

Date of Submission	07 July 2025
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## **IPL Project (IPL-Number) Annual Report Form**

**Period of activity under report  
from 1 January 2024 to 30 June 2025**

### **1. Project Number and Title:**

*IPL 242 - Studies of disasters related to natural and anthropogenic landslides in Brazil - Characterization of landslides triggers and impacts as a tool to rapid risk analysis – IPL 242 – PHASE I*

### **2. Main Project Fields**

Select the suitable topics. If no suitable one, you may add new field.

#### **(1) Technology Development**

##### **B. Hazard Mapping, Vulnerability and Risk Assessment**

#### **(2) Targeted Landslides: Mechanisms and Impacts**

##### **A. Catastrophic Landslides**

#### **(3) Capacity Building**

##### **B. Collating and Disseminating Information/ Knowledge**

#### **(4) Mitigation, Preparedness and Recovery**

##### **A. Preparedness**

Select the suitable topics. If no suitable one, you may add new field.

#### **(1) Technology Development**

##### **B. Hazard Mapping, Vulnerability and Risk Assessment**

#### **(2) Targeted Landslides: Mechanisms and Impacts**

##### **A. Catastrophic Landslides**

#### **(3) Capacity Building**

##### **B. Collating and Disseminating Information/ Knowledge**

#### **(4) Mitigation, Preparedness and Recovery**

##### **A. Preparedness**

### **3. Name of Project Leader**

Prof. Renato Eugenio de Lima

Affiliation: Director of the Center for Scientific Support on Disasters (CENACID) – Federal University of Paraná (UFPR) - Brazil

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Core members of the Project:

1. Prof. Lazaro Valentim Zuquette(CENACID –USP-SCar)
2. Prof. Tiago Marino(CENACID –UFRRJ)
3. Prof. Luis Gustavo de Castro(CENACID –UFPR)
4. Prof. Jefferson Picanço(CENACID –UNICAMP) :

#### **4. Objectives (5 lines maximum)**

Prepare the map of the distribution of types of mass movements throughout the country,

Classify the most destructive landslides in Brazil.

Provide scientific knowledge to facilitate the preparation and response of landslides disasters.

Apply and develop RRLA (Rapid Risk Landslides Analysis) methodology for rapid analyses of landslides, useful in disasters.

#### **5. Study Area**

The project aims to assess all landslide-prone areas in Brazil and foresees the development of detailed studies in the states of Paraná, Rio de Janeiro and Santa Catarina, **as well as other landslide-affected areas. In 2024 and beginning of 2025, the project group researched areas affected by destructive landslides in the states of Rio Grande do Sul, Paraná and Santa Catarina.**

#### **6. Project Duration**

**We are in the second half of the project's actions in PHASE 1, scheduled for 2025. However, since among the results already obtained in Phase 1, we received a new invitation from the National Institute of Historical and Artistic Heritage – IPHAN to study landslides that affect historical heritage, we propose continuing with "PHASE 2" of the research until 2027. CENACID is receiving financial support from APPA – Paraná State Port Administration for this research.**

**Therefore, on this occasion, we request approval to extend the IPL 242 project until 2027, with the title "IPL 242 - Studies of disasters related to natural and anthropogenic landslides in Brazil - Characterization of the triggers and impacts of landslides as a tool for rapid risk analysis and community protection – PHASE 2".**

#### **7. Report**

- 1) Progress in the project (30 lines maximum)

In the period 2024-2025 (1st semester), the group of CENACID scientists responsible for the IPL-242 project continued regular scientific activities, including office studies, field investigations, field training for scientists and a course on drone operation and applications in risk assessment.

We applied the group's methodologies, trained the use of the center tools as GIS “VICON”

developed by the members of the center, the RRLA - Relative Rapid Landslides Analysis (Lima, 2013), new equipment like the center tracker, and one new applicative useful to assess and investigate landslides.

Studies in various landslide and disaster situation locations have so far indicated high-intensity rainfall lasting 12 to 36 hours as the main triggers of major disasters associated with landslides in the country. We also have some situations in which we are unable to determine the process of triggering mass movements. At this moment, we are dealing with three hypotheses: day-night thermal gradient, microseisms and a new idea is related to the humidity of the night fog. For most situations, the mass movements continue to confirm their classification as translational landslides and gravitational flows. As usual in the group, all evaluated landslides were classified using the Relative Rapid Landslide Analysis (RRLA) methodology and included in the GIS software "VICON-desastres", developed by members of CENACID

In this phase of the project, we continue to advance in the qualification of the impacts caused by landslides in Brazil, with emphasis on the impacts on strategic transport systems, which were greatly affected during this period. A new applied research topic was included to study landslides that affect historical heritage. The National Institute of Historical and Artistic Heritage - IPHAN, proposed these studies to CENACID.

Highlight for participation of IPL-242 results in the XIII SOUTH-BRAZILIAN SYMPOSIUM ON GEOLOGY and in the I MERCOSUR CONFERENCE ON GEOLOGY AND MINING, both promoted by the Brazilian Society of Geology (SBG). Also

Emergency missions were carried out to assess, study and provide emergency scientific support to the response to landslide-related disasters in the country, especially for the mega-disaster in southern Brazil in May 2024.

In 2024-2025, the team continued to update the database on major landslide-related disasters in Brazil. These data are being prepared for submission for publication in the journal "Landslides". Members also continued to participate in several interviews with national media outlets.

Additionally we participated in the Federal Government project to study landslides in urban areas with poor and vulnerable populations.

## 2) Planned future activities or statement of completion of the Project (15 lines maximum).

The project is going well and we have received letters of thanks from mayors of cities that have been supported by the center's activities. Also as a result of the activities developed the group was invited by the National Institute of Historical and Artistic Heritage – IPHAN, to develop a project to protect the historical heritage, particularly the Fortress of Holy Mary, located on island “Ilha do Mel” in Paranaguá Bay, in South Brazil.

This invitation requires us to add at least two more years to the activities, so we are proposing a new stage to the project, called "PHASE 2", lasting 3 years.

Planned activities include continuing studies of specific areas affected by natural and anthropogenic disasters associated with gravitational mass movements. Also maintaining the database of landslide

disasters, including significant disasters during the period, and presenting the scientific paper already in preparation analyzing the data obtained over two decades of information.

Prof. Renato de Lima was invited to continue his participation in the Federal Government project to study landslides in urban areas with poor and vulnerable populations.

We continue to face the challenge of obtaining more financial support for the activities.

### 3) Beneficiaries of Project for Science, Education and/or Society (15 lines maximum)

The main beneficiaries of the project continue to be the communities living in landslide-prone areas in Brazil, especially the poorest, who feel safer when served by CENACID's emergency scientific support missions. In the mega-disaster that hit the state of Rio Grande do Sul, in the municipality of Caxias do Sul alone, 463,501 people [2022 census] directly benefited from the studies on geological risk associated with landslides developed by the project. As an example of the results of the prevention studies, carried out in cooperation with LAGEAMB, a prominent partner of CENACID, the municipality of Colombo, with 232,212 inhabitants (2022 census), received studies on the risk associated with landslides in urban areas that affect poor and vulnerable populations. Many other cities have benefited from the center's studies and emergency missions. In these missions, the team applies the scientific knowledge developed in the group's research. Managers and concessionaires of strategic systems on federal highways have also benefited from our research and activities. Through reports and the exchange of ideas and knowledge, scientific groups from Brazilian universities and other bodies, such as Civil Protection, planning bodies and municipalities, use research aimed at disaster preparation and prevention.

### 4) Results (15 line maximum, e.g. publications)

We produce many technical reports, including the Report about the Major landslide disaster of the State of Rio Grande do Sul.

Some specific results:

-01 (one) scientific Seminar in November 2024

-02 (two) technical field trips in the "Serra do Mar" mountains.

-03 (one) technical field trips to study the strategic federal highways BR-277 and BR-376 affected by landslides that killed people and interrupted vehicle traffic for months

-04 (four) Conferences in Geological Associations, State Secretariats and Geological Congresses.

-04 (four) Technical Reports: -Landslides in Almirante Tamandaré (PR), Earthquake and associated landslides in Rio Branco (RS), landslides in the State of Rio Grande do Sul, landslides and mudflows in the Coastal Zone, Southern Brazil, Canavieiras region.

-Prof. Renato de Lima was invited to coordinate the Session on Geological Risks and Disasters, and the team presented studies, abstracts and lectures at the event. The Director of CENACID was also invited to deliver the keynote lecture on "Experience in Major Disasters" at the Geology Conference of the MERCOSUR Countries, participation of Argentina, Uruguay, Paraguay, Chile and Colombia.

## 8. Attachments:

Some examples of studies, reports and documents produced by the team during the period. The titles are translated into English (*in blue translation of the titles to English*), but the full texts are in Portuguese (blue)

-Relatório 03-2024 (Missão RS maio2024) - Avaliação preliminar de áreas associadas a movimentos gravitacionais de massa em Caxias do Sul – RS - Renato Eugenio de Lima (UFPR), Lázaro Valentim Zuquette(USP-EESC), Marcelo Renato Lamour (UFPR), Profa. Morgana V. Silva (UFPel). (73pgs).

*-Report 03-2024 (RS Mission May 2024) - Preliminary assessment of areas associated with gravitational mass in Caxias do Sul – RS. Renato Eugenio de Lima (UFPR), Lázaro Valentim Zuquette (USP-EESC), Marcelo Renato (UFPR), Prof. Morgana V. Silva (UFPel). (73pgs)*

Below is information about the studies presented at the Technical Session “Geological Risks and Disasters” in Foz do Iguaçu-PR (Brazil) during the XIII SOUTH-BRAZILIAN SYMPOSIUM ON GEOLOGY and at the I MERCOSUR CONGRESS (South American countries) ON GEOLOGY AND MINING, both promoted by the Brazilian Society of Geology (SBG) in June/2025.

-Lima RE, Zuquette LV. Soares WA, Lamour MR, Castro LG, Marino T B - Estudo de processos deflagradores de movimentos de massa gravitacionais recentes em algumas rodovias sul-brasileiras.

Anais e Resumos do XIII Simpósio Sul-brasileiro de Geologia, 2025. Sociedade Brasileira de Geologia. - *Study of processes triggering recent gravitational mass movements on some southern Brazilian highways. Proceedings-abstracts of the XIII Southern Brazilian Geology Symposium, 2025 (in press). Brazilian Geological Society.*

-Lima RE, Zuquette LV. Soares WA, Lamour MR, Torques CV, Silva MV - Avaliação rápida de Deslizamentos em Caxias do Sul durante o desastre no Rio Grande do Sul em 2024. Anais e Resumos do XIII Simpósio Sul-brasileiro de Geologia, 2025. Sociedade Brasileira de Geologia. -

*-Rapid Assessment of Landslides in “Caxias do Sul” during the 2024” Rio Grande do Sul” Disaster. Proceedings and Abstracts of the XIII South-Brazilian Geology Symposium, 2025 (in press). Brazilian Geological Society.*



**Figure 1 - Field research in cooperation with road system engineers and geologists (left). Providing scientific support to the State of Rio Grande do Sul during the major disaster of May 2024, when a landslide destroyed the water supply system (right).**



**Figure 2 - House destroyed by a landslide during the catastrophic event that hit the Rio Grande do Sul State in May 2024.**



**Figure 3 - Translational landslide studied by CENACID that hit the BR-116 highway and several houses on top of the hill near the highway. Six people lost their lives in this mass movement in Rio Grande do Sul.**

Note:

- 1) If you will change items 2-6 from the proposal, please write the revised content **in Red**.
- 2) Please fill and submit this form to **ICL Network** <[icl-network@landslides.org](mailto:icl-network@landslides.org)>
- 3) Reporting year must be one or two years (Maximum).