

Geotechnologies and Geoconservation in the Consolidation of the Transcarioca Long Distance Trail

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Santos, EES; Peixoto, MNO; Cunha e Menezes, P



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Welcome, thank you for attending my talk. We are a multidisciplinary group, from the Earth Sciences Institutes of 3 universities and the Brazilian Trail Network.

I will be talking on the establishment of a LDT in Rio de Janeiro, Brazil.

Long Distance Trails



Rede Brasileira de
Trilhas de Longo Curso



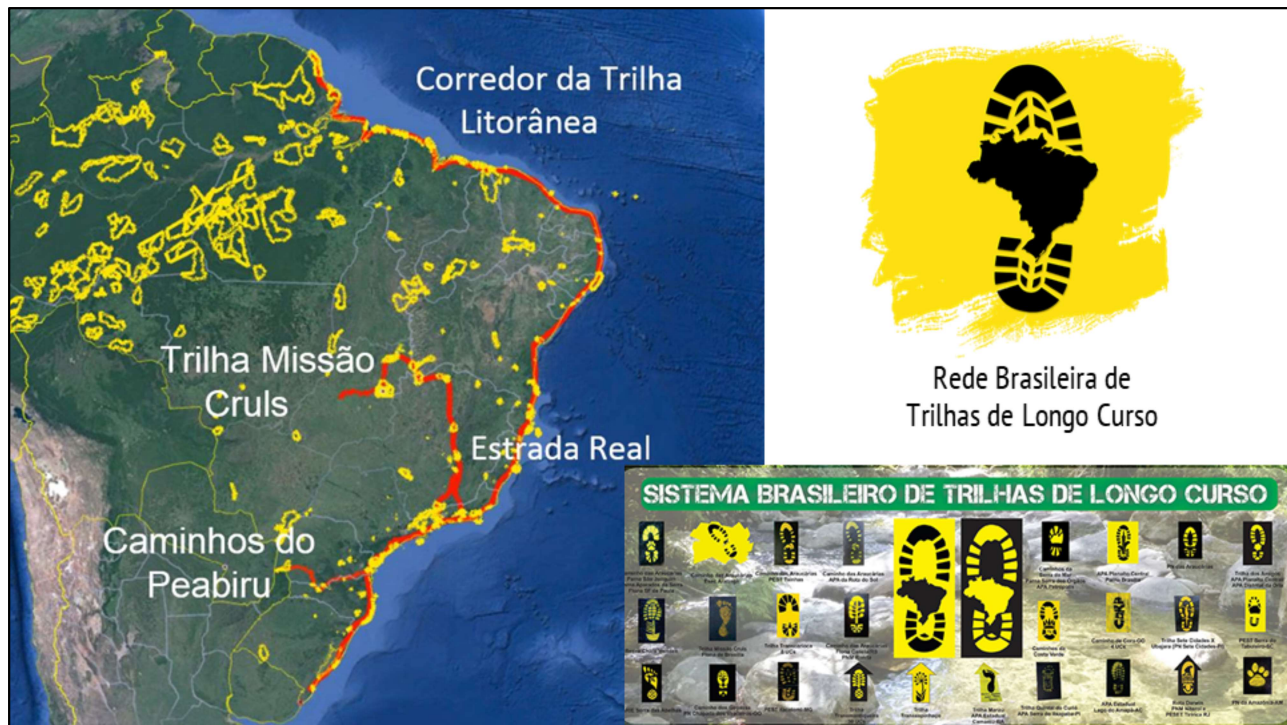
GREAT PLAINS TRAIL
ALLIANCE



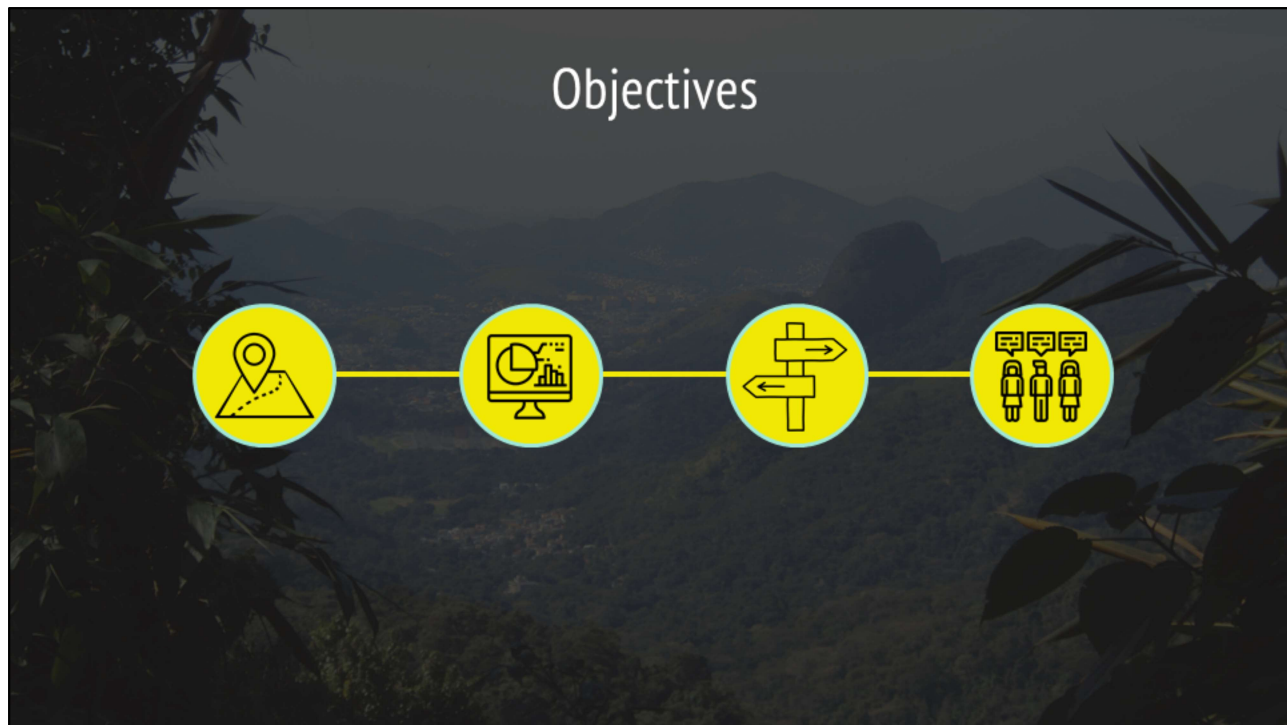
<https://worldtrailsnetwork.org/trails-atlas/>

<https://worldtrailsnetwork.org/portfolio-item/brasilian-trails-network/>





- Loose federation of trails, Bottom-Top network, privilege grassroots. Common signage and coordinated activities, individual ID. “Sense of Belonging”. Long-term objective: linking every CU in the country!
- *TT is part of Trilha do Oiapoque ao Chui along the Brazilian coastline (Omena & Bregolin, 2020).*
- *Adopting a consistent symbology (yellow & black in one direction, reversed to black & yellow on the way back!) generates a sense of belonging. In order to provide individuality for each trail local elements are added at the center of the logo.*



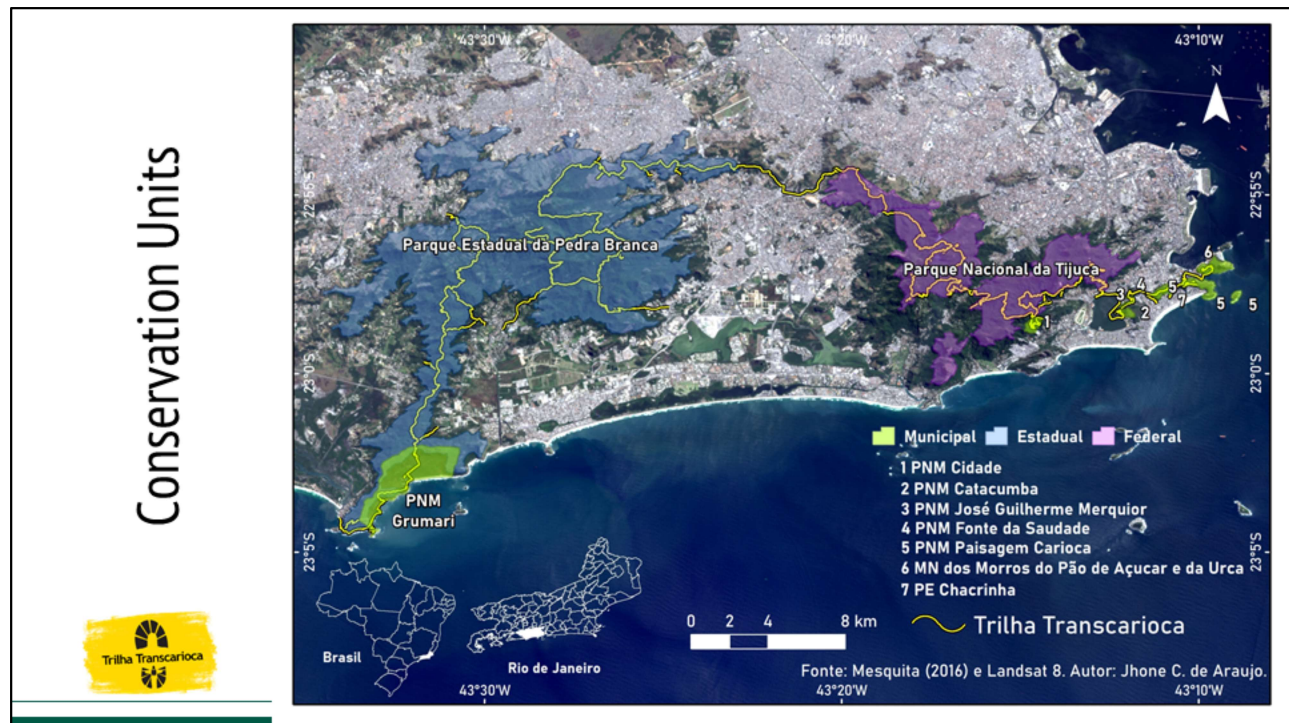
Main objective: Application of Geotechnologies for Geoconservation. Emphasis on developing tools for trail managers 4 fronts:

- (i) Cartographical production for the 1st Edition of a pocket trail guide;
- (ii) Map geodiversity, aiming to popularize the concept, along trail sectors and attractions;
- (iii) Create a method for tackling trail geodiversity;
- (iv) Consider trail user input: whether and how do users recognize geodiversity, whether they are interested in learning more, and which type of communication is most effective.

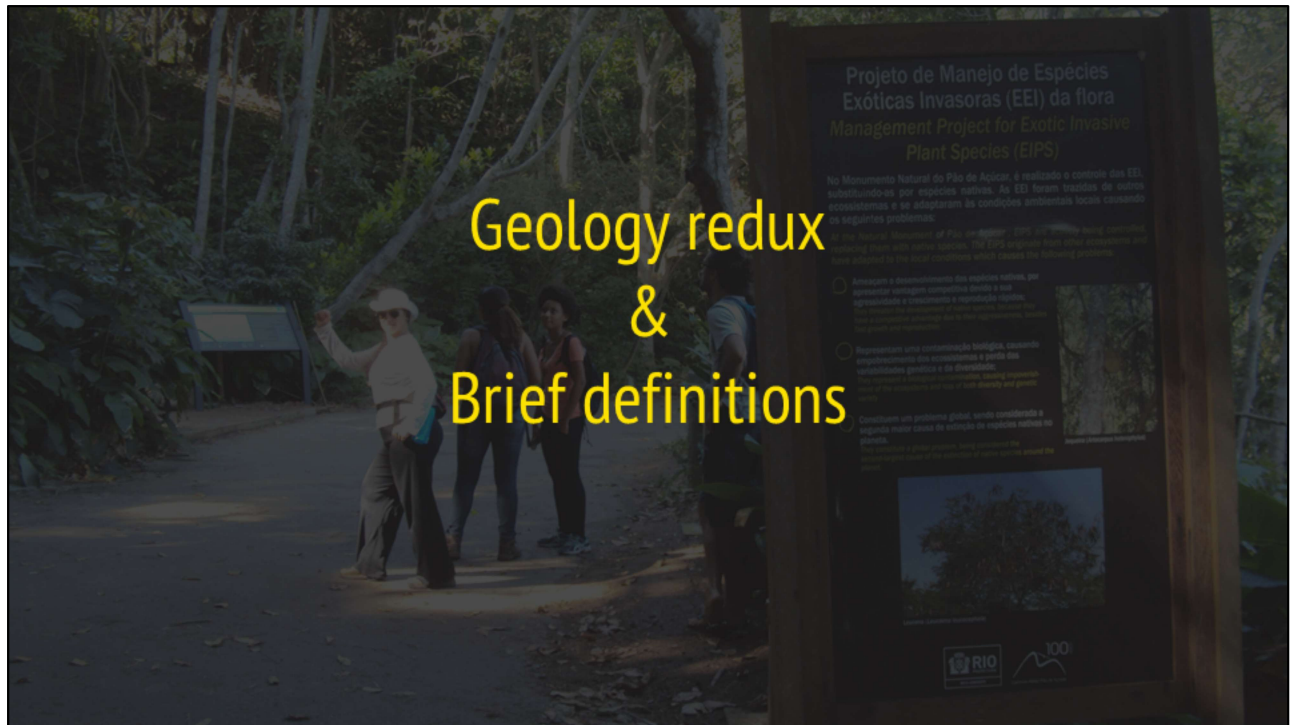
Study Area Rio de Janeiro, Brazil



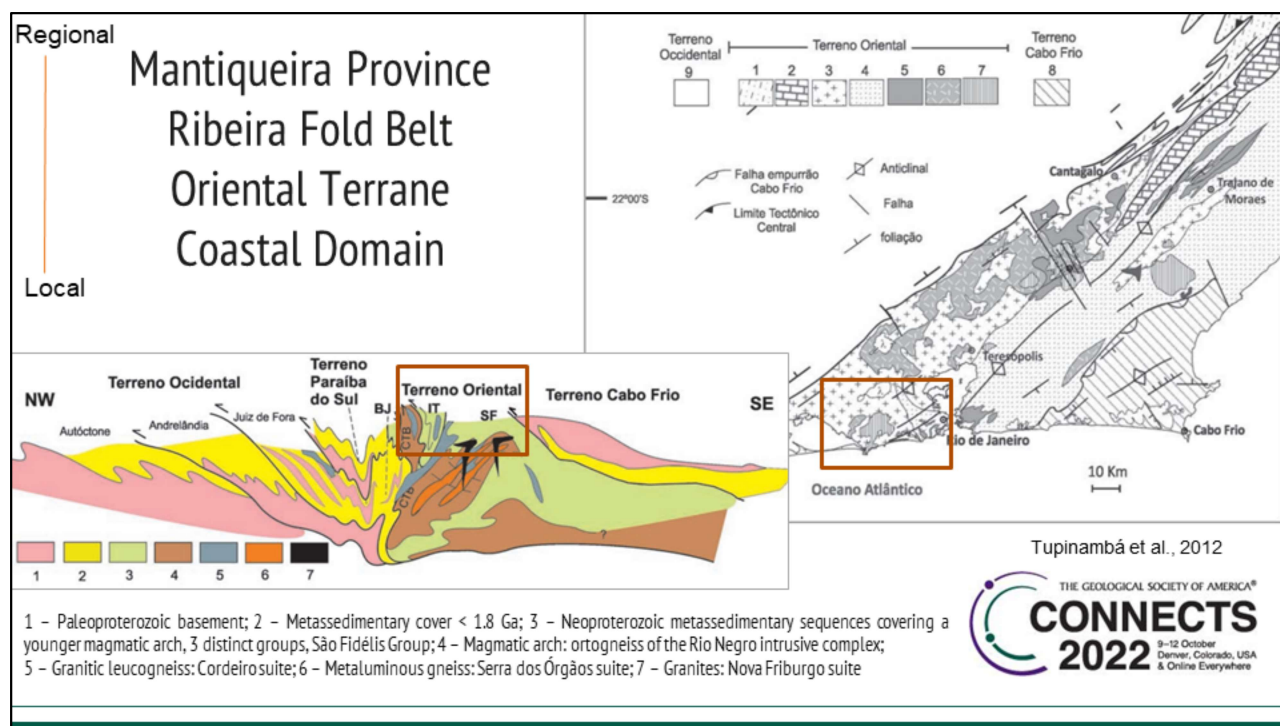
- The five year old trail is 180 km long, divided in 25 sectors.



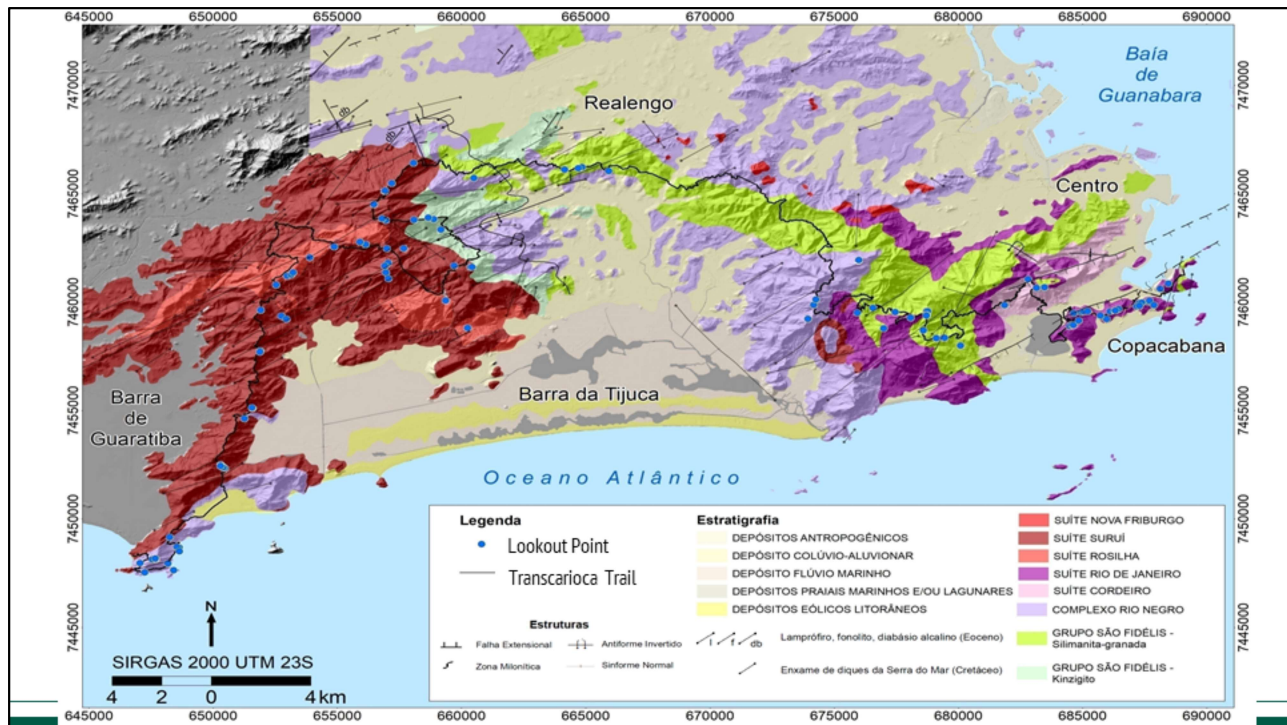
- *The trail is an ecological corridor linking 7 city, state and federal conservation units*



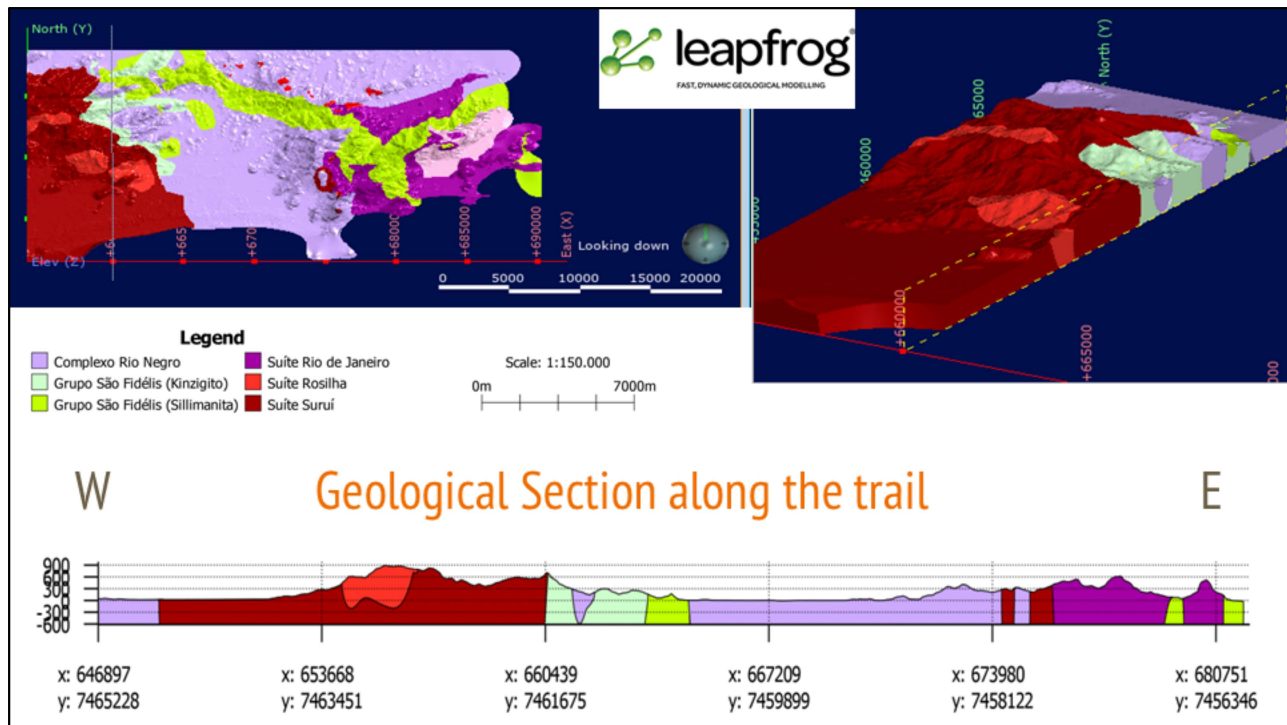
Geology redux & Brief definitions



- Regional rocks and outcrops tell the story of the assembly of Gondwana and its break-up. The red box is the area covered by the trail.
- As a curiosity we have in the state of Rio de Janeiro the Cabo Frio terrain that was part of Africa before the assembly, and was left behind after the break up.

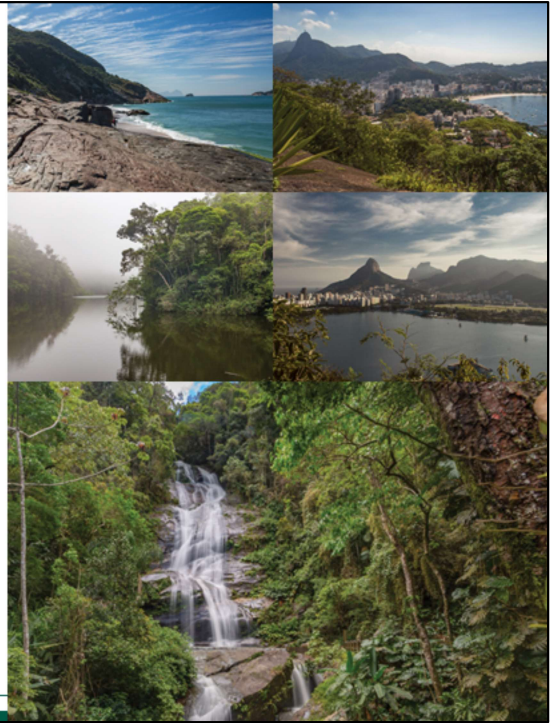


- Varied geology spanning the last 800 million years presents an excellent opportunity for education and outreach activities.
- Today I will be concentrating most examples on most famous eastern sectors
- In green: São Fidelis metasediments: sillimanite- garnet gneiss and Kinzigites, 800 Ma
- In light purple: Rio Negro complex, pre-collisional magmatic arch, 600 Ma
- In pink, purple and redish tones: Sin- to post-collisional magmatism, 580-500 Ma
- Post-collisional Friburgo suíte, undeformed, 500 Ma not shown
- Cretaceous to Eocene magmatism: basalt, diabase and alkaline dikes
- Yellow tones: Quaternary



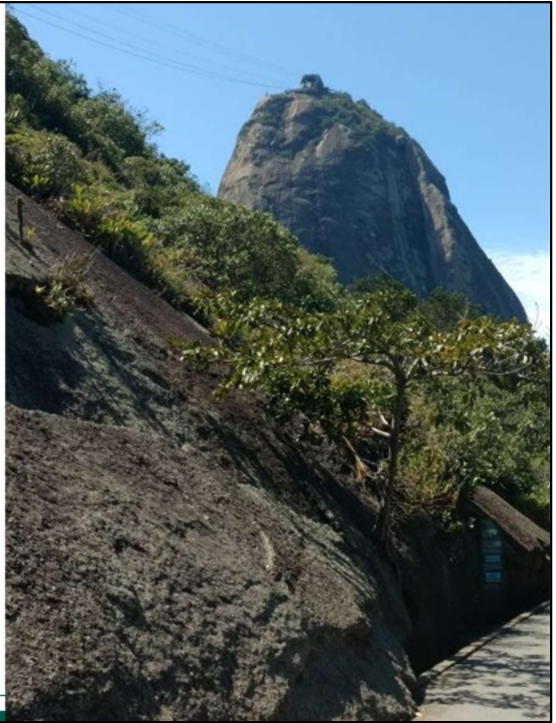
- *The Geology modelled in 3-D was used to create a Geological Section along the trail for Education and outreach...*
- *But before we go into that, some definitions*

Geodiversity



- Geodiversity considers the variety of Geological materials, forms and processes that sustain life (Murray Gray, 2004 + 2013)

Geoheritage



- Geodiversity that has some societal value is Geoheritage: Sugarloaf

IUGS 60TH ANNIVERSARY EVENT

THE FIRST 100 IUGS GEOLOGICAL HERITAGE SITES

Limited places. Registration available from June 15th
www.geoparks.eu/iugs-geosites



October 25 - 28 th
Zurich
Bosque Coste UGSP
Spain

Save the dates!



A SBG parabeniza as pessoas envolvidas pela inclusão de três sítios brasileiros na lista dos "The First 100 IUGS Geological Heritage Sites".



PÃO DE AÇÚCAR NO RIO DE JANEIRO, DESCRITO POR KÁTIA LEITE MANSUR (UFRRJ) E CLAUDIO DE MORAES VALERIANO QUEIROZ.



ESTRUTURA DE IMPACTO DO DOMO DE ARAGUAÍMA, DESCRITA POR ALVARO PENTEADO COSTA (UNICAMP), NATHÁLIA HAUSER (UNB) E UMBE REIMOLD (UNB).

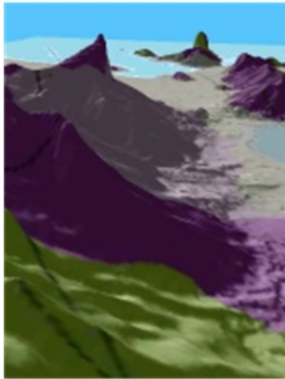
FORMAÇÕES FERROFERRAS BANDAADAS PALEOPROTEZOICAS DO QUADRILÁTERO FERROFERO, DESCRITAS POR URSULA RUCHKYS (UFMG) E PAULO DE TARSO CASTRO (UFOP).

<https://iugs60.org/100-geosites/>

- Sugarloaf is a landmark of Rio de Janeiro. UN's World heritage site, part of the SIGEP, has many billboards, signs and Caminhos Geológicos and Transcarioca Trail equipment as part of the Conservation efforts at the site.
- The first 100 IUGS Geological Heritage Sites, soon to be announced.

Geotechnologies

*Proa Lookout point of view,
with geology draped over DEM*

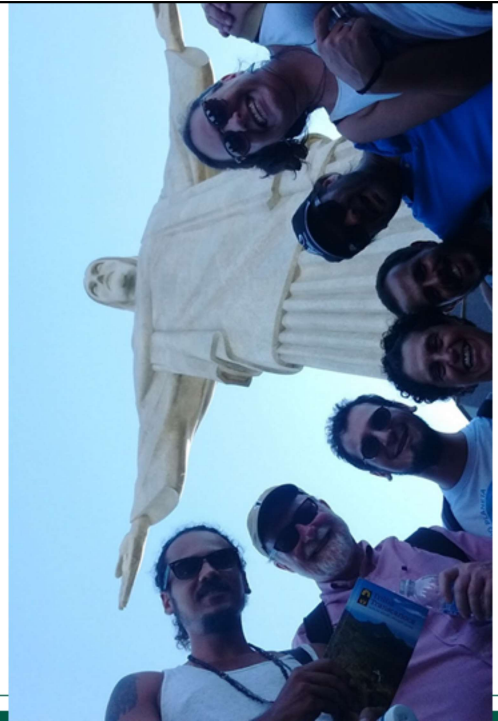


*Student's Trail, Tijuca National Forest, the
largest urban man-planted forest in the world*

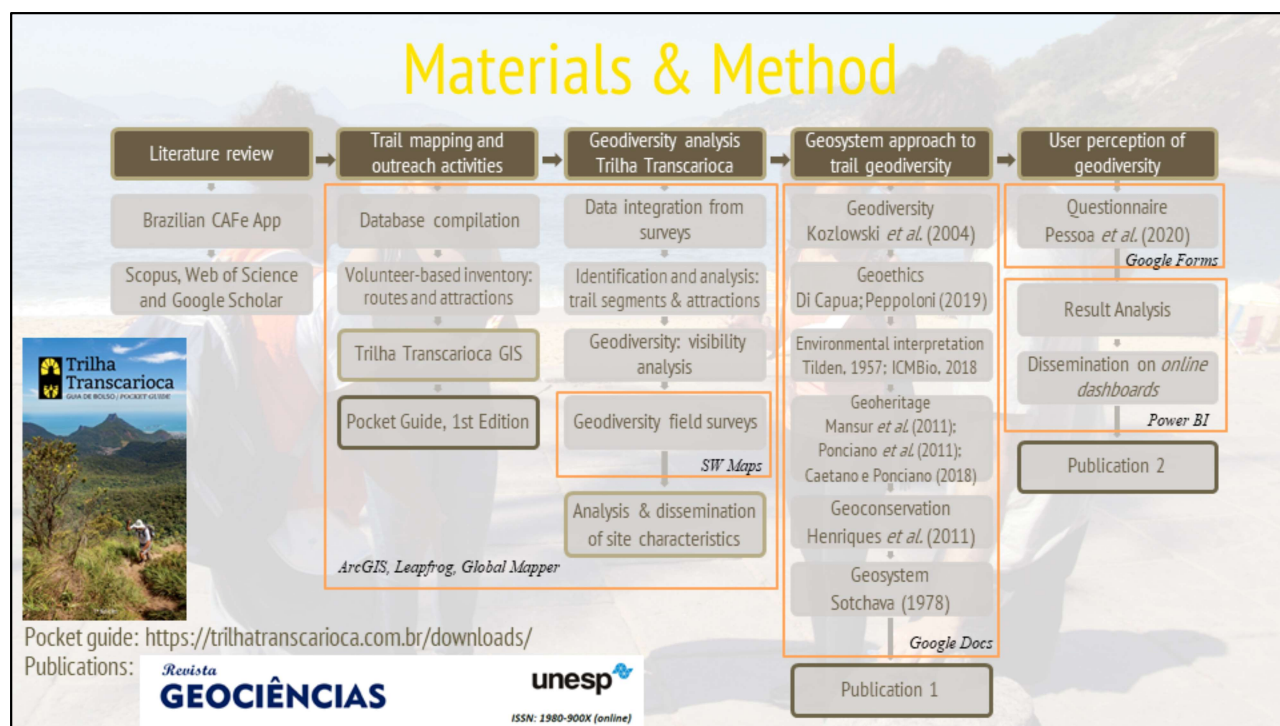


- Techniques and tools! Georeferenced spatial data.
- Inventory! But also for every task: analysis, management, education, outreach activities... Motion Tablet running ArcGIS
- Note faults, lithological contacts, and man-made earthworks : Lagoa Rodrigo de Freitas and Enseada de Botafogo.

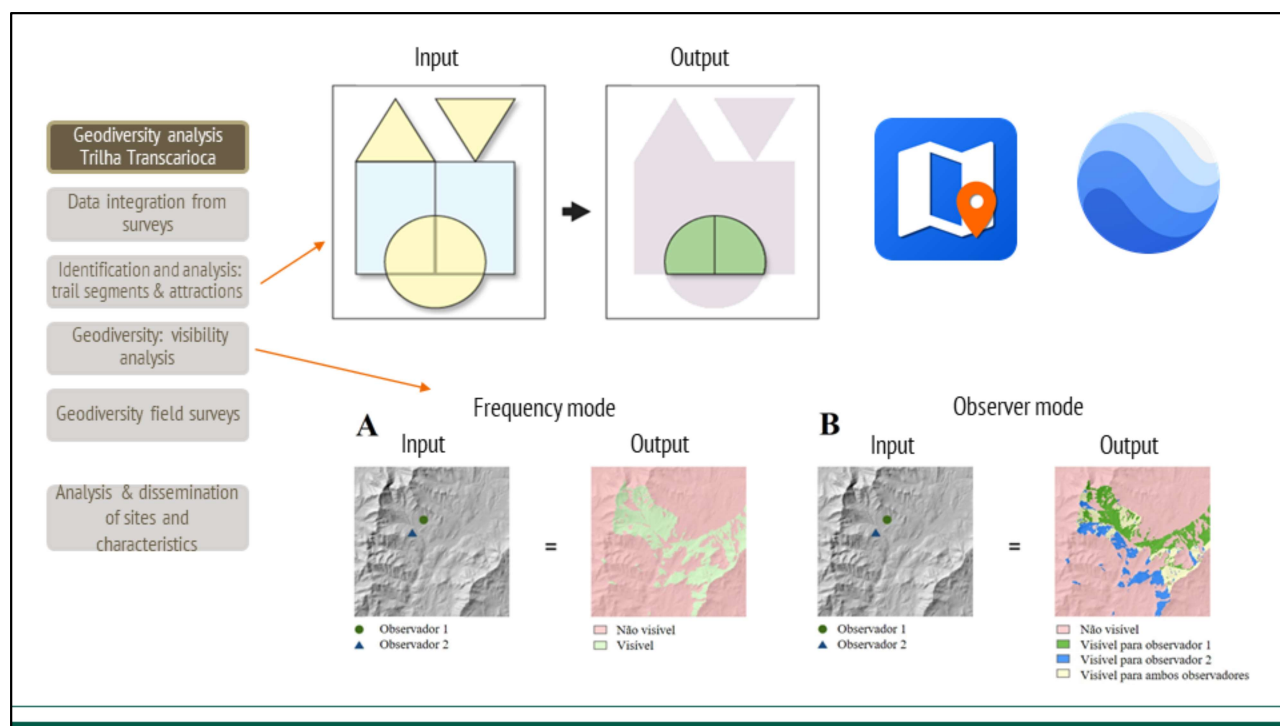
Geoconservation



- Geoconservation: management of Geoheritage.
- An emerging geoscience, according to Henriques et al 2011: has its own periodicals, scientific meetings and events, both National and International!
- Murray Gray in Rio. Trilha Transcarioca and Mosaico Carioca de Áreas Protegidas supported the visit.
- Reynard & Brilha (2018)



- Software & Apps in Orange boxes
- Deliverables: General Public / Academia in dark boxes, internal in light boxes



- One article on GIS methodology for mapping geoheritage

Geosystem approach to trail geodiversity

Geodiversity
Kozłowski *et al.* (2004)

Geoethics
Di Capua; Peppoloni (2019)

Environmental interpretation
Tilden, 1957; ICMBio, 2018

Geoheritage
Mansur *et al.* (2011);
Ponciano *et al.* (2011);
Caetano e Ponciano (2018)

Geoconservation
Henriques *et al.* (2011)

Geosystem
Sotchava (1978)

2 Research articles
4 BSc. Hons.
1 PhD



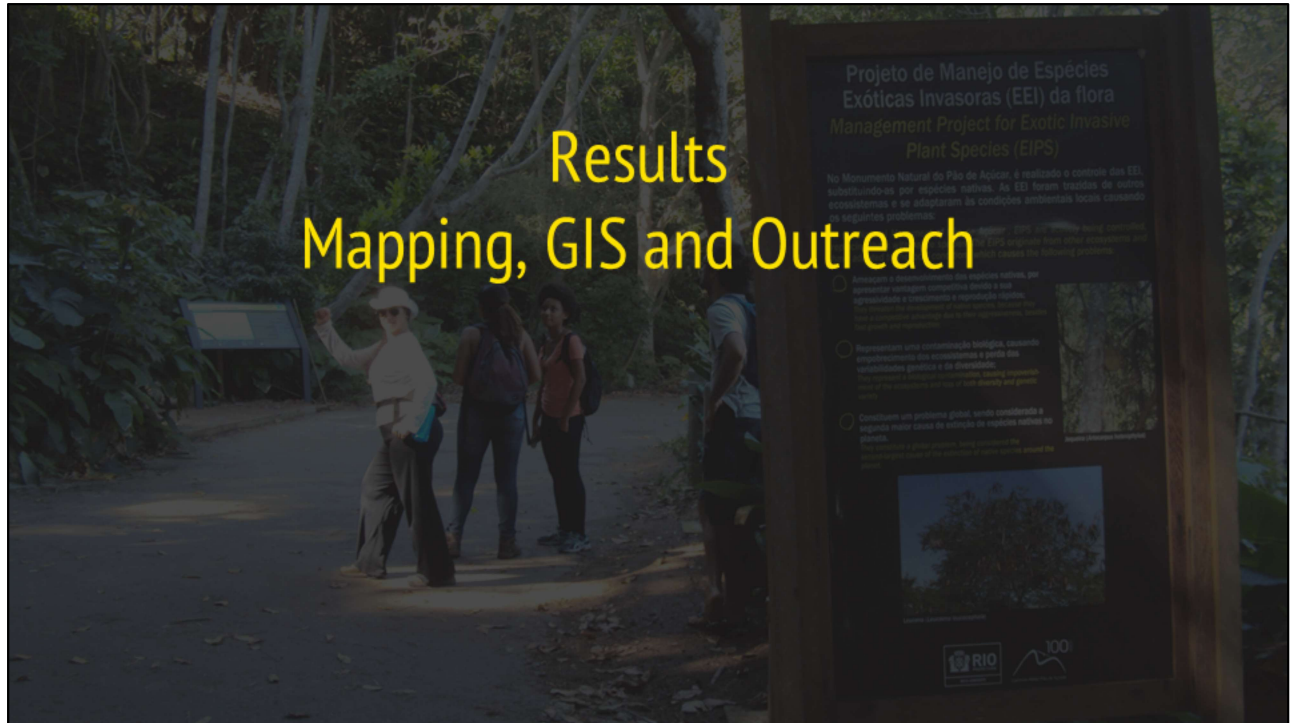


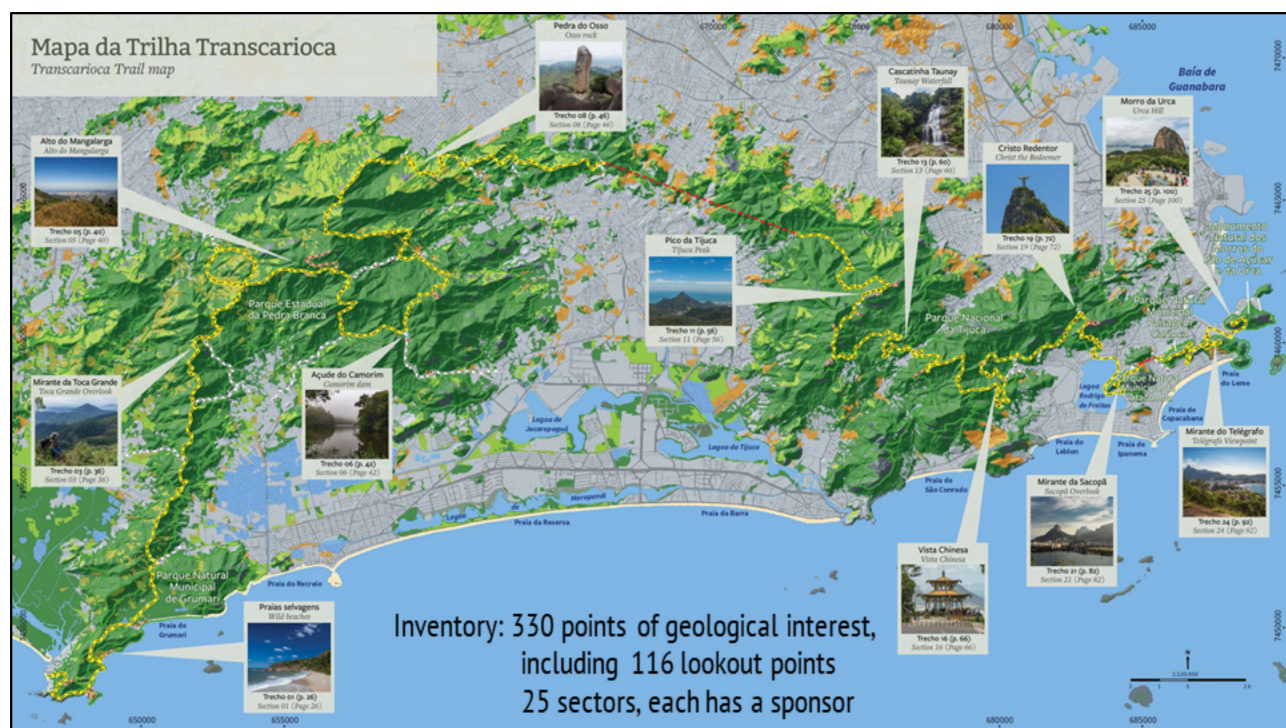




- One article on user perception of geodiversity, from managers of Conservation Units to trail guides, tourist operators, trailrunners, volunteers and occasional users.

Results Mapping, GIS and Outreach

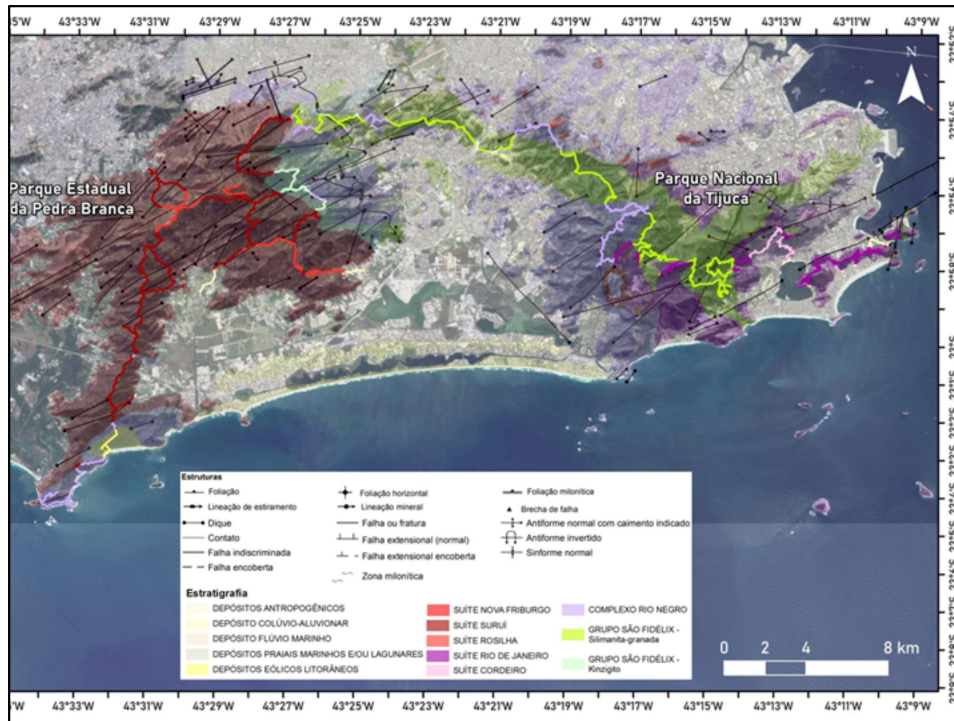




For the general public, our main product is the pocket trail guide with the complete inventory. Each trail sector has been adopted by volunteers.



- Sectors 21 to 25 are shown in several slides due to their importance (Sugar Loaf is sector #25, the last if you start from the West).



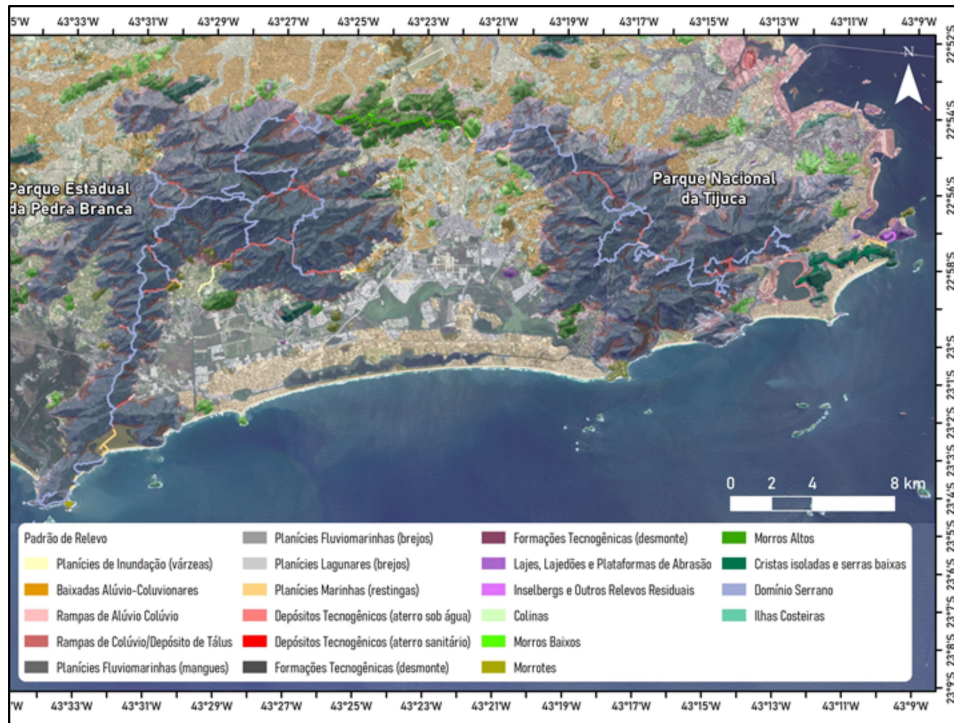
GIS overlays:

Geology +
Satellite imagery



ArcGIS

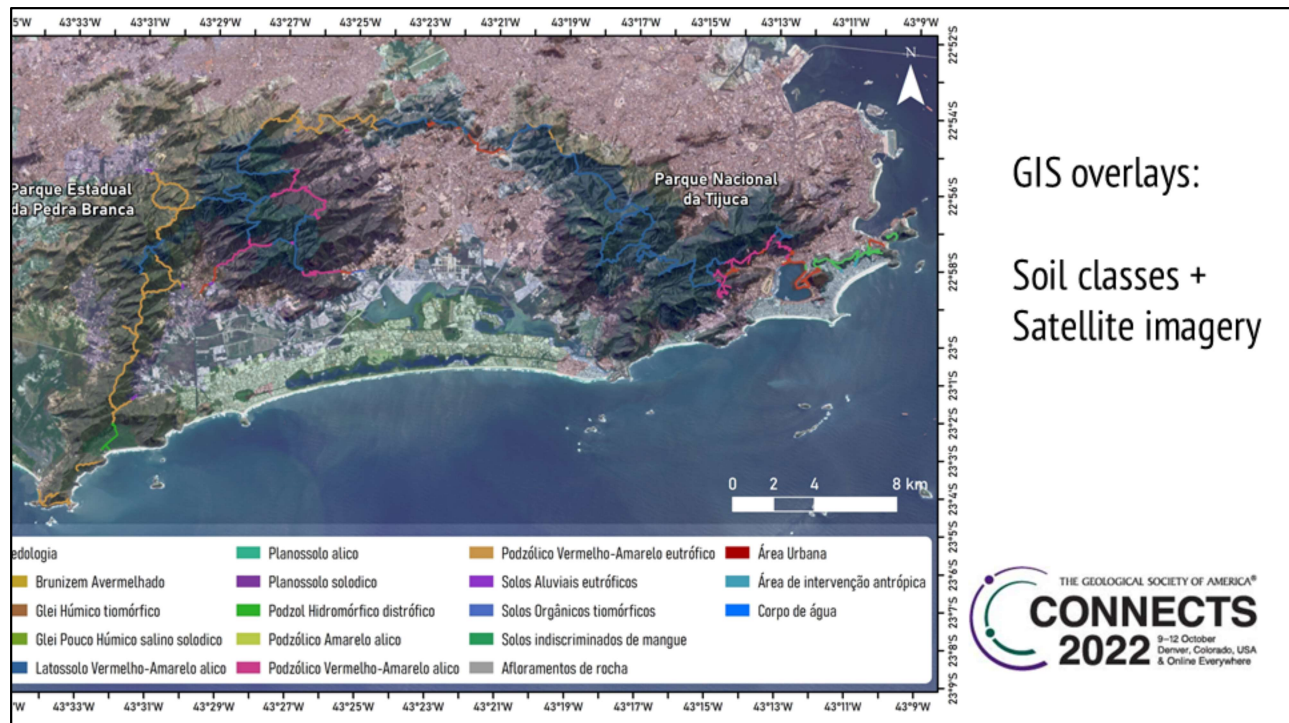




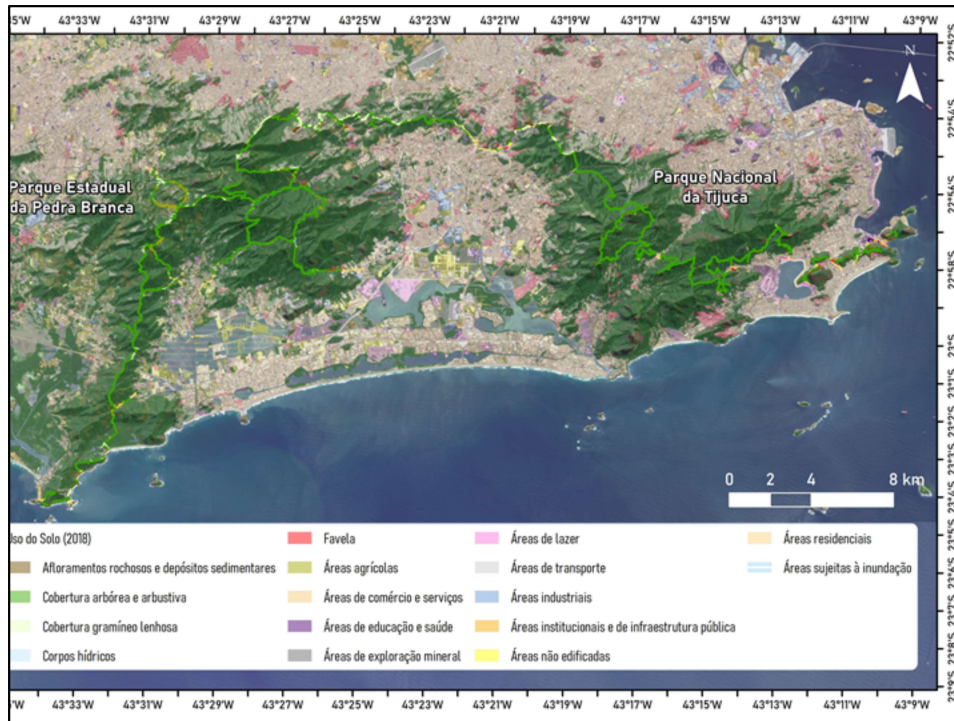
GIS overlays:

Geomorphology +
Satellite imagery





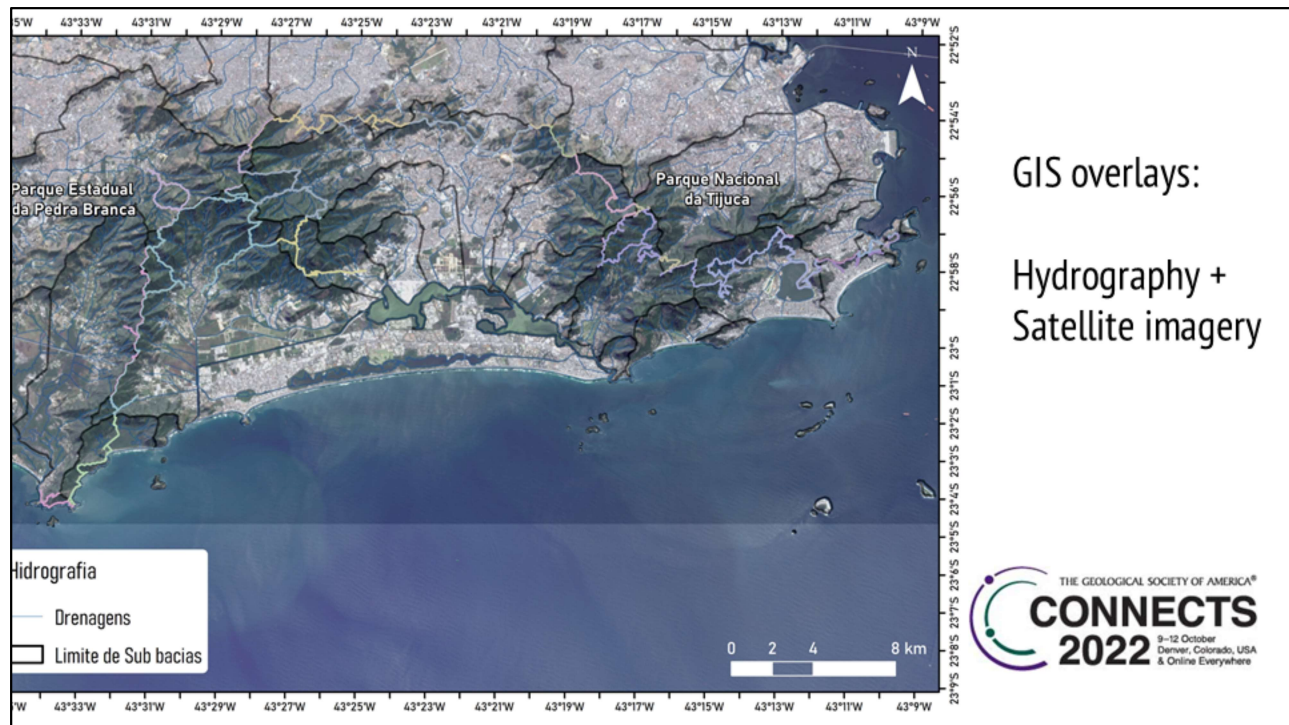
- This 3 are very important as they are used as the input for automated geodiversity modelling...



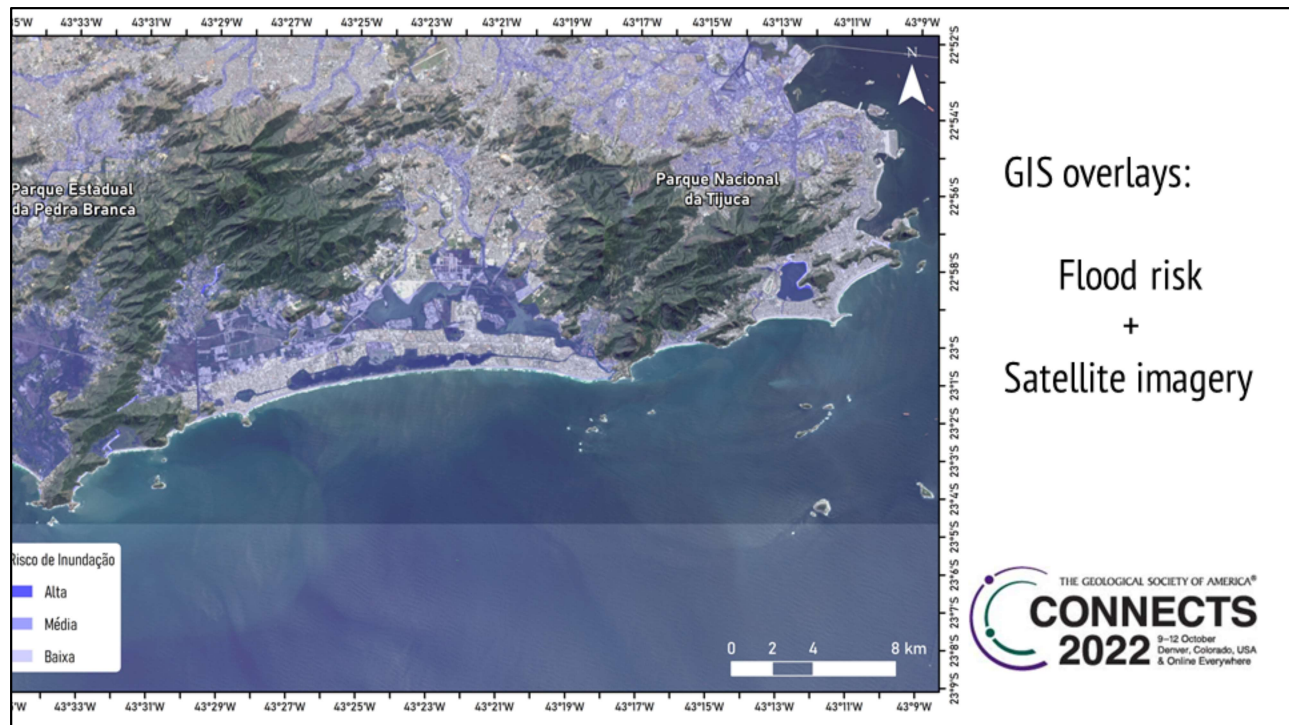
GIS overlays:

Land use +
Satellite imagery

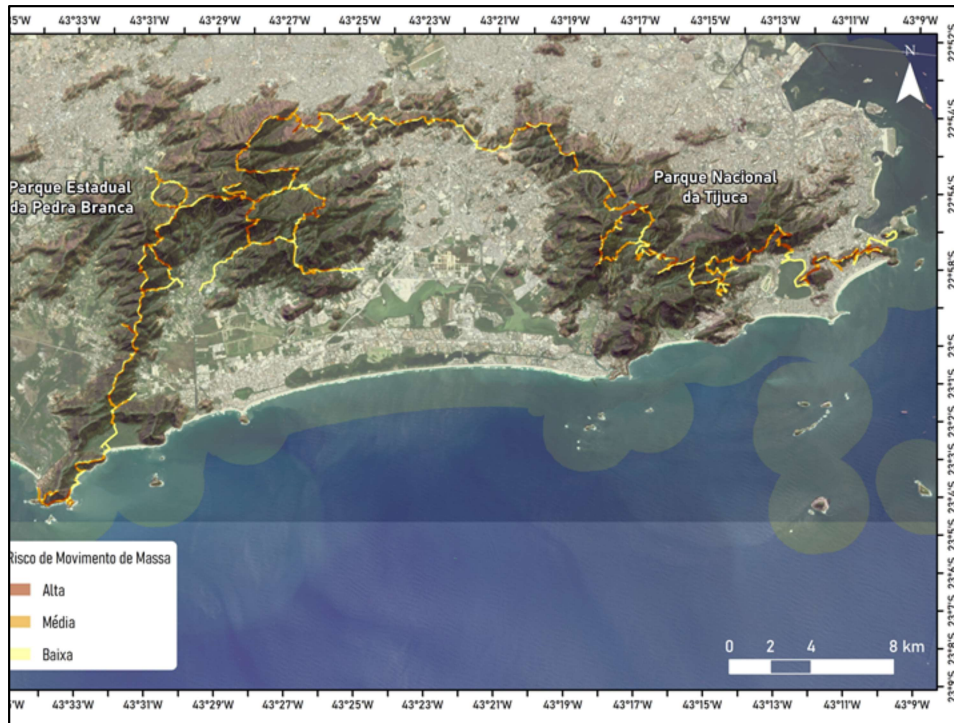




- Other ancillary data such as hydrography is used for...



- Not a concern for our trail... but also



GIS overlays:

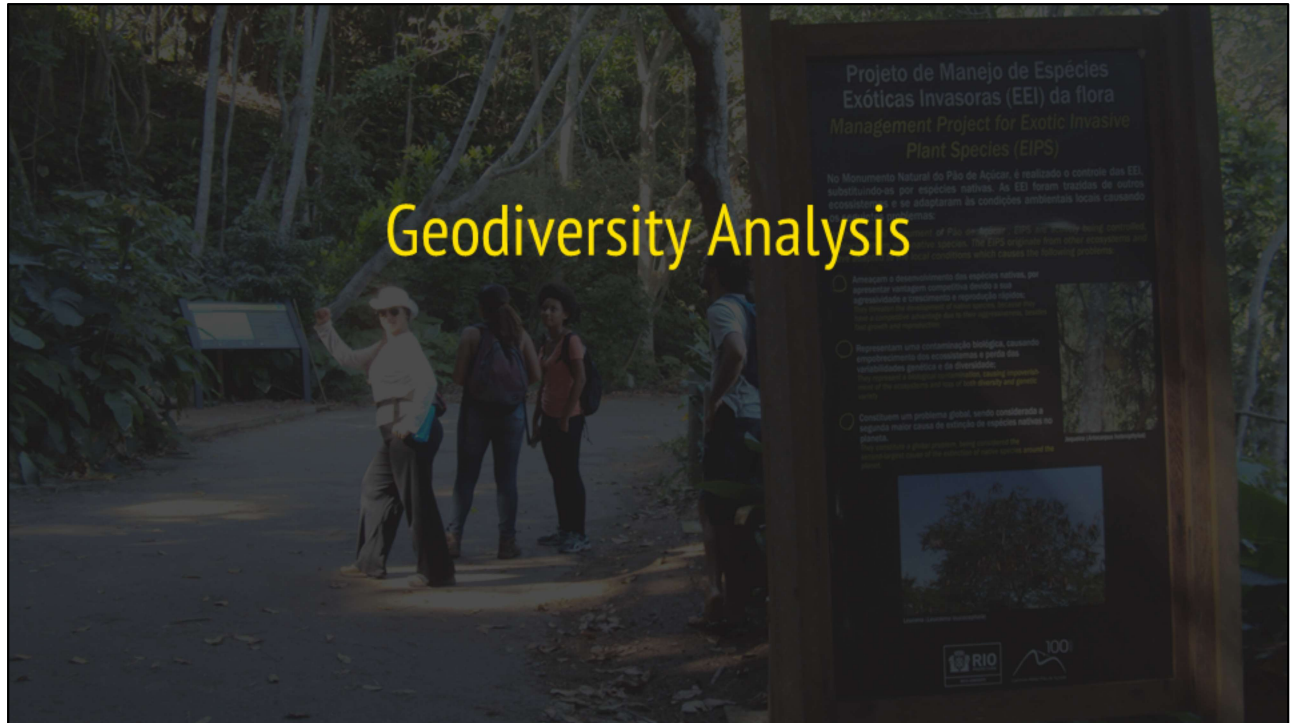
Mass movement risk

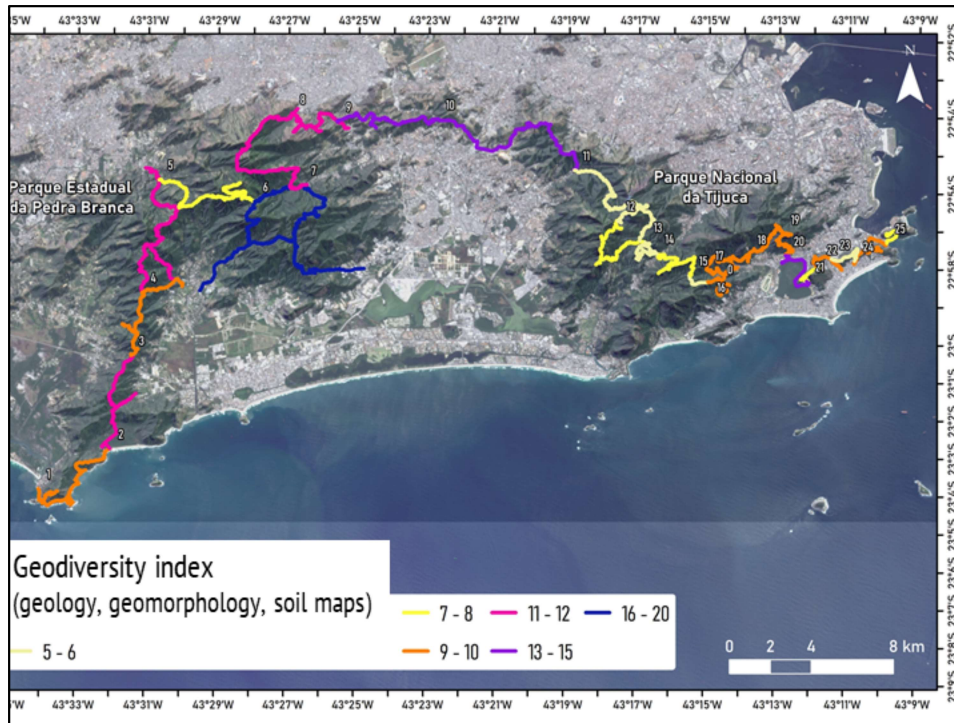
+

Satellite imagery



Geodiversity Analysis

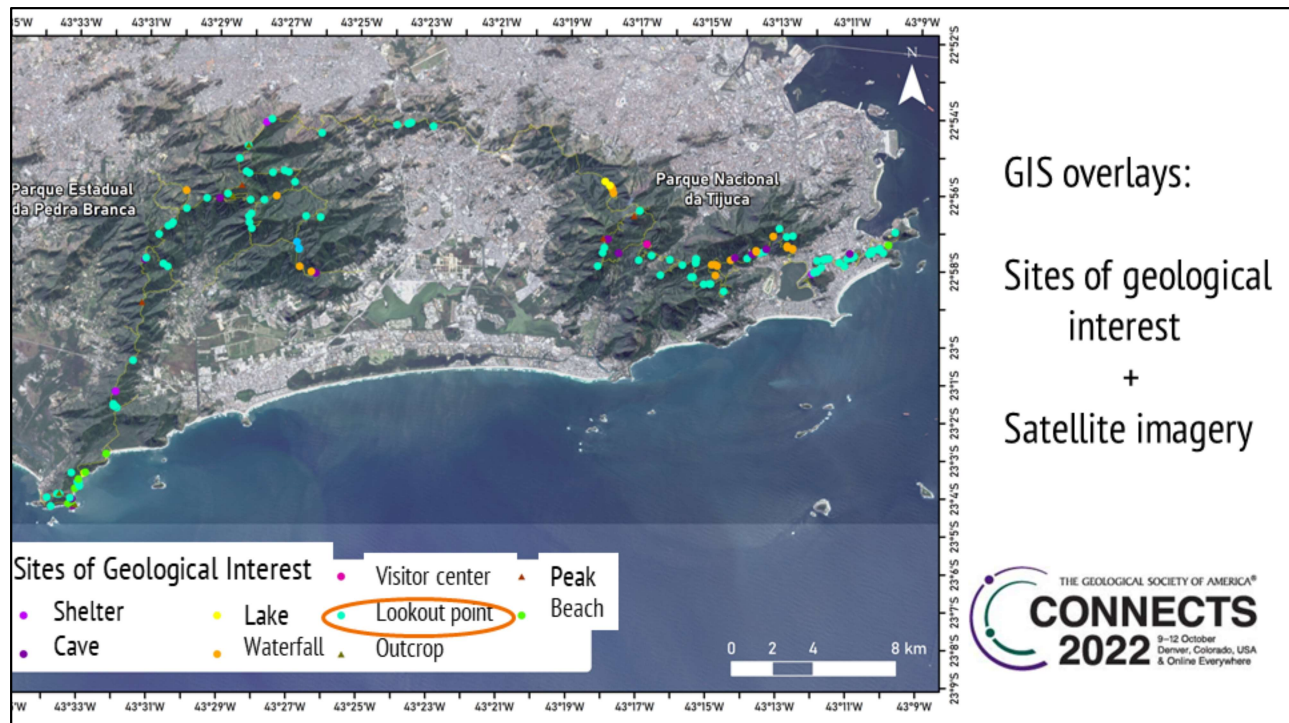




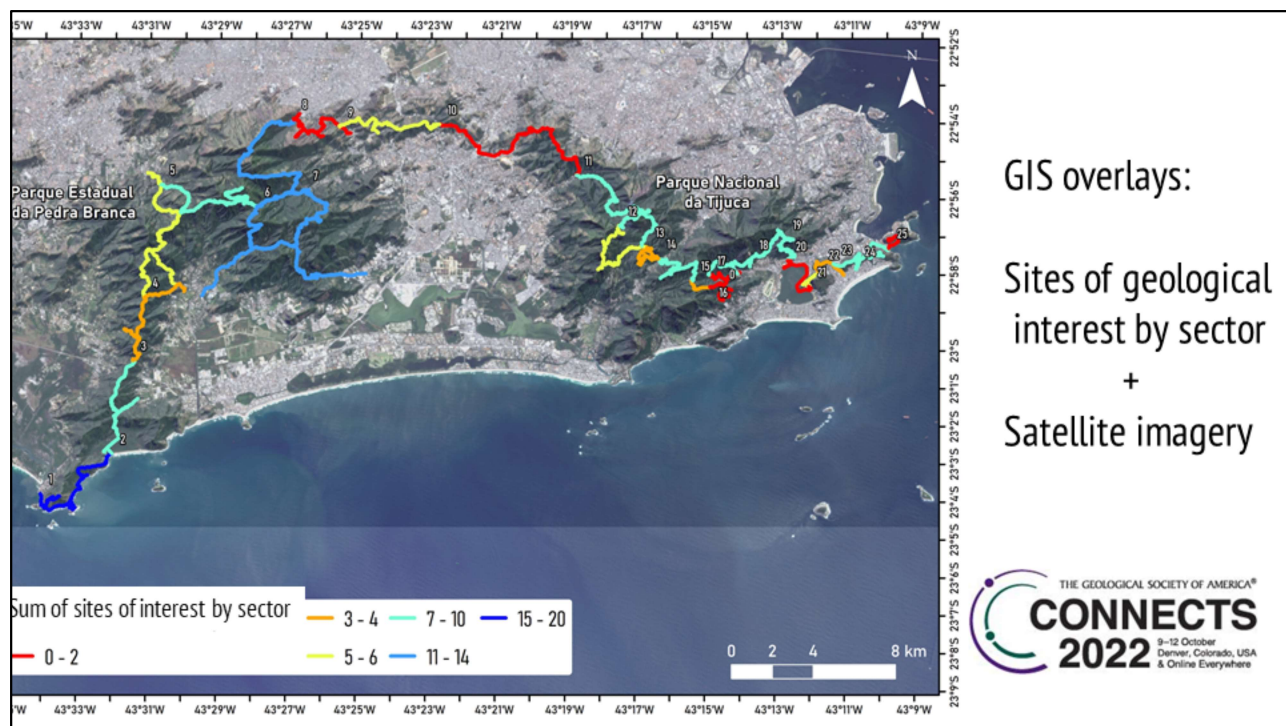
GIS overlays:

Calculated
trail sector
geodiversity index
+
Satellite imagery

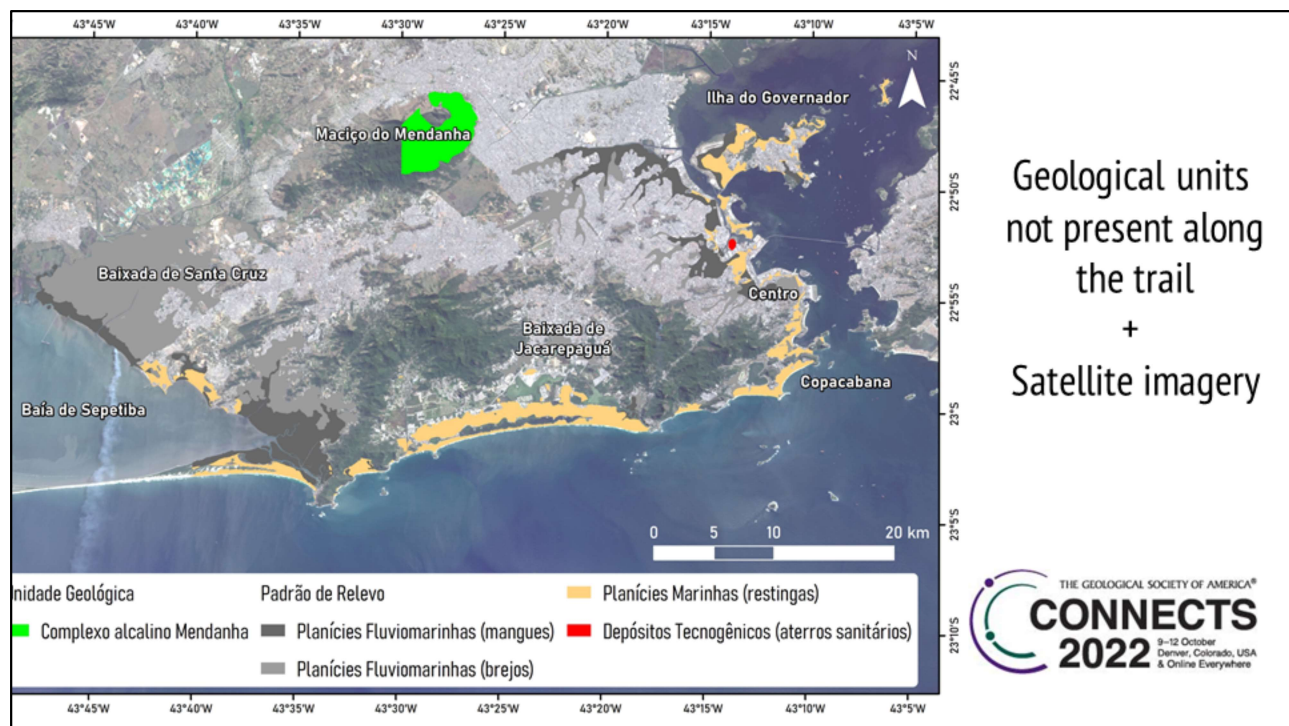




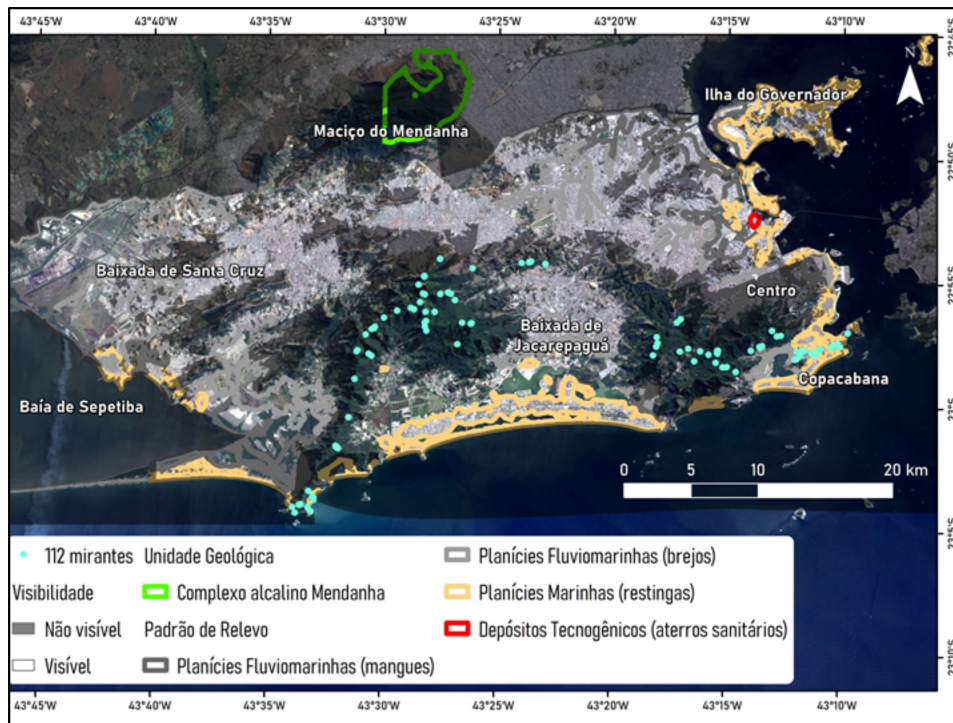
- Combined with sites of geological interest (landmarks and lookouts), and I will detail Lookouts shortly,



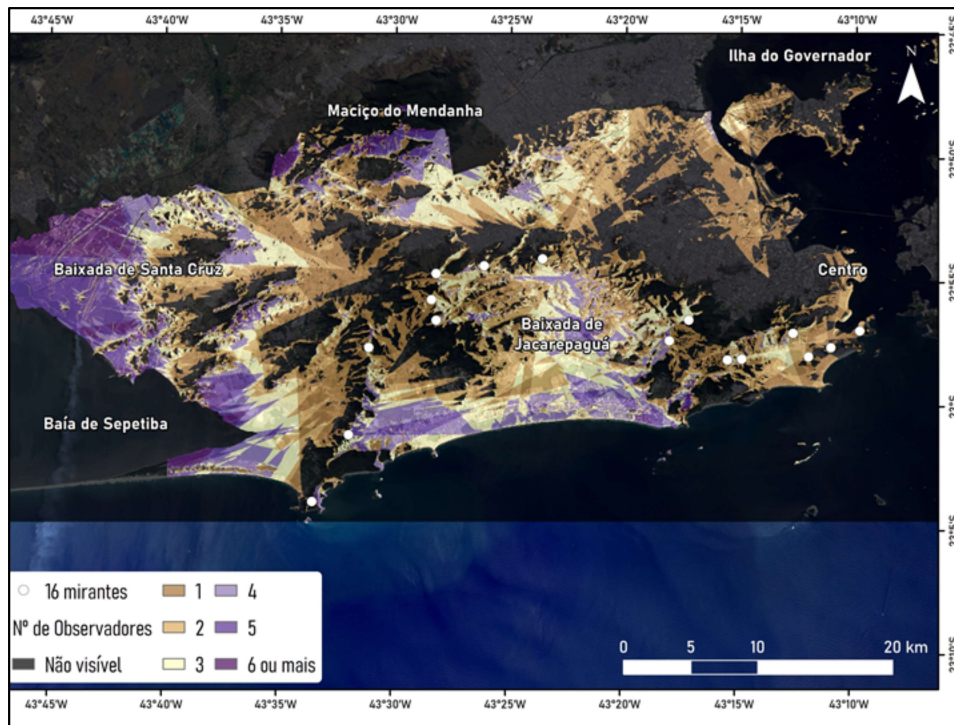
- Resulting in



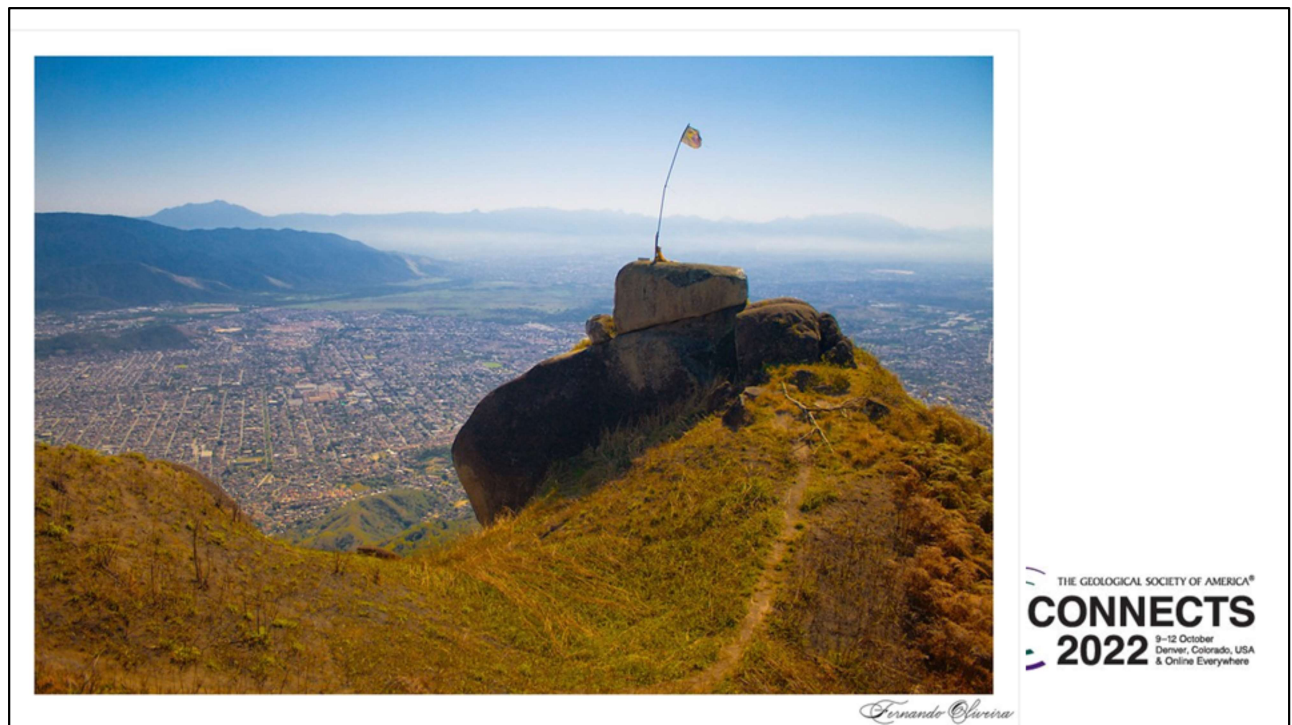
- Note zoom out to cover entire municipality



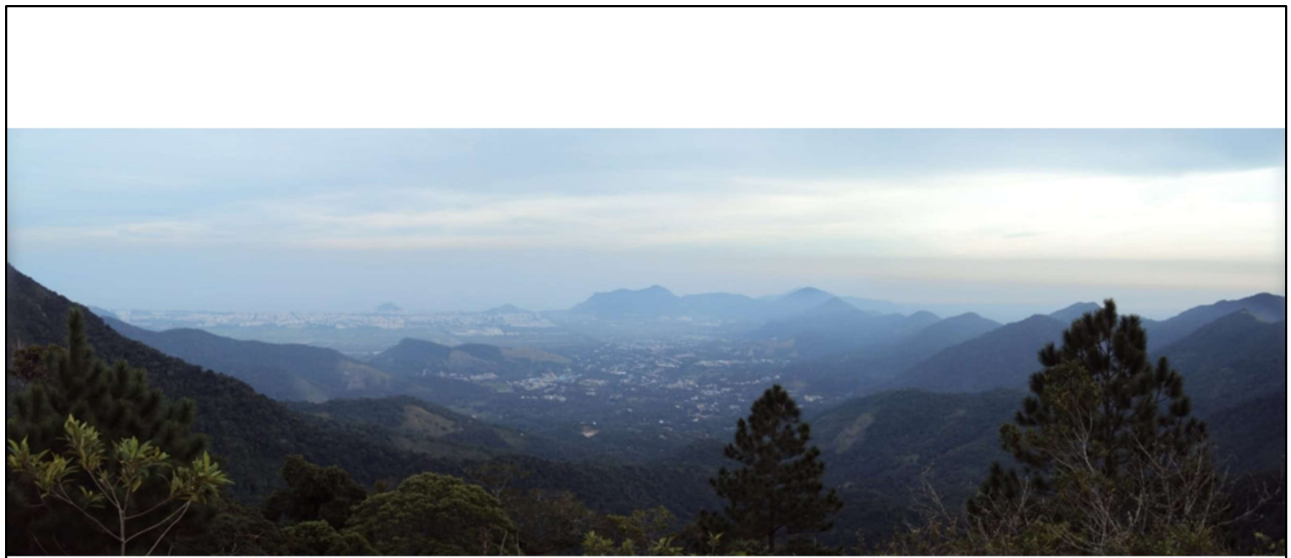
Visibility of geological units not present along the trail in relation to lookout points



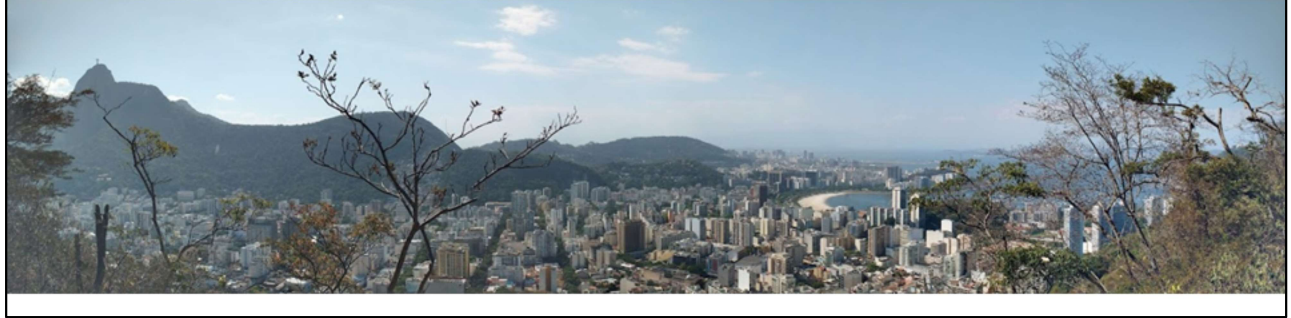
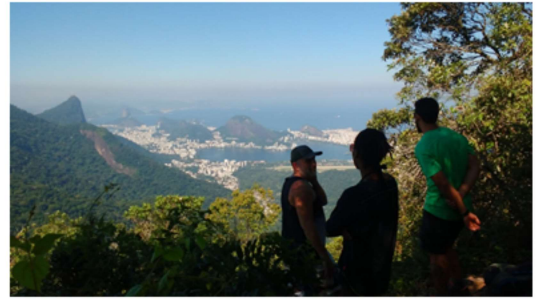
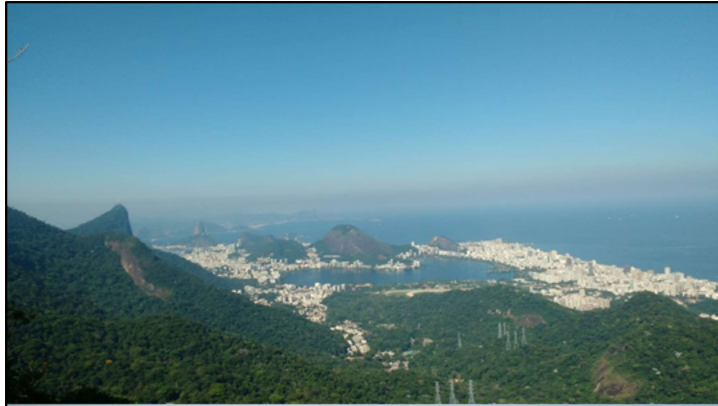
General visibility of
Municipality area
in relation
to lookout points

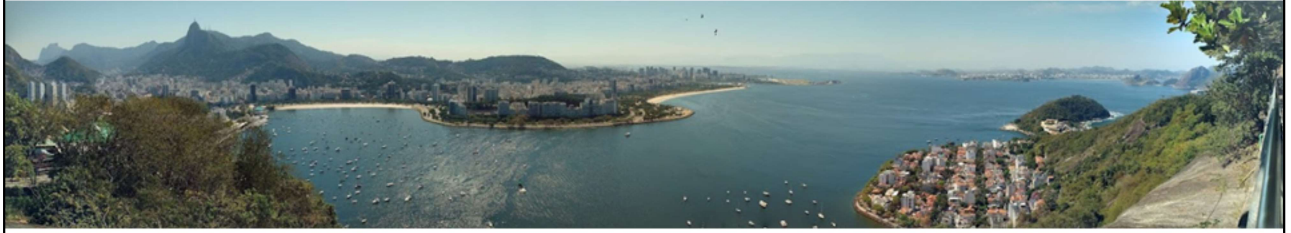


- Lookouts from East to West...



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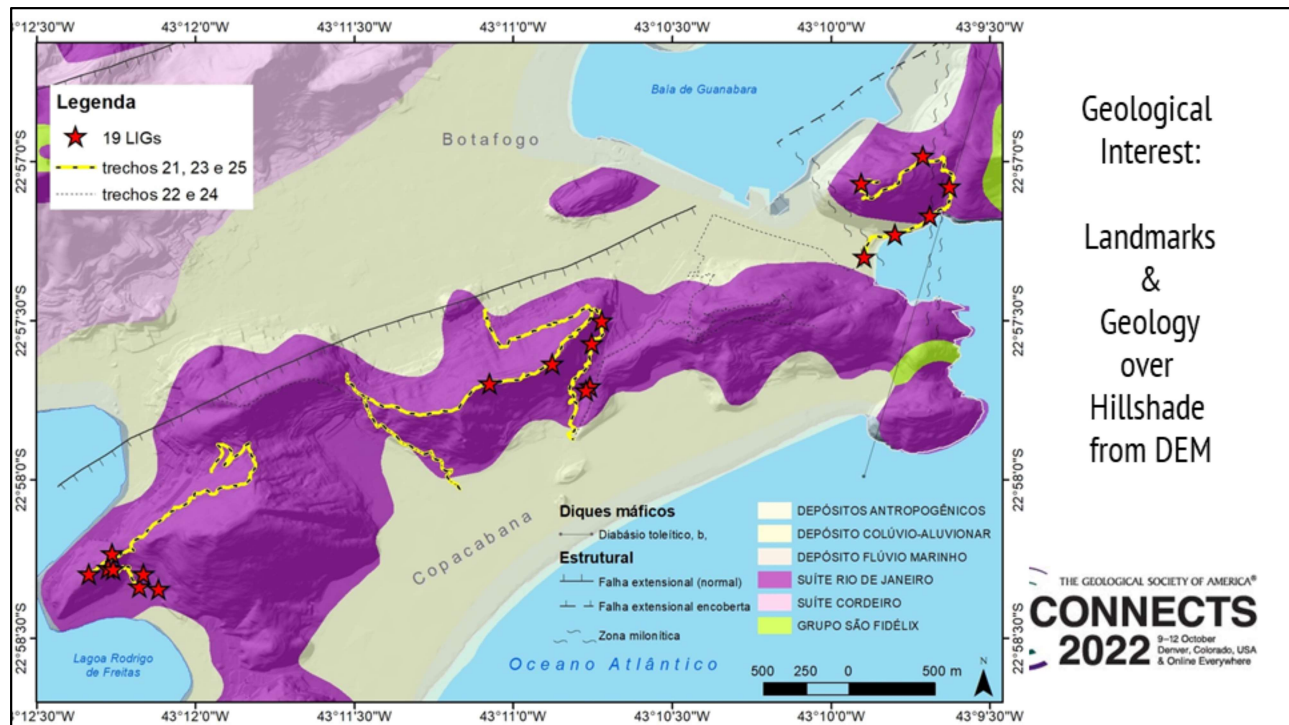




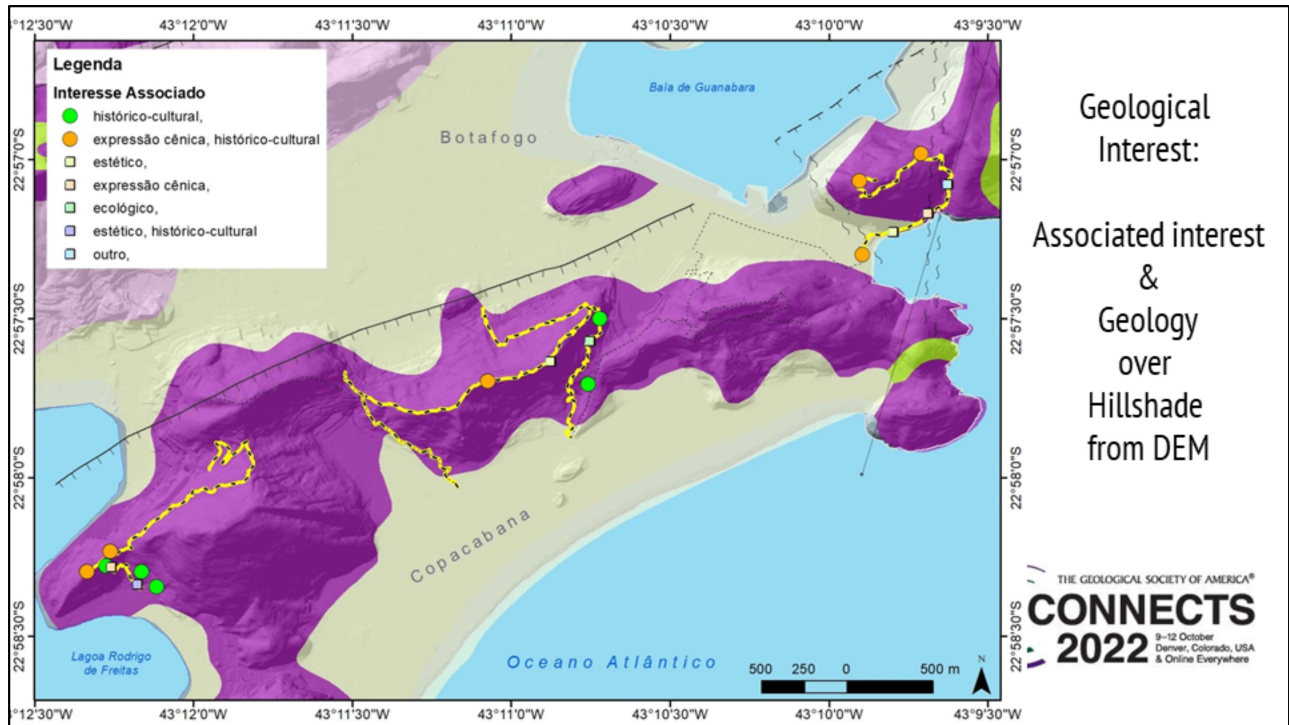
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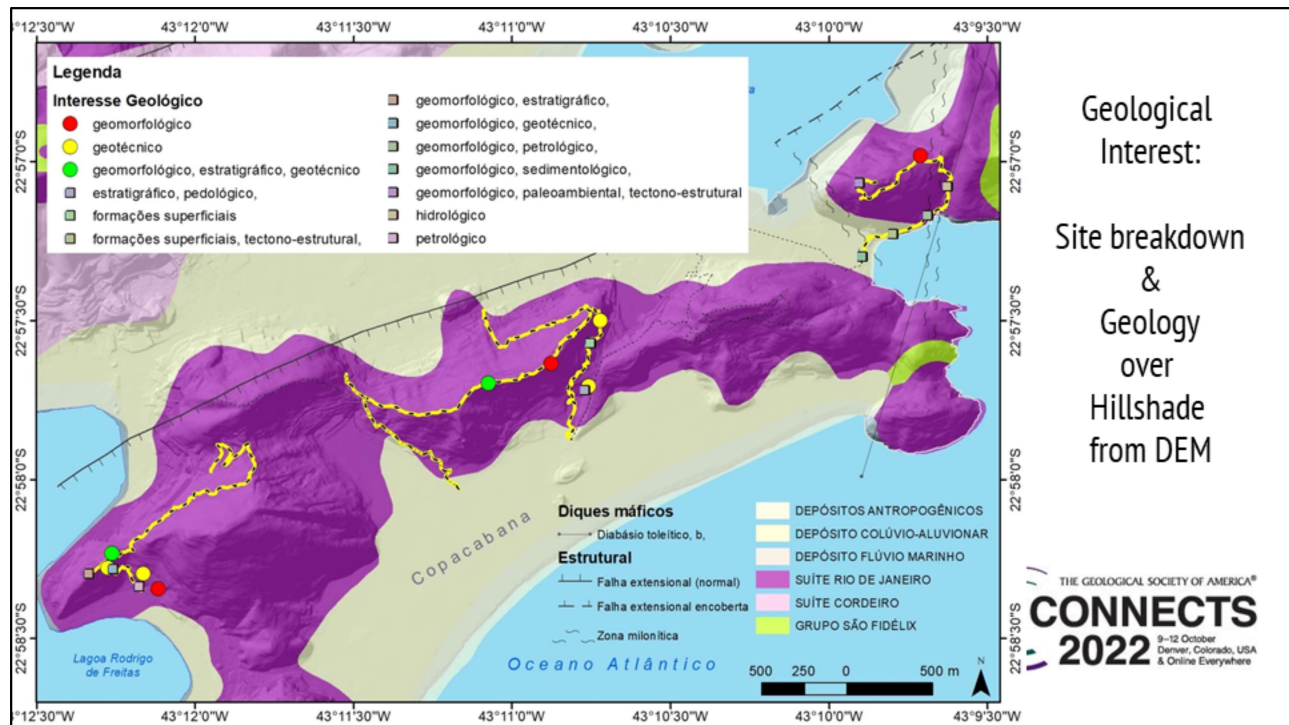
Geological sites of interest



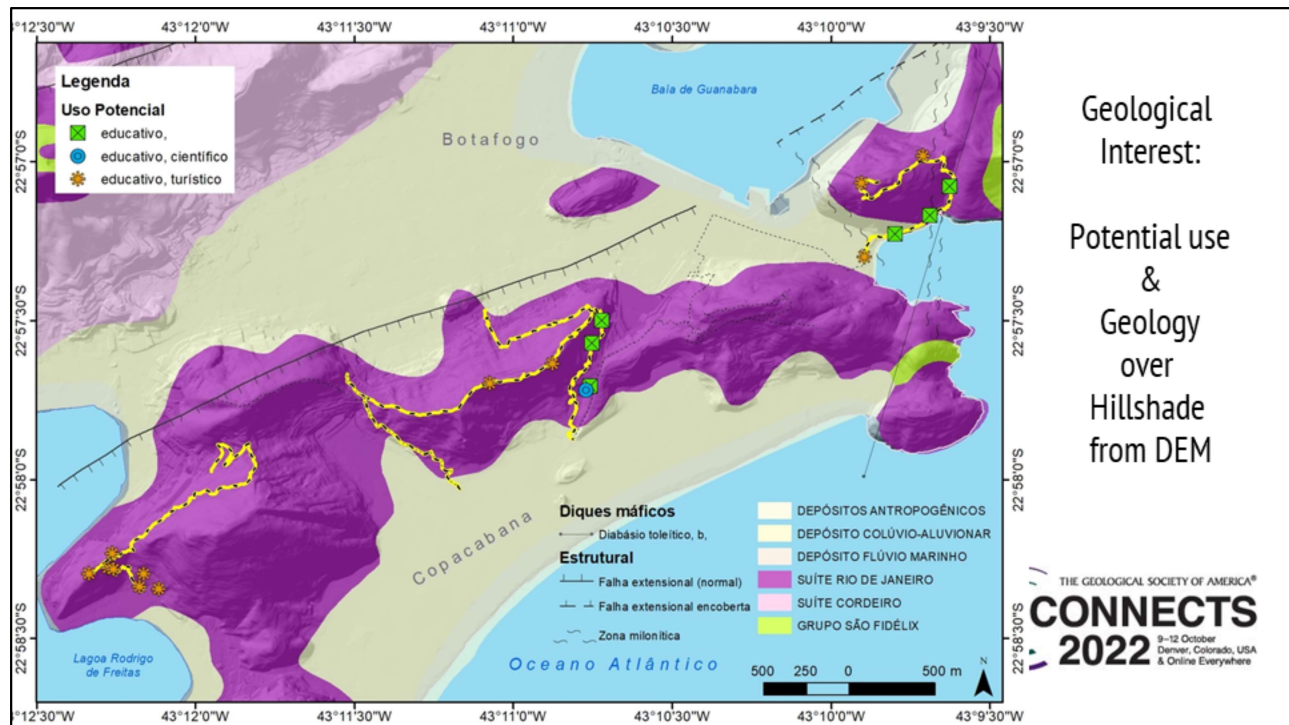


- 19 sites of interest (landmarks) in a short distance, here over a shaded geology base map. Sites can be classified according to varied criteria such as

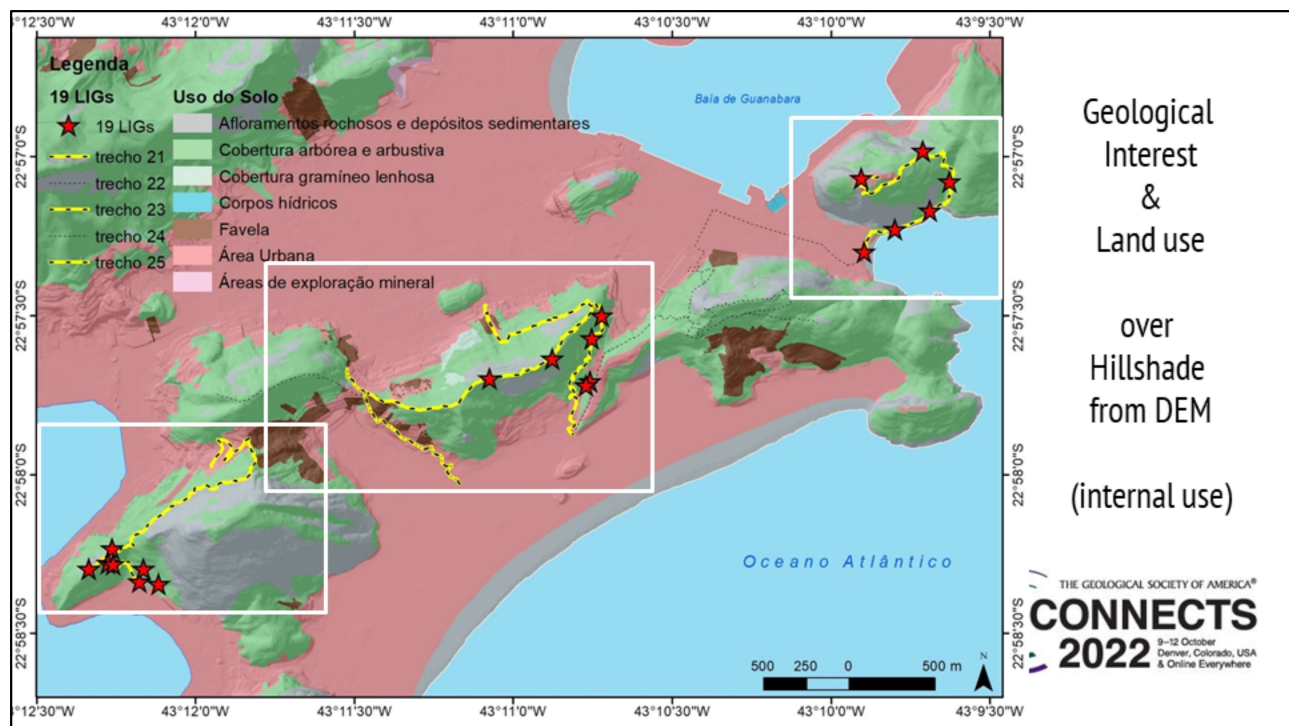




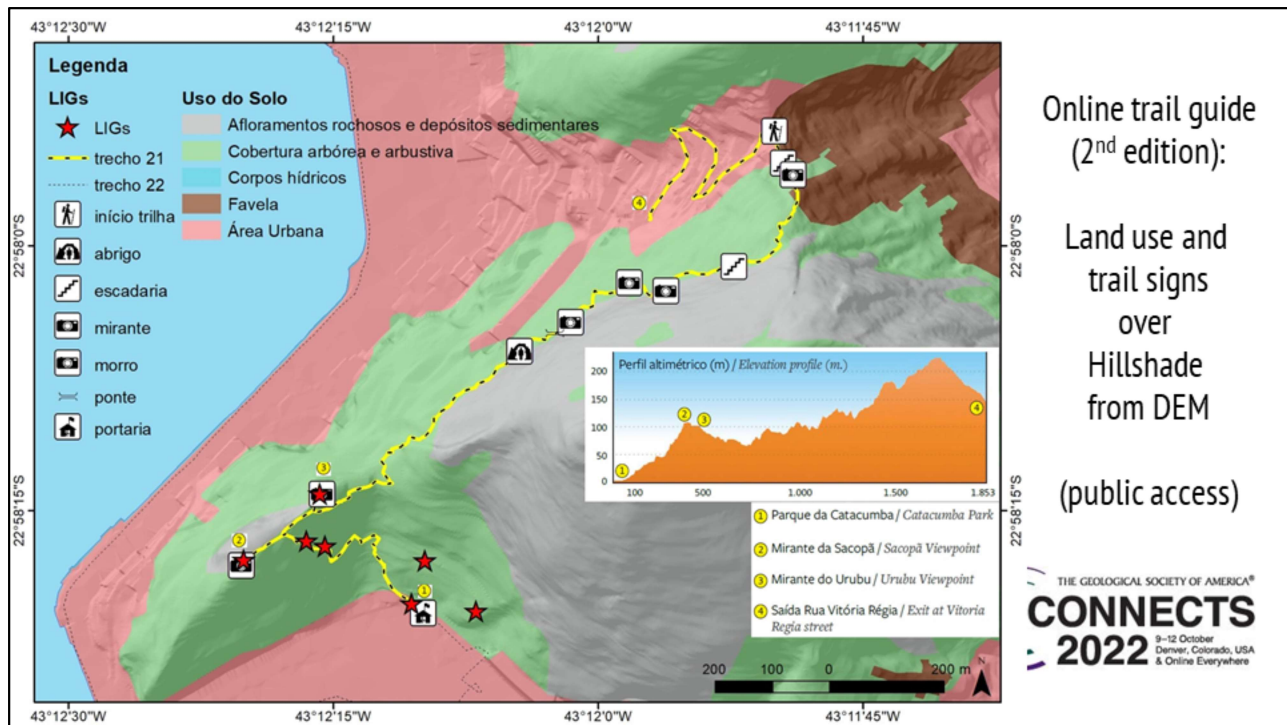
- What makes each site Geoheritage-worthy?



- What are the sites potential uses?
Education? Science? Tourism?



- The same area, Geoheritage sites land use over shaded relief, GENERATES...

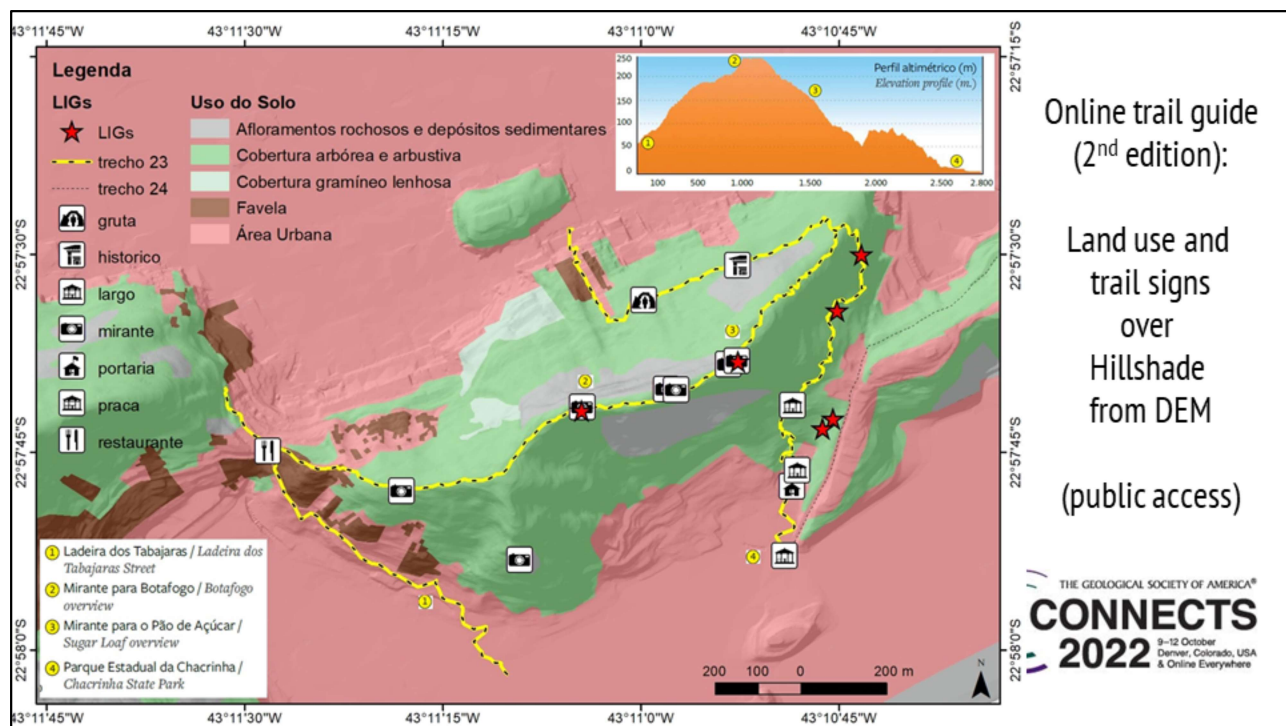


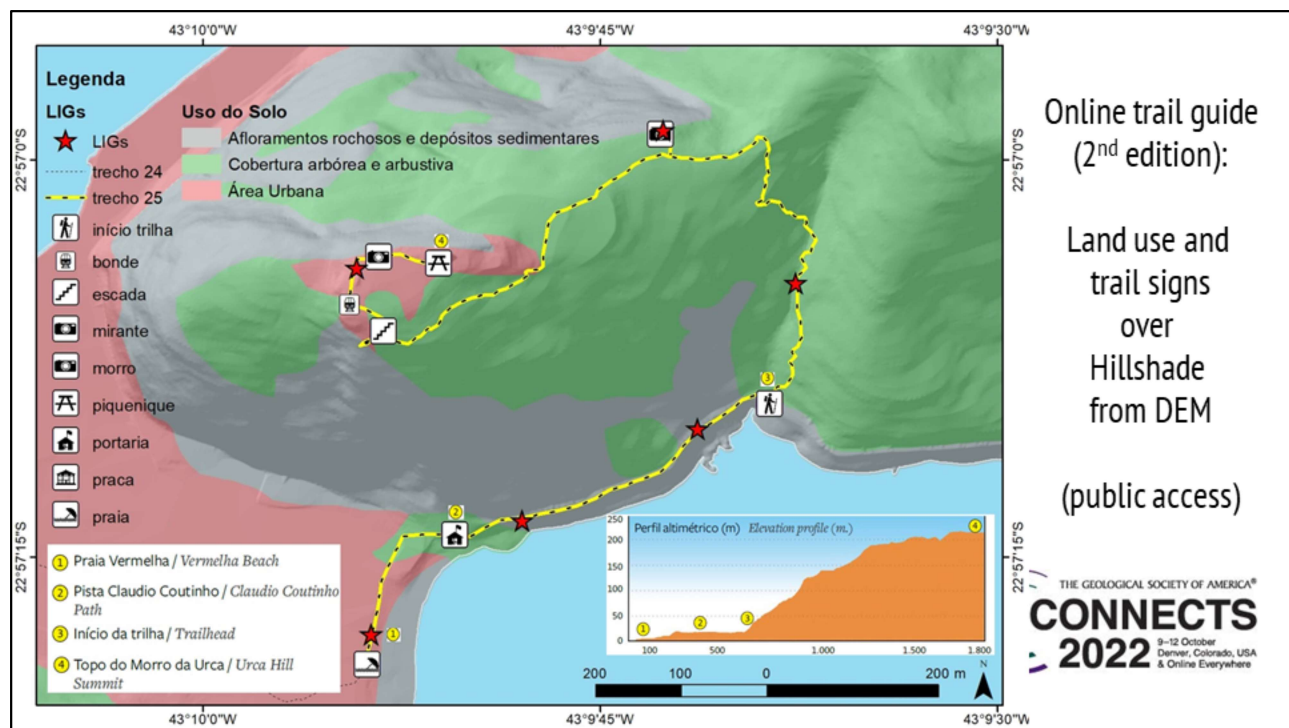
Online trail guide
(2nd edition):

Land use and
trail signs
over
Hillshade
from DEM

(public access)

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- Up to the top of the 1st cable car station.

LIGs
Lugares de Interesse Geológicos
na Trilha Transcarioca nos trechos 21, 23 e 25

Legenda
● Sítios -

Sítios - 1

Praia Vermelha

Unid. Estratigráfica	quaternário praial
Tipo	área/completo
Interesse Geol	geomorfológico/sedimentológico
Interesse Associado	expressão cênica/histórico cultural
Obs	turístico/didático
Foto	

Rotas: [Até aqui](#) - [Daqui](#)

Google Earth (stand-alone public access)

Image Landsat / Copernicus

site photo

400 m

Seguro | <https://earth.google.com/web/@-22.95229549,-43.16273118,136.68261521a,1307.32136664d,35y,-86.2932921h,76.84338553t,0r>

Apps | cursos e tutoriais | bolsas para sanduich | livros para comprar | blogs | trilhas | georoiteiro | Geoparks and Protec | base de dados inter | Outros favoritos

Estação IV - bondinho do Pão de açúcar

Morro da Babilônia

Museu de Ciências da Terra

Morro Da Urca

Trabalho BEEP

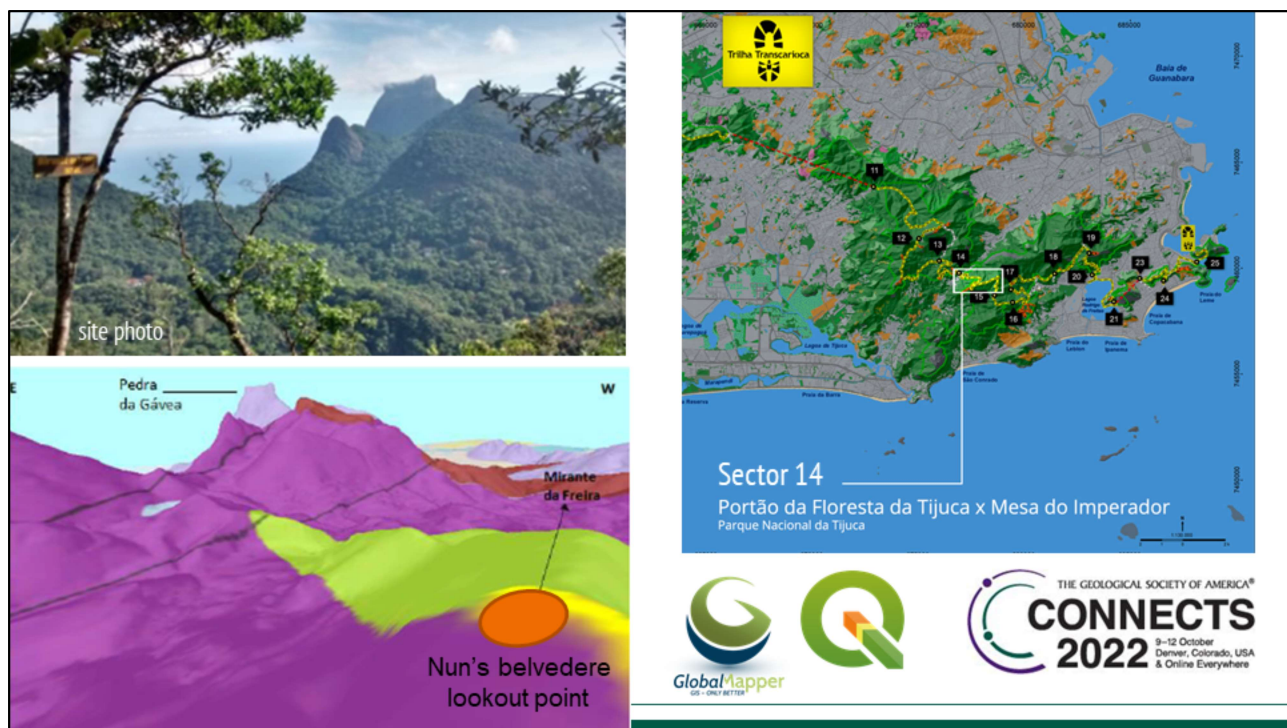
Praia Vermelha

Unid.	quaternário prai
Estratigráfica	
Tipo	área/complexo
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Interesse Associado	expressão cênica/histórico cultural
Obs	turístico/didático
Foto	

RIO 2018 CONGRESSO BRASILEIRO DE GEOLOGIA

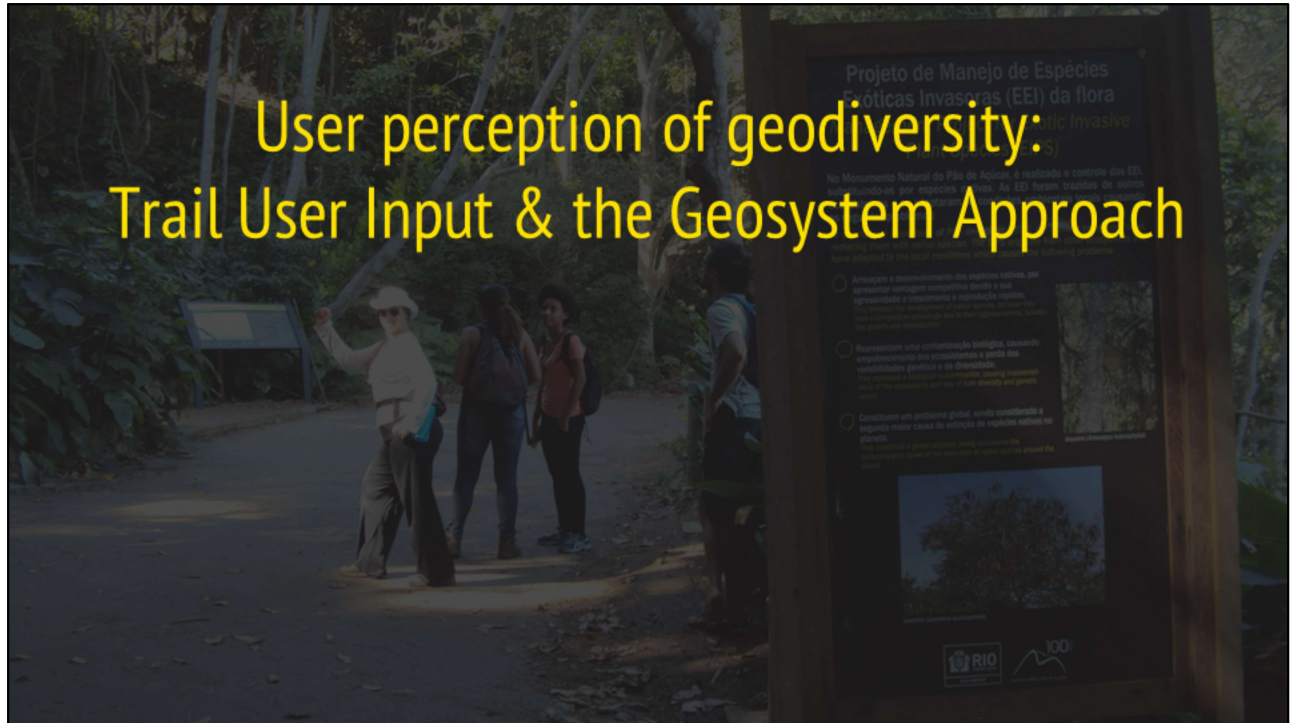
Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Landsat / Copernicus, TerraMetrics, DigitalGlobe, Google, Câmera: 434 m, 22°57'09"S, 43°09'30"W, 55 m, 91%

Web-based public access: field guide

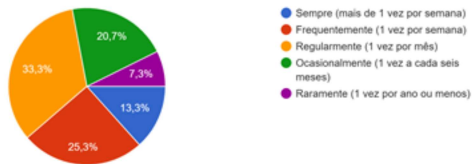


Preparation of Poster and Billboard explanations for the general public

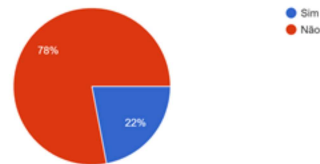
User perception of geodiversity: Trail User Input & the Geosystem Approach



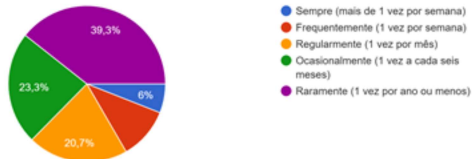
1 - Com que frequência você fazia trilhas antes da pandemia de COVID-19?
150 respostas



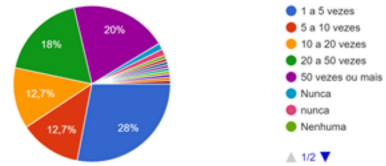
3 - Você já fez a Trilha Transcarioca com algum guia/conductor?
150 respostas



2 - E durante a pandemia de COVID-19?
150 respostas



4 - Quantas vezes você já fez alguma parte da Trilha Transcarioca?
150 respostas

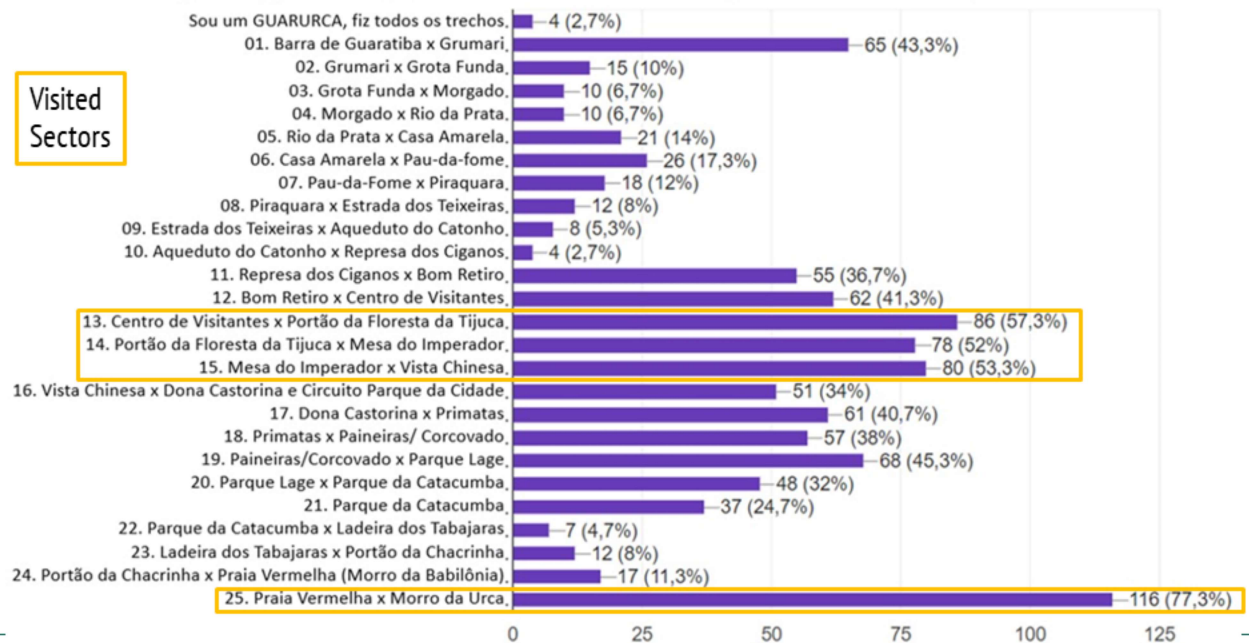


Spatial analysis and evaluation of user perception of geodiversity
Curiosity towards geodiversity and best means of communication:
The 15 question **Google Docs** questionnaire



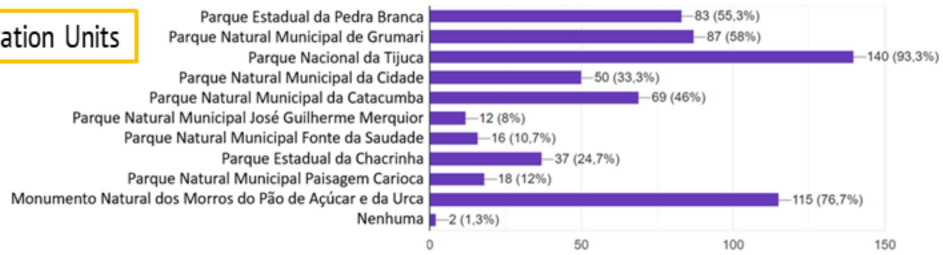
5 - Marque o(s) trecho(s) que você já percorreu da Trilha Transcarioca. (Pode marcar mais de um)

Visited
Sectors



6 - A Trilha Transcarioca percorre diversas Unidades de Conservação, qual(is) delas você já visitou? (Pode marcar mais de uma)

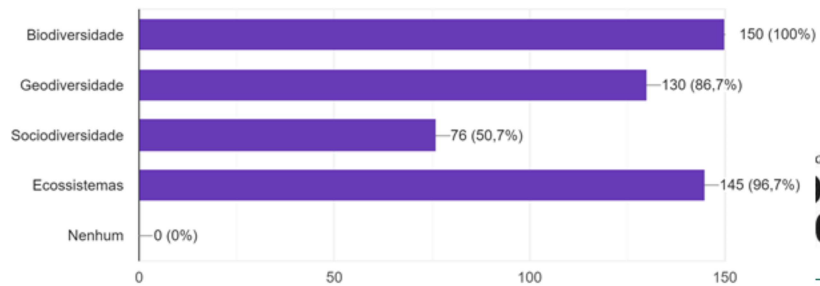
Conservation Units



7 - Marque o(s) termo(s) que você tem conhecimento ou já ouviu falar. (Pode marcar mais de um)

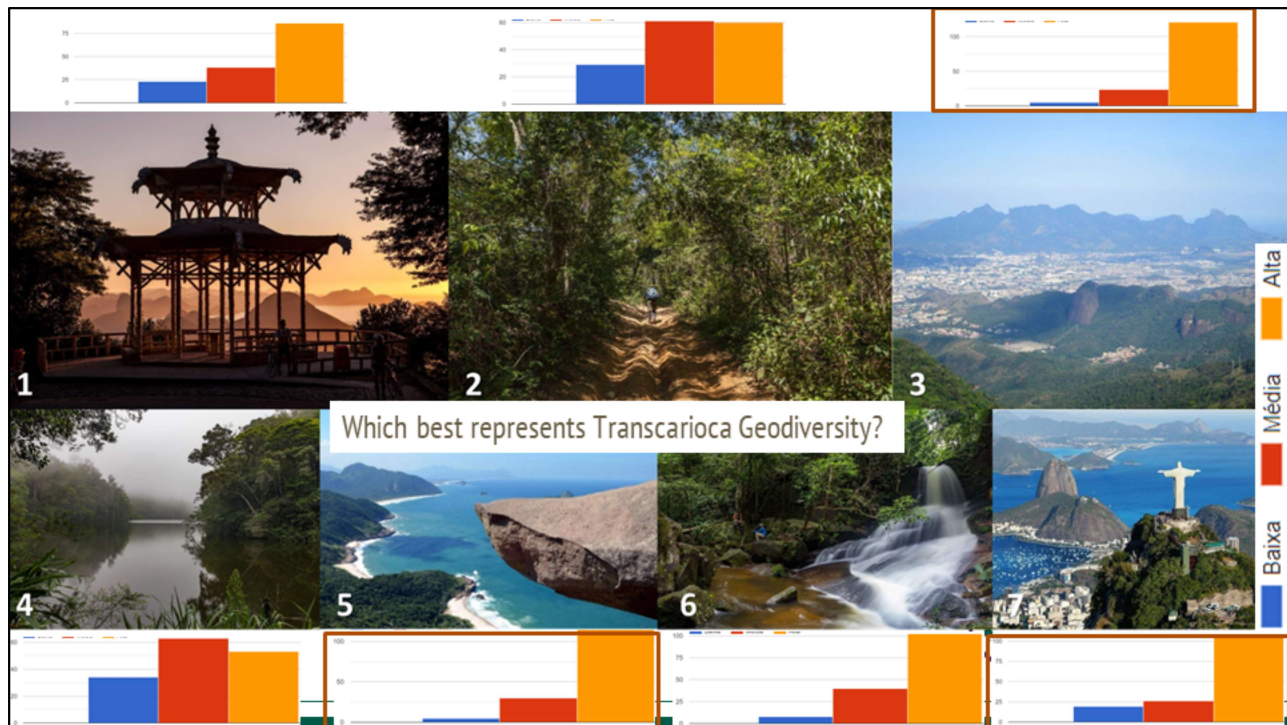
150 respostas

Terminology



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- Question 8: Which best represents Transcarioca Geodiversity? Urban or idilic settings? Generic or a landmark?
- 3 – Tijuca National Forest viewed from Pedra Branca, in the west. Urban sprawl in between. Underexplored potential!
- 5 – Telegraph Rock, a newcomer in the winner's list

Which best represents Transcarioca Geodiversity?

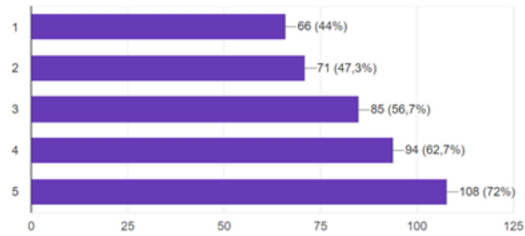
From outcrop detail to outcrop to narrow- and wide-views from lookout points



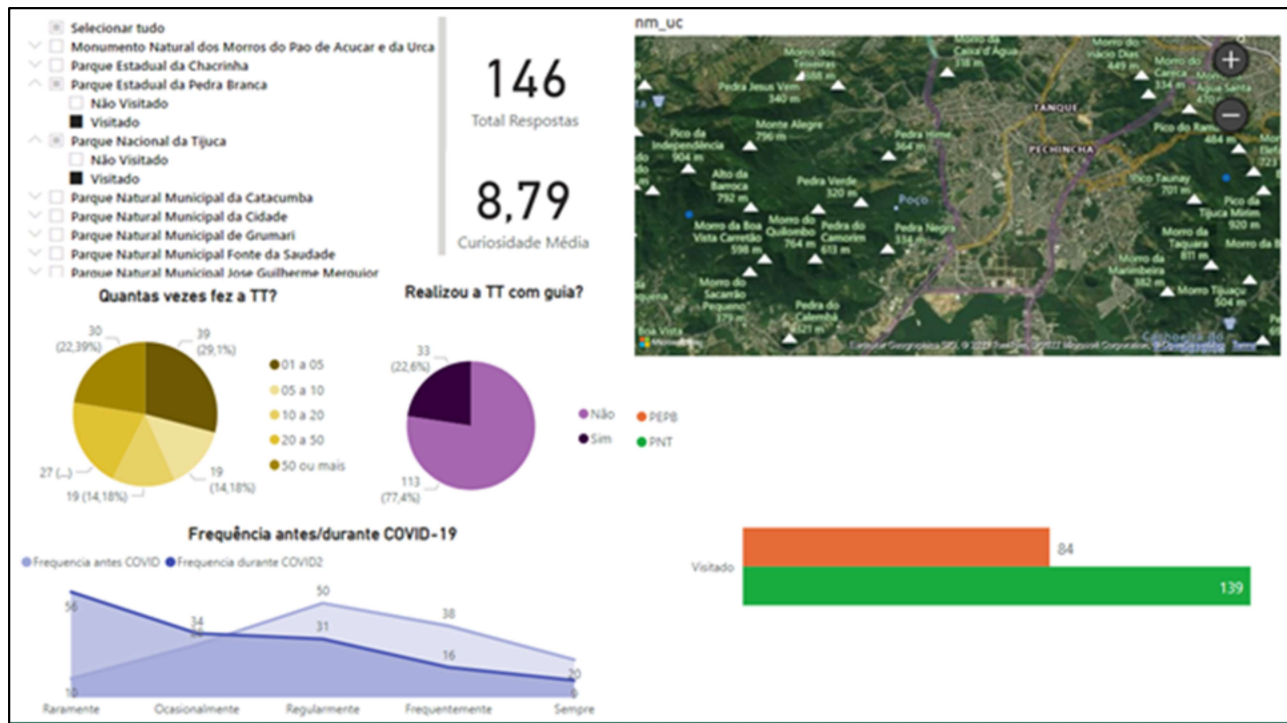
- As Cristina De Vera mentioned in the morning talk, geodiversity depends on public recognition...



Which best represents
Transcarioca Geodiversity?
General public's favorites:
wide-views from lookout points



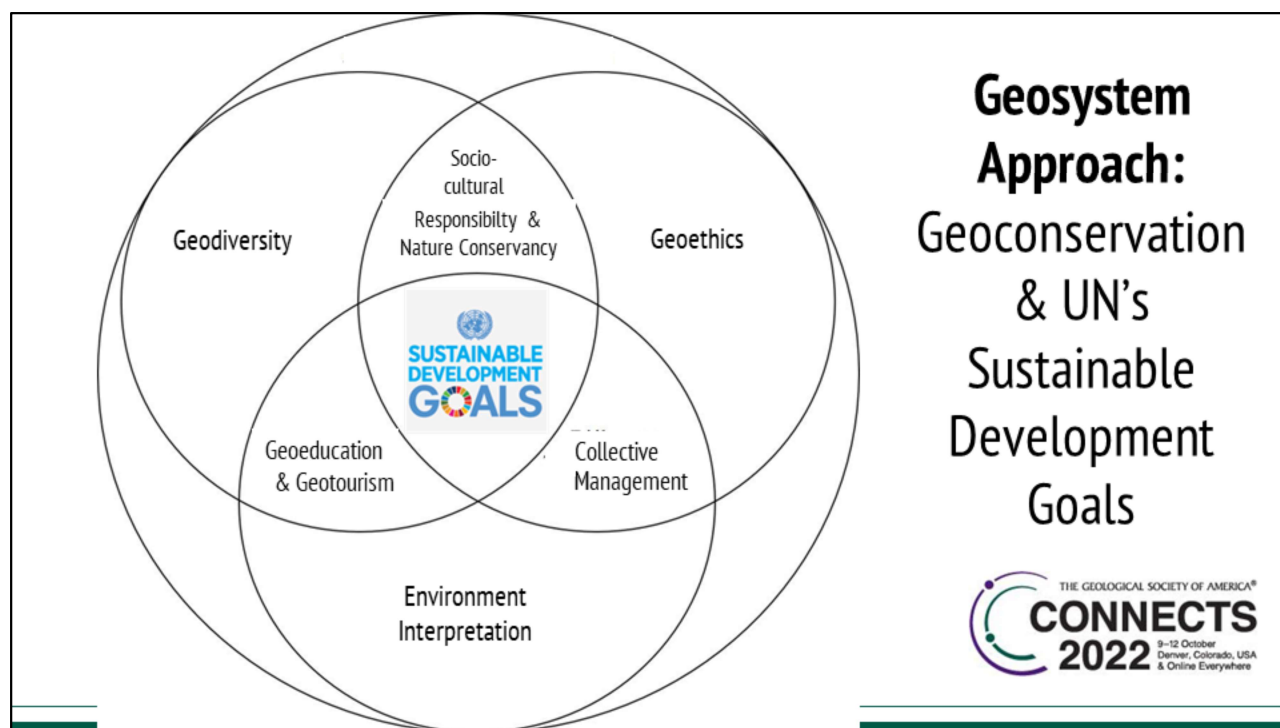
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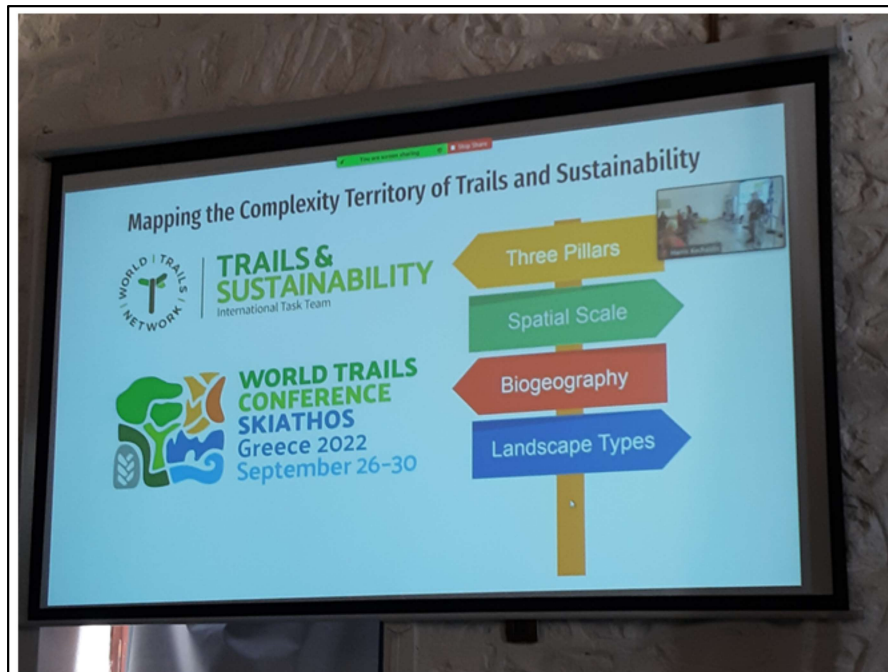
- Power BI for analysis, a powerful tool to understand user perception







- So here is our approach, and if you want more detail, please check our Publications!



Geosystem Approach: Geoconservation & UN's Sustainable Development Goals



- Worldf Trails Network Conference in Greece has recently discussed the theme, our team participated.



- And I urge you to become acquainted with sustainability goals!



- We are all volunteers at the trail, and as I conclude my talk I wish to thank you for your attention and I will be happy to answer any questions.



Thank you!

