

Data Exploitation della missione PRISMA precursore delle missioni iperspettrali nazionali

Scenari di utilizzo di
osservazioni iperspettrali per
lo studio dei sistemi naturali e
antropici

M. Pepe, C. Giardino, M. Boschetti,
R. Lanari & IREA collaborators



istituto per il rilevamento
elettromagnetico dell'ambiente

 Consiglio Nazionale delle Ricerche

1-3 marzo 2017

ASI

Roma

Background: the hyperspectral eras

in the '90s

thinking hyperspectral: the “ultimate” optical solution

2000 - today

testing hyperspectral: research on optically complex systems

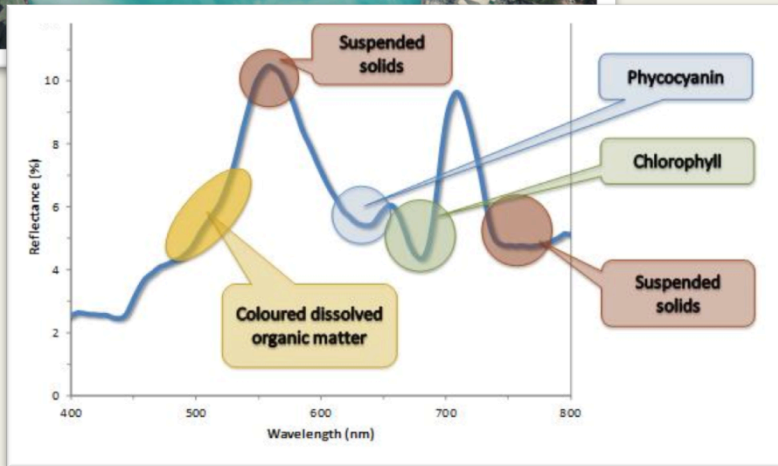
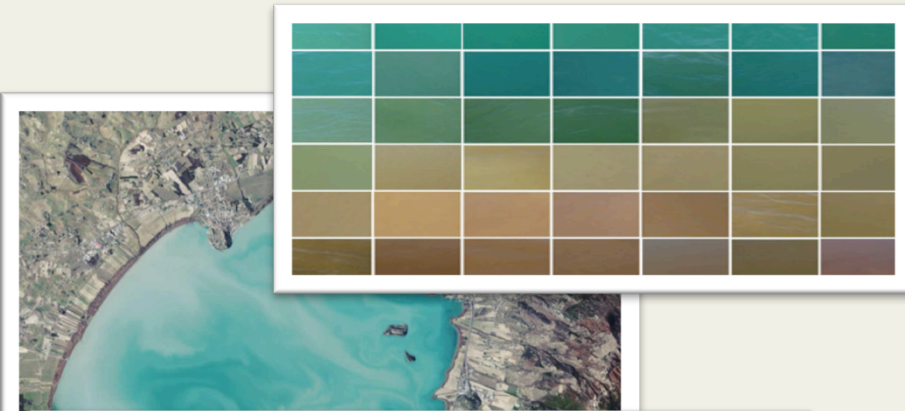
from today on

exploiting hyperspectral: the real world application challenges

Optically complex systems

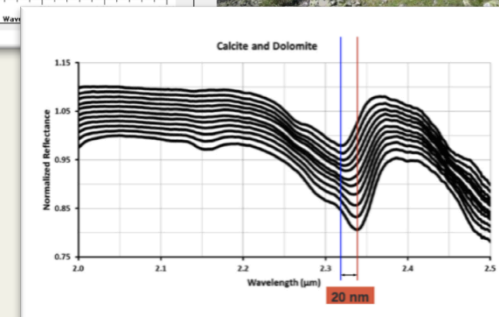
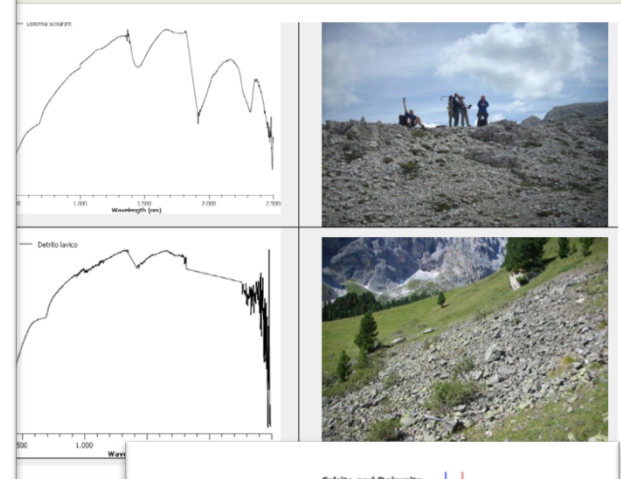
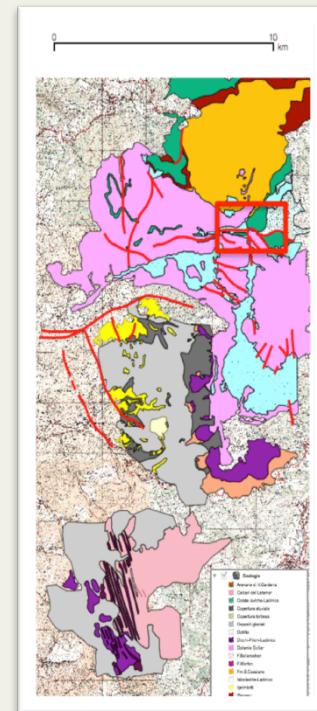
Inland and coastal water

- optically shallow,
- optically deep waters
- bottom



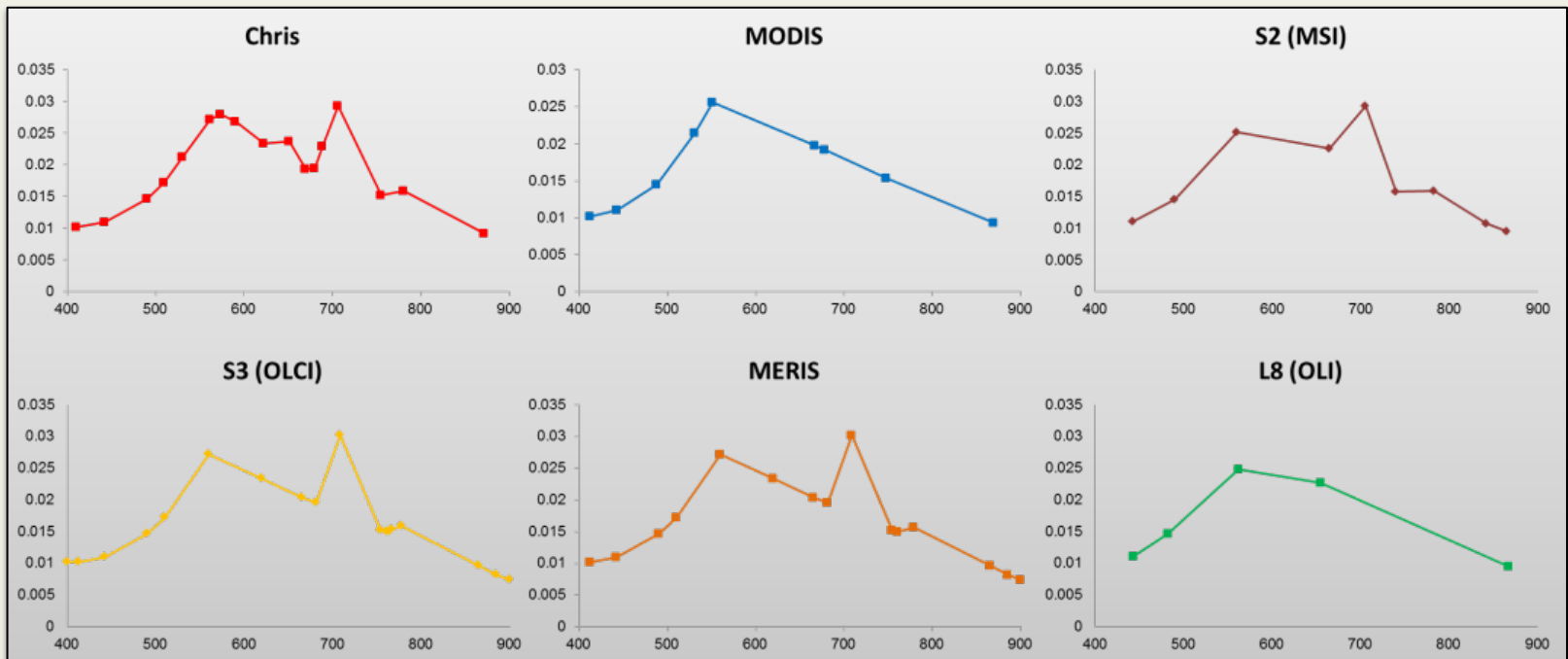
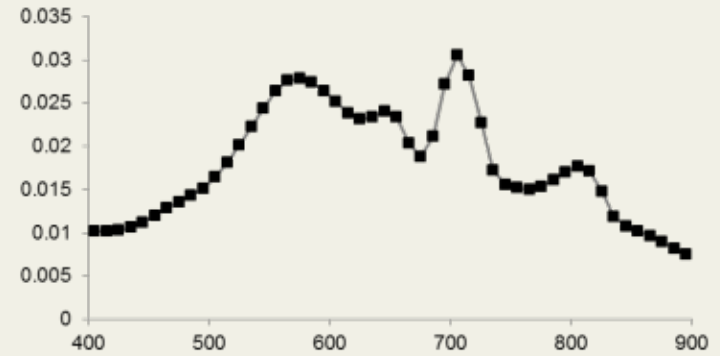
Geolithological/mineral mapping

- narrow and subtle absorption peaks
- transitional geologic formations

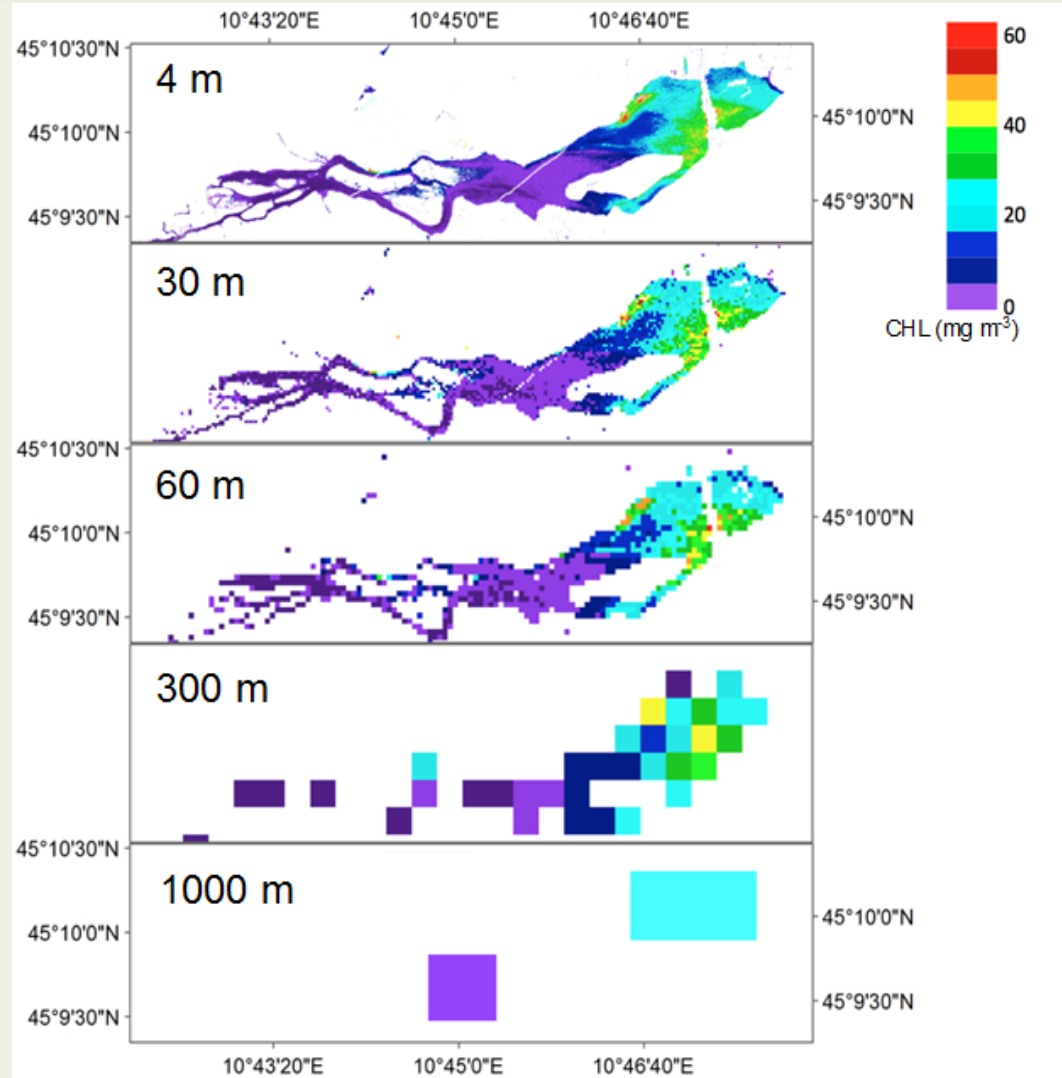


phytoplankton pigments retrieval

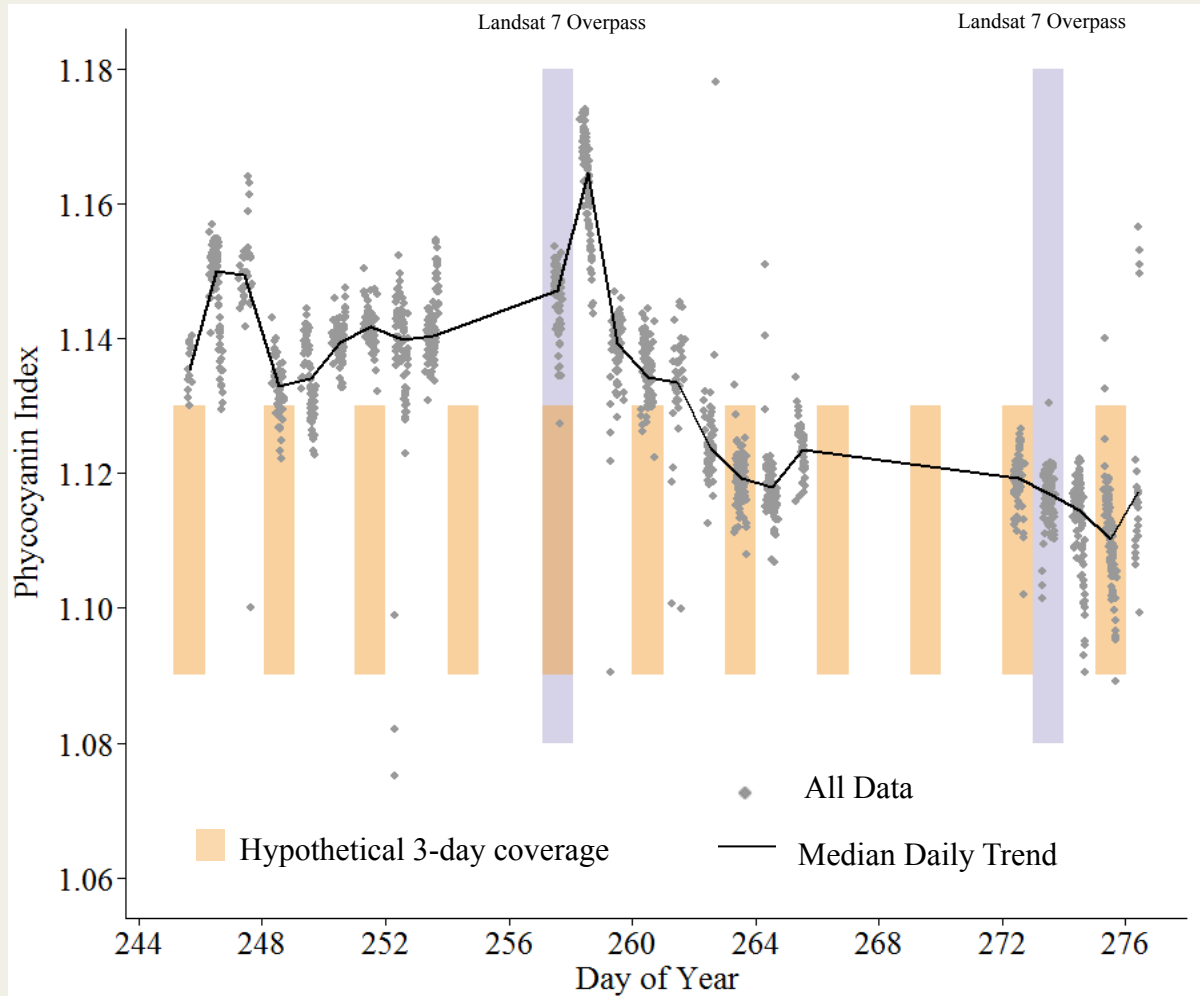
PRISMA



low resolution pixels may still resolve inland lakes, but may lose the ability to pin point-source pollution

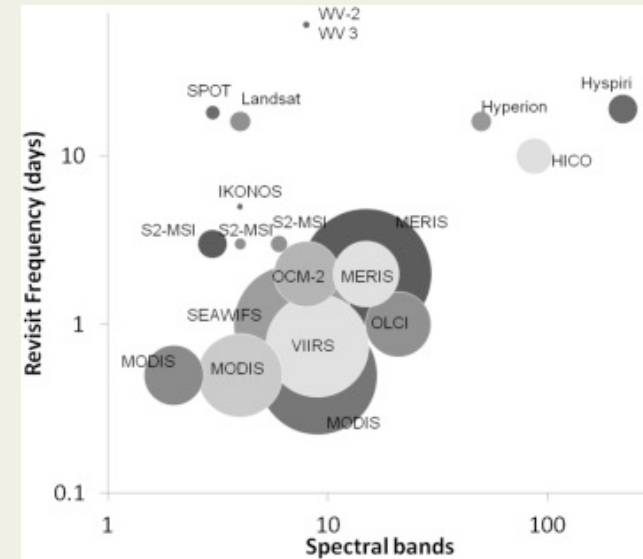


Hestir et al., 2015, Remote Sens Environ



Cyanobacteria concentrations in Mantua Lake (Italy)

timeliness of information and dynamics



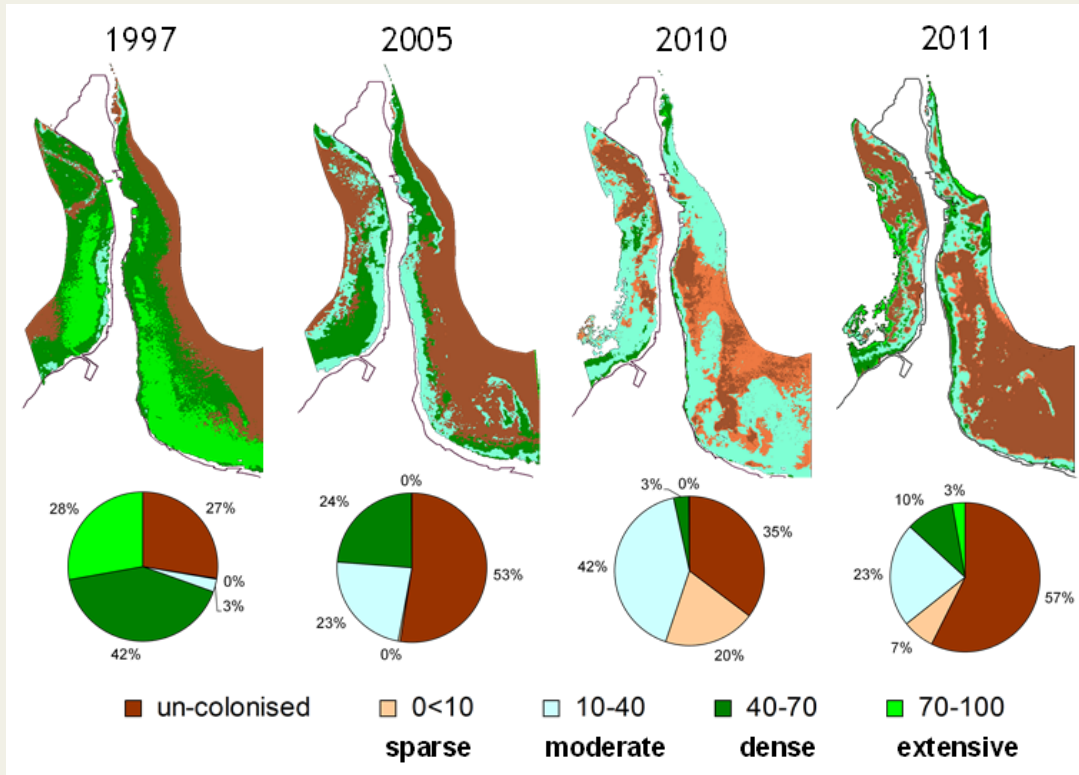
Hestir et al., 2015, Remote Sens Environ

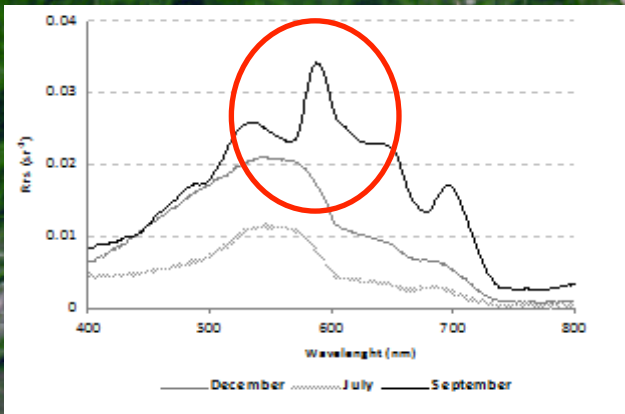
Information to support decision making



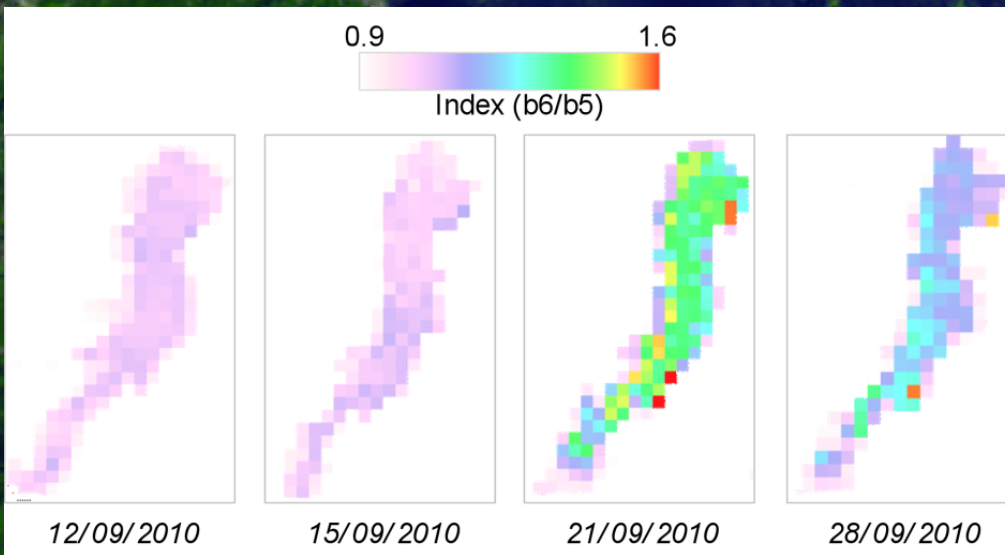
Retrospective analyses in the recent years (1997-2011) of substrate types composition in Sirmione

Bresciani et al. 2012, J Limnol
Giardino et al. 2007, J Appl Remote Sens





There is an important economic impact of harmful algal blooms



Economic effects of HABs in the U.S. are at least \$82 million/year*

Commercial Fisheries Impacts: **\$38 million/year**

Public Health Costs of Illness: **\$37 million/year**

Recreation and Tourism Impacts: **\$4 million/year**

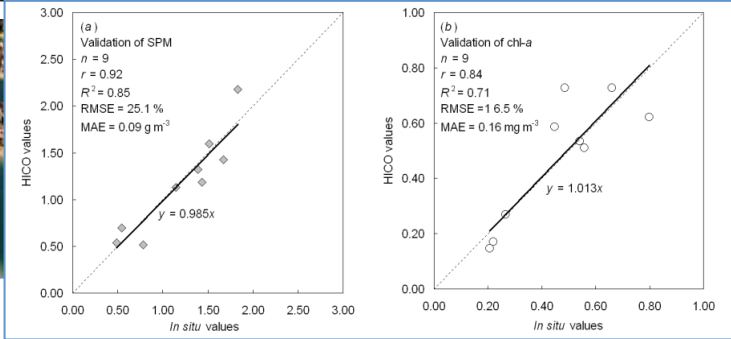
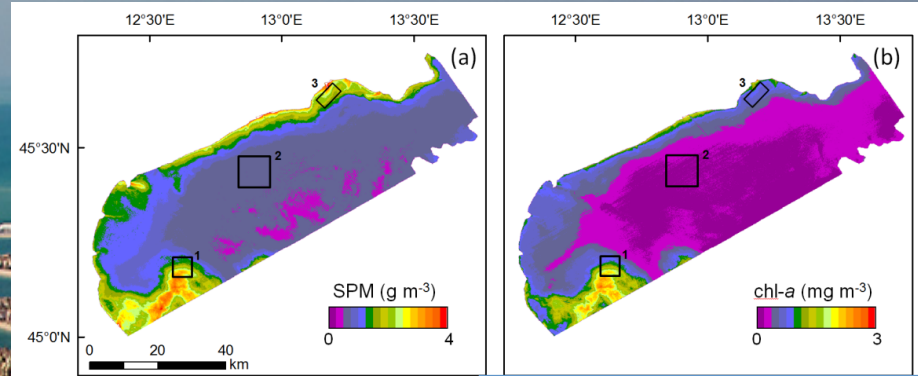
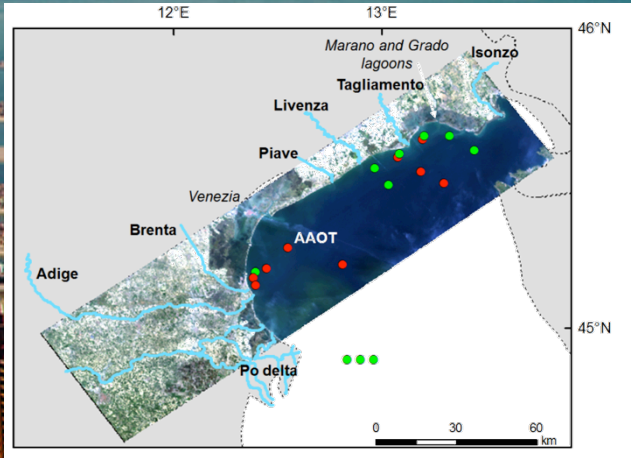
Coastal Monitoring and Management: **\$3 million/year**

*2005 dollars, Hoagland and Scatasta (2006). Based on subset of outbreaks in 1987-2000.

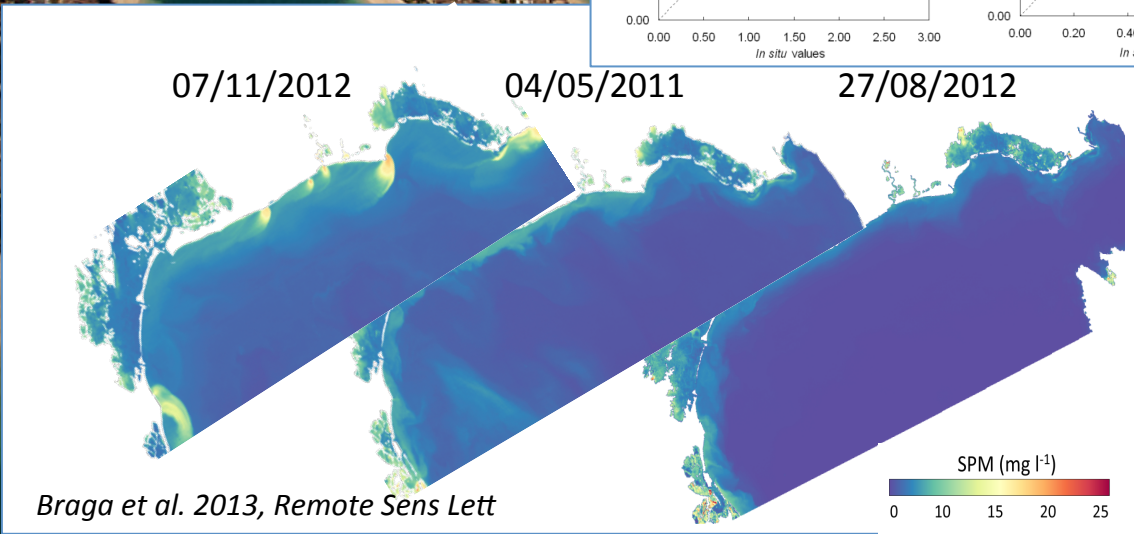
Bresciani et al. 2011, J Appl Remote Sens

Coastal zones

Mapping the effect of hydrologic-meteo events



More than a billion people live in low-lying coastal zones



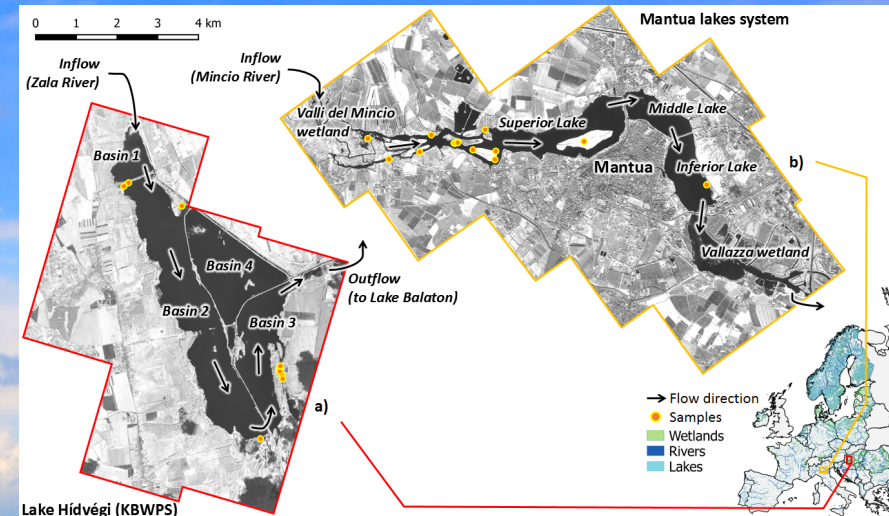
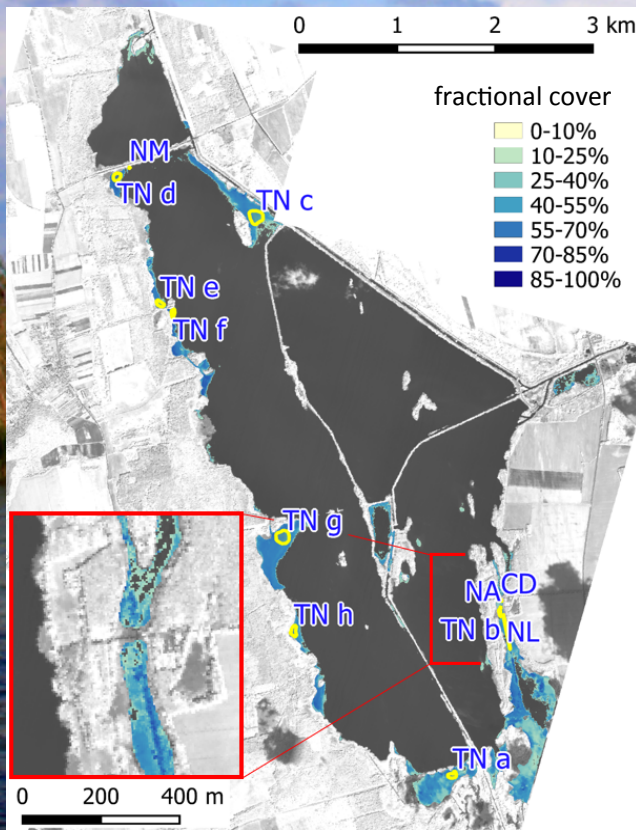
Braga et al. 2013, Remote Sens Lett



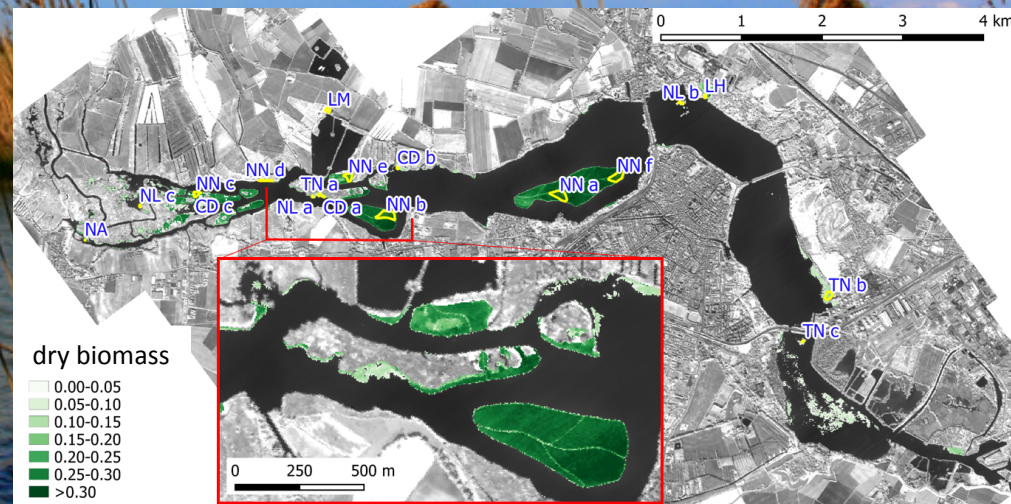
Wetlands

Mapping floating, emerging macrophyte species

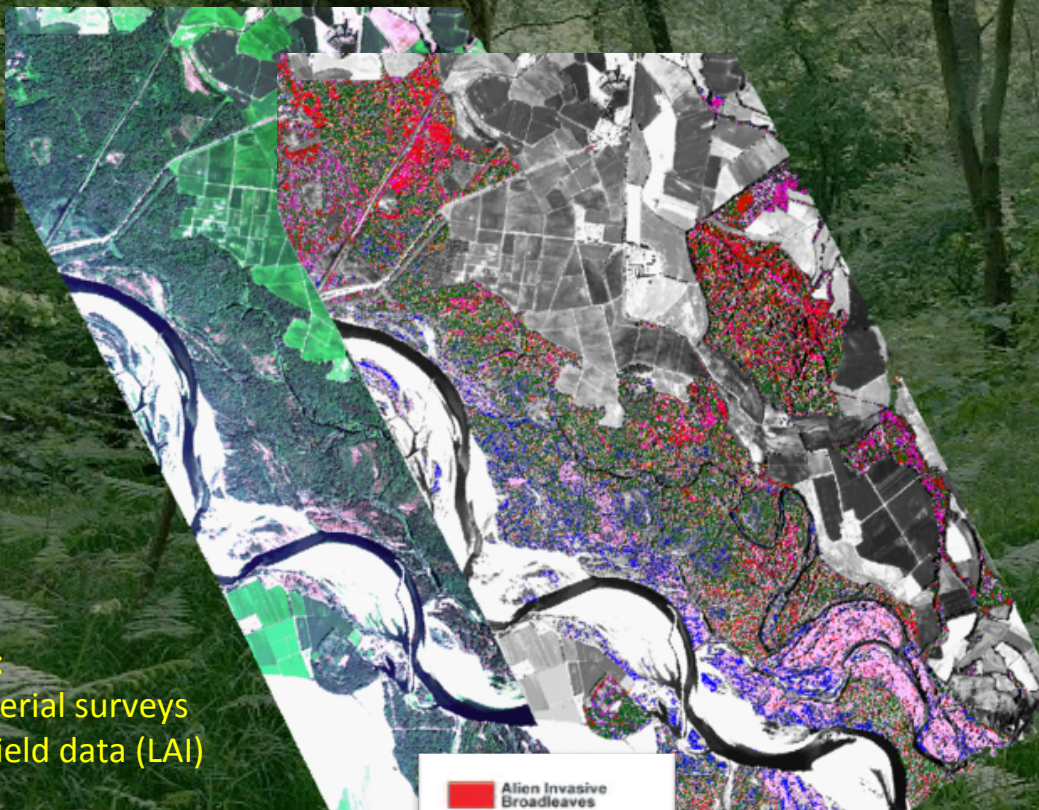
Wetlands support some of the highest biodiversity in the world



Villa et al. 2016, Journal of Limnology



Boschetti et al., 2007, International Journal of RS



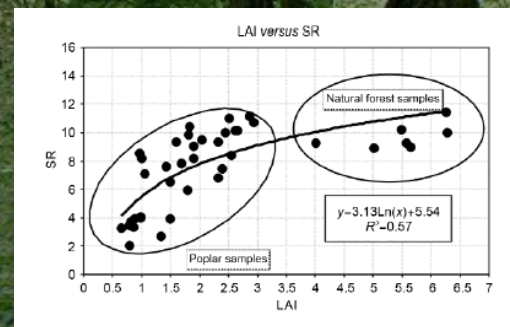
Red	Alien Invasive Broadleaves
Dark red	Sweet chestnut
Yellow	Pine
Green	Quercus - carpinetum
Purple	Alder
Blue	Willow
Light purple	Poplar and Aspen

Data:

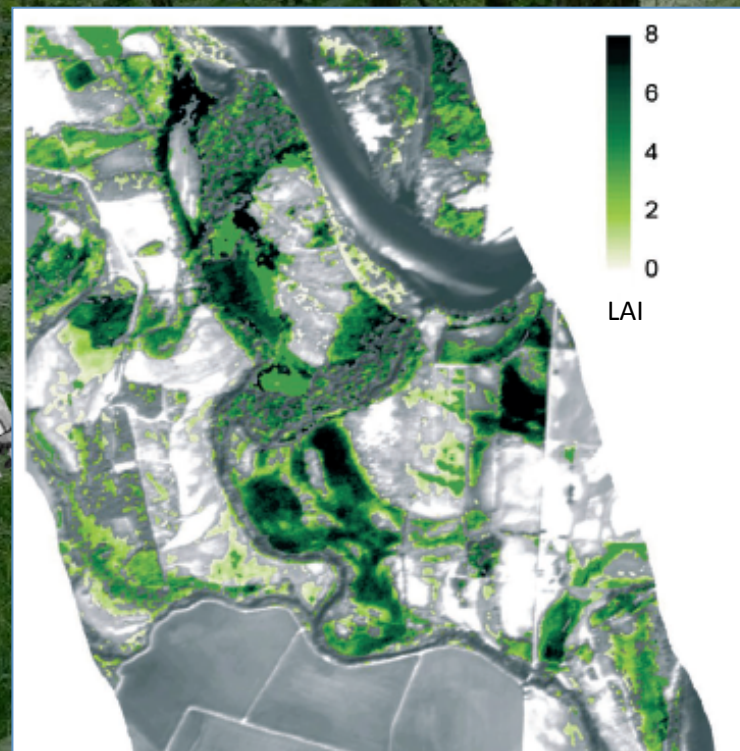
- Aerial surveys
- Field data (LAI)

Methods:

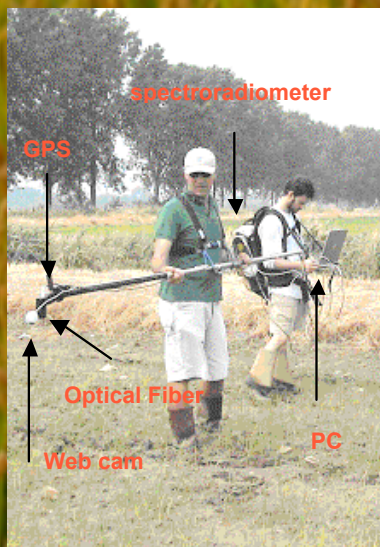
- Hyperspectral data analysis
- Classification techniques
- Empirical modelling



Boschetti et al., 2006, Annals of Geophysics



The Italian Ministry for Agriculture reports that "ad oggi circa l'1% della superficie agricola coltivata in Italia vede l'impiego di mezzi e tecnologie di agricoltura di precisione. Il nostro obiettivo è arrivare al 10% entro il 2021, con lo sviluppo di applicazioni sempre più adatte alle produzioni agricole nazionali"*

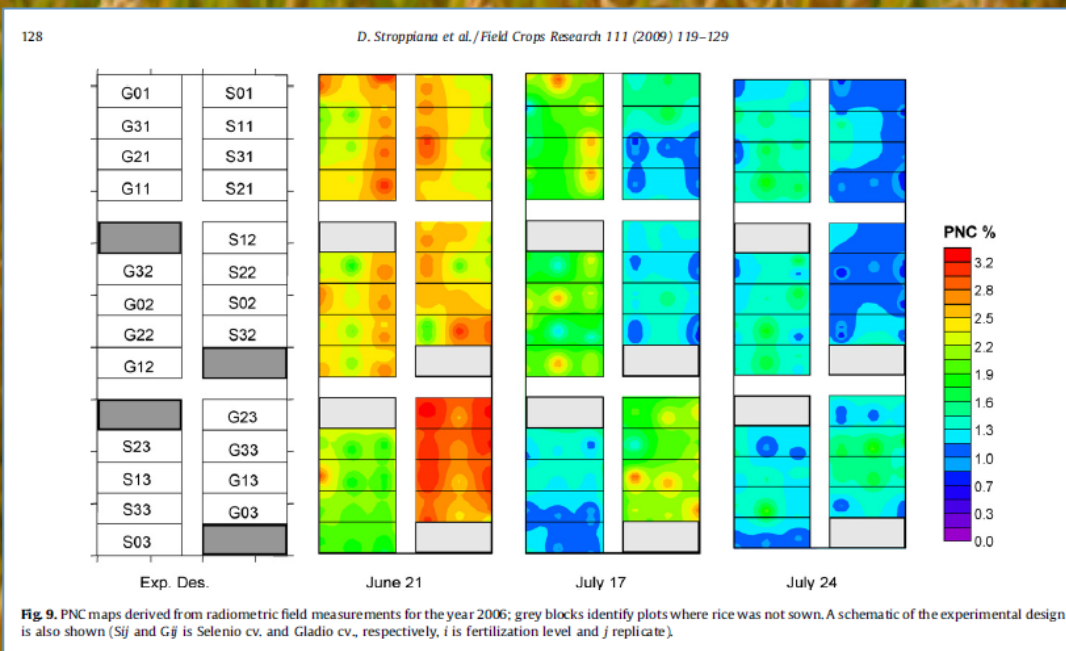


Data:

- In situ spectral and lab measurements

Method:

- Hyperspectral data analysis
- Identification of absorptioth features



Stroppiana et al., 2009, Field Crops Research

*<https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/10349>

- we are supposed to move from experiments to operational products and services
- hyperspectral remote sensing missions shall consider the spatial and temporal dimension for addressing societal challenges and specific needs
- we are supported by knowledge and technology as a starting point
- novel research and solutions are still needed

