Strengthening Natural Resource Management with New Protected Area Connectivity Tools

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(1) Northern Arizona University

(2) University of Oxford

(2) WILDCRU Wildlife Conservation Research Unit

(6) kaza Kavango Zambezi Trans Frontier Conservation Area — Angola, Botswana, Namibia, Zambia, Zimbabwe

(3) IP

(4) US Forest Service, Department of Agriculture

(5) University of Montana

(7) TKPP Transkalahari Predator Programme

Conservation Need

- The proliferation of infrastructure, agriculture, and other land uses has decreased movement potential for wildlife across much of the world
- Tools exist for assessing land use impacts, but they generally require technical expertise to run, may rely on proprietary software, and are not explicitly designed for scenario assessment
- The Wildlife Conservation Research Unit (WildCRU) and United States Forest Service expressed a need for an easy-to-use DSS that could automate assessment of conservation and development impacts on connectivity

Project Structure

Earth Observations

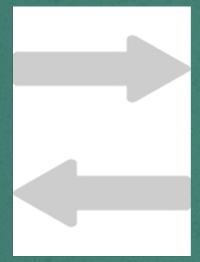
+

In-situ observations

+

Analysis, Modeling, and DSS Development

Scenario Development, Workshops, Training, Applications

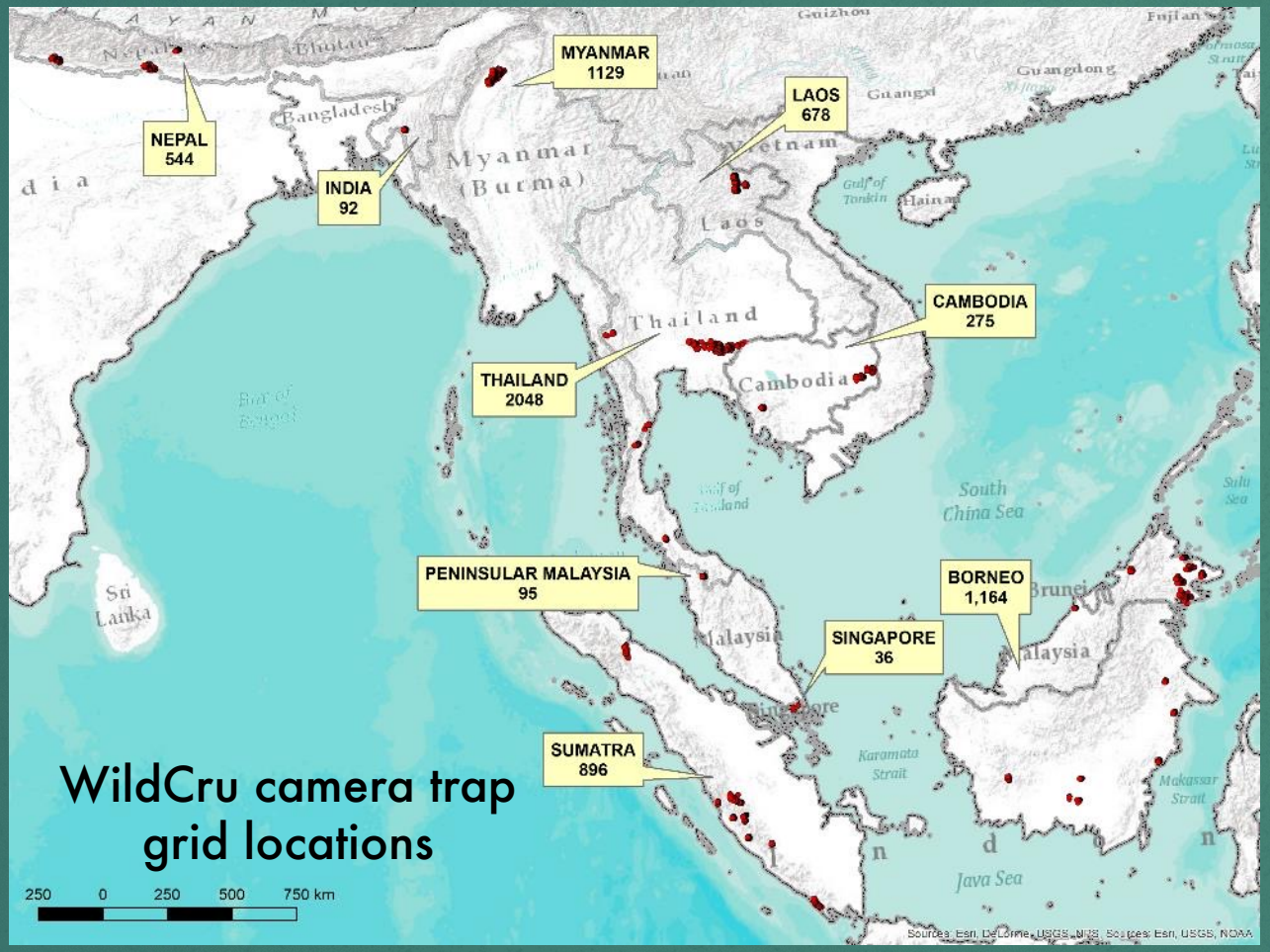


Participatory watershed management planning exercise led by USFS, Mount Elgon, Kenya.

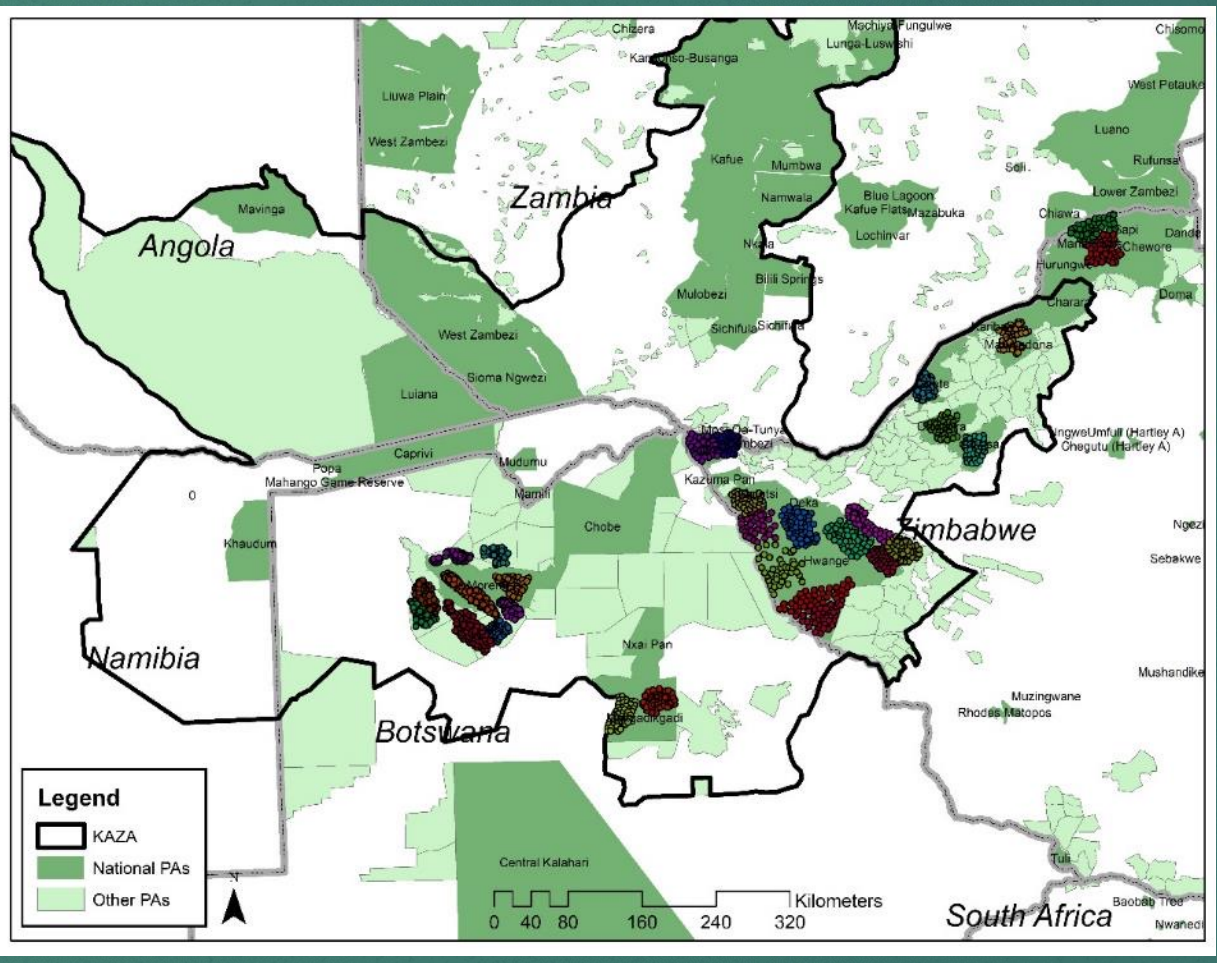
Participatory land use planning facilitated by WCS and USFS, Tanintharyi Region, Myanmar.

Focal Areas

Southeast Asia



Kavango-Zambezi Transfrontier Conservation Area



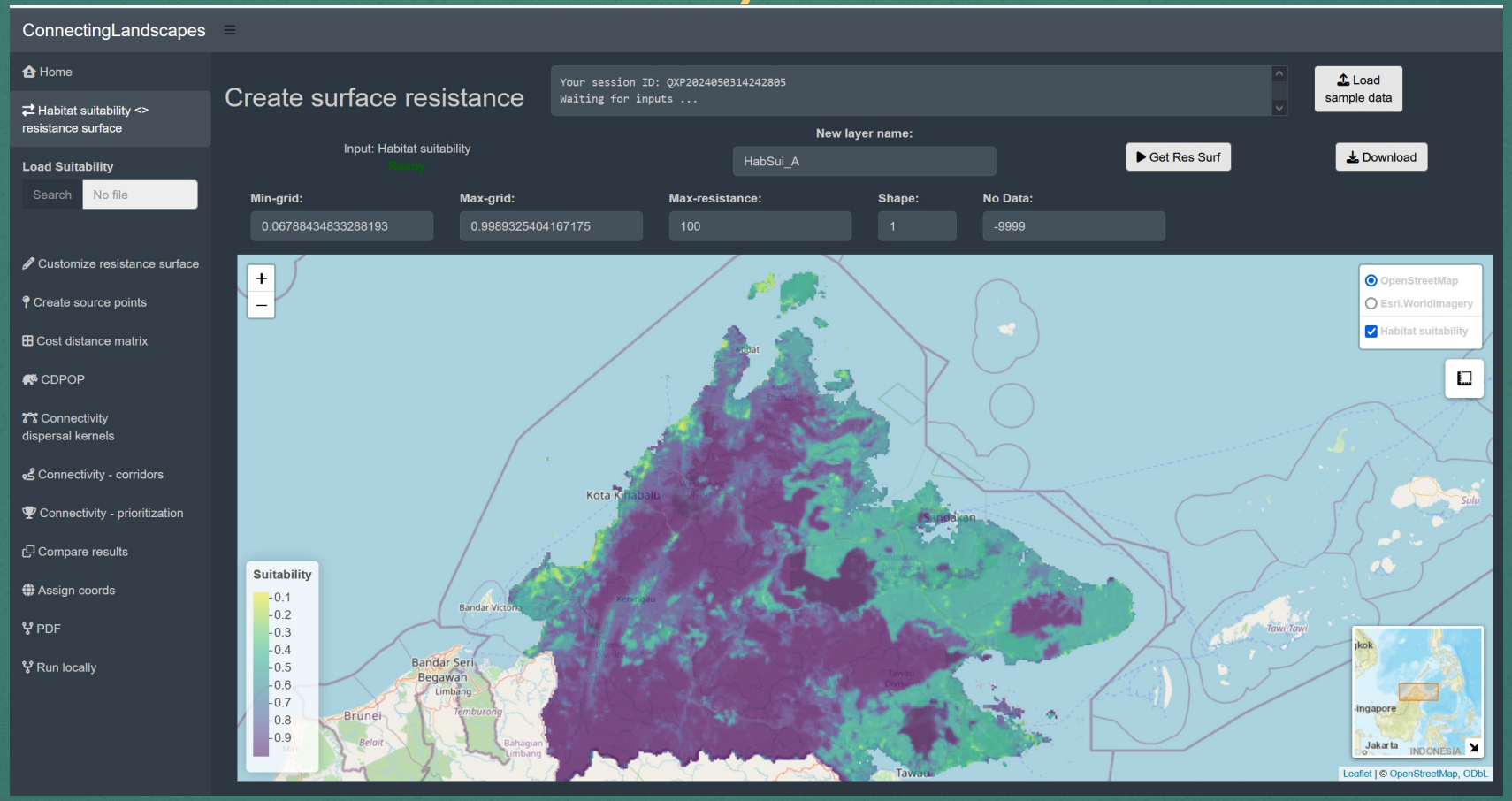
Connecting Landscapes DSS

- Predecessor tools (UNICOR and CDPOP, Landguth et al. 2010, 2012) used by WildCRU and USFS for connectivity modeling via command line in Python (e.g. Kaszta, Ż., Cushman, S.A., Hearn, A., Sloan, S., Laurance, W.F., Haidir, I.A. and Macdonald, D.W., 2024. Projected development in Borneo and Sumatra will greatly reduce connectivity for an apex carnivore. Science of The Total Environment, 918, p.170256.)

- We updated and integrated these tools using high performance graph libraries running in Python, accessed via a Shiny front-end

Project Status

- DSS delivered to end-users and is in use
- The DSS currently runs on an AWS server
- We are also finalizing an R package that will allow anyone to download, install, and run the DSS interactively in a web browser.



Applications

CHOBE ZAMBEZI FLOODPLAIN INTEGRATED LAND USE AND MANAGEMENT PROJECT

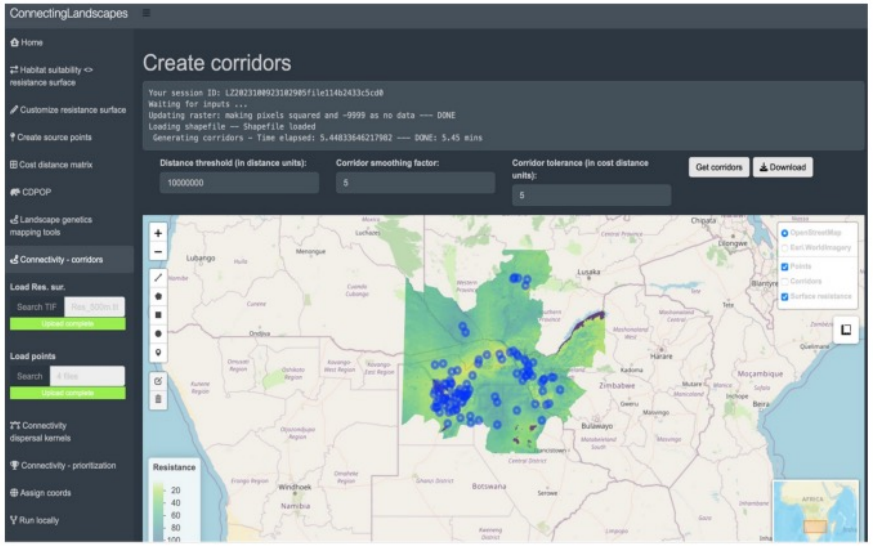
PROJECT PROFILE

PROJECT

APPROACH

DEVELOPING DECISION SUPPORT SYSTEM TOOL

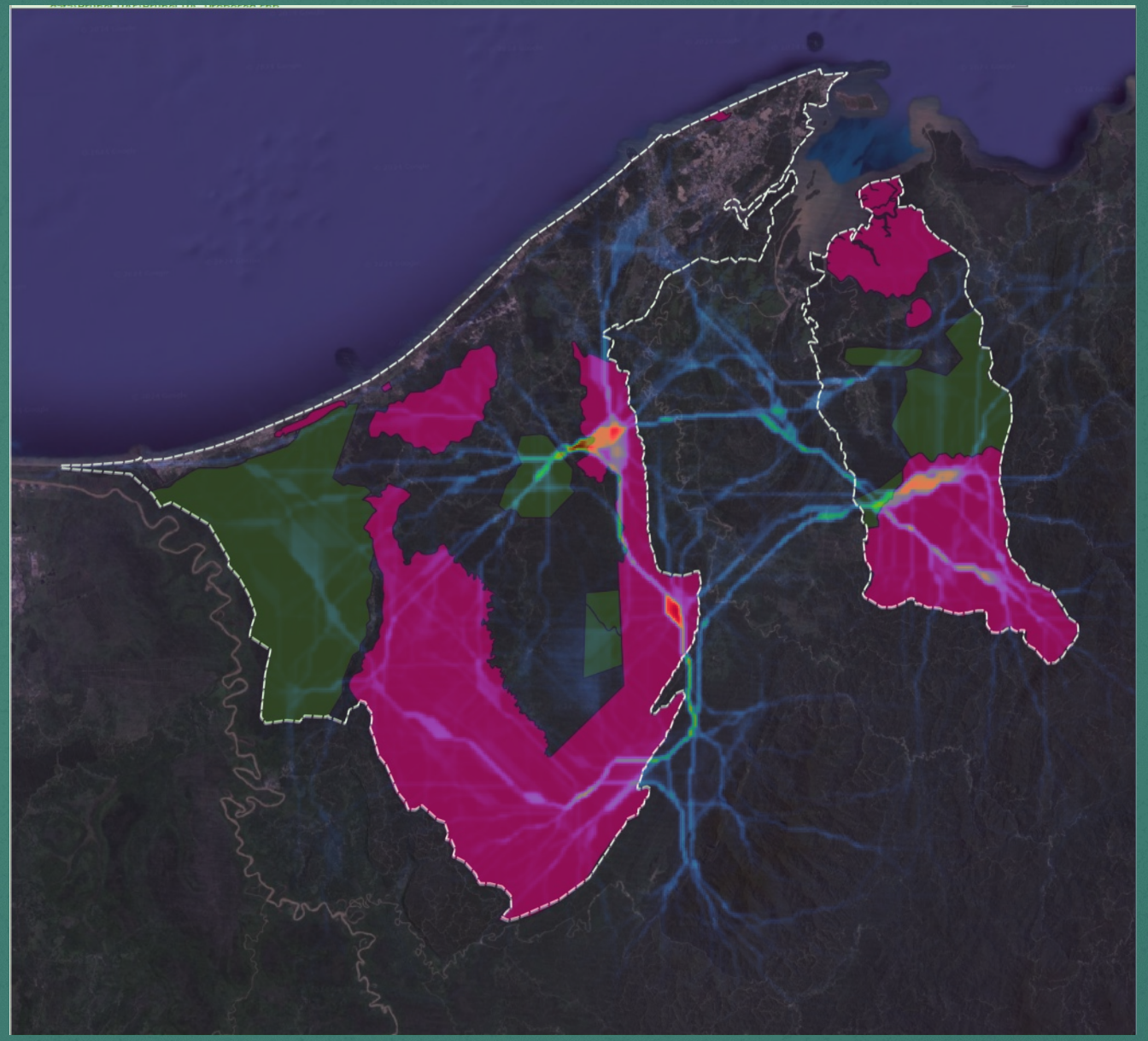
To ensure the accessibility of this process to stakeholders, the NASA Biodiversity and Ecological Conservation program funded the four year "Strengthening Natural Resource Management with New Protected Area Connectivity Tools" project, with Northern Arizona University as the lead institution and the U.S. Forest Service International Programs (USFS-IP), USFS domestic, WildCRU, the KAZA Secretariat, and the University of Montana as project collaborators. A primary goal of the project is to extend and integrate existing connectivity and landscape genetics software, specifically UNICOR and CDPOP, into a toolkit, accessible via a graphical user interface, that can be used to prioritize land use planning to optimally balance the tradeoffs between development and conservation. The toolkit is free and open source and designed to work in the cloud or on desktop computers.



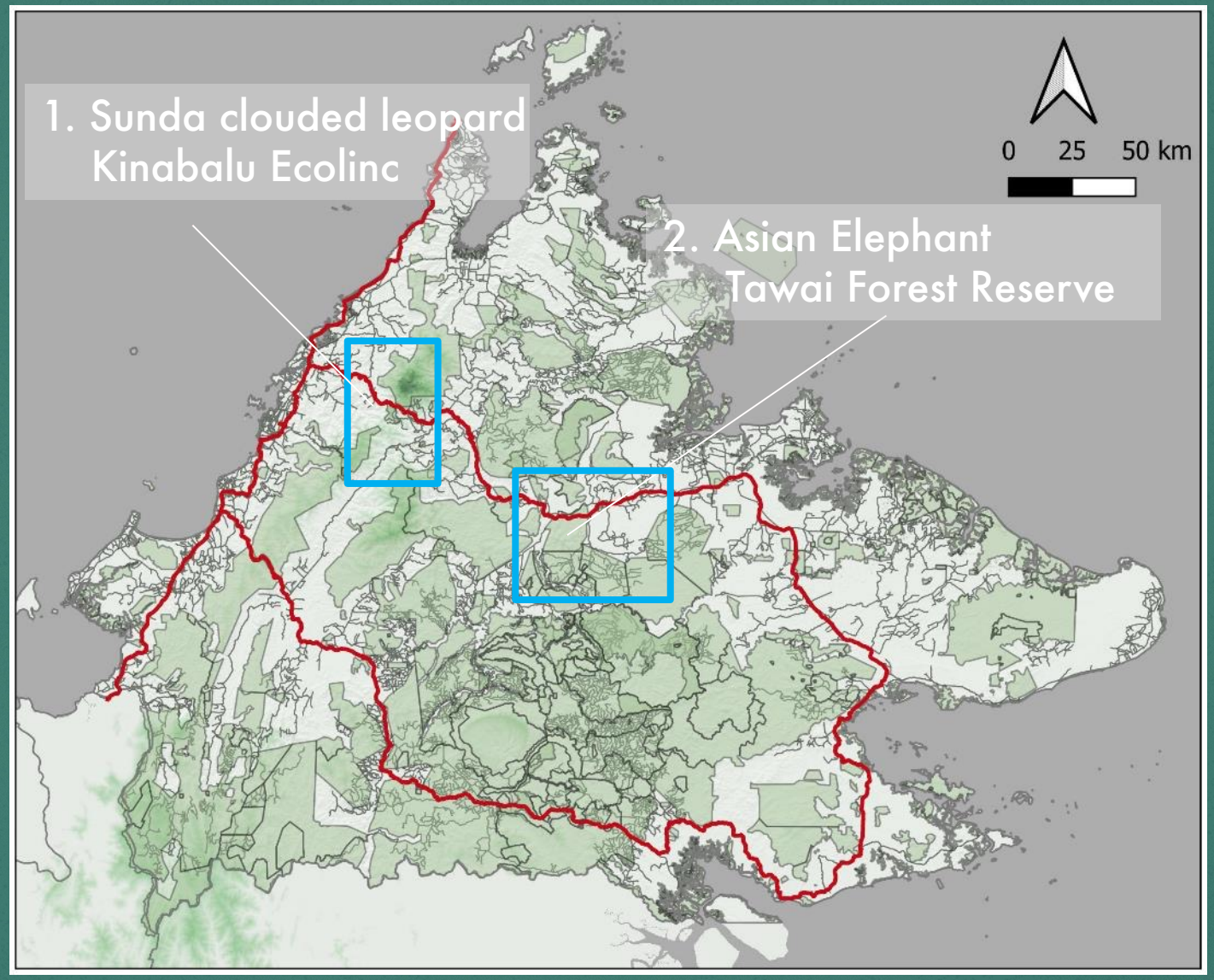
The motivation behind this user-friendly toolkit is to ensure that local stakeholders within the KAZA landscape could be trained to evaluate the impact of future land use change or development scenarios on corridor longevity or develop their own corridor models for land use planning in other landscapes. NASA also provided support for the KAZA workshop to present final models, engage potential end-users and identify opportunities to enhance decision making in the KAZA landscape where WildCRU has on-the-ground partnerships. Matching funds were provided by USFS-IP and USFS.

Brunei

- Multispecies corridors to inform new PA placement

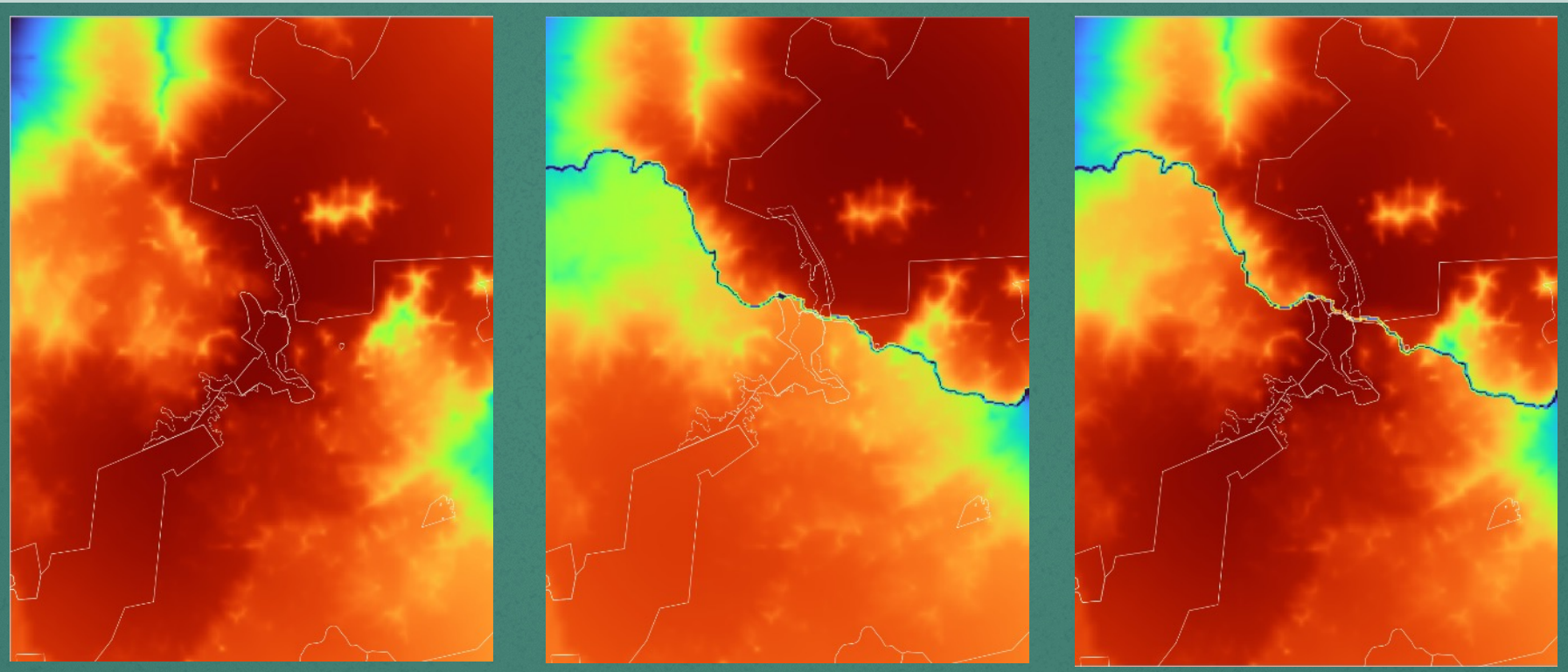


Sabah, Malaysia



Sabah, Malaysia

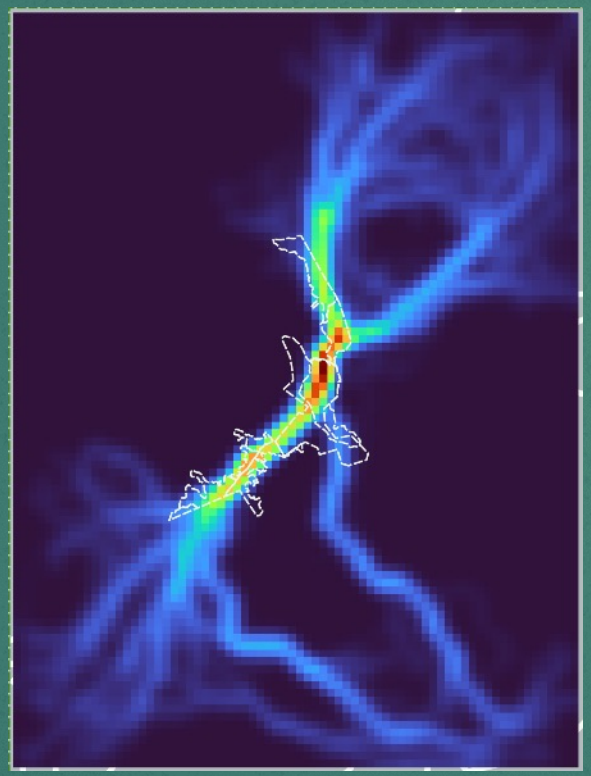
- Local Movement Kernels
  - Current condition
  - Impermeable road
  - Strategic overpass

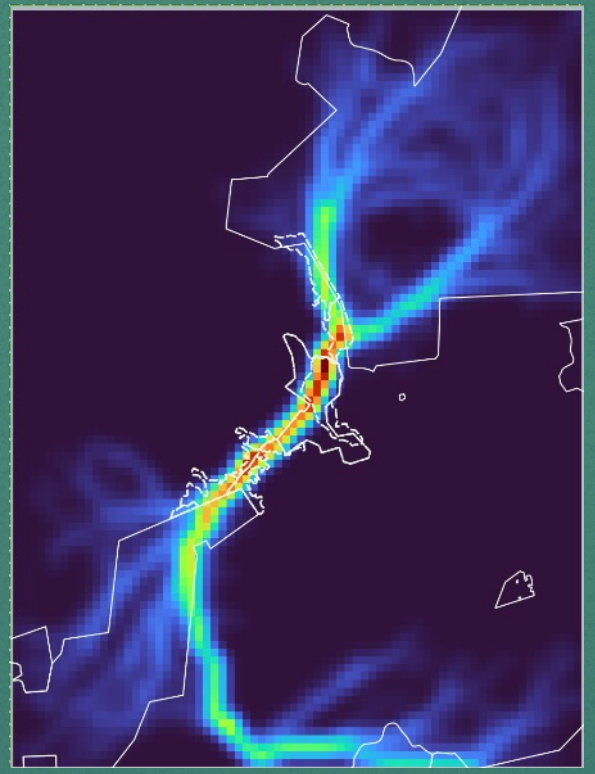


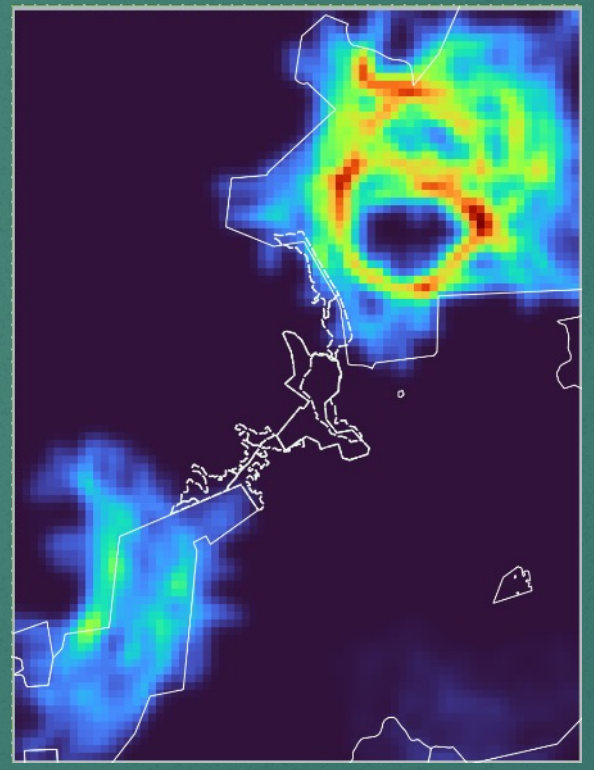
- Impacts of pan-Borneo highway expansion on Kinabulu Ecolinc corridor

Sabah, Malaysia

Corridors Current condition	Forest loss, expansion of village & agriculture; retention of PA	Forest loss, expansion of village & agriculture; loss of PA



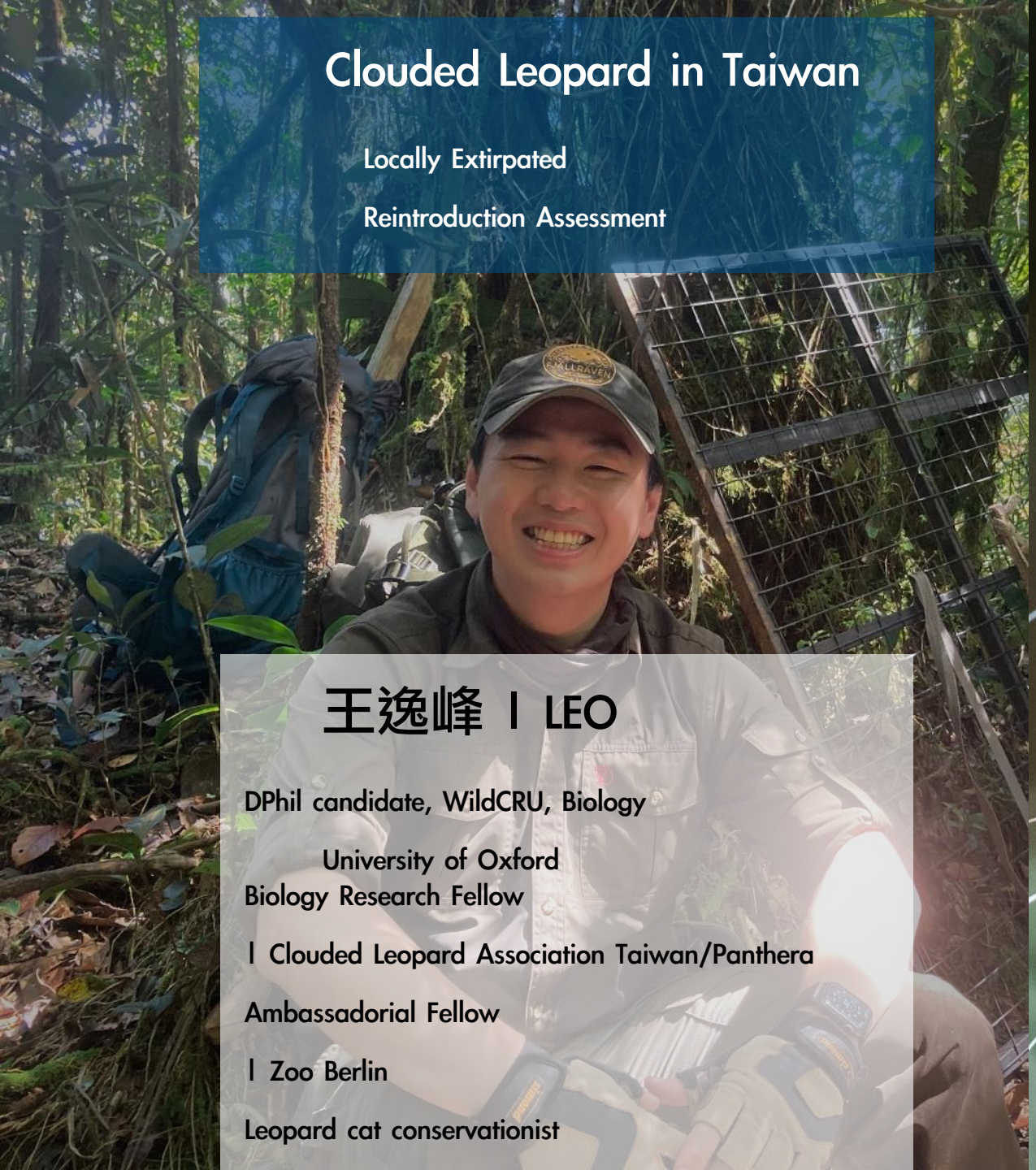




Clouded Leopard in Taiwan

Locally Extirpated

Reintroduction Assessment



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| Clouded Leopard Association Taiwan/Panthera

Ambassadorial Fellow

| Zoo Berlin

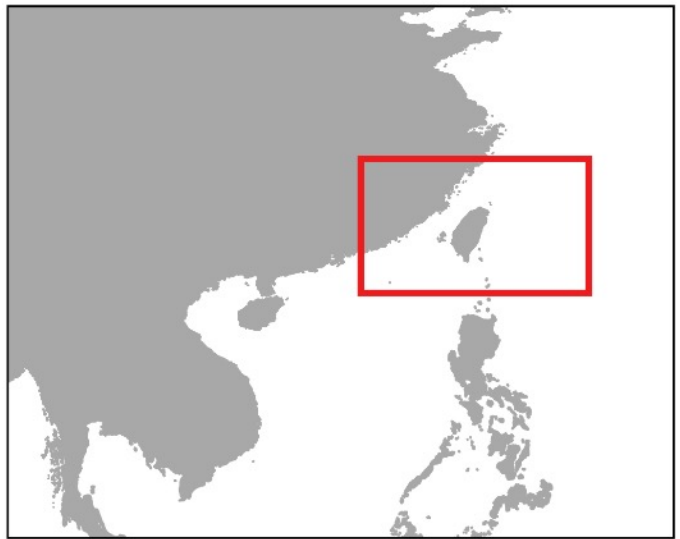
Leopard cat conservationist

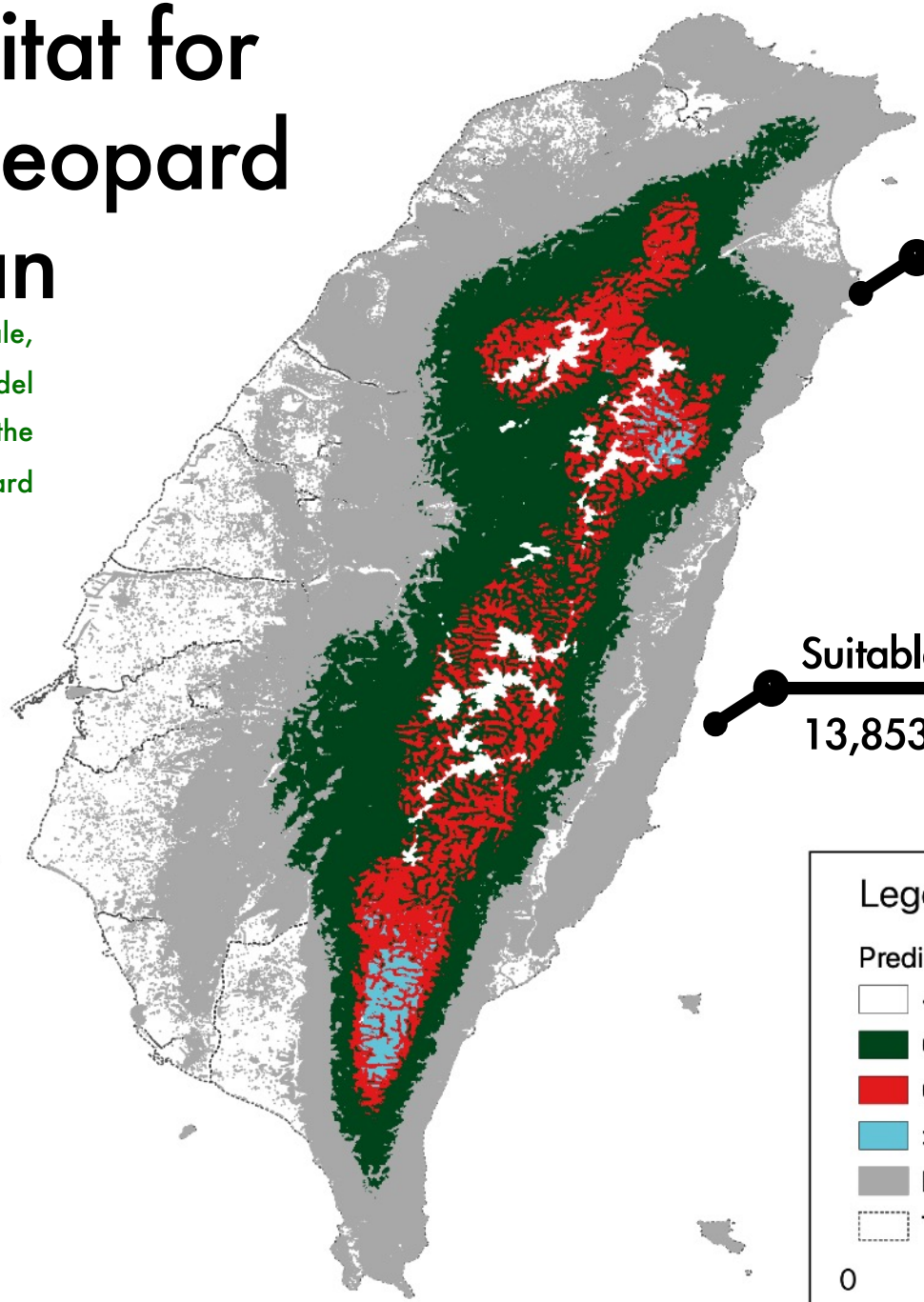
WILDCRU
Wildlife Conservation Research Unit

Suitable Habitat for the Clouded Leopard in Taiwan

WILDCRU
Wildlife Conservation Research Unit

Wang et al. (In press). A Multi-scale, Multivariate Habitat Selection Model Demonstrates High Potential for the Reintroduction of the Clouded Leopard (*Neofelis nebulosa*) to Taiwan. Oryx.





High quality habitat

3,812.67 km² (10.44%)

Suitable habitat

13,853.54 km² (37.95%)

Legend

Predicted Habitat Suitability

- <= 0.75
- 0.75 - 0.90
- 0.90 - 0.95
- >= 0.95
- Forest
- Taiwan

0 50 100 km

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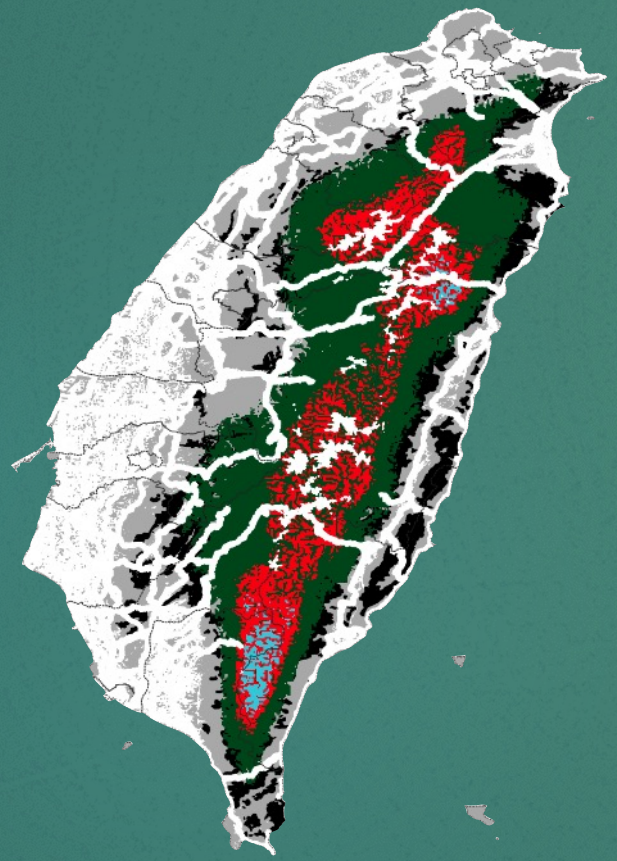
Wildlife Conservation Research Unit

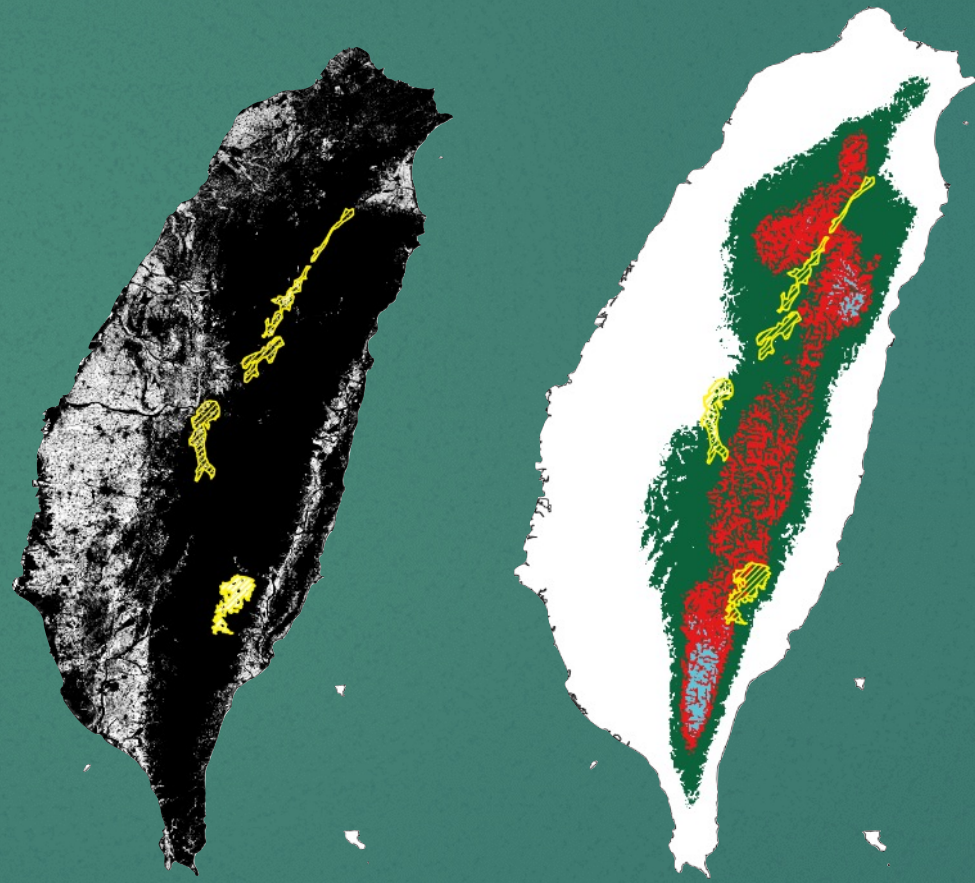
Scenario 1

Considering the current road system in Taiwan, including those within the identified suitable habitat.

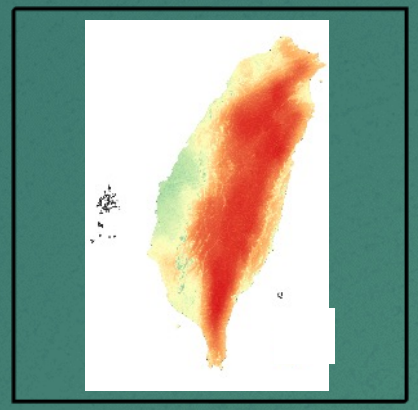
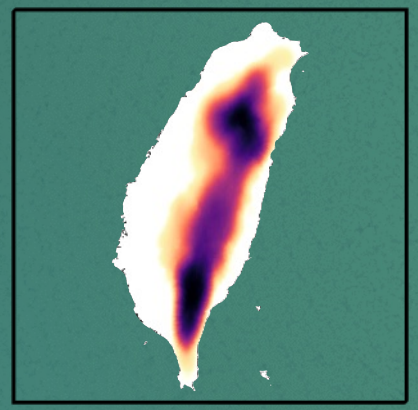
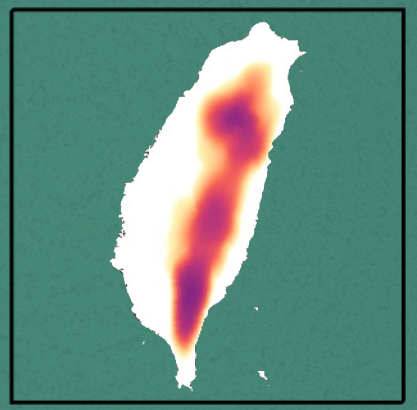
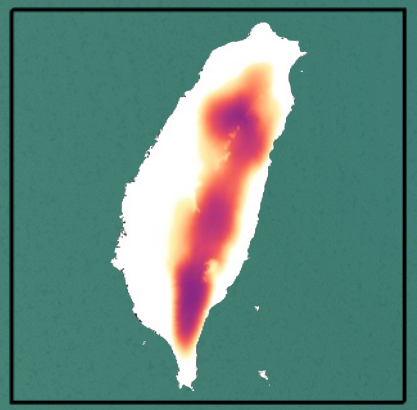
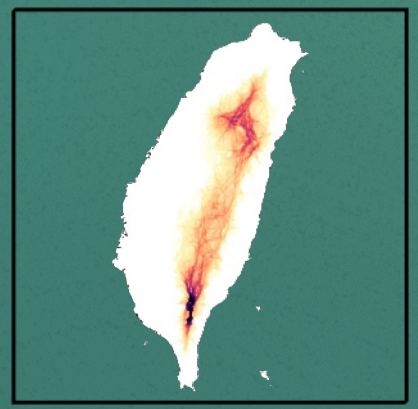


Scenario 2

Considering the current agriculture area intersecting with the identified suitable habitat, which was not included in our habitat study.



WILDCRU
Wildlife Conservation Research Unit

	Current conditions	Scenario 1: Road effect	Scenario 2: Inland Agriculture
Landscape Resistance			
Resistant Kernel			
Factorial Least Cost Corridor			

- C = 1
- Dispersal limit: 250 km
- Tolerance: 5 km

Next Steps

- We are co-convening a series of workshops in Brunei, Malaysia, and Taiwan in ~2 weeks that address the conservation and development issues described above. Attendees at these workshop include government representatives from forestry, wildlife, and parks departments as well as NGOs, universities, and the Taipei Zoo.
- Workshops and DSS trainings in Namibia and Botswana this Summer.
- Workshops and DSS trainings in Bhutan, Thailand, and Laos this Fall
- Finalize last bits of DSS functionality

Thank You!!

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