



# **Assessing the impacts of Pan American bioenergy development on birds and insect pollinators**

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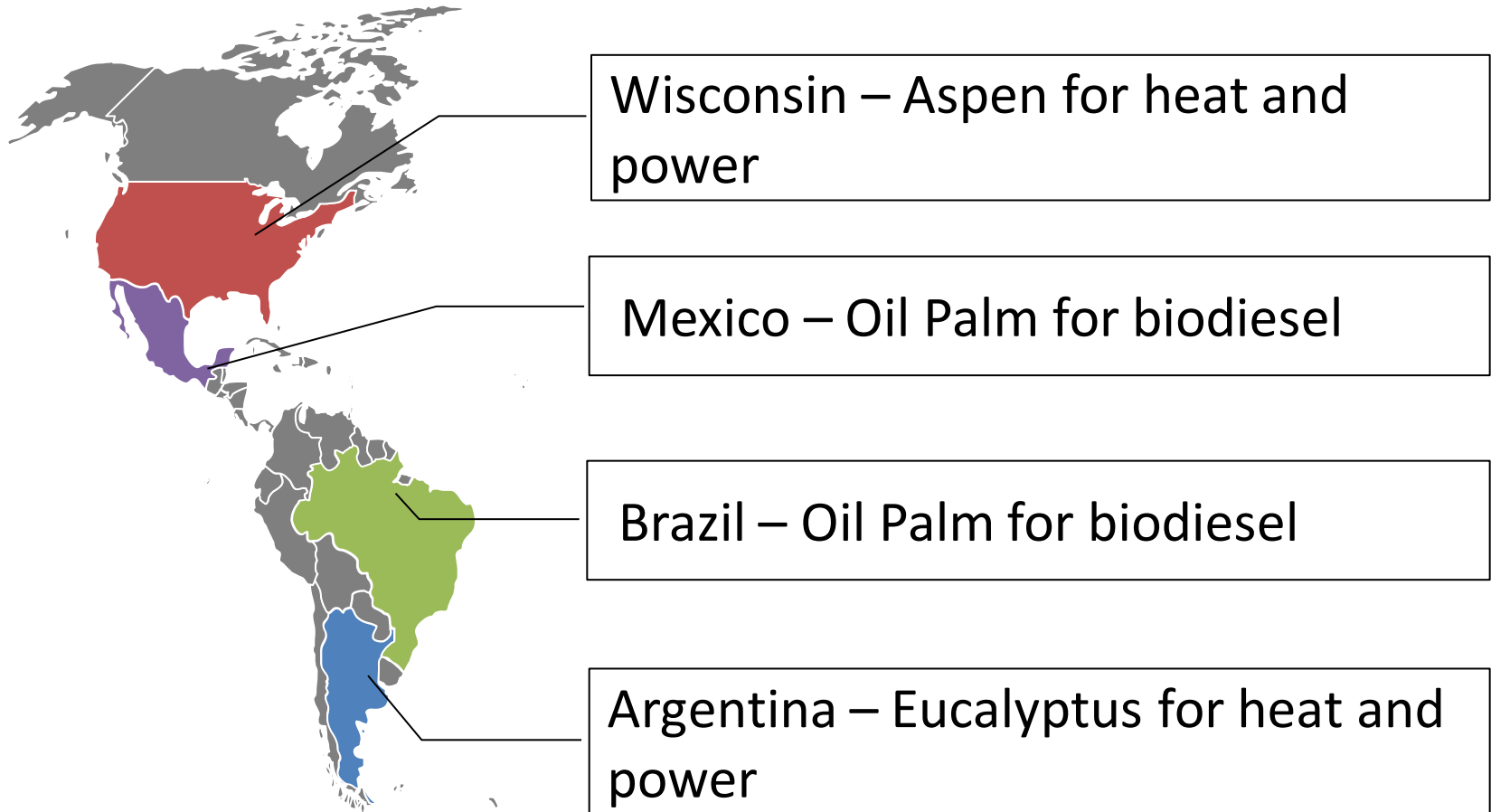
# Partnerships in International Research & Education (PIRE) Sustainability, Ecosystem Services, and Bioenergy Development across the Americas



## Research Question:

How will Pan American bioenergy development impact socio-ecological systems, and associated ecosystem services, and how can those impacts best be measured, modeled, and mitigated?

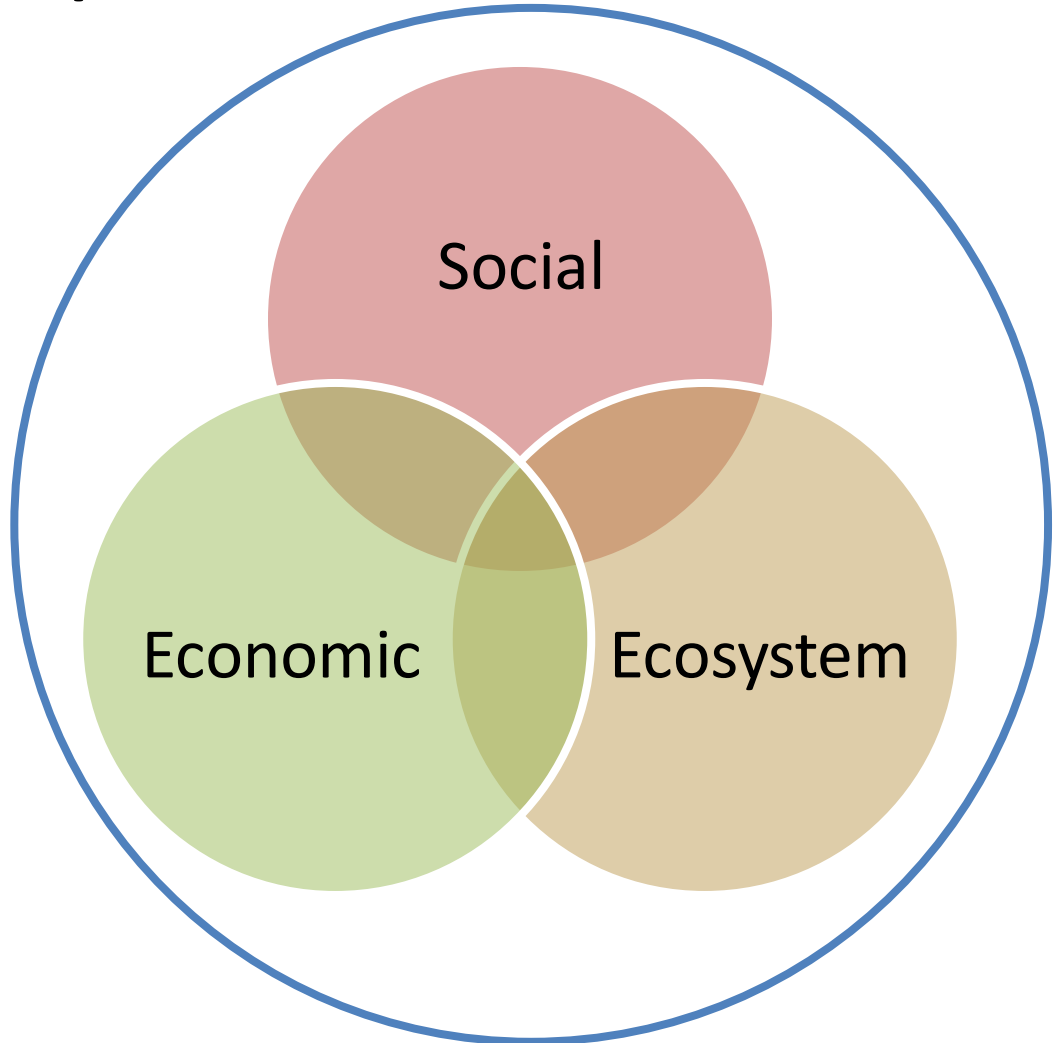
# Partnerships in International Research & Education (PIRE) Sustainability, Ecosystem Services, and Bioenergy Development across the Americas



# Partnerships in International Research & Education (PIRE) Sustainability, Ecosystem Services, and Bioenergy Development across the Americas



**Metrics**

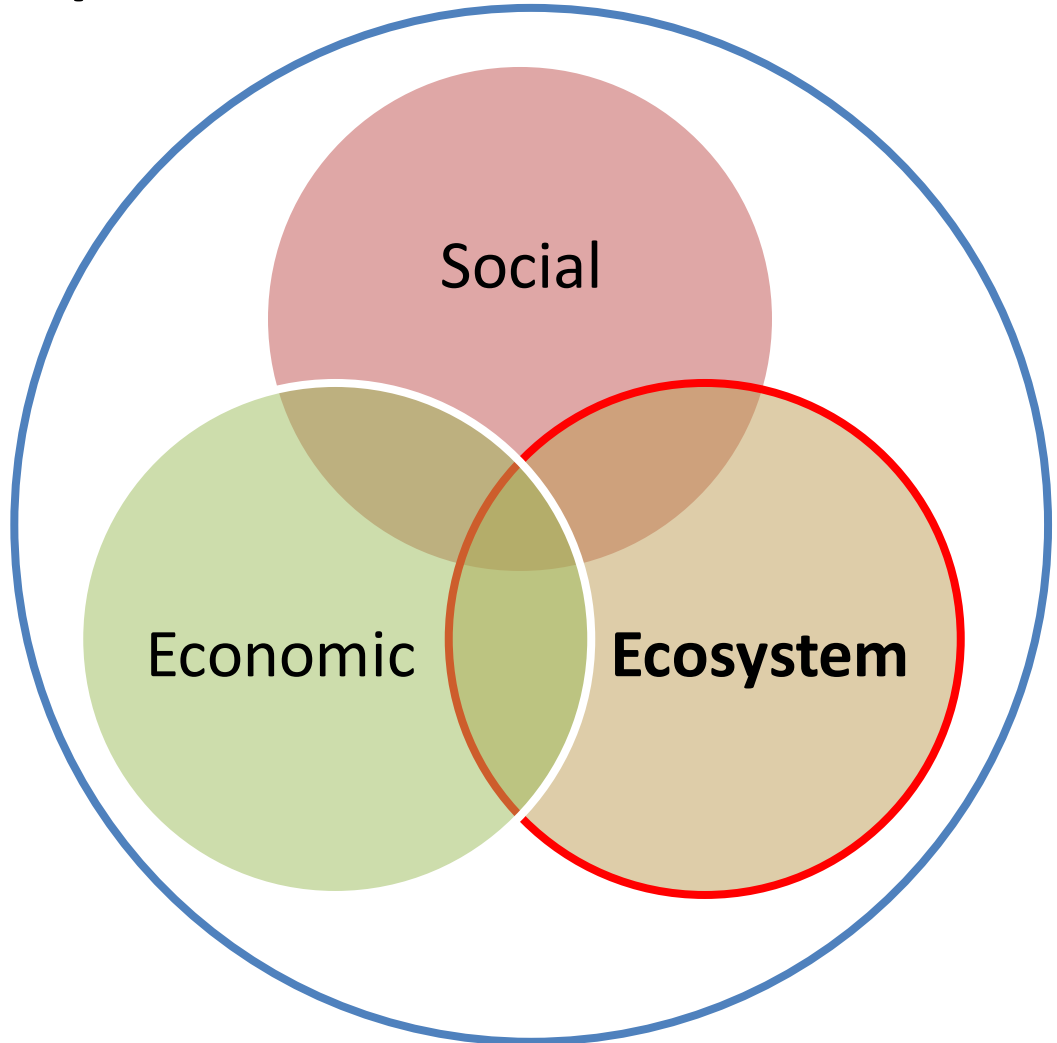


**Policy**

# Partnerships in International Research & Education (PIRE) Sustainability, Ecosystem Services, and Bioenergy Development across the Americas



**Metrics**



**Policy**



# How will bioenergy development affect ecological systems?

- 1) Identify broad patterns of ecosystem response to land use change associated with bioenergy production systems
- 2) Identify how local conditions (e.g. climate, soils) affect ecosystem responses to bioenergy production
- 3) Assess tradeoffs between ecosystem services provisioned by alternative land use systems

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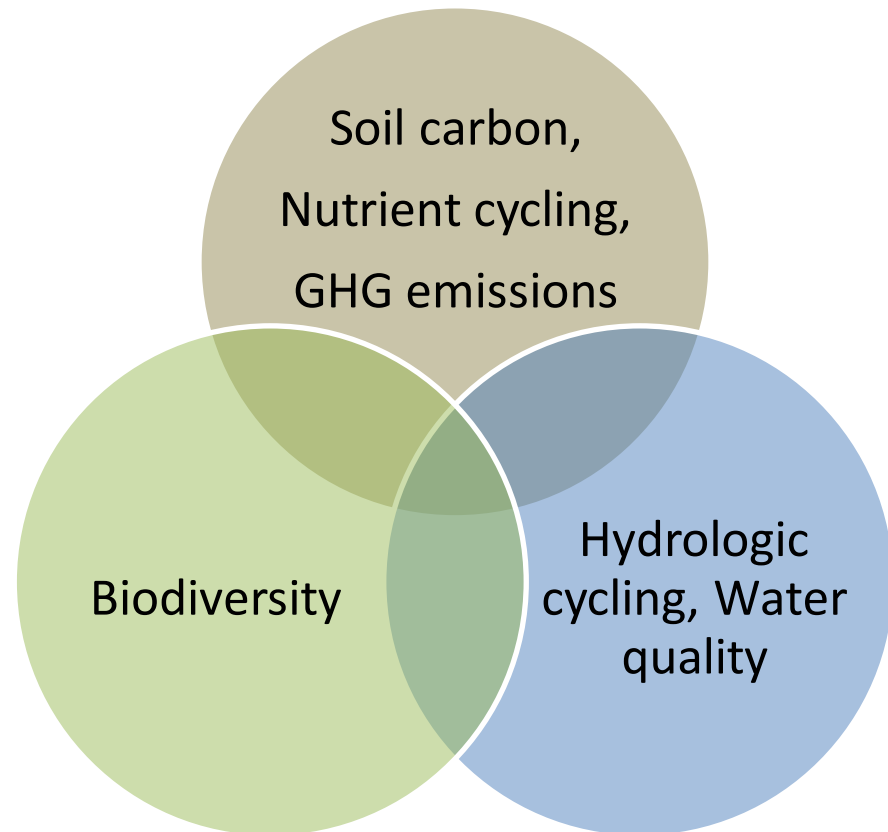
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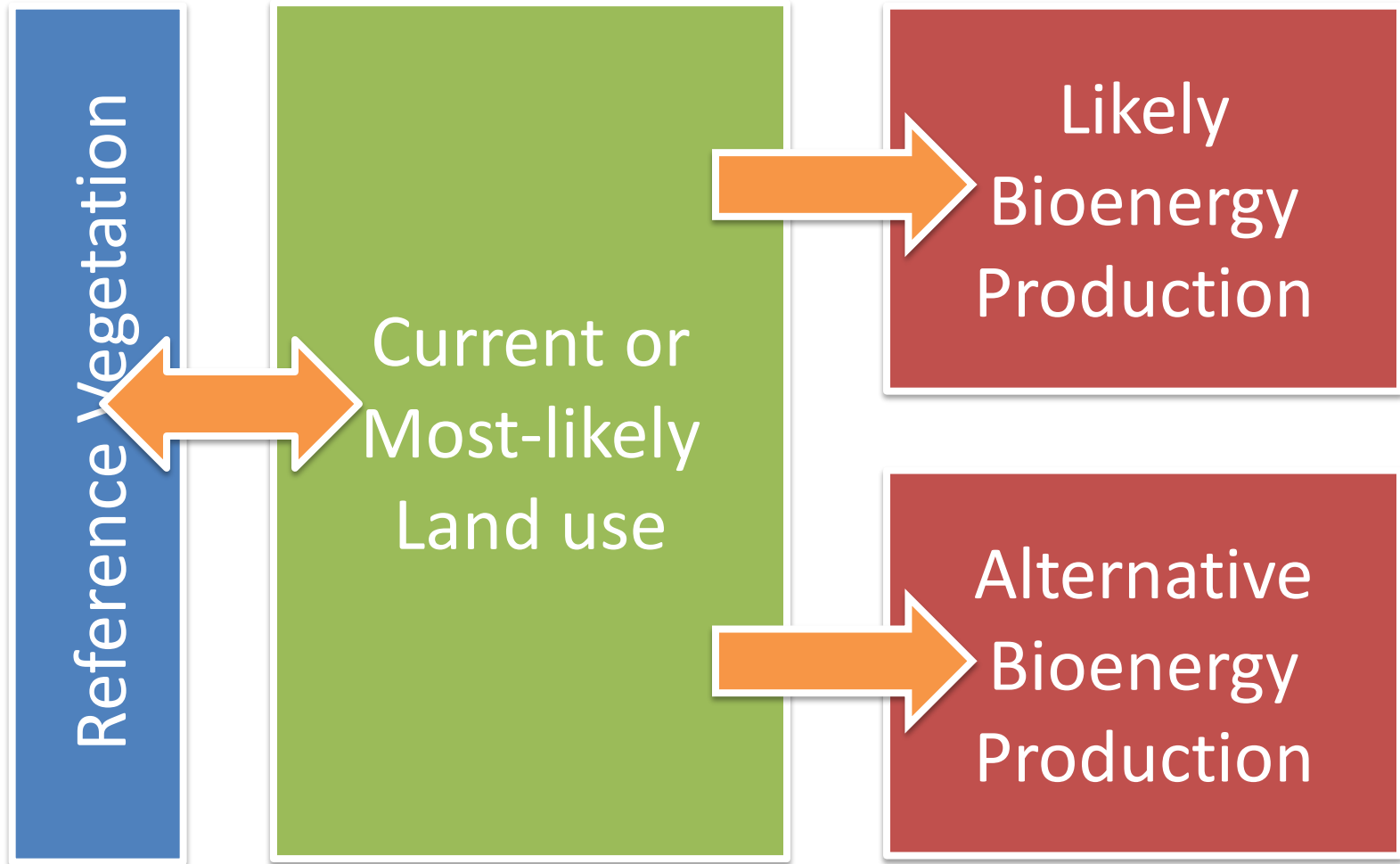


# How will bioenergy development affect ecological systems?

Quantify how bioenergy production alters:



# Experimental Design





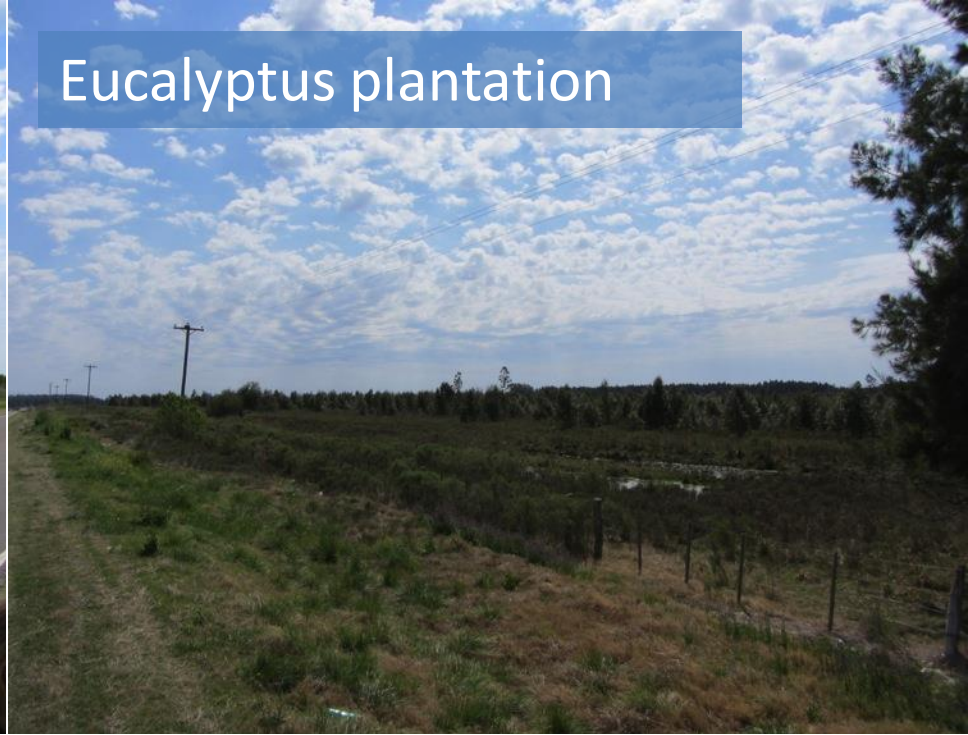
Argentina: Large plantations



Citrus plantation



Eucalyptus plantation



Blueberries



Grazing



Argentina: Mixed Use





Argentina: Pasture





Argentina: El Palmar National Park (Reference)



# Villahermosa, Tabasco







Mexico Case Study: Oil Palm in Tabasco



# Brazil

- Vegetation type, land use and deforestation
- Availability of areas according to agro-ecological zoning
- Land ownership structure





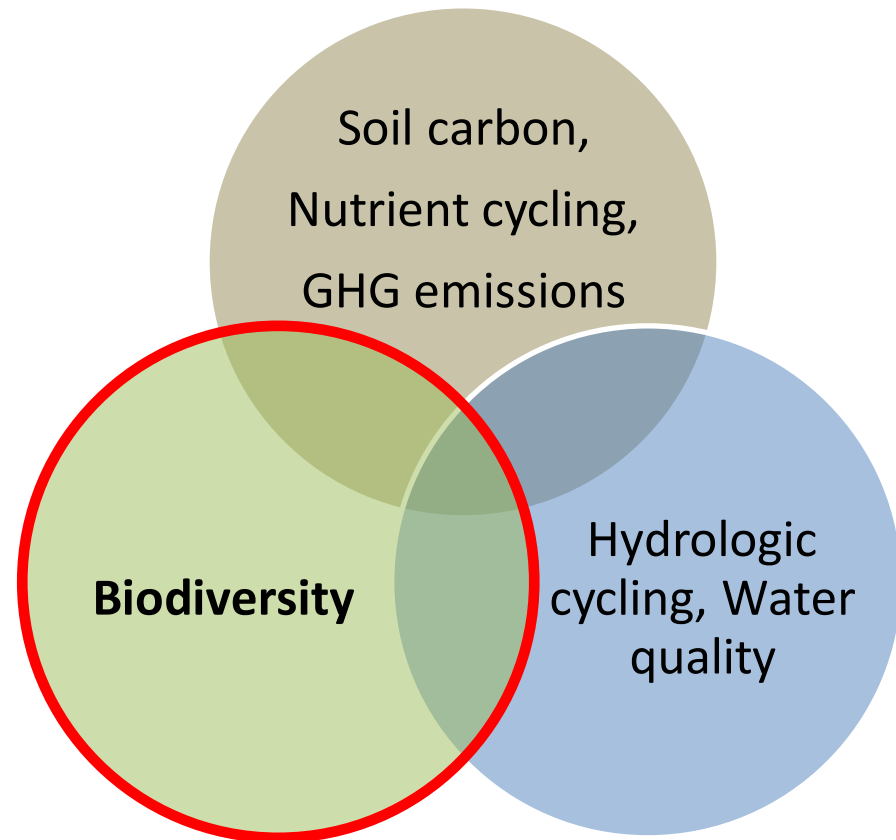


Brazil Case Study: Oil Palm in Para



# How will bioenergy development affect ecological systems?

Quantify how bioenergy production alters:



# Biodiversity: Birds and Insects

- Cost and time effective
- Sensitive to habitat change
- Indicator species
- Widely studied
- Important ecosystem service providers



# Biodiversity Research Objective

Examine the impacts of both **local** and **landscape** scale factors in production systems on **birds** and **insects** and the **ecosystem services** they provide







Argentina: Local scale



# Landscape Scale

What is the role of landscape composition and configuration in:

1. Maintaining regional biodiversity?
2. Providing ecological services to adjoining cultivated lands?





How can bioenergy systems & adjoining land support both commodity production and ecological services?



Pest control



Pollination

Ecological Function?

Production?

# Biodiversity Research Objective

Examine the impacts of both **local** and **landscape** scale factors in production systems on **birds** and **insects** and the **ecosystem services** they provide

In each country and land-use type:

- 1) Which species are present?
- 2) How do species use modified landscapes?
- 3) What ecosystem services are provided?

# Biodiversity Design

- Replicated 5 km<sup>2</sup> landscapes, each consisting of >80% of one of the following:
  - 1) Plantation
  - 2) Cattle pasture (most likely alternative)
  - 3) Mixed cropland/small plantation
  - 4) Natural vegetation

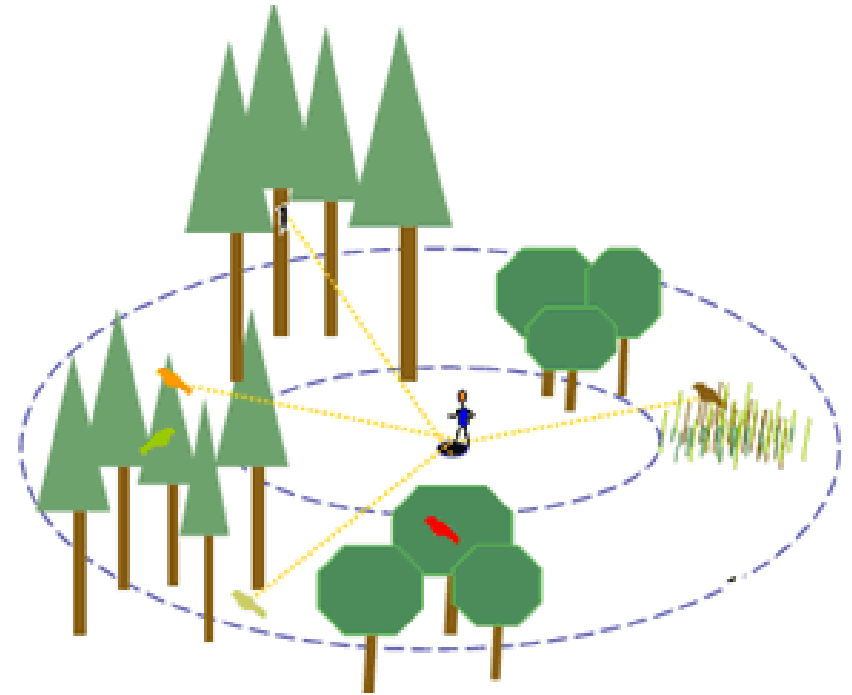
Three replicates each, for a total of 12 study landscapes/country







# Which species are present?

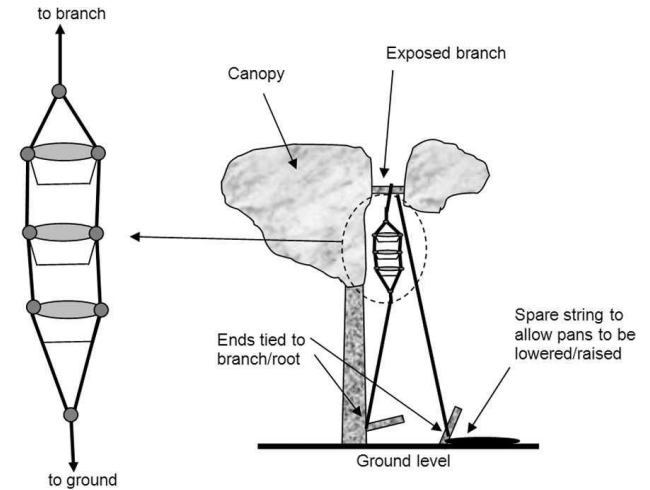


Graphic: USGS PWRC



# Which species are present?

- Bee bowl sampling
- Blue vane traps
- Active netting
- Canopy traps



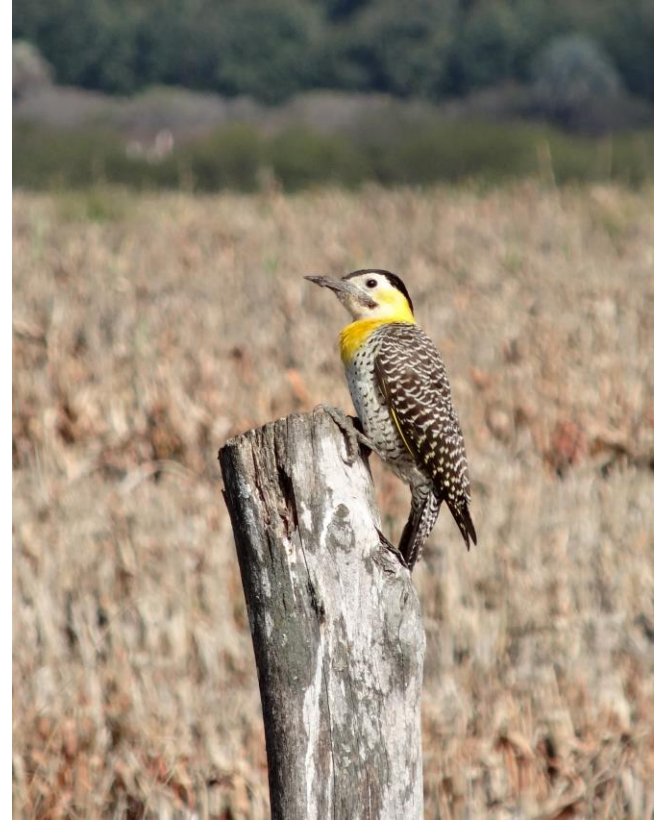
Nuttman et al. 2011





# Expected Results

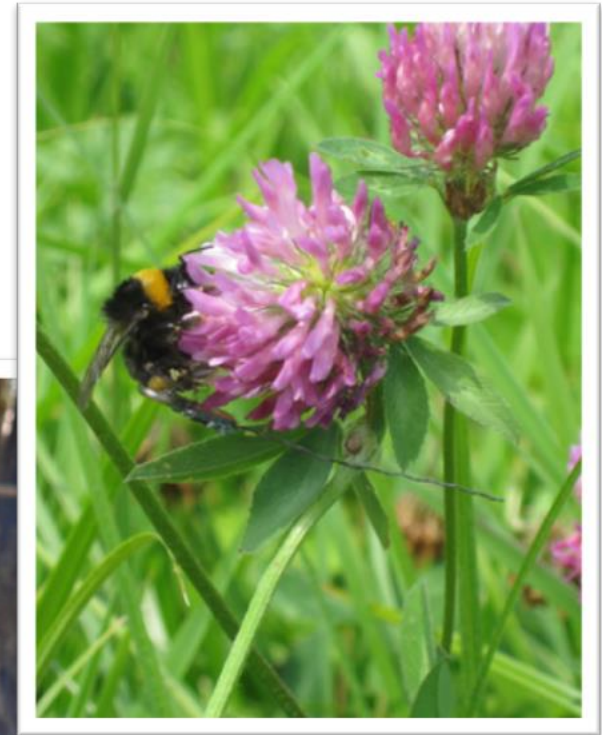
- Species richness
- Density and/or Abundances of individuals
- Functional group diversity
- Rare and threatened species presence
- Habitat specialists vs. generalists



# How do species use these modified landscapes?



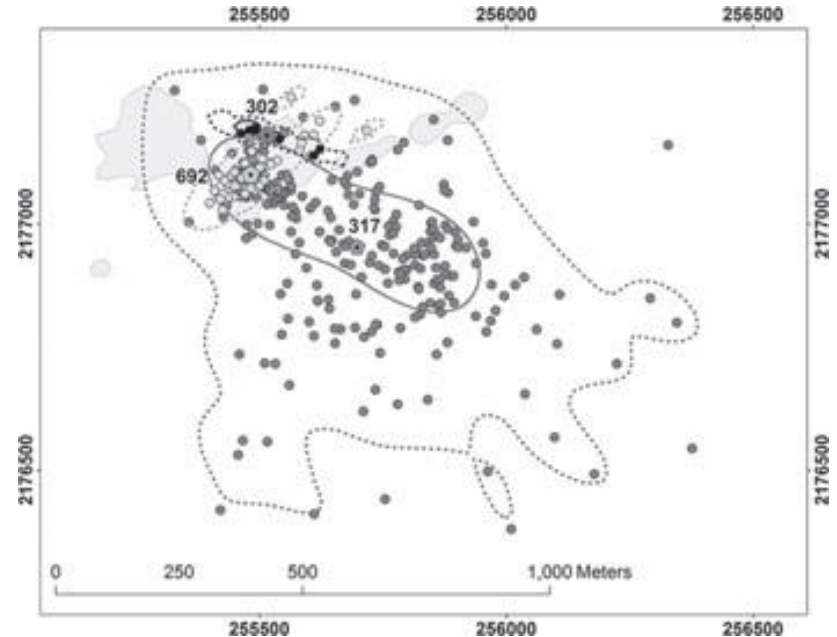
Gilles et al. 2011



Hagen et al 2011.

# Expected Results

- Home range habitat composition and sizes
- Measure of habitat use and preference
- Barriers to movement



Wu et al. 2014

# What ecosystem services are provided?

- Experimental approaches (local level)
  - Adjacent crop pollen limitation
  - Bird pest removal (exclosures)



D. Karp

# Expected Results

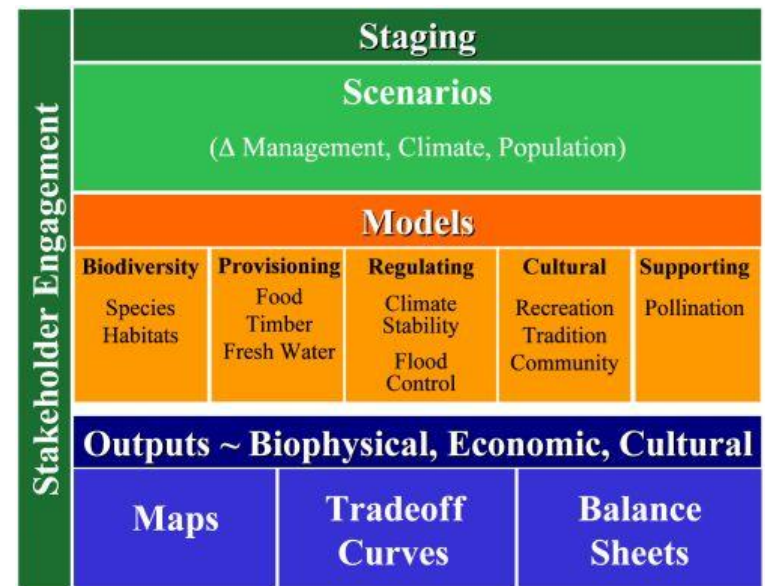
- Are the other crops in the landscape pollination limited?
- Do birds provide a pest removal service to crops in the landscape?





# What ecosystem services are provided?

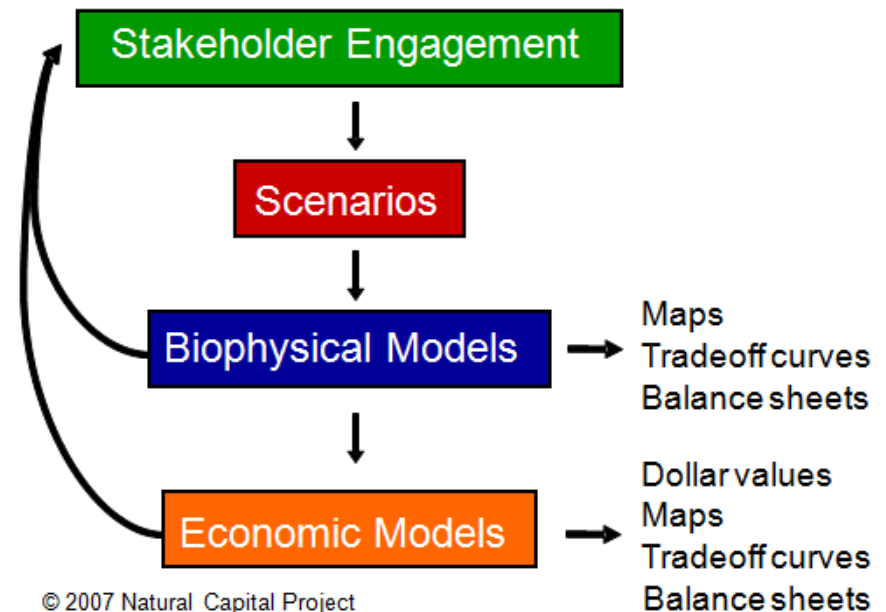
- Modeling approach (landscape level): InVEST
  - How changes in ecosystems are likely to lead to changes in benefits that flow to people
- Inputs:
  - Habitat quality and quantity
  - Pollinator model
    - Species and abundances of pollinators
    - Flight ranges



The Natural Capital Project, Stanford

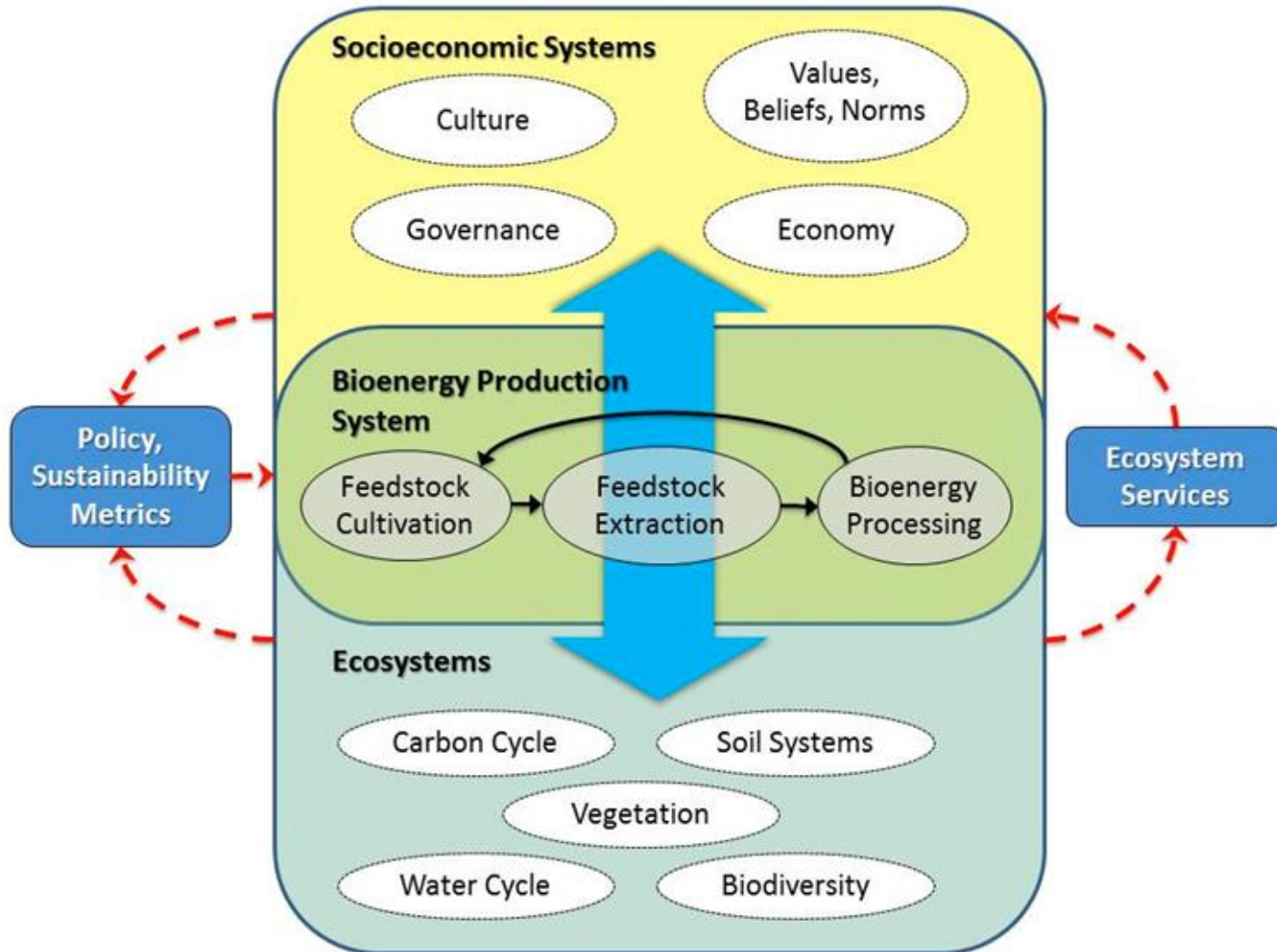
# Expected Results

- Under future land use change scenarios:
  - Levels of biodiversity protection
  - Ecosystem services
- Integrate with the carbon and water ecosystem PIRE subteams and the socio-economic and policy teams





# Integration



# Contact Information:

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