

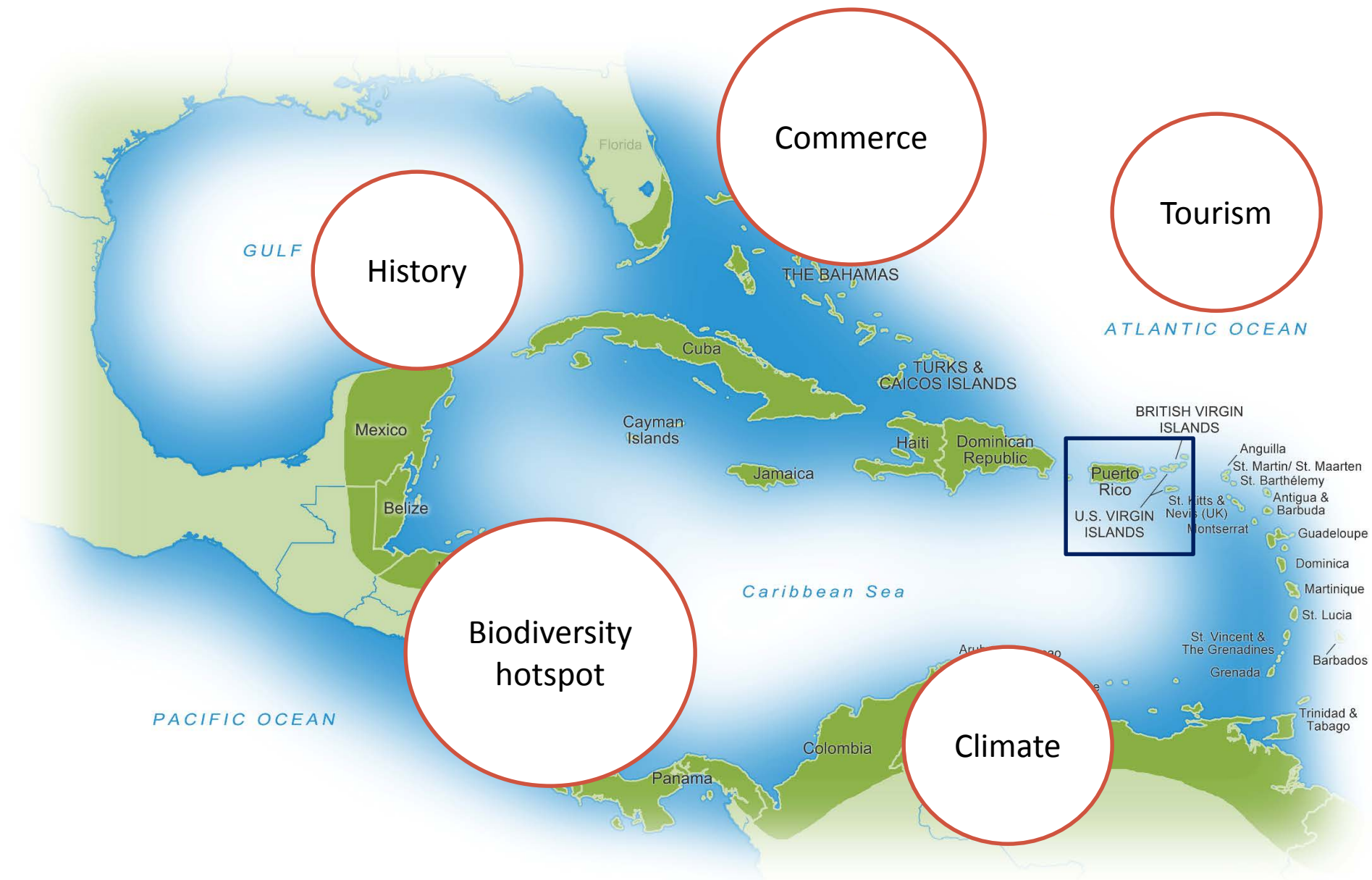


# Large-scale view of USDA agricultural incentives programs for Puerto Rico and the US Virgin Islands and their contribution to climate change adaptation

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USDA Caribbean Climate Hub

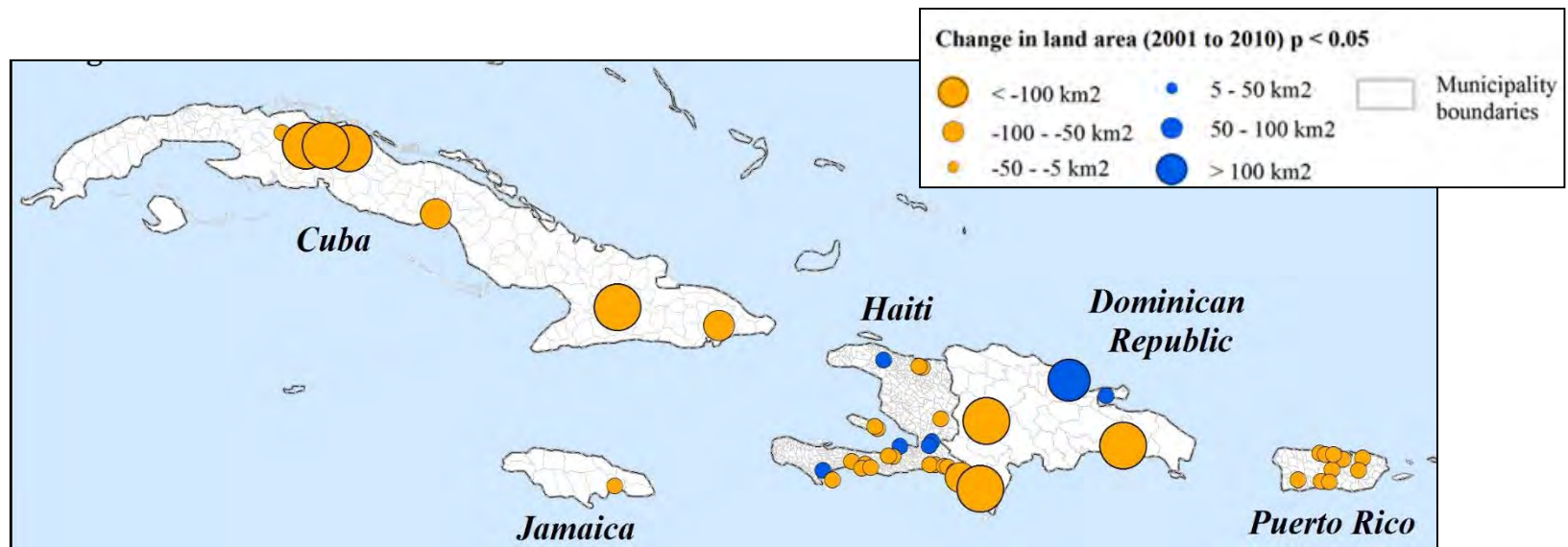


# Introduction





# Decrease of agricultural lands 2001 to 2010



## Agriculture/herbaceous

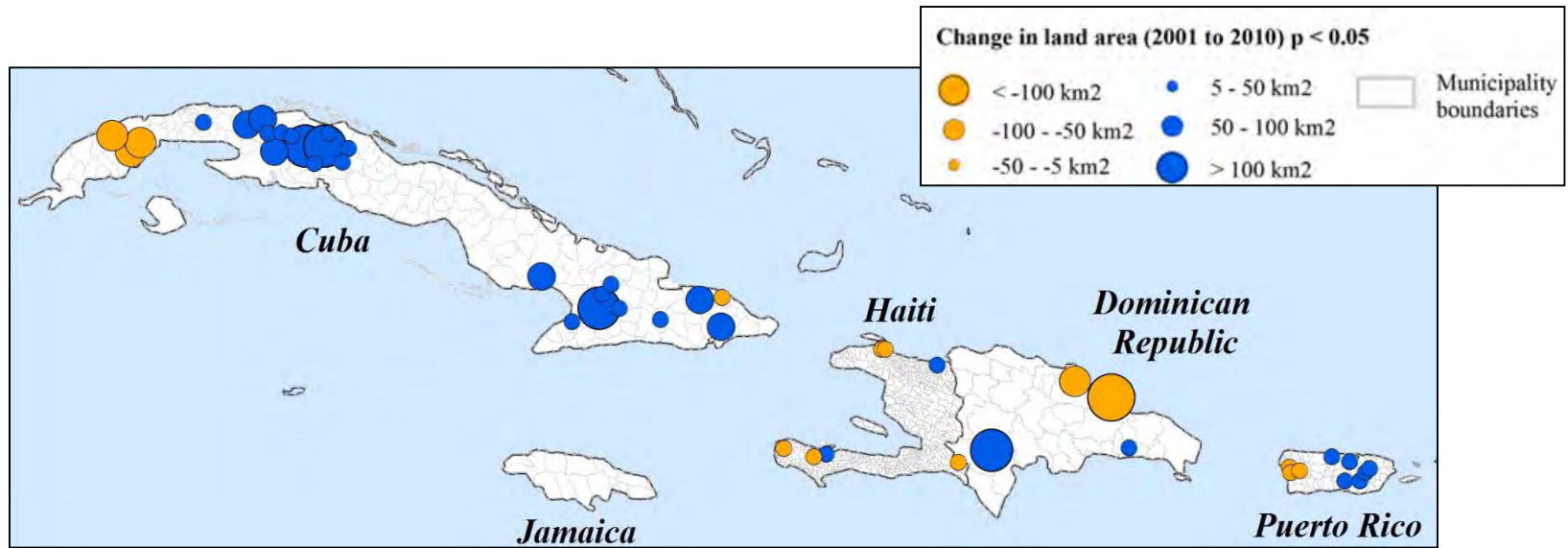
Decreased by 1,498 km<sup>2</sup>



- Cuba (-753 km<sup>2</sup>)
- Haiti (-317 km<sup>2</sup>)
- Dominican Republic (-301 km<sup>2</sup>)
- Puerto Rico (-119 km<sup>2</sup>)
- Jamaica (-8 km<sup>2</sup>)

(Alvarez et al., 2013)

# Increases and decreases in woody vegetation



## Woody vegetation

Region 801 km<sup>2</sup>

- Cuba (+799 km<sup>2</sup>)
- Puerto Rico (+19 km<sup>2</sup>)
- Dominican Republic (+4 km<sup>2</sup>)

- Haiti (-21 km<sup>2</sup>)



# Historical background

## Puerto Rico

### o1930s:

- o 90% of Puerto Rico in agricultural use
- o 70% rural population
- o 45% of GDP

### o1940s

- o Shift toward industrialized economy – US Operation Bootstrap
- o Massive rural to urban migration
- o Abandonment of agricultural lands and recovery of the woody cover

### oToday

- o Woody cover 54.7% in 2009
- o Agriculture < 1% of Puerto Rico's GDP
- o Imports 85% of food supply

## USVI

- o 1960's shift to manufacturing and tourism as main activities
- o Agriculture ~1% of GDP
- o Imports ~97% of food

# Today: Agriculture is a weak economic activity

	<b>Puerto Rico</b>	<b>Virgin Islands</b>
Land use	Arable land: 6.76% Permanent crops: 4.5% Other: 88.7%	Arable land: 2.86% Permanent crops: 2.86% Other: 94.29 %
GDP	Agriculture: 0.7% Industry: 48.8 % Services: 50.5%	Agriculture: 1% Industry: 19% Services: 80%
Food imports	85%	97%
Natural hazards	Hurricanes, periodic droughts and floods	Hurricanes, periodic droughts and floods
Environmental issues	Erosion, droughts causing water shortages	Lack of natural freshwater resources

Source: CIA World Factbook, 2014

# There is hope for agriculture in Puerto Rico!

**CIVIL EATS**



## Is Puerto Rico the Next Sustainable Ag Hot Spot?

As the U.S. island territory faces a \$70 billion debt crisis, some advocates see sustainable farming as one potential solution.

By [Lisa Munnikma](#) on [September 19, 2016](#)

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Agriculture on the Caribbean island is reviving as Puerto Ricans go back to the land to grow food for local consumption and help tackle a \$73bn debt crisis



Jorge and Pedro Casas at one of their two greenhouses where they produce organic herbs. Photograph: Richard Luscombe for the Guardian

## Puerto Rico finds unexpected source of growth in agriculture

By [The Associated Press](#) on [September 28, 2016](#)

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# Climate projections for Puerto Rico

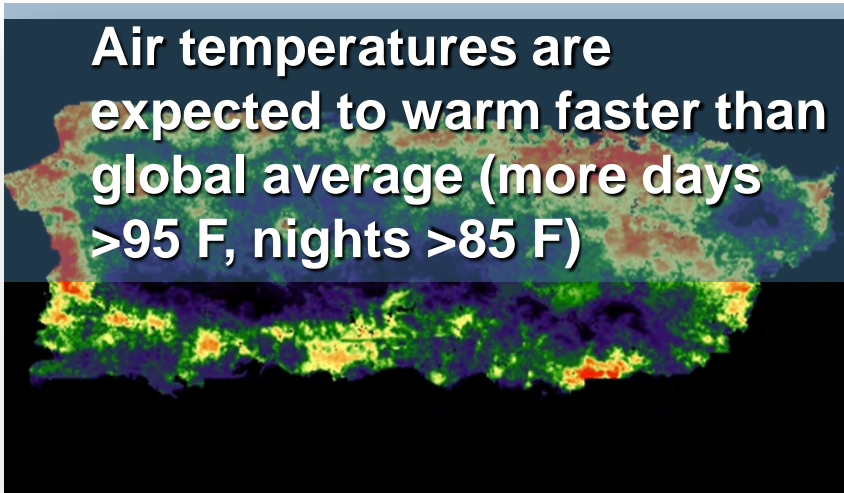
## General pattern for the Caribbean

- Increasing temperatures
- Rising sea levels
- Shifting rainfall patterns
- Intense tropical storms and hurricanes

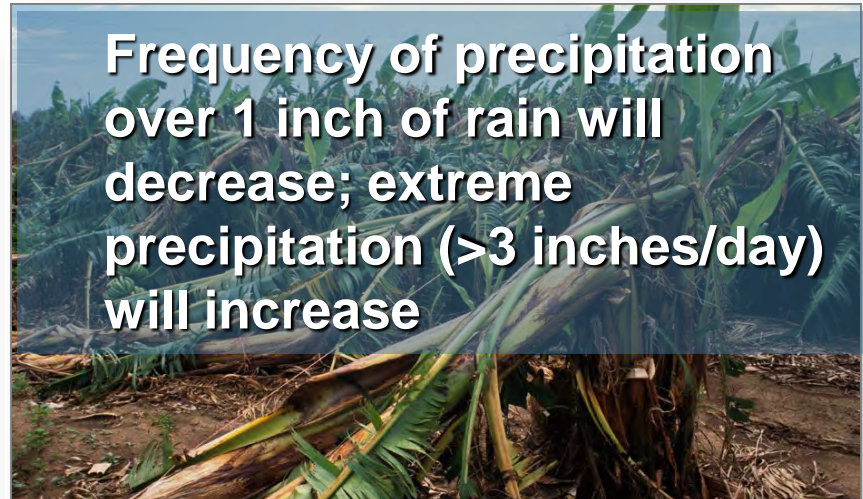
Rainfall will decrease, particularly in the wet season. More dry days



Air temperatures are expected to warm faster than global average (more days >95 F, nights >85 F)

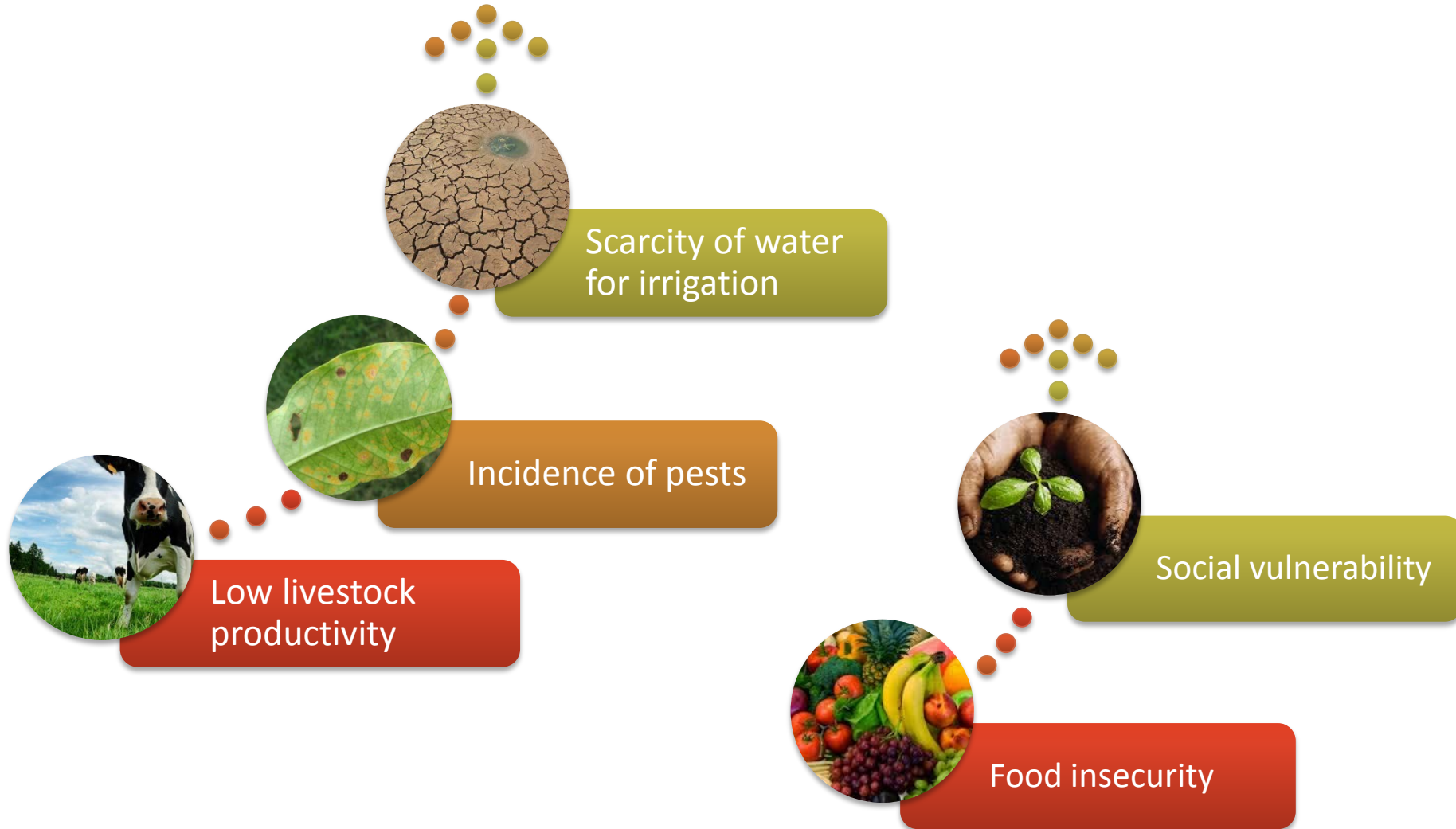


Frequency of precipitation over 1 inch of rain will decrease; extreme precipitation (>3 inches/day) will increase



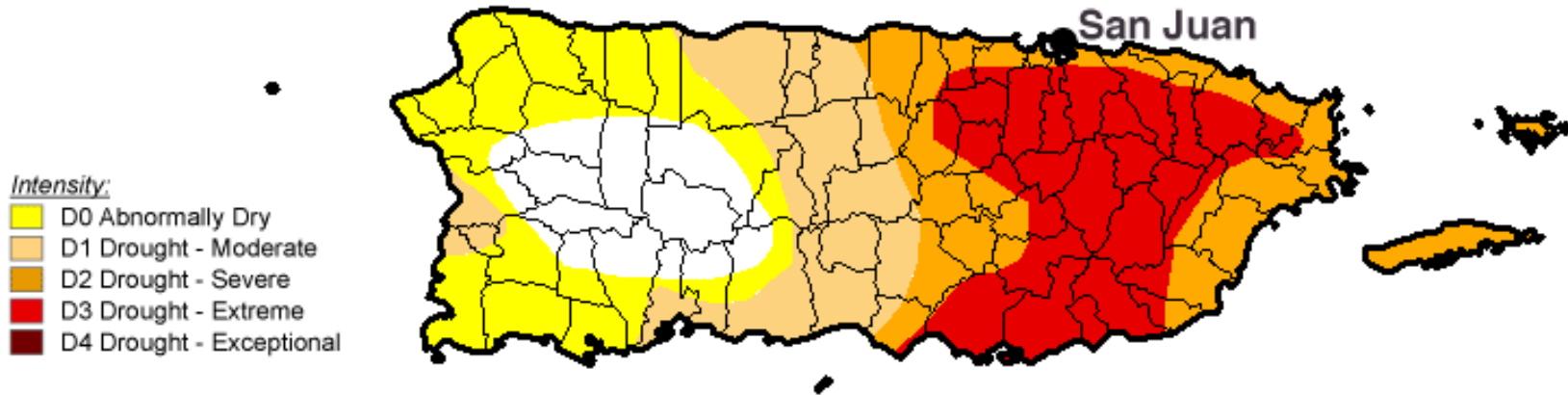


# Climate change impact on agriculture



# 2015 Drought

## Puerto Rico Drought Monitor for August 18, 2015



- 86% of Puerto Rico and the US Virgin Islands were under a water deficit
- 25% Puerto Rico in extreme drought and 45% under severe drought
- Drought impact 2015 - > \$100 million was loss in agricultural sector
- Water rationing. Many areas received water only 1 every 3 or 4 days
- Water deficit impacted cash crops – plantains, root crops, bananas, and coffee in Puerto Rico
- Livestock in the eastern part of Puerto Rico and on St. Croix

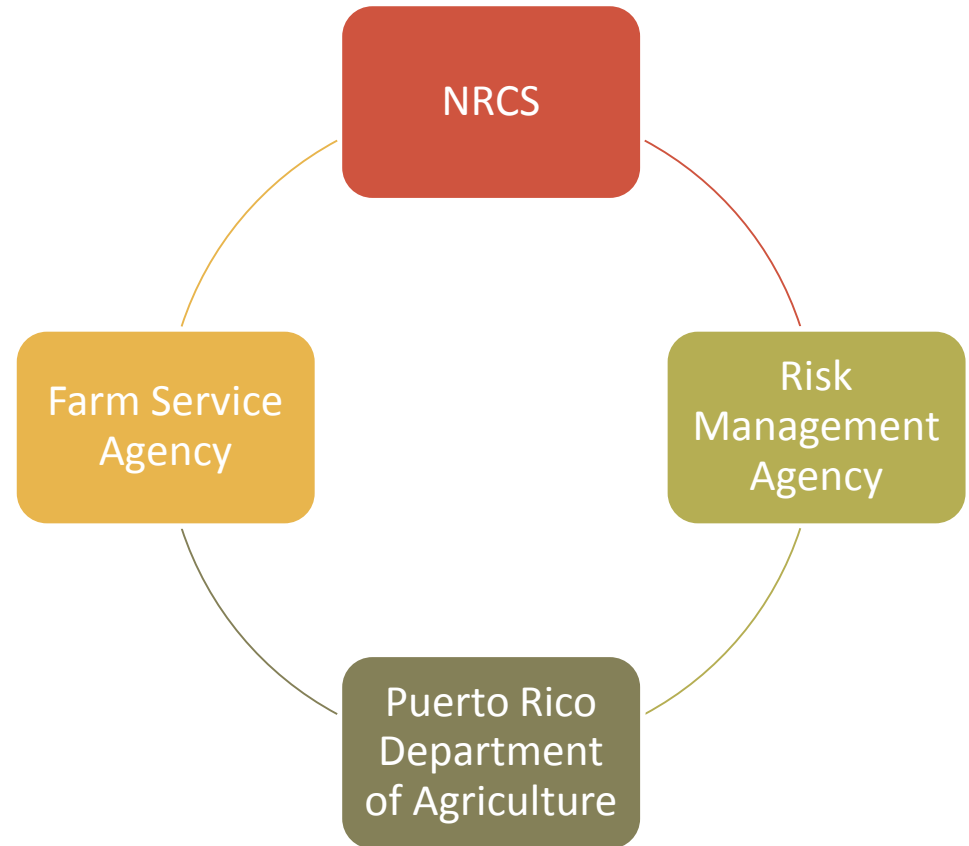
# USDA incentive programs

## Role of USDA programs

1. NRCS: Conservation programs and technical assistance activities. Reduce GHG emissions or increase carbon sequestration and build greater resiliency to climate and weather variability.

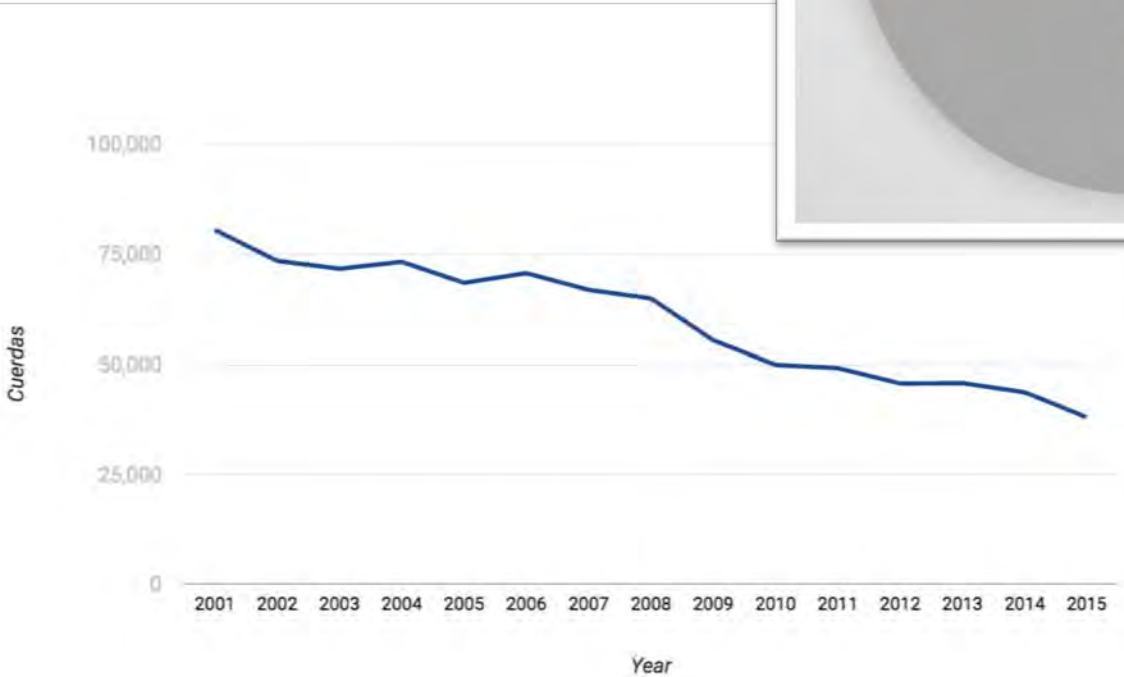
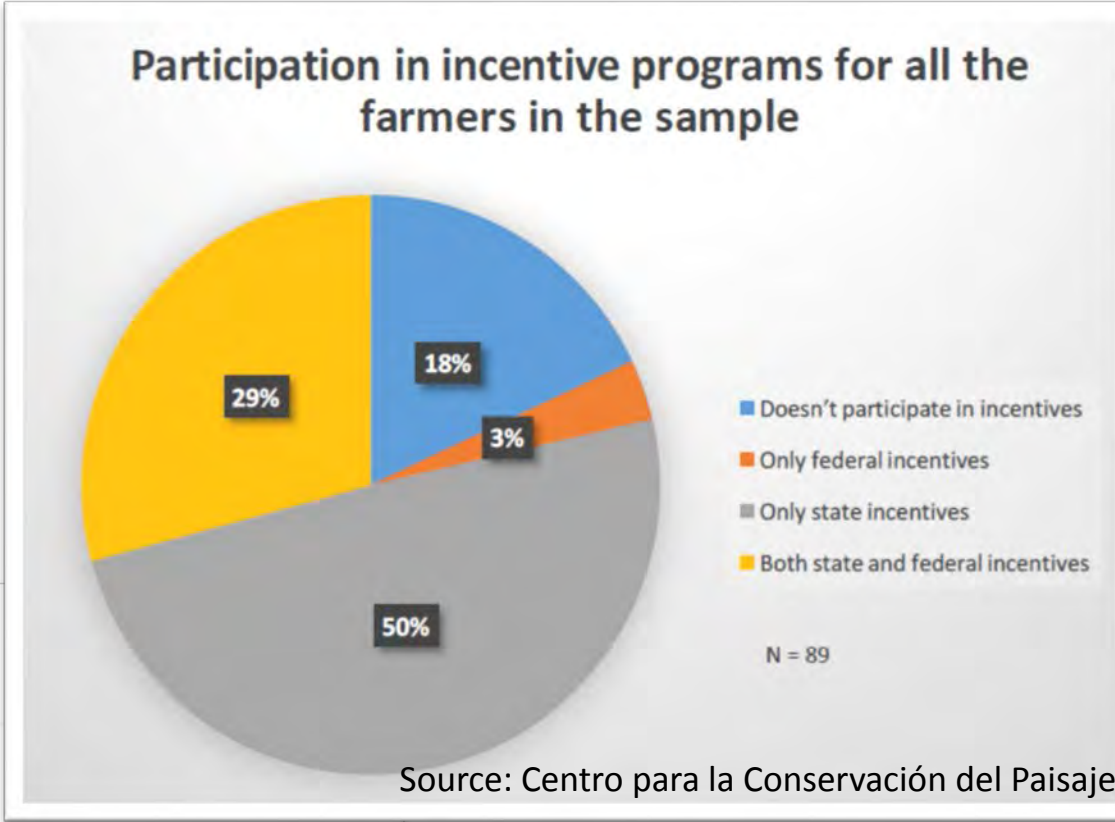
2. FSA: Conservation and energy, commodity crop, disaster assistance, and farm loan programs. Virtually all of FSA's programs affect producers' ability to adapt to and even mitigate the effects of climate change.

3. Risk Management Agency: Crop related insurance products to help farmers and ranchers manage the risks related to agricultural production. In Puerto Rico coverage is provided against agricultural production losses due to unavoidable natural perils such as hurricanes, floods, and fire. Funds are managed by Corporación de Seguros Agrícolas de Puerto Rico.



# Challenges

Decline in participation  
RMA incentives  
(insurance)



Relatively low  
participation in federal  
incentives in the coffee  
region of Puerto Rico



# Challenges

- Low or no participation in programs
  - Language constraints
  - Internet availability
  - Geographical barriers
  - Confusion about programs
- Limited program availability
  - Hurricanes are covered, but not droughts
  - Coverage limitations (USVI does not covered for insurance)

Applied research is needed to understand gaps in information, bottlenecks in outreach, geographical coverage of incentives, impacts of incentives on climate change adaptability



# General Research Program

- 1) Conduct a large-scale analysis aimed at providing insights into the long term benefits of USDA programs that relate to climate adaptation and greenhouse mitigation,
- 2) to determine what kinds of analyses help identify best practices for current and future climate scenarios, and
- 3) to evaluate the gaps in information and information delivery that hinder implementation and alignment of USDA-recommended actions.



# Applied research

## **Topic 1: Government incentives program participation in a complex tropical landscape**

- Tropics: Farm diversity, crop diversity, soil diversity, language diversity
  - What are the factors of success of government incentive programs?
  - What are the characteristics of farms and farmers enrolling in programs from NRCS, RMA, FSA?
  - Who are the programs reaching? Who are not reaching?
  - Evaluate both environmental, and socio-economic variables
- Analyze programs with a direct link with climate adaptation
- Draw conclusions applicable to similar tropical countries

# Applied research

Agricultural census  
(1997, 2002, 2007,  
2012)

GIS: Common Land  
Units  
(Farm Service Agency)

GIS: Incentives spatial  
location  
(FSA, NRCS, RMA)

Based on literature review, some variables that have been tested: Crop size, primary occupation, age, internet, program

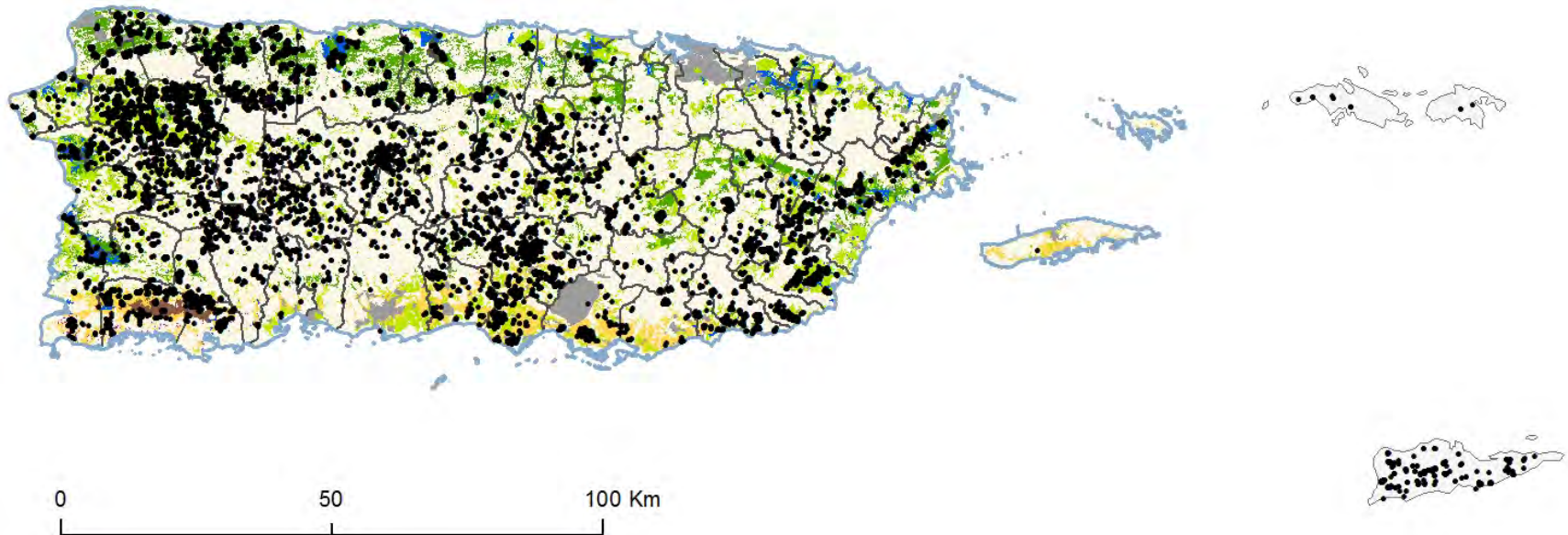
Other variables: accessibility, crop type, geographical region (coffee region vs livestock region)









- Identify significant characteristics of US Caribbean farmers and farms that participate in NRCS, FSA and RMA conservation and incentives program
- Identify significant characteristics of farmers and farms that participate in programs related to climate adaptation to selected climate events (hurricanes, drought, storms)
- Analyze with multiple regressions (based on research by Agouridis, et al. 2012)
- Conduct interviews with farmers participating and not participating



# Landscape view of NRCs practices

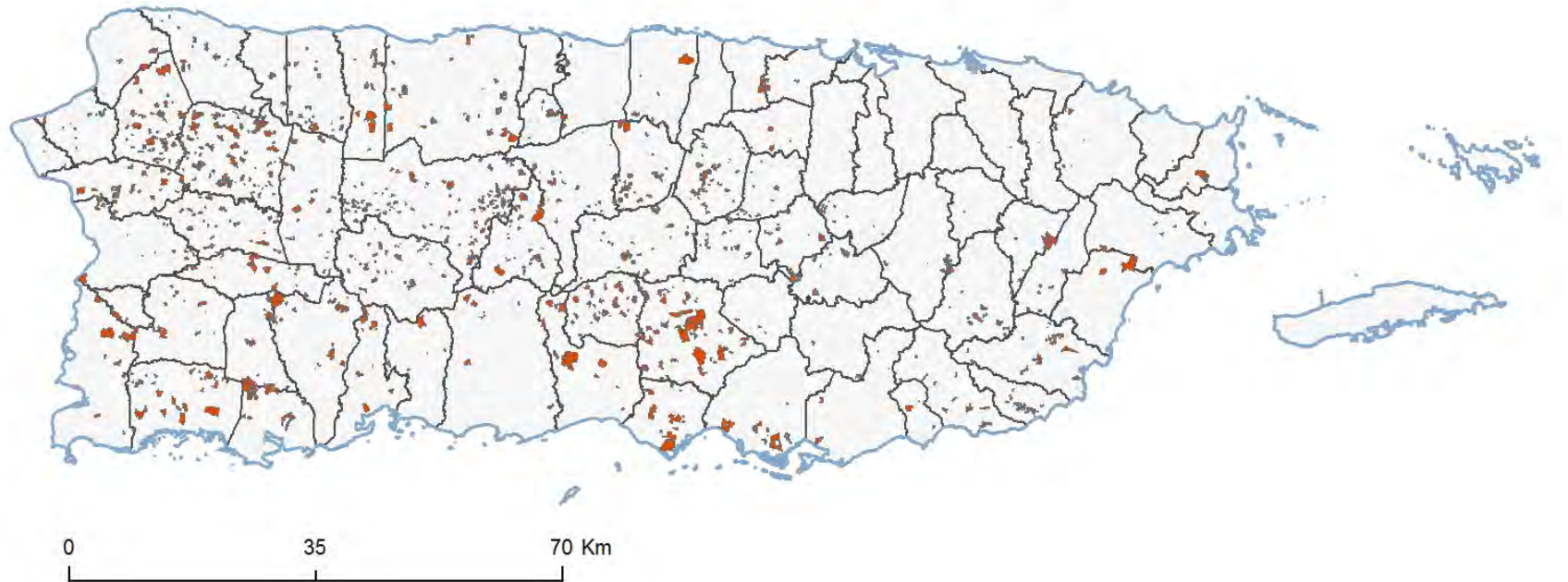
1992-2016



- |  |  |  |
|--|--|--|
|  All areas are prime farmland                   |  Prime farmland if irrigated  |  Not prime farmland |
|  Farmland of statewide importance               |  Prime farmland if irrigated and reclaimed of excess salts and sodium |  No data            |
|  Farmland of statewide importance, if irrigated |  Prime farmland if drained  |  |

# Common land units and EQUIP practices

1992-2016





# Applied Research

## **Topic 2:** Assessing adaptation practices in relation to climatic stressor

1. Understand the spatial pattern of practices and incentives enrollment with respect to drought prone areas in Puerto Rico and USVI
2. Historical time-series analysis of drought practices – where are the gaps?

### **Quantitative**

•Controlling for environmental variables (soil type, elevation, field, others), we would expect that farms with adaptation practices for drought better adapted to 2015 drought impacts

1. Was the farm maintained?
2. Was the size of the field maintained?
3. Crop type?
4. Willingness to participate?

Interviews with selected farmers that enrolled in adaptive practices and with a few that did not, can provide insights into these questions

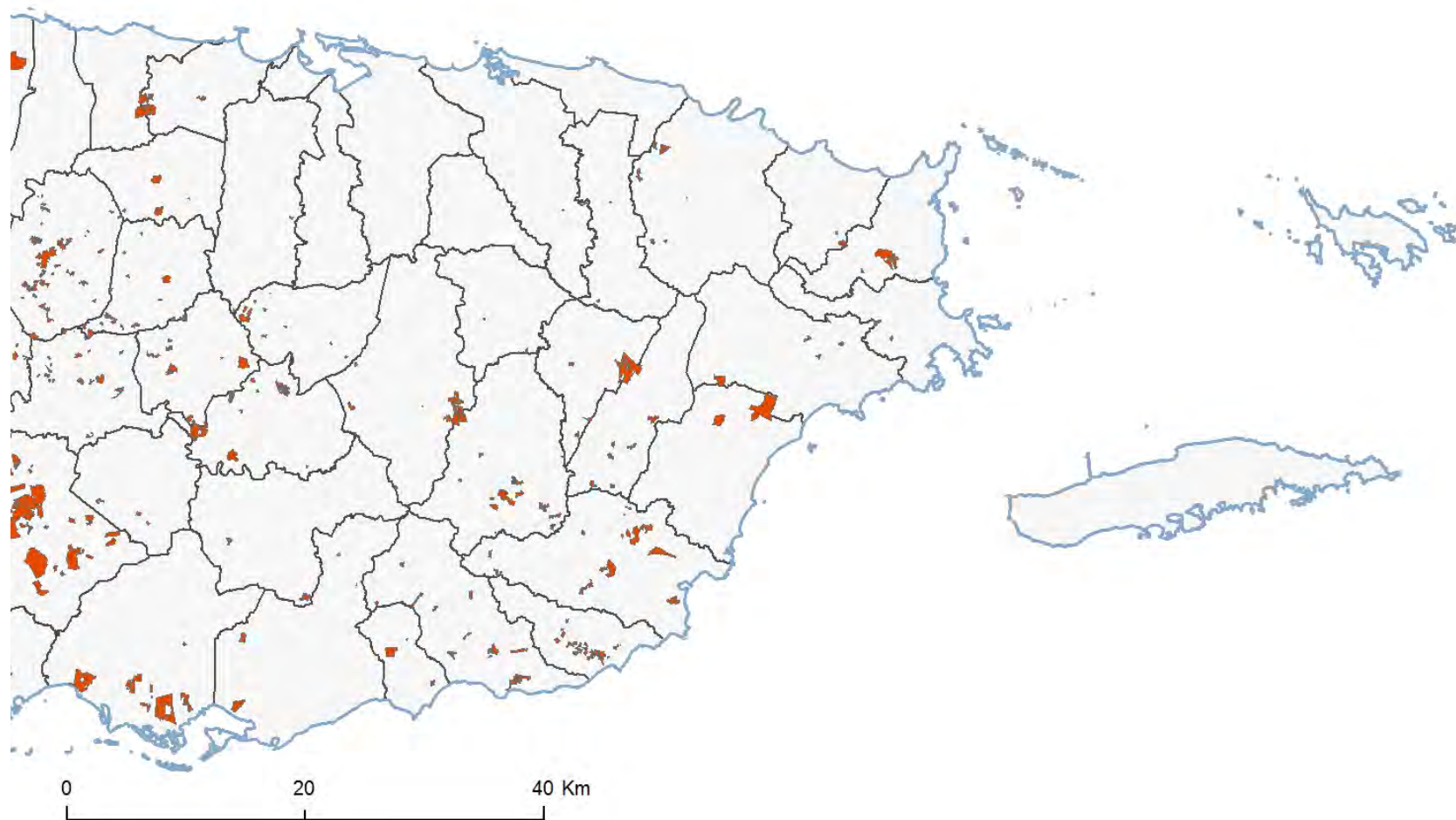
# NRCS Adaptation practices related to drought

Land_Use	Practice	Practice_Code
Pasturelands	Rotational grazing	528
Pasturelands	Grazing land mechanical treatment	548
Pasturelands	Silvopasture	381
Pasturelands	Exclusion fences	382
Pasturelands	Ponds	378
Pasturelands	Wells	642
Pasturelands	Water conveyance systems	
Pasturelands	Springs development	574
Pasturelands	Watering system designs	614
Cropland	Water Harvesting Catchments	636
Cropland	Underground Outlets	620
Cropland	Cover crops	340
Cropland	Crop residue management	329; 345; 384
Cropland	Riparian Forest Buffers	391
Cropland	Irrigation water management	449
Cropland	Water management practices	449; 554

**Land Use Efficiency Score indicators that include soil erosion, soil quality, insufficient water, and fire hazards.**

# CLU enrolled in EQUIP drought practices

1992-2016





# Broader impacts

- Provide suggestions of approaches to improving participation (i.e. enrollment) and the implementation of practices
- Provide suggestions to *WHERE* to focus outreach program and what materials should be covered (based on the analysis) in the outreach material
- Provide suggestion to which other incentives are needed in Puerto Rico and USVI
- On a bigger scale, extrapolate suggestions to other tropical regions with similar agricultural practices

# Outreach component



STORYMAP: Spatial Representation of Incentives Available for Agriculture, Forestry and Conservation in Puerto Rico and the U.S. Virgin Islands

Technical report: Government incentives program participation in a complex tropical landscape

Posters and factsheets: Incentives for climate adaptation

# Suggestions!

- Similar studies in mainland US
- Similar studies in the tropics
- Reports
- Ideas?

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**Thank you!**

