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## Evaluation for the UMA's of Diversified Breeding in the Mixteca Poblana, México

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### 1. Introduction

The ethnic zone named Mixteca in the state of Puebla, Mexico; is a region with rough topography, arid and semiarid climate, critical poverty, and isolated of the development. In that area, the white tail deer (*Odocoileus virginianus*) from the "mexicanus" subspecies is used, in Units for the Management and Wildlife Conservation or UMA's, by means of the model called Diversified Breeding (livestock) (Villarreal, 2006). This technology is based on a productive model of Diversified Integrated and Self-sufficient type (Sustainable Farming Systems), where the exploitation of bovine of meat is diversified, by means of rational and sustained utilization of the white tailed deer, other species of the wild fauna and their habitat, in the hunting game and the tourism of nature. These sustainable models are an alternative for the conservation of the natural resources, since they'll favor the recycling of nutrients, production of biomass and their movement across the ecosystem, achieving to establish schemes that integrate the productive managing, with the exchange of energy and nutrients, with a natural base of coherent performance (Pimentel, 2001). The objective of this work was to realize an ecological and socioeconomic evaluation of the application of the model of Diversified Breeding in the UMA's of white-tailed deer, in the Mixteca region in the south of the Mexican state of Puebla. (Villarreal et al. 2008).

#### 1.1 Study's setting

The Mixteca poblana belongs to the dry tropic of the depression of the Balsas River (Fig. 1), with habitat whit tropical deciduous forest (Fig. 2), arid brushwood and oaks forest, among other vegetative types. It covers 47 Municipalities, with a principally mountainous surface of 10.565 km<sup>2</sup>. Due to its geographical conditions the region shows under agricultural potential, the activities of the primary sector of the economy are the agriculture of temporarily and the extensive ranching of bovine's and goats livestock. The secondary and tertiary activities concentrated in two growth points, the cities of Tehuacán and Izúcar of Matamoros (Villarreal, 2006). Due to the lack of opportunities of development the rural

population migrates principally to the New York, California and Texas states in the American Union. In the region the white tailed deer of the "*mexicanus*" subspecies, is distributed in 37 Municipalities by a surface of 547.550 ha. (Villarreal & Guevara, 2002).



Fig. 1. Map from location of Mixteca region, Puebla State, Mexico.

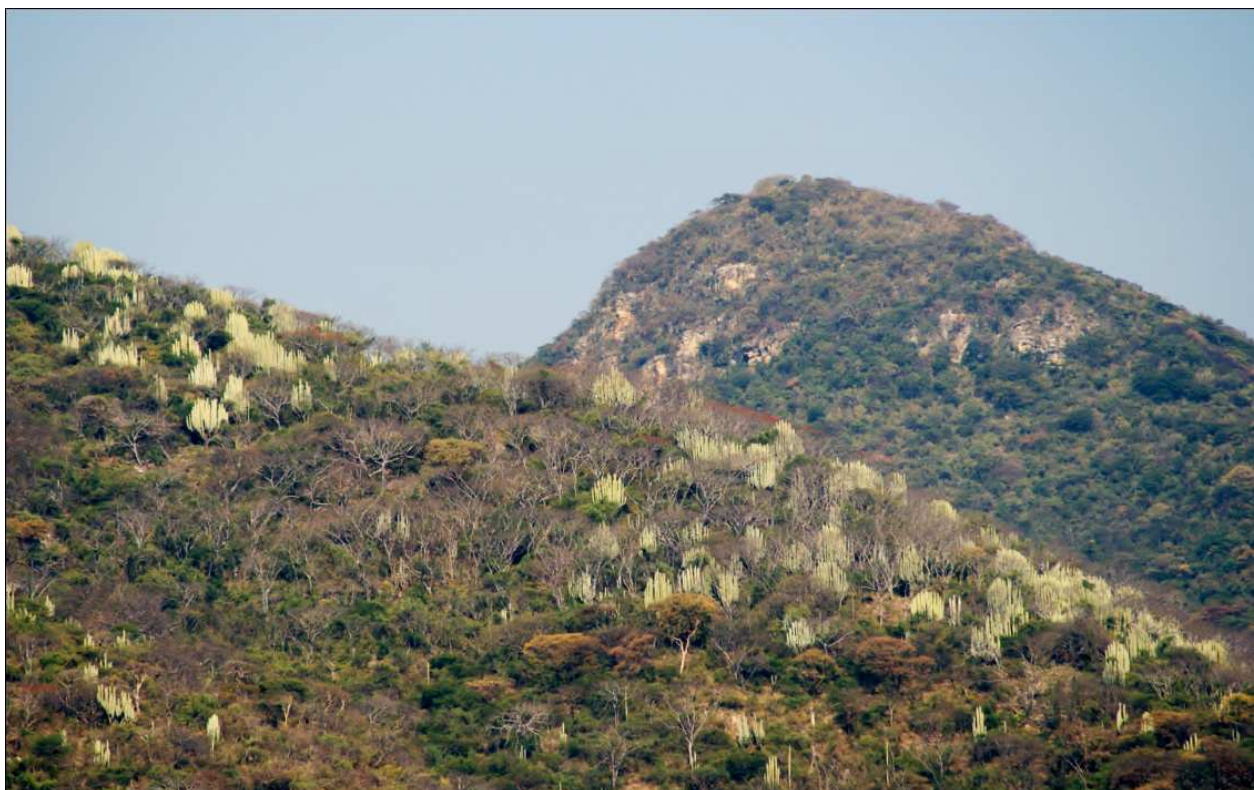


Fig. 2. Tropical deciduous forest in the Mixteca Poblana, México (Picture, Oscar Villarreal).

## 2. Materials and methods

The application of the Pressure-State-Response framework or PSR was used, which allows to analyze and to quantify the socioeconomic and environmental sustainability of agricultural systems to regional or local levels (De Camino & Muller, 1993; OCDE, 1993 Winograd, 1995). The work was realized by means of technologies of group by the farmers from seven UMA's, as well as the collection of information of all the UMA's in governmental dependences, into federal level as the Environment and Natural Resources Secretary (SEMARNAT), and Puebla State Government as, the Sustainable Environmental and Territorial Organization Secretary (SSAOT), and the Rural Development Secretary (SDR). The information was analyzed attending to a group of variables of the technological model such as: the population density, evaluation of the habitat, carrying capacity and diversity of the diet, the rate of crop and regional development between others. The determined results for the different variables used in the matrix appeared for unit of measure, or according to the type of action quantifiable.

## 3. Results and discussions

The socioeconomic and environmental evaluation by means of the PSR matrix to the UMA's of Diversified Breeding, threw the following results (Table 1): the increase of the population density of deer like response to the application of the technological model; though they are not spectacular for treating itself about animals in free life, represent a positive progression already brought in hunting ranches in the southwest of the United States, and UMA's the North-East of Mexico (Brown, 2004). On the other hand, the calculations "*in situ*" of the primary productivity of phytomass usable in the order of 0,79 and 0,88 ton./dray matter per year, has contributed in the decisions of managing of the population density and its relation with the capacity of load, which is between 7,28 and 9,41 has./UA (United Animal), besides 139 vegetable species which have been identified like consumed by the deer. As a consequence, it has produced an optimization itself in the employment of food supplements and waters in critical epochs (Villarreal, 2006). The consumption of herbaceous plants and tree and shrub in the diet constitutes an advantage for the system of corporal reservations in drought (Savory, 2005; Villarreal & Marín, 2005); that produced increases in the rates of crop of the deer. Another undeniable aspect though not quantified, it is the relative to environmental services for the capture of carbon of the biomass, and the recycling nitrogen in the soil (Savory, 2005). In relation to the use of land, has been observed that for the past period from March, 2001 to December, 2009, occurred unexpectedly an increase in the number of properties incorporated as UMA's from 13 to 72, which means the pass from 14.423,92 ha. to 82.522,02 ha., incorporated into this model which respects the biodiversity and takes advantage of the animal resource in rational form; in addition, of six initial Municipalities it has increased to 35. This information relates to the degree of adoption in the time of the technology in the region, where the works of conservation, managing and crop, developed by institutions of top education (Benemérita Universidad Autónoma de Puebla) and lenders of technical services for the UMA's, have had good results recognized and supported by the Federal institutions Environment and Natural Resources Secretary (SEMARNAT) and Government of Puebla State, that are the organisms tracers of the public policies in the rural way.

Variables	Element	Indicator	Period or years	Effects
Deer`s population	Growth	Population density	Before Later	-- + +
Habitat	Components	Evaluation	Before Later	-- +
Deer`s supply	Phytomass	Capacity of load	Before Later	-- Evaluated <i>in situ</i>
	Consumption of forage	Variety	Before Later	Unknown 139 <i>Spp.</i>
Big game trophies	Utilization	Rate of crop	Before Later	-- +
Management of land	Extension	Surfaces (has.)	2001 2009	14.423.92 82.522,02
Biodiversity	UMA`s	Number of lands	2001 2009	13 Predios 72 Predios
Regional development	Municipalities	Numbers	2001 2009	13 35
Socio-economic Development	Generation of permanents employments	Increase of each 1000 ha., of operation	Before Later	00 2-3
Information and participation	Activities of training and capture of decisions	UMA`s Management plan.	Before Later	-- ++
Agreements and events	Agreements big game trophies	Regional Tournament and Mexican "Slam"	Before After	Non include Include
Investigations and consultations	Universities and ONG`s	Researching groups	2000 2011	1 3
		Working groups	2000 2011	Anyone 5
Conservation	Protected natural areas	Number of Municipalities	1998 2011	9 11
		Nº hectares	1998 2011	145.715,8 161.662,8

Table 1. Analysis of PSR Matrix (framework) to model of Diversified Breeding from Mixteca Poblana region, Mexico

Other measured indicators in the PSR matrix are: the participation of the producers in the accomplishment of socio cultural events such as: the "Thummler Award" (Mexican Deer Super Slam) and the "Regional Tournament of Hunting Game, slams directed in order to obtain big game trophies, which confirms the validity of the technological adoption, in the search of the sustainability of the use of the natural resources, in harmony with the agricultural activities to attack the poverty and social inequality (Fig 3); which they are a

reason of emigration of the population in productive age to the United States, and that affect the sustainable regional development (Villarreal, 2002, 2006).



Fig. 3. Arturo Villarreal, young hunter and his trophy of Mexican white tailed deer, taken in the Mixteca Poblana region (Picture from Oscar Villarreal).

In addition, it is necessary to indicate, the labor in favor of the wild fauna with game potential, since there are three groups of investigators that realize functions of researching, transferring of technology, extensions, promoting and advising (Villarreal et al. 2011). On the part of Benemérita Universidad Autónoma de Puebla (BUAP), stand out the groups of the Faculty of Veterinary and Animal Science (FMVZ) and the Biology School, besides the group of the Faculty of Veterinary and Animal Science, from Universidad Autónoma Metropolitana (UAM). The Benemérita Universidad Autónoma de Puebla has come organizing the "Symposiums on Game Animals of Mexico", academic and national event that looks for the conservation of the natural resources and generation of socioeconomic benefits, using as tool the hunting game and the ecotourism.

On the other hand, the sector of the Non-Governmental Organizations (ONG's), is represented in a general form by three groups that are employed at subject matters of forestry development join with wild fauna. Finally only there was only a natural protected area. The Biosphere Tehuacán-Cuicatlán Reserve (RBT-C), dependent organism on the National Commission of Natural Protected Areas (CONANP) from Environment and

Natural Resources Secretary, which includes nine Municipalities of the east of the region, with a surface of 145.715,8 ha., (Villarreal, 2006). On May 2, 2011, the Sustainable Environmental and Territorial Organization Secretary, of the Puebla State Government, had decreed the Natural Protected State Area "Tentzo's Sierra", which includes inside the Mixteca Poblana two north Municipalities with 15.947 ha. from the conservation and sustainable managing in to the region(Fig. 4).



Fig. 4. Dr. Rafael Moreno Valle, Governor of Puebla State and Eng. Juan Elvira Quesada, Minister of Environment and Natural Resources Secretary, during inauguration of Natural Protected State Area "Tentzo's Sierra". At right show up the Mexican royal (golden) eagle *Aquila chrysaetos canadensis* (Picture Oscar Villarreal).

#### 4. Conclusion

We can conclude that the analysis-summary of the PSR matrix for the conservation and managing of the Mexican white-tailed deer in the UMA's from Mixteca, demonstrated the potentials of the rational utilization of the cervid and its habitat, a regional level as resource of wild life inside the model of Diversified Breeding, to reach the sustainability of this technological model in the region, from the auto management, the empowerment and the community participation, respecting its biodiversity. Therefore, there is advisable the application of PSR matrix for similar valuations in other regions of Mexico.

We recommend to have care in the conservation and the appropriate managing of this biodiversity, since some threats besides the deforestation due to the advance of the urban borders, industrial and agricultural, it is the introduction of plants and species and

subspecies (geographical races) exotic animals, it means, foreign to the regional ecosystems, such as: the red deer (*Cervus elaphus*), sika deer (*Cervus nippon*), axis deer (*Axis axis*), fallow deer (*Dama dama*), Texan white tailed deer (*Odocoileus virginianus texanus*) and European wild boar (*Sus scropha*), among other exotic species (Álvarez et al. 2008). The society in general and the government in its three levels (Municipal, State and Federal) are correspondents of the conservation, managing and rational utilization and supported of the Mexican white tailed deer and its habitat for the benefit of the Puebla society, Mexico and the world.

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