Rumo ao Big Data nas Ciências Ambientais

access2perspectives.com

Alexandre Camargo Martensen

4ntena Ambiental - 02/06/2022

Ciência 2.0

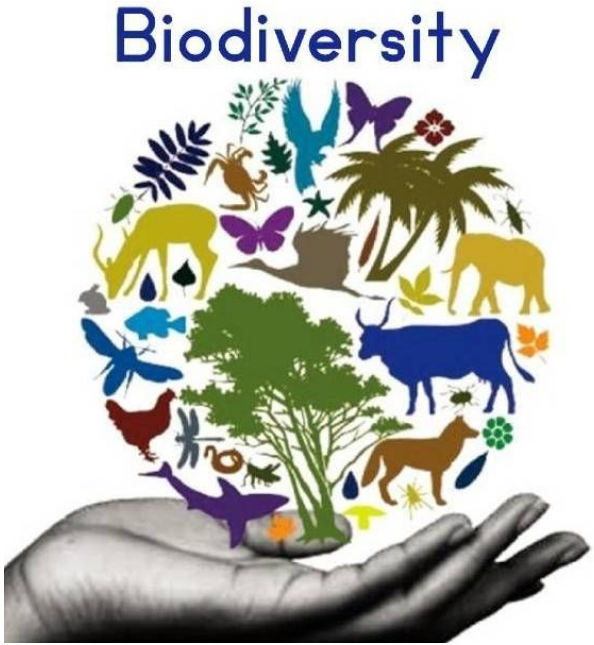
Novos paradigmas da ciência

access2perspectives.com

Alexandre Camargo Martensen

4ntena Ambiental - 02/06/2022

2 dos maiores desafios da humanidade



https://www.safeworldhse.com/2020/04/biodiversity-types-importance-loss-conservation.html

https://www.usatoday.com/story/news/nation/2020/09/10/climate-change-covid-19-does-global-warming-fuel-pandemics/5749582002/

O que é Ciência 2.0?

- **Nova forma de se fazer ciência, baseada na troca de informações e na colaboração**
  - Open research
  - Open science
  - Big data

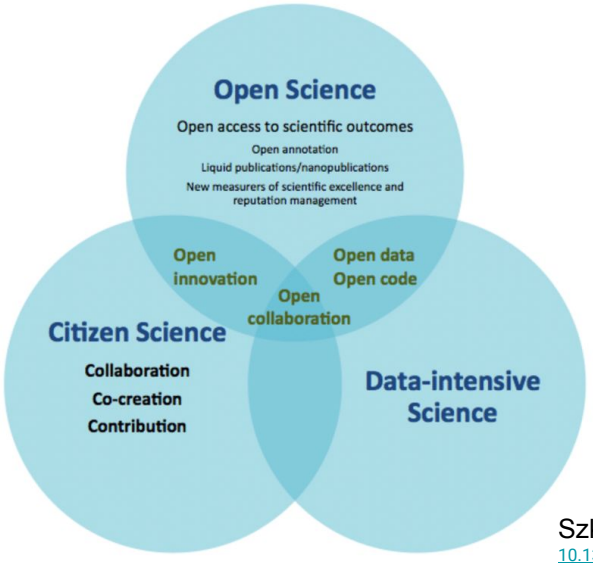
"Science happens not just because of people doing experiments, but because they're discussing those experiments"

Christopher Surridge

https://www.scientificamerican.com/article/science-2-point-0-great-new-tool-or-great-risk/

O que é Ciência 2.0?

- **Novas ferramentas de colaboração/comunicação como wikis, blogs, videos, open lab notebooks, gitHub, figShare, pré-prints, live figures, live code (ex. Shiny), data repositories, data-intensive, open reviews...**



Data-intensive

Szkuta & Osimo (2012)
10.13140/RG.2.2.35128.03842

Levantamento e monitoramento da biodiversidade

20 anos atrás…

Levantamento e monitoramento da biodiversidade

Métodos tradicionais (dificuldades)

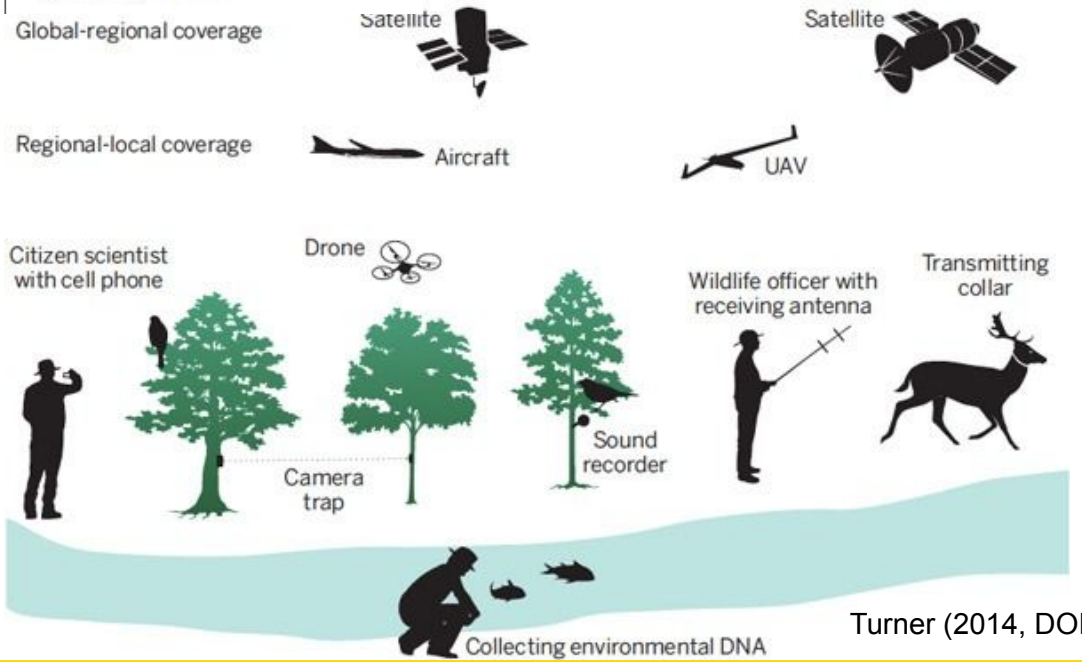
- Espécies ainda não descritas
- Identificação de espécies crípticas
- Complexidade na identificação de jovens, etc
- Falta de especialistas/taxonomistas
- Amostragens não padronizadas (espacialmente, temporalmente, questões climáticas…)
- Técnicas e métodos de amostragens variáveis
- Amostragens invasivas
- Dificuldades cobertura amostral (espacialmente/temporalmente)
- Coleta > triagem > armazenamento > resgate da informação >> processo mecânico, passível de erros humanos
- ...

CONSERVATION

Sensing biodiversity

Sophisticated networks are required to make the best use of biodiversity data from satellites and in situ sensors

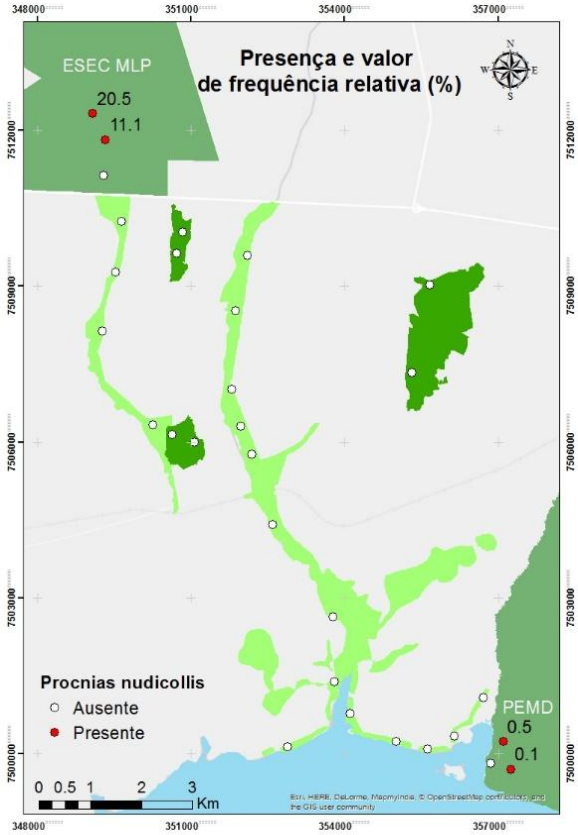
By **Woody Turner**

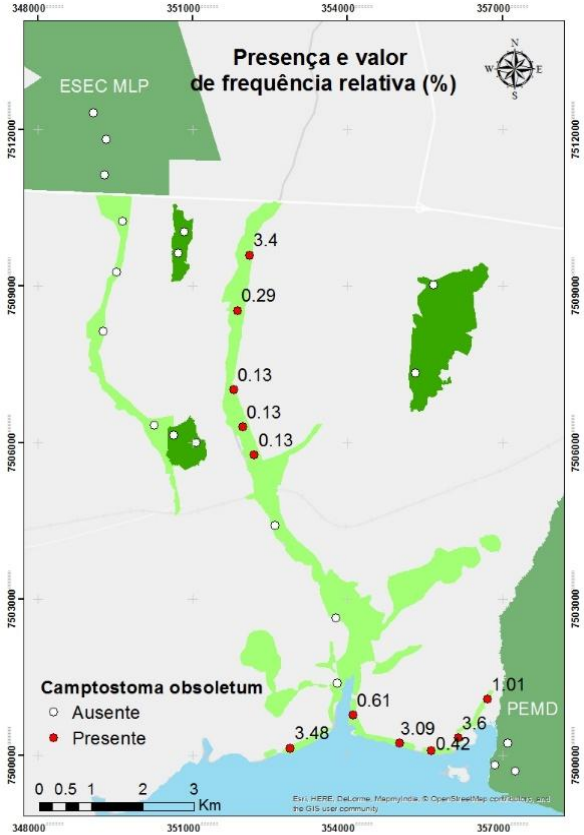


Turner (2014, DOI: 10.1126/science.1256014)

Monitoramento Sonoro

- Aves
- Anfíbios
- Morcegos
- Macacos



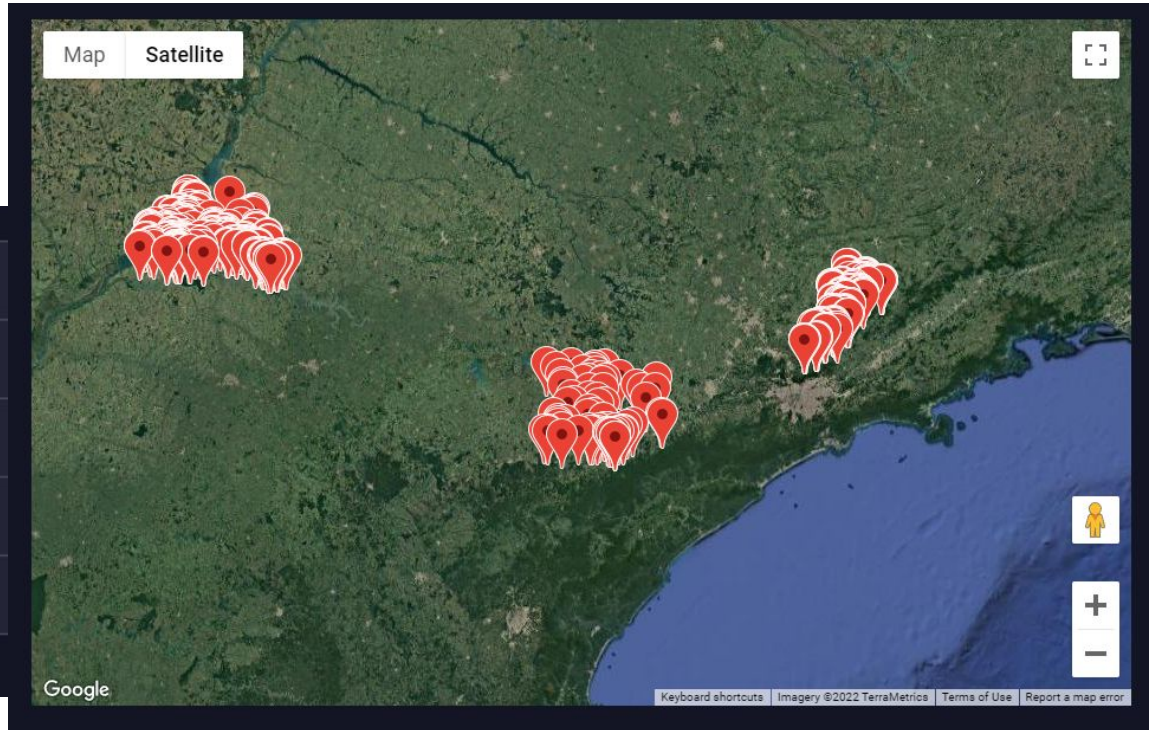


Monitoramento Sonoro

CCN
Centro de Ciências
da Natureza **UFSCar**

IPÊ INSTITUTO DE PESQUISAS ECOLÓGICAS

- Sites: 604
- Recordings: 2,006,027
- Templates: 142
- Pattern Matchings: 53
- Validated species: 93

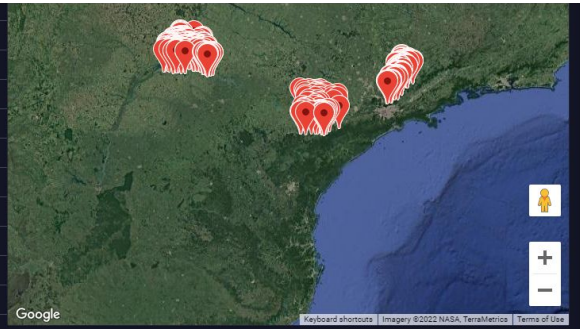


Monitoramento Sonoro

CCN
Centro de Ciências
da Natureza UFSCar

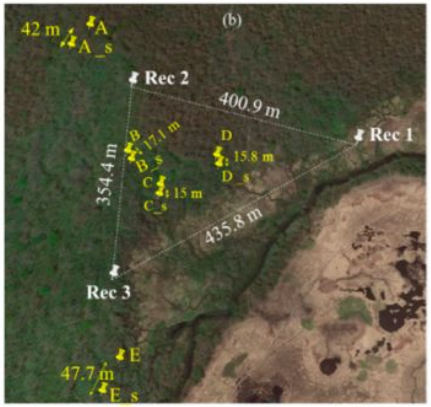
IPÊ INSTITUTO DE PESQUISAS ECOLÓGICAS

ALPA_P3_35_45_MD	4675	-24.142	-48.559	812.00	May 10, 2022 3:15 PM
SC_B19P146GIPE12	6968	-22.855	-45.873	1,548.67	May 6, 2022 8:46 AM
SC_B06P107GIPE20	8149	-22.980	-46.041	856.18	May 4, 2022 4:26 PM
SC_B06P106GIPE36	8746	-22.985	-46.039	798.19	May 4, 2022 11:44 AM
ALPA_P2_45_55_MD	7151	-24.093	-48.246	770.00	May 4, 2022 11:02 AM
ALPA_P3_35_45_HD	7155	-24.079	-48.190	652.00	May 3, 2022 11:40 PM
ALPA_P3_55_65_LD	7159	-24.138	-48.273	837.00	May 3, 2022 5:24 PM
ALPA_P1_65_85_MD	7739	-24.091	-48.874	673.00	May 2, 2022 11:24 PM
ALPA_P1_15_25_HD	7753	-23.998	-48.927	652.00	May 2, 2022 4:53 PM
ALPA_P2_55_65_LD	7741	-24.139	-48.983	787.00	May 2, 2022 11:46 AM
ALPA_P2_45_55_HD	7734	-24.064	-48.882	701.00	May 2, 2022 12:49 AM
ALPA_P1_65_85_HD	3989	-24.119	-48.847	741.00	May 1, 2022 6:03 PM
SC_B09P090GIPE34	6492	-23.059	-46.163	982.59	Apr 15, 2022 4:05 PM
SC_B26P004GIPE02	4297	-23.215	-46.321	904.72	Apr 14, 2022 11:55 AM
SC_B15P012GIPE44	4623	-23.259	-46.294	759.80	Apr 14, 2022 7:57 AM
SC_B11P007GIPE67	8045	-23.135	-46.316	791.53	Apr 12, 2022 12:20 PM
SC_B31P153GIPE88	7161	-22.942	-46.165	1,066.37	Apr 12, 2022 7:55 AM
SC_B31P152GIPE15	6332	-22.947	-46.175	941.42	Apr 12, 2022 7:52 AM
SC_B31P154GIPE14	7161	-22.944	-46.172	968.76	Apr 11, 2022 2:00 PM
SC_B10P051GIPE58	5593	-23.113	-46.344	1,054.68	Apr 8, 2022 6:04 PM
SC_B10P046GIPE05	5592	-23.122	-46.341	1,047.72	Apr 8, 2022 3:58 PM
SC_B09P089GIPE73	3750	-23.057	-46.170	1,026.81	Apr 8, 2022 12:56 PM
SC_B09P088GIPE43	4154	-23.056	-46.163	1,021.52	Apr 7, 2022 7:12 PM
SC_B08P098GIPE45	4025	-23.061	-46.227	873.24	Apr 5, 2022 2:30 PM
SC_B17P106GIPE02	0	-23.225	-46.435	894.96	Mar 31, 2022 12:35 PM
SC_B29P180GIPE59	3300	-22.843	-46.10		:35 PM



Monitoramento Sonoro

Monitoramento Sonoro



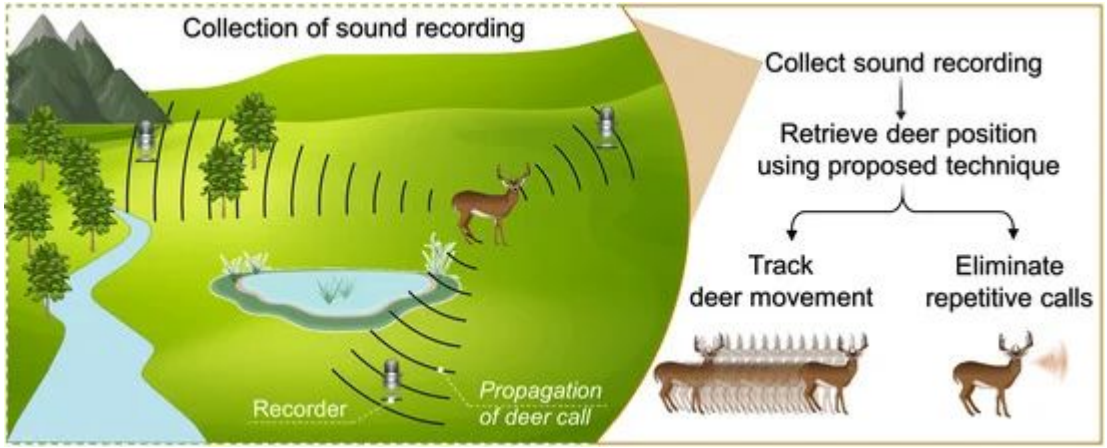
sensors

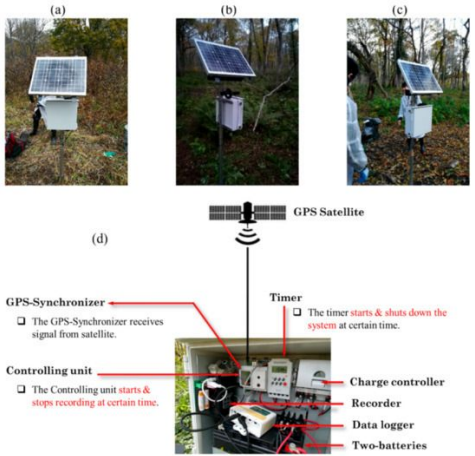
MDPI

Article

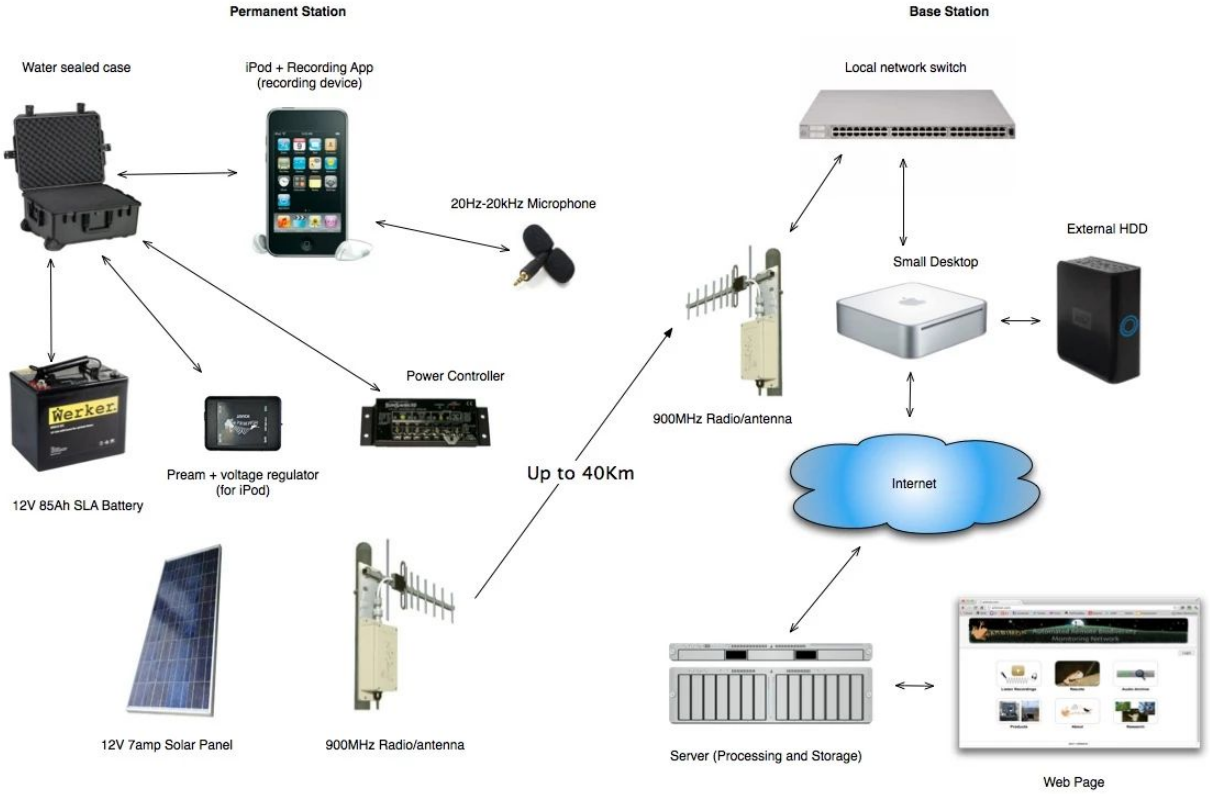
Detecting and Tracking the Positions of Wild Ungulates Using Sound Recordings

Salem Ibrahim Salem [1,2,*], Kazuhiko Fujisao [3,4], Masayasu Maki [5], Tadanobu Okumura [6] and Kazuo Oki [1,3]



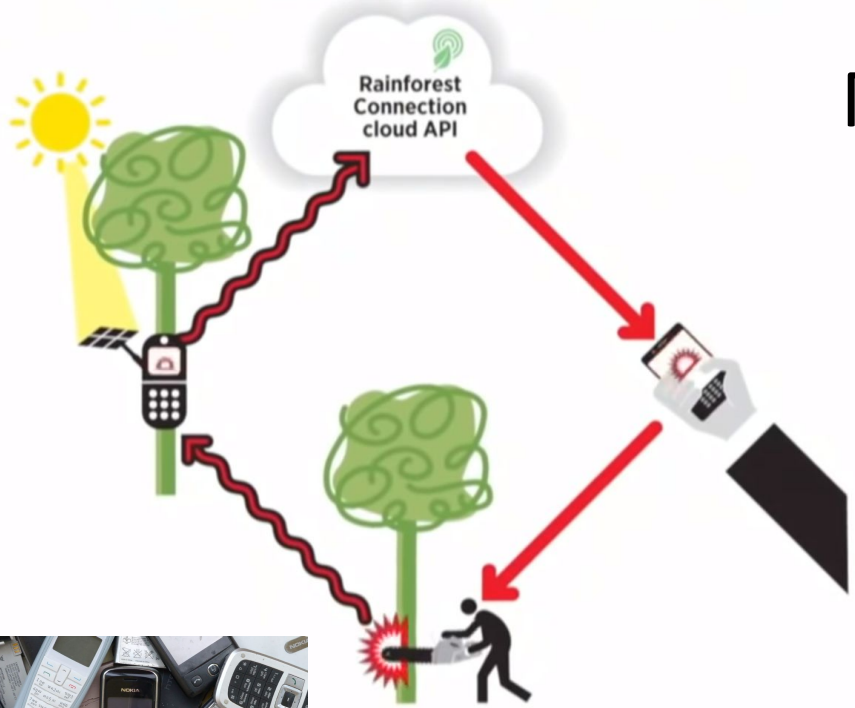


Monitoramento Sonoro em tempo real (Real Time)



https://newatlas.com/arbimon-wildlife-monitoring/28361

Monitoramento Sonoro e desmatamento



https://youtu.be/xPK2Ch90xWo

Topher White

Monitoramento Sonoro
e incêndio florestal em tempo real

Figure 2. Proposed system infrastructure.

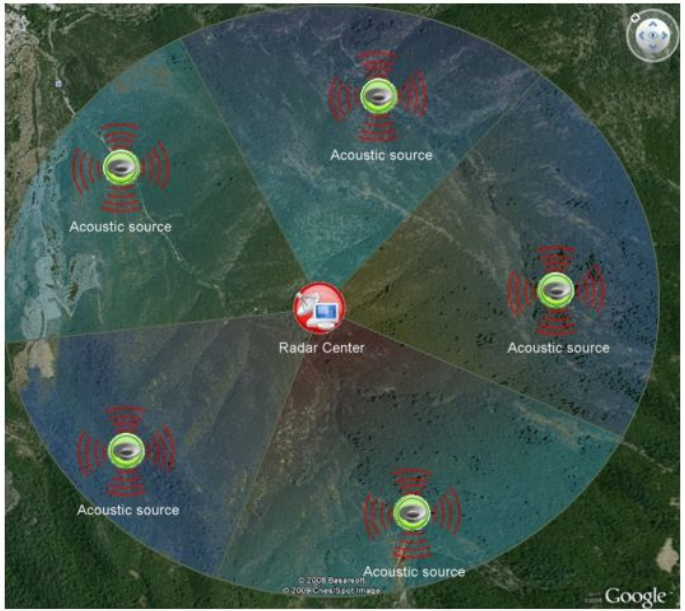
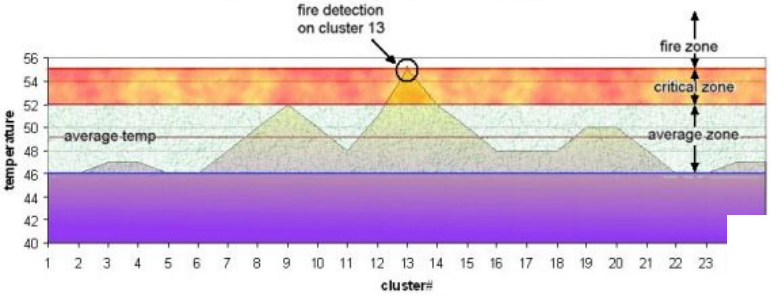


Figure 5. Warm region thermal data spectrum.



OPEN ACCESS
sensors
ISSN 1424-8220
www.mdpi.com/journal/sensors

Sensors **2009**, 9, 1485-1498; doi:10.3390/s90301485

Article

Early Forest Fire Detection Using Radio-Acoustic Sounding System

Yasar Guneri Sahin [1,*] and Turker Ince [2]

Monitoramento Sonoro e incêndio florestal em tempo real

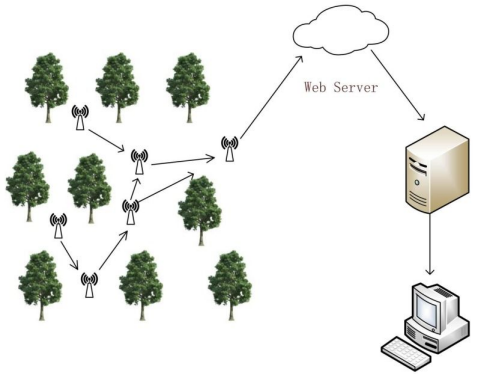
sensors

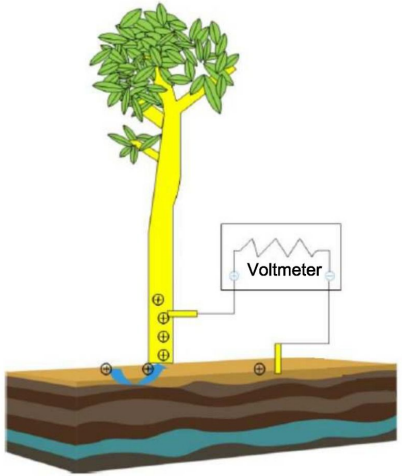
MDPI

Article

Wildfire Detection Using Sound Spectrum Analysis Based on the Internet of Things

Shuo Zhang †, Demin Gao *,†, Haifeng Lin † and Quan Sun †





3.1. The Principle of Energy Harvesting from Living Trees

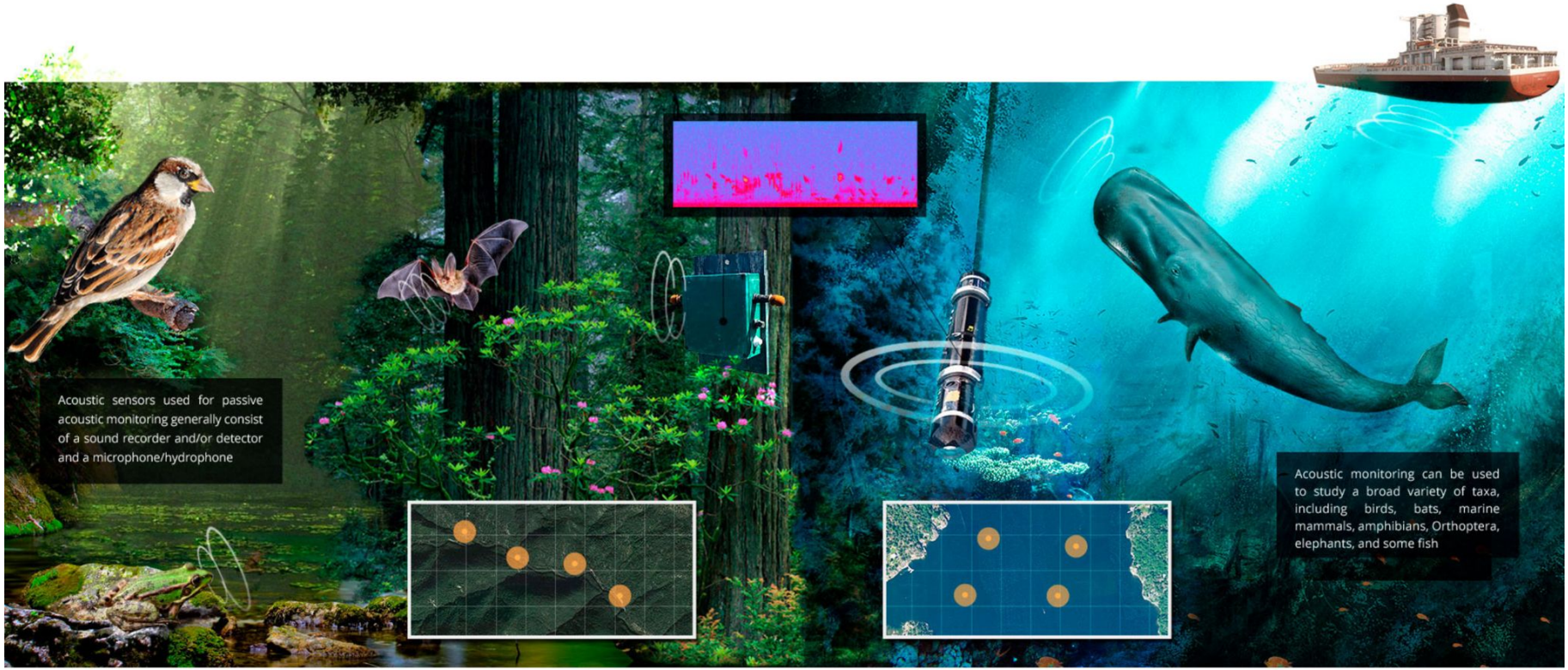
In the previous section, we discussed the energy supply issue of existing wildfire detection technologies, while the traditional solution is to use disposable chemical batteries with limited energy to provide power for conventional wireless sensor networks [40]. The reason why batteries are chosen to power nodes is that forested areas are generally in remote areas, and the terrain is rugged, which is unfavorable for supplying power to the sensors and to the data transmission of the sensors. It is universally acknowledged that it is inconvenient to replace disposable chemical batteries with limited energy in forested areas, and these batteries will cause severe pollution to the environment. To solve this issue, we did some related studies and found that we could harvest energy from living trees.

1.1. The Voltage Caused by Differences in the pH of the Xylem and Soil of Trees

In the process of measuring the voltage of eucalyptus, the Nernst equation generated from the potential voltage of the pH concentration is expressed as: $V = V' - \frac{RT}{nF}[\triangle pH] \sim 56mV[\triangle pH]$, where R is a general gas constant of 8.314 JK^{-1} mol^{-1}, T is the Kelvin temperature, and F is the electric charge mes Avogadro's constant, which is 9.648 $\times 10^4$ C mol^{-1}, and $[\triangle pH]$ is the difference between the vo pH values [41]. This formula can be used to calculate the theoretical power that Eucalyptus can roduce. From Figure 2, we can observe that under the effect of the tree's metabolism, it can produce a eak current.

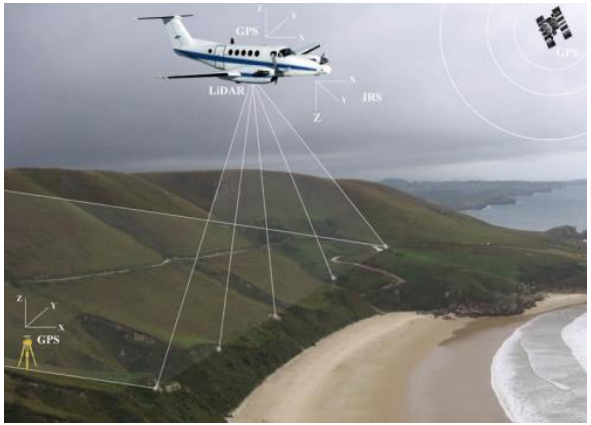
doi: 10.3390/s19235093

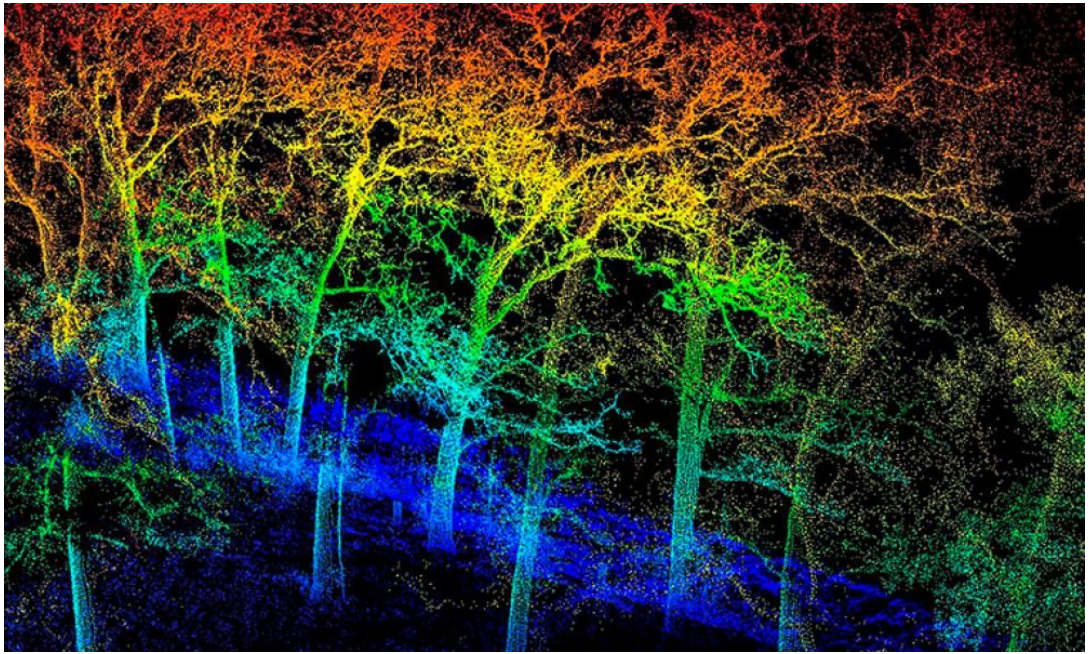
Monitoramento Sonoro



https://www.wwf.org.uk/project/conservationtechnology

Lidar - Light detection and ranging





https://www.wwf.org.uk/project/conservationtechnology

Lidar

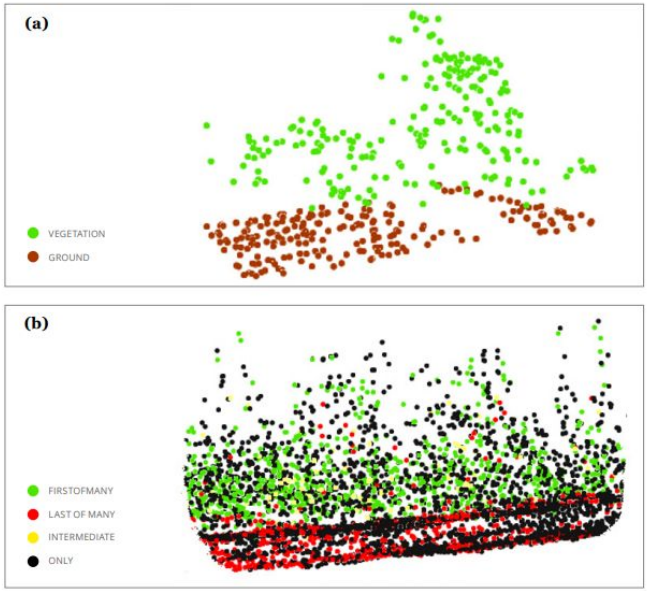
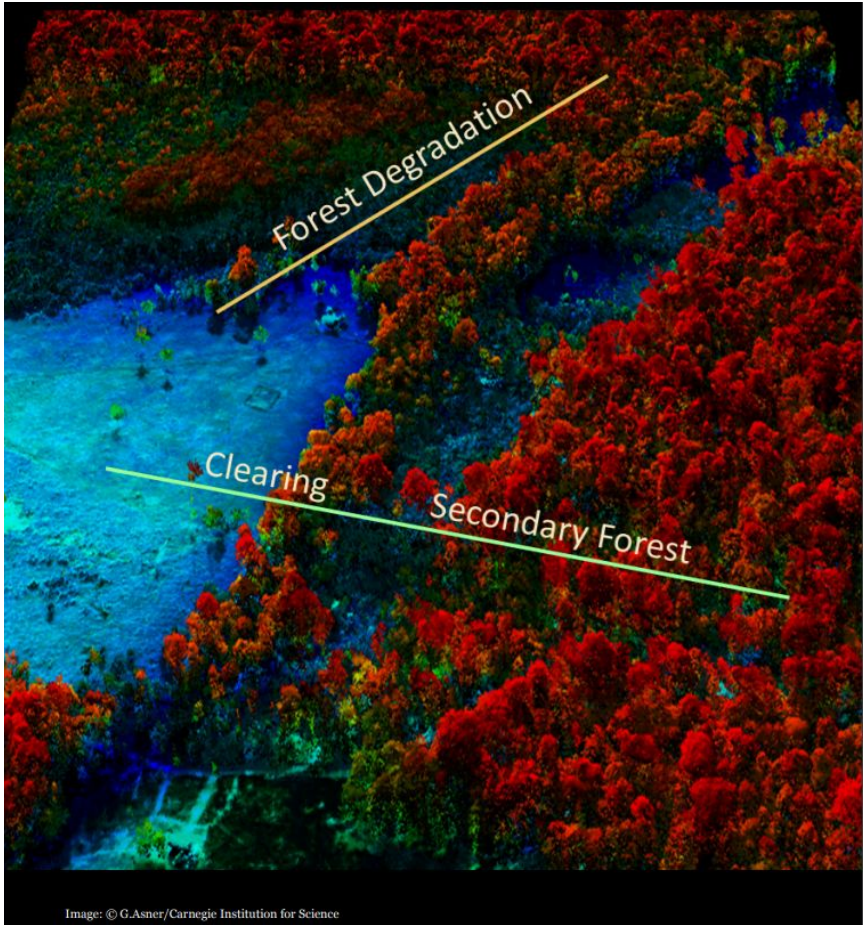
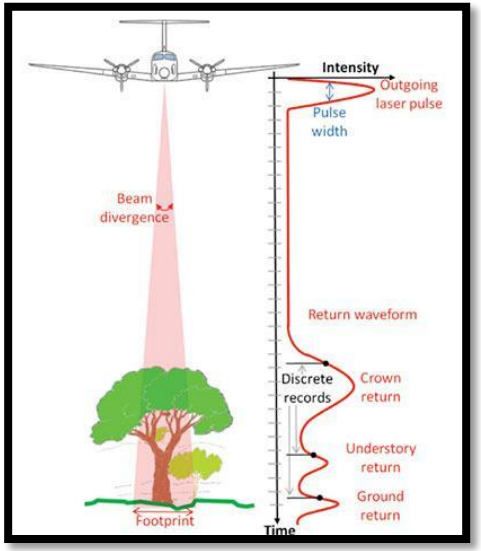


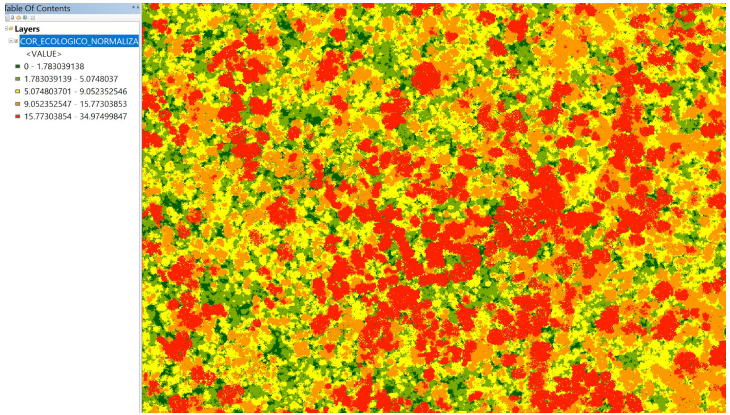
Figure 2.3 LiDAR echoes in point clouds categorized by target (a) or order of return of the echoes (b).

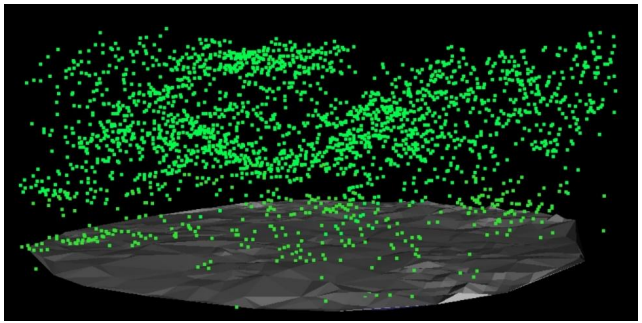
Melin, Shapiro Glover-Kapfer 2017



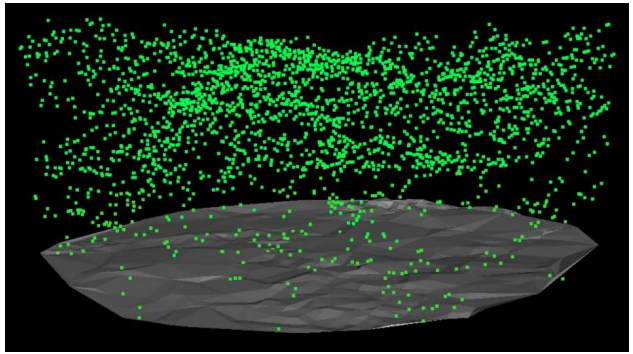
Corredor do Pontal







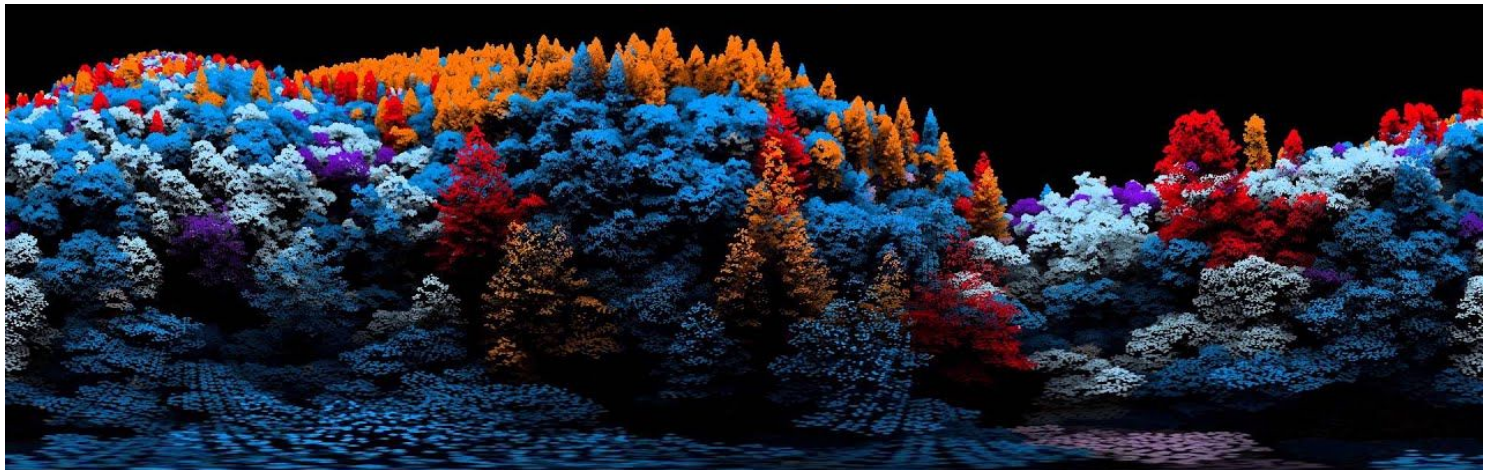
Parcela amostral 20 em Out/2015



Parcela amostral 20 em Nov/2016

Hiperespectral

- Identificação de espécies vegetais por imagens hiperespectrais



Hiperespectral

remote sensing

Article

Tree Species Classification in a Highly Diverse Subtropical Forest Integrating UAV-Based Photogrammetric Point Cloud and Hyperspectral Data

Camile Sothe [1,*], Michele Dalponte [2], Cláudia Maria de Almeida [1], Marcos Benedito Schimalski [3], Carla Luciane Lima [4], Veraldo Liesenberg [3], Gabriela Takahashi Miyoshi [5] and Antonio Maria Garcia Tommaselli [5]

Remote Sens. 2019, 11, 1338; doi:10.3390/rs11111338

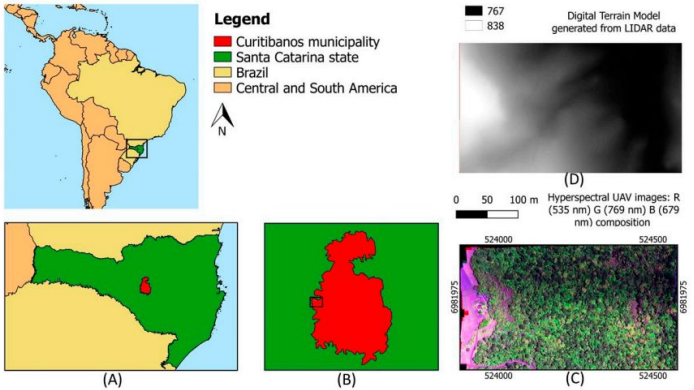


Figure 1. Study area location. (**A**) Santa Catarina State. (**B**) Curitibanos municipality. (**C**) Hyperspectral UAV image R (535 nm) G (769 nm) B (679 nm). (**D**) Digital Terrain Model.

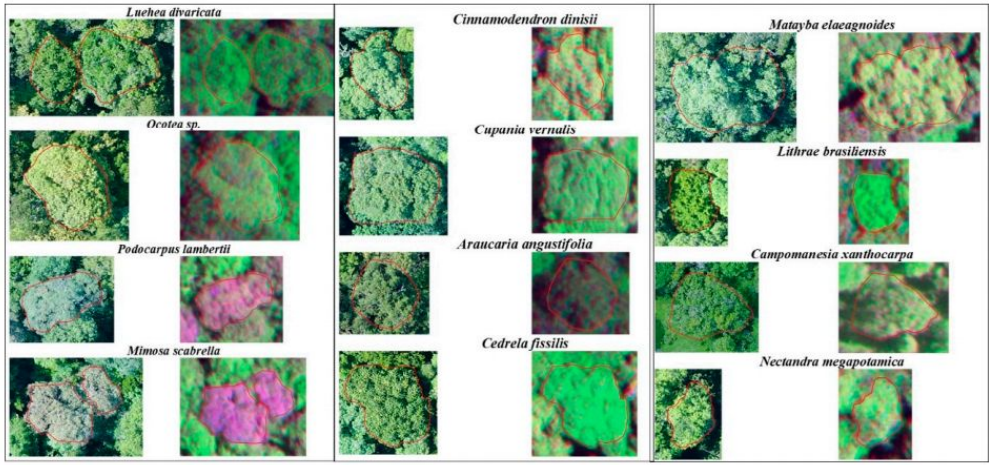


Figure 2. Tree species classes delimitated in the unmanned aerial vehicle (UAV)-RGB image and the corresponding UAV-hyperspectral image.

Foi eficiente para a classificação das 12 espécies escolhidas

Drone térmico

F. Melo

eDNA/iDNA

Efficiency of eDNA and iDNA in assessing vertebrate diversity and its abundance

ENVIRONMENTAL DNA | INGESTED DNA | INVERTEBRATE-DERIVED DNA | METABARCODING | METANALYSIS | VERTEBRATE SURVEYS

+2 Carolina Carvalho, Marina Oliveira, Karen Rodriguez-Castro, Bruno Saranholi, Pedro Galetti Jr

DOI: 10.22541/au.161777019.96557508/v1

"The metanalysis showed that, in general, there is no difference in the number of species detected or number of sites that a target species was detected when using eDNA/iDNA or conventional methods, suggesting that eDNA/iDNA and conventional methods were equally efficient in characterizing the biodiversity."

eDNA/iDNA

Efficiency of eDNA and iDNA in assessing vertebrate diversity and its abundance

ENVIRONMENTAL DNA | INGESTED DNA | INVERTEBRATE-DERIVED DNA | METABARCODING | METANALYSIS | VERTEBRATE SURVEYS

Carolina Carvalho, Marina Oliveira, Karen Rodriguez-Castro, Bruno Saranholi, Pedro Galetti Jr

DOI: 10.22541/au.161777019.96557508/v1

"The metanalysis showed that, in general, there is no difference in the number of species detected or number of sites that a target species was detected when using eDNA/iDNA or conventional methods, suggesting that eDNA/iDNA and conventional methods were equally efficient in characterizing the biodiversity."

However, for water sampler and fish, separately, the risk of not finding a species was greater using conventional method than eDNA, suggesting that eDNA/iDNA was more efficient in finding the target species.

eDNA/iDNA

Efficiency of eDNA and iDNA in assessing vertebrate diversity and its abundance

ENVIRONMENTAL DNA | INGESTED DNA | INVERTEBRATE-DERIVED DNA | METABARCODING | METANALYSIS | VERTEBRATE SURVEYS

+2 Carolina Carvalho, Marina Oliveira, Karen Rodriguez-Castro, Bruno Saranholi, Pedro Galetti Jr

DOI: 10.22541/au.161777019.96557508/v1

Abundance and biomass showed similar correlation patterns, and there was a positive correlation between eDNA/iDNA and abundance/biomass data, suggesting that eDNA/iDNA can be used as a proxy for abundance and biomass.

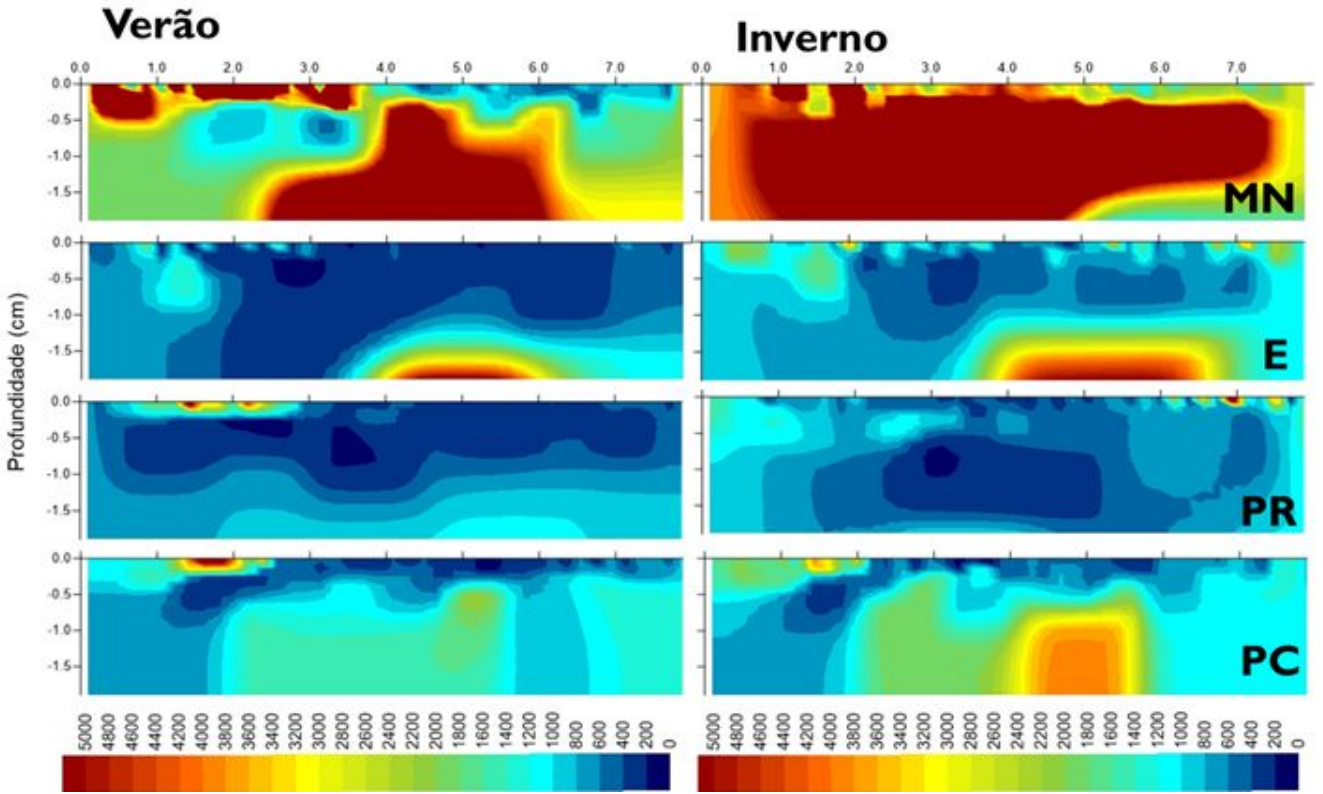
Monitoramento biofísico

Datalogger
(a cada 10 min)

- ❑ Precipitação
- ❑ Temperatura
- ❑ Turbidez
- ❑ Nível
- ❑ Ph
- ❑ …

Monitoramento biofísico

Umidade do solo



Monitoramento biofísico

Sensor
Eletroquímico

Doenças

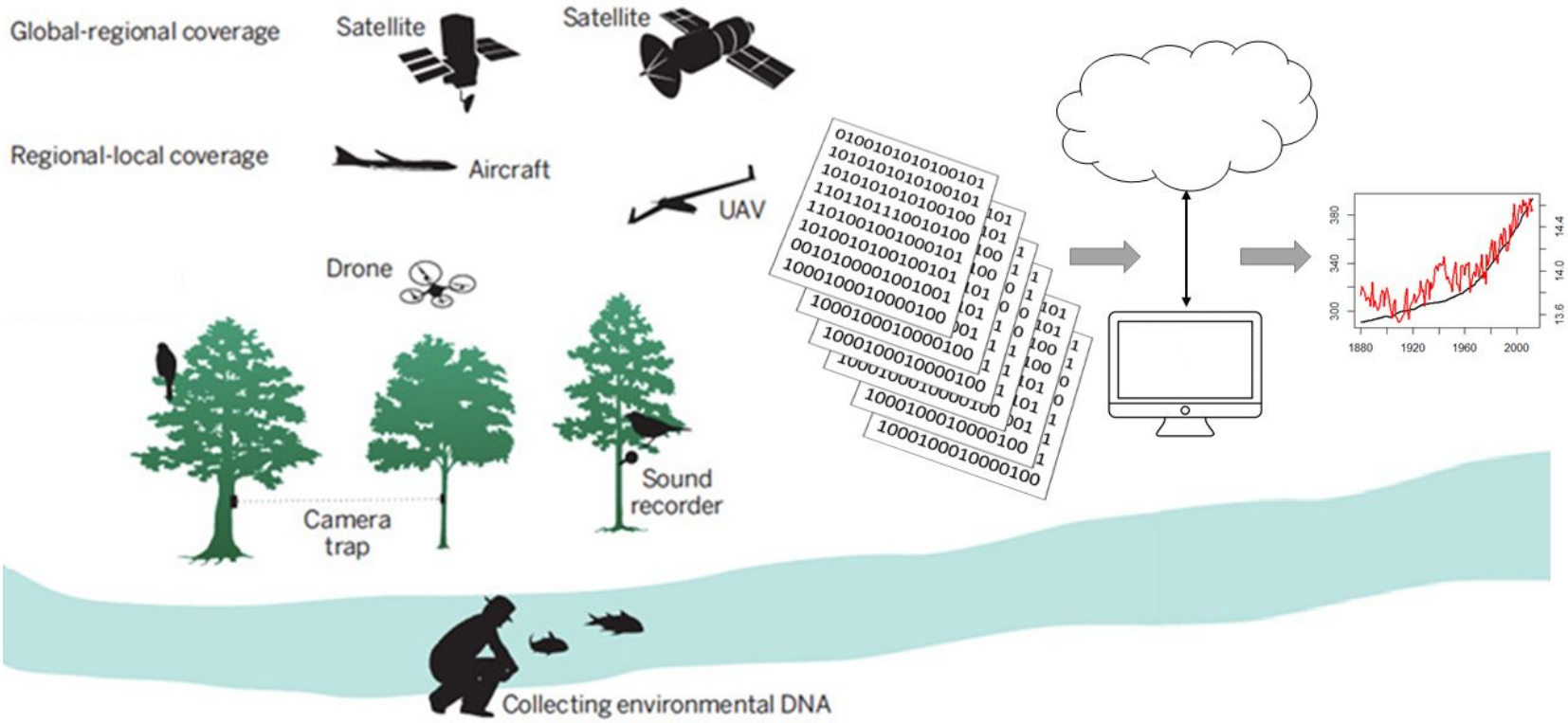
Pesticidas

Hormônios

Componentes
tóxicos

Drogas

Coleta, publicação e análise de dados



Adaptado de: Turner, 2014 (Science)

Coleta, publicação e análise de dados

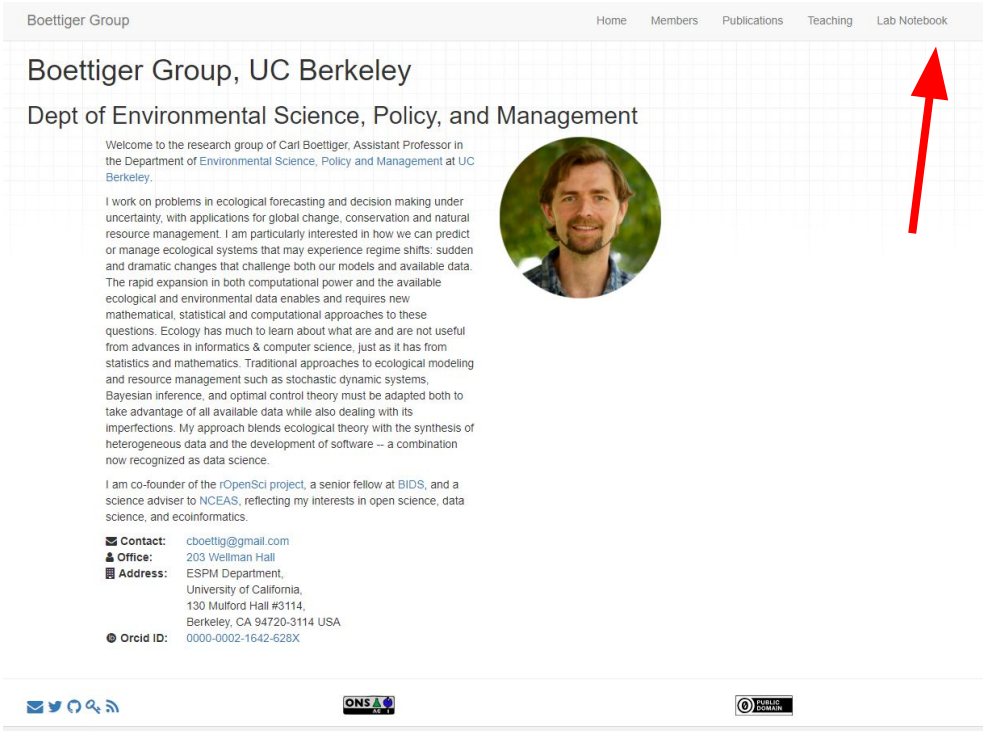
Data Papers

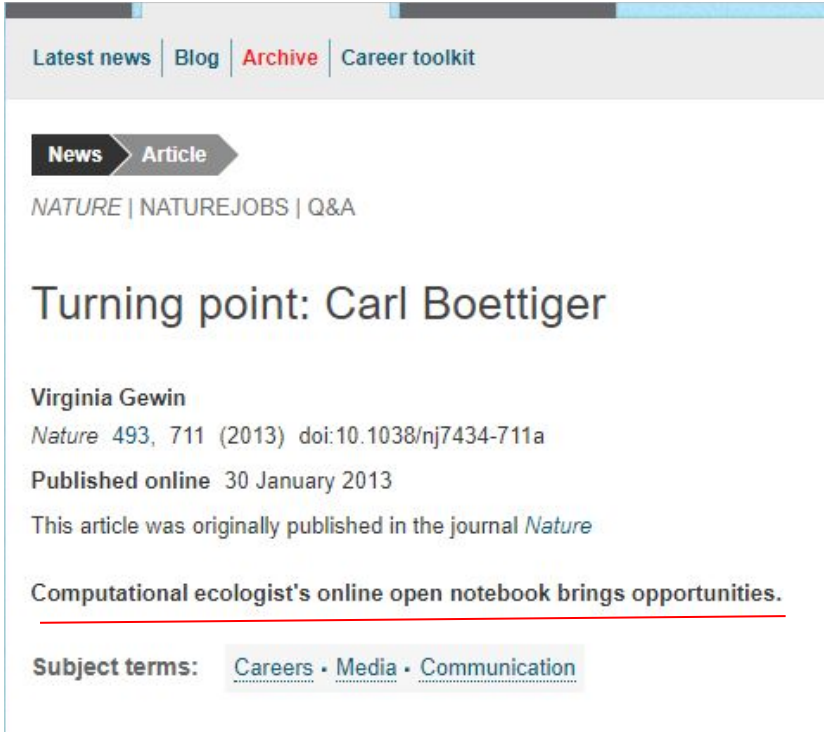
Ecology, 100(12), 2019, e02861

FragSAD: A database of diversity and species abundance distributions from habitat fragments

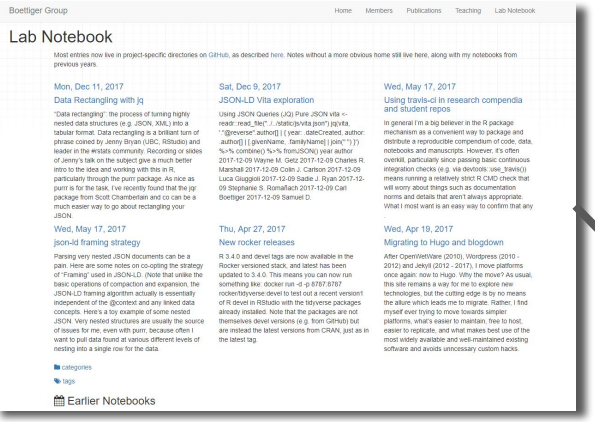
Jonathan M. Chase,[1,2,43] Mario Liebergesell,[1] Alban Sagouis,[1] Felix May,[3] Shane A. Blowes,[1] Åke Berg,[4] Enrico Bernard,[5] Berry J. Brosi,[6] Marc W. Cadotte,[7] Luis Cayuela,[8] Adriano G. Chiarello,[9] Jean-Francois Cosson,[10] Will Cresswell,[11] Filibus Danjuma Dami,[12] Jens Dauber,[13] Chris R. Dickman,[14] Raphael K. Didham,[15,16] David P. Edwards,[17] Fábio Z. Farneda,[18,19,20] Yoni Gavish,[21] Thiago Gonçalves-Souza,[22] Demetrio Luis Guadagnin,[23] Mickaël Henry,[24] Adrià López-Baucells,[19,20,25] Heike Kappes,[13] Ralph Mac Nally,[26,27] Shiiwua Manu,[12] Alexandre Camargo Martensen,[28] Duncan McCollin,[29] Christoph F. J. Meyer,[19,20,30] Selvino Neckel-Oliveira,[31] André Nogueira,[32] Jean-Marc Pons,[33] Dinarzarde C. Raheem,[34] Flavio Nunes Ramos,[35] Ricardo Rocha,[19,20,36] Katerina Sam,[37] Eleanor Slade,[38] John O. Stireman III,[39] Matthew J. Struebig,[40] Heraldo Vasconcelos,[41] and Yaron Ziv[42]

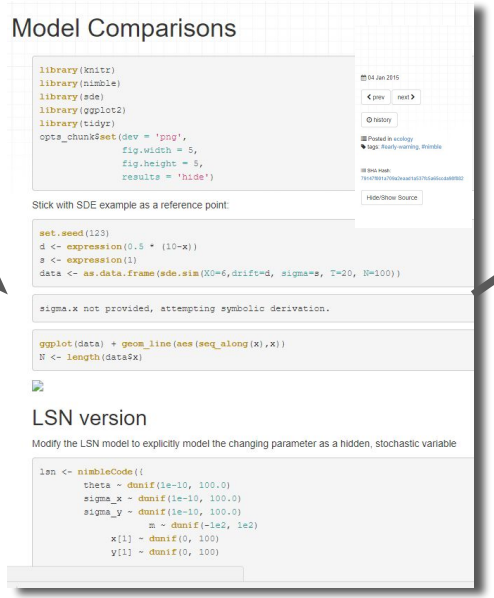
Análise de dados

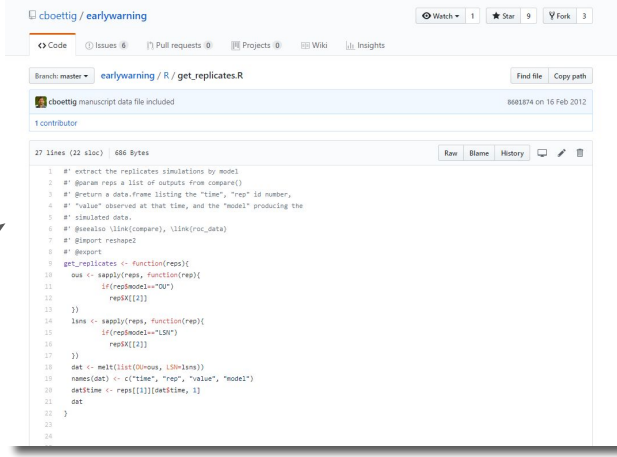




Análise de dados

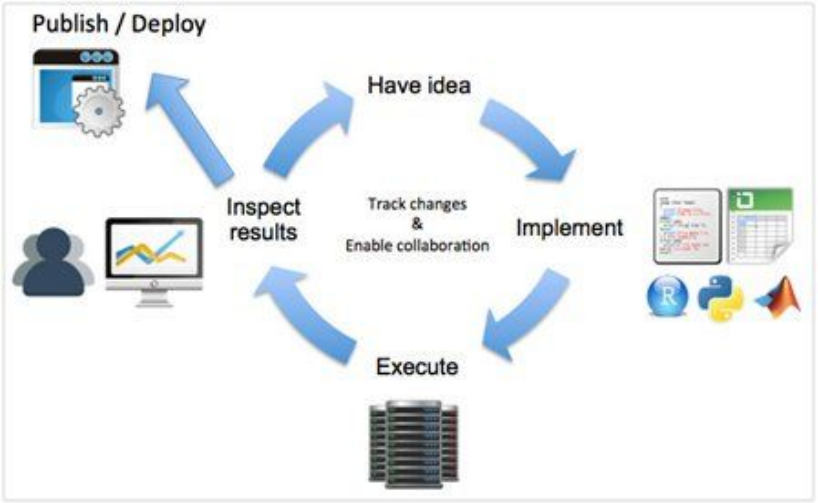






Análise de dados

- gitHub
- Workflow
- Código



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Review

Defrosting the Digital Library: Bibliographic Tools for the Next Generation Web

Duncan Hull[1,2]*, Steve R. Pettifer[2,3], Douglas B. Kell[1,2]

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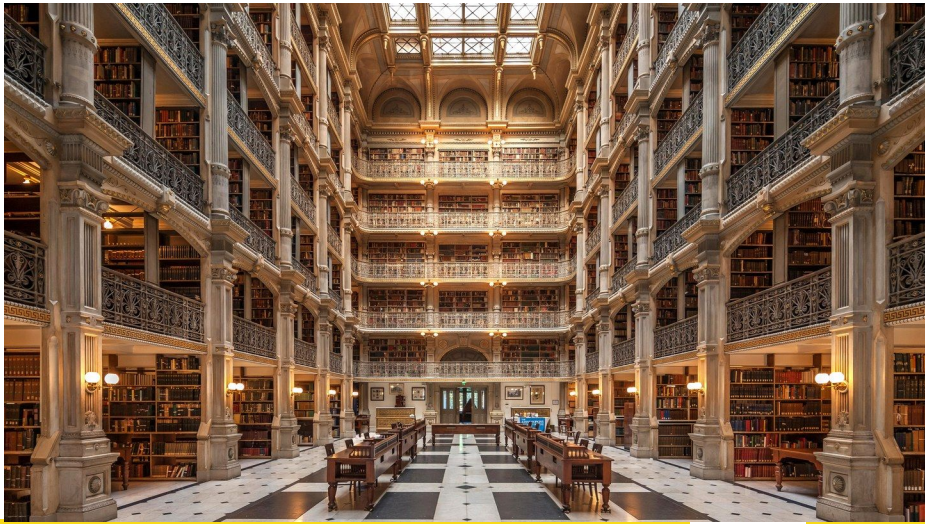
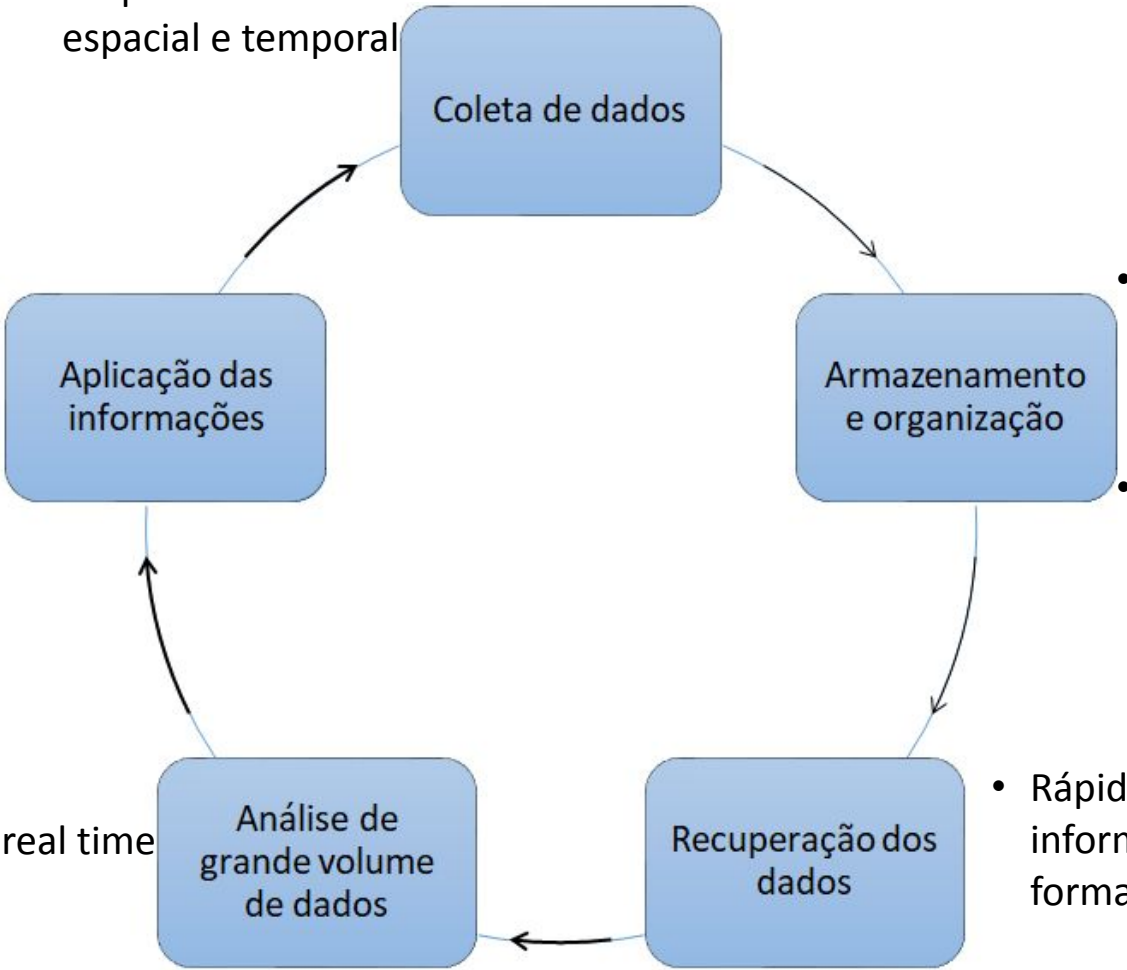


- Novas tecnologias
- Ampla cobertura espacial e temporal



- Áreas prioritárias para a conservação
- Manejo de paisagens
- Monitoramento de impactos
- Manejo de espécies

- Sons, dados genéticos, informações ambientais, etc
- Nuvem

- Open source
- Open data
- Open protocol
- Open Science em real time

- Rápido resgate da informação em formato útil

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