

Impact case study (REF3)

Institution: Lancaster University		
Unit of Assessment: 7, Earth Systems and Environmental Sciences		
Title of case study: Strengthening environmental sustainability and social justice in the Brazilian Amazon: protecting secondary forest, guiding climate mitigation and expanding land rights.		
Period when the underpinning research was undertaken: 2008–2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Jos Barlow	Professor of Conservation Science	01/08/2007–present
James Fraser	Senior Lecturer in Political Ecology	01/03/2013–present
Period when the claimed impact occurred: 2014–2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact</p> <p>Lancaster research has played a key role in improving the socio-ecological sustainability of the Brazilian Amazon, with three main areas of impact.</p> <p>(i) Defining policies that protect the most ecologically important secondary forests across the 1.25M km² State of Pará. The research provided the scientific basis for a new policy defining the legal protection of older and more ecologically valuable secondary forests (<i>i.e.</i> forests that have regrown following deforestation). This policy was the first to legally mandate the protection of secondary forests in the Brazilian Amazon, and has been considered “<i>essential</i>” by the municipalities that licence or prohibit secondary forest clearance, supporting decisions on 400 km² of land in just one municipality [5.4].</p> <p>(ii) Guiding large-scale climate change mitigation strategies in the State of Pará. Research outputs quantifying the carbon accumulation rates of secondary forests have contributed to an official decree that defines the measures needed for the State to achieve carbon neutrality by 2035. The research provided up-to-date and regionally appropriate estimates of carbon accumulation that were considered “<i>fundamental</i>” for defining the area of reforestation required [5.3].</p> <p>(iii) Expanding social justice in two Amazonian regions. The research contributed to more secure land tenure by providing the evidence upholding forest peoples’ territorial rights in the Mamuru River valley, and by using environmental protection to restore their ability to practice traditional livelihoods in the 4,413 km² Saracá-Taquera National Forest.</p> <p>Overall, the significance of these contributions to Brazilian policy and social rights are remarkable, as testimonial [5.1] by Dr. Joice Ferreira points out: “<i>Brazil (i) does not have a strong tradition of using scientific evidence in policy, and (ii) has a strong nationalist identity that would normally preclude the involvement of researchers from outside of Brazil in guiding policy or management decisions</i>”.</p>		
<p>2. Underpinning research</p> <p>Lancaster has led a sustained programme of research on the Brazilian Amazon, which was initiated by Barlow in 2007 and extended by Fraser since 2013. Since August 2013, they have contributed to over 100 papers on the Amazon and have led projects worth over GBP4.0 million in funding. The research outlined below is presented according to the three main impacts.</p> <p>(i) Defining the most ecologically important secondary forests</p> <p>Forests regenerating in previously deforested areas - secondary forests - have become an increasingly prominent feature of tropical landscapes, covering c. 130,000 km² in the Brazilian Amazon. However, until recently, it has not been clear at what point they begin to attain the biotic attributes of undisturbed primary forests. Work led by Barlow evaluated more than 1,600 large and small-stemmed plants, birds, and dung beetles in 59 naturally regenerating secondary forests, and 30 co-located undisturbed primary forests in the eastern Amazon [3.1]. This showed that secondary forests display a high degree of biodiversity resilience: after 40 years of regeneration they recovered over 85% of the species richness and species composition recorded in primary forests.</p>		

The research in [3.1] underpinned the impact by demonstrating that above-ground biomass was the strongest environmental predictor of the occurrence of forest-dependent species, supporting the use of basal area as a predictor of conservation value in legislation. Above-ground biomass and basal area are both calculated from stem sizes and are collinear at $r = 0.9$, but basal area was considered better suited for legislation as it is easier for landholders to calculate. Crucially, the research in [3.1] also identified important change-points in the relationship between species occurrence and above-ground biomass, providing the rationale for licencing either the clearance or protection of secondary forests. First, it showed that clearance of secondary forests would have the least conservation impact where above-ground biomass was less than 25 Mg ha^{-1} (equal to a basal area of $5 \text{ m}^2 \text{ ha}^{-1}$, and an age of c. 5 years), as these secondary forests were dominated by early successional species with the largest geographic range sizes. Second, it revealed that the protection of secondary forest was most important where above-ground biomass levels exceed 75 Mg ha^{-1} (equal to a basal area of $10 \text{ m}^2 \text{ ha}^{-1}$, and an age of c. 20 years), as this was the point at which there was a marked increase in the occupancy of high-conservation-value forest species (e.g. birds with significantly smaller range sizes).

(ii) Quantifying the carbon stocks and accumulation rates of secondary forests

Secondary forests can play an important role in mitigating climate change by sequestering and storing carbon. The greatest opportunities for large-scale forest restoration exist in the most deforested regions of the Amazon, such as the eastern Amazonian state of Pará. Yet there are few up-to-date assessments of carbon accumulation rates in these regions. This is an important knowledge gap as previous assessments were all made at a time when conditions were more favourable: the climate was cooler and less seasonal, there was more primary forest, and land-uses prior to forest regeneration were less intense meaning soils and seed banks were in better condition. Barlow has led research to reduce this uncertainty, analysing the carbon storage [3.2] and accumulation rates [3.1, 3.3 and 3.4] of secondary forests at scale, and in a unique 18-year record of repeated tree censuses. This research shows that secondary forests in the eastern Amazon accumulate carbon at a rate that is as much as 11 times lower than some previous estimates, and that the slow rate of forest regrowth was in part explained by increasing drought severity [3.3]. The contemporary and regionally-derived carbon accumulation rates derived from Barlow's research are a considerable improvement on previous estimates: they have been used to develop the State of Pará's plan to use reforestation as part of its aim to be carbon neutral by 2035 [5.6].

(iii) Providing empirical and theoretical support for social justice

The recognition of forest people's territorial rights is critical for social justice and effective conservation in the Amazon. However, this is complicated by the variety of distinct yet overlapping identity categories for forest peoples' that are present in Brazilian legislation [3.5]; different and unequal rights are afforded to different groups of forest peoples depending on their identity category (e.g. indigenous people or traditional non-indigenous people). Fraser addressed this by creating a novel theoretical framework which combines a non-essentialist approach to identity with a universally applicable framework for assessing recognition [3.5]. He used this approach to assist forest peoples in the Mamuru region to gain recognition for their land claims [5.7]. Fraser also analysed the ways in which forest peoples' land rights claims can be effective at resisting territorial dispossession driven by industrial resource extraction [3.6]. Maintaining forest peoples in their territories is now acknowledged as the most effective means of achieving social justice and conservation.

3. References to the research

- [3.1] Lennox, G.D.... **Barlow, J.** (2018). [Second rate or a second chance? Assessing biomass and biodiversity in regenerating Amazonian forests.](#) *Global Change Biology*. 24: 5680–5694. Citations (WoK: 30), (Altmetric: 112)
- [3.2] Berenguer, E.... **Barlow, J.** (2014). [A large-scale field assessment of carbon stocks in human-modified tropical forests.](#) *Global Change Biology*. 20: 3713–3726. Citations (WoK: 166), (Altmetric: 258).
- [3.3] Elias, F.... **Barlow, J.** (2020). [Assessing the growth and climate sensitivity of secondary forests in highly deforested Amazonian landscapes.](#) *Ecology*. 101(3), e02954. Citations (WoK: 7), (Altmetric: 287)

- [3.4] Ferreira, J.... **Barlow, J.** (2018) [Carbon-focused conservation may fail to protect the most biodiverse tropical forests](#). *Nature Climate Change*. 8, 744–749. (WoK: 32), (Altmetric: 423)
- [3.5] **Fraser, J.A.** (2018). [Amazonian Struggles For Recognition](#). *Transactions of the Institute of British Geographers* 43(4): 718–732. Citations (WoK: 6), (Altmetric: 29)
- [3.6] Nepomuceno, Í., Afonso, H, **Fraser, J.A.**, Torres, M. et al. (2019). [Counter-conducts and the green grab: Forest peoples' resistance to industrial resource extraction in the Saracá-Taquera National Forest, Brazilian Amazonia](#). *Global Environmental Change*. 56: 124–133. Citations (WoK: 4), (Altmetric: 33).

Additional quality indicators

All outputs were supported by H2020-MSCA-RISE Project 691053-ODYSSEA “Observatory of the dynamics of interactions between societies and environment in the Amazon”, EUR1,849,500 (2015 to 2019).

NE/G000816/1 “Longer-term responses of Amazonian vegetation to fire” GBP75,577 (2008 to 2010); [3.1, 3.2, 3.4]

NE/K016431/1 “Biodiversity and ecosystem functioning in degraded and recovering Amazonian and Atlantic forests” GBP1,167,089 (2013 to 2018); [3.1, 3.2, 3.4]

NE/M017389/1 “Human-modified Tropical Forest Programme Management” GBP101,679 (2014 to 2019). [3.1, 3.2, 3.4]

NE/N01250X/1 “Biomes of Brasil - resilience, recovery, and diversity: BIO-RED” GBP154,318 (2016 to 2020). [3.3]

4. Details of the impact

Key to the impacts stemming from **Barlow's** research (impacts **i** and **ii**) has been the *Rede Amazonia Sustentavel* (RAS), known in English as the Sustainable Amazon Network. Barlow co-founded RAS in 2009 with Dr. Toby Gardner (Stockholm Environment Centre) and Dr. Joice Ferreira (Embrapa). Dr. Alexander Lees (Manchester Metropolitan University) became a member of the steering committee in 2015. Since then, Barlow has led this network by applying scientific evidence to underpin and strengthen socio-ecological sustainability across the Amazon region. He has spent more than a third of his time in Brazil since August 2013 and has had a fundamental role in the network's influence. For example, he “*is senior author on all of those [publications] that have had the strongest influence on policy*” [5.1], including those that support impacts **i** and **ii** in this case study. The impacts stemming from **Fraser's** research (impact **iii**) have been supported by the 2015-2019 Horizon 2020 project (Project 691053-ODYSSEA), which enabled him to spend 10 months in Brazil. This resulted in research outputs [3.5] and [3.6], and led to the impacts relating to the legal recognition and self-demarcation of Amazonian territories.

(i) Defining policies that protect the most ecologically important secondary forests

In 2014, the large-scale research on human-modified Amazonian forests being conducted by RAS (e.g. [3.2]) led to Barlow being invited to join a working group that was established and coordinated by the Brazilian State of Pará Environment Secretariat (SEMAS). The state of Pará is the second largest in Brazil and covers most of the eastern Amazon. The working group was tasked with resolving a lack of clarity within state-level legislation responsible for determining the legal status of secondary forests. The working group used Barlow's research to develop robust ecological criteria to define ‘early’, ‘intermediate’ and ‘late’ stage forest regeneration. This was essential to allow the state to licence the re-use of forests with the lowest ecological value and protect the most ecologically important forests. Specifically, the working group compiled evidence from Barlow's research [3.2] and a limited number of other studies (contributing less than 20% of the data) to identify when secondary forests begin to hold much higher levels of biodiversity. The analysis was originally conducted using above-ground biomass as the unit of forest growth, which is directly related to above-ground carbon stocks (carbon stocks are biomass divided by two). However, results were converted to basal area in the legislation to facilitate implementation. Basal area is the cross-sectional area of trees at breast height; it is collinear with above-ground biomass and carbon ($r = 0.9$) and does not require complex allometric equations or information on wood density or tree height.

The final analysis of the working group that was used to guide policy [5.2] was subsequently developed and published as [3.1]. Specifically, it suggested that: all forests above 20 years old

should be protected; all forests less than five years old could be cleared; and forests between 5 and 20 years old should be protected if their basal area sits above a certain threshold (between 5 and 10 m² ha⁻¹). The precise basal area threshold was linked to the level of forest cover in the municipality, as the analysis (supported by the subsequent research [3.3]) showed that secondary forest growth rates were slower in the most deforested regions.

The above recommendations from the working group formed the basis of a new law that was published in three revisions [5.2]: the first (Instrução Normativa N° 02, dated 26th February 2014) outlined the change points that defined the 'early', 'intermediate' and 'late' forest regeneration stages. The second revision (Instrução Normativa N° 07, dated 5th October 2015) defined the methods that a landholder must follow to define regeneration stages during an application to clear secondary forests. In the final revision (Instrução Normativa N°08, dated 28th October 2015), the working group: clarified the measurement criteria for field-based assessments of carbon stocks; refined the thresholds between basal area and forest cover at the municipality level; and added clauses to ensure that the legislation guards against perverse outcomes, such as secondary forests being wilfully degraded prior to carbon assessments [5.3]. The licencing detailed by this law allows farmers to return low-value secondary forests to agricultural use whilst ensuring those with the highest carbon stocks and highest biodiversity values are protected.

Pará was the first state in the Brazilian Amazon to develop legislation giving specific protection to secondary forests. The law been widely applied in highly deforested municipalities and was considered "*fundamental*" to the activities of the municipal environmental secretariat in the 1.5 Mha region of Paragominas, where it was used to determine the applications for 400 km² of secondary forest [5.4].

(ii) Guiding large-scale climate change mitigation strategies

In July 2020, Barlow was invited by the SEMAS to provide scientific guidance about the carbon accumulation rates of secondary forests in the eastern Amazon to help formulate the 'State Plan for Amazonia Now' (Plano Estadual Amazonia Agora; PEAA), which aims to achieve carbon neutrality in Pará by 2035 [5.5, 5.6]. Under the PEAA, the state is planning to reforest over 5 million ha of land, almost half of Brazil's total target under its Nationally Determined Contributions from the Paris agreement of the United Nations Framework Convention on Climate Change (UNFCCC). Barlow-led research [3.1, 3.2, 3.3 and 3.4] provided up-to-date and regionally-defined assessments of the carbon accumulation rates of secondary forests. These were substantially lower than the ones that were initially proposed, which were based on a 20th Century study from another region of the Amazon. The change therefore increased the coverage of secondary forest required to reach carbon neutrality. The Director of Strategic Planning and Special Projects in the state of Pará's environmental secretariat considered Barlow's research to be "*essential*" for the PEAA [5.5]. The official decree, State Decree no. 941 from the 3rd of August 2020, cites Barlow's research [3.1, 3.3], and explains the role of Barlow's input through RAS [5.6]. Barlow has also been invited to form part of a Scientific Advisory Committee accompanying further development and implementation of the PEAA [5.5, article 1 in 5.6].

(iii) Expanding social justice for indigenous peoples and traditional communities

Under the auspices of the 2015-2019 Horizon 2020 project ODYSSEA (691053) and guided by his novel approach to Amazonian recognition [3.5], Fraser has assisted the Saterê-Mawé indigenous people and traditional communities in obtaining territorial recognition and in resisting threats from loggers and land-grabbers in the Mamuru River valley. The attorney general of Santarém, the major administrative centre of Western Pará, requested Fraser's help as an expert in territorial recognition to support indigenous territorial re-occupations of the 788,500-ha Andirá-Marau indigenous land, whose delimited perimeter appears to exclude part of the territory being reoccupied by the Saterê-Mawé. Drawing on Fraser's findings, on 30th July 2019, the agrarian justice attorney of Santarém wrote to the President of the Government Land Institute of Pará State (ITERPA), requesting that he review land tenure in the region with a view to expanding the Saterê-Mawé territory of the Andirá-Marau and the PEAX Mamuru territory of the traditional communities to reduce land grabbing and logging [5.7]. As a result, the Saterê-Mawé, in the middle of the very challenging COVID-19 pandemic, produced a "counter-map" of the part of their ancestral territory that was excluded from the original demarcation of Andira-Marau. This

involved opening a track in the forest that strategically links the last village on the Andirá River to the last village on the Mariaquã River [5.8], providing critical evidence that legal authorities have acted upon. This impact benefitted the 13,350 Saterê-Mawé inhabiting the Andirá-Marau territory, along with hundreds of others who live outside this indigenous land, as their inclusion in the expanded Andirá-Marau territory provided them with secure land tenure.

Fraser has also worked on forest peoples' resistance to "green grabbing" [3.6], where the state and capital use claims of sustainability to justify appropriation of land and resources and the displacement of traditional communities. Fraser's research highlighted misleading claims of "sustainability" in the 441,300 ha Saracá-Taquera National Forest. In 2017 this resulted in the suspension by a Federal Judge of the Forest Stewardship Council (FSC)-certified logging that had been carried out in the national forest since 2013 [5.9]. The ruling prohibits timber companies and the certifying body (Imaflora) from using the FSC seal for logging projects in the Saracá-Taquera National Forest until a recovery plan for degraded areas is prepared and executed in a channel that connects a lake to the Trombetas river. The plan must "*contain solutions that prevent further damage.*" The timber companies and Imaflora were ordered to indemnify community members for "*collective moral damages*", of BRL100.0 for each defendant, which will be allocated to the Fund for the Defense of Diffuse Rights (FDD). They were also obliged to publicise advertising campaigns to promote the rights of traditional communities and preserve the environment. This ruling supports both the rights of traditional communities and the preservation of the environment, benefitting the entire population (approximately 2500 people) of the Saracá-Taquera National Forest [5.9] by allowing them to continue their traditional forest livelihoods which had been disrupted by the logging [3.6]

5. Sources to corroborate the impact

5.1 Testimonial from Dr. Joice Ferreira dated 4th December 2020, Senior Researcher at EMBRAPA Amazonia Oriental in Brazil, outlining how the RAS network developed and describing Jos Barlow's role in this.

5.2 Legislation defining the regulations regarding the clearance or protection of secondary forests in the state of Pará. The legislation underwent two revisions on 26th February 2014 and 5th October 2015, before the final version published on 28th October 2015 as [Instrução Normativa 08](#). These documents are in Portuguese and can only be accessed within Brazil, or with VPN to a Brazilian IP address (pdf copies provided).

5.3 Testimonial from the chair of the working group and former state Environmental Secretary outlining the development of the secondary forest legislation. Dated 1st November 2019. In Portuguese with English translation provided.

5.4 Testimonial from the municipal Environmental Secretariat of Paragominas outlining the development and importance of the secondary forest legislation. Dated 19th December 2019. In Portuguese with English translation provided.

5.5 Testimonial from the Environmental Secretary (SEMAS) in Pará outlining Barlow's role in the State decree (5.7). Dated 23rd November 2020. In Portuguese with English translation given.

5.6 Official State of Pará Decree mentioned in [5.5], and which cites the input of Rede Amazonia Sustentavel and the importance of research outputs [3.1] and [3.4, page 7]. Dated 4th August 2020. Please note that the stated title for reference [3.4] should have referred to the first of the three references on page 7, which was a Figshare file including a small amount of additional unpublished data. The rest of the reference, including the lead author, year, volume & page numbers, is accurate. In Portuguese.

5.7 Letter from Dr. Nakamura in response to evidence provided by Mauricio Torres on land grabbing and illegal logging in the Mamuru River area and promising legal action in support of ribeirinho and Satare territorial rights. Dated 30th July 2019. In Portuguese.

5.8 Testimonial reporting on the Satare workshop, held in September 2019, and a report and photographs of self demarcation of the excluded part of their territory dated March 2020. Please note that parts of this document are in Portuguese.

5.9 News article: [Justice confirms suspension of FSC certification of logging companies in Pará that delivered misleading propaganda about sustainability](#). Dated 11th October 2019. In Portuguese with an English translation provided.