WINROCK INTERNATIONAL

Building capacity for monitoring compliance with standards

IPIECA Seminar

Biofuels sustainability standards and regulations

Brussels

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September 18th, 2012

Winrock Objectives

- Non-profit organisation that aims to:
  - Empower the disadvantaged and accelerate economic development opportunities through effective management of natural resources
  - Build local and regional capacity to apply and improve available technology
  - Mobilize investment
  - Use robust science and economics to inform its work

Why bioenergy & biofuel?

- Development benefits of bioenergy
  - New sources of revenue and jobs for rural areas
  - Strengthened rural infrastructure (roads, communications, technical services, production inputs, governance)
  - Increase quantity and reliability of local energy supply

Presentation Overview

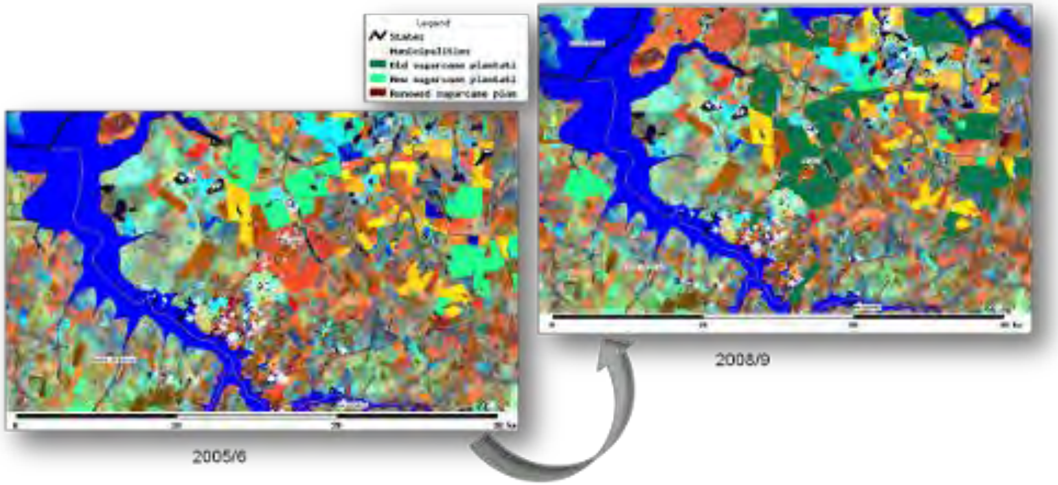
- Common items for compliance
- Relevant tools and techniques
  - focus on exploring remote sensing
- Assessing compliance vs monitoring outcomes

Common items for compliance within standards (environmental)

Land cover /land use	Need to identify at 1ha scale. Satellite data with a 30m or higher (max 60m) is considered sufficient to serve as reliable evidence of the land cover but may not be conclusive (EU guidance for RED)
Carbon stocks	Avoid high carbon stocks Proxies using land cover and assigning carbon stock numbers
Biological diversity	Some no-go area approach; protected areas, 'highly biodiverse' grasslands*
Water quality	(At least) No detriment to water quality Often requires water management plan
Water availability	(At least) No detriment to water availability Often requires water management plan
Soil health	(At least) no detriment to soil health References to sustainable residue removal rates

Land cover identification from freely available satellite imagery

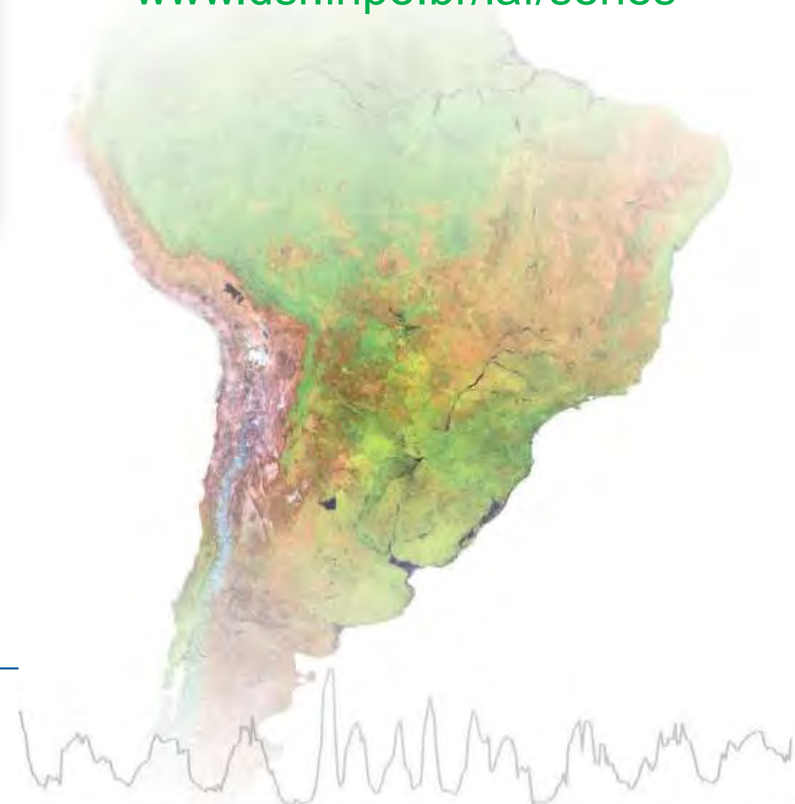
Screenshots from the CANASAT Project, Brazil, illustrating changes in cane distribution from crop year 2005/6 to 2008/9.



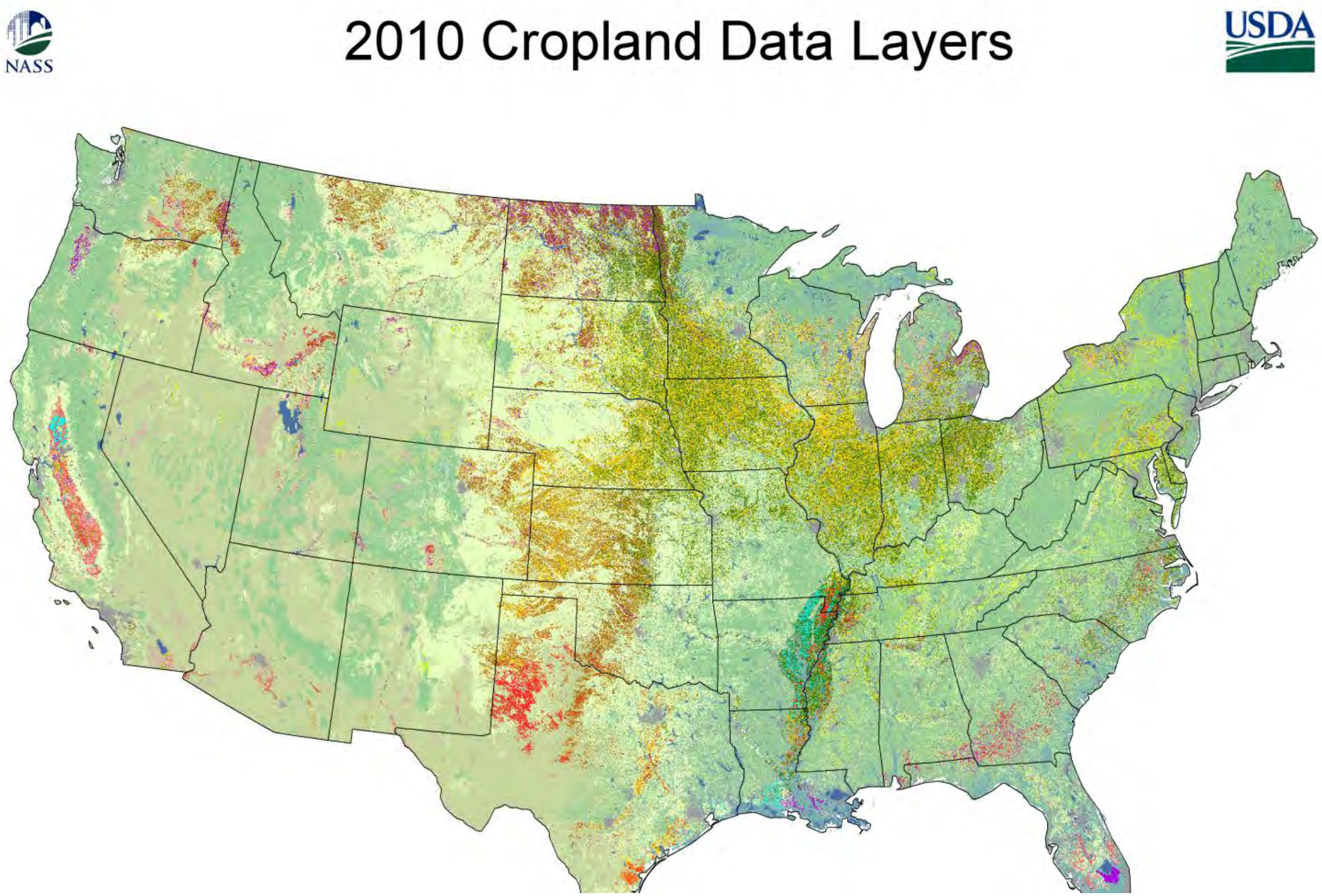
Source: CANASAT Project (2009).

Visualization of MODIS time-series for land use and land cover change analyses

www.dsr.inpe.br/laf/series



US Cropland Data Layer

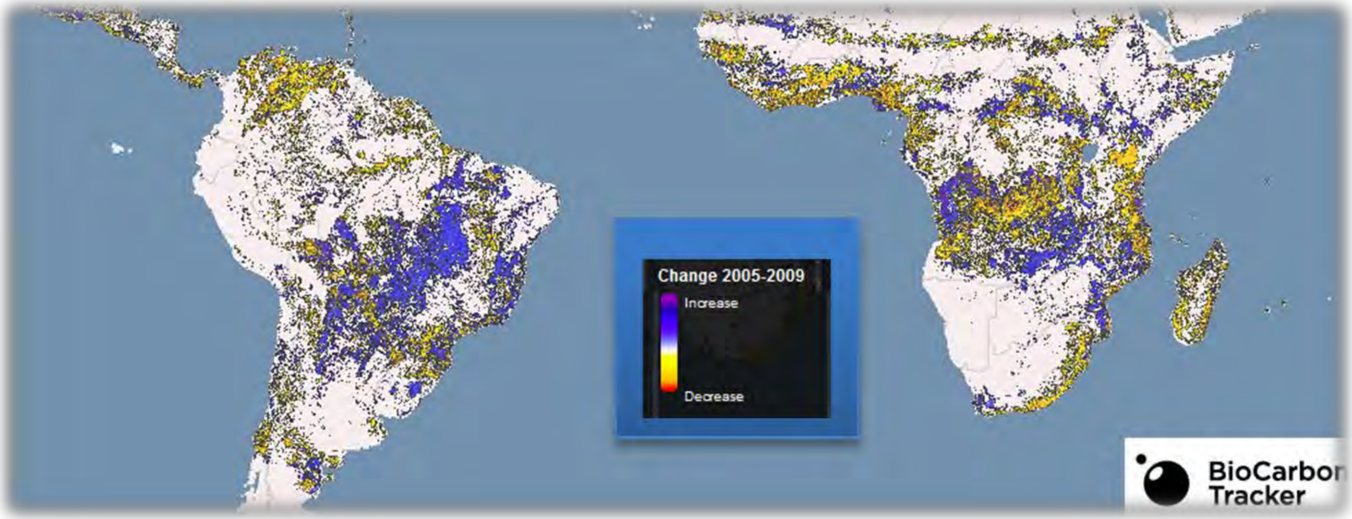


www.nassgeodata.gmu.edu/CropScape

Global tools for monitoring carbon stocks and change

BioCarbon Tracker uses satellite data to

- map the ecosystems where biocarbon is stored
- identify vegetation at risk from land use change and
- monitor where high biocarbon stock land such as forest is converted to agriculture (soil carbon not yet included).



Source: http://biocarbontracker.com/

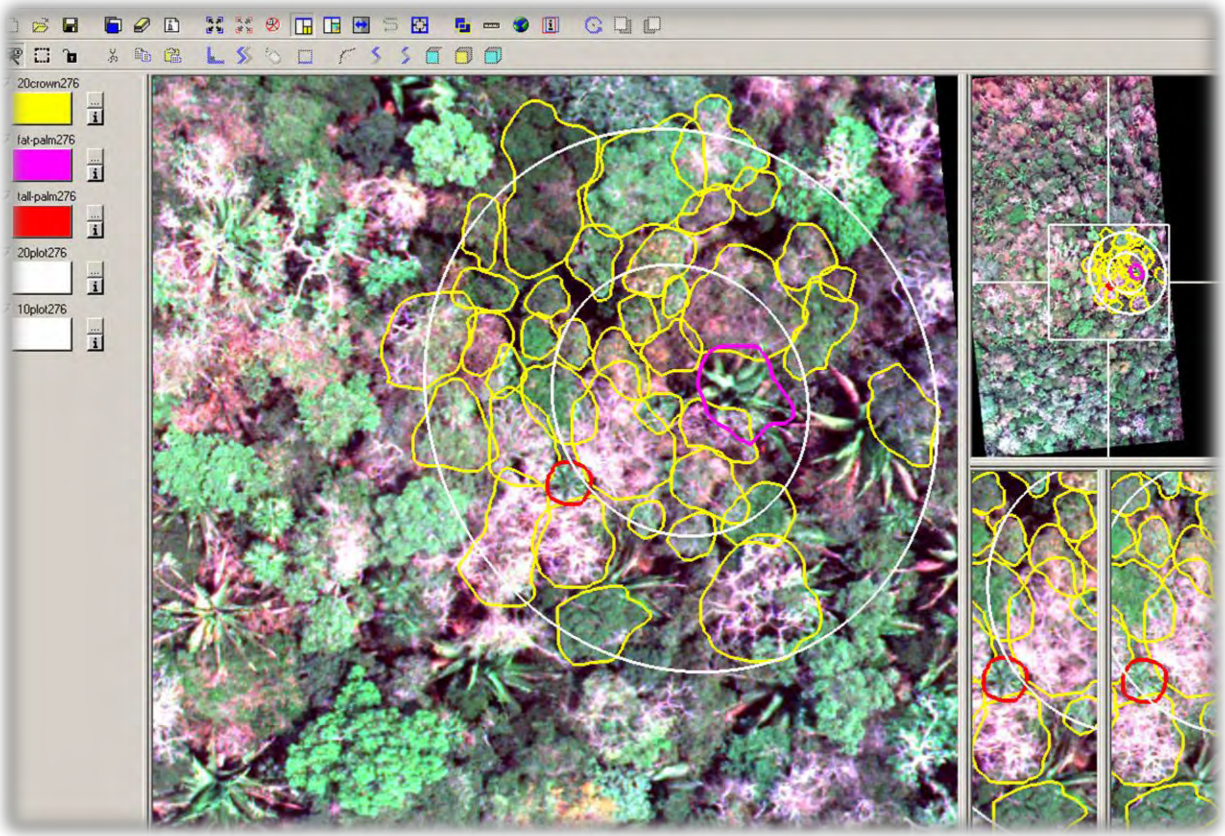
Tools to address carbon stock requirements: regional scale

- Under discussion – create go and no-go area mapping to demonstrate compliance with RED carbon criteria.
  - Options: hard distinctions vs indicative risks

Impact	Range of change in GHG emissions	Notes
"High threat" High Negative Impact	TBD	Ranges are likely to demonstrate that even accounting for errors the impact is negative.
Moderate Negative Impact	TBD	The outcome on paper is negative, but the ranges are based on numbers that suggest they can be mitigated with best agricultural management practices.
Moderate Positive Impact	TBD	The outcome on paper is positive, but the ranges are too uncertain to determine the impact without more precise data.
"Low threat" High Positive Impact	TBD	Ranges are likely to demonstrate that even accounting for errors the impact is positive.

- Issues
  - No clear support for approach
  - Potentially substantial uncertainty
    - *Coarse scale estimates of carbon stocks can help develop threat assessments at national scales (using MODIS data).*
    - *Forest carbon estimates improving but others e.g., pasture land not well assessed*
  - Still based on good identification of land cover so appropriate geographic scale and availability of satellite data (e.g., for 2008 reference date) are issues

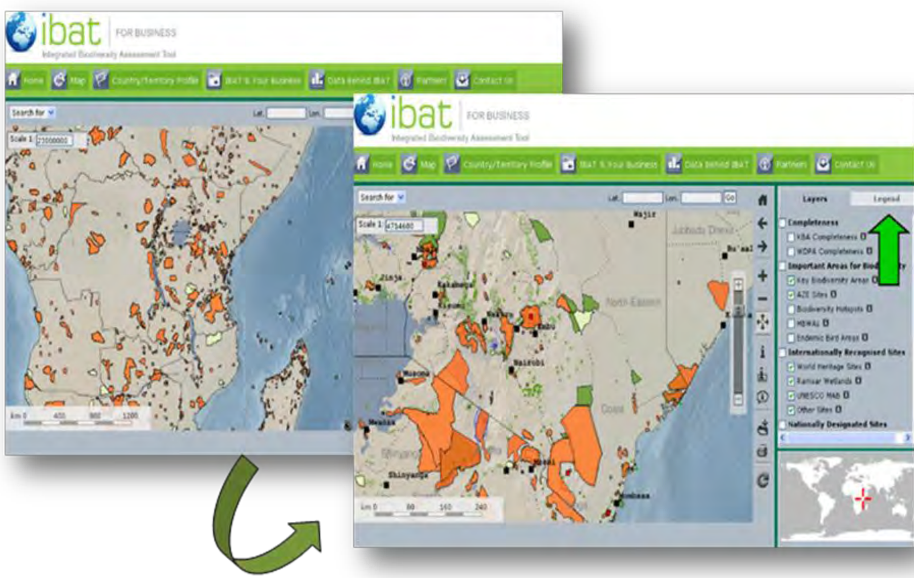
Tools to address carbon stocks: site scale



Source: Pearson et al, 2005 *www.winrock.org/.../TAP_presentation-**M3DADI**vsCONV_2006.pdf*

Biodiversity tools

- **Integrated Biodiversity Assessment Tool (IBAT)**

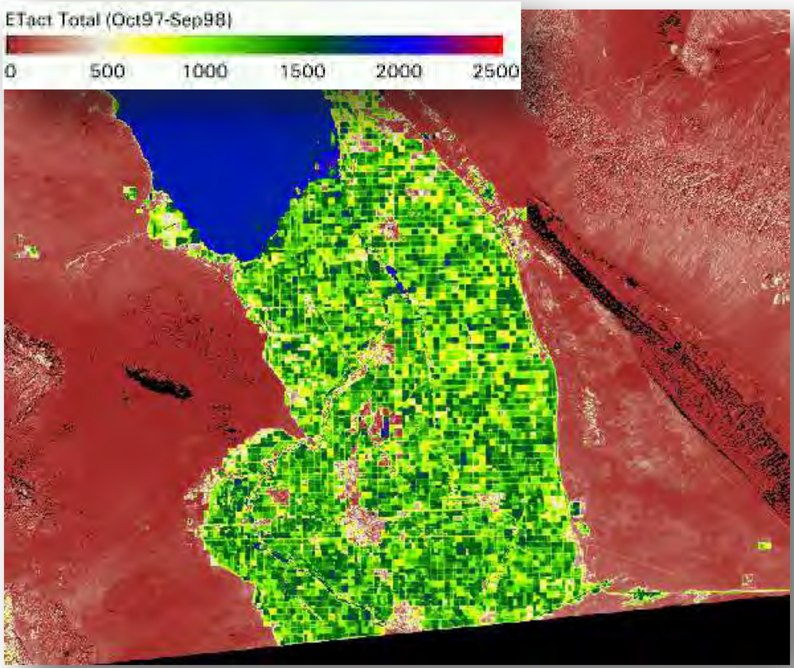


- **High Conservation Value areas**
  - Referenced by a number of standards
  - A framework for regional and site scales
  - Includes social values
  - Requires trained / experienced people to undertake

Remote sensing: Identifying habitats and suitability has been done through the use of RS but measuring function within an ecosystem is challenging.

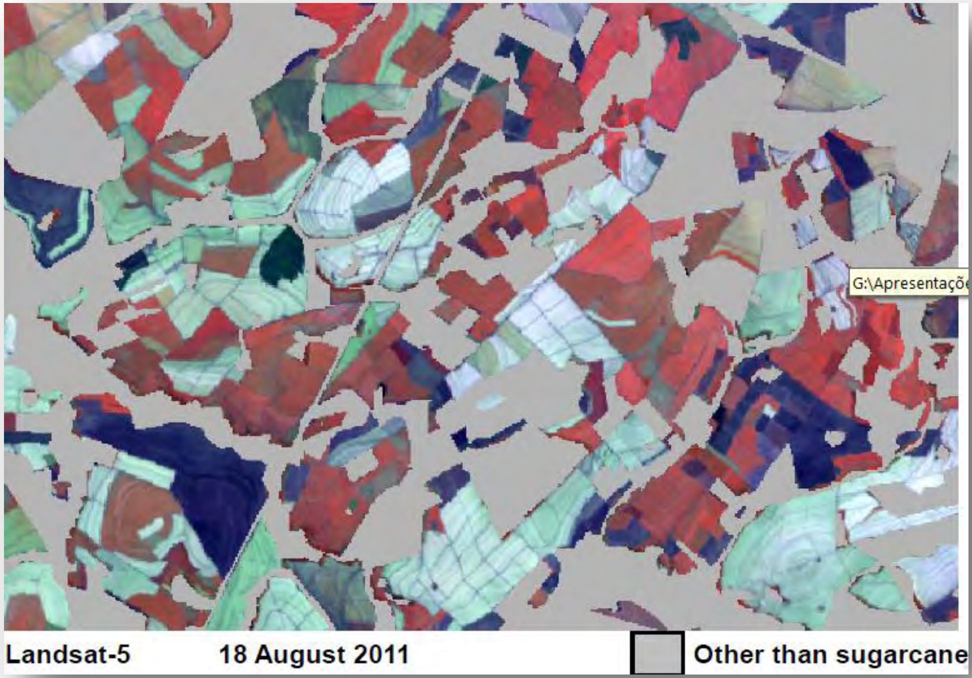
Other uses of RS

Water consumption



Annual total ET in Imperial Valley (California, US) in the period Oct 1997 – Sep 1998. The image dimension is approx 75 km x 75 km, pixel size is 30 m (source: Thoreson et al., 2009 cited in eLEAF/Winrock paper).

Harvest practice

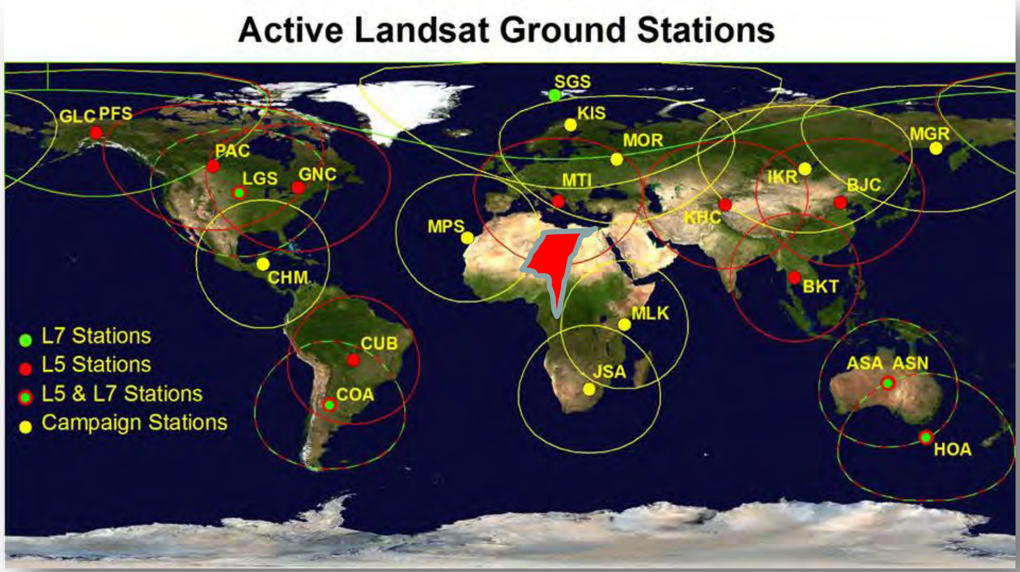


Differences between burned (dark) and unburned fields in Brazil. Presented by Dr. Bernardo Rudorff at Winrock workshop on RS for monitoring biofuels, Jan 2012.

Residues: there is not a good operational sensor that can estimate dry cellulosic matter well.

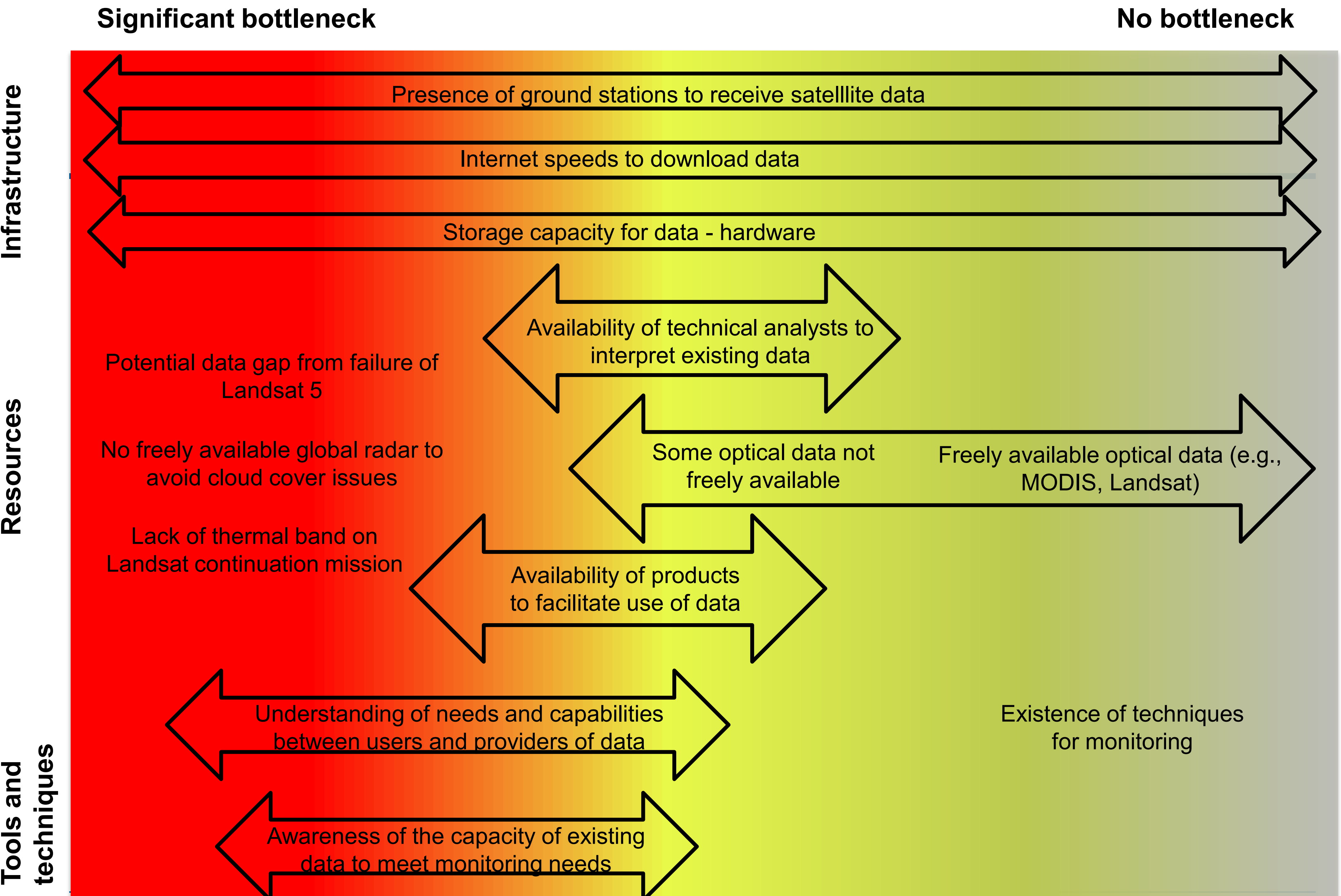
Optical satellite data: infrastructure the elephant in the room

- Lack of trained data analysts
- Lack of clear demand/promotion for this approach from potential users
- Lack of infrastructure for some developed and developing nations for downloading RS data
- Landsat 5 failure this year with a serious potential loss of data
- Some regions have problems getting cloud-free imagery and need supplementary RS data (may incur costs)



Landsat active ground station. Green circles download Landsat 7 data, red circles Landsat 5, red and green Landsat 5&7, and yellow circles are potential future stations (http://landsat.usgs.gov/about_ground_stations.php).

- Small field sizes (<5ha was suggested) can present a challenge and finer resolution data may be needed.



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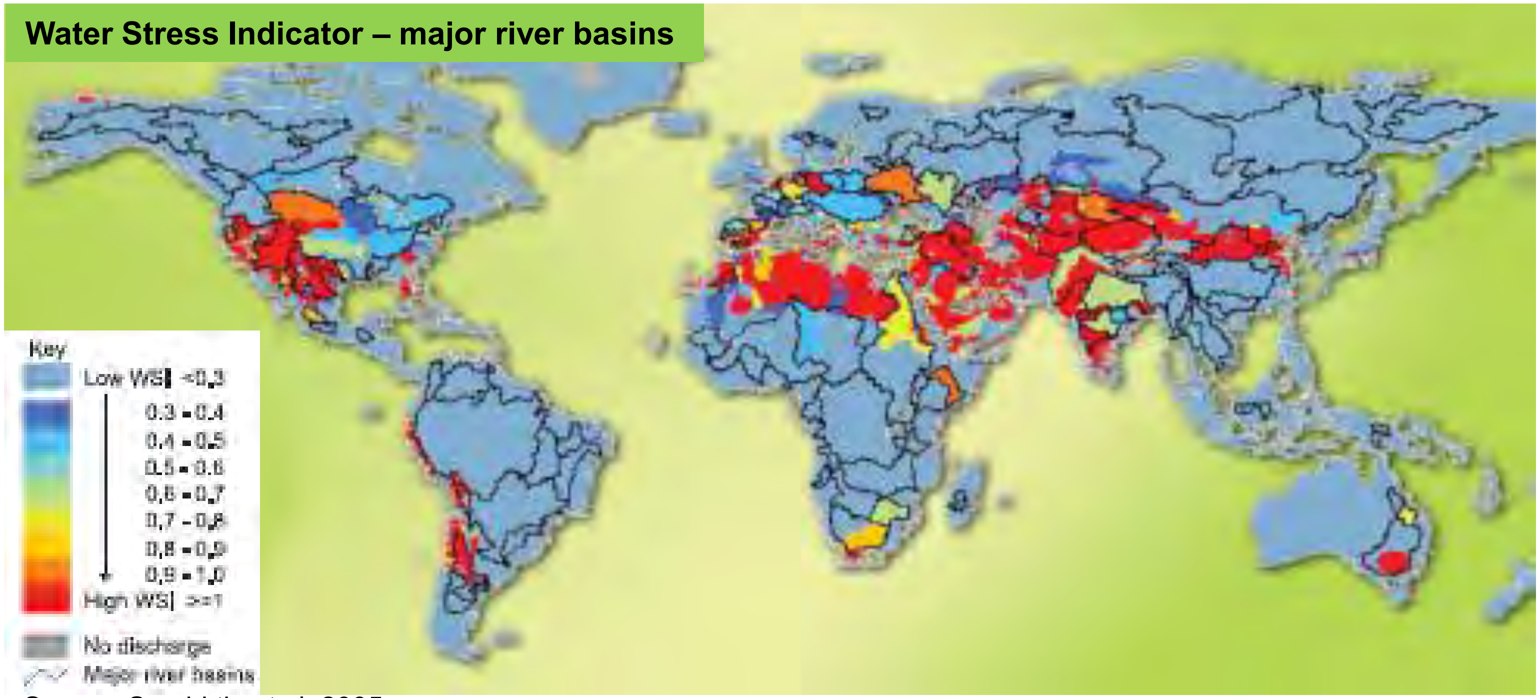
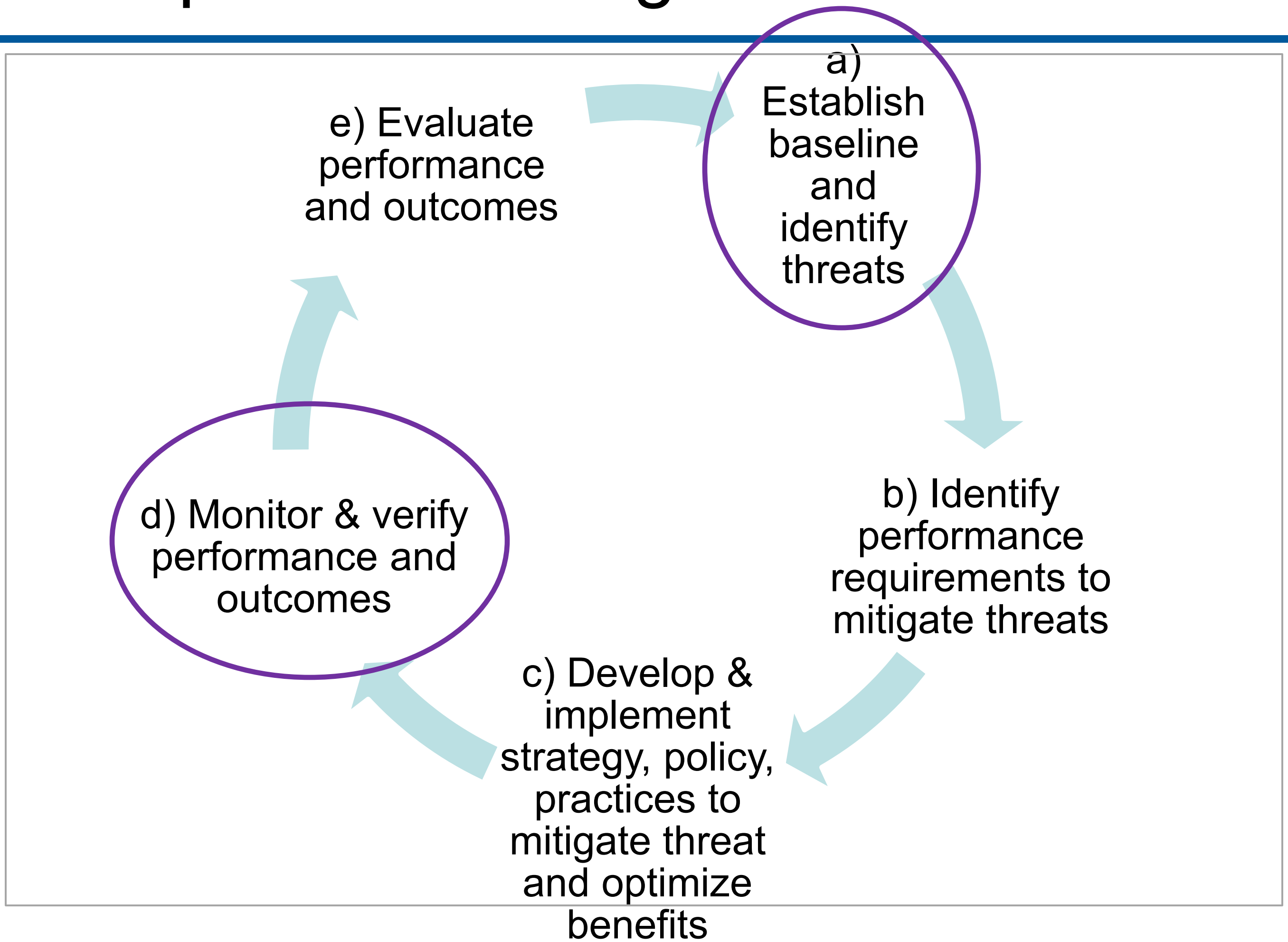
Assessing compliance vs monitoring outcomes: the case of water

- Some requirements of standards include: water management plans, water footprints, reduction of water use by X%
- But what about the appropriate context? – river basin availability

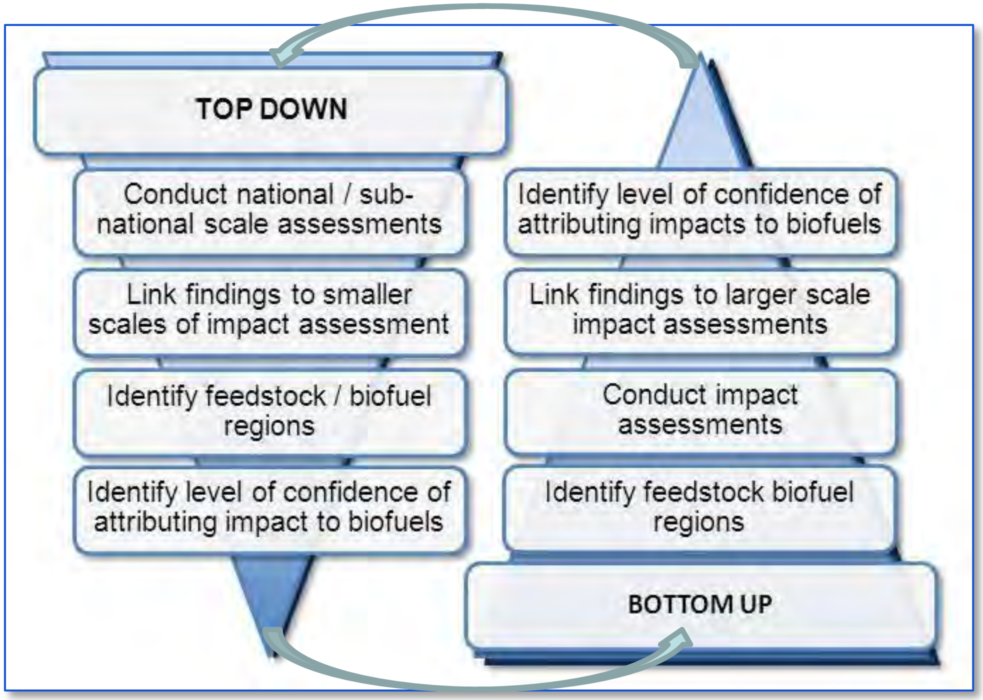


Source: Smahktin et al, 2005

Monitoring **outcomes** is the essential feedback loop for delivering sustainable biofuels



Links across geographic scales are critical



Conclusions: building capacity for monitoring

- Objectives of standard and therefore the requirements for building capacity may differ between standards, actors and within different national settings
- Generally, tools and techniques to assess compliance are available – different scales
- Remote sensing is underutilised, not a panacea but could make substantial contributions and *could* reduce admin burden
  - Freely available imagery (Landsat and MODIS) could be used to a much greater extent than currently but..
    - Will they be acceptable for compliance? At what scales?
      - Dialogue between potential users and RS scientists needed
    - Investment in infrastructure needed (failure of Landsat 5, future of Landsat?)
    - Need to train analysts in utilising the information
    - Need ground-truth data for validation of RS data
- Enabling access to imagery is key
- Creating new and user-friendly products likely to be needed
- We need to focus on monitoring <u>outcomes</u> not just one-off assessments for compliance.
  - Assessment and monitoring across temporal and geographic scales is needed – context and baseline data
  - Communication network needed to co-ordinate data across geographic scales (top down and bottom up) <u>Are we really delivering biofuels sustainably?</u>

Thank you!

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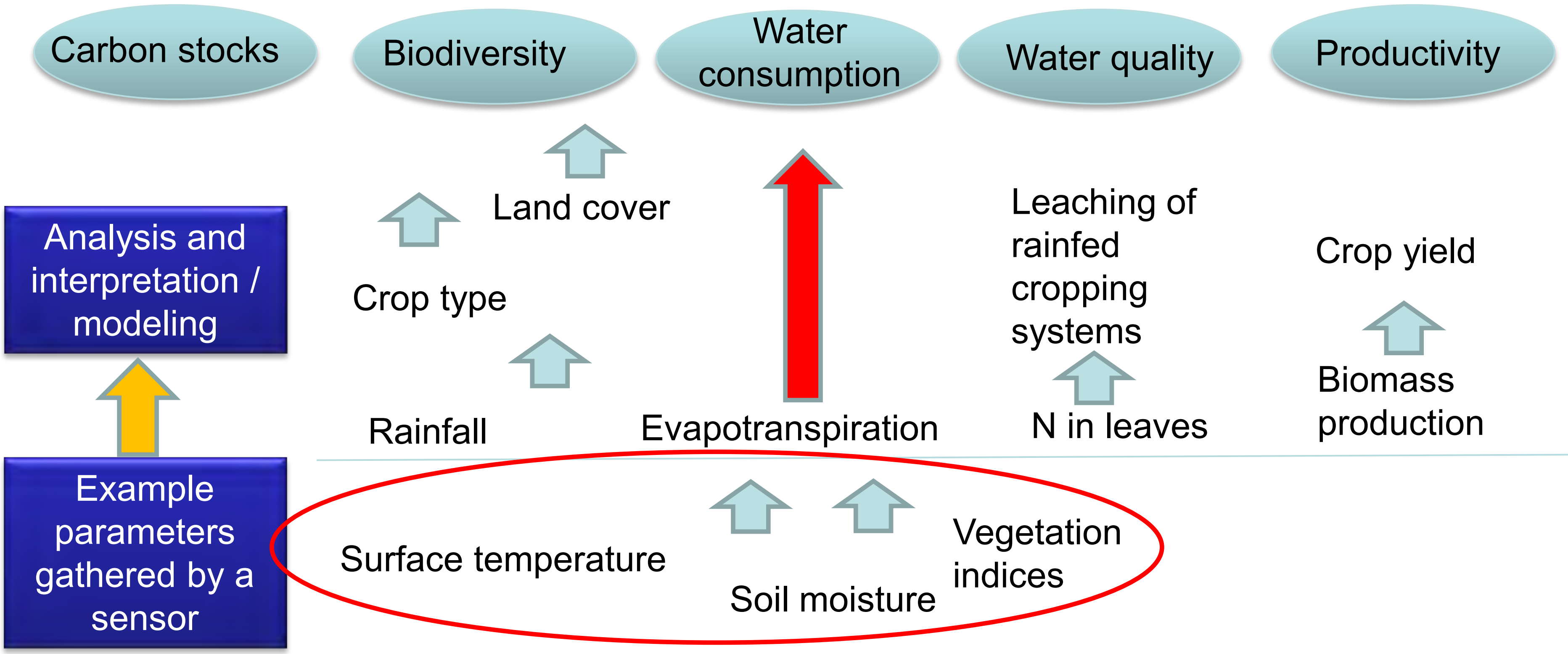
Satellite data (optical)

Scale (Resolution)	Sensor	Swath Width	Frequency of Passes	Spectral Resolution	Comment
Large (>60m)					Useful mapping scale: global. General scale for identifying land cover: 100-1000ha. This imagery has been used to map large area croplands and cropland types. It can be used to identify broad forest categories such as broadleaf and conifer, but **likely high error with other woody land cover like shrub lands. Able to map large grassland areas but has very limited ability to determine grassland conditions**.
1000m	SPOT Vegetation*	2,250km	10 days	4 bands	
250-500m	MODIS*	2,330km	8-16 day	7 bands	
Medium (10-60m)					Useful mapping scale: **national**. General scale for identifying land cover: 1-5ha. This imagery has routinely been used to map crop types across regional areas and more recently has reached national scales for countries as large as the US. Has been used to identify different forest types but is relatively limited. **Has been used to determine grassland conditions in numerous studies with varying degrees of accuracy.**
56m	IRS AWiFS	796km	8-16 days	8 bands	
30m	**Landsat***	185km	16 days	8 bands	
	DMC	600km	4 days	3 bands	
15-60m	ASTER	60km	16 days	15 bands	
Small (>10m)					Useful mapping scale: sub-national. General scale for identifying land cover: 2-50m. This imagery can be used to map cropland types. More often high resolution is used for identifying crop conditions for purposes such as determining irrigation or fertilization deficits. Can be used to map different forest types grassland conditions and other detailed land cover dynamics.
2.5-5m	SPOT-5	60km	5 days**	5 bands	
1-4m	Ikonos	11.3km	5 days**	4 bands	
0.5-2m	WorldView-2	16.4km	3 days**	8 bands	

Table 3: Opportunities, limitations and challenges for RS and agricultural productivity

Opportunities	Limitations and challenges
Quantifying annual yields on an area basis – simulation modeling	Requires high resolution imagery and availability of ground truth data While substantial data is available through existing satellites there is a lack of trained analysts Multiple data sources are combined in simulation modeling and require co-operation between numerous disciplines (agronomist, meteorologist, RS experts etc)
Optimizing yield through monitoring yield development throughout the growth cycle	Currently only products offered are by private companies, which increases the price Requires field validation to support results Has to be dealt with seasonally and not on average Need at least weekly imagery Need to know data on cultivation cycle,harvest timings therefore collaborations between RS scientists, agronomists, meteorologists are needed

Generating better and timely data: the potential role of remote sensing



Monitoring compliance is one use but RS can be used in an active management approach to optimise productivity with given resource base, providing farmers with real-time information

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