

# Agricultural Classification of Multi-Temporal MODIS Imagery in Northwest Argentina Using Kansas Crop Phenologies

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background.pdf

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# RESEARCH QUESTIONS

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- ▶ develop a phenological classification toolset?

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- ▶ extract crop signatures from Kansas data?
- ▶ classify an Argentina study area with the Kansas signatures?

# OUTLINE

1. Background
2. Study Areas
3. Data and Methods
4. Results and Discussion
5. Concluding Remarks

BACKGROUND

# DEFORESTATION IN ARGENTINA

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# DEFORESTATION IN ARGENTINA

- ▶ 1998 to 2002: 940,000 ha deforested
- ▶ *Ley de Bosques* passed in 2007
  - ▶ Classified red, yellow, and green areas

## DEFORESTATION IN ARGENTINA

**Table:** Deforestation in Argentina, 2006 to 2011

<b>Time Period</b>	<b>Hectares Deforested</b>
2006 to <i>Ley de Bosques</i> (2007)	573,296
<i>Ley de Bosques</i> to OTBN (2009)	473,001
OTBN to 2011	459,108
<b>Total</b>	1,505,405

# DEFORESTATION IN ARGENTINA

- ▶ Deforestation has remained extremely high
- ▶ The effect of the the *Ley de Bosques* has been questioned

## SOY AND ITS EFFECTS

- ▶ Argentina's soybean cultivation has continually increased
  - ▶ 5 million ha in 1993 to 19 million ha in 2011

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- ▶ **Capital requirements cut out small producers**

## SOY AND ITS EFFECTS

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- ▶ Prevailing perception that soy drives deforestation
- ▶ Deforestation research has neglected to analyze specific crop cover

# GOAL 1

## Goal

Develop a crop mapping toolset which is efficient and economical

# GOAL 1

Why?

- ▶ Better understanding of the dynamics of deforestation

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- ▶ Better understanding of the dynamics of deforestation
- ▶ More effective land management policies

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## Problem

Must be able to classify crops by type

- ▶ A Vegetation Index (VI) can help with crop identification
  - ▶ Normalized Difference Vegetation Index (NDVI)
  - ▶ Enhanced Vegetation Index (EVI)

# VEGETATION INDICIES

NDVI

$$NDVI = \frac{\rho_{NIR} - \rho_{red}}{\rho_{NIR} + \rho_{red}}$$

# VEGETATION INDICIES

Thus, NDVI

- ▶ is a ratioing index

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Thus, NDVI

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- ▶ minimizes multiplicative noise

# VEGETATION INDICIES

Thus, NDVI

- ▶ is a ratioing index
- ▶ minimizes multiplicative noise
- ▶ has issues with non-linearity and additive noise

# VEGETATION INDICIES

EVI

$$EVI = G \frac{\rho_{NIR} - \rho_{red}}{\rho_{NIR} + C_1 \times \rho_{red} - C_2 \times \rho_{blue} + L}$$

# VEGETATION INDICIES

## MODIS EVI

$$EVI = 2.5 \frac{\rho_{NIR} - \rho_{red}}{\rho_{NIR} + 6.0 \times \rho_{red} - 7.5 \times \rho_{blue} + 1.0}$$

# VEGETATION INDICIES

With EVI

- ▶ input bands require atmospheric correction



# VEGETATION INDICIES

With EVI

- ▶ input bands require atmospheric correction
- ▶ no saturate in high biomass

## VEGETATION INDICIES

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2. How to determine the VI values of a crop in an image?

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What if two crops have similar VI values on a single date?

- ▶ Use imagery from multiple dates to maximize the number of pixels that can be clearly classified.

# PHENOLOGICAL CLASSIFICATION

Graphics/wardlowCropSignatures.png

(From Wardlow and Egbert 2005)

# PHENOLOGICAL CLASSIFICATION

How to determine the VI values of a crop in an image?



# PHENOLOGICAL CLASSIFICATION

How to determine the VI values of a crop in an image?

- ▶ Traditional approaches all require training sites.

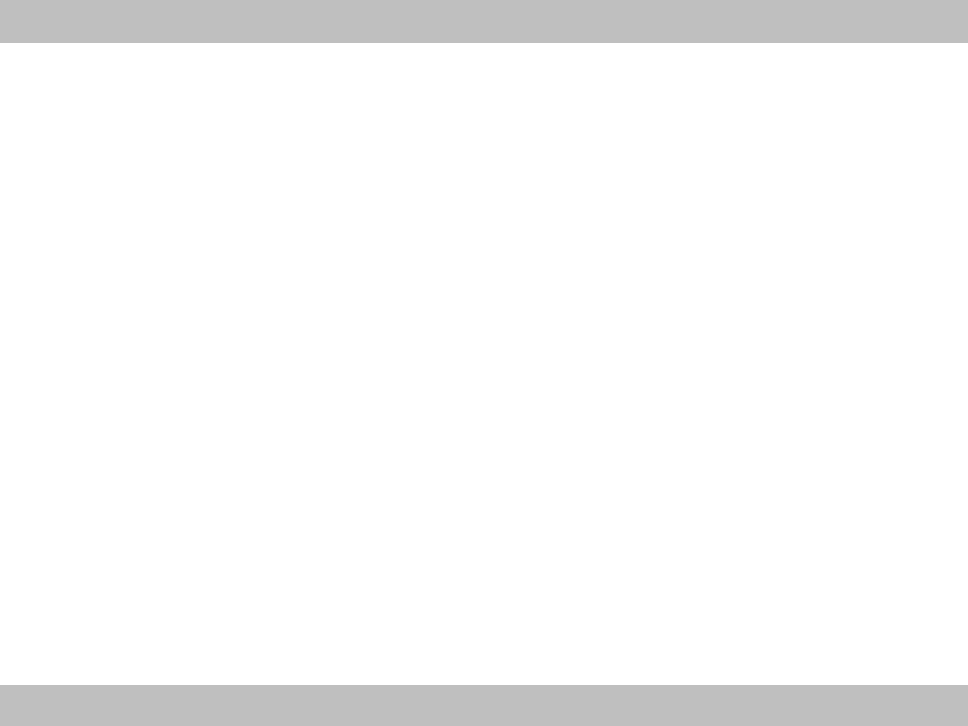
# PHENOLOGICAL CLASSIFICATION

How to determine the VI values of a crop in an image?

- ▶ Traditional approaches all require training sites.

**But what if you don't have training sites?**

# STUDY AREAS



# DEPARTMENT OF PELLEGRINI

# DATA AND METHODS

## RESULTS AND DISCUSSION

## CONCLUDING REMARKS