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“Walking the talk” in land management: Structural factors influencing pro-environmental intention-action links in a tropical watershed

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ABSTRACT

In this paper, we examine structural factors conditioning the adoption of pro-environmental practices in land management. While the thinking-action relationship has been widely studied in psychology, there is a need to further investigate, from a geographical perspective, how structure shortens or widens the gap between pro-environmental intentions and actions in land management. In filling this need, we examine the structural factors reported to influence this intention-action link in a Costa Rican watershed recently designated a UNESCO Biosphere Reserve for its social-ecological importance. To this end, we draw on intensive fieldwork and land manager interview data. Research design was informed by theoretical and conceptual insights from social psychology, land systems science and political ecology. Results suggest a strong influence of diverse structural factors on the pro-environmental intention-action connection in land use in this social-ecological system, both as a facilitating and/or constraining force. More salient is the marked gap between intentions and actions among managers, largely influenced by market dynamics and incentive structures, land tenure policies, perceptions about government institutional performance, and deficient extension networks. These results highlight the need to “clear the way” for pro-environmental intentions to materialize into actions through selective structural measures, especially in social-ecological landscapes facing dire needs to reduce ecological impacts of productive systems.

1. Introduction

Understanding patterns of human thinking and behavior and their consequent impacts on Earth system processes is a key task for promoting sustainability (Gardner and Stern, 2002; Meyfroidt, 2013; Duraiappah et al., 2014). Achieving the U.N.'s Sustainable Development Goals, for instance, strongly depends on effectively changing human behavioral trends in several areas, including social relations, political management, economic production and human-environment interactions (ISSC and UNESCO, 2013; FAO, 2020). Although societal concern about environmental problems such as biodiversity loss, soil and resource depletion, and human-induced climate change has risen in recent decades, this has not resulted in a dramatic shift in environmental behaviors at the individual level that can help remediate these problems (Gardner and Stern, 2002; MEA, 2005; Steffen et al., 2018). In the U.S., for example, despite an increasing concern about climate change among the general population (Leiserowitz et al., 2018), the country continues

its trend as the second largest contributor of atmospheric greenhouse gases worldwide, without compelling signs of changing in the short term.

This incongruence between professed values and individual action is not well understood. Social psychology research suggests that environmental actions are determined to a large extent by “internal” factors, such as values, beliefs, and norms, while also acknowledging that these factors are also shaped by broader socio-economic contexts (Kollmuss and Agyeman, 2002; Steg and Vlek, 2009; Hill et al., 2010; Schultz and Kaiser, 2012). This interplay between internal (psychological) and external (contextual) factors in determining behaviors is at the heart of what has been termed the “value-action gap” or “attitude-behavior gap” (Blake, 1999; Kollmuss and Agyeman, 2002; Clark et al., 2003), wherein a behavior does not accord with professed values and beliefs and, therefore, the individual experiences a type of “cognitive dissonance” (Festinger, 1957) with regards to her/his relationship with the environment.

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Understanding this cognition-behavior relationship is not trivial. The consideration of “intra-agent cognitive dissonance” involved in land use decisions, for instance, is fundamental for designing more effective governance strategies that address complex social-ecological problems (Duraiappah et al., 2014). From a policy perspective, it is particularly useful for understanding how the broader context influences cognitive-behavior mismatches, helping substantially reduce policy implementation costs and improve overall acceptance and effectiveness of regulatory mechanisms. Indeed, a pivotal task in the promotion of sustainable behaviors is the *a priori* assessment of how actions are facilitated or constrained by contextual factors (Hill et al., 2010), and how this influence varies in space and time. Moreover, behavioral change interventions that address the broader context have proven to be more effective than mere information-based approaches (Kantola et al., 1984; Heberlein, 2012), supporting arguments about the influential role that these broad socioeconomic, institutional, and political forces play in promoting certain actions.

Meanwhile, research within social psychology has considerably improved understanding of cognitive-action relationships. The focus within this field, however, has been on the role of intra-personal factors, while much less attention has been given to the extra-personal determinants influencing behaviors (Kollmuss and Agyeman, 2002; Steg and Vlek, 2009; Gifford, 2011; Barr, 2007; Huddart et al., 2009; Hill et al., 2010; Schultz and Kaiser, 2012). Moreover, relatively few studies have considered internal and external factors conjunctively (Gaspar de Carvalho et al., 2010; Hill et al., 2010), and those few that have, tend to focus on certain structural components assumed *a priori* to be influential, such as socio-demographic or economic variables (Brody et al. 2004, 2005; Clark and Finley, 2007). Also, when assessing pro-environmental behaviors, research on this interplay between cognitive and structural factors has rarely approached the topic from the agent’s perspective. Capturing these subjectivities is important because, irrespective of their objective validity, they constitute individual appraisals that can considerably influence environmental decision-making. As Michel-Guillou and Moser (2006) note: “adopting pro-environmental behaviors does not seem to depend on the objective perception of the problem; instead, it seems to be linked to the representation that the individual has” (p. 228).

Human-environment studies that seek to better articulate cognitive dynamics and structural factors could greatly benefit from the integrative and diverse conceptual and methodological perspectives within geography (Turner, 1989; Bryant and Wilson, 1998). Geographers have a history of studying both agency and structural components and the ways in which they determine spatial dynamics and configurations (Roy Chowdhury and Turner, 2006). Cultural ecology, a subfield that emerged in the 1960s, focused primarily on the agent and its immediate milieu (i.e. household, community) (Zimmerer, 2004), and made important contributions to our understanding of cultural adaptation and the environment (Moran, 2010). Political ecology, on the other hand, sought to situate people, places and practices within wider political-economic structures to understand human-environment dynamics in the context of unequal power relations at multiple scales (Blaikie and Brookfield, 1987; Forsyth, 2003; Robbins, 2004). In effect, political ecology emerged partly as a response to critiques to cultural ecology as well as to natural hazards research that centered around the omission of forces outside of the immediate geographical space (Walker, 2005; Roy Chowdhury and Turner, 2006; Turner and Robbins, 2008). Political ecologists filled this void by situating local phenomena and events within broader and trans-scalar contexts, such as the national and global economy, and in so doing, move towards “chains of explanation” (Blaikie and Brookfield, 1987). Thus, while individually held attitudes and values remain important to understanding changes in the landscape, political ecologists are keen to understand the land manager as enmeshed in a more extensive chain of social, political, and economic relations. These multi-scalar, integrative approaches to the study of nature-society relations also have the potential to contribute to physical

geography, a part of the discipline that has traditionally overlooked the “human” in human-environment traditions, (e.g. Zimmerer, 1994; Terrell, 2006; Goudie, 2018).

Furthermore, what is defined as “structural” varies across disciplinary fields and research designs. Theoretical and empirical works from psychology, sociology, geography, anthropology, and economics utilize distinct terms that, at least broadly, share similar understandings of the concept but that may vary considerably once applied to specific contexts or situations. Aside from “structural”, some other terms commonly used include “external”, “contextual”, “situational”, “exogenous”, and “extra-personal”. Following the human-environment geography perspective, and particularly the branch of land systems science, by structural we allude to factors “largely external to and beyond the management of the household (or community), those factors that control the larger rural economy (access to capital, land and resources) or that differentially empower and constrain farmers’ decisions” (Roy Chowdhury and Turner, 2006, p. 309). Conceptual typologies and ontological viewpoints from land systems science (e.g. Geist and Lambin, 2001, 2002) can be especially useful in agency-structure studies in land management, notably the theoretical frameworks relating proximate sources and underlying driving forces involved in landscape change. The driving forces refer to the more distal factors influencing change (e.g. policies, economic factors, population dynamics), and these, in turn, underlie the more proximate, immediate sources (e.g. urbanization, wood extraction, expansion of agricultural and cattle frontiers) (Geist and Lambin, 2001; Geist et al., 2006). Further, distinguishing between ‘exogenous’ and ‘endogenous’ factors in land use decision-making is especially relevant for behavioral approaches in human-environment research (Burton, 2004). Usually operating at finer scales, endogenous factors are understood as those “upon which local land managers exert the highest possible control in order to ensure sustainable land use in their surroundings” (Geist et al., 2006, p. 205), while exogenous factors refer to forces outside of land manager control that commonly exert their influence at supra-local scales (Geist et al., 2006b), and can include policy structures, market demands, access to technologies, or demographic trends. Both factors typically interact jointly and in complex ways to determine land use decisions and consequent social and biophysical effects on the landscape (Lambin et al., 2003; Geist, 2006a; Geist et al., 2006).

In this paper, we examine the subjective appraisals of land managers regarding the structural forces that mediate the relationship between pro-environmental intentions and actions in a social-ecological system characterized by notable disjunctures between pro-environmental discourses and actions. To this end, this research takes an integrated approach to the study of cognitive-action interplays, drawing from varied analytical frameworks within political ecology, land systems science and social psychology. We find that three structural factors are of special importance when trying to understand the gap between professed thinking and environmental behavior in this social-ecological system. These three factors are: market-based incentive structures, insecure land tenure, and rural extension schemes. Together, these factors powerfully shape how individuals negotiate the gap between their professed intentions and their actions on the ground regarding pro-environmental land management.

2. Study site

Occupying an area of approximately 600 km², the Savegre river watershed (hereafter SRW) is located in the Central Pacific region of Costa Rica (Fig. 1). The Savegre river represents the epitome of a relatively well-conserved riverscape in the national imaginary. It is common to hear Costa Ricans declare the river the cleanest in Central America, despite this assertion not being scientifically validated. Although Savegre river waters are seldom used directly for consumption or irrigation due to abundant precipitation and groundwater sources, the river has significant cultural value as a tourist attraction and as a source of

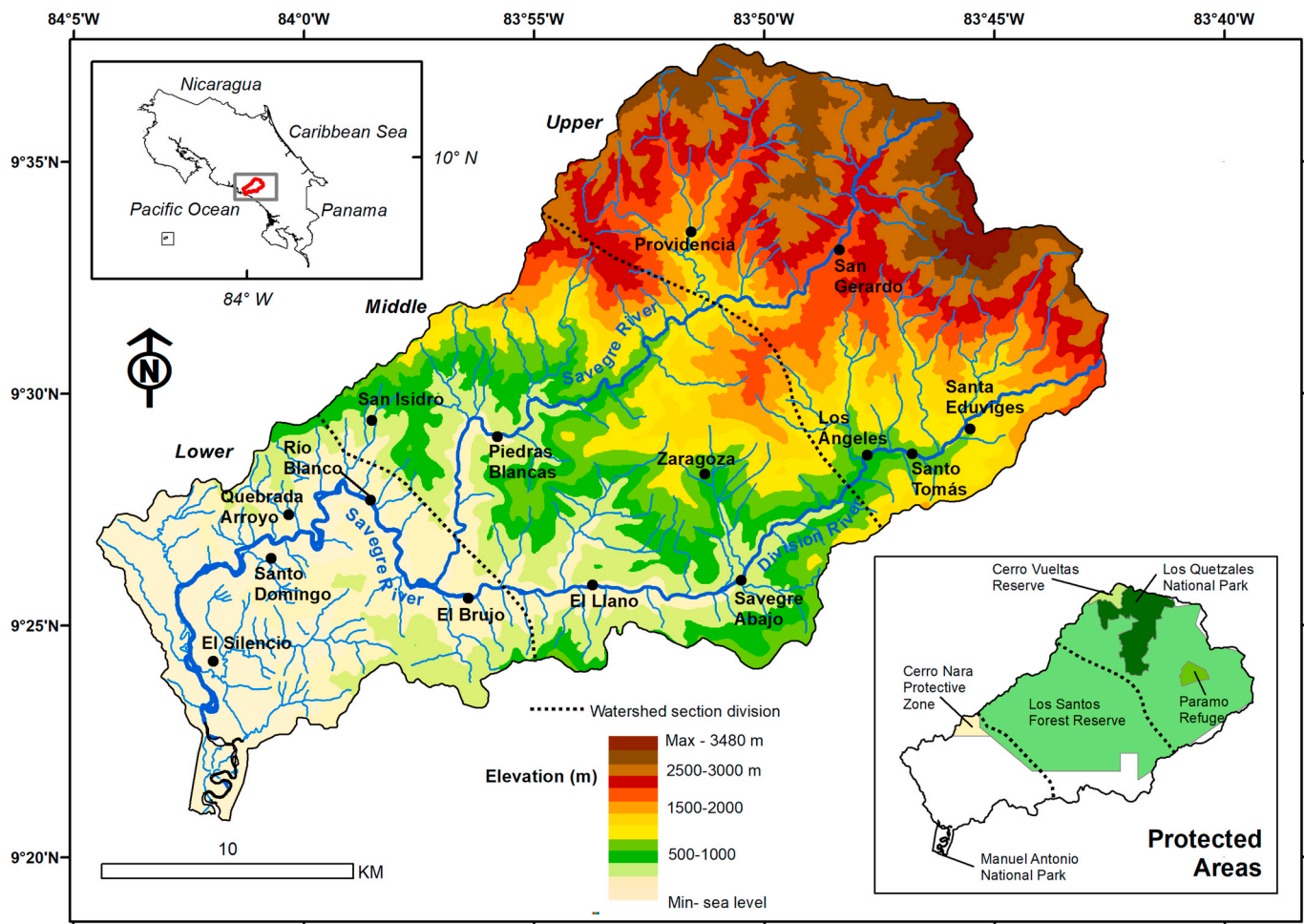


Fig. 1. Study area. Main map shows the SRW with elevation gradient, main communities, fluvial network, and broad watershed sections. Watershed section areas were based on the SRW's territorial plan (MINAE-AECL, 2003), as well as from its management plan (MINAE, 2004). Inset map on the bottom right shows protected areas and watershed sections.

cultural ecosystem services including sense of place, community bonding, recreation, and aesthetic appreciation. Yet despite this cultural significance, the SRW has faced increasing environmental problems including ecosystem fragmentation, sedimentation and pollution of fluvial waters, as well as greater slope instability leading to intense and frequent landslides and soil loss. These problems derive in large part from unregulated land clearing associated with the expansion of the agricultural and cattle frontiers, unsustainable land use practices, intensive aquaculture and destructive fishing practices (CEDARENA (Centro de Derecho Ambiental y de los Recursos Naturales), 2001; MINAE (Ministry of Environment and Energy), 2004; Sánchez et al., 2004; SINAC, 2017).

These issues are especially concerning considering the SRW is among the most biodiverse places in the world (Acevedo et al., 2002; Rodríguez-Herrera, 2004; Kappelle, 2006, 2008), owing to its variety of microclimates and their associated ecosystem diversity. The watershed's steep elevation gradient (sloping from almost 3500 m to sea level in 42 linear km) has not only favored this diversity but has also historically discouraged human settlement. This is especially true in the upper and middle sections, where population density is relatively low (approximately 30 people/km²). The rough topography and settlement unsuitability also partly led to the premature establishment of a series of private and state protected areas in the watershed starting in the 1970s (Fig. 1). In 2017, the SRW and adjacent areas were designated a UNESCO Biosphere Reserve due to their social and ecological importance.

Mixed crop-livestock smallholder systems predominate in the SRW, with most production being mixed market and subsistence. Major crops cultivated within the watershed include coffee, oil palm, and fruit varieties including berries, avocados and apples, all of which are produced for export markets. Ecotourism has also become a major activity in the SRW, especially in its upper sections and primarily focused on bird-watching and naturalist tourism. Small to medium-scale trout aquaculture farms have also been established in the headwater communities, while in the middle and lower watershed smallholder livestock raising is prevalent.

3. Methods

3.1. Analytical framework

This research utilizes theoretical and methodological insights from social psychology, political ecology and land systems science. From social psychology, it draws conceptually from widely used behavioral models such as the Theory of Planned Behavior (TPB) (Ajzen, 1985). The TPB posits that a behavior is preceded by the intention to perform it, and this intention is in turn undergirded by dispositional factors such as attitudes toward the behavior, subjective norms and perceived behavior control (PBC). Worthy of note in the context of this research is the behavioral intention variable, as it represents a mediator construct between the internal factors favorable to the action and the actual performance of the action, helping better situate the role of structural

factors within this connection. Thus, as per the TPB logic, an individual might have the intention to act, but external determinants might impede this intention from materializing into actual behaviors. The PBC variable in the TPB largely considers the role of these external influences, by assessing perceptions regarding how much of the performance of the behavior depends on factors within the control of the individual (Barr, 2004; Steg and Vlek, 2009).

While common applications of the TPB model typically focus on a single or small set of behaviors, in here it was used more as a conceptual/analytical underpinning for qualitative research design and data analysis. A simplified analytical framework guiding this research is shown in Fig. 2. Five main components are considered: dispositional/cognitive factors, intentions, structural factors, pro-environmental land management practices, and the environment. As mentioned before, in the TPB model, dispositional factors determine intentions, which implies that if an intention exists, the preceding internal constructs are conducive to performing a behavior. Yet, as mentioned above, we situate structural factors, which enable or constrain the materialization of those intentions, between intentions and actions to more appropriately reflect this mediating role. The resulting behaviors, in turn, lead to environmental changes, which feed back to dispositional factors. Finally, this dynamic between cognition, structure, behavior, and environment occurs within a broader social-ecological setting.

From land systems science, we draw particularly from the proximate sources/driving forces typologies and frameworks describing landscape change causative dynamics (Geist and Lambin, 2001, 2002; Roy Chowdhury, 2006). Also drawing from this disciplinary subfield, pro-environmental land use is defined here as “the use of land-based resources to produce goods and services in such a way that over the long term the natural resource base is not damaged and that the basic needs of land managers can be met” (Lambin and Geist, 2003 p. 16).

3.2. Research design and data collection

This research used data from semi-structured interviews with 91 land managers in sixteen communities throughout the SRW, which represents approximately 35% of the total land management units in the watershed. Interviewees were selected purposively from lists of land units for

each community. The lists were provided by the local community development associations, which act as state-recognized groups that oversee economic, cultural and environmental development in communities throughout the country. Land manager interviews were supplemented with data from key informant interviews as well as from participant observation. Key informants interviewed included three agricultural extension officers, four public institution representatives, seven community development association members, and five rural aqueduct association representatives from communities throughout the watershed. Participant observation was used mostly to validate interview data in the field, by contrasting it with observed activities. The data collection process lasted approximately 15 months. All interviews were conducted in Spanish and took between 40 min and 1.5 h.

Data were collected on two general themes: structural factors *facilitating* current sustainable practices performed (Table 1, Theme A) and structural factors *constraining* the materialization of pro-environmental intentions (Table 1, Theme B). For each theme, three items were used.

Table 1
Guiding themes and main items used in the data collection process.

Theme	Items used	Item type
A. Current practices and facilitating factors	<i>Item A1:</i> Do you currently carry out pro-environmental practices? Please specify which.	Close-ended
	<i>Item A2:</i> Which external factors have facilitated the implementation of those pro-environmental practices?	Open-ended
	<i>Item A3 - Additional items:</i> Free-format follow up questions based on responses in item 2	Open-ended
B. Intentionality and constraining factors	<i>Item B1:</i> Do you intend to implement (more) pro-environmental practices?	Close-ended
	<i>Item B2:</i> What specific factors of which you have little control over inhibit you from taking action?	Open-ended
	<i>Item B3 - Additional items:</i> Free-format follow up questions based on responses in item 2	Open-ended

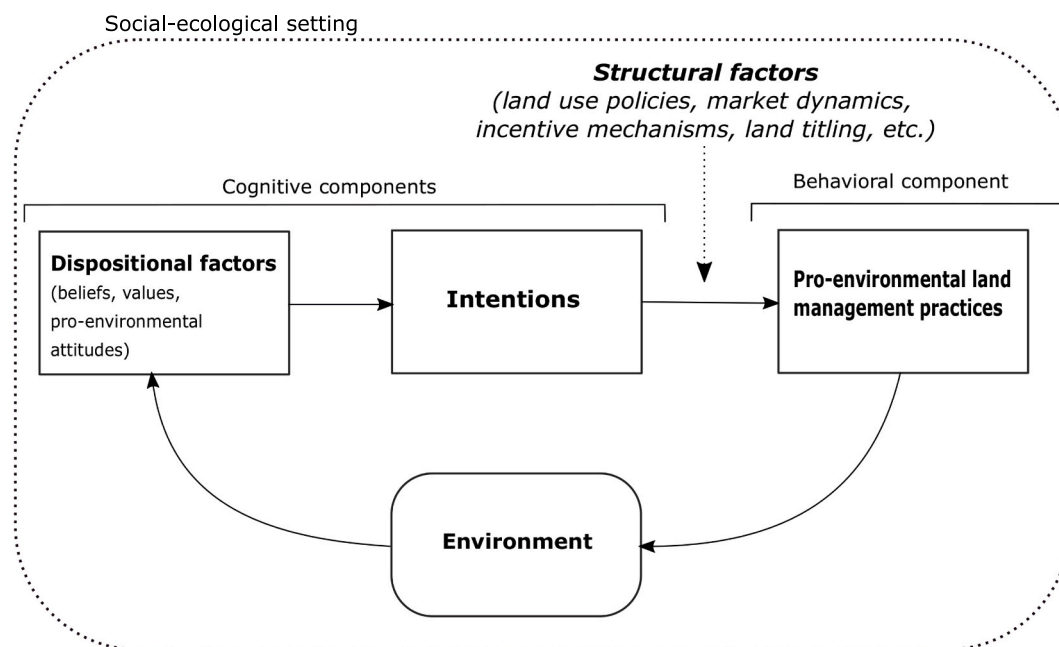


Fig. 2. Analytical framework used in this research. Intentions are underpinned by dispositional factors such as attitudes, values, and beliefs toward the behavior, while structural factors mediate the materialization of intentions into pro-environmental practices. Forming a feedback loop, these practices determine environmental change, which in turn influences dispositional factors (Meyfroidt, 2013).

For the facilitating factors (Theme A), land managers were first asked whether they performed pro-environmental practices that minimized negative impacts on the fluvial system within their productive land unit (Item A1), and they were then asked to specify the pro-environmental practices performed using a list based on the latest Costa Rican agricultural census (from the year 2014) as well as on key informant input. The practices varied by land use activity. The activities considered were tourism, agriculture, forestry and aquaculture. If the respondent answered affirmatively to the first item, he/she was then asked the open-ended question of which external factors facilitated the implementation of each reported practice (Item A2). At first the respondent could answer freely, and then a list of pre-determined factors obtained from pilot studies (more detail on this below) was shared with the respondent for further identification of facilitating factors. Additional free-format follow up questions were also asked (Item A3) based on the responses given on the previous item.

Managers were then asked about pro-environmental intentionality (Theme B), through the following question: “Do you intend to implement (more) pro-environmental practices?” (Item B1). Notably, the focus here is not on a specific practice but rather on the general pro-environmental intentionality of the land manager. This was important as most land use units in the SRW are mixed systems, hence the idea was to capture the overall pro-environmental tendency in land management within a mixed system and not for a specific practice. If answering affirmatively to this question, one open-ended item asking about specific structural factors limiting those intentions followed (Item B2), as well as free-format follow up questions to further capture additional information based on previous responses given (Item B3).

It is acknowledged that the intentionality question is particularly prone to social desirability bias especially in the Costa Rican context, characterized by a strong pro-environmental discourse (Evans, 1999; Honey, 2008; Informe Estado de la Nación, 2017a). To reduce the bias on this item, the respondent was prompted to elaborate more on what specifically he/she intended to do in order to substantiate the response and identify possible bias cues. Item B2 was also useful to this end, as it sought to make the respondent connect how the factors mentioned for this item affected the intentionality reported in item B1.

The interview protocol and overall data collection approach were reviewed and pre-tested during fifteen pilot interviews (seven at the upper watershed communities, four at the middle communities, and four at the lower section communities). These tests allowed a better anticipation of the free-format questions (items A3 and B3) upon which the interviews were based. Also, from these pilot interviews, economic and policy and institutional factors were preliminarily identified as the more prominent types of structural factors involved in land use decision-making in the SRW, after data saturation (Francis et al., 2010) during those pilot interviews. Hence, emphasis was placed on these two broad types from the outset. At the end of the data collection process, results were “member-checked” (Prokopy, 2011) through two focus group sessions to further explore and validate the results.

3.3. Data processing and analysis

Open-ended item responses were thematically coded into categories derived from land systems science typologies. Based on responses, economic and technological factors were grouped into one single category for analytical purposes, as they are commonly associated in land systems science (Geist et al., 2006). Table 2 synthesizes the salient factors and sub-factor categories based on the interview data. For the facilitating factors (Item A2), under the economic and technological factors category, access to credits/subsidies, enrollment in market-based certification schemes, access to financial incentives and market demands stood out as important sub-factors, while for the policy and institutional factor category, main sub-factors were access to extension services and networks, influence of community relations/informal norms, access to government assistance programs, and influence of state regulations and

Table 2

Breakdown of relevant sub-factors for each of the main structural factor categories identified based on interview data, also classified by their facilitating or constraining role.

	Economic & technological factors	Policy & institutional factors
Facilitating structural sub-factors (item A2)	<ul style="list-style-type: none"> • access to credits/subsidies • enrollment in market-based certification schemes • access to financial incentives • market demands 	<ul style="list-style-type: none"> • access to extension services and networks • influence of community relations/informal norms • access to government assistance programs • influence of state regulations and policies
Constraining structural sub-factors (item B2)	<ul style="list-style-type: none"> • lack of economic means/incentives • labor shortages • lack of access to pro-environmental technologies 	<ul style="list-style-type: none"> • lack of training • deficient or inexistent extension networks • formal regulations and policies • limited access to credits • insecure land tenure • weak or inefficient government authorities • social norms

policies. For the structural constraints (Item B2), main sub-factors within the economic and technological factors category were lack of economic means/incentives, lack of labor, and lack of access to pro-environmental technologies. For the policies and institutional factors category of this item, the relevant sub-factors were lack of training, deficient or inexistent extension networks, formal regulations and policies, limited access to credits, insecure land tenure, weak/inefficient government authorities, and social norms. An “Other factor” category was included for topics unrelated to the two main factors used in this study, and it mostly includes cultural (e.g. family tradition) and biophysical factors (e.g. difficult access, risk of landslides).

4. Results and discussion

4.1. Structure and thinking-action mismatches in land use management in the SRW

A recent study that was part of an annual country-wide assessment of environmental governance in Costa Rica examined the environmental “thinking-action” mismatch in the Costa Rican context (Informe Estado de la Nación, 2017b). According to a survey conducted as part of this study, within the country’s population there is an overwhelming acknowledgement of, and concern for, environmental problems, yet also a recognition that remediating actions from the population in general have not been sufficient to reverse degrading environmental trends (Informe Estado de la Nación, 2017b; Lentini, 2017). For over 67% of survey respondents, environmental matters are equally as or more important than traditionally more prioritized societal concerns, such as improving education and health services, reducing corruption and poverty, more job opportunities, and reducing social inequality. Yet, as also reported in this study, 73% of respondents considered that people in general in the country (including the respondents themselves) do not do enough to address these environmental problems, evidencing a perceived mismatch between thinking and action in the general population.

Tables 3 and 4 were derived from the interview data coding and show the percentages of land managers reporting the various structural factors facilitating their current adoption of sustainable practices (Table 3) as well as those limiting the materialization of their pro-environmental intentions (Table 4). Data are further broken down by watershed section and land system type.

By and large, thinking-action relationships among land managers in the SRW mirror the pattern above. Environmental stewardship and

Table 3

Percentage of interviewed land managers reporting the various economic and policy & institutional factors facilitating their adoption of sustainable land use practices in the SRW, also by watershed section and land system type.

All values expressed as percentages	Total interviews (91)	Watershed section			Land system type			
		Upper (31)	Middle (30)	Lower (30)	Crop only (20)	Livestock only (18)	Mixed crop-livestock (38)	Mixed other (15)
Economic factors								
Access to credits/subsidies	2.2	–	3.3	3.3	–	–	5.3	–
Enrollment in market-based certification schemes	8.8	12.9	6.7	6.7	15	–	5.3	20
Access to financial incentives	18.7	16.1	10	26.7	10	16.7	18.4	33.3
Market demands	8.8	9.7	6.7	10	10	5.6	2.6	33.3
Policy & Institutional factors								
Access to rural extension and information networks	47.3	64.5	46.7	30	60	22.2	55.3	40
Influence of community relations/informal norms	25.3	19.4	40	23.3	15	33.3	31.6	13.3
Access to government assistance programs	5.5	3.2	10	3.3	5	5.6	7.9	–
Influence of state regulations & policies	8.8	12.9	6.7	10	5	5.6	13.2	13.3
Other factors	13.2	16.1	6.7	13.3	15	11.1	5.3	33.3

Table 4

Percentage of interviewed land managers reporting the various economic & technological and policy & institutional factors constraining their pro-environmental land use practice intentions in the SRW, by watershed section and land system type.

All values expressed as percentages	Total interviews (91)	Watershed section			Land system type			
		Upper (31)	Middle (30)	Lower (30)	Crop only (20)	Livestock only (18)	Mixed crop-livestock (38)	Other ^a (15)
Intentions to implement more pro-environmental practices	78	67.7	83.3	86.7	80	77.8	78.9	80
Economic & technological factors								
Lack of economic means/incentives	48.4	41.9	60	46.7	30	50	63.2	26.7
Lack of labor	6.6	6.5	13.3	3.3	–	11.1	7.9	13.3
Lack of access to technologies	3.3	3.2	3.3	3.3	–	5.6	2.6	6.7
Policy & institutional factors								
Lack of/deficient rural extension and information networks	27.5	38.7	26.7	20	35	16.7	31.6	20
Formal regulations and policies	7.7	6.5	10	6.7	15	5.6	10.5	–
Limited access to credits	5.5	3.2	3.3	3.3	–	11.1	2.6	–
Insecure land tenure	4.4	–	6.7	6.7	–	11.1	7.9	–
Weak/inefficient government authorities	14.3	3.2	10	33.3	15	16.7	10.5	20
Social norms	3.3	6.5	–	6.7	10	–	2.6	–
Other factors	11	13	6.7	13.5	20	5.5	8	5

^a This category includes any other mix of land uses other than crop-livestock as well as productive units dedicated exclusively to tourism, as these cases were few (3).

general concern about environmental problems affecting the fluvial system in the SRW is notable among interviewed land managers. There were widespread expressions of pro-environmental intentionality, with most (78%) stating pro-environmental intentions in their land management (Table 3). How this pro-environmental thinking contrasts with practice adoption patterns in productive units in the SRW portends a cognitive-action mismatch that is important to understand more profoundly in order to devise more effective sustainability strategies.

4.2. Market-based (dis)incentives and pro-environmental land management

By virtue of its biophysical conditions, the entirety of the SRW can be considered suitable for conservation. This is because, first, its climatic and geomorphologic characteristics are conducive to a remarkable ecosystem diversity and species endemism (Acevedo et al., 2002; Estrada and Zamora, 2004; Rodríguez-Herrera, 2004; Sánchez et al., 2004); and second, its steep topography throughout makes most of the watershed inappropriate for human settlement and agriculture due to landslide risk and easily erodible soils (Saborío and Ureña, 2003). Indeed, biophysical conditions of the SRW, particularly its topography, have historically indisposed human settlement despite being relatively close to major population centers in Costa Rica's main urban

conurbation. As previously stated, this characteristic of settlement unsuitability also partly favored the early establishment of protected areas within the watershed (Fig. 1), beginning with the Los Santos Forest Reserve (LSFR) in 1975, and which, at that time, covered almost half the watershed's area. Later, starting in the 1980s, gradually came the proliferation of nature-based tourism activities in parts of the watershed, which was driven by, and in turn drove, a pro-environmental discourse that has pervaded the country in cultural, economic, and policy circles since that decade (Evans, 1999; Honey, 2008; Herrera-Rodríguez, 2013; Allen and Vásquez, 2017).

This pro-environmental rhetoric emerged largely in response to country-wide episodes of rapid forest loss especially during the 1960s and 1970s, Costa Rica's most intense deforestation period to date (Sanchez-Azofeifa, 2000; Sánchez-Azofeifa et al., 2003). These land clearing processes were largely driven by thriving international meat markets (Arroyo-Mora et al., 2005; Harvey and Haber, 1998), yet neoliberal structural reforms further favored the expansion of intensive monoculture crops throughout the country (Shaver et al., 2015). This trend eventually led to a series of conservation policies whose aim was the recovery of the country's forest ecosystems (Brockett and Gottfried, 2002; Calvo-Alvarado et al., 2009). These policies included the expansion and consolidation of a robust national network of protected areas (Sanchez-Azofeifa, 2000; SINAC, 2007; Herrera-Rodríguez, 2013) and

later the creation of a payment for environmental services (PES) scheme by the Costa Rican government in the 1990s, which was a pioneer initiative at that time (Gómez-Baggethun et al., 2010; Börner et al., 2017).

Undeniably serving as a model for subsequent PES programs in other countries, the Costa Rican case has nonetheless experienced inconsistencies to fund contracts, and has been critiqued for distributional, livelihood and equity issues (Porrás, 2010; Arriagada et al., 2015; Informe Estado de la Nación, 2018). PES schemes in tropical and subtropical countries, in fact, have been characterized by an “uneven treatment of the procedural and distributive considerations of scheme design and payment distribution” (Calvet-Mir et al., 2015, p. 150). In the SRW, PES programs are part of a complex situation involving insecure land tenure due to protected area restrictions. In Costa Rica, the Forest Reserve management category aims to protect forests without completely limiting productive uses, mainly through tenure restrictions. Landowners within the LSF (almost half the watershed’s area) are not eligible for property titles unless evidence of ownership and occupation of at least ten years prior to the establishment of the protected area is provided. And without official proof of ownership, landholders are ineligible for a PES incentive. As one PES-ineligible land manager put it: “I conserve because I care for the trees, despite not receiving any monetary benefit. But it is frustrating that we cannot receive the incentive due to an administrative government injustice”. As expected, PES incentives were mostly mentioned as key facilitating factors in the upper and lower watershed sections, the ones less affected by the LSF land title regulations.

These issues related to PES access in the SRW are apparent despite efforts from the Costa Rican government to consider greater equity when assigning these incentives (Pascual et al., 2014). Interestingly, despite PES ineligibility, weak forest policy enforcement, and increasingly more common production shortages in certain land use activities, many land managers in the SRW decide to conserve their forests. While land colonization in the SRW during the 60s and 70s involved extensive land clearings, many of these initial colonizers preserved forest patches mostly along riparian zones or areas of difficult access. Posterior generations of land managers, usually from the same family, have maintained and –in some cases - expanded these forested areas despite not receiving any pecuniary incentive.

These matters beg the question of whether there are differences between PES and non-PES units in the SRW, in terms of the incentive’s capacity to improve livelihoods and greater provision of ecosystem services vis-à-vis land units not receiving the incentive. Outside the LSF, land units with PES are widespread, and it is possible these mechanisms represent a significant contributing factor in hastening forest regrowth and improving ecosystem integrity within the watershed area; however, no formal studies on PES impacts in the SRW exist. Research done by Sierra and Russman (2006) in the Costa Rican Osa Peninsula, for instance, concluded that forest cover dynamics between PES and non-PES land units in this site are similar in some respects, at least in the short term, but PES units tend to experience a more rapid land abandonment leading to forest recovery, as well as an increased permanency of the gained forest cover. In the SRW, most land managers under PES have the impression that these incentives have been effective in safeguarding forests and improving their livelihoods, yet more in-depth studies are needed to explore this claim in its various dimensions.

Meanwhile, disincentive structures influencing pro-environmental land use in the SRW are linked to commodity markets. Managers of livestock operations, particularly in the middle section of the watershed, highlighted these factors the most. Livestock raising in the SRW is subject to greater market price instability and economic downturns compared to major cash crops like coffee. Furthermore, most markets for livestock products from the SRW are domestic, paying less for production compared with international export markets. Many livestock operations, most being small-scale, additionally face greater difficulties

accessing credits and other assistance mechanisms compared with major cash crops, disfavoring land investments (“landesque capital”) directed toward improving farm environmental performance. Coffee growers, in contrast, tend to affiliate to regional cooperatives that sell to international markets and that commonly follow social and environmental certification schemes that guarantee pay rates to members irrespective of market price fluctuations, hence representing an incentive to producers.

In response to these disincentives for livestock producers in the SRW, land use configurations within these livestock land units have gradually shifted towards more production diversification for improving social-ecological resilience. Many land managers dedicated primarily to cattle raising were improvising with a variety of crops including coffee, oil palm, banana, maize, and, to a lesser degree, tomato, avocado and vanilla. Tourism is also increasingly becoming part of the land use portfolio of these units. Social norms largely seem to influence crop choice in these cases, as well as extension services available, market prices, previous cultivation experience, biophysical factors, and the role of intermediaries. Indeed, more research is needed on how, and on what grounds, livestock operations diversify, in order to better understand how these changing land use configurations influence ecosystem conditions.

For tourism-based units, the role of market demands in incentivizing pro-environmental practices is more salient. With Costa Rica considered an ecotourism “hotspot”, tourism operations within the country need to conform to pro-environmental standards in order to access key markets. In the SRW, travel agencies and ecotourism certification schemes are vital in promoting pro-environmental practices among tourism operations, including wastewater treatment, recycling, conserving forest patches and use of biodegradable products. These demands, in turn, appear to galvanize greater environmental awareness and stewardship among managers and community members whose livelihoods depend on tourism, nurturing a general collective consciousness around pro-environmentalism.

4.3. Insecure land tenure, responsibility ascriptions and institutional performance

Perceptions of government institutional performance, especially the ones overseeing environmental matters, seem to play a relevant role in the pro-environmental intention-action link in the SRW, a finding which also coincides with the aforementioned general perceptions among the Costa Rican population in this matter (Lentini, 2017). By and large, land managers in the SRW express distrust in government authorities and most consider them ineffective, which discourages individual implementation of pro-environmental practices through perceptual tensions regarding responsibility attributions; that is, perceptions about the responsibilities of institutions that are distrusted and considered ineffective clash with a sense of personal responsibility to improve environmental conditions. The Ministry of Environment and Energy (MINAE in Spanish) is particularly brought up by land managers given its implication in their land tenure condition. Land manager reluctance to act more pro-environmentally is thus largely related to responsibility ascriptions towards an institution many hold a grudge against. This situation fits the “responsibility” category of obstacles that interfere between environmental concern and action described in Blake (1999), wherein people’s responsibility ascriptions to institutions as well as lack of ownership preclude environmental actions.

Moreover, within the national context, the environmental institutional system has been recurrently criticized for its complex and disordered operation, leading to weak institutional interplay and unclear institutional roles and responsibilities amidst a vast and convoluted normative framework (Informe Estado de la Nación, 2016, 2018). This is succinctly reflected in the testimony of a land manager, when talking about illegal fishing in the Savegre river: “Laws and regulations prohibit certain fishing practices such as blast and poison fishing. We denounce

[transgressors] to the authorities, but MINAE staff seldom comes to investigate. Many other times, they say it is the Coastguard's responsibility, but when we call the Coastguard, they say it is MINAE's job".

These institutional issues are further exacerbated by the lack of formal autonomy of producer groups and community organizations to locally craft and oversee self-designed environmental and resource regimes, downplaying existing and potential community efforts. In other words, group intentions, without official government recognition, can hardly materialize. By and large, land managers perceive community organization in relation specifically to environmental issues as deficient, citing a lack of participative discussions and weak community networks that could guide them in the adoption of pro-environmental practices, despite expressed intentions to participate in forging closer intra- and inter-community collaborations regarding environmental matters. This perception, we argue, results not because of a lack of intention for collective action, but from weak community latitude vis-à-vis government authority when addressing social-ecological problems.

These matters have important implications for land use decision-making in the SRW, so some background is warranted. As mentioned above, relationships between landholders and MINAE in the SRW began to deteriorate especially after the establishment of the LSFR in the mid 1970's. Lately, landholder concerns over the land tenure implications of protected areas have accentuated with the recent designation of the watershed as a UNESCO Biosphere Reserve, as many believe this will further reduce any possibility of securing land tenure. There is a precedent regarding this skepticism. During the late 1990s, in the aftermath of hurricane Caesar (which severely impacted communities in the SRW), a group of community leaders from the lower watershed sought government assistance to develop preventive strategies for improving risk management. This coincided temporarily with an initiative from the Spanish Cooperation Agency consisting on a series of programs in Latin America that aimed to "conserve Latin-American ecosystems, creating a series of protected spaces where examples of the most important biomes of Latin America are represented" (Gago, 2000, p. 253). In Costa Rica, this program was called Araucaria.

To promote social-ecological resilience within the watershed, the Savegre Project was established as part of the Araucaria program. Besides the aforementioned overarching goal of the program, this project further sought to work on "local participation, training, local management, the development and improvement of productive systems and the replacement of those not suitable for environmental conservation, the development of basic infrastructure and spatial planning" (Gago, 2000, p. 260). The program, to many land managers, did promote tourism initiatives and scientific research in the watershed, but most reported that investments in infrastructure, sustainable entrepreneurship, or technical assistance programs to small and medium producers had been negligible. What was more evident were investments in studies on a variety of topics, including socio-economic characterizations of communities (MINAE-AECI, 2001) hydrological studies (Barrantes and Vega, 2001), land tenure assessments (CEDARENA, 2001; Price and Leviston, 2014; Stern et al., 1999; Vignola et al., 2010), and ecological and biological inventories and classifications (INBIO and MNCR, 2001; Acevedo et al., 2002), many of which served as input for watershed-wide land use management plans (MINAE-AECI, 2003; INBIO, 2001; MINAE, 2004; Kempton et al., 1996; MEA (Millennium Ecosystem Assessment), 2005).

These plans included among their key management strategies the expansion and consolidation of a protected area system largely by incorporating "vacant" properties (*baldíos* in Spanish). Technically, however, this term refers to properties that are owned by the State, a definition that includes lands without a formal title. Some land managers even expressed that, during meetings with MINAE and Araucaria officials to discuss some protected area initiatives, they were led to sign documents in support of the establishment of these protected areas without knowing these definitional nuances related to land tenure.

Shortly after the official culmination of the Araucaria project in 2006, the Quetzal National Park was created in the upper watershed, and other protected areas within the watershed were expanded, including Manuel Antonio National Park and Cerro Vueltas Reserve (Fig. 1). Further, thirteen years after the project culminated comes the UNESCO designation. Thus, this series of events dating back more than 40 years, involving protected areas and insecure ownership of lands, seem to influence pro-environmental intentionality in the SRW in important ways. Indeed, state authorities and other local, regional, and national planning agencies should ponder whether more sustainable land management could result from granting formal land ownership to managers in the SRW without a title.

4.4. Rural extension schemes and pro-environmental intentionality

Differences in analytical scale notwithstanding, many findings here reflect those reported in meta-analyses of agricultural best management practice (BMPs) adoption in the United States (Prokopy et al., 2008; Baumgart-Getz et al., 2012), wherein social networks and access to information were found to be important influencing factors. Lack of knowledge, training, and extension services in the SRW appear as both a significant barrier *and* facilitating factor in implementing pro-environmental practices, because while most managers have received training in this respect, they consider it insufficient to cover the wider portfolio of intended sustainable strategies within the mixed nature of their productive units. In other words, the extension services they receive apply only to a specific land use activity and not to the increasingly-mixed configuration of their units.

But access to rural extension services were also significant as facilitating factors to pro-environmental management. As expected, stronger extension services are available for major cash crops, especially for cooperative-affiliated producers. One major coffee cooperative in the region, Coopeagri, adheres to international certification schemes that encourage producers to adopt social and environmental BMPs, and whose effective implementation requires robust information networks and training services. Outside coffee cooperatives, access to these services and resources is scarcer, save for tourism and oil palm activities which are also strongly linked to international markets and social and environmental certification programs.

The fact that access to robust extension services is highly crop- or service-dependent suggests that these structures do not respond to the reality of current land use configurations in the SRW. Developing extension service schemes that consider this greater diversity in productive units should, therefore, encourage more sustainable practices in the SRW. Unlike most government entities and large cooperatives, some regional producer coalitions attempt to improve land use information networks that account for the diversified nature of land use systems. Groups like the Diversified Association of Small Producers (ASODIP-PRO, Spanish acronym), as well as the Union of Independent Producers and Varied Activities (UPIAV; Spanish acronym), provide technical assistance and support programs for producers working with mixed systems, in most cases with an orientation towards sustainable production. Thus, it is important that sustainability strategies in the SRW align rural extension services with the more diversified land allocation in smallholder productive systems within the watershed.

Finally, social norms and family customs associated to land use also influence intention-action relationships in land management in the SRW. These were more notable in the middle sections of the watershed, where communities are more dispersed and isolated. These characteristics, however, seem to lead to closer interaction with immediate neighbors and peers for information exchange. Further, social norms tied to customary family practices also prompt managers to conserve existing forests in their lands or abstain from using agrochemicals or minimize their use. One land manager, for instance, expressed the following: "I remove weeds manually because my father did so, as he never liked to use herbicides. He also conserved the trees along the

streambeds. I have been doing those things since then, despite obviously representing more labor and possibly sacrificing income". In effect, in most cases, current managers are second-generation administrators whose parents were the initial settlers. This factor is important to consider as farm permanence within the family circle seems to influence BMP adoption in other contexts (Prokopy et al., 2008).

Indeed, land management in the SRW represents a quintessential example of how the interplay between individual dispositions and structural factors conditions pro-environmental practices and, more importantly, how land managers are faced with a mismatch whereby their cognitive dispositions do not materialize into pro-environmental actions due to factors largely outside of their control. This, however, has been increasingly conditioning land management on a global scale. As Lambin and Geist (2003, p. 23) note: "with the growing importance of [...] exogenous driving forces for local communities, it becomes increasingly difficult for local land managers to maintain control on their land use and ensure a sustainable management of local land resources". With greater economic globalization, intentions of land managers are increasingly at the mercy of market demands and other underlying structural forces. In the SRW, political-economic factor interplays, as mediated by institutions, have led to a situation in which land managers have lost control of their land and their pro-environmental intentionality.

5. Concluding remarks

Despite the urgent need to make rural productive activities more sustainable for achieving the U.N.'s Sustainable Development Goals, there is still much to learn about the drivers of land management practices, and particularly how those drivers influence the cognitive-action connection. Drawing from diverse theoretical and methodological approaches, this paper sought to expose some of the structural factors behind human (in)action regarding pro-environmental practices in a social-ecological system in Costa Rica. We conclude that in the SRW, access to market-based incentive schemes, insecure land tenure, perceptions of government institutional performance, and deficiencies in rural extension programs are important mediating factors in land managers' cognitive-action connection.

These matters beg the question of how to stage effective interventions in cases where managers are not implementing pro-environmental land management actions but are cognitively receptive to them, which has substantial implications for sustainability. Indeed, normative strategies at various governance spheres should prioritize addressing the structures that impede individual pro-environmental dispositions from materializing, as well as conform to the general dispositional patterns of land managers (e.g. attitudes and values that may align with policy objectives). These aspects would not only make the political processes in governance less arduous and cost-effective, but would also increase the likelihood of normative schemes succeeding.

Finally, integrative, multidisciplinary approaches are paramount to better understand cognitive-action mismatches in human-environment interactions and their role in sustainability outcomes. This paper drew inspiration from the political ecology tradition for situating the broad cognitive and behavioral scheme (traditionally the focus of social psychology) of land managers within a broader political economic context. This study has highlighted how the decisions of land managers are shaped by structural factors that transcend the individual by drawing attention to market, tenure, and rural extension schemes. While political ecology and land change science are engaged with similar types of questions and topics, there remains significant room for continued cross-fertilization between these traditions intimately concerned with understanding how and why natural resources and landscapes are governed and managed (Turner and Robbins, 2008). As our landscapes become increasingly fragile in the face of anthropogenic-induced changes, it is vital that we continue to draw on both these traditions that define geographic approaches to sustainability. Similarly,

integrating social psychology insights, particularly cognitive-behavioral frameworks, with political ecological and land systems science approaches is especially useful. Such frameworks can be important, for example, for more explicitly connecting agency and structure in human-environment research through a better articulation of structural factors within the cognition-behavior link. Indeed, conclusions from these integrative efforts can go a long way in providing national, regional and local decision-makers more useful input for the design and implementation of practical and long-term solutions for sustainability.

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CRedit authorship contribution statement

Edgar Espinoza-Cisneros: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing - original draft, Writing - review & editing. **Majed Akhter:** Conceptualization, Methodology, Supervision, Validation, Writing - review & editing.

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None.

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