Analysis of the Socio-Environmental Impacts of a Proposed Highway between Nuevo Italia and Puerto Breu, Ucayali, Peru

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Introduction

- The Amazon Biome
  - Over 25% of the world's terrestrial species (Malhi et al. 2011, Plotkin 2020)
  - Almost 15% of planet's freshwater (Ghai et al. 2011)
  - Nearly 50% of global tropical forest carbon stocks (Saatchi et al. 2011)
  - Approximately 20% of planet's terrestrial carbon (Plotkin 2020)
- Yurua-Alto Juruá region
  - Southwestern Amazon, borderlands of Peru (Ucayali) and Brazil (Acre)
  - Links two biodiversity hotspots (Vriesendorp et al., 2006, Leite-Pitman et al., 2003)
  - High in cultural diversity with a majority percentage of inhabitants being Indigenous people from at least eight ethnicities: Arara, Ashéninka, Asháninka, Amahuaca, Shipibo, Yaminahua, Chitonahua, and Kaxinawá

Impacts of Roads

Local governments in the Peruvian interior have escalated their promotion of a road to Brazil through the remote and bioculturally rich Yurua/Juruá borderlands

Roads

- Provide access to services and markets
- Adversely impact flora, fauna, and waters of tropical rainforests (Laurance et al. 2009)
- Contribute to the loss of cultural traditions (Sawyer 2005)
- Facilitate the spread of outside diseases to Indigenous peoples with limited immunity (Napolitano 2007)
- Encourage illegal cultivation of drugs
- Facilitate trafficking of drugs, weapons, wild animals, resources, and land titles (Young 2004; Suarez et al. 2009)
- Beget other roads, deforestation, and forest fragmentation
  - In the Southwestern Amazon 75% of deforestation (83%) and degradation (66%) occur within 18-20 km of a road (Oliveira et al., 2007, Southworth et al. 2011)

Deforestation changes watershed and stream dynamics

- Deforestation and degradation of watersheds in the Eastern Amazon has led to
  - decreased water quality (Figueiredo et al., 2020, Riskin et al., 2017)
  - increased stream temperature (Figueiredo et al., 2010)
  - increased sediment concentrations (Abe et al., 2018)
  - changing structure and function of streams, particularly small streams (Deegan et al., 2010, Thomaz et al., 2020)

Limited research exists on the relationship between deforestation and waterways in the Western Amazon (Rios-Villamizar et al., 2017, Thomaz et al., 2020), and we found little research on the relationship between road development, deforestation, and streams

Data and Methods

Source	Date	Type
GTASO database	2019	Proposed road routes
GTASO Database	2019	Protected areas, current roads, forest concessions, settlement projects
RAISG	2020	Indigenous territories
HydroRIVERS Database	2020	Rivers (stream orders 1-8)
HydroBASINS Database	2020	Sub-basin level 8

Table 1. Summary of data used in hydrological and administrative analyses (also see map sources).

- Mixed methods included geospatial analysis (ESRI ArcGIS Pro Version 2.7); data cataloging and refinement; meta-analysis of previous studies on the impact of roads in tropical forests.
- Created a 20 km buffer around each route to determine the impact zone based
  - Intersection of HydroRIVERS (class 1-8) and HydroBASINS (level 8 sub-basins) with proposed route (FIgure 1).
  - Intersection of various administrative units (Figure 2)

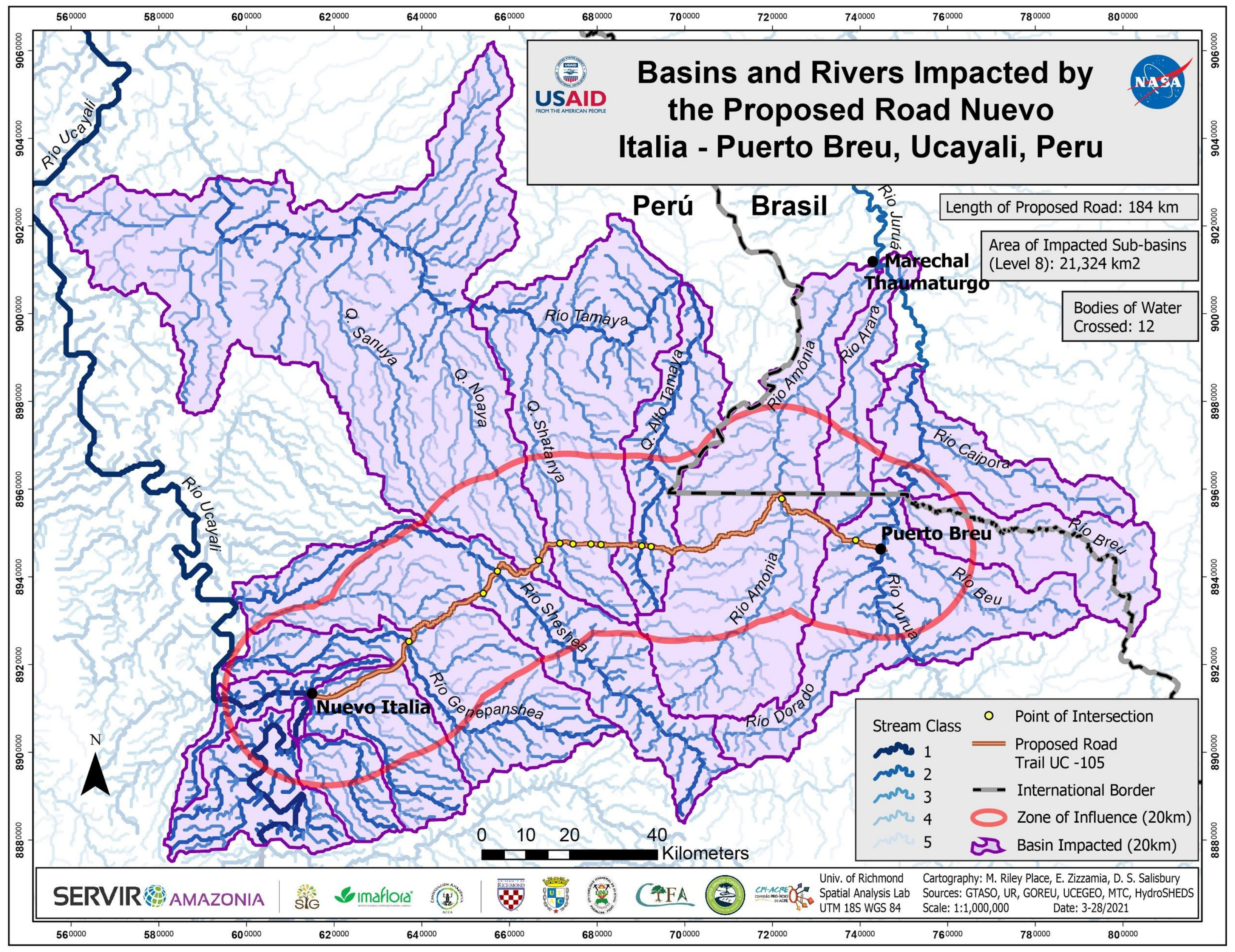

Figure 1. Analysis of potential impacts on rivers and watersheds from the proposed Nueva Italia - Puerto Breu road within a 20 km impact zone (highlighted in red).

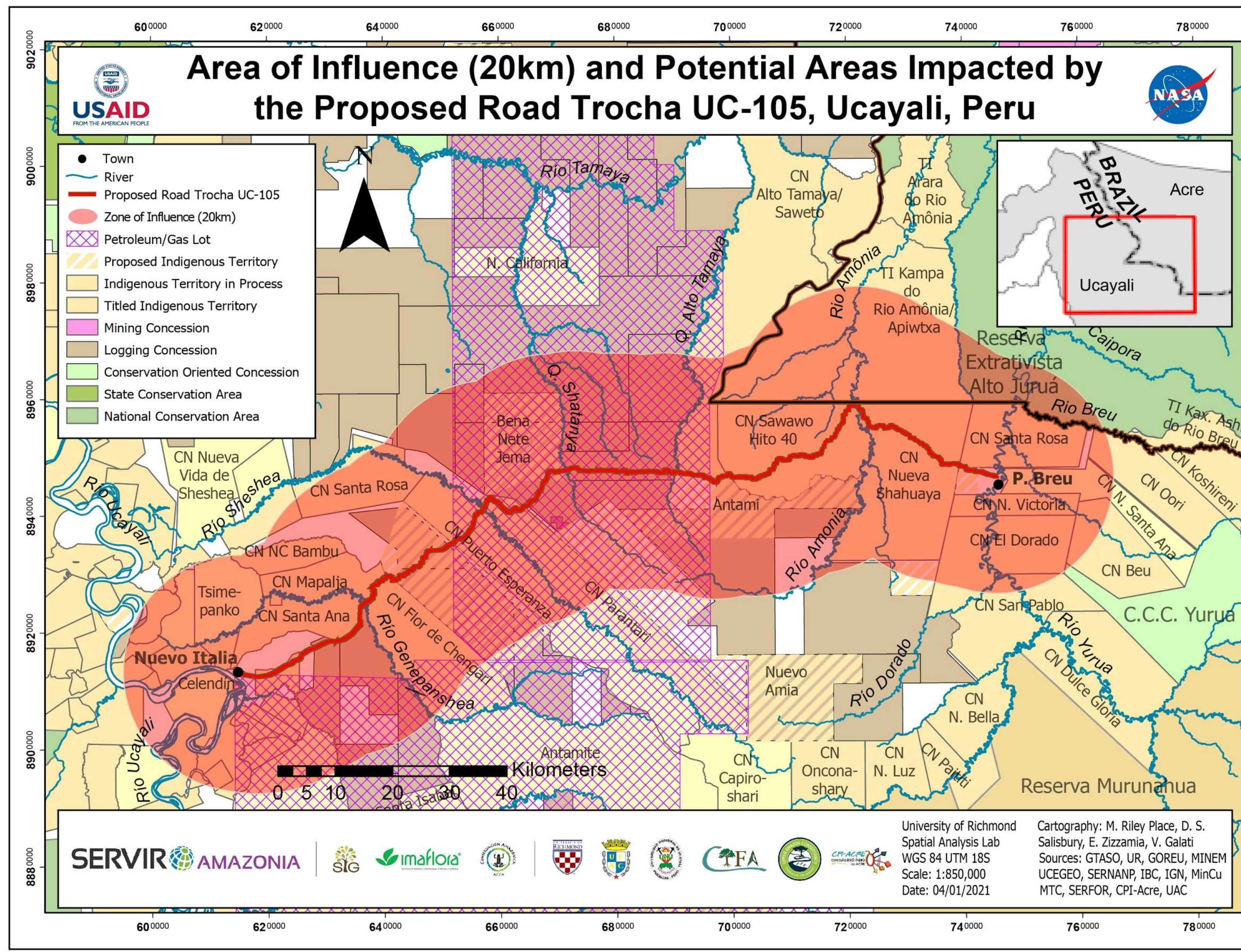

Figure 2. Proposed Nueva Italia - Puerto Breu road with a 20 km impact zone (highlighted in red).

Results

This road would impact 21,323.8 km^2 of watersheds and 3059.69 km of streams and rivers

Stream Class	Number of Intersections
2	3
3	6
4	2
5	1
Total	12

Table 2. Stream crossings by stream class (classical ordering).

Administrative Unit	Area Within Zone of Influence (km2)	Length Intersected by Road (km)
Titled Indigenous Territories	3,732.70	107.1
Proposed Indigenous Territories	1,495.50	29.4
Conservation Areas (Parks and Concessions)	188.5	0
Logging Concessions	2,383.80	63.8
Mining Concessions (+illegal mining zones)	4	0
Petroleum/Gas Lots	2,541.90	65.9

Table 3. Administrative units within the 20km impacted zone and intersected by the road.

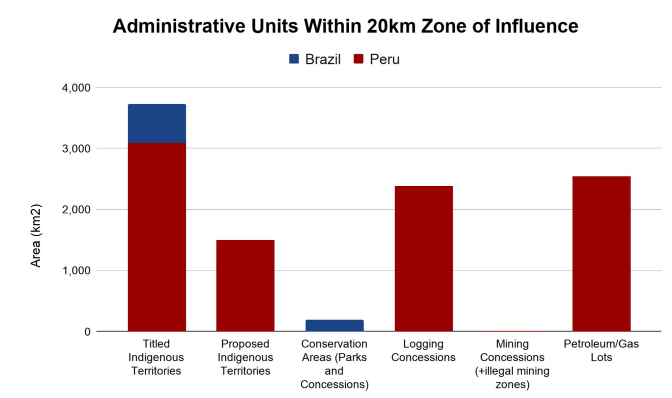

Figure 3. Total area (km^2) of administrative units within 20km impact zone.

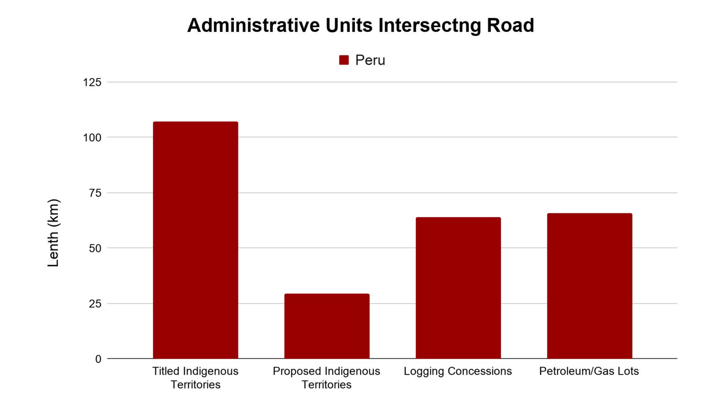

Figure 4. Total length of proposed road (km) intersecting administrative units.

Discussion

- The use of spatial analysis allows for an objective representation of the consequences of road building for stakeholders, informing local community members and policy makers
- As roads through remote Amazon regions continue to be proposed, further research is necessary to explore the potential socio-environmental impacts of road-building in these areas

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