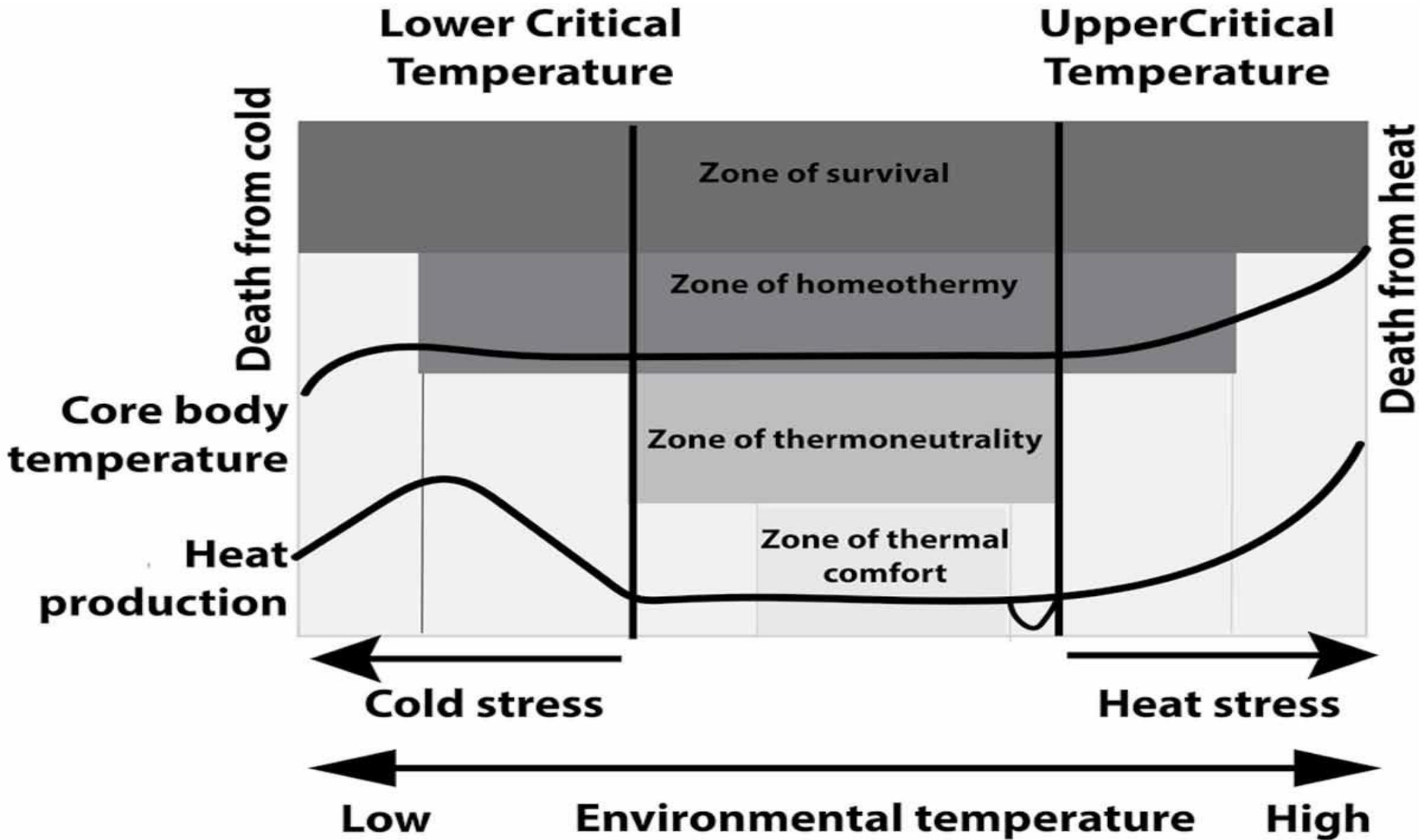


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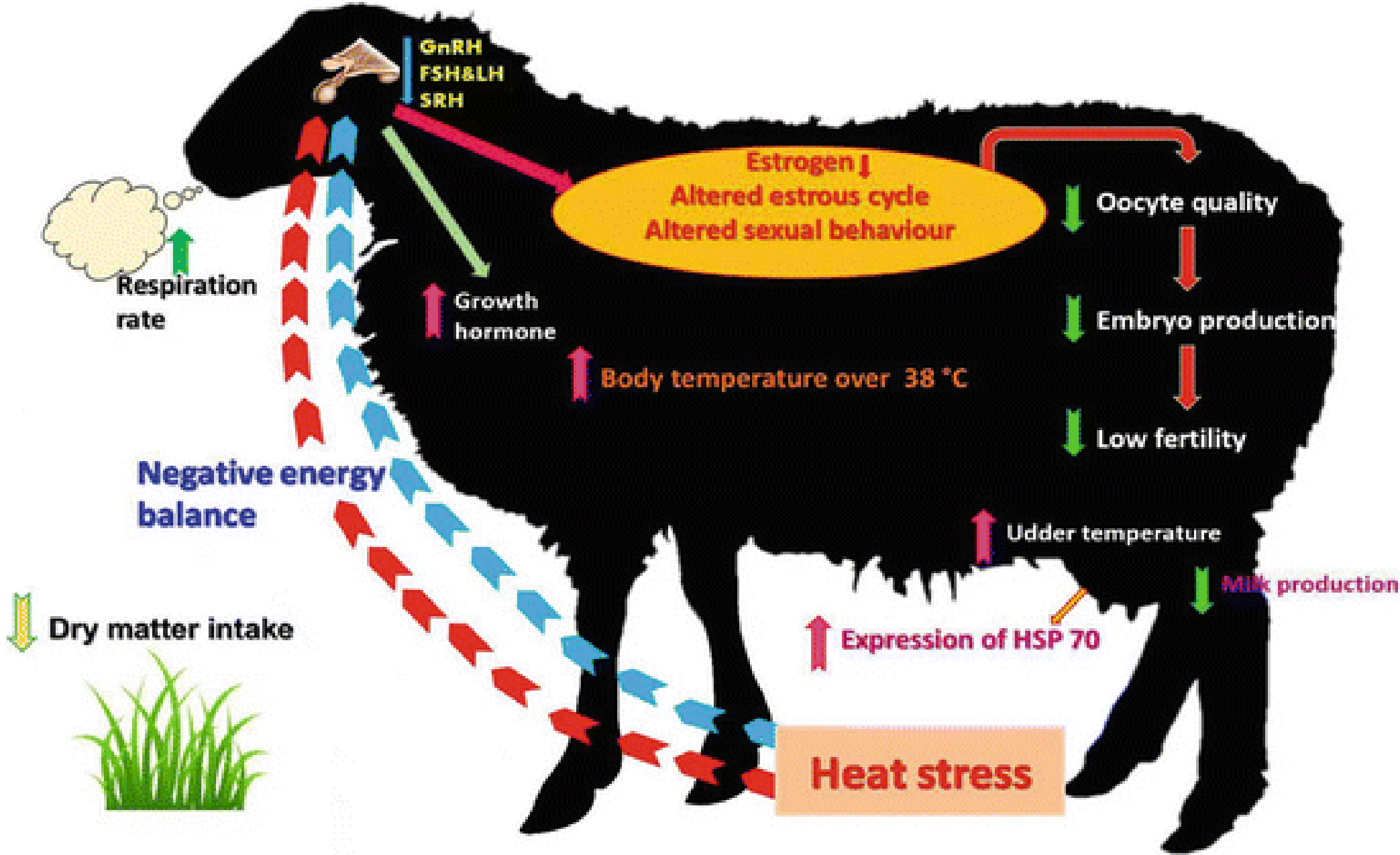


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# Effect of temperature on CH<sub>4</sub> emission

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- In warmer regions grass grows very quicker, thus forage lose nutrient quicker while lignification increases.
- Lignified forage is hard to digest.
- Therefore, it take long in the animal's stomach and that favors the enteric methane emission.

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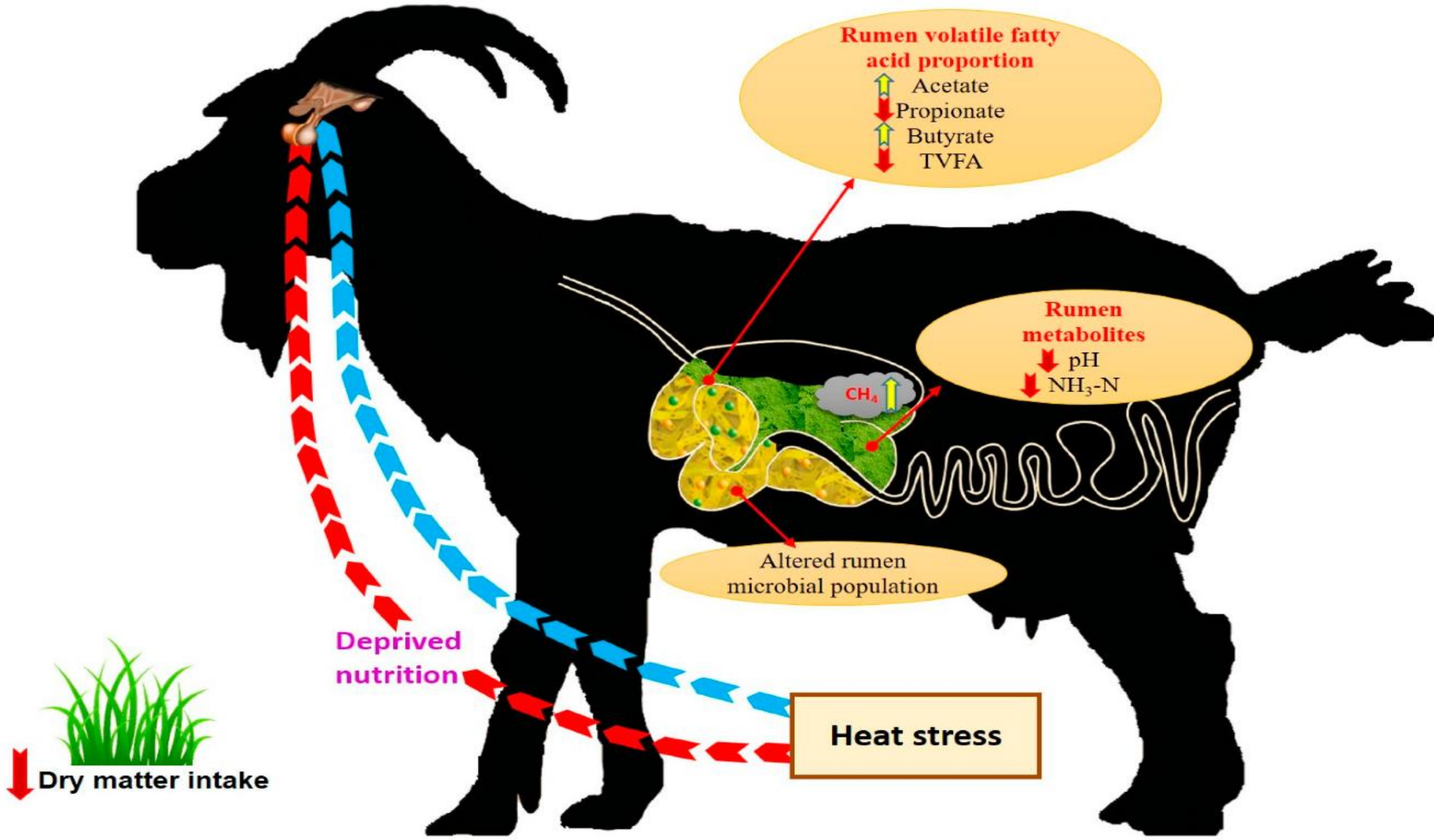


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# Adaptive behavior of goats

Criteria	Special character
<ul style="list-style-type: none"><li>• <b>Adaptability</b></li></ul>	<ul style="list-style-type: none"><li>• <b>Adapt in broader environment.</b></li><li>• <b>Reduce body size and weight.</b></li><li>• <b>Low metabolic requirement.</b></li></ul>
<ul style="list-style-type: none"><li>• <b>Thermo-tolerance</b></li></ul>	<ul style="list-style-type: none"><li>• <b>Survive in different agro-ecological zones.</b></li></ul>
<ul style="list-style-type: none"><li>• <b>Drought tolerant</b></li></ul>	<ul style="list-style-type: none"><li>• <b>They reduce water use.</b></li><li>• <b>Gut act as water reservoir during dehydration.</b></li></ul>
<ul style="list-style-type: none"><li>• <b>Thrive in low pasture</b></li></ul>	<ul style="list-style-type: none"><li>• <b>Efficient use of poor quality feed.</b></li><li>• <b>Improve digestibility.</b></li><li>• <b>Low feed intake hence CH<sub>4</sub> is low.</b></li></ul>

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# Adaptive behavior of goats

## Criteria

- **Digestibility and feed conversion efficiency**
- **Suitable for landless farmer**

## Special character

- **Increased efficiency to convert feed to product.**
- **Low proportion gut to BW.**
- **Require small area.**
- **Require less feed.**
- **Can be integrated easily to other farming systems.**

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# Mitigation strategy

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- **There is a possibility to reduce greenhouse gas emission from livestock farming.**
  - **Feeding and nutrition.**
  - **Reducing greenhouse gas emission from livestock.**
  - **Modify the environment.**

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# Nutrients required to animal

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- Ruminant are blame to be major contributors to climate change, by emitting high CH<sub>4</sub> and CO<sub>2</sub>
- Thus nutrition is important in reducing emission from animal.
  - Energy (GE, DE, ME & NE)
  - Protein (TP & NPN)
  - Mineral (Macro & Micro)
  - Vitamin (Essential & Non-essential)
  - Water.
    - Digest food
    - Body temperature
    - Lubricate
    - Waste removal in the body.

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# Feed quality

## Low quality feed

- Decrease digestibility, long retention period.
- High CH<sub>4</sub> production
- High loss of energy
- Low production efficiency.

## Improved quality feed

- Improve digestibility through milling or supplementation.
- Improve production efficiency.
- Reduced retention rate, less exposure to fibrolytic bacteria.
- Low CH<sub>4</sub> production and less energy lost

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# Enteric fermentation

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- Enteric fermentation is the source of CH<sub>4</sub> emission.
- Improving feed quality.
  - Nutritive value.
  - Improve surface area through milling.
- Increase dietary fat content in animal feed.
- Add supplements
  - Feed antibiotic

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# Manure management

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- **Manure is also a source of CH<sub>4</sub> .**
- **Subsequently, It is must be managed properly.**
  - **Shortening storage period.**
  - **Anaerobic digesters.**
  - **Covering of storage.**
  - **Use of solid separator.**
  - **Change animal diet.**

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# Modifying the environment

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- The exposure to radiation increases heat load in animal's body.
- Hence providing shade is critically important.
- Shade reduces more than 30% of heat radiation on animal.
- In building the shade it is important to consider orientation.

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# Thank you

**Tip.**  
**1 sheep: 1  
umbrella, 1 sun  
glasses and 1 cool  
drink!!!**

**Production ??**



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