

Appendix 4. Semi-structured interviews

Conducted interviews and their main contents relevant to the respective research questions

Table A4.1 List of interviews with actors of the main actor groups including representatives of institutions, initiatives, and associations (EUR= Europe, BRA=Brazil, MA= Mata Atlântica)

Affiliated actor group	Considered institutions / initiatives / associations	N	Scale
Bow maker	International Pernambuco Conservation Initiative (IPCI)	1	EUR
	Individual bow maker	1	BRA
	Individual bow makers	4	MA
Environmental agency	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA), Instituto Chico Mendes de Conservação da Biodiversidade, (ICM-Bio)	4	MA
Environmental NGO	Associação Plantas do Nordeste (APNE), Floresta Viva, Fundação Nacional do Pau Brasil, SOS Mata Atlântica,	4	MA
Scientists	Instituto Florestal São Paulo, Universidade de São Paulo, Universidade Federal do Espírito Santo, Jardim Botânico de Rio de Janeiro (JBRJ)	8	BRA
Violin maker	Individual violin makers	3	EUR, INT
Farmers/Forest ranger	Comissão Executiva do Plano da Lavoura Cacaueira (CEPLAC)	9	MA

Historical trajectory analysis

Table A4.2 Main aspects of the semi-structured interviews for the historical trajectory analysis

Affiliated actor group	Description of main aspects
Environmental NGOs	Experiences in reforestation and tree nurseries in the Mata Atlântica, pau-brasil plantations in agroforestry systems (with small-scale farmers), pau-brasil plantations in the northeast in monocultures and agroforestry systems. History of first pau-brasil plantations to protect and conserve the species, period of existing pau-brasil planting projects, type of funding, difficulties/challenges in reforestation projects, type of planting projects/plantations (forest enrichment, monoculture, agroforestry system, mixed plantation, plans for future commercial use); involved actors (small-holder farmers, big-scale farmers, bow makers with their own territories), number and type of plantations that fulfill all criteria for future commercial use.
Farmers, plantation owners, rangers	Interest of integrating pau-brasil in cocoa plantations (agroforestry systems), potential of pau-brasil within native mixed tree plantations and future legal use (obstacles), ecological and protection situation, potentials for planting pau-brasil in areas of small-scale farmers.
Bow (incl. subgroup: bow manufactories) and violin makers	Current situation of bow making in Europe, traditional knowledge on wood properties and choice, construction of high-quality bows, bow making in Brazil, situation within the bow making manufactories in Brazil, situation of private pau-brasil plantations of owners of the bow making manufactories, trade of legal pau-brasil, awareness of violin makers about the situation of pau-brasil.
Scientists (experts), research on pau-brasil	Overall situation of pau-brasil, actual distribution, wood anatomy of pau-brasil, alternative wood species for making bows for string instruments, information on morphotypes, genetic variations, dendrochronology, and its cultural value for Brazilians.

Social actor and power relations analysis

Table A4.3 Main aspects of the semi-structured interviews for the social actor and power relations analysis

Affiliated actor group	Description of main aspects
All interview respondents	Origin, age, gender; recommendation on which other key actors should be approached (snowball sample), profession, representative position.
Environmental NGOs	Scale of action, level of concern regarding pau-brasil and its ES, existence of interconnections to other NGOs or actor groups, level of influence on policy decisions, e.g., consultation as experts of decision-making processes regarding native species and pau-brasil and at what scales.
Bow makers/ violin makers	Existence of associations (Brazil, Europe, International), role of pau-brasil in livelihoods, existence of connections among bow makers across scales, level of influence in decision making processes and policy decisions.
Farmers/ plantation or forest owners	Role of pau-brasil and its ES for livelihoods, concern over pau-brasil, cultural importance, existence of farmer associations (formal institutionalization), interconnections with other actor groups at different scales, possibilities for participation and influence in decision-making processes.
Scientists	Concerns about pau-brasil from the scientific community at all scales, level of influence on decision-making processes or policy decisions, e.g., consultation as experts to assess the threats to pau-brasil.

Interview scripts

Bow makers/violin makers

1. When was your company/workshop founded?
2. Are you a bow maker/violin maker personally?
3. Was there a history of bow making within your family?
4. Was there a specific moment when the situation in respect of pau-brasil worsened?
5. How many bows per year do you produce/sell in your workshop? Are these bows all made from Pernambuco wood?
6. For how long do you consider having enough Pernambuco wood in your stock? (only bow makers)
7. Under the consideration of the market of string instrument bows, there are bows on the market under the trade name 'Brasilholz'/'brazilwood'; what tree species is meant with that trade name for violin and bow makers?
8. Do you think it will also be possible in future to build string instrument bows made from pernambuco wood/pau-brasil?
9. In how far is the Chinese Market affecting the situation of your company/workshop, of the Mata Atlântica and of Brazil?
10. To your opinion are there any other wood species that could replace pernambuco wood?
11. To your experience do you think musicians would buy bows made from other wood species?
12. How much influence has the Chinese bow production on the Brazilian/European market?
13. What were generally the most important changes in the bow making tradition?
14. Which key characteristics does pernambuco wood fulfill for making string instrument bows?
15. In how far does storing time of wood influence the wood quality?
16. In the literature one can read that one bow needs on average 1kg of raw material, can you confirm that? Or what are your experiences?
17. Talking about the NGO IPCI, how many German members does the NGO have? (only for IPCI)
18. What do you think is the biggest threat for bow making?
19. Considering the situation of the pernambuco tree, to what extent can its use in bow making be linked to the threat of the tree species?
20. Which are the difficulties using alternative wood species?
21. Do you think certification of pernambuco wood could be a solution for the problem?
22. When did you buy the last time pernambuco wood?
23. Did you notice increasing prices? And if so, how much did prices increase?
24. Based on your experience did the supply of pernambuco string instrument bows increase or decrease?
25. Where do you need to register your pernambuco stock in Germany/Brazil?

Environmental agencies

1. Which are the relevant laws at the federal level for the conservation of endemic native tree species in danger of extinction?
2. Is there any specific law for the protection or conservation of pau-brasil?
3. Which are the relevant laws on the federal level for plantations of endangered native tree species with the goal of a future commercial use?
4. Is there any specific law for pau-brasil plantations related to future commercial use?

5. Are there any specific laws on the state level for the regulation of plantations of endangered native species or especially for pau-brasil with the goal of a future commercial use?
6. Are there any specific laws on the state level for the conservation of native species or especially for pau-brasil?
7. Based on the legislative regulations is it theoretically possible to have mixed silviculture plantations only with native tree species of the Mata Atlântica?
8. Are there any limitations for a future commercial use of planted native tree species and especially of pau-brasil trees?
9. How is the process of the registration of an area for cultivating native tree species?
10. Is there a national register about confiscated wood/illegal trade of native and/or protected species? Specifically, also for pau-brasil?
11. When was the last case when pau-brasil got confiscated?
12. Do you know if there exists a central federal or state register of the registered legal stocks of pau-brasil?
13. From which date onwards was it necessary to register pau-brasil stocks in Brazil?
14. Is there any data available on legal trade of pau-brasil in the past or nowadays?
15. What do you consider the biggest problem in the protection and conservation of pau-brasil?

Environmental NGOs/ Farmers association (CEPLAC)

1. What is the focus of your NGO?
2. Which are the most valued species of the Mata Atlântica?
3. Since how long have you been working with pau-brasil within the work of your NGO?
4. Which are the aspects of pau-brasil you are working with?
5. In which regions are you working with pau-brasil?
6. Since how long are you working together with IPCI?
7. Do you think that a sustainable use of pau-brasil is possible?
8. Do you think it is possible to include small-scale farmers in a sustainable use of pau-brasil?
9. Would you consider a commercial monoculture with pau-brasil as a possibility for sustainable cultivation?
10. There are many other existential problems for farmers in your region. Nevertheless, do you think that there are possibilities for sustainable pau-brasil plantation activities in your region?
11. How does climate change manifest in this region here?
12. Do you think climate change will potentially affect the growth and success of pau-brasil plantations?
13. Are there any findings on how drought affects the growth of pau-brasil?
14. What are the main potentials and obstacles that you would name talking about pau-brasil protection and its future commercial use?
15. Do you consider it a realistic option to establish mixed pau-brasil plantations with cocoa and other agricultural plants?
16. What is your opinion about nature-oriented silviculture for a future commercial use of pau-brasil?
17. Do you also work with other endemic tree species of the Mata Atlântica besides pau-brasil?

Farmers

1. What do you plant on your farm?
2. What is your motivation to plant pau-brasil?
3. Does pau-brasil have a specific importance for you?
4. How did you get the idea to plant pau-brasil?
5. Why did you plant pau-brasil and not another tree species?
6. Do you think other farmers are interested in planting pau-brasil as well?
7. To your knowledge what is the main use of pau-brasil wood?
8. Do you know of any traditional use of pau-brasil?
9. Do you use pau-brasil (wood, leaves, bark, roots, seeds) for anything in specific?
10. Do you know any farmer that has planted pau-brasil mixed with other agricultural plants?
11. Do you think it is difficult to find space for planting pau-brasil within your agricultural area?
12. Does planting pau-brasil have any positive effect for you?
13. Which are the difficulties or challenges when planting pau-brasil?

Forest ranger

1. For how long have you been working as a forest ranger in this conservation area?
2. Has there ever been illegal logging, especially of pau-brasil, in this conservation area?
3. What are your observations regarding the pau-brasil population in this conservation area?
4. Are there any pau-brasil trees left in this conservation area?

Plantation owners

1. When did you start planting pau-brasil trees?
2. What was your main motivation to plant pau-brasil trees?
3. Are you planting pau-brasil in monocultures, agroforestry systems, or mixed tree plantations (silviculture)?
4. In how many plantations did you include or plant pau-brasil trees?
5. Are your plantations registered in the rural environmental cadaster (Cadastro Ambiental rural)?
6. What processes of registration are necessary for a future commercial use of your planted pau-brasil trees?
7. Do you plant other tree species in the same area and if so, which ones? What were your criteria for selecting the other tree species?

Scientists (botany/taxonomy)

1. Can the three morphotypes of *Caesalpinia echinata* be related to genetic variations?
2. How can it be explained that all the three morphotypes can only be found in Bahia?
3. Have you also researched relationships between morphotype and wood characteristics? Do you know any studies on this?
4. There was/is a brazilwood project developed by the Botanical Garden of Rio de Janeiro – do you know that project and is it still going on?
5. Has there ever been done an ecological analysis on pau-brasil occurrence (e.g. regarding soil, surrounding plant species, etc.) within the natural remnants of the Mata Atlântica?
6. Are distribution maps available of the natural remnants of pau-brasil populations?
7. In all your research on pau-brasil, have you found any traditional use of pau-brasil?

8. How relevant is it to consider the genetic variations when establishing pau-brasil plantations?

Scientists (geography)

1. Do you know of any records of pau-brasil exportations from 1800 until today?
2. To your opinion how reliable are such kind of data regarding pau-brasil exportations and ship loads?
3. Based on your research is it possible to draw conclusions on whether pau-brasil was cut selectively or as part of clear cutting in the past?
4. Is it possible to draw conclusions from which regions of the Mata Atlântica pau-brasil was cut mainly for the export and why?
5. Did you ever find indications during your research that pau-brasil was used for barrels, e.g., sugar barrels?
6. Were there already regulating laws for pau-brasil before the 20th century?
7. What were the typical trade routes in the past?

Scientists (wood anatomy and wood identification)

1. What are characteristic wood anatomy features of pau-brasil?
2. How can pau-brasil wood be distinguished and clearly identified from similar tropical wood species?
3. Based on your knowledge, is there a lot of illegal trade with pau-brasil?
4. What is the typical procedure to detect and identify illegal wood transportation and trade in Brazil?
5. How effective are the wood trade controls in Brazil and what are the main challenges?
6. Based on your research what are scientifically alternative wood species that could replace pau-brasil wood for string instrument bows?
7. Are these alternative species more abundant and not endangered or regulated by CITES?

Scientists (forestry)

1. Do you consider the wood quality of planted pau-brasil trees to be comparable to the wood quality of pau-brasil wood from natural forests?
2. What are the differences in wood quality and how can they be explained?
3. In your research projects did you examine annual increase of the heartwood of pau-brasil?
4. What is the minimum age pau-brasil seedlings need to reach before they can be harvested for bow-making of stringed instruments?