

Annual Report 2022

The Biodiversity Research Consortium

Brazil- Norway (BRC)



BRC back to face-to-face activities after two years of pandemic. Above: The 2022's edition of the Tropical Ecology course Between Brazil and Norway (Photo: Rafael Assis). Below: Researchers members of the BRC and staff from Hydro who organized and/or attended the workshop on Coexistence Human-Carnivores (Photo: Hydro).

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1. Introduction and background

The Brazil-Norway Biodiversity Research Consortium (BRC) conducts research on biodiversity and climate change in the Brazilian Amazon. Founded in 2013, the consortium is formed by the Federal University of Pará (UFPA), the Museu Paraense Emílio Goeldi (MPEG), the Federal Rural University of the Amazon (UFRA), the University of Oslo (UiO) and the Norwegian aluminum company Norsk Hydro (Hydro). The first BRC Consortium agreement lasted for five years (2013 – 18), but was renewed for a new period of another five years (November 2018 to October 2023).

BRC is the result of a Hydro initiative. In 2012, shortly after taking over the aluminum operations of Companhia Vale do Rio Doce in Pará, Hydro contacted the Museum of Natural History (NHM) of the University of Oslo. NHM was given the responsibility to facilitate the creation of a consortium for research cooperation based on the recommendations of the Hydro technical report entitled “Reforestation and Wild Animals Program - HYDRO Paragominas, Pará, Brazil”, by Salomão *et al.* (2012).

In the BRC Consortium agreement, the main objective of the cooperation is “to develop applied and basic research activities, and build a solid base of results in biodiversity and climate knowledge” among the partners. The consortium should also contribute to “increasing the university-industry partnership”. In addition to joint research and publications, “post-graduation (master's and doctorate) will be an important element of the consortium's activity”.

This annual report is prepared by the BRC secretariat. It presents the main results and activities of the consortium in 2022. In the final section, important lessons learned are presented. We refer to the minutes of the meetings of the Board and Scientific Committee of the BRC and reports of specific events for the preparation of this report.

2. Main results 2022

This has been a very successful year for the BRC. After a long period with restrictions due the Covid-19 pandemic, BRC activities were resumed in 2022. Field campaigns and field courses were finally allowed, meetings and other events returned to be face-to-face format. These post-pandemic activities have been extremely important to strengthen the integration between the members of the Consortium, as well make further progress with the BRC research projects. Some of the main results throughout the year are listed below:

- The BRC has surpassed the number of publications of the previous year, which already was a very successful year in terms of publications. In 2022, a total of 12 articles were published;
- The partnership between the BRC secretariat and the Hydro's team of communication allowed the dissemination of several reports, specially posts in social media, improving even more the relevance of BRC for the non-academic audience;
- The Consortium has been represented at six events in Brazil and abroad. Among them, the Annual Meeting of the Association for Tropical Biology and Conservation (Colombia) and the XV Industry Fair of Pará (Belém). This is in accordance with our strategic plan, of disseminating BRC results and increasing its relevance;
- All BRC projects that were before delayed are now fully operational. During the year, nine projects

have started or resumed field work in the mine, and four are planning to start in the near future. It is very satisfactory to know that BRC projects are getting back on track;

- The contract for editing the BRC book has been signed and first versions of many of the chapters have already been submitted to the editor. We expect a great progress in this issue in the first months of the coming year;
- BRC's involvement in human training and capacity was remarkable in 2022. Field courses, workshops, online courses and others similar activities organized in collaboration with the consortium have significantly increased the relevance of BRC for Amazonian people;
- Although the online meetings played an important role for keeping the communication between the partners, the return to face-to-face meetings has brought a perspective of an even better progress of the consortium.

3. The BRC Board

The BRC board is composed of one representative from each institution participating in the consortium. During this year, the members were: professor Marcos Piedade (UFRA), professor Alexandre Bragio Bonaldo (MPEG), professor Leonardo Sena (UFPA), Domingos Campos (head of HSE - Hydro) and Fridtjof Mehlum (senior researcher - UiO). However, substitutions of some of the members will take place from the next board meeting, in February 2023. Eduardo Figueiredo (Hydro) will replace Domingos Campos, and Hugo de Boer (UiO) will replace Fridtjof Mehlum. Leonardo Sena (UFPA) served as chairman of the board.

The Board held its annual meeting on February 10th 2022 by video conference. The extension of the BRC agreement and the implications of the pandemic for the progress of BRC projects were some of the topics discussed during the meeting.

4. The BRC Scientific Committee

The Scientific Committee (SC) of the BRC makes all scientific and operational decisions in general. It is composed of two representatives from each member institution and normally meets twice a year. In 2022, the committee members were: professors Lina Bufalino and Norberto Cornejo Noronha (UFRA), researchers Alberto Akama and Rogerio Rosas Silva (MPEG), professors Ana Cristina Mendes de Oliveira and Leandro Juen (UFPA), senior researcher Fridtjof Mehlum and professor Øystein Wiig (UiO). Patrick Brading (environmental manager - Norsk Hydro), Domingos Campos (head of HSE & CSR, Hydro). The latter was during the year replaced by Eduardo Figueiredo.

The Scientific Committee had two meetings in 2022. The first took place by video conference on February 9th. Fridtjof Mehlum (UiO) chaired the meeting. The following members were present: Rafael Assis (UiO/BRC), Øystein Wiig (UiO), Ana Cristina Oliveira (UFPA), Leandro Juen (UFPA), Domingos Campos (Hydro), Patrick Brading (Hydro), Norberto Noronha (UFRA), Lina Bufalino (UFRA), Alberto Akama (MPEG). One of the main focuses of this meeting was to resume many of the BRC activities that have been interrupted since 2020 due to the pandemic. Among the main topics discussed: updates on resumption of field activities, logistic issues (such as the car rental, hospital letter, safety introductory course, etc), updates on projects' extensions and changes on budget, the BRC annual report 2021, status on the Biodiversity Indicators initiative, status of the BRC book, and others.

The second meeting took place on September 27th (Figure 1), in Belém (UFPA). It was the first face-to-face meeting since February 2020, when online meetings took place due to the pandemic. Participants were: Rafael Assis (UiO/BRC), Fridtjof Mehlum (UiO), Øystein Wiig (UiO), Lenardo Sena (replacing Ana Cristina Oliveira -UFPA), Luciano Montag (replacing Leandro Juen -UFPA), Eduardo Figueiredo (Hydro), Norberto Noronha (UFRA), Alberto Akama (MPEG). Other BRC members participated as observers. From this meeting on, Eduardo Figueiredo (director of sustainability and social impact, Hydro) replaced Domingos Campos. Eduardo was thus nominated as a new member of the SC, since Domingos is retiring from his position at Hydro. Fridtjof Mehlum (UiO) chaired this meeting. Some of the issues addressed at the meeting were: status of all BRC projects (including contracts issues and resumption of field activities), status on the Biodiversity Indicators initiative, and situation of the accommodation inside the Paragominas mining area. for BRC field campaigns, updates of the BRC book, BRC evaluation survey 2022, Hydro's plans for mining operations and the new system for bauxite tailing management, procedures for updating the BRC research plan and priorities for research themes for new calls for projects, extension of the BRC agreement, among others. This meeting was also marked by paying tribute to Victor Barbosa, who left the BRC in the middle of the year (Figure 2). Victor has been an important member of the consortium since its beginning, and the attendees acknowledged Victor for all his contributions.



Figure 1. BRC Scientific Committee members and observers during the face-to-face meeting, in September 2022, at UFPA (Belém – PA) (Photo: Rafael Assis).



Figure 2. Victor Barbosa is honored by Fridtjof Mehlum, head of the SC, for his partnership and contributions for the BRC (Photo: Rafael Assis).

5. The BRC Secretariat

The BRC secretariat is responsible for coordinating the activities of the consortium and for preparing and planning Board and Scientific Committee meetings. It is also responsible for coordinating project submission processes, fundraising initiatives, as well as internal and external communication. It is headquartered at the Natural History Museum in Oslo and led by Dr. Rafael Leandro de Assis.

6. The BRC Monthly Meetings

Established in June 2020, the monthly meetings have been a good channel for communication between the consortium members. In these meetings, everyone is welcome to participate: BRC researchers, staff from Hydro and FADESP, students, and other members. The

monthly meetings take place always online, preferably on the 15th day of each month, and it is mediated by the BRC's secretariat. They last about two hours, and all kinds of topics are addressed, such as doubt about projects' contracts, field work logistics, updates, achievements, etc. The minutes for those meetings are always prepared by the secretariat right after the meeting. They are sent to all members of the consortium, and stored in the BRC's repository folder.

We had along the year 10 monthly meetings. They did not occur in the months when we had the SC meetings, such as February and September. In average, about 15 people attended the meetings, from both Brazilian and Norwegian counterparts. Among the main topics addressed, doubts/updates about BRC projects, preparations for resumption of field work, discussions on the Indicators Initiative, the BRC book, and many other issues.

These meeting have been of major importance to discuss all sort of topics relevant to the consortium, and approximate members of the BRC the secretariat and Hydro. Also, it has been a great opportunity get people from FADESP and other partners of the consortium involved. We thank you for all those that attended the meetings and that contributed for the discussions.



Figure 3. Attendees during the BRC monthly meeting, edition of December 2022 (Photo: Rafael Assis).

7. Overcoming the Challenges Faced by the Pandemic

The years of 2020 and 2021 will forever be remembered as the years of the Covid-19 pandemic. Several sectors of society were deeply impacted by the pandemic, from industries to segments that include travel agencies, services and businesses in general. Similarly, the sector involving academic institutions also suffered its consequences. With regard to the BRC projects, all had to stop fieldwork in mid-March 2020 and could not resume activities until the end of 2021. Laboratory activities were also severely impacted by the pandemic.

Although the year of 2022 also began with several restrictions related to the pandemic, such as limited lab activities and field work, the situation during the last part of the year reached close to pre-pandemic levels. Thus, many of the projects managed to resume their planned activities regarding lab and field work, especially in the second semester. This was possible thanks to the preparations that were made while restrictions applied to field work were still ongoing. For example, to facilitate this resumption, and speed up the restart of projects whose activities were delayed, Hydro moved the “recycling” course to Belém (work safety course to work in mining areas, generally provided in Paragominas). This initiative started in the end of 2021, and continued until May 2022.

Also, the close contact between research leaders, the BRC secretariat and Hydro staff allowed this transition from the pandemic to the post pandemic situation to happen in the most efficient way. Many of the projects that were planning field work this year were new projects, which means they did not have experience with all the requirements demanded to work in the mining area. In addition to that, several of the rules to access the mining have been first implemented or updated since the last two years, which also demands adaptation from all the partners. One example is the Hospital letter, a document necessary to testify that anyone who faces an accident in the mining will have the proper medical assistance. This and many other issues were solved through dialogues and negotiations, mostly mediated by the BRC secretariat. Thus, the good communication between the partners was the engine to make the resumption of activities happen in the best way possible.

Finally, it is worth mentioning the administrative/financial support that the company Hydro has been offering to all project leaders, in order to prevent the delays caused by the pandemic from affecting the quality of their projects. In this context, Hydro has been flexible in helping solving the problems encountered by the projects, and is considering adjusting the schedules and budgets of the projects. Thanks to Hydro’s efforts, 10 projects had concluded the contract amendments in 2022 for the adjustment of budget and/or schedule. In addition, Hydro maintained the scholarships payment during the pandemic period, even though most activities were paused. This enabled the project leaders to keep their team and be ready to resume field activities the soonest possible.

This confirms the solid partnership that has been built between Hydro and the research groups, and the willingness to support the studies so that they achieve the goals initially proposed. In addition, there was a great concern with measures to protect the health status of the BRC members. From the beginning of the pandemic, the well-being of all participants was considered as first priority, and all partners were very transparent in communicating measures to contain the spread of the virus. It has been highly important to show all BRC members that health is a major concern and that activities will be resumed only when the safe conditions are guaranteed for everyone.

8. Research project activities

In 2022, most of the BRC projects from the last call for new projects (2019) were ready to start, with all the delays involving contract issues been solved. In addition, many of them had either started or resumed their field work activities. This is also true for some of the older projects which had to interrupt their campaigns due to the pandemic.

Many of the delays were caused due to negotiations between Hydro and project leaders related to financial adjustments (mainly caused by the devaluation of the Real against the Dollar, increasing costs for reagents and equipment) have impacted several projects' budgets. In face of this problem, Hydro has agreed on adjustments to the previously proposed budget for all the projects that needed such changes. Thanks to these adjustments in the initial budget, projects will be able to perform their activities as proposed in their projects.

Therefore, all the BRC projects approved after the last call for project proposals (except one) are already in full operation (Annex 1). Only one of the projects listed in Annex 1 however, has not yet started - BRC 15/17 (The *Topsoil* project). The reason is that there has been a change in funding to support this research. It was anticipated that this project would be financed by external funds, but in the end no external funds were obtained.

As for scientific production, the year 2022 was another very productive year in terms of the number of articles published. There were, in total, twelve articles published or accepted for publication. These publications covered a large variety of research topics: forest restoration, aquatic and terrestrial insects, herbivory, aquatic plants and many others. Below are some highlights of the publications:

- a. we now have a better understanding of how bird communities respond to different methods of restoration (“BRC0033 – *Taxonomic diversity and functional diversity of bird communities in mining areas undergoing passive and active restoration in eastern Amazon*”, Barros et al. 2022 – Ecological Engineering);
- b. we improved our knowledge on how Odonata larvae (dragonflies – aquatic insects) are influenced by habitat conditions (“BRC0036 – *Habitat conditions in streams influence Odonata larval assemblages in the eastern Amazon*”, Ribeiro et al. 2022 - International Journal of Odonatology);
- c. we obtained insight in the relationship between herbivory, environmental variables and functional traits for a species of aquatic plant (“BRC0040 – *Which variables influence the herbivory amount on Montrichardia spp. in aquatic ecosystems?*”, Fares et al. 2022 - Revista Biología Tropical);
- d. and how fishes respond to habitat alteration across Amazonian streams (“BRC0045 - *Fish functional responses to local habitat variation in streams within multiple land uses areas in the Amazon*, Maia et al. 2022 - Neotropical Ichthyology).

All BRC publications are listed in Annex 2. These studies are very important to increase knowledge of the most diverse biome on the globe, and reveal that there is still a lot to be known about the flora and fauna of the Amazon, as well as better understanding how to minimize the impact on the environment caused by the exploitation of natural resources. The results are also very relevant as a scientific basis for greener practices in the attempt to ensure more sustainable exploration in the region. In addition, the high number of publications reveals that some of the consortium's most important objectives, which is the development of research activities and the strengthening of the university-industry partnership, are being achieved.

9. Field Course in Tropical Rainforest Ecology and Biodiversity

The field course is carried out by the partner institutions of BRC and is part of the graduate programs of the participating institutions. Funding for the course was obtained from the Norwegian Center for International Cooperation in Education (DIKU), during the UTFORSK call. The course includes two parts: one in Brazil and one in Norway. In the first part, eight students from Norway (NMBU and UiO) travel to Brazil and join eight students from Brazilian institutions (UFRA, UFPA and MPEG) for fieldwork in the Amazon rainforest. For the second part, they go in the opposite direction: students from Brazil travel to Norway and work together with students from Norwegian institutions. Due to the pandemic, the course was not offered in 2020 and 2021, but finally was held again in 2022 after two years of hiatus.

The third edition of the course took place between August and November 2022. Firstly, the Norwegian students from UiO and NMBU (Norwegian University of Life Sciences) went to Belém, Brazil and met with students and professors from UFRA, UFPA and MPEG. The group travelled by boat to a field station in Caxiuanã National Forest – Amazonia (Figure 4 - *Top*) where they had classes on tropical ecology and had a chance to develop their own short-term field projects (supervised by the professors in the field). After concluding this stage, the students had a chance to visit the Hydro mining area in Paragominas (Figure 4 – *bottom*).

The second part of the course took place between October and November 2022, in Norway. Students and professors from both countries had a chance to meet each other once again, this time in Oslo (Figure 5). The group developed lab activities related to DNA extraction and analysis of samples collected in Brazil at the University of Oslo. They also had classes on scientific writing, and visited places in Oslo such as the Norwegian Folk Museum, and a Natural Reserve located in the Gressholmen Island.

This initiative is very important for our objectives of exchanging students and teachers between the two countries, as well as for strengthening collaboration between institutions and research groups.





Figure 4: The 2022's edition of the Field Course in Tropical Ecology and Biodiversity. Top: Students and professors at the field station, in Caxiuanã National Forest (Brazilian Amazon). Bottom: Visit at Hydro Paragominas (Photo: Rafael Assis).



Figure 5: Students and professors of the field course at the Natural History Museum, Oslo (Photo: Rafael Assis).

10. Course on Forest Restoration between BRC and UFPA

Between June 28th and 30th, BRC and UFPA organized the course “*Introduction to Ecological Restoration for the Recovery of Degraded Areas*”. The course aimed to provide theoretical and practical training on concepts, legislation and application of methods for planning and executing forest restoration, stimulating the debate on the subject. Its objective is to expand knowledge on the subject, collaborating with actions under development in the Amazon region and, therefore, contributing to the technical training of professionals in the area.

The course was held by the leader of the secretariat, Rafael Assis, and was taught entirely online a virtual platform (Figure 6). As the course was conducted over the internet (*online*), it opened up the possibility of participation by people from different regions of the country. By the end of the application period, more than 25 people had applied, from different parts of Brazil. The professional profile of those enrolled was very diverse, including biologists, forestry and environmental engineers, agronomists, among others.

The course was a success. Many of the students participated in the final evaluation of the course and the vast majority highlighted the importance of the learning obtained, and submitted excellent course evaluations, as well as great suggestions for improvement.



Figure 6. Students during the virtual course “*Introduction to Ecological Restoration for the Recovery of Degraded Areas*”, organized by UFPA and BRC (Photo: Rafael Assis).

11. Workshop on Coexistence Human-Carnivores

From the November 8th to 10th 2022, the Coexistence Planning Workshop was held for Hydro Paragominas, as part of the Action Plan for Human-Carnivore Coexistence Project (Figure 7). This Workshop is a creation of BRC prof. Silvio Marchini (USP) and Lara Ramos (UFPA), both members of the project “BRC 24/19 - Coexistence plan for human and carnivores”, coordinated by professor

Leonardo Sena (UFPA). The main focus was addressing the conflicts between humans and jaguars.

The workshop took place at Hydro Paragominas, and had as main objective to reach the society of Paragominas as a whole: stakeholders and organizations involved in human-fauna interactions or that may have governance over these interactions. According to Lara Ramos, the workshop aims to use the jaguar as an ambassador species for the project, understanding its various interactions in various contexts in the municipality of Paragominas, and reducing the negative impact of this conflict for both carnivores and people. It may help to mitigate the negative effects in the short and medium term for jaguars and several other carnivore species.

Another researcher who participated in the workshop was Dr. Rogério Cunha de Paula (National Center for Research and Conservation of Carnivorous Mammals - CENAP, belonging to the Chico Mendes Institute for Biodiversity Conservation - ICMBio), one of the leading specialists in Action Plans for Big Cats in Brazil. He stated that there will be a National Action Plan for the conservation of the Jaguar. Thus, the BRC's Coexistence plan for human and carnivores project will have actions that will have a strong impact on the jaguar's conservation, placing Hydro as a mining company that will have coexistence as an important principle for its sustainability at its core, and Paragominas as a whole will be able to serve as an example for other places in Brazil.

The organizers of the event had the full support of the BRC and Hydro, which also recognize the importance of efforts like these to guarantee the conservation of crucial species for the Amazonian ecosystems, as well the welfare of the human populations that live in eventual contact with those animals.



Figure 7. Researcher members of the BRC and staff from Hydro who organized and/or attended the workshop on Coexistence Human-Carnivores (Photo: Hydro)

12. BRC represented at the Annual Meeting of the Association for Tropical Biology and Conservation

During the days 10-14 of July 2022, the 58th Annual Meeting of the Association for Tropical Biology and Conservation, took place in Cartagena (Colombia). The Association for Tropical Biology and Conservation (ATBC) is a scientific professional society formed in 1963 as the Association for Tropical Biology. The Association comprehends over 900 members from 67 countries, which are students, researchers, educators, and conservation practitioners concerned with issues of science, conservation, development, and environmental policy in the tropics. They organize a meeting every year, which is one of the most relevant in the field of tropical ecology and conservation. However, due to the pandemic, they postpone the event in the years 2020 and 2021. So, after two years of hiatus, the conference was once again organized now in 2022.

The BRC was represented in the event by the leader of the secretariat, Rafael Assis, who held a presentation entitled "A decade of studies on forest recovery after mining in the Eastern Amazon: what have we learned?" (Figure 8). In the talk, Rafael explained that the BRC has for nearly ten years conducted projects on forest recovery, restoration of biodiversity and soils, biomonitoring and bioindicators, and greenhouse gas fluxes related to mining, both in terrestrial and aquatic systems. Among the main results presented, the success of the natural regeneration as restoration technique, the tolerance that several ground-living mammals present across different habitats in the mining area, how diversity of birds is much higher in the altered primary forests (even after eight years of recovery), among others.

The feedback of the attendees of the meeting was extremely positive regarding BRC's contribution to the field. Many recognized that BRC indeed works as a laboratory to understand ecosystems' restoration in areas impacted by mining and provide low-impact alternatives. Finally, this was a great opportunity to disseminate the achievements of the consortium in what regards results on forest restoration, as well as significantly improve the international network.



Figure 8. Rafael Assis at the 58th Annual Meeting of the Association for Tropical Biology and Conservation, in Cartagena (Colombia). Rafael represented the BRC in the conference with the work entitled: "A decade of studies on forest recovery after mining in the Eastern Amazon: what have we learned?" (Photo: Rafael Assis).

13. BRC in Online Events

Although Web Seminars were the main format for communication across the years of 2020 and 2021, this has been reduced during the year of 2022. Still, some events were held in this format, especially at the first months of the year when the physical attendance was still not recommended (due to the pandemic restrictions).

For example, some students who developed their work within BRC projects performed online public defenses. Mrs. Suellen F. Vinagre, student of Prof. Leandro Juen (UFPA), presented online the qualification of her master thesis, entitled “Physiological Characteristics and Body Temperature Regulation of Dragonflies (Insecta: Odonata), Central Amazon” (Original title: “Características Fisiológicas e a Regulação da Temperatura Corporal das Libélulas (Insecta: Odonata), Amazônia Central”). Another student, Mr. Victor R. S. Ferreira, presented his qualification for PhD of the work entitled “The Effect of Bauxite Mining on the Biodiversity and Morphophysiological Patterns of Odonata (Insecta) from the Amazon” (Original title: “O Efeito da Mineração de Bauxita Sobre a Biodiversidade e Padrões Morfofisiológicos de Odonata (Insecta) da Amazônia”) (Figure 9).



Figure 9. Online events with master's and doctoral qualification of students who developed projects with BRC. Mrs. Suellen F. Vinagre (left - 8A), and Mr. Victor R. S. Ferreira, both from UFPA (right - 8B).

14. Other Participation in Events

Researchers and colleagues associated with BRC participated in several events throughout 2022 and had the opportunity to disseminate results of BRC projects, in addition to joining round tables and debates on themes related to environment and mining. One of them, the “2nd Mining and Environment Symposium”, occurred as an online event on 10-11 August 10, and was organized by

the Federal University of Vicosa (Minas Gerais, Brasil). Prof. Gracialda Ferreira attended the Symposium and presented results of her projects developed in collaboration with the BRC.

Another event was the “XV Industry Fair of Pará”, organized and promoted by the Federation of Industries of the State of Pará System (FIEPA) for more than 30 years. In the Fair, the visitors had a chance to see potential investment for the region, in addition to facilitating the exchange of experiences between companies. The BRC was represented in the event by professors Ana Cristina M. de Oliveira (UFPA) and Marlúcia B. Martins (MPEG), and staff from Hydro including Mayra Barral (Figure 10 - *left*). The event took place in the Hangar Convention Center (Belém), on 19-22 October.

Members of the BRC were also present in the event “Pará Forest 2022”, organized by the IDEFLOR-Bio (The Institute for Forestry Development and Biodiversity of the State of Pará), on 9-10 November (~~online format~~). BRC was represented in the roundtable “Forest Restoration” by the former BRC student Walmer Bruno Martins (UFRA), and Hydro’s staff Mayra Barral. Also, prof. Gracialda Ferreira, former member of the BRC, was pointed as moderator of the panel “Wood products from the forest: diversity, productivity, production and market”.

BRC was also represented at the 2022’s Science Summit of the 77 United Nation General Assembly, which took place in the period 13-30 September. The Summit aims to examine what enabling policy, regulatory and financial environments are needed to implement and sustain the science mechanisms required to support genuinely global scientific collaborations across continents, nations and themes. The event brings together thought leaders, scientists, technologists, innovators, policymakers, decision-makers, regulators, financiers, philanthropists, journalists and editors, and community leaders to increase health science and citizen collaborations across a broad spectrum of themes ICT, nutrition, agriculture and the environment. For this event, the BRC was represented by the leader of the secretariat, Rafael Assis, which held a talk in the panel “Industry-based research to support environmentally sustainable practices”. Rafael presented the BRC as a model for conservation of the Amazon, by developing researches on forest restoration on post-mined areas and improving human capacity in the Amazon region. The talk was given online.

Finally, BRC was also represented in the November Conference - Brazil and Norway, which took place in Rio de Janeiro 7-9 November. The November Conference is an annual event that brings together academics and industrial practitioners from Norway and Brazil to discuss challenges in the energy industry. This year the focus of the conference is on the “Twin Transition”: digital and sustainable. Rafael Assis represented the BRC in the event with the talk: “The Industry-based Research and the Protection of the Amazon: The case of the BRC”. The talk highlighted the importance of the energy transition in the Amazon, from fossil fuels to clean energy, but aiming in sustainable practices and investment on human capacity, taking the BRC Consortium of an example (Figure 10 - *right*).



Figure 10. BRC represented in events. To the left, professor Marlúcia Martins at the XV Industry Fair of Pará (Belém) (Photo: Marlúcia Martins); to the right, Rafael Assis at the November Conference Brazil and Norway (Rio de Janeiro) (Photo: Rafael Assis).

15. Partnership between BRC and Hydro's Communication Team

Since 2021, the BRC secretariat has been working close together with Hydro's communication staff. They held a monthly meeting and update each other about important events or achievements of the Consortium that may yield relevant material for dissemination. This resulted in several articles published in print newspapers and digital media, in addition to television reports, were released during the year.

On October 27th, an article in the newspaper "Portal Rede Pará" highlighted the field course in Tropical Ecology and Biodiversity, coordinated by the BRC secretariat and having the BRC universities, museums and Hydro as partners (Figure 11). The report also acknowledged the importance of the course for training and international exchange of students from BRC partner institutions. Similar reports highlighting the field course were published by other media channels, such as "Notícias de Paragominas", "Portal Guarany Junior", and UFPA's online newspaper.

In addition to dissemination in newspapers, Hydro's communication team has produced dozens of materials for social media (mainly Instagram) based on BRC projects and achievements. One example was the presentation that the BRC secretariat held in the 58th Meeting of the Association for Tropical Biology and Conservation, that took place in Cartagena (Colombia), in July. Pictures and short texts were produced for dissemination on Instagram, based on what was presented during the Conference (Figure 12).

Similar dissemination, via social media (Instagram and Facebook), was applied to several events or achievements in which BRC was involved. Among them, the Coexistence Workshop conducted by the project BRC 24/19 ("Coexistence plan for human and carnivores"), that took place in Paragominas. As well for Instagram, a video highlighting the results of the project BRC 08/15 ("Bird diversity in three areas in different states of conservation in the Eastern Amazon") was produced and disseminated by Hydro's social media.

To summarize, the partnership between the BRC secretariat and Hydro's communication team has been active in producing material for dissemination for a broader audience. There is a tendency that the format to be used for this type of dissemination will be mainly via social media. We expect that much more material be produced in the near future, highlighting even more the achievements of the consortium.



Figure 11. Pará's local newspaper highlighting the BRC field course in Tropical Ecology and Biodiversity for Brazilian and Norwegian students (Figure: Portal Rede Pará Newspaper – *online*).

BRC marca presença em Congresso na Colômbia



Figure 12. “BRC is represented in a Conference in Colombia” says the text in Portuguese. This material was disseminated on social media (Instagram) by Hydro’s communication team. The material was produced in collaboration with the BRC secretariat (Image: Instagram – account “hydronobrasil”).

16. BRC’s Website and Social Media

The official website of BRC was established in 2018. News, reports, events and other relevant information about the activities of the consortium were regularly posted on the website (www.brcbn.com). This is an important tool for students and the general public to get to know the BRC better and be informed about upcoming events, such as courses, seminars, opportunities, research teams and others.

In addition to the website, BRC has been very active on social media. The consortium has an account in the Twitter page (@BRCAmazon), which has about 50 followers. On this channel, most of the information is posted in English, in an attempt to reach a more international audience. BRC also has a Facebook account, created in 2018 (@BRCAmazon). This account has been constantly updated with posts related to news from the BRC (e.g. publications, achievements, etc.), opportunities, events and news about forest science, environment, etc. These media channels are extremely important to spread the science that is done by the BRC teams, and to attract more people who might be interested in collaborating or integrating some of the research projects – mainly students. Posts on the BRC Facebook page are written mainly in Portuguese, with a focus on the Brazilian audience. However, stats from Facebook shows that we have reached about 10

countries along the year, being most people from Brazil, followed by Norway, Portugal, USA, Finland and Germany. Today, our Facebook page has more than 550 followers (fifty more than the previous year), and reached more than 4000 people during the year of 2022 (Figure 13), a thousand less than the previous year. This is probably caused by the fact that many webinars and other online events were disseminated by the BRC Facebook page in 2021, but this number of events has decreased in 2022 due to the end of restrictions caused by the pandemic.

Although the number of people reached has decreased, the number of people that actually accessed the page has increased near 20%. These numbers can show some directions on how to manage the BRC’s social media channels in order to increase its relevance in disseminating content from the consortium.

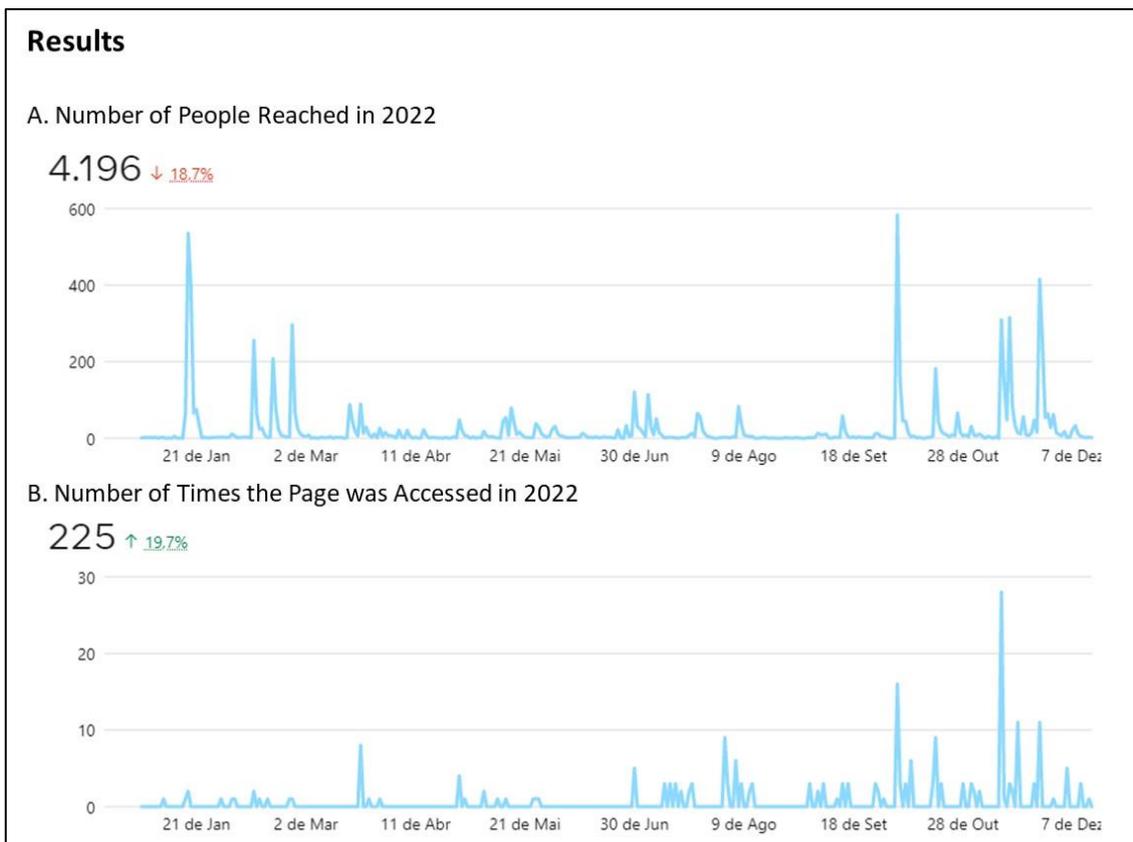


Figure 13. Number of people monthly reached (A) and number of times in which the BRC’s Facebook page was accessed (B) along the year of 2022 (Source: Facebook Insights).

17. Student Involvement and Exchange

One of BRC’s main objectives is to integrate students into research projects. With the expansion of research activities, the number of students involved also increases. By the end of 2022, a total of 77 students were involved in BRC research projects: 13 at the bachelor’s level, 29 at the master’s level, 18 at the doctoral level, and 17 at the postdoctoral level (Figure 14). These numbers are relatively lower in relation to the previous year, which had in total 99 students involved in BRC projects.

This decrease is mainly due to the less participation of students at bachelor level. One possible explanation is the effect of the pandemic, in which many students are still reluctant to return to

scientific activities. In addition to that, few projects have finished their research. About 8 projects are now concluded, and the number of operational projects now is substantially lower than in the previous year. On the other hand, some of the new projects are starting now, by the end of the year, and are still recruiting students to perform field and lab activities. Thus, we expect that the number of students will start increasing again in 2023.

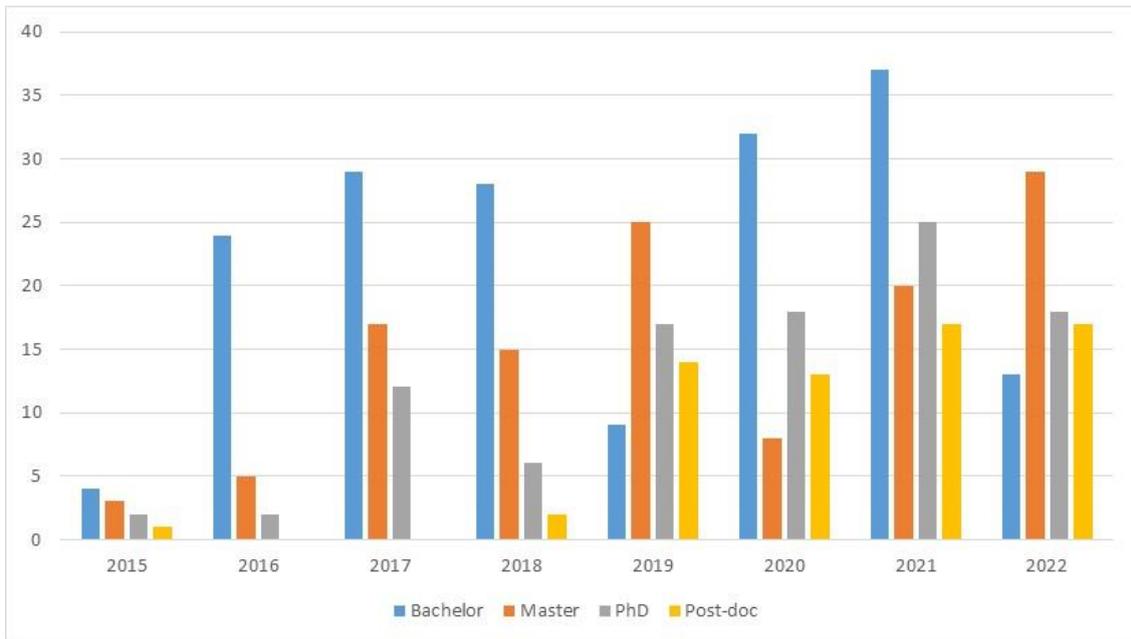


Figure 14. Number of students involved in BRC research projects from 2015 to 2022.

In previous years, some of these students had the opportunity to experience part of their studies abroad, taking part in exchange programs at the institutions participating in the Consortium. For example, some Norwegian students who participated in the tropical forest field course extended their stay in Brazil to develop their master's thesis. In all cases, they recognized that the exchange was a very important experience, both professional and personal, despite the language barrier.

In 2022, we had at least three students from UFPA that came from Brazil to Oslo to have an academic experience abroad. These students are supervised by Dr. Jonathan Ready, who coordinate the project “BRC 16/19 - Measuring biodiversity dynamics using environmental DNA and Metabarcoding: establishing baselines and monitoring recovery in affected ecosystems”. Also, another students from UiO went to Brazil to perform her field work in the same project. Although in the previous years the physical exchange of students was not possible due to travel limitations caused by the pandemic, we experienced some exchange in 2022. We expect an increase in this number in 2023, with full operational status of several of the most recent BRC projects.

18. The BRC Book

A proposal for the creation of a BRC book was initiated in March 2020. This book should be mainly focused on Amazon rainforest biodiversity, and how human disturbance influence the biodiversity. Specifically, the book will be targeting the Paragominas case, where the forest was degraded by mining, among many human activities. In this case though, the mining company (Hydro) has

initiated a forest restoration program. To support the program, Hydro proposed the creation of the BRC, which has been conducting biodiversity surveys and research at the mining area. The book thus aims to summarize this partnership, as well the achievements that the projects have made so far.

For authorship, several BRC collaborating researchers from different areas of expertise were invited. In addition to researchers, the book should also have the participation of the BRC secretariat, Hydro employees, and other members of the consortium.

After a very challenging year in 2021 regarding the progress on the BRC book, the contract for the book production was finally signed in April 2022. The editor company hired by Hydro to produce the book was the “Agência Líquida”, based in Belém. Of the total of eight chapters planned for the book, drafts of five have already been delivered. These are now being revised by the book committee, which is constituted by professors Norberto Noronha (UFRA), Ana Cristina M. Oliveira (UFPA) and Leonardo Sena (UFPA), and the leader of the secretariat Rafael Assis. To this moment, a preliminary layout for the book has been developed by the designer Mauro de Lima, who works for the Agência Líquida.

Due to delays in the delivery of the chapters, as well regarding their reviewing, and the acquisition of the images for the book, an extension for the deadline of the book was requested. The contract for the book initially ended in April 2023, but now will last until April 2024. We expect though to have this book concluded in the next year, potentially by November 2023 when the consortium celebrates its 10th anniversary.

19. BRC in the Alliance for Restoration of the Amazon

The Alliance for Amazon Restoration, created in 2017, is a multi-institutional initiative focused on facilitating and promote forest restoration in the Brazilian Amazon. The mission of this union of partners is to promote integration between different actions and cooperation between multiple agents engaged in the theme, including NGOs, companies, academia, governments and civil society. The Alliance acts as a catalyst and amplifier of the restoration agenda in the Amazon, seeking to: reconcile interests and integrate actions in favor of expanding the scale and efficiency of forest restoration; generate, systematize and disseminate knowledge and information on forest restoration, tropical forestry and agroforestry systems; support fundraising by members to enable forest restoration actions and projects; boost the economy of forest restoration, stimulating all links in the production chain, generating business, employment and income opportunities; contribute to the formulation and implementation of public policies and positions that favor forest restoration; among others.

BRC is represented in the Alliance by some researchers, such as professors Ana Cristina Oliveira (UFPA), Alberto Akama (MPEG) and Marlúcia Martins (MPEG). Since May 2021, the BRC secretariat has also taken a more active part of the Alliance, joining meetings, debates, seminars and assemblies. BRC has played an important role in the elaboration of the Alliance's strategic planning, mission propositions, in addition to the choice of members belonging to the Alliance's board and executive secretariat. In the year of 2022, the secretariat also joined several meetings of the Alliance, and participated in some of the decisions. The meetings and debates took place via webinar.

The role of BRC in the Alliance is of great importance for expanding the network of the

consortium partners, in addition to sharing experiences and also improving the learning. In addition, it is important to combine efforts to improve actions for the recovery and restoration of Amazonian environments. BRC is expected to continue working in collaboration with Alliance members for years to come.

20. Lessons Learned

The year 2022 was a great year for the BRC. After two years of restrictions due to the pandemic, 2022 was marked as a year when activities went back to the pre-pandemic stage, such as the developing of research activities, improving the university-industry partnership, increasing its relevance through its publications and social networks, and finally in the integration of students and professors/researchers from different institutions. In addition to that, many very interesting and relevant project which had been on standby are now fully operational. Below are some of the achievements and challenges faced:

- *We've trespassed the difficulties caused by the pandemic with mutual trust and reliability among the partners. It was a great lesson learned and served to strengthen our confidence that we rely on a very well-established consortium, and with an adequate structure for its long-term existence;*
- *The monthly meetings are extremely important in order to address topics relevant for the consortium as a whole. These meetings avoid the crucial matters be lost under the radar, bringing the partners closer together and permit us to pinpoint priority issues that need a more detailed approach;*
- *BRC had another very successful year in the production of publications in relevant scientific journals. The number of publications, which are expected to continue to be high for the coming years, demonstrate that the consortium is fulfilling its objective of increasing its relevance in advancing the field of forest restoration and biodiversity in areas affected by mining;*
- *The increase on BRC's participation on all kinds of events, both national and international, indicate that we are in the right track in what regards the improvement of the relevance of the BRC on the world scene. More and more people are paying attention to BRC's research and relevance, thanks to the great efforts of all the people involved in the consortium;*

Oslo, January 30th 2023.

Rafael Assis and Fridtjof Mehlum

Annex 1: BRC – Overview of all research projects (Last Update: 16.12.2022).

Project title	Institution / Coordinator	Contract signed	Did it start already?
BRC 01/14: Arbuscular mycorrhizal fungi in natural areas and areas in restoration after bauxite mining in Pará	UFPA Altamira/Magali Goncalves Garcia UNIFESSPA/Ulisses Albino	YES	YES
BRC 02/14: Measuring the emissions of trace gases in chrono-sequence of reforestation in areas influenced by bauxite mining in Paragominas	UFPA Braganca/Hudson Cleber Pereira da Silva	YES	YES
BRC 03/14: Biodiversity, proliferation of plant species and restoration of degraded areas from bauxite mining	UFRA/Marcos André Piedade Gama	YES	YES *
BRC 04/15: Entomology Survey and Bioindicators for Biodiversity Monitoring	MPEG/Rogério Rosas	YES	YES
BRC 05/15: Camera trap survey of ground-living mammals in the Hydro bauxite mine area	UiO/Øystein Wiig, UFPA/Ana Cristina de Oliveira	YES	YES*
BRC 06/15: Evaluation of chemical compounds of different forest species stored, susceptible to contamination in the soil.	UFRA/Gracialda Costa Ferreira	YES	YES *
BRC 07/15: Impact study of a biodiversity recovery program in a bauxite mining area on populations of insect vectors	UFPA/Ivoneide Maria da Silva	YES	YES *
BRC 08/15: Bird diversity in three areas in different states of conservation in the Eastern Amazon.	UFPA/Marcos Persio Dantas Santos	YES	YES *
BRC 09/15: Wood-decay fungi in Paragominas and Trombetas: baseline information, monitoring priorities, and how to achieve the “no net loss” target?	UiO/Hugo de Boer	YES	YES
BRC 10/15: Aquatic biota monitoring of streams in mining areas of Paragominas SA, Pará, Brazil	UFPA - MPEG/Akama, Juen and Montag	YES	YES *
BRC 11/15: Diversity of the herbivorous insects in four areas of the Hydro mining company	UFPA/José Antonio M. Fernandes	YES	YES *
BRC 12/16: How ecological interactions are influenced by mining activities and efforts for environmental restoration after exploration	MPEG/Marluca Martins	YES	YES
BRC 13/16 Tracking jaguars in the Hydro bauxite mine area in Paragominas, Brazil	UiO/UFPA Øystein Wiig /Leonardo Sena	YES	YES *
BRC 14/17 Monitoring Amphibians and Squamata Reptiles in Reforestation Areas in the Hydro Bauxite Mine Area in Paragominas, Brazil.	UFPA/Youszef Bitar	YES	YES
BRC 15/17 Rehabilitation techniques in bauxite mining areas - A topsoil study	UFRA/Gracialda Ferreira	NO	NO
BRC 16/19 - Measuring biodiversity dynamics using environmental DNA and metabarcoding	UiO - Jonathan Stuart Ready	YES	YES
BRC 17/19 - Metabarcoding and metagenomics for high throughput inventory and monitoring of terrestrial arthropod biodiversity	UFPA/Gustavo Ruiz UiO/ Vladimir Gusarov	YES	YES
BRC 18/19 – Metagenomic and metabarcoding as a tool for developing One Health In Hydro Area	UFPA/Leonardo Sena	YES	YES

BRC 19/19 - Use of native species from different trophic levels and occurring in bauxite mining area to evaluate the toxicity of residues	UFPA/Lilian Lund Amado	YES	YES
BRC 20/19 - Aquatic biota monitoring and assessment upstream and downstream of bauxite pipeline Norsk Hydro Paragominas - Barcarena	UFPA/Luciano Montag	YES	YES
BRC 21/19 - Bird telemetry monitoring to evaluate loss of habitat in mining area	UFPA/Marcos Persio Dantas Santos	Yes	YES
BRC 22/19 - Effect of large herbivorous mammals on forest regeneration in post-mined areas	UFPA/Maria Aparecida Lopes	YES	YES
BRC 23/19 - The use of physical, chemical and biological tools to evaluate the water resources under the influence of the Norsk Hydro	UFPA/Rossineide Martins da Rocha	YES	YES
BRC 24/19 - Coexistence plan for human and carnivores	UFPA/Leonardo dos Santos Sena	YES	YES
BRC 25/19 - Assessing the integrity of aquatic ecosystems by implementing a next generation DNA sequencing-based method for biomonitoring	UFPA/Raphael Ligeiro	YES	YES
BRC 26/19 - Effects of soil use on diversity and ecophysiology on the riparian vegetation, aquatic macrophytes and plankton in streams and lagoons	UFPA/Thaísa Sala Michelan	YES	YES

* Project concluded

Annex 2: BRC – List of all published articles from the BRC series number (Last update: 16.12.2022).

BRC number	Title	Journal/book	Authors	Affiliation	Vol.	Issue n.	Pages	Year
BRC0001	<i>Imantodes lentiferus</i> - Geographic Distribution	Herpetological Review	Axandre C. Ascenso; Alexandre F.R. Missassi	MPEG	46	3	386	2015
BRC0002	Deposição de serapilheira e nutrientes em áreas de mineração submetidas a métodos de restauração florestal em Paragominas, Pará	FLORESTA	Martins, Walmer B.R.; Ferreira, Gracialda C., Souza, Fernanda P.; Dionísio, Luiz Fernandes S.; Oliveira, Francisco de Assis	UFRA	48	1	37-48	2018
BRC0003	Forest Restoration Evaluation Through Indicators in Areas of Bauxite Mining	Floresta e Ambiente	Ribeiro, Sabrina S.; Oliveira, Francisco de Assis; Ferreira, Gracialda C.; Santos, Daniel E.; Cruz, Denis C.	UFRA	26	3	online	2019
BRC0004	Litterfall, litter stock and water holding capacity in post-mining forest restoration ecosystems, Eastern Amazon	Revista Brasileira de Ciências Agrárias	Martins, Walmer B.R.; Vale, Raquel L.; Ferreira, Gracialda C.; Andrade, Vanda M.S.; Dionísio, Luiz Fernandes S.; Rodrigues, Richard P.; Oliveira, Francisco de Assis; Souza, Giuliana M.P.	UFRA	13	3	online	2018
BRC0005	After 10 years the myth of <i>Crotalaria</i> spp. and dragonflies remains alive	Biota Netropica	Joás Brito; Nayara Louback-Franco; Cristian Mendoza; Flávia Nonato; Leandro Juen; Thaisa Michelan	UFPA				2020
BRC0006	Environmental factors influencing the abundance of four species of threatened mammals in degraded habitats in the eastern Brazilian Amazon	PlosOne	Juliana Teixeira-Santos, Ana Carolina da Cunha Ribeiro, Øystein Wiig, Nelson Silva Pinto, Lorrane Gabrielle Cantanhede, Leonardo Sena, Ana Cristina Mendes Oliveira	UFPA, UiO	online	online	online	2020
BRC0007	Environmental factors affect macrophyte diversity on Amazonian aquatic ecosystems inserted in an anthropogenic landscape	Ecological Indicators	Ana Luísa B. Fares, Lenize Batista Calvão, Naiara Raiol Torres, Ely Simone C.Gurgel, Thaísa Sala Michelan	UFPA	113	online	online	2020
BRC0008	New records of the invasive macrophyte, <i>Urochloa arrecta</i> extend its range to eastern Brazilian Amazon altered freshwater ecosystems.	Acta Amazonica	Ana Luisa Biondi Fares; Flávia Alessandra da Silva Nonato; Thaísa Sala Michelan	UFPA				2020
BRC0009	<i>Voragocoris weirauchae</i> sp. n. (Heteroptera: Schizopteridae: Schizopterinae), a further minute litter bug species from Brazil	Zootaxa	Flavio Roberto de Albuquerque Almeida, Fernando da Silva Carvalho-Filho, Jose Antonio Marin Fernandes	UFPA, MPEG	4729	1	138-144	2020
BRC0010	Tree communities in 3-yr-old post-mining sites under different forest	Forests	Denis Conrado da Cruz, José María Rey Benaya, Gracialda Costa Ferreira, Sabrina Santos Ribeiro	UFRA	527	11		2020

	restoration techniques in the Brazilian Amazon								
BRC0011	The Habitat Integrity Index and aquatic insect communities in tropical streams: A meta-analysis	Ecological Indicators	Leandro Schlemmer Brasil, Edgar Luiz de Lima, Zander Augusto Spigoloni, Danielle Regina Gomes Ribeiro-Brasil, Leandro Juen	UFPA	116	online			2020
BRC0012	Morphological and allometric variation due to percentage of cover in <i>Eichhornia azurea</i> (Swart) Kunth (Pontederiaceae)	Brazilian Journal of Botany	Cintia Oliveira Carvalho, Kelsey Archer Barnhill, Alexandre Cordeiro Ascenso, Barbara Dunck, Grazielle Sales Teodoro, Thaisa Sala Michelan	UFPA, MPEG, NMBU		online			2020
BRC0013	Survival, growth and regeneration of forest species in mining areas in the Eastern Amazonia	Scientia Plena	W. B. R. Martins; W. dos S. Barros; L. F. S. Dionisio; T. G. Bezerra; M. L. dos Santos; Gracialda. C. Ferreira; V. M. Barbosa; F. de A. Oliveira	UFRA	6	online			2020
BRC0014	Caracterização biométrica de sementes de <i>Solanum paniculatum</i> L. e desempenho germinativo após superação de dormência	Revista Colloquium Agrariae	Elson Junior Souza da Silva, Lorene Bianca Araújo Tadaiesky, Jéssy Anni Vilhena Senado, Dênmorea Gomes de Araujo	UFRA	6	4	29-37		2020
BRC0015	Assessing sodium limitation as a resource for ground-dwelling ants (Hymenoptera: Formicidae) in an area of the Amazonian Terra Firme Forest	Bol. Mus. Para. Emílio Goeldi. Cienc. Nat.	Cristian Camilo Mendoza-Penagos, Knut Olav Vadla Hessen, Rony Peterson Santos Almeida	UFPA, MPEG, UiO	15	1	135-143		2020
BRC0018	Contamination of stream fish by plastic waste in the Brazilian Amazon	Environmental Pollution	Danielle Regina Gomes Ribeiro-Brasil, Naiara Raiol Torres, Ana Beatriz Picanço, David Silva Sousa, Vanessa Serrao Ribeiro, Leandro Schlemmer Brasil, Luciano Fogaça de Assis Montag	UFPA	266	online			2020
BRC0019	Diversity of macrophytes in the Amazon deforestation arc: information on their distribution, life-forms and habits.	Rodriguésia	Ana Luísa Biondi Fares, Raimundo Luiz Morais de Sousa, Ely Simone Cajueiro Gurgel, André dos Santos Bragança Gil, Carlos Alberto Santos da Silva, Thaisa Michelan.	UFPA	72				2021
BRC0020	Distribution of metals in different environmental compartments and oxidative stress biomarkers in <i>Bryconops caudomaculatus</i> (Osteichthyes: Characiformes) from a bauxite mining area in the Eastern Amazon	Environmental Research	Sildiane Martins Cantanhêd, Irina Sofia Cardoso de Carvalho, Franciele Rovasi Adolfo, Gabriela Leal, Gabriel Moraes Reis, Leandro Machado de Carvalho, Luciano Fogaça de Assis Montag, Lillian Lund Amado	UFPA	216				2022
BRC0021	Growth and Quality of <i>Inga</i>	Journal of	Elson J. S. da Silva, Jéssy A. V. Senado, Ádson E. da Silva,	UFRA	11	5	479-		2019

	<i>heterophylla</i> Wild Seedlings According to the Slow Release Fertilizer	Agricultural Science	Marcos A. P. Gama, Selma T. Ohashi, Giuliana M. P. de Souza, Gracialda C. Ferreira, Norberto C. Noronha, Gilson S. B. de Matos, Dênora G. de Araujo				484	
BRC0022	Collecting arboreal arthropods: a technique for sampling plant-inhabiting arthropod communities in a tropical forest understory	Entomologia Experimentalis et Applicata	Viana-Junior AB, Quijano-Cuervo L, Ferreira JC, Reis RRN, Santos IA, Martins MB	MPEG				2021
BRC0023	Effects of landscape and local habitat on Odonata larvae (Insecta) communities in eastern Amazon streams (<i>in submission</i>)	Marine and Freshwater Research	Rodrigo Arison Barbosa Ribeiro ^{1, 2*} , Leandro Juen ^{1, 2} & Leandro Schlemmer Brasil ^{1, 2}	UFPA				2020
BRC0024	Mudanças no uso da terra alteram os riachos e afetam os grupos funcionais alimentares de insetos aquáticos na amazônia (<i>in submission</i>)	Ecological Indicator	Myllena Suzi Lima Silva, Viviane Caetano Firmino, Carina Kaory Sasahara de Paiva, Leandro Juen, Leandro Schlemmer Brasil	UFPA				2020
BRC0025	Seed viability changes during fruit ripening of <i>Tapirira guianensis</i> : Implications for collection	Research, Society and Development	Lorene Bianca Araújo Tadaiesky, Dênora Gomes de Araújo, Tainah Kaylla dos Santos Aquino, Saulo Fabrício da Silva Chaves, Elson Junior Souza da Silva	UFRA	9	11		2020
BRC0026	Morphological and phylogenetic factors structure the distribution of damselfly and dragonfly species (Odonata) along an environmental gradient in Amazonian streams	Ecological Indicators	Rafael Costa Bastosa, LeandroSchlemmer Brasil, José Max Barbosa Oliveira-Juniora, Fernando Geraldo Carvalho, Gareth D. Lennox, Jos Barlow, Leandro Juen	UFPA	122			2021
BRC0027	The role of macrophyte architecture in driving periphytic algal communities in a lowland river in the Brazilian Amazon	Brazilian Journal of Botany	Híngara Leão; Louise Cathrine Rolstad Esdar; Bárbara Dunck	UFPA, MPEG, NMBU	<i>online</i>			2021
BRC0028	The anthropic gradient determines the taxonomic diversity of aquatic insects 1 in Amazonian streams.	Hydrobiologia	Carina Kaory Sasahara de Paiva, Ana Paula Justino Faria, Lenize Batista Calvão, Leandro Juen	UFPA	<i>online</i>			2021
BRC0029	Bark of <i>Astronium lecontei</i> Ducke Trees from the Amazon: Chemical and Structural Characterization	European Journal of Wood and Wood Products	Graciene S. Mota; Elesandra S. Araujo; Mario Lourenco; Juliana Livian L. de Abreu; Claudia L.S. de O. Mori; Cassiana A. Ferreira; Marcela G. Silva; Fabio Akira Mori; Gracialda Ferreira	UFRA	<i>online</i>	5		2021
BRC0030	Estoque de serapilheira e nutrientes: indicadores da restauração de ecossistemas degradados pela mineração de bauxita	Empreendedorismo e Inovação na Engenharia Florestal 3 (<i>Book</i>)	Julia Isabella de Matos Rodrigues, Walmer Bruno Rocha Martins, Victor Pereira de Oliveira, Gracialda Costa Ferreira, Victor Moreira Barbosa, Francisco de Assis Oliveira.	UFRA				2021

BRC0031	Desenvolvimento e qualidade de mudas de <i>Parkia gigantocarpa</i> Ducke (Fabaceae) em função de fertilizante de liberação controlada	Scientia Plena	V. P. Oliveira; R. S. Mendes; W. B. R. Martins; E. A. Santos; D. G. Araújo; M. A. P. Gama	UFRA					2021
BRC0032	Natural Regeneration for restoration of degraded areas after bauxite mining: a case study in the Eastern Amazon	Ecological Engineering	Alberto B. Brasil Neto; Gustavo Schwartz; Norberto C. Noronha; Marcos A. P. Gama; Gracialda Costa Ferreira	UFRA	171				2021
BRC0033	Taxonomic diversity and functional diversity of bird communities in mining areas undergoing passive and active restoration in eastern Amazon	Ecological Engineering	Fernanda de Carvalho Barros, Sara Miranda Almeida, Bruno Spacek Godoy, Ricardo Ribeiro da Silva, Larissa Cardoso Silva Kaue Felipe de Moraes, Marcos Persio Dantas Santos	UFPA					2021
BRC0034	Response of aquatic insects to an environmental gradient in Amazonian streams (<i>accepted</i>)	Environmental Monitoring and Assessment	Ana Paula Justino Faria; Carina Kaory Sasahara de Paiva; Lenize Batista Calvão; Gabriel Martins da Cruz; Leandro Juen	UFPA					2021
BRC0035	Evaluation of the phytosociological structure of a forest fragment in the Municipality of Paragominas-PA, Brazil	Research, Society and Development	Ana Cláudia Vale do Nascimento; Paulo Luiz Contente de Barros; Gracialda Costa Ferreira; Jéssica Costa dos Santos; Francimary da Silva Carneiro	UFRA	10	9			2021
BRC0036	Habitat conditions in streams influence Odonata larval assemblages in the eastern Amazon	International Journal of Odonatology	Rodrigo Arison Barbosa Ribeiro; Leandro Juen; Leandro Schlemmer Brasil	UFPA	25				2022
BRC0038	Fitossociologia do Estrato Arbóreo em Florestas Nativas e em Áreas de Recuperação de Áreas Degradadas Sobre a influência da mineração, Paragominas, Pará, Brasil	Revista Nature and Conservation.	Cerqueira, R.M., Jardim, M.A.G; Silva Junior, L.L.M; Paixao, L.P.; Martins, M.B.	MPEG UFPA	14	3	22-41		2022
BRC0039	Patterns and metacommunity structure of aquatic insect (Trichoptera) in Amazonian streams depends on the environmental condition	Hydrobiologia	Gabriel Martins Cruz, Ana Paula Justino Faria, Leandro Juen	UFPA	<i>online</i>				2022
BRC0040	Which variables influence the herbivory amount on <i>Montrichardia</i> spp. in aquatic ecosystems?	Revista Biología Tropical	Ana Luisa Biondi Fares; Wendell Vilhena de Carvalho; Thaisa Sala Michelin; Grazielle Sales Teodoro	UFPA	<i>online</i>				2022
BRC0041	Does the structure of riparian vegetation affect the diversity of macrophytes in eastern amazonian streams	Biologia	Rayssa Silva Carmo, Ana Luísa Biondi Lima Fares, Gizelia Ferreira Matos Pereira, Thaisa Sala Michelin	UFPA	<i>online</i>				2022
BRC 042	Correlates of Odonata species	Ecological	Lenize B. Calvao, Tadeu Siqueira, Ana Paula J. Faria,	UFPA	<i>online</i>				2022

	composition in Amazonian streams depend on dissimilarity coefficient and oviposition strategy	Entomology	Carina K. S. Paiva, Leandro Juen					
BRC 043	Wild canids and ecological traps, facing deforestation and climate change in the Amazon Rainforest (<i>submitted</i>)	Oikos	Cris Oliveira et al.	UFPA				2022
BRC 044	Niche breadth and habitat preference of Ephemeroptera, Plecoptera, and Trichoptera (Insecta) in streams in the Brazilian Amazon	Hydrobiologia	A. Luiza-Andrade, R. R. Silva, Y. Shimano, A. P. J. Faria, M. N. Cardoso, L. S. Brasil, R. Ligeiro, R. T. Martins, N. Hamada & L. Juen	UFPA	<i>online</i>			2022
BRC 045	Fish functional responses to local habitat variation in streams within multiple land uses areas in the Amazon	Neotropical Ichthyology	Calebe Maia, Gilberto N. Salvador, Tiago O. Begot, Pâmela V. Freitas, Flávia A. S. Nonato, Naiara R. Torres, Leandro Juen & Luciano F. A. Montag	UFPA	20	4		2022
BRC 046	Effects of the loss of forest cover on Odonate communities in eastern Amazonia	Journal of Insect Conservation	Lenize Batista Calvão, Joás da Silva Brito, Driane Ferreira, Erlane José Cunha, José Max Barbosa Oliveira-Junior, Leandro Juen	UFPA	<i>online</i>			2022
BRC 049	Land use changes disrupt streams and affect the functional feeding groups of aquatic insects in the Amazon	Journal of Insect Conservation	Myllena Lima, Viviane Caetano Firmino, Carina Kaory Sasahara de Paiva, Leandro Juen & Leandro Schlemmer Brasil	UFPA	<i>online</i>			2022
BRC 050	Detecting Darwinian Shortfalls in the Amazonian Odonata	Neotropical Entomology	Fernando Geraldo Carvalho, Leandro Duarte, Guilherme Dubal Santos Seger, Gabriel Nakamura, Rhainer Guillermo-Ferreira, Adolfo Cordero-Rivera & Leandro Juen	UFPA	<i>online</i>			2022

