

Workshop Report

Transboundary Corridors and Ecosystem Services of the Southwestern Amazon (SERVIR Amazonia and GTASO)



June 2022





Workshop on "Transboundary Corridors and Ecosystem Services of the Southwestern Amazon (NASA SERVIR Amazonia and GTASO)"

Facilitated by University of Richmond, UFAC, ACCA, NASA, IPGH Funded by USAID, NASA, SERVIR Amazonia, UNU, ACCA, University of Richmond

> June 13 to 18, 2022 Pucallpa, Ucayali, Peru

Final Technical Report

"Taller de Corredores Transfronterizos y Servicios Ecosistémicos de la Amazonía Sudoccidental (NASA SERVIR Amazonía y GTASO)"

"Workshop sobre Corredores Transfronteiriços e Serviços Ecossistêmicos da Amazônia Sudoeste (NASA SERVIR Amazonía e GTASO)"

"Workshop on Transboundary Corridors and Ecosystem Services in the Southwestern Amazon (NASA SERVIR Amazonía and GTASO)"

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Fig. 1. Participating Institutions of the workshop

Participating Institutions

1. Association for the Conservation of the Amazon Basin (ACCA)

- 2. Regional Environmental Authority of Ucayali (ARA-Ucayali)
- 3. Pro-Indian Commission of Acre (CPI-Acre)
- 4. Department of Economic Development Regional Government of Ucayali (GOREU)
- 5. Institute for the Common Good (IBC)
- 6. National Geographic Institute (IGN)
- 7. Pan-American Institute of Geography and History (IPGH)
- 8. AIDESEP Ucayali Regional Organization (ORAU)
- 9. ProPurús
- 10. Secretary of State for the Environment and Indigenous Pueblos (SEMAPI)
- 11. National Service of Protected Natural Areas-Perú (SERNANP-Perú)
- 12. Peruvian Society for Environmental Law (SPDA)
- 13. SOS Amazonia, Acre, Brazil
- 14. Amazon National Intercultural University (UNIA)
- 15. National University of Ucayali (UNU)
- 16. National University of San Marcos (UNMSM)
- 17. Federal University of Acre- Cruzeiro do Sul (UFAC-CZ)
- 18. University of Richmond (UR)
- 19. Upper Amazon Conservancy (UAC)

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Context

The cross-border territory shared by the Peruvian regions of Ucayali and Madre de Dios and the Brazilian state of Acre is a geographic space of elevated physical, social, economic, and environmental sensitivity given its geographic location: tropical climate, poor accessibility, abundant natural resources, high biocultural diversity and isolation in relation to the respective central governments. This border territory includes areas, such as the Peru-Acre border, occupied mainly by various indigenous populations. These regions have seen an increase in resource extraction activities and informal roads in recent years. These activities include logging, informal gold mining, oil exploration, and planning of cross-border road infrastructure projects, among others. Taking into account the impacts of resource extraction, climate change and other border dynamics, local Geographic Information Science (GISc) Professionals have identified the need to update, standardize and produce cross-border geographic information on socio-environmental corridors and ecosystem services to highlight the challenges and possibilities for the protection of diversity. biocultural and sustainable development of the region (Powell, C. et al, 2019).

In an important step to achieve sustainability in the Amazon region shared between Peru (Ucayali and Madre de Dios) and Brazil (Acre), the workshop called *"Transboundary Corridors and Ecosystem Services of the Southwest Amazon"* took place from June 13 to 18 of 2022. This meeting followed the template of the three previous successful workshops of the Transboundary Geographic Group of the Southwest Amazon (GTASO) and the Pan-American Institute of Geography and History (PAIGH) in 2012, 2013 and 2019, with the additional benefit of training led by the teams of SERVIR Amazonia: NASA (The National Aeronautics and Space Administration), ACCA (Association for the Conservation of the Amazon Basin), and ABSAT (Amazon Frontier Spatial Analysis Team) of the University of Richmond. A total of 42 professionals, professors, and students from 19 institutions in Peru (Ucayali, Madre de Dios, and Lima), Brazil (Acre), and the United States (Virginia and Alabama) participated.

The workshop emphasized that the Geo-Dashboards and the process of participatory creation of thematic maps would improve the understanding of the Southwestern Amazon, the threats to its ecological corridors (Sierra del Divisor, Yurúa/Juruá and Purus conservation complexes) and its ecosystem services. of regulation (temperature of the land surface, evapotranspiration, and precipitation).

GISc professionals gathered the latest socio-environmental data (protected areas, population centers, indigenous territories, concessions, forest cover...) on the thematic corridors, both biological and infrastructure, that link the Southwestern Amazon in order to learn new techniques of spatial analysis and data acquisition. Policymakers will be able to use the maps immediately to identify the challenges and opportunities of a sustainable future.



Figure 2. Pedro Tipula and David Salisbury lead a facilitation event to identify the GIS layers most needed for an accurate portrayal and analysis of the Amazon borderlands. Photo. Jacob Ramthun, NASA

Objectives

The main objective was to train the participants from Acre-Ucayali in the Geo-Dashboards of transboundary ecosystem services, taking advantage of the updated transboundary database focused on socio-environmental dynamics.

The objectives of the workshop were:

- 1) Train participants in ABSAT SERVIR NASA Geo-Dashboards focused in ecosystem services, climate change, land cover change and transportation networks
- 2) Update, compile, standardize and distribute geographic data
- 3) Update and expand a cross-border geographic information database
- 4) Integrate the indigenous perspectives collected in the Puerto Breu workshop
- 5) Create a set of rigorous, persuasive and attractive cartographic products focused on ecosystem services and transboundary corridors
- 6) Present the initiative and results to the Ucayali public and policymakers at a conference
- 7) Strengthen and expand a transboundary network of spatial analysts (both NGOs, GOs, and IPOs) capable of assessing conservation and development issues with deep geographic knowledge rather than speculation and uncertainty.
- 8) Create a report of the process, results and next steps

Methodology

This GTASO workshop followed a participatory methodology to discuss potential issues for maps focused on ecosystem services and border corridors using various data and information sources. Over the course of five days, GTASO participants divided into six thematic groups 1) protected areas (indigenous lands and natural areas), 2) deforestation and forest degradation, 3) temperature, 4) evapotranspiration, 5) precipitation, and 6) transportation corridors, to share ideas, update data, geovisualize dynamics, develop the style of the thematic maps, review the cartography, and finally print the best versions. During the process, the GTASO updated the geographic database.

Activities Performed:

- Icebreakers to create an inclusive community of learning and mutual collaboration
- Brainstorm to create a list of existing geographic information
- Training in Google Earth Engine
- Training in the three Geo-Dashboards ABSAT-Richmond
- Creation of five transboundary thematic maps
- Conference to present the project to the public
- Brainstorm a list of the gaps in existing geographic information
- Brainstorm a list of challenges

The International Conference on Transboundary Corridors and Ecosystem Services

On Tuesday, June 14, in the auditorium of the National University of Ucayali, the formal opening of the International Conference on Transboundary Corridors and Ecosystem Services began with multiple presentations by institutions and groups from Peru, Brazil, and the United States in front of an audience of

200 people, with 104 of them being university students and 96 being professionals, community members, or professors. The conference included presentations from NASA (Msc. Helen Parache), Universidade Federal do Acre (Dr. Willian Flores de Melo), University of Richmond (Dr. David Salisbury, Dr. Yunuen Reygadas, Scott LaRocca), Universidad Nacional of Ucayali (Dr. Jorge Vela, Dr. Edgar Díaz Zuñiga), the Association for the Conservation of the Amazon Basin (Mgsc. Lucio Villa), and the Pan-American Institute of Geography and History and the Institute of the Common Good (Msc. Pedro Tipula). In the end, the public realized the importance of cooperation and transboundary geographic information in order to achieve a sustainable future for the Amazonian borders.



Figure 3: Second day of the workshop, an audience of 200 people listened to presentations by Scott LaRocca (UR), Jorge Vela (UNU) and Helen Parache (NASA in the photo) among others in the auditorium of the National University of Ucayali (UNU). Photos, Jacob Ramthun (NASA).

Geo-Dashboards

The main objective of this workshop was to train the participants in three dynamic geographic information applications, also called Geo-Dashboards, from SERVIR Amazonía and the ABSAT team that facilitate planning for a sustainable Amazon. Dr. Yunuen Reygadas and Scott LaRocca introduced the three Geo-Dashboards showing:

1) The Geo-Dashboard of Meteorological Stations and Forest Conditions: How to monitor changes in climate using the meteorological stations of the two countries (Peru and Brazil);



Figure 4: Geo-Dashboard de Estaciones Meteorológicos y Condiciones Forestales. Scott LaRocca, University of Richmond

 The Geo-Dashboard of Ecosystem Services and Forest Conditions: To predict how differing extents of deforestation and forest degradation would impact temperature and evapotranspiration in the Amazon;



Figure 5: Geo-Dashboard of Ecosystem Services and Forest Conditions. Scott LaRocca, University of Richmond

3) The Geo-Dashboard of Informal Roads and Forest Conditions: How informal roads are expanding in the Peruvian and Brazilian Amazon in the last 20 years with important impacts on forest conditions.



Figure 6: Geo-Dashboard of Informal Roads and Forest Conditions. Scott LaRocca, University of Richmond

The participants of the workshops, also experts in the field of GIS and Remote Sensing, in addition to knowing the environmental and data management challenges of the region, made recommendations for the three Geo-Dashboards:

• The Geo-Dashboard of Meteorological Station recommendation:

 \circ Have the ability to download data

- The Informal Roads and Forest Conditions Geo-Dashboard recommendations:
 - More visible data source
 - Sort roads by years
 - Add information layers
 - Clarify that the bar is for trucks
 - Upload shapes / download the information
 - More metadata about layers
 - Split layers on different screens
- The Geo-Dashboard of Ecosystem Services and Forest Conditions recommendations:
 - \circ Search by area name
 - \circ Integrate the different layers to correlate
 - \circ Name the basins
 - Differentiate bodies of water

Information Gaps and Challenges to Sustainable Planning

Taking advantage of the presence of more than 40 experts from Peru, Brazil and the USA in Geographic Information Systems and science (GISc) and remote sensing as well as taking advantage of the results of the Indigenous perspective of the previous week's Workshop on Indigenous Landscapes, GTASO identified a variety of topics where there is a need have more information:

- 1) Terrestrial carbon (extent and amount)
- 2) Deforestation and forest degradation
- 3) Meteorological Stations (real and historical data)
- 4) Environmental health (water pollution, air quality, others)
- 5) Health services in border areas (location and access)
- 6) Education (Initial, Primary, Secondary, Higher) in border areas (location and access)
- 7) Migration between Peru and Brazil (quantity and routes)
- 8) Trade flow between Peru and Brazil (quantity and routes)
- 9) Interventions to monitor and control illegal activities on the border
- 10) Updated cadaster of property rights and rural communities in the border area
- 11) Surveillance Committees (registry)
- 12) Ecosystem rehabilitation in border areas (need for more studies and projects)
- 13) Indigenous territories / Native Communities (location, extent, tenure status, population)
- 14) Indigenous populations in initial contact (migratory routes and extent)
- 15) Fauna and flora species (quantity, diversity, endemism, threatened)
- 16) Fish species (quantity, diversity, endemism, threatened)
- 17) High-quality data on the number and variety of fish
- 18) Higher resolution satellite images (less than 3 meters)
- 19) Virtual repository of Geo-information
- 20) Training in Geo-Technology and GIScience (Google Earth Engine among others)



Figure 7. Dr. Antonio Willian Flores de Melo of the Universidad Federal do Acre-Campus Floresta, Cruzeiro do Sul, talks about the challenges and lack of GIS information in the Southwestern Amazon. Photo, David Salisbury, University of Richmond

The participants also outlined how things have changed since the last time they all met in GTASO 2019, pre-pandemic, and found the following challenges in border areas:

- Lack of land use planning
- Land speculation
- Limited presence of the State
- Uncontrolled and aggressive expansion of informal and illegal roads and highways
- Aggressive expansion of illegal coca cultivation
- Oil exploitation
- Mining Concessions
- Expansion of informal mining
- Timber concessions
- Expansion of illegal logging
- Selective hunting of animals
- Lack of integrated geographic information

The Transboundary Maps

The five transboundary maps that the experts completed at the end of the four days of technical collaboration focused on the Southwestern Amazon's forest and climatic dynamics that need to be understood in order to achieve sustainability through the maintenance of ecosystem services and conservation corridors.



Figure 8: Specialists from ORAU, IGN, ABSAT-Richmond, SEMAPI, ACCA, SERNANP, IBC, and PAIGH discuss what to include in their maps. Photo, David Salisbury, University of Richmond.



Figure 9: Dr. Sonaira Silva de Souza of UFAC-Floresta, Brazil writes a suggestion while participants from ORAU, UNMSM, NASA, and Richmond wait their turn. On the other tables, students and participants from Peru and Brazil analyze additional maps. Photo, David Salisbury, University of Richmond.

1. Map of Indigenous Territories and Protected Natural Areas in the Amazon Borders between Ucayali and Madre de Dios (Peru) and Acre (Brazil)

This map serves as a foundation for the others and shows the administrative areas dedicated to the conservation of ecological and cultural diversity in the transboundary region that includes Acre, Brazil, and Ucayali and Madre de Dios, Peru.



Figure 10. View of the Map of Indigenous Territories and Protected Natural Areas in the Amazon Borders between Ucayali and Madre de Dios (Peru) and Acre (Brazil).

2. Map of Forest Conditions in the Amazon Borders between Ucayali and Madre de Dios (Peru) and Acre (Brazil), 2021

This map shows how deforestation and forest degradation often occur near Amazonian roads, and to a lesser extent near rivers. The data comes from an algorithm produced by ABSAT called the "Multi-variate Time-series Disturbance Detection (MTDD)" <u>https://doi.org/10.1088/2515-7620/ac2210</u>



Figure 11. View of the Map of Forest Conditions in the Amazonian Borderlands between Ucayali and Madre de Dios (Peru) and Acre (Brazil).

3. Annual temperature of the land surface between 2003 and 2021 in the Amazon Borders of Ucayali and Madre de Dios (Peru) and Acre (Brazil)

The largest map of the average temperature (2003-2021) indicates how deforested areas tend to have the highest temperatures. But this map also contains maps from 2003, 2014, 2019 and 2021 and a graph indicating temperature anomalies in the area (2005, 2010, 2015, 2016, 2017, 2019, 2020, 2021).



Figure 12. View of the Annual Temperature Map of the land surface between 2003 and 2021 in the Amazon Borderlands between Ucayali and Madre de Dios (Peru) and Acre (Brazil).

4. Evapotranspiration between 2003 and 2021 in the Amazon Frontiers of Ucayali and Madre de Dios (Peru) and Acre (Brazil)

Evapotranspiration, on average, has low rates in deforested areas in the largest map (2003-2021), but the additional annual maps of 2003, 2014, 2019 and 2021 show variance. The graph of evapotranspiration anomalies is consistent with the strong droughts of 2005, 2010, and 2016.



Figure 13. View of the Evapotranspiration Map between 2003 and 2021 in the Amazon Borderlands between Ucayali and Madre de Dios (Peru) and Acre (Brazil).

5. Precipitation between 2003 and 2021 in the Amazon Borders of Ucayali and Madre de Dios (Peru) and Acre (Brazil)

Precipitation maps (2003-2021 average and 2003, 2014, 2019, and 2021 annual maps) used CHRPS data to indicate the importance of elevation in creating orographic rainfall in the high jungle of Madre de Dios and Ucayali.



Figure 14. View of the Precipitation Map between 2003 and 2021 in the Amazon Borderlands between Ucayali and Madre de Dios (Peru) and Acre (Brazil). Source: GTASO, NASA, SERVIR, ABSAT, 2022.



Figure 15: Workshop participants GTASO, NASA SERVIR, ABSAT, Pucallpa, Ucayali, Peru. Photo, Miguel Alva Huayaney, UNMSM

Conclusion and Next Steps

This workshop showed the strategic importance of transboundary organizations and initiatives such as GTASO and SERVIR Amazonia in realizing a sustainable future for the Amazon biome. First, the ability of SERVIR Amazonia and GTASO to share data across borders and provide informed border context is crucial for collaborative scientific investigations into the most important challenges of the Southwestern Amazon: climate change, ecosystem services, pandemics, informal roads, and forest degradation to name a few. Similarly, the workshop facilitated the transdisciplinary, transboundary and scientific discussions needed to conduct research and create analytical maps along and across dynamic frontiers. The GTASO methodology combined with the ABSAT-SERVIR Geo-Dashboards to incorporate border knowledge into GIS to present the human-environmental dynamics on both sides of the border and accelerate the expansion of geographic information to inform decision makers and land managers at multiple scales.

Ultimately, the workshop's focus on climate variables and informal roads underscored the importance of investing in transboundary GIS workshops to further develop human capacity and ensure the continued production of useful geospatial analyses, geo-visualizations, and up-to-date transboundary geodatabases. These services and products are critical to reconciling conservation and development in a dynamic and little-known border region threatened by illegal loggers, land use and climate change, but still teeming with the ecological and cultural diversity essential for an equitable and sustainable future.

To reach this future, it is essential to have another GTASO SERVIR Amazon workshop in two years (2024) to take advantage of the technical advances of the Geo-Dashboards and generate new discussions based on better imagery and analysis. GTASO's recommendation is to hold a workshop at UFAC-Campus Floresta Cruzeiro do Sul in 2024 to reinforce the importance of Brazil in the discussions and give an important and international boost to a university known for its unique focus on traditional populations and spatial technology. In the short term, GTASO and SERVIR Amazonia should not forget transboundary issues but also look for opportunities for virtual training taking advantage of the Geo-Dashboards and their periodic updates. Of utmost importance is the map of informal roads given the rapid expansion of these corridors during the dry season.