

# Science at the amazonian coast: Scientific production and training of human resources from the Coastal Studies Program – Museu Paraense Emílio Goeldi

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**Abstract**— *The scientific production and the training of human resources in Brazil have been investigated in many knowledge areas to subsidize their scientific, educational and technological development. To disseminate the intellectual and training of human resources contribution of the Coastal Studies Program (PEC/MPEG) at the coastal Amazon, in its timeline (1997 to 2016), it was compiled data of Curriculum Lattes of the PEC researcher and of data banks of institutional Programs of training from the Museu Paraense Emílio Goeldi (MPEG) agreed or not with others teaching and research institutions from Belém do Pará that, were typed and analyzed in the EXCELL 10.0 software. The production of 434 published articles (230 in the Biological, Health and Agricultural Sciences Area, 98 in Earth Sciences and Engineering and 76 in Human and Social Sciences) and of 427 training of human resources (128 in the Biological, Health and Agricultural Sciences Area, 128 in Earth Sciences and Engineering and 100 in Human and Social Sciences) mapping quantitatively the intellectual and training of human resources production in a multidisciplinary character, exposing the contribution of the program in its timeline, as also points out gaps and advances that can subsidize the academic and social demands fulfilling its mission.*

**Keywords**— *Amazon, coastal zone, knowledge production, human resources, scientific research.*

## I. INTRODUCTION

**1.1 The timeline in the Coastal Studies Program (PEC) from the Museu Paraense Emílio Goeldi (MPEG).**

The year of 1996 followed full of events, between them highlighted one, where the coastal zone was the focus. A researchers group from Museu Paraense Emílio Goeldi (MPEG) met in Salinas, City of Salinópolis, at the Pará Coastal Zone in the Tropical Coastal Ecosystems Studies Program (ECOLAB) – *Franco-Brazilian Cooperation International Program* “an international and multidisciplinary network that develop integrate scientific studies at amazonian coastal ecosystems” (Mendes & Prost, 2001). The event has been organized and sealed by MPEG with institutional contributions, with the participation of many scientific institutions, including the United Nations Educational Scientific and Cultural Organization (UNESCO).

Other event in 1996, happened in this year: a workshop of the *Amazon Mangrove’ Program* (MADAM- Mangrove, Dynamics and Management), at Bragança, embryo of the idea of a specific Program creation inside of MPEG about Pará and its coastal zone, considering the existing critical mass and the accumulated experiences in the issues raised in the two cited events, from the various Scientific Departments – nowadays, Scientific Coordinations. Inspired in what they saw and heard during that workshop, a researchers group – integrated by Lourdes de Fátima Gonçalves Furtado, José Francisco Berrêdo Reis da Silva, Amílcar Carvalho Mendes, Cristina do Socorro Fernandes de Senna, Helena Doris Quaresma - , met in the lunch break, during the MADAM event, conjectured informally the idea of a studies program at the paraense coast developed by MPEG. That group should have its own identity seizing the individual experiences accumulated *in situ*, in a

multidisciplinary and interdisciplinary approach, preferably, to put their perceptions about the nature, characteristics and problems related to that ecosystem of the amazonian biome.

Indeed, the idea resulted: and, in 1997 the Coastal Studies Institutional Program (PEC) was created with the leadership of Maria Thereza da Costa Prost. This Program follows a chronological trajectory of investments and events checked in Borges et al., (2016). In this chronology are emphasized categories of analysis, performance evaluation and knowledge's production dynamic of the involved researchers, related to the coastal zone of the Brazilian Amazon. In the timeline between 1997 and 2016 the following facts assume relevancy in the cited indicative categories: (a) the insertion of analysis in the Social Sciences field, particularly of the Anthropology, as science that aims to know the relationship between the man and the nature, or in other words: between the social groups and the nature, or even, between nature and culture. Science that indicates and decodes *classifications* of the real (natural resources) and of the immaterial (representations about the concrete world), proposed by the social groups, and obviously, in that context they indicate the inherent logics to that human groups related to the territory that they inhabit, use and handle.

This data means that besides their purely methodological and objective practices, the Anthropology has as its priority to reach the heart of the issues through the *subjectivity* as a research technic – to approach the community (for example) from the perception of the subject, of the social actors in the presence. (b) the training of human resources to the research, from the aggregation of college students in the level of undergraduate and postgraduate, through internships with scholarships of the PIBIC or of the postgraduate programs linked to them. (c) aggregation of students from up-country with CNPq scholarship through RENAS Project (Natural Resources and Social Anthropology) and, at the same time, of people from the worked about communities to integrate research actions in real time. Of that process resulted the interaction research-community, relevant factor in the fieldwork performance of the teams.

## 1.2 Projects and the guiding research lines of the project.

Researches were developed by researchers from the Departments of Ecology, Botanic, Human Sciences and Museology. In this multidisciplinary context, it was elaborated the referred project, oriented by research lines in Human Sciences – Anthropology, Archeology, Communication and Museology; Biological, Health and

Agricultural Sciences – Botanic and Zoology and Earth Sciences and Engineering.

Related to the Human and Social Sciences of the RENAS Project at the fishing populations scope, previous to PEC, with studies in the coastal, estuarine and river amazonian areas, it was welcomed as one of the Anchor Projects, as was been classified at that time by Dr. Maria Thereza Prost, PEC coordinator.

The anthropological perspective glimpses the social organization, the history and the people culture that studies, in its environment (*in situ* and *in vitro*), their relationship with the natural resources and the biodiversity in their social representations that involve the social landscape, their relations and process of human occupation and mobility (migrations and internal inflows) in the long term history. Exposing in this way: cultural matrices of social groups or of the focused region, the identity and the otherness – their corollary -, the kinship, crony and neighborhood relations, the classifications of the lived world at the plan of its experiences and logics of belonging, appropriation, use of the natural resources and belonging to territories.

Later, in the PEC scope emerged the *Paraense Mangroves: Natural researchers, local uses and indicators for the sustainability* Project financed by Das Leibniz-Zentrum für Marine Tropenforschung-ZMT/German, and with financial support of the Science and Technology Fund of the Estate of Pará (FUNTEC) and more, the technic and scientific support of the Institut de Recherche et Développement (IRD-Cayenne) and of the CAPES-COFECUB Program, (developed by MPEG), Federal University of Pará (UFPA) and the Paris VII and Paris XI University (IBID).

In the FUNTEC Project the RENAS contributed to field works in different subjects, particularly in the social-anthropological characterization of the studied sites at the regions of the coastal cities from Marapanim and São Caetano de Odivelas.

Along the timeline, in the pointed out period, between other studies realized it highlights Mendes & Prost (2001), Furtado (2002), Souza-Filho et al., (2005), Furtado et al., (2012), Prost & Mendes (2013), Lins et al., (2014), Carmo et al., (2014), Furtado et al., (2015) and Borges et al. (2016).

## 1.3 The PEC epistemological relevance

The PEC Program is and will be a crucial institutional program for the comprehension of the social dynamics to what the various ecosystems of the amazonian biome and the involved human occupation areas are subdued, right by the multidisciplinary methodology that it uses. It is necessary to internalize a notion: the one who conceives that the scientific fields,

presents in it, does not be fragmented into monoblocs or following in a parallel way – biological sciences and social sciences, as in a previous occasion -, but in constant dialogical and interpretative relationship, if we want to have epistemological and more consistent results. This dialogical experience, how we see, gives sustentation to the teams in their respective field performance, to fortify the dialogues between research and community, the intercultural dialogues between their *partners* and other research groups from the amazonian region, from Brazil and from the Exchange.

Into this scope, the experience of the Anthropology team integrate to PEC, through the Anchor Project RENAS, has been contributed to diversify the knowledges related to the Brazilian coastal zone, particularly to the Brazilian North Coast.

The extension of these experiences at the amazonian seaboard, left this anchor project team to other latitudes, as to Portugal and Africa in Moçambique seaboards, resulting in the book *Olhares cruzados sobre os povos litorâneos de comunidades dos países de língua portuguesa: Percepção acerca do uso e gestão de territórios em comunidades haliêuticas no Brasil, Moçambique e Portugal*. Published by MCTI/Museu Paraense Emílio Goeldi and launched in 2015.

Subjects as millenarian occupation of this region fishing areas; social organization and change; social conflicts; traditional fishing technologies; fishing agreements; environmental protection areas – particularly the areas of the Marine Extractive reserves of Marapanim, Mãe Grande de Curuçá, Mocapajuba in São Caetano de Odivelas, Quatipuru-Primavera, Marauanazese do Pesqueiro, both from Soure, inscribe yourselves into their previous work schedule, participate of the interest in the anthropological and of the natural sciences perspective.

Among other Anchor Projects developed in the PEC/MPEG scope it highlights: Baía de Guajará Socioenvironmental Diagnostic, developed in the scope of the North-Northeast Environmental Monitoring of the Risk areas to Petroleum and its Derivative Spills Cooperative Network (PETRORISCO); Amazonian Coastal Ecosystems: ecological characteristics, social challenges and sustainable development; Potential Environmental Impacts of Petroleum and Derivative Transport in the Amazonian Coastal Zone (PIATAM mar I e II); Use and Appropriation of the Coastal Resources (RECOs); Preservation and diffusion of the photograph collection about amazonian coastal ecosystems; Fluvial Environmental Study in the Amazon: Hydro geochemical, climate and of vegetal philosophy implications; Economical valuation of the direct and indirect uses of the mangrove ecosystem in São Caetano de Odivelas-Pará and Botanical Research interdisciplinary Network in

Amazon, Atlantic Forest, Caatinga and Cerrado that were condemned by researchers of the Botanical and Earth Sciences Coordinations and, developed in the 1997-2016 period. These projects were executed along the north coast of Brazil, both on land and in water (estuary and sea) and, had the collaboration of researchers from many state and national institutions, always with the interdisciplinary and of training of human resources vision. The results of these important actuations are highlighted in the items result and discussion.

The PEC is a program that involves studies whose spectrum favor the comprehension of the ocean-continent line, that is, it includes objectively in course studies, other already performed and in perspective that can serve as an analytical base for regional evaluations. In a time, it appreciates an area – the coastal or maritime area -, that has links with the waters and interior territories – with the forest – a link between *Green Amazon and the Blue Amazon*. Both are inseparable in the scientific conditions. Therefore, it is necessary to appreciate this dimension. Theoretically in this case, they can be manifested (a) by the goods and services provides by the nature, especially by the flows and water pulses of the big, medium and small rivers (between the sea and the coast; between the sea and the estuaries, between the estuaries and the existent big and medium hydrographic basins). Studies in this direction, supposedly yield good fruit. In the same way they could be pointed out by the social mobility flow and pulse, those transits particularly along this line, charging its sociocultural *ethos* through the human occupation migratory processes, in the circuit of this line or of this ocean-continent axis.

In this sense it is intended to disseminate the intellectual and of training of human resources contribution of the coastal studies Program (PEC/MPEG) at the north coast of Brazil, along 19 years (1997 a 2016), exposing by a quantitative form its actuation in the timeline.

## II. METHODS

The data were compiled from the search of the Curriculum Lattes (CVLattes) of 37 researchers involved in the program, of databases of the postgraduate programs in partnership with the Museu Paraense Emílio Goeldi (Biological Sciences Postgraduate Program – Tropical Botanic in agreement with the Federal Rural University of Amazon - PPGBOT/UFRA/MPEG; Environmental Sciences Postgraduate Program in agreement with the Universities: Federal Rural of Amazon, Federal of Pará and the Farming Researches Enterprise - EMBRAPA/CPATU; Human, Social Sciences and Anthropology Postgraduate Program (PPGSA) and in Zoology (PPGZOO) in agreement with the Federal

University of Pará (UFPA), and of institutional programs from the Museu Paraense Emílio Goeldi: Scientific Research Scholarship Program (PIBIC) and Institutional Training Program (PCI).

## 2.1 Consulted literature

A priori a search was performed about the items related to the intellectual and of Training of Human Resources production in CNPq (National Council of Scientific and Technologic Development) Curriculum Lattes from members of PEC/MPEG as also in databases of institutional and/or agreed Programs. Thus, 434 published articles about the north coast of Brazil (marine, coastal and estuary) were compiled, of Curriculum Lattes, of 37 researchers' members of (PEC/MPEG), in scientific journals, books and book's chapters and in scientific events reports, in the idioms: Portuguese, English, Spanish and French, in the period of 1997 to 2016.

The intellectual and training of human resources production of the PEC members were grouped by production type, concentration areas and activity sector in the time and in the space. The publications involve ecosystem functions and services and/or socioeconomic and cultural benefits.

However, items as: executed projects, maps, CD-ROM, research reports, events held and others, that were not analyzed here, can also, highlight the PEC actions to the north coast of Brazil development giving fundamental bases to the environmental diagnostic, public politics proposes, conservation, sustainable use and management of the Amazonian seaboard. For the discussion available publications in the subject's literature were consulted.

## 2.2 Selection criteria

To de intellectual and of training of human resources production obtained from the 37 Curriculum Lattes of the PEC/MPEG members, available at the CNPq Plataforma Lattes were selected: scientific articles, books, book's chapters, full articles and abstracts in scientific events reports, articles of popularization of the science, databases of the institutional training Programs (PIBIC/CNPq/MPEG - Scientific Research Scholarship Program e PCI - Institutional Training Program) and of Zoology Postgraduate Programs (PPGZool) UFPA/MPEG, Biological Sciences – Tropical Botanic (PPGBot) MPEG/UFRA, Environmental Sciences UFPA/MPEG/EMBRAPA (PPGCA) and of Social Sciences and Anthropology (PPGCSA) UFPA/MPEG that were created and implemented during the evaluated period.

## 2.3 Collected data

The collected data were organized by the following way: 1) Production type (scientific article, books, book's chapters, articles in events reports (full and abstracts), articles of popularization of the science and by education level (PhD, Master, Specialization and Undergraduate); 2) Knowledge areas of PEC actuation: a) Biological, Health and Agricultural Sciences (CBSA); b) Earth Exact Sciences and Engineering (CTE); c) Human and Social Sciences (CHS); d) Interdisciplinary (Environmental Education, others); 3) Sectors of Institution Activities – Coordinations: Botanic (CBO), Earth Sciences and Ecology (CCTE), Human Sciences (CCH), Zoology (CZO) and Communication and Extension (CCE); 4) Degree per level of training of human resources: PhD – D, Master – M, Specialization and Undergraduate (Scientific Research and Thesis (TCC – undergraduate conclusion issue), involving the Institutional Programs: a) the postgraduate – Zoology (PPGZool), Tropical Botanic (PPGBot), Environmental Sciences (PPGCA) and, Social Sciences and Anthropology (PPGCSA); b) others – PCI (post-doctoral and others and PIBIC (Scientific Research Scholarship Program).

## 2.4 Conceptual structure of the data

To adjust the performance indicators of the PEC, the production were organized using the following disposition: a) Ordination of the intellectual production informations in the knowledge areas established by the National Council of Scientific and Technologic Development (CNPq) from Brazil, followed by the ordination by research activities sectors of the institution in the period between 1997 to 2016, using as an indicator the CAPES - Qualis (A (1, 2), B (1, 2, 3, 4 e 5), C and SC (without classification). This production also was grouped in authorship and co-authorship and by collaboration type (departmental, institutional and interinstitutional); b) Organization per training of human resources level, knowledge areas and activity sector in the Institution in the period (1997 a 2015). The main reason for this information bank was to show the actuation indicators in perspectives, objectives and multiple scales of the PEC contribution for the development of the Amazonian coast.

## 2.5 Data analysis.

The data were compiled and analyzed in EXCELL spreadsheets version 10.0, producing dynamic tables and graphics.

## III. RESULTS AND DISCUSSION

The intellectual contribution and the training of human resources of the PEC/MPEG approach ecosystem

services, social and sociocultural giving basic information's to some coastal areas as also reflects the availability of resources and people available to actuate at the Amazonian coast.

**3.1 Contribution of the Coastal Studies Program (PEC) from the Museu Paraense Emílio Goeldi (MPEG) to the development of the North Coast of Brazil.**

**3.1.1 Intellectual contribution**

**3.1.2 Diffusion and Popularization of Science**

**3.1.3 Training of Human Resources.**

**3.1.1 Intellectual contribution.**

The intellectual contribution of 37 researchers of the Coastal Studies Program (PEC) from the Museu Paraense Emílio Goeldi (MPEG), during 19 years of existence, was of 434 publications: 50 articles into congress reports, 84 abstracts in congresses, 165 articles in indexed scientific journals, 94 book's chapters, 23 books and 18 articles of popularization of the science, focused accord to the demands, opportunities and people availability. It is important to emphasize that more 30% of these researchers have less than five years actuating in the PEC. Besides, this contribution seems simple in quantitative terms, but it is very relevant qualitatively to subsidize important studies of environmental impact and proposes of use, management and conservation for the development of north coast of Brazil (Fig. 1).

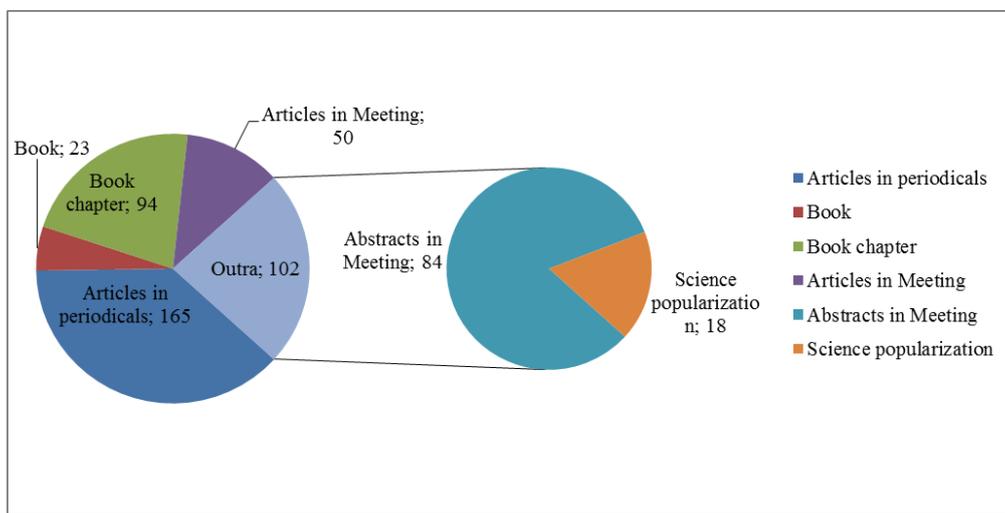


Fig. 1: Coastal Studies Program of Museu Paraense Emílio Goeldi (PEC/MPEG) contribution to the development of the North Coast of Brazil, 1997-2016

As one of the structuring programs from the Museu Goeldi (MPEG), the Coastal Studies Program (PEC), since its creation, has been engaged to develop multidisciplinary activities involving the participation of different knowledge areas, showing in small, medium and big scale the expertise of its members, to understand better the Amazonian coastal environments. On the other hand, the scarcity of human and financial resources has been provided to the program considerable fluctuations in its academic-scientific production along its existence. These factors lead to a reflection about the limitations and possibilities that affected the performance of the program.

**3.1.1.1 Production per knowledge area**

During 19 years, the PEC produced 434 technic-scientific articles with more emphasis in the Biological, Health and Agricultural Sciences Area (230 articles),

followed by the Earth Sciences and Engineering (98 articles) and by the Human and Social Sciences (76 articles). From this production (434 articles), 165 (38,02%) were published in scientific journal, 23 (5,3%) in books, 94 (21,66%) in book's chapters, 50 (11,53%) in congresses reports, 84 (19,35%) in abstracts in congresses and 18 (4,15%) in journals of popularization of the science. According to Café & Bräscher (2008), Silva (2013) and Freitas (2017) to measure the scientific knowledge production one should use measures that show clearly the individual production, of groups or institutions. Thus, complying with the Lotka Law, the scientific production of the program is related to the number and time of researchers' actuation in the program. When evaluated in the knowledge areas, the highest production occurred in the Biological, Health and Agricultural Sciences area (53%), followed by 22,5% in

the Natural Sciences areas and of 17,5% in the social areas. The highest scientific production in the area of the Life Sciences is related to the number of researchers (20) and their highest actuation from the year 2000 in institutional and interinstitutional Postgraduate Programs. The lowest intellectual production observed in the areas of Human and Environmental Sciences is related to the lowest researchers' number in these areas (17). Our data corroborate the data of Matos & Job (2008) related to the highest brazilian scientific production produced in the

Biological, Health and Agricultural Sciences area and, the data of Freitas (2017) who analyzed the methodological dimensions and different metrics of the Bibliometry in many fields of the brazilian scientific production.

It is observed that only 30 (6,91%) articles were classified as interdisciplinary, this did not reflect the multidisciplinary, odd activities, developed by the PEC researchers. the publications need to answer the disciplinary requirements of the majority of the current scientific journals (Fig. 2).

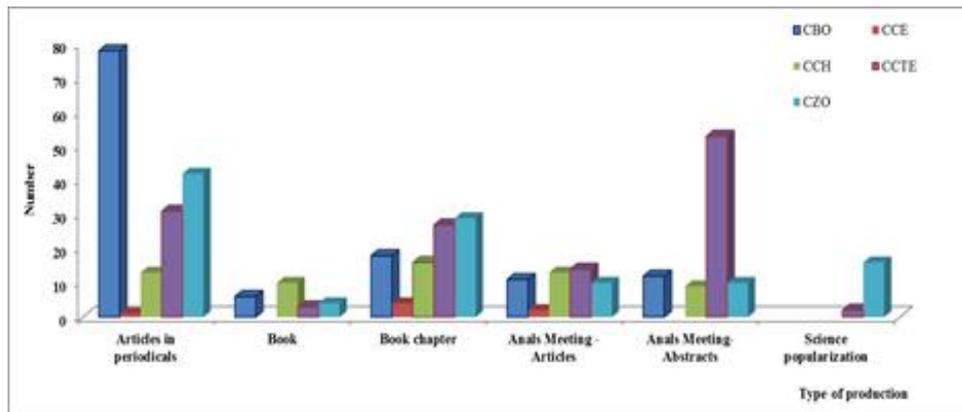


Fig. 2. Technical scientific production of the Coastal Studies Program at Museu Paraense Emílio Goeldi (PEC/MPEG) per sector of activity (CBO - Botanic Coordination, CCE - Communication and Extension Coordination, CCH - Human and Social Sciences Coordination, CCTE - Earth Sciences and Ecology Coordination, CZO - Zoology Coordination), 1997-2016.

On the other hand, we know that the availability of financial resources to the research has been decreasing, substantially, in the last twenty years and, what justifies the decrease of the activities and of the intellectual production, although, the encouragement of publications in partnership has favored the maintenance of many productions. These results corroborate the data of Borges et al., (2016).

**3.1.1.2 Production per sector of activity**

The highest intellectual production per sector of activity occurred at the Earth Sciences and Ecology Coordination – CCTE (130 articles) followed by the Botanic Coordination – CBO (125 articles), by the Zoology Coordination – CZO (111 articles) and by the Human Sciences Coordination – CCH (51 articles) and by the Communication and Extension Coordination – CCE (7 articles). This production is related to the time and the number of the members actuating in these sectors.

Table 1 - Intellectual production of the coastal studies program at Museu Paraense Emílio Goeldi (PEC/MPEG) per knowledge areas (CBSA - Biological, Health and Agricultural Sciences, CTE - Earth Sciences and Engineering, CHS - Social and Human Sciences, INTERD – Interdisciplinary sciences, 1997-2016.

Type of production/sector	CBO	CCE	CCH	CCTE	CZO	Total
Articles in periodicals	78	1	13	31	42	165
Book	6	0	10	3	4	23
Book chapter	18	4	16	27	29	94
Anals Meeting- Articles	11	2	13	14	10	50
Anals Meeting - Abstracts	12	0	9	53	10	84
Science popularization	0	0	0	2	16	18
<b>Total Geral</b>	<b>125</b>	<b>7</b>	<b>61</b>	<b>130</b>	<b>111</b>	<b>434</b>

Many factors contributed to the PEC intellectual production, for example: the availability of financial resources, the number and the actuation time of the researchers in the program. In addition, there were changes of mentality at the academy since the start of this century and, the highest requirement by the development agencies and by the institution to actuating in the training of human resources, in multidisciplinary projects and in partnerships. When we evaluate per activity sector was verified that the Zoology Coordination (CZO) concentrates the highest number of members (10), followed by the Botanic Coordination (CBO- 9) and with seven at the Human Sciences Coordinations (CCH) and Earth Sciences (CCTE). However, the Botanic Coordination commands the number of scientific publications (78) because of the greatest performance of the researchers, since 2004, in Postgraduate Programs. On the other hand, the 42 articles published by the CZO members, are due to the shorter time of performance of these researchers in the PEC.

It was observed that the shorter number of the CCTE and of the CCH members in the program, even actuating since the creation, the production is highlighted in Books and Books chapters' publications. A similar panorama has been showed, in many knowledge areas in

Brazil reflecting the changes and trends of the Brazilian science and academy (Mugnaini, et al., 2004).

### 3.1.1.3 Temporal production

In the implementation period (1997-2001) of the PEC, the 22 active researchers were responsible for 70 publications (18 articles in scientific journals, 2 books, 13 books chapters, 17 full articles in scientific event reports and 10 expanded abstracts corresponding to 15,13% of the PEC production during the evaluated period.

The shorter production occurred in 1997 with six issues and the highest were in 2007 with (31 articles), 2013 (38 articles), 2014 (35 articles) and 2015 (39 articles). This reflects the availability of financial resources, the inclusion of researchers in postgraduate programs and the change in the national and international politics. It is important to highlight that from 2004 the institution incorporated the academic activities in the annual evaluation of the servants (researchers) that, started to act in many Postgraduate Programs in agreement with local teaching institutions. This activity reflected significantly in the academic-scientific production of the institution and the demands of available financing for the research (Table 2).

Table 2 - Temporal distribution by type of intellectual production of the Coastal Studies Program at Museu Paraense Emílio Goeldi (PEC/MPEG), 1997-2016. APCI- Articles in indexed journals, B- Book. BC- Book's chapter. AAM- articles in Reports of Events, AEM- Expanded abstracts in Meeting, SP- Science dissemination.

Year	APCI	B	BC	AAM	AEM	SP	Total
1997	2	0	1	1	2	0	6
1998	3	0	1	0	0	0	4
1999	3	0	1	0	3	0	7
2000	2	0	0	3	9	0	14
2001	8	2	10	6	3	0	29
2002	4	4	3	3	8	0	22
2003	3	0	3	7	2	0	15
2004	3	2	3	7	2	0	17
2005	10	0	6	11	0	0	27
2006	9	0	5	4	2	0	20
2007	6	1	3	16	5	0	31
2008	5	1	9	2	2	0	19
2009	9	3	10	4	0	0	26
2010	7	2	7	4	1	0	21
2011	10	2	12	0	2	0	26
2012	8	1	2	2	3	0	16
2013	22	0	8	5	3	0	38
2014	18	4	7	5	1	0	35
2015	20	1	3	4	2	9	39
2016	13	0	0	0	0	9	22
<b>Sum</b>	<b>165</b>	<b>23</b>	<b>94</b>	<b>84</b>	<b>50</b>	<b>18</b>	<b>434</b>

The increase of the knowledge production in 2006 (31 articles), should be a reflection of the quantity of the

program members actuating in institutional or not postgraduate programs and, also, of the institutional

changes in relation to the researchers activities from 2004 (Relatório de Gestão MPEG, 2006). The results of the search in the Curriculum Lattes of the PEC researchers not only identify but map the evolution and trends of the program showing the growth of their contribution at the Brazilian north coast. Similar studies in other knowledge areas were carried out by Raghiani et al., (2006), Reveles & Takahashi (2007), Ravelli et al., (2009), Pinheiro et al., (2012) and Urbizagsastegui, & Arango (2017).

When we evaluate the intellectual production in the timeline of the PEC/MPEG (19 years) it was observed fluctuations that are shorter in the implementation period (1997 to 2000). The increase of the production in 2001 and 2011, can be justified by the actuation of the members in long term multidisciplinary projects and by the participation in postgraduate programs. On the other hand, the significant addition in the last five years, follows the world trend of the academy, even most of this production is abstracts published in scientific events. These results corroborate those found by Maia et al., (2015) that although approach different subjects, keep up with the current trend of the research in Brazil.

It is worth mentioning that the lack of financial resources for the research, has not been significantly about the knowledge generation and training of potential young people (Relatório de Gestão do MPEG, 2015). This demonstrates that the researchers have been engaged to find resources in different sources, national and international, either through notices or in person.

### 3.1.1.4 Performance indicator

The indicators used to measure the institutional performance of the scientific production as: a) Publication Index (PI) – corresponds to the number of published articles in scientific journals classified as A and B1 and, b) Publication General Index (GPI) – correspond to the sum of the published articles with the International Standard Serial Number (ISSN) and indexed into

Publication General Indexes (GPI) or other database that were not tested (Relatório de Gestão do MPEG 2009). On the other hand, published articles in national and international scientific journals, books, books chapters, full articles published in national and international journals or national and international congresses were evaluated using the classification QUALIS-CAPES (a,b,c and without classification (SC). Other factor measured were the partnerships (authorship and co-authorship) in the publications.

The publications were grouped in the three PEC actuation areas: Biodiversity, Environmental Sciences and Interdisciplinary accord to the classification of CAPES - Qualis, 2016, considering that the criteria of classification of this indicator are different between the different knowledge areas. It is important to mention that due to the unavailability of the Evaluations and to their respective criteria to the production of books, books chapters, articles, expanded abstracts into scientific events reports and articles of science dissemination (popularization of the science) they were computed as Without Classification (SC), and that they consist in more than 67% of all production in the evaluated knowledge areas. The results to the evaluated areas were: a) Environmental Sciences, 13 A [A1=1, A2=12]; 98 B [B1=35, B2=46, B3=7, B4=6, B5=4] and 323 SC; b) Biodiversity, 7 A [A1=5, A2=2]; 55 B [B1=11, B2=22, B3=10, B4=2, B5=10]; 75 C and 297 SC and, c) Interdisciplinary, 2A [A1=1, A2=1]; 108 B [B1=4, B2=22, B3=55, B4=20, B5=7]; 1 C and 323 SC. Was indicated a shorter production to meet the current evaluation criteria of the Postgraduate Programs in Brazil since only about 10, 20 and 3.6% of the scientific production reached the classification criteria to the mentioned areas. Besides, about 50% of the 117 publications in books and books chapters and of the 134 in scientific events reports mirror the interdisciplinary character of the PEC strengthening the condition of the structuring Institutional Research Program (Table 3).

Table 3 - Performance Indicator based on CAPES-Qualis (Coordination of Improvement of Higher Education Personnel) classification 2016 for the Biodiversity, Environmental Sciences and Interdisciplinary knowledge areas.

Qualis-Capes	Biodiversity	Environmental	Interdisciplinary
A1	5	1	1
A2	2	12	1
B1	11	35	4
B2	22	46	22
B3	10	7	55
B4	2	6	20
B5	10	4	7
C	75		1
SC	297	323	323

Accord to Pinheiro et al (2012) the use of qualitative and quantitative techniques or the combination of both is fundamental to produce indicators that show the state of art of the scientific production of the mentioned studies.

It was observed that the intellectual production of the PEC demonstrates strong interinstitutional partnerships in articles in indexed journals (93), scientific events reports (58) and dissemination of Scientific Popularization (4). Besides, of the 165 PEC publications

in interdepartmental collaboration (58 - 35,15%), intra-institutional (10-15,38%) and interinstitutional (93 - 56,37%) reflect the strong collaborative capability of the program (Table 4) that, reflects the strong capability of the program to overcome the scientific dichotomies between the natural and social sciences. Similar results using epistemological logical-historic analysis and other metrics to other knowledge areas were found by Oliveira & Gracio (2008) and Gamboa & Gamboa (2014).

Table 4 - Index of the intellectual collaborations by type of publications of the Coastal Studies Program at Museu Paraense Emílio Goeldi (PEC/MPEG, 1997-2016).

Type of production/Colaboratio	INTRADE	INTRAINST	INTERINST
Articles in periodicals	60	10	95
Book	12	1	9
Book chapter	39	14	41
Anal Meeting- Articles	22	5	23
Anal Meeting - Abstracts	36	18	30
Science popularization	15	0	3
<b>SUM</b>	<b>184</b>	<b>48</b>	<b>202</b>

Legend: Intra-departmental – INTRADEP; Intra-institutional – INTERINST; Interinstitutional – INTERINST.

Similar percentage occurred with other type of publication evaluating different metrics (Oliveira, Gracio, 2008) that show the influence of the government politics (Nobrega & Fonseca, 2010). It is observed that the highest collaborations were inside the sectors and between institutions (they occurs at the coordinations and between institutions) although, there is a simple growth of the intra-institutional partnerships that can be due to the demands of the development notices. This fact is similar to those found by Urbizagsastegui (2016) who evaluated the metrics in the brazilian literature.

Thus, is believed that the intensification of partnerships maximize the potential of the scientific production (Balancieri et al., 2005; Urbizagsastegui, 2016) and enlarge the dimensions of the programs in all aspects, fact that corroborate the propositions of Silva (2013) to the health area. Besides, the PEC/MPEG researchers showed that partnerships (between institutional, intra-departmental, intra-institutional and interinstitutional) are important factors to improve the program performance.

### 3.1.2 Diffusion and science popularization

The PEC/MPEG since its foundation in 1997 has been worried to divulge the results of the researches to the local society. This activity is very evident in the RENAS

Project actions (*Natural Resources and Social Anthropology* Project) – one of the lines of this program that, gives back to the community all researches accomplished since its beginning in 1967 and, that contributed with 18% of all the institutional production in the period of 2000 to 2004 (Moraes, 2010). This type of action has been practiced in the majority of the projects developed with the seal of the PEC, where the interdisciplinarity and the intra and interinstitutional interaction, have been constant, since its creation. Therefore, the structuring capability of this program comes from the actions developed by it since its idealization, in 1996. The development of multidisciplinary activities, not only strengthen the structuring characteristic of the program but also answer the communities demands, clarifying, instructing, enlarging and enabling the development of actions that come to improve their welfare and, consequently the life quality.

These activities are one of the biggest concerns of the United Nations Organization (UNU) and of the 2030 Agenda of the Paris treaty for the development of the globe. Between the multidisciplinary activities developed by PEC are highlighted: a) the publication of the book *Amazônia, costeira: termos técnicos e populares* and organized by Lins et al., (2014), unprecedented book

that approaches beliefs, myths and language of the Amazonian coastal people and, that had the participation of all the program members and, b) the execution of the project “*Valoração econômica de uso direto e indireto dos manguezais no município de São Caetano de Odivelas*” where there was commitment of members of all the PEC sectors to appreciate the mangroves of the São Miguel island, in the city of São Caetano de Odivelas. In that action, there was the recognition of the cultural and social value of the community that, also was guided to know other aspects of the mangrove and, thus to contribute with the team to appreciate this important natural environment (mangrove). Other social action involving the same project was developed as activity of the Museu Portas Abertas Project at the Museu Goeldi Research Campus, in 2016. The participants of all knowledge areas of the Project (Biology – Restinga and medicinal plants, birds and ants) and Social Anthropology (RENAS Project), introduced the results of the research in an integrate way for the visitant public.

Thus, the PEC/MPEG develops research and diffusion actions (with the highest number of publications

in journals and divulgation magazines) answering its mission to contribute for the environmental, biological, sociocultural and economic development of the Amazonian coast, utilizing recent stimuli of the research developers and of the public power to that.

### 3.1.3 Contribution in the training of human resources

The coastal areas were and remain one of the fundamental accesses to the continental areas of the globe. This area has a variety of peculiar ecosystems, in many cases little known and that find themselves under natural and anthropic pressure. Thus, the Coastal Studies Program from the Museu Paraense Emílio Goeldi (PEC/MPEG), since its creation, in 1997, contributes to the Training of qualified Human Resources with focus in coastal areas, aiming to enlarge the knowledge about the brazilian north coast. In this context, were qualified through the PEC/MPEG, in the period between 1997 – 2015 (18 years), 427 young people: 13 in PhD level, 104 in Master level, seven in Specialization level and 303 in Scientific Research level (PIBIC= 233 and TCC= 69) (Fig. 3).

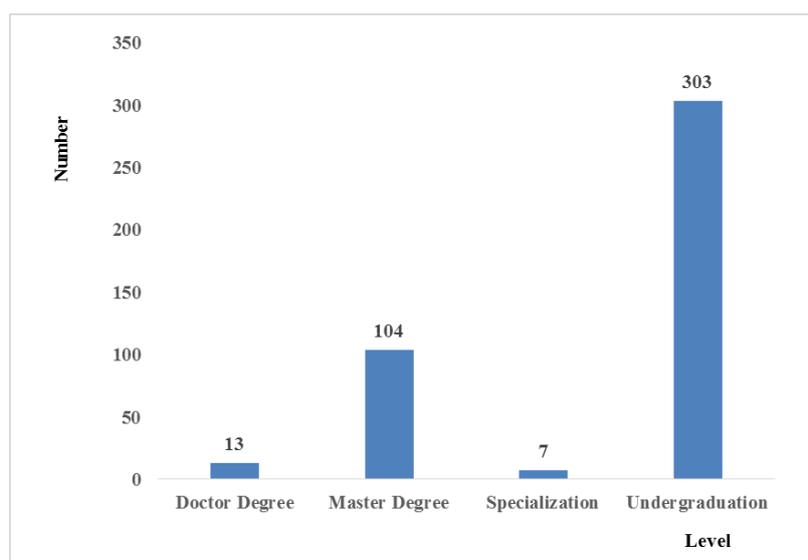


Fig. 3 - Contribution of human resources training per level of the Coastal Studies Program at Museu Paraense Emílio Goeldi (PEC/MPEG), 1997-2015.

#### 3.1.3.1 Education by knowledge areas and sectors (coordinations) of activities.

The contribution to the training of human resources is distributed in the following knowledge areas: Biological, Health and Agricultural Sciences with 49,41% (211 degrees: 7 doctorates, 71 masters, 4 specializations, 129 scientific researches (98 PIBICs and 31 TCCs));

Earth Sciences and Engineering with 29,98% (128 degrees: 3 doctorates, 18 masters, 3 specializations and 105 scientific researches (74 PIBICs and 31 TCCs) and Human and Social Sciences with 23,19% (99 degrees: 3 doctorates, 15 masters, 1 specialization, 80 scientific researches (72 PIBICs and 8 TCCs) (Table 5).

Table 5. Number of training people per level of training and sector of activity by Coastal Studies Program at Museu Paraense Emílio Goeldi (1997-2015). CBSA- Biological sciences, Health and Agrarian, CTE- Earth Sciences and Engineering, CHS- Human and Social Sciences, INTERD - Interdisciplinary, 1997-2016.

Level of training	CBSA	CHS	CTE	Total
Doctor Degree	7	3	3	13
Master Degree	71	15	18	104
Specialization	4	1	2	7
Graduation	128	81	105	303
<b>SUM</b>	<b>128</b>	<b>100</b>	<b>128</b>	<b>427</b>

This action answer not only the program's mission as also the assumption that the education should be eclectic and when it is possible, attached to the scientific knowledge (Freire, 1996). The contributions of the PEC members per activity sector were: Botanic Coordination – CBO (128 training/8 researchers), Earth

Sciences Coordination – CCTE (128 training/7 researchers), Human and Social Sciences Coordination – CCH (98 training/10 researchers) and Zoology Coordination – CZO (82 training/9 researchers) (Tables 6 and 7).

Table 6 - Number of Training per level and per Sector of activity of the Coastal Studies Program at Museu Paraense Emílio Goeldi for the north coast of Brazil CBO- Botanic Coordination, CCE - Communication and Extension Coordination, CCH- Human Sciences Coordination, CCTE- Earth Sciences and Ecology Coordination, CZO- Zoology Coordination (1997-2016).

Level of training	CBO	CCE	CCH	CCPG	CCTE	CZO	Total
Doctor Degree	3		3		3	4	13
Master Degree	60	1	14		18	11	104
Specialization	2		1		2	2	7
Graduation	63		80	1	105	65	303
<b>SUM</b>	<b>128</b>	<b>1</b>	<b>98</b>	<b>1</b>	<b>128</b>	<b>82</b>	<b>427</b>

The biggest difference in the training of human resources per research sectors due to, mainly to the time of actuation of the PEC members, in their participation in postgraduate programs, in Institutional Programs: of Scientific Research and of Institutional Training, in interdisciplinary projects or not, of long, medium and short term. Therefore, the smallest participation of the CZO in this aspect due to the shortest time of actuation of the majority of the researchers in the PEC, while that, in other sectors, a big part of the researchers actuate in the PEC since its creation. Thus, the researchers have been contributed to the education and training in all the levels. Also, the scientific vision contributes in the learning process stimulating the creativity and enlarging the change of knowledge (Nascimento & Santiago, 2012), even the learning process depends of the theoretical and practical dimensions used (Abrantes & Martins, 2007).

### 3.1.3.2 Space-temporal training

It is observed that in the decade 1990 there was a shorter contribution than from the year 2000, in the

training of human resources, even very expressive in 1999 (26 training). However this action was intensified from 2003 with the participation of the researchers in postgraduate programs (Zoology and Botanic) and in institutional in force scientific research programs since 1996. The greater training of masters since 2007 and of doctors from 2009, is related to the institutional performance evaluation politic that stimulates a greatest actuation of the researchers in the interdisciplinary intra and interinstitutional projects and that favored the implantation of other postgraduate programs in the institution from 2004 with the creation of the Biological Sciences Programs – Tropical Botanic, Environmental Sciences and Human and Social Sciences with emphasis in Anthropology agreed with teaching and research local institutions Federal University of Amazon (UFRA), Federal University of Pará (UFPA) and Farming Researches Enterprise (Oriental EMBRAPA – CPATU) (Table 7).

Table 7- Temporal distribution of the training of human resources per sector of activity of the Coastal Studies Program at Museu Paraense Emílio Goeldi (PEC/MPEG), 1997-2015.

Year	CBO	CCE	CCH	CCPG	CCTE	CZO	Total
1997	8		5		1	2	16
1998	2		8		2	2	14
1999	7		5		7	7	26
2000	2		4		2	6	14
2001	1		2		2	3	8
2002	2		1		5	5	13
2003	4		5		10	4	23
2004	5		1		8	7	21
2005			3		5	3	11
2006	4		3		8	2	17
2007	4		6		14	2	26
2008	13		3		11	3	30
2009	14		4		10	2	30
2010	8		5		7	6	26
2011	5		7		10	6	28
2012	9		4		4	2	19
2013	12	1	11	1	8	7	40
2014	16		8		7	3	34
2015	9		6		7	9	31
<b>SUM</b>	<b>125</b>	<b>1</b>	<b>91</b>	<b>1</b>	<b>128</b>	<b>81</b>	<b>427</b>

The temporal variation with the training of human resources by the PEC/MPEG researchers due to not only the availability of resources but also the change in the institutional politic from 2000 that is directly related to the academy demands, innovation and world technologies. These results corroborate with the ones found by Nobrega & Fonseca (2010) in a case study in the Social Service area.

It is important to emphasize that the program has been worried in the institutional academic education, involving, also community members where the researches are accomplished, actions that answer the program's mission.

Other important factor in this training is the investigative capability involving education, science and technology of the titled that differentiates them of the majority of the academy trainings that also was highlighted by Nascimento & Santiago (2012), as important aspects to be approached.

#### IV. CONCLUSION

The analysis of the found results of the intellectual production and of the Human Resources Training in the PEC timeline (1997 to 2016), highlighted the historical construction of the PEC Program of the MPEG. The intellectual (434 articles) and personnel training (427 degrees) contribution of the Coastal Studies Program from the Museu Paraense Emílio Goeldi, in the period of 19 years (1997-2016) even it seems quantitatively simple, it gives qualitative subsidies very important to base environmental impact studies and use, management and conservation proposals to the development of the north coast of Brazil.

The PEC contributes in the training of personnel since the undergraduate until the postgraduate studies, involving members of the studied communities. The results show the multidisciplinary characteristic as one of the structuring programs from Museu Goeldi, involving all institution sectors, producing and disseminating the scientific knowledge, pointing out gaps and advances that can subsidize the academic and community demands. Besides, it concerns about turn back the produced knowledges to the communities, accomplishing, thus, its mission.

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