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Sustainable Character of Agroproductive Nodes in Intermontane Arid Territories of Sonora, Mexico †

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Highligths

The sustainability of the agro-productive nodes of the Sonoran Desert is a function of environmental and water limitations, the degree of eco-technological inclusion and the strategic diversification of its production processes.

The objective of this work is to evaluate the inclusion of the ecotechnological approach of an Agroproductive Node with a Sustainable Trend (NATS) in Moctezuma, Sonora, Mexico

The global evaluation of the activity is tending towards a decrease in sustainability and a value of the environmental compatibility trait of 25 BU.

The valuation of the same trait for the new productive approaches included in the node, result from collateral categories that contribute to production and sustainability, among which are distinguished a) Definition and practice of arid tourism with 47 BU, b) Buffer areas for protection of wildlife with 100 BU and c) the use of rescue grazing with 68 BU.

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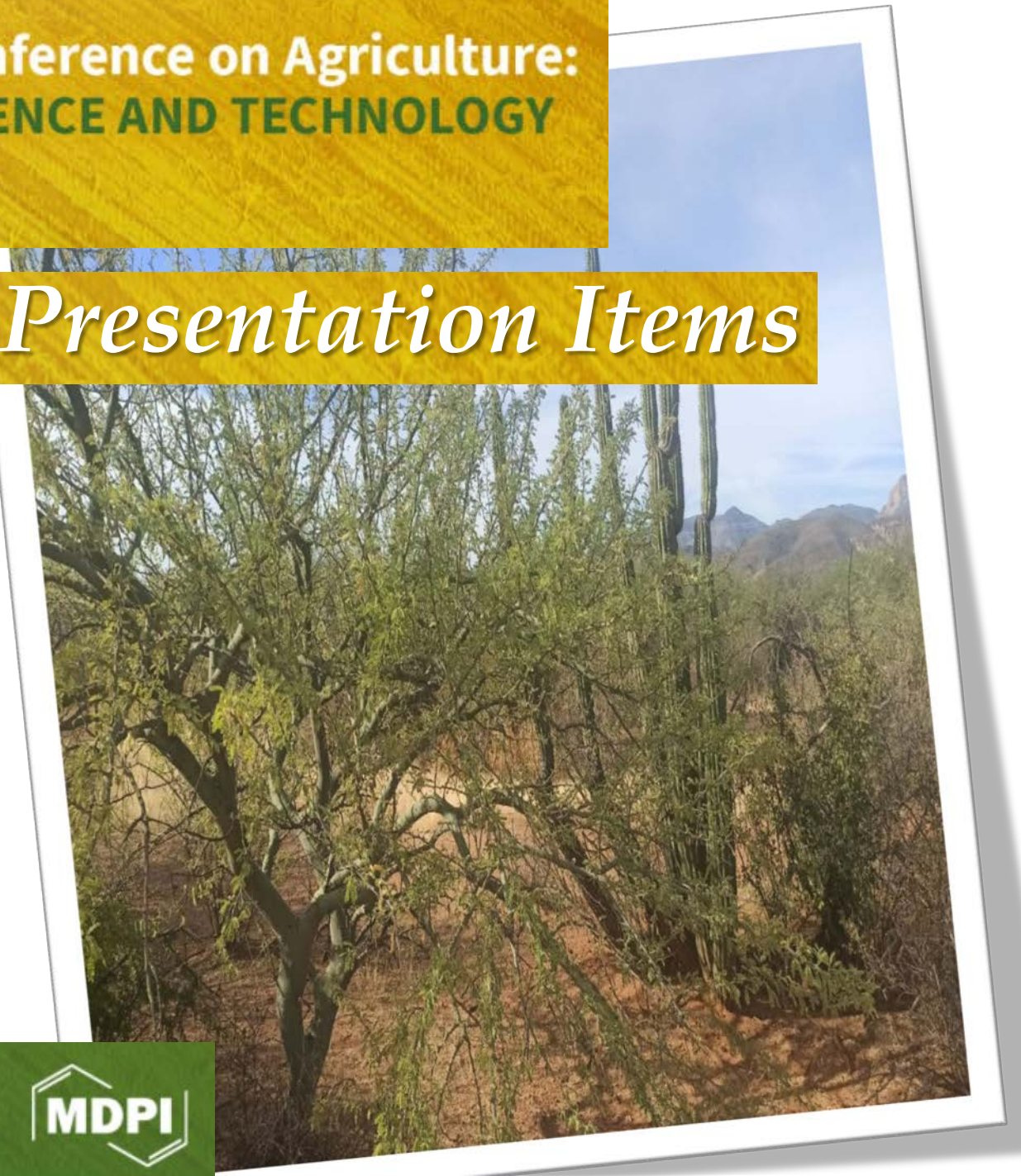
Presentation Items



1. *Introduction*
2. *Methods*
3. *Results*
4. *Conclusions*

References

agriculture MDPI

1. Introduction

Integrated and sustainable strategic management in agroproductive nodes

- In the management of natural resources in arid Mexican territories, a complex and integrative approach cannot be postponed
- There is a diversity of factors related to environmental and climatic risks or catastrophes, determining factors for effective development.
- The combination of nodes and their productive interconnection with the sustainable management of resources constitutes the Sustainable Ecotechnological Agrópolis [4,5,16].

General Objective & Specific research aims

- Apply an ecotechnological adoption evaluation methodology to an agroproductive hay node in Moctezuma, Sonora, Mexico.
- 1) Assess the aptitude of new sustainable activities for the potential development of the study agro-productive node
- 2) Define the inclusion of the activity suggested to the node based on the capacity and sustainable and ecotechnological trend from the processes inserted in that activity

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2. Methods

2.1. Study region and site

- The study was managed in 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

2.2 Elements of the agroproductive node and its identification

The primordial activity is evaluated and compared with those activities of possible insertion to the node. it is necessary to identify:

a) The vulnerable points of the process

b) Establish the risks, respective indicators.

For both cases, a value from 0 to 1 is assigned, defined by the operator of the agroproductive node.

c) Identify the value of the threat (VT) using equation

2.3 Selection criteria of the elements or activities of the agroproductive node

To choose the activities or elements of the agroproductive node in transition, the following conditioning criteria were taken

a) Vulnerable processes or with potential risks, that represent athreat to the existence of the node

b) The options for the use of natural resources generate a sustainable activity

c) Products or services with a sustainable category

d) Contributes to the development and food security of the comunity

2.4 Definition of the scale of ecotechnological and sustainable adoption

This scale is applicable in the agroproductive production process.

The pressure exerted must result in a change in the processes of the agroproductive node, thereby inducing an ecotechnological transition of the node

The change moves from a conventional approach to an ecotechnological state, which reduces the vulnerability and risk of the agroproductive node.

Arid territory, Moctezuma, Sonora, México

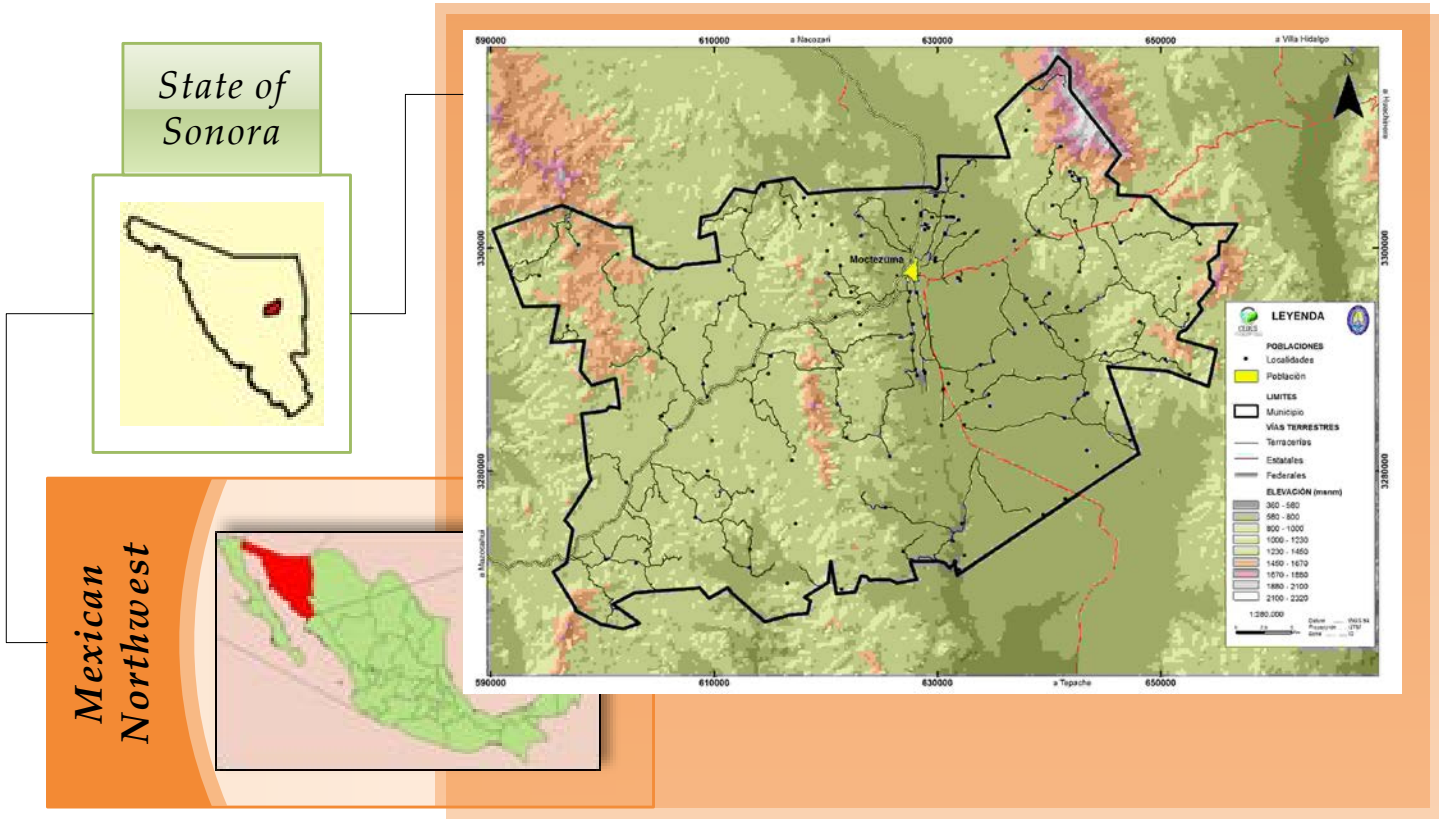

Figure 1. *Location of the arid territory of Moctezuma, Sonora, Mexico.*

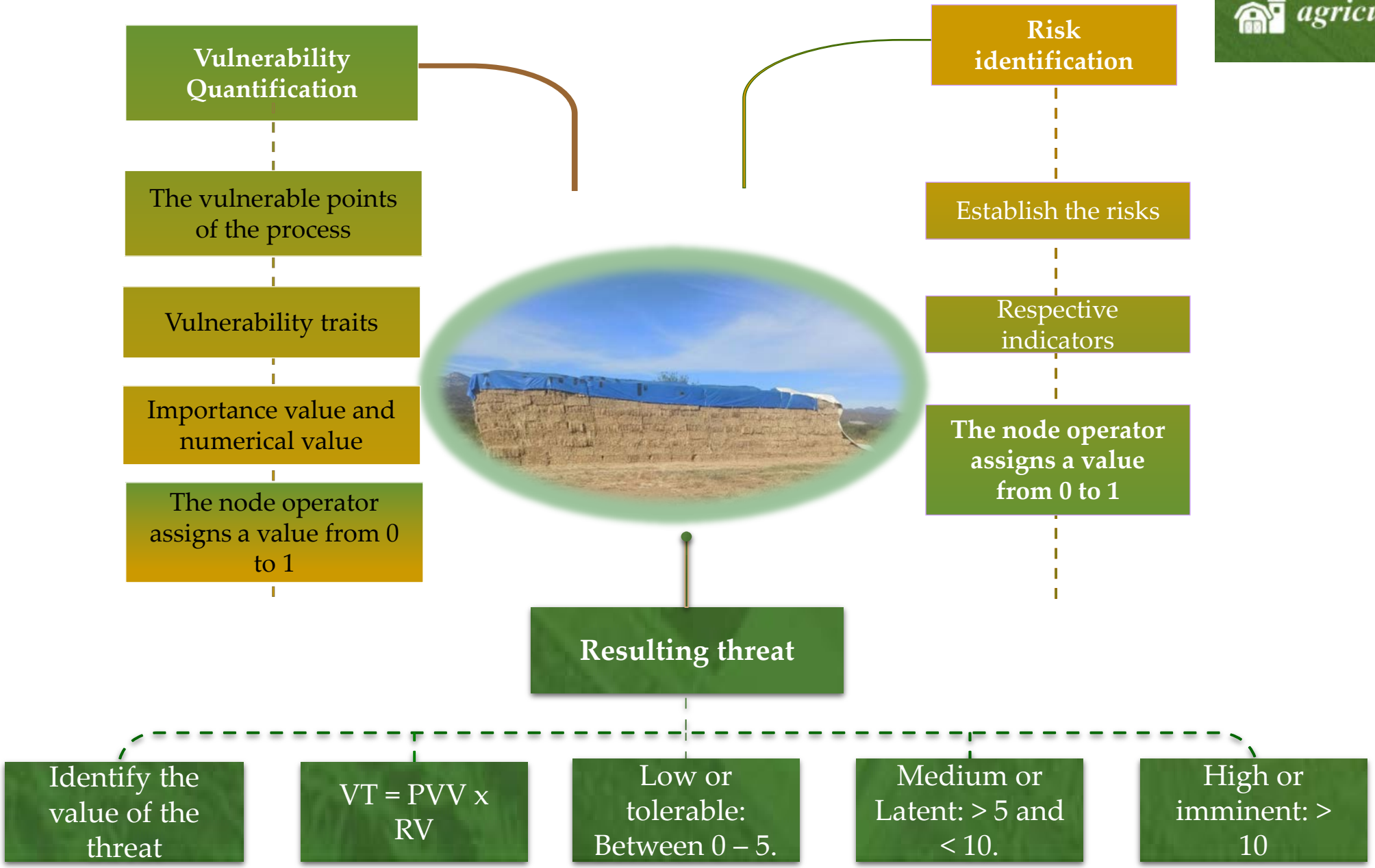

Figure 2: Elements of the agroproductive node and its identification

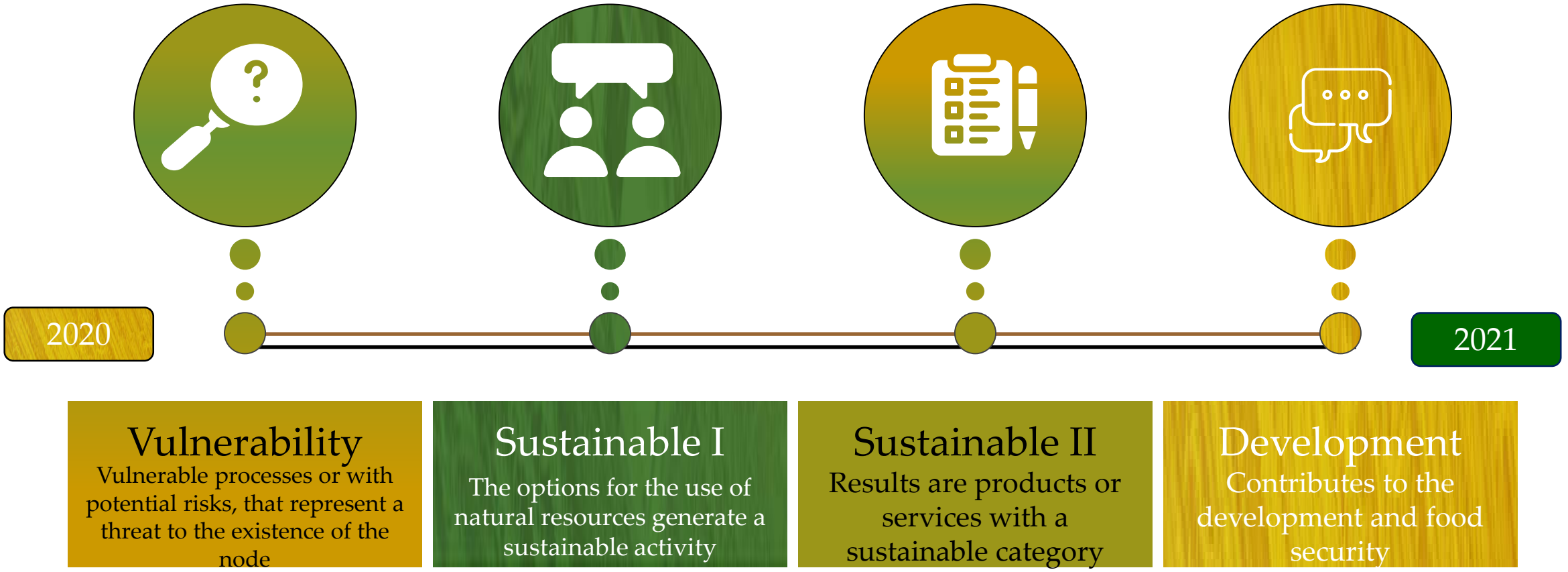

Figure 3: Selection criteria of the elements or activities of the agroproductive node (during the period 2021 – 2021)

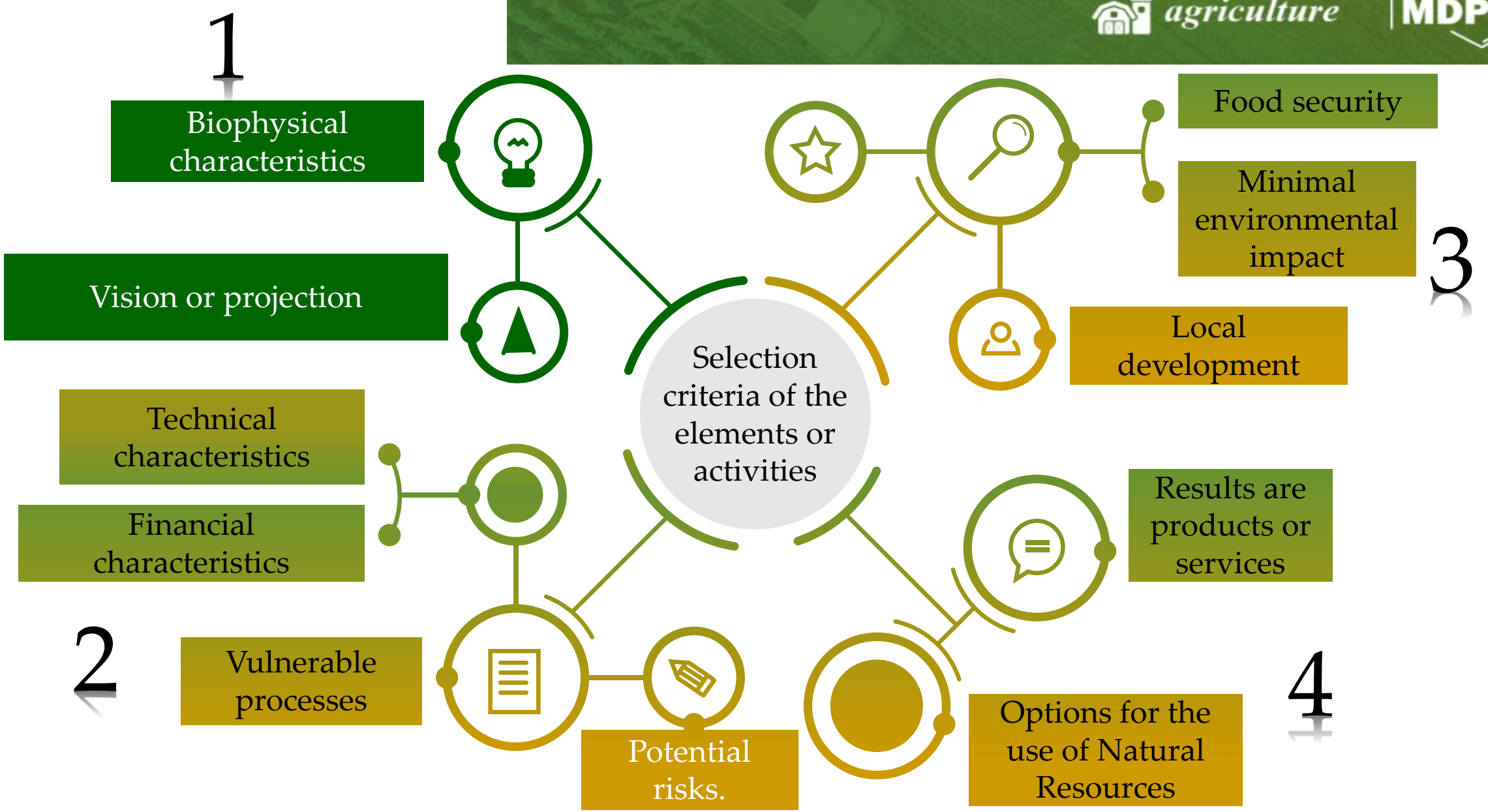

Figure 4: Selection criteria of the elements or activities of the agroproductive node

Table 1. Fundamentals of the Braden Scale adapted for the ecotechnological insertion in the elements of the agroproductive node

Score[1]	1	2	3	4
Process versatility	Completely rigid	Rigid in some parts	Rigid but open to change	Completely innovative and open to change
Water requirement	More than 24 hours	Between 12 and 24 hours	One hour a day	Rarely, once a month
Resilience in the natural resources involved	Nil	Low resilience in all	Partial resilience	Resilience in all
Consumption dynamism	Consumed more than twice per week	Consumed more than twice per season	Consumed twice per season of the year	In one season of the year
Contribution to the ecosystem, economy or food security	Does not offer immediate contribution	Only to the ecosystem	To the ecosystem and flow in the local economy	Total contribution
Environmental compatibility	Not compatible	Moderate	High	Very high

[1] Each value represents a quartile of ecotechnological adoption in the agroproductive node process

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3. Results

3.1 Analysis of the agroproductive process of the original activity in Moctezuma, Sonora, México

The original activity is oriented to the production of hay from Alfalfa and Sorghum, the vulnerable stages of the process and their respective score.

Identification of vulnerable stages of the process were: Planting, Irrigation, Growth – Development, Cut – baled, Storage with importance values between medium and very high

3.2 Identification of Risk Indicators

Those directly linked to the main activity of hay production were identified as main risks. The faults, shortcomings or deficiencies of the inputs in some part of the process stand out.

The assigned values ranged, according to the operator, from 0.23 for germination failure, to 0.97 for the necessary irrigation water for growth; 0.95 for hours of irrigation with electricity and 0.62 for low prevalence of plants in the meadow

3.3. Alternatives for the transition of node of study

The main attributes identified according to the criteria defined in the methodology were: a) **Biophysical characteristics,** b) **Projection of the node,** c) **Technical capacity,** and d) **Financial capacity:**

The alternative activities identified for the ecotechnological conversion of the node, were : The practice of aridtourism (14 - 93 BU), Areas for the protection of wildlife (12 - 100 BU), and Rescue grazing use 36 - 86 BU).

Table 2. Identification of vulnerable stages of the process

Process vulnerability	Vulnerability trait	Importance value	Assigned value*
Planting	The seed loses its germinative capacity	High	0.85
Irrigation	Water is not available due to lack of electricity	Very high	0.95
Growth - Development	Lack of water / nutrients	High	0.85
Cut – baled	Machinery in bad condition or lack of fuel	Middle	0.50
Storage	Putrefaction or combustion	Middle - high	0.5 – 0.85

* Assigned by the operator of the agroproductive node

Table 3. Identification of risks indicators of the process

Risk	Indicator	Assigned value*
Lack or failure of germination (LFG)	Number of lost or unviable seeds	0.23
Inefficient use of water (IUW)	Number of liters of water needed for growth	0.97
Inefficient use of energy (UIE)	Number of hours of irrigation applied with electricity	0.95
Infertile soil or soil with pathogens (ISP)	Number of hectares without vegetation or low plant density	0.62

* Assigned by the operator of the agroproductive node

Table 4. Quantifying the value of the threat in the nodeo of Moctezuma, Sonora, México

VULNERABLE POINT OF THE PROCESS	VALUE	RISK	RISK VALUE	VALUE OF THE THREAT FOR EACH PROCESS
PLANTING	0.85	LFG	0.23	0.1955
	0.85	IUW	0.97	0.8245
	0.85	UIE	0.95	0.8075
	0.85	ISP	0.62	0.527
IRRIGATION	0.95	LFG	0.23	0.2185
	0.95	IUW	0.97	0.9215
	0.95	UIE	0.95	0.9025
	0.95	ISP	0.62	0.589
GROWTH - DEVELOPMENT	0.85	LFG	0.23	0.1955
	0.85	IUW	0.97	0.8245
	0.85	UIE	0.95	0.8075
	0.85	ISP	0.62	0.527
CUT – BALED	0.5	LFG	0.23	0.115
	0.5	IUW	0.97	0.485
	0.5	UIE	0.95	0.475
	0.5	ISP	0.62	0.31
STORAGE	0.675	LFG	0.23	0.15525
	0.675	IUW	0.97	0.65475
	0.675	UIE	0.95	0.64125
	0.675	ISP	0.62	0.4185
				10.59525

Technical capacity

Sufficient to moderate, with necessary technical support for the development of low-energy eco-technologies

Projection of the node

To be a diverse node in the activities aimed at fulfilling the SDGs. Presents innovative activities and ideas

Biophysical characteristics

Soils with 73% fertility level. 46% erosion, 67% vegetation cover; existence of native vegetation - pristine in 95% of the area, 5% slope of the land. Presence of faunal diversity

Financial capacity

Sufficient for the development of ecological projects that require low investment

5. Conditioning criteria for the adoption of potential productive activities

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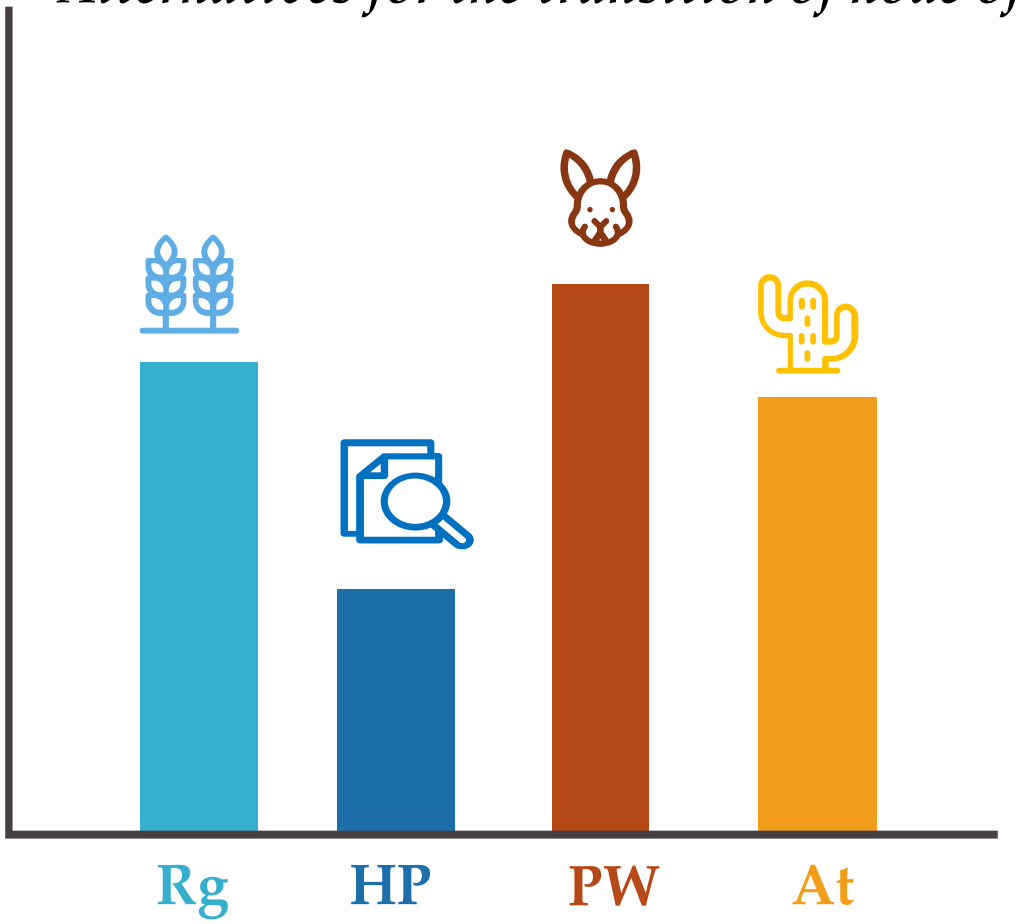
Alternatives for the transition of node of study

Rg

Rescue grazing use (36 - 86 BU)
Provides a healthy soil cover without pressure from trampling or soil erosion.

PW

Areas for the Protection of Wildlife (12 - 100 BU),
The purpose is to conserve undisturbed spaces on the site for the maintenance of migratory and local species



HP

Hay production
Original activity

At

Aridtourism (14 - 93 BU),
Values spaces that are direct to the environment and focused on the appreciation of nature

6. Alternatives for the transition towards a sustainable ecotechnological management of the agroproductive node of Moctezuma, Sonora, Mexico

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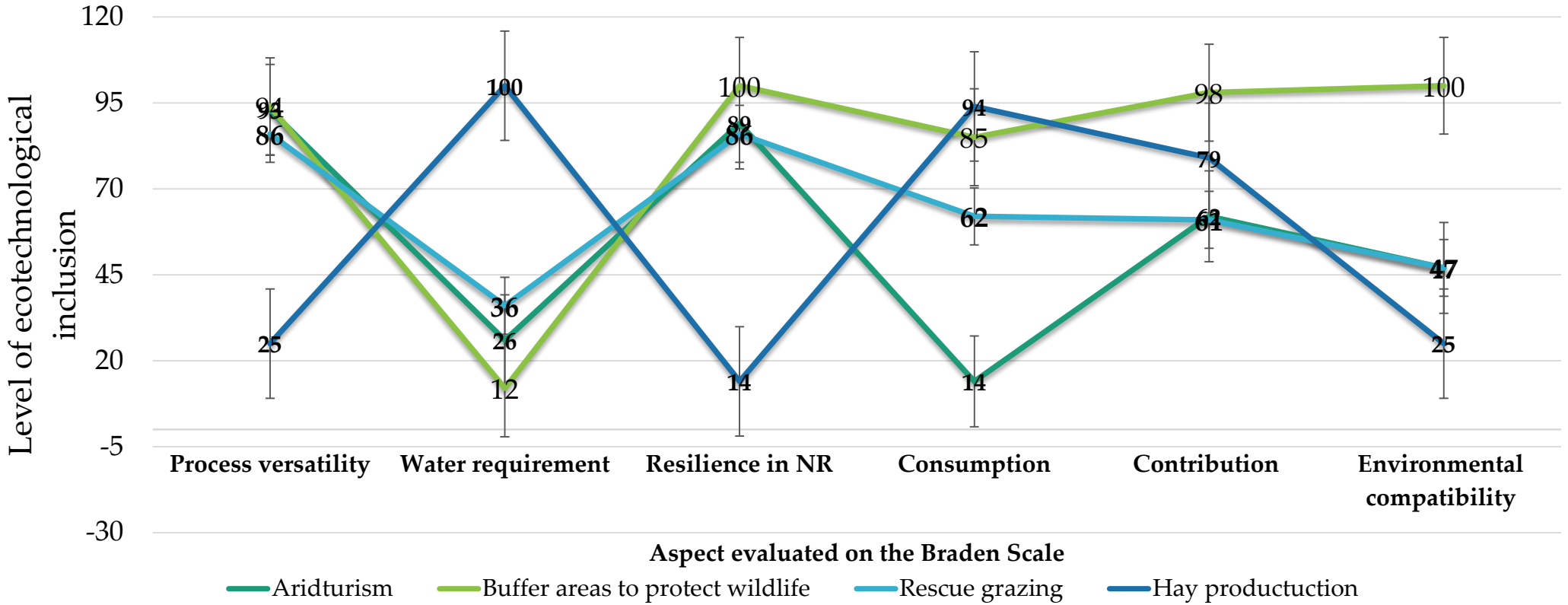

Figure 6. Comparison of the level of ecotechnological inclusion in the activities of the agro-productive node under study using the Braden scale

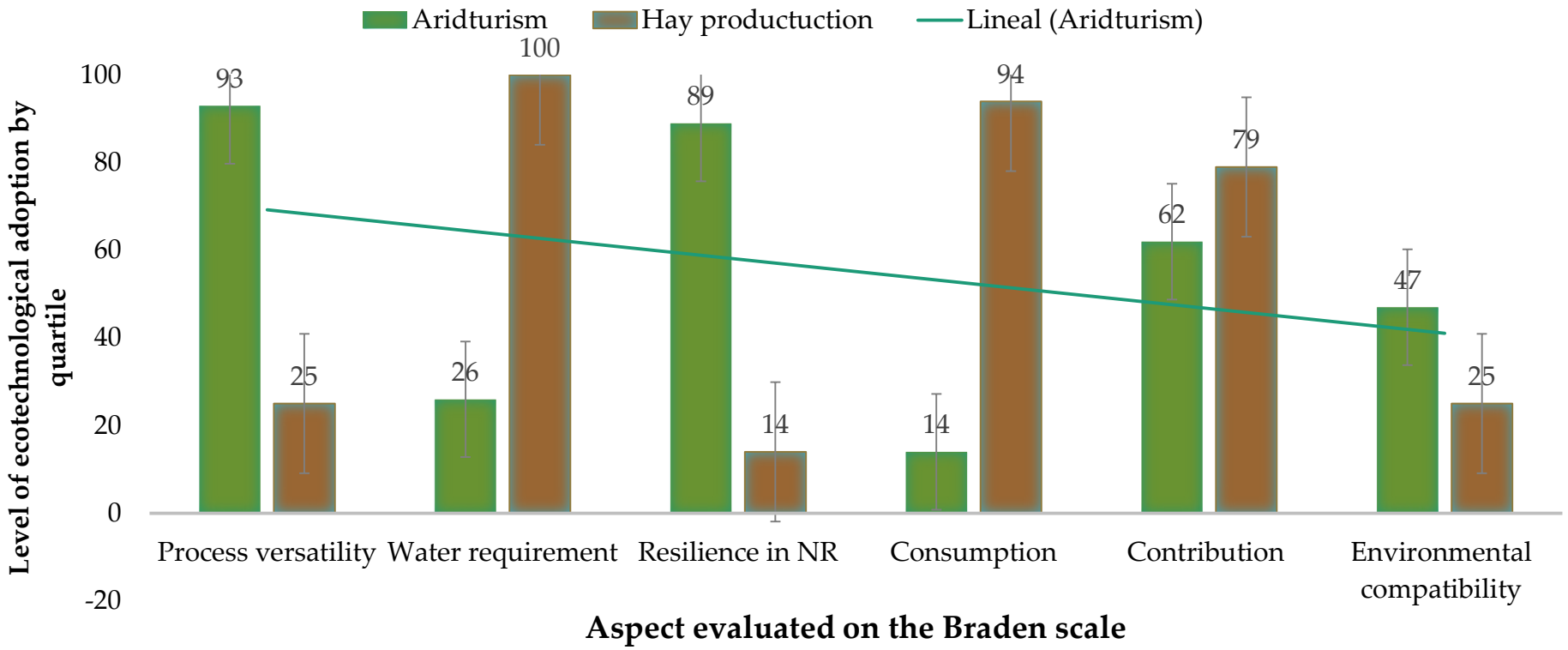

Figure 6. Comparison between the main activity of the node and aridtourism

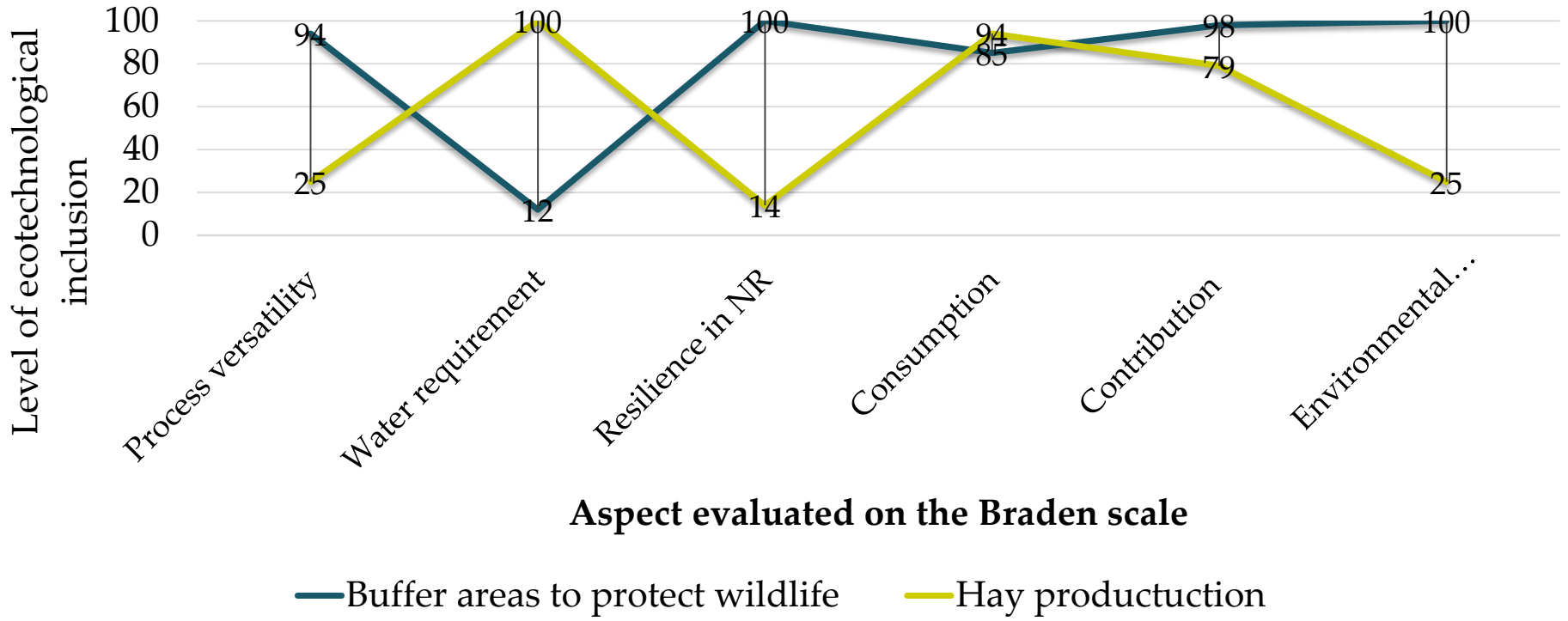

Figure 7. Comparison between the main activity of the node and Buffer areas to protect wildlife in the node of Moctezuma, Sonora, México

01 Represent an alternative for food security and for local-regional self-consumption

02 The level of ecotechnology adoption is influenced by the physical-climatic conditions and the climatic emergency.

03 Severe conditions of a climatic nature occur in various ways during the seasons of the year in the arid territories of study

04 It guarantees the existence of supplies and food for local users under an eco-technological production approach.

Figure 7. Importance of agricultural production systems in arid Mexican territories & Level of ecotechnology adoption

4. Conclusions

- In the node for hay production in Moctezuma, Sonora, Mexico, diversity traits were identified in the existence of resources, capacities and biophysical aptitudes.
- The complex integration as well as the link in the optimal and sustainable use of the natural resources of the node derives from the implementation of the integrated strategic management
- Both the sustainable and ecotechnological capacity of the node, as well as its gradual changes in the processes over time, were determined in Braden Units.
- The essential for the pragmatism of sustainability was valued with the various strategies applied in the activities included in the agroproductive node

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Very grateful for your attention !!

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Photo album

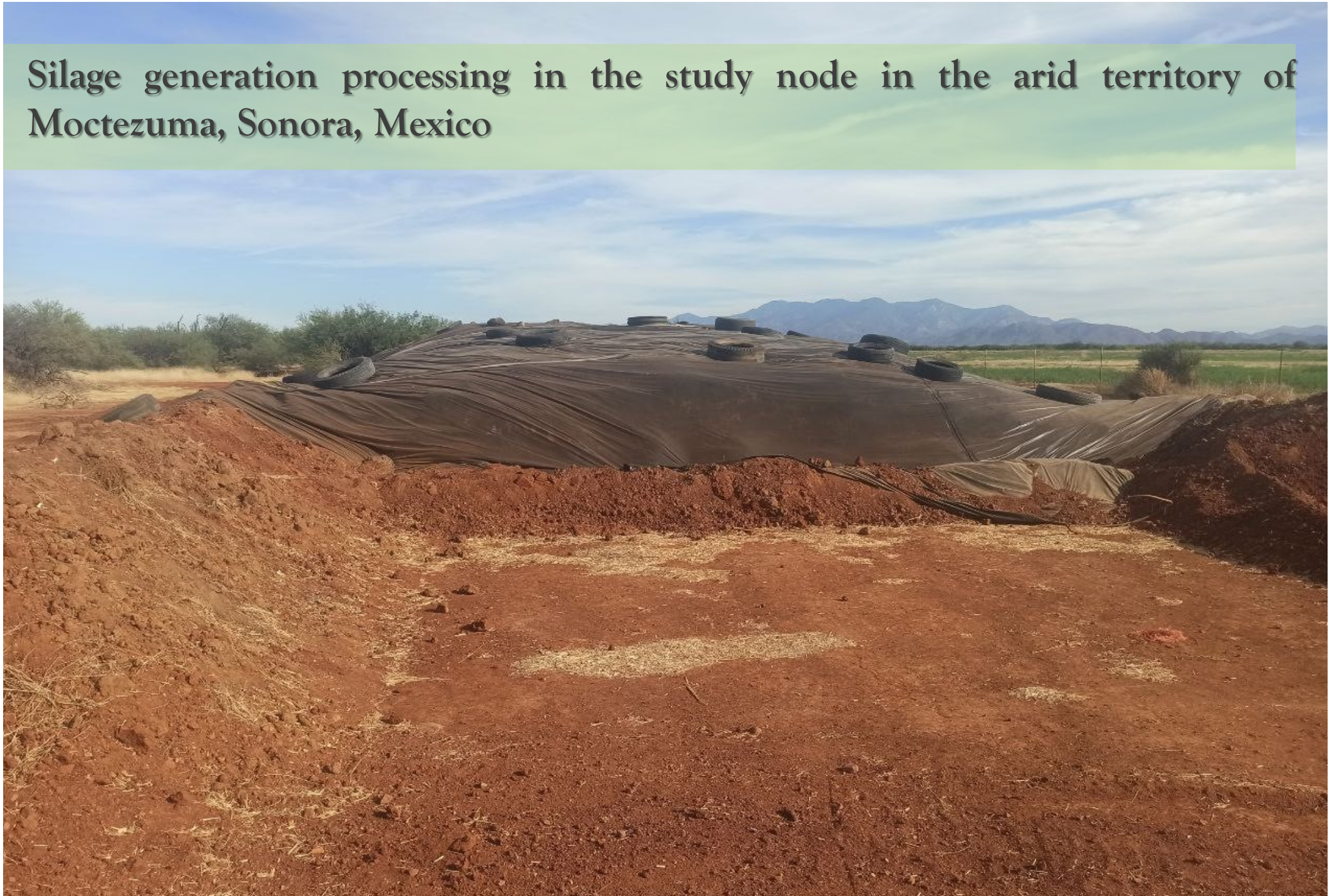
By Héctor T. Mojica

Grazing area & Alfalfa meadow for hay

Xeric orchards and establishment of organic vineyards (next slide) as potential activities in the agro-production node

Establishment of organic vineyards

Silage generation processing in the study node in the arid territory of Moctezuma, Sonora, Mexico



Buffer areas to protect the flora and fauna

Buffer areas to protect the flora and fauna(continuation)