

Community Remote Sensing

Joint Agency Commercial Imagery Evaluation
Civil Commercial Imagery Evaluation Workshop

Boulder, CO

29 March 2011

William B. Gail

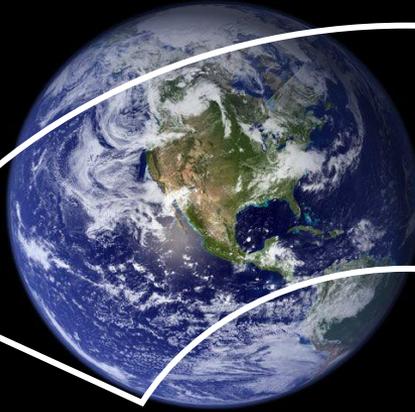
Microsoft® Corporation
IEEE Geoscience & Remote Sensing Society



The Remote Sensing Scale-Gap

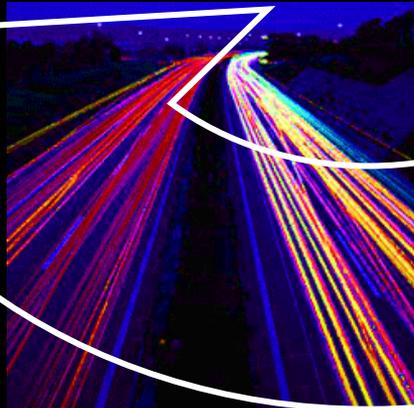
COMPLETE AT LARGE SCALES

- Weeks to Years
- Kilometer-Scale



INCOMPLETE AT FINE SCALES

- Seconds to Minutes
- Centimeter-Scale



What is Community Remote Sensing

LOOSE DEFINITION

Community reflects the role of *decentralized* individuals rather than *centralized* systems - either common citizens or volunteer professionals

Remote Sensing reflects use or collection of data from a distance - activities that differ from strict mapping or in-situ data collection

RELATED FIELDS

- Volunteered Geographic Information (VGI)
- Participatory GIS
- Citizen Science
- Citizens as Sensors
- Community Mapping
- Geo-Social Networking

FORMS OF CRS

- Data collection
- Calibration/validation
- Analysis
- Applications

		ANALYSIS	
		Centralized	Community
COLLECTION	Community	CRS	CRS
	Centralized		CRS

The Power of Community Remote Sensing

Courtesy Scott Blair/NWS



Courtesy ImageCat

VDV

Virtual Disaster Viewer

<http://www.virtualdisasterviewer.com>

Viewing event: 2009 L'Aquila Earthquake (change)
Home - Help - About - Results - Login

2D 3D | Road Aerial Bird's eye

Information

Id: 951
 Damage Level: 4
 Comment:
 Building completely destroyed by landslide. Not recognizable in post-event image

Event Imagery

YingXiu Pre-Event

YingXiu Post-Event

At least one of the Event Imagery checkboxes must be checked to view high resolution satellite imagery. (help)

Analysis Results

Building Damage

Infrastructure Damage

Landslide Areas

Landslide Blocking Road

Tent Count

Tent Clusters (inactive)

Show Statistics

Field Data

Show Video Stills

Show Photos

(Click on to preview photo)
 (upload photos)
 (most recent photos)
 (most recent photo comments)
 (search photo comments)

Photo courtesy of EERI. © 2008 EERI

Author's comment: Structure type: School, No. of stories: 3.
 Construction details: RC frame, masonry infill walls, concrete floors and roof, damage state: Collapse

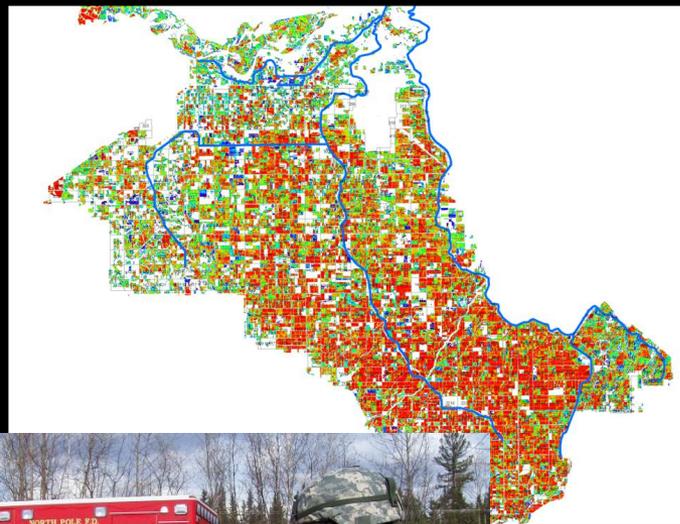
[View Comments](#)

<p>Building Damage</p> <p> Indistinguishable</p> <p> Slight / No Damage</p> <p> Extensive Damage</p> <p> Collapse</p>	<p>Infrastructure Damage</p> <p> Indistinguishable</p> <p> Serviceable</p> <p> Spans collapsed</p> <p> Completely collapsed</p>
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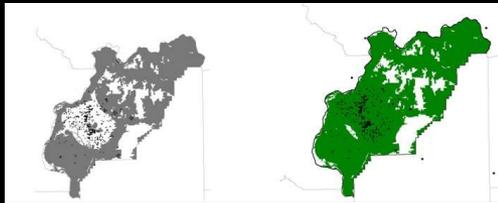
© 2009 Microsoft Corporation © AITN © 2009 DigitalGlobe

Relevant Domains

- Emergency management
- Biodiversity
- Environmental monitoring
- Weather
- Climate monitoring
- Transportation
- Agriculture
- More . . .



Applications Within A Domain - Biodiversity



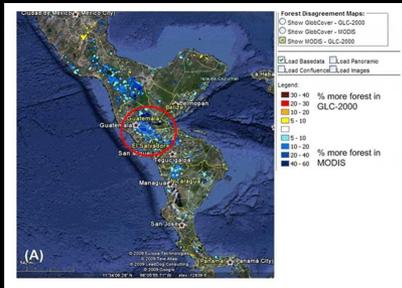
Inventory Validation
Nature Mapping - UW



Systematic Monitoring
Picture Post - UNH



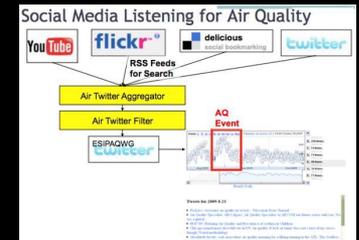
Invasive Species ID
What's Invasive! App - UCLA



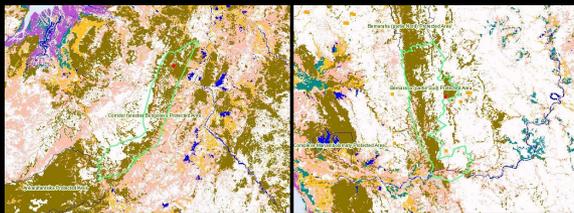
Forest Inventory
World Forest Observatory - RFF



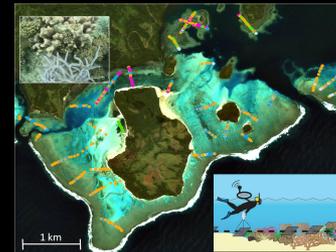
Tool Validation
Yaqui Valley Wheat Farming - Stanford



Event Detection
Air Twitter - Washington U



Habitat Management
Fire Alert System - Conservation International



Detailed Assessment
Coral Reef Habitat Mapping - U Queensland

Biodiversity Inventory

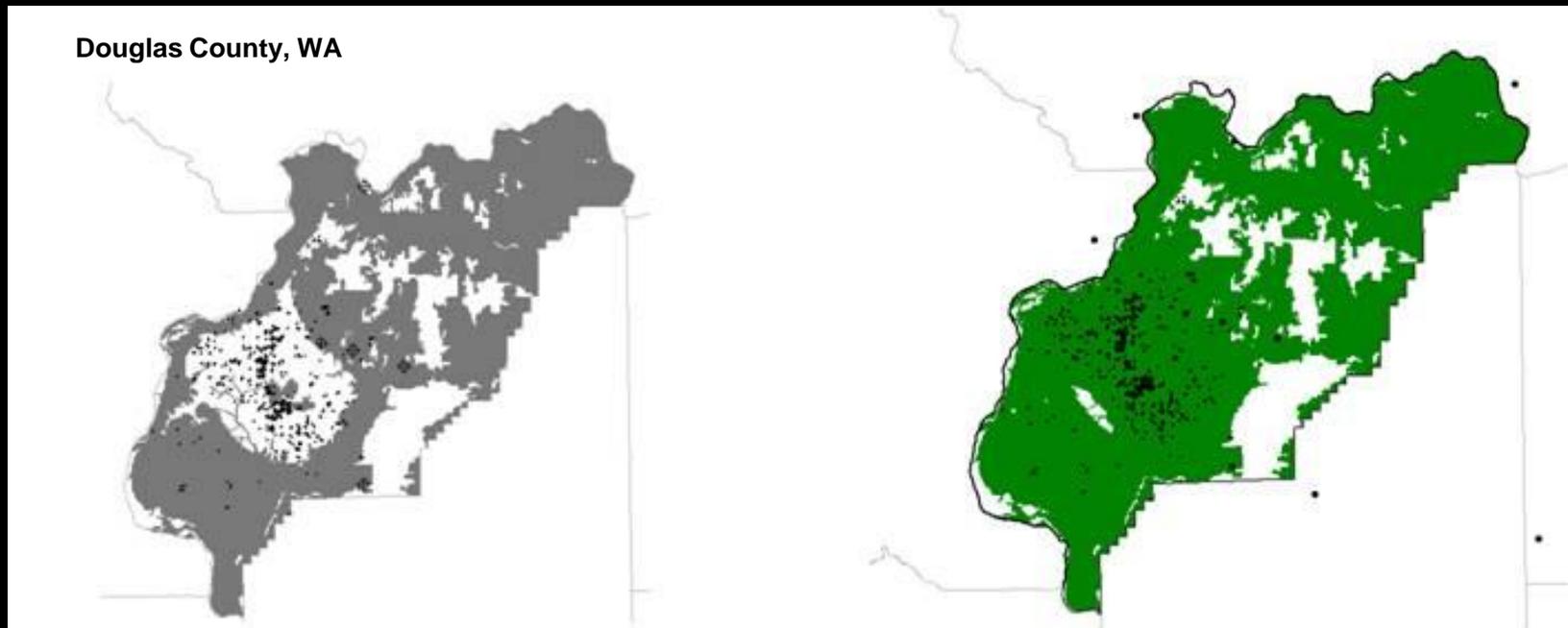
Project

NatureMapping

The University of Washington – College of the Environment, Washington Department of Fish and Wildlife, Waterville School District, and Pierce County Biodiversity Alliance

CRS Relevance

Community-based observational sampling of ecological habitats to validate and refine centralized databases of remotely sensed data



The predicted distribution range of the short-horned lizard (*Phrynosoma douglasii*)

The actual range after updating with farmer's observations (noted by points)

Systematic Biodiversity Monitoring

Project

Digital Earth Watch and Picture Post Network

University of New Hampshire with the Federation of Earth Science Information Partners, Worcester Polytechnic Institute, and the University of Southern Maine

CRS Relevance

A community network and simple sensor platform for systematic monitoring of local environmental conditions

The screenshot shows the 'Picture Post: Home' website. At the top, there is a navigation bar with links for Home, About, Stuff You Can Do, Buy, Build, Help, and Login. Below this is a featured section for a 'Menotomy Rocks Park, post 1' with a panoramic view. A central map of the United States shows several red location pins. To the left of the map, there is a 'picture post' logo and a list of actions: 'contribute photographs to any Picture Post', 'add your own Picture Post', 'measure environmental change in your neighborhood, and contribute to science networks'. A 'Learn how!' link is at the bottom left. The footer includes 'POWERED BY Google' and 'Map data ©2009 Google, Tele Atlas, INEGI, MapLink/Tele Atlas, Europa Technologies'.



Building a Picture Post

The Digital Earth Watch Network

Biodiversity Management

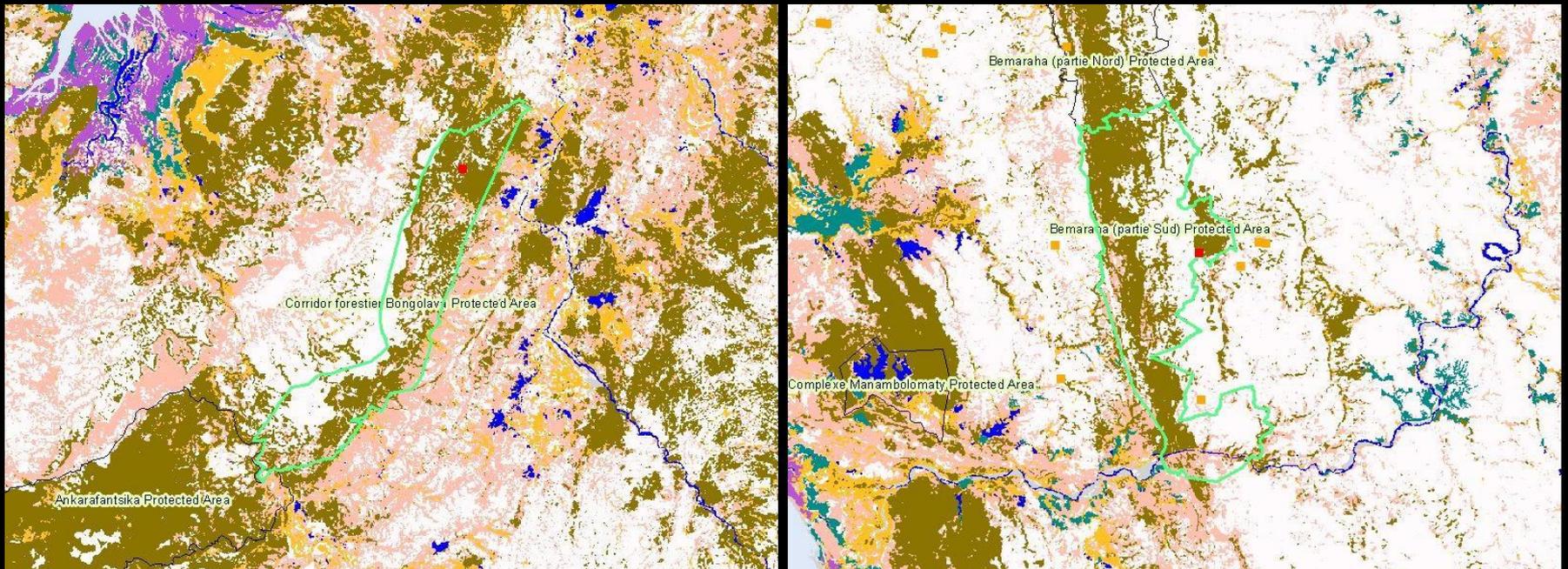
Project

Fire Alert System

Conservation International

CRS Relevance

Community-based tools to augment real-time satellite monitoring of forest fires, illegal logging, and encroachment



Fire Alert System notification imagery showing fires in two areas of Madagascar, obtained from the Terra satellite

Invasive Species

Project

Participatory Sensing

Center for Embedded Networked Sensing (CENS), UCLA

CRS Relevance

Citizen use of mobile phones and associated web services to gather imagery and related information for 'participatory' environmental monitoring, with applications such as invasive species.



Students using *What's Invasive*

What's Invasive! Android mobile phone client for the Santa Monica mountains

Biodiversity Assessment

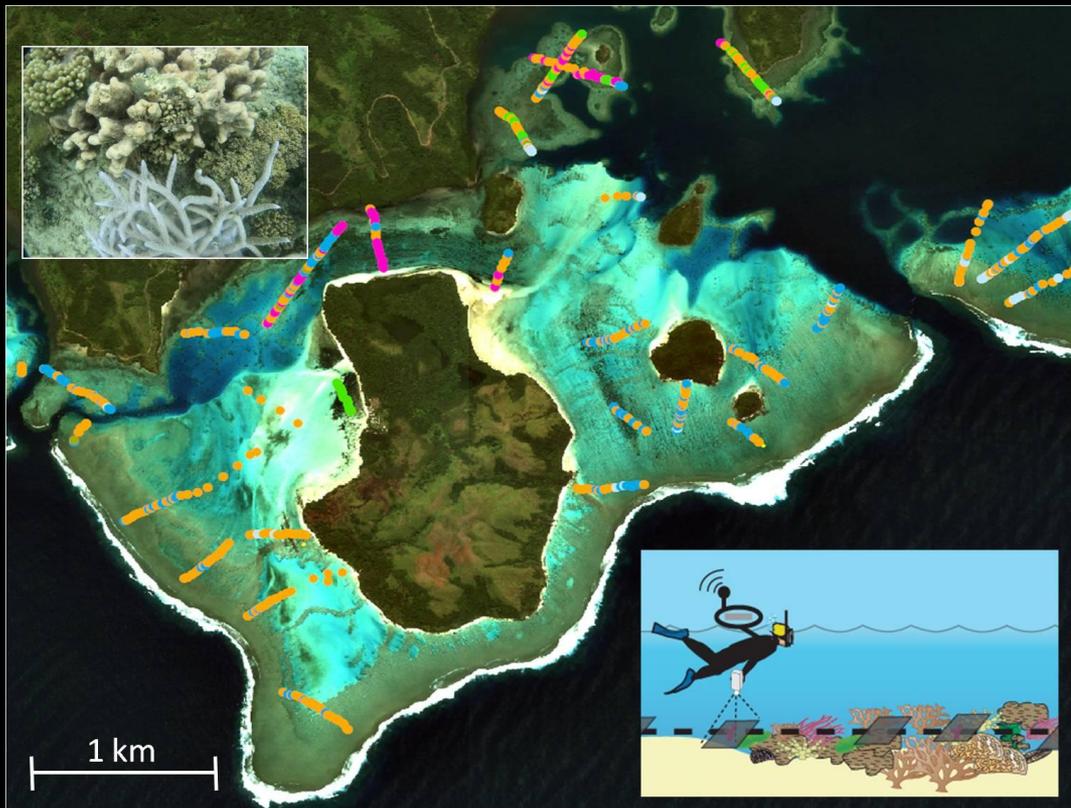
Project

Coral Reef Habitat Mapping

University of Queensland, supported by Wildlife Conservation Society, South Pacific Applied Geosciences Commission, and University of South Pacific

CRS Relevance

Geo-referenced photo transects of coral reefs by individual Fijian and Cook Islanders to augment satellite imagery



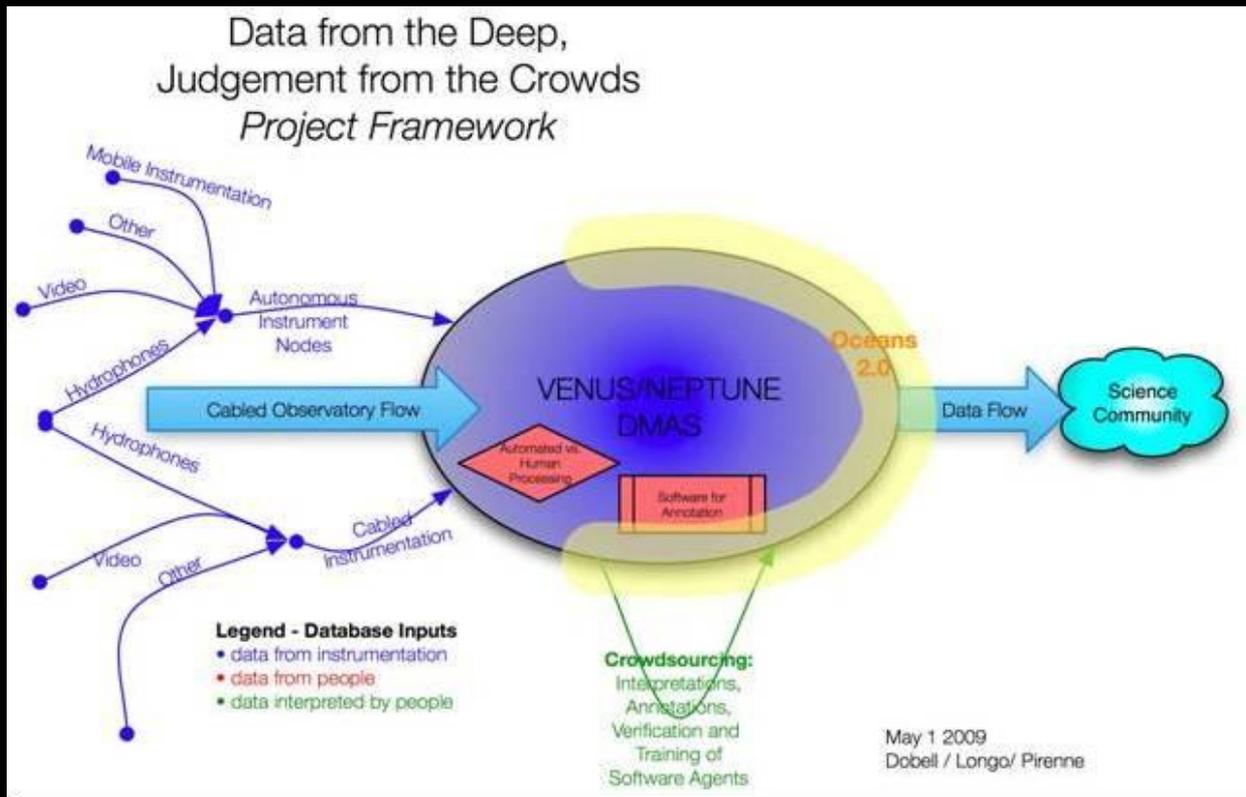
Geo-referenced photo transects distributed over a coral reef environment

- Collected and analyzed by Fijian islanders
- Color represents benthic composition derived from each photo

Ocean Biology Exploration

Project **NEPTUNE: Data from the Deep, Judgment from the Crowds**
University of Victoria

CRS Relevance **Community-contributed quality control, validation, and analysis of networked ocean sensor data**



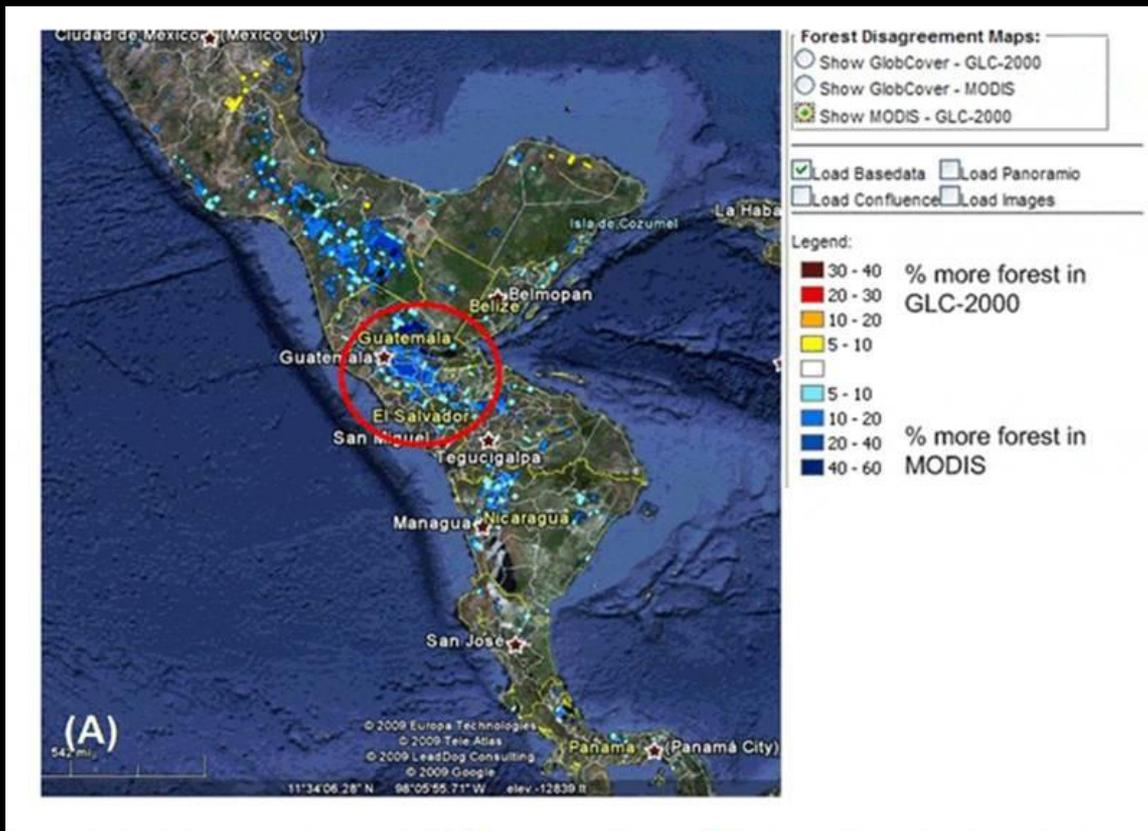
NEPTUNE project framework

Forest Inventory & Monitoring

Project **World Forest Observatory**

Resources for the Future

CRS Relevance **Wiki-based community remote sensing tools for performing a fine-scale global census of forest attributes**



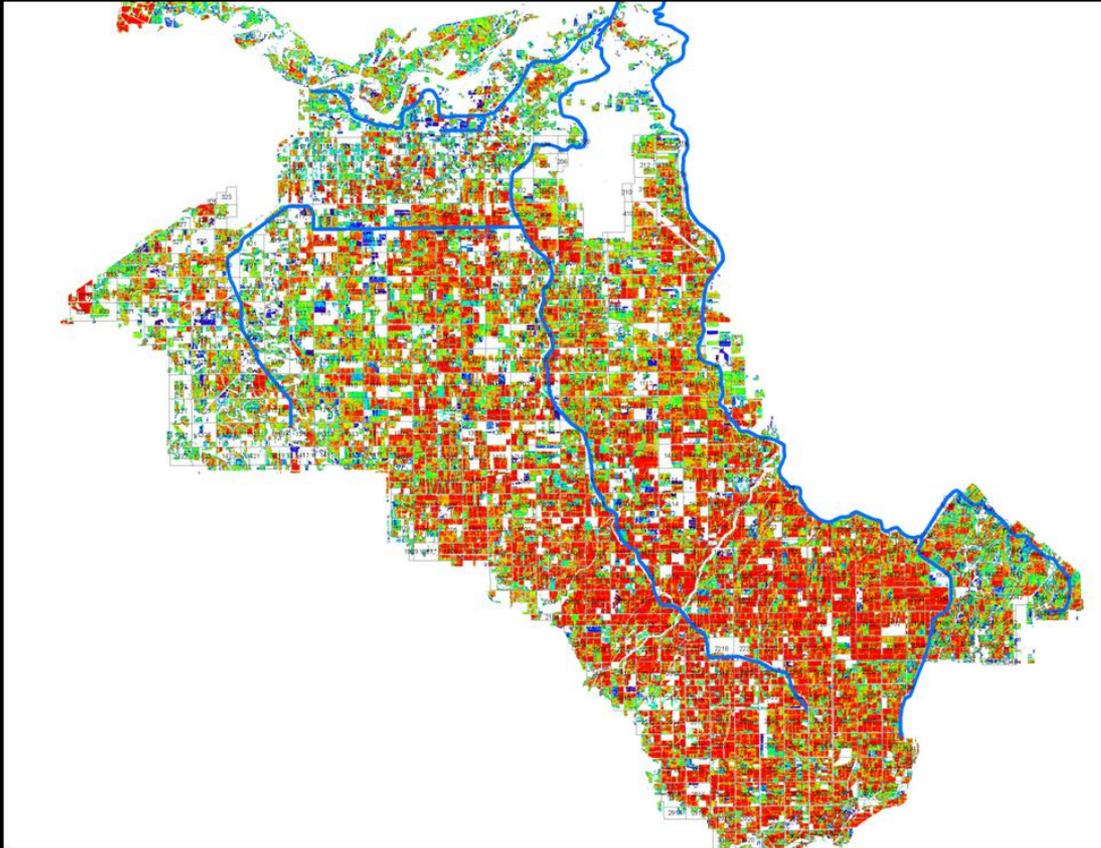
Forest cover classified by GLC2000 and by MODIS and the disagreement between them

The red circle identifies a hot spot of disagreement in Guatemala and El Salvador

Biodiversity Tool Validation

Project **Wheat Farming in Yaqui Valley**
Stanford University

CRS Relevance **Web tools for gathering user feedback on usability and value of remote sensing data sources**



Map of Yaqui Valley wheat yields supplied to individual farmers to gather feedback on how they make use of such information

Biodiversity Data from Social Networks

Project

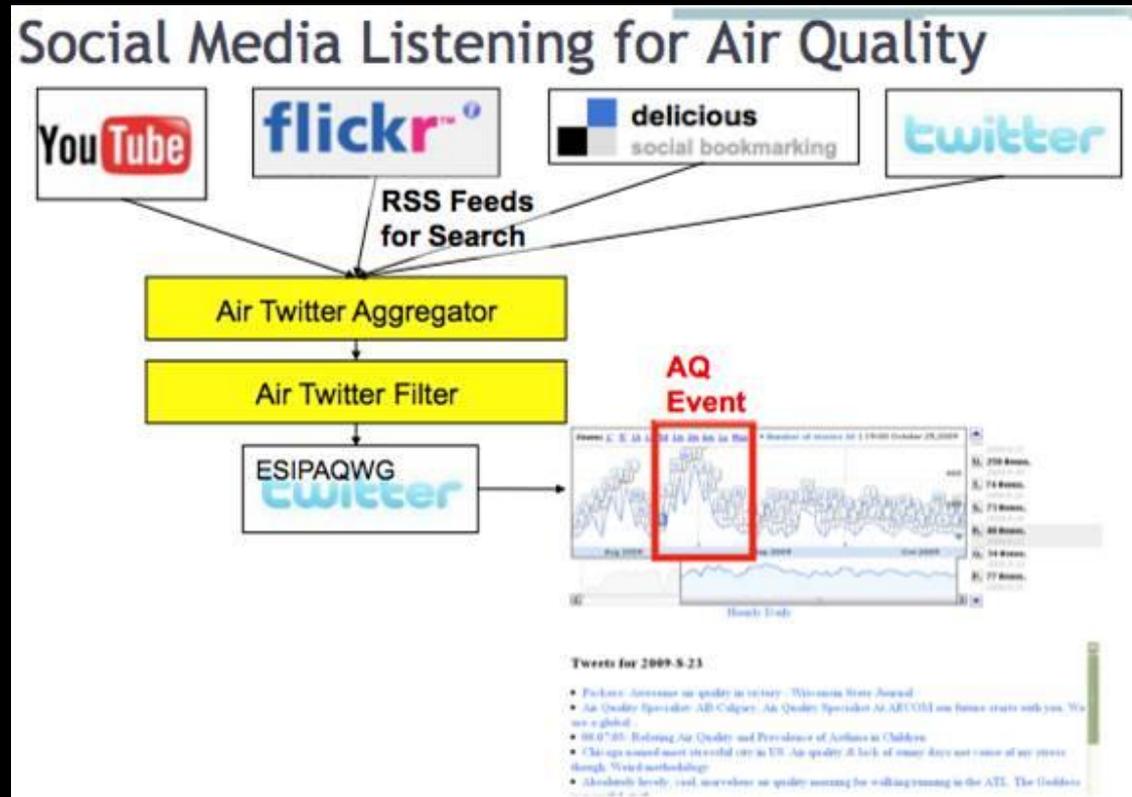
Air Twitter

Washington University in St. Louis, as part of Earth Science Information Partners (ESIP)

CRS Relevance

Use of commercial social networks to 'discover' air quality events for remote sensing analysis

The Air Twitter discovery and analysis process



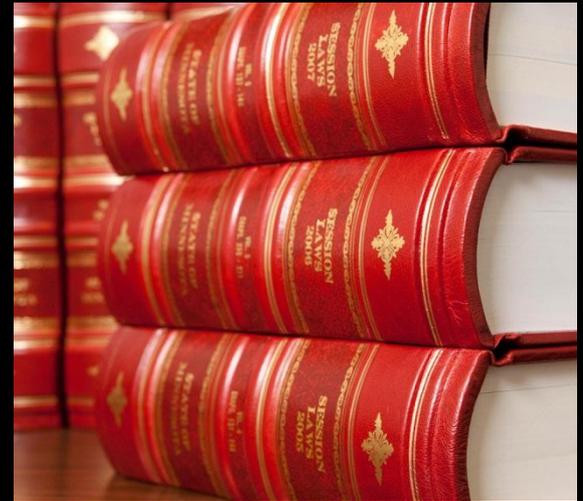
Driving Technologies

- Global high-bandwidth internet access
- Location-based (GPS) mobile phones
- Social networks
- Digital cameras
- Mobile phone cameras
- Low-cost data storage
- Cloud computing



Issues

- Privacy, privacy, privacy
- Data assimilation
- Data management
- Intellectual property
- Data quality
- Data coverage and reliability
- International law discrepancies



*These represent new areas of academic research
associated with CRS*

Where Has it Come From



- **30th IGARSS** (International Geoscience and Remote Sensing Symposium, Honolulu, July 25-30 2010)
 - **Plenary** headlined by OSTP with CRS as theme, followed by CRS-focused panel discussion with space agency heads
 - **Website section** dedicated to CRS, with Projects (16) and Perspectives
- Special issue of **Imaging Notes**
- **Citizen Cyberscience Summit** (London, Sep 2-3 2010)

GRASSROOTS

Where Is it Going

CHALLENGE

Earth information is central to society's rapid progress in the 21st century.

The required undertaking is enormous – observing and understanding our world at all space and time scales.

VISION

Within just a decade or so, the influence of community remote sensing will be as profound for understanding Earth as the satellite revolution has been.

SOLUTION

Meeting this challenge will be accomplished in part by citizens who contribute to remotely sensed versions of the world.

IMPACT

Governments will depend on it to understand climate change and natural disasters.

The commercial sector will use it to build 2D/3D online maps to make commerce more efficient and accessible.

Reminder

Visit Microsoft's Boulder facility Tuesday evening

Bus loads at hotel 5:45, returns 7:30

Refreshments, demos, and tour of data center for Bing imagery production

Sign up at registration desk