

# Mapping and assessment of irrigation crop land using satellite imageries for the last decade in the GAP region, Turkey

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# My contributions

- Monitoring crop and orchard field in GAP region, Turkey using time-series satellite remote sensing imageries.
- Monitoring ground water table and salinity in Harran plain.
- Developing a land use and water use map in GAP, called GAPMAP.

# Objective in this presentation

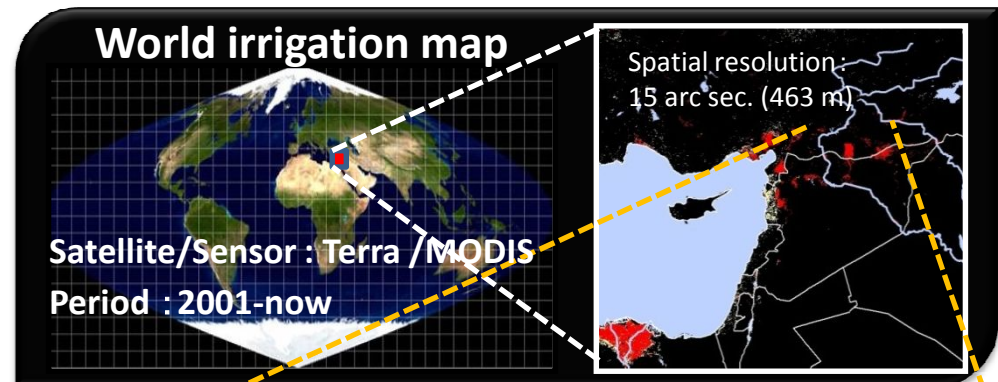
- **This presentation**

is focused on irrigated crop land in the GAP region to investigate changes in spatial distribution and cropping patterns on it in last decade, using WAIASS (World Atlas of Irrigation Agriculture for Sustainability Sciences).

# World Atlas of Irrigation Agriculture for Sustainability Science: WAIASS

## Outline of the WAIASS

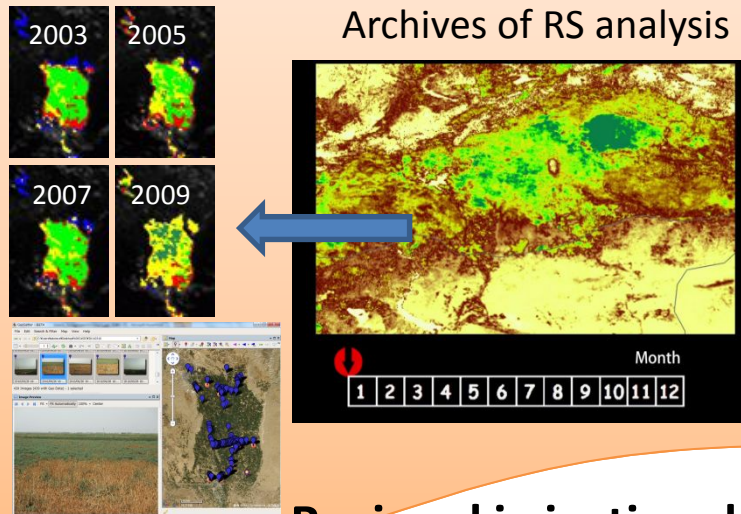
- ◆ WAIASS is an Atlas aiming at the comprehensive information resources concerning the irrigation agriculture and its water use/management in regions of the world.
- ◆ WAIASS is based on world irrigation map derived from time series satellite data.
- ◆ WAIASS is being developed with thanks to collaborator around the world. Turkey is the pilot region for developing it.



Spec of irrigation, water management and technology

Statistical data and cropping pattern

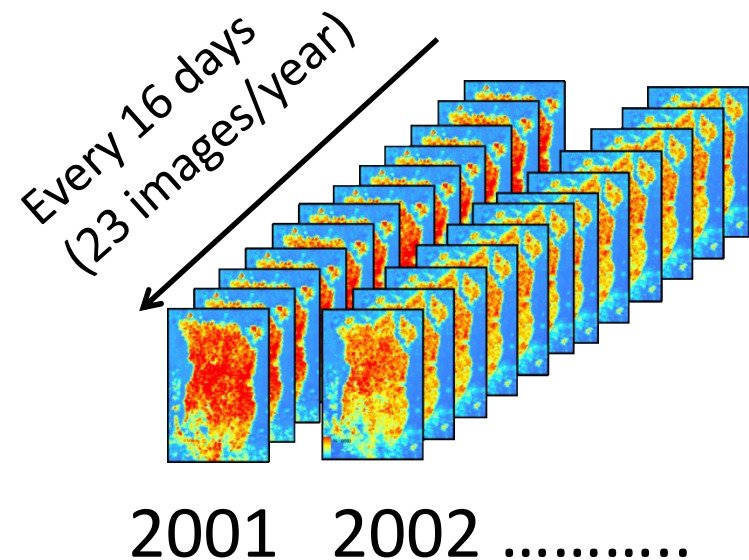
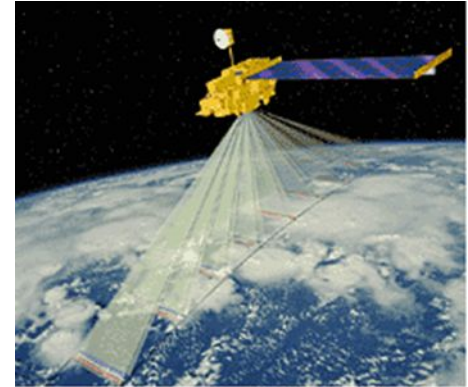
Archives of RS analysis



Regional irrigation data base

# Time-series satellite images

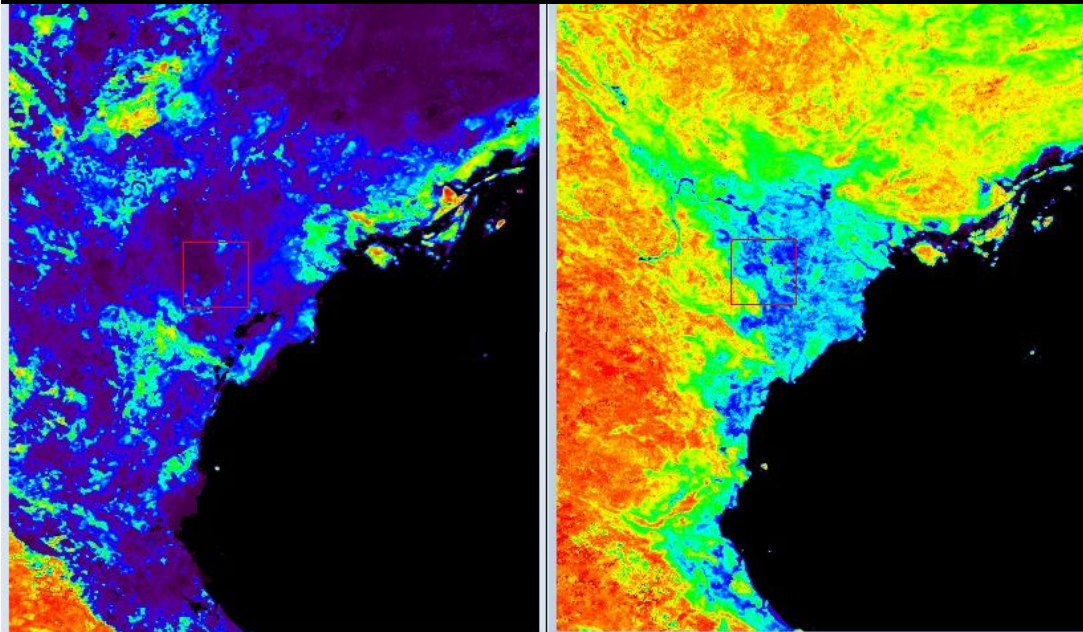
- **Satellite/Sensor**
  - Terra/MODIS
- **Time and spatial resolution**
  - 16 days composite (23 imaged/year)
  - 500 m X 500 m
- **Data period**
  - From 2001 up to now
- **Vegetation index**
  - EVI (Enhanced Vegetation Index)
- **Noise reduction**
  - (mainly occurred by cloudy condition)
  - HANTS algorithm



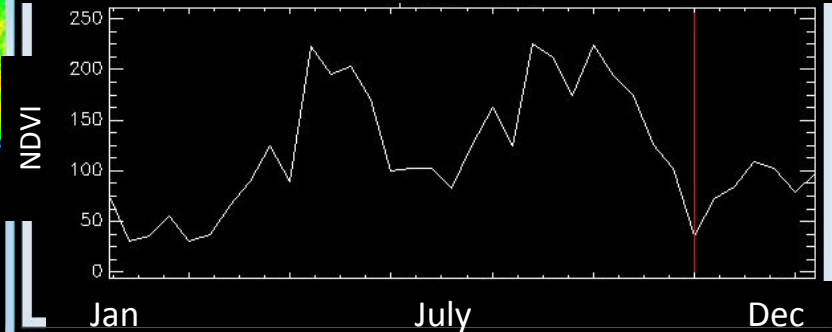
# Noise reduction

Original EVI

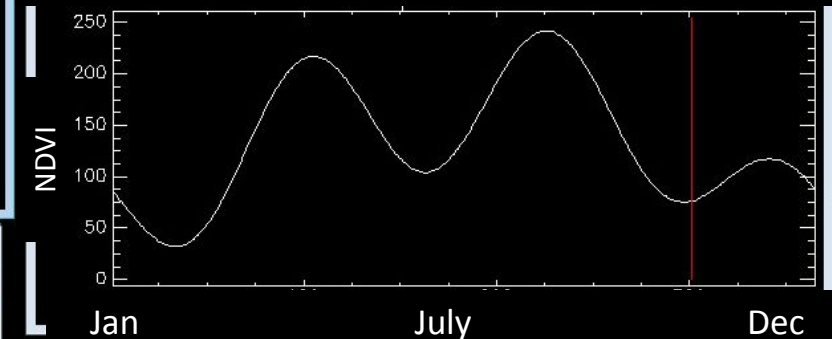
Denoised EVI



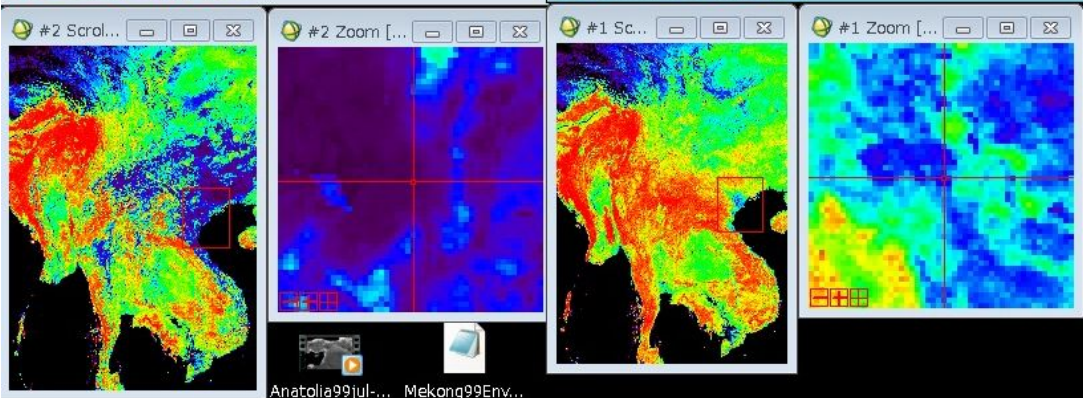
Original time-series EVI



Denoised time-series EVI

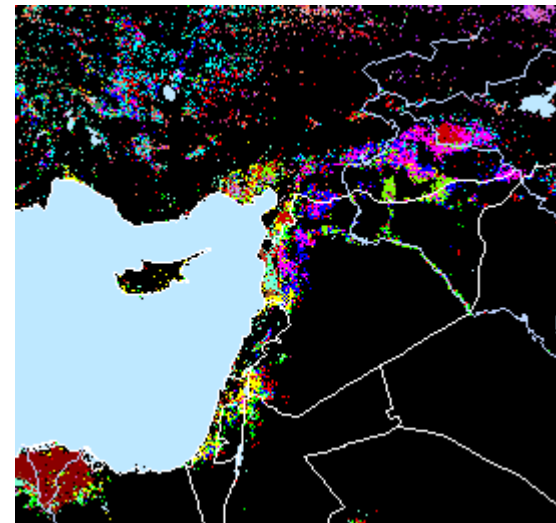
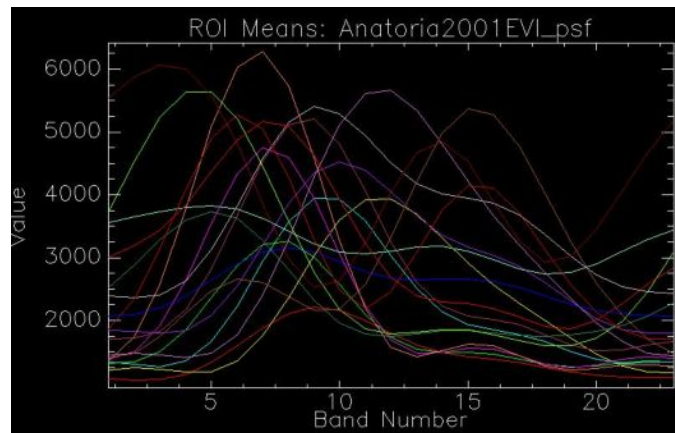


Denoised by HANTS algorism

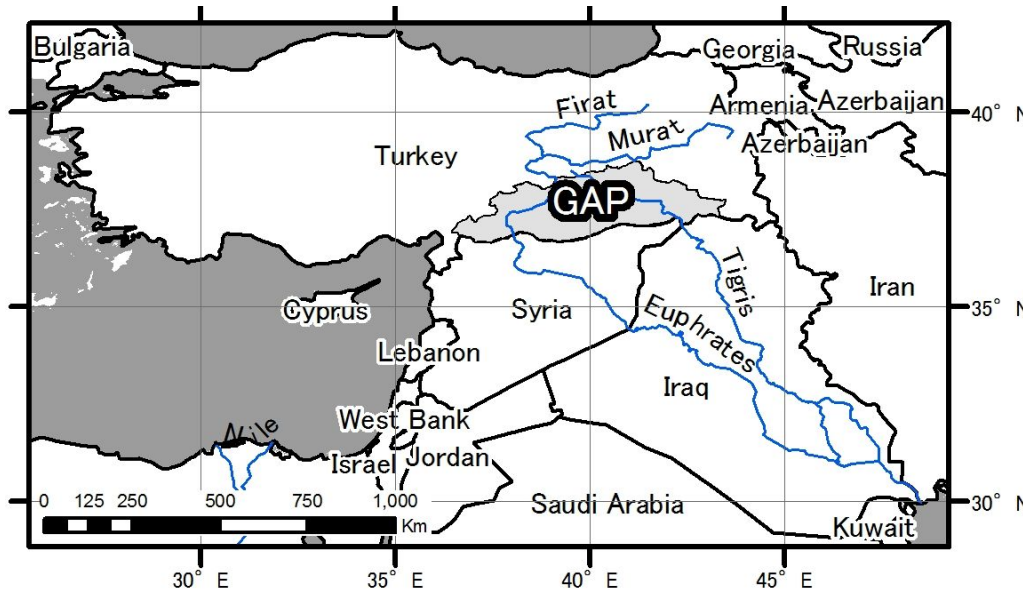


# Detection of irrigated area

1. Classification by phenology-pattern (time-series EVI)
  - GPU K-mean unsupervised classification method.
2. Extract candidate for the irrigated pixels by using threshold and decision tree.
  - In the case of GAP region, maximum vegetation during the summer season was used as threshold.
3. Return to #1.



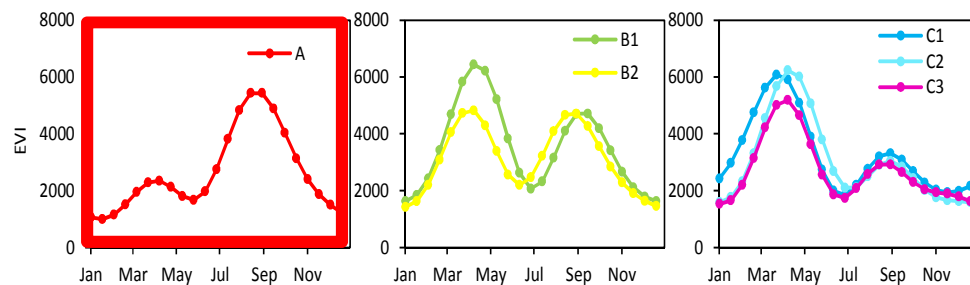
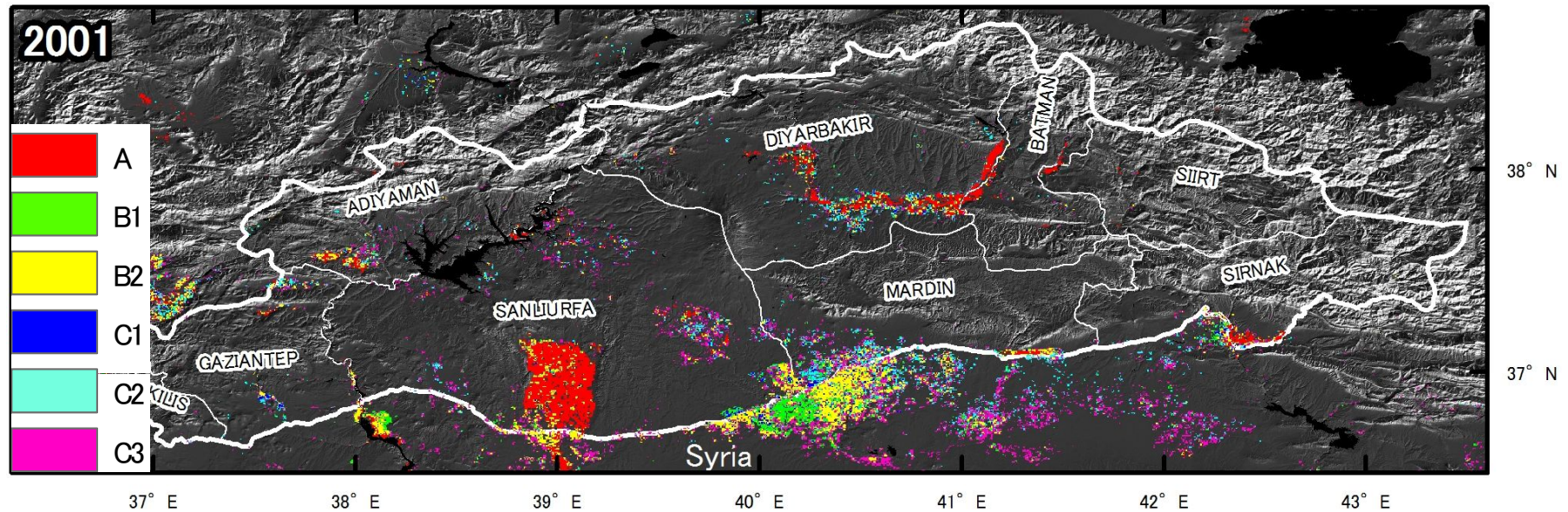
# Study area: GAP region



- GAP is Turkish acronym “The Southern Anatolia Project” placed at the upper Euphrates and Tigris river basin in southeastern Turkey.
  - Total area: 75,000 km<sup>2</sup>
  - Annual rainfall: 350 mm.
- 
- The water resources development program of the GAP have started since 1980’s including 22 dams, 19 hydropower plants, and irrigation networks.
  - Major cultivated crop:
    - winter-Spring (rain fed): Wheat
    - summer (irrigation) : Cotton, Maze and Vegetables. [movie](#)



# Irrigated area in 2001

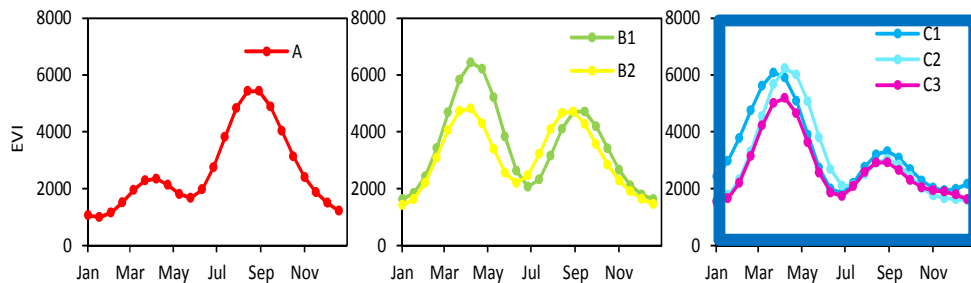
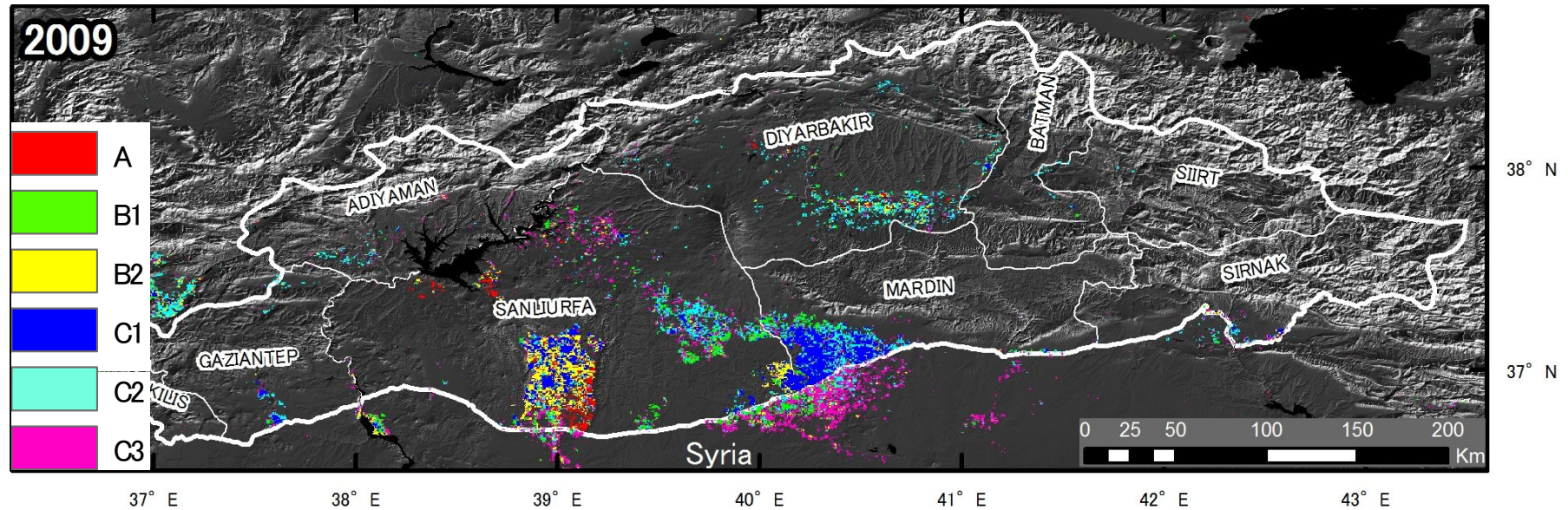


Estimated irrigated area: **254,000 ha**  
 Dominant phenology pattern: **A**

Typical phenology pattern in GAP:

**A:** Low vegetation in the winter rain-fed crop (mainly wheat) and high vegetation in the summer irrigation crop (mainly cotton) with earlier sowing time than the other cropping patterns. Low vegetation in the winter crop in phenology A might be caused by mixing of fallow fields.

# Irrigated area in 2009

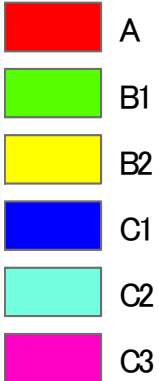
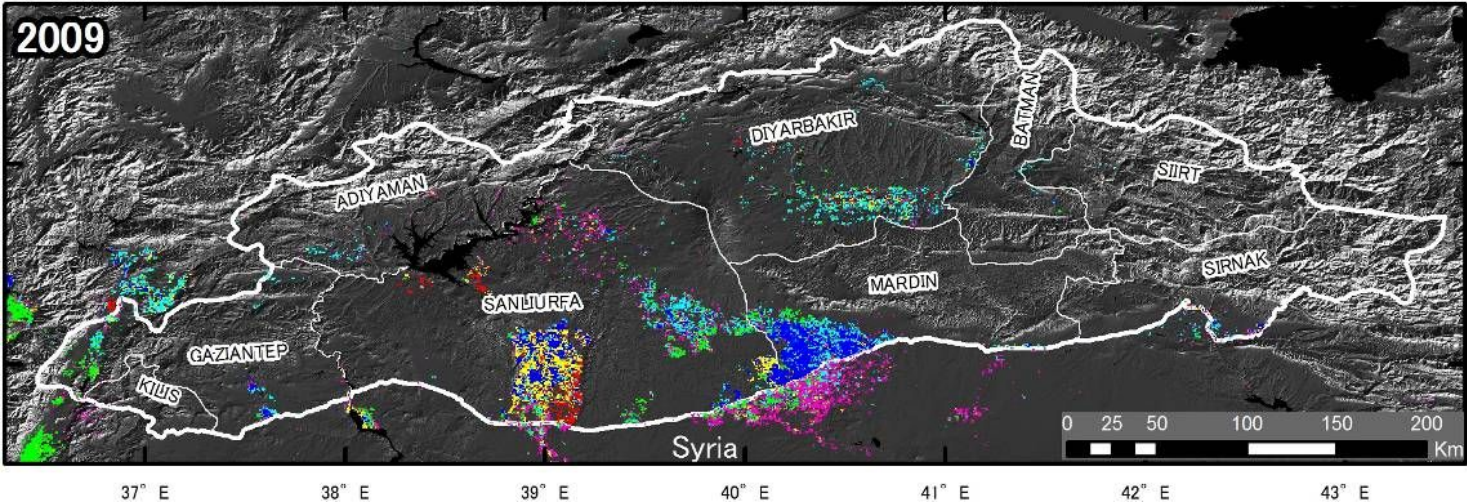
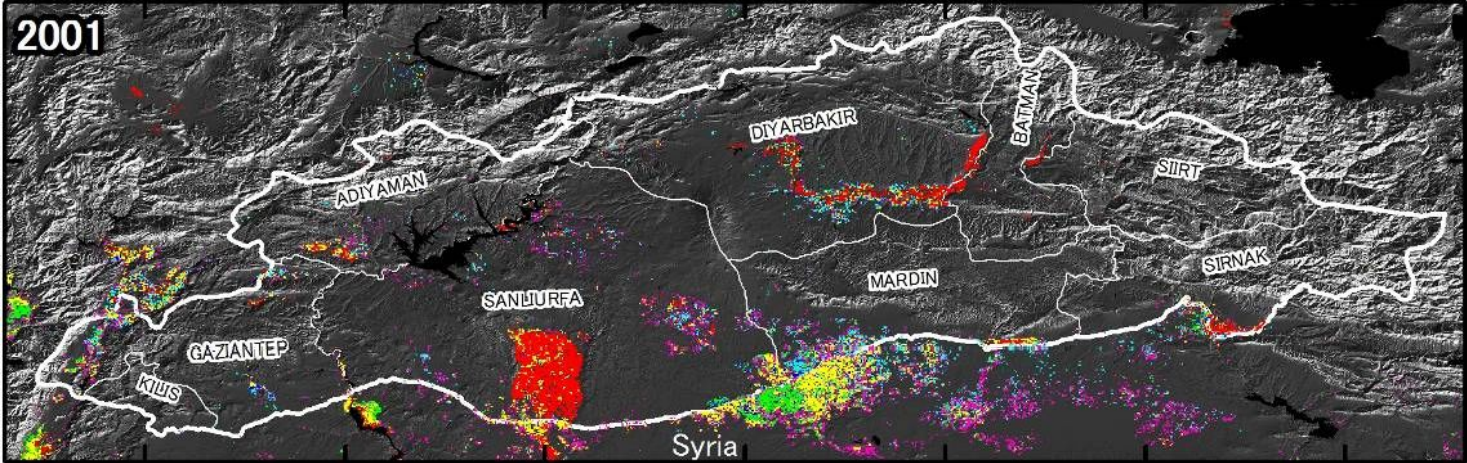


Estimated irrigated area: **278,000 ha**  
 Dominant phenology pattern: **C**

Typical phenology pattern in GAP:

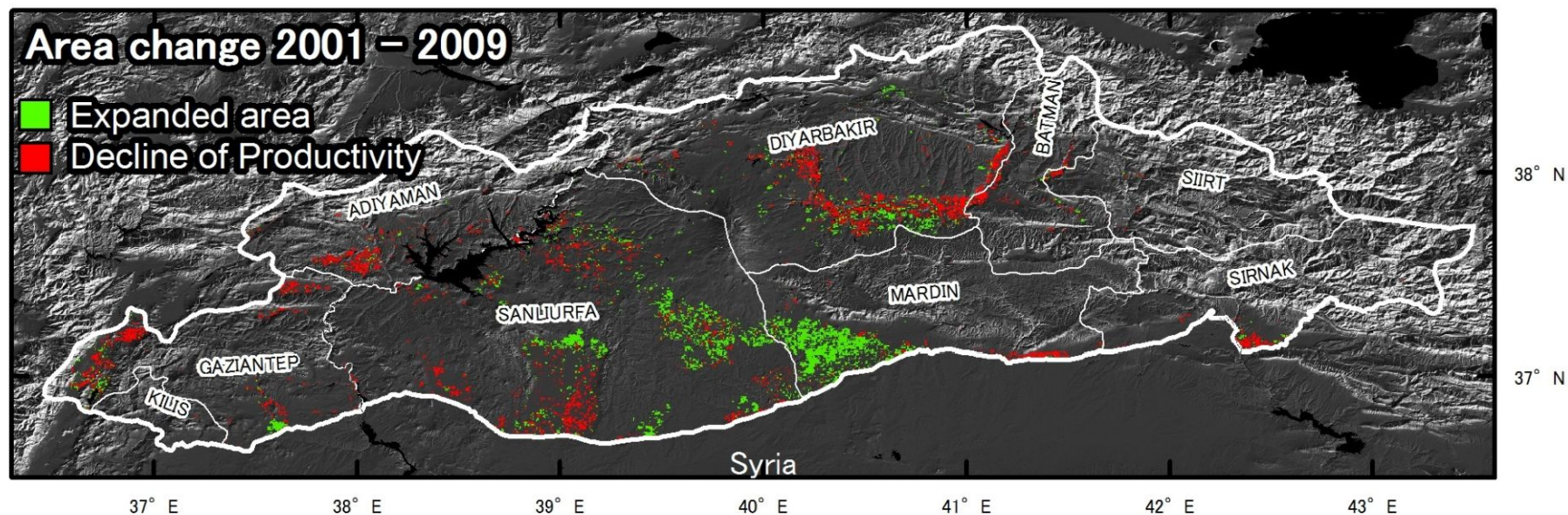
**C:** High vegetation in the winter rain fed crop and lower vegetation in the summer irrigation crop (mainly Maze and Vegetables). Concerning this lower vegetation pattern in the summer irrigation crop, it seems to come from a difference of crop plant type.

# Change detection of Irrigated area and cropping pattern 2001-2009



# Change detection

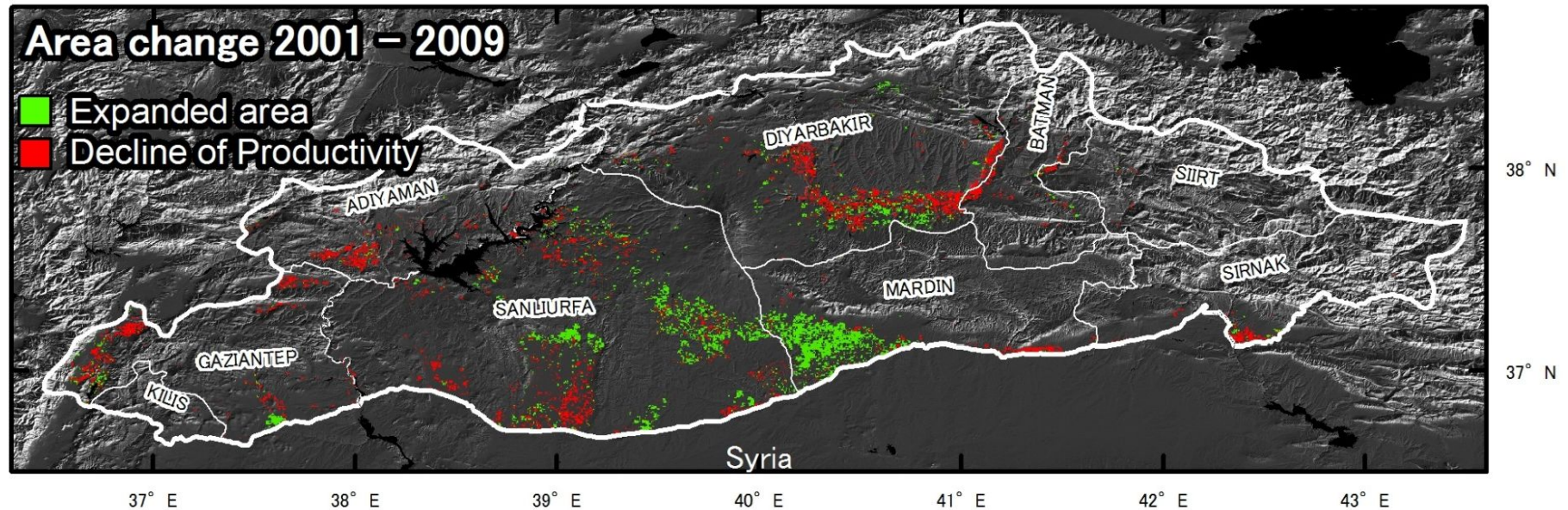
## Expansion of irrigated area



- **Green colored area** shows the irrigated area expanded from 2001 by 2009.
- Irrigation in Mardin where is the largest expanded area have been maintained by ground water. Surface water irrigation system in Mardin will be completed by 2015.

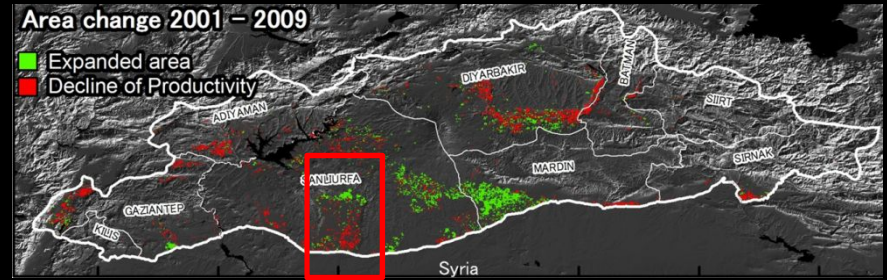
# Change detection

## Productivity decline in irrigated area

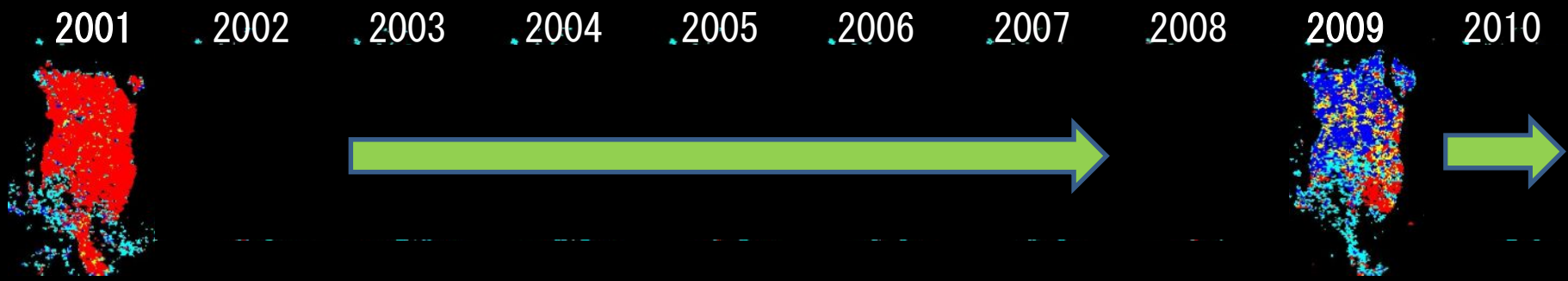


- **Red colored area** shows the area the maximum vegetation in the summer irrigation crop was intensely declined from 2001 by 2009.
- Possibly, these phenomena could be caused by problems in water supply, soil degradation with salinization, or land use change.

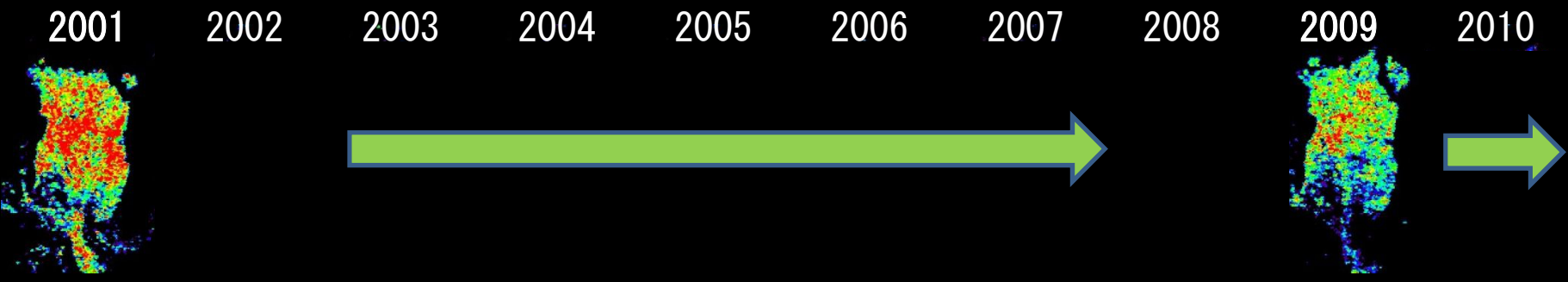
# What was going on in the Harran plain?



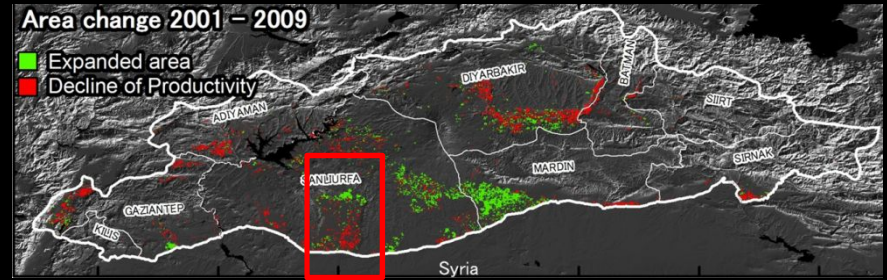
Change of cropping pattern



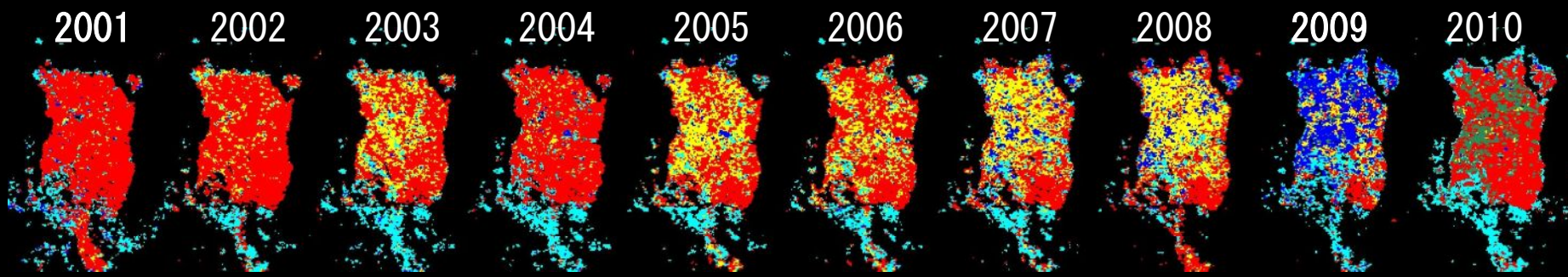
Maximum vegetation during irrigation (implicated in crop productivity)



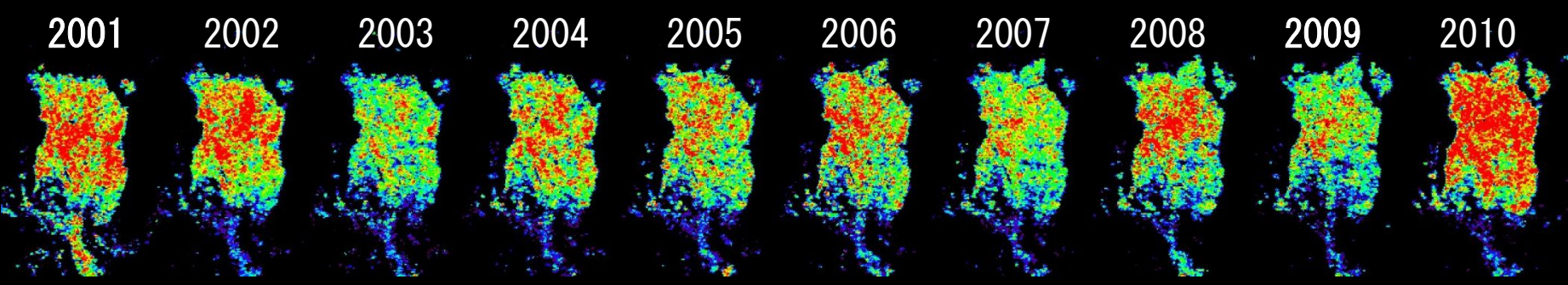
# What was going on in the Harran plain?

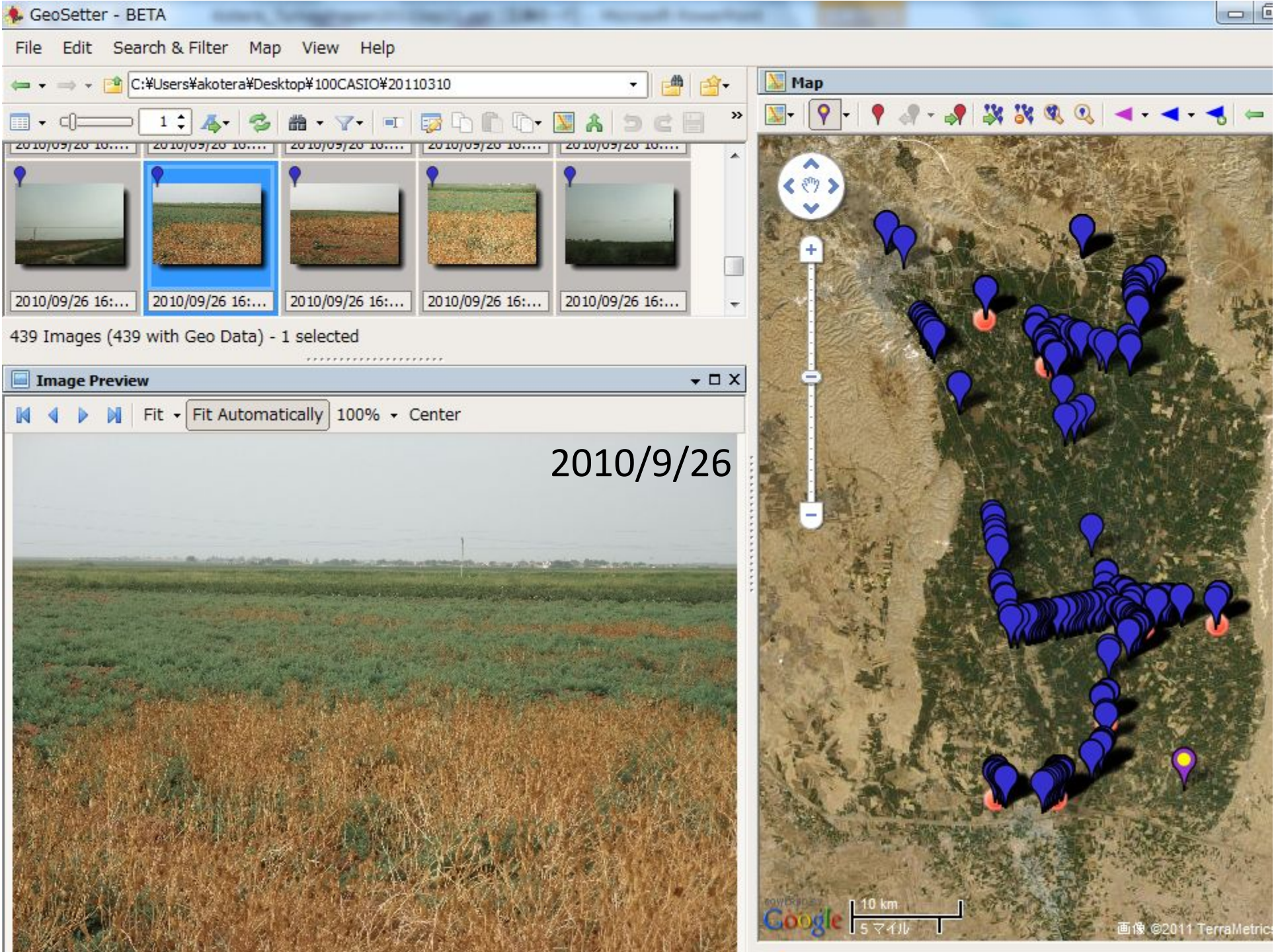


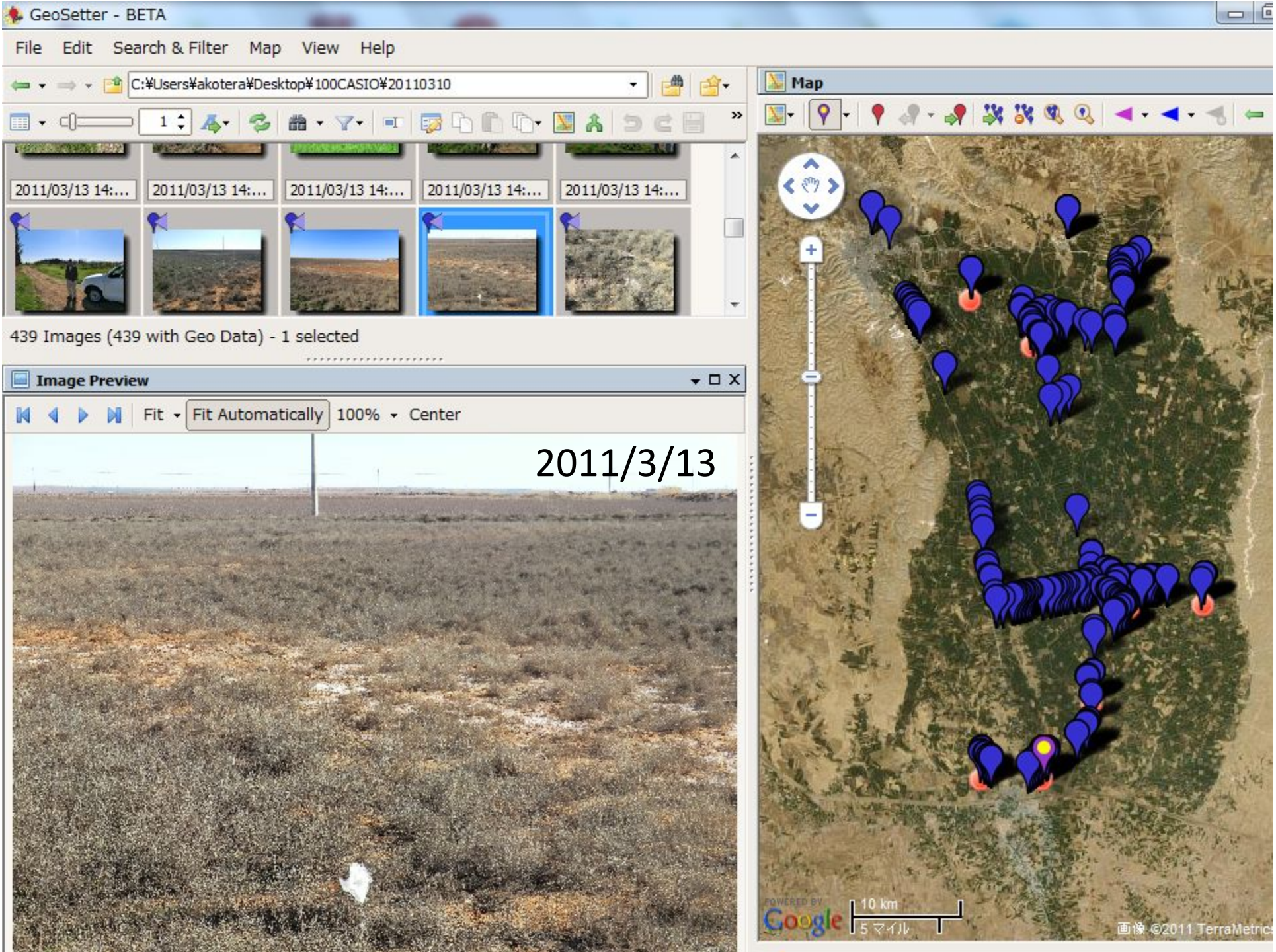
Change of cropping pattern

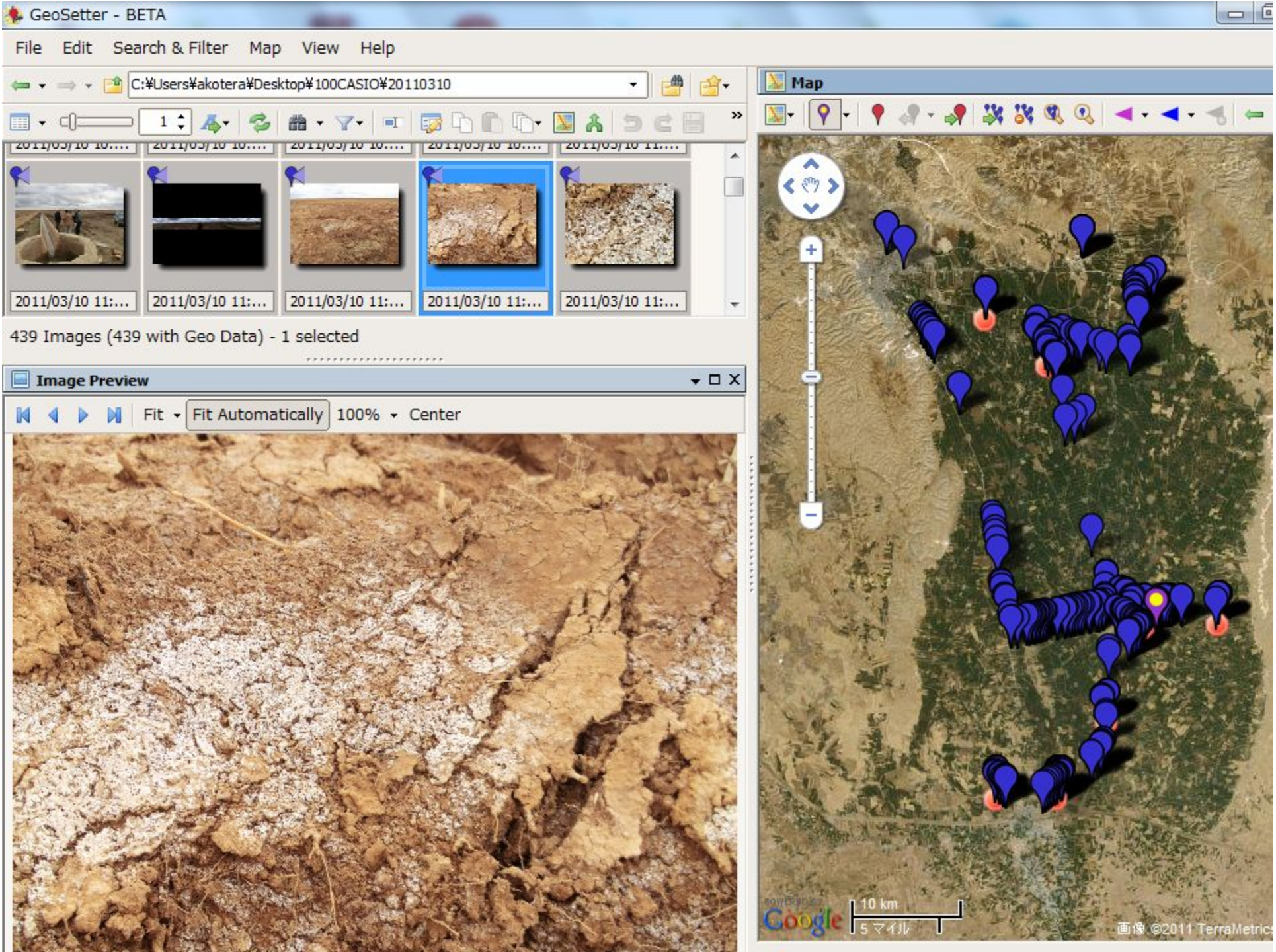


Maximum vegetation during irrigation (implicated in crop productivity)









GeoSetter

ファイル 画像 検索&抽出 地図 表示 ヘルプ

プレビュー画面

表示形式 表示サイズ自動調整 倍率 センタリング

C:\Users\koter\Desktop\Obs\_well\_Harran

data2011mar	data2011sep	D11a.JPG	D11b.JPG	D19a.JPG	D19b.JPG	D44a.JPG
D44b.JPG	D46a.JPG	D46b.JPG	D47a.JPG	D47b.JPG	D48a.JPG	D48b.JPG
D55a.JPG	D55b.JPG	D156a.JPG	D156b.JPG			

地図画面

Observation point for ground water monitoring (water level and salinity) using data logger

アクチャカレ

5 km  
2 マイル

# Conclusion

- Through the analysis using WAIASS (World Atlas of Irrigation Agriculture for Sustainability Sciences) in this study, changes in spatial distribution of irrigated area and cropping patterns in the GAP region from 2001 by 2009 were observed.
- These changes may suggest that there were considerable changes in water use and management in this region.
- The maps pointed out places of interest where we should go for an intensive survey for the land and water management.
- WAIASS is ready for collaborating in your study field.