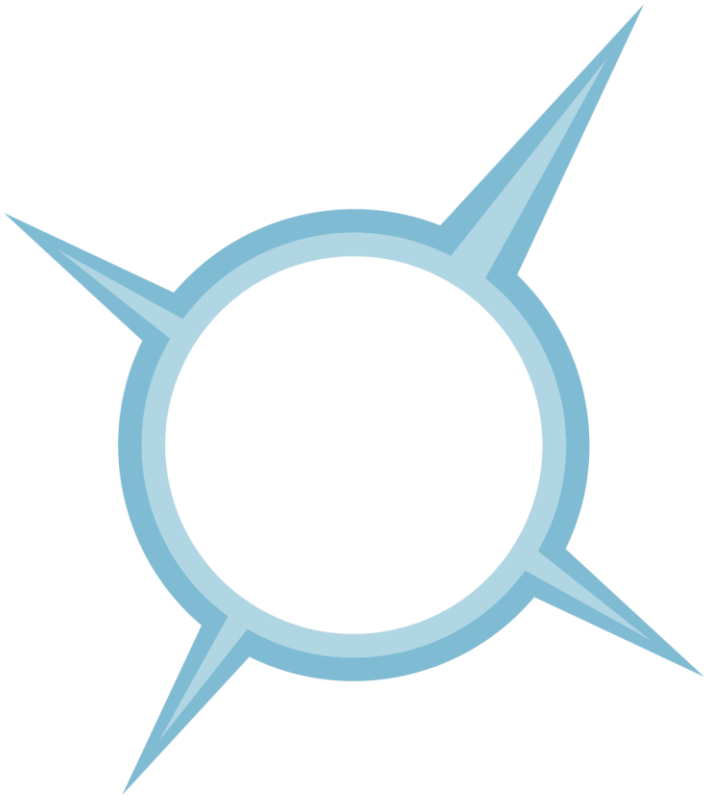
UNEP WCMC

Proteus Annual Meeting

28th - 29th June 2016

David Attenborough Building, Cambridge, UK



BARRICK

bp

Chevron

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ExxonMobil

REPSOL

RioTinto

Statoil

TOTAL

woodside

International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

science for global insight

Remote Sensing – the application of technology to identify and monitor impact on biodiversity

Steffen Fritz
IIASA
Ecosystems Service and Management (ESM)
Earth Observation Systems (EOS)

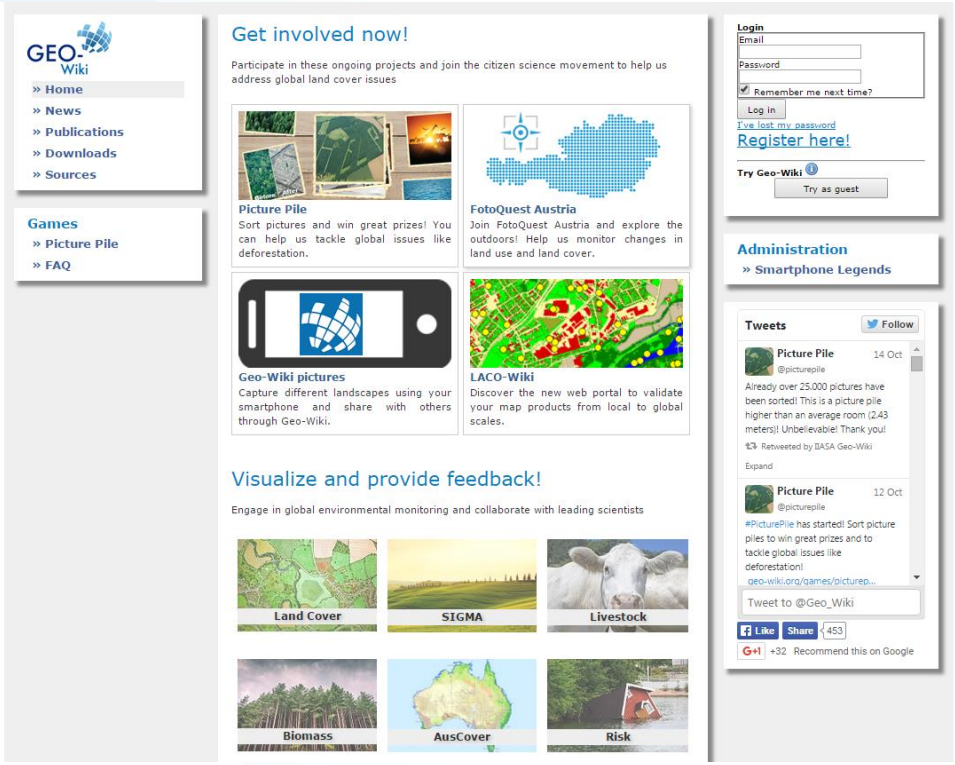
Remote Sensing and new Technologies help transparency

- Much more free and open data – explosion of Remote Sensing data
  - Landsat (30m), Sentinel I and II (10-20m), World-View 3 (30 cm)

- Smartphones
  - ground truthing

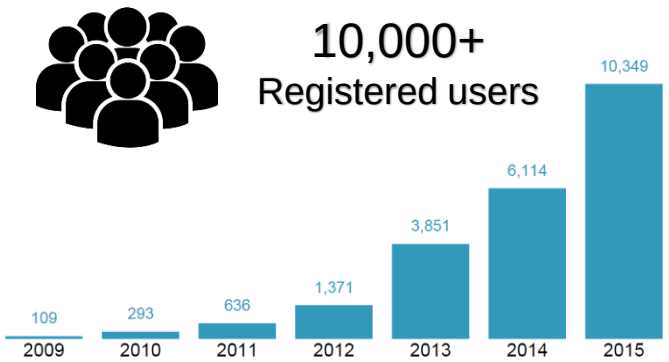
Geo-Wiki Engagement Platform

Geo-Wiki is an open platform that provides citizens with the means to engage in environmental monitoring by providing feedback on existing spatial information overlaid on satellite imagery or by contributing entirely new data.



GEO-Wiki

http://www.geo-wiki.org/



BIOeCON

STUDY ESTIMATES LAND AVAILABLE FOR BIOFUEL CROPS

Study Estimates Land Available for Biofuel Crops

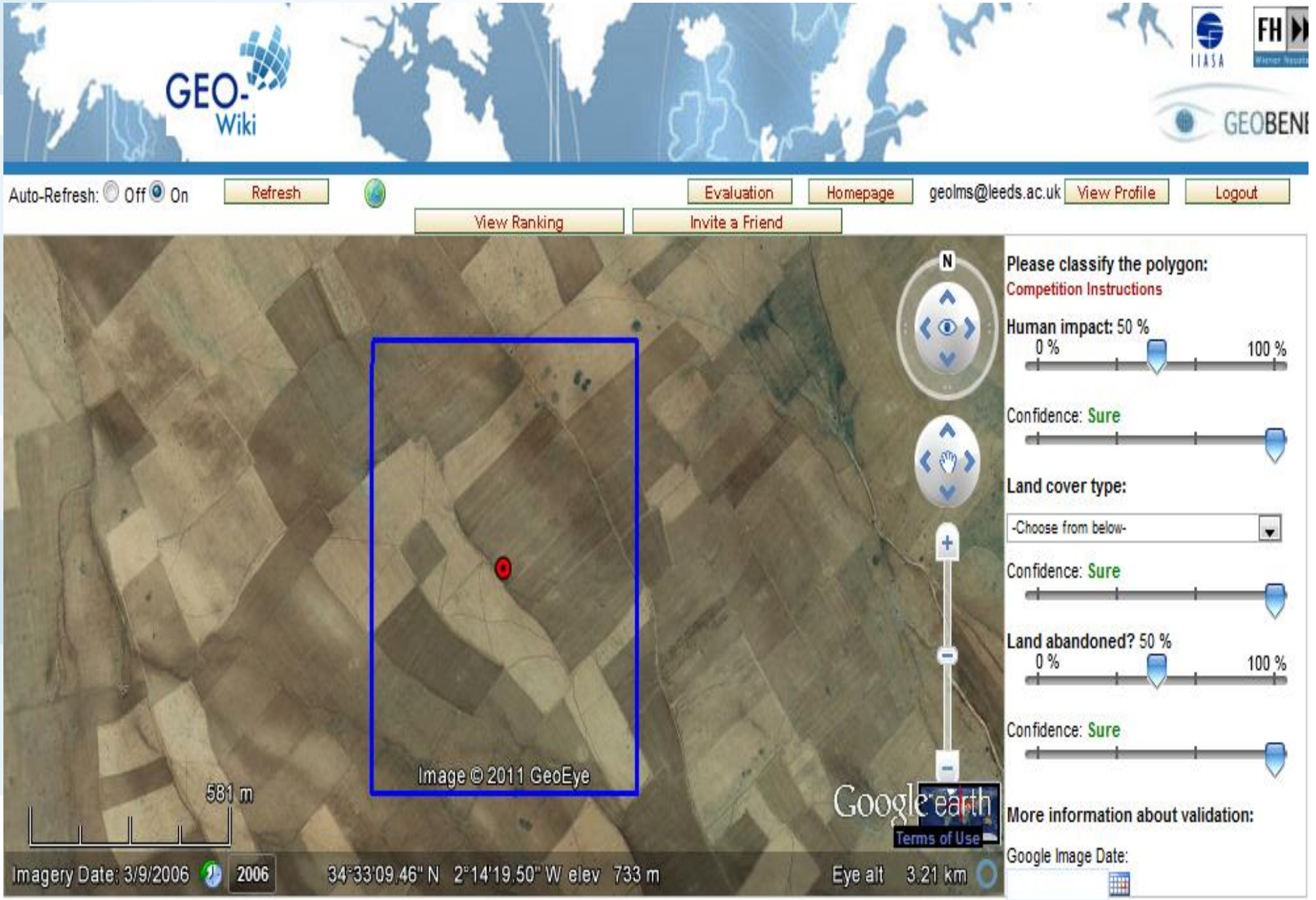
By Science Daily,

January 19, 2011

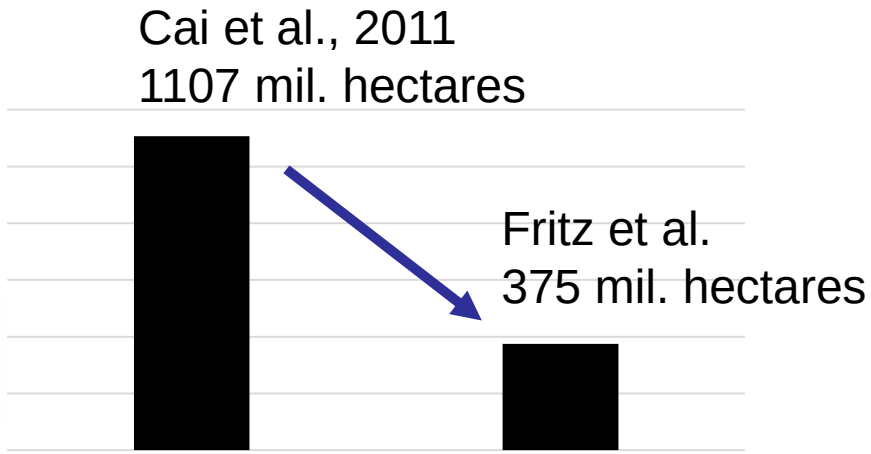
Using detailed land analysis, Illinois researchers have found that biofuel crops cultivated on available land could produce up to half of the world's current fuel consumption -- without affecting food crops or pastureland.

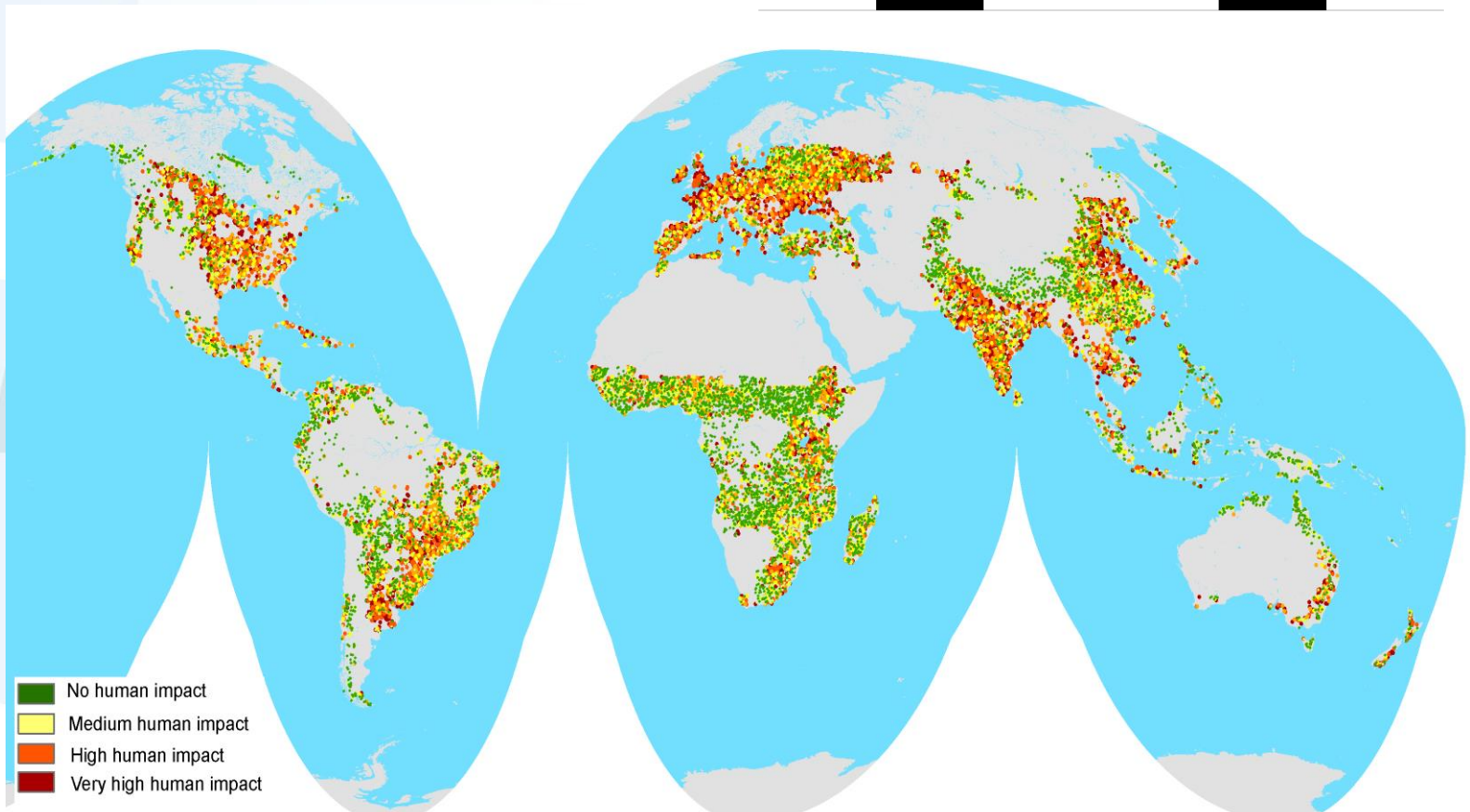
Published in the journal Environmental Science and Technology, the study led by civil and environmental engineering professor Ximing Cai identified land around the globe available to produce grass crops for biofuels, with minimal impact on agriculture or the environment.

Many studies on biofuel crop viability focus on biomass yield, or how productive a crop can be regionally. There has been relatively little research on land availability, one of the key constraints of


GEO-Wiki
IIASA
FH
GEOBENE
Auto-Refresh: Off On
Refresh
Evaluation
Homepage
geolms@leeds.ac.uk
View Profile
Logout
View Ranking
Invite a Friend
N
Please classify the polygon:
Competition Instructions
Human impact: 50 %
0 %
100 %
Confidence: Sure
Land cover type:
-Choose from below-
Confidence: Sure
Land abandoned? 50 %
0 %
100 %
Confidence: Sure
More information about validation:
Google Image Date:
Image © 2011 GeoEye
581 m
Google earth
Terms of Use
Imagery Date: 3/9/2006
2006
34°33'09.46" N 2°14'19.50" W elev 733 m
Eye alt 3.21 km

Downgrading recent estimates of land availability using crowdsourcing





Fritz et al, 2013, Environmental Science and technology

Picture Pile

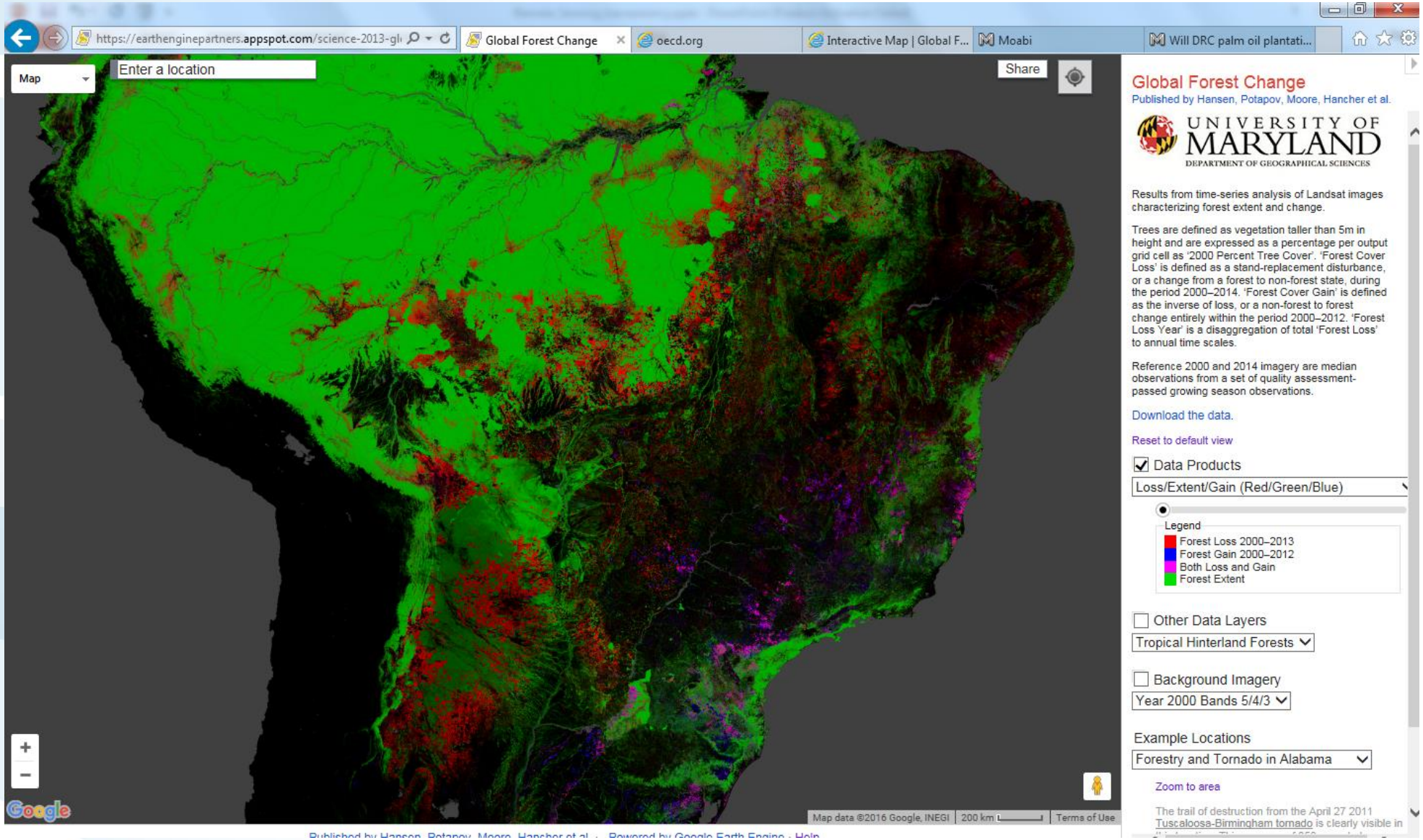
http://geo-wiki.org/games/picturepile

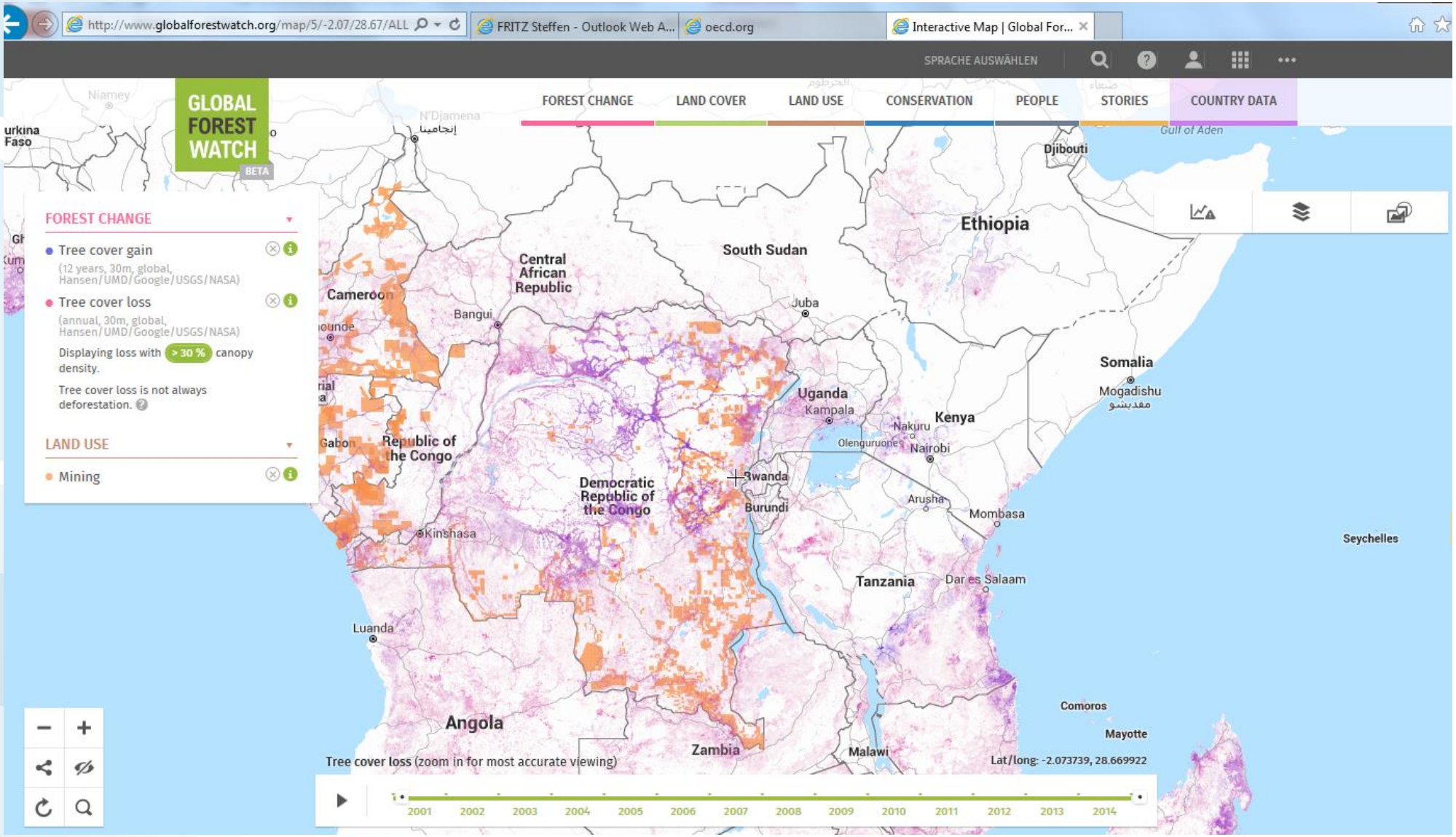
The App

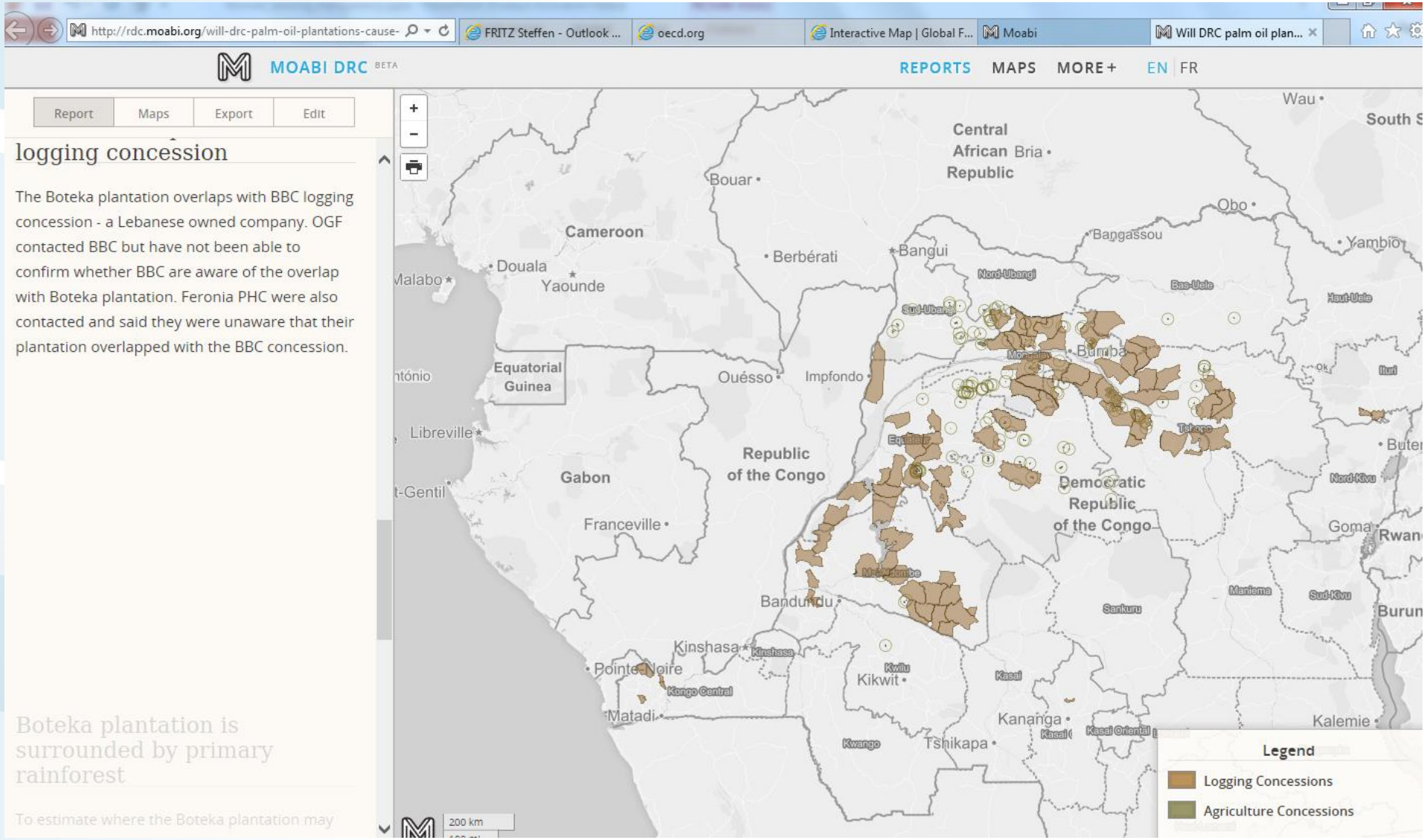

14:38
GEO-
Wiki
pictures


14:38
Geo-Wiki pictures
Pictures Queue
GPS
Take Photo
i
Select classification
573 Coniferous Trees
574 Abias alba


14:43
Geo-Wiki pictures
Pictures Queue
Select classification
573 Coniferous Trees
574 Abias alba
Comment:
my comment
Value:
pH value or tree height
Upload

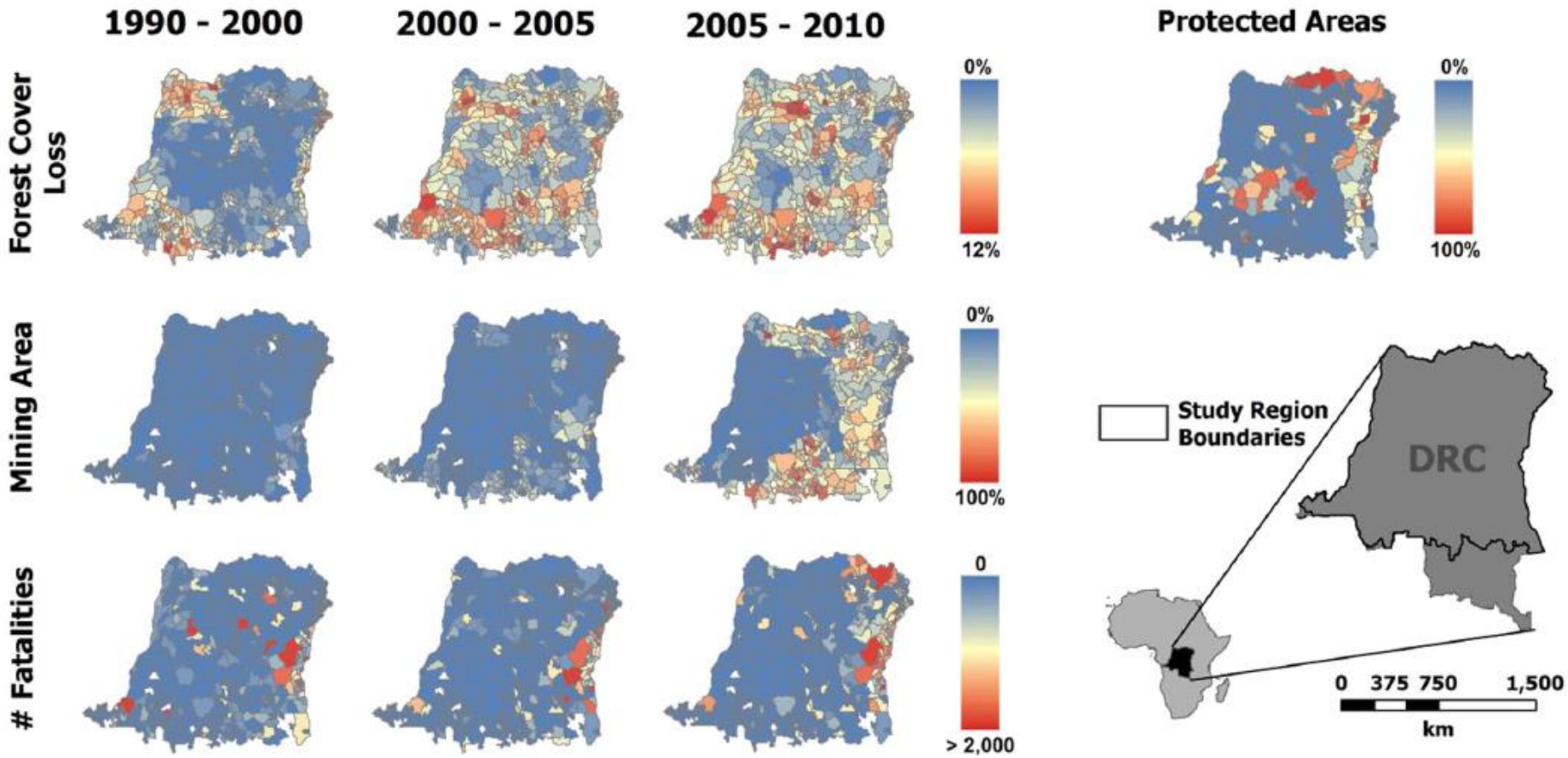

https://earthenginepartners.appspot.com/science-2013-gl
Global Forest Change
oecd.org
Interactive Map | Global F...
Moabi
Will DRC palm oil plantati...
Map
Enter a location
Share
Global Forest Change
Published by Hansen, Potapov, Moore, Hancher et al.
UNIVERSITY OF MARYLAND
DEPARTMENT OF GEOGRAPHICAL SCIENCES
Results from time-series analysis of Landsat images characterizing forest extent and change.
Trees are defined as vegetation taller than 5m in height and are expressed as a percentage per output grid cell as '2000 Percent Tree Cover'. 'Forest Cover Loss' is defined as a stand-replacement disturbance, or a change from a forest to non-forest state, during the period 2000–2014. 'Forest Cover Gain' is defined as the inverse of loss, or a non-forest to forest change entirely within the period 2000–2012. 'Forest Loss Year' is a disaggregation of total 'Forest Loss' to annual time scales.
Reference 2000 and 2014 imagery are median observations from a set of quality assessment-passed growing season observations.
Download the data.
Reset to default view
Data Products
Loss/Extent/Gain (Red/Green/Blue)
Legend
Forest Loss 2000–2013
Forest Gain 2000–2012
Both Loss and Gain
Forest Extent
Other Data Layers
Tropical Hinterland Forests
Background Imagery
Year 2000 Bands 5/4/3
Example Locations
Forestry and Tornado in Alabama
Zoom to area
The trail of destruction from the April 27 2011 Tuscaloosa-Birmingham tornado is clearly visible in
Google
Map data ©2016 Google, INEGI
200 km
Terms of Use


http://www.globalforestwatch.org/map/5/-2.07/28.67/ALL
FRITZ Steffen - Outlook Web A...
oecd.org
Interactive Map | Global For...
SPRACHE AUSWÄHLEN
GLOBAL FOREST WATCH
BETA
FOREST CHANGE
LAND COVER
LAND USE
CONSERVATION
PEOPLE
STORIES
COUNTRY DATA
FOREST CHANGE
Tree cover gain
(12 years, 30m, global, Hansen/UMD/Google/USGS/NASA)
Tree cover loss
(annual, 30m, global, Hansen/UMD/Google/USGS/NASA)
Displaying loss with > 30 % canopy density.
Tree cover loss is not always deforestation.
LAND USE
Mining
Niamey
N'Djamena
Gulf of Aden
Djibouti
Ethiopia
South Sudan
Central African Republic
Cameroon
Bangui
Juba
Somalia
Mogadishu
Uganda
Kampala
Kenya
Nakuru
Olenguruone
Nairobi
Gabon
Republic of the Congo
Democratic Republic of the Congo
Rwanda
Burundi
Arusha
Mombasa
Kinshasa
Seychelles
Tanzania
Dar es Salaam
Luanda
Angola
Zambia
Malawi
Comoros
Mayotte
Tree cover loss (zoom in for most accurate viewing)
Lat/long: -2.073739, 28.669922
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


http://rdc.moabi.org/will-drc-palm-oil-plantations-cause-
FRITZ Steffen - Outlook ...
oecd.org
Interactive Map | Global F...
Moabi
Will DRC palm oil plan...
MOABI DRC BETA
REPORTS
MAPS
MORE +
EN
FR
Report
Maps
Export
Edit
logging concession
The Boteka plantation overlaps with BBC logging concession - a Lebanese owned company. OGF contacted BBC but have not been able to confirm whether BBC are aware of the overlap with Boteka plantation. Feronia PHC were also contacted and said they were unaware that their plantation overlapped with the BBC concession.
Boteka plantation is surrounded by primary rainforest
To estimate where the Boteka plantation may
Central African Republic
Cameroon
Equatorial Guinea
Gabon
Republic of the Congo
Democratic Republic of the Congo
Douala
Yaounde
Bouar
Berbérati
Bangui
Bangassou
Obo
Yambio
Libreville
Franceville
Ouésso
Impfondo
Bumba
Kinshasa
Pointe-Noire
Matadi
Kikwit
Tshikapa
Kananga
Kalemie
Goma
Bandundu
Sankuru
Legend
Logging Concessions
Agriculture Concessions
200 km

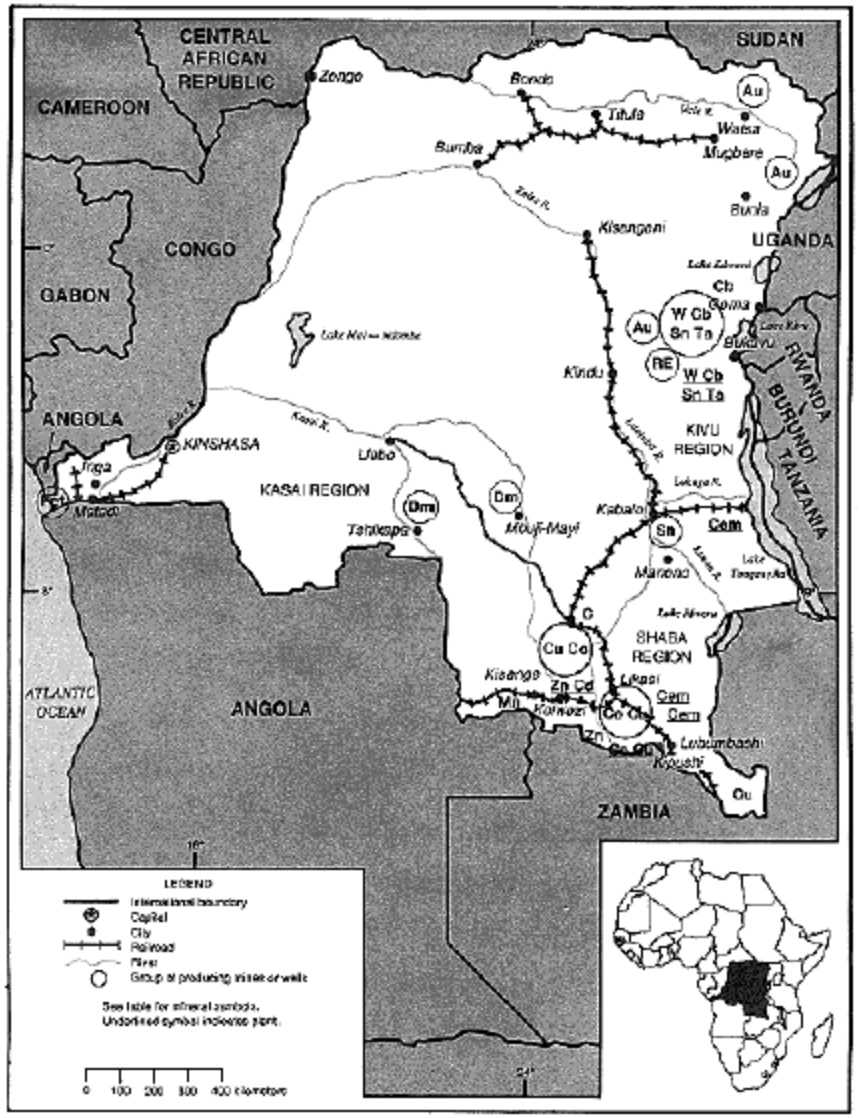
- DRC CASE STUDY

Case study – Congo DRC Mining, armed conflict and protected areas

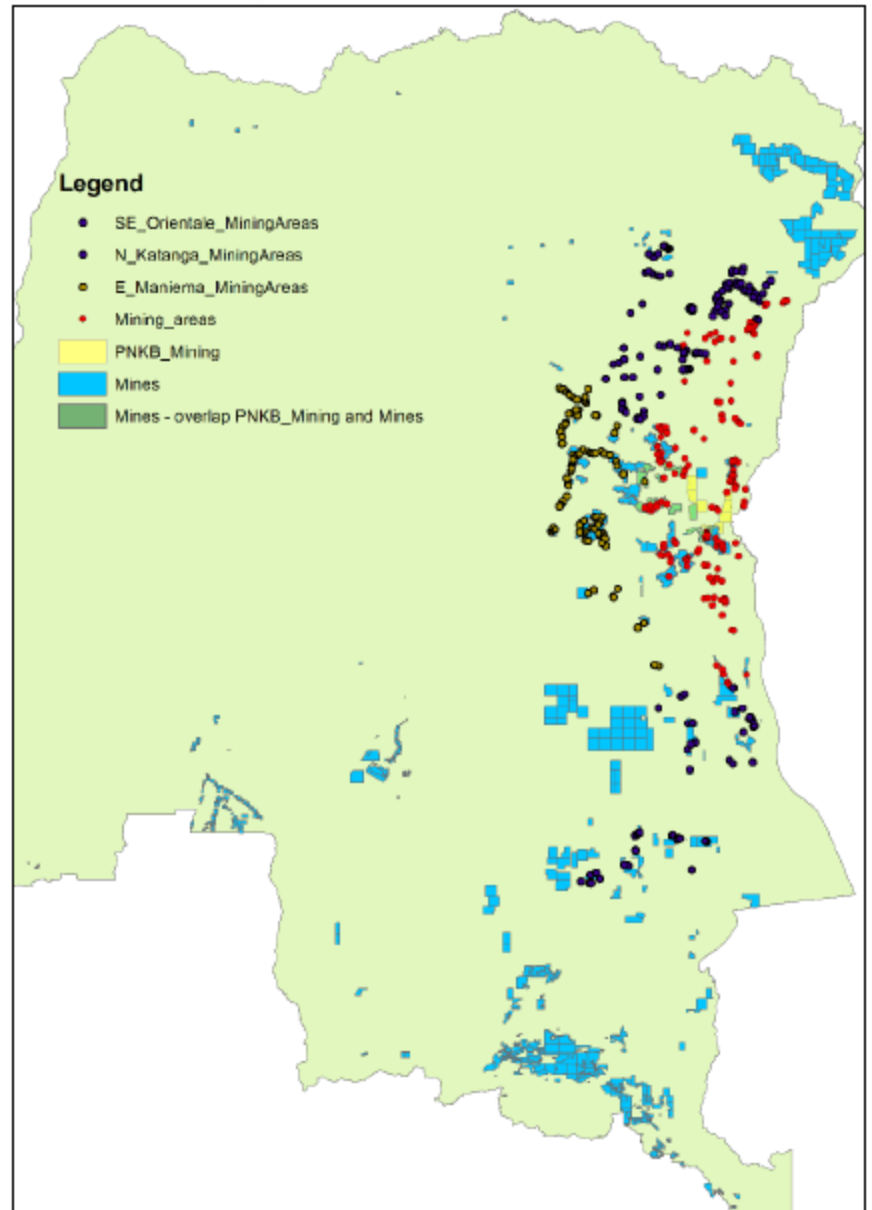


V. Butsic et al. / Biological Conservation 191 (2015) 266–273

Availability of spatial data for mining areas

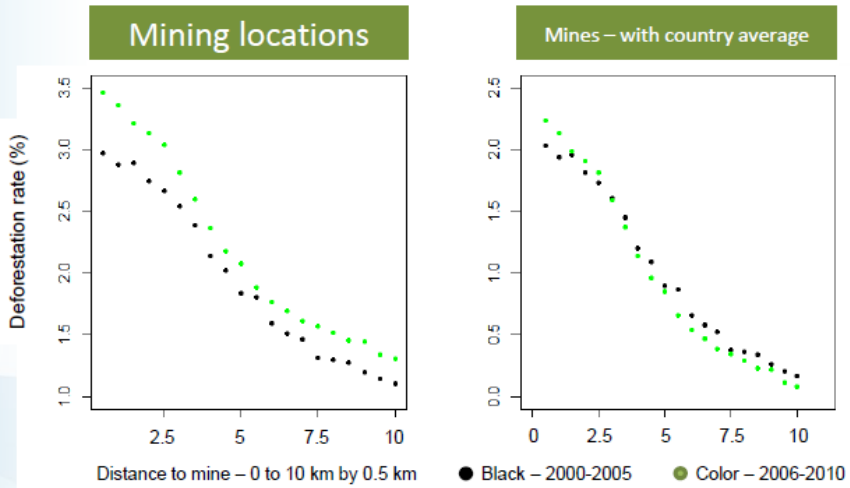


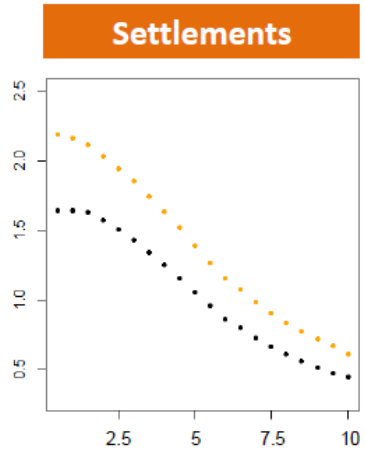
Regional map of mineral facilities in DRC
USGS reports *(minerals.usgs.gov)*

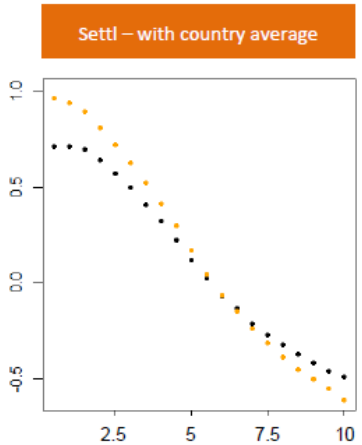


- Different regions – different minerals
- Main minerals
  - Gold
  - Diamonds
  - Co, Cu
  - Cassiterite
- Mining locations:
  - Polygons (Forest Atlas)
  - Points (IPIS)

Deforestation rate: mines and settlements



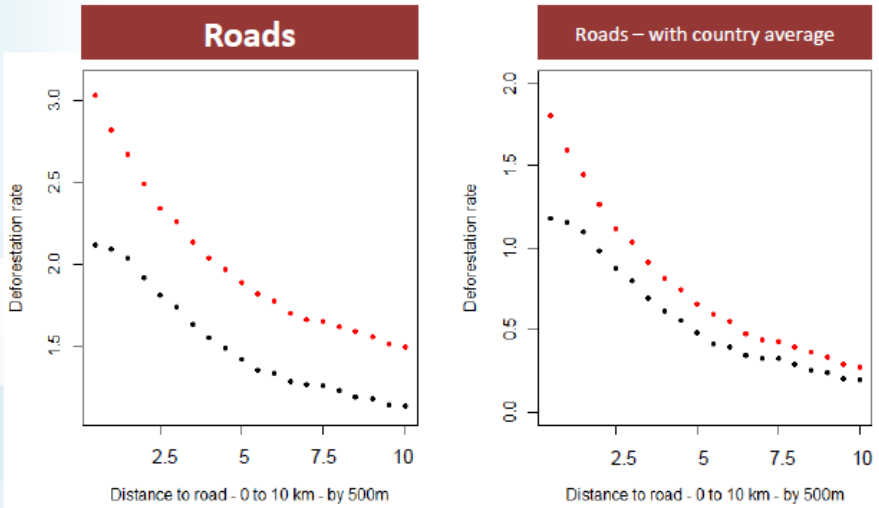


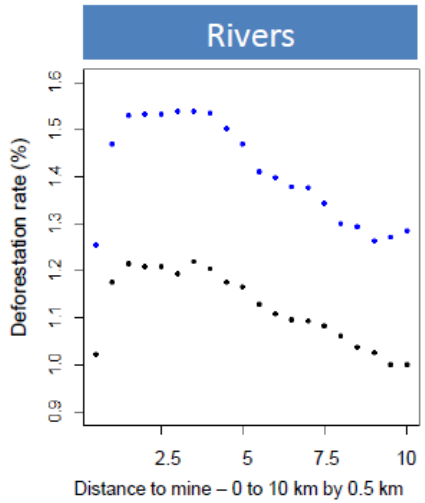


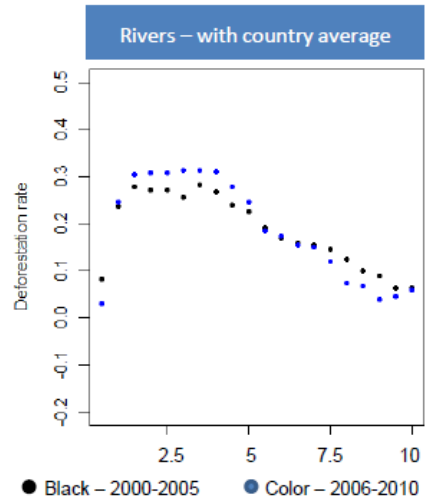
- Further from mine – lower deforestation rate
- 5 km away – deforestation rate drops down by around 1.5%

- Deforestation rate drops down, but slower than for mining locations
- Pattern changed for 2006-2010
- No data on how big the populated places are

Deforestation rate: rivers and roads



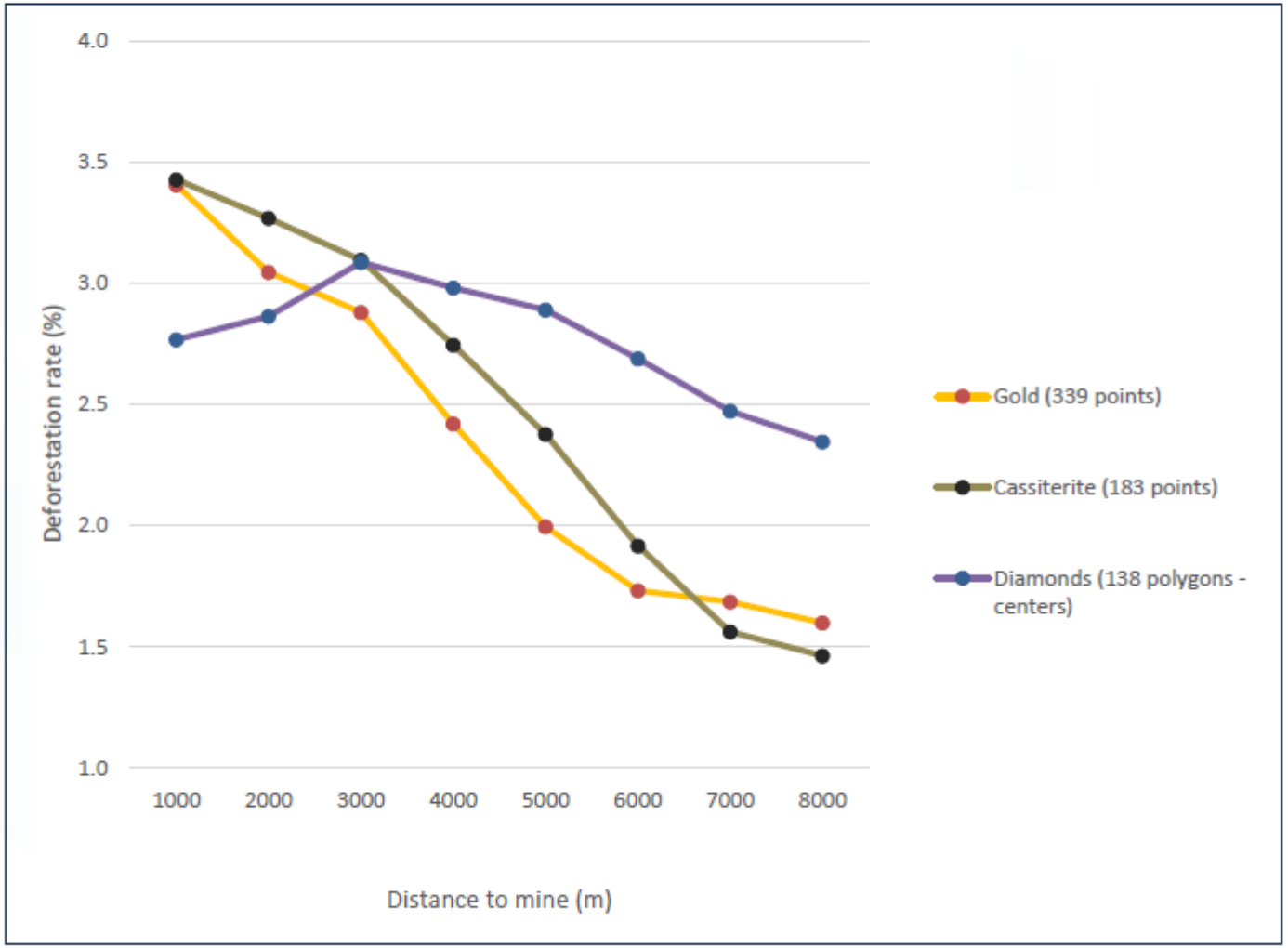




- 2006-2010 – deforestation is higher
- 3 km from primary roads – deforestation drops by 0.7%

- Range is small 1.25%-1.55%
- [0, 500 m) – lower deforestation rate

Deforestation vs distance to mining locations

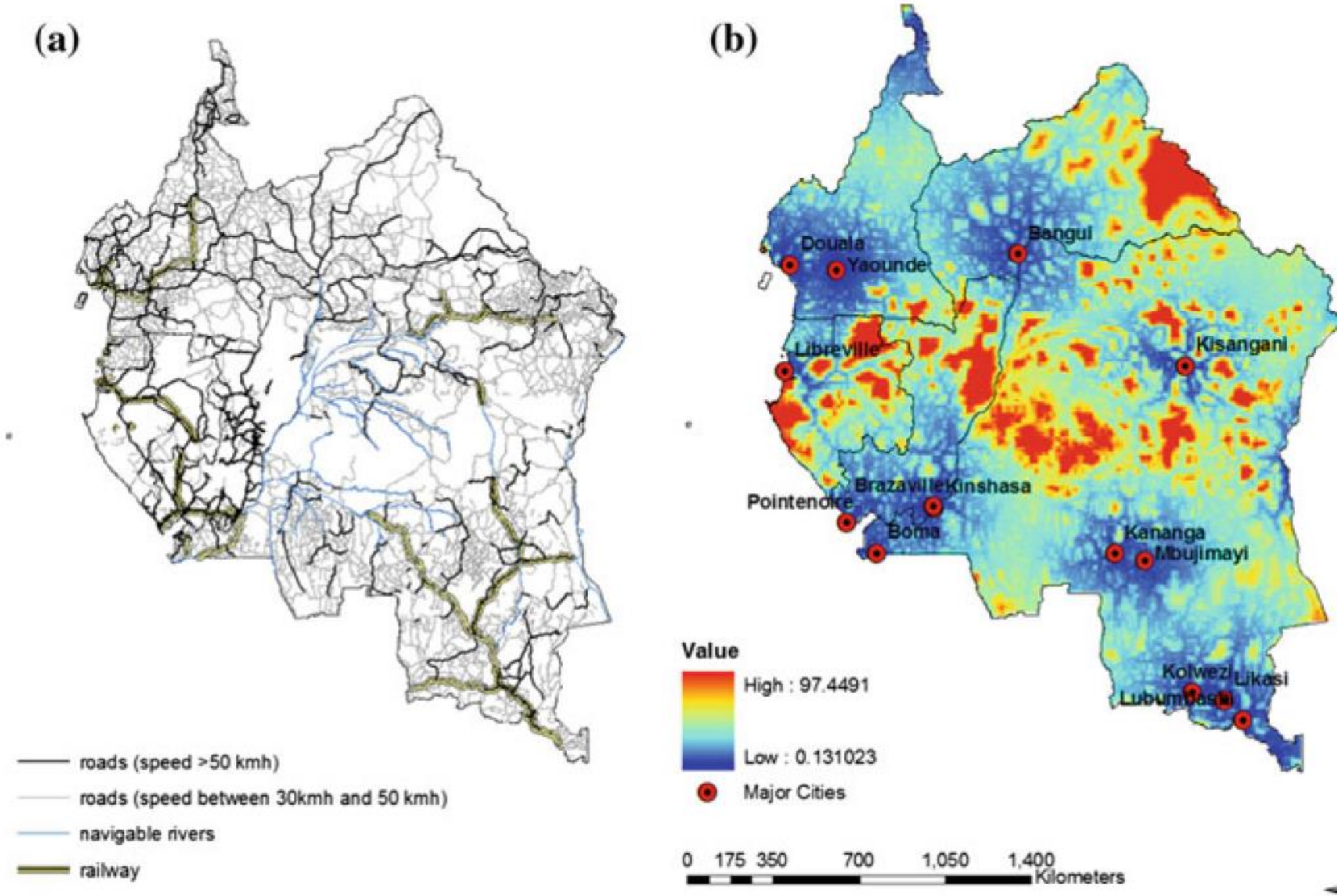


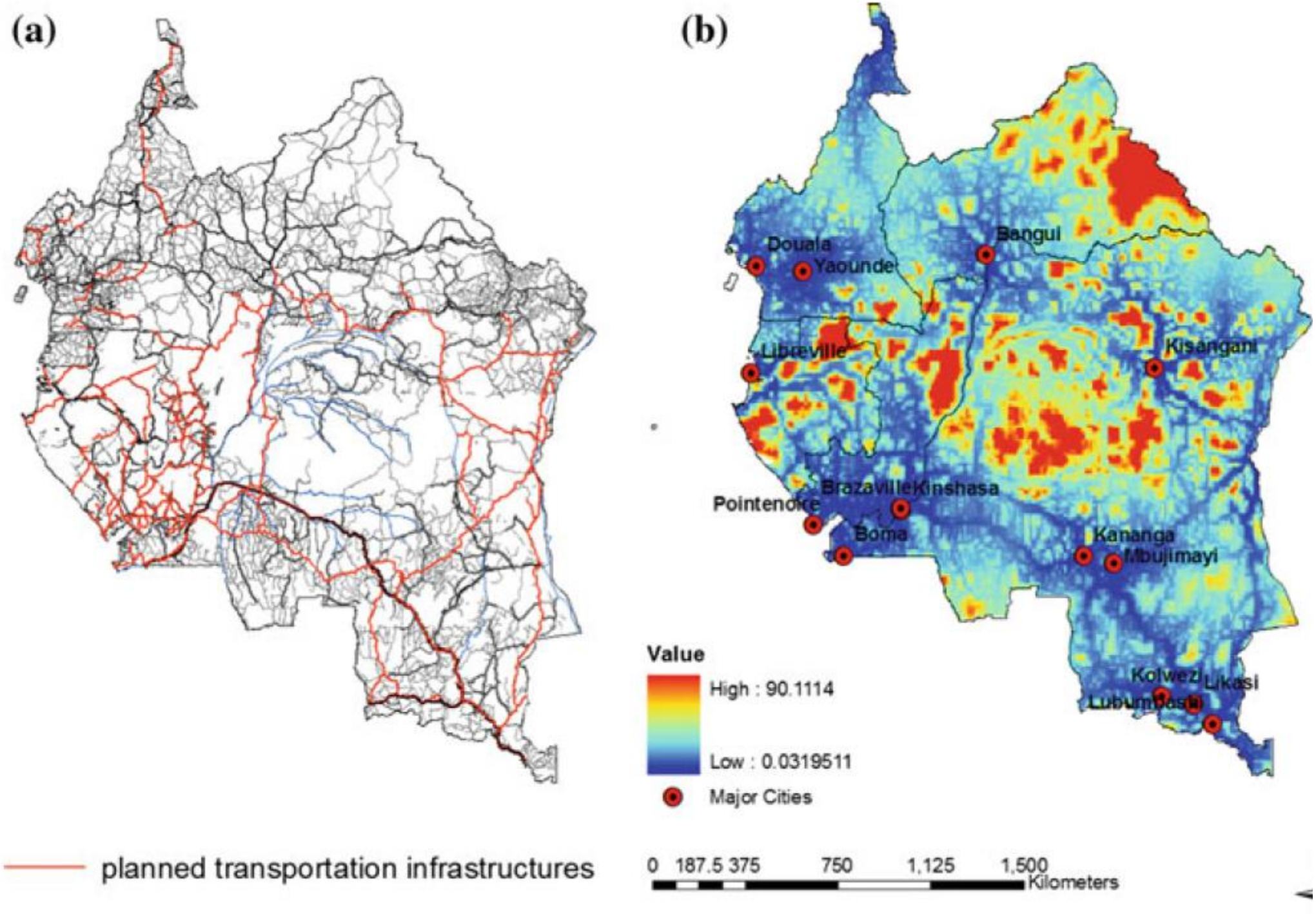
- Deforestation rate declines with increasing distance from mines
- Gold, cassiterite – similar pattern – deforestation decreases

Infrastructure as a major contributor to economic growth

- **Eight essential conditions for strong growth**
  - ***Physical Capital***
  - ***Human Capital***
  - ***The rule of law***
  - ***Competitive markets***
  - ***Macroeconomic stability***
  - ***Infrastructure***
  - ***Openness to trade and investment***
  - ***Increased agricultural productivity***

- DRC study using the Globiom Model


(a)
roads (speed >50 kmh)
roads (speed between 30kmh and 50 kmh)
navigable rivers
railway
(b)
Douala
Yaounde
Bangui
Libreville
Kisangani
Brazaville
Kinshasa
Pointenoire
Boma
Kananga
Mbujimayi
Kolwezi
Likasi
Value
High : 97.4491
Low : 0.131023
Major Cities
0 175 350 700 1,050 1,400
Kilometers


(a)
(b)
Douala
Yaounde
Bangui
Libreville
Kisangani
Brazzaville
Kinshasa
Pointenoire
Boma
Kananga
Mbujimayi
Kolwezi
Likasi
Lubumbashi
Value
High : 90.1114
Low : 0.0319511
Major Cities
planned transportation infrastructures
0 187.5 375 750 1,125 1,500
Kilometers

Results of GLOBIOM study

- the REDD+ fund is a unique opportunity that could help developing countries reduce their deforestation.
- However, a strong collaboration between the different sectors of the economy is required for the success of REDD
- REDD+ could be limited to few project sites while overall deforestation could increase in the region.
- Intelligent spatial planning is key

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www.iiasa.ac.at

science for global insight

Thanks!

fritz@iiasa.ac.at

Steffen Fritz, Linda See, Ian McCallum, Christoph Perger, Dmitry Schepaschenko, Myroslava Lesiv, Inian Moorthy, Anatoly Shvidenko, Carl Salk, Martina Duerauer, Mathias Karner, Tobias Sturn, Christopher Dresel, Dahlia Domian, Antonia Dunwoody, Olha Danylo, Juan-Carlos Laso

Earth Observations Group

Ecosystems Service and Management (ESM)

UNEP WCMC

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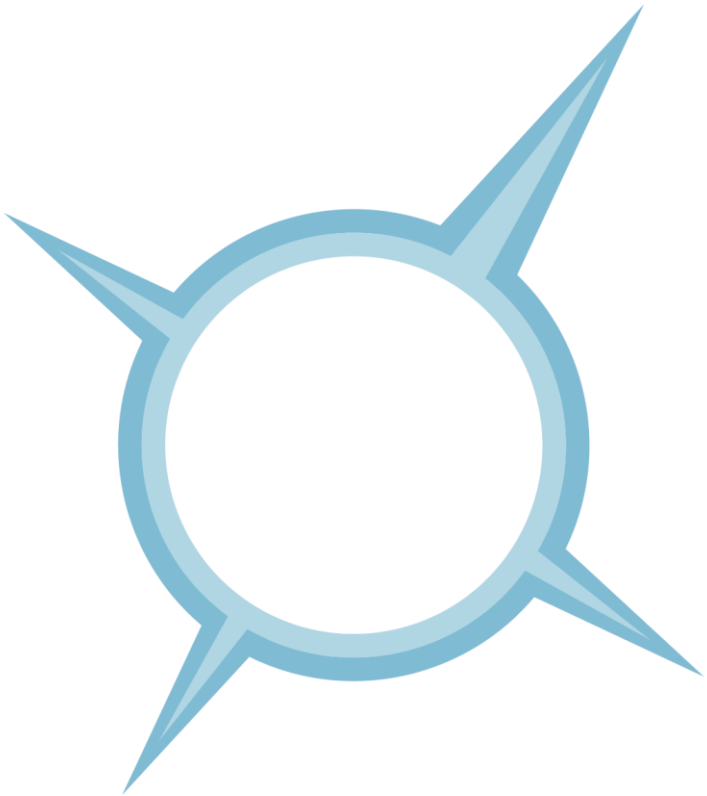

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Statoil

TOTAL

woodside

Using remote sensing to monitor habitat change

Mark Johnston, Group Ecologist

Overall Purpose

Investigate the potential application of remote sensing technology to map and monitor habitat change around our major operations.

- Does the technology provide sufficient resolution to be practical, reliable and cost effective?
- Can the technology be used across all operations or environments?
- Case studies:
  - Sullom Voe terminal, Shetlands, UK
  - Tangguh LNG, West Papua, Indonesia

Habitat change at Sullom Voe, Shetland

Sullom Voe terminal, Shetland Islands:

I. Natura 2000 protected areas.

II. Habitats of European and national importance.

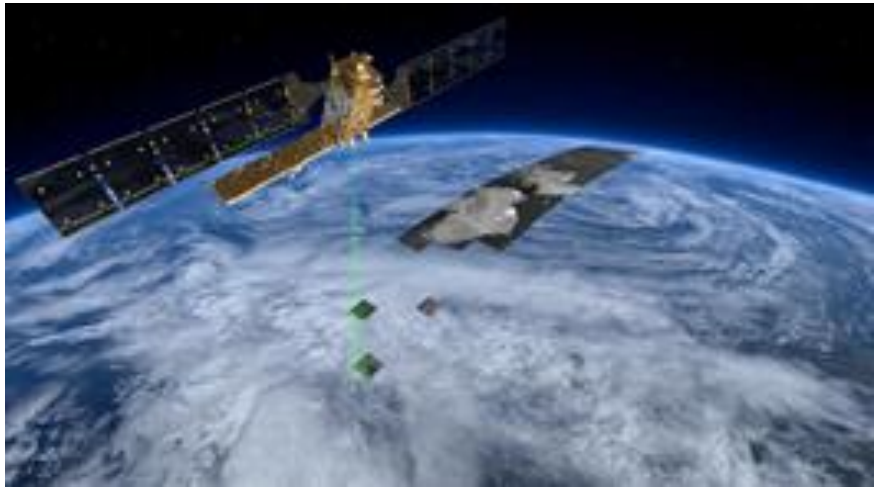
Purpose:

- Map habitats and habitat change around the terminal
- Assess applicability and reliability of the EO data to monitor change

G-ECO-MON
Earth observation for ecosystem service monitoring
Funded esa
Contract number: 4000107446/12/I-AM

Habitat change at Sullom Voe, Shetland

- Optical VHR (0.6 m) land use and change mapping (2003-2013)
- Optical VHR (0.5-4m) bathymetric map for 2013
- Optical VHR (0.5-4m) benthic habitat classification maps (including seagrass for 2003 and 2013)

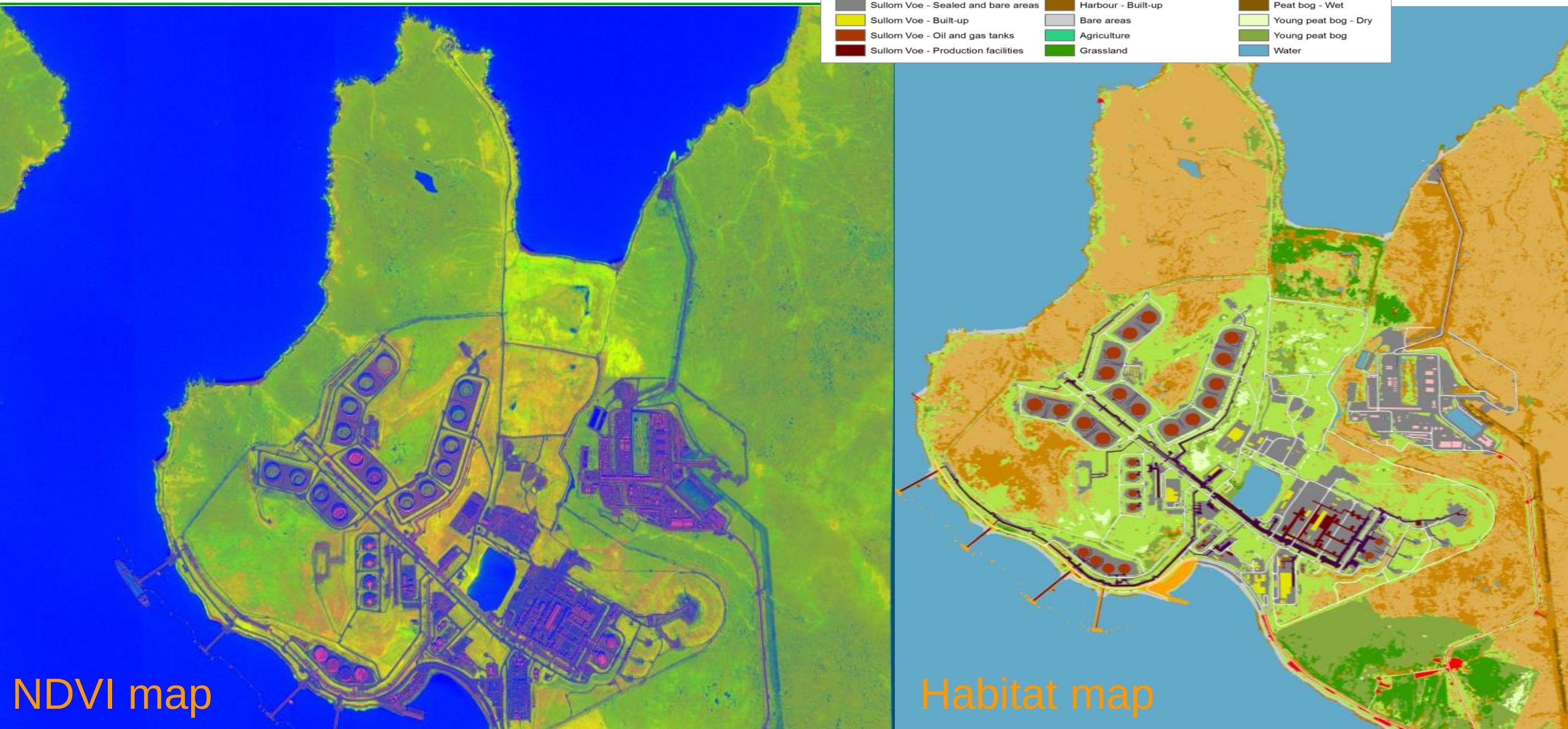


Additional Analysis:

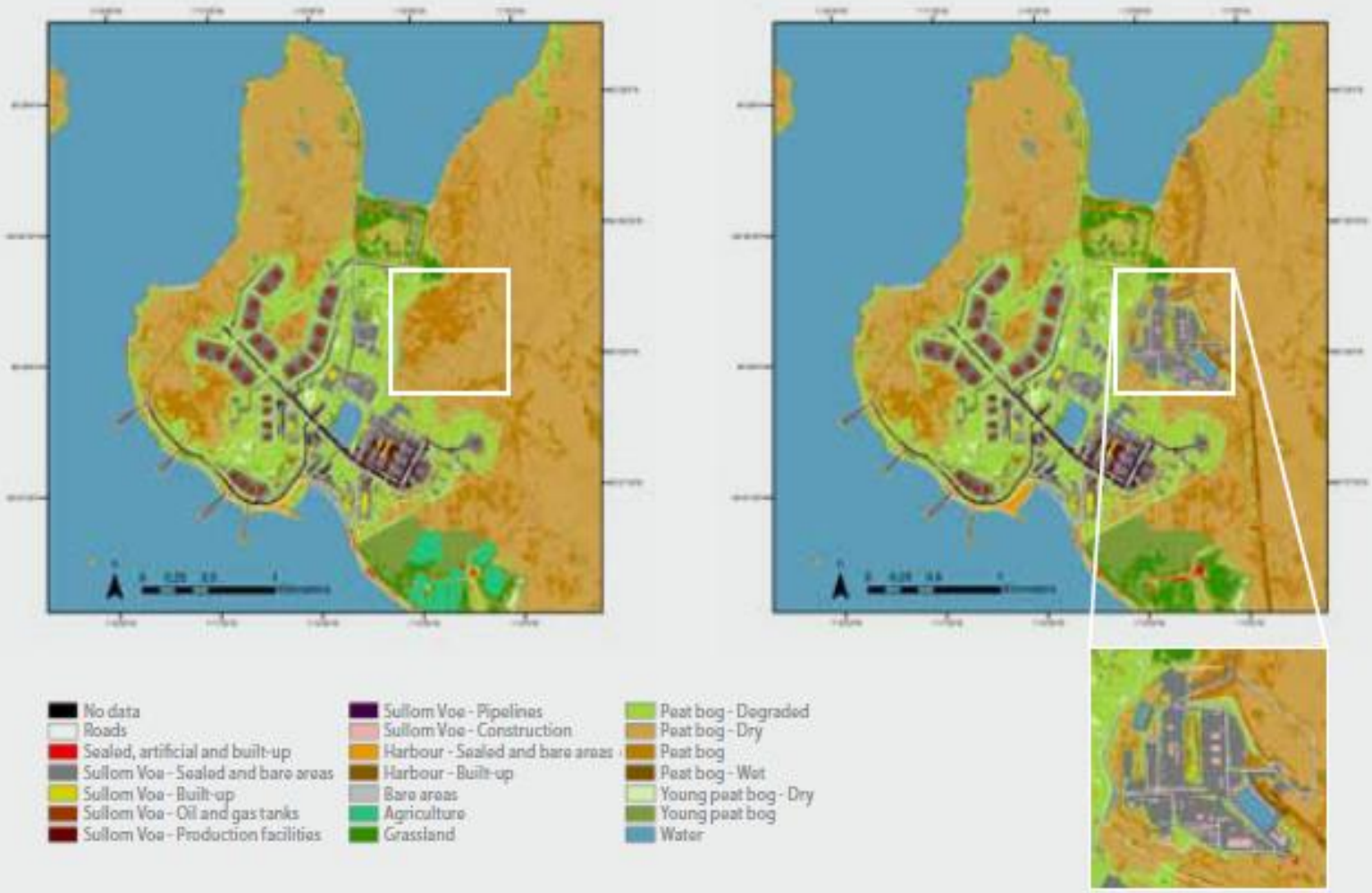
- Normalized Difference Vegetation Index (NDVI) for 2003 and 2013

Quickbird 2 satellite image (2003, at 0.6 m), IKONOS satellite image (2013, at 0.8 m) & GeoEye satellite image (2013, at 0.5 m)

Mapping habitat types



Mapping habitat change



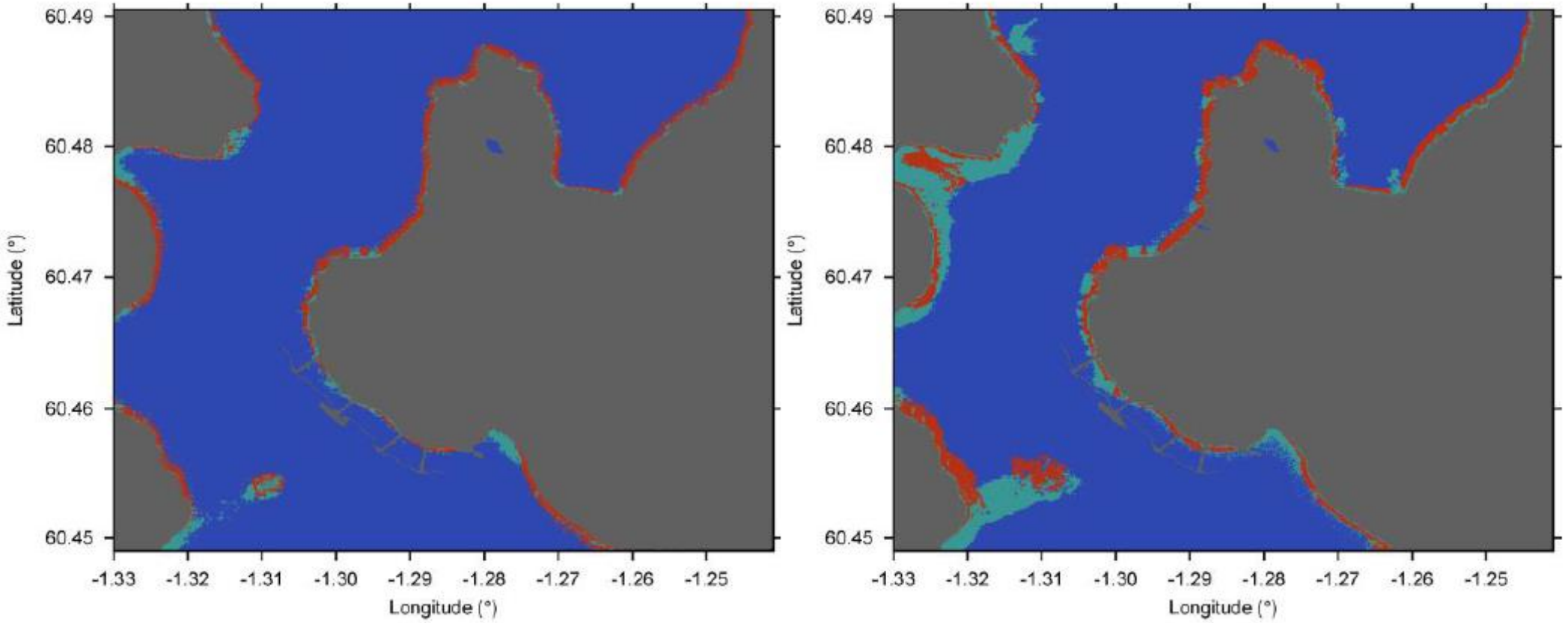
Land cover mapping around Sullom Voe Terminal 2003 and 2013

© GeoVille

Change between 2003 and 2013

© GeoVille

Benthic habitat mapping



1		Land
2		Deep water (bottom not visible)
3		Bare substrate
4		Macroalgae

- Depth up to 20m
- 4m to 0.5m spatial resolution (2003, 2013)

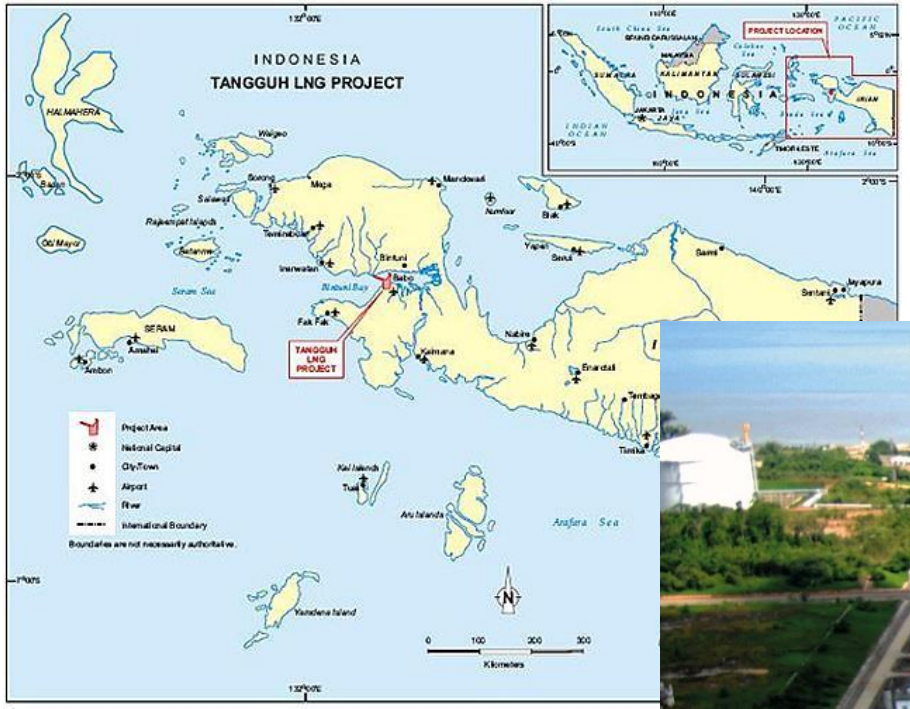
Lessons learnt

- For terrestrial - technically feasible to map and monitor habitat change at appropriate level of resolution.
- For marine - Broad marine/benthic habitat mapping with limitations.
- Historical image resolution differences makes it difficult to compare between years.
- Relatively inexpensive

Questions:

- Can we develop a single metric/indicator which represent habitat change around a facility?
- Can this methodology be applied to other locations, other habitats?

Habitat change at Tangguh, West Papua



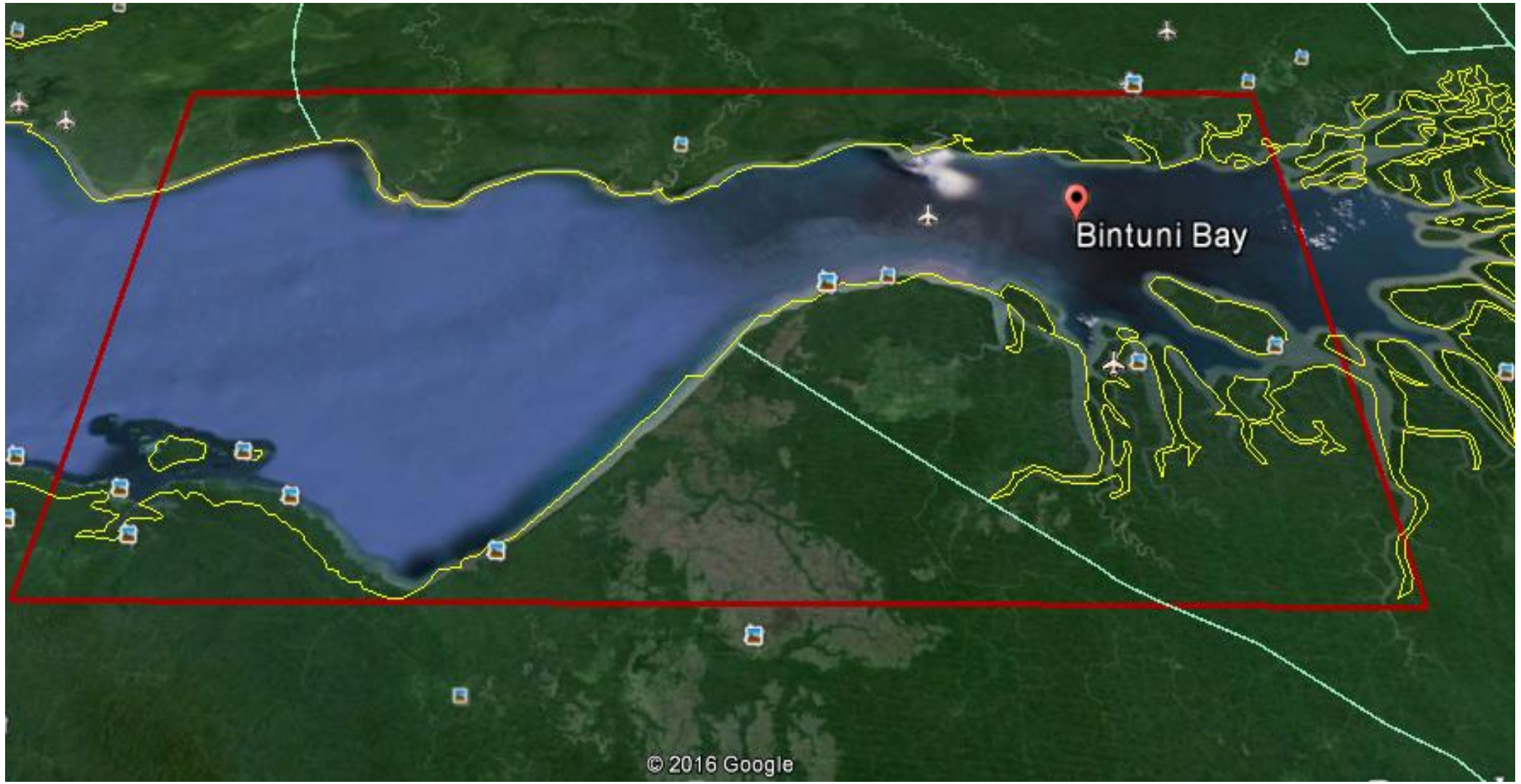
Two proposed applications (2016-2018)

1. **Landscape assessment - low resolution monitoring over wider area (3m resolution)**

   To monitor: extent of broad habitat types, landscape habitat change, cumulative impacts

   Data: broad habitat types, rivers, lakes/ponds, agriculture, roads, major tracks, jetties, settlements, pipelines.

Landscape habitat change at Tangguh

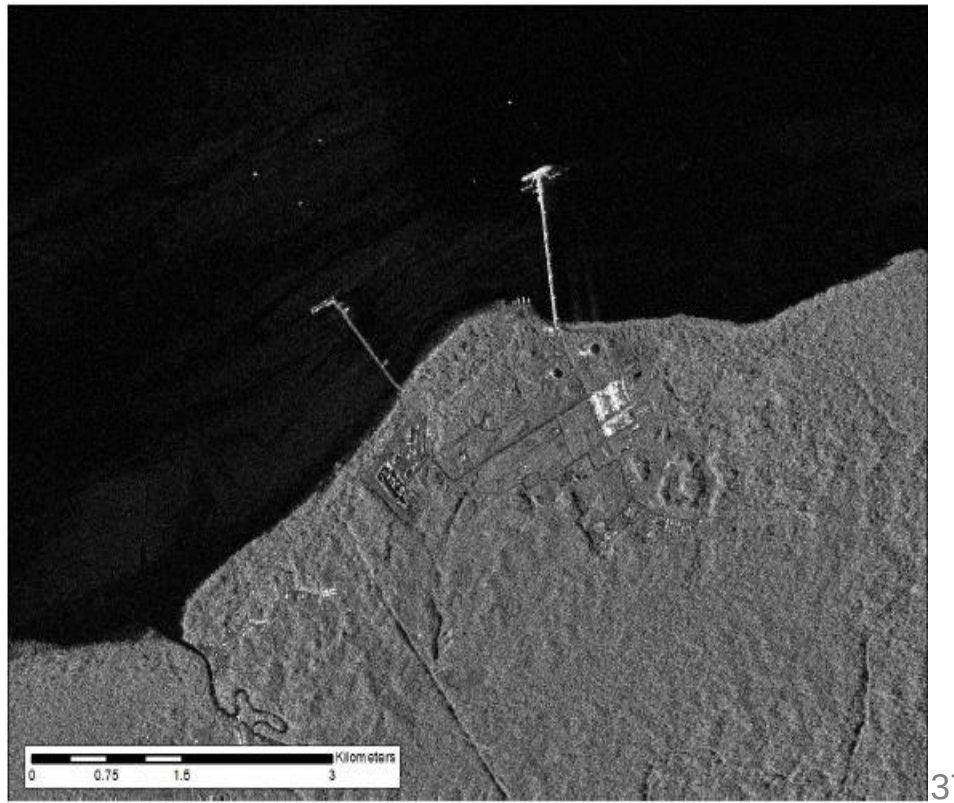


Two proposed applications (2016-2018)

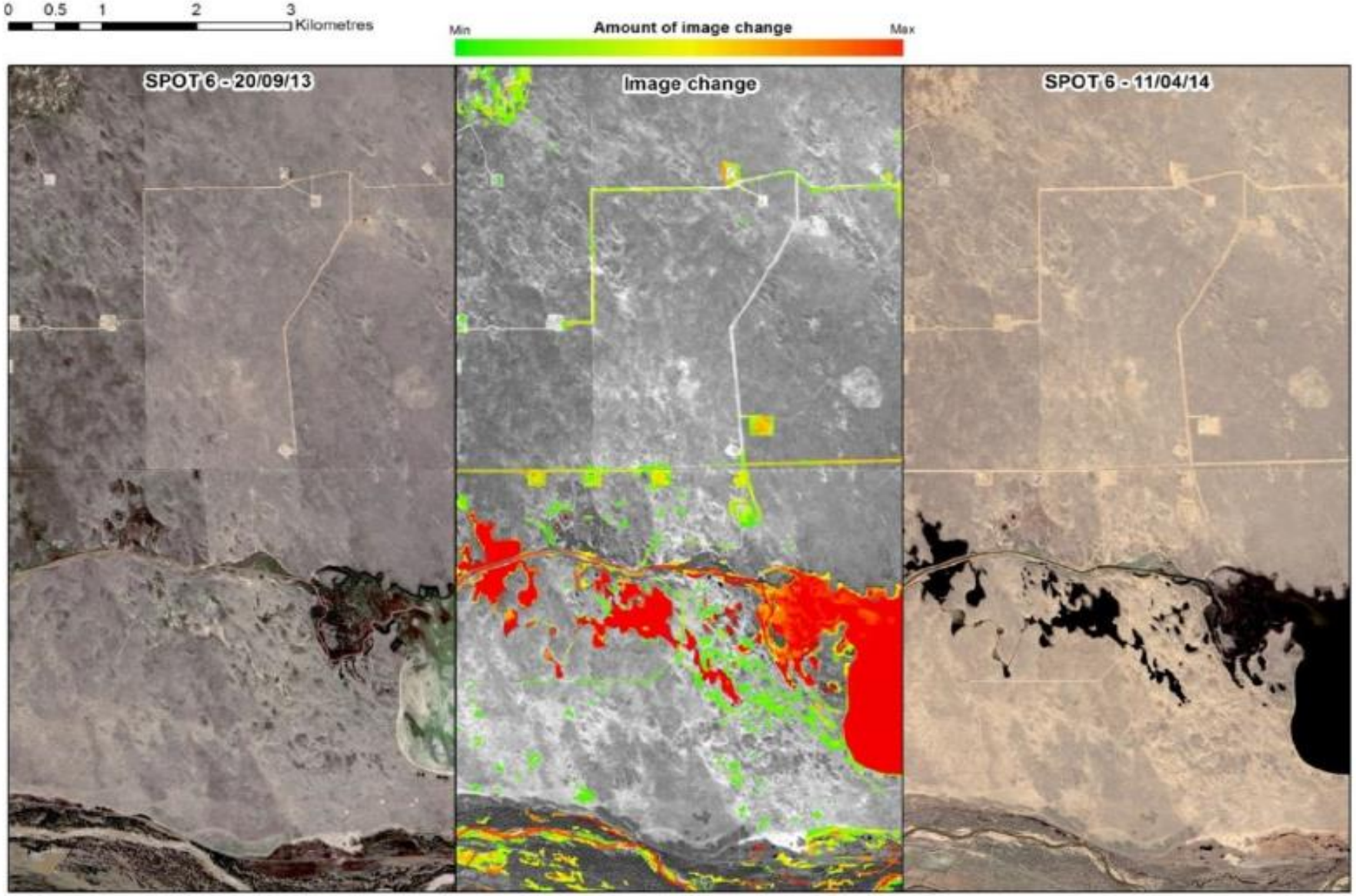
2. **Site assessment - high resolution monitoring (0.5m resolution):**

To monitor: Habitat baseline (prior to clearance), monitor habitat clearance and area of habitat removed, and monitor post-construction habitat restoration.

Data: Primary/secondary forest,
forest habitat types (lowland, swamp)



Automated change detection…



What next?

- A single metric/indicator of habitat change, regardless of location?
- Automated monitoring of critical habitat?
- Link to natural capital accounting?

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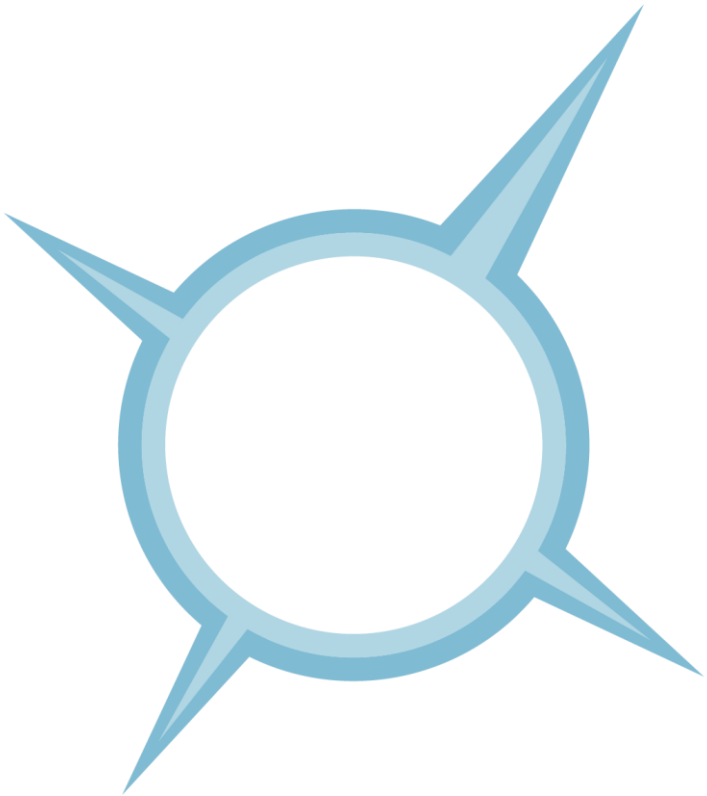

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Chevron

eni

ExxonMobil

REPSOL

RioTinto

Statoil

TOTAL

woodside

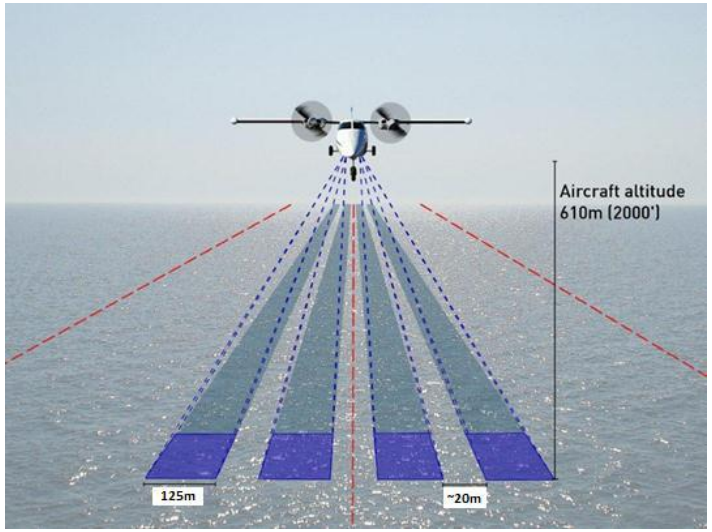
Using new logger technologies for mapping and monitoring seabirds at sea

Steinar Eldøy, Statoil

Boatbased and aerial surveys

- Standard methods for boatbased surveys based on transect surveys
- Aerial surveys, using either direct counts, still cameras or video
- Give a good overview and indication of where the birds are, and their value inclreases if linked to collection of other physical and ecological parameters
- However, these methods do have inherent weaknesses and uncertainties

- Repsesent snapshots
- Where do the birds come from?
- Power to detecthanges weak
- Expensive

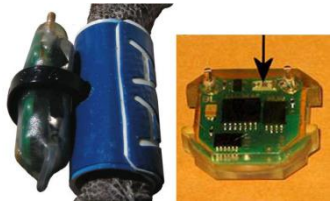


New tracking technologies

New and improved technologies for geo-location provide opportunities for significantly improved understanding of bird movements and migration, including the connectivity between breeding colonies and feeding grounds.

- Satellite transmitters –
  provide real time data transmission.

- GLS loggers - suitable for determining large scale movements and population/colony connectivity, limited accuracy (± 180 km).



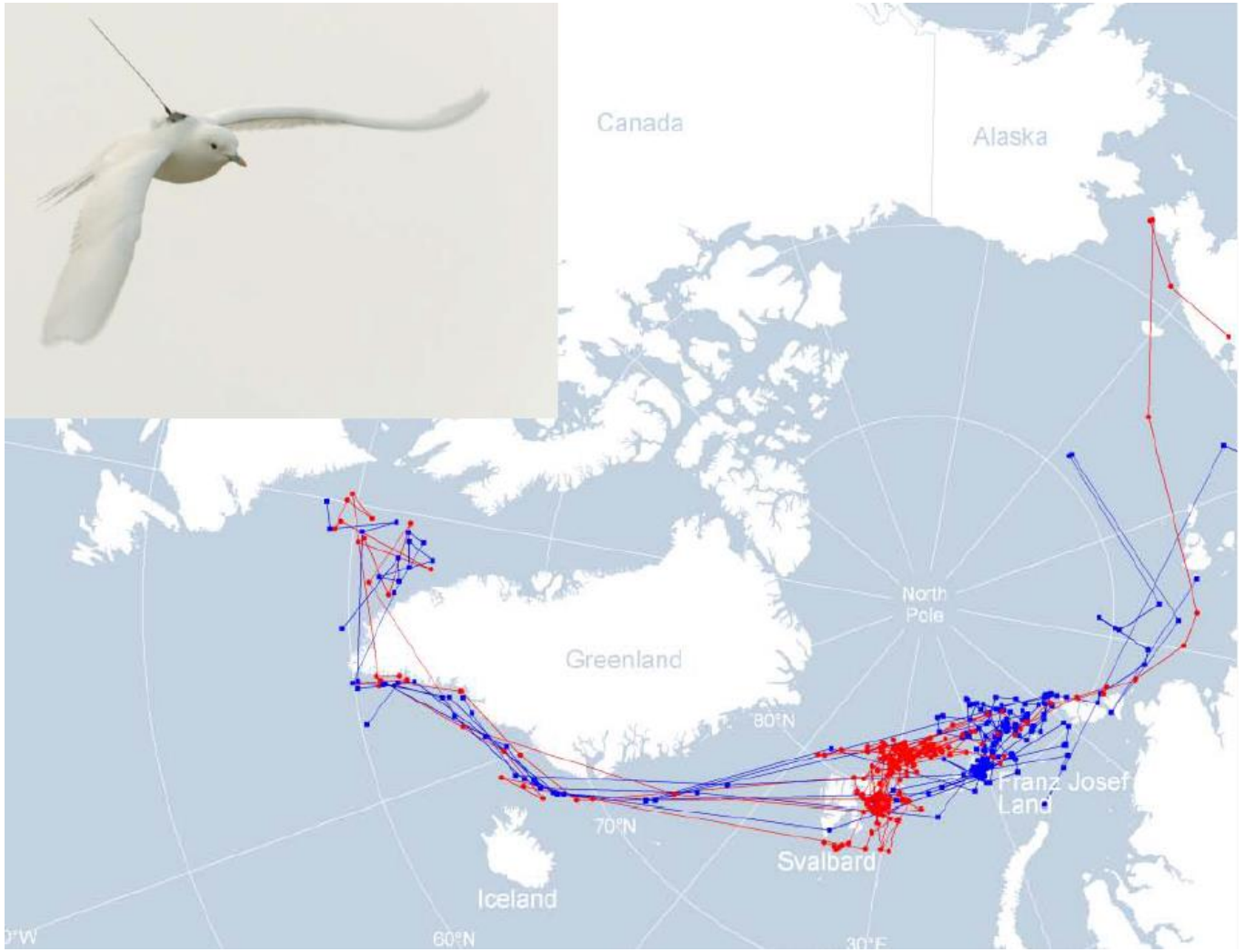
- GPS loggers – give accurate location (± 1 m) data, which are stored and need to be down loaded onshore.

The Norwegian seabird program - SEAPOP

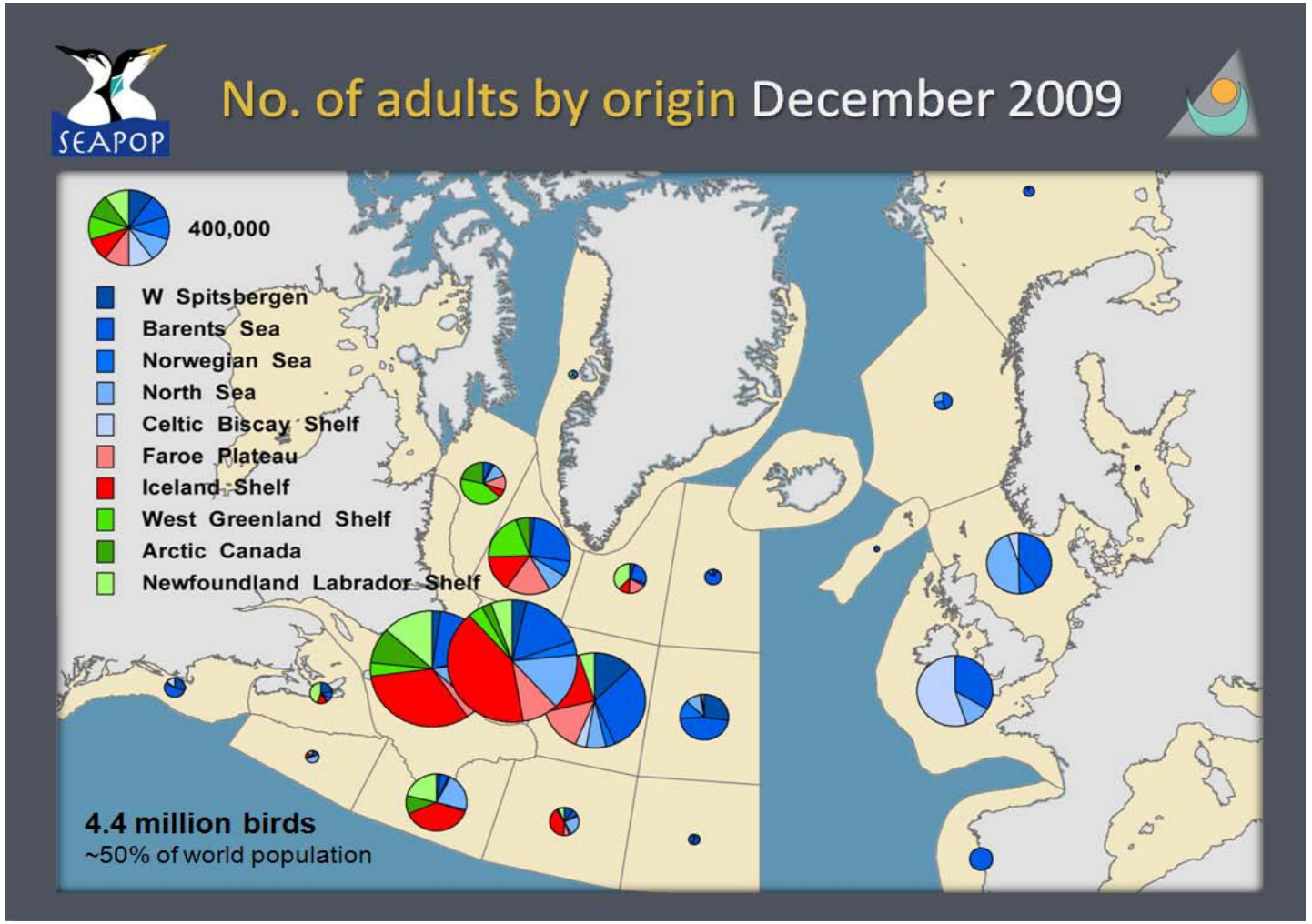
- Updating sebird baseline data repetedly requested (late 1990ies) when the oil industry was preparing environmental risk assessments and impact assessments for different exploration and development plans
- Statoil engaged NINA (the Norwegian Institute for Nature Research) to develop a proposal for a national seabird programme in 1999
- Implementation started 2005, funded by the Norwegian Oil and Gas Assossiation
- The authorities joined from 2006, and has since then covered approximately 85% of the costs (Ministry of Environment and Climate + Ministry of Oil and Energy)
- Steering committee apponted by the Ministry of Environment (differents authority agencies and the Norwegian Oil and Gas Assossiation)
- Implemented jointly by NINA, Norwegian Polar Research Institute, Tromsø Museum
- SEAPOP web page http://www.seapop.no/no/

SEAPOP Key Sites

Sattelite tagging of Ivory Gulls

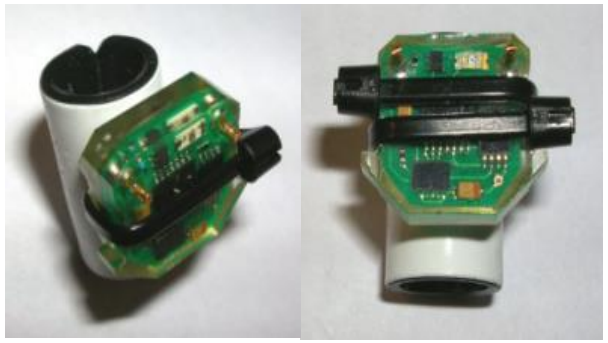


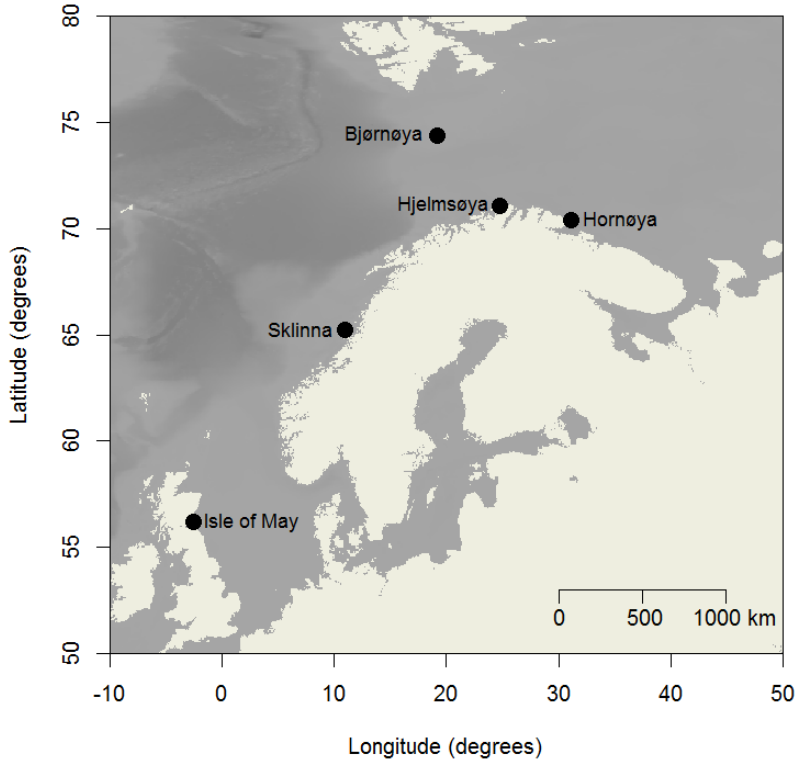
Kittiwake GLS study– winter distribution



Guillemot GLS study - Methods

- 5 different breeding sites.
- 3 field seasons.
- Use of lightweight tracking devices.
- Financed by the oil industry

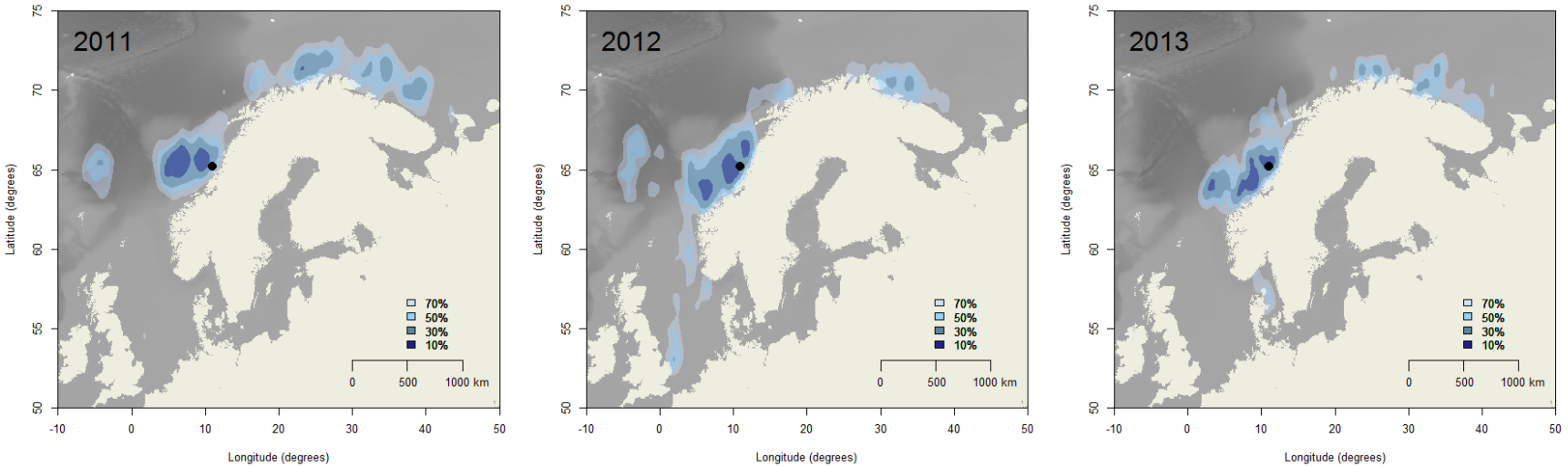




Results

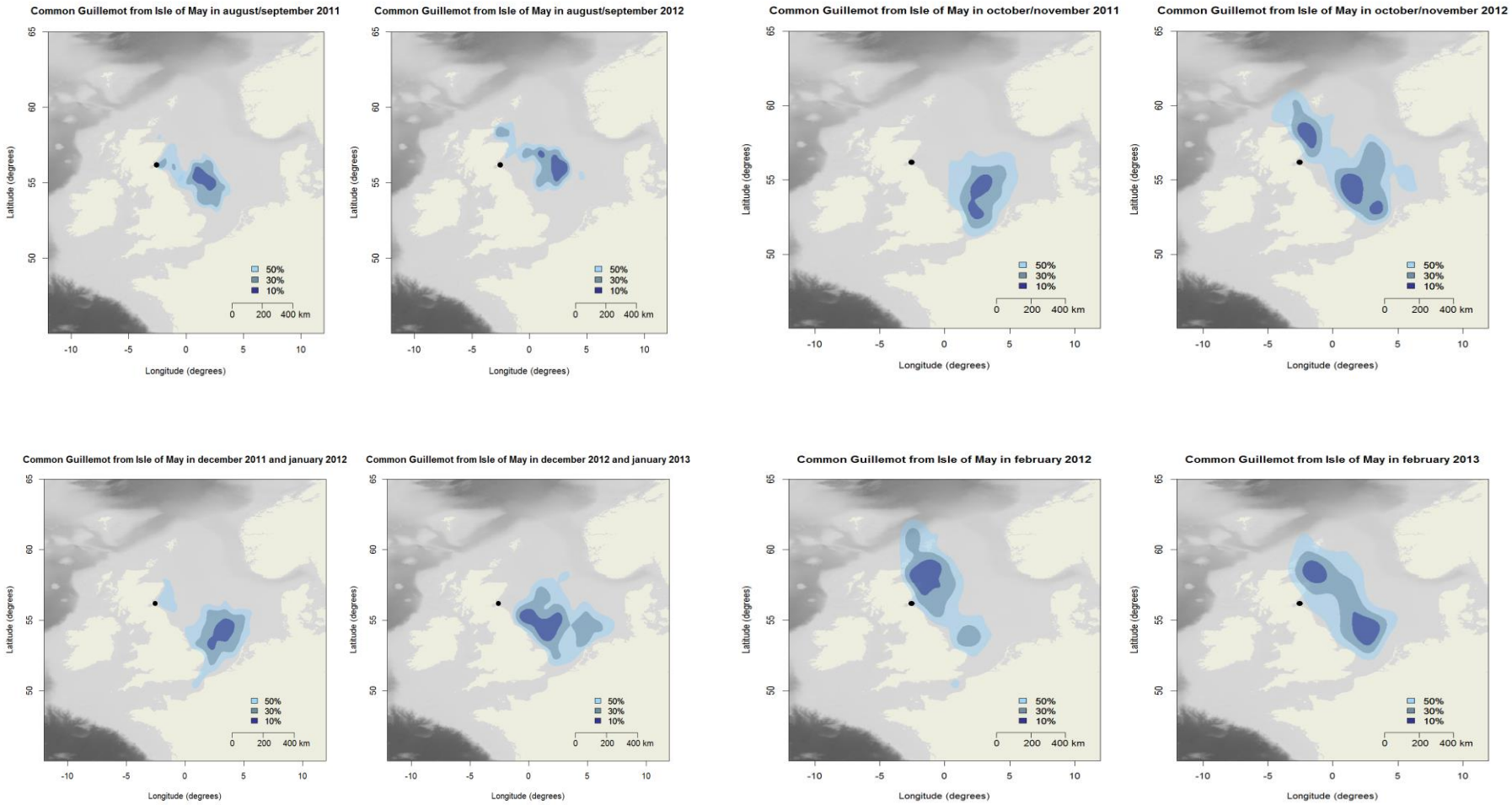
Inter-annual variations

Common Guillemot from Sklinna in October/November



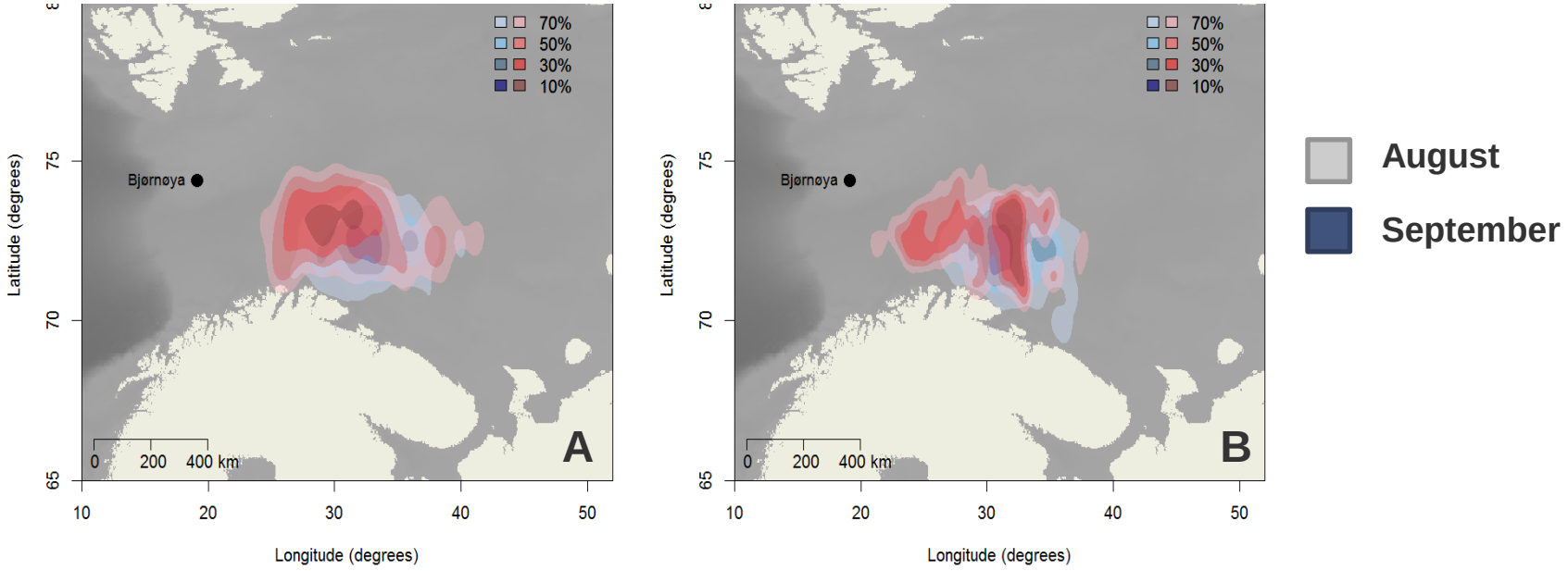
- Dispersion variability in Southern Norway with for example the presence of birds in the North Sea in 2012 while they were absent in 2011.
- Dispersion variability along the coast of Northern Norway and Russia.

Isle of May Guillemots – *intra- and inter-annual variability*



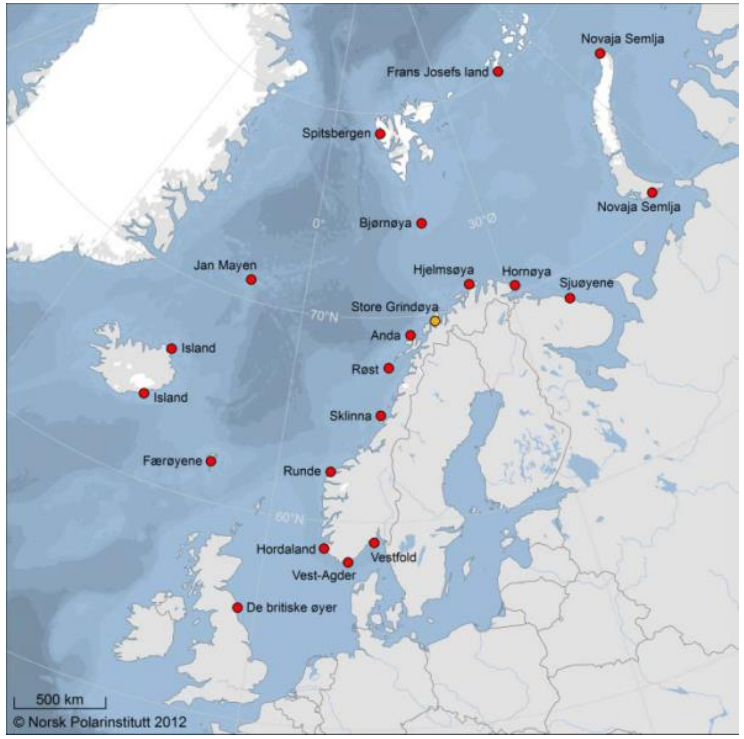
Post-breeding dispersion

Utilization distribution of female (A) and male (B) Common Guillemot from Bjørnøya

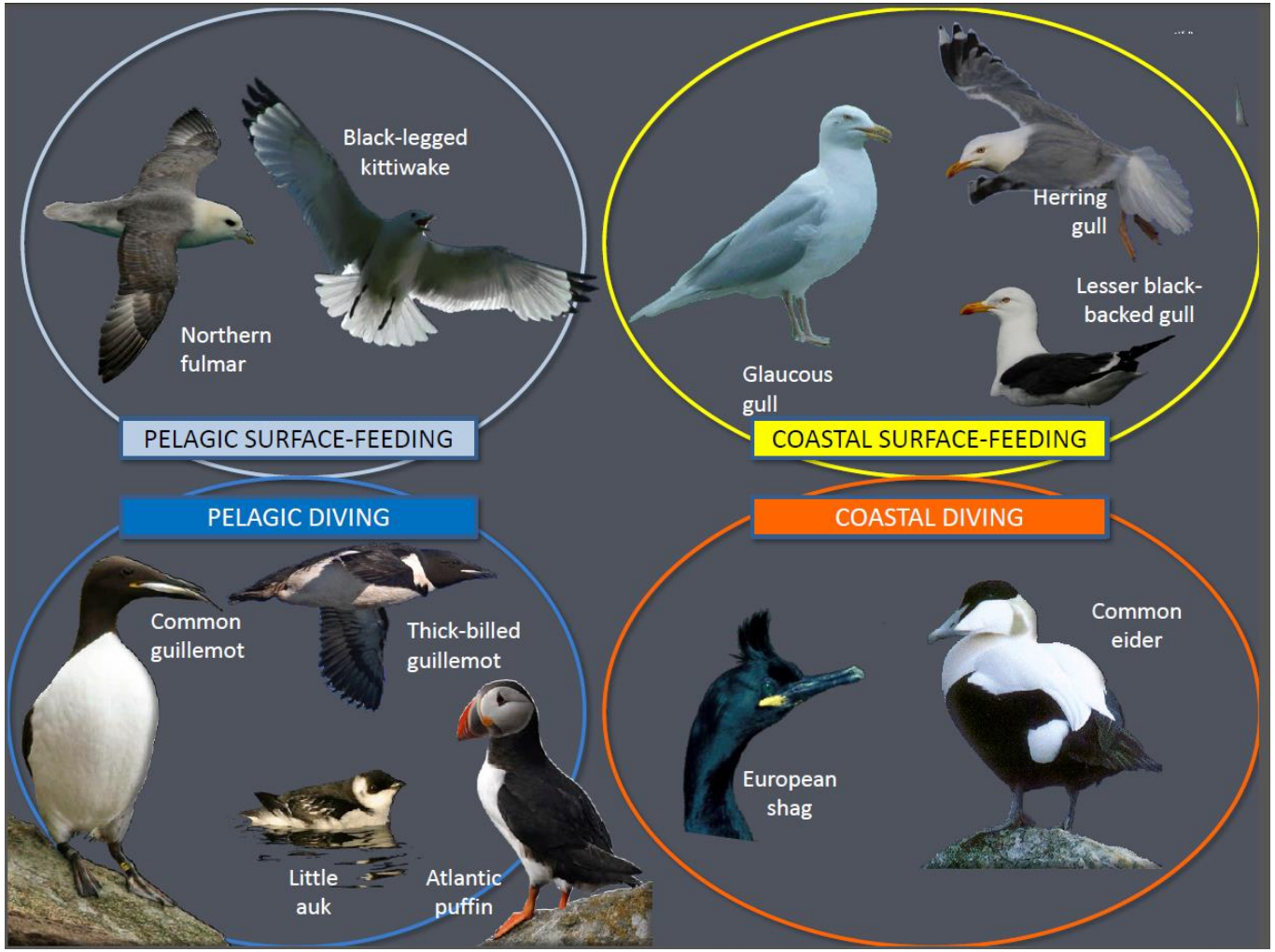


SEATRACK

- SEATRAK is an addition to SEAPOP intending to track movements of seabirds at sea outside the breeding season
  - Started 2014
  - Funding from the Norwegian Ministry of Environment, the Foreign Ministry and industry
  - Several colonies in Norway, Russia, Iceland, the Faroe Islands and one one UK colony (Isle of May

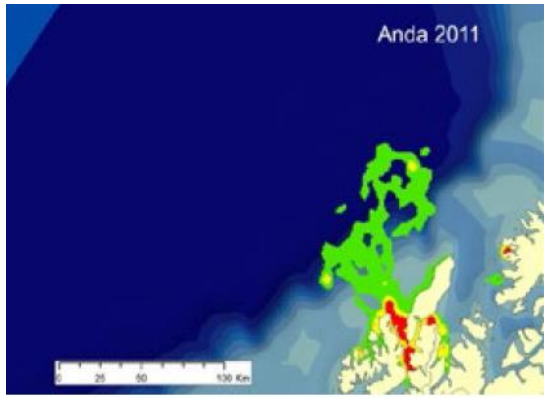


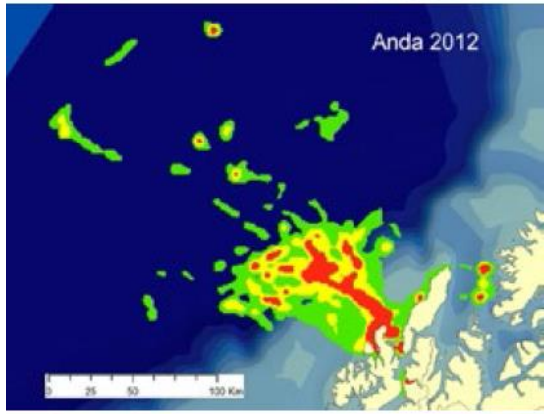
SEATRACK - species

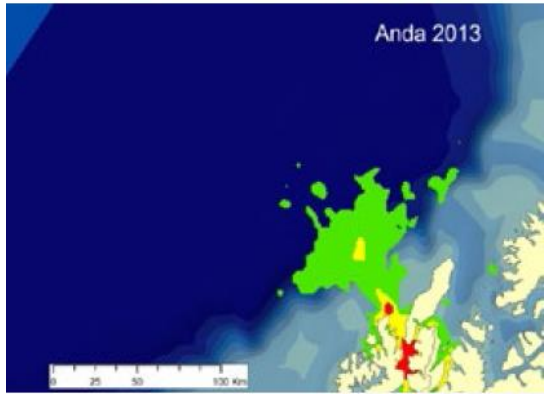


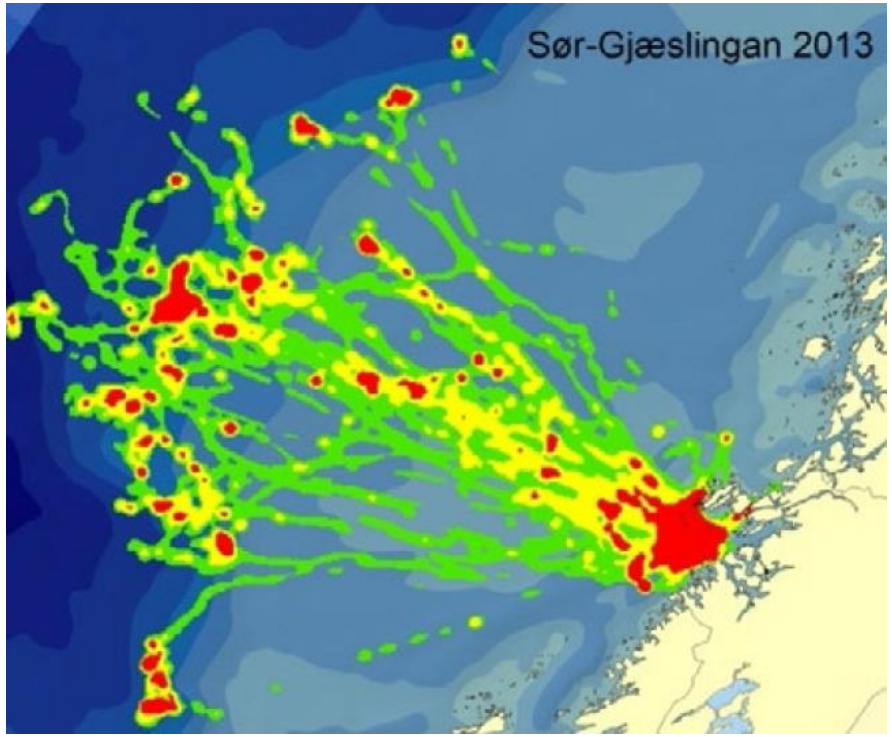
Havområde/lokalitet		Lokalitetsansvarlig	Lomvi	Lunde	Polarlomvi	Alkekonge	Krykkje	Sildemåke	Havhest	Gråmåke	Polarmåke	Toppskarv	Ærfugl	Antall arter
Barentshavet	Spitsbergen	Sebastien Descamps/Børge Moe			40	40	30		30		30		40	6
	Bjørnøya	Hallvard Strøm	30	40	40	40	30		30		30			6
	Frans Josefs land	Maria Gavrilo			40	40	30				30		40	5
	Novaya Zemlya	Maria Gavrilo			40	40	30				30			4
	Murmankysten	Juri Krasnov	30	40	40		30			30		40	40	7
	Kvitsjøen	Grigory Tertitski						40		30			40	3
	Hornøya	Rob Barrett/Kjell Einar Erikstad	30	40	40		30							3
	Hjelmsøya	Geir Helge Systad		40						30		40		4
	Grindøya	Kjell Einar Erikstad											40	1
	Anda	Signe Christensen-Dalsgaard					30			30				3
	Røst	Tycho Anker-Nilssen	30	40			30					40		3
Norskehavet	Jan Mayen	NP	30	40	40	40		40	30		30			7
	Sklinna	Svein-Håkon Lorentsen	30	40			30	40		30		40	40	7
	Runde	Geir Helge Systad	30	40			?							2
	Island	?	30	40	40		30	40	30	30	30	40	40	10
Nordsjøen/ Skagerrak	Hordaland	?								?		40		1
	Vest-Agder	?						40		30			40	3
	Vestfold	?								?				
	Færøyene	Bergur Olsen	30	40			30	40	30	30		40	40	8
	De britiske øyer	Francis Daunt	30	40			30	40	30	30		40		7
Totalt antall lokaliteter			*10*	*11*	*8*	*5*	*12*	*7*	*6*	*9*	*6*	*8*	*9*	*91*
Totalt antall loggere			*300*	*440*	*320*	*200*	*360*	*280*	*180*	*270*	*180*	*320*	*360*	*3210*

Kittiwake GPS logger studies

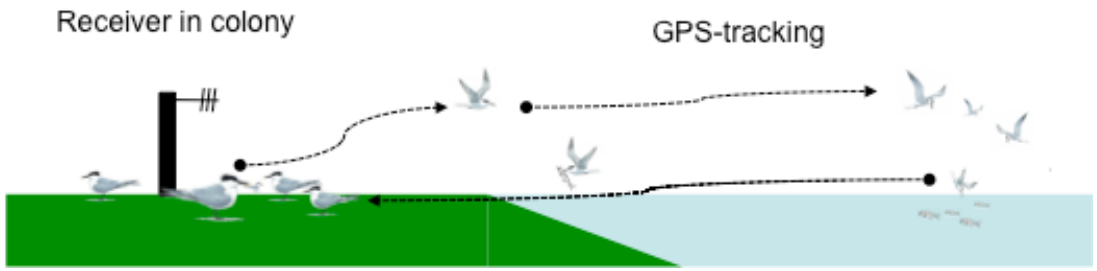








GPS logger study - Sandwich Tern

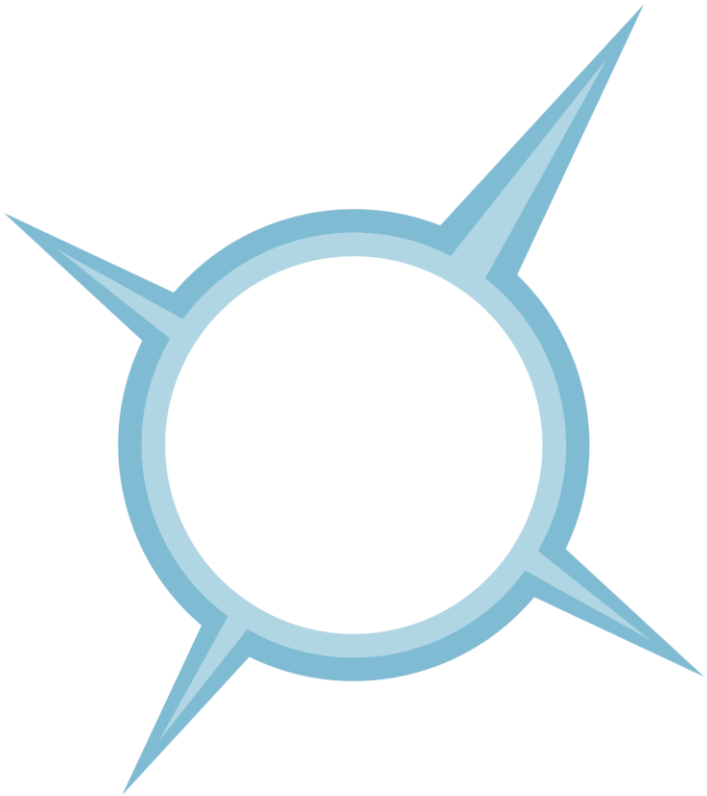


UNEP WCMC

Proteus Annual Meeting

28th - 29th June 2016

David Attenborough Building, Cambridge, UK



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ExxonMobil

REPSOL

RioTinto

Statoil

TOTAL

woodside

Use of emerging technologies for satellite remote sensing

1. To what extent is satellite remote sensing being used by Proteus members to assess and monitor impact on biodiversity?
2. Does this use focus on direct footprint or consider indirect and cumulative impacts?
3. What further support is required to access and interpret satellite remote sensing data for application within biodiversity management programmes?

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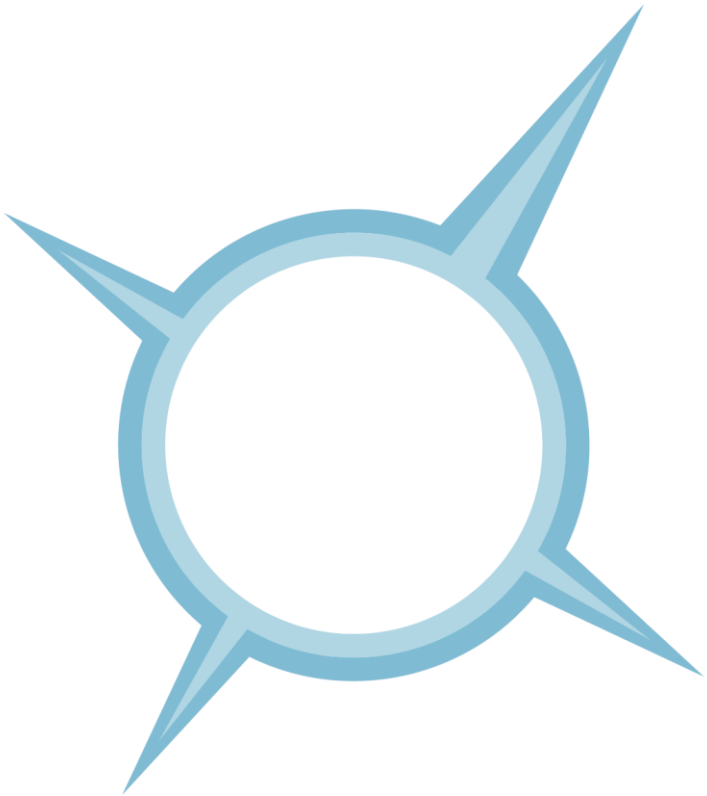

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