



Title: Application of beneficial microorganisms rhizobacteria to improve plant production in protected natural areas

Author: GÓMEZ-LUNA, Blanca Estela

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ECORFAN-México, S.C.

143 – 50 Itzopan Street

La Florida, Ecatepec Municipality

Mexico State, 55120 Zipcode

Phone: +52 1 55 6159 2296

Skype: ecorfan-mexico.s.c.

E-mail: contacto@ecorfan.org

Facebook: ECORFAN-México S. C.

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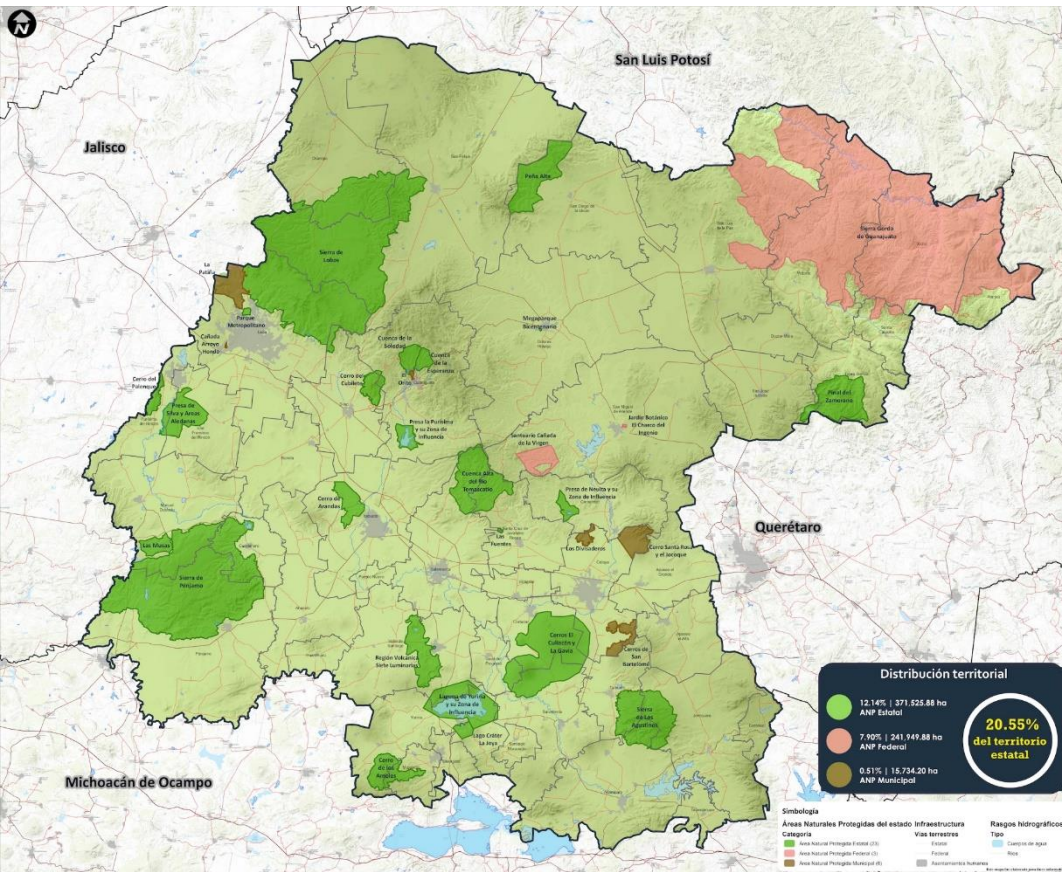
Holdings

Mexico	Colombia	Guatemala
Bolivia	Cameroon	Democratic
Spain	El Salvador	Republic
Ecuador	Taiwan	of Congo
Peru	Paraguay	Nicaragua

Introduction

Protected Natural Areas generate environmental services, form soil, are habitats of wide biodiversity of plants, animals, insects and microorganisms, recharge of aquifers, capture of CO₂, buffer the effects of global climate change. They provide economic resources for the communities that live in the areas. There is concern about the proper use of natural resources and to achieve this, numerous actions have been generated to maintain the conservation of biological diversity.

Map of Protected Natural Areas in the state of Guanajuato, Institute of Ecology of the State of Guanajuato, Mexico. Oak forest (*Quercus spp.*)



Áreas Naturales Protegidas

23 ANP Estatales

Riqueza de fauna dentro de las ANP

- 381 especies de aves
- 91 especies de mamíferos
- 24 especies de anfibios
- 78 especies de reptiles
- 18 especies de peces
- 90 especies NOM

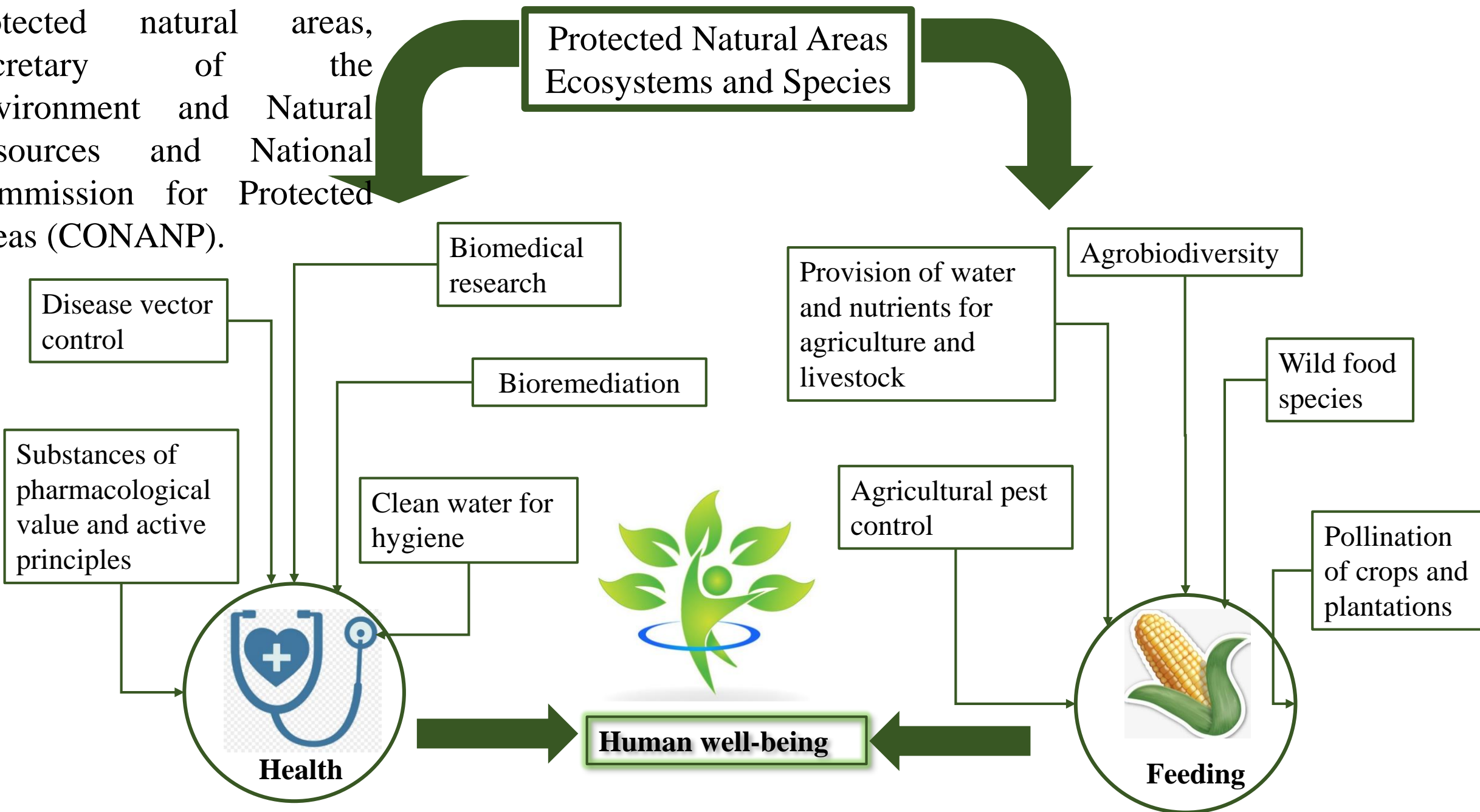
6 ANP Municipales

3 ANP Federales

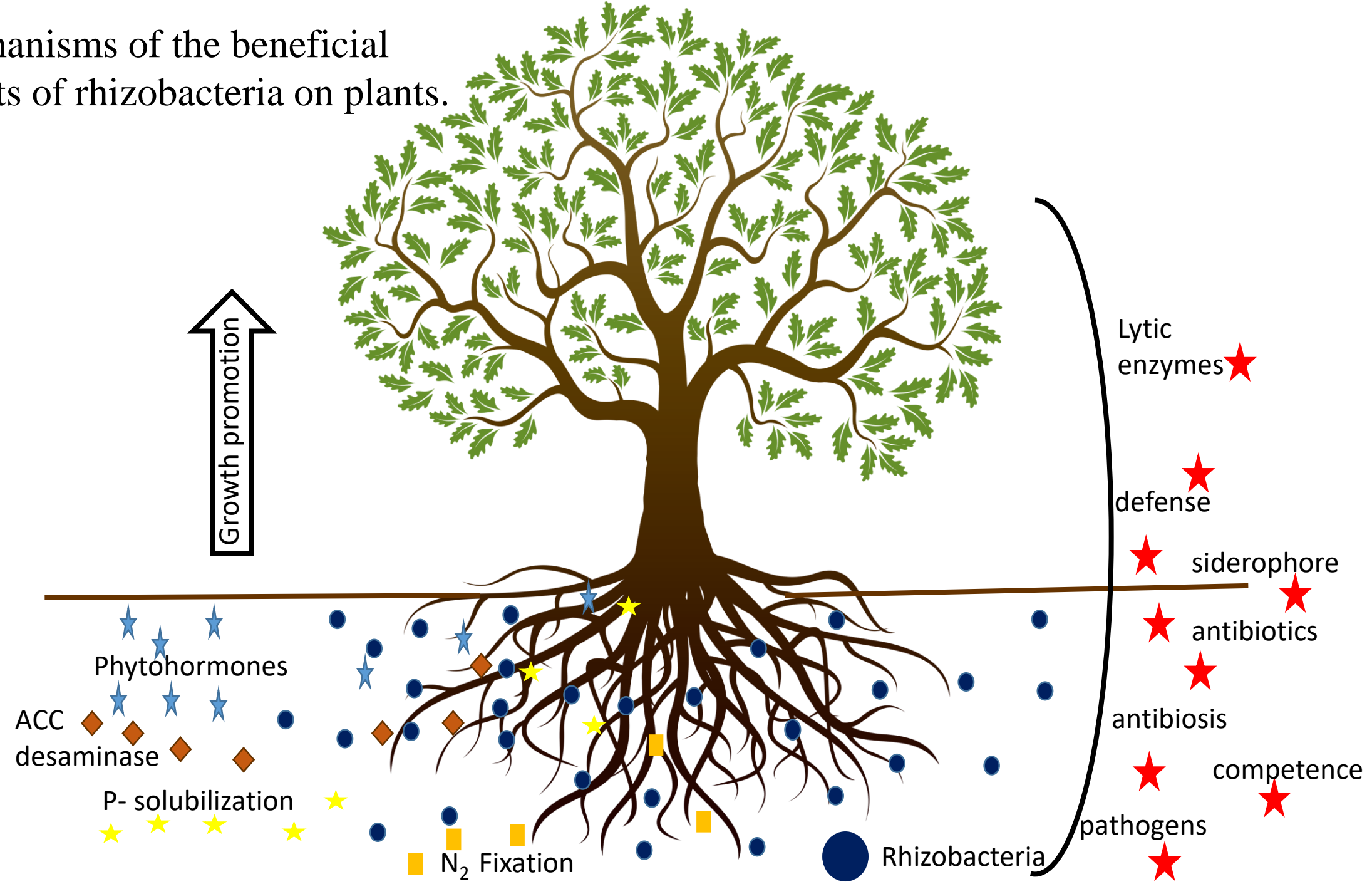
GUANAJUATO
Gobierno del Estado • Secretaría de Medio Ambiente y Ordenamiento Territorial



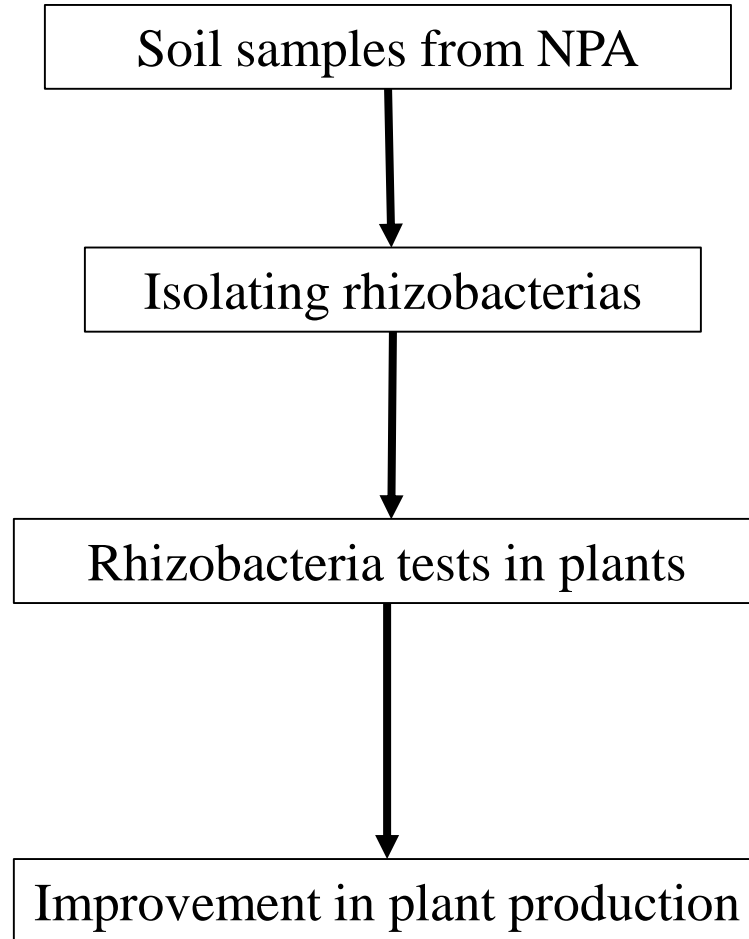
Services provided by protected natural areas, Secretary of the Environment and Natural Resources and National Commission for Protected Areas (CONANP).



Mechanisms of the beneficial effects of rhizobacteria on plants.



Methodology



Results

The use of rhizobacteria in plants of agronomic importance has resulted in an important alternative to production systems with a high consumption of fertilizers and agrochemicals, thus working towards sustainable agriculture.

In the state of Guanajuato, the works that have been carried out with isolated rhizobacteria from the soil are from various PNAs and from guava orchards. The rhizobacteria isolates were characterized. To verify their capacity for growth-promoting rhizobacteria, they were tested with plants of importance for the PNA such as Huizache (*Acacia farneciana*), which is a vegetation of the region and of economic and ethnobotanical importance; Furthermore, guava (*Psidium guajava*), lentil (*Lens culinaris*), cucumber (*Cucumis sativus*), radish (*Raphanus sativus*) have also been tested with plants of nutritional importance; in ornamentals such as marigolds (*Tagetes erecta*) and sunflowers (*Helianthus annuus*). In all cases there have been beneficial effects from the germination of the seeds and their development. Additionally, the rhizobacteria isolated from the PNAs also presented plant protection and health capabilities by producing compounds that reduce or stop the growth of phytopathogenic fungi, that is, they have potential for biological control, the benefits in seed germination are indicated (Gómez-Luna, et al 2012; Gómez-Luna, et al 2018; Gómez-Luna, et al 2020).

Conclusions

Protected Natural Areas provide diverse services and resources for human beings and it is their responsibility to make a sustainable use of resources.

A biotechnological and eco-friendly strategy is the use of beneficial microorganisms such as rhizobacteria, isolated from the soils of the PNA and applied to improve the plant production of the area and also plants of nutritional importance.

With the application of rhizobacteria, the use of agrochemicals in plant production could be reduced.

Rhizobacteria have the ability to be used as biofertilizer, biocontrol and biostimulant of the soil and with this regenerate or conserve the PNA and thus all its resources and services.

These rhizobacteria that already exist naturally in the soils of the PNA.

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