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1    *Abstract*

2    This paper scrutinises claims made about the promise and efficacy of ecosystems-based adaptation  
3    (EBA), through an exploration of EBA-relevant interventions in two fieldsites in Mexico. Our data  
4    starts to fill important gaps in current global debates about EBA. We find evidence of the important  
5    contribution of interventions relevant to EBA objectives at a small scale and under very specific  
6    conditions. However, the viability of similar interventions is substantially reduced, and arguably  
7    rendered null, as an incentive for conservation in a more populous fieldsites. Furthermore, evidence  
8    suggests that other adaptation options risked being overlooked if the context were viewed solely  
9    through the lens of EBA. We conclude that EBA needs to: a) engage with and address the trade-offs  
10   which characterised earlier attempts to integrate conservation and development, and; b) acknowledge  
11   the implications for its objectives of a globally predominant, neoliberal political economy.

12   *Keywords:* Ecosystems-based adaptation; payments for ecosystems services; climate change; political  
13   ecology; Mexico; protected areas

14   *1. Introduction*

15   Ecosystems-based adaptation (EBA) has been gaining prominence since the mid-2000s (BirdLife  
16   International 2009, World Bank 2009, Andrade et al. 2010, Munroe et al. 2012, UNEP 2012). The  
17   most common definition of EBA is “the use of biodiversity and ecosystem services to help people  
18   adapt to the adverse effects of climate change” (SCBD 2009, p. 41). EBA is not focussed purely on  
19   “biodiversity for its own sake” (Petersen and Holness 2011, p. 4). This is partly due to the conceptual  
20   influence of social-ecological systems thinking, which is antithetical to the study of ecological or  
21   social systems in isolation (Gunderson and Holling 2002, Olsson et al. 2004, Berkes 2008, Berkes et  
22   al. 2008, 2008, Folke and Gunderson 2012). But it also reflects the effort by international  
23   conservation (and development) actors such as IUCN, the UNEP, TNC, The World Bank and others  
24   to ensure that biodiversity conservation is not left out of the broader climate change adaptation agenda.  
25   This, to date, has been characterised predominantly by a focus on development.

26   Many claims have been made for what EBA is able to offer the broader climate change adaptation  
27   agenda. A widely-cited example of its benefits is mangrove forests, given their capacity to shield  
28   coastal populations from storm surges (i.e. Alongi 2008), and their potential contribution to food  
29   security, health, sustainable water management and livelihood diversification (Mensah et al 2012).  
30   The ostensible virtues of EBA lead Munang et al (2013) to conclude that it can achieve not just win-  
31   win but in fact ‘quadruple-win’ outcomes for: climate change adaptation and mitigation; socio-  
32   economic development; environmental protection and biodiversity conservation; and contributing to  
33   sustainable economic development. (2013:68). Others make similar claims to synergy in outcomes (i.e.  
34   Bood 2012, CATIE 2010, UNEP 2012). This framing, like ‘sustainable development’ before it, holds  
35   intuitive appeal, some of it derived from the substantial economic value posited for ecosystem  
36   services. At the global level, it has been estimated that an annual investment of US\$45 billion in  
37   protecting ecosystems could yield US\$5 trillion per year (TEEB 2010). Costanza et al (2014)  
38   estimated that the total global value of ecosystem services – which they define as the monetised  
39   contribution of ecosystem services to sustainable human well-being – had in 2011 reached \$125-45  
40   trillion/yr. It follows from this that one mechanism for leveraging this value could be payments for  
41   ecosystem services.

42   Whilst ecosystems-based adaptation clearly has some enthusiastic and influential advocates, the  
43   evidence base around its efficacy in practice remains a work in progress; partly because the

44 ambiguities in the term's meaning make it difficult to determine what constitutes relevant evidence  
45 (Reid 2011, 2014). A recent systematic review by Doswald et al (2014) provides the most  
46 comprehensive global overview of EBA to date. At the heart of the paper lies a helpful conceptual  
47 distinction between EBA and EBA-relevant intervention. The former specifies interventions explicitly  
48 conceived and framed in terms of EBA objectives. The latter identifies a broader range of  
49 interventions with the potential to achieve EBA objectives, but not designed or implemented with the  
50 stated aim of achieving EBA. Doswald et al draw this distinction because whilst there is as yet little  
51 published work on the results of intervention designed explicitly as ecosystems-based adaptation,  
52 there are many existing ways of using ecosystems which could serve adaptation purposes, such as  
53 sustainable forest management, integrated coastal zone management. Indeed, the mangrove  
54 restoration mentioned above as the best known example of EBA turns out in fact to be EBA-relevant,  
55 rather than a 'pure' instance of EBA. The payments for ecosystems services schemes we explore in  
56 this paper are likewise more accurately termed EBA-relevant. There is a wider point here about what  
57 can be said to constitute an example of EBA. Just like sustainable development, EBA is a concept  
58 which expresses an objective, a desirable outcome. As such the only way to study EBA empirically is  
59 via the interventions that are explicitly used, or could be used, to serve its objectives. At the level of  
60 empirical research, the distinction Doswald et al (2014) formulate between 'pure' and 'EBA-relevant'  
61 is thereby collapsed. It is, though, still useful to retain this distinction for the purposes of conceptual  
62 debate about what EBA should comprise and aim to achieve.

63 Overall, Doswald et al reach mixed conclusions. Whilst they find some evidence to suggest that EBA-  
64 relevant interventions "can be effective in enabling the reduction of vulnerability to certain climate  
65 induced impacts" they also contend that "it is difficult to provide any conclusions as to the  
66 effectiveness [of EBA] over the long term in a changing climate" (2014:199). Of particular concern,  
67 they report that there is more coverage of hypothetical benefits than empirical evidence of benefits.  
68 This evaluation, then, is not exactly a glowing recommendation to match the soaring rhetoric which,  
69 at least in some quarters, heralded the arrival of EBA. Yet nor, in our view, is it sufficient to declare  
70 the term an oxymoron, as sustainable development was famously branded (cf. Redclift 2005). The  
71 critique of sustainable development (or adaptation; cf. Brown 2011) as oxymoronic perhaps fails  
72 sufficiently to recognise that it is not inherently so: it depends upon what is declared to be sustainable  
73 development. This proviso leaves plenty of space for conceptualisations of sustainable development  
74 which are not oxymoronic. It is hard to see that implying sustainable development *per se* is an  
75 oxymoron helps us to maintain this vital space. By the same token, it would be unfair to frame EBA  
76 from the outset in terms of whether it is oxymoronic; it is not so, in our view, in any *a priori* sense.  
77 Nevertheless, the mismatch between such optimistic framings and the more ambivalent empirical  
78 experiences documented may lead us to wonder, as John Potter (1997) did of sustainable development,  
79 *are we being conned?*

80 We explore this question through presenting a climate vulnerability analysis of people living in or  
81 adjacent to protected areas in the Mexican state of San Luis Potosí. The research was commissioned  
82 by Mexico's National Commission for Protected Natural Areas (CONANP). Ultimately, their  
83 objective was to improve their capacity to respond to the challenges posed by climate change to  
84 Mexican protected areas. Project objectives were framed explicitly in terms of identifying  
85 ecosystems-based adaptation options, to be implemented in the existing and nascent protected areas  
86 which comprise a new biological corridor across the Sierra Madre Oriental region. The work is thus  
87 well placed to make a contribution to filling important gaps in the evidence base and to formulating a  
88 more grounded set of expectations around the prospects, locally and globally, for EBA. The research  
89 addresses two important gaps.

90 First, the empirical fieldwork comprised a participatory vulnerability analysis, grounded conceptually  
91 in a political ecology framework (Blaikie et al. 2004, Cannon and Schipper 2014). This approach is  
92 under-represented in the literature on EBA to date. In the context of our fieldwork, a political ecology  
93 lens serves as a corrective to the tendency of EBA studies to over-report hypothetical benefits. A  
94 political ecology approach suggests that EBA outcomes will be better understood not as win-wins but  
95 as trade-offs, and we outline the trade-offs visible in our fieldsites. We agree with Doswald et al (2014)  
96 and other EBA commentators (i.e. Pramova et al. 2012, van de Sand et al. 2014, Brink et al. 2016)  
97 that the conceptualisation of EBA so far gives insufficient attention to trade-offs (with some  
98 honourable exceptions, such as Andrade et al 2010 or Reid 2014). We find this surprising, given the  
99 rich literature, and substantial body of experience accompanying it which concluded, more often than  
100 not, that integrated conservation and development lead more frequently to unpalatable trade-offs than  
101 to win-win synergy (Adams and McShane 1992, Brandon and Wells 1992, Murombedzi 1992,  
102 Murphree 1997, Neumann 1997, Newmark and Hough 2000, Adams et al. 2001, 2004, Hulme and  
103 Murphree 2001, Brockington 2002, Brown 2004, McShane and Wells 2004, McShane et al. 2011). In  
104 addition to foregrounding trade-offs, political ecology turns our focus to the winners and losers that  
105 result from the power relations governing resource allocation and access (Forsyth 2003, Blaikie et al.  
106 2004, Robbins 2012). These considerations are also relevant to broader adaptation debates beyond  
107 EBA. As Eriksen et al (2015) argue, much climate change vulnerability research continues to  
108 foreground analyses of climate hazards, to the detriment of a thoroughgoing engagement with the  
109 socio-political determinants of vulnerability.

110 Second, the prospects for using payments for ecosystem services (PES) as a means of delivery of  
111 EBA are sparsely covered in the literature, although recent examples have been offered by van de  
112 Sand (2014). Wertz-Kanounnikoff et al. (2011), extrapolating from existing instances of PES, have  
113 contributed to the conceptualisation of how PES may meet EBA objectives. They argue that PES can  
114 be promising instruments for EBA in certain conditions, and identify four potential synergies: natural  
115 adaptation co-benefits; piggy-backing; adaptation-relevant spill-overs from PES schemes; and direct  
116 payments for adaptation benefits. As we conducted our research on local level vulnerability to climate  
117 impacts, it became increasingly clear that Payments for Ecosystem Services schemes, which were  
118 being used in both the field sites we discuss in this paper, might already be providing options relevant  
119 to EBA, even though they were not being implemented with EBA objectives explicitly in mind. The  
120 key potential contribution to adaptation that we identified is: if PES can contribute to ecosystem  
121 conservation whilst providing income locally, there would appear to be potential for it to contribute to  
122 EBA objectives effectively *to the extent that* it reduces household dependency on climate sensitive  
123 livelihood activities. This is probably closest to the ‘piggy-backing’ synergy – where adaptation  
124 benefits are coincidental outcomes – identified by Wertz-Kanounnikoff et al. (2011), at least in the  
125 context of our field sites. The prevalence of PES schemes in our fieldsites, in combination with the  
126 project objective of identifying EBA options for CONANP, therefore provided a tailor-made  
127 opportunity in which to explore this proposition empirically.

128 In the conclusion, we deliver our verdict on whether EBA is a ‘con’, and explore the implications of  
129 our findings for the future EBA research agenda. Why, we wonder, do the trade-offs we identify  
130 persist both within our fieldsites and far beyond them? An underlying reason relates to the existing  
131 priorities associated with a globally predominant neoliberal political economy (Sklair 2001, Newell  
132 2008, Brockington et al. 2010, Newsham and Bhagwat 2016). We contend that what is still missing in  
133 the EBA literature is insight into the implications for its objectives of these existing priorities.

134 *2. Theory and methods*

135    2.1 Research context and fieldsites

136    This research was commissioned as part of an exercise to inform policy-making by CONANP (the  
137    National Commission for Protected Natural Areas), and funded by the German development  
138    cooperation agency (GIZ). CONANP was formulating its climate change adaptation strategy  
139    (CONANP-GIZ, 2013), which set out how CONANP would address the challenges posed by climate  
140    change for biodiversity conservation in Mexico's protected areas. Given the particular conservation  
141    mission of CONANP, in conjunction with its mandate to help protected area residents deal with  
142    climate impacts, ecosystems-based adaptation was an obvious framing concept for operationalising its  
143    climate change strategy. It was also the framing concept of choice for GIZ.

144    As a prior input to formulating the strategy, a 'multi-scalar' vulnerability analysis was conducted in  
145    2011-2013 across the Sierra Madre Oriental (SMO), a mountain range running north-to-south on the  
146    eastern side of Mexico (CONANP-GIZ, 2013). The broad objectives of the vulnerability analysis  
147    were to establish adaptation priorities, identify EBA measures and document existing instances of  
148    adaptive capacity upon which EBA interventions could build.

149    The vulnerability analysis was conceived as an interdisciplinary, 'multi-scalar' endeavour (CONANP-  
150    GIZ 2013), deploying quantitative and qualitative methods and concepts from agronomy, atmospheric  
151    physics, ecology, human geography and hydrology, amongst others. The analysis was organised into  
152    16 discrete components, undertaken by research teams comprised of members of the various  
153    institutions commissioned to conduct the analysis. We were allocated the task of designing and  
154    conducting the vulnerability analysis at the local level. It sought to understand the climate  
155    vulnerability profile of people living within or adjacent to protected areas, and identify appropriate  
156    ecosystems-based adaptation measures. The results of the overarching vulnerability analysis are  
157    available at CONANP-GIZ (2013).

158    2.2 Fieldsites

159    The local vulnerability analysis was conducted in two field sites within the Sierra Madre Oriental: La  
160    Trinidad (Newsham et al 2012a) and Laguna del Mante (Newsham et al. 2012b) (TABLE 1). The  
161    field sites were selected by CONANP because of existing relations and work with communities.

162    The two fieldsites are *ejidos*, which are lands, forests and waters that the state has granted, in the form  
163    of a communal land title, to their inhabitants (*ejidatarios*), to be used in the manner prescribed by the  
164    law, under the orientation of the state and community organisation for administration (Appendini  
165    2008). This type of communal land tenure category was first established by the Mexican Revolution  
166    and modified, in the 1990s, in line with neoliberal reforms. These permitted the establishment of  
167    private property, through granting *ejidatarios* parcels of land within the *ejido* which could be bought,  
168    sold or rented to third parties (Durand-Alcantará 2009). La Trinidad resembles a conventional, pre-  
169    reform *ejido*, in which land has not been split into individual parcels. In Laguna del Mante, privately-  
170    held land parcels have been established, even though the *Comisariado*, the standard mechanism for  
171    collective *ejido* governance still exists. This difference in the type of land tenure between these two  
172    *ejidos* – along with the substantial difference in population size – has fundamental implications for  
173    resource access and distribution of PES revenues and related benefits we encountered within them  
174    (explored in sections 3 and 4).



175  
176 Figure 1: Location of fieldsites in San Luis Potosí state, Mexico (Adapted from INEGI, mapa digital  
177 de México)

178  
179  
180 General features of fieldsites are summarized in Table 1, while size sample is available in Table 2.

Field site	STATE/ Municipality	Area (ha)	human population	Language	Marginalization index (CONAPO 2011)	Type of ecosystem	Annual precipitation (mm)	Protected Area	PES
La Trinidad	SAN LUIS POTOSÍ/ Xilitla	1885	78	Spanish, Nahuatl	-0.76974 (High)	Cloud forest	1300	National forest reserve of San Luis Potosí	yes
Laguna del Mante	SAN LUIS POTOSÍ/ Xilitla	45000	2036	Spanish, Teeneek	-0.76835 (High)	Dry forest	965	Abra Tanchipa Biosphere Reserve	yes

181 Table 1. Key characteristics of fieldsites

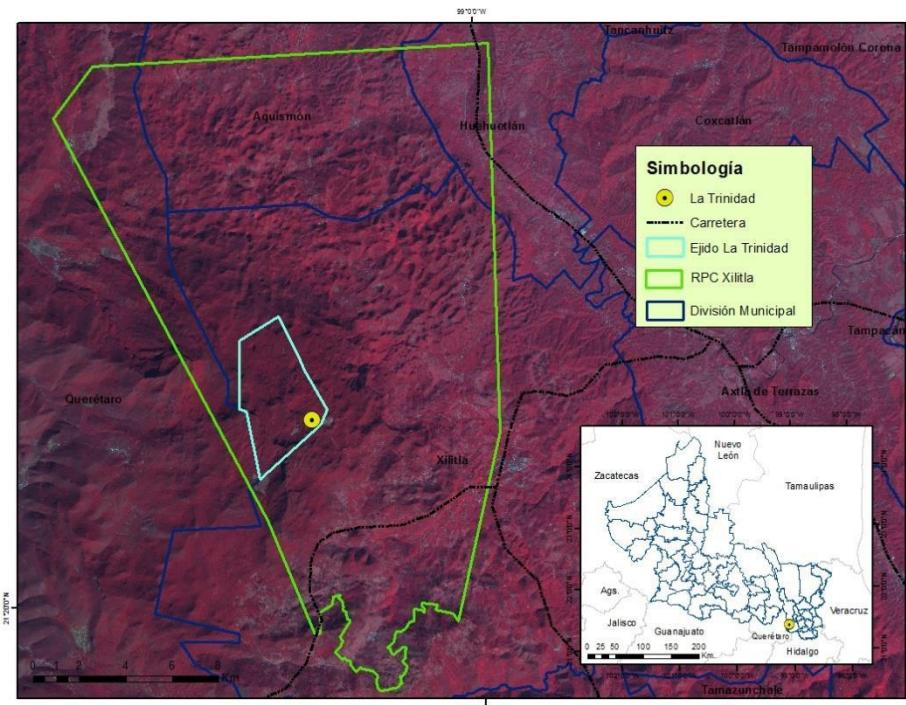
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183

184 2.2.1 *La Trinidad*

185 La Trinidad has 91 inhabitants and is characterised by the Mexican government by a high degree of  
186 marginalization (SEDESOL 2013a)<sup>1</sup>. It was originally founded as a settlement in 1967, and whilst its  
187 founders requested land title almost immediately thereafter, it did not legally become an *ejido* until  
188 1990. La Trinidad is part of the national forest reserve of San Luis Potosí, and is important for its  
189 biodiversity and environmental services such as water infiltration and supply, regulating climate, CO<sub>2</sub>  
190 capture and oxygen generation. Approximately 696 hectares of its forests are part of a payments for  
191 ecosystems services scheme instituted by the National Forestry Commission (CONAFOR), which has  
192 been in place since 2003.

193 Aside from PES activities, farming is a mainstay for many inhabitants, with maize and vegetables  
194 most commonly grown. Migration for work in nearby cities, or seasonal agriculture, is also central to  
195 livelihood activities. Over time, residents have experimented with a number of livelihood projects  
196 with support from NGOs and government agencies. At the time of the research a new eco-tourism  
197 project with rural cabins had been launched, representing a potential source of local revenue.



198  
199 Figure 1: La Trinidad, within the Municipality of Xilitla – (Newsham et al, 2012a)  
200

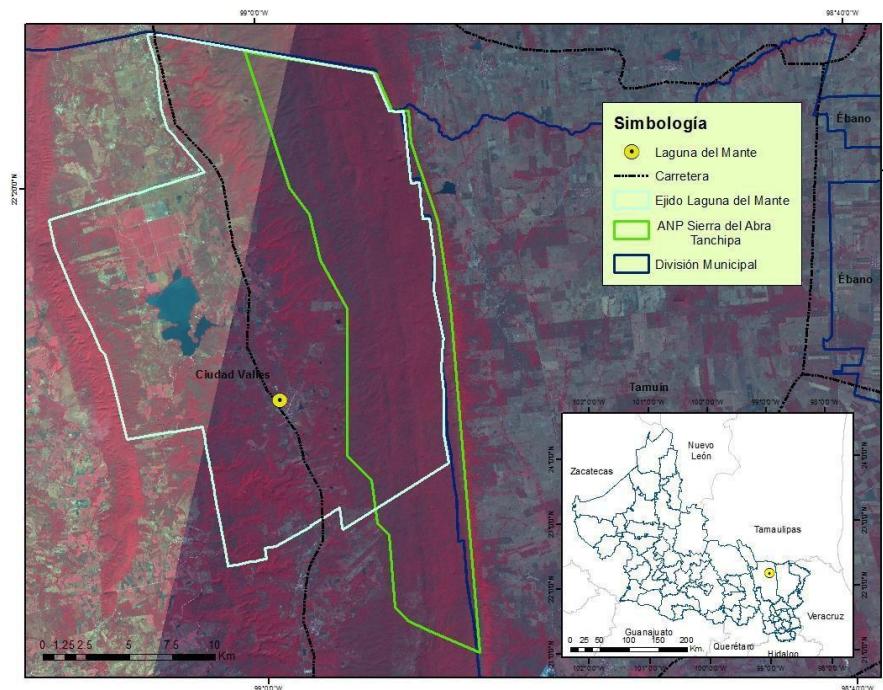
## 2.2.2 Laguna del Mante

201 Laguna del Mante emerged as an *ejido* when land known as the Hacienda Pasquel, owned by Mexican  
202 industrialist Jorge Pasquel, was redistributed by the Government in 1974. Through this  
203 program, economically important land was classified as private property, while natural areas –  
204 including the Abra Tanchipa Biosphere Reserve – were classified as “*uso común*” (common use). This  
205 history has given rise to four relevant local identity categories, all related to land ownership (or non-  
206 ownership): *ejidatarios* (ejido members), *hijos de ejidatario* (children of ejido members), *avecindados*  
207 (rent paying inhabitants living in the vicinity) and *posesionarios* (private land owners). As explored in

<sup>1</sup> Marginalization is the closest translation of the term ‘Marginación’ used by the Mexican government, which is broadly synonymous with the concept of multi-dimensional poverty

208 subsequent sections, the people described by these four categories differ greatly in economic activity,  
209 local political rights, and vulnerability to climate impacts.

210 Census data for Laguna de Mante records a population of 2036 people, most of whom live in  
211 conditions of high marginalization (SEDESOL 2013b). As can be seen in Figure 2, the boundaries of  
212 the *ejido* overlap with the Abra Tanchipa Biosphere Reserve, which was established in 1994. Its  
213 surface covers approximately 65% of the Abra Tanchipa Biosphere Reserve. In practice, this means  
214 that within the nuclear zone of the Reserve, the greater part of which lies within the *ejido* boundaries,  
215 land use and livelihood activities are restricted and governed by national conservation legislation. It  
216 also means that Laguna del Mante as an *ejido* is eligible for payments for ecosystem services. The  
217 Forestry Commission, CONAFOR, has supported PES incentives, specifically water and biodiversity  
218 services, since 2008. While the primary economic activities and urban centre are concentrated in the  
219 plains, the adjacent mountains form part of the reserve. One important feature is Presa La Lajilla, an  
220 artificial lagoon of approximately 10 km<sup>2</sup>. Drinking water and primary economic activities are  
221 dependent on this lagoon. The main economic activities are sugar cane and industrial lemon farming,  
222 and shifting cultivation, as well as small-scale cattle farming, fishing and apiculture. Secondary and  
223 tertiary activities include the citrus fruit industry and some employment via the Biosphere Reserve.



224  
225 Figure 2: Satellite Image of Laguna del Mante – (Newsham et al, 2012b)

## 226 2.2 Theoretical and methodological framework

227 The framework we then devised to guide our work on the local level vulnerability analysis is  
228 grounded in the ‘Pressure and Release’ (PAR) vulnerability model of Blaikie et al (2004), which we  
229 modified to fit our research purposes more precisely (see Figure 2 below, and also Cannon and  
230 Schipper 2014 for more detail). Whilst PAR is a well-established tool associated with political  
231 ecology, it is necessary to spell out, before briefly describing it, what we mean specifically by  
232 ‘political ecology’ and how PAR links to the principal concerns of the field – as we see them – at this  
233 time. Political ecology is such an eclectic approach that it runs the risk of being caricatured as “all  
234 things to all people” (Blaikie 1999, p31). Here is not the place to list the myriad definitions offered

235 (for those, see Forsyth 2003 or Robbins 2012). In the context of the intertwined socio-environmental  
236 processes which govern responses to climate change (Taylor 2014, Eriksen et al. 2015), our interest in  
237 political ecology is directed toward: a) identifying the winners and losers that result from the power  
238 relations governing resource access (Blaikie et al 2004); b) the implications of discursive power and  
239 submerged politics of win-win narratives, which can obscure both the trade-offs which occur and  
240 potential alternative courses of action (for those, see Fairhead and Leach 1998, Forsyth 2003, Leach et  
241 al. 2010, Robbins 2012). All of these concerns are abundantly manifest in our fieldsites. We maintain  
242 that the PAR framework, especially with the ‘access’ component added to it in the second edition of  
243 *At Risk* (Blaikie et al 2004), remains well-suited to exploring them despite having fallen from favour,  
244 as a result of debates about how it has fared in the aftermath of the ‘post-modern turn’ in political  
245 ecology (see Forsyth 2008 for a review).

246 The underlying causal logic of PAR is the ‘progression of vulnerability’: root causes, dynamic  
247 pressures and unsafe conditions, in combination with the ‘trigger event’ of an environmental hazard,  
248 lead to potentially disastrous outcomes. In our model, this logic remains intact, but we reorient the  
249 focus of the analysis with a view to: a) incorporating more centrally the implications of climate

250 Table 2: methods deployed and numbers of research participants involved

Participatory method	La Trinidad	Laguna del Mante
<b>Transect walk (rural)</b>	1 walk/ 2 people	2walks/ 2 people per walk
<b>Transect walk (urban)</b>	1 walk/ 3 people	2walks/ 2 people per walk
<b>Mapping</b>	1 group of 14 men; 1 group of 23 women.	1 group of 9 men; 1 group of 5 women.
<b>Historical timeline</b>	First time: 6 men + 2 women; second time: 8 men + 2 women	Approx. 15
<b>Wellbeing ranking</b>	1 group of 22 men; 1 group of 10 women.	1 group of 9 men and 9 women.
<b>Seasonal calendar</b>	1 group of 20 men; 1 group of 22 women.	1 group of 8 men; 1 group of 22 women.
<b>Climate shocks ranking</b>	1 group of 16 men; 1 group of 14 women.	1 group of 8 men; 1 group of 22 women.
<b>Venn diagram</b>	1 group of 22 men; 1 group of 8 women.	1 group of 7 men and 5 women.
<b>Interviews</b>	approx. 8 individual interviews	1 to High School Director; 2 to eco-club; collective interview to 13 high school students; 5 to local people

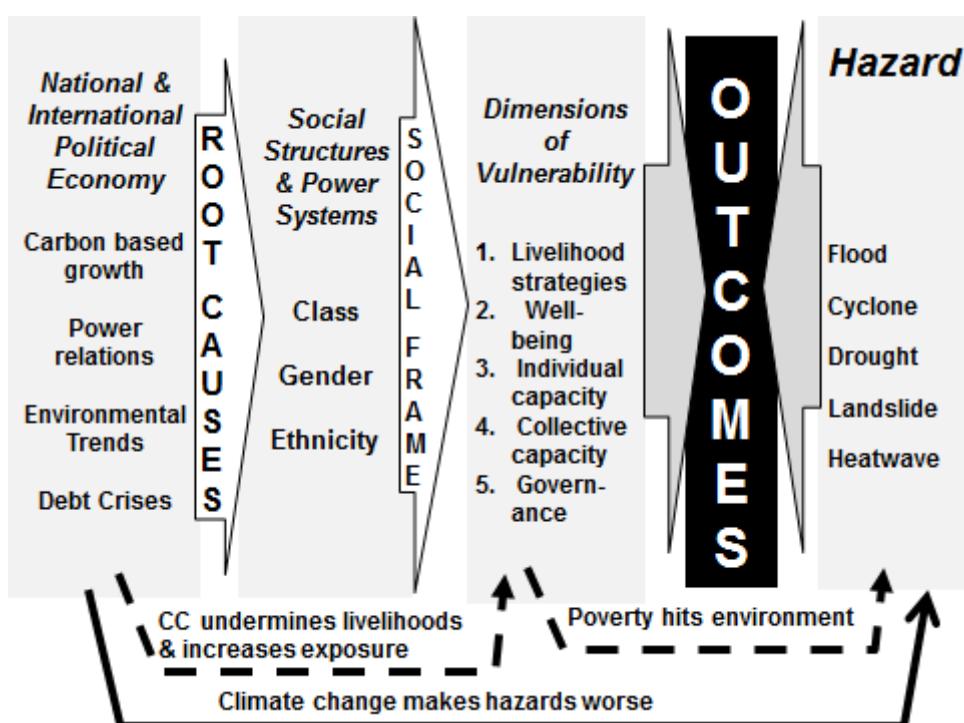
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252 change for the ‘progression of vulnerability’, and; b) operationalising the framework  
253 methodologically, in the guise of a participatory vulnerability analysis toolkit (Ulrichs et al 2013). At  
254 the heart of our modified PAR model are five ‘dimensions of vulnerability’ (DoV): livelihood  
255 strategies, wellbeing, individual capacity, collective capacity and governance. These relate to the  
256 characteristics of individuals and households with whom the research was conducted. Each of the five  
257 dimensions of vulnerability was assessed by the participatory tool most useful for understanding that  
258 particular dimension (see Table 3). The tools were implemented in a particular sequence, to gradually  
259 build up and triangulate information collected in groups with semi-structured interviews. The

260 participatory methods were applied over 4-6 days per site in village-level meetings and were led by a  
261 multidisciplinary facilitation team of 10-12 people. Additional days were required for CONANP  
262 personnel to announce and organise the visit, as well as for the research team to return to the sites to  
263 present our results locally and give residents the chance to cross-check the accuracy of the findings.  
264 Fieldwork in these sites was conducted in Spanish.

265 In order to analyse age and gender-specific aspects of vulnerability, the group exercises were  
266 conducted separately with male, female, young and old participants. Table 2 details the methods  
267 which comprised the vulnerability analysis toolkit, as well as the number of research participants with  
268 which they were used, in both fieldsites. Table 3 presents these methods and relates them to: a) the  
269 type of result each tool provided data on; b) where to find coverage of the results of each method in  
270 the various sections of this paper; c) the research questions we used to explore each of the five  
271 dimensions of vulnerability, at the heart of our conceptual framework; and d) the relative utility (from  
272 high to low) of each method for providing data relevant to each dimension of vulnerability. Additional  
273 methodological details can be found in CONANP et al. (2014).

274



275

276 Figure 2: Modified Pressure and Release model centred on 5 local-level dimensions of vulnerability  
277 (Quintero et al. 2012).

278

	Type of result obtained per tool	Use of results in this paper	Dimension of vulnerability (DoV) and research questions				
			DoV 1 Livelihood strategies	DoV 2 Wellbeing	DoV 3 Individual capacity	DoV 4 Collective capacity	DoV 5 Governance
	<i>Relevance of method to each DoV</i>		1. What are the social and ecological characteristics of the community? 2. What livelihood strategies are important for the various sub-groups e.g., gender, age, economic status, ethnicity? 3. How are various livelihood strategies affected by climatic impact (including if the livelihood strategies are affected in a differential way)?	1. What are the local criteria for wellbeing? 2. What is the percentage of households within each category of wellbeing? 3. Which households are the most vulnerable and least able to adapt to climatic changes, and why?	1. What levels of access to resources for adaptation do the various groups within the community have? 2. How much control do the various groups have over their resources and livelihoods in order to adapt?	What community norms, practices, and institutions influence the collective vulnerability and the ability to adapt by different groups?	To what extent are the various participants and political organizations involved in climate change capable, responsible, and sensitive to the community?
Transect walk	1. Main ecological and social features. 2. List of natural resources and ecosystem services. 3. Primary zones productive and communal activities.	Narrative sections in 2.2.1, 2.2.2					
Historical timeline	1. Location of main community features, including urban area, agricultural plots, streets, vegetation type, infrastructure. 2. Vulnerability patterns and zones most impacted by climate risk and threat.	Table 4; Narrative section in 3.2.1, 3.2.2					
Wellbeing ranking	1. Wellbeing categories and local criteria to define it. 2. Identification of particularly vulnerable households and analysis of causes.	Narrative in section 3.1.1, 3.2.1 (e.g. <i>Ejidatarios, avecindados</i> )					
Seasonal calendar	1. Seasonality of economic activities and availability of natural resources throughout the year. 2. Climatic impact on productive activities and human responses to it. 3. List of impacts and adaptive capacity throughout seasons.	List of climate-related impacts; Section 3.1.1 ; 3.2.1 ; 3.3.1					
Climate shocks ranking	1. Identify significant risk per community. 2. Extent of impact on livelihoods. 3. Adaptive mechanisms and capability at the home and community level.	Table 4. List of climate-related impacts; Section 3.1.1; 3.2.1; 3.3.1.					
Venn diagram	List of external organisations and relationship with the community, as well as their ability to help to implement adaptative strategies.	PES & PET info; Section 3.1.2; 3.2.2; 3.3.2					

279 Table 3. Methods deployed and research questions explored for each dimension of vulnerability (DoV). Colours represent the contribution of each method to generating  
 280 an understanding of each DoV. The darkest colour indicates the highest level of relevance of the method to a given DoV (adapted from Ulrichs et al 2013).

282 Whilst a central concern for us was with capturing local perceptions and experiences, we were also  
 283 aware of a common critique of participatory methods: they do not automatically take into account  
 284 differentiated access and control over resources by different social groups (Brown 1999). More  
 285 concerningly still, from a methodological point of view, the data that can be collected through  
 286 participatory group exercises is to a great extent contingent upon intra-community power relations  
 287 which determine what can be said, and by whom, in public settings (Mosse 1995, 2001, Cooke and  
 288 Kothari 2001, Hickey et al. 2004). The use of PRA methods devoid of significant understanding of the  
 289 context in which they are applied can therefore be ill-advised. The substantial Mexican expertise in  
 290 our research team, the gender balance in its composition and the size of it (8 researchers) allowed us  
 291 to gain relevant insight into salient intra-community differentiations and inequalities, and to a  
 292 surprising extent counterbalanced the limited time (5 days in each field site) that we were able to  
 293 spend. We communicated explicitly to research participants our independence from CONANP. Yet  
 294 whilst in both focus groups and individual interviews, many critical comments were made about  
 295 CONANP, it is possible, perhaps likely, that some people withheld their full private views from us out  
 296 of a concern for the consequences of such honesty.

297 *3. Results and discussion*

298 Space does not permit us to cover here the results of the full vulnerability analysis conducted. The  
 299 focus in this section draws out the broad contours of vulnerability relative to the key climate impacts  
 300 identified, and the broad social characteristics most relevant to the differentiated and uneven  
 301 distribution of vulnerability that we found. This lays the foundation for the discussion of the potential  
 302 relevance and efficacy of payments for ecosystem services (PES) as a mechanism for bringing about  
 303 ecosystems based adaptation (EBA).

304 Table 4. Individual and collective adaptive capacity in relation to identified impacts in field sites.  
 305 Acronyms: SAGARPA (state agricultural extension), CONAGUA (the National Water Commission).

<b>Field site</b>	<b>Climate impact</b>	<b>Coping and adaptive strategies</b>	
<b>La Trinidad</b>	Fires	Individual/household	Collective
	Hurricanes	More selective and fewer cultivation activities	Temporary Employment Programme access
	Frosts	Little capacity to respond	Leveraging of political support to resist forced resettlement
	Pests	Plant and harvest twice a year	Reduced owing to focus on ' <i>vivir del bosque</i> '
	Heavy rainfall/flooding -	Constrained by restrictions on pesticide use	Constrained by lack of coordination and resources for dealing with infected trees
	Water availability	Install concrete floor	Little organised capacity, but good relations with state/federal institutions
<b>Laguna del Mante</b>	Droughts	Little response capacity	Contingent upon relations with other communities
	Fires	Dependent on access to irrigation	Good relations with SAGARPA
		Care in burning land for cultivation	Construction of firebreaks to contain fires; local fire brigade

	Pests and disease	Dependent on access to pesticides	Good relations with SAGARPA
	Heavy rainfall	Limited	Water levels determined by floodgate, operated by CONAGUA

306

307 *3.1 La Trinidad*

308 *3.1.1 Vulnerability and adaptation in La Trinidad*

309 When asked about the most damaging climate-related impacts, the inhabitants of La Trinidad  
 310 identified six types:

- 311 1. Fires, like the 'great fire' of 1998, which resulted in the temporary abandonment of the  
 312 settlement.
- 313 2. Frequent hurricanes. Hurricanes Diana of 1992 and Gilberto in 1994 are remembered because  
 314 they destroyed houses.
- 315 3. Frosts have decreased, allowing planting and harvesting twice a year, but there is no certainty  
 316 that any given year will be free of frost.
- 317 4. An increased incidence of pests on crops, and, notably, trees in particular the bark beetle,  
 318 which attack and kill trees, but which is difficult to treat because the use of pesticides are  
 319 forbidden within the Reserve.
- 320 5. Heavy rainfall and flooding have impact on crops and homes. It was unclear whether their  
 321 frequency and/or magnitude have increased in recent decades.
- 322 6. Decreased water availability is not yet a problem, although there are tensions with 13  
 323 neighbouring communities sharing access to the same water sources.

324

325 The decreased incidence of frost, the spike in pests and the reduced availability of water may be  
 326 linked to an increase in average temperatures in recent decades, which is also projected to continue  
 327 according to climate scenarios for the Sierra Madre Oriental (Magaña et al 2012). Higher average  
 328 temperatures may also be associated with the greater incidence of forest fires; although the 'great fire'  
 329 which loomed heavily in participatory group exercises, was allegedly started by people from another  
 330 settlement who were burning land to clear it for cultivation.

331 The individual and collective coping and adaptive strategies displayed by inhabitants of La Trinidad  
 332 are summarised in Table 4. However, these are more fully understood against the background of a  
 333 longer history of events and processes that influenced adaptive capacity, dating back to the  
 334 establishment of the settlement, in 1967. The broad contours are evident in a number of achievements  
 335 and changes over time:

- 336 1. Not only establishing the settlement in the 1960s but having it recognised, in 1990 as an *ejido*  
 337 (land held in communal tenure), with the attendant rights to residence, government support  
 338 and facilities that accompany this status.
- 339 2. Adjustments to cultivation activities in the face of climate variability over the course of  
 340 almost 60 years.
- 341 3. Substantial change in the make-up of primary livelihood activities. Up until the year 2003,  
 342 subsistence agriculture, accompanied by livestock keeping and (illegal) timber extraction  
 343 were prevalent. Thereafter, through closer relations with conservation and forestry agencies, a  
 344 greater emphasis on revenue generating activities derived from conserving the forest - by  
 345 reducing agricultural or livestock activities - became more common. This shift away from  
 346 predominantly agricultural livelihoods came locally to be referred to as *vivir del bosque* (to

347 make a living from the forest), based on receiving payments to prevent forest fires, funded  
348 either from the government's Temporary Employment Programme (PET) and payments for  
349 environmental services (PES) schemes. Another prominent option has been the ecotourism  
350 cabins, supported initially by a local NGO, Grupo Ecológico Sierra Gorda, and subsequently  
351 by CONANP. Not all activities changed: for instance, the seasonal migration that had, from  
352 the start, supported the establishment of the settlement remains important.

- 353 4. The establishment of a well-functioning *Comisariado* (the committee governing the *ejido*)  
354 which provides a collective decision-making mechanism. For instance, after the 'great fire' of  
355 1998, the residents of La Trinidad came under significant local political pressure to be  
356 resettled outside of the forest reserve. With the support of a local NGO, the *Comisariado*  
357 bypassed local municipal and conservation authorities and negotiated directly and  
358 successfully with the state governor to be able to return to La Trinidad.

359  
360 This history demonstrates an existing level of collective capacity to adapt to a variety of shocks and  
361 stresses, and it is important to take such capacity into account when considering why payments for  
362 ecosystems services appear to be a viable mechanism for ecosystems-based adaptation in this field  
363 site.

364 *3.1.2 Ecosystems-based adaptation in La Trinidad*

365 *Vivir del bosque* (to shift toward livelihood activities which generate a living from the forest, and  
366 away from agriculture) in La Trinidad is an example of the potential of PES to be used as an EBA-  
367 relevant intervention to generate important social, economic and ecological benefits. Whilst not  
368 intended to respond to climate change, PES helps to improve livelihood strategies via partnerships and  
369 interactions with national agencies (cf. Wertz-Kanounnikoff et al. 2011). The income people receive,  
370 when they procure work with CONAFOR (the state forestry agency) and CONANP (the state  
371 conservation agency) in PES and PET (Temporary Employment Program) schemes makes them less  
372 dependent on agricultural activities that are highly sensitive to climate impacts. Indeed, in all the  
373 group work which asked participants to identify and rank livelihood activities according to importance,  
374 income from PES or PET was classified as the second most important. It is this benefit which most  
375 clearly contributes to adaptive and coping capacity. It also confers two other important advantages.  
376 First, the work is sufficiently remunerative that those involved in such schemes do not need to migrate  
377 in search of seasonal agricultural employment, renowned for its gruelling demands on labourers.  
378 Second, these schemes are at least partially accessible to women. This is particularly advantageous in  
379 a place where income generating activities for women are limited and social assistance coverage of  
380 programmes like the *Oportunidades* cash transfer is low. The majority of the community benefits  
381 from these programmes to the extent that they could be seen as a viable livelihood strategy; albeit that  
382 migration in search of seasonal labour remains necessary for some, because there were not always  
383 sufficient funds to offer everyone PES/PET employment. Notwithstanding this caveat, the *ejido*  
384 retained the structure of pre neoliberal reform period *ejidos*, in which *ejidatarios* retained an equal  
385 share of a communal title. This facilitated a broad sharing of the revenues and employment  
386 opportunities from the PES schemes because everyone in La Trinidad was an *ejidatario* or related to  
387 one. As such, the use made of this more communal *ejido* structure could be seen as empowering, from  
388 the perspective of what it made possible in terms of benefits distribution. This is in stark contrast with  
389 the distribution arrangements in Laguna del Mante. Furthermore, there seemed to be scope to  
390 strengthen existing *vivir del bosque* activities with complementary funding from programmes for the  
391 reduction of bark beetle and REDD+.

392 Even within this encouraging picture, limitations and trade-offs were also evident. First, a key reason  
393 for the strength of adaptive capacity in La Trinidad was that its small population size facilitated

394 collective decision-making and ensured that payments for environmental services, along with other  
395 revenue generating activities associated with *vivir del bosque*, reached many inhabitants, thereby  
396 offering more compelling incentives for conservation. The findings from La Trinidad suggest that  
397 using PES as an EBA-relevant intervention at this small scale can work, even if questions about its  
398 efficacy remain at a larger scale.

399 Second, although the families of La Trinidad have adapted to new circumstances individually and  
400 collectively, considerations of gendered power relations have to be taken into account in  
401 understanding the distribution of adaptive capacity across the community. Women had less access to  
402 job opportunities and the inheritance of land, and lacked political representation. Men control the  
403 *Comisariado* and also the political relations with State authorities, because only male household heads  
404 are recognised as *ejidatarios*. Women were clearly marginalised by this dominance, and expressed  
405 dissatisfaction with it. For instance, the CONANP Forest Reserve director who was so instrumental to  
406 procuring access to PES and PET programmes insisted on women being employed in them. Yet  
407 women's participation was criticised and, by some accounts, constrained by key *Comisariado*  
408 members on the grounds that they could not care for their children properly when at work.

409 Third, there is a clear trade-off arising from the extent to which the *vivir del bosque* strategy involves  
410 the restriction of "traditional" agricultural activities, as evidenced by the reforestation of land that was  
411 previously farmed, and by the abandonment of cattle herding. This reflects power relations that  
412 determine how and who defines what is compatible or not, with conservation objectives. This was  
413 decided more by CONANP than by the community. Yet whilst the *Comisariado* clearly supported  
414 activities associated with *vivir del bosque*, interviews and focus group discussion indicated that some  
415 community members would have preferred greater autonomy over using the *ejido* land for farming.  
416 Good relations with CONANP also have other costs, given the role it plays as a 'gatekeeper' in  
417 permitting the access of other government agencies and services. For instance, CONANP staff  
418 working in La Trinidad had been unwilling to allow SAGARPA, the state agricultural extension  
419 agency, to enter, for fear they would conflict with the conservation objectives of the reserve. They had  
420 also favoured the introduction of solar panels over extending the electricity grid, despite the fact that  
421 the panels did not meet local electricity demand and were unreliable. Whilst understandable from a  
422 conservation perspective, there are trade-offs posed by these restrictions which create both winners  
423 and losers, and alternative adaptation strategies around agricultural activities which could not be  
424 considered. The concern, then, is that framing adaptation in La Trinidad in terms of EBA from the  
425 outset, as CONANP has done, privileges one set of adaptation responses even as it discourages  
426 consideration of others, and masks political contests over whose livelihood strategies receive support.

427 Fourth, the growing incidence of bark beetle in the forest, with fundamental implications for tree  
428 health, had CONANP staff concerned about its potential to expand exponentially: the area of forest  
429 that the beetle had been found in had increased from 50ha to 400ha within the space of a year. The  
430 heightened occurrence of the bark beetle was held to be a result of the higher temperatures and milder  
431 winters which were no longer cold enough to kill off these pests. Ironically, therefore, the gains in  
432 adaptive capacity that are currently offered to those receiving income from the PES and PET schemes  
433 may be threatened by bark beetle which, if left unchecked, could decimate the entire reserve. If that  
434 were to happen, then *vivir del bosque* could cease to be a viable adaptation strategy.

435 Finally, revenue from the PET and PES schemes was not guaranteed to be available over the medium  
436 and long term. Nor had the ecotourism cabins become financially self-sustaining at the time of  
437 fieldwork, raising questions over the medium and long-term future of 'living from the forest.'

438    3.2 *Laguna del Mante*

439    3.2.1 *Vulnerability and adaptation in Laguna del Mante*

440    The main climate-related events mentioned by local residents in Laguna del Mante were:

- 441    1. Droughts, which affect sugar cane, corn and bean cultivation, as well as cattle farming.  
442         Although sugar cane is well adapted to dry conditions, some extreme events – such as the  
443         2011 drought – surpass the crop endurance threshold
- 444    2. Fires, which are part of sugar cane cultivation practices, often flare out of control, threatening  
445         biodiversity and crops, and are also blamed for health problems. Whilst, therefore, not always  
446         climate related, fire dynamics can be influenced by rising temperatures
- 447    3. Pest and disease incidence appears also to have increased with rising temperatures, and sugar  
448         cane is frequently vulnerable to both
- 449    4. Heavy rainfall, less common than drought, is a concern for farmers who report that it damages  
450         the lemon flower bud, decreasing yield.

451    The four types of local landholders recognized by the residents have different rights and obligations in  
452         the *ejido*, access to resources and vulnerability profiles differentiated primarily by their land tenure  
453         status but also by gender. *Ejidatarios* (inhabitants with recognised communal tenure rights in the  
454         *ejido*), who are mostly male, enjoy exclusive privileges: speaking and voting rights in the local  
455         assembly; eligibility to receive PES benefits; and 60 ha of land per person. However, *ejidatarios* have  
456         to care for the *ejido*, which reduces their availability to migrate seasonally to the USA to work. *Hijos*  
457         *de ejidatarios* (sons of *ejidatarios*) can access land through inheritance, purchase or sharing with their  
458         *ejidatario* parent. They often migrate to work in big cities but work the land if they stay in the village.  
459         *Posesionarios* are persons who live outside the *ejido*, but own private land holdings of up to 300 ha.  
460         These properties were purchased from *ejidatarios*, and are mainly used for livestock farming. The  
461         most marginalised group are the *avecindados*, migrants to Laguna del Mante who generally do not  
462         own land and sell their labour to *posesionarios* or *ejidatarios*. *Avecindados* do not have *ejido*  
463         obligations, leaving them free to migrate to work elsewhere, an advantage according to local  
464         perception. Many *avecindados* and some *hijos de ejidatarios* work in the citrus fruit industry or on  
465         sugar cane plantations, but some sell food, wares or services (such as fixing tyres) by the side of the  
466         highway adjacent to the entrance to the main settlements in Laguna del Mante.

467    Vulnerability to climate impacts differs between these social groups, and is affected by direct and  
468         indirect adverse impacts on livelihoods. Across the groups the most vulnerable are those whose  
469         livelihoods are most dependent on agricultural activities. This includes former *ejidatarios* who have  
470         sold their land and those *avecindados* who work the land of another owner, because their jobs depend  
471         on the availability of farm work, which is highly affected by climate impacts. *Ejidatarios* with land  
472         are also vulnerable because their livelihood revolves around agricultural activities.

473    Economic activities are not only influenced by land tenure categories (*ejidatario*, *avecindado* etc.),  
474         but also by gender. While men tend to work predominantly in agricultural activities, which are most  
475         vulnerable to climate impacts, women work in commercial activities, non-farm income generating  
476         activities and at home. Both women and men work in cane farming, encouraged by government  
477         support for a women's association. Male-dominated activities are thus more exposed to climate  
478         impacts, which has an indirect impact on women who need to diversify their income-generating  
479         activities to compensate for household income losses incurred through lower agricultural output.  
480         Against these difficulties, farmers in Laguna del Mante have much better access to and, thereby,

481 relations with SAGARPA, the government agricultural extension agency, than their counterparts in La  
482 Trinidad. They receive assistance with the pests associated with higher temperatures experienced in  
483 recent years, as well as with advice on plant varieties best adapted to these changing conditions. This  
484 important difference between the field sites demonstrates the extent to which CONANP does not yield  
485 quite the same power to affect livelihood strategies in Laguna del Mante as it does in La Trinidad. The  
486 adaptive and coping responses are summarised in Table 4.

487 *3.2.2 Ecosystems-based adaptation in Laguna del Mante*

488 PES is offered for particular conservation activities related to El Abra Tanchipa Biosphere Reserve.  
489 Principally, these consist of patrolling and monitoring activity within the Biosphere Reserve, and  
490 creating and maintaining firebreaks between the Reserve and cultivated land. There are also payments  
491 made, via the PET (Temporary Employment Programme), which fund the provision of a fire brigade,  
492 seasonal maintenance of the fire break and monitoring activities within the Biosphere Reserve. These  
493 fire brigade and firebreak maintenance provisions are valued not just for the protection they afford the  
494 Reserve, but also because of the threat to life and property posed by burning land for cultivation  
495 purposes. Securing income-generating activities which also have such clear local benefits has allowed  
496 CONANP to cultivate good relations with local leaders and, albeit to a much lesser extent, some  
497 residents in Laguna del Mante. As in La Trinidad, to the extent, therefore, that these payments provide  
498 income to some residents and reduce dependency upon climate-sensitive livelihoods, they can be  
499 considered EBA-relevant.

500 However, there are numerous factors which impinge upon the efficacy of this type of intervention.  
501 First, payments amounted to approx. US \$50/ejidatario/year (2012 prices), which research participants  
502 agreed, both in participatory group work and individual interviews, was an insignificant contribution  
503 to household income. There is little evidence to suggest that the size of payments leveraged from the  
504 Abra Tanchipa Biosphere Reserve is sufficient to make *ejidatarios* consider the reserve a better option  
505 than, say, expanding the agricultural frontier. Agriculture continues to provide the mainstay of  
506 household income for *ejidatarios* and *avecindados*. At present, the area would still need to be  
507 protected by law, rather than offering sufficient incentive to *ejidatarios* to make them desirous of its  
508 continued presence. Additionally, payments are restricted to *ejidatarios* (constituting an estimated 20%  
509 of the population, although including their families the proportion rises to 70%). Moreover, similar  
510 concerns about gendered power relations acting on access to benefits from PES/PET as those  
511 witnessed in La Trinidad also surfaced in Laguna del Mante, in three ways. First, *ejidatarios* were  
512 almost exclusively men. Second, men dominated the *Comisariado*. Third, it was mostly men who  
513 were given paid employment in the fire brigade or working on firebreak maintenance. *Avecindados*  
514 (estimated to be 20% of the population) are ineligible. Many do not even know of the payments,  
515 which, therefore, do not influence their resource use behaviour: illicit trading of wood and illegal  
516 harvesting of plants from the Reserve is held locally to be widespread. Indeed, some *avecindados* felt  
517 obliged to cut wood in the Reserve because they did not have the permission of *ejidatarios* to extract  
518 it from their privately-owned parcels. As in La Trinidad, then, the empowering effects of holding land  
519 tenure were evident for some actors, in terms of the benefits they received, but the disempowering  
520 effects, for those with no legal standing within the *ejido*, are clearer to see.

521 Further, there was little scope to increase the size of the payments. Laguna del Mante could not apply  
522 for carbon forestry and other PES schemes because the level of revenues already received from  
523 existing activities meant, according to the Park Director, that they were ineligible for further subsidy.

524 Compounding this difficulty, land use regulations provoked a trade-off between preserving  
525 biodiversity with high conservation value and potentially EBA-relevant cropping strategies. Current  
526 regulations prohibited options such as the cultivation of biofuels or other commercially viable crops  
527 such as ponytail palms (*Beaucarnea recurvata*). Indeed, biodiversity outside the reserve was  
528 ineligible for PES, regardless of EBA or commercial potential. Those receiving PES, in other words,  
529 not included in the processes through which the conservation value of particular forms of biodiversity  
530 was defined or assigned, and in consequence saw some adaptation potential options effectively ruled  
531 out. The concern, then, is that the politics of knowledge production around valued biodiversity, act  
532 effectively as a power relation with clearly exclusionary effects in this case.

533 Situating EBA in a broader context, decisions about water management may have more profound  
534 implications for livelihoods and for adaptation than do the PES schemes related to the biosphere  
535 reserve. Cane and lime are the main income-generating crops in Laguna del Mante. Cane is drought-  
536 resistant and retains a consistent, year-round selling price, providing economic security. The lime  
537 industry brings in perhaps the greatest amount of local wages, but it is controversial because it  
538 requires large volumes of water and receives priority in terms of water provision. While the reservoir,  
539 Presa La Lajilla, is the engine of the local economy, its management also courts controversy.  
540 According to information provided by key informants, before the onset of the rainy season, the state  
541 water agency, CONAGUA opens the floodgate to prevent flooding in the nearby city of Ciudad  
542 Valles. Locally, people claimed that this constrains cultivation and can even leave them short of  
543 drinking water because water is available only twice per week (although we were unable to verify this  
544 claim independently). These claims raise the concern that key livelihood prospects in Laguna del  
545 Mante are traded-off against flood protection for Ciudad Valles inhabitants. Ultimately, their lack of  
546 involvement in decisions over the levels at which to leave the water, and the seeming lack of  
547 consideration of the consequences for them, weakens rather than strengthens their own resilience.

548 Through all of these issues can be traced the influence of access to land, as governed by land tenure  
549 status and reform. Not only did these factors determine eligibility for PES, but *ejidatarios* tended to  
550 be given employment in the fire brigade, fire break and reserve monitoring activities. The costs of  
551 conservation restrictions on resource use, which PES are an attempt to compensate for, fall more  
552 heavily on *avecindados* than *ejidatarios*, who are already more marginalised within the decision-  
553 making structures of the *ejido*. The neoliberal reforms which led Laguna del Mante to be divided up  
554 into individual, titled property parcels also underpin the uneven distribution of benefits from PES and  
555 restrictions on water owing in part to the presence of the privately-owned citrus plantation. They may  
556 also have weakened the bargaining power *ejidatarios* have with CONAGUA, when it comes to setting  
557 the water levels at different times of year. The contrast with arrangements in La Trinidad is instructive.  
558 Whilst the lack of control over key resource use is to some extent also seen in La Trinidad, there is a  
559 significantly more equitable distribution of benefits in La Trinidad, partly owing to the smaller size of  
560 the settlement but also because it still operates as a communal *ejido*. Therefore, the effects of  
561 neoliberal reform, in this regard, appear to have had adverse implications for the prospects for  
562 payments for ecosystem services for serving as a conduit to ecosystems-based adaptation.

563

564

565 *4. Conclusions*

566 In conclusion, in the context of using payments for ecosystem services to achieve ecosystems-based  
567 adaptation for people living in and adjacent to protected areas in Mexico's Sierra Madre Oriental, we  
568 contend that, it would be unfair to argue that we are 'being conned', to return to Potter's sceptical  
569 question (1997). It is too early to say to what extent CONANP, Mexico's national protected area  
570 commission, will in practice be able to help SMO residents, living in or adjacent to protected areas, to  
571 adapt to climate change. Yet CONANP has shown strong commitment to developing a national  
572 adaptation strategy and invested substantially in developing its own capacity to understand local level  
573 climate vulnerabilities. These demonstrate the concern held by CONANP not just for biodiversity but  
574 for the people whose lives are most intimately connected to its conservation. Further, our evidence  
575 suggests that PES can yield EBA-relevant benefits, albeit so far only at a very small scale. In La  
576 Trinidad, existing PES schemes a) offer income streams which reduce dependency on climate  
577 sensitive livelihood activities; b) increase options to avoid incorporation into immiserating forms of  
578 seasonal migration; and c) contribute to some of CONANP's most central conservation objectives in  
579 the area.

580 However, there is also clear evidence that, at least in the context of protected area management, there  
581 is a risk of a trade-off between favouring EBA over other kinds of adaptation measures would be at  
582 least as – and quite possibly more – relevant. The provision of adaptation support around agricultural  
583 activity in La Trinidad, for instance, was ruled out by the choice of EBA to frame the kinds of  
584 intervention that would be deployed in the first place. Most crucially of all, as we see in Laguna del  
585 Mante, there are significant constraints which impinge fundamentally on the efficacy of payments for  
586 ecosystem services to be EBA-relevant. Even aside from the issues arising from the fact that only  
587 *ejidatarios*, not *avecindados*, have any incentive to modify their use of biodiversity within the Abra  
588 Tanchipa Biosphere Reserve, the payments offered look meagre in comparison with the potential  
589 returns from expanding the agricultural frontier. This is another example of a broader phenomenon,  
590 which we might term NEPES ('not enough payment for ecosystem services'), which is well  
591 documented within the PES literature (Kosoy and Corbera 2010, Guzmán et al. 2011, Farrell 2014).  
592 Our study shows how the people living adjacent to Protected Areas are constrained in their use of  
593 natural resources (Ruiz-Mallén et al. 2015), thereby transferring the conservation cost to local human  
594 populations. Especially in the context of Laguna del Mante, the benefits from PES do not appear to  
595 compensate sufficiently for these costs.

596 This difficulty – of insufficient reward (financial or otherwise) – is by no means new. It was one  
597 amongst a number of potentially terminal problems identified with the integrated conservation and  
598 development projects of the 1990s (see, for instance, Emerton et al. 2001 for a pithy account of the  
599 failure of wildlife conservation to provide sufficient local economic benefit across many African  
600 countries). It is in many ways to be expected. Its sheer predictability is the main reason why the lack  
601 of consideration given to it within the EBA literature is cause for concern. Perhaps we do the concept  
602 no favours by building in such high expectations of what EBA can achieve; yet that is the frequent  
603 effect of much of the literature on EBA. The most important lesson to be derived from the experiences  
604 with ICDPs, and which is borne out in our research findings, is to problematise the notion of win-win.  
605 Both conservation and development practitioners have frequently concluded that conservation and/or  
606 development objectives suffer when trying to do both. Wide-ranging reviews have signalled the  
607 difficulties that many ICDPs did not overcome (Wells et al. 1992, 1999, Newmark and Hough 2000,  
608 McShane and Wells 2004, Roe 2008). The concept of the trade-off offers much greater analytical  
609 purchase when attempting to understand the relationship between conservation and development.  
610 Successors to the thinking of the 1990s, such as the 'new conservation debate', compellingly argue  
611 that trade-offs remain a better predictor of the outcomes of combined conservation and development

612 intervention than does the idea of synergy (McShane et al. 2011, Minteer and Miller 2011, Salafsky  
613 2011). Set against this background, the credibility of win-win claims made by some EBA proponents  
614 appear tenuous, especially when considered against the difficulties encountered in our field sites. We  
615 argue, therefore, that a closer engagement with the ‘new conservation debate’ and its ICDP forebears,  
616 and a shift in focus from hypothetical to intervention-related benefits and, crucially, costs, would  
617 make for useful next steps in the ecosystems-based adaptation research agenda. Our empirical work in  
618 Mexico offers an early contribution to tracing its contours.

619 Important though the new conservation debate’s emphasis on trade-offs is, however, it does not pose  
620 the question as to *why* these trade-offs, seen in the ICDP literature, in our fieldsites and in many other  
621 contexts, are *globally* prevalent, and indeed more likely than synergy. In further deepening the EBA  
622 research agenda, we would do well to draw on the insights of political ecologists, and critical  
623 environmental scholarship more broadly. A number of scholars have argued that we have a global  
624 neoliberal<sup>2</sup> political economy which: a) tends to privilege economic growth over all other policy  
625 considerations; b) looks to the market as the means through which to achieve prosperity and  
626 development through the establishment of private property regimes; c) is associated with a weakening  
627 of state power; and d) serves the interests of capital accumulation more effectively than the  
628 achievement of human wellbeing, or the equitable distribution of the benefits of economic activity  
629 (Sklair 2001, Harvey 2007, Newell 2008). Arguably, these conditions reduce the space available for  
630 alternative visions which might serve either environmental, poverty reduction or wellbeing objectives,  
631 *including* the win-win scenarios prized by many EBA commentators.

632 The most visible aspect of this agenda in our fieldsites is the effect of land tenure reform along  
633 neoliberal lines, which has divided the Laguna del Mante *ejido* into smaller, private parcels. These  
634 reforms have excluded those who are not *ejidatarios*, or not related to them, from the benefits of  
635 payments for ecosystem services, thereby operating as a constraint on adaptation. Another visible  
636 aspect was the decrease in water quantity and/or quality in both study sites. While this seems to be  
637 due to an interplay between declines in rainfall, climate change and increase in human populations,  
638 our research suggests that the same neoliberal land reform policies have also contributed. Evidence of  
639 this is the hoarding of land with available water by the most powerful economic groups, such as the  
640 citrus companies in Laguna del Mante.

641 A growing body of literature charges that influential conservation actors have inadvertently embraced  
642 neoliberal capitalism as the means through which to ‘save nature’ (Sullivan 2006, Brockington and  
643 Duffy 2010, Brockington et al. 2010, Duffy 2010, Buscher and Arsel 2012). This strategy may  
644 conceivably be self-defeating, to the extent that it is “inherent in neoliberal capitalism to  
645 discount...the value of nature” (Newsham and Bhagwat 2016, p. 4) even though the system is built on  
646 what Castree (2008) has referred to as the commodification of nature. Commodifying nature, and  
647 simultaneously giving it insufficient value (economic or otherwise) to ensure that what humans need  
648 from it remains available, is the contradiction currently at the heart of neoliberal capitalism. PES 649  
commentators like Wertz-Kannounnikof et al. (2011) allude to this conundrum when identifying  
650 EBA adaptation benefits that nobody wants to pay for. However, they do not make the link to the  
651 fundamental point that it is the workings of capital accumulation which determine what will or will  
652 not be paid for, and that unless underlying dynamics of capital accumulation change, and the interests

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<sup>2</sup> We follow David Harvey’s definition of ‘neoliberalism’: “A theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterised by strong private property rights, free markets, and free trade” (Harvey 2007, p. 2)

653 served by these dynamics confronted, it is difficult to see how such benefits will ever be paid for. One  
654 expression of this conundrum is that neoliberal capitalism is fundamentally implicated in the  
655 production of global climate change and, thereby, of the climate impacts witnessed in our fieldsites  
656 The prospects for ecosystems based adaptation – and reconciling conservation and development more  
657 broadly – hinge upon whether this global political and economic system can be reformed to resolve  
658 this contradiction, or whether it is an inherent and inevitable consequence of neoliberal capitalism and,  
659 therefore, not susceptible to reform.

660 These considerations are mirrored in the work of scholars keen to better theorise the politics of  
661 adaptation. Some have questioned whether incremental adaptation, to ensure the current system or  
662 status quo can retain form and function in the face of external shocks and stresses such as climate  
663 impacts, should really be the object of development; especially if ‘development’ remains a byword for  
664 economic growth (Boyd et al. 2009, Brown 2011). The concern is that making incremental  
665 adjustments perpetuates, rather than confronts, processes which entrench and perpetuate vulnerability  
666 to climate impacts; and indeed to poverty and marginalisation more broadly (Pelling 2011, Inderberg  
667 et al. 2015). This has led on the part of some to calls for transformative adaptation (Pelling 2011,  
668 O’Brien 2012) which, in a more radical guise, might look for inspiration toward the explicitly anti-  
669 capitalist philosophy and movement ‘de-growth’ (cf. D’Alisa et al. 2014). Whatever form it takes, it  
670 will be crucial for the prospects for transformative adaptation – and indeed for its theorisation – to  
671 understand the uneven socio-natural effects of capitalism as an essentially political process (Taylor  
672 2014, Eriksen et al. 2015). More fundamental engagement with politics at this level is required in our  
673 thinking, essentially, about responding to climate change (*ibid.*).

674 For the authors of this paper, it remains an open question as to whether neoliberal capitalism is  
675 susceptible to incremental reform, or whether more radical transformation is required. But it is telling  
676 that these considerations are yet to surface in the EBA literature, even in recent contributions which  
677 call for EBA to play a role in transformative adaptation (i.e. Brink et al. 2016, Huq et al. 2017). If we  
678 want to understand the prospects for achieving the conditions under which conservation and  
679 development synergies can become more prevalent than trade-offs, and thereby work towards the  
680 prospect of realising the potential of EBA, these debates provide important resources for future  
681 research in this area. Our research is an attempt at providing an early empirical contribution to this  
682 agenda.

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