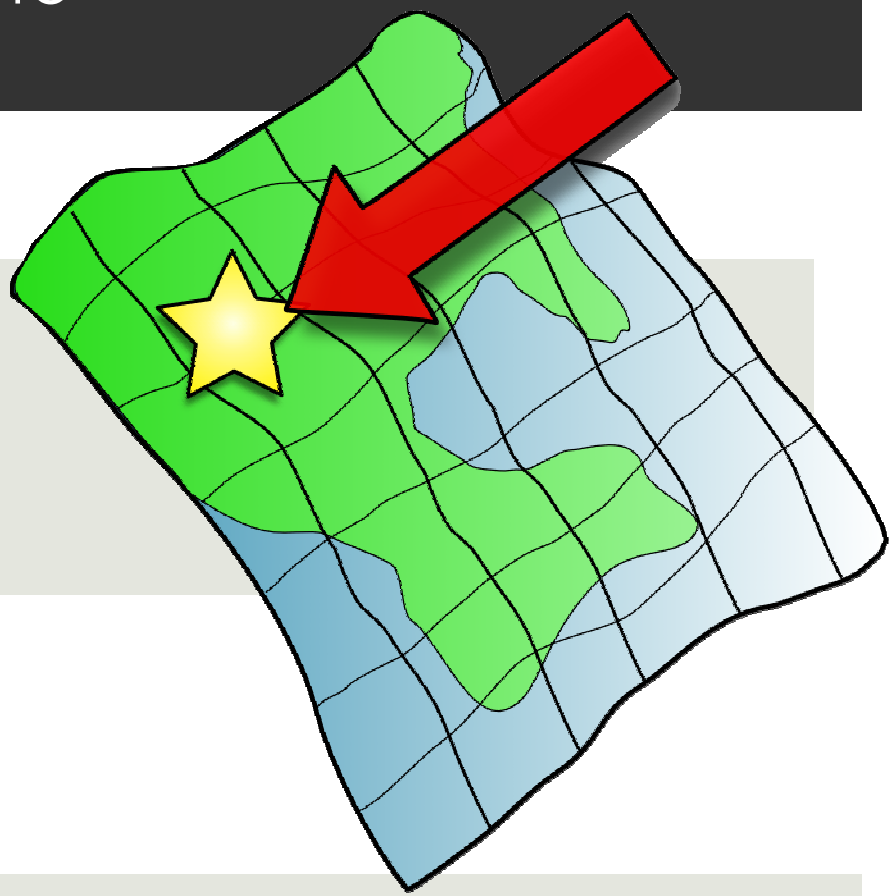
GIS technology related to rice production



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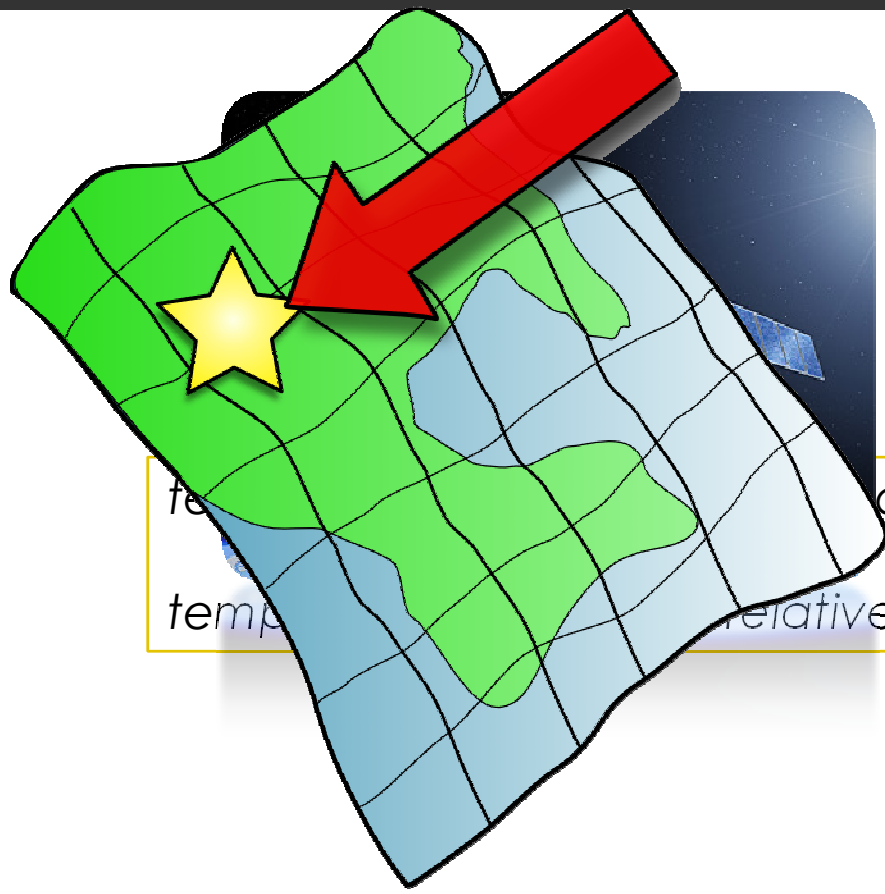
Outline

- Tools
- GIS
- Remote sensing
- Crop Health Modelling
- Conclusions

What tools do we use?



- GIS
- Satellite technologies (remote sensing)
- Modelling

te *on = crop growth*

temp *elative humidity = crop disease*

Remote sensing

Remote sensing

- What do we want to know?

A combination of remote sensing and crop modelling can provide this information *under some situations*

information on rice production and supplies.

- When will it be harvested?
- What is the yield?

How it works

Stage 1

Satellite data is processed with remote sensing software to estimate the extent and planting/harvesting dates of rice growing areas

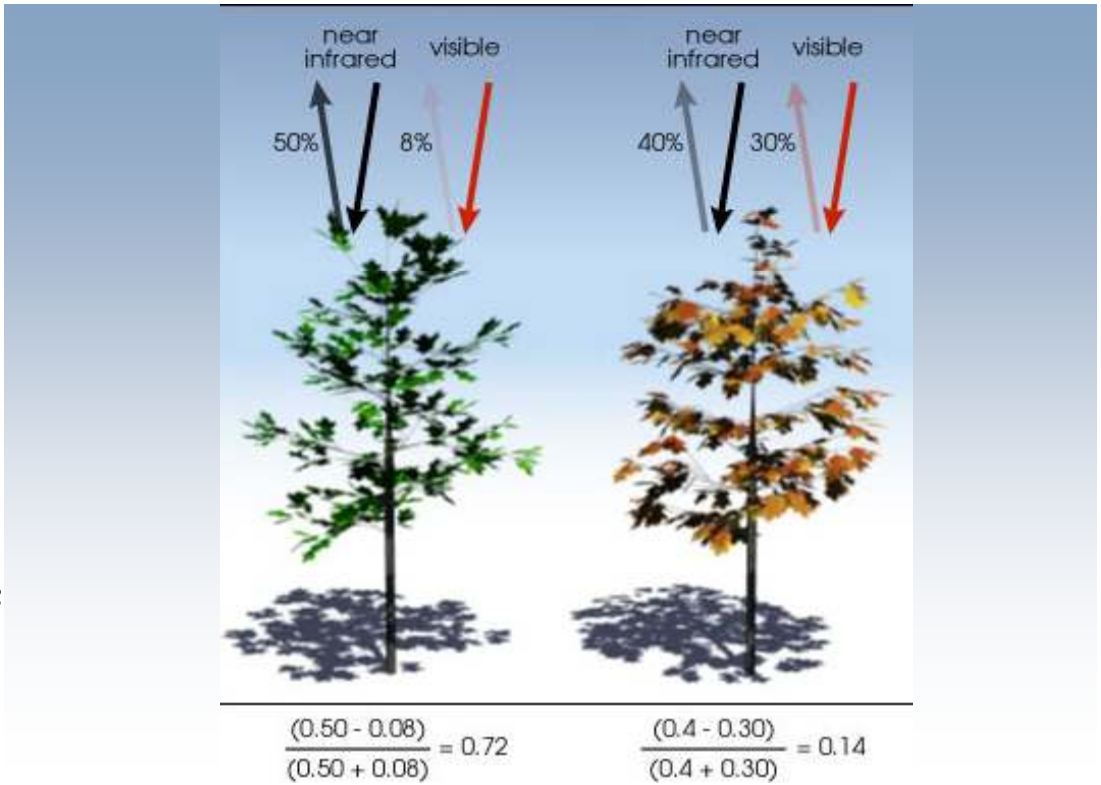
Stage 2

A crop growth model is used to estimate the yield using information on planting dates, climate, rice variety, soil and water management

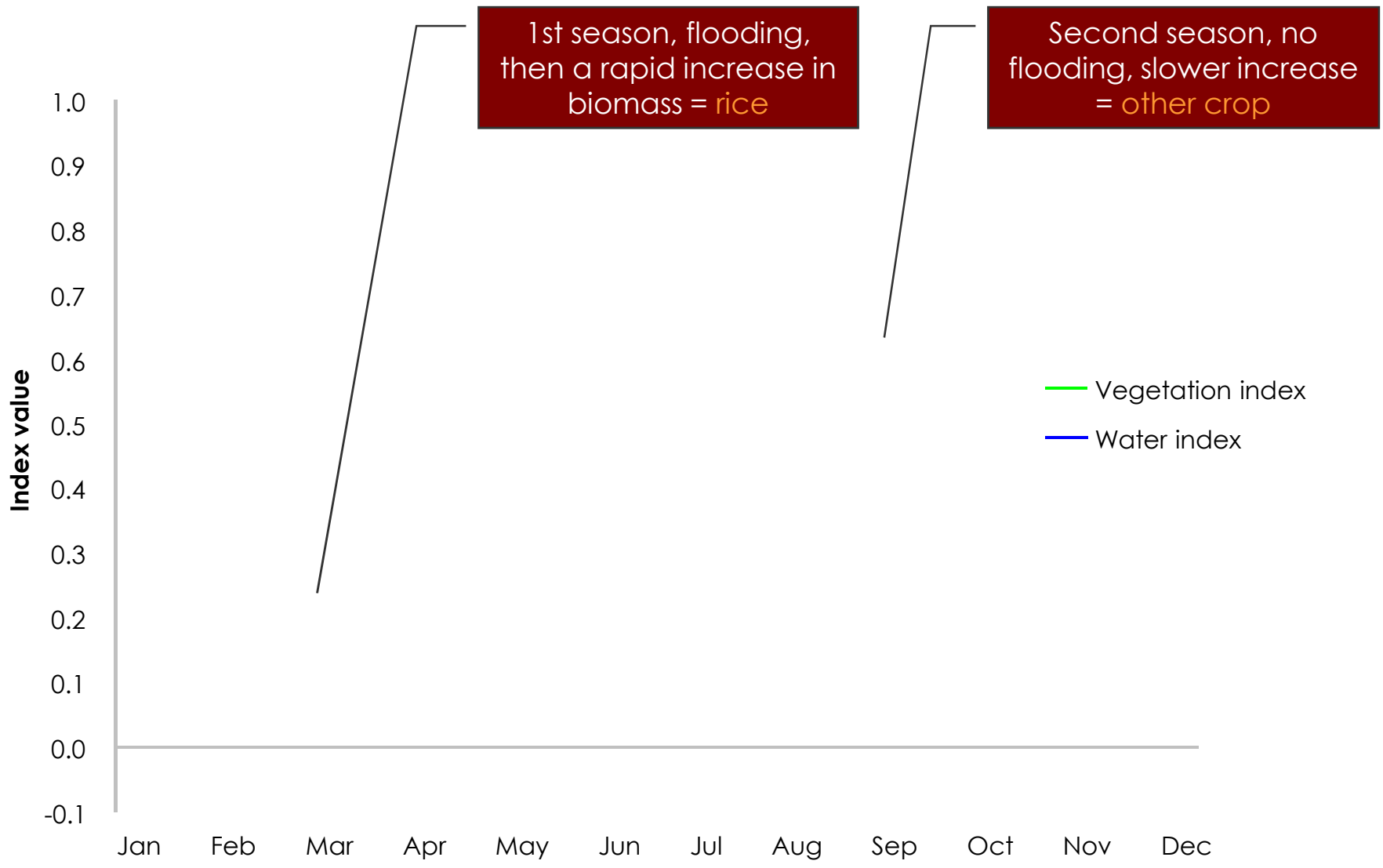
I will focus on the remote sensing aspect

Optical remote sensing

- Spectral reflectance is *a measure of the sun's energy that is reflected back into space*
- this is detected by satellite sensors at various wavelengths across the visible and infrared parts of the spectrum.



Detecting rice from remote sensing



paddy rice detection heuristic derived from Xiao *et al.* (2005)

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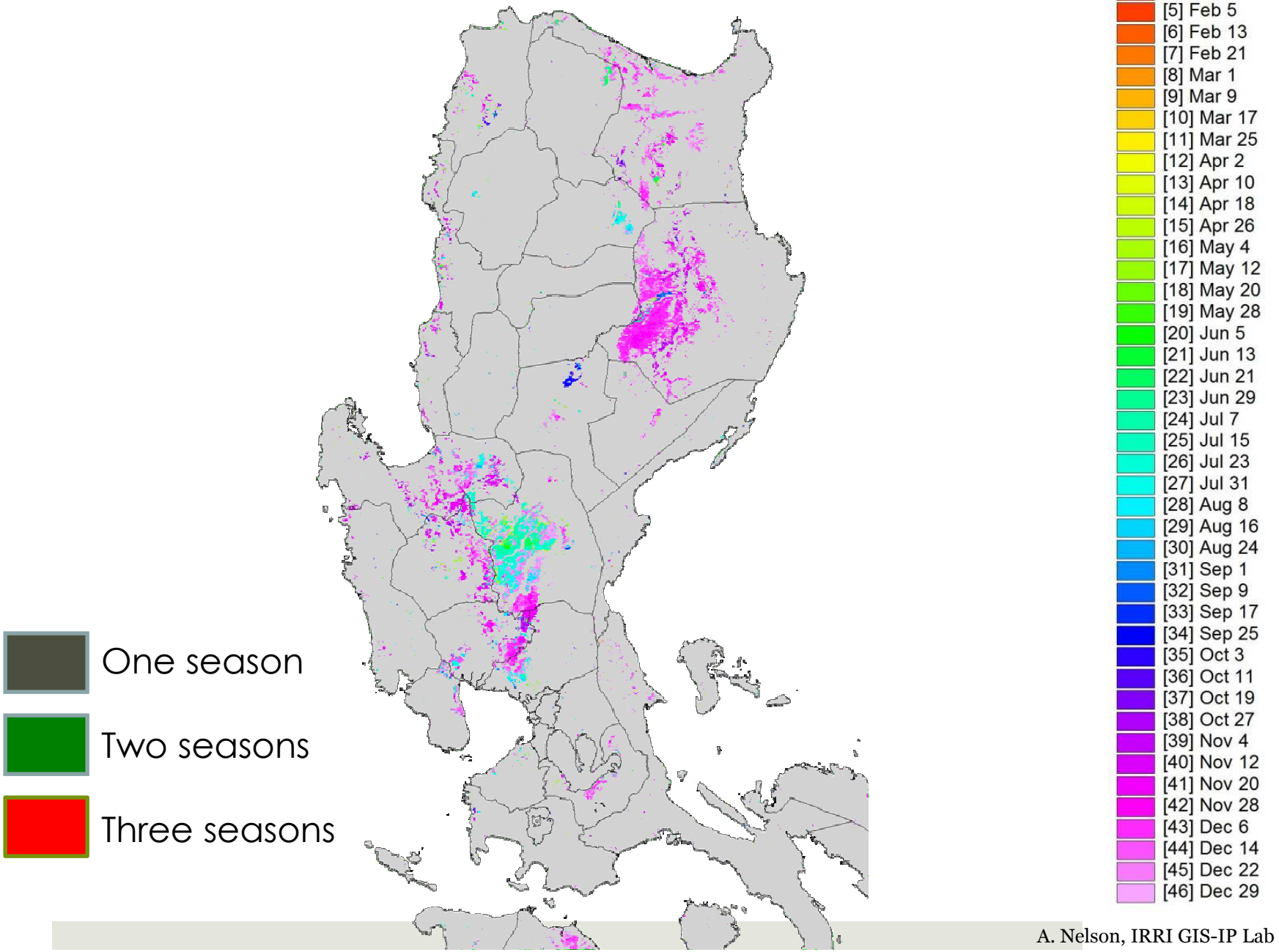
Luzon: Rice extent and planting date



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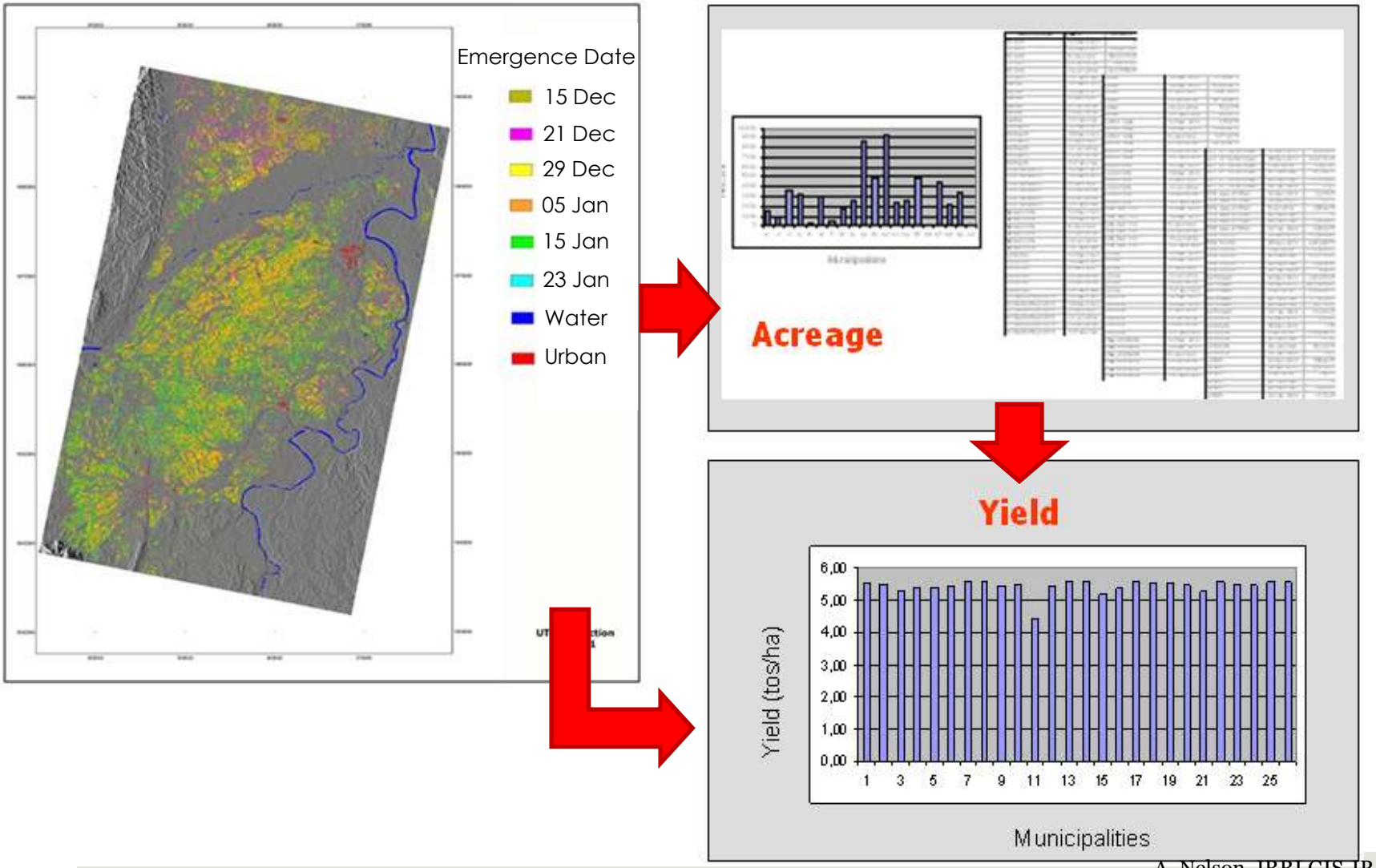
Once the area and planting dates are known, we can use crop models to estimate yield and production at high spatial detail



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Anticipated outputs of a remote sensing/crop modeling approach:

- accurate rice area and planting/harvesting dates for each season,
- estimates of yields under rainfed and irrigated conditions,
- estimates of production at municipal level and smaller units

If this information can be produced in a timely manner then it can feed into crop production estimates, supply forecasts and crop insurance business models.

Crop health modelling

Modelling

What do we want to know?

A combination of remote sensing and disease, pest and stress modelling can provide this information
under some situations

production?

- Insect

EPIRICE

- Generic model for 5 rice diseases
- Linked with GIS (Savary et al. 2012)
- Maps of *potential* epidemics

Prioritization

Exploration

Savary et al. 2012. Crop Protection. 34:6-17

EPIRICE

Five diseases:

- Brown spot
- Leaf blast
- Bacterial blight
- Sheath blight
- Rice tungro

Developed as a general model framework to address rice (any plant) disease.

Savary et al. 2012. Crop Protection. 34:6-17

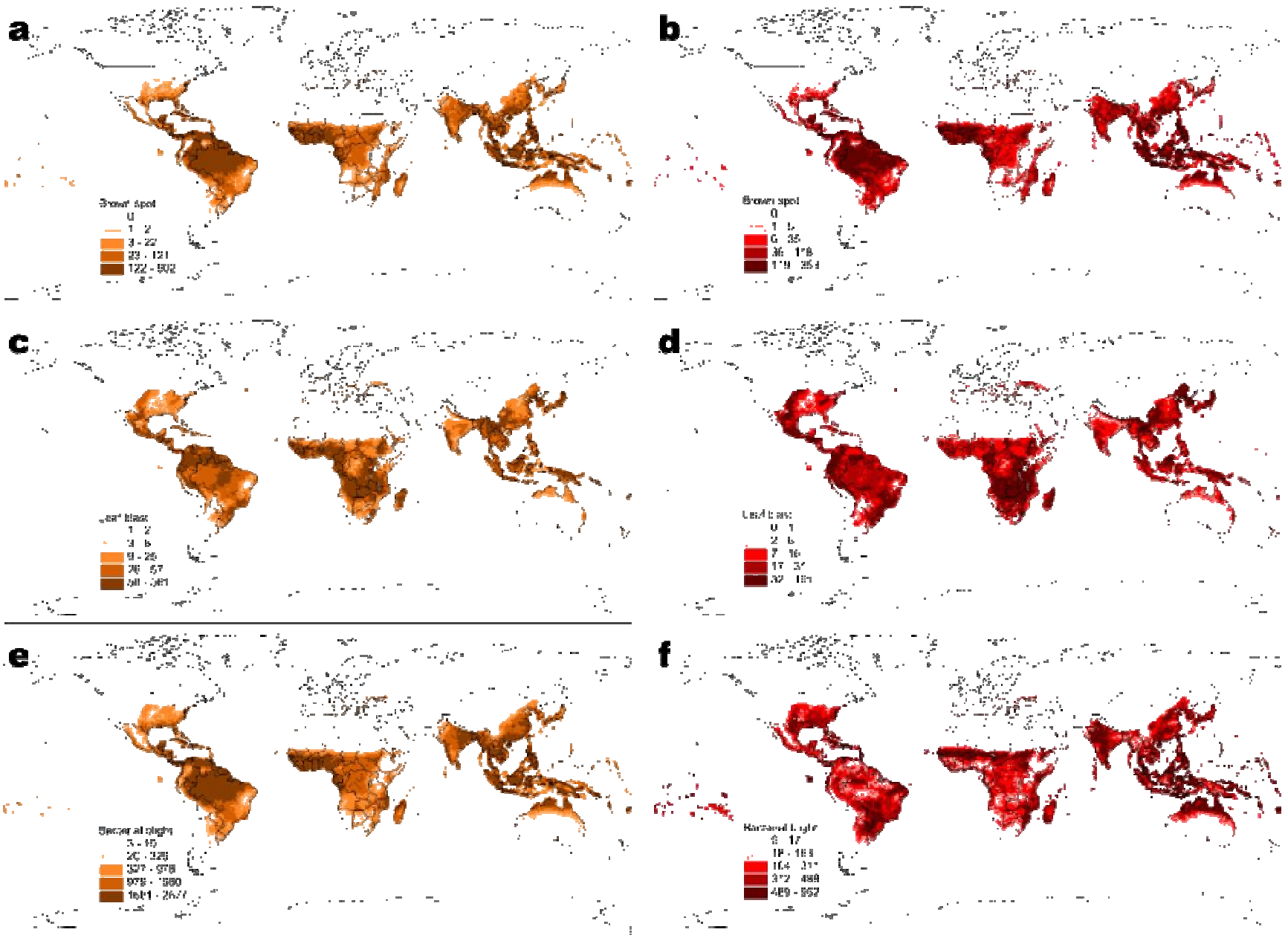
EPIRICE

- crop establishment date
- NASA/POWER
  - precipitation
  - tmean
  - tmin
  - tmax
  - RH
  - tdew
  - rad
  - wind speed

12 years of climate data results were used to generate mean and standard deviation of AUDPC (overall potential disease intensity).

These values were used to generate maps of potential disease intensity.

Savary et al. 2012. Crop Protection. 34:6-17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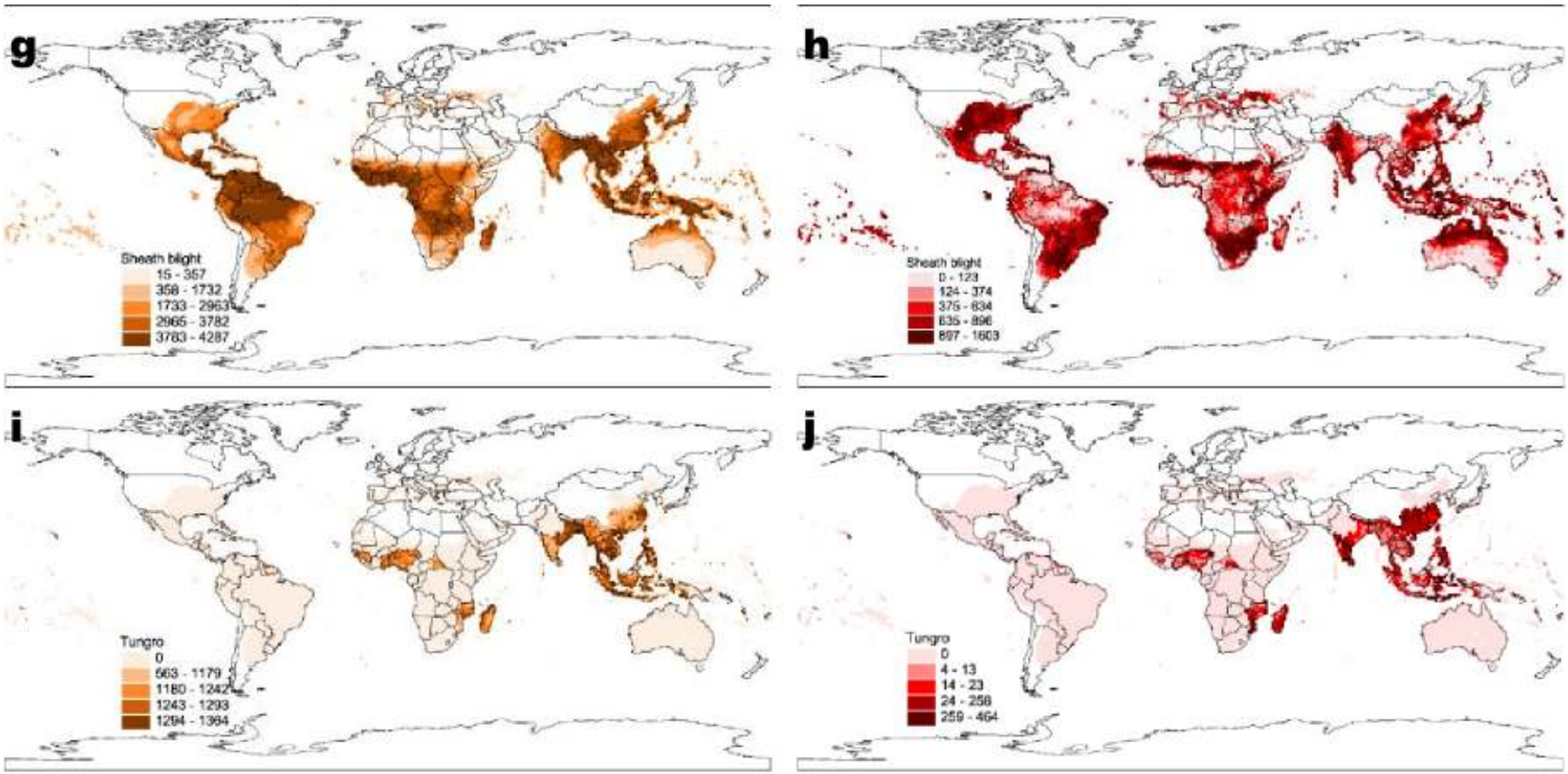


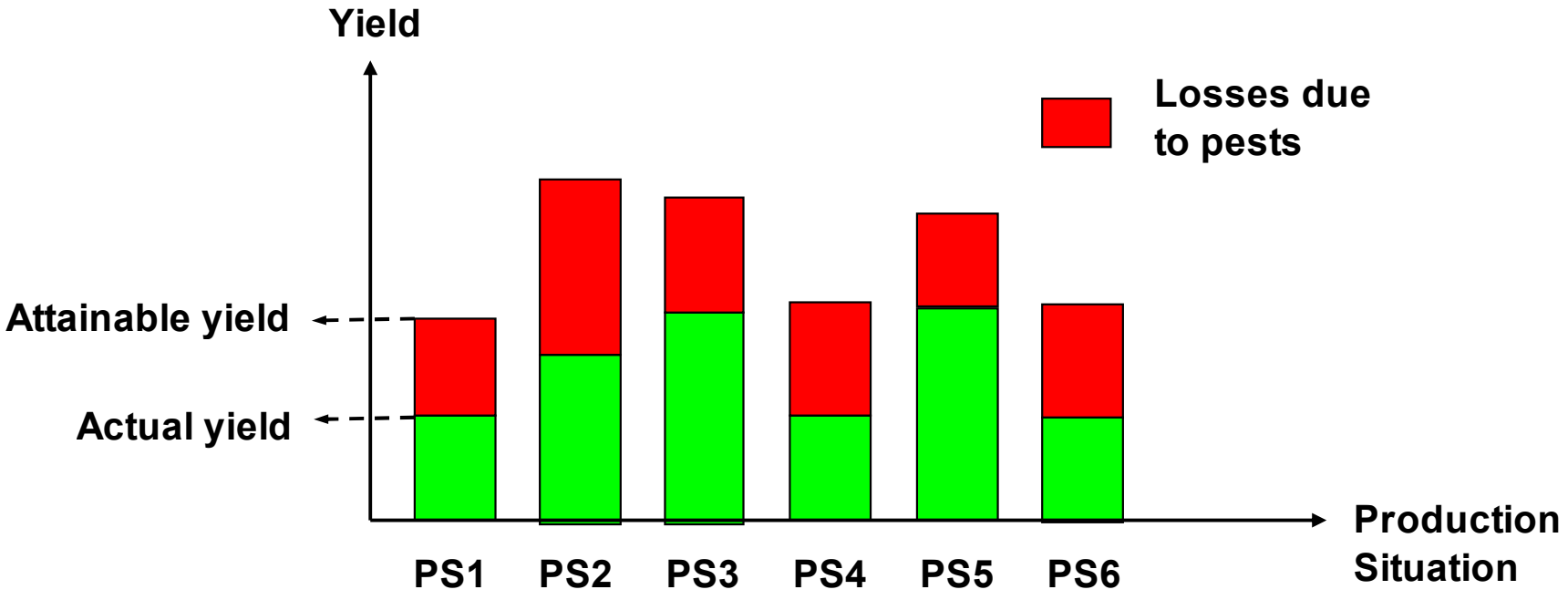
Savary et al. 2012. Crop Protection. 34:6-17

RICEPEST

- A flexible, multiple-pest, production situation specific rice yield-loss model
  - Willocquet et al. 2002
- Bacterial leaf blight
- Sheath blight
- Brown spot
- Leaf blast
- Neck blast
- Sheath rot
- Brown plant hoppers
- Insect defoliators
- Weeds

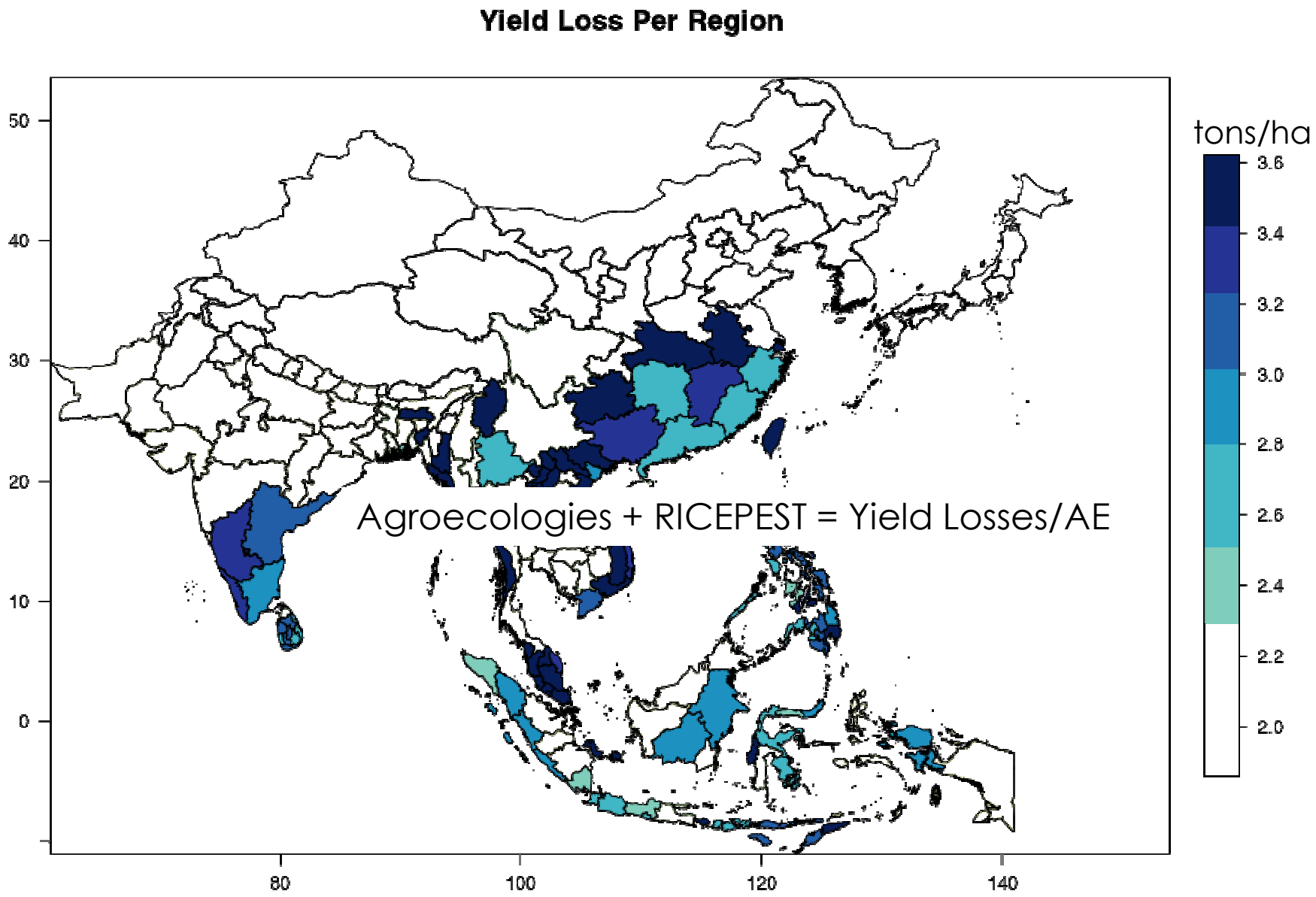
Willocquet et al. 2000. Ecological Modelling 131:133-59

Relationships between production situation, attainable yield, actual yield, and yield losses



Agroecologies

Agroecology code	Description
1 - IR	Single season, irrigated rice, no other crop
2 - IR / other	Double season, irrigated rice / irrigated other crop
3 - IR / IR	Double season, irrigated rice / irrigated rice OR Triple season, irrigated rice / irrigated rice / irrigated rice
4 - IR / IR / other	Triple season, irrigated rice / irrigated rice / irrigated other
5 - RF	Single season, rainfed rice, no other crop
6 - RF / RF	Double season, rainfed rice / rainfed rice
7 - RF / RF other	Double season, rainfed rice / rainfed other
8 - RF Dry/Upland	Single season, rainfed rice, not bunded



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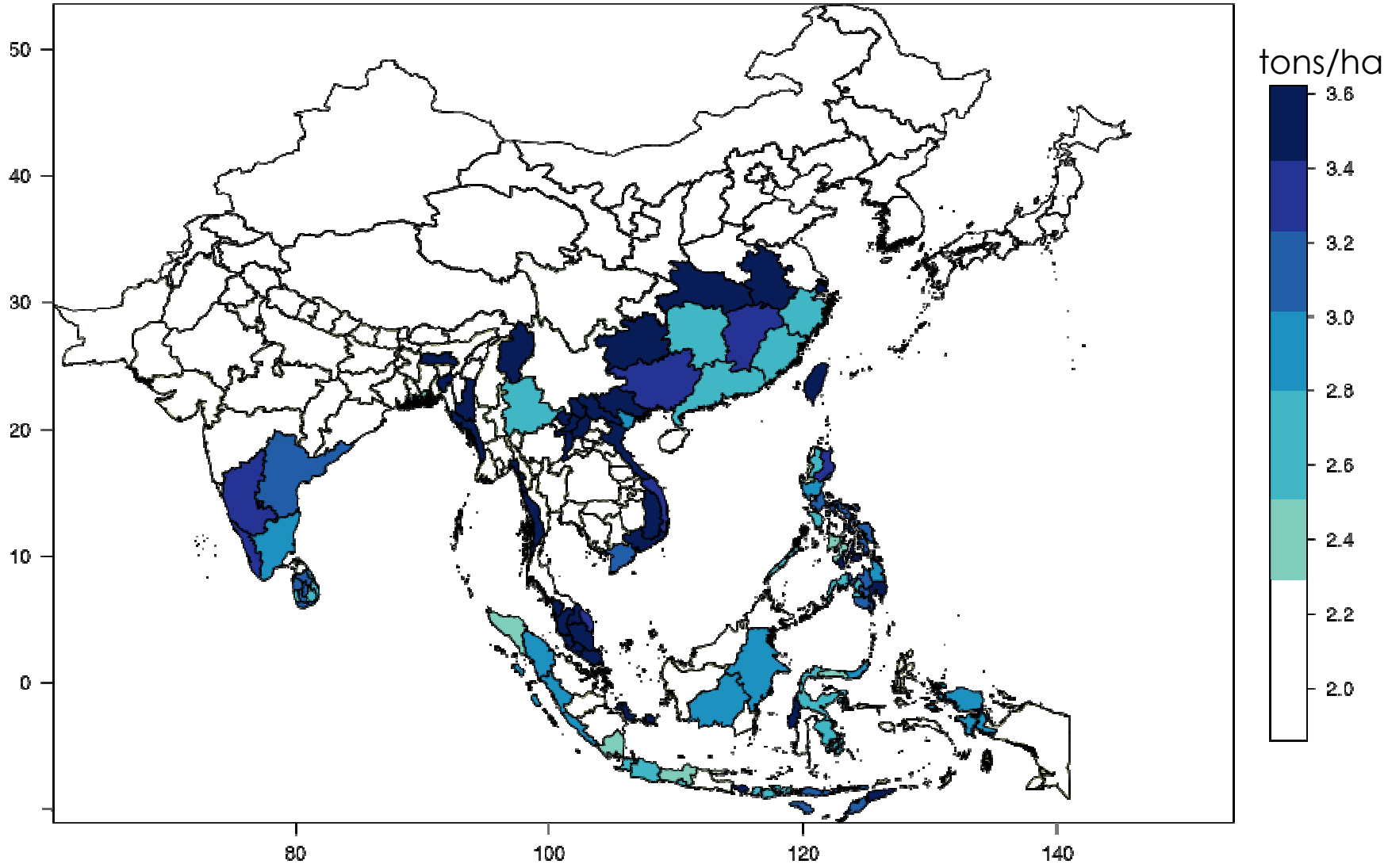
RICEPEST: Future

- tmin
- tmax
- rad
- planting date
- Agroecologies (PS)

NASA/POWER satellite derived data

Agroecology area/region

Yield Loss Per Region



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Conclusions

Conclusions

- Powerful tools
- More to come

Location-specific,
Near real-time maps e
of production
estimates.

Enhanced resolution
maps

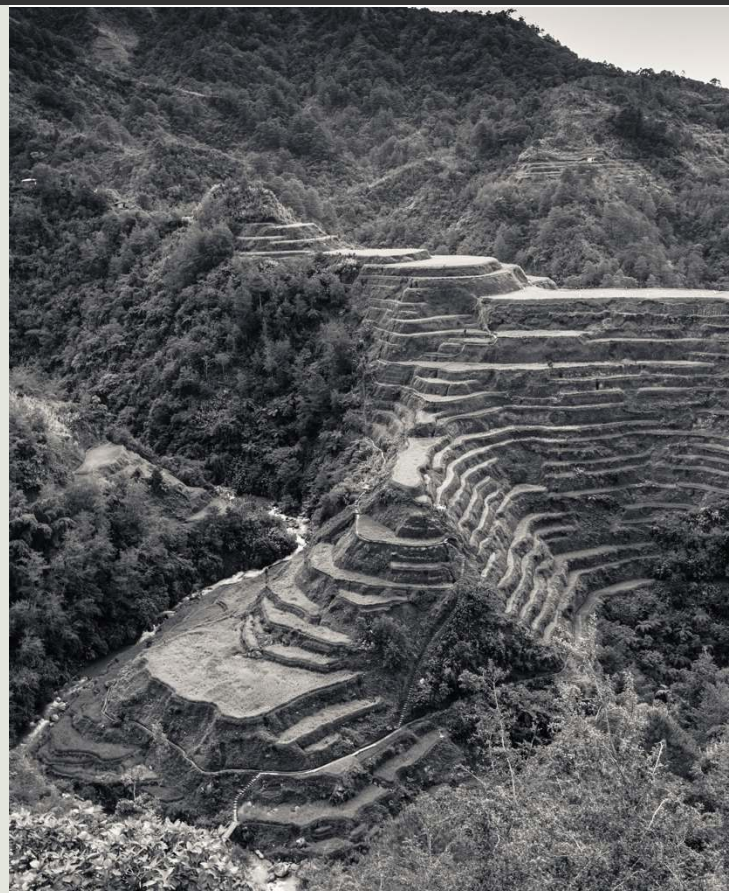
Everything
happens
SOMEHWERE

GIS gives us a *broader picture*
of rice production

Visualization is a powerful tool

Thank you

Adam Sparks

Epidemiology and Crop Health and
Geographic Information System Units

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