The Tropical Ecology, Assessment and Monitoring (TEAM) Network: an Early Warning System for nature

Francesco Rovero[1] and Jorge Ahumada[2]

[1]Tropical Biodiversity Section, MUSE – Museo delle Scienze, Trento, Italy

[2]TEAM Network, Betty & Gordon Moore Center for Science and Oceans, Conservation International, Washington DC, USA

1st Int. Conference on Anticipation, Trento 2015

Science Museum MUSE

TEAM NETWORK
Tropical Ecology Assessment & Monitoring

CONSERVATION INTERNATIONAL

Science Museum MUSE

Contents

TEAM Network - an early warning system for life on earth

Why do we need to monitor tropical biodiversity?

The problem: lack of standardized biodiversity data from the tropics - needed to anticipate changes

TEAM protocols with focus on the monitoring of mammals

Examples of results from this protocol at site and global level

Conclusions on the relevance of TEAM for anticipating decisions

Challenges

TEAM NETWORK

Early Warning System for Nature

MISSION

Generate real time data to monitor long-term trends in tropical biodiversity through a global network of field stations, providing an early warning system on the status of biodiversity to effectively guide conservation action.

INTERACTIVE TOUR

CONSERVATION INTERNATIONAL

Acknowledgements & Partners

TEAM NETWORK

Early Warning System for Nature

Why do we need TEAM?

Currently there are well established Early Warning Systems for earthquakes, catastrophic fires, tsunamis, hurricanes, volcanoes and many other natural systems.

However, we do not have an Early Warning System for life on Earth.

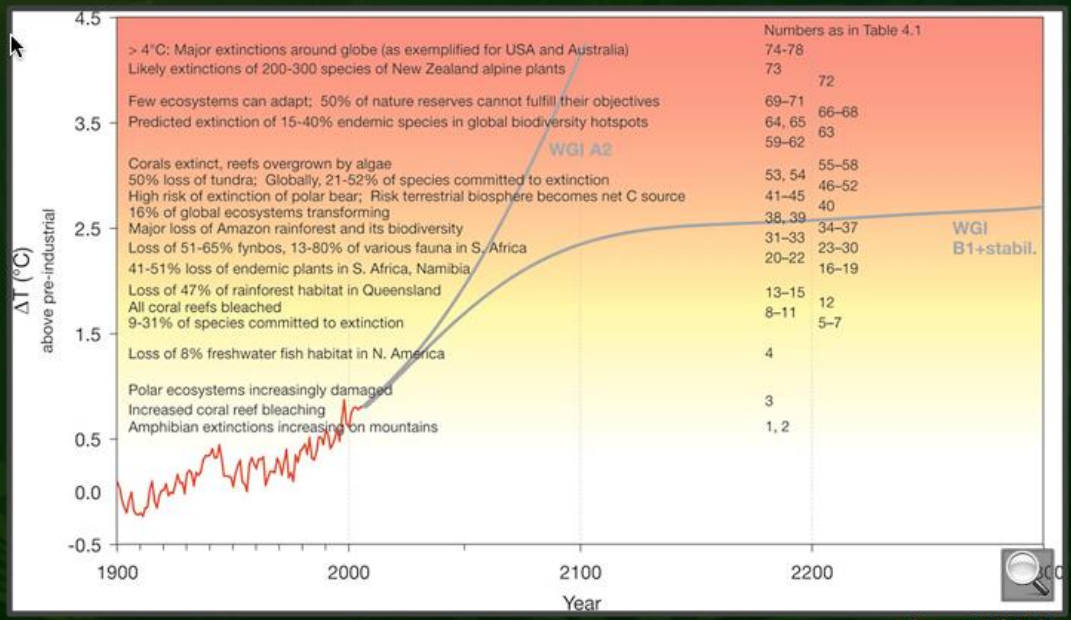
TEAM NETWORK

Early Warning System for Nature

Why do we need TEAM?

Climate Change

If global average temperatures exceed 2-3 degrees above pre-industrial levels, 20-30% of plant and animal species will be at high risk of extinction and the structure and functioning of terrestrial ecosystems will change substantially (IPCC 2007).



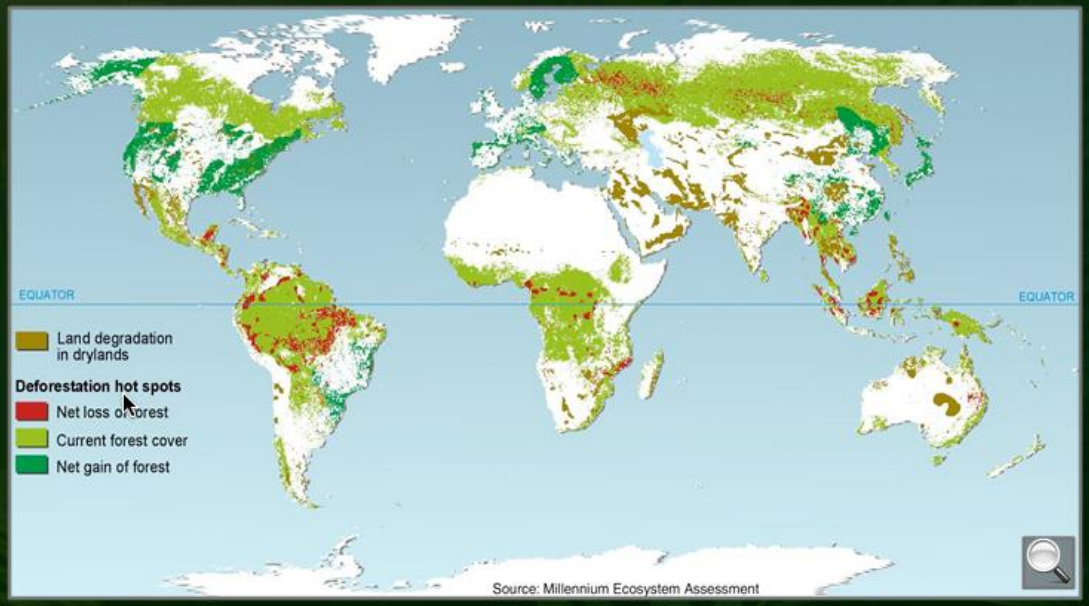
Source IPPC 2007

TEAM NETWORK
Early Warning System for Nature

Why do we need TEAM?

Forest Cover Loss

Most of the current deforestation is happening in tropical forests and is expected to continue in the future.



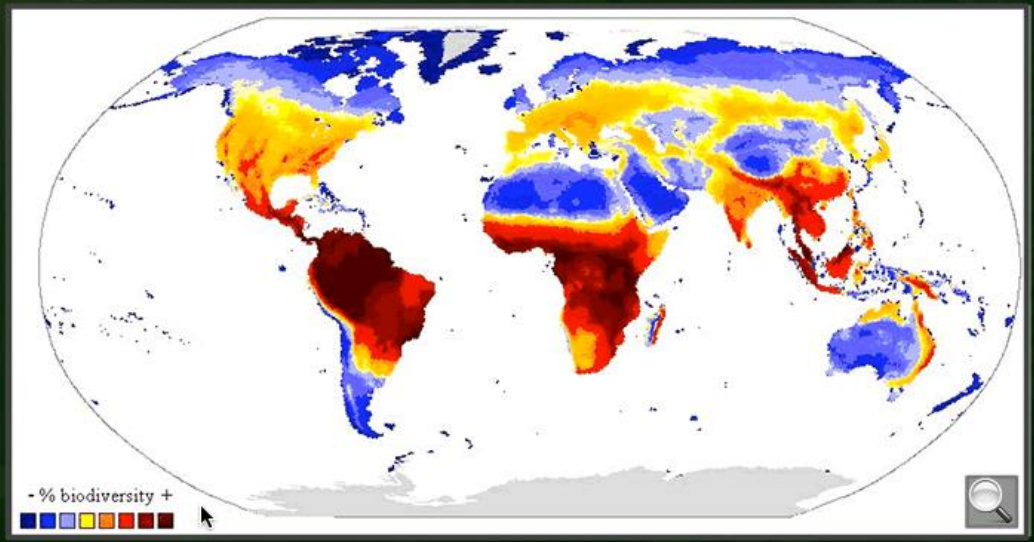
TEAM NETWORK

Early Warning System for Nature

Why do we need TEAM?

Why should we care about diversity in tropical forests?

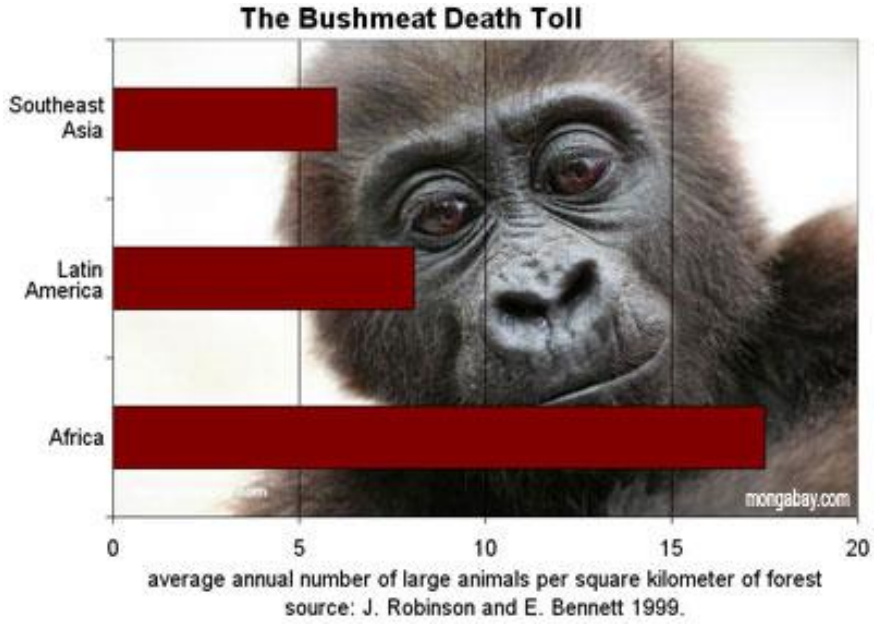
- More than 50% of species described on Earth live in tropical areas.
- Tropical forests play a crucial role in maintaining the global carbon and energy cycles.
- Compared to other natural systems we do not know how changes in tropical forests will affect life on Earth.



Source: Modified from Baillie et al. (2004) Global Species Assessment. IUCN

Threats to biodiversity call for global efforts

- Local (hunting, selective logging, small-scale disturbance)
- Regional (land use transformation, fragmentation, invasive species)
- Global (climate change, global land demands)



The CBD-Aichi Biodiversity Targets 2011-2020 need standardized data to measure indicators of progress

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

We lack the data to measure progresses against AICHI targets and hence anticipate changes !!

Target 11: protected areas are effectively managed…

We only have secondary data on PA status in the tropics.

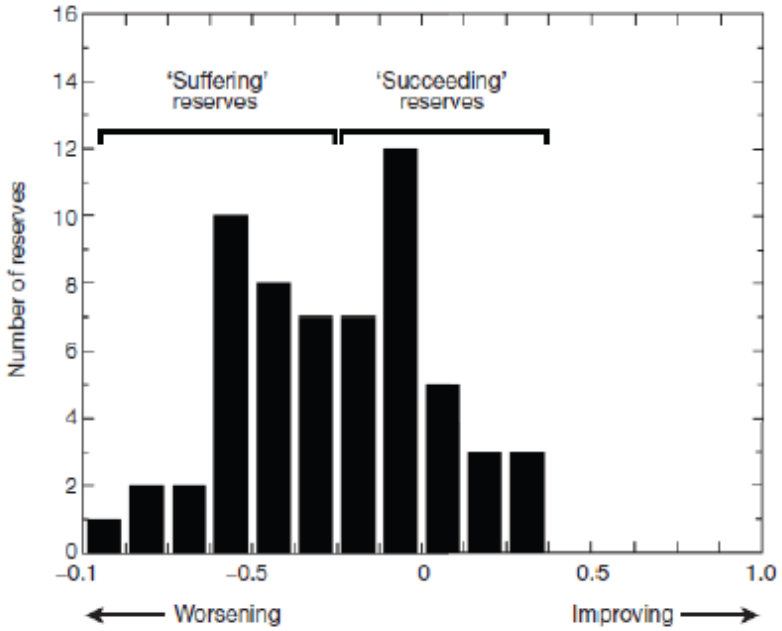


Figure 1 | Distribution of the 'reserve-health index' for 60 protected areas spanning the world's major tropical forest regions. This relative index averages changes in 10 well-studied guilds of animals and plants, including disturbance-avoiding and disturbance-favouring groups, over the past 20 to 30 years.

LETTER

doi:10.1038/nature11318

Averting biodiversity collapse in tropical forest protected areas

A list of the authors and their affiliations appears at the end of the paper.

(Laurance et [215] al. 2012, Nature)

Target 12: decline of species is prevented….

We lack standardized data to assess trends, especially in the tropics.

Target 12: decline of species is prevented….

We lack standardized data to assess trends, especially in the tropics.

Out of 30,000 long-term data sets available for forests and natural systems, only

15 came from tropical forests.

Alfa:Users:jorge:Documents:IUCN:TEAM_flash_demo:interface1 Projector

TEAM NETWORK
Early Warning System for Nature

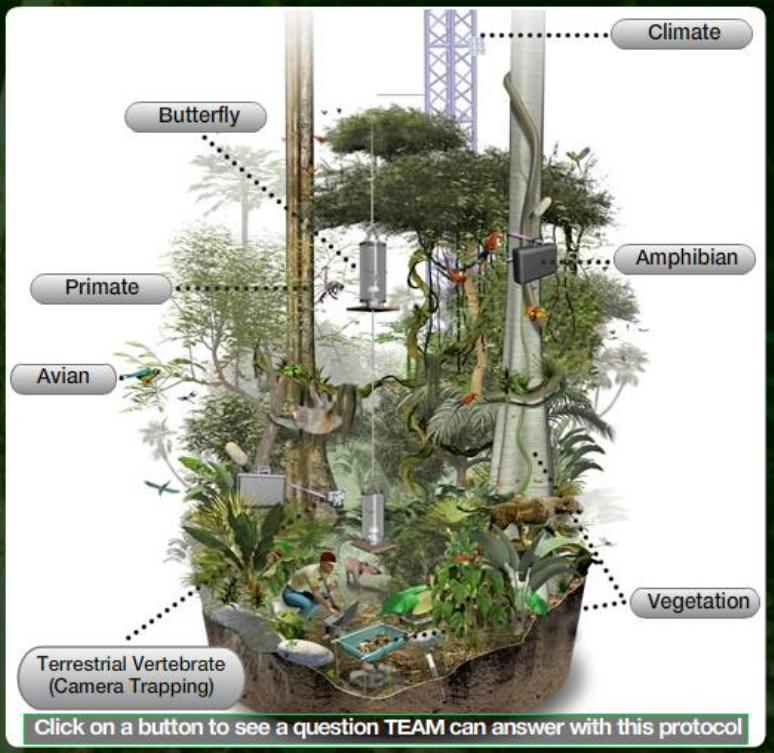
Why do we need TEAM? | How TEAM works | Evolving Network | Products

How TEAM Works

The TEAM Network implements standard protocols to monitor biodiversity through a network of tropical field sites. Information is collected in near-real time.

How does forest fragmentation affect the trophic structure of tropical terrestrial vertebrate communities?

X



Click on a button to see a question TEAM can answer with this protocol

Previous | Page: 1 2 | Next

How TEAM works

TEAM Monitoring Sites

Data are collected according to standardized protocols

Mobile technology facilitates data collection in the field

Data are transferred and stored in servers and databases

Data are disseminated globally in near-real time using advanced technologies

Data are used by NGOs, government agencies, scientists, educators, etc.

A network of currently 17 field stations in the tropics

TEAM NETWORK

WILDLIFE CONSERVATION SOCIETY

Smithsonian

Science Museum MuSe

TEAM Protocols

Terrestrial vertebrates: uses camera trapping to detect ground-dwelling mammals and birds and hence monitor abundance of populations and communities

Vegetation: uses 1-ha plots to measure carbon stock and assess tree species composition..

Climate: automatic weather station: T, HR, rainfall, solar radiation

Zone of Interaction: uses remote sensing to define and monitor coupled human-natural system surrounding the monitoring sites where changes will directly affect biodiversity at the sites

TEAM Protocols

Terrestrial vertebrates: uses camera trapping to detect ground-dwelling mammals and birds and hence monitor abundance of populations and communities

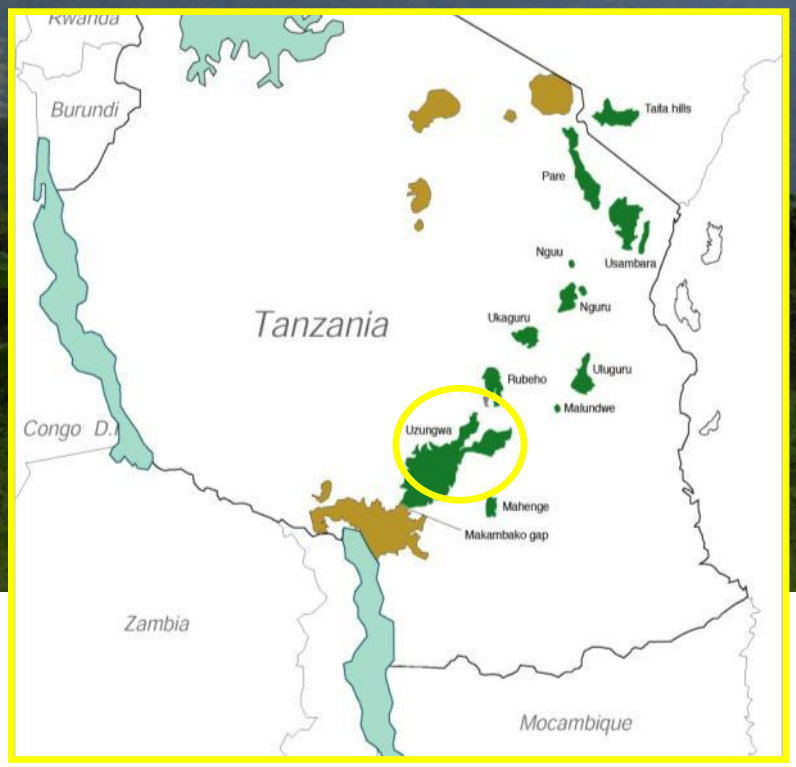
Vegetation: uses 1-ha plots to measure carbon stock and assess tree species composition..

Climate: automatic weather station: T, HR, rainfall, solar radiation

Zone of Interaction: uses remote sensing to define and monitor coupled human-natural system surrounding the monitoring sites where changes will directly affect biodiversity at the sites

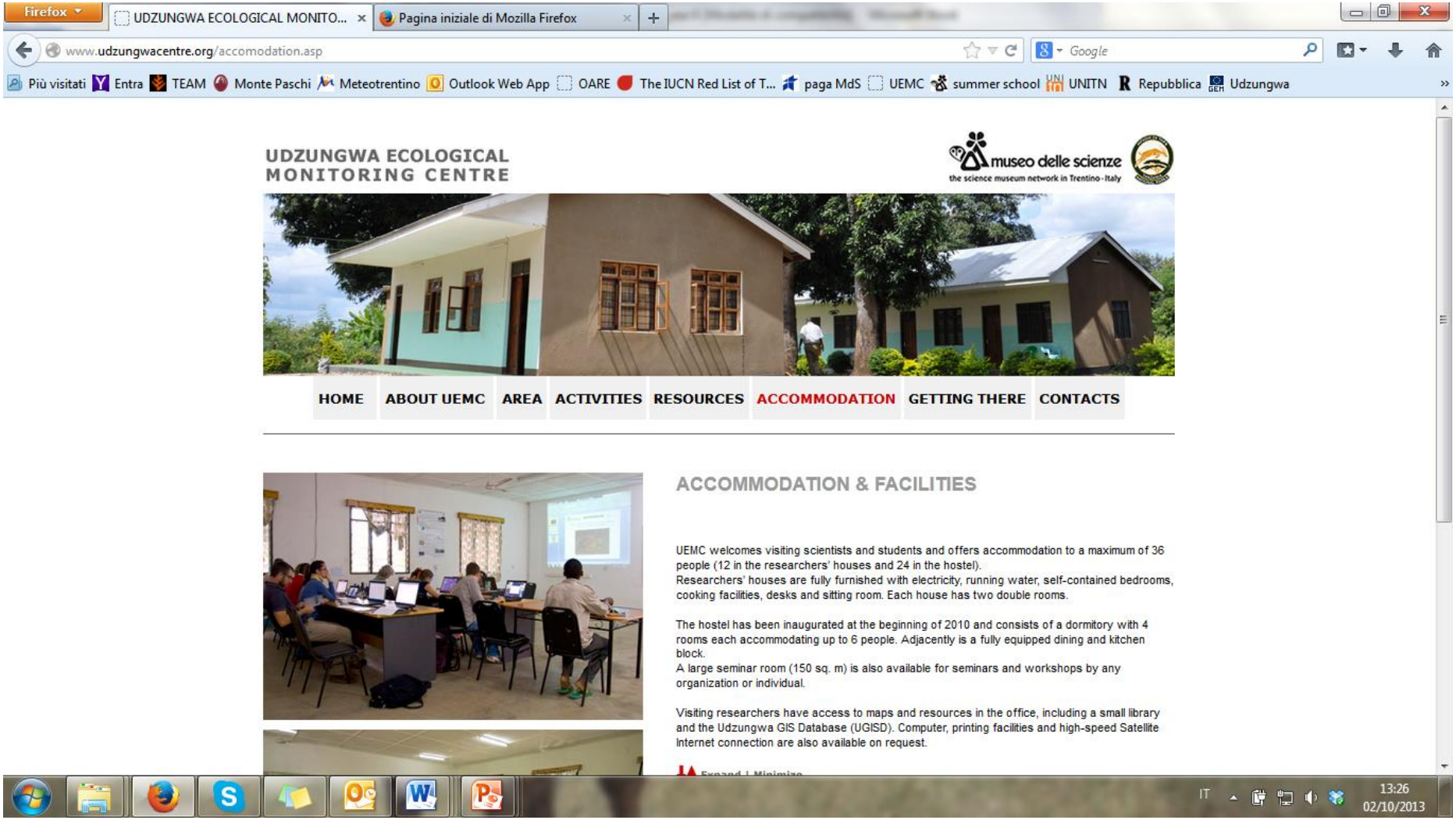
MUSE – Science museum's TEAM site: Udzungwa Mountains, Tanzania

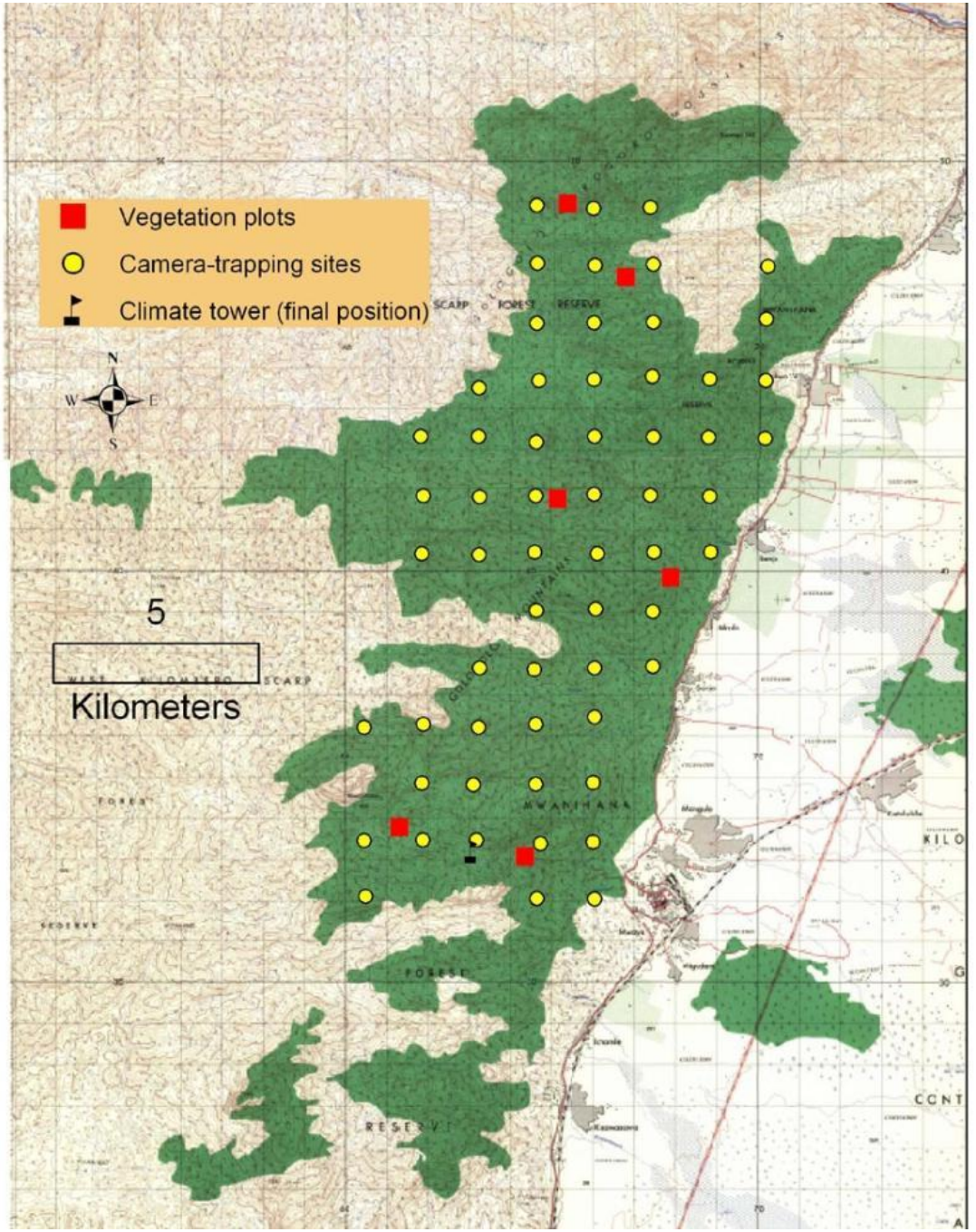
A global biodiversity hotspot



Partnership MUSE – Udzungwa Mountains National Park (since 2002)

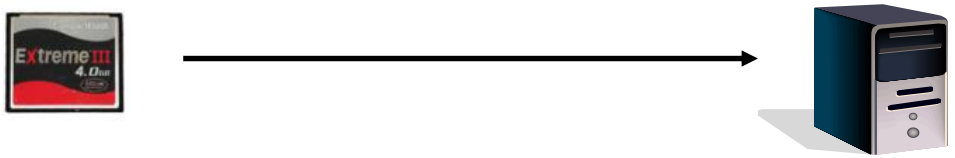
Udzungwa Ecological Monitoring Centre (UEMC) established in 2006

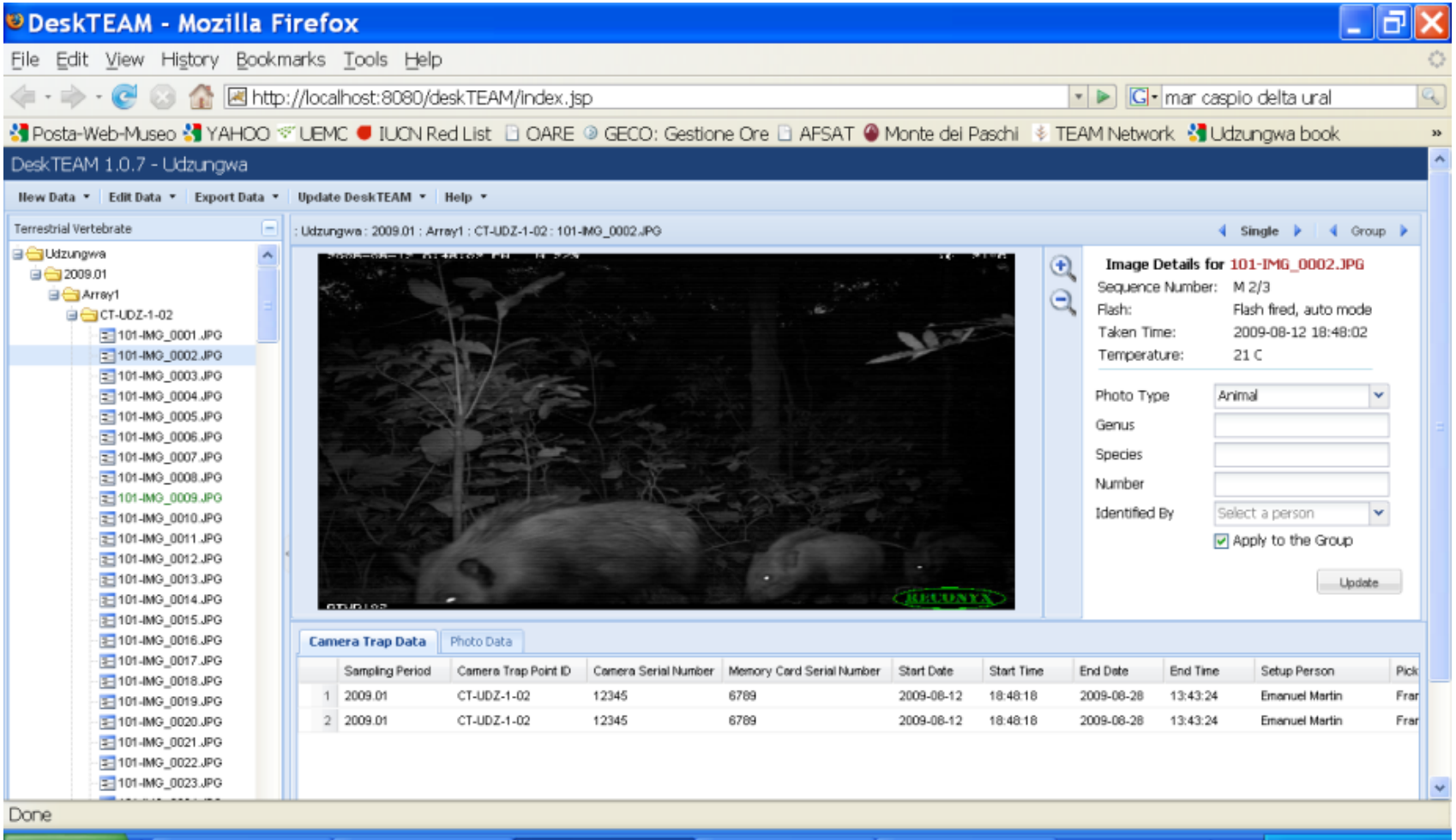




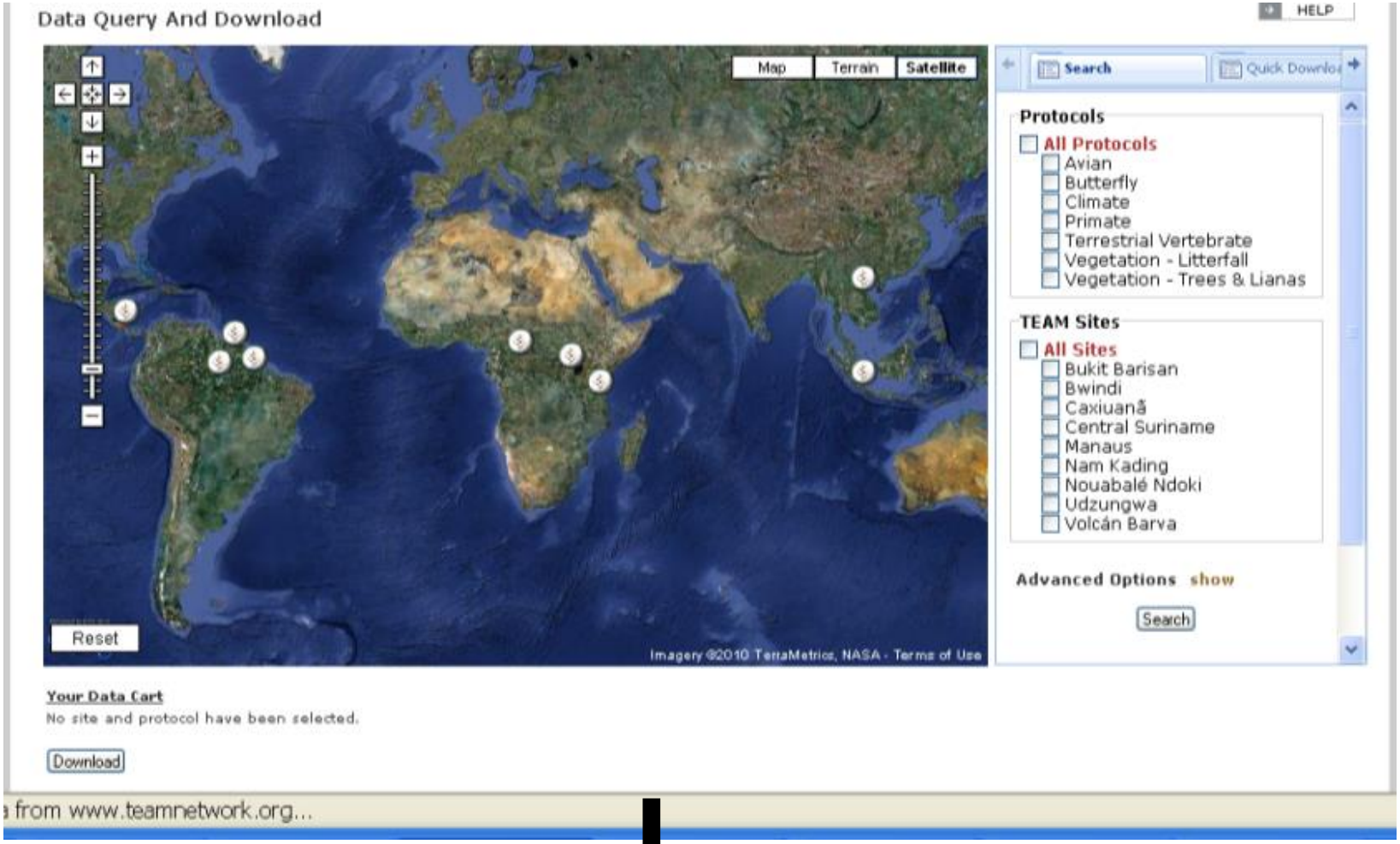
Camera trapping sampling: 60 camera trap points (one each 2 km^2) active every year for 30 days since 2009

Data (10-15k images per year) processed with dedicated software, and uploaded in TEAM web repository in near real time





All TEAM data are publicly available at www.teamnetwork.org

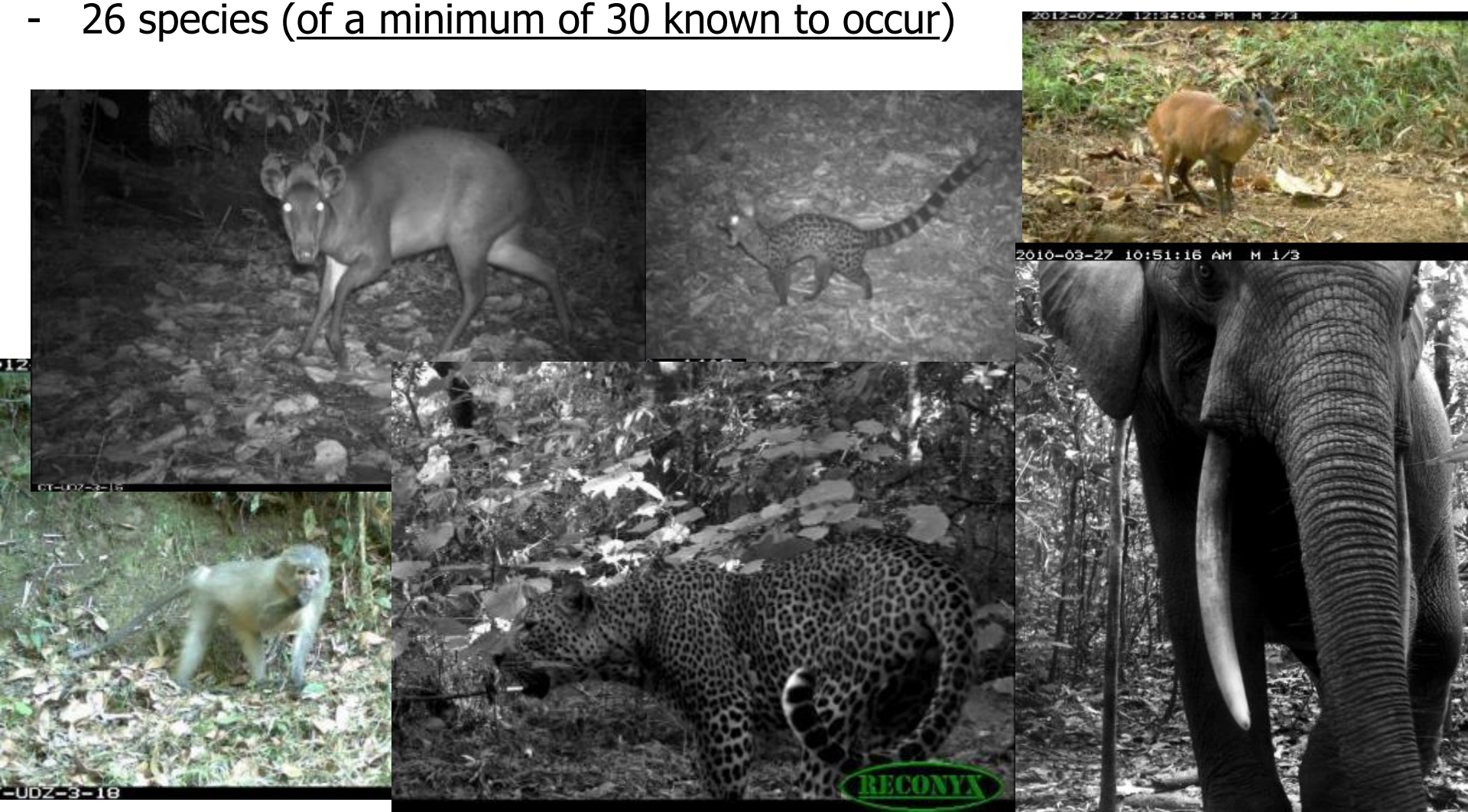


Data Set Identifier: TEAM-DataPackage-20100901070318_1450

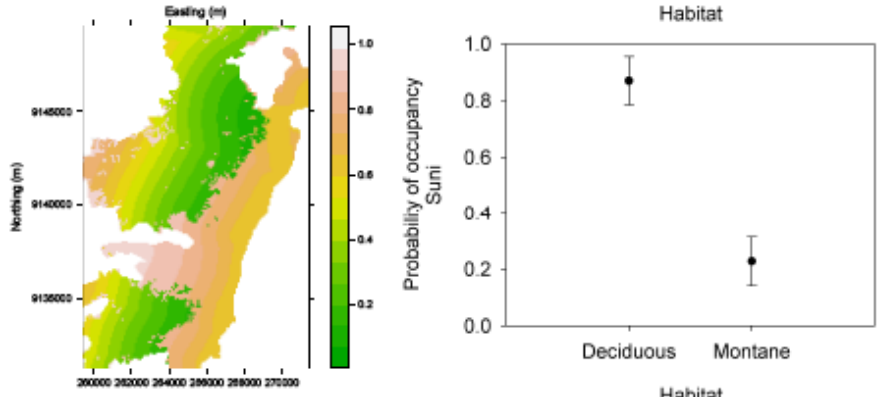
ID	Site Name	Sampling U	Latitude	Longitude	Sampling Perio	Photo Date	Photo Time	Raw Name	Photo Note	Photo ID U	Class	Order	Family	Genus	Species	Number of
33450	Udzungwa	CT-UDZ-3-	-7.696.016	36.891.628	2009.01.00	05/11/2009	1608	CT-UD-3-20	011.jpg	http://www.	MAMMALI	HYRACOII	Procaviidae	Dendrohyra	arboreus	1
33451	Udzungwa	CT-UDZ-3-	-7.696.016	36.891.628	2009.01.00	25/11/2009	720	CT-UD-3-20	127.jpg	http://www.	MAMMALI	ARTIODAC	Bovidae	Cephaloph	spadix	1
33452	Udzungwa	CT-UDZ-3-	-7.696.016	36.891.628	2009.01.00	25/11/2009	815	CT-UD-3-20	132.jpg	http://www.	MAMMALI	ARTIODAC	Bovidae	Cephaloph	natalensis	1
33454	Udzungwa	CT-UDZ-3-	-7.696.016	36.891.628	2009.01.00	25/11/2009	305	CT-UD-3-20	107.jpg	http://www.	MAMMALI	PRIMATES	Cercopithe	Cercocebu	sanjei	1
33456	Udzungwa	CT-UDZ-3-	-7.696.016	36.891.628	2009.01.00	09/11/2009	433	CT-UD-3-20	023.jpg	http://www.	MAMMALI	ARTIODAC	Bovidae	Cephaloph	spadix	1
33457	Udzungwa	CT-UDZ-3-	-7.696.016	36.891.628	2009.01.00	23/11/2009	303	CT-UD-3-20	087.jpg	http://www.	MAMMALI	ARTIODAC	Bovidae	Cephaloph	natalensis	1
33458	Udzungwa	CT-UDZ-3-	-7.696.016	36.891.628	2009.01.00	09/11/2009	2105	CT-UD-3-20	048.jpg	http://www.	MAMMALI	ARTIODAC	Bovidae	Cephaloph	spadix	1
33459	Udzungwa	CT-UDZ-3-	-7.696.016	36.891.628	2009.01.00	09/11/2009	1531	CT-UD-3-20	043.jpg	http://www.	MAMMALI	RODENTIA	Nesomyida	Cricetomys	ansorgei	1

1) **Example of results at the site level:** species checklist, relative abundance index and occupancy (probability of presence)

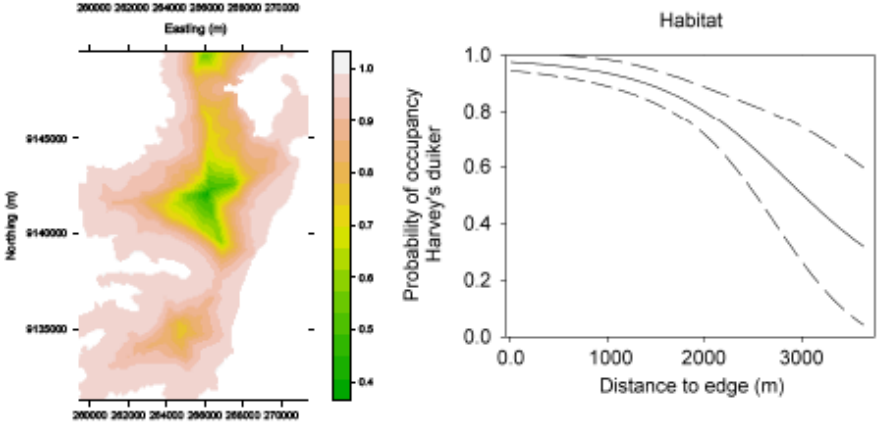
- 10,647 images of mammals in the baseline year (2009)
- 26 species (<u>of a minimum of 30 known to occur</u>)



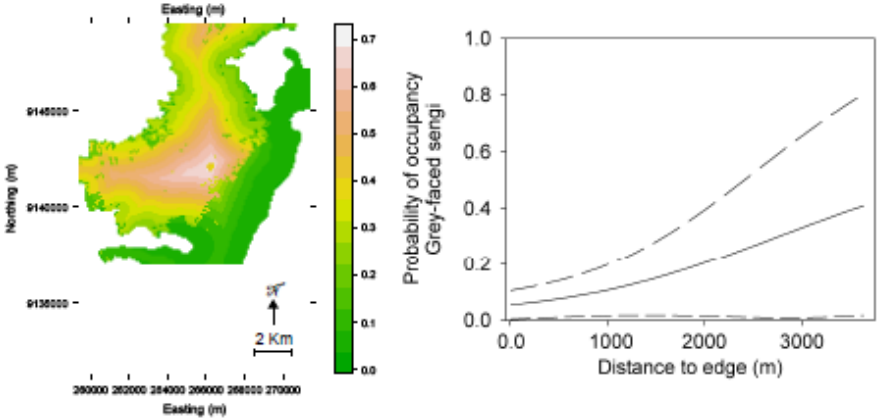
Models predicting occupancy at the fine scale, useful to identify potential drivers of changes (Rovero et al. 2014)



Lowland, deciduous forest dweller



Edge-lover



Forest interior dweller

2) **Comparison between sites with contrasting protection**: effect of hunting and habitat degradation on mammals (Hegerl et al. 2015)

Useful to predict how local human pressure impact the fauna

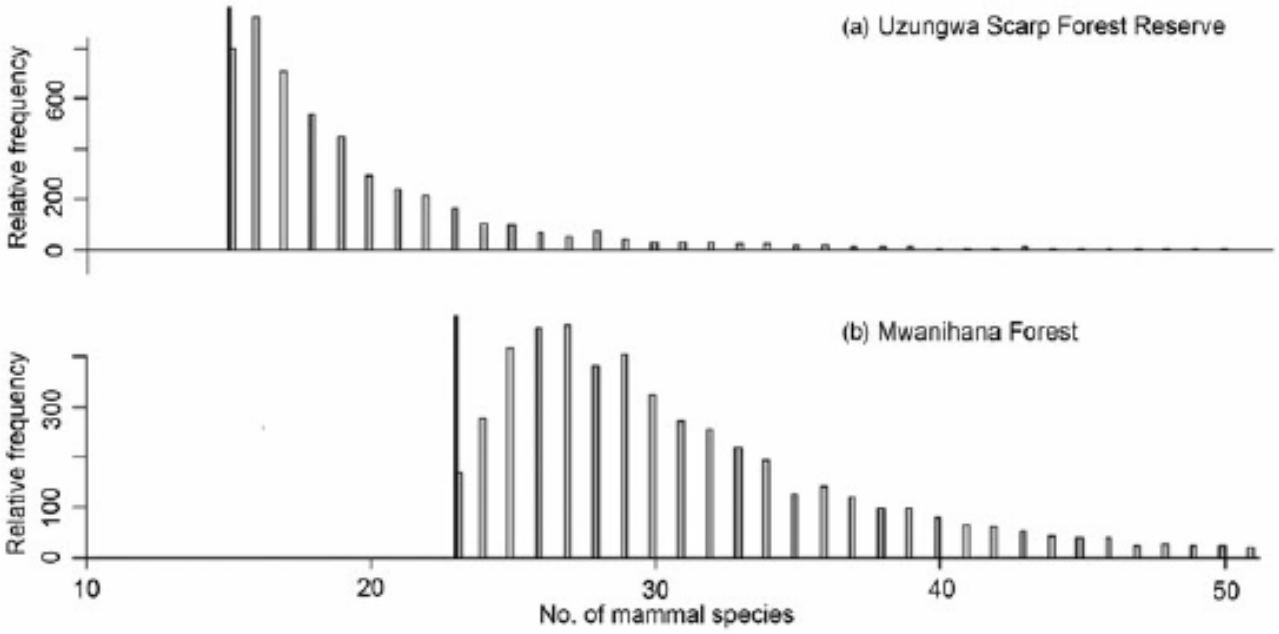
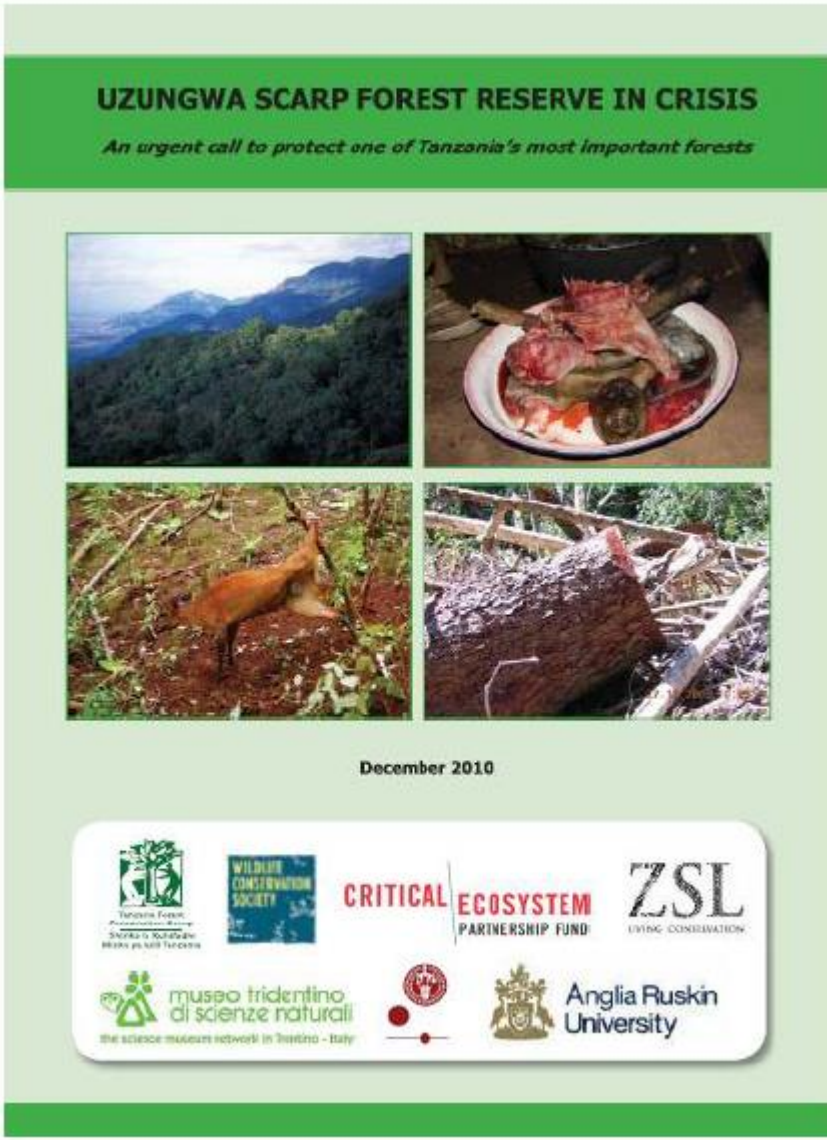
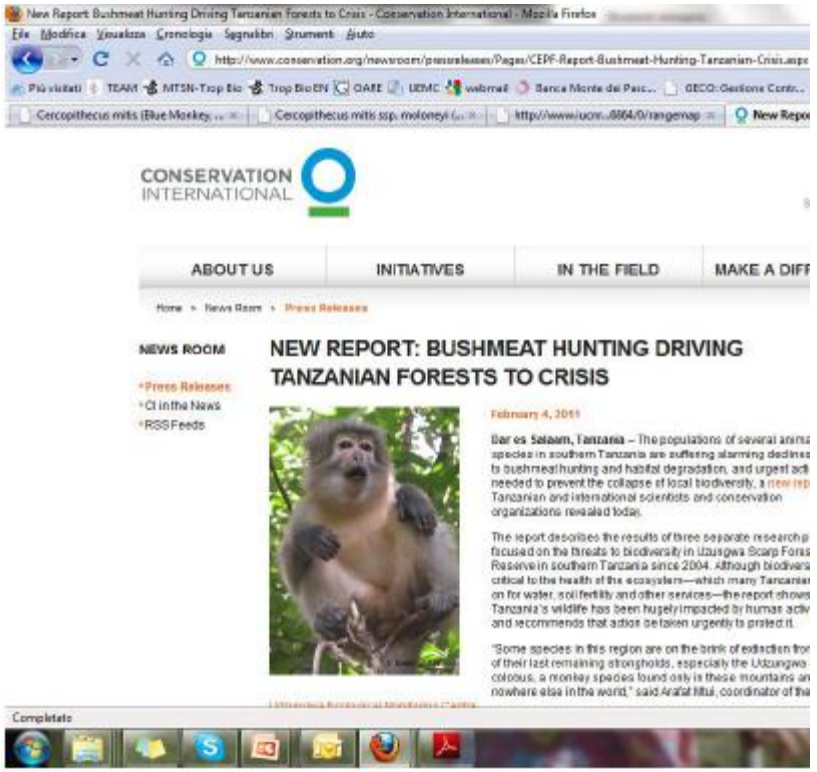


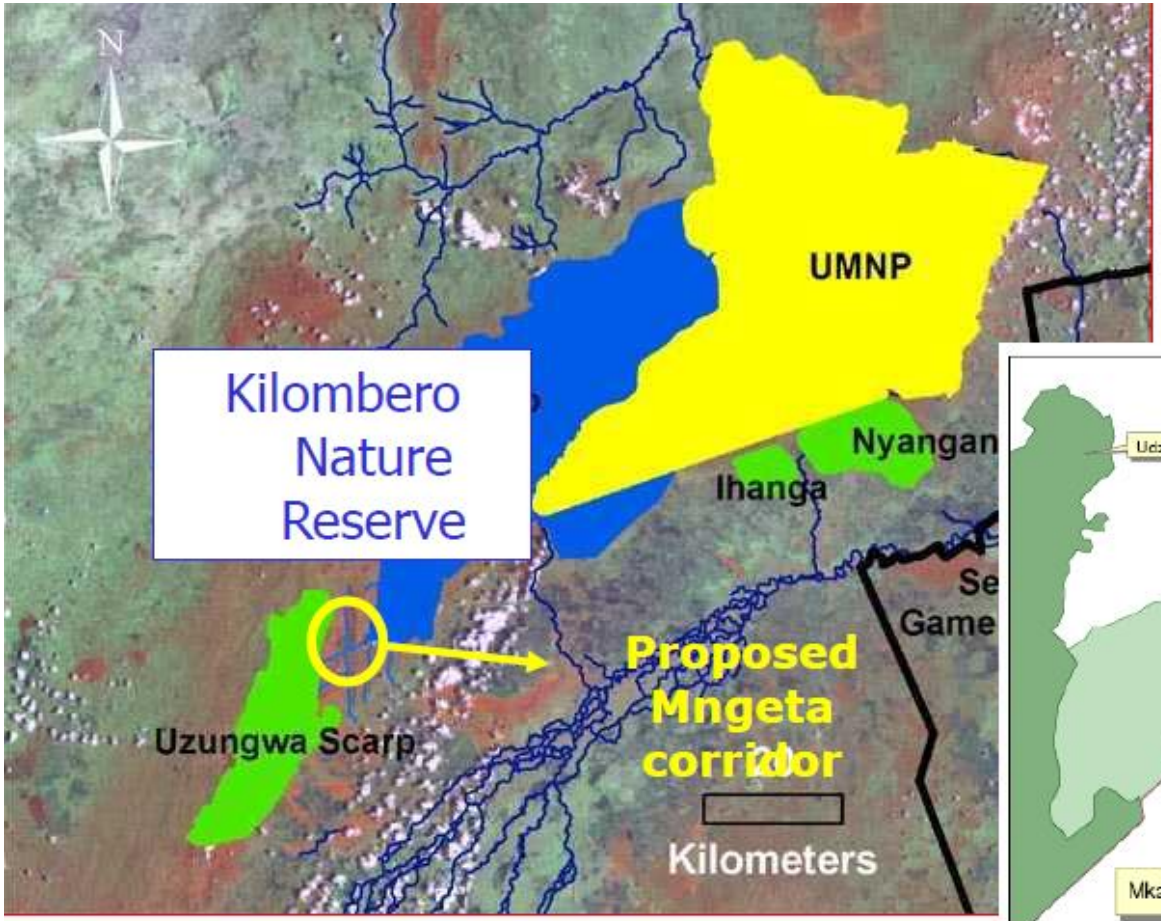
FIG. 2 Bayesian posterior distribution of species richness in (a) Uzungwa Scarp Forest Reserve and (b) Mwanihana Forest (Fig. 1). The analysis follows Dorazio et al. (2006); the vertical black line is the observed species richness, 15 and 23 in the Reserve and Mwanihana Forest, respectively, whereas the estimated median richness is 18 (mean 19.3, highest posterior density interval 15–30) and 29 species (mean 31.5, highest posterior density interval 23–47), respectively.

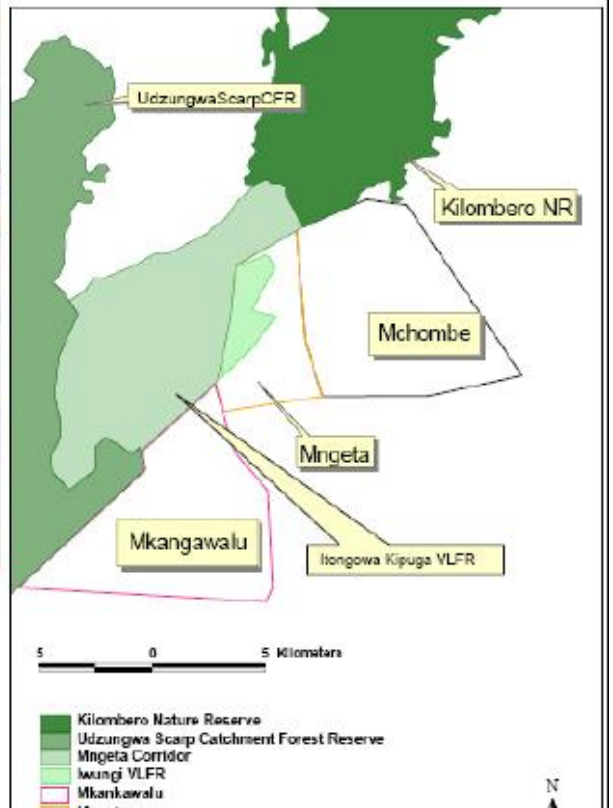
Example of management decision that was contributed by these data: dissemination of the results helped increasing protection





Government's endorsement of recommendations: Kilombero Nature Reserve and Uzungwa Scarp proposed Nature Reserve, with the proposed Mngeta corridor linking these 2 PAs

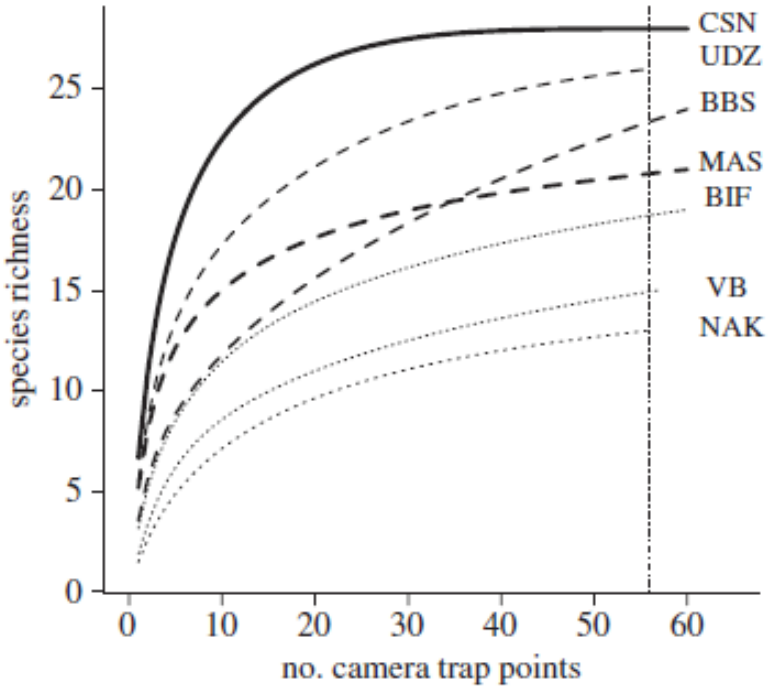




Greater protection ensured/planned

3) **Regional / global analysis**: species richness and the effect of forest fragmentation (Ahumada et al. 2011)

The first analysis ever of this sort, shows how fragmentation impacts community richness, intactness and composition

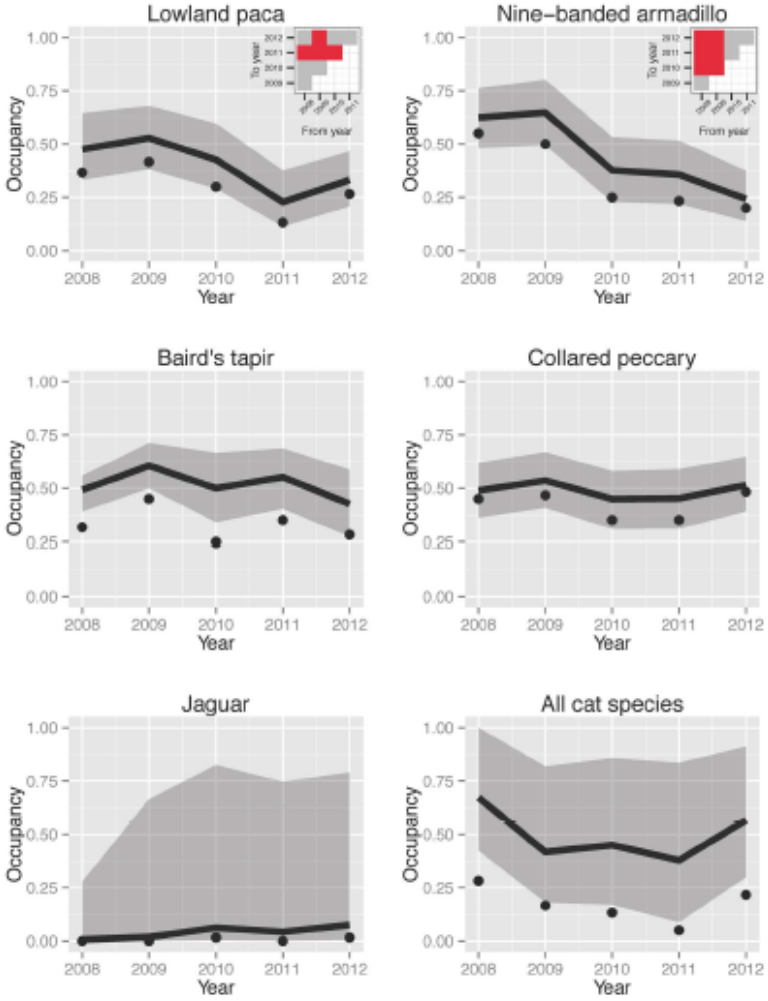


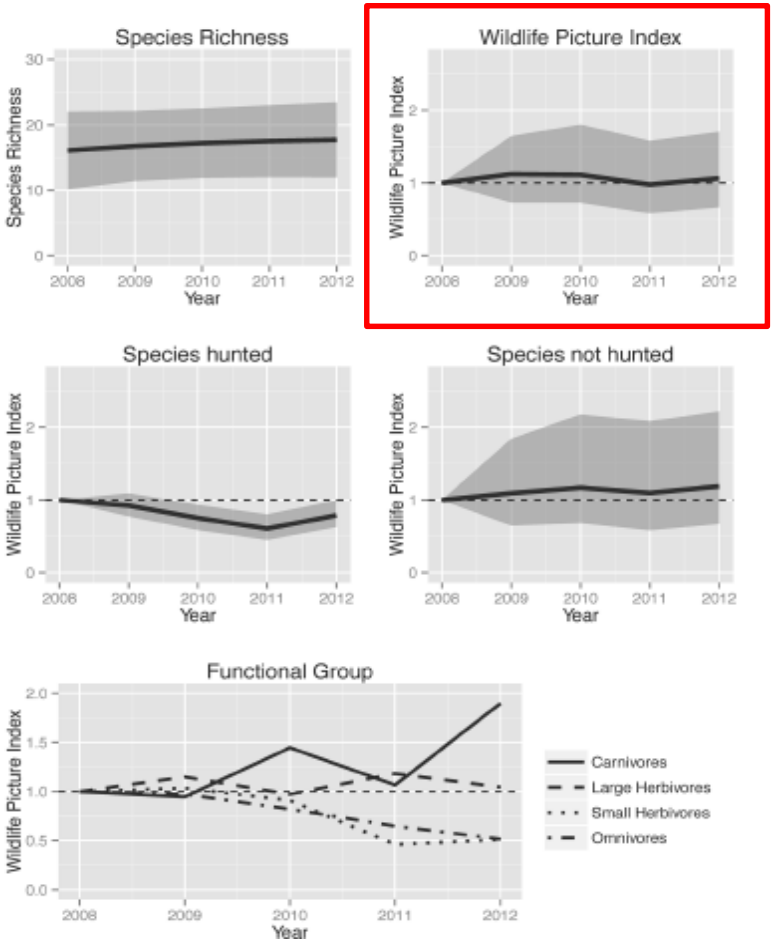
continuous forests

fragmented forests

4) **Temporal analysis at site level and the WPI**: detecting trends in threatened species and whole communities (5 yrs data from Costa Rica, Ahumada et al. 2013)

The essential analysis to anticipate changes and monitor Aichi targets

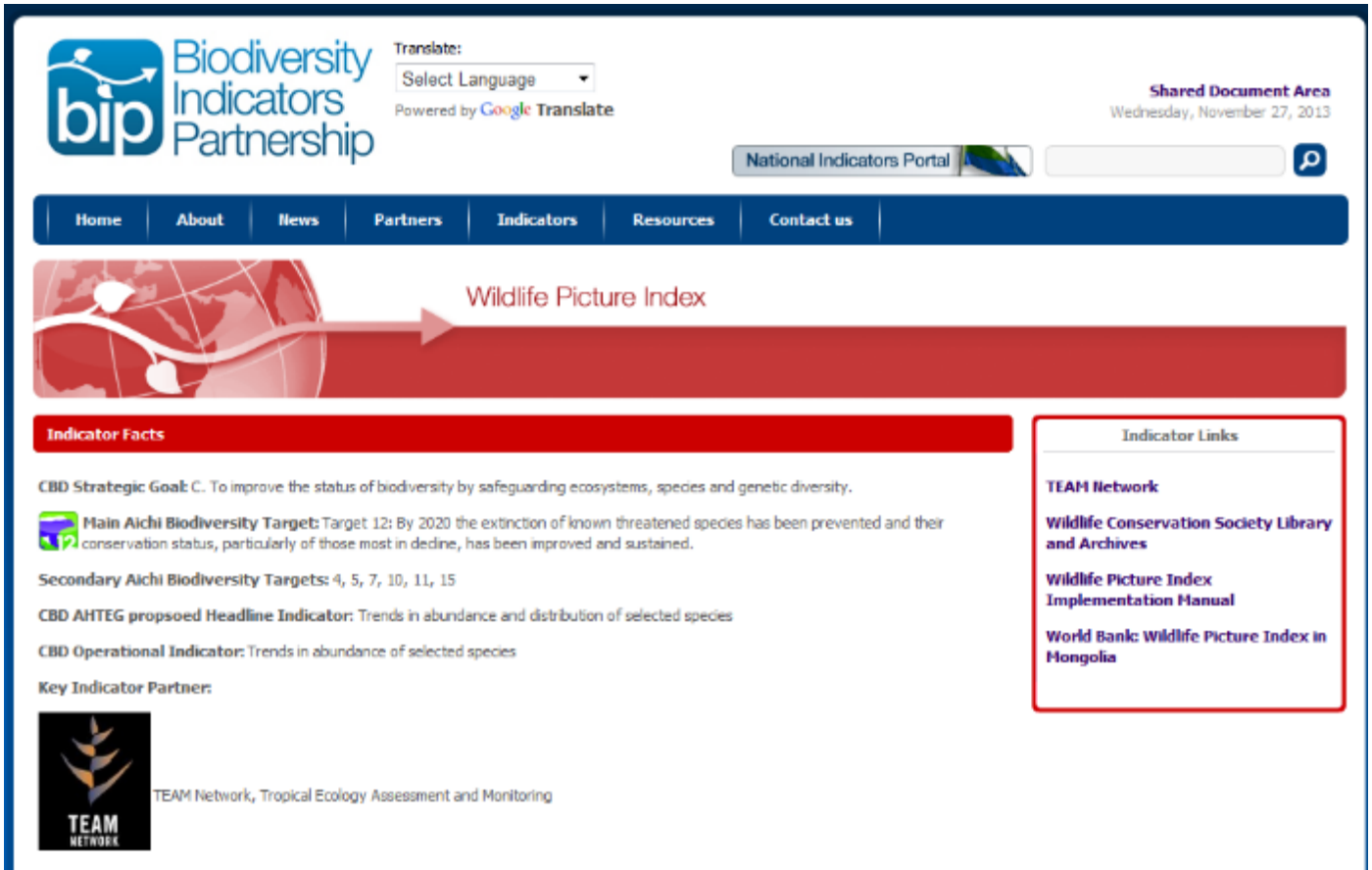


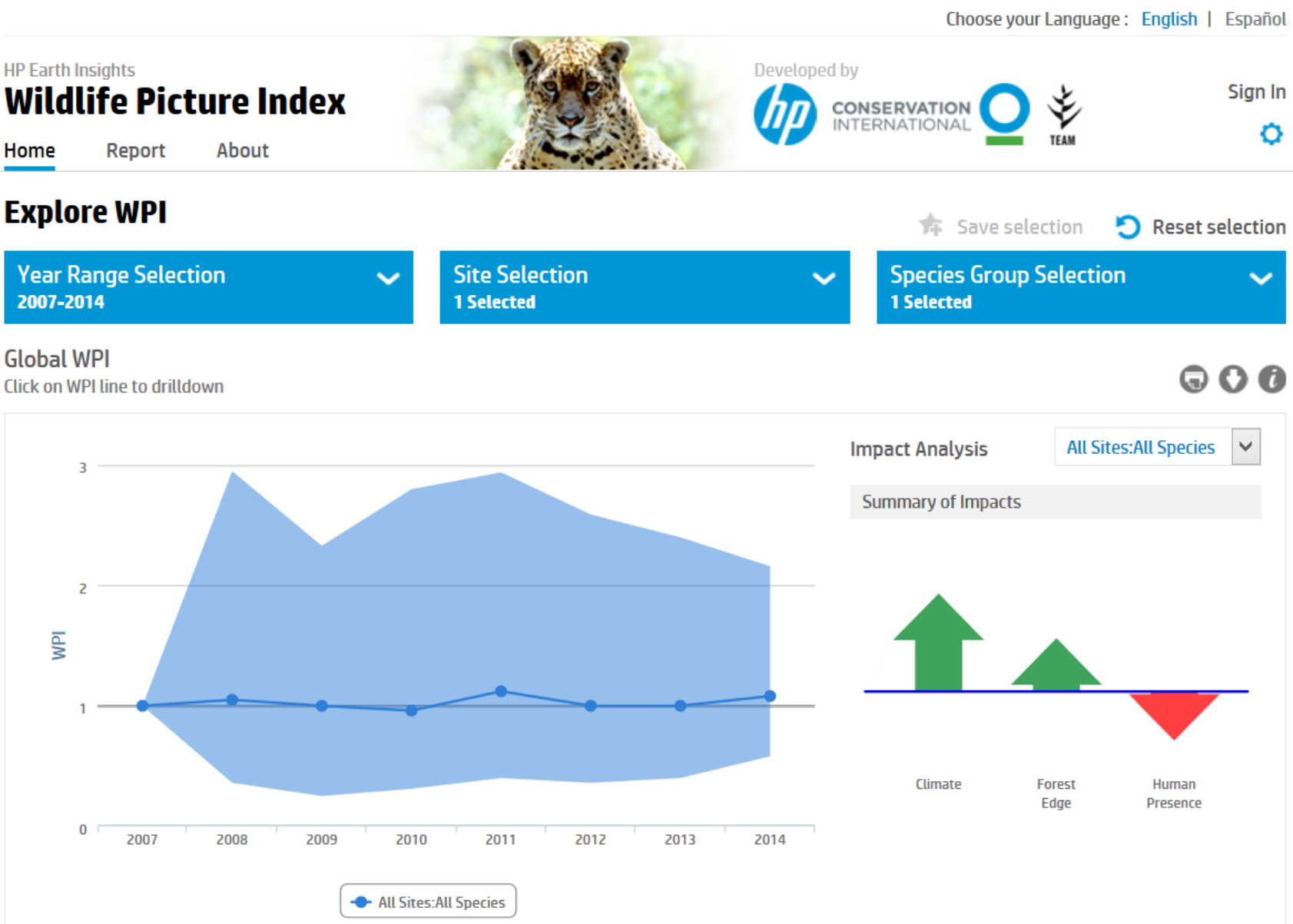


The Wildlife Picture Index to assess temporal trends

WPI is an index for assessing temporal changes of mammal communities derived from TEAM data

Since 2013 WPI is one of the indicators of the **CBD's** Aichi Targets, esp. number 11 and 12: assessing trends and preventing extinction

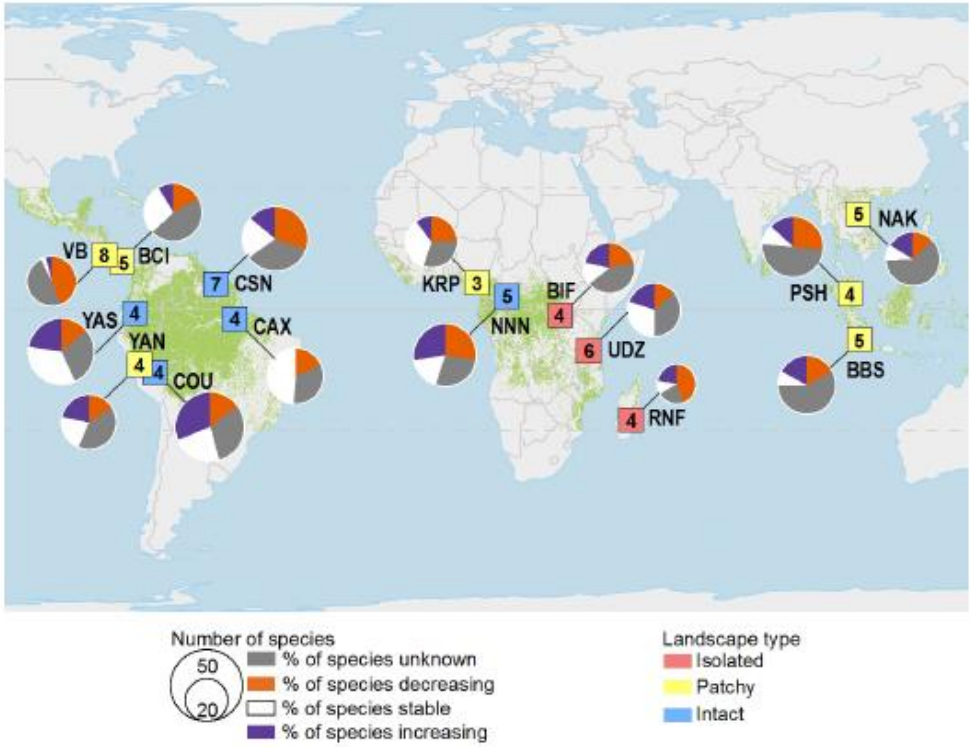


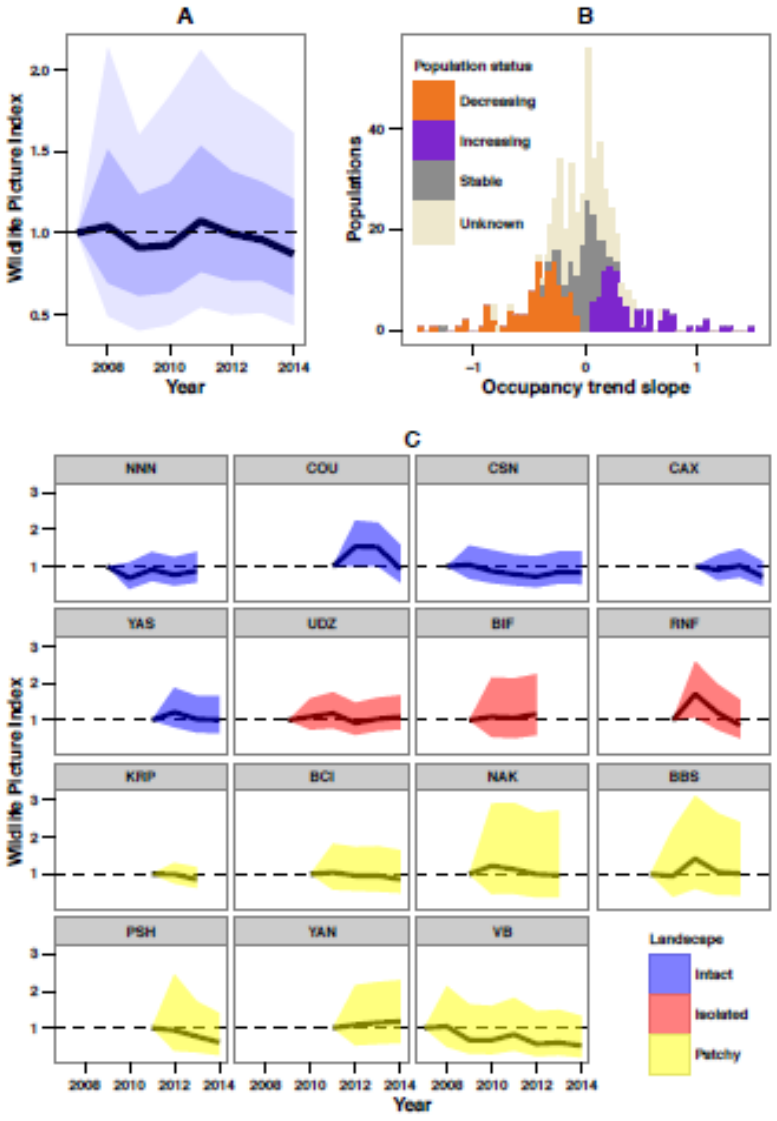


http://wpi.teamnetwork.org/wpi/dashboard

5) **The first global analysis** of temporal trends in WPI (Beaudrot, Ahumada et al. in revision)

- > 2.4M images forming the dataset
- 511 populations of 244 species
- 22% of populations declined, 17% increased, and 22% exhibited no change during the last 3-8 years





Conclusions

TEAM shows the value of standardized and timely data collection to anticipate changes in biodiversity and hence contribute decision-making (the integration of protocols enhances this function …)

Added value of TEAM vs usual (individual) approach to research in terms of time (several years/decades vs 1-3 years), space (global vs local) and sampling effort (200 km^2 each site vs few km^2)

TEAM potential for influencing decisions:

- Policy level: WPI as official indicator of Aichi target, participation into CBD and other global biodiversity fora
- Protection: new/upgraded status of PAs, species-specific conservation measures, site prioritization, etc.
- Trigger national monitoring systems (capacity building, replication at many sites of standardized monitoring – 1st example in the Alps…)

Challenges

Funding to biodiversity research and conservation remains dramatically limited (threat to long-term monitoring efforts)

In the TV protocol, uncertainty inherent with rarity of species (e.g. 39% of populations detected too infrequently for assessing trends in occupancy in the WPI global analysis)

Academic culture and funding not conducive to long-term efforts (emphasis on 'newsy' or provokative articles in scientific journals, etc.)

Gap between science and local/regional decision-making processes

…

francesco.rovero@muse.it