# CoLa - Connecting landscape

## App demo

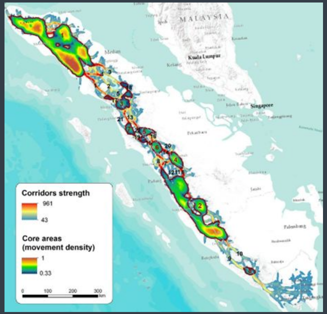
Founded by

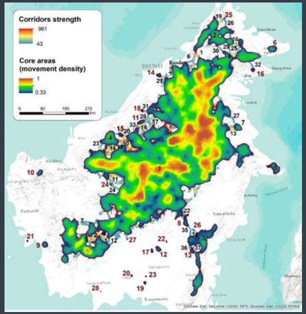
Developed by

# Tutorial

18.190.126.82:3838/connecting-landscapes/

# Intro



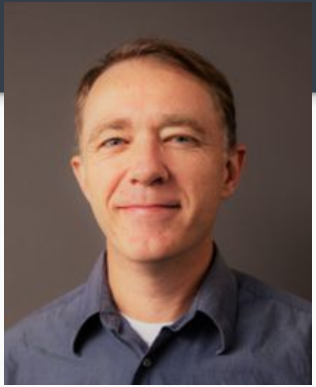



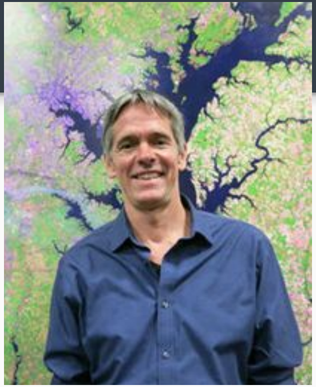

Increasing loss and fragmentation of habitats has resulted in an urgent need to identify areas for conservation that also maintain and enhance ecological connectivity of protected areas. End-users lack easy to use tools to objectively identify connectivity priorities.

**Outcome:** User friendly software to automatically generate and visualize wildlife connectivity priorities and scenarios using habitat suitability layers derived from NASA Earth observations.

**Value:** end-users can generate actionable connectivity priorities, enhancing interagency planning, improving protected area technical cooperation programs, improving sustainable forest management, and informing conservation crime assessments related to poaching and illegal land use.

# The (great!) team









## Investigators

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## Students

Ivan Gonzalez, Ph.D. student, Northern Arizona University

## End Users

Beth Hahn, Southern Africa Program Manager - USFS International Programs

Robynne Kotze, Research Coordinator, WildCru, TKPP, U. Oxford

Nyambe Nyambe, Executive Director, KAZA Secretariat

Kathy Zeller, Research Biologist, Rocky Mountain Research Station, USFS

David Macdonald, Collaborator, Founder, WildCru, U. Oxford

Andrew Loveridge, Collaborator, Deputy Director, WildCru, TKPP, U. Oxford

# Agenda

0 - 10 min: Welcome

10 - 20: The tool. Main directions

20 - 30: Suitability to resistance

30 - 40: Edit scenarios

40 - 50: Simulate/load points

50 - 60: Corridors

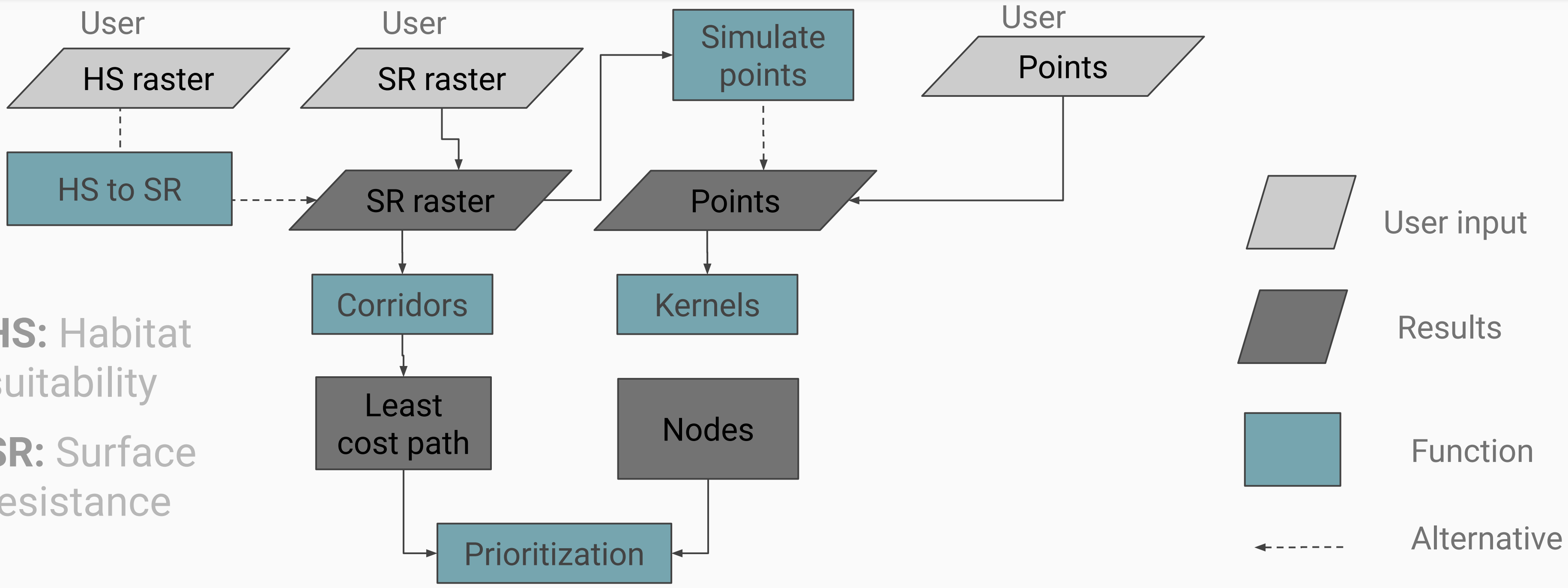
60 - 70: Kernels

70 - 80: Prioritize

80 - 100: Debug + known issues

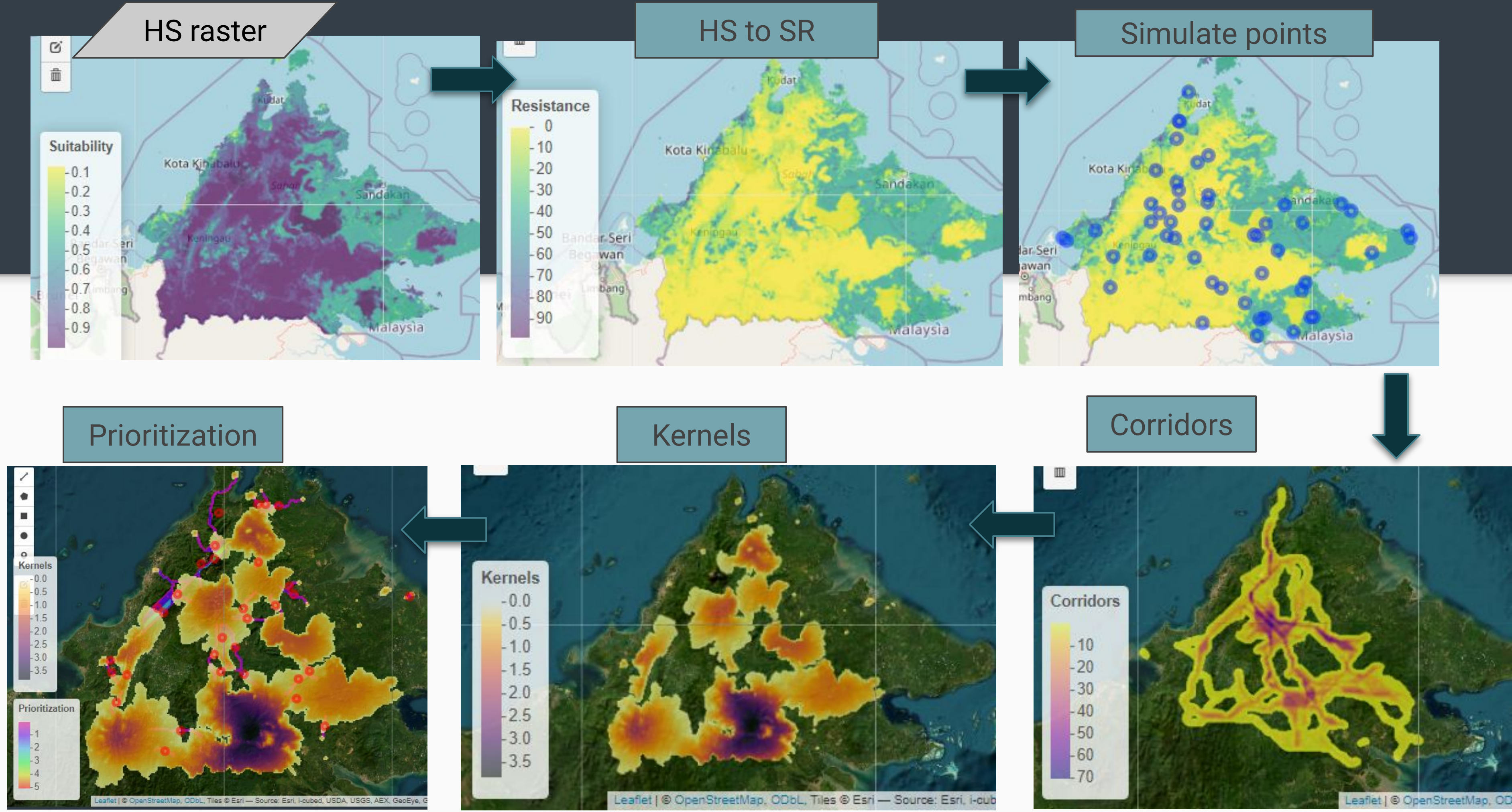
100 - 120m: Concluding remarks

# Complete workflow




**HS:** Habitat suitability

**SR:** Surface resistance


HS raster
HS to SR
Simulate points
Corridors
Kernels
Prioritization
Suitability
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Resistance
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10
20
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80
90
Kota Kinabalu
Kudat
Sandakan
Keningau
Malaysia
Corridors
10
20
30
40
50
60
70
Kernels
0.0
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1.0
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2.0
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3.5
Prioritization
1
2
3
4
5
Leaflet | © OpenStreetMap, ODbL, Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, G

# Overview

ConnectingLandscapes ≡

- Home
- Habitat suitability <> resistance surface
- Customize resistance surface
- Create source points
- Cost distance matrix
- CDPOP
- Connectivity - corridors
- Connectivity dispersal kernels
- Connectivity - prioritization
- Assign coords
- PDF
- Run locally

Home | How it works | Performance | Showcase | ShowcasePriv

## Toolkit Overview

Increasing loss and fragmentation of habitats has resulted in an urgent need to identify areas for conservation that also maintain and enhance ecological connectivity of protected areas. The Connecting Landscapes (*CoLa*) toolkit integrates and enhances numerous landscape genetics and habitat connectivity tools (Landguth and Cushman 2010, Landguth et al. 2012) to aid in identifying connectivity conservation priorities and areas of potential human wildlife conflict.

The toolkit is supported by NASA Biological Diversity & Ecological Conservation program Grant No. 80NSSC21K1942 - Strengthening Natural Resource Management with New Protected Area Connectivity Tools, and was co-developed with the Wildlife Conservation Research Unit (WildCRU) of University of Oxford and the United States Forest Service (USFS) Rocky Mountain Research Station, USFS International Programs.

Primary inputs to the tools include habitat suitability layers or spatially explicit estimates of animal movement potential across different land use types (resistance layers), and population source points. When properly parameterized, the toolkit can generate estimates of population genetic structure, population density, core movement areas, and long-distance dispersal corridors.

For recent examples of how the individual tools have been used for wildlife research and conservation assessments see *Kaszta et al.* (2020a), Kaszta *et al.* (2020b), Zeller *et al.* (2021), *Ash et al.* (2023), *Makwana et al.* (2023).

### >> References

Ash, E., Cushman, S., Kaszta, Ż., Landguth, E., Redford, T. and Macdonald, D.W., 2023. Female-biased introductions produce higher predicted population size and genetic diversity in simulations of a small, isolated tiger (Panthera tigris) population. *Scientific Reports*, 13(1), p.11199.

Kaszta, Ż., Cushman, S.A. and Macdonald, D.W., 2020a. Prioritizing habitat core areas and corridors for a large carnivore across its range. *Animal Conservation*, 23(5), pp.607-616.

Kaszta, Ż., Cushman, S.A., Htun, S., Naing, H., Burnham, D. and Macdonald, D.W., 2020b. Simulating the impact of Belt and Road initiative and other major developments in Myanmar on an ambassador felid, the clouded leopard, Neofelis nebulosa. *Landscape Ecology*, 35, pp.727-746.

Landguth, E.L. and Cushman, S., 2010. CDPOP: a spatially explicit cost distance population genetics program. *Molecular ecology resources*, 10(1), pp.156-161.

Landguth, E.L., Hand, B.K., Glassy, J., Cushman, S.A. and Sawaya, M.A., 2012. UNICOR: a species connectivity and corridor network simulator. *Ecography*, 35(1), pp.9-14.

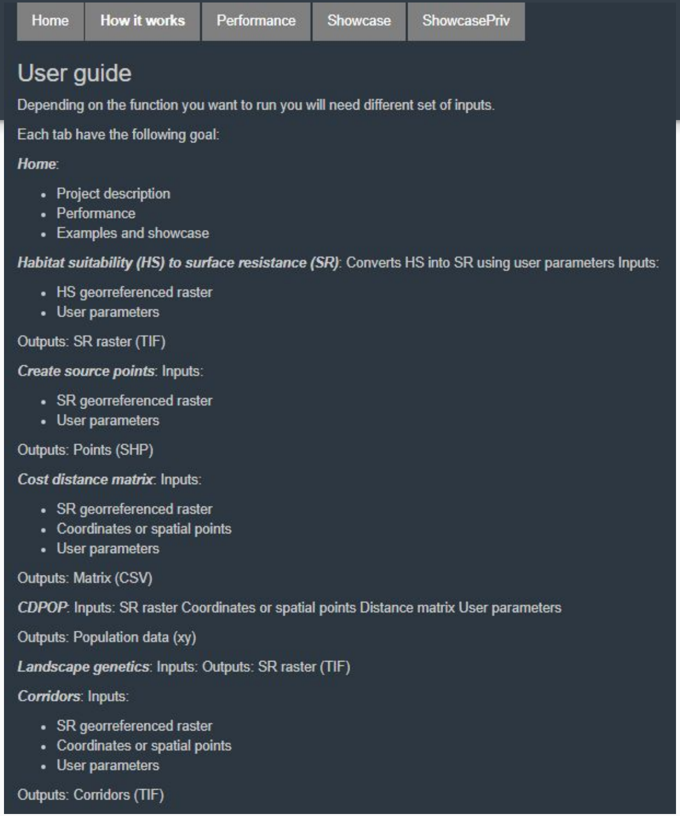
Makwana, M., Vasudeva, V., Cushman, S.A. and Krishnamurthy, R., 2023. Modelling landscape permeability for dispersal and colonization of tigers (Panthera tigris) in the Greater Panna Landscape, Central India. *Landscape Ecology*, 38(3), pp.797-819.

Zeller, K.A., Schroeder, C.A., Wan, H.Y., Collins, G., Denryter, K., Jakes, A.F. and Cushman, S.A., 2021. Forecasting habitat and connectivity for pronghorn across the Great Basin ecoregion. *Diversity and Distributions*, 27(12), pp.2315-2329.

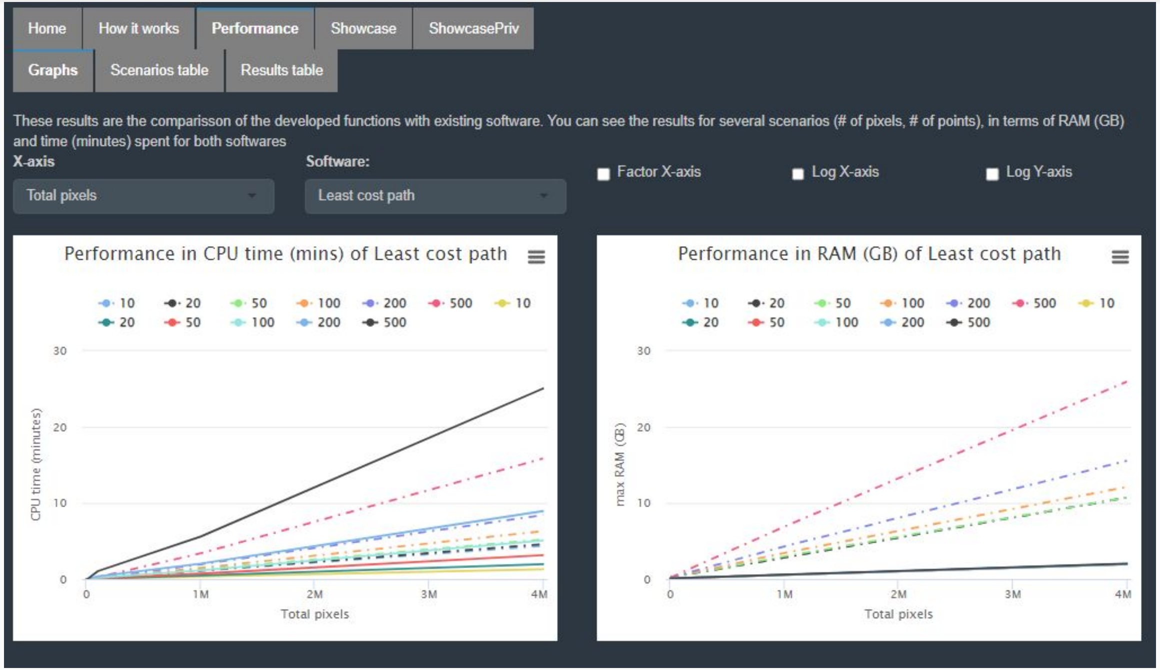
### >> Contact

Write Patrick.Jantz@nau.edu or ig299@nau.edu (Ivan Gonzalez) for questions and suggestions

# Overview




# Performance

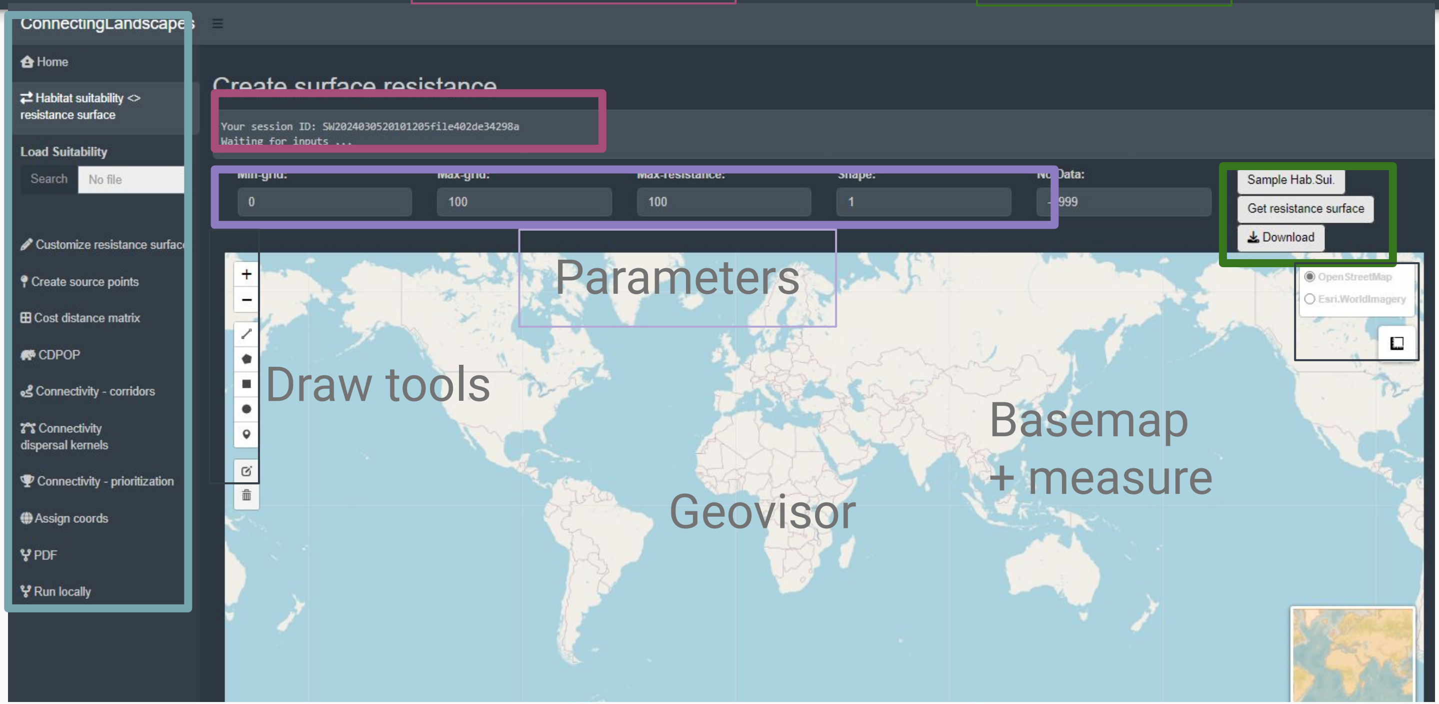


# The visuals

Log box + session ID

Run / download

Functions

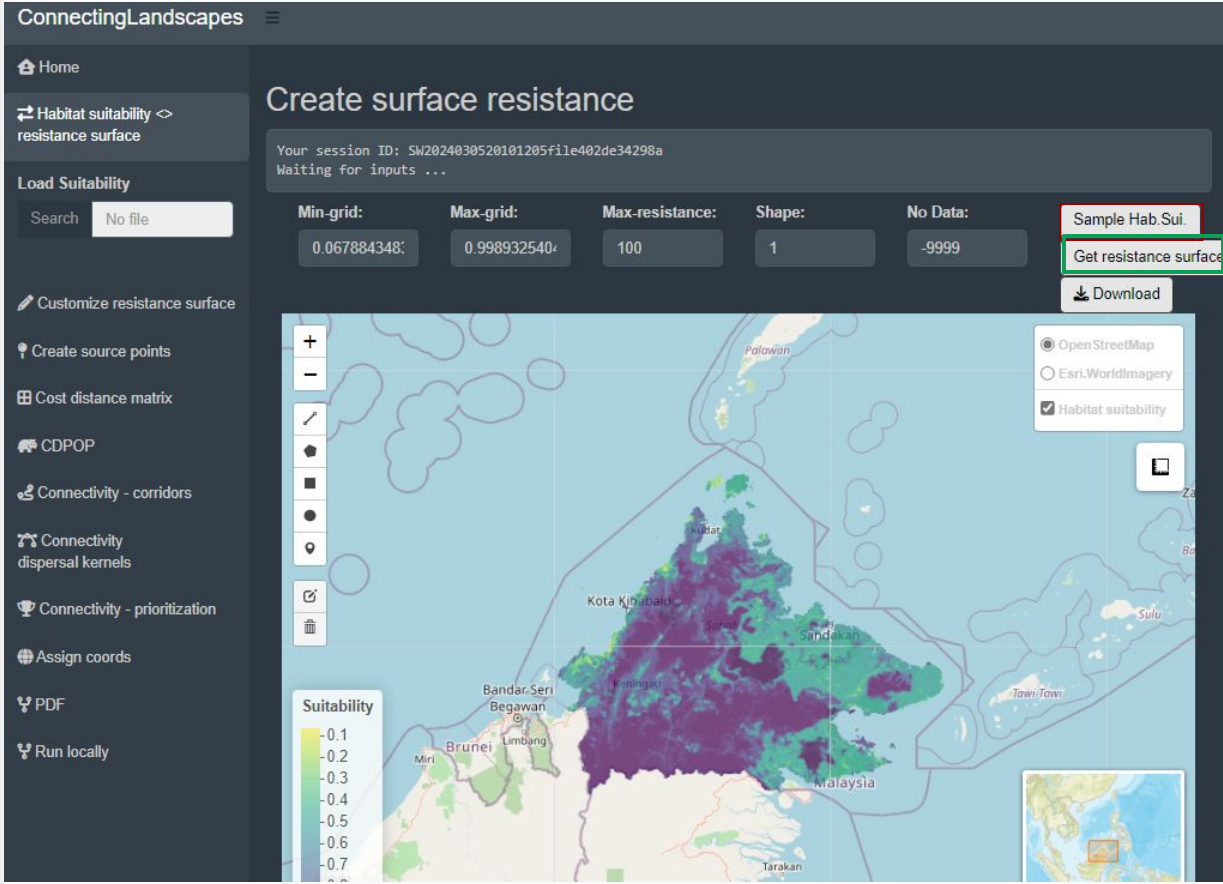



Save your **session ID** for questions or bugs

# 1. Suitability to resistance

For running:

1. Load a valid TIF raster with continuous values
2. Define the parameters. They are gess forum your raster as a prior. Modify as you consider
3. Click on “**Get resistance surface**”
4. Download the resulting raster in TIFF format

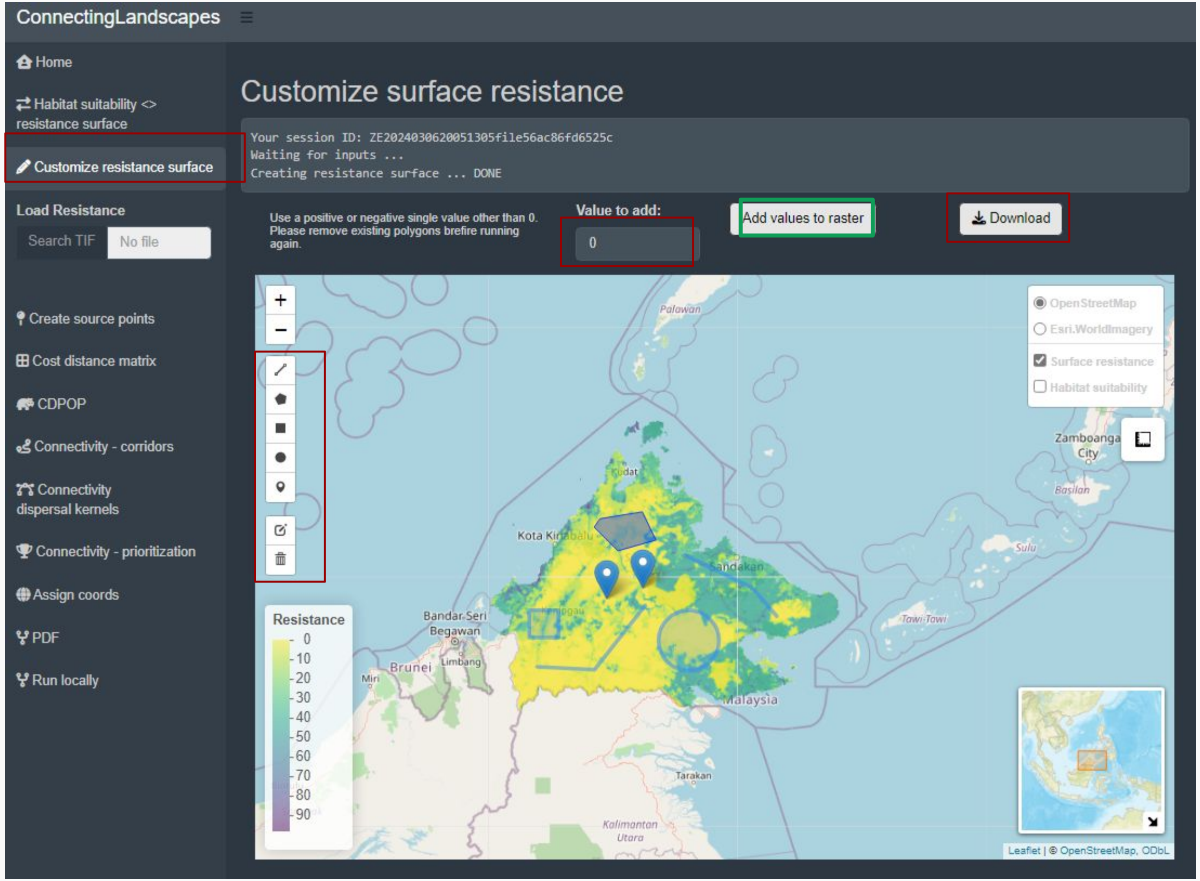



No data? Load the sample dataset

# 2. Customize resistance surface

For running:

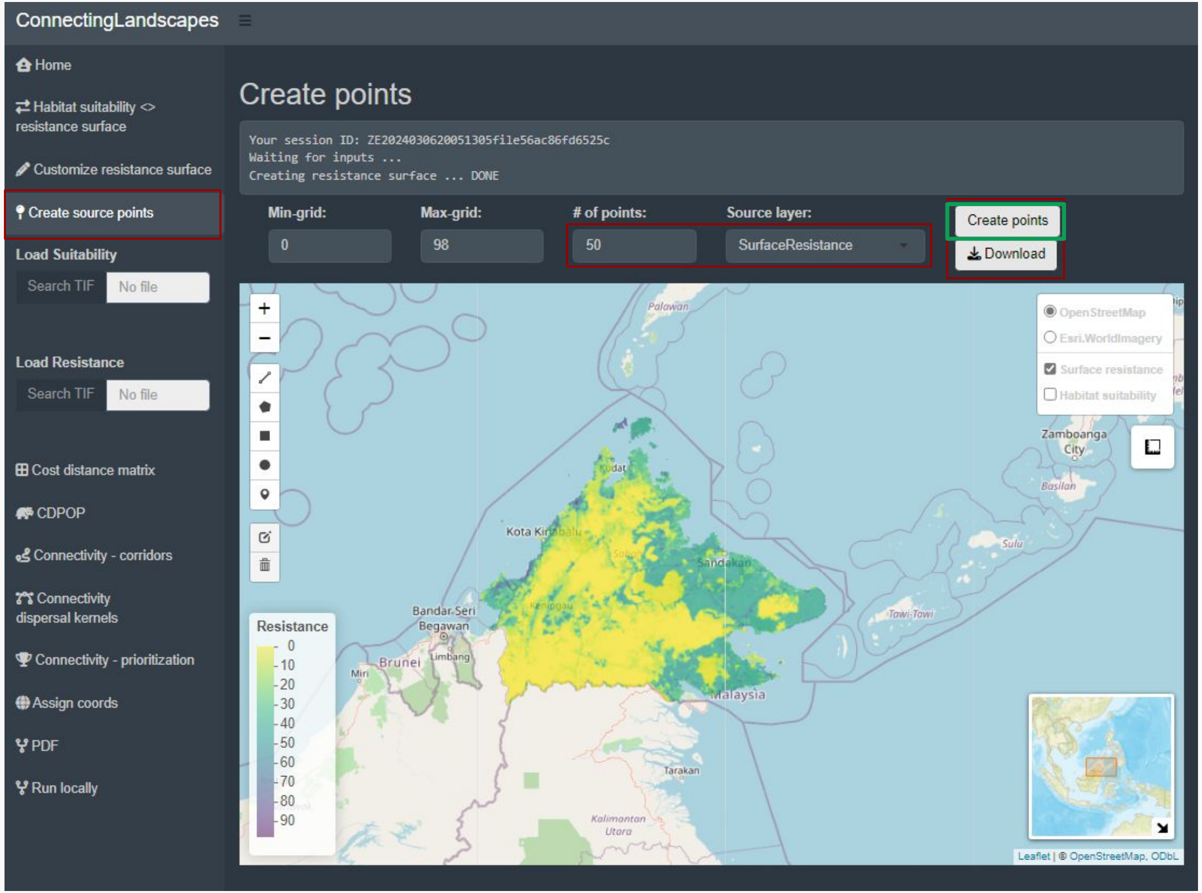
1. Load a valid TIF raster with continuous values if skipping last step. No extra SR required
2. Draw figures you want to “burn”. Multiple geometry types allowed
3. Provide a “value to add”. Number positive or negative
4. Click on “**Add values to raster**”
5. Download the resulting raster in TIFF format



# 3. Create source points

For running:

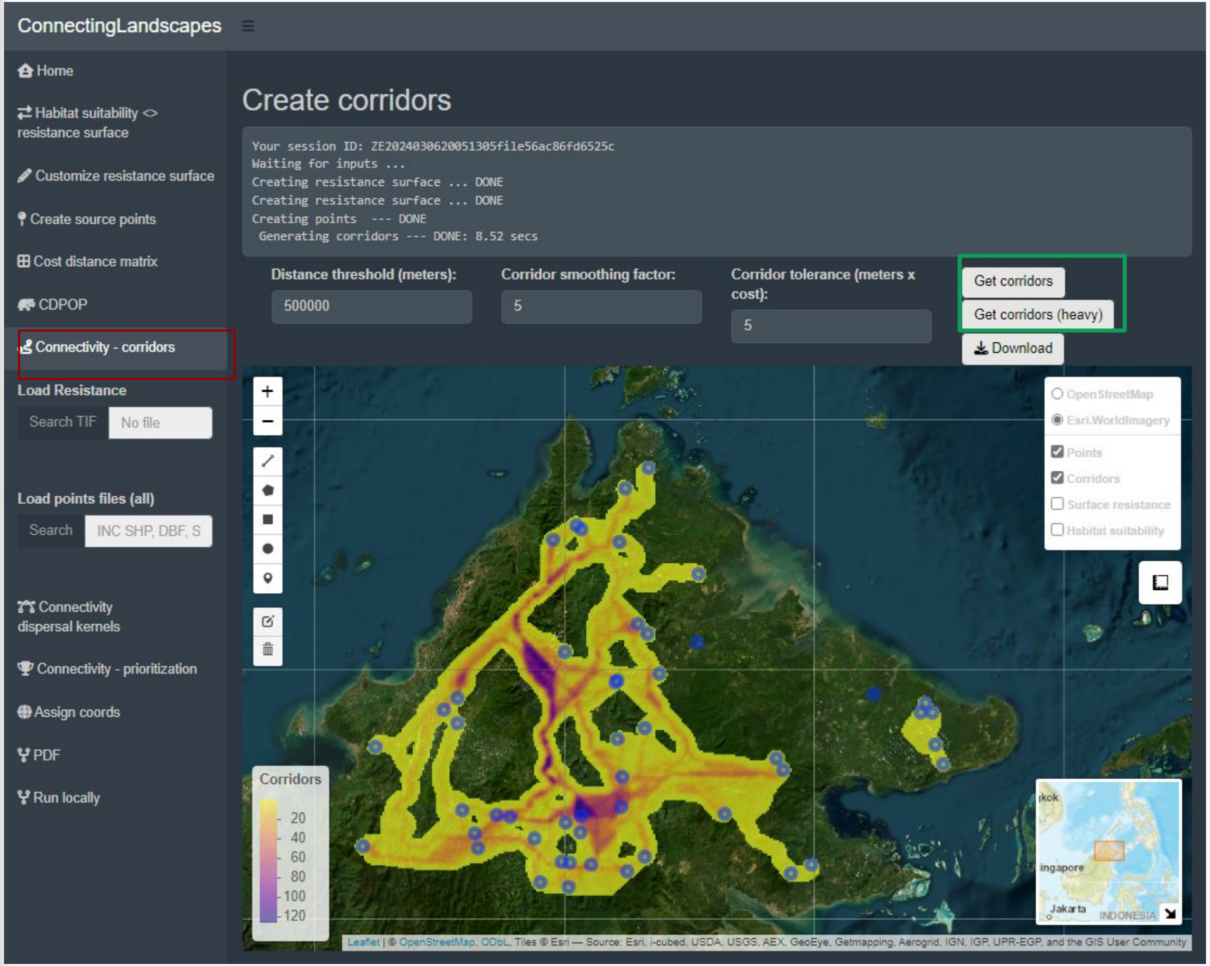
1. Load a valid TIF raster with continuous values if skipping previous steps. Can use HS or SR
2. Select the min-max range on the raster to simulate the points, and the total number of points
3. Select which (available) layer to base the analysis on.
4. Click on "**Create points**"
5. Download the resulting raster in TIFF format



# 4. Corridors

For running:

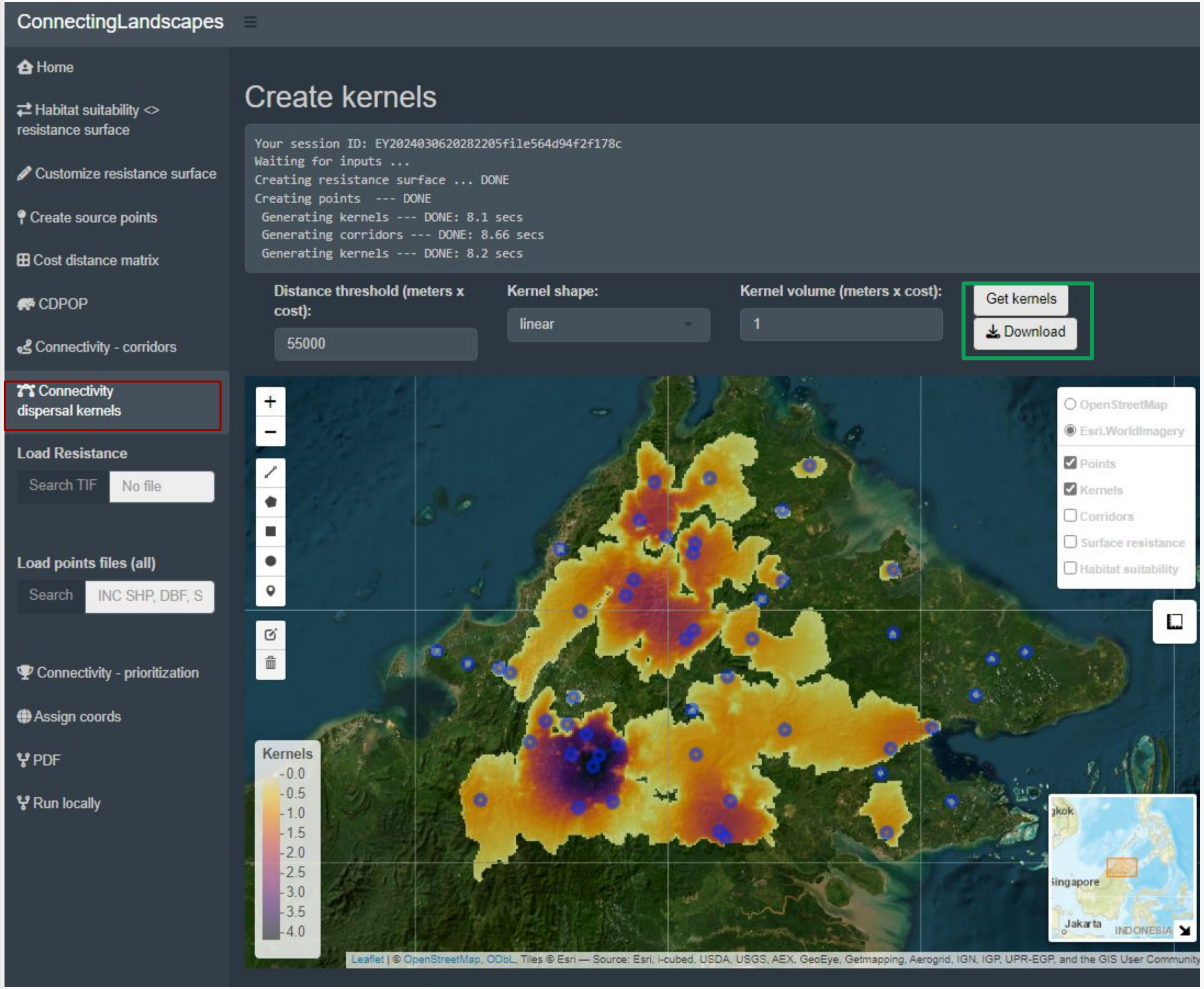
1. Load a valid TIF raster with continuous values if skipping previous steps. No required to upload SR again
2. Load a valid point shapefile if skipped previous steps
3. Select parameters
4. Click on “**Get corridors**” or “**heavy**” for big rasters.
5. Download the resulting raster in TIFF format



# 5. Kernels

For running:

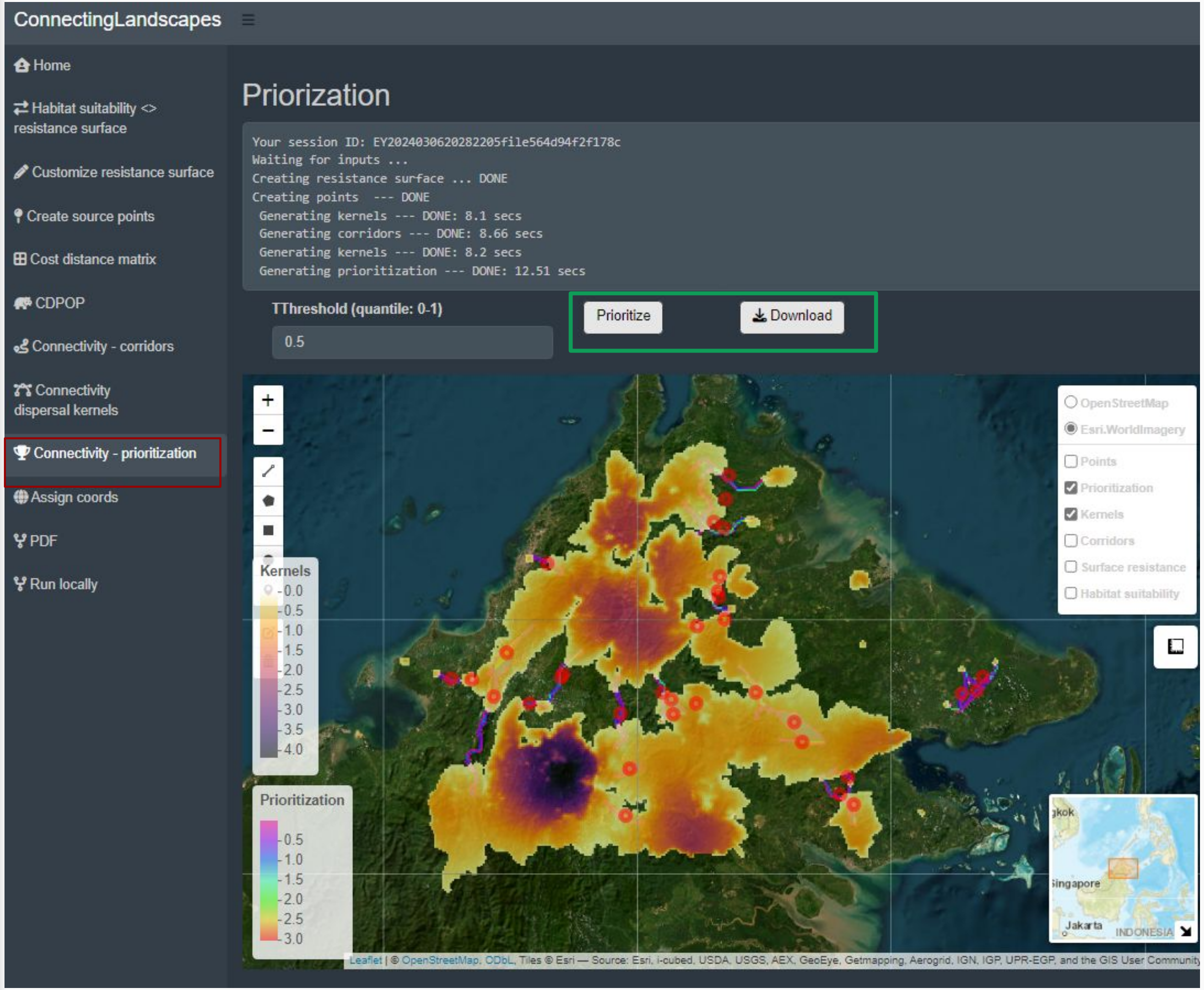
1. Load a valid TIF raster with continuous values if skipping previous steps. No required to upload SR again
2. Load a valid point shapefile if skipped previous steps
3. Select parameters
4. Click on "**Get kernels**"
5. Download the resulting raster in TIFF format



# 6. Prioritization

For running:

1. Must have corridors and kernels developed on the app
2. Select parameters
3. Click on "**Prioritize**"
4. Download the resulting raster in TIFF format



# Known issues

It will not stop the algorithm but is good to keep this in mind:

1. Use a valid NODATA value in your raster, and be aware of which it is
2. Assign a coordinate reference system
3. Your TIFs are big

# Thanks!

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github.com/forestrev/