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Challenges and perspectives in the management of backyard poultry production systems in native communities in the Sonoran Desert, Mexico†

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Highligths

The level of animal welfare is altered due to the climatic emergency and presents more severe conditions of origin such as in the arid territories, of the Sonoran Desert, in Mexico derived from the extreme conditions in the seasonal cycles

The importance of poultry production systems in arid Mexican territories represent an optimal and safe source of protein for self-consumption

Backyard poultry production units, which have differences in their direction, strategy, and approach to managing backyard production, present several challenges, among which are the lack of efficient feeding, attention to sanitary management, as well as extreme temperatures.

The management and ethnoecotechnological vision of the mestizo population of Térapa, Sonora, Mexico is manifested in the backyard poultry production units studied, including techniques adapted to the various contemporary strategies to alleviate extreme climatic effects.

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Presentation Items

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1. Introduction

Animal welfare and climate emergency

- Animal welfare is related to environmental aspects and its greatest effect is reflected in the ethology of animal organisms.
- It prioritizes the physical and mental state of an animal in relation to the conditions in which it lives and dies, even more so with the current climate emergency.
- One of the effects of the climate emergency on animal welfare is the modification of behavior and productive and vital parameters

Poultry production systems in arid territories

- One of the elements that promote backyard poultry production is directly related to food security and other aspects of the SDGs.
- With indigenous knowledge, in Térapa, Sonora, the production systems still improve the nutritional indicators and the risk of the climatic emergency.
- Sudden changes in meteorological variables in the Sonoran desert ecosystem alter the essence of backyard poultry production systems

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2. Materials and Methods

2.1. Study region and site

- The study was managed in Térapa, province of Moctezuma, Sonora, México, 658 above sea level (29°42′ 01′′ N; 109° 39′ 05′′W).
- The study area corresponds to a landscape of the Sonoran desert located in an intermontane valley. (Figure 1)
- Climate Dry semi-warm with rains in summer BS0hw (x '), with maximum and minimum temperatures in the range of -3 to 48 ° C, the hottest period in the year is between June to September, and the coldest month in January .

2.2 Identification of the profile of Backyard Poultry Production Units

The profile of the 16 backyard productive units of *Gallus gallus* was identified from aspects related to conformation, vulnerability and management

For the evaluation, production units of alternative spaces located within a radius of no more than 20 kilometers were also included to maintain homogeneity, climatic influence and prevalence of local conditions and care strategies.

2.3 Observation and evaluation of productive units

Observation is based on factors related to the existence and permanence of 16 flocks in a period of two consecutive years (2020 - 2021) of management and infrastructure in the backyard environment.

For the temporal observation, the grounded theory of Glasser and Strauss was used, on which the quantitative assessment was superimposed.

2.4 Analysis of the trend of flock behavior from the possible scenarios

The trend of flock welfare is analyzed through various possible hypothetical scenarios according to the direction and ecotechnological strategies in the management of production, depending on the climatic effects.

Arid territory, Moctezuma, Sonora, México

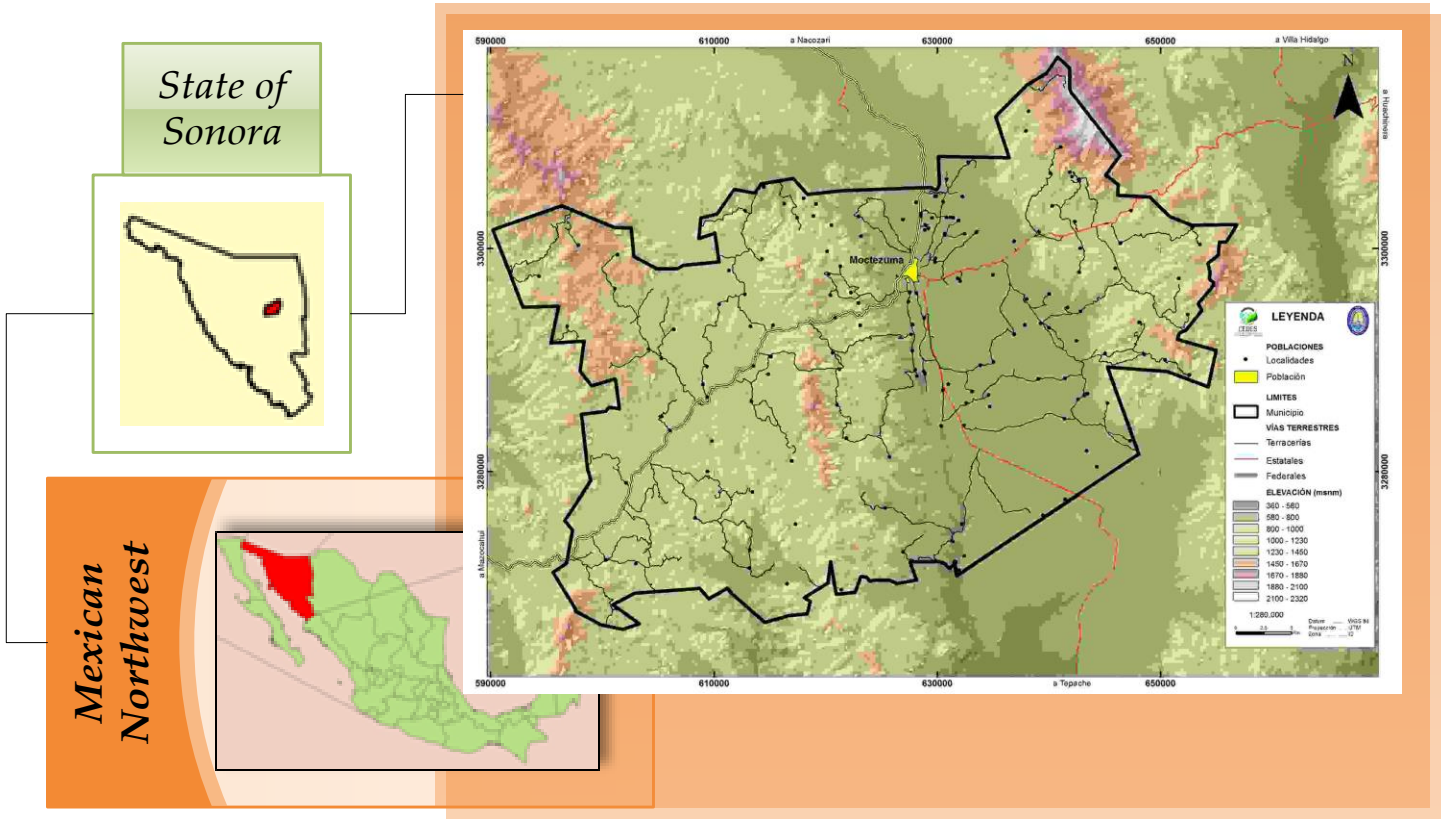

Figure 1. *Location of the arid territory of Moctezuma, Sonora, Mexico.*

Table 1. The actual profile of the backyard productive units of *Gallus gallus in Térapa, Sonora, México*

Productive unit	Composition of the Productive unit[1]			Disease incidence	Infraestruture for protection*	Provision of drinking water "ad libitum"	Type of food	Grazing
	R	H	C					
1	4	10	0	X	☑	☑	pellets	☑
2	1	6	0	X	☑	☑	pellets	☑
3	2	10	0	☑	☑	X	wheat	By schedule
4	6	11	2	X	☑	☑	Mixed grains	☑
5	2	5	0	X	☑	☑	Mixed grains	☑
6	3	6	0	X	X	X	Mixed grains + pellets	X
7	7	10	1	X	☑	☑	wheat	X
8	4	9	0	X	☑	X	Broken corn + pellets	☑
9	2	8	1	☑	☑	☑	pellets	X
10	3	5	1	X	☑	☑	pellets	☑
11	15	11	0	☑	X	☑	Mixed grains	X
12	2	2	1	X	☑	X	wheat	☑
13	1	7	0	X	☑	☑	pellets	X
14	4	4	2	X	☑	☑	Mixed grains	☑
15	7	2	0	☑	☑	X	wheat	☑
16	9	8	0	X	☑	X	pellets	X

1 Rooster (R), Hen (H), Chicken (C) /* Hen house

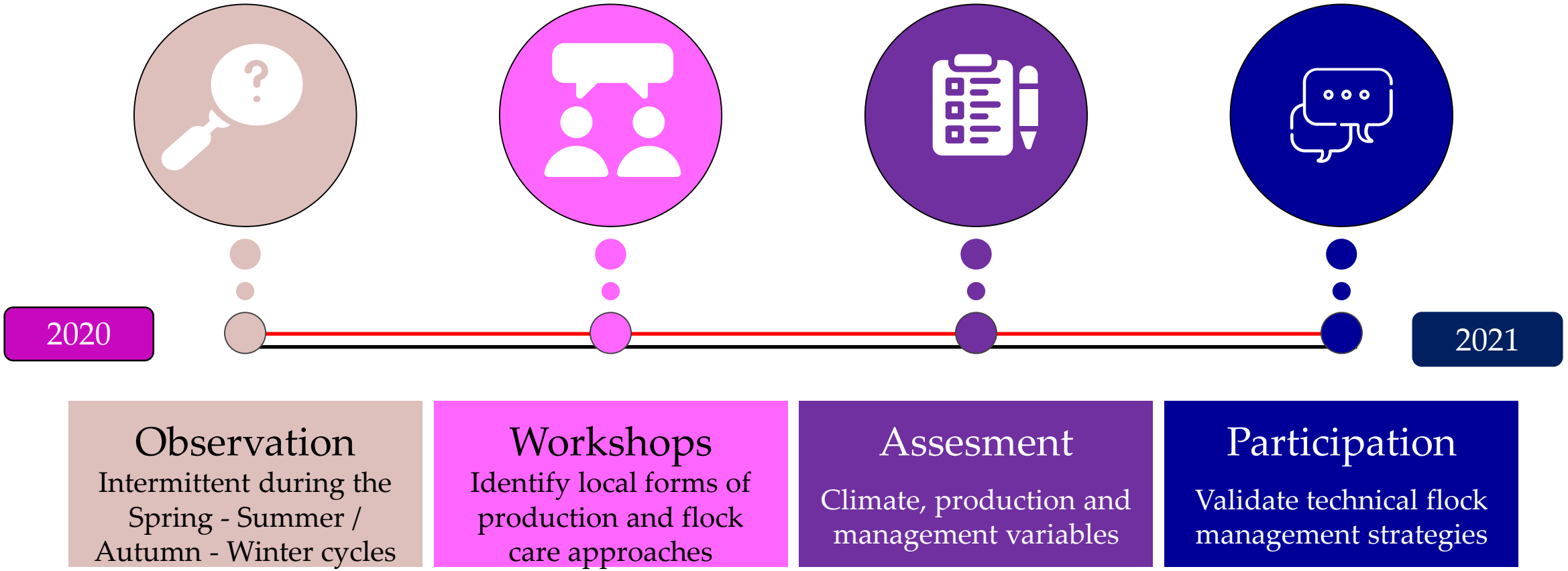

Figure 2: *Temporal observation. Grounded theory of Glasser and Strauss during 2020 -2021 period*

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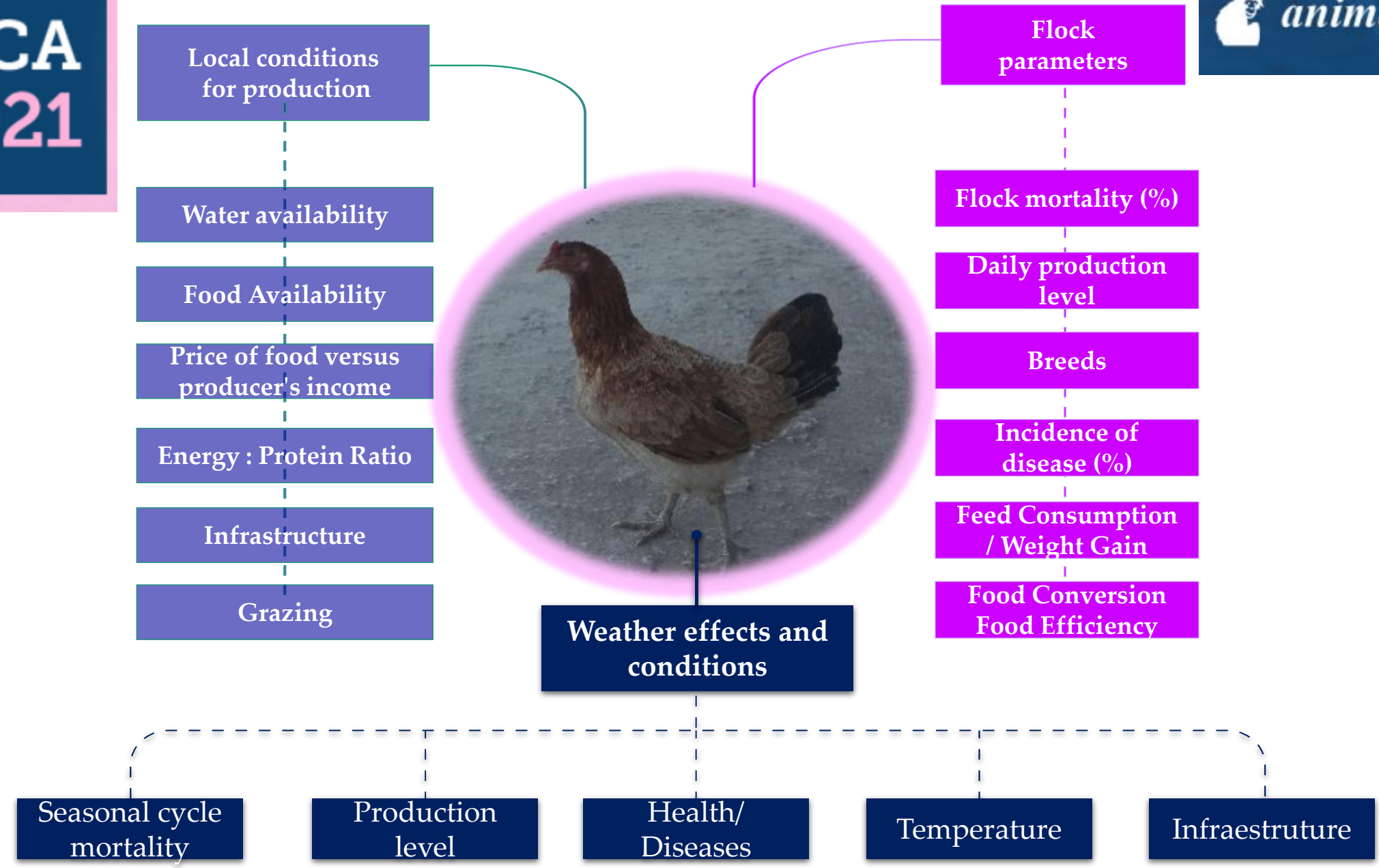

Figure 3: Parameters and conditions identified in backyard production units

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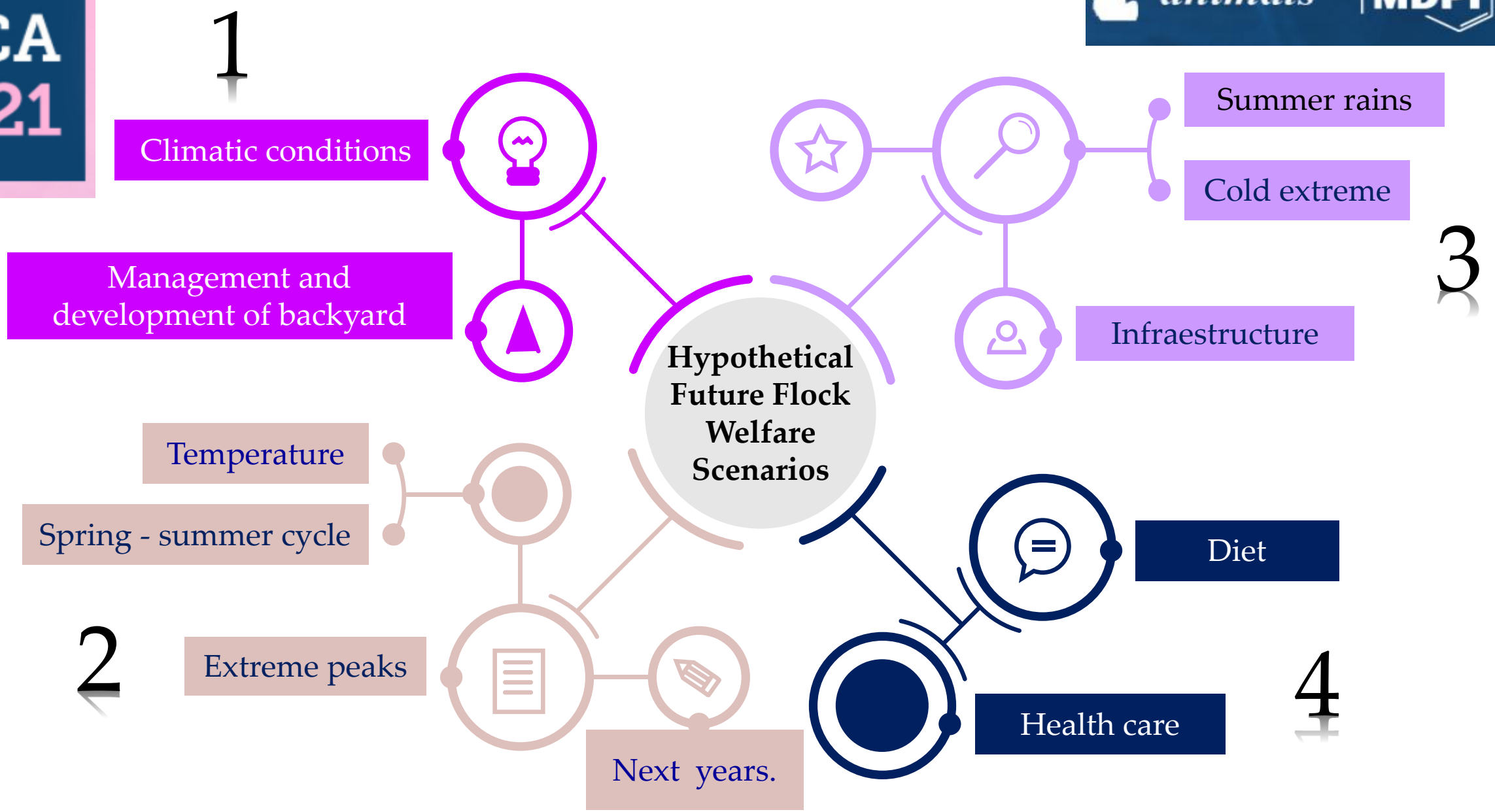


Figure 4: Trend of flock behavior based on possible scenarios

3. Results

3.1 General evaluation of backyard poultry production conditions in Térapa, Moctezuma, Sonora

Production conditions remain in a common denominator between bad and precarious

In the spring - summer cycle 57% of the units evaluated had decreases in food consumption in a range between 12 and 68% due to the effect of heat. For the same cycle, in all production units an increase in water consumption of up to 23% was observed

3.2 Climatic effects and production conditions

The trend of mortality in the productive units was upward since 93.75% of the observed flocks presented at least 4.54% mortality in the spring-summer 2021 cycle.

The variables that most affected were those evaluated during the Spring - Summer cycle, with a value of 94% for Rainfall 97% for Extreme Temperature; 89% relative humidity and solar radiation with 96%.

3.3. Futuristic theoretical scenarios

The trend of flock welfare is analyzed through four possible hypothetical scenarios. According to the direction and ecotechnological strategies in the management of production, depending on the climatic effects

Scenario 1: Climatic conditions and management 2: The temperature exceeds extreme peaks ; 3: Extreme cold with permanence in the protection infrastructure and 4: Increase in the incidence of diseases with the same diet

Table 2. Characterization of the general production conditions, challenges and prospects for the welfare of the backyard poultry production units in the study region

	Cycle[1]		
Indicator	**Spring Summer**	**Autumn - Winter**	**Challenge / Perspective**
Production thermal range (°C)	36 - 42	3 - 31	Promote a change of infrastructure accessible to the producer
Mortality per cycle (%)	3.8%	1.2%	Decrease mortality improves backyard production conditions
Production level[2]	89.6%	10.4%	Improve with diet and exogenous conditions
Global conditions for production[3]	0	1	Improve with ecotechnologies to maintain conditions in the productive infrastructure

[1] The values were averaged for the years 2020 and 2021; [2]Consider only annual egg production; [3]Roofs, walls, floor, ventilation, protection, and nesting equipment, feeding and drinking were evaluated, with a scale of good (2), sufficient (1) and precarious (0).

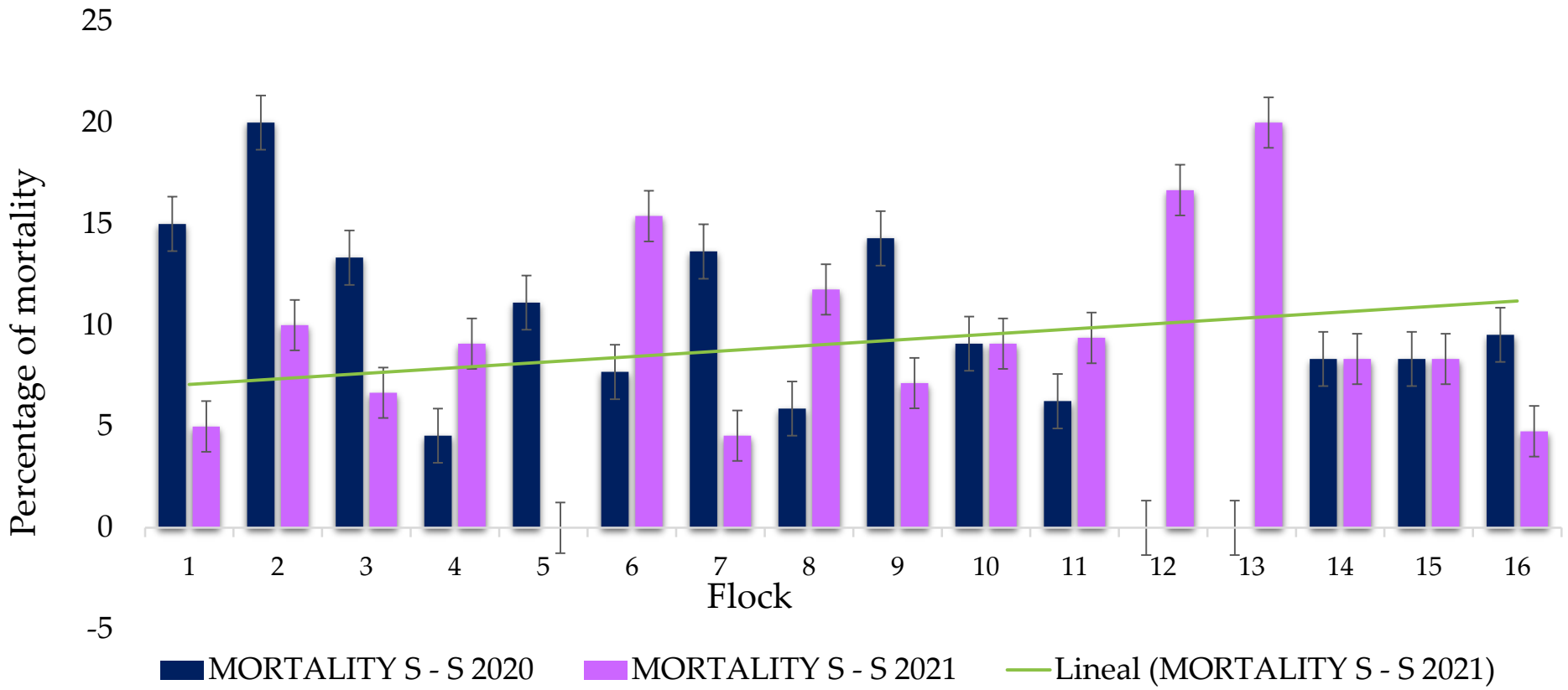


Figure 5. Comparison and trend of annual mortality of individuals per flock during the spring - summer 2020/2021 cycle.

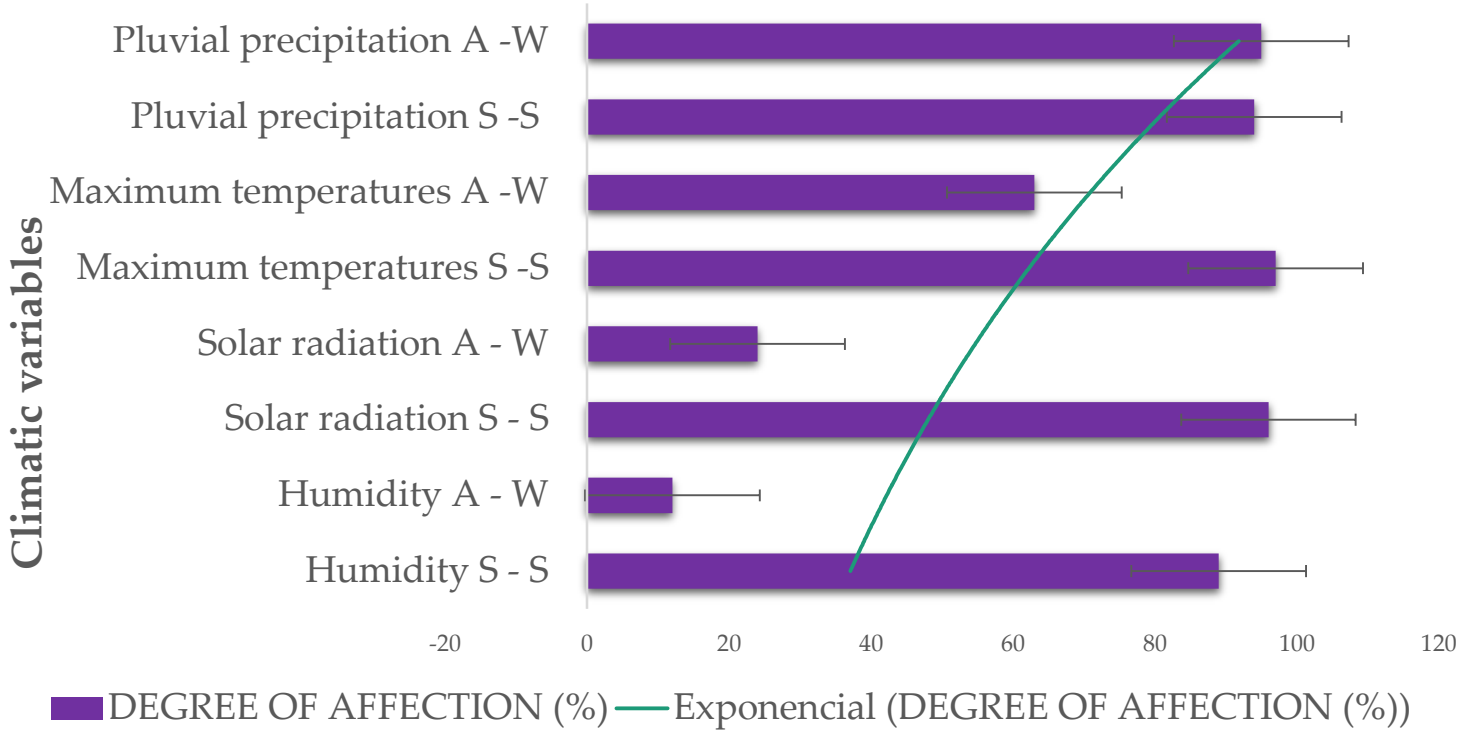


Figure 3. Degrees of affectation of the various climatic variables on the flocks of the backyard production units in Térapa, Sonora, Mexico

01 Climatic conditions and management strategies for the development of backyard units remain constant over time

02 The temperature in the spring - summer cycle exceeds extreme peaks during the next 5 years.

03 An increase in summer rains, presence of extreme cold in winter with permanence in the protection infrastructure.

04 Increase in the incidence of diseases with the same diet and the same health care of the flock.

Figure 6. The trend of flock welfare is analyzed through four possible hypothetical scenarios according to the direction and ecotechnological strategies in the management of production (Parameters of the flock, the local conditions for backyard production and the effects and climatic conditions)

Feed consumption / Weight gain

They are maintained according to current levels

Disease incidence (%)

They are maintained according to current levels

Daily egg production level

It remains with a downward trend

Flock mortality (%)

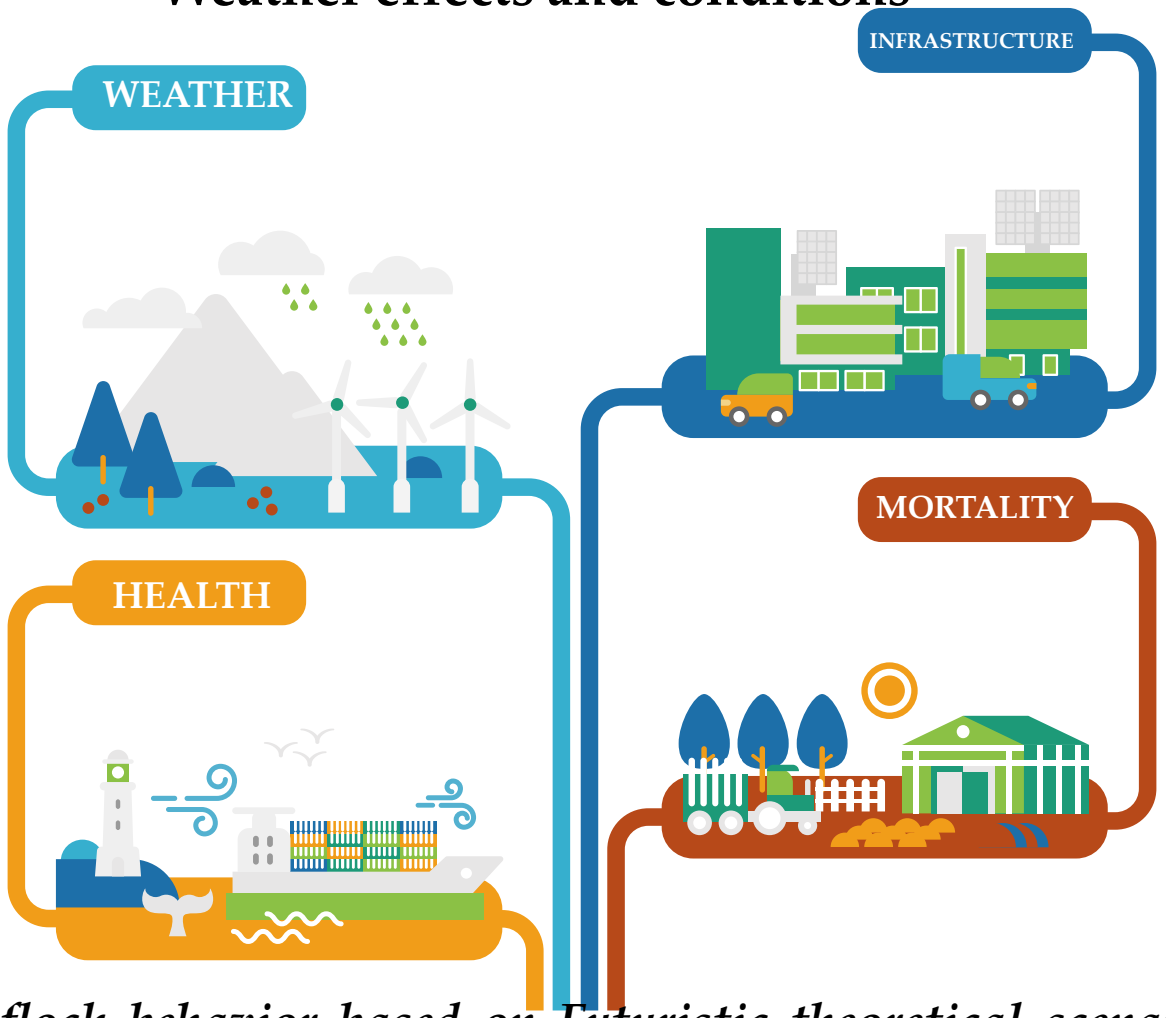
It increases in summer 2 %

3.3. Analysis of the trend of flock behavior based on Futuristic theoretical scenarios from the parameters of the same flock, example for first scenario

Weather effects and conditions

L W

Local weather
Temperature rises 1 ° C
Intense rainfall in winter
Radiation and humidity increase 5%



I

Infrastructure (Protection, Security, Comfort)
Protect against radiation
Provide shade and ventilation
Humidify shelter and protection areas

H & D

Health / disease, wild animal attacks.
Increase 20 %

S M

Seasonal cycle mortality
Increase 20 %

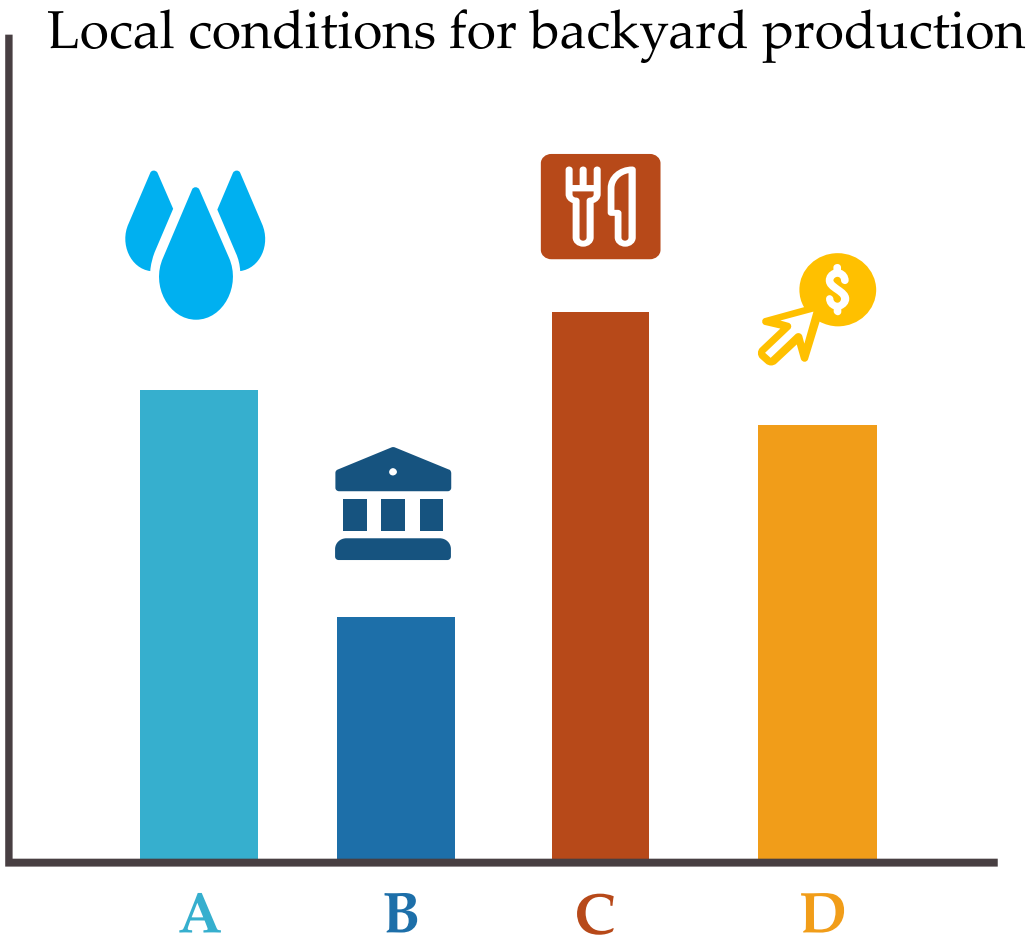
3.3. Analysis of the trend of flock behavior based on Futuristic theoretical scenarios from the parameters of Weather effects and conditions. Example for second scenario.

W

Water availability
Increase access to 20%

F

Food availability
Increase access to 20%



I

Infrastructure
Improve roofs and walls of chicken coops

P

Price of food versus producer's income
Price increases. look for natural foods, local insects, increased

3.3. Analysis of the trend of flock behavior based on Futuristic theoretical scenarios from the parameters of local conditions for backyard production. Example for third scenario.

4. Discussion

4.1 Production level and permanence of backyard poultry production units through current seasonal variations

- The strategies followed by the owners of the production units are rudimentary, in addition to giving the possibility of maintaining a level of production within the limits of self-consumption.
- This level is not optimal since it is required to offer an adequate diet in time and of nutritional quality, with an adequate ratio of Energy: Protein in addition to offering food ad libitum especially in the summer where consumption decreased considerably.

4.2 Redefining the welfare of backyard poultry in arid Mexican territories

- The climatic emergency and the health parameters in the backyard poultry production systems of arid territories result in a binomial that renews the concept of animal welfare.
- This concept is further revalued where the desert ecosystem magnifies its severity due to climatic variation, so that to alleviate the thermal extremes it is necessary to adopt green, friendly strategies with different degrees of modernization and that at the same time reflect inclusion of the Sustainable Development Goals

4. Conclusions

- The main challenge of backyard poultry production in Térapa, Sonora focuses on local technical strategies to reduce the effects of the climate emergency on production parameters.
- Based on the trend of the climatic emergency, it is expected that the flocks in the study community make specific changes to be able to survive in the seasons with extreme temperatures.
- To maintain backyard productive activity with local ethnoecotechnological customs, the management of the productive units is based on the generation of changes in the rudimentary infrastructure, integrating sanitary management and assimilating the severity of the climate in the way of producing and managing the flock.
- For the practical incursion of the SDGs in the backyard poultry production systems in Térapa, Sonora, the managers of the production units contemplate an incipient integrated approach and a minimum link with other local production systems to have useful inputs and maintain animal welfare in the flock

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Very grateful for your attention !!

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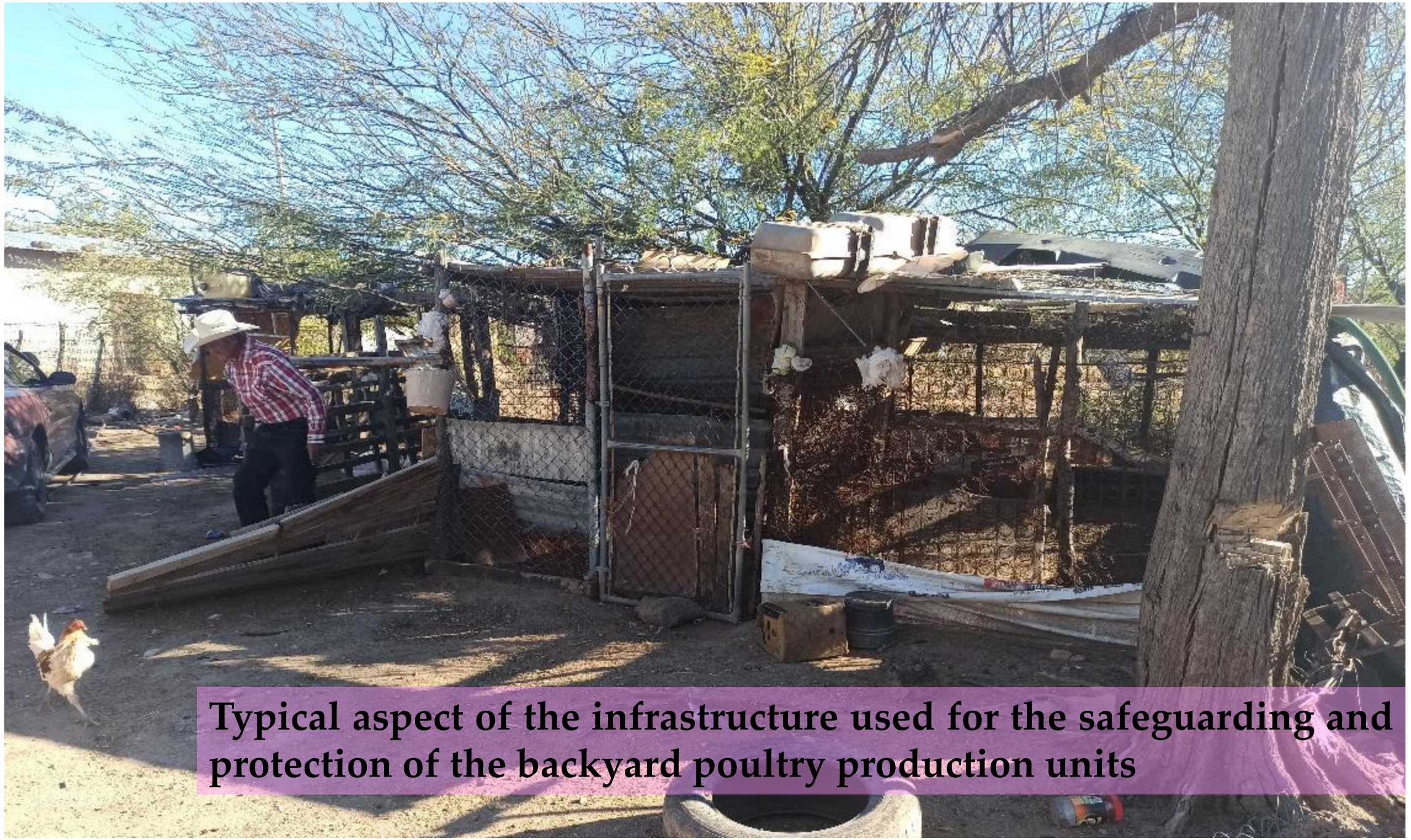
Photo album

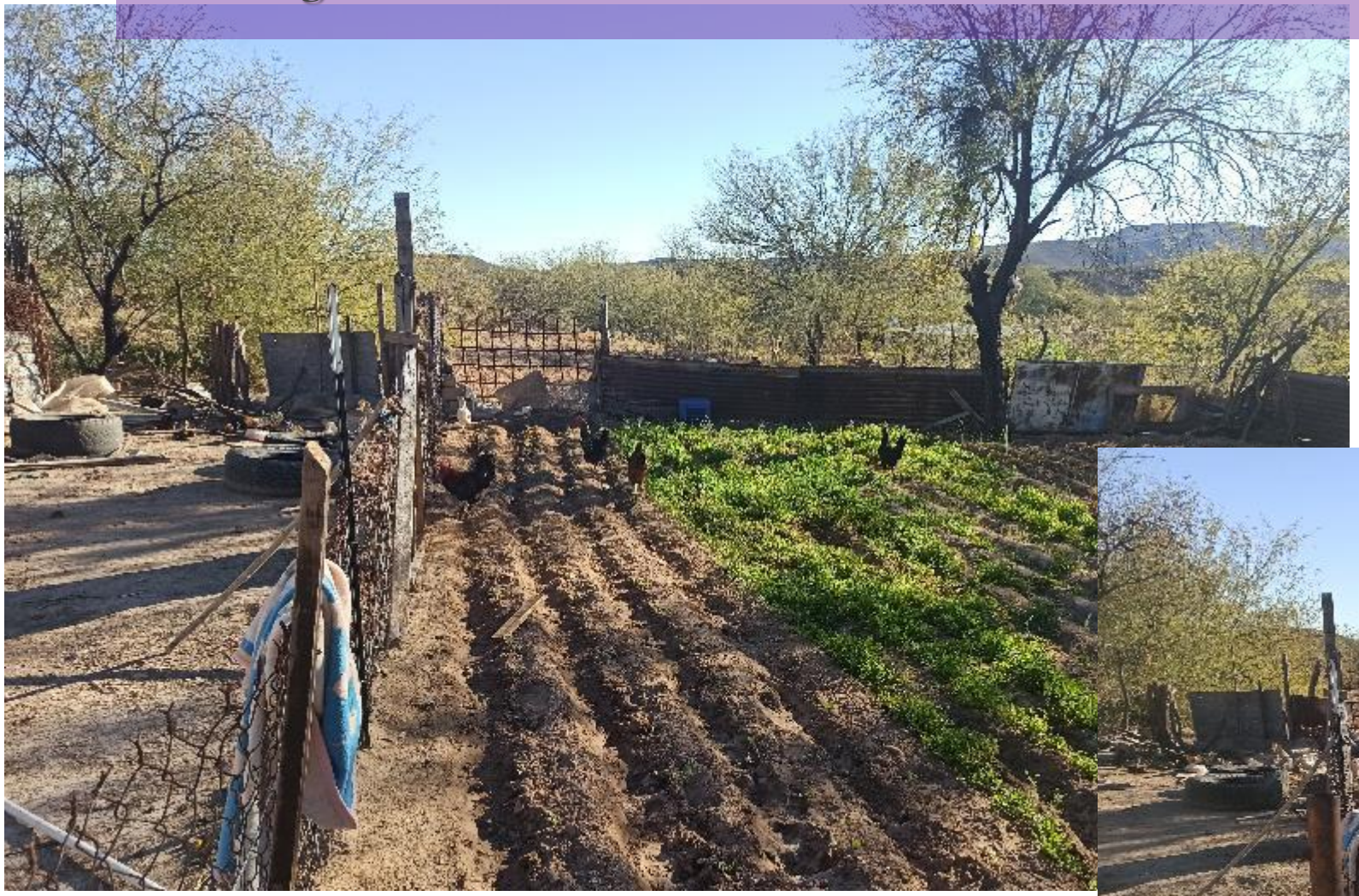
By Héctor T. Mojica


With climatic variations, protection is required above all to provide shade and optimal temperature for metabolic functions



Typical aspect of the infrastructure used for the safeguarding and protection of the backyard poultry production units

Grazing area



Most common backyard unit breeds in Térapa, Sonora, Mexico

Appearance of the typical backyard in the arid territory of Térapa, Sonora, Mexico