



# Landscape connectivity analysis to reduce cocoa swollen shoot virus disease in Ghana

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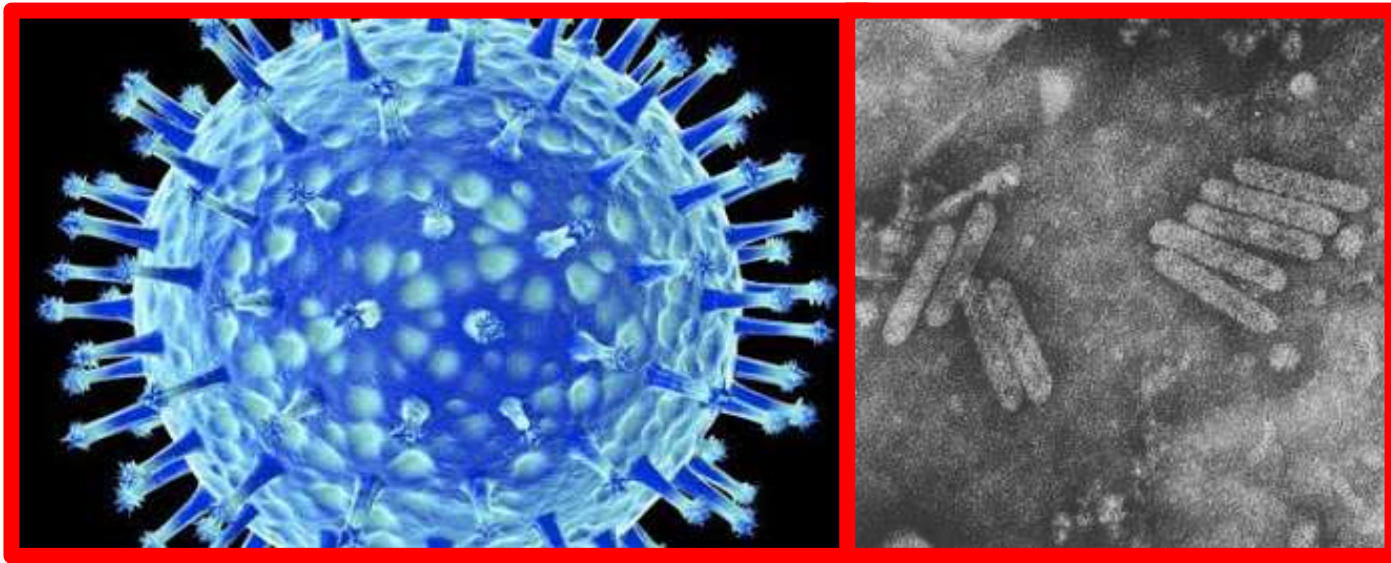
Conadti Network Meeting  
Tuesday 15<sup>th</sup> March 2016  
University of Liverpool, UK

# Content

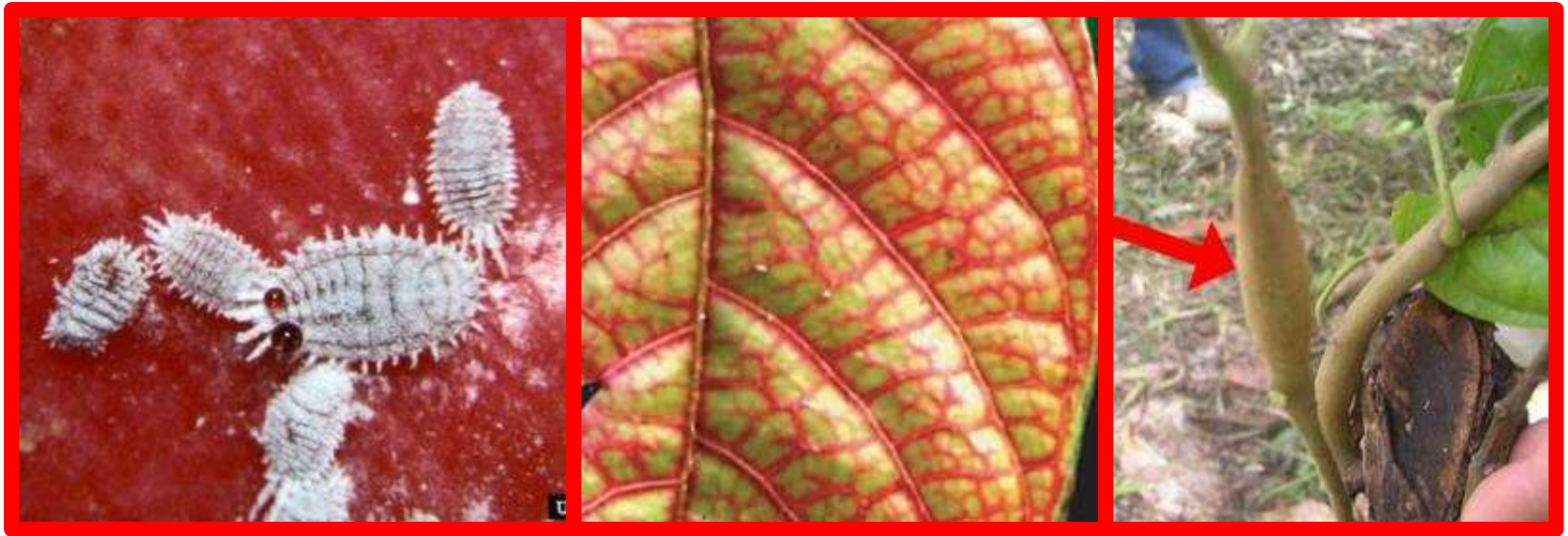
1. The virus, its' spread and how to reduce it
2. Objective and hypothesis
3. Current state of methodology

# Cocoa Swollen Shoot Virus Disease

- West Africa (WA) is the world's most important region for cocoa production (mainly Côte d'Ivoire and Ghana)
- One of the major limitations to cocoa productivity in WA is the Cocoa Swollen Shoot Virus Disease (CSSVD).



# CSSVD spread and control



- CSSVD spreads through mealybug vectors (Muller, 2016)
- Only control measure: cut out infected cocoa trees (Muller, 2016)
- Launched as early as 1946, governmental eradication program cut > 200 Mio. infected trees (Dzahini-Obiatey *et al.*, 2010)

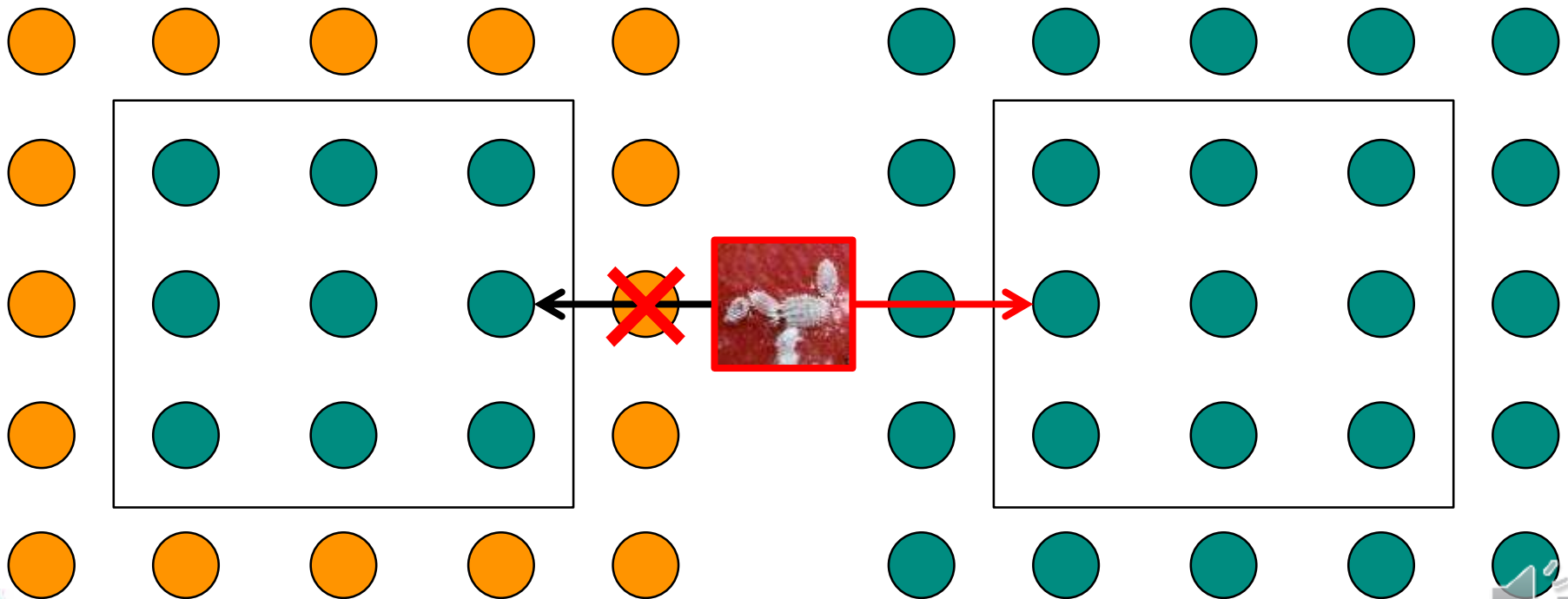
# How to reduce CSSVD spread

## Diversification of cocoa production landscape

● cocoa

● citrus

- E.g. barrier cropping (10m barrier with non-host crop such as citrus to protect new plantings from infection)
- By the time mealybugs reach cocoa (slow movement), they would have become non-infective (semi-persistent virus transmission)



# Objective and hypothesis

## Objectives

- Establish ecological network model to:
  - 1) quantify potential of fragmented cocoa landscapes to decrease CSSVD spread (Antidote to connectivity for conservation)
  - 2) Elaborate minimum distance by which cocoa plantations should be separated

## Hypothesis

- $H_0$ : Diversification of cocoa production landscapes has no effect on CSSVD spread
- $H_A$ : Diversification of cocoa production landscapes significantly reduces CSSVD spread

# Current state of methodology

## Data to build ecological network model

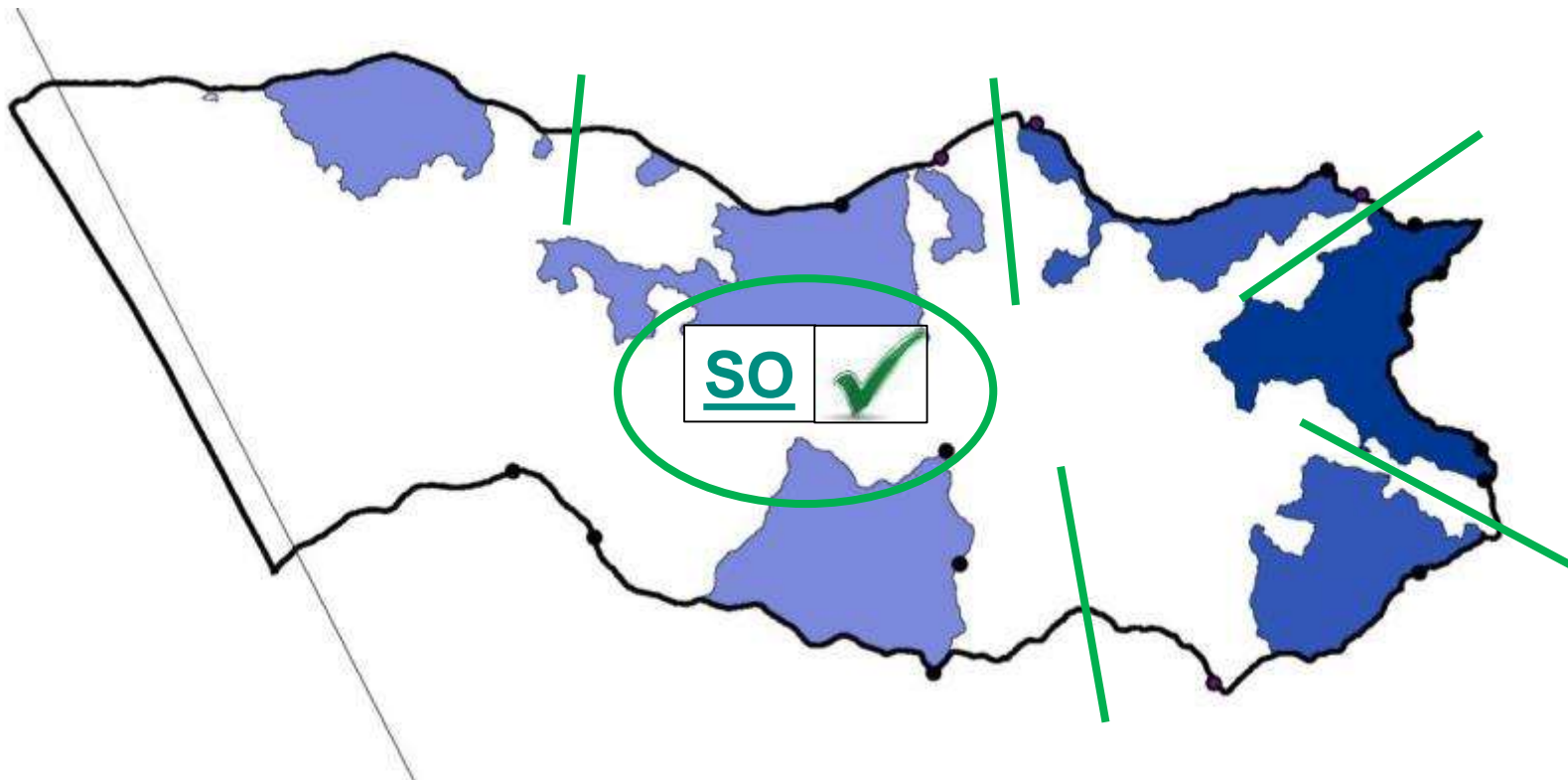
- Cocoa Health and Extension Division (CHED), subsidiary of COCOBOD (governmental cocoa organization) has mapped the location and CSSVD presence for all of Ghana's cocoa between 2010 and 2013.
- I am planning to integrate these data with information on the mealybug behavior (speed of movement) and time period of infectivity (how long vector transmits CSSVD?).
- I will also consider important co-factors such as genetic material and age of the cocoa trees (available in CHED data), as well as pedo-climatic conditions (data on soils and weather, these information are also available)

# Example

SO: scattered outbreaks only

## Brong Ahafo Region

- 300 ha
- CAs not connected → CSSVD incidences ↓



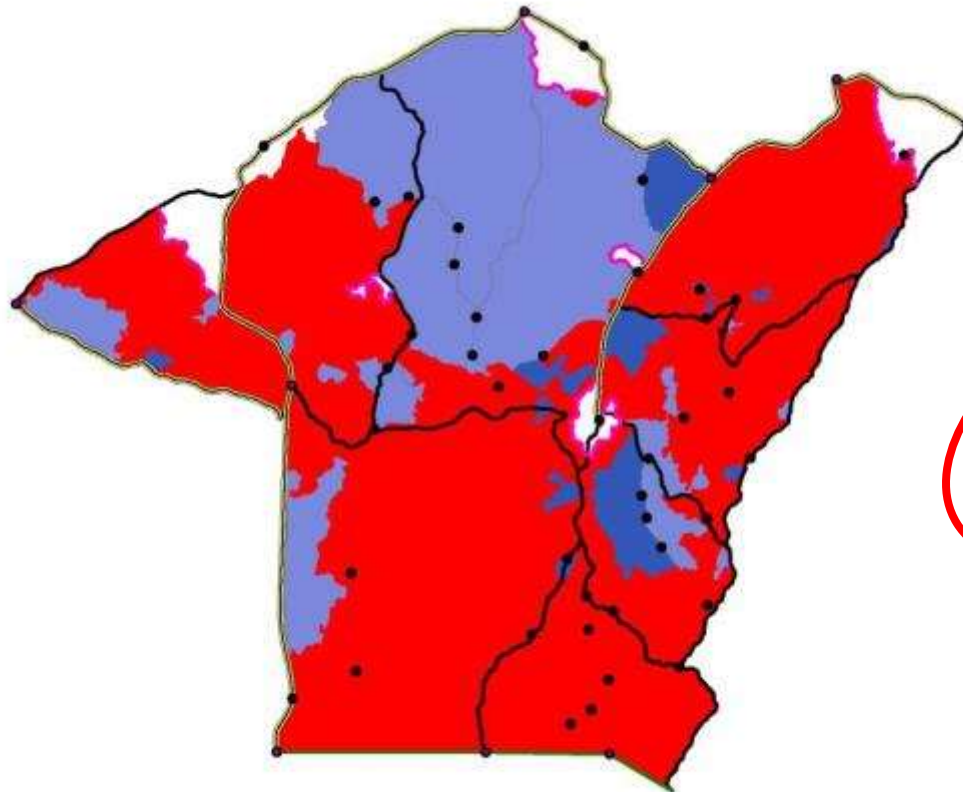


# Example (cont.)

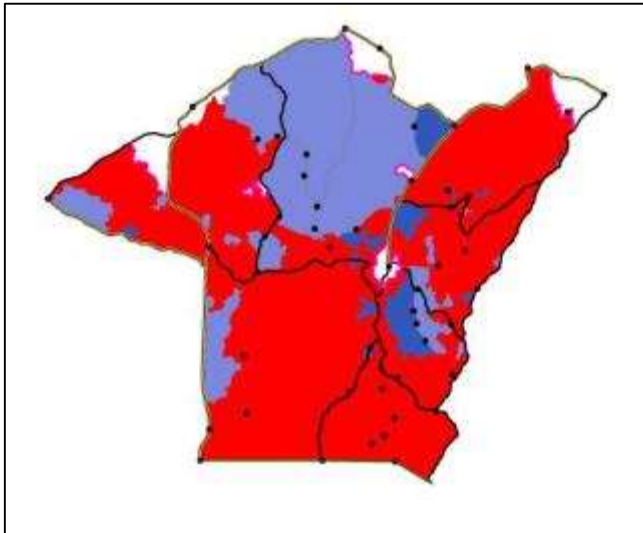
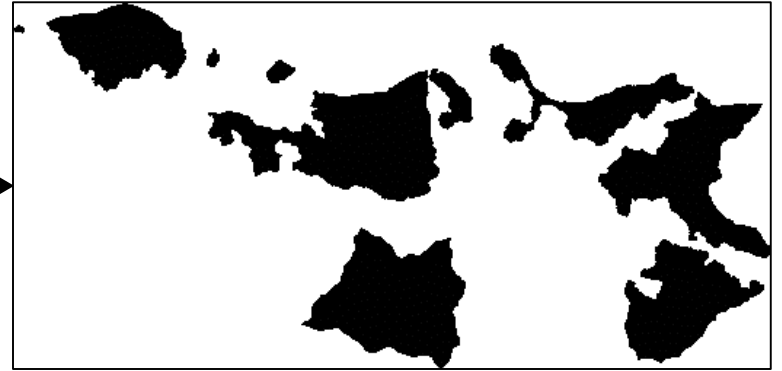
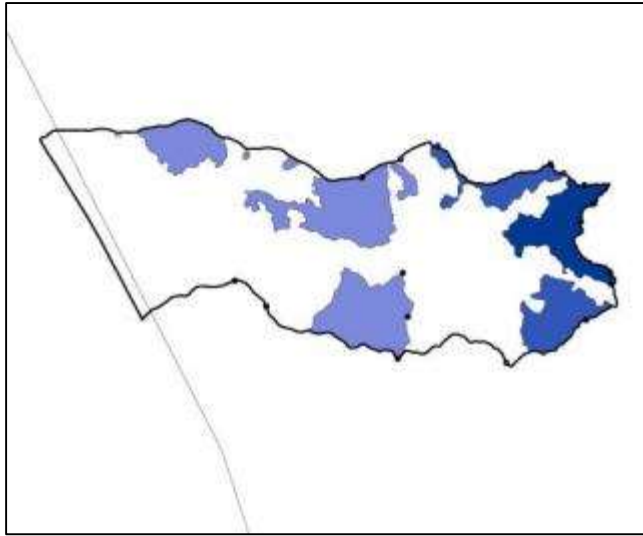
**AMI**: area of mass infection

## **Western North Region**

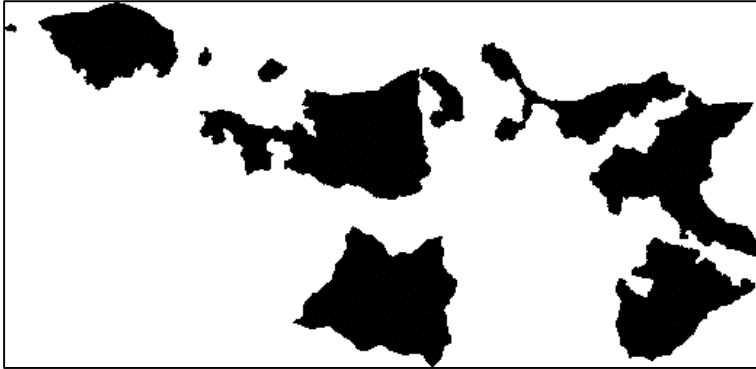
- 2'000 ha
- CAs connected → CSSVD incidences ↑



# Example (cont.)



# Example (cont.)

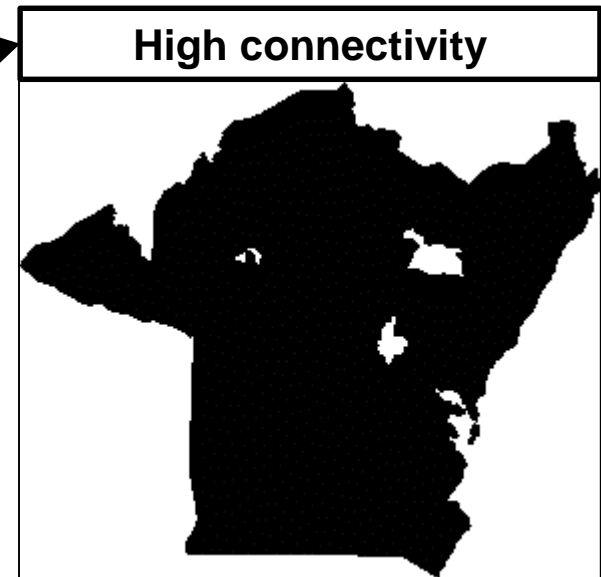
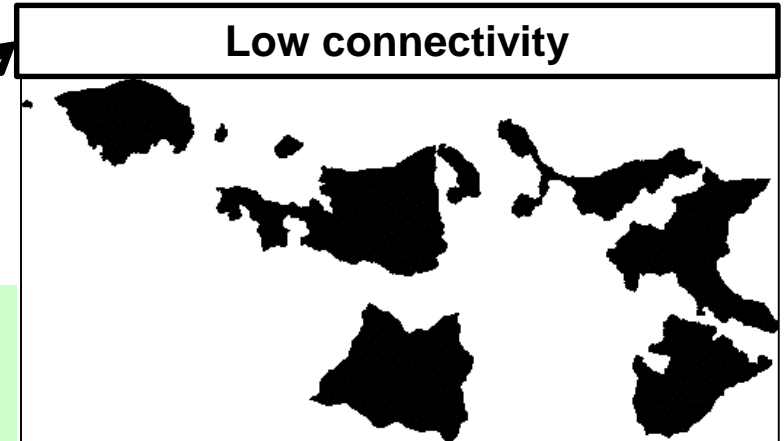


**FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps**

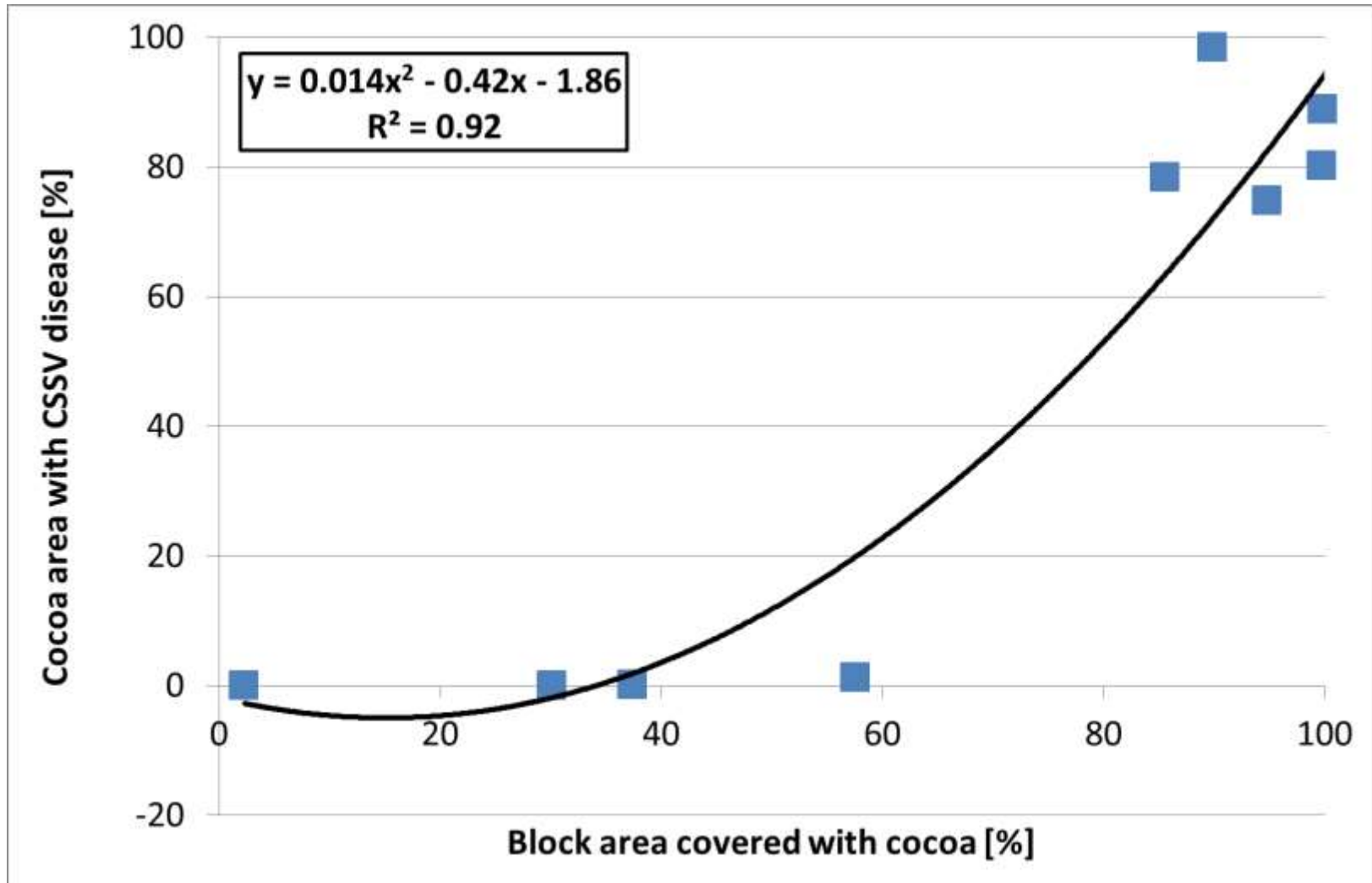


# Example (cont.)

**FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps**



# Preliminary result “Landscape study” (4'612 ha)



# Thank you for your attention!

## Project partners:



**ETH**

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Swiss Federal Institute of Technology Zurich



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