Overview of carbon cycle science initiatives in land and ocean across Mexico

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LAND

Jose Luis Andrade, Gregorio AngelesTulio Arredondo, Richard Birdsey, Bernardus de Jong, Jorge D. Etchevers, Jaime Garatuza-Payan, Eugenia González del Castillo, Walter Oechel, Henry W. Loescher, Elisabeth Huber-Sannwald, Marcela Olguin, Fernando Paz, Werner Kurz, Julio C. Rodríguez, Youngryel Ryu, Arturo Sánchez-Azofeifa, Lucio Santos, Samuel Villareal

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Outline

-Introduction

LAND

- Overview of international projects
- Forest biomass and forest photosynthesis
- Eddy covariance network (MexFlux)

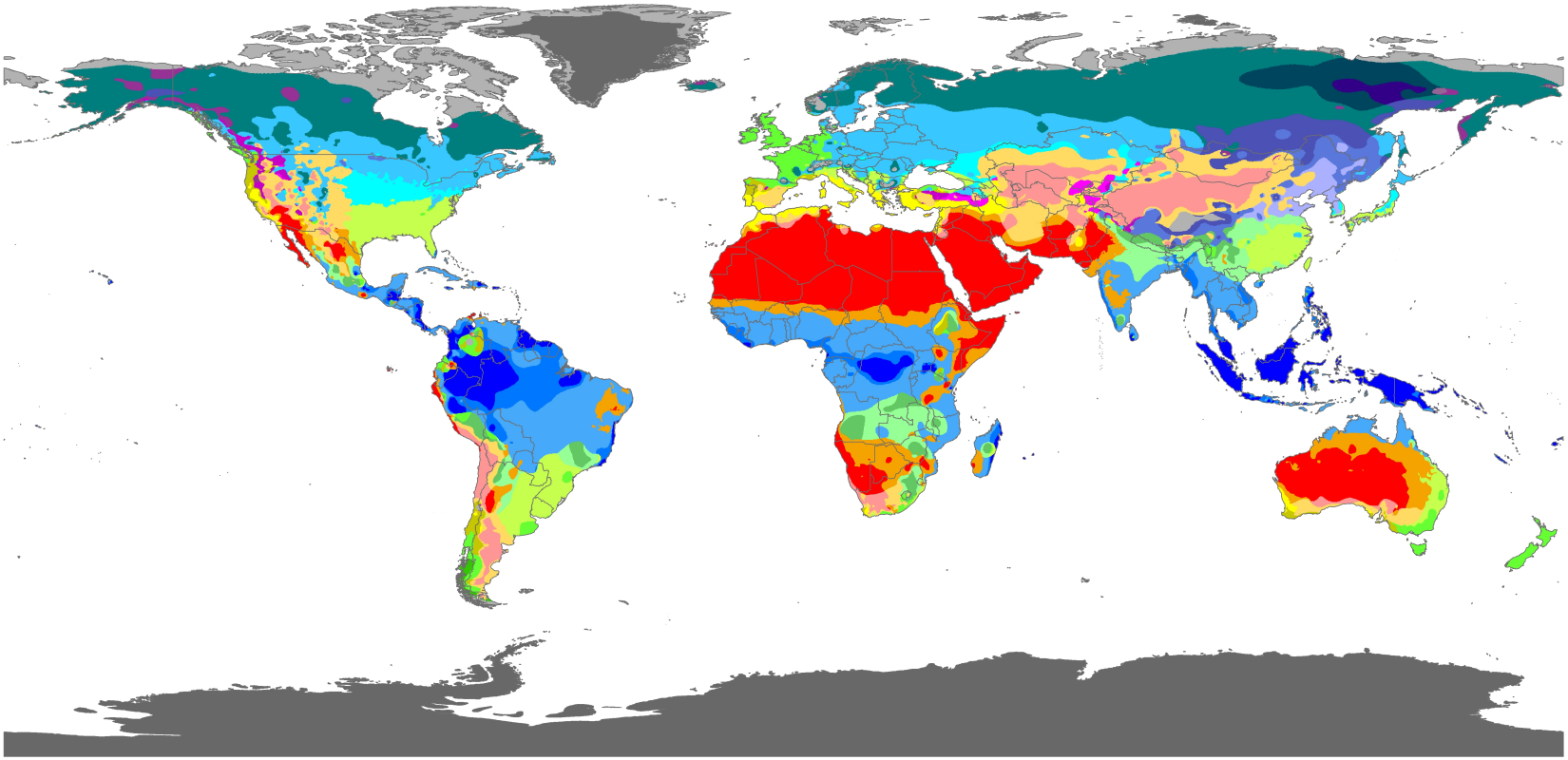
OCEAN

- IMECOCAL
- FLUCAR

Future considerations

Introduction

World map of Köppen-Geiger climate classification



Af	BWh	Csa	Cwa	Cfa	Dsa	Dwa	Dfa	ET
Am	BWk	Csb	Cwb	Cfb	Dsb	Dwb	Dfb	EF
Aw	BSh		Cwc	Cfc	Dsc	Dwc	Dfc	
	BSk				Dsd	Dwd	Dfd	

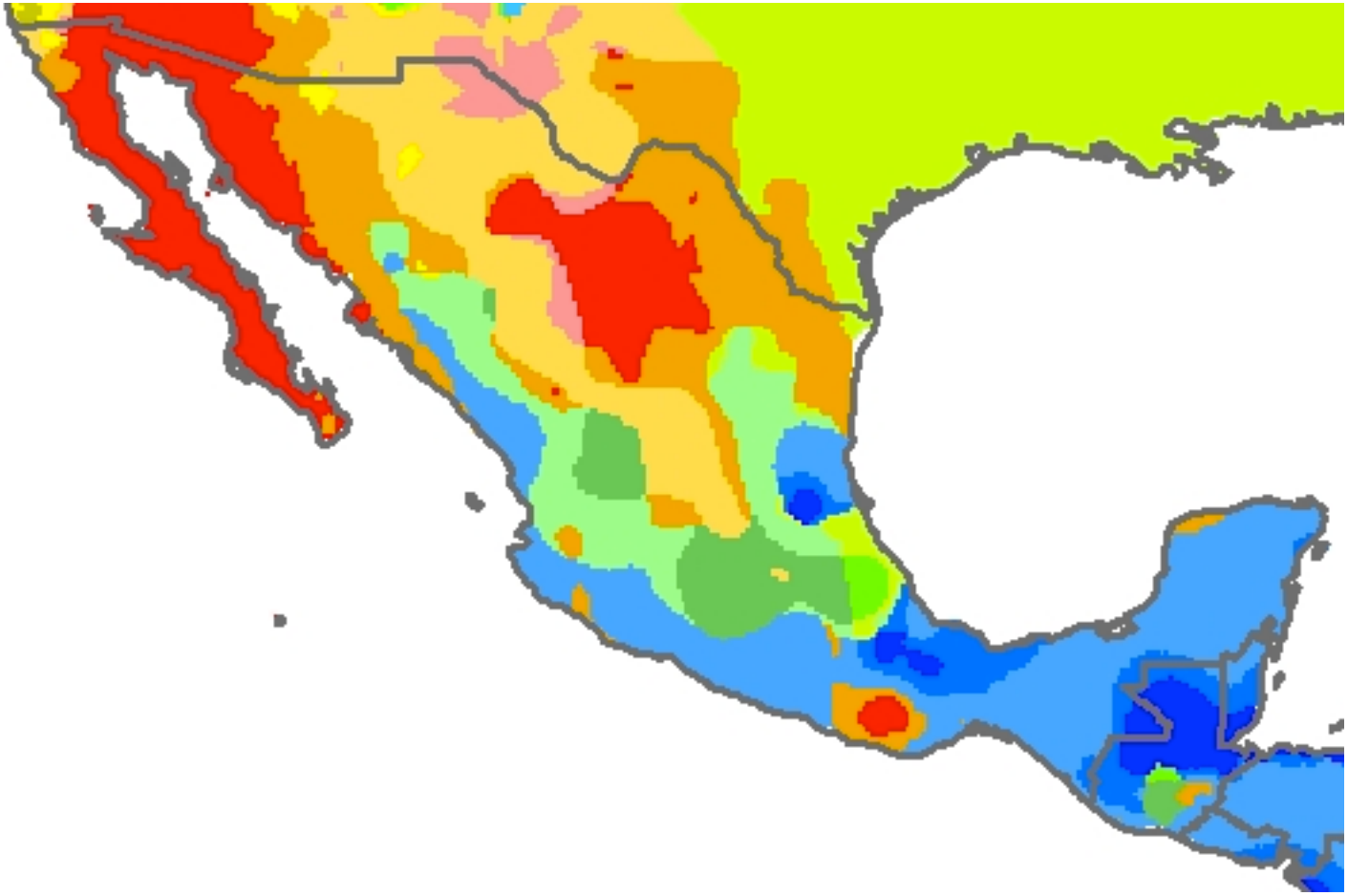
DATA SOURCE : GHCN v2.0 station data
Temperature (N = 4,844) and
Precipitation (N = 12,396)

PERIOD OF RECORD : All available

MIN LENGTH : ≥30 for each month.

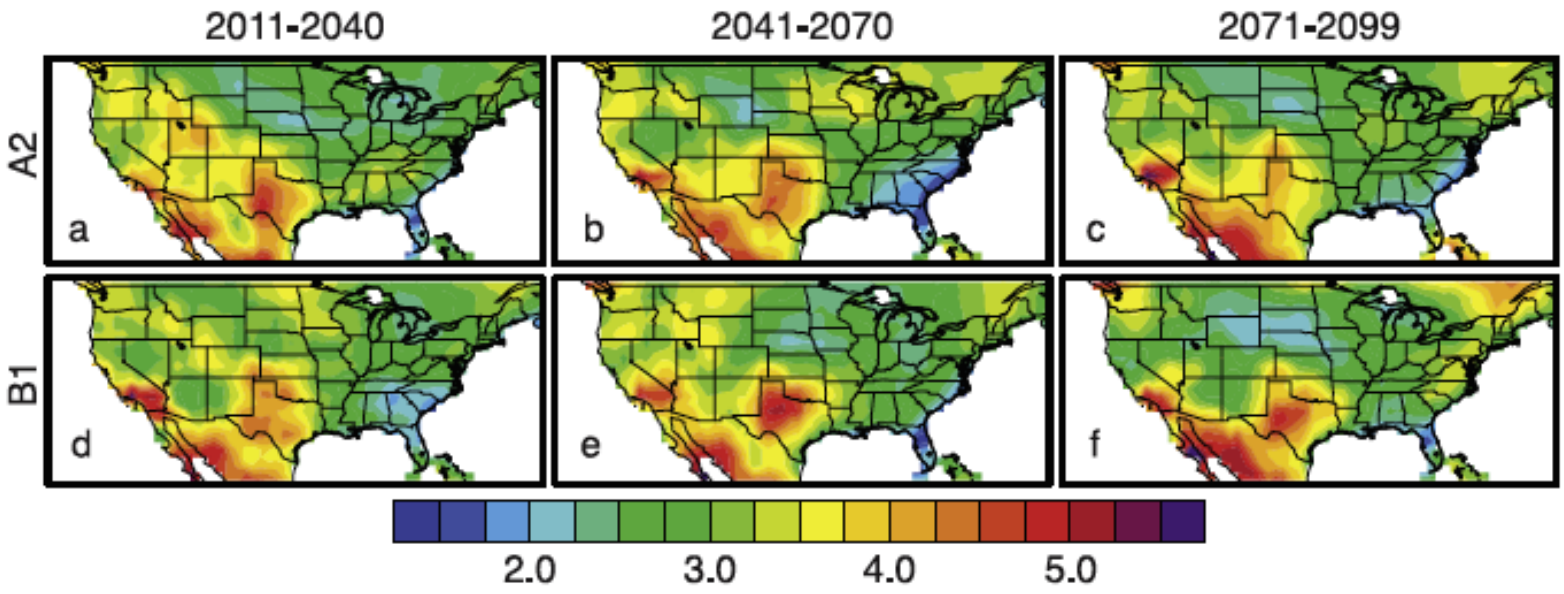
RESOLUTION : 0.1 degree lat/long

Introduction



Introduction

- The general pattern of an ensemble of climate models suggest that areas of the southwestern United States and northern Mexico are the most persistent hotspots for climate change



(Diffenbaugh *et al.*, 2008).

Overview of International ongoing projects

Land

Mexico-Norway Project **(CONAFOR)**

"Reinforcing REDD+ readiness & South-South cooperation"

Objectives:

1) Development and implementation of a MRV system as part of the ultimate REDD+ regime

2) Promotion of Mexico as a center of excellence for South-South cooperation and strengthening national/regional technical training

3) Characterization of past local incentives in the forestry sector to provide financial management options for REDD + in Mexico

Santos et al.

Land

SilvaCarbon

- Mexico is a collaborating country with the SilvaCarbon initiative
  - National Forest Inventories
  - Intensive carbon monitoring sites

- National Demonstrator in GEO-FCT
  - Participates in planning regional GEO FCT workshops
  - Works with GEO FCT investigators
- Some past and future activities with SilvaCarbon
  - Hosted two GEO FCT workshops
  - Participated in GEO FCT summits

Land

Promoting Sustainable Landscapes in Mexico

- Establish MRV systems for reducing emissions from deforestation and forest degradation
- Strengthen institutional and technical capacity with respect to REDD+
- Develop and test climate mitigation tools, technologies and methodologies key to implementing REDD+
- Support new intensive forest monitoring sites

Birdsey et al.

North American Forest Carbon Modeling Sponsored by the Commission for Environmental Cooperation

- Tri-lateral project to improve North American forest carbon modeling and assessment

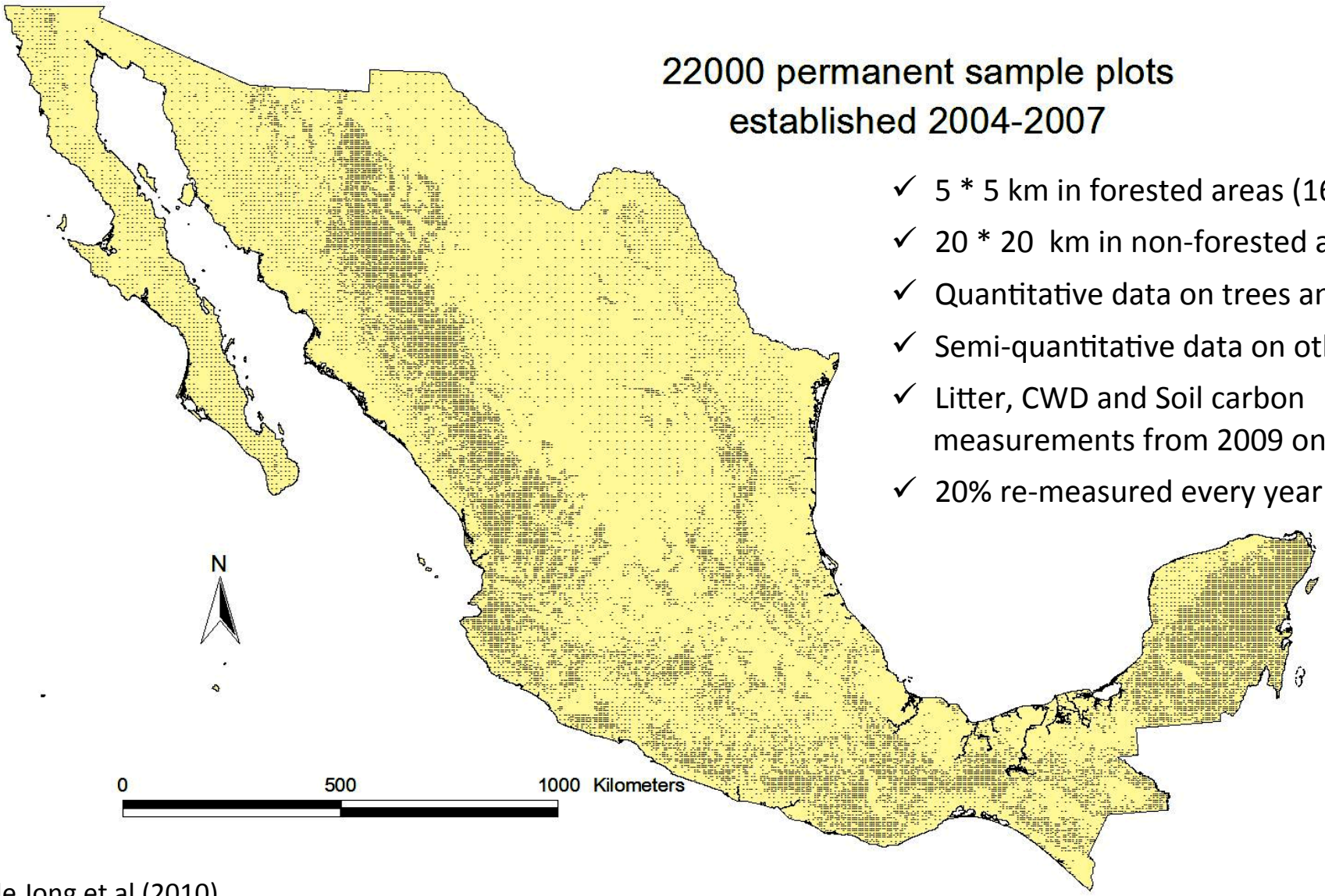
- Collaboration among the 3 country's Forest Services and partners

- Modeling Objectives:
  - Estimate past GHG emissions and removals using data from Mexican National Forest Inventory
  - Provide estimates of future GHG emissions under various scenarios of REDD+ strategies

Kurz et al

Forest inventories and forest photosynthesis

Land

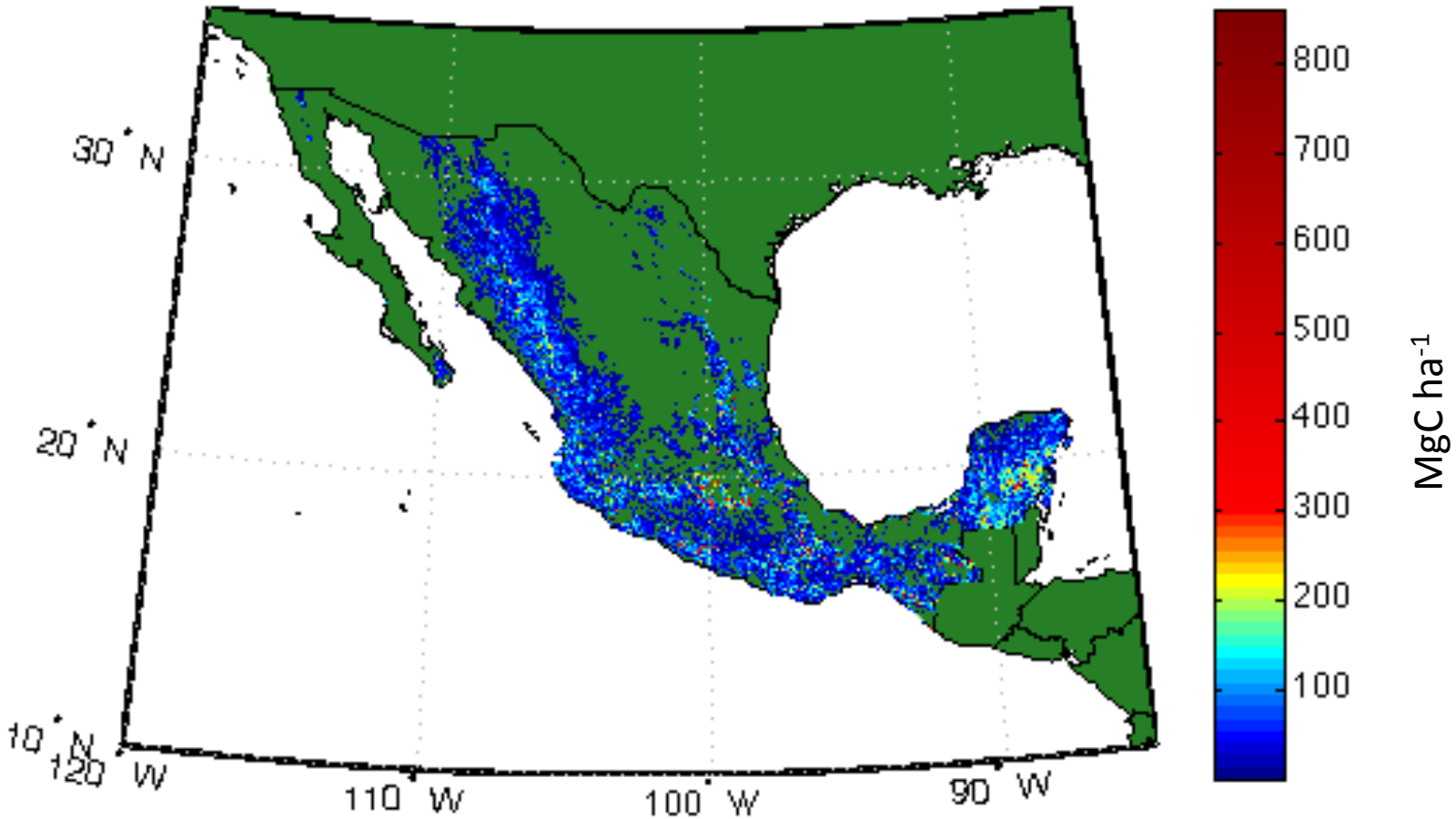


22000 permanent sample plots established 2004-2007

- ✓ 5 * 5 km in forested areas (1600 m2)
- ✓ 20 * 20 km in non-forested areas
- ✓ Quantitative data on trees and shrubs
- ✓ Semi-quantitative data on other pools
- ✓ Litter, CWD and Soil carbon measurements from 2009 onward
- ✓ 20% re-measured every year

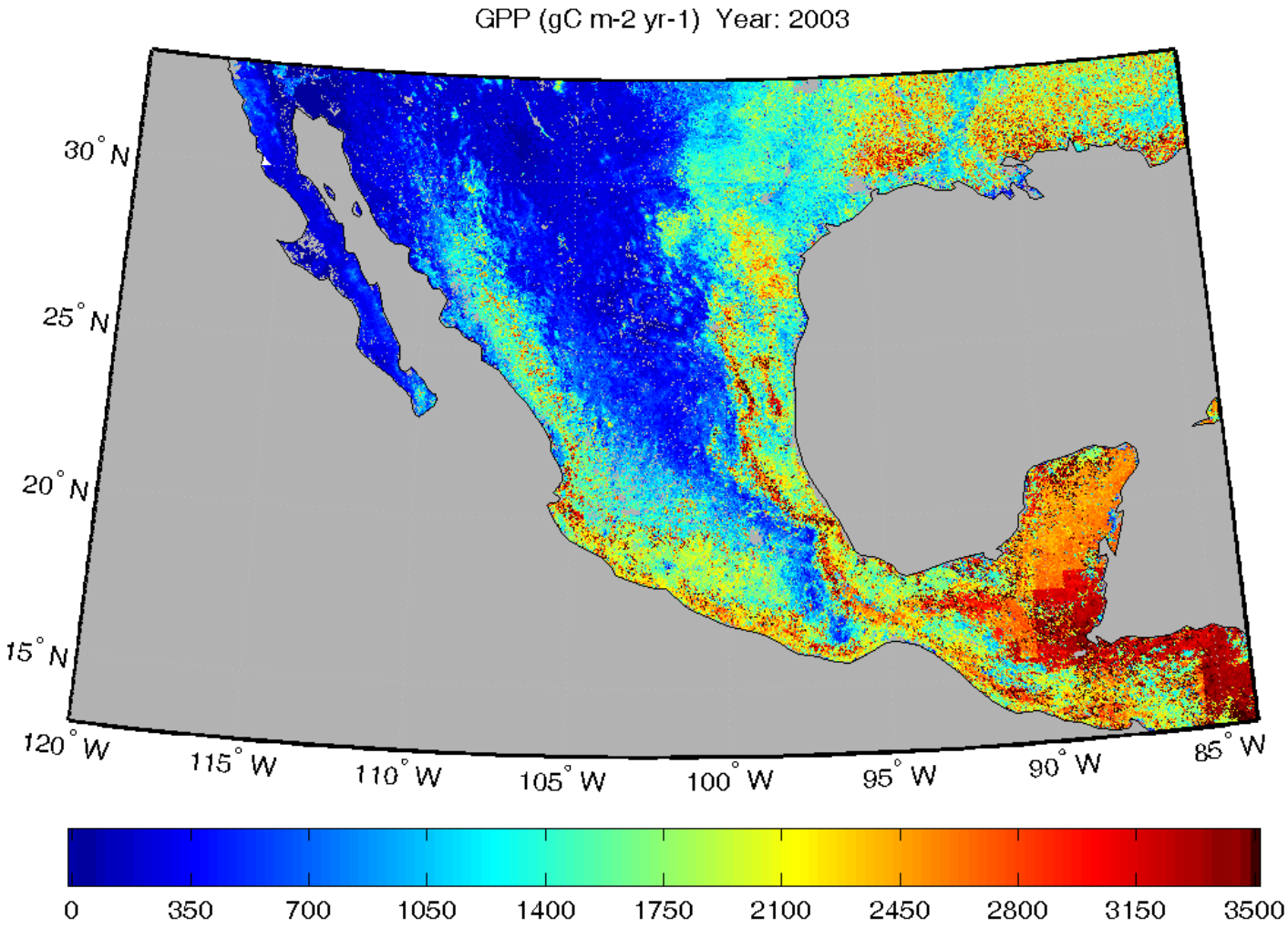
de Jong et al (2010)

Land



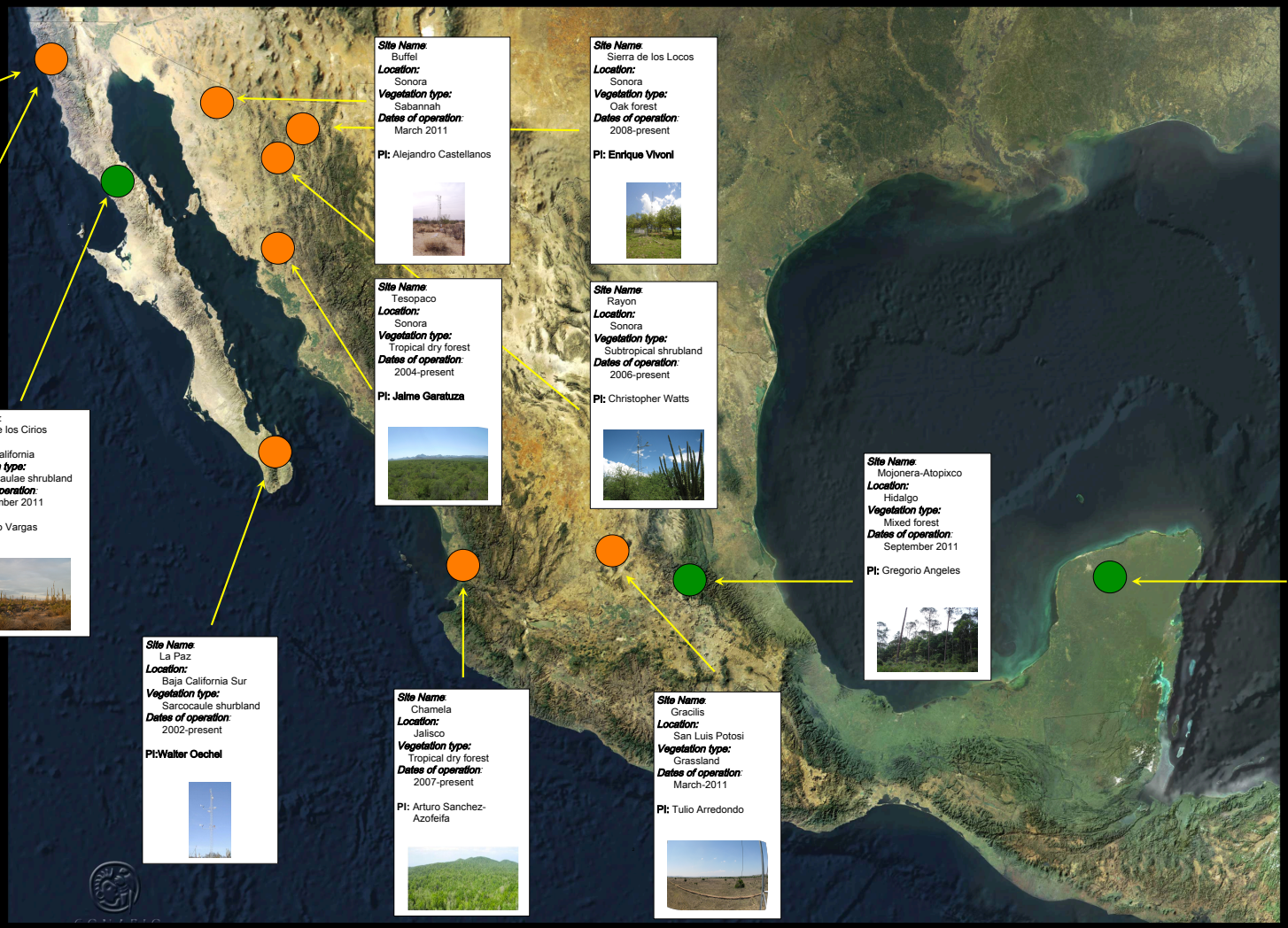
Vargas et al (in preparation)

Land



Vargas et al (in preparation)

Land



Site Name:
El Mogor
Location:
Baja California
Vegetation type:
Chaparral shrubland
Dates of operation:
2007-present

PI: Rodrigo Vargas

Site Name:
Todos Santos
Location:
Baja California
Vegetation type:
Marine tower
Dates of operation:
2007-2010

PI: Rodrigo Vargas

Site Name:
Valle de los Cirios
Location:
Baja California
Vegetation type:
Sarcocaulae shrubland
Dates of operation:
September 2011

PI: Rodrigo Vargas

Site Name:
La Paz
Location:
Baja California Sur
Vegetation type:
Sarcocaule shurbland
Dates of operation:
2002-present

PI:Walter Oechel

Site Name:
Buffel
Location:
Sonora
Vegetation type:
Sabannah
Dates of operation:
March 2011

PI: Alejandro Castellanos

Site Name:
Sierra de los Locos
Location:
Sonora
Vegetation type:
Oak forest
Dates of operation:
2008-present

PI: Enrique Vivoni

Site Name:
Tesopaco
Location:
Sonora
Vegetation type:
Tropical dry forest
Dates of operation:
2004-present

PI: Jaime Garatuza

Site Name:
Rayon
Location:
Sonora
Vegetation type:
Subtropical shrubland
Dates of operation:
2006-present

PI: Christopher Watts

Site Name:
Mojonera-Atopixco
Location:
Hidalgo
Vegetation type:
Mixed forest
Dates of operation:
September 2011

PI: Gregorio Angeles

Site Name:
Kaxil-Kiuic
Location:
Yucatan
Vegetation type:
Seasonally dry tropical forest
Dates of operation:
September 2011

PI: Jose Luis Andrade

Site Name:
Chamela
Location:
Jalisco
Vegetation type:
Tropical dry forest
Dates of operation:
2007-present

PI: Arturo Sanchez-Azofeifa

Site Name:
Gracilis
Location:
San Luis Potosi
Vegetation type:
Grassland
Dates of operation:
March-2011

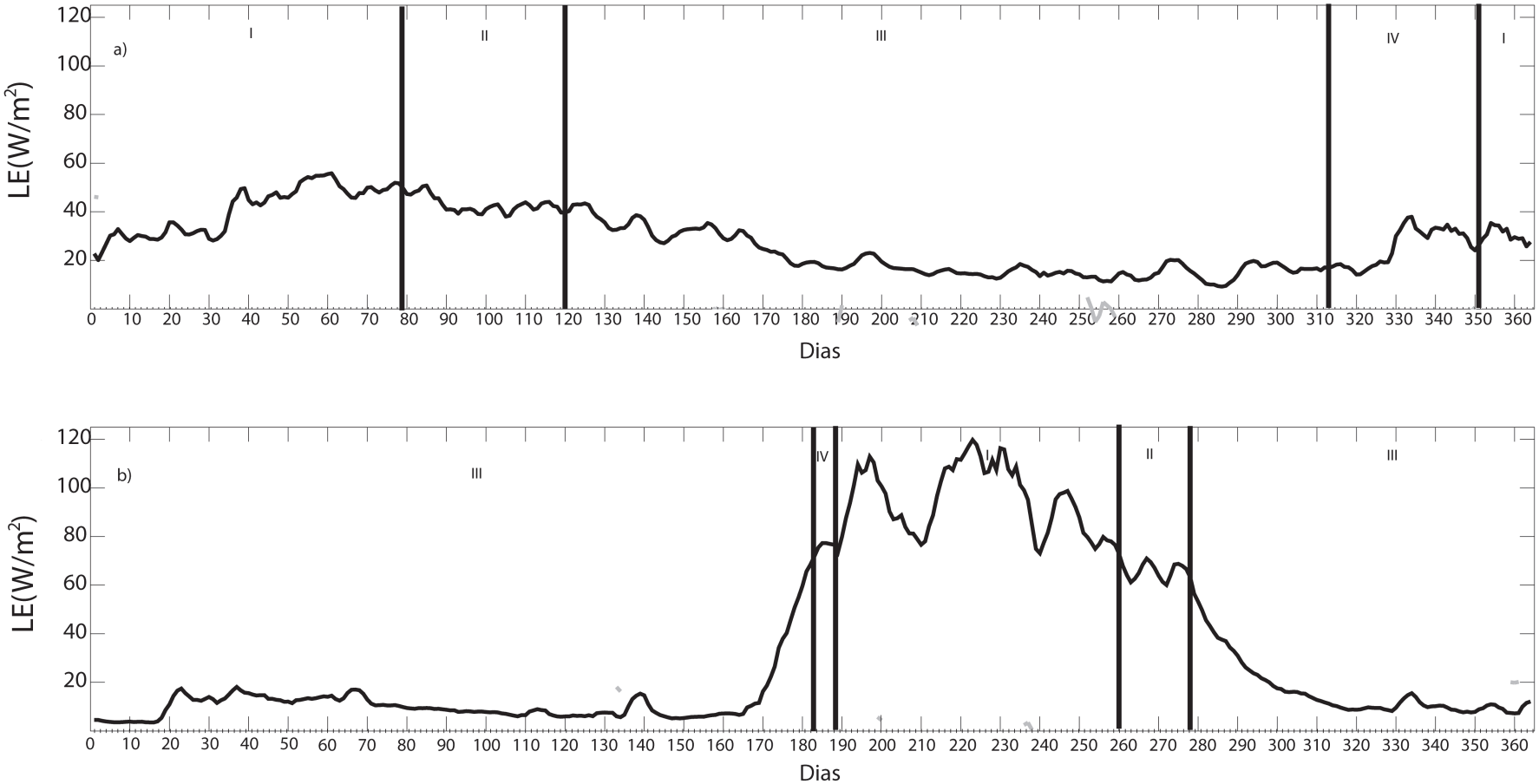
PI: Tulio Arredondo

Established

Planned

Con
rvargas@

Land

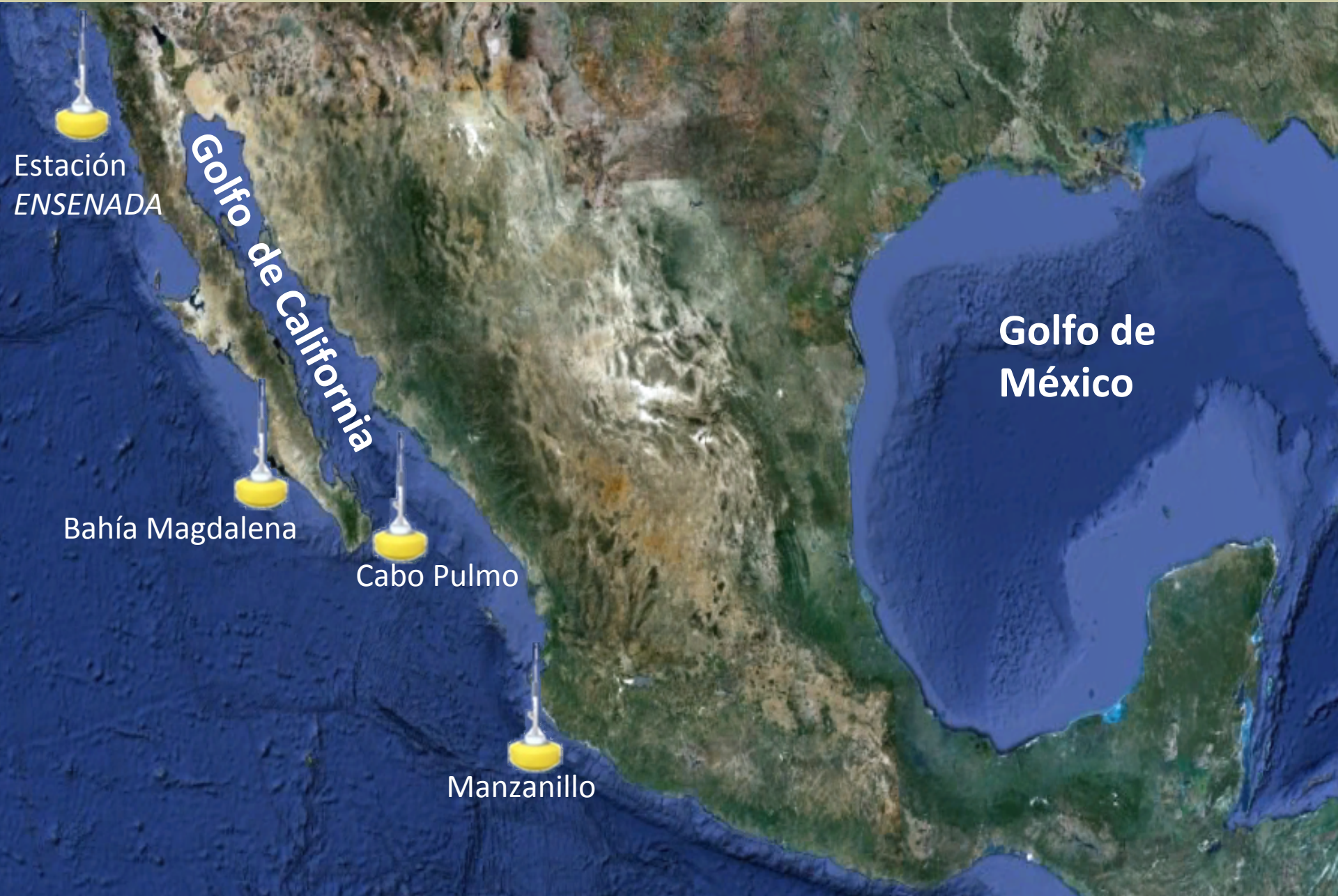


Villareal etal (in prepapartion)

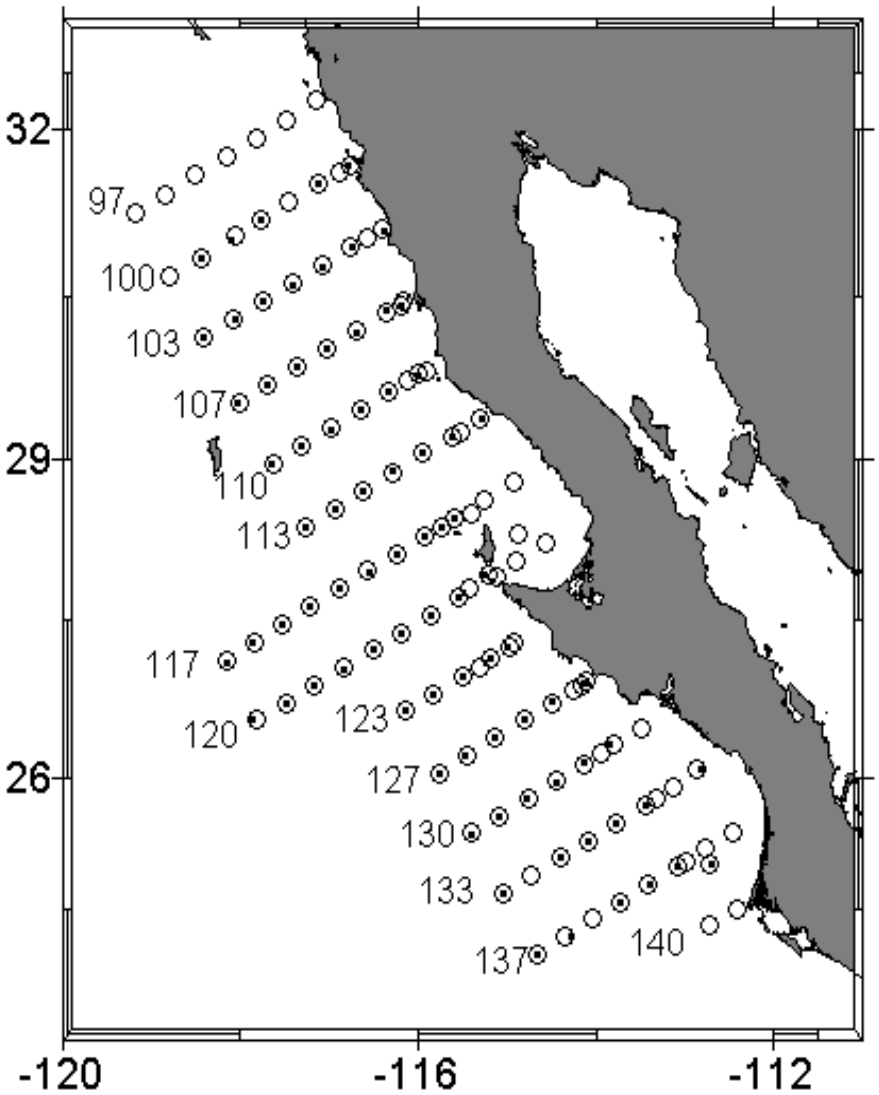
OCEAN

-Flucar and IMECOCAL initiatives

Ocean


Estación
ENSENADA
Golfo de California
Golfo de México
Bahía Magdalena
Cabo Pulmo
Manzanillo

Ocean

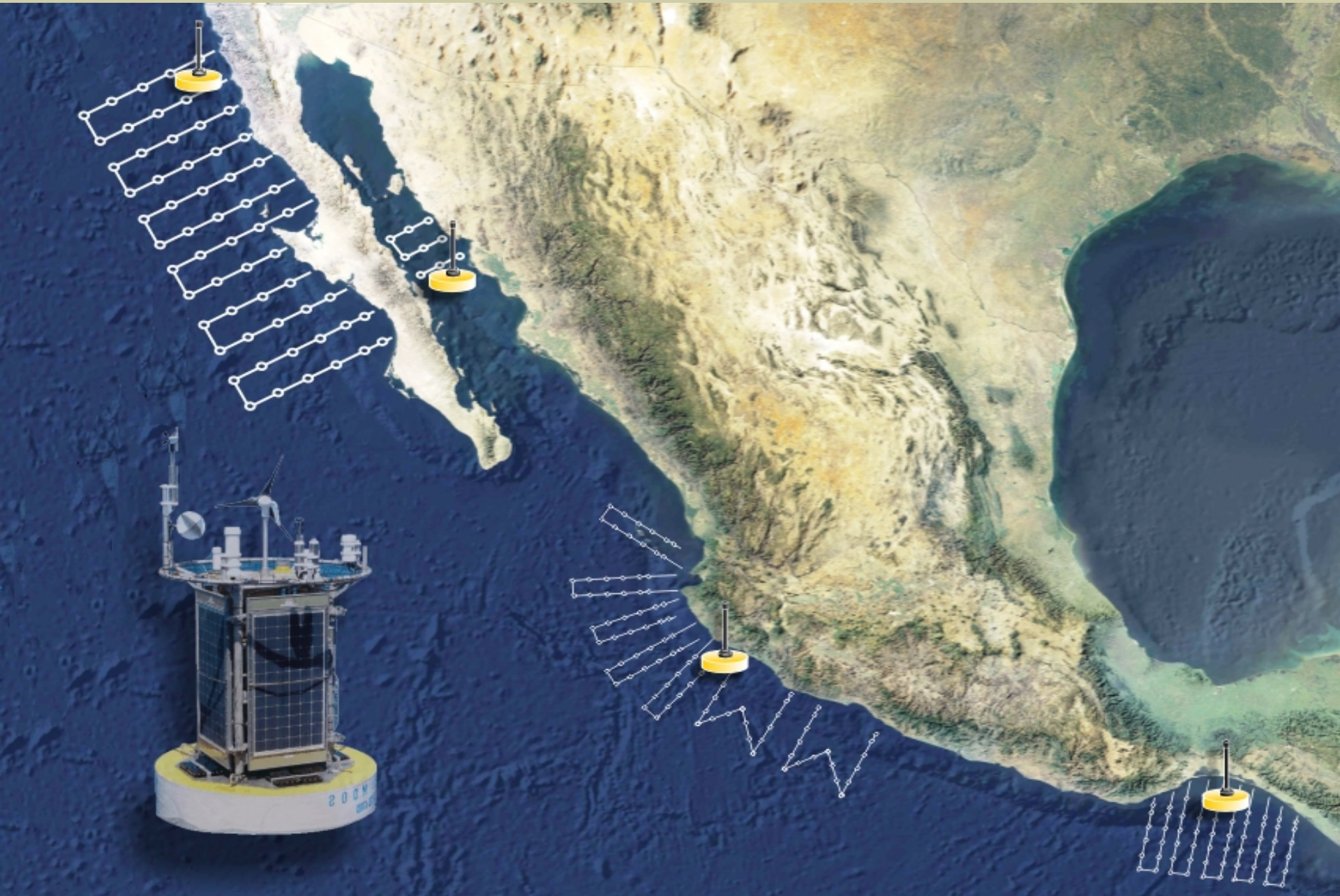


IMECOCAL

Over 15 years!

Gaxiola-Castro et al

Ocean

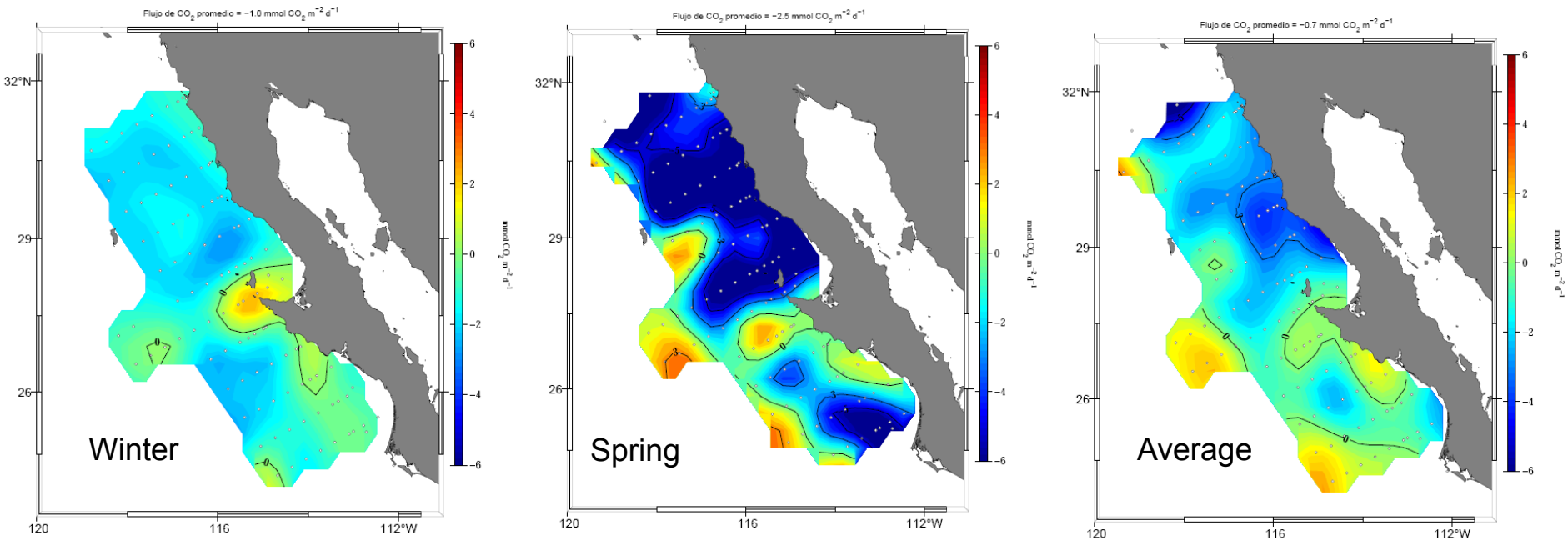


Ocean

Coastal ocean in Baja California is a moderate sink for carbon

Annual average = -0.90 mmol CO_2 m^{-2} d^{-1}

Annual sum = -0.33 mol CO_2 m^{-2}



Gaxiola-Castro et al (in preparation)

Future Considerations

Future considerations

- We believe that Carbon Cycle Science in Mexico could benefit by developing a government funded monitoring network across various research platforms.

Some challenges (New political visions)

-Limited economic and human resources

-Lack of long-term funding strategies that prevent long-term monitoring commitment

-Bureaucracy locks for accessing information

-Lacking of timely processed information available for the research community

Vargas et al (2012)

Future considerations

-Provide a prognostic capability to inform likely trajectories of these processes given a decision made today.

-Support bottom-up strategic planning activities of coordinated research scientists (e.g., CONACyT networks, MexFlux)

-Establish a clear and transparent open data sharing policy with a robust data archiving scheme

-Continental-scale developments and resources towards a tri-national research, infrastructure, and education network.

Vargas et al (2012)

Future considerations

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Opportunities for advancing carbon cycle science in Mexico: toward a continental scale understanding

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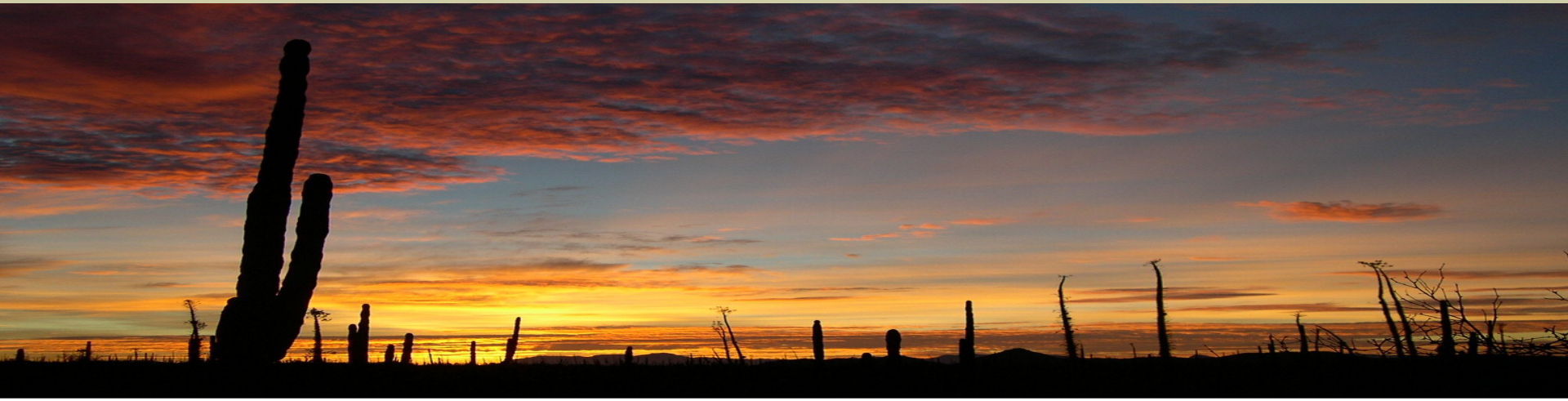

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