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Abstract

Most recent studies addressing the effectiveness of policies aiming at combatting deforestation produce mixed results, showing no consistency between a certain policy design and its success in preventing or deterring deforestation. Hence, why anti-deforestation policies succeed or not remains unclear. Against this background, this paper studies the literature evaluating the effectiveness of anti-deforestation policies. 264 empirical evaluations are reviewed and synthesized in order to reveal the theory of change (ToC) that emerges from the current practice of forest policy evaluation. This allows visualising what is described in the forest policy evaluation literature in terms of the causal relations and the conditions at stake for a policy instrument to combat deforestation successfully. It also reveals those conditions that are under-researched. In other words, the paper depicts what makes forest policies successful in evaluators' minds.

Our results expose the context-specificity of the effectiveness of anti-deforestation policies and confirm the mixed-success that has been characterizing them. They also indicate that policy evaluators tend to focus on the policy implementation phase rather than on its design, and correspondingly tend to focus their evaluations on downstream outcomes. More specifically, how implementation generates a social acceptance of and compliance to the policy rules is among the most commonly reported conditions. Likewise, results also indicate that conditions needed to deliver environmental outcomes differ from those needed to deliver social and economic outcomes, which suggests considering multi-purposes policies with care. Among most notable under-developed fields of investigation are the role of improved information on local populations' behaviour with respect to deforestation, the effect of generating social and economic benefits on environmental outcomes, and the effectiveness of anti-deforestation policies in terms of final environmental impacts (biodiversity, carbon sequestration and watershed protection).

These analyses aim at providing researchers with directions for research programming, as well as providing policy designers with indications about conditions for policy effectiveness.

Keywords

Deforestation, Forest degradation, Forest policy, Theory of change, Policy evaluation, Causal relations, Effectiveness, Conditions of effectiveness, Research synthesis, Research biases, Meta-database, REDD+.

JEL Codes

Q23, Q28, Q57.

1 Introduction

Although the importance of forest ecosystem services, as well as the detrimental consequences of forest loss, have been increasingly acknowledged, forests are shrinking globally (IPCC, AR5, Chapter 11). Quantifications of global forest change report 129 million hectares of natural and planted forests losses between 1990 and 2015 (FRA 2015), to 230 million hectares of gross forest loss between 2000 and 2012 (Hansen et al., 2013). Tropical forested are the most affected, with an annual cover loss increasing by 0.2 million ha every year, according to Hansen et al. (2013).

Many countries have been devoting efforts to curb deforestation and promote forest conservation. For instance, deforestation rates declined substantially in Brazil since the mid-2000s. According to the latest FAO report, 96% of the world forests are now under forest policy or forest legislation. Larger land areas have been appointed for permanent forests and for biodiversity conservation (FRA 2015). Besides, since the initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) was introduced on the international scene in 2005¹, policies and research studies on forest conservation have multiplied.

Forested and agricultural lands are regulated by a wide variety of instruments. Some of them directly affect land use through restrictions, labelled as “command-and-control instruments”. Others instruments exert an indirect influence through incentives conferred by “market-based instruments” or “voluntary approaches” (Lambin et al., 2014). Most recent studies addressing the effectiveness of forest policies produce mixed results, showing no consistency between a certain policy design and its success in preventing or deterring deforestation².

Yet, why anti-deforestation policies succeed or do not succeed remains a pending question. Causal mechanisms, and their effectiveness to avoid deforestation or forest degradation, do not only depend on the policy design, but also on the context which the policy is implemented in.

Most forest policy evaluations rely on quantitative impact analyses³. While such quantitative analyses are essential to assess forest policy effectiveness, they generally do not allow for determining the causes and mechanisms underlying the impacts, especially when results are mixed and diverse. They often imperfectly account for the socioeconomic context, and hardly address side effects. They may also fall under the

¹ The Governments of Papua New Guinea and Costa Rica were first to raise this subject during the UNFCCC COP11 in 2005 in Montreal.

² Among those are e.g. Blackman, 2015; Brandt, *et al.*, 2015; Shah and Baylis, 2015; Ferraro and Hanauer, 2011; Figueroa *et al.*, 2009

³ Among the most cited, up to 2015, are Pfaff and Sanchez-Azofeifa, 2004; Wünscher, Engel, and Wunder, 2008; Robinson, Albers and Busby, 2013; Pfaff, A., Amacher, G.S. and Sills, E.O., 2013; Busch, Ferretti-Gallon, et al., 2015; Sparovek et al., 2015; Börner, Marinho and Wunder, 2015, etc.

general critics and controversies related to the limitations of impact analysis tools. An example is the controversy initiated by the study on the effectiveness of Sustainable Forest Management (SFM) principles in the Congo Basin, which revealed that the evaluation results were very sensitive to the choice of the comparison group (Brandt, Nolte and Agrawal, 2016; Karsenty et al., 2017). More generally, some authors warn against the inappropriate use of experimental and quasi-experimental methods (Deaton, 2010) especially in the assessment of conservation programs (Vincent, 2015).

Forest policies act on forest resources but also on communities living there, which partially or fully rely on forest resources. Forest policies are combinations of complex activities of different natures. They are likely to exert indirect impacts, such as influencing agricultural prices or inducing population migrations. Therefore, forest policy evaluation does not escape the universal policy evaluation challenge: isolating effectiveness factors within a complex web of causal relations (Miteva, Pattanayak and Ferraro, 2012).

This suggests the need to broaden the scope of policy evaluation over quantitative impact assessment, and to proceed to qualitative systematic reviews. Such reviews may usefully complement existing quantitative meta-analyses (see e.g. Choumert et al. 2013). While meta-analyses focus on publications' characteristics that drive the results obtained in the literature review, a qualitative approach is needed to account for the causal mechanisms at stake. More specifically, there is a need to map the numerous causal relations that participate to the success or failure of a forest policy, and to visualise which have received more or less attention in the forest policy evaluation literature.

In our view, this is important for different reasons. One of these reasons is the inadequate uptake of policy evaluation literature in institutions dealing with science and biodiversity policies, which tend to focus on ecology and to ignore the peer-reviewed social sciences literature dealing with policies and policy evaluation. This was especially the case in the first assessment produced by the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) on pollinators, which lacked knowledge on the existing policy evaluation literature to be treated in such reviews (Rankovic et al., 2016). Another important reason is that forest policy evaluators, as well as evaluation users, should be better informed on the blind spots in the current coverage of the subject, as well as on already well-addressed questions (Poteete, 2008). Lastly and more generally, the field of environmental policy evaluation needs a better linkage between theoretical orientations and empirical research, as when Miteva et al. (2012: 81) stated it: "One of the major drawbacks of the current literature is that the empirical work is disconnected from theories that describe how the interventions affect outcomes".

This article aims to shed light on what empirical evaluations tell us about factors influencing the effectiveness or ineffectiveness of Policy Instruments intending to fight Deforestation and forest Degradation in the Tropics (termed PIDDTs hereafter). With a review of the literature dealing with PIDDTs' effectiveness, we intend to bridge the gap between empirical work and theories in the field of forest policy evaluation. By mapping policy evaluation as currently practiced, this paper aims at revealing the theory of change

(ToC) that emerges from current forest policy evaluation. The ToC of a PIDDT refers to the reasons “*why*” the policy is designed, as well as the conditions and the transmission channels to its potential outputs and outcomes (“*how*”), and to the degree to which they produce impacts (“*how much*”). Overall, the ToC provides views on the mechanisms at stake from policy implementation to policy results. It identifies the range of conditions to PIDDTs’ effectiveness, as identified in the literature; it then reveals the *de facto* anti-deforestation policy ToC, according to the pool of forest policy researchers, hereby treated as one “aggregated” forest policy researcher. It also provides indications on the success conditions of PIDDTs.

This article therefore intends to answer the “urgent call” among forest researchers “for more evaluations from much more biodiversity-relevant locations. (...) and to use theories of change to characterize causal mechanisms that can guide the collection of data and the interpretation of results.” (Miteva, Pattanayak, and Ferraro, 2012).

The paper is organized as follows. Section 1 exposes the analytical framework of this research. Section 2 shortly describes the methodology and provides a typology of PIDDTs. Section 3 presents our findings on research coverage and the resulting mapping. Section 4 provides a discussion while section 5 concludes.

2 Conceptual framework and methodology

This section presents the typologies and terminologies used in this paper to draw the aggregated Theory of Change that resulted from the literature review.

2.1 Characterizing anti-deforestation policies

A categorization of three different types of anthropological drivers of deforestation and forest degradation is described in Table 1, following the work of Geist and Lambin (2001; 2002). This categorization differentiates *proximate* and *underlying* causes. *Proximate causes* are defined as “human activities or immediate actions at the micro-local-level, such as agricultural expansion, that originate from intended land use and directly impact forest cover”. *Underlying causes* are “the fundamental social processes, such as human population dynamics or agricultural policies that underpin the proximate causes and either operate at the local level or have an impact on the national or global level” (Geist and Lambin, 2002).

Table 1. Typology of anthropogenic drivers of deforestation and forest degradation

	Proximate causes	Underlying causes
Micro-level (local scale)	Direct Pressure Ex.: forest conversion from agricultural or city expansion...	Indirect local pressure Ex.: Local dependence on agricultural expansion, poverty...
Macro-level (national or global scale)	∅	Macro-level pressure Ex.: market drivers like the demand for commodities driving forest conversion...

Source: Geist and Lambin, (2001 and 2002)

Deriving from this categorization, a typology of three major types of PIDDTs is proposed in Table 2. Each PIDDT type is defined according to the category of anthropogenic drivers of deforestation it is designed to respond to:

- Proximate causes (“direct pressure”) are generally targeted by regulation-based or command-and-control instruments (Lambin et al., 2014; Wunder, 2007),

- Underlying causes are rather targeted by incentive-based instruments which differ in terms of scale of intervention, whether they target “indirect local pressure” (micro-level) or “Macro-level pressure”. At the “micro” level, incentive-based instruments target local forest resource users, and may be called “people-centred instruments”. At the “macro” level (i.e. national or global scale), the instruments can be labelled “supply chain instruments”, as they target actors within production and supply chains.

Table 2. Typology of Policy Instruments dedicated to combat Deforestation and forest Degradation in the Tropics (PIDDTs)

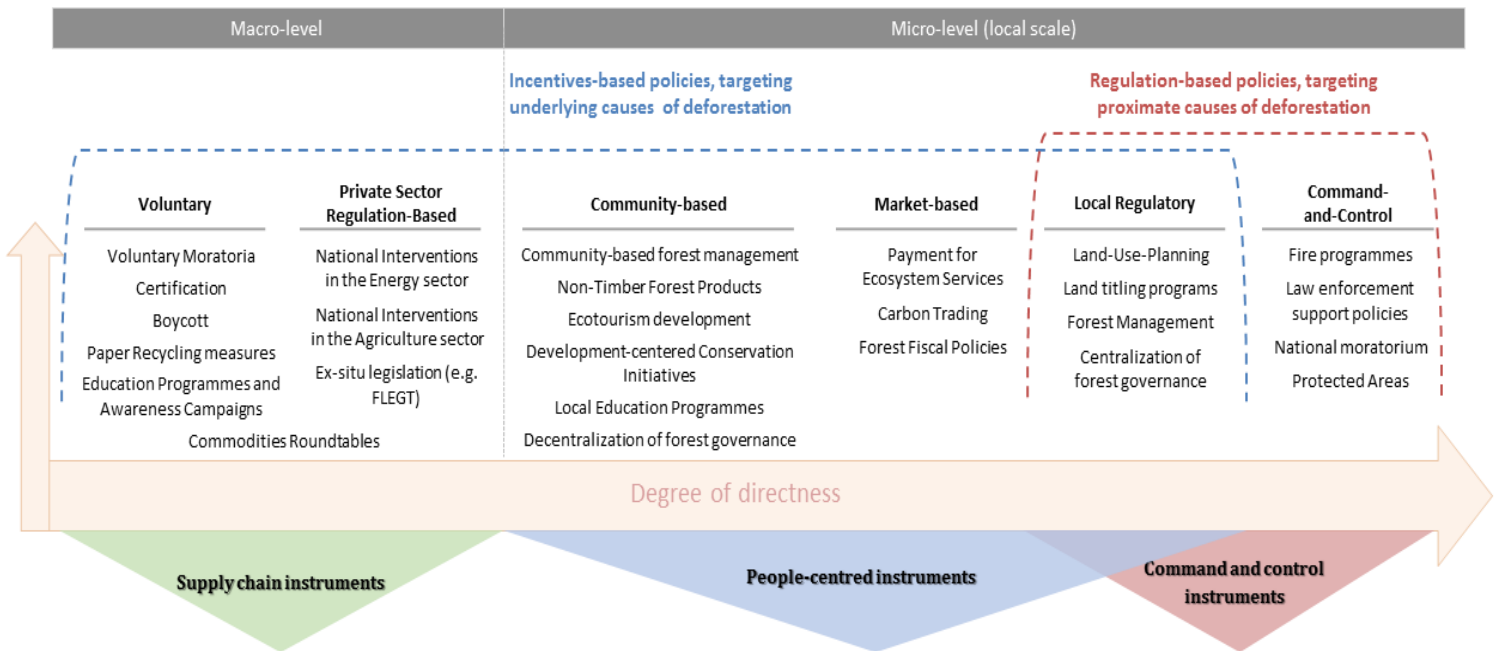
	Regulation-based policies, targeting proximate causes	Incentives-based policies, targeting underlying causes
Micro-level (local scale)	Command-and-control instruments e.g. Protected Areas, Forest codes, National moratorium, etc.	People-centred instruments e.g. market-based Instruments, voluntary approaches, CBNRM, education programs, etc.
Macro-level (national or global scale)	∅	Supply chain instruments e.g. forest Commodities Roundtable, FLEGT, soy moratorium, etc.

Source: Authors' elaboration. CBNRM: Community-Based Natural Resource Management; FLEGT: Forest Law Enforcement Governance and Trade

Since PIDDTs target drivers of deforestation that are more or less direct, they can be ordered by their degree of directness. For instance, a protected area rather directly targets deforestation, while paper recycling measures are rather indirect policy instruments. Figure 1 displays the twenty-six (26) different PIDDTs that were identified

in the literature, according to the typology used here (Table 2), and ordered by their degree of directness (certain instruments overlap two categories).

Figure 1. Classification of the 26 different PIDDTs found in the literature



Source: Authors' elaboration. FLEGT: Forest Law Enforcement Governance and Trade

2.2 Using Theory of Change to analyse causal mechanisms and understand the effectiveness of anti-deforestation policies

Diverse definitions of ToC exist. Howard White's definition is chosen here (White, 2009) and illustrated in Table 3: it formalises causal mechanisms and linkages (transmission channels), in a logical order, from means and action implemented (Input), to their direct consequences (Outputs), their results (Outcomes, be they intermediary or final), and ultimately their final desired social and biophysical impacts (Final Impacts). The difference between "final outcomes" and "final impacts" lies in that "outcomes" can be reliably attributed to the policy, while "final impacts" are rather considered as beyond the policy "accounting ceiling". In the case of PIDDTs, avoided deforestation is considered a final outcome, while the various social and economic benefits that avoided deforestation provides will rather be considered as final impacts, including biodiversity conservation, carbon emissions mitigation, watershed protection, and poverty alleviation. Nonetheless, trade-offs can occur between the different benefits of forest preservation, as it will be discussed later.

The effectiveness of a PIDDT can be assessed at every node of the causal chain. Meijer (2015) for instance distinguishes three successive levels of effectiveness when analysing supply chain instruments: the degree of implementation (effectiveness in the

output production, in the first nodes of the causal chain); the level of behavioural change (effectiveness in the *intermediary outcome*, in the intermediate nodes); and finally the magnitude of reduced deforestation (effectiveness in the *final outcome*, in the final nodes).

Table 3. Different causal steps within the Theory of Change

<i>Inputs</i>	<i>Outputs</i>	<i>Intermediary and final Outcomes</i>	<i>Final Impacts</i>
Policy implementation and concrete action	Direct consequences from action / policy implementation	Intended results of the policy, which are reversible, measurable and attributable to it	Social and bio-physical transformation on a large scale of space and time (not necessarily fully attributable to outcomes).

Source: Authors' elaboration, adapted from White, 2009

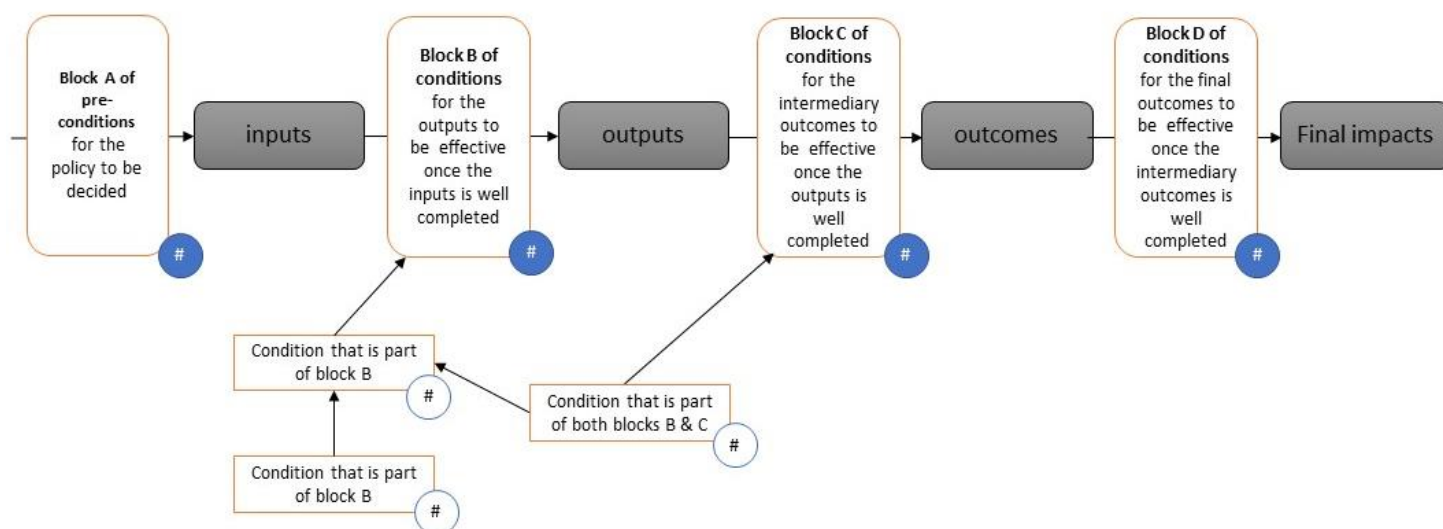
This framework will be used here to structure the literature review.

2.3 Formalizing the aggregated Theory of Change for anti-deforestation policies

Visually, the results section displays causal mechanisms at stake and their conditions for each PIDDT type, according to the literature review, following the mapping model in Figure 2. The three visualizations for each PIDDT type (Table 2) are thereafter grouped, based on their degree of directness.

Three types of information are included in the mapping model (Figure 4). First, pre-conditions to the policy decisions are displayed (Block A). Then each causal node (grey boxes) in the causal chain illustrates each inferred change. A number of conditions to the achievement of the following causal node are identified (white "blocks"); for instance, inputs lead to output, only if block B of conditions is realised. Each block of conditions is therefore an aggregate made out of individual and specific conditions. The symbol "#" indicates where the number of articles that deal with the corresponding block or individual conditions is counted.

Figure 2. Visualizing an aggregated Theory of change (for a given PIDDT type)



2.4 The database⁴

A Boolean search was performed in October 2015, using a keywords selection (Table 4) purposely selected to capture a vast diversity of phrasing related to PIDDTs evaluation.

Keywords were chosen to reflect respective categories of “studied objects”, “action”, “instruments”, and “results” (Figure 4)⁵. To allow for a replicable systematic review, the database was limited to peer-reviewed scientific literature. Elseviers’ Scopus search engine was used because it stands as the biggest online bibliographic database of scientific papers, particularly in recent years and in social sciences. An iterative checking process was performed to validate this keywords selection, by testing the corresponding database with a set of a dozen of well-known articles of the field, and their references.

Table 4. Keywords selection to obtain the data collection⁶

Studied objects	Action	Instruments	Results
deforest* ; forest W/3 degradation	reduc* ; protect* ; preserv* ; conserv* ; fight ; avoid*	program* ; policy ; management ; initiative ; intervention ; instrument ; planning ; project ; strategy	Impact ; evaluat* ; effect* ; consequence ; output ; outcome ; additionality

⁴ A full description of the database production, the selection methodology as well as a full statistical description and list of articles in the extended database is available upon request.

⁵ The choice was made not to include geographical terms into the keywords selection.

⁶ In Elseviers’ Scopus database we looked for this list within the articles’ “keywords”, “title” or “abstract”.

Search results provided a corpus of 3,609 texts (named hereafter the “extended database”), dated from 1974 up to October 2015. They were sorted out based on their nature and on their relevance. Since they generally do not follow peer-review procedures, book chapters and conference papers were excluded. Relevance was assessed through a systematic reading of titles and abstracts, based on the nature of the evaluation (empirical evaluations only), the nature of the policy (only policies dedicated to combat gross deforestation) and the geography (developing countries in the tropics). Consequently, papers dealing with model-based predictions and/or scenarios-based evaluations, reforestation policies, and PIDDTs in non-tropical countries and developed countries were excluded. The geographical focus on tropical developing countries is due to a need for homogeneity in terms of social contexts and policy issues.

Applying this series of relevance criteria, 264 papers (named after “the selection”) were selected. Articles may address a single, or several PIDDTs, in isolation or combined together.

Most selected papers date from after 2004. The research coverage appeared unbalanced in terms of geographical criteria. For instance, over twice more articles evaluate PIDDTs located in Latin America (41.3% of papers) than in Africa (19.7%). Articles in the selection also tend to evaluate policies much more often at the local scale (N= 244, 92% of the selection) rather than at global or national scale. With 159 articles in the selection, assessments of people-centred instruments are a majority (60 %), while 114 articles evaluate command-and-control instruments (43%). Protected Areas (within “command-and-control instruments”) are most researched (N=89, 33%), which corresponds to the fact they are the most commonly used tool for biodiversity conservation in developing countries. Community-Based Forest Management (N=34, 13%), and Payment for Ecosystem Services (N=32, 12%), which are both people-centred instruments, are similarly well researched. Supply chain instruments are way less evaluated (N=20, 8%).

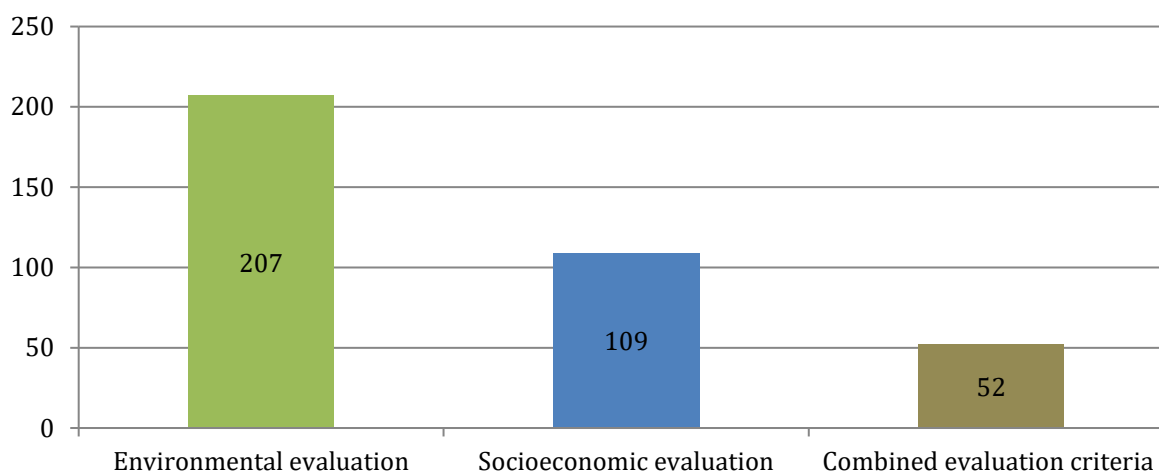
3 Results

Results first lie in (3.1.) identifying the traits of evaluation research – in terms of policy and instruments coverage; (3.2.) mapping the Theory of Change of PIDDT emerging from the literature on forest evaluation.

3.1 What does the evaluative research on PIDDTs focus on?

PIDDTs are expected to have environmental outcomes, evaluated based on forest cover change and biodiversity indices among other evaluation criteria. They may also aim at socioeconomic outcomes, which evaluators look at through changes in livelihood, in employment rate, etc. Figure 3 shows - based on the selected articles - the extent in which forest evaluators look at PIDDTs’ effectiveness through environmental criteria and/or socioeconomic ones.

Figure 3. Number articles evaluating anti-deforestation policies according to environmental and/or socioeconomic criteria



Note: This graph indicates the number of texts from the data collection (264 papers with a policy evaluation) using environmental and/or socioeconomic. Most publications focus on a sole type of evaluation (80%), while some others combine both types of evaluation criteria (20%).

The majority of selected articles (N=207, 78% of the selection) undertake PIDDT evaluation in light of environmental criteria (see Figure 3). Significantly, out of these, 109 articles (38%) use avoided deforestation proxies (*e.g.* change in forest cover, land use or logging level) in order to assess the PIDDT success - or lack thereof. Such environmental outcomes are indeed more easily subject to quantitative evaluations, especially since the standardisation and spread of remote sensing, geographical information system (GIS) techniques and Spatial Multi-Criteria Analysis (SMCA). Those techniques have allowed collecting large samples of aerial and spatial data on forest cover, for relatively low costs and short time (Ferretti-Gallon, and Busch, 2014). Other environmental criteria include biodiversity conservation measures, carbon sequestration calculations, illegal fires incidences, etc.

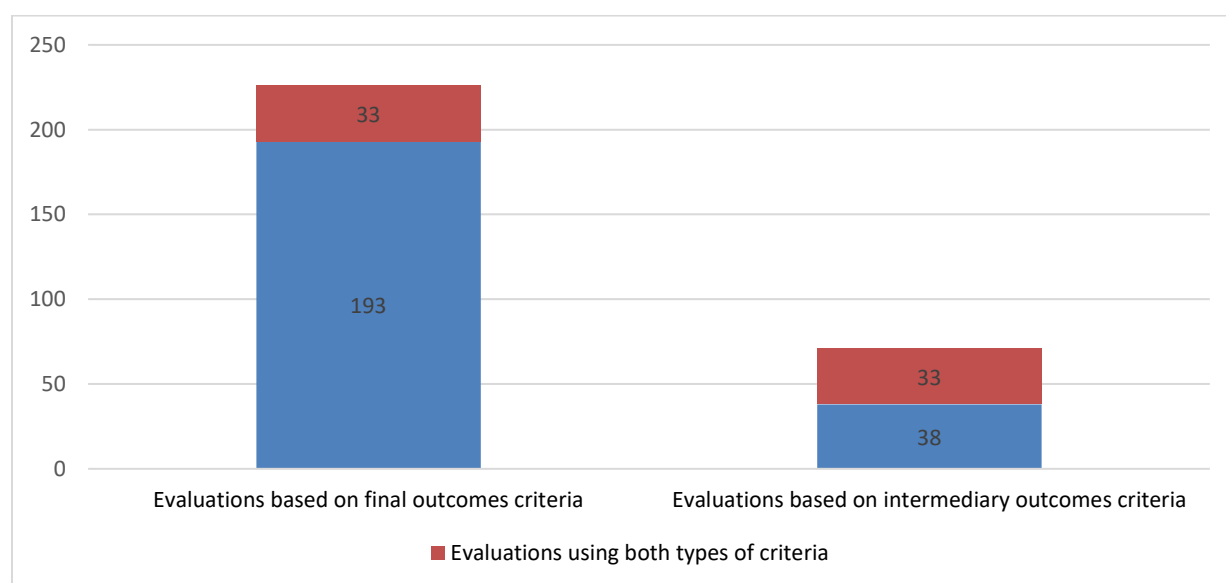
Still, quite a large part of articles (N=109, 41%) use socio-economic evaluation criteria. Most of them correspond to indexes of improvement in local livelihood, social welfare, or equity. Others include changes in behaviours, social empowerment, as well as general economics such as the effects on price or employment. Least used socio-economic criteria include changes in institution and governance, in demography, in production performance, etc.

Some articles (N=52, 20%) combine both categories of criteria, for example using remote-sensing data on forest cover together with on-site interviews to estimate the change in landowner behaviour (*e.g.* Scullion *et al.*, 2011; Bruggeman, Meyfroidt, and Lambin, 2015).

Last, few articles include in their evaluation the PIDDT's capacity to sustain its effect on the long run. Overall, only 11 selected papers (4%) assessed for policy permanence.

A large majority of the selection (N=226 texts, 86%) evaluate PIDDTs in light of their final outcomes (Figure 4). Such evaluation criteria include proxies of avoided deforestation (tree cover, land use cover, etc.), environmental benefits from avoided deforestation (biodiversity conservation, watershed protection, etc.) and socioeconomic benefits from the policy (local livelihood, social welfare, poverty level, etc.). In comparison, 71 texts (27%) provide evaluations of intermediary outcomes, through criteria including a reduction in the targeted drivers (logging intensity, fire incidence, etc.), as well as policy effective implementation (compliance of actors, enrolment in the policy programme, enhancement of perceived forest value, etc.). Finally, 33 texts (13%) evaluate both levels of outcomes.

Figure 4. Number of articles (in the selection) evaluating anti-deforestation policies according to their final and/or intermediary outcomes



Note: This graph indicates the number of texts from the selection evaluating final outcomes (avoided deforestation, avoided forest degradation, socioeconomic benefits generation), or intermediary outcomes (change in behaviour, change in the level of threat to which an area is exposed, level of enrolment in the programme, etc.), or both levels of outcomes.

3.2 The ex-post appearing aggregated theory of change of anti-deforestation policies

Building on the analytical framework (Figure 2), causal chains emerge by treating the selection as if it provided an ex-post and aggregated theory of change. Cause-consequence links clearly identified in selected papers lay the basis to map an arborescence of causes and consequences, forming an aggregated ToC for each of the three PIDDTs types.

Figure 5 displays the causal mechanisms at stake for the different types of PIDDTs to avoid deforestation and forest degradation effectively - i.e. to reach their final outcome. It shows “blocks of conditions” along the three causal chains (for each PIDDT type as described in Figure 1). As described in the methodology (Figure 2), each of those blocks

of conditions is composed of a series of sub-conditions, which emerge from the selected literature⁷ and are presented in Figure 6.

3.2.1 Anti-deforestation policies' causal mechanisms

Figure 5 illustrates that results align with the intuitive assumption that causal chains are more complex when policies are less direct and less local, and that they converge at the outcome level, since they share a similar final objective (avoided deforestation)

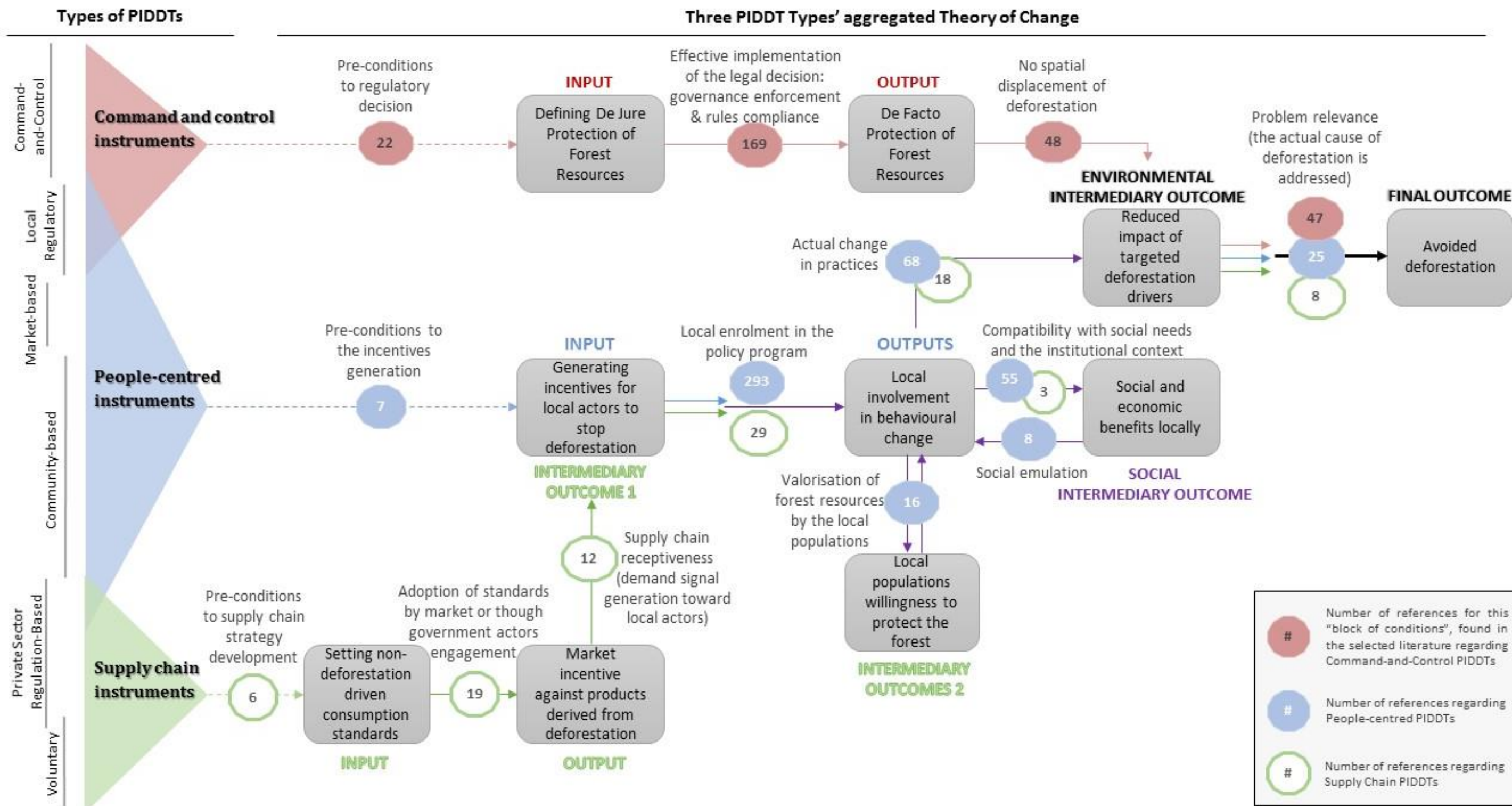
Interestingly, most identified conditions concern the link from input to output, which corresponds to the implementation phase of the policy instruments. For example regarding command-and-control instruments, 22 references on to precondition for the regulatory decision (input level) to be taken were found in the selected literature; 169 on the effective *de facto* protection of forest resources (output), 48 on the effective impact reduction of the targeted drivers (intermediary outcome), and 47 on effectively avoided deforestation (final outcome).

That evaluation focuses on implementation phases suggests that such phases are deemed the most important for policy effectiveness.

It is worth noting that preconditions are only marginally researched in the scientific literature, compared to any other causal link, for every type of PIDDT (Figure 5: only 22, 7 and 6 references for respectively command-and-control instruments, people-centred instruments, and supply chain instruments).

⁷ A full list of articles, with corresponding quotation for each subcondition, is available upon request.

Figure 5. Overview of the Theory of Change (ToC) of Policy Instruments dedicated to combat Deforestation and forest Degradation in the Tropics (PIDDTs), aggregated from the literature review. Spotlight on PIDDTs' causal mechanisms.



Note: The "types of PIDDTs" on the left side follows Figure 1. Classification of the 26 different PIDDTs found in the literature". Grey text boxes indicate the different causal steps, and the white text boxes indicate the "blocks of conditions" following Figure 2. Visualizing an aggregated Theory of change (for a given PIDDT type)". The steps of the ToC (from input to final outcome) is indicated in red for Command-and-control instruments, in blue for people-centred instruments, in green for Supply chain instruments, in purple for the convergence of people-centred and supply chain instruments, and in black for the convergence between all three types of instruments. Please refer to paragraph 2.3 for further explanation on the reading of this figure. To facilitate the reading, "deforestation and forest degradation" is simplified as "deforestation" only.

3.2.2 Detailed map: the effectiveness conditions of anti-deforestation policies

The Figure 6.1, 6.2 and 6.3 map the precise conditions at stake at every causal step, of respectively Command-and-Control PIDDTs (6.1), People-Centred PIDDTs (6.2), and Supply Chain PIDDTs (6.3).

Conditions that are common to more than one type of PIDDT are highlighted (yellow stripes), drawing attention on the common denominators between the three causal chains, as well as their specific features. For instance, Figure 6.1 shows a total of 17 different sub-conditions at the output levels for the Command-and-control PIDDTs. Thirteen (10) of them are common to the output conditions for People-Centred PIDDTs (Figure 6.2). This suggests that similar contextual factors influence the implementation of the policies on the ground, regardless of the policy. However, the three different PIDDT types do not share the same conditions for effectiveness at the intermediary outcome level, where the causal chains yet converge. For instance, the environmental intermediary outcome “reduced impact of targeted deforestation driver(s)” is common to all three causal chains, however conditions to reach it widely differ across the different PIDDT types: only 4 out of the 14 conditions are common to at least 2 causal chains (as highlighted in Figure 6.).

A few conditions are found at different nodes of the causal chains. For instance, for command-and-control instruments, “Minimal Political Willingness” is a condition to the legal decision (input level), but it also conditions the effective implementation (output level) and the relevance of the policy (final outcome level). Regarding people-centred instruments, a “Supportive and Uncorrupt Local Governance with Evolved Institutional Arrangements” (Dietz, Ostrom, and Stern, 2003), is both a condition for “behavioural change” (output level), “Social and economic benefits locally” (social intermediary outcome), and for a “Reduced Impact of the Targeted Driver” (environmental intermediary outcome).

Last, some controversies are exposed regarding whether a certain element leads to more or less effectiveness of the policy. For example, opinions may differ on whether stringent restriction of access to forest resources result in more successful Command-and-Control policies or not (Figure 6.1).

Figure 6. Detailed Theory of Change of PIDDTs. Spotlight on the effectiveness conditions of anti-deforestation policies

Figure 6.0. Legend of figures 6.1, 6.2, 6.3, detailing the Theory of Change of PIDDTs

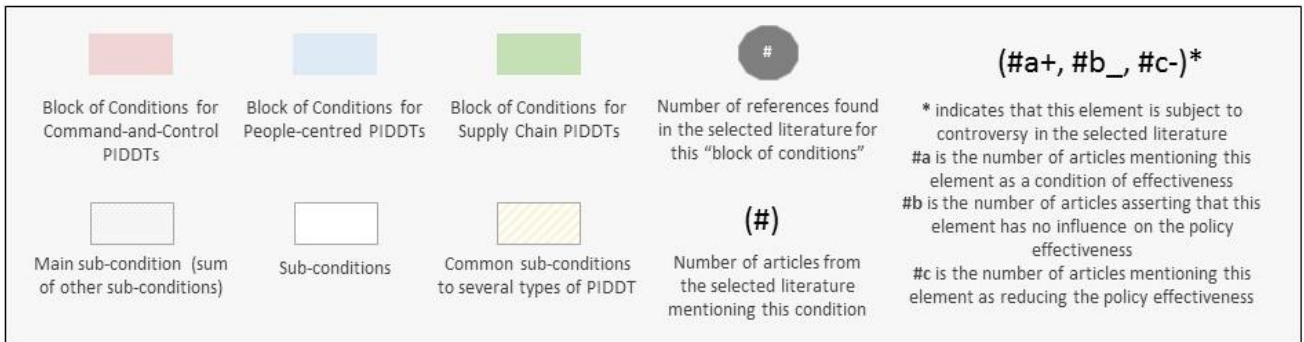


Figure 6.1. Detailed ToC of Command-and-Control PIDDTs

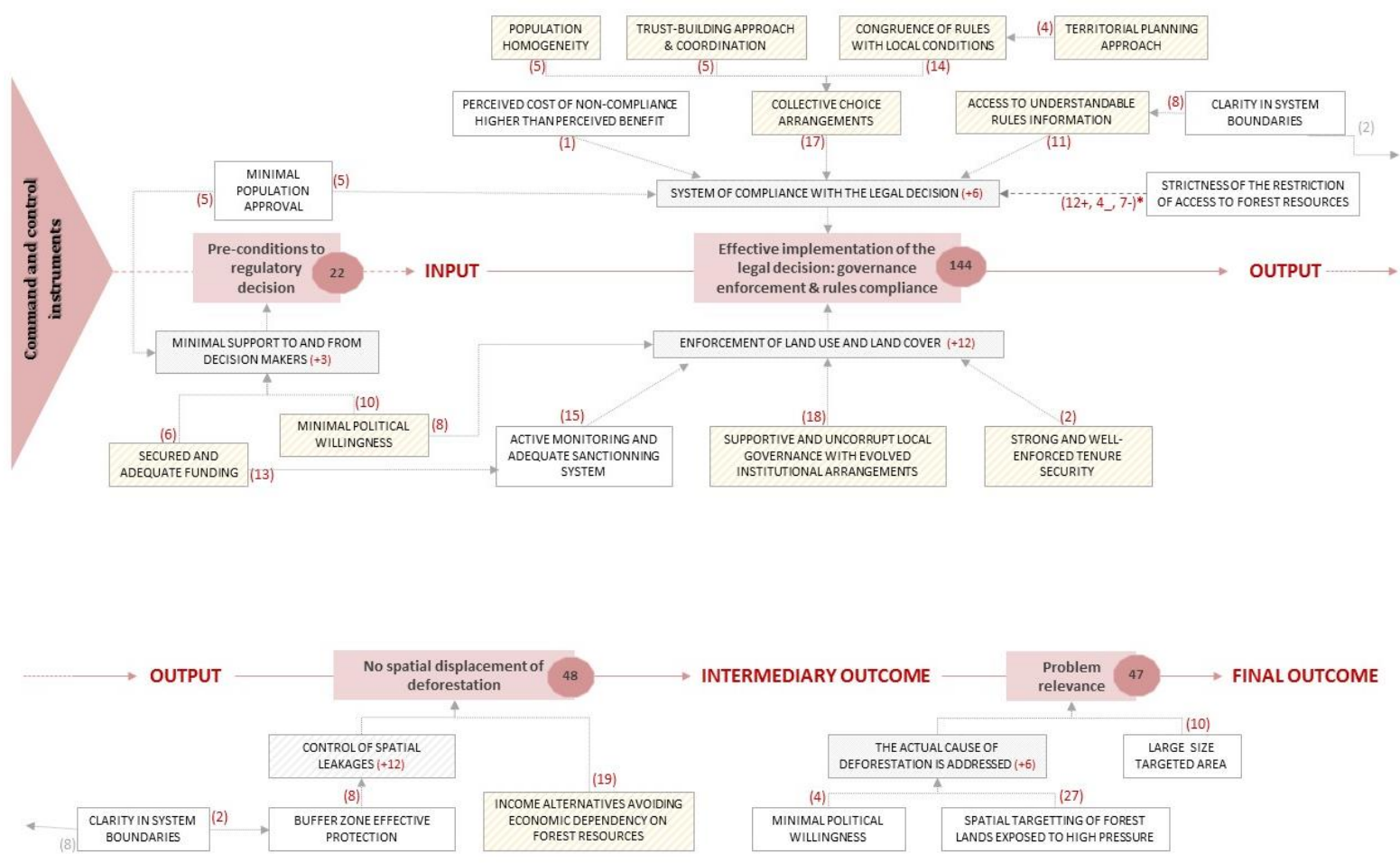


Figure 6.2. Detailed ToC of People-Centred PIDDTs

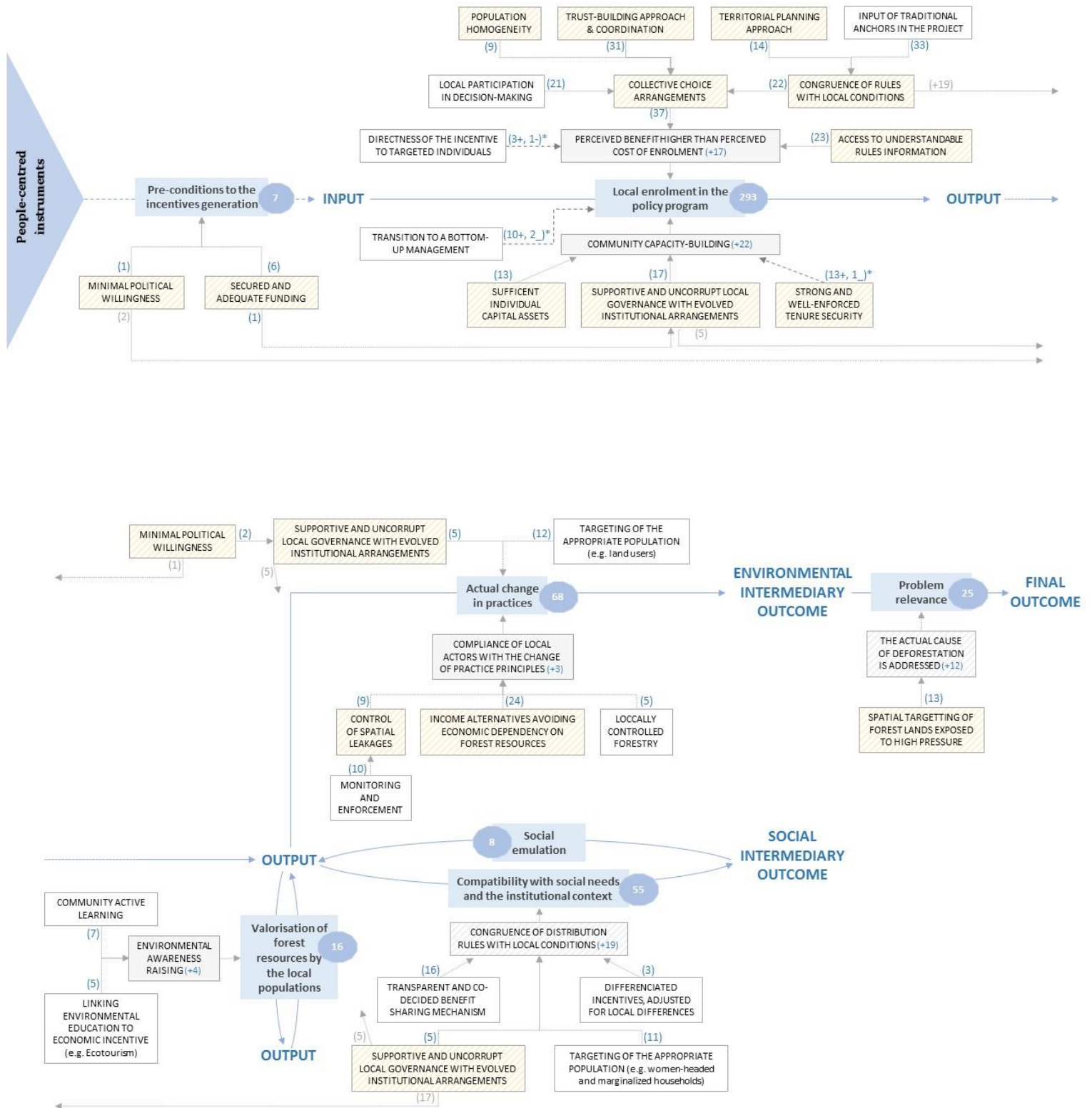
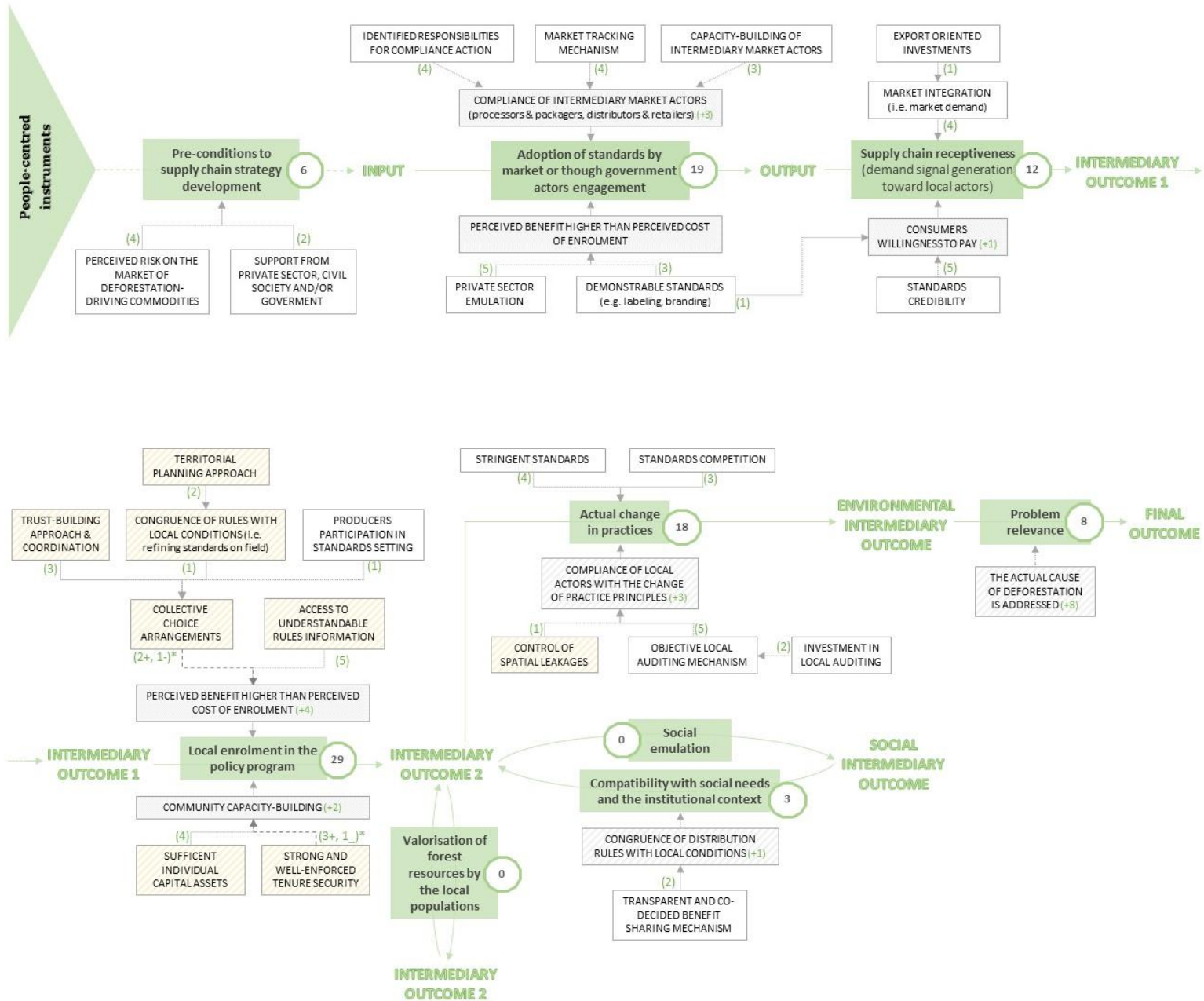


Figure 6.3. Detailed ToC of Supply Chain PIDDTs



4 Discussion

Analysing the available scientific literature on the effectiveness of PIDDTs, through the lens of their theory of change, allows uncovering “why” and “how” forest policies effect (or fail to), according to their evaluators.

The distribution of the conditions along the causal chains will be first discussed in order to shed light on how contextual parameters influence the effectiveness of a PIDDT. Second, we will question the ability of PIDDTs to integrate both environmental and socio-economic goals.

4.1 How does anti-deforestation policies effectiveness vary with context?

PIDDTs’ effectiveness depends on local factors within the context but also on conditionality generated by larger-scale external influences (Sassen et al., 2013 ; Rajão, Azevedo and Stabile, 2012).

Evaluations often mention the need to generate social acceptance and compliance to the policy rules, through an adequate congruence of the policy design with local contexts, as conditions for effectiveness for policies at the local level (command-and-control, and people-centred PIDDTs). With respect to enforcement, evaluations predominantly frame the issue as a need for extensive communication as a key condition. For example, encroachment in protected forests is often seen as resulting from uncertain forest boundaries, thus aligning with one of Ostrom’s eight principles (clearly defined boundaries for Common Pool Resources; Ostrom, 1990). Uncertainty over the policy outcomes and over its promised social or economic benefits also appear to hinder policy compliance, as it was seen for instance in strip plantations in Bangladesh (Muhammed *et al.*, 2011).

Such local conditions are driven by macro factors, such as political interests, institutional and law enforcement capacities, population structure, cultural assets, wealth and market access; for instance, whether devolution of forest management to the benefit of local communities gives rise to increased deforestation; or, as in Engel and Palmer’s analysis (2011), how globalization weakens decentralisation initiatives and may lead to an increased deforestation.

Most effectiveness conditions are dealt rather downstream the causal chain (output level Figure 6). This suggests that anti-deforestation policy evaluators tend to believe that PIDDTs effectiveness depends on its implementation phase rather than on its policy design. Correspondingly, they tend to focus their evaluations on downstream outcomes rather than on the design phase, concurring with warnings from Wilshusen and colleagues (2002) about the risk of “ignor[ing] key aspects of social and political processes that shape how conservation interventions happen in specific contexts”. This coincides with the idea that people–environment coupling is particularly strong in developing countries (Miteva *et al.*, 2012), and that policies increasingly attribute the policy

management authority to local actors since the mid-1980s (Larson and Soto, 2008; Colchester *et al.*, 2003).

Nevertheless, even when correctly implemented, a PIDDT might not reduce deforestation if it is ill-conceived, and especially if it does not address the main drivers of deforestation. For example, PIDDTs are more efficient when targeting locations subject to higher deforestation pressure (see Figure 6.1, “conditions for problem relevance, spatial targeting of forest lands exposed to high pressure”). Threats indeed greatly vary in space (Ferraro and Hanauer, 2011) and time (Haruna *et al.*, 2014), and political pressures are suspected to direct the PIDDTs to locations and moments where pressure – and opposition – are minimized, therefore reducing policy effectiveness (Pfaff, and Robalino, 2012). As such, when dealing with upstream causal mechanisms, “political willingness” is often mentioned by evaluations as an important pre-condition (Figure 6) for the instrument to combat deforestation. Other “upstream” evaluated conditions are enforcement capacities, institutional arrangements and population economic dependency.

Results also indicate a strong effect of contradictory factors on the effectiveness of PIDDTs. Evaluations suggest the importance of ensuring the alignment of a PIDDT with different sectoral policies within national governments (Rajão, Azevedo and Stabile, 2012). The type of governance systems implemented may also clash with the requirements of community-based forest policy instruments (Leventon *et al.*, 2014). In addition, central governments tend to oppose the decentralization of resource management (Ribot, Agrawal and Larson, 2006). Inconsistency happens as well when the very means of the PIDDT are detrimental to its core objectives, as it was shown in Mexico, where better governance of *ejidos* was supported to reduce deforestation, but evaluation showed that it increased deforestation by encouraging the expansion of agriculture (Ferretti-Gallon and Busch, 2014).

Policy planning resting on a cautiously designed theory of change will therefore pay attention to the contextual macro conditions (Miteva *et al.*, 2012; Joppa and Pfaff, 2011; Singh *et al.*, 2011), so as to adequately design the policy targets as well as, *in itinere*, to adapt the policy’s means of action to contextual changes. It will also better highlight eventually contradictory causal mechanisms to reach different policy targets and take trade-offs into account when setting priorities (Dyer *et al.*, 2012).

4.2 Can anti-deforestation policies realistically generate both environmental and socioeconomic benefits?

The aggregated ToC map shows that anti-deforestation policies often result in a combination of environmental, social and economic changes. However, as stated by Chapman and colleagues (2016): “improving ecosystem outcomes, economic and material benefits, forest cover and carbon sequestration are commonly stated objectives, but they are not necessarily convergent”.

PIDDTs causal chains (Figure 5) indeed diverge into two different branches towards environmental final outcomes (avoided deforestation and forest degradation) and socio-economic final outcomes. On those two branches, conditions can sometimes be antagonistic or synergistic. For instance, the condition “Targeting the appropriate population”, regarding people-centred PIDDTs, appears on both final outcomes branches, meaning it influences both environmental and socio-economic benefits achievements (Pfaff et al. 2007; Romero, 2012 ; Robalino and Pfaff, 2013; Mahanty et al., 2013; Jewitt, et al., 2014; Chapman et al., 2016; Brimont et al., 2015). However, the “appropriate population” to be targeted so as to avoid deforestation may differ from the “appropriate population” for generating socio-economic benefits. More socio-economic benefits will indeed be generated if the policy targets poor populations while more environmental benefits will be delivered if the policy targets populations with higher deforestation risk (larger landholders, owners of potential fertile agricultural areas, etc.), who are not necessarily the poorest.

Furthermore, trade-offs can be needed within the same policy goal. Regarding socio-economic benefits, for example, Larson, Barry and Dahal (2010) mention trade-offs between orienting profits generated by new tenure rights toward businesses and their members, or toward community projects, with different implications for employment and wage income. Regarding environmental benefits, conditions to maximize carbon storage often differ from conditions to enhance biodiversity conservation or watershed preservation, notably in terms of spatial prioritization (Busch and Grantham, 2013).

This stresses the difficulties involved in designing policies that generate all kinds of benefits without prioritizing some. Those policies critically hinge upon the Tinbergen rule according to which every policy target should be supported by at least one policy tool. This is exemplified by the controversy on integrating both forest conservation and poverty alleviation into the same policy scenario which is hoped to be a win-win solution. This debate was crystalized around Wunder’s (2011) and Muradian et al.’s (2013) papers, both warning on the “unrealistic expectations on the (...) prospect of sustainable forest development” (Wunder, 2011) and that “win-win solutions at the interface of conservation and development are (only) possible under particular institutional and governance contexts” (Muradian et al., 2013). Some of the conditions reported in our results confirm that environmental and socio-economic benefits can be produced together under particular contextual conditions only. Such conditions are for instance targeting lands subject to strong pressure while not hindering economic activities, selecting population targets accordingly, and cautiously organizing the distribution of benefits while avoiding social conflicts.

5 Concluding remarks: blind spots and avenues for research

Results show that PIDDTs effectiveness relies on a complex balance of contextual factors, but the level of influence of reported conditions on the policy effectiveness is however poorly evaluated, both qualitatively and quantitatively. For example, using

“collective choice arrangements” is identified as an important effectiveness conditions, however little is known on *how much* it affects the success of PIDDTs.

The fact that most effectiveness conditions are searched for at the implementation phase tends to revive the question of its evaluation; it shows a need for more empirical evaluations rather than evaluations based on (spatial) modelling only, thus concurring with observations by Vincent (2015) and Ferraro and colleagues (2015). Strictly physical terms (e.g., forest cover change) used in most impact evaluations ignore heterogeneity in the costs and benefits, especially for local populations.

Moreover, our mapping of the aggregated theory of change of anti-deforestation policies, and of its coverage by research, suggests at least three broad categories of under-researched causal relations:

- Many people-centred instruments are believed to change people’s behaviour through increased knowledge and perceived value of protecting forest resources. It is the case for ecotourism (Almeyda, *et al.*, 2010) or for local training (Bacha and Rodriguez, 2007). However, how such knowledge and modified perceptions actually lead to a change of behaviour appears under-researched.
- Results show that the generation of socio-economic benefits can further spread changes in local behaviours, through ‘contagion’, ‘common exposure’ (actors respond to similar interventions in a similar manner), or ‘selection’ (an intervention affects a cluster of connected actors)” (Newton, Agrawal and Wollenberg, 2013). However, the effectiveness of such mechanisms is rarely evaluated.
- The coverage of the different PIDDTs’ *final impacts* is yet incomplete, especially with respect to biodiversity conservation, carbon sequestration and watershed protection.

Our review also confirms the spatial unevenness of the evaluation effort, within tropical regions: evaluation coverage is much less intense in Africa than in Latin America, which may obviously be related to strong inequalities in terms of statistical as well as geographical data availability (Godar *et al.*, 2014; McDermott; Irland, and Pacheco, 2015; Ferretti-Gallon, and Busch, 2014). It also points to a paucity of long-term evaluations.

These results illustrate that “people and their environment are part of dynamic coupled systems” (Miteva *et al.*, 2012), and that anti-deforestation policies have both to carefully integrate the specificities of the local contexts in which they are to be deployed, and to take full account of their numerous large scale macro-conditions.

Although some inconsistency in policy evaluation methods remains (Agrawal, *et al.*, 2014), we also observed a steady increase of PIDDTs evaluations over time, and this gives hope for more data accessibility, which constitutes a *sine qua non* condition to

relevantly measure forest policies performance. Better knowledge does not guarantee better policy. It does, however, increase the possibilities for appropriate policy choices (Ostrom, 2009).

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