Introduction

- The Amazon Biome
  - Over 25% of the world's terrestrial species (Malti et al., 2011, Plotkin 2020)
  - Almost 15% of planet's freshwater (Ghi et al. 2011)
  - Nearly 50% of global tropical forest carbon stocks (Saati et al. 2011)
  - Approximately 20% of planet's terrestrial carbon (Plotkin 2020)
- Yurua-Altura 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, Asheninka, Ashininka, Amahuaca, Shipibo, Yaminahua, Chinahua, and Kasiope

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-Altura borderlands

- Roads
  - Provide access to services and markets
  - Adversely impact flora, fauna, and waters of tropical rainforests (Launarde 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 deforestation, reforestation, 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., 2017, 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 (Figureide et al., 2020, Riskin et al., 2017)
  - Increased stream temperature (Figueiredo et al., 2010)
  - Decreased water quality (Figueiredo et al., 2020, Riskin et al., 2017)

Limited existence of research 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

<table>
<thead>
<tr>
<th>Source</th>
<th>Date</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTASO Database</td>
<td>2019</td>
<td>Proposed road routes</td>
</tr>
<tr>
<td>GTASO Database</td>
<td>2019</td>
<td>Protected areas, current roads, forest concessions, settlement projects</td>
</tr>
<tr>
<td>RAISG Database</td>
<td>2020</td>
<td>Indigenous territories</td>
</tr>
<tr>
<td>RAISG Database</td>
<td>2020</td>
<td>Rivers (stream order 1-8)</td>
</tr>
<tr>
<td>HydroBASINS Database</td>
<td>2020</td>
<td>Sub-basin level 8</td>
</tr>
</tbody>
</table>

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 HYDROBASINS (class 1-8) and HydroBASINS (level 8 sub-basins) with proposed project (route 1)
  - Intersection of various administrative units (Figure 2)

Results

This road would impact 21,323.8 km² of watersheds and 3059.69 km of streams and rivers

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

Works Cited